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REMEDIAL INVESTIGATION, RBCA TIER 2 EVALUATION AND REMEDIAL ACTION PLAN FRIESMAN RANCH PROPERTY LIVERMORE, CALIFORNIA

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A Report Prepared for :

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**REMEDIAL INVESTIGATION,
RBCA TIER 2 EVALUATION AND
REMEDIAL ACTION PLAN
FRIESMAN RANCH PROPERTY
LIVERMORE, CALIFORNIA**

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
µg/L	Micrograms per Liter, approximately equivalent to a parts per billion
ACFCD	Alameda County Flood Control and Water Conservation District
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
BAAQMD	Bay Area Air Quality Management District
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CME	Colorado Mining Equipment
COC	Chain-of-Custody
DHS	California Department of Health Services
DOT	United States Department of Transportation
EPA	United States Environmental Protection Agency
gal/day/ft^2	Gallons per Day per Square Feet
gpm	Gallons per Minute
GSI	Groundwater Services, Inc.
HSA	Hollow Stem Auger
ID	Inside Diameter
IDW	Investigation-Derived Wastes
Kleinfelder	Kleinfelder, Inc.
lbs/day	Pounds per Day
LUFT	Leaking Underground Fuel Tank
MCL	Maximum Contaminant Level
mg/Kg	Milligrams per Kilogram
MSL	Mean Sea Level
ND	Not or None Detected
NPDES	National Pollutant discharge Elimination System
NTU	Nephelometric Turbidity Units
OD	Outside Diameter
PID	Photoionization Detector
POC	Point of Compliance
POE	Point of Exposure
RAP	Remedial Action Plan
RBCA	Risk-Based Corrective Action
RBSL	Risk-Based Screening Level
RI	Remedial Investigation
RWQCB Region	California Regional Water Quality Control Board - San Francisco Bay
SSTL	Site-Specific Target Level
TOC	Top of Casing
VOA	Volatile Organic Analysis
USCS	Unified Soil Classification System
UST	Underground Storage Tank

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

Chemical	Short Name
Benzene, Toluene, Ethylbenzene and Total Xylenes	BTEX
Methyl Tertiary Butyl Ether	MTBE
Polynuclear Aromatic Hydrocarbon	PAH
Polychlorinated Biphenyls	PCBs
Total Petroleum Hydrocarbons	TPH
Total Petroleum Hydrocarbons as Diesel	TPH-d
Total Petroleum Hydrocarbons as Gasoline	TPH-g
Total Extractable Petroleum Hydrocarbons	TEPH
Total Purgeable Petroleum Hydrocarbons	TPPH
Volatile Organic Compounds	VOCs

EXECUTIVE SUMMARY

A Remedial Investigation (RI) and Risk-Based Corrective Action (RBCA) Tier 2 Evaluation were implemented at the Friesman Ranch Property, Livermore, California, to assess potential adverse environmental impacts associated with a former heating oil aboveground storage tank (AST) located at the site. In addition, other potential environmental concerns, such as nitrate, organochlorine pesticide and polychlorinated biphenyl (PCB) impacts, were addressed by the RI. The purpose of the RI and RBCA Tier 2 Evaluation is to gather the information and data required to develop a Remedial Action Plan (RAP) for the site.

The objectives of the RI are to: investigate potential residual nitrate, organochlorine pesticide and PCB contamination in surface materials; characterize the lateral and vertical extent of petroleum hydrocarbon impacts in soil and the lateral extent of petroleum hydrocarbon impacts in groundwater associated with the former heating oil AST and associated piping; initiate an assessment of potential temporal changes in groundwater quality; evaluate the human health and environmental risk associated with residual contamination detected; and recommend remedial actions to unacceptable impacts.

REMEDIAL INVESTIGATION ACTIVITIES

RI activities performed consisted of utility surveys, wipe sample collection, surface soil sample collection, soil boring/sampling and reconnaissance groundwater collection, monitoring well installations, implementation of a groundwater monitoring event and IDW-handling procedures.

Prior to the implementation of any field activities utility clearance surveys were performed, consisting of contacting USA Locator, Inc., a site walk to mark the location of any observable utilities and a geophysical survey. The locations of the intrusive sampling activities were based on the results of these surveys.

Two wipe samples were collected from concrete beneath the 55-gallon drums that reportedly were used for the storage of hydraulic oil. These samples were analyzed for PCBs.

Six surface soil samples were collected from the pasture areas located along the northwestern and southwestern portions of the property. The objective of this activity was to assess the potential impact from historical agricultural activities.

A soil boring/sampling program and reconnaissance groundwater sampling program were implemented to assess the potential lateral and vertical extent of hydrocarbon impacts to soil and the potential lateral extent of hydrocarbon impacts to groundwater.

A total of 20 soil borings were advanced to a maximum depth of 28 feet bgs with soil samples being collected as the boring was advanced. A total of 14 soil samples were collected for

lithologic and laboratory analyses at five foot depth intervals from 7 soil borings. Samples collected were analyzed for at least one of the following constituents: total petroleum hydrocarbons as gasoline (TPH-g), total petroleum hydrocarbons as diesel (TPH-d), the aromatic hydrocarbons benzene, toluene, ethylbenzene and total xylenes (BTEX), methyl tertiary-butyl ether (MTBE) and polynuclear aromatic hydrocarbons (PAHs).

Groundwater samples were collected from all 20 soil borings. Samples collected were analyzed for at least one of the following constituents: TPH-g, TPH-d, BTEX, MTBE and PAHs.

A total of six groundwater wells were installed on the central portion of the property to act as monitoring points to assess temporal and spatial variations in groundwater depth, flow, free-product thickness and chemistry. Well locations were selected based on the results of the reconnaissance groundwater sampling program.

One groundwater monitoring event was performed to verify the analytical results obtained from the reconnaissance groundwater sampling program. Water levels and free-product thicknesses were measured and water quality samples were collected as part of this monitoring event. The samples collected were analyzed for TPH-g, TPH-d, BTEX, MTBE and PAHs.

Prior to the initiation of the RI field activities, and between sampling locations, all equipment was decontaminated. Soil cuttings, decontamination rinsate fluids, well development and purge water were containerized and stored on-site in DOT-approved 55-gallon drums. Following completion of field activities, all soil borings not converted to monitoring wells, were abandoned by backfilling with a cement/bentonite slurry. The work area was left in a presentable and workable condition, as nearly as practicable to original conditions.

SITE HYDROGEOLOGY

Subsurface site materials encountered consisted of stiff silty clays with minor silty sands. The sandy materials encountered appeared to be discontinuous across the site. These materials do not usually allow appreciable volumes of groundwater to migrate through them. Reported hydraulic conductivity values for these materials range from 10^{-5} to 1 gallons per day per square feet (gal/day/ft^2).

First groundwater was encountered at depths ranging from 13 to 23 feet below ground surface (bgs) and stabilized at depths ranging from 12 to 14.5 feet bgs. Groundwater conditions appear to range from unconfined to confined.

No measurable free-product was encountered in any of the groundwater monitoring wells, but a hydrocarbon sheen and odor was observed in the water purged and sampled from well KMW-6.

On September 8, 1997, groundwater flow was to the northwest with a hydraulic gradient of 0.008 ft/ft.

WIPE, SOIL AND GROUNDWATER CHEMISTRY

Wipe Samples

PCBs were not detected in the two wipe samples and the trip blank submitted for analysis. PCBs do not appear to have impacted the area underlying the 55-gallon drums storing hydraulic oil.

Surface Soil Samples

Nitrate was detected in the composite surface soil sample at a concentration of 17 milligrams per kilogram (mg/Kg). This concentration is not considered to be significant.

Organochlorine pesticides were not detected in the composite surface soil sample and do not appear to have adversely impacted the property.

Subsurface Soil Samples

TPH-d was not detected in any of the subsurface soil samples. TPH-g was detected in 3 of the 14 samples at a concentration in excess of 10 mg/Kg. The highest concentrations of TPH-g were detected in samples KB-18 at depths of 15 (2,100 mg/Kg) and 20 feet (4,000 mg/Kg) feet bgs; however, these areas appear to be within the saturated zone and may represent residual groundwater smearing.

BTEX was detected in the same three subsurface soil samples in which TPH-g was detected; however, the highest concentrations were associated with the lowest TPH-g concentration detected and conversely, the lowest concentrations of BTEX were associated with the highest concentrations of TPH-g.

MTBE was detected in only one sample at a concentration of 0.065 mg/Kg. PAHs were not detected in any of the samples.

The lateral and vertical extent of TPH, BTEX and MTBE contamination in soil appears to be limited. With the exception of a few isolated locations, chemicals of concern were not detected at depths less than 10 feet bgs, being concentrated at the capillary fringe at a depth of 19 feet bgs.

Reconnaissance Groundwater Samples

TPH-g, TPH-d, BTEX and MTBE were detected in at least one of the reconnaissance groundwater samples collected. PAHs were not detected in any of the samples.

TPH-g and TPH-d were detected at concentrations of thousands of milligrams per liter (µg/L) in at least one sample collected and analyzed. At least one sample contained concentrations of BTEX at or in excess of their respective MCLs. Although MTBE was detected, concentrations were not in excess of the compound's proposed cleanup level.

Groundwater Monitoring Well Samples

Only one groundwater monitoring well sample (KMW-6) contained any hydrocarbon compounds. TPH-g was detected at 13,000 µg/L, TPH-d was detected at 3,200 µg/L, BTEX was detected at 1,314 µg/L and the PAH naphthalene was detected at 140 µg/L. MTBE was not detected in any of the groundwater monitoring well samples.

Impacts of TPH and BTEX appear to be concentrated in the vicinity of soil borings KB-11 and KB-13. The maximum TPH-g and TPH-d concentrations and observed sheen suggest that free-product is floating on the piezometric surface. The center of the groundwater plume was assumed to be in the vicinity of KB-13.

The most likely source of the contamination is the former heating oil AST located in the metal shed near the east central portion of the property.

RBCA TIER 2 EVALUATION

The RBCA Tier 2 evaluation was performed in accordance with American Society for Testing and Materials (ASTM) standards and guidelines and was based on conservative assumptions for exposure and transport of the chemicals of concern such as uniform chemical of concern concentrations, residential exposure of contaminants for 30 years, no biodegradation or other loss mechanism occurring in groundwater or in the vapor phase and soil vapor concentrations reaching immediate equilibrium with the groundwater source. The calculated site-specific target levels (SSTLs) should be viewed as a conservative reference point for site cleanup.

Based on the data collected to date, the following chemicals were considered to be of concern in either soil and/or groundwater: BTEX, MTBE and naphthalene. The threat of these chemicals to human health and the environment appears to be short-term (0 to 2 years), if remediation is implemented.

The SSTL estimated for the leaching potential for benzene from soil to groundwater (0.0038 mg/Kg) was exceeded in only one soil sample, KB-1 and 15 feet bgs (0.056 mg/Kg).

If shallow groundwater is considered a potential drinking water source, toluene, naphthalene and MTBE did not exceed their SSTLs in any of the reconnaissance or groundwater monitoring wells samples collected. Benzene exceeded its SSTL in reconnaissance and one groundwater monitoring well sample with concentrations ranging from 73 to 390 µg/L. Ethylbenzene and total xylenes exceeded their SSTLs in one boring (KB-13) with concentrations of 890 and 4,200 µg/L, respectively.

If shallow groundwater is not considered as a potential drinking water source and institutional controls can be applied, ethylbenzene, toluene, total xylenes, naphthalene and MTBE did not exceed their calculated on-site SSTLs. The maximum detected groundwater benzene concentration exceeded the alternate point of exposure SSTL by approximately 7.5 times.

Because the concentrations of the chemicals of concern exceed the calculated SSTLs, further investigation, fate and transport modeling and/or remedial action are warranted.

RECOMMENDATIONS

Kleinfelder, Inc. (Kleinfelder) makes the following recommendations concerning further investigations and remedial actions at the property:

- The findings presented in this report should be presented to the local implementing agencies responsible for releases of petroleum hydrocarbons from ASTs or USTs.
- One additional monitoring well should be installed in the vicinity of KB-13, which is assumed to be the source area of the petroleum hydrocarbon impacts. This well could be utilized for both source area monitoring and remedial activities.
- All of the installed groundwater monitoring wells should be placed on a regular monitoring schedule for a period of one year, at which time the monitoring schedule will be re-evaluated and modified as appropriate. The initial proposed monitoring schedule is quarterly.
- Due to the potential for petroleum hydrocarbon contamination to impact nearby surface water (Arroyo De Las Positas), surface water samples should be collected on a quarterly basis from this water body. Samples should be collected from both upgradient and downgradient locations. Following the completion of a year of sampling (four consecutive quarterly monitoring events), the schedule will be re-evaluated and modified as appropriate.
- The water quality samples collected should be analyzed for TPH-g, TPH-d, BTEX, MTBE and PAHs.
- Based on the results of the remedial alternatives evaluation, a biosparging/soil venting system that is applied to the higher plume concentration areas with indirect bioremediation of the outer plume is recommended. This alternative rated good for technical feasibility, regulatory acceptability and effectiveness. It is the lowest cost (estimated at approximately $260,000) remedial alternative evaluated with a moderate cleanup time (0.5 to 2 years).

1.0 INTRODUCTION

This report describes the investigative procedures and results of the Remedial Investigation (RI) and Risk-Based Corrective Action (RBCA) Tier 2 Evaluation for the Friesman Ranch Property, Livermore, California. The RI focused on potential adverse environmental impacts associated with a former heating oil aboveground storage tank (AST) located at the site. In addition, other potential environmental concerns, such as nitrate, organochlorine pesticide and polychlorinated biphenyl (PCB) impacts, are addressed in this report. Preparation of this report is a key task of our proposal dated August 5, 1997 [Kleinfelder, Inc. (Kleinfelder), 1997a] and our *Workplan for a Remedial Investigation with Risk-Based Corrective Action Tier 2 Evaluation for the Friesman Ranch Property, Livermore, California* (Kleinfelder, 1997b).

The work was performed in accordance with the procedures and protocols described in the following regulatory agency and industrial standard guidance documents:

- *Guidelines for Hydrogeologic Characterization at Hazardous Substances Release Sites, Volumes I (Field Investigation Manual) and II (Project Management Manual).* California Environmental Protection Agency (Cal/EPA), September 1994;
- *Standard Guide for Risk-Based Corrective Action (RBCA) Applied at Petroleum Release Sites.* American Society for Testing and Materials (ASTM), Designation E 1739-95, September 1995;
- *California Underground Storage Tank (UST) Regulations*, California Code of Regulations, Title 23, Division 3, Chapter 16 and Health and Safety Code, Chapter 6.7, 1994;
- *California Aboveground Storage Tank Act of 1989*, Health and Safety Code 25270-24270.12
- *Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites.* Staff Report prepared by the North Coast Regional Water Quality Control Board, San Francisco Regional Water Quality Control Board and Central Valley Regional Water Quality Control Board, August 1990;
- *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.* State of California, Leaking Underground Fuel Tank Task Force. State Water Resources Control Board, October 1989;
- *A Compilation of Water Quality Goals.* Staff Report of the Central Valley Regional Water Quality Control Board, July 1995.

1.1 PURPOSE, OBJECTIVES AND SCOPE OF WORK

The purpose of this RI is to gather the information and data required to develop a Remedial Action Plan (RAP) for potential subsurface impacts associated with the former heating oil AST and piping. In addition, the potential for environmental impacts associated with historical site operations were evaluated.

The objectives of this RI are to:

- Investigate potential residual nitrate, organochlorine pesticide and PCB contamination in surface materials;
- Characterize the lateral and vertical extent of soil petroleum hydrocarbon impacts and the lateral extent of groundwater petroleum hydrocarbon impacts associated with the former heating oil AST and associated piping;
- Initiate an assessment of potential temporal changes in groundwater quality; and
- Evaluate the human health and environmental risk associated with residual contamination detected and recommend remedial actions to unacceptable impacts.

In order to meet these objectives, the following scope of work was implemented:

- A soil and groundwater sampling program;
- A monitoring well installation program;
- A groundwater monitoring event;
- A RBCA Tier 2 risk evaluation; and
- Preparation of a this combined RI Report, RBCA Tier 2 Evaluation and RAP.

1.2 REPORT ORGANIZATION

This report is organized into 10 sections. This section describes the purpose, objectives, general scope of work and organization of the report. A section describing the site and its history immediately follows this introductory section. Section 3 describes the activities performed as part of the RI. Sections 4 and 5 describes the site hydrogeology and presents the analytical results, respectively. The RBCA Tier 2 Evaluation and the Remedial Action Plan are contained in Sections 6 and 7, respectively. Summary and Conclusions are contained in Section 8. The limitations of this report are described in Section 9. Section 10 contains the references listed in the report.

In addition to the narrative descriptions in the main body of the report, eight references contain pertinent supplemental information and data. Photodocumentation of RI activities is contained in Appendix A. Soil boring/monitoring well permit documentation and logs are contained in Appendices B and C, respectively. Field Monitoring notes are contained in Appendix D.

Appendix E contains chain-of-custody records and certified analytical laboratory reports. RBCA Tier 2 evaluation support documentation is contained in Appendices F (equations) and G (modeling results), respectively.

2.0 SITE DESCRIPTION

2.1 SITE DESCRIPTION

2.1.1 Local Description, Surrounding Land Use and Climate

The Friesman Ranch Property is located at 1600 Friesman Road, Livermore, Alameda County, California (Plate 1). The property covers an area of approximately 55 acres and is used for agricultural and residential purposes. Although the majority of the site is undeveloped and was used for grazing purposes, the southwest central portion of the site is occupied by six single family residences, three detached garages, the former dairy building, seven barns and a stable.

Several ASTs are present on the central portion of the site. All of these ASTs are located on concrete pads that appeared to have only minor oil staining. In addition, two 55-gallon drums containing hydraulic fluid are located on the southern section of the central portion of the developed area. Minor stains were observed on the concrete pad beneath these drums. Reportedly, no underground storage tanks (USTs) were or are located at the site.

Surrounding land use is mixed (agricultural, recreational and residential). The site is bordered to the south by scattered residential buildings, Las Positas Golf Course and undeveloped grazing land; to the north by Interstate 580; to the west by Tri-Valley Golf Center's driving range; and to the east by Las Positas Golf Course.

The climate of the area is characterized by wet mild winters and dry, hot summers. Rainfall occurs intermittently, but is concentrated between September and March. Between 1990 and 1994, annual rainfall ranged from 8.96 to 19.67 inches, with an average of 13.88 inches (National Weather Service, 1997).

2.1.2 Local Geology and Hydrology

The site is located in the Livermore Basin portion of the Coast Range Geomorphic Province of California (Norris and Webb, 1990). The Livermore Basin, including the Friesman Ranch property, is underlain by non-marine, Pleistocene and Holocene deposits of fluvial and lacustrine origin. Most significant of these deposits is the Livermore Gravels, an approximately 4,000 foot thick sequence of gravels, sands, silts and clays, with scattered lake bed deposits. On the northern side of the basin, where the Friesman Road Property is located, these deposits are commonly buried by younger alluvium.

Site subsurface materials consist of silts and clays down to a depth of at least 24 feet below ground surface (bgs). Reported hydraulic conductivity values associated with these materials range from 10^{-5} to 1 gallon per day per square foot (gal/day/ft^2) (Freeze and Cherry, 1979). First groundwater was encountered at a depth of approximately 20 feet bgs and probably represents a perched layer because it was not encountered in every boring (Kleinfelder, 1997b).

The Livermore valley is drained by a number of small streams that originate in the surrounding hills and flow into larger drainages that ultimately discharge into Alameda Creek, through Niles Canyon, and into San Francisco Bay. One small drainage, Arroyo Las Positas, transects the southeastern portion of the site and flows into Alamo Creek to the west.

2.1.3 Surface Water and Groundwater Use

Municipal and industrial water are obtained from a combination of treated surface water and groundwater supply wells located in residential areas in and around the San Ramon, Livermore and Amador Valleys. There is one domestic water supply well (3S-1E-2P3) located on the property that reportedly is used only by the on-site facilities. This well is located several hundreds of feet upgradient of the developed portion of the site and across Arroyo De Las Positas (Plate 2).

2.2 SITE HISTORY

2.2.1 Operational History

The Friesman Ranch Property was undeveloped until the 1910s when the buildings (barns, outbuildings, residences) associated with the dairy operation were constructed. The property was used as a dairy until operations ceased in 1971. The equipment used in the dairy operations was powered by steam generated by two boilers located in the former dairy building. These boilers were reportedly fueled via a heating oil AST that was located in the metal shed located to the north of the dairy building. Open areas on the northern and southern portions of the property were and still are used as agricultural land and pastures for cattle and horses.

Currently, the site is occupied by six residences, the former main dairy and associated support buildings, several garages, seven barns and a stable. The property owner occupies the main residence while the remaining residences and several of the barns are leased to tenants. Debris (tires, old furniture, scrap metal and lumber) is scattered across the property.

2.2.2 Previous Site Investigations

In July 1997, a Phase I Environmental Site Assessment (Phase I ESA) and limited soil and groundwater investigation were performed at the site (Kleinfelder, 1997c). During the site reconnaissance portion of the Phase I ESA, a number of ASTs, reportedly used for fueling of vehicles and equipment and two 55-gallon drums used to store hydraulic fluid, were observed around the central part of the developed portion of the facility. A heating oil AST, that supplied fuel to the boilers in the former dairy building and that was reportedly removed from the facility several years earlier, previously occupied the metal shed (Plate 2). Each of the ASTs was mounted on towers above concrete pads. No evidence of piping, either above or below ground, was observed. Reportedly, no USTs were ever installed on the property.

Other facilities that potentially could be associated with the handling, storage and disposal of hazardous materials/wastes include: a barn immediately east of the former dairy building at which numerous paint and thinner cans were stored; a barn located on the southwestern corner of

the facility where numerous 55-gallon drums were noticed; and large quantities of debris (tires, old furniture, scrap metal and lumber) that were observed at various locations across the site.

In order to assess environmental impairment associated with these facilities, a limited soil and groundwater sampling program was implemented. Sampling locations are shown on Plate 2. Surface soil (KSF-6, KSF-7, KSF-8 and KSF-9), shallow soil (sample numbers KSH-3, KSH-4 and KSH-5), subsurface soil (sample numbers KB-2 and KB-1) and groundwater (sample number KB-2) samples were collected using a truck-mounted Geoprobe™ sampling system. The soil and groundwater samples collected from borings KB-1 and KB-2 and the shallow subsurface soil samples (KB-3, KB-4 and KB-5) were analyzed for total purgeable petroleum hydrocarbons (TPPH) and total extractable petroleum hydrocarbons (TEPH), and for aromatic hydrocarbons (benzene, toluene, ethylbenzene and total xylenes - BTEX). The four surface soil samples (KSF-6, KSF-7, KSF-8 and KSF-9) were composited and analyzed for purgeable halocarbons and total and extractable lead.

TPPH, TEPH and BTEX were detected in the soil and groundwater samples collected from the areas where the boilers and former AST were located. The maximum concentrations of TPPH and TEPH detected in soil samples were 280 and 160 milligrams per kilogram (mg/Kg), respectively. The aromatic hydrocarbons ethylbenzene (1.6 mg/Kg), toluene (0.52 mg/Kg) and total xylenes (1.2 mg/Kg) were detected at the maximum concentrations specified (Table 1); however, benzene was not detected in any of the soil samples.

TPPH, TEPH and BTEX were detected in the one groundwater sample collected at concentrations of 3,100, 160,000, 7.3, 19, 11 and 22 micrograms per liter (µg/L), respectively. Benzene was present at a concentration that exceeded its State of California Maximum Contaminant Limit (MCL), 1.0 µg/L (Title 22, California Code of Regulations [CCR], Section 64444.5).

No VOCs were detected in the composited surface soil sample analyzed for this suite of chemicals. This composite sample (KSF-6-9) did contain total lead at a concentration of 73 mg/Kg, but did not contain extractable lead.

3.0 REMEDIAL INVESTIGATIVE ACTIVITIES

3.1 INTRODUCTION

This section summarizes the field activities performed for the RI. All field activities were performed from August 27 through September 12, 1997. The field activities discussed in this section include utility clearance procedures, wipe sample collection, surface soil sample collection, soil boring/monitoring well permitting, soil boring/sampling and reconnaissance groundwater sampling program, monitoring well installation procedures, the groundwater monitoring event, investigation-derived waste (IDW) handling procedures and site restoration activities. Plates 3 through 5 show the locations of actual field activities. Photodocumentation of these activities are included in Appendix A.

3.2 WORKPLAN DEVIATIONS

This section summarizes work performed that deviated from the work proposed in the Workplan (Kleinfelder, 1997c) dated August 29, 1997. These deviations are as follows:

- Locations of Surface Soil Sampling Activities - The Workplan proposed collecting six surface soil samples from the pasture area located along the northwestern portion of the site, but actually four surface soil samples were collected from this portion of the property and two were collected from pasture areas located on the southwestern portion of the property. The southwestern portion of the property is also used as pasture land for horses and cattle and it was deemed prudent to include this area into the sampling program.

- Number of Soil Borings Advanced for the Soil Sampling and Reconnaissance Groundwater Sampling Program - A maximum of 25 soil borings were proposed to be advanced for the RI; 20 soil borings were actually advanced during implementation of these RI field activities.

- Locations of Soil Borings - Plate 3 of the Workplan (Kleinfelder, 1997c) indicates the proposed locations of the soil borings, whereas Plate 4 of this document indicates the actual locations of the soil borings. The main areas where the proposed and actual soil boring locations deviated are to the southeast and west of the dairy building. These areas were not accessible due to aboveground obstructions (utilities, buildings, trees, debris) and/or aboveground and underground utilities.

- Number of Soil Samples - In the Workplan, a maximum of 20 soil samples were proposed to be collected for analysis from a maximum of 10 soil borings. The total number of samples and the number of soil borings from which they were collected were 14 and 7, respectively.

- Locations of Monitoring Wells - Plate 4 of the Workplan (Kleinfelder, 1997c) indicates the proposed locations of the monitoring wells, whereas Plate 5 of this document indicates the actual locations of the monitoring wells. The main areas where the proposed and actual monitoring well locations are to the east and west/southwest of the dairy building. Three monitoring wells were proposed to be installed on the eastern side of the dairy building, but only one was actually installed because of accessibility limitations due to aboveground and underground obstructions and utilities. Only two wells were proposed for installation to the west/southwest of the dairy building, but four wells were actually installed because of the lateral extent of the petroleum hydrocarbon impacts detected during the implementation of the reconnaissance groundwater sampling program.

- Depth of Monitoring Wells - The proposed maximum depth of all of the wells as proposed in the Workplan was 35 feet bgs. The actual depth of all of the wells as installed was 24 feet bgs, based on the groundwater conditions encountered during the reconnaissance program.

- Number of Quality Assurance/Quality Control Samples - The Workplan stated that a total of 2 duplicate soil samples would be collected. However, no duplicate soil samples were collected. In addition, one duplicate reconnaissance groundwater sample were collected.

3.3 UTILITY SURVEYS

Prior to the implementation of any subsurface field activities, aboveground/underground utility surveys were performed to delineate the locations of potential utilities. The first phase of this utility survey consisted of contacting USA Locator, Inc., who contacted potential utility companies that could have lines crossing the property. The second phase of the survey consisted of a site walk to mark the location of any observable utilities, both aboveground and underground, and perform a geophysical survey to locate underground utilities not identified by USA Locator, Inc. This geophysical survey was performed by JR Associates, under the direction of Kleinfelder personnel, on August 27, 1997. Both electromagnetic and ground-penetrating radar were used to locate potential underground utilities. All suspect underground utilities were marked on the ground surface with white paint. The location of all proposed intrusive sampling activities was based on these utility surveys.

3.4 WIPE SAMPLE COLLECTION ACTIVITIES

Two wipe samples were collected from concrete beneath the 55-gallon drums that reportedly contained hydraulic fluid (Plate 3). The objective of this activity was to assess the potential for PCB impacts. Sampling protocol consisted of wiping the hexane-soaked filter papers over a specified area (12-inches by 12-inches), placing the filter papers in appropriate containers, labeling the containers and placing them in an iced cooler for delivery to the laboratory under approved chain-of-custody (COC) procedures. In addition to the wipe samples collected, one trip blank (consisting of a pre-soaked filter paper) accompanied the samples to the laboratory.

3.5 SURFACE SOIL SAMPLING ACTIVITIES

Six surface soil samples were collected from the pasture areas located along the northwest and southwest portion of the property (Plate 3). The objective of this activity was to assess the potential for nitrate and organochlorine pesticide impacts. Sampling protocol consisted of driving a 2-inch diameter by 6-inch long stainless steel tube into the soil, capping both ends of tube with Teflon™-tape and non-reactive plastic caps, labeling the sample and placing it in an iced cooler for delivery to the laboratory using approved COC procedures.

3.6 SOIL BORING/SAMPLING AND RECONNAISSANCE GROUNDWATER SAMPLING ACTIVITIES

A total of 20 soil borings were advanced on the property between August 27 and 29, 1997 (Plate 4). The purpose of these soil borings was to provide soil sampling (lithology and analysis) and reconnaissance groundwater sampling locations for the evaluation of potential hydrocarbon impacts associated with the historical site ASTs.

Prior to the initiation of this field activity, a soil boring/well installation permit was obtained from the Alameda County Flood Control and Water Conservation District - Zone 7 (ACFCD-Zone 7). This permit (No. 97448) is contained in Appendix B.

3.6.1 Soil Sampling Methods

Soil borings were advanced using direct-push techniques (Diedrich™), combined with a hollow system auger (HSA) drill rig (Photos 1 and 2; Appendix A). The borings were advanced to a maximum depth of approximately 28 feet bgs and soil samples were collected at five-foot depth intervals from seven borings (KB-1, KB-3, KB-9, KB-14, KB-15, KB-17 and KB-18) using the Diedrich™ Environmental Soil Probe System. All soil samples retrieved from the soil borings were visually inspected for signs of staining and screened for the presence of hydrocarbon odors and the evolution of organic vapors with a photoionization detector (PID). The soil samples were used to describe subsurface lithology and to evaluate soil chemistry.

The soil borings from which soil samples were collected were logged by an experienced Kleinfelder geologist. Soil borings from which no soil samples were collected were not logged. The soil boring logs (Appendix C) include a description of the geologic character of the materials encountered, classification of materials by the United Soil Classification system (USCS), depth at which changes were observed, thickness of units, depth to water, if encountered, and color of materials encountered. Sample depths and PID measurements are included on the soil boring logs.

The Diedrich™ Environmental Soil Probe system is a double rod system that allows for the sampling of both soil and water. The system utilizes an outer and inner rod that are driven simultaneously. The outer rod has an outside diameter (OD) of 1 ¾-inches and an inside diameter (ID) of 1 ¼-inches. The inner rod has an OD of 1 1/8-inches and an ID of 5/8-inches.

The probe system was operated with a Colorado Mining Equipment (CME) Model 55 drill rig. The rods are pushed hydraulically with the top head of the rig. If the hydraulic rams met refusal, an automatic hydraulically driven hammer was used to drive the rods. The use of the CME 55 drill rig allows the flexibility to switch to hollow stem augers (HSAs) should the subsurface materials encountered stop the probe system from reaching the desired depth.

Soil samples were collected in a 24-inch long by 7/8-inch ID split spoon sampler. The soil sampler threads to the inner rod that is placed inside the outer rod. The two rods are driven simultaneously for 24-inches. The inner rod is retrieved with the sampler attached and the outer rod remains in the hole and acts as temporary casing to keep the hole from caving.

A total of 14 soil samples were collected for laboratory analysis from 7 soil borings (KB-1, KB-3, KB-9, KB-14, KB-15, KB-17 and KB-18). Samples were labeled, entered onto a COC record and either delivered to an onsite mobile laboratory for analysis or placed in an iced cooler for shipment to a fixed analytical laboratory via a courier. For samples that were shipped to the fixed laboratory, the COC was placed into a Ziploc™-type bag and taped to the inside lid of the ice chest.

3.6.2 Reconnaissance Groundwater Sampling Methods

Reconnaissance groundwater samples were collected using the Diedrich™ Environmental Soil Probe system by inserting a ¾-inch diameter slotted polyvinyl chloride (PVC) pipe into the boring to the desired sampling depth (Photo 3; Appendix A). The pipe was driven to the desired depth with the drill rig. Once the pipe was set, the outer direct push drive casing or augers were withdrawn from the bottom of the boring leaving the ¾-inch pipe in the borehole. The pipe is allowed to fill with water and the sample is collected with a stainless steel bailer. When the groundwater reconnaissance sampling was completed, the pipe was withdrawn from the borehole and discarded for proper disposal.

Groundwater samples were collected from all 20 boreholes (KB-1 through KB-20). The recovered groundwater was decanted into unpreserved 40-milliliter (ml) volatile organic analysis (VOA) vials and one liter amber bottles. Each VOA vial was capped, inverted, tapped and checked for bubbles. No bubbles were observed at the time the VOA vials were sealed. Samples were labeled, entered onto a COC record and either delivered to an onsite mobile laboratory for analysis or placed in an iced cooler for shipment to a fixed analytical laboratory via a courier. For samples that were shipped to the fixed laboratory, the COC was placed into a Ziploc™-type bag and taped to the inside lid of the ice chest.

3.7 MONITORING WELL INSTALLATION ACTIVITIES

A total of six monitoring wells were installed on the central portion of the property from September 2 through 4, 1997. The locations of these monitoring wells are displayed on Plate 5.

3.7.1 Soil Boring Advancement

The testholes that were converted to monitoring wells were advanced using a truck-mounted drilling rig equipped with 10-inch OD HSAs (Photo 5; Appendix A). All monitoring well testholes were advanced to a maximum depth of 24 feet bgs. Soil samples were not collected from the testholes; however, soil cuttings were visually examined and described by an experienced, Kleinfelder geologist. The soil boring logs (Appendix C) include a description of the geologic character of the materials encountered, classification of materials by the United Soil Classification system (USCS), depth at which changes were observed, thickness of units, depth to water, if encountered, and color of materials encountered.

3.7.2 Well Construction

Upon completion of soil boring advancement, the testholes were converted to Monitoring Wells KMW-1 through KMW-6. Well completion diagrams are included in Appendix C.

The blank casing and screen of the monitoring well were constructed of 4-inch diameter schedule 40 PVC with 15 feet of well screen (slot size 0.010 inch) located from 9 to 24 feet bgs (Photo 6; Appendix A). Lonestar™ No. 2/12 sand was placed in the annulus next to the screen to a depth of eight feet bgs and capped with approximately two feet of bentonite pellets (Photo 7; Appendix A). The remaining six feet of annular space was backfilled with a cement/bentonite grout to complete the sanitary seal (Photo 8; Appendix A). The PVC casing was completed with a locking cap and covered by a flush-mounted steel protective curb box. The protective curb box was grouted into place to limit disturbance to the PVC well pipe (Photo 9; Appendix A).

3.7.3 Well Development

The six new wells were developed on September 4, 1997. The goals of development were to remove fine sediment from the well casing and screen, to stabilize the filter pack to maximize flow between the well and the shallow water-bearing zone, and to repair formation damage routinely created from drilling.

Well development procedures were initiated when the six newly installed wells were opened and ventilated. The wells were allowed to vent for a minimum of 0.5 hours so that water levels could stabilize.

Prior to development, the depth to water was measured in each new well using a calibrated electronic water-level indicator. Water level data were used to calculate well purge volumes. Measurements were recorded on the water level measurement logs to the nearest 0.01 foot and transferred to development and sampling logs. Copies of these forms and calculations are included in Appendix D.

Well development was performed using a surge block and a peristaltic pump. The surge block was forcibly moved up and down to cause formation water to surge in and out of the well screen. The well was then purged using a peristaltic pump with new plastic tubing to remove the suspended sediment. Aquifer parameters (temperature, pH, electrical conductivity, and turbidity) were measured for each well casing volume purged. No detergents, soaps, acids, bleaches, or other additives were used to develop wells.

Development continued until ten casing volumes of water were purged from each well. The turbidity goal of less than 50 Nephelometric Turbidity Units (NTUs) could not be achieved for the six wells (Appendix D).

3.7.4 Well Surveying

The six newly installed monitoring wells were surveyed on September 12, 1997, by Kier and Wright, Inc., a California licensed land surveyor. The elevation of the top of casing (TOC) of each monitoring well was measured at the north side. A notch was made on the top of the well casing immediately adjacent to the survey point. Survey elevations were referenced to mean sea level (MSL). Horizontal locations were established with reference to the California Coordinate System. A copy of the surveyor's results, including references to benchmarks and control points, is included in Appendix C.

3.8 GROUNDWATER MONITORING ACTIVITIES

The six new wells were monitored (water levels and free product thickness measured and water quality samples collected) on September 8, 1997. The goal of sampling was to collect water samples which accurately represent conditions in the vicinity of each well. To this end, the wells were purged until stabilization of aquifer parameters was achieved.

First field instrumentation was calibrated and/or checked prior to opening the monitoring wells. All instruments were successfully calibrated or checked (Appendix D). Temperature probe calibration was checked later and found to be within acceptable tolerances.

3.8.1 Water Level Measurements

The wells were opened and ventilated, for a minimum of 0.5 hours. Prior to purging, the depth to water was measured in each of the wells to the nearest 0.01-foot using a calibrated electronic water-level indicator. Water level data were used to calculate the required purge volumes for sampling. Measurements were recorded on sampling logs and on water-level measurement logs (Appendix D).

No free product was observed and no free product thickness could be measured in any of the wells. A hydrocarbon sheen and odor were observed in well KMW-6 (Appendix D).

3.8.2 Groundwater Sample Collection

Upon completion of the water-level measurements, the monitoring wells were purged with a submersible pump (decontaminated between wells) and using new hose at each location. During purging, aquifer parameters (pH, temperature, and electrical conductivity) were measured for stability for every casing volume. The wells were purged until a minimum of three and a maximum of five casing volumes of water were removed and water levels were allowed to recover to near static before sampling. Groundwater monitoring field notes are contained in Appendix D.

Water from each well was collected using a new disposable PVC bailer. The water samples were collected by inserting the tip of the bottom emptying device on the bailer into the appropriate sample container, either VOA vials or one liter amber bottles. For the purgeable samples, as the contents of the bailer drained into the VOA vial, the tip of the tube was withdrawn so that the tip was always immersed in the uppermost portion of the liquid accumulating in the VOA. The VOA vials were sealed, checked for bubbles, and along with one liter bottles, were labeled, individually wrapped in bubble wrap and placed into Ziploc™ -type bags and into a chilled ice chest. No bubbles were observed in the VOA vials at the time of sample collection.

3.9 DECONTAMINATION PROCEDURES

Prior to the initiation of any investigative activity (surface sample collection, soil boring advancement, subsurface soil sample collection, monitoring well installations, water level and free product thickness measurements, groundwater sampling) and between sampling locations, all equipment was thoroughly decontaminated. Prior to advancing each soil boring, all downhole boring and sampling equipment was decontaminated by steam cleaning (Photo 10; Appendix A). All sampling equipment was decontaminated prior to collection of each sample by scrubbing with an Alconox™ solution, followed by a rinsing with deionized water.

3.10 INVESTIGATION-DERIVED WASTE (IDW) HANDLING PROCEDURES

Investigation-derived wastes (soil boring cuttings, monitoring well development and purge water and decontamination rinsate fluids) were containerized on-site in labeled, United States Department of Transportation (DOT)-approved 55-gallon drums. IDW and drums are currently being stored on-site. There are currently no plans for disposal of the IDW and drums.

Drums were inspected prior to use for physical integrity and condition. Each drum was labeled to identify the waste source location, physical contents, date collected and generator's name. A total of 22 drums (13 containing solid and 9 containing liquid) of IDW were generated during this RI field activities.

3.11 SITE RESTORATION

Following completion of sampling activities, all soil borings not converted to monitoring wells were abandoned by backfilling the total depth of the boring with a cement/bentonite grout. The grout was emplaced by gravity by slowing pouring the slurry directly into the borehole.

The work area was left in a presentable and workable condition so that normal site activities and future potential construction could be accommodated. The work area was returned as nearly as practicable to original conditions.

4.0 SITE HYDROGEOLOGY

4.1 STRATIGRAPHY

Soil boring during this and previous investigations provided geologic data for characterization of the shallow stratigraphy beneath the subject property. The soil boring logs completed for this investigation are contained in Appendix C.

Subsurface materials encountered during soil boring advancement included stiff to very stiff brownish to very dark grayish brown silty clays and silty sands. The predominant material encountered was the silty clays.

The sandy materials were not encountered in every soil boring and appear to be discontinuous across the site, probably representing alluvial channel deposits. For example, in soil boring KB-1 a silty sand was encountered at a depth of approximately 24.5 feet bgs, whereas in the testholes for monitoring wells KMW-3 and KMW-4 the sand is first encountered at a depth of approximately one foot and ranges in thickness from 1 to 23 feet, respectively.

4.2 GROUNDWATER CONDITIONS AND FLOW

Shallow subsurface water was encountered during soil boring advancement at depths ranging from between approximately 13 and 23 feet bgs (Appendix C). When the testholes for the monitoring wells were advanced, groundwater was encountered at a fairly consistent depth of approximately 21 feet bgs and stabilized at depths ranging from between 12 and 14.5 feet bgs (Appendix C). Groundwater conditions at the site appear to range from unconfined to confined.

As part of the groundwater monitoring event that took place on September 8, 1997, water levels were measured in the six new monitoring wells. Water levels were measured at depths ranging from 12.3 to 14.3 feet bgs (Table 1 and Appendix D). These water level measurements were used to calculate the groundwater contour map depicted on Plate 6. On September 8, 1997, groundwater flow was to the northwest with a hydraulic gradient of 0.008 feet per foot (ft/ft).

5.0 ANALYTICAL RESULTS

5.1 INTRODUCTION

Wipe samples were analyzed for PCBs using United States Environmental Protection Agency (EPA) Method 8080. Surface soil samples were composited and analyzed for nitrates as nitrogen (EPA Method 352.1) and organochlorine pesticides (EPA Method 8080).

Subsurface soil and groundwater samples collected during this RI were analyzed for at least one of the following constituents: total petroleum hydrocarbons as gasoline (TPH-d); total petroleum hydrocarbons as diesel (TPH-d); the aromatic hydrocarbons benzene, toluene, ethylbenzene and total xylenes (BTEX); methyl tertiary butyl ether (MTBE); and polynuclear aromatic hydrocarbon (PAH) compounds. TPH-g and TPH-d were quantified using the California Department of Health Services (DHS)/LUFT Field Manual Method (modified EPA Method 8015). EPA Method 8020 was used to analyze for BTEX and MTBE. PAH compounds were identified and quantified using EPA Method 8270.

Wipe and surface soil samples were analyzed at a fixed analytical laboratory (McCampbell Analytical, Inc.). A mobile analytical laboratory (On-site Environmental Laboratories, Inc.) was used to analyze the soil and reconnaissance groundwater samples for TPH-g, TPH-d, BTEX and MTBE. Soil and reconnaissance groundwater samples were analyzed for PAH compounds at a fixed analytical laboratory (American Environmental Network under subcontract with McCampbell Analytical, Inc.). Groundwater monitoring well samples parameters were quantified at a fixed analytical laboratory (McCampbell Analytical, Inc. or American Environmental Network). All analyses were performed at a laboratory certified by the Cal/EPA, DHS Environmental Laboratory Accreditation Program for the specific analyses performed.

A summary of the subsurface soil samples collected and the analyses performed on them is presented in Table 2. Tables 3 and 4 summarize the samples collected and analyses performed on reconnaissance and monitoring well samples, respectively. Appendix E contains COC records and certified analytical laboratory reports.

5.2 WIPE SAMPLE RESULTS

A total of two samples and one trip blank were analyzed for PCBs. PCBs were not detected in any of the samples or the trip blank.

5.3 SURFACE SOIL SAMPLE RESULTS

Six surface soil samples were collected, composited into one sample by the laboratory and analyzed for nitrate and organochlorine pesticides.

5.3.1 Nitrate

Nitrate was detected at a concentration of 17 mg/Kg. Due to the fact that six samples were composited into the sample analyzed, there are three potential scenarios that could explain the result: (1) all of the individual samples collected contained 17 mg/Kg nitrate; (2) nitrate is below the detection limit in five of the samples collected and at a concentration of up to 102 mg/Kg (6 times 17 mg/Kg) in one sample; and (3) the samples contain varying concentrations of nitrate but the mean concentration is 17 mg/Kg. In any case, the level of nitrate detected is not considered to be of potential impact to the property.

5.3.2 Organochlorine Pesticides

Organochlorine pesticides were not detected in the composite sample analyzed.

5.4 SUBSURFACE SOIL SAMPLE RESULTS

A total of 14 samples were collected and analyzed for TPH-g, TPH-d and BTEX. MTBE was quantified in three samples. A total of 7 samples were analyzed for PAH compounds. Subsurface soil sample analytical results are summarized on Table 2.

5.4.1 Total Petroleum Hydrocarbons as Gasoline

TPH-g was detected in only 3 of the 14 samples analyzed. TPH-g was detected at concentrations in excess of 10 mg/Kg, a commonly applied screening level for TPH-g, in all three samples in which it was detected (Table 2).

5.4.2 Total Petroleum Hydrocarbons as Diesel

TPH-d was not detected in any of the 14 samples analyzed (Table 2).

5.4.3 Aromatic Hydrocarbons

BTEX was detected in only three samples; the same three samples in which TPH-g was detected. The highest relative concentrations of BTEX were detected in the sample (KB-1 at 15 ft) that contained the lowest detectable concentrations of TPH-g and, conversely, the lowest relative concentrations of BTEX were detected in the samples (KB-18 at 15 and 20 ft) that contained the highest concentrations of TPH-g (Table 2).

5.4.4 Methyl Tertiary-Butyl Ether

MTBE was detected in only one of the three samples for which it was analyzed at a concentration of 0.065 mg/Kg (KB-1 at 15 feet).

5.4.5 Polynuclear Aromatic Hydrocarbon s

PAHs were not detected in any of the seven samples analyzed.

5.5 RECONNAISSANCE GROUNDWATER SAMPLE RESULTS

A total of 20 samples were collected and analyzed for TPH-g, TPH-d and BTEX. MTBE was quantified in six samples. A total of three samples were analyzed for PAH compounds. Reconnaissance groundwater sample analytical results are summarized on Table 3.

5.5.1 Total Petroleum Hydrocarbons as Gasoline

TPH-g was detected in 10 of the 20 samples analyzed (Table 3). TPH-g was detected at concentrations ranging from 91 (KB-4) to 38,000 µg/L (KB-13). Plate 7 shows the estimated distribution of TPH-g.

5.5.2 Total Petroleum Hydrocarbons as Diesel

TPH-d was detected in 15 of the 20 samples analyzed (Table 3). TPH-d was detected at concentrations ranging from 74 (KB-4) to 13,000 µg/L (KB-13). Plate 8 shows the estimated distribution of TPH-d.

5.5.3 Aromatic Hydrocarbons

BTEX was detected in 8 of the 20 samples and ranged in concentration from 0.63 (KB-4) to 4,200 µg/L (KB-13). Benzene was detected at or in excess of its MCL (1 µg/L) in five samples, toluene was detected in at or in excess of its MCL (150 µg/L) in two samples, ethylbenzene was detected at or in excess of its MCL (700 µg/L) in one sample and total xylenes were detected in excess of its MCL (1,750 µg/L) in one sample (Table 3). Plate 9 shows the estimated distribution of BTEX.

5.5.4 Methyl Tertiary-Butyl Ether

MTBE was detected in all four samples for which it was analyzed at concentrations ranging from 5.1 (KB-9) to 27 µg/L (KB-10). There is no MCL for MTBE and concentrations detected were below the proposed cleanup level for MTBE (35 µg/L) (Cal/EPA - State Water Resources Control Board, 1996).

5.5.5 Polynuclear Aromatic Hydrocarbons

PAHs were not detected in any of the samples analyzed.

5.6 GROUNDWATER MONITORING WELL SAMPLE RESULTS

Groundwater samples were collected from each of the six newly installed monitoring wells and analyzed for TPH-g, TPH-d, BTEX and MTBE. Groundwater monitoring well sample analytical results are summarized on Table 4. Plate 10 shows the spatial distribution of the analytical results.

5.6.1 Total Petroleum Hydrocarbons as Gasoline

TPH-g was detected only in the sample from well KMW-6 at a concentration of 13,000 µg/L. Unmodified or weakly modified gasoline was believed to be a significant portion of the sample (Table 4, Appendix E).

5.6.2 Total Petroleum Hydrocarbons as Diesel

TPH-d was detected only in the sample from well KMW-6 at a concentration of 3,200 µg/L. However, the laboratory interpreted the chromatogram as containing gasoline range compounds (Table 4, Appendix E).

5.6.3 Aromatic Hydrocarbons

BTEX was detected only in the sample from well KMW-6 at a concentration of 1,314 µg/L Benzene, detected at a concentration of 250 µg/L, was the only aromatic hydrocarbon detected at a concentration in excess of its MCL.

5.6.4 Methyl Tertiary-Butyl Ether

MTBE was not detected in any of the samples collected. However, the reporting limit for sample KMW-6 had to be raised to < 150 µg/L due to the high concentration of TPH-g detected. The reporting limit is greater than the proposed cleanup level for MTBE (35 µg/L) (Cal/EPA - State Water Resources Control Board, 1996).

5.6.5 Polynuclear Aromatic Hydrocarbons

Naphthalene was the only PAH detected in the sample from well KMW-6 at a concentration of 140 µg/L. The other wells did not contain detectable concentrations of PAHs.

5.7 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Several types of field QA/QC samples were collected and analyzed: duplicate samples, an equipment blank and a trip blank. Field QA/QC sample results are summarized on Tables 3 and 4 and in are contained in Appendix E.

5.7.1 Duplicate Samples

One duplicate reconnaissance groundwater sample (KB-10D) was collected from location KB-10 on August 29, 1997. One duplicate groundwater monitoring well sample was collected from KMW-5 (KMW-5D) on September 8, 1997.

Comparability of the data is assessed by calculating "relative percent difference" (RPD). The RPD for the reconnaissance groundwater sample ranged from approximately 20 (MTBE) to 58 percent (total xylenes) for detected analytes. The RPD for the groundwater monitoring well sample (KMW-5 and KMW-5D) was not calculable because both sets of samples did not detect analytes above the laboratory reporting limits. The RPDs calculated are not considered to be significant.

5.7.2 Equipment Blank

One equipment blank was collected during the September 1997 groundwater monitoring event. TPH-d, TPH-g, BTEX and MTBE were not detected above the reporting limits in this blank.

5.7.3 Trip Blank

One trip blank was submitted during the September 1997 groundwater monitoring event. TPH-d, TPH-g, BTEX and MTBE were not detected above the reporting limits in this blank.

10.0 REFERENCES

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6.0 RISK-BASED CORRECTIVE ACTION TIER 2 EVALUATION

6.1 INTRODUCTION

This section presents the methods and results of the Risk-Based Corrective Action (RBCA) Tier 2 evaluation for the Friesman Ranch Property. The purpose of this evaluation is to assist in the development of a RAP for soil and groundwater impacted by petroleum hydrocarbons at the site.

6.2 EVALUATION OF SOIL AND GROUNDWATER DATA

This section contains a summary of the site investigation data that were used to perform the RBCA Tier 2 evaluation. Analytical data for specific soil borings and groundwater monitoring wells are presented in this section. In performing the RBCA Tier 2 evaluation, the analytical data collected during June (Kleinfelder 1997b), August and September 1997 were assumed to be representative of current site conditions.

6.2.1 Soil Data

The soil investigation indicates that there is a limited extent of petroleum hydrocarbons, BTEX, MTBE and lead in the soil at the site. Soil contaminants were not detected at depths between 0 to 10 feet bgs except for two samples, KSH-4 and KSH-5 between 2 and 3 feet bgs. TPH-d was detected in KSH-4 and KSH-5 (160 mg/Kg and 5.2 mg/Kg respectively) and toluene was detected in KSH-5 (0.016 mg/Kg). With the exception of soil samples KSH-4 and KSH-5, the detected soil impact appears to be limited to 15 to 20 feet bgs, with the impact concentrating around the capillary fringe at 19 feet bgs. Benzene and MTBE were detected in one sample, KB-1 at 15 feet bgs at concentrations of 0.056 mg/Kg and 0.065 mg/Kg respectively. The maximum concentration of TPH-g was 4,000 mg/Kg in KB-18 at 20 feet bgs and the maximum concentration of TPH-d was 100 mg/Kg in KB-1 at 19 feet bgs. The maximum concentrations for toluene, ethylbenzene and total xylenes (0.52 mg/Kg, 1.6 mg/Kg, and 1.2 mg/Kg, respectively) were detected in KB-1 at 19 feet bgs. A composite soil sample from KSF-6 through KSF-9 was submitted for lead analysis. Lead was detected at 73 mg/Kg (Kleinfelder 1997b).

6.2.2 Water Data

The groundwater investigation indicates that the petroleum hydrocarbon plume appears to be concentrated in the vicinity of soil borings KB-11 and KB-13. The maximum petroleum hydrocarbon concentrations for analyzed constituents were detected in KB-13 except for TPH-d which was detected at 160,000 µg/L in KB-2. The concentration of TPH-d constitutes free-product in the groundwater. Therefore, the petroleum hydrocarbon source location for the RBCA Tier 2 model, described in section 6.5, was assumed to be in the vicinity of KB-13. One

polynuclear aromatic hydrocarbon, naphthalene, was detected at a concentration of 140 µg/L in the sample from KMW-6.

Analytical data indicates that petroleum hydrocarbon groundwater plume has not migrated offsite. The proximity of the plume to Arroyo De Las Positas suggests the potential for surface water impacts. The creek bank did not show any evidence of hydrocarbons seeping into the arroyo. However, it is recommended that the arroyo be monitored for potential hydrocarbon impacts in the future.

6.2.3 Chemicals of Potential Concern

The following chemicals were identified as chemicals of potential concern in soil and groundwater, based on the information in Sections 6.2.1 and 6.2.2:

- TPH-g
- Benzene
- Toluene
- MTBE
- Lead
- TPH-d
- Ethylbenzene
- Total xylenes
- Naphthalene

Because TPH-g and TPH-d are mixtures of many different chemicals whose identity and relative concentrations are unknown, they cannot be evaluated in the RBCA Tier 2 analysis. The concentration of total lead in the composite soil sample collected from the site is below the PRG for residential soils (130 mg/Kg) established by the EPA Region IX (California-modified) and the Total Threshold Limit Concentration (TTLC) of 1,000 mg/Kg [Title 22, California Code of Regulations (CCR), Section 66261.24]. Therefore, benzene, toluene, ethylbenzene, total xylenes, MTBE, and naphthalene were selected as the chemicals of concern in this evaluation. Of the six chemicals selected as chemicals of concern, benzene is generally considered to be of greatest concern based on its classification as a known human carcinogen by the State of California and the EPA.

6.3 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to identify exposure pathways for the chemicals of concern that are present at Friesman Ranch. Tier 2 site-specific target levels (SSTLs) are based on the exposure pathways identified for the groundwater contaminants at the Friesman Ranch properties; therefore, an exposure assessment is a necessary step in the RBCA process. Six exposure pathways were identified for soil and groundwater contaminants at the subject site:

- Release of BTEX, MTBE and naphthalene vapors from groundwater to soil gas and subsequently to ambient (outdoor) air;
- Release of BTEX, MTBE and naphthalene vapors from groundwater to soil gas and subsequently to enclosed building space;

- Ingestion of BTEX, MTBE and naphthalene from impacted groundwater at on-site residences;
- Release of BTEX and MTBE vapors from soil to ambient air;
- Release of BTEX and MTBE vapors from soil to enclosed building space; and
- Migration of BTEX and MTBE from soil to groundwater and subsequent ingestion by on-site residents.

Exposure pathways may be defined as the means by which people (receptors) are exposed to chemicals in the environment (EPA, 1989). The following factors must be present for complete exposure pathways to occur:

- Source of contamination;
- Release and/or transport of chemicals to the environmental media (e.g. soil, groundwater , or air);
- Potentially exposed population (receptor);
- Exposure point (i.e., contact point); and
- Intake of chemicals by receptors.

If one of these factors is not present, then exposures are unlikely to occur. For example, direct contact with soil contaminants at the subject site is not likely due to the depth at which the contaminants have been detected. Therefore, the exposure point for direct contact of contaminants is not present. Potential exposure pathways for the site are generally presented in a diagram, defined as the conceptual site model. The conceptual site model for the Friesman Ranch properties is shown on Plate 11. Specific components of this model are described in the following sections.

6.3.1 Primary and Secondary Sources of Contamination

The primary source of soil contamination at Friesman Ranch appears and is assumed to be the former heating oil AST which was housed in the metal shed located to the north of the dairy building. It was assumed these contaminants were accidentally released to soil and subsequently migrated downwards through the vadose (unsaturated) zone to groundwater. Soil and groundwater are considered to be secondary sources of contamination.

6.3.2 Potential Release and Transport Mechanisms

Release of chemicals from one environmental medium to another depends on the characteristics of the chemical as well as the characteristics of the environmental media. The soil and groundwater contaminants at Friesman Ranch are volatile organic compounds (VOCs) and PAHs. The chemical characteristics for these constituents are listed in Table 5.

The fate of a chemical after it is released to the environment can be one or a combination of the following:

- Transportation, such as leaching from soil to groundwater;
- Physical transformation, such as volatilization;
- Chemical transformation, such as oxidation or reduction;
- Biological transformation, such as biodegradation (the reduction of a chemical's concentration through microbial action); and
- Accumulation in one or more media.

The chemical and physical properties of the constituent determine its environmental fate and its environmental transport mechanism(s).

VOCs, such as BTEX, are subject to rapid volatilization in ambient air and above ground environments. When found in subsurface environments, these constituents are usually mobile in soil due to their high water solubilities and their relatively low to moderate soil sorption capacities. Therefore, the potential for these constituents to leach to groundwater is likely. VOCs are biodegradable and therefore, are not expected to accumulate.

Much like the VOCs, PAH compounds, such as naphthalene, have vapor pressures high enough to volatilize. PAHs are less mobile in the subsurface environments due to their moderate water solubilities and their soil sorption potential, but only the smaller polynuclear aromatics such as naphthalene and methylnaphthalene maintain the potential for substantial movement and the ability to leach to groundwater. PAHs can be biodegradable and are not likely to bioconcentrate.

Based on the above characteristics for the chemicals of concern, the environmental transport mechanisms for the subject site are:

- Volatilization from subsurface soil and groundwater to ambient air and enclosed space;
- Migration of subsurface contaminants to groundwater; and
- Downgradient groundwater migration.

Direct contact with chemicals of concern in soil is not likely due to the depth at which the contaminants have been detected.

6.3.3 Potential Exposure Routes

Exposure routes are the means by which chemical intakes may occur in human receptors. Exposure routes depend on which environmental media are contaminated and how humans may be exposed to contaminated media. The potential routes of exposure for Friesman Ranch are:

- Inhalation of BTEX and MTBE vapors from soil to ambient and enclosed air space;
- Inhalation of BTEX, MTBE and naphthalene from groundwater to ambient and enclosed air space; and
- Ingestion of BTEX, MTBE and naphthalene from impacted groundwater.

6.3.4 Potentially Exposed Populations and Exposure Point Locations

Potentially exposed populations are defined as people who may be exposed to soil and groundwater contaminants at Friesman Ranch, as a consequence of their release from the site. The potentially exposed current and future populations at the site are the current residents and the future employees and residents of any entity working/residing at the site.

Exposure point locations are the locations where current or future potentially exposed populations exist. The current exposure point locations are the six on-site residences and future exposure point locations are any proposed facilities/residences.

6.4 INITIAL SITE CLASSIFICATION

The purpose of a RBCA evaluation is to develop site-specific risk-based cleanup goals for soil and groundwater contaminants. The RBCA process is a tiered approach, where each successive tier replaces the assumption of the previous tier with site-specific information.

Before implementation of the tier analysis can be conducted, a site assessment and site classification are required. The contaminant source, surrounding environmental impacts, potential or current human and/or environmental receptors, and all significant transport pathways must be identified during the site assessment. Once this has been achieved, the site is categorized into one of four classifications, as follows (ASTM, 1995):

- Classification 1 Immediate threat to human health and the environment;
- Classification 2 Short term (0-2 years) threat to human health and the environment;
- Classification 3 Long term threat (>2 years) to human health and the environment;
- Classification 4 No reasonable potential threat.

Using the criteria recommended by ASTM (ASTM, 1995), Friesman Ranch is considered to be a Classification 2 site. Site-specific factors that were considered for this classification are summarized in Table 6. It was assumed that the factors presented in Table 6 would result in a potential short-term threat (i.e., 0-2 years) without implementation of remedial action.

6.5 TIER 1 SCREENING EVALUATION

In the first Tier of the RBCA process, Risk-Based Screening Levels (RBSLs) are calculated for chemicals of concern at the site. The RBSLs are generic chemical concentrations that are protective of human health and the environment. The RBSLs are based on conservative, non-site-specific parameters for exposure pathways and media physical constants, and the assumption that both the point of compliance (POC) and the point of exposure (POE) are situated on or in close proximity to the contaminant source. A POC is the area of contaminated source media that

must not exceed RBCA screening levels, whereas the POE is the area where receptors may be exposed to the contaminants of concern at the site.

The maximum detected concentrations of the chemicals of concern were compared with the ASTM RBCA Tier 1 RBSLs. The soil and groundwater Tier 1 RBSLs are based on a cancer risk level of $1x10^{-6}$ (one in one-million) and a chronic hazard quotient of 1.

6.5.1 Tier 2 Screening - Soil

The maximum soil concentrations were compared to their respective RBSLs for the on-site soil exposure pathways: inhalation of soil volatile emissions in ambient air and enclosed building space, and migration of contaminants to groundwater. Based on the Tier 1 RBSLs, benzene exceeded its respective RBSL, whereas the remaining chemicals of concern did not. Therefore, the soil concentration levels of ethylbenzene, toluene, total xylenes, and MTBE do not represent a significant risk to human health and the environment, and were excluded from further evaluation. Benzene in soil did not pass the Tier 1 screening and therefore was evaluated in the Tier 2 analysis.

6.5.2 Tier 2 Screening - Groundwater

Maximum groundwater concentrations were compared to their associated exposure pathway RBSLs: ingestion of impacted groundwater, inhalation of groundwater volatile emissions in ambient and indoor air. Based on the Tier 1 comparisons, the six chemicals of concern evaluated exceeded the Tier 1 screening goals, therefore a Tier 2 analysis of groundwater contaminants was warranted.

6.6 DEVELOPMENT OF TIER 2 SITE-SPECIFIC TARGET LEVELS

The Tier 2 evaluation differs from the Tier 1 screening in three significant ways:

- Site-specific data are used to calculate SSTLs;
- Human exposure can be assumed to occur at alternate POCs outside of the site; and
- Natural attenuation can be accounted for during lateral (groundwater) transport.

The RBCA Tier 2 spreadsheet system developed by Groundwater Services, Inc. (GSI) was used to calculate SSTLs for soil and groundwater contaminants at Friesman Ranch. The GSI spreadsheet system calculates SSTLs based on site-specific exposure scenarios, then compares current or predicted future chemical concentrations to the SSTLs. The methods and results of the GSI spreadsheet model are described in this section.

6.6.1 Overview of the RBCA Tier 2 Model

The RBCA Tier 2 spreadsheet system used in this evaluation closely follows the RBCA Tier 2 methods recommended by ASTM (ASTM, 1995). The RBCA Tier 2 model calculates SSTLs for chemicals of concern and evaluates whether chemical of concern concentrations on-site or

off-site exceed the SSTLs. There are two general components of the RBCA Tier 2 model, a health risk assessment, and a chemical fate and transport component. The equations used in the risk assessment component of the model are based on methods recommended by the EPA for conducting human health risk assessments. Site-specific assumptions and/or exposure parameters pertaining to the risk assessment component of the RBCA Tier 2 include the following:

- Receptors were assumed to be on-site residents who could potentially be exposed to soil and groundwater contaminants by inhalation of vapors released from groundwater and soil, and ingestion of impacted groundwater;
- It was assumed that residents could potentially be exposed to soil and groundwater contaminants for 16 hours per day, 350 days per year, for 30 years;
- It was assumed that on-site groundwater would be used for drinking water purposes by current and future residents;
- A theoretical excess cancer risk probability of 10^{-6} (1 in 1,000,000) was used to develop SSTLs for carcinogens (cancer-causing agents) such as benzene. California cancer potency factors, which are much more conservative, were used instead of EPA cancer potency factors;
- A hazard quotient of 1.0 was used to develop the SSTLs for each non-carcinogen (e.g., toluene, ethylbenzene, and xylenes); and
- The California MCLs for chemicals of concern that impact groundwater were used to calculate SSTLs for ingestion of groundwater.

Kleinfelder also calculated alternate point of exposure SSTLs which included the following assumptions:

- The on-site domestic groundwater well would be destroyed and not used for drinking water purposes; and .
- The nearest downgradient well is a municipal drinking water well which draws from the same aquifer as the current on-site domestic well. This municipal well is approximately 1,600 feet downgradient of the site.

The second general component of the RBCA Tier 2 model uses chemical fate and transport equations to estimate the release of chemicals from contaminated media to other environmental media. For example, the RBCA Tier 2 model contains equations for estimating the release of chemicals from groundwater to soil or soil gas and subsequently, to air. The chemical fate and transport equations are based on site-specific exposure scenarios entered by the model user. The RBCA Tier 2 model refers to the fate and transport equations as cross-media factors. The following cross-media transfer factors were used in this evaluation:

- Soil leaching factor;
- Subsurface soil volatilization factor;

- Subsurface soil to enclosed space volatilization factor;
- Groundwater volatilization factor;
- Groundwater to enclosed space volatilization factor;
- Domenico lateral groundwater dilution attenuation factor; and
- Lateral air dispersion factor.

Key assumptions and limitations of these cross-media factors are listed in Table 7. Equations for these factors are provided in Appendix F.

6.6.2 Summary of Modeling Scenario

There are three calculation options for estimating SSTLs in the RBCA Tier 2 model. These options are as follows:

- Option 1: Calculate SSTLs for individual chemicals of concern using site-specific parameters in the Tier 1 RBSL equations, assuming exposure point locations occur within the source zone on-site;
- Option 2: Calculate source zone SSTLs required to prevent exceedance of individual chemicals of concern risk limits at site-specific exposure points; and
- Option 3: Calculate source zone SSTLs required to prevent exceedance of both individual and cumulative chemicals of concern risk limits at site-specific exposure points (this option requires a baseline risk assessment to be conducted prior to calculation of SSTLs).

Option 2 was selected for this Tier 2 RBCA evaluation, because it most closely fit the site assumptions and the site conditions.

6.6.3 Results of the Modeling Run

The results of the RBCA Tier 2 modeling run for the Friesman Ranch properties are provided in Table 8 and Appendix G. The lowest SSTL calculated for benzene in soil was for the potential exposure pathway of soil contaminants leaching to on-site groundwater. The lowest SSTL for benzene was volatilization from groundwater to indoor air, and the lowest SSTLs for toluene, ethylbenzene, xylenes, naphthalene and MTBE were those for ingestion of groundwater contaminants by residents of Friesman Ranch and by potential future downgradient residents.

should use soil conc. above and GWE

6.6.4 Comparison of Site Data to SSTLs

Concentrations of soil and groundwater contaminants detected at Friesman Ranch are compared to the calculated RBCA Tier 2 SSTLs in this section. The SSTL estimated for the potential leaching of benzene from soil to groundwater was used for the soil comparison. The calculated SSTL for benzene in soil at the site is 0.0038 mg/Kg. One soil boring exceeds the soil SSTL; KB-1 at 15 feet bgs with a soil concentration of 0.056 mg/Kg.

Two sets of groundwater SSTLs were considered: one that considers the shallow groundwater underlying the site to be a "potential" source of drinking water; and that does not consider the shallow groundwater to be a potential drinking water source, but considers receptor exposure by volatilization of chemicals of concern from groundwater to indoor air.

If the shallow groundwater is considered a potential drinking water source, the SSTLs for ingestion of on-site impacted groundwater were used for the groundwater comparison. The calculated SSTL for benzene volatilization from groundwater to indoor air was lower than the California MCL for benzene in groundwater. This SSTL was not used in the comparison because it was lower than the regulatory MCL for groundwater. Therefore, the SSTL used for the groundwater comparison of benzene in groundwater was the California MCL. Because the calculated SSTLs for ingestion of on-site groundwater for ethylbenzene, toluene and total xylenes were in excess of their MCLs, the respective MCLs for these compounds are the SSTLs. There are currently no MCLs for naphthalene or MTBE; therefore, the calculated SSTL for groundwater ingestion was used for comparison of these constituents.

If the shallow groundwater is not considered a potential drinking water source, the SSTLs for ingestion of on-site impacted groundwater were used for the groundwater comparison (not MCLs). The calculated SSTL for benzene volatilization from groundwater to indoor air was lower than the California MCL for benzene in groundwater. This SSTL was not used in the comparison because it was lower than the regulatory MCL for groundwater. Therefore, the SSTL used for the groundwater comparison of benzene in groundwater was the California MCL. We are assuming institutional controls can be placed on the shallow groundwater and it will not be considered a potential drinking water source. The calculated SSTLs for on-site ingestion of groundwater containing ethylbenzene and toluene were used for comparison since they are lower than the exposure from volatilization from groundwater to indoor air. The calculated SSTL for volatilization to indoor air for total xylenes was used for comparison purposes. There are currently no MCLs for naphthalene or MTBE; therefore, the calculated SSTL for groundwater ingestion was used for comparison of these constituents.

The table below lists the borings and monitoring wells that exceeded the SSTLs for each constituent.

Contaminant	SSTL[1] µg/L	SSTL [2] µg/L	Borings	Monitoring Wells
Benzene	1.0	1.0	KB-2, KB-10, KB-10D, KB-11, KB-13, KB-2W1	KMW-6
Ethylbenzene	700	3,700	KB-13 [1], None [2]	None
Toluene	150	7,300	None	None
Total Xylenes	1,750	67,000	KB-13 [1], None [2]	None
Naphthalene	150	150	None	None
MTBE	180	180	None	None

(1) Shallow Groundwater Considered a "Potential" Drinking Water Source; MCLs Apply

(2) Shallow Groundwater Not Considered a "Potential" Drinking Water Source; Considers Receptor Exposure by Volatilization of Chemicals of Concern from Groundwater to Indoor Air

If shallow groundwater is considered a potential drinking water source, toluene, naphthalene and MTBE did not exceed their SSTLs in any of the borings or monitoring wells analyzed. Ethylbenzene and total xylenes exceeded their SSTLs in one groundwater reconnaissance sample (KB-13) with concentrations of 890 µg/L and 4,200 µg/L, respectively. Benzene exceeded its groundwater SSTL in six borings and one monitoring well with concentrations ranging from 7.3 µg/L to 390 µg/L. The maximum groundwater concentration of benzene was detected in boring KB-13.

If shallow groundwater is not considered a potential drinking water source, ethylbenzene, toluene, total xylenes, naphthalene and MTBE did not exceed their SSTLs in any of the borings or monitoring wells analyzed. Benzene exceeded its groundwater SSTL in six borings and one monitoring well with concentrations ranging from 7.3 µg/L to 390 µg/L. The maximum groundwater concentration of benzene was detected in boring KB-13.

When the current groundwater concentrations were compared with the alternate point of exposure concentrations, benzene exceeded the calculated SSTL of 52 µg/L in borings KB-11 and KB-13 and monitoring well KMW-6. The remaining five constituents did not exceed their calculated SSTLs for the alternate point of exposure.

6.7 CONCLUSIONS

The SSTLs developed for Friesman Ranch are estimated to be protective of human health and the environment based on the health risk assessment and chemical fate and transport components applied in the Tier 2 evaluation. The evaluation was based on conservative assumptions for exposure and transport of the chemicals of concern such as uniform chemical of concern concentrations, residential exposure to contaminants for 30 years, no biodegradation or other loss mechanism occurring in groundwater or in the vapor phase, and soil vapor concentrations reaching immediate equilibrium with the groundwater source. Therefore, although the Tier 2 calculated SSTLs are based on available site-specific information, the calculated SSTLs may be highly conservative for the site. The calculated SSTLs should be viewed as a conservative reference point for site cleanup. Therefore, if contaminant concentrations exceed the calculated SSTLs, further investigation, fate and transport modeling or remedial action may be warranted. If the contaminant concentrations do not exceed the calculated SSTLs then further evaluation of those constituents is not necessary.

The maximum concentration of benzene (0.056 mg/Kg) in soil exceeds its calculated SSTL by approximately 15 times (Table 8 and Appendix G). Benzene was detected in only one soil sample at 15 feet below ground surface in soil boring KB-1.

Considering shallow groundwater as a potential drinking water source, the maximum detected groundwater concentrations of benzene (390 µg/L), ethylbenzene (890 µg/L) and xylenes (4,200 µg/L) exceed their calculated on-site SSTLs by approximately 390, 1.3, and 2.4 times respectively. Toluene, naphthalene and MTBE did not exceed their calculated on-site SSTLs. The maximum detected groundwater benzene concentration exceeded the alternate point of exposure SSTL by approximately 7.5 times.

Not considering shallow groundwater as a potential drinking water source, ethylbenzene, toluene, total xylenes, naphthalene and MTBE did not exceed their calculated on-site SSTLs. The maximum detected groundwater benzene concentration exceeded the alternate point of exposure SSTL by approximately 7.5 times.

Kleinfelder recommends the following based on the conclusions of this RBCA Tier 2 evaluation:

- The current concentrations of benzene and TPH-d in groundwater are likely to pose an adverse human health effect, especially in the vicinity of borings KB-2, KB-11 and KB-13 and monitoring well KMW-6. Although TPH-d was not analyzed in the RBCA evaluation, current groundwater concentrations are indicative of free product and therefore, are likely to pose an adverse human health effect if on-site, impacted groundwater is used for drinking water purposes. In addition, current benzene concentrations in groundwater exceed the California MCL for benzene which is set at a level that is representative of no adverse human health risks. Therefore, current concentrations of both TPH-d and benzene would require remediation to be protective of human health and the environment.

FOR TPH, we can use naphthalene conc. to determine health risk.

Also, need to do ecological risk due to TPHd, TPHd, BTEX, naphthalene.

7.0 REMEDIAL ACTION PLAN

7.1 INTRODUCTION

The objective of the remedial action plan is to first define the portion of the site that requires remediation, then evaluate and recommend a remedial option that is technically and economically appropriate for the site. A proposed design is presented for the selected option including an estimate of the operation time required for treatment and an approximate total cost of implementation.

7.2 EXTENT OF CONTAMINATION REQUIRING TREATMENT

The extent of contamination requiring treatment assumed for the RAP was that area above the Tier 2 SSTLs developed in the risk evaluation presented in Section 6.

The magnitude and extent of contamination assumed for the RAP was based on the available information presented in Section 5. The extent of contamination north of borings KB-13, KB-11, and KB-10 is unclear and were not included in the evaluation.

7.3 TREATABILITY OF CONTAMINANTS

The chemicals of concern (benzene, toluene, ethylbenzene, total xylenes, MTBE and naphthalene) detected at the site are volatile (except TPH-d) and degradable. These characteristics create effective avenues for treatment. The more volatile components of the TPH-g are readily treatable by vapor extraction and the more soluble components are treatable by vapor/groundwater extraction or air sparging technologies. Treatment of the contaminants at Friesman Ranch by extraction technologies (i.e., dual phase extraction) would be effective but may be expensive to implement over the entire plume. Though to varying degrees, all hydrocarbons, including those at Friesman Ranch, are degradable., treatment of the contaminants at the site by biodegradation technologies would be effective but may require more operation time and maintenance than extraction technologies.

7.4 PROPOSED REMEDIATION OBJECTIVES

Target clean-up goals are, in general, the lowest levels for all contaminants that are technically and economically feasible. Regulatory based cleanup goals for TPH and BTEX in groundwater are often set at their MCL. For this site, SSTLs have been derived for use as cleanup goals for

soil and groundwater. The approach and feasibility of achieving these goals are discussed later in this section.

7.5 DESCRIPTION OF REMEDIATION ALTERNATIVES

Soil, smear zone (capillary fringe) and groundwater remediation alternatives to be screened for the site are identified and described below. These alternatives were formulated for consideration based on their recognized applicability on similar projects though some conditions may differ from those at the Friesman Ranch Property. For alternatives involving treatment of water or gases, more than one treatment option may be considered. Treatment options are addressed in a succeeding section.

(1) **No Further Action at the Site** - This option involves foregoing active remediation of the site with the assumption that present concentrations are not a threat to human health or the environment and will attenuate by passive bioremediation with time. Oftentimes this option involves monitoring the groundwater for an extended period to verify the plume is not increasing in concentration or migrating, and that it is attenuating naturally at an acceptable rate.

(2) **Groundwater Extraction and Off-Site Water Disposal** - This method involves the pumping of groundwater from extraction wells and the subsequent disposal of the water. The disposal would involve transporting the extracted groundwater to a water treatment facility.

(3) **Groundwater Extraction and On-Site Treatment** - The groundwater extraction and on-site treatment (pump and treat) option involves the pumping of the groundwater from extraction wells and the treatment of the water using an on-site system. Water treatment system options include an air stripper, liquid phase carbon or a UV/peroxidation system. Treated water could be disposed to the nearby surface water under a National Pollutant discharge Elimination System (NPDES) permit.

(4) **Dewatering and Soil Vapor Extraction** - Dewatering is the rapid pumping of the groundwater to cause a depression in the water table. The depression of the water table allows for the exposure of the smear zone. This provides the opportunity to remove the source of groundwater contamination through soil vapor extraction.

(5) **Air Sparging with Soil Vapor Extraction** – Air sparging is the injection of compressed air into the groundwater at low flows so that the contaminants can be stripped from the groundwater and smear zone as the sparge air moves to the unsaturated zone. The contaminant laden sparge air must be removed from the unsaturated zone by a soil vapor extraction system. The soil vapor extraction system will also effectively mediate any contamination remaining in the soil.

(6) **Bioremediation** - Bioremediation is the use of naturally occurring bacteria to convert petroleum hydrocarbons to inert compounds, carbon dioxide and water. In order for biodegradation to occur at an appreciable rate, the bacteria needs a source of moisture, nutrients and oxygen.

(7) **Air Sparging with Passive Bioremediation** – This option is a combination of options 5 and 6 and involves air sparging the central portion of the groundwater plume while monitoring the technology's effectiveness in passively bioremediating the outer plume.

7.6 INITIAL SCREENING OF REMEDIAL ALTERNATIVES

Alternatives will be screened using three general criteria: 1) effectiveness, 2) implementability, and 3) cost. Effectiveness includes the alternative's ability to attain cleanup goals and to protect human health and the environment during remediation activities. Implementability includes technical feasibility, and acceptability to regulatory agencies and the public. For the screening evaluation, an alternative will be judged implementable and effective or will be eliminated from further consideration for a stated reason. For screening, alternatives will not be compared to each other for implementability or effectiveness.

Since detailed costs are not prepared for the screening evaluation, costs are used as a screening criterion when the rough cost estimated for screening of an alternative is clearly higher (approximately 50% or more) than the screening costs of the others.

Initial screening of the above remedial options indicates that some are not feasible because of prohibitive costs or difficulties in implementation. These options that have been screened out are discussed below. Section 7.8 will provide a detailed assessment of the remedial options that are available for use at the site.

No further action at the site is not a feasible option given the results of the risk assessment evaluation presented in Section 6. Therefore this option will not be considered further.

The pump and treat and dewatering methods were evaluated considering the nature of the site and found to be impractical because of the large number of groundwater extraction wells that would be required to cause an appreciable influence on the groundwater. Considering the low hydraulic conductivity of the clay soils indicative of the area (10^{-5} to 1 gal/day/ft^2; Freeze and Cherry, 1979) it is expected that an economically impractical number of groundwater extraction wells will be required to sufficiently dewater or influence the area of concern.

The cost of groundwater extraction with off-site disposal is also expected to be cost prohibitive. For example, the groundwater extraction pump and discharge method would likely achieve a pumping yield of 3-5 gallons per minute (gpm) at a minimum discharge cost of $0.45 per gallon. This would cost approximately $1,000,000 per year. This is significantly higher than the remaining remedial options presented.

The two remedial options that will be evaluated in detail are air sparging with soil vapor extraction (option 5) and bioremediation (option 6). In addition, a third option will be evaluated which involves air sparging the central plume while augmenting attenuation of the outer plume with passive bioremediation (option 7). A combination of the two technologies may enhance remedial efforts. Secondary treatment systems for the extracted soil gas will be analyzed separately from the primary remedial actions.

7.7 SCREENING OF VAPOR TREATMENT TECHNOLOGIES

Vapors resulting from soil vapor extraction operations may require treatment under Bay Area Air Quality Management District (BAAQMD) Regulation8, Rule 47. It is assumed that if vapor emissions are below 1 pounds per day (lbs/day) for total petroleum hydrocarbons and 1.0 lbs/day for benzene, an air permit and a control device are not required. Three separate technologies will be considered for treatment of the vapor streams. These technologies are a catalytic oxidizer, vapor phase carbon, and a resin bed adsorption system. The catalytic oxidizer involves the oxidation of the vapor stream at temperature of 700-800 degrees Fahrenheit (^{o}F) with the oxidation occurring in a catalyst bed. The vapor phase carbon system involves the use of activated carbon to treat the vapor stream, and is generally effective for more dilute vapor streams. The resin bed system is a vapor recovery system that adsorbs the contaminants on a polymer bed. The bed then undergoes a desorption process and the contaminant is recovered as a liquid waste. All three technologies are technically feasible and effective.

Based on estimated hydrocarbon concentrations from soil venting or an air stripper, initial carbon usage would be approximately 500 lbs/day (roughly $1,200/day). The estimated carbon usage rate results in a cost significantly higher than that for the catalytic oxidizer. Therefore, activated carbon will not be considered further to control vapor emissions.

Resin bed systems costs approximately $10,000 per month to lease, operate, and maintain. This is significantly more than a catalytic oxidizer, so the resin bed system will not be considered further. Therefore, a catalytic oxidizer appears to be the best choice to control gaseous emissions.

As vapor concentrations decrease over time, it may become more economical to switch to carbon instead of continuing to heat the entire gas stream to destroy a small quantity of hydrocarbons. Many factors will affect this possibility and it cannot be evaluated reliably now. Emissions will be regularly monitored to assess this possibility and to evaluate whether emissions may have decreased below quantities where oxidation has a lower cost than carbon.

7.8 DETAILED ASSESSMENT OF REMEDIAL ALTERNATIVES

In this section the three alternatives that survived the screening evaluation will be evaluated in more detail. The three alternatives are as follows:

- Alternative 1: Air sparging the entire plume;

- Alternative 2: Bioremediation of the entire plume; and
- Alternative 3: Air sparging the higher plume concentrations combined with passive bioremediation of the outer plume.

7.8.1 Alternative 1: Air Sparging of Entire Plume

7.8.1.1 Description

Air sparging involves the injection of air into the groundwater at low flows to volatilize contaminants in the water. The air sparging system is usually operated in conjunction with a soil vapor extraction system to capture the sparge air rising into the unsaturated zone. Soil venting is necessary at this site considering the residences directly above the contaminated area that may be exposed to uncaptured sparge air diffusing into the building. Soil venting will also remove any contamination remaining in the soil.

The proposed sparge well depth is 35 feet below grade which, based on Kleinfelder's experience with similar sites, would generate a radius of influence of approximately 30 lateral feet. Based on a treatment area of approximately 300 by 100 feet, we have assumed that 10 sparge wells will be required. It is estimated that this technology could reach clean-up goals within one year. The soil venting portion of the system would be integrated into the sparge wells as shown on Plate 13.

7.8.1.2 Effectiveness

Air sparging, which is a newer technology, has shown great promise in treating contaminated groundwater with volatile contaminants. Previous air sparging operations have been effective in reaching the target clean-up levels in 6 to 18 months. Air sparging in conjunction with soil venting has been effective in remediating the smear zone to remove the source of groundwater contamination. The diesel detected at the site is not expected to be directly affected by the air sparging, but will experience some aerobic degradation via the addition of oxygen to the groundwater. This alternative was ranked very good with regard to effectiveness.

7.8.1.3 Implementability

Installing a network of sparging and soil vapor extraction wells to cover the entire plume would require the drilling of wells in the vicinity of residential areas. Trenching, including across roadways, is also needed to connect the wells to the equipment. Based on the site conditions and the size of the plume it may be difficult and costly to implement this option.

7.8.1.4 Cost

The estimated cost to air sparge the entire contaminant plume is approximately $290,000. This may be assumed accurate within approximately 30% with the assumed duration. A breakdown of the estimated costs is provided in Table 9.

7.8.2 Alternative 2: Bioremediation

7.8.2.1 Description

Bioremediation involves the treatment of subsurface pollutants by stimulating the native microbial population to biodegrade the pollutants into biomass, CO_2, CH_4, inorganic salts and water. The biodegradation process is a biochemical reaction by indigenous microorganisms that exist naturally in the subsurface.

Petroleum hydrocarbons undergo aerobic biodegradation requiring supplemental oxygen. Aerobic biodegradation of benzene, a primary contaminant at Friesman Ranch, will occur according to the following equation:

$$C_6H_6 + 7.5O_2 \Rightarrow 6CO_2 + 3H_2O$$

To utilize this remedial technology at the Friesman Ranch Property, it was estimated that eight nested oxygen/nutrient injection wells would be necessary to encompass the contaminated area. Each well will consist of a sparging component to facilitate oxygen injection and a liquid injection component screened in the saturated zone above the sparge point to release nutrients to the groundwater. The source of the water for nutrient injection would be from an outside water supply. It is assumed that the system will need to run for (at least) two years to reach clean-up levels.

7.8.2.2 Effectiveness

Bioremediation of contaminants has been implemented in municipal wastewater treatment processes for years, including activated sludge reactors, lagoons, and waste stabilization ponds. In most cases, complete contaminant reduction is achieved without generating any waste products. In addition, the treatment is effective on sorbed contaminants, contaminants trapped in pore spaces, and capillary fringe contamination. Furthermore, because of the unconfined and expansive nature of the process, it will move with the groundwater flow compensating for any expansion of the contaminant plume.

The effectiveness of bioremediation relies primarily on contaminant-degrading microorganisms being present in the subsurface, their ability to consume the contaminants present, and their response to any nutrients added. To effectively implement this alternative a site specific microbial degradation study should be performed to address these concerns.

Like many remediation processes, effective bioremediation is also dependent on subsurface soil characteristics. Low permeability soils will not permit adequate circulation of oxygen and nutrients making the method less effective. At Friesman Ranch, the low permeability of the soil may inhibit bioremediation. This alternative was ranked fair with regard to effectiveness.

7.8.2.3 Implementability

Drilling the proposed injection and extraction wells, including the necessary networking and trenching, does not pose any significant implementation problems. The alternative requires standard operating equipment. The power required to drive the pump and compressor is not expected to exceed the capacity of the site.

Bioremediation requires more careful maintenance and added sampling relative to other remedial options. Injection of air may create some limited movement of contaminants to the surface potentially exposing residences to hydrocarbon vapors. This will increase monitoring activities. Nutrient/oxygen injection rates must be carefully monitored to avoid excessive microbial growth that may lead to clogged injection wells. Monitoring nutrient addition rates is also important to avoid excessive nitrate concentrations in the groundwater that may render it non-potable. In addition, degradation rates must be closely monitored to avoid creating partially degraded metabolites that may impart objectionable tastes and odors in groundwater. Addition of nutrients to groundwater required a permit from the RWQCB.

7.8.2.4 Cost

The estimated cost of the bioremediation option is approximately $320,000. This may be assumed accurate within approximately 30% with the assumed duration. A breakdown of the estimated costs is provided in Table 10.

7.8.3 Alternative 3: Air Sparging/Soil Venting with Passive Bioremediation

7.8.3.1 Description

A combination of air sparging and indirect bioremediation can be used for the sitewide cleanup. The installation of 5 sparge wells at a spacing of 30 feet per well would treat the inner plume to the isoconcentration lines of greater than 100 µg/l of TPH (shown on Plate 7). Using air sparging to remediate the high concentrations relatively rapidly obviates the slower effect that bioremediation alone would have on the plume decreasing the total remediation time significantly. Benzene and TPH outside and downgradient of the sparge system would eventually be passively degraded by the introduction of oxygen to the groundwater. It is assumed that soil venting with air treatment will be necessary for the first year, then soil venting directly to the atmosphere will be applicable for an additional six months to complete to bioremediation for a total operation duration of 18 months.

Nutrients will not be injected as part of the indirect bioremediation, but additional monitoring for dissolved oxygen and carbon dioxide concentrations in groundwater and soil vapor will be necessary during implementation. The conceptual layout of the soil vapor extraction system portion of the system would be integrated with each sparge well as shown in Plate 12.

7.8.3.2 Effectiveness

Both of these treatment systems have been shown to be effective in groundwater remediation. The use of the sparge wells to treat the inner plume will allow for the direct remediation of the groundwater and capillary zone. The soil-venting portion will be effective in removing any

additional source in the soil. The passive bioremediation of the outer plume will be slow, but considering the concentrations detected, it is expected to be relatively timely and effective. This alternative ranked good with regard to effectiveness.

7.8.3.3 Implementability

The installation of sparge/vent wells in the inner plume is easily implemented. Trenching will be required for piping from the sparge to the treatment system, but the tighter focus will substantially limit the trenching and intrusion necessary relative to Alternative 1.

7.8.3.4 Cost

The cost for the air sparging/bioremediation is approximately $260,000. This may be assumed accurate within approximately 30% with the assumed duration. A breakdown of the estimated costs is provided in Table 11.

7.9 SUMMARY OF EVALUATION AND RECOMMENDATION

Results of the detailed evaluation are summarized in Table 12. For the table, the implementability criterion was separated into technical feasibility and regulatory acceptability to distinguish the source of potential complications for the alternatives. Evaluation of the technical feasibility included factors such as ease of construction, equipment availability, maintenance and monitoring requirements, and reliability. Alternatives were ranked as very good, good, fair, or poor for their ability to meet a criterion based on the detailed evaluation. The estimated duration of each alternative was also included in the table.

The air sparging of the entire plume took the shortest duration of 0.5 to 1 year, but cost more and is more intrusive than alternatives 2 and 3. It rated good in technical feasibility and regulatory acceptability and very good in effectiveness.

The estimated cost of the bioremediation system was $320,00 and had an estimated duration of 2-5 years. It was the most expensive option primarily due to increased operation time and added monitoring costs. The best case duration was selected for a more direct technology-based cost comparison with the other options; it is likely that the duration will be longer than 2 years. The alternative rated good for technical feasibility and fair for regulatory acceptability and effectiveness.

The air sparge/soil venting with passive bioremediation was the most inexpensive option and least intrusive to the site. It is in the middle of the range for estimated cleanup times. The alternative rated good for technical feasibility, regulatory acceptability and effectiveness.

7.9.1 Recommendation

It is Kleinfelder's recommendation that air sparging/soil venting with passive bioremediation (alternative 3) be selected for implementation at the site. It is the least intrusive, most cost effective, and is expected to be reliable in remediating the central hydrocarbon plume. A conceptual layout for this alternative, consistent with the description presented previously, is

provided in Plate 12. The system will require weekly site visits for routine monitoring and monthly air sampling for BAAQMD permit compliance. A specific sampling and monitoring strategy for the system would be developed in a Remediation Workplan.

7.10 PROGRESS TOWARD CLEANUP GOALS AND SITE CLOSURE

7.10.1 Soil

As designed, and with the current information on the size and extent of hydrocarbon contamination, the soil venting system portion of the selected technology is expected to fully encompass the soil impacted with TPH. As such, the broad remediation goal in soil will be to reduce concentrations either to non-detect or to SSTLs. The remediation goal is to reduce the remaining TPH concentrations in the soil by at least 95%. Whether such a goal is technically or economically feasible will be contingent on site geology and contaminant distribution. Most likely, after a period of 6-12 months of operations, the inlet concentration will reach a low asymptotic level where continued operation becomes impractical. At this point the cumulative data will be evaluated for recommendation on either discontinuing air treatment or discontinuing operation depending on groundwater concentrations. The evaluation will consider the following at a minimum:

- The decrease in TPH-g and benzene soil vapor concentrations from initial start-up concentrations;
- The cumulative mass of TPH-g and benzene removed plotted against operation time versus the initial mass estimates at the site; and
- Potential human health risks of residual soil concentrations.

7.10.2 Groundwater

Unlike the soil venting system, the air sparging system was not designed to cover the entire TPH groundwater plume. The design objective was to focus on the area of the plume with highest impacts with the intention of indirectly stimulating bioremediation of the outer plume. The ultimate goal of the system will be to reduce concentrations of contaminants present, particularly benzene, to MCLs.

If results indicate groundwater remediation goals have been achieved, no further air sparging will be recommended. Otherwise, depending on the magnitude of deficiency, continued or modified operation may be recommended.

8.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

The data points used during this investigation are necessarily limited due to economic and site constraints and should be viewed as generally, but not explicitly, representative of contamination likely to be associated with the site. This, Kleinfelder assumes no responsibility for the representation of the data as exact surface and/or subsurface conditions, but only for conditions at the data points. There is always the possibility that other contaminated areas exist in the subsurface environment underlying the property and that they were simply not encountered during the limited soil boring/sampling program.

8.2 SUMMARY AND CONCLUSIONS

The summary and conclusions presented in this section are based on research implemented, information collected and interpretations developed in this and the previous investigations performed at the property. The information analyzed was collected by Kleinfelder between June and September 1997. The summary and conclusions that follow are presented in the categories of field investigations, geologic and hydrogeologic setting, soil and groundwater chemistry and RBCA Tier 2 evaluation.

8.2.1 Remedial Investigation Activities

- RI activities performed consisted of utility surveys, wipe sample collection, surface soil sample collection, soil boring/sampling and reconnaissance groundwater collection, monitoring well installations, implementation of a groundwater monitoring event and IDW-handling procedures.
- Prior to the implementation of any field activities, utility clearance surveys were performed, consisting of contacting USA Locator, Inc. to identify potential utilities that could cross the property, a site walk to mark the location of any observable utilities (aboveground and underground) and a geophysical survey (utilizing both electromagnetic and ground-penetrating radar techniques) to locate any other possible utilities. The locations of the intrusive sampling activities were based on the results of these surveys.
- Two wipe samples were collected from concrete beneath the 55-gallon drums that reportedly were used for the storage of hydraulic oil. These samples were analyzed for PCBs.

- Six surface soil samples were collected from the pasture areas located along the northwestern and southwestern portions of the property. The objective of this activity was to assess the potential impact from historical agricultural activities.

- A soil boring/sampling program and reconnaissance groundwater sampling program was implemented to assess the potential lateral and vertical extent of hydrocarbon impacts to soil and the potential lateral extent of hydrocarbon impacts to groundwater.

- A total of 20 soil borings were advanced to a maximum depth of 28 feet bgs with soil samples being collected at five foot intervals as the boring was advanced. A total of 14 soil samples were collected from a total of 7 soil borings. Samples collected were analyzed for at least one of the following constituents: TPH-g, TPH-d, BTEX, MTBE and PAHs.

- Groundwater samples were collected from all 20 soil borings. Samples collected were analyzed for at least one of the following constituents: TPH-g, TPH-d, BTEX, MTBE and PAHs.

- A total of six groundwater wells were installed on the central portion of the property to act as monitoring points to assess temporal and spatial variations in groundwater depth, flow, free-product thickness and chemistry.

- One groundwater monitoring event was performed to verify the analytical results obtained from the reconnaissance groundwater sampling program. Water level and free-product thickness measurements and the collection of water quality samples were the components of the event. The samples collected were analyzed for TPH-g, TPH-d, BTEX, MTBE and PAHs.

- Prior to the initiation of the RI field activities, and between sampling locations, all equipment was decontaminated.

- Soil cuttings, decontamination rinsate fluids, well development and purge water were containerized and stored on-site in DOT-approved 55-gallon drums.

- Following completion of field activities, all soil borings not converted to monitoring wells, were abandoned by backfilling with a cement/bentonite slurry. The work area was left in a presentable and workable condition, as nearly as practicable to original conditions.

8.2.2 Geologic and Hydrogeologic Setting

- Subsurface site materials encountered consisted of stiff silty clays with minor silty sands. The sandy materials encountered appeared to be discontinuous across the site.

- These materials do not usually allow appreciable volumes of groundwater to migrate through them. Reported hydraulic conductivity values for these materials range from 10^{-5} to 1 gal/day/ft^2.

- First groundwater was encountered at depths ranging from 13 to 23 feet bgs and stabilized at depths ranging from 12 to 14.5 feet bgs. Groundwater conditions appear to range from unconfined to confined.
- No free-product could be measured in any of the groundwater monitoring wells, but a hydrocarbon sheen and odor was observed in well KMW-6.
- On September 8, 1997, groundwater flow was to the northwest with a hydraulic gradient of 0.008 ft/ft.

8.2.3 Wipe, Soil and Groundwater Chemistry

- PCBs were not detected in the two wipe samples nor in the trip blank. PCBs do not appear to have impacted the area underlying the 55-gallon drums storing hydraulic oil.
- Nitrate was detected in the composite surface soil sample at a concentration of 17 mg/Kg. This concentration is not considered to be an adverse impact to the environment.
- Organochlorine pesticides were not detected in the surface soil sample and do not appear to have adversely impacted the property.
- TPH-d was not detected in any of the subsurface soil samples. TPH-g was detected in 3 of the 14 samples at a concentration in excess of 10 mg/Kg. The highest concentrations of TPH-g were detected in samples KB-18 at depths of 15 (2,100 mg/Kg) and 20 feet (4,000 mg/Kg) feet bgs. However, these areas appear to be within the saturated zone and may represent residual groundwater smearing.
- BTEX was detected in the same three subsurface soil samples in which TPH-g was detected. However, the highest concentrations were associated with the lowest TPH-g concentration detected and conversely, the lowest concentrations of BTEX were associated with the highest concentrations of TPH-g.
- MTBE was detected in only subsurface soil sample at a concentration of 0.065 mg/Kg. PAHs were not detected in any of the samples.
- The lateral and vertical extent of TPH, BTEX and MTBE contamination in soil appears to be limited. With the exception of a few isolated locations, chemicals of concern were not detected in soil at depths less than 10 feet bgs, being concentrated at the capillary fringe between depths of 15 and 20 feet bgs.
- TPH-g, TPH-d, BTEX and MTBE were detected in at least one of the reconnaissance groundwater samples collected. PAHs were not detected in any of the samples.
- TPH-g and TPH-d were detected at concentrations of thousands of µg/L in at least one sample collected and analyzed. At least one sample contained concentrations of BTEX at or in excess of their respective MCLs. Although MTBE was detected, concentrations were not in excess of the compound's proposed cleanup level.

- Only one groundwater monitoring well sample (KMW-6) contained any hydrocarbon compounds. TPH-g was detected at 13,000 µg/L, TPH-d was detected at 3,200 µg/L, BTEX was detected at 1,314 µg/L and the PAH naphthalene was detected at 140 µg/L. MTBE was not detected in any of the groundwater monitoring well samples.

- Impacts of TPH and BTEX appear to be concentrated in the vicinity of soil borings KB-11 and KB-13. The maximum TPH-g and TPH-d concentrations indicate that free-product is probably floating on the piezometric surface. The center of the groundwater plume was assumed to be in the vicinity of KB-13.

- The most likely source of the contamination is the former heating oil AST located in the metal shed near the east central portion of the property.

8.2.4 RBCA Tier 2 Evaluation

- The RBCA Tier 2 evaluation was performed in accordance with ASTM standards and guidelines and was based on conservative assumptions for exposure and transport of the chemicals of concern such as uniform chemical of concern concentrations, residential exposure of contaminants for 30 years, no biodegradation or other loss mechanism occurring in groundwater or in the vapor phase and soil vapor concentrations reaching immediate equilibrium with the groundwater source. The calculated SSTLs should be viewed as conservative reference points for site cleanup.

- Based on the data collected to date, the following chemicals were considered to be of concern in either soil and/or groundwater: BTEX, MTBE and naphthalene.

- The threat of these chemicals to human health and the environment appears to be short-term (0 to 2 years) if remediation is implemented.

- The SSTL estimated for the leaching potential for benzene from soil to groundwater (0.0038 mg/Kg) was exceeded in only one soil sample, KB-1 and 15 feet bgs (0.056 mg/Kg).

- If shallow groundwater is considered a potential drinking water source, toluene, naphthalene and MTBE did not exceed their SSTLs in any of the reconnaissance or groundwater monitoring wells samples collected. Benzene exceeded its SSTL in reconnaissance and one groundwater monitoring well sample with concentrations ranging from 73 to 390 µg/L. Ethylbenzene and total xylenes exceeded their SSTLs in one boring (KB-13) with concentrations of 890 and 4,200 µg/L, respectively.

- If shallow groundwater is not considered as a potential drinking water source and institutional controls can be applied, ethylbenzene, toluene, total xylenes, naphthalene and MTBE did not exceed their calculated on-site SSTLs. The maximum detected groundwater benzene concentration exceeded the alternate point of exposure SSTL by approximately 7.5 times.

- Because the concentrations of chemicals of concern exceeded the calculated SSTLs, further investigation, fate and transport modeling and/or remedial action are warranted.

8.3 RECOMMENDATIONS

Kleinfelder makes the following recommendations concerning further investigations and remedial actions at the property:

- The findings presented in this report should be presented to the local implementing agencies responsible for releases of petroleum hydrocarbons from ASTs or USTs. The regulatory agencies that may require notification include the RWQCB, the California Office of Emergency Services, the California Department of Fish and Game, the Alameda County Health Care Services Agency and the responsible fire department or district.

- One additional monitoring well should be installed in the vicinity of KB-13, which is assumed to be the source area of the petroleum hydrocarbon impacts. This well could be utilized for both source area monitoring and remedial activities.

- All of the installed groundwater monitoring wells should be placed on a regular monitoring schedule for a period of one year, at which time the monitoring schedule will be re-evaluated and modified as appropriate. The initial proposed monitoring schedule is quarterly.

- Due to the potential for petroleum hydrocarbon contamination to impact Arroyo De Las Positas, surface water samples should be collected on a quarterly basis from this water body. Samples should be collected from both upgradient and downgradient locations. Following the completion of a year of sampling (four consecutive quarterly monitoring events), the schedule will be re-evaluated and modified as appropriate.

- The water quality samples collected should be analyzed for TPH-g, TPH-d, BTEX, MTBE and PAHs.

- Based on the results of the remedial alternatives evaluation, an air sparging/soil venting system that is applied to the higher plume concentration areas with passive bioremediation of the outer plume is recommended. This alternative rated good for technical feasibility, regulatory acceptability and effectiveness. It is the lowest cost (estimated to be approximately $260,000) remedial alternative evaluated with a moderate (0.5 to 2 years) cleanup time.

9.0 LIMITATIONS

The scope of services described here is not intended to be inclusive, to identify all potential concerns, or to eliminate the possibility of environmental problems. Within current technology, no level of assessment can show conclusively that a property or its structures are completely free of contaminated and/or hazardous substances. Therefore, Kleinfelder cannot offer a certification that the recommendations made in this report will clear the property of environmental liability.

The estimate of remediation costs prepared herein have been prepared on the basis of experience and judgment of an engineering professional. Since Kleinfelder has no control over the cost of labor, materials or equipment, the general inflation of prices, or over contractor's methods of determining prices, Kleinfelder does not and cannot guarantee that the actual cost for construction will not vary from the opinions of probable cost prepared by Kleinfelder.

During the course of the performance of Kleinfelder's services, contaminated and/or hazardous materials were discovered. Our client or the property owner are solely responsible for notifying all governmental agencies, and the public at large, of the existence, release, treatment or disposal of any contaminated and/or hazardous materials observed at the project site, either before or during performance of Kleinfelder's services. Kleinfelder will assume no responsibility or liability whatsoever for any claim, loss of property value, damage, or injury which results from pre-existing hazardous materials being encountered or present on the project site, or from the discovery of such hazardous materials.

Kleinfelder performed the investigative activities and evaluations in accordance with generally accepted standards of care that existed in Northern California at the time the work was performed. No warranty, expressed or implied, is made.

10.0 REFERENCES

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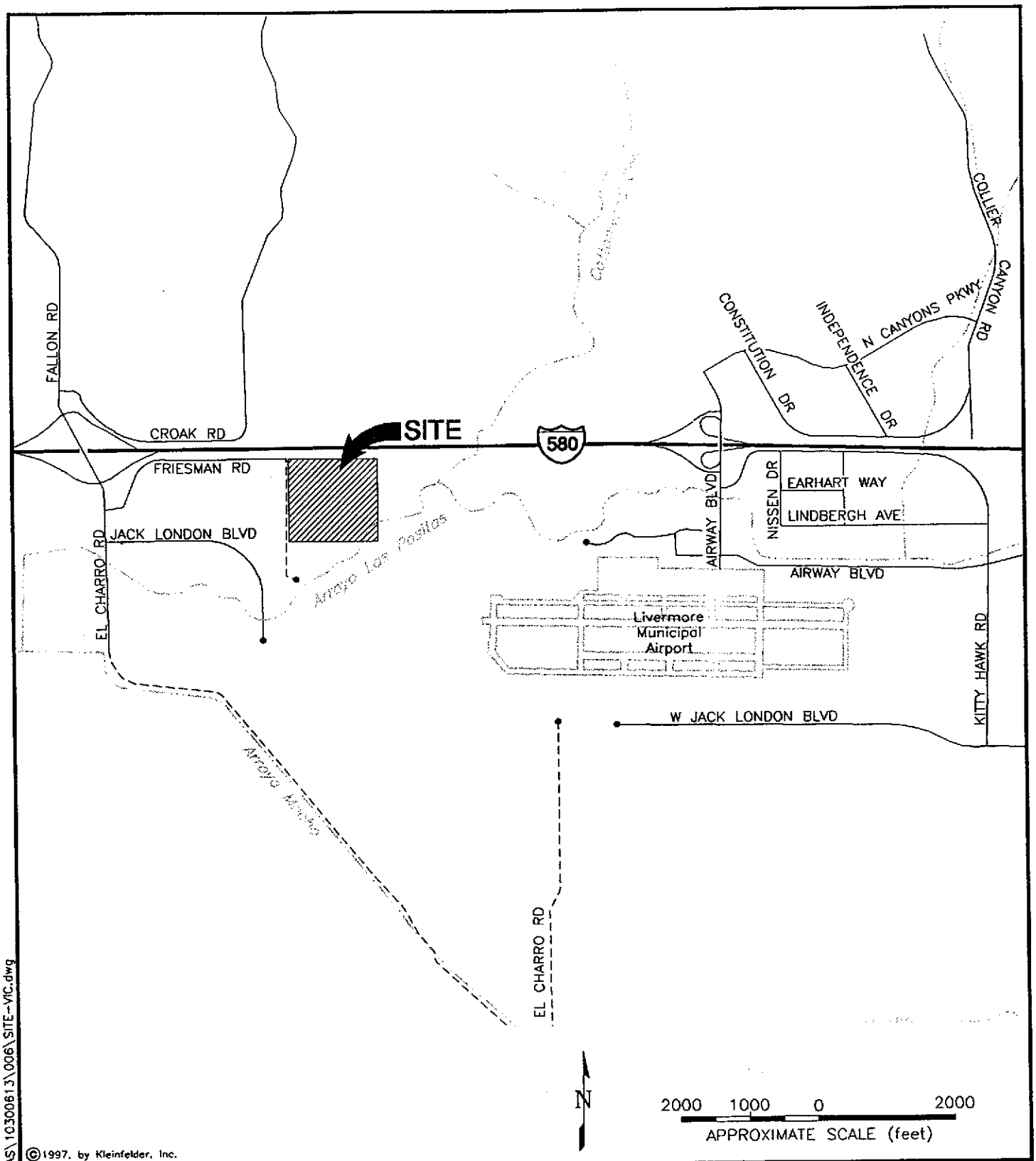

KLEINFELDER

SITE VICINITY MAP

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

PLATE 1

DRAFTED BY: L. Sue	DATE: 9-17-97
CHECKED BY: N. Siler	DATE: 9-17-97

PROJECT NO. 10-300613-006

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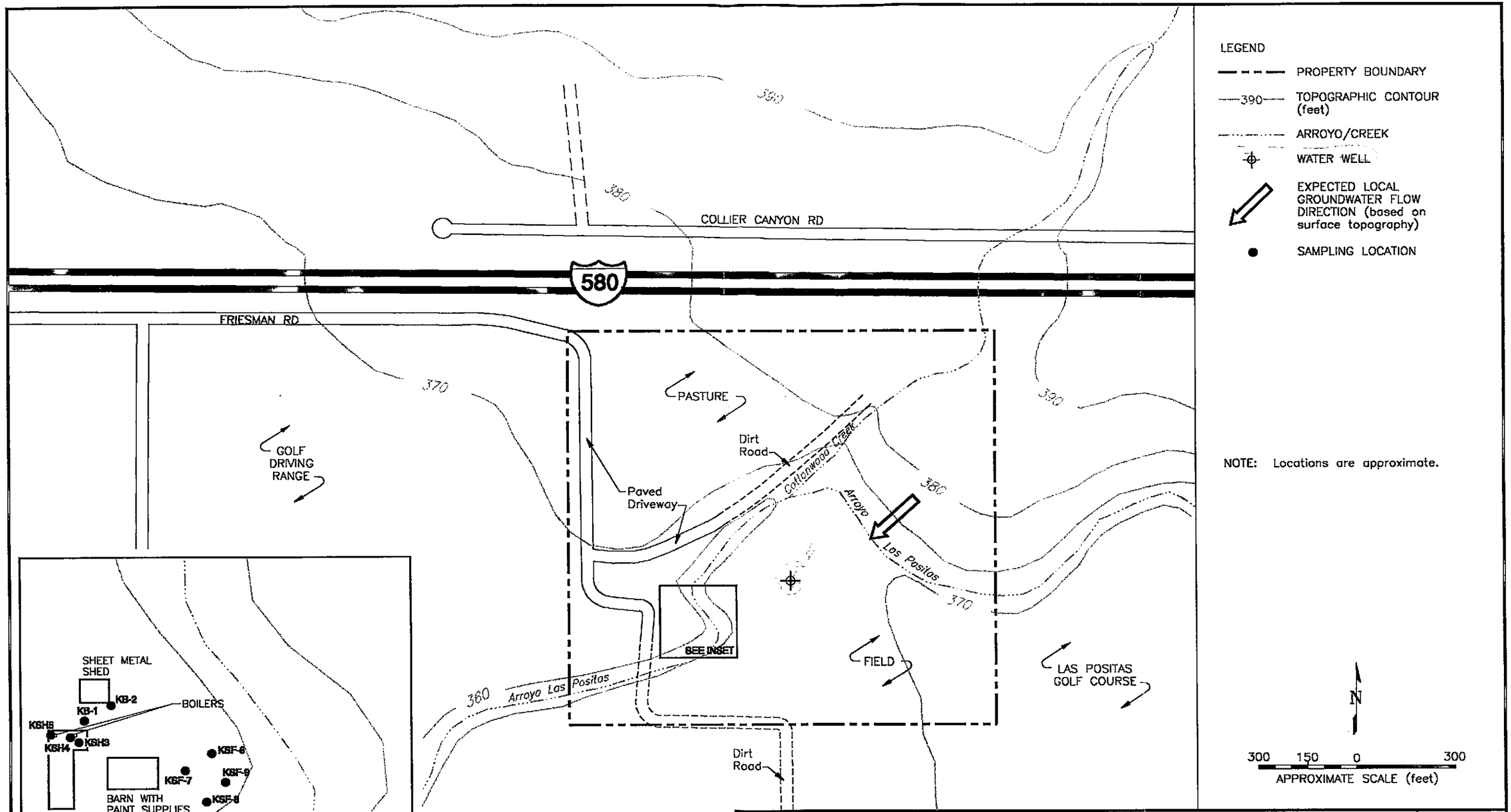

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KLEINFELDER

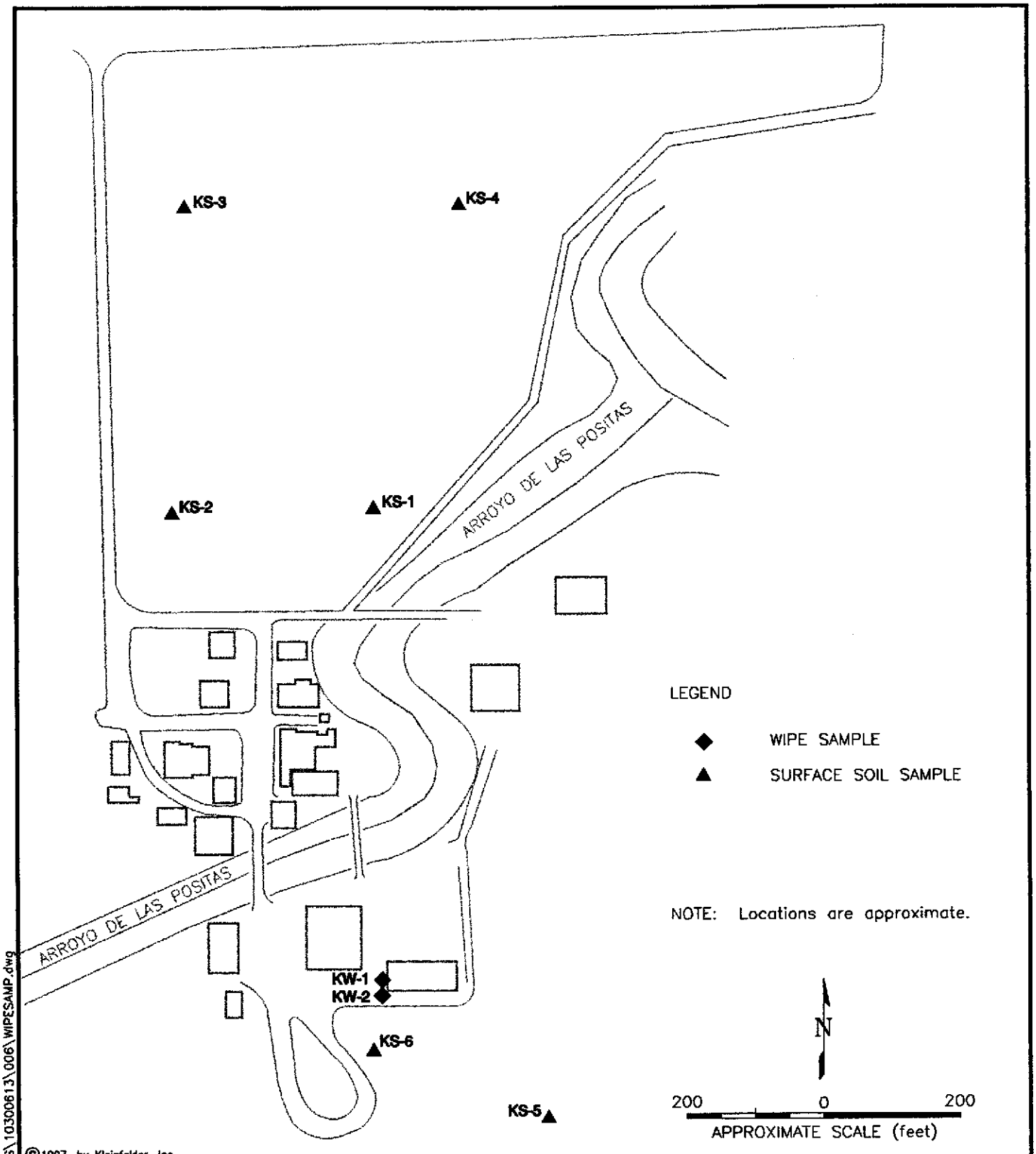
DRAFTED BY: L. Sue	DATE: 9-17-97
CHECKED BY: N. Siler	DATE: 9-17-97

SITE PLAN

FRIESMAN RANCH
1660 FRIESMAN ROAD
LIVERMORE, CALIFORNIA

PROJECT NO. 10-300613-006

PLATE 2



KLEINFELDER

DRAFTED BY: L. Sue	DATE: 9-18-97
CHECKED BY: N. Siler	DATE: 9-23-97

WIPE AND SURFACE SOIL SAMPLE LOCATIONS

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

PROJECT NO. 10-300613-006

PLATE 3

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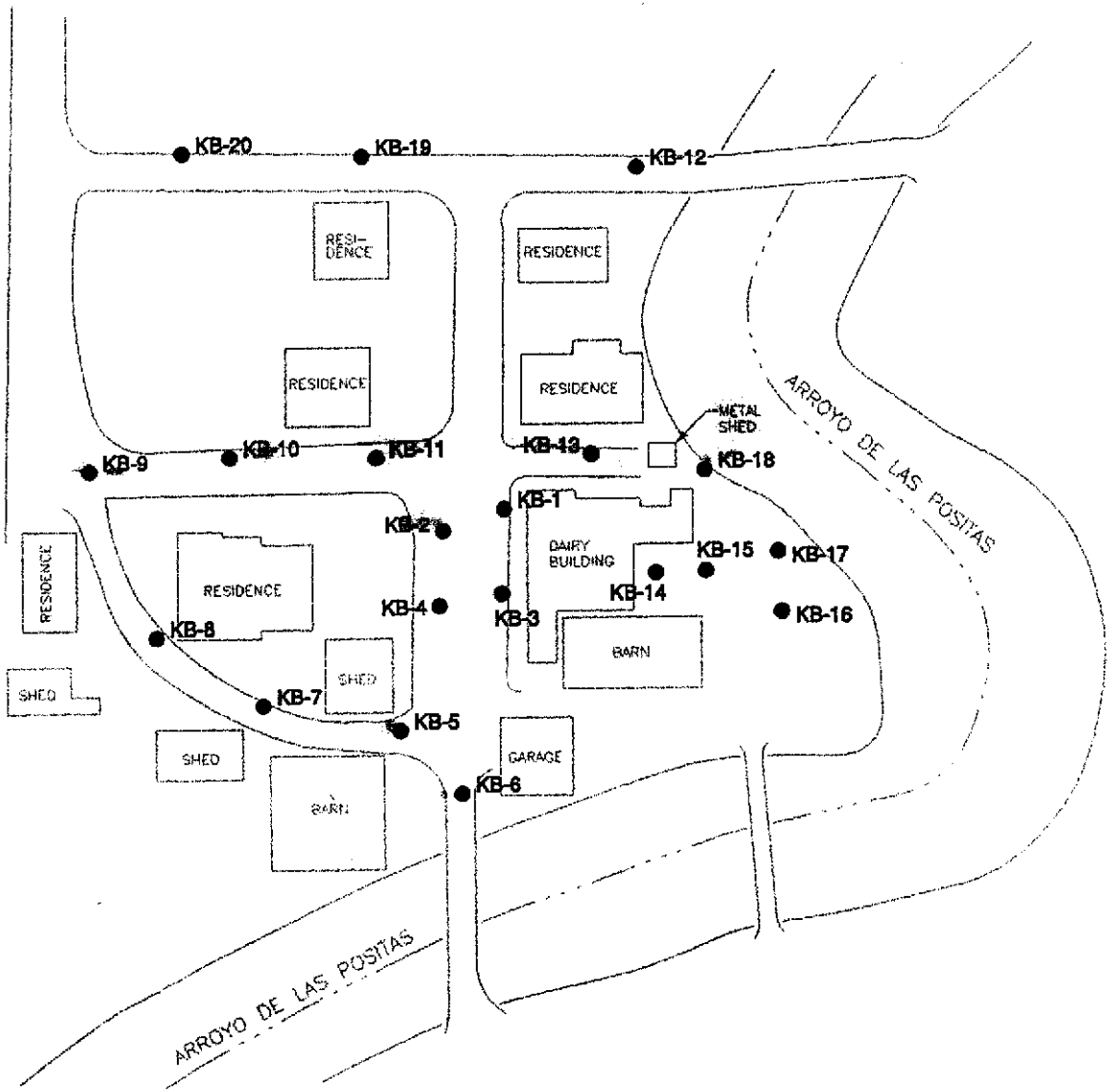
LEGEND

● SOIL BORING/SAMPLING AND RECONNAISSANCE GROUNDWATER SAMPLE



NOTES:

1. Locations are approximate.

N

80 0 80

APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue	DATE: 9-16-97
CHECKED BY: N. Siler	DATE: 9-17-97

SOIL BORING/SAMPLING AND RECONNAISSANCE GROUNDWATER SAMPLING LOCATIONS

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

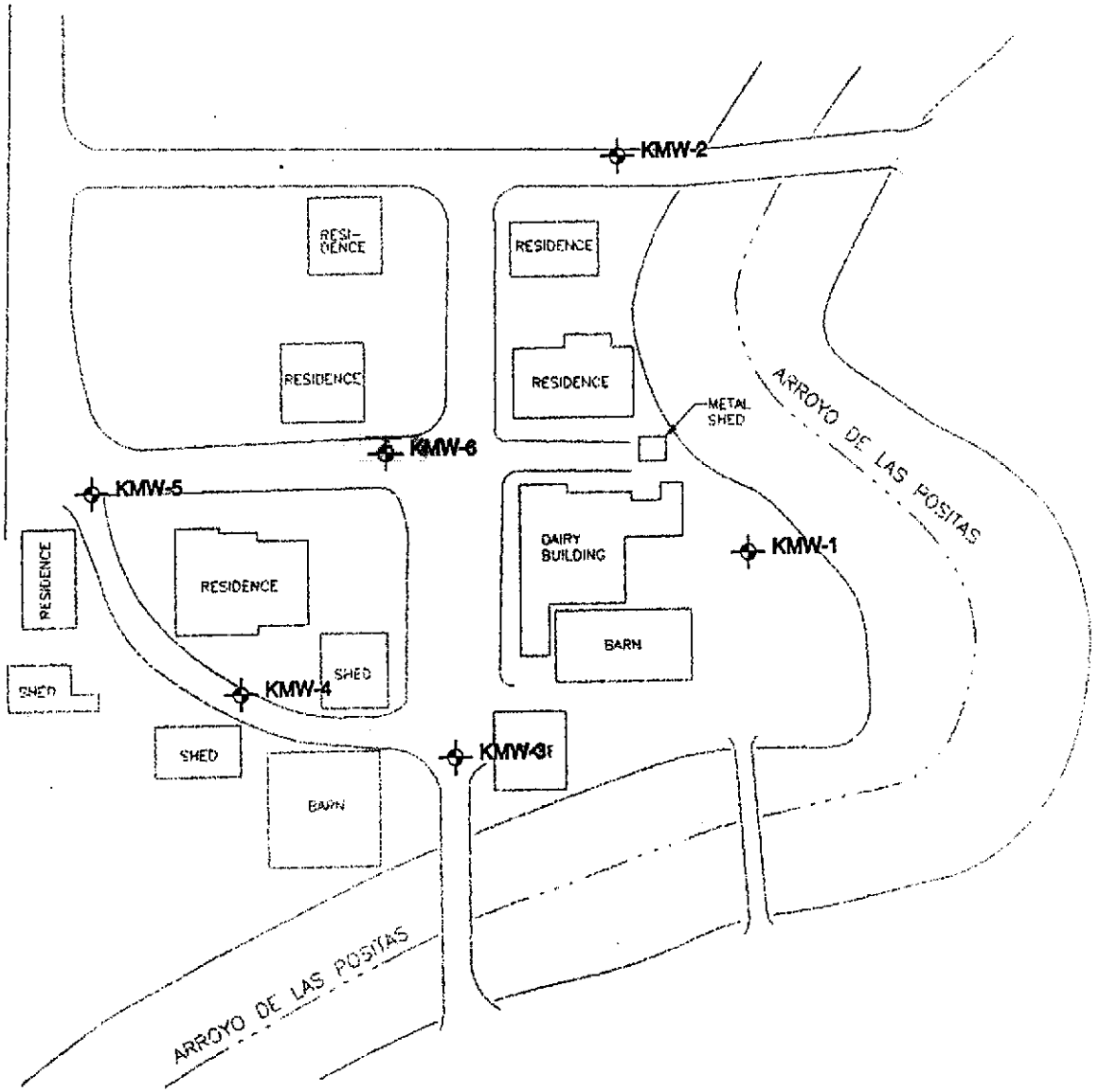
PROJECT NO. 10-300613-006

PLATE 4

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg

LEGEND

GROUNDWATER MONITORING WELL



NOTES:

1. Locations are approximate.

N

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APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue	DATE: 9-16-97
CHECKED BY: N. Siler	DATE: 9-17-97

GROUNDWATER MONITORING WELL LOCATIONS

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

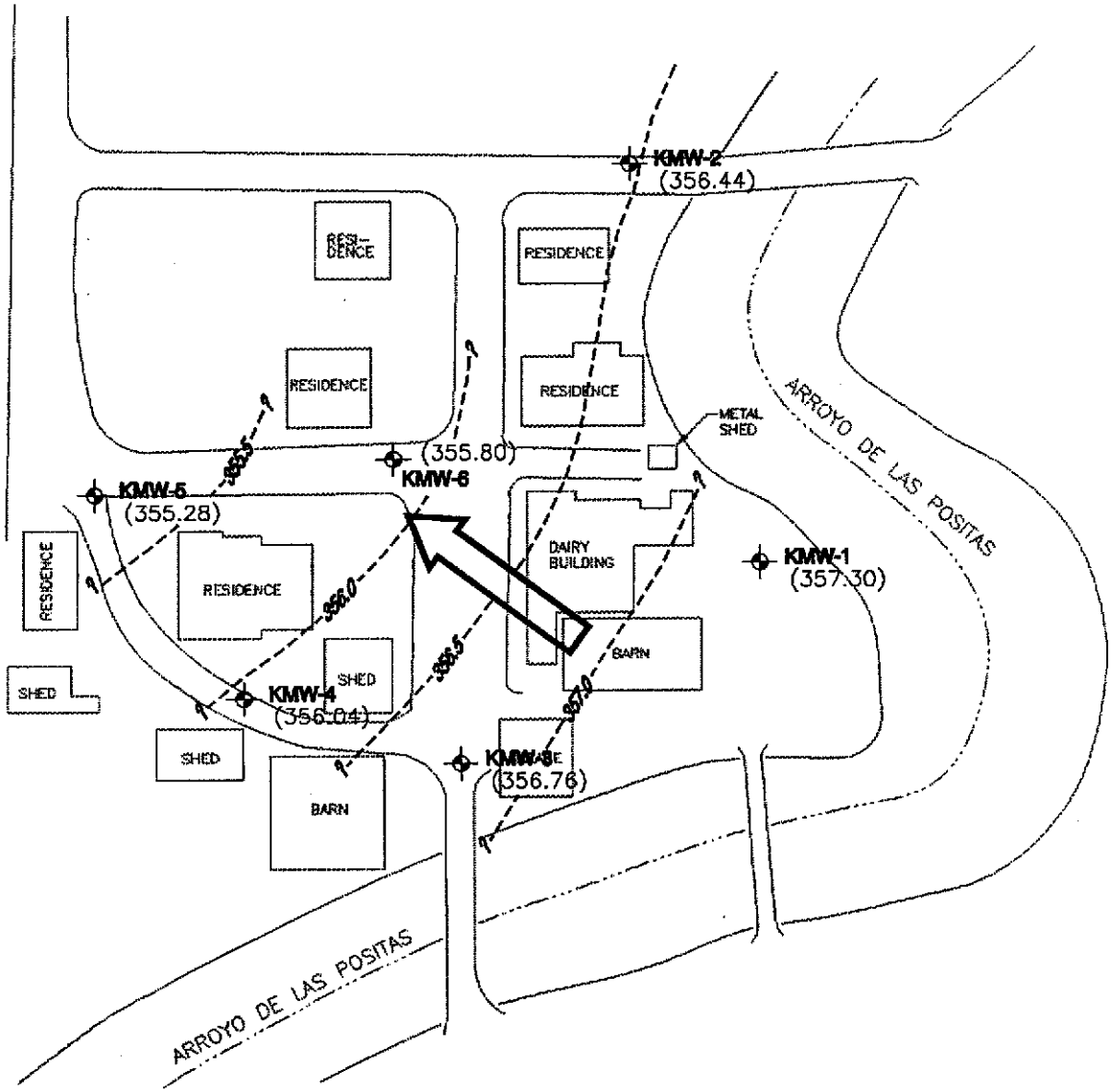
PROJECT NO. 10-300613-006

PLATE 5

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg

LEGEND

- GROUNDWATER MONITORING WELL
- (356.04) GROUNDWATER ELEVATION, feet above mean sea level
- GROUNDWATER ELEVATION CONTOUR, queried where approximate
- GROUNDWATER FLOW DIRECTION



NOTES:

1. Locations are approximate.

N

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APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue	DATE: 10-16-97
CHECKED BY: N. Siler	DATE: 10-16-97

GROUNDWATER ELEVATIONS: SEPTEMBER 8, 1997

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

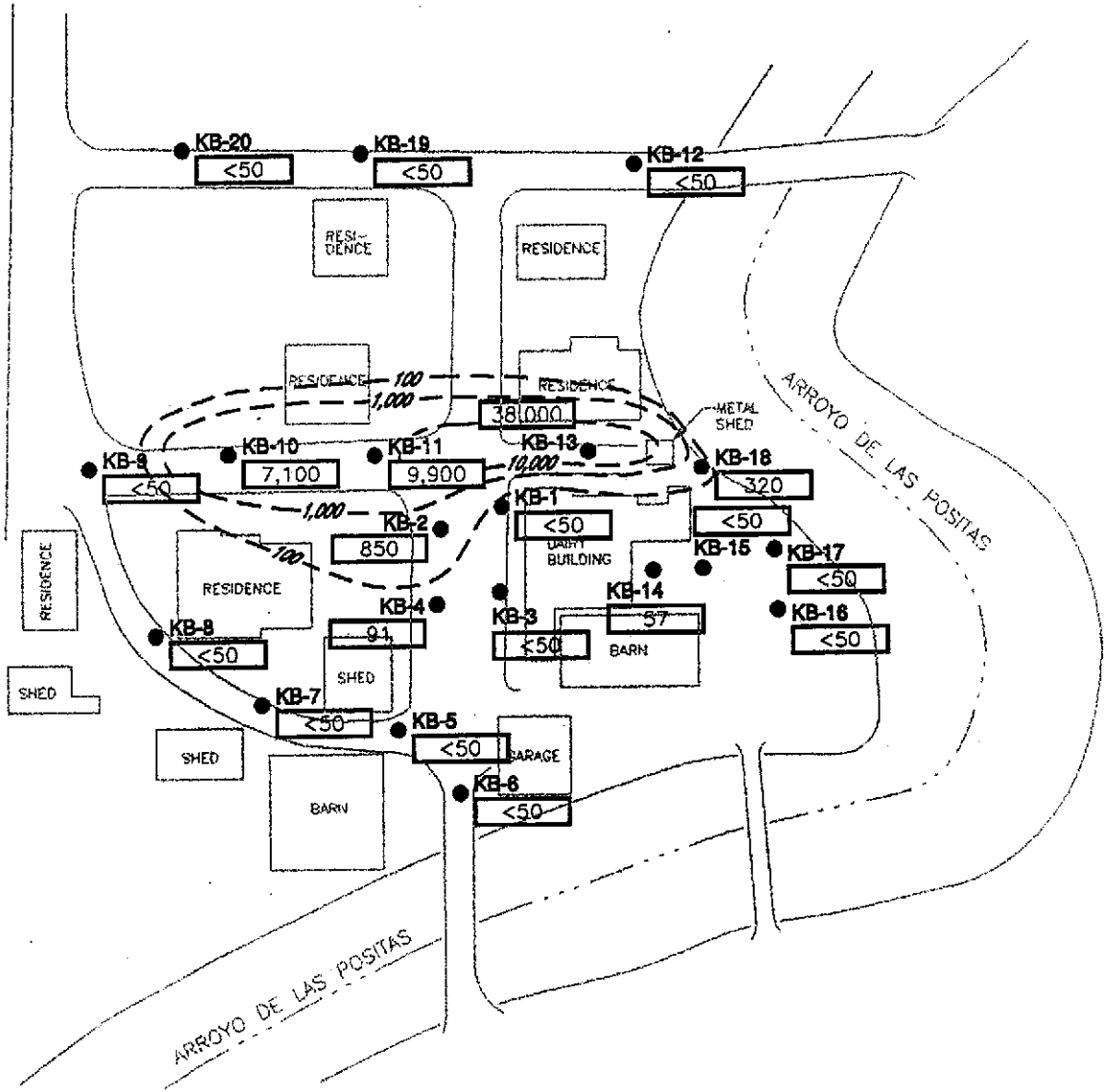
PROJECT NO. 10-300613-006

PLATE 6

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg

LEGEND

- ● SOILBORING/SAMPLING AND RECONNAISSANCE GROUNDWATER SAMPLE
- 91 TPH–g DETECTED Concentration in µg/L.
- <50 TPH–g NOT DETECTED above laboratory reporting limit
- NA TPH–g NOT ANALYZED
- 100 ISOCONCENTRATION CONTOUR (µg/L) Queried where approximate.



NOTES:

1. Locations are approximate.
2. All concentrations are reported in micrograms per liter (µg/L), approximately equivalent to parts per billion (ppb).

N

80 0 80

APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue DATE: 9–16–97

CHECKED BY: N. Siler DATE: 9–17–97

RECONNAISSANCE GROUNDWATER SAMPLE ANALYTICAL RESULTS: TPH-g, AUGUST 1997

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

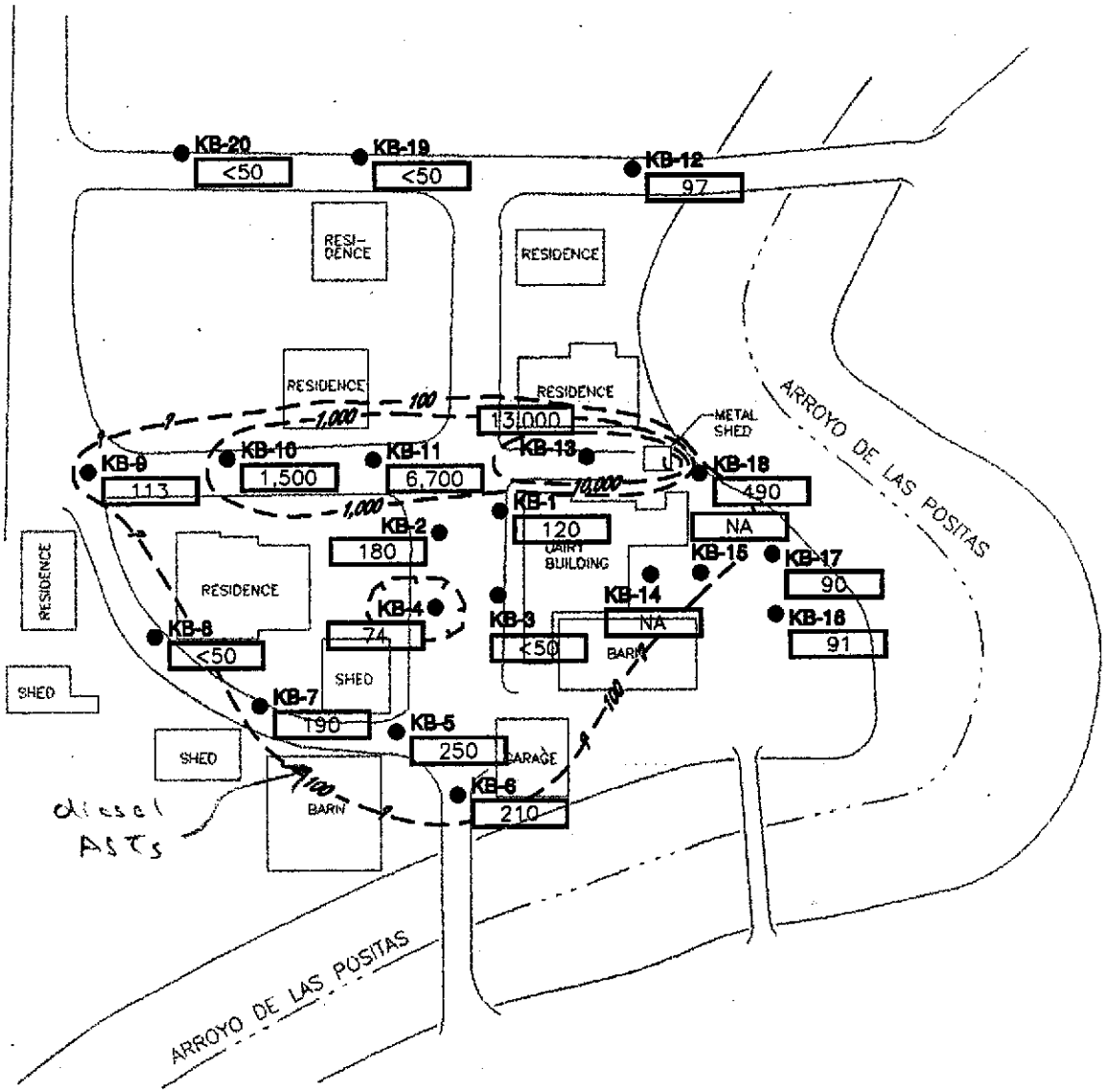
PROJECT NO. 10–300613–006

PLATE 7

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3–10.dwg

LEGEND

- ● SOIL BORING/SAMPLING AND RECONNAISSANCE GROUNDWATER SAMPLE
- 90 TPH–d DETECTED Concentration in µg/L.
- <50 TPH–d NOT DETECTED above laboratory reporting limit
- NA TPH–d NOT ANALYZED
- 100 ISOCONCENTRATION CONTOUR (µg/L) Queried where approximate.



NOTES:

1. Locations are approximate.
2. All concentrations are reported in micrograms per liter (µg/L), approximately equivalent to parts per billion (ppb).

N

80 0 80

APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue DATE: 9–16–97

CHECKED BY: N. Siler DATE: 9–23–97

RECONNAISSANCE GROUNDWATER SAMPLE ANALYTICAL RESULTS: TPH-d, AUGUST 1997

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

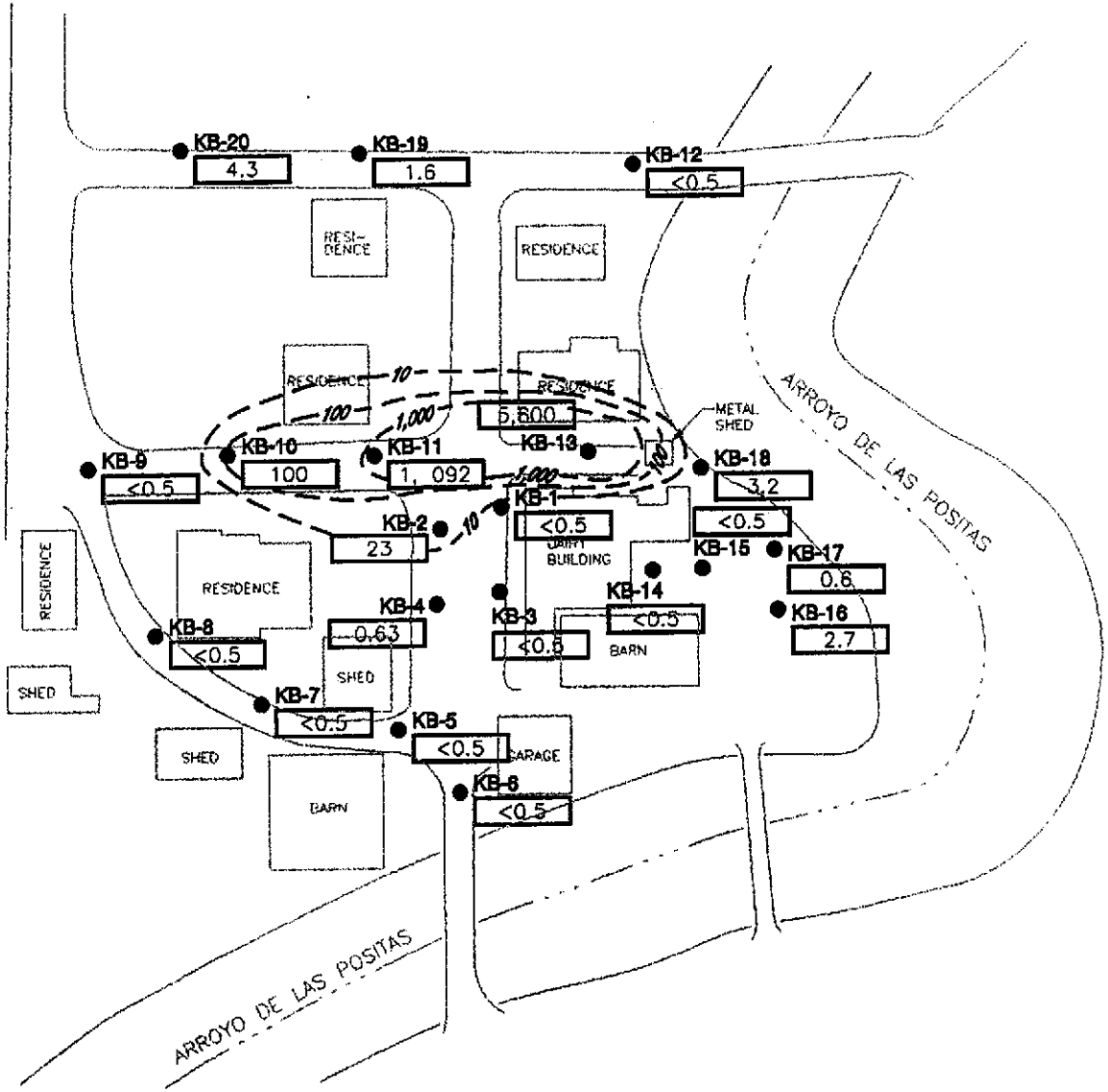
PROJECT NO. 10–300613–006

PLATE 8

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg

LEGEND

- ● SOILBORING/SAMPLING AND RECONNAISSANCE GROUNDWATER SAMPLE
- 1.5 BTEX DETECTED Concentration in µg/L.
- <0.5 BTEX NOT DETECTED above laboratory reporting limit
- NA BTEX NOT ANALYZED
- 100 ISOCONCENTRATION CONTOUR (µg/L) Queried where approximate.



NOTES:

1. Locations are approximate.
2. All concentrations are reported in micrograms per liter (µg/L), approximately equivalent to parts per billion (ppb).

N

80 0 80

APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue DATE: 9-16-97

CHECKED BY: N. Siler DATE: 9-17-97

RECONNAISSANCE GROUNDWATER SAMPLE ANALYTICAL RESULTS: BTEX, AUGUST 1997

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1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

PROJECT NO. 10-300613-006

PLATE 9

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg

LEGEND

- ⊕ GROUNDWATER MONITORING WELL
- TPH TOTAL PETROLEUM HYDROCARBONS
- TPH–g TPH AS GASOLINE
- TPH–d TPH AS DIESEL
- BTEX BENZENE, TOLUENE, ETHYLBENZENE AND TOTAL XYLENES
- MTBE METHYL TERTIARY BUTYL ETHER
- PAH POLYNUCLEAR AROMATIC HYDROCARBON COMPOUNDS
- <50 NOT DETECTED above laboratory reporting limit

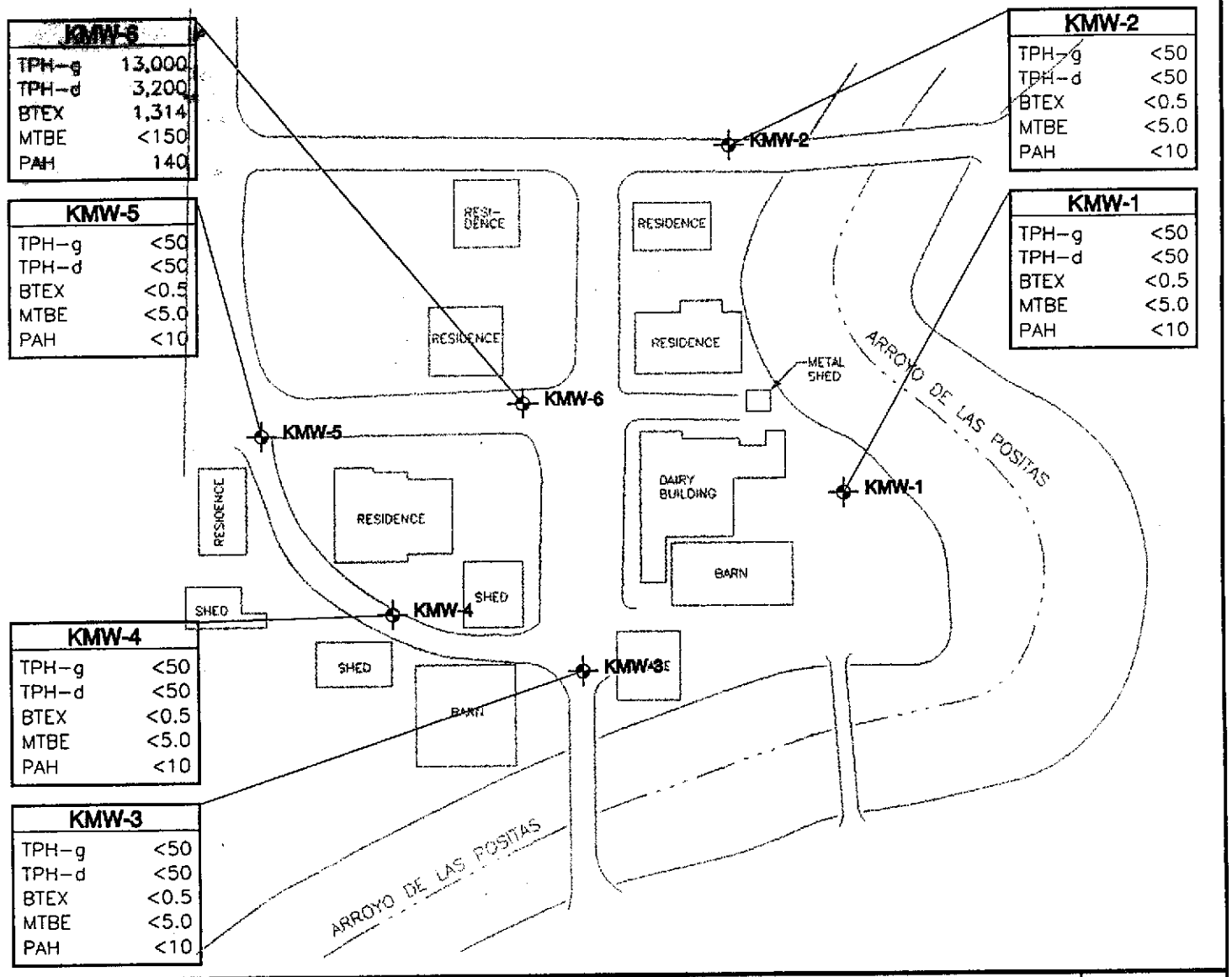
NOTES:

1. Locations are approximate.
2. All concentrations are reported in micrograms per liter (µg/L), approximately equivalent to parts per billion (ppb).

N

80 0 80

APPROXIMATE SCALE (feet)



KLEINFELDER

DRAFTED BY: L. Sue	DATE: 9–16–97
CHECKED BY: N. Siler	DATE: 9–17–97

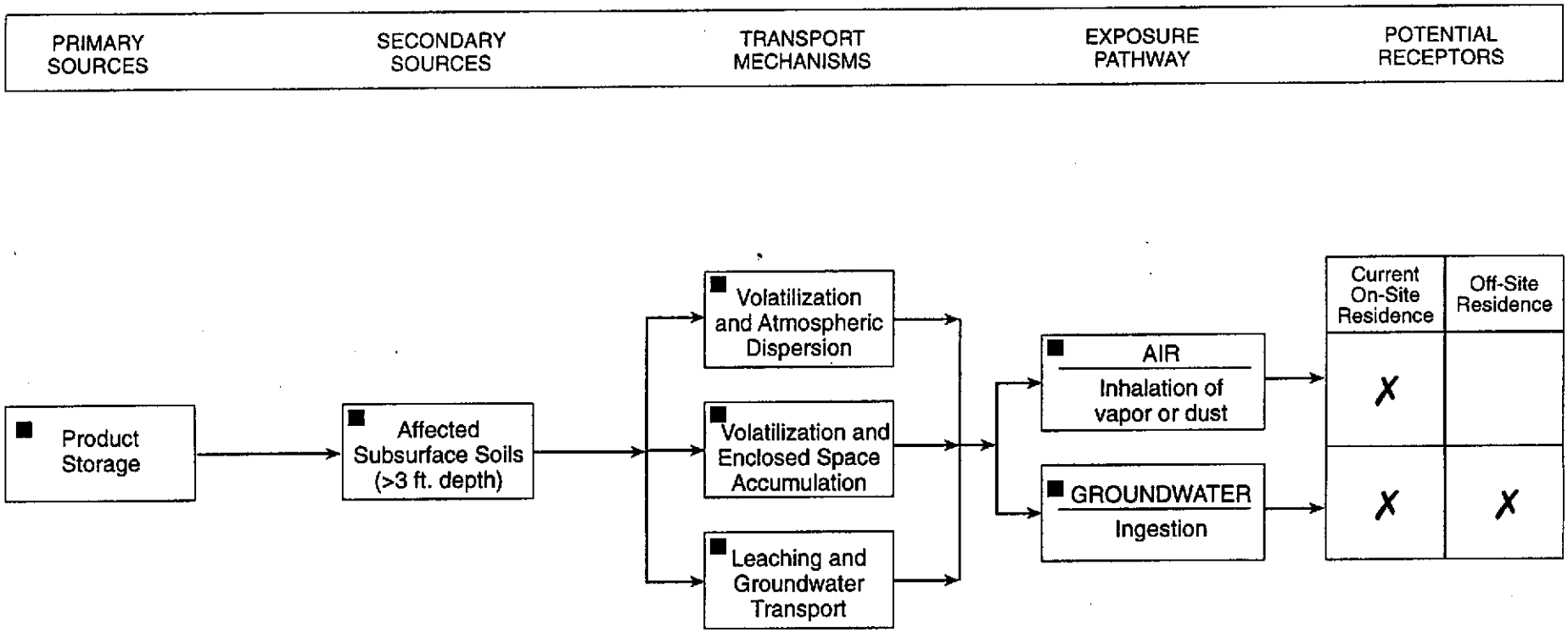
GROUNDWATER MONITORING WELL SAMPLE ANALYTICAL RESULTS: SEPTEMBER 1997

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

PROJECT NO. 10–300613–006

PLATE 10

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg



■ Complete Mechanism or Pathway

KLEINFELDER

DRAFTED BY: R. Kantor DATE: 10-16-97

CHECKED BY: N. Siler DATE: 10-17-96

CONCEPTUAL SITE MODEL/ EXPOSURE PATHWAYS

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

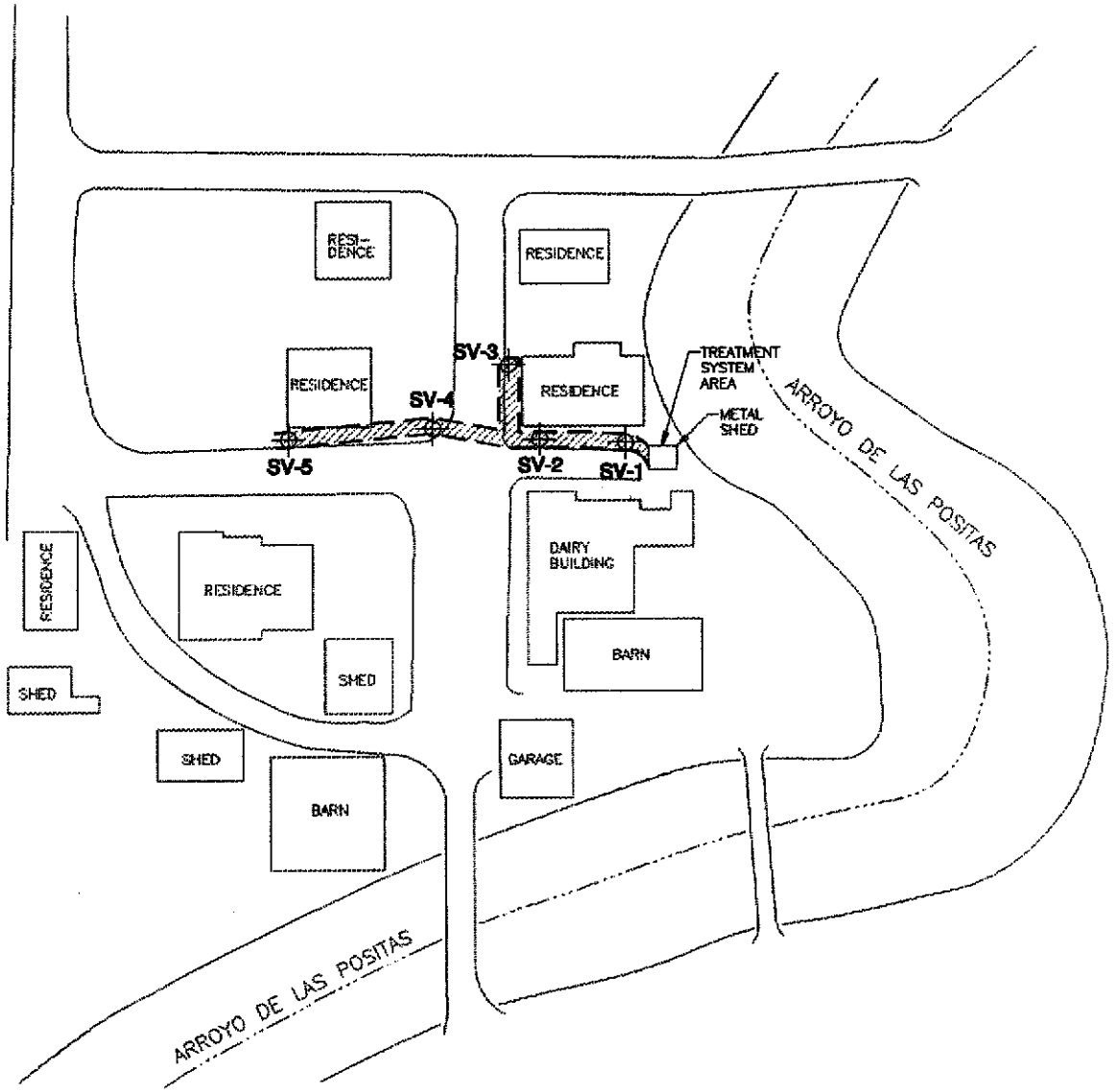
PROJECT NO. 10-300613-006

PLATE 11

CAD FILE: C:_KA-PROJ\10300613\P-11.DWG

LEGEND

- GROUNDWATER MONITORING WELL
- SOIL VENTING/AIR SPARGING WELL
- PROPOSED TRENCHING



NOTES:

1. Locations are approximate.

N

80 0 80

APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Sue DATE: 10-16-97

CHECKED BY: N. Siler DATE: 10-16-97

PROPOSED LAYOUT OF REMEDIATION SYSTEM

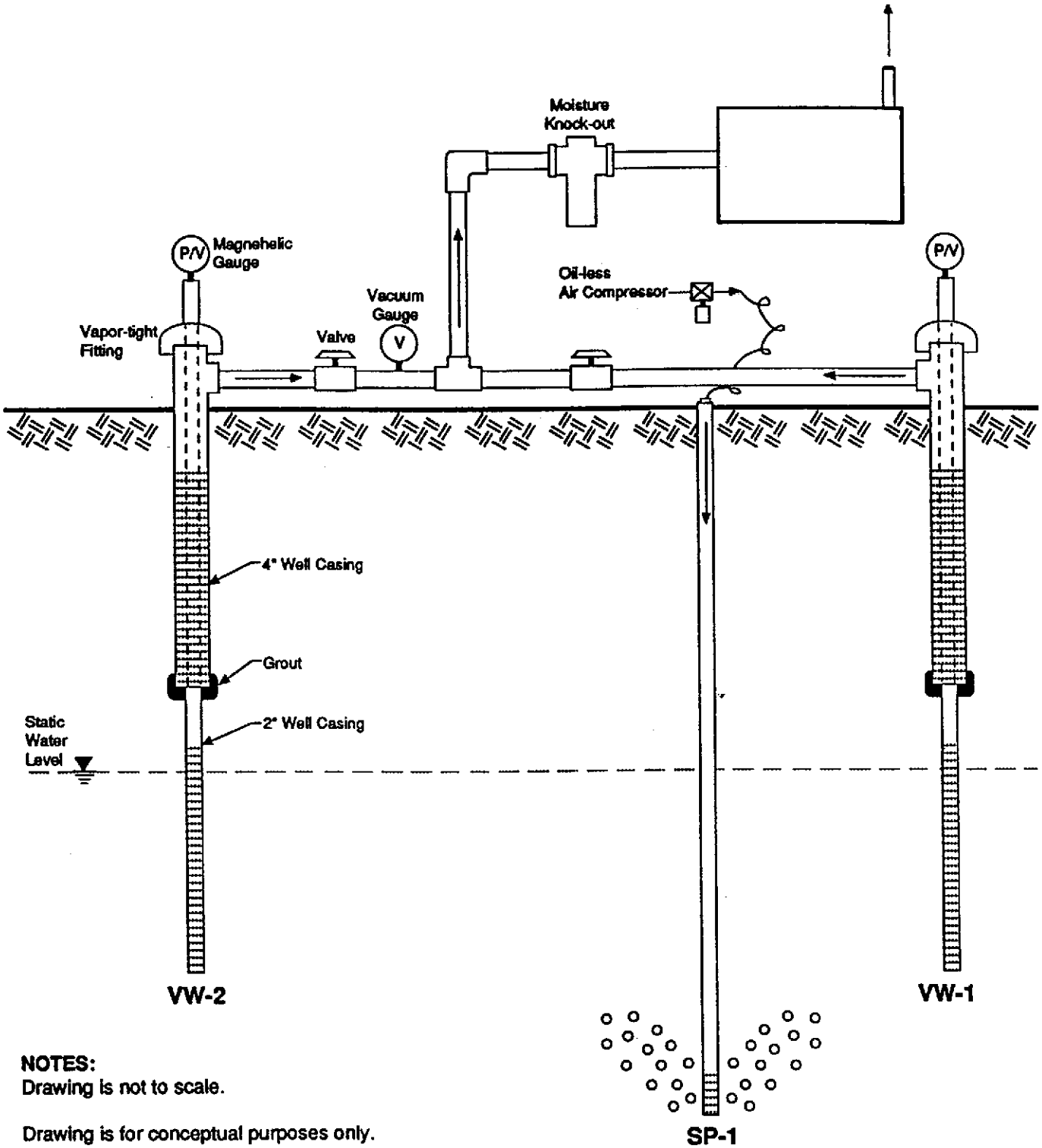
FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

PROJECT NO. 10-300613-006

PLATE

12

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P3-10.dwg



NOTES:

Drawing is not to scale.

Drawing is for conceptual purposes only.

See boring logs for well construction details.

KLEINFELDER

DRAFTED BY: R. Kantor	DATE: 10-16-97
CHECKED BY: N. Siler	DATE: 10-16-97

CONCEPTUAL ILLUSTRATION
SOIL VENTING/SPARGING WELL

FRIESMAN RANCH PROPERTY
1600 FRIESMAN ROAD
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

PROJECT NO. 10-300613-006

PLATE

13

CAD FILE: C:_KA-PROJ\PLEAS\10300613\006\P-13.dwg

TABLE 2
SUBSURFACE SOIL SAMPLE ANALYTICAL RESULTS
FRIESMAN RANCH PROPERTY
LIVERMORE, CALIFORNIA

BOREHOLE NUMBER	SAMPLE COLLECTION DATE	TPH-D (mg/kg)	TPH-G (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL BENZENE (mg/kg)	TOTAL XYLENES (mg/kg)	MTBE (mg/kg)	PAHs (mg/kg)
KB-1 at 10 ft.	8/28/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	NR
KB-1 at 15 ft.	8/28/97	<10	28	0.056	0.0025	0.043	0.071	0.065	<330
KB-3 at 10 ft.	8/28/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	NR
KB-3 at 15 ft.	8/28/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	<330
KB-9 at 15 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	NR
KB-9 at 20 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	<330
KB-14 at 10 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	NR
KB-14 at 15 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	<330
KB-15 at 10 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	NR
KB-15 at 15 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	<330
KB-17 at 5 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	NR	NR
KB-17 at 15 ft.	8/29/97	<10	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	<330
KB-18 at 15 ft.	8/29/97	<10	2,100	<0.005	<0.005	0.006	0.006	NR	NR
KB-18 at 20 ft.	8/29/97	<10	4,000	<0.005	<0.005	0.007	0.02	<0.005	<330

NOTES:

TPH-D	Total Petroleum Hydrocarbons as Diesel
TPH-G	Total Petroleum Hydrocarbons as Gasoline
MTBE	Methyl Tertiary-Butyl Ether
PAHs	Polynuclear Aromatic Hydrocarbons
mg/kg	Milligrams per Kilogram (approximately equal to parts per million)
NR	Not Requested
<0.005	Not detected at or above the laboratory method reporting limit

TABLE 3
RECONNAISSANCE GROUNDWATER SAMPLE ANALYTICAL RESULTS
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

BOREHOLE NUMBER	SAMPLE COLLECTION DATE	TPH-D (µg/L)	TPH-G (µg/L)	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	MTBE (µg/L)	PAHs (µg/L)
KB-1	8/28/97	120	<50	<0.5	<0.5	<0.5	<0.5	NR	<10
KB-2	8/28/97	180	850	7.9	1.7	10	3.4	NR	NR
KB-3	8/28/97	320	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-4	8/28/97	74	91	<0.5	<0.5	0.63	<0.5	NR	NR
KB-5	8/28/97	250	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-6	8/28/97	210	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-7	8/28/97	190	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-8	8/28/97	<50	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-9	8/29/97	113	<50	<0.5	<0.5	<0.5	<0.5	5.1	<10
KB-10	8/29/97	1,500	7,100	41	26	17	16	27	NR
KB-10D	8/29/97	2,700	10,000	53	38	21	29	33	NR
KB-11	8/29/97	6,700	9,900	100	22	380	530	NR	NR
KB-12	8/29/97	97	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-13	8/29/97	13,000	32,000	390	120	890	4,200	NR	NR
KB-14	8/29/97	NA	57	<0.5	<0.5	<0.5	<0.5	6.5	NR
KB-15	8/29/97	NA	<50	<0.5	<0.5	<0.5	<0.5	NR	NR
KB-16	8/29/97	91	<50	0.6	1.0	<0.5	1.1	NR	<10
KB-17	8/29/97	90	<50	<0.5	<0.5	<0.5	0.6	4.5	NR
KB-18	8/29/97	490	320	<0.5	<0.5	1.0	2.2	NR	NR
KB-19	8/29/97	<50	<50	<0.5	0.7	<0.5	0.9	NR	NR
KB-20	8/29/97	<50	<50	0.7	0.8	0.7	2.1	NR	NR
MCL	--	--	--	1.0	150	700	1,750	--	--

NOTES:

TPH-D	Total Petroleum Hydrocarbons as Diesel
TPH-G	Total Petroleum Hydrocarbons as Gasoline
MTBE	Methyl Tertiary-Butyl Ether
PAHs	Polynuclear Aromatic Hydrocarbons
µg/L	Micrograms per Liter (approx. equal to parts per billion)
NA	Not Analyzed
NR	Not Requested
<0.5	Not detected at or above the laboratory method reporting limit
MCL	Maximum Contaminant Level

TABLE 4
GROUNDWATER MONITORING WELL SAMPLES ANALYTICAL RESULTS
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

WELL NUMBER	SAMPLE COLLECTION DATE	TPH-D (µg/L)	TPH-G (µg/L)	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	MTBE (µg/L)	PAHs (µg/L)
KMW-1	9/8/97	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10
KMW-2	9/8/97	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10
KMW-3	9/8/97	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10
KMW-4	9/8/97	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10
KMW-5	9/8/97	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10
KMW-5D	9/8/97	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10
KMW-6	9/8/97	3,200, d	13,000, a	250 *	14	560	490	<150**	140*
MCL	9/8/97	--	--	1.0	150	700	1,750	--	--

NOTES:

TPH-D	Total Petroleum Hydrocarbons as Diesel
TPH-G	Total Petroleum Hydrocarbons as Gasoline
MTBE	Methyl Tertiary-Butyl Ether
PAHs	Polynuclear Aromatic Hydrocarbons
MCL	Cal EPA Maximum Contaminant Level

µg/L	Micrograms per Liter (approx. equal to parts per billion)
<0.5	Not detected at or above the laboratory method reporting limit
a	Unmodified or weakly modified gasoline is significant
d	Gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline ?
*	Naphthalene only, all other chemicals were <20 µg/L
**	Reporting limit raised due to high presence of TPH-g

TABLE 2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

WELL NUMBER	SAMPLE COLLECTION DATE	TPH-D (µg/L)	TPH-G (µg/L)	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	MTBE (µg/L)	PAHs (µg/L)	LEAD (µg/L)
KMW-7	12/28/1998	1,000, d,h	9,100, a,h	23	17	190	700	<70**	110*	38
	3/25/1999	1,200 d,b	4,300, a,h	19	16	56	270	<70**	23 *	22
	6/21/1999	1,300, d,b	1,300, a	6.5	<0.5	21	62	<5.0	27 *	<5.0
dup.	6/21/1999	1,200, d	2,000, a	6.4	6.7	24	76	<5.0	17 *	-
	9/16/1999	1,100, d	950, a	3.3	2	19	33	<10	<10	<10
	10/16/2002	480, d	270, a	1.3	<0.5	4	15	<5.0	-	-
	1/17/2003	610, d	1,100, a	7.8	1.3	24	84	<10	-	-
	4/15/2003	350, d	880, a	7.1	0.69	4.4	52	<5.0	-	-
	7/21/2003	830, n	1,500, e/g, a	2.8	<0.5	8.3	28	<5.0	-	-
	10/30/2003	100, d	150, a	0.54	<0.5	<0.5	<0.5	<5.0	-	-
KMW-8	12/28/1998	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<10	12
	3/25/1999	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-
	6/21/1999	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
	9/16/2002	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
	10/16/2002	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-
	1/17/2003	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-
	4/15/2003	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-
	7/21/2003	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-
	10/30/2003	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-
TAP Sample	4/15/2003	-	<50	<0.5	<0.5	<0.5	<0.5	<5.0	-	-

Notes:

TPH-D	Total Petroleum Hydrocarbons as Diesel	d	Gasoline range compounds are significant
TPH-G	Total Petroleum Hydrocarbons as Gasoline	e	TPH pattern that does not appear to be derived from gasoline (possibly stoddard solvent/mineral spirit)
MTBE	Methyl Tertiary-Butyl Ether		
PAHs	Polyaromatic Hydrocarbons	g	strongly aged gasoline or diesel range compounds are significant
MCL	Cal/EPA Maximum Contaminant Level	h	Lighter than water immiscible sheen is present
µg/L	Micrograms per Liter (approx. equal to parts per billion)	n	stoddard solvent/mineral spirit
<0.5	Not detected at or above the laboratory method reporting limit	**	Reporting limit raised due to high presence of TPH-g
a	Unmodified or weakly modified gasoline is significant	-	Not analyzed
b	Diesel range compounds are significant; no recognizable pattern	NS	Not Sampled

TAP Sample was collected from the water supply well on-site.

* Napthalene only, all other chemicals were <10 micrograms per liter

TABLE 5
CHEMICAL CHARACTERISTICS OF CONSTITUENTS OF CONCERN
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

CONSTITUENT	MOLECULAR WEIGHT (g/mol)	DIFFUSION COEFFICIENT IN AIR (cm^2/s)	DIFFUSION COEFFICIENT IN WATER (cm^2/s)	KOC (L/kg)	HENRY'S LAW CONSTANT ($atm\text{-}m^3/mol$)	SOLUBILITY (mg/L)
Benzene	78.1	9.30 E-02	1.10E-05	98	5.29E-03	1750
Ethylbenzene	106.2	7.60E-02	8.50E-06	95.5	7.69E-03	152
Toluene	92.4	8.50E-02	9.40E-06	134.9	6.25E-03	515
Xylene	106.2	7.20E-02	8.50E-06	239.9	6.97E-03	198
MTBE	88.1	7.92E-02	9.41E-05	1.08	5.77E-04	48000
Naphthalene	128.2	7.20E-02	9.40E-06	1288.2	4.83E-04	31.7

NA = not applicable

TABLE 6
INITIAL SITE CLASSIFICATION
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

CLASSIFICATION 2 CRITERIA[1]	SITE CHARACTERISTICS
Potential for explosive levels or concentrations of accumlated vapors to cause adverse affects in buildings.	TPH-d concentrations in groundwater are indicative of free-product.
Shallow contaminated soils are open to public access or dwellings, schools, parks etc are within 500 feet of these soils.	N/A
Non-potable water supply well is impacted or immediately threatened	N/A
Ground water is impacted and a public or domestic water supply well is located within a 2 year travel distance downgradient of known extent of COCs	On-site domestic water supply well and an off-site municipal supply well within 1,600 feet of site.
Impacted surface water, storm water, or groundwater discharges within 500 feet of a sensitive habitat or surface water body used for drinking water or contact recreation.	The Arroyo de las Positas is within 50 feet of impacted groundwater.
Ground water is impacted and a public or domestic water supply well producing from a different interval is located within the known extent of COCs	N/A

NOTES:

1 = American Society for Testing and Materials (ASTM, 1995)

N/A = Not applicable

TABLE 7
KEY ASSUMPTIONS AND LIMITATIONS OF THE RBCA TIER 2 SPREADSHEET SYSTEM
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

CROSS-MEDIA TRANSFER FACTORS	KEY ASSUMPTIONS[1]	SITE-SPECIFIC LIMITATIONS
Soil Leachate Partition Factor	**Rainfall Infiltration:** Assumes deep percolation to groundwater regardless of soil thickness or permeability **No COC Decay** **Default Dilution Parameters:** Assumes a conservative default value for infiltration rate.	**Infiltration factor:** Site soil is not likely to have the same infiltration rate as the conservative default value.
Soil Volatilization Factor	**Uniform COC Concentrations:** Assumes contaminant levels are uniformly distributed and constant over the exposure duration. **No COC Decay** **Finite Source Term:** Source term adjusted for constant volatilization over exposure period.	**COC Concentrations:** Contaminant levels are not uniformly distributed throughout the site
Soil Enclosed Space Volatilization Factor	**Uniform COC Concentrations** **No COC Decay** **Source Term** **Default Building Parameters:** Conservative default values for foundation crack area and air exchange rate.	**COC Concentrations:** Contaminant levels are not uniformly distributed throughout the site. **Building Parameters:** Does not take into account possible ventilation systems (i.e. air conditioning)
Groundwater Volatilization Factor	**Vapor Equilibrium:** Soil vapor concentrations reach immediate equilibrium with groundwater source. **No COC Decay** **Inifinite Source:** Assumes COC source is constant over time.	**Infinite Source:** It is unlikely that the groundwater source will remain constant since the assumed source has been removed.
Groundwater Enclosed Space Volatilization Factor	**Vapor Equilibrium** **No COC Decay** **Infinite Source** **Default Building Parameters**	**Infinite Source:** Unlikely that groundwater source will remain constant with source removed **Building Parameters:** Does not take into account possible ventilation systems (i e. air conditioning)
Lateral Air Dispersion Factor	**Source Term:** Vapor source concentration based on steady-state, soil-to-air cross-media equations. **Default Stability Class:** Default dispersion coefficients matched to class C stability classifications. **Receptor Location:** assumed directly downwind	**Time Factor:** Does not calculate time from source to receptor

1. Groundwater Services, Inc., 1995

TABLE 8
RBCA TIER 2 MODELING RESULTS
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

POTENTIAL EXPOSURE PATHWAY	POTENTIAL EXPOSURE ROUTE	COMPUTED BENZENE SSTL b	COMPUTED ETHYLBENZENE SSTL b	COMPUTED TOLUENE SSTL b	COMPUTED XYLENE SSTL b	COMPUTED NAHTHALENE SSTL b	COMPUTED MTBE SSTL (ppb)
Soil							
Contaminant Leaching to On-Site Groundwater	Ingestion	3.2	NA	NA	NA	NA	NA
Contaminant Leaching to On-Site Groundwater (MCL)	Ingestion	3.8	NA	NA	NA	NA	NA
Contaminant Volatilization to Ambient Air	Inhalation	2,600	NA	NA	NA	NA	NA
Contaminant Volatilization to Indoor Air	Inhalation	15	NA	NA	NA	NA	NA
Groundwater							
Groundwater Ingestion (on-site)	Ingestion	0.9	3,700	7,300	73,000	150	180
Groundwater Ingestion (on-site,MCL)	Ingestion	1.0	700	150	1,750	NA	NA
Groundwater Ingestion (off-site, 1,600 feet downgradient)	Ingestion	52.0	36,000	7,800	91,000	7,600	9,500
Volatilization to Ambient Air	Inhalation	810	>SOL	>SOL	>SOL	NA	>SOL
Volatilization to Indoor Air	Inhalation	0.8	84,000	36,000	67,000	NA	1,700,000

NOTES:

SSTL = site-specific target level

ppb = parts per billion: ug/kg for soils and ug/L for groundwater

>SOL = greater than the constituents solubility in water

NA = not analyzed due to elimination during Tier 1 screening or physical properties of the constituent

TABLE 9
COMPARATIVE COST ESTIMATE FOR ALTERNATIVE 1
AIR SPARGING OF ENTIRE PLUME
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

ITEM	Quantity	Unit Cost	Units	Present Worth Cost
Pre - Construction				
Design, Plans, Bid Documents	-	-	LS	$15,000
Work Plan	-	-	LS	$5,000
Permitting (BAAQMD, Bldg Dept)	-	-	LS	$3,000
Construction				
Piping Trenches	1000	$30	l.f.	$30,000
Sparging Points (3/4" Dia, 35 ft. deep)	10	$1,500	est.	$15,000
Soil Vapor Extraction Wells	10	$1,000	est.	$10,000
Plumbing	-	-	est.	$12,000
Equipment Compound and Electrical (Outdoors)	-	-	est.	$20,000
SV Sys. (200 cfm) and Sparging Sys. (50 cfm)	-	-	LS	$60,000
Activated Carbon	0	$5	pound	$0
Start - Up				
Start-Up Labor	-	-	LS	$8,000
Start-Up Analytical	-	-	est.	$5,000
Start-Up Report for BAAQMD and ACDEH	-	-	LS	$6,000
Operation and Maintenance				
O&M Labor (per year)	1	$20,000	year	$20,000
O&M Analytical and Equipment (per year)	1	$10,000	year	$10,000
Bimonthly O&M Reporting (per year)	1	$12,000	year	$12,000
Utilities (per year)	1	$25,000	year	$25,000
Quarterly Groundwater Monitoring (2 years)	2	$14,000	year	$28,000
Closure Report (end of year 2)	-	-	LS	$6,000
TOTAL COMPARATIVE COST TO CLOSURE, ALTERNATIVE 1*				**$290,000**

NOTES:
LS - Lump sum estimate.
l.f. - Linear feet.
* - Indicates present value of future cash flows discounted at 7% rate.
Equipment cost based on quote from Enviro Supply & Service Inc.
Duration of active remediation assumed to be 6 months, followed by 1 year of Groundwater Monitoring.
Not a proposal to perform the above. Costs are estimated for comparison purposes only.
For a detailed discussion of the assumed scope of Alternative 2, please refer to Section 7.8.1. of the report

TABLE 10
COMPARATIVE COST ESTIMATE FOR ALTERNATIVE 2
BIOREMEDIATION
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

ITEM	Quantity	Unit Cost	Units	Present Worth Cost
Pre - Construction				
Design, Plans, Bid Documents	-	-	LS	$12,000
Work Plan	-	-	LS	$5,000
Permitting (BAAQMD, Bldg Dept, RWQCB)	-	-	LS	$10,000
Construction				
Piping Trenches	700	$35	l.f.	$24,500
Oxygen/Nutrient Injection Points	8	$2,000	est.	$16,000
Plumbing	-	-	est.	$12,000
Equipment Compound and Electrical (Outdoors)	-	-	est.	$16,000
Equipment (Nutrient mix station, sparge blower)	-	-	LS	$25,000
Start - Up				
Start-Up Labor	-	-	LS	$8,000
Start-Up Analytical	-	-	est.	$12,000
Start-Up Report for BAAQMD and ACDEH	-	-	LS	$6,000
Operation and Maintenance				
O&M Labor (per year)	2	$25,000	year	$50,000
O&M Analytical and Equipment (per year)	2	$16,000	year	$32,000
Bimonthly O&M Reporting (per year)	2	$15,000	year	$30,000
Utilities (per year)	2	$15,000	year	$30,000
Quarterly Groundwater Monitoring (2 years)	3	$14,000	year	$25,312
Closure Report (end of year 3)	-	-	LS	$6,000
TOTAL COMPARATIVE COST TO CLOSURE, ALTERNATIVE 2				**$320,000**

NOTES:
LS - Lump sum estimate.
l.f. - Linear feet.
Equipment cost based on quote from Enviro Supply and Service, Inc.
Duration of active remediation assumed to be 2 years, followed by 1 year of Groundwater Monitoring.
Not a proposal to perform the above. Costs are estimated for comparison purposes only.
For a detailed discussion of the assumed scope of Alternative 2, please refer to Section 7.8.2. of this report.

TABLE 11
COMPARATIVE COST ESTIMATE FOR ALTERNATIVE 3
AIR SPARGING/SOIL VENTING WITH PASSIVE BIOREMEDIATION
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

ITEM	Quantity	Unit Cost	Units	Present Worth Cost
Pre - Construction				
Design, Plans, Bid Documents	-	-	LS	$12,000
Work Plan	-	-	LS	$5,000
Permitting (BAAQMD, Bldg Dept)	-	-	LS	$5,000
Construction				
Piping Trenches	400	$30	l.f.	$12,000
Sparging Points (3/4" Dia, 35 ft. deep)	5	$1,500	est.	$7,500
Soil Vapor Extraction Wells	5	$1,000	est.	$5,000
Plumbing	-	-	est.	$9,000
Equipment Compound and Electrical (Outdoors)	-	-	est.	$18,000
SV Sys. (200 cfm) and Sparging Sys. (50 cfm)	-	-	LS	$50,000
Activated Carbon	0	$5	pound	$0
Start - Up				
Start-Up Labor	-	-	LS	$8,000
Start-Up Analytical	-	-	est.	$5,000
Start-Up Report for BAAQMD and SMEHD	-	-	LS	$6,000
Operation and Maintenance				
O&M Labor (per year)	1.5	$20,000	year	$30,000
O&M Analytical and Equipment (per year)	1.5	$8,000	year	$12,000
Bimonthly O&M Reporting (per year)	1.5	$10,000	year	$15,000
Utilities (per year)	1.5	$20,000	year	$30,000
Quarterly Groundwater Monitoring (2.5 years)	2.5	$14,000	year	$25,312
Closure Report (end of 2.5 years)	-	-	LS	$5,000
TOTAL COMPARATIVE COST TO CLOSURE, ALTERNATIVE 3*				**$260,000**

NOTES:
LS - Lump sum estimate.
l.f. - Linear feet.
* - Indicates present value of future cash flows discounted at 7% rate.
Equipment cost based on quote from Stealth Industries, Anaheim, CA, August 7, 1997.
Assumed MW-Backfill also used as a SV well.
Duration of active remediation assumed to be 6 months, followed by 1 year of Groundwater Monitoring.
Not a proposal to perform the above. Costs are estimated for comparison purposes only.
For a detailed discussion of the assumed scope of Alternative 2, please refer to Section 6.2.
Financing costs are a result of a premium on current site improvement loans for the duration of activity on the site (until end of groundwater monitoring plus six months).

TABLE 12
SUMMARY OF DETAILED EVALUATION OF REMEDIATION OPTIONS
FRIESMAN RANCH PROPERTY
LIVERMORE, ALAMEDA COUNTY, CALIFORNIA

CRITERIA	AIR SPARGING/SOIL VENTING	BIOREMEDIATION	SPARGING/VENTING WITH BIOREMEDIATION
Cost of Alternative	$290,000	$320,000+	$260,000
Technical Feasibility	Good	Good	Good
Regulatory Acceptability	Good	Fair	Good
Effectiveness	Very Good	Fair	Good
Estimated Duration	0.5 – 1 year (1 year assumed)	2 - 5 Years (2 years assumed)	0.5 - 2 years (1.5 years assumed)

APPENDIX A

PHOTODOCUMENTATION

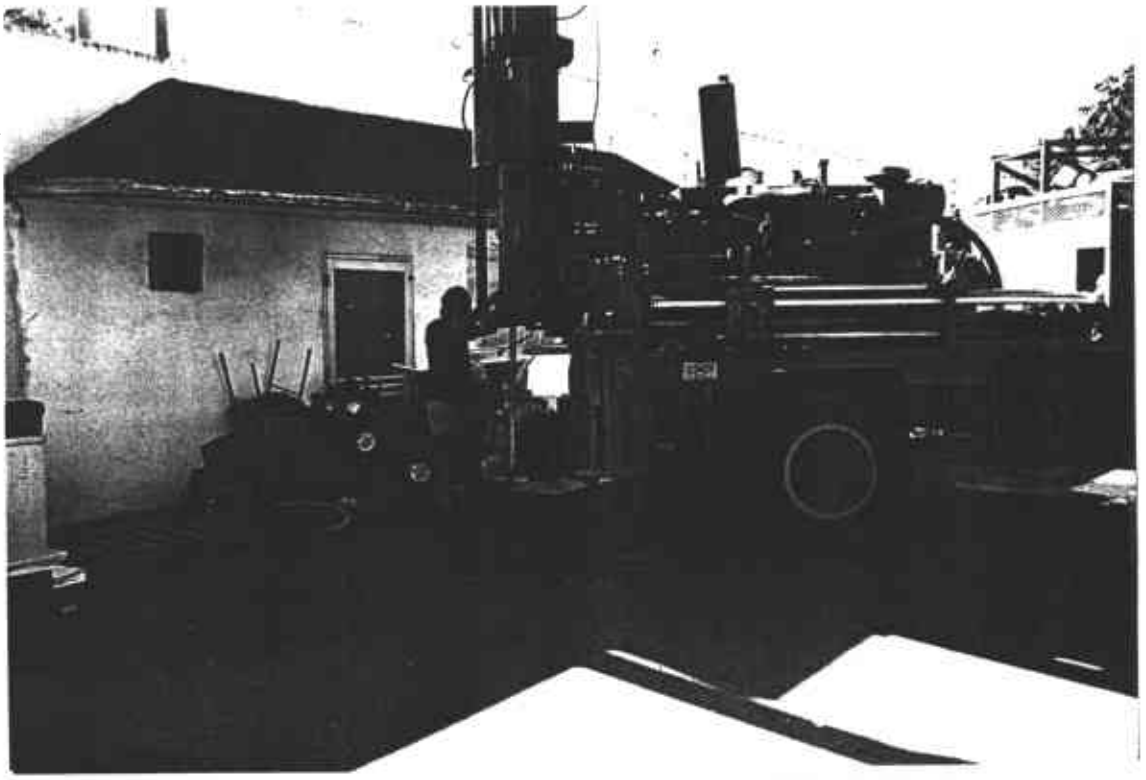
KLEINFELDER PHOTODOCUMENTATION LOG SHEET

CLIENT Children's Hospital Foundation JOB NO. 10-3006-13 Sheet 1 of 5

DATE: 8/28/97

DESCRIPTION: Soil Boring/ Sampling Using Direct Push Method at KB-1.

PHOTO 1



PHOTOGRAPHED BY: RS

DATE: 8/28/97

DESCRIPTION: Soil Boring/ Sampling Using Direct Push Method at KB-14.

PHOTO 2

PHOTOGRAPHED BY: RS

DATE: 8/28/97

DESCRIPTION: PVC Pipe Used for Collection of Reconnaissance Groundwater Sample at KB-7.

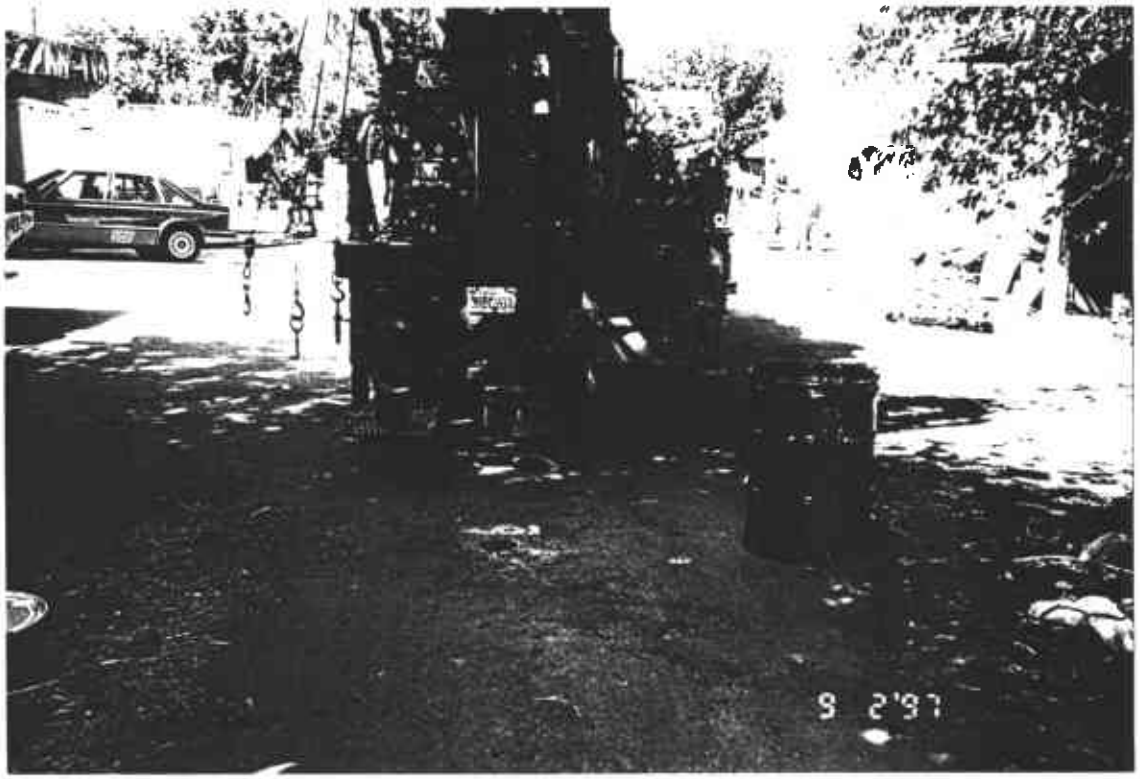
PHOTO 3

PHOTOGRAPHED BY RS

DATE: 9/2/97

DESCRIPTION: Cutting of Asphalt Surface Prior to Advancing the Soil Boring for Well KMW-3.

PHOTO 4

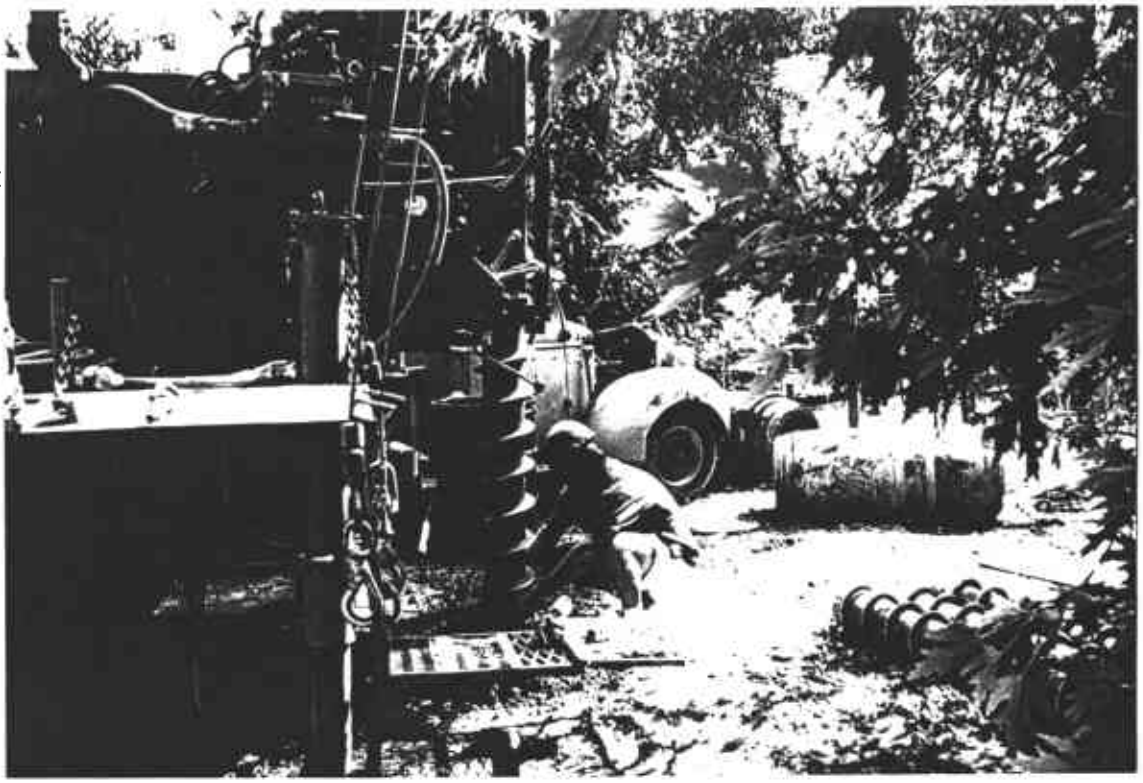


PHOTOGRAPHED BY RS

DATE: 9/2/97

DESCRIPTION: Advancement of Soil Boring for Monitoring Well KMW-1.

PHOTO 5



PHOTOGRAPHED BY RS

DATE: 8/28/97

DESCRIPTION: PVC Well Casing Installation at Well KMW-6.

PHOTO 6

PHOTOGRAPHED BY RS

KLEINFELDER PHOTODOCUMENTATION LOG SHEET

CLIENT Children's Hospital Foundation JOB NO. 10-3006-13 Sheet 4 of 5

DATE: 9/2/97

DESCRIPTION: Emplacement of Filter Pack at Monitoring Well KMW-6.

PHOTO 7

PHOTOGRAPHED BY: RS

DATE: 9/2/97

DESCRIPTION: Emplacement of Cement/ Bentonite Grout at Well KMW-4.

PHOTO 8

PHOTOGRAPHED BY: HP

KLEINFELDER PHOTODOCUMENTATION LOG SHEET

CLIENT Children's Hospital Foundation JOB NO. 10-3006-13 Sheet 5 of 5

DATE: 9/3/97

DESCRIPTION: Wellhead Completion at Monitoring Well KMW-1.

PHOTO 9

PHOTOGRAPHED BY: RS

DATE: 8/28/97

DESCRIPTION: Decontamination of Direct Push and Sampling Equipment Using Steam Cleaner.

PHOTO 10

PHOTOGRAPHED BY HP

APPENDIX B

SOIL BORING/WELL INSTALLATION PERMIT DOCUMENTATION

ZONE 7 WATER AGENCY

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

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 1610 Freisman Road Livermore, CA

CLIENT
Name Childrens Hospital Foundation c/o Eric Eng Dutra Realty
Address 5950 Stoneridge Dr. Voice 510-734-5024
City Pleasanton, CA Zip 94588

APPLICANT
Name Kleinfelder Lita Freeman Fax 510-484-5838
Address 7133 Koll Center Pkwy Voice 510-484-1700
City Pleasanton, CA Zip 94566

TYPE OF PROJECT

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

PROPOSED WATER SUPPLY WELL USE
Domestic ___ Industrial ___ Other 6 MWS. Monitoring
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger X
Cable ___ Other GEOPROBE

DRILLER'S LICENSE NO. C57-512268

WELL PROJECTS
Drill Hole Diameter 10 in. Maximum Depth 40 ft.
Casing Diameter 4 in. Number 6
Surface Seal Depth 20 ft.

GEOTECHNICAL PROJECTS
Number of Borings 25 Maximum Depth 25 ft.
Hole Diameter 1 3/4 in.

ESTIMATED STARTING DATE 9/2/97 ~~8/27/97~~
ESTIMATED COMPLETION DATE 9/3/97

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

APPLICANT'S SIGNATURE [signature] Date 8/25/97

FOR OFFICE USE

PERMIT NUMBER 97448
LOCATION NUMBER
APN: 904-0001-001-10

PERMIT CONDITIONS

Circled Permit Requirements Apply

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

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

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

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

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Wyman Hong Date 25 Aug 97

91992

APPENDIX C

SOIL BORING LOGS AND WELL CONSTRUCTION SUMMARIES

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel sand mixture little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand, and silt mixtures.
		SC	Clayey sands, and clay mixtures.

MAJOR DIVISIONS		LTR	DESCRIPTION
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean silty clays.
		OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS LL > 50	MH	Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

- Bulk, bag, or grab sample
- Soil Probe Split Spoon Sampler (SPT), 7/8 in. ø
- Modified California (Porter) Sampler (MPS), 2.5 in. ø
- California Sampler, 3 in. ø
- Shelby Tube, 3 in. ø

OVA — Organic Vapor Analyzer

PID — Total organic vapors (parts per million) measured by a photo-ionization device

FID — Total organic vapors (parts per million) measured by a flame-ionization device

NA — Not Applicable

- Blank casing
- Screened casing
- Cement grout
- Bentonite
- Sand pack or gravel pack
- Sharp Contact (observed)
- Inferred Contact (contact not observed)
- Gradational Contact (observed)
- Water level observed in boring
- Stabilized water level

NFWE — No free water encountered

NOTES: Blow counts represent the number of blows of a 140-pound hammer falling 30 inches required to drive a sampler through the last 12 inches of an 18-inch penetration.

The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

References to plasticity of cohesive soils are based on qualitative field observations and not on quantitative field or laboratory tests. Qualitative soil plasticity is noted solely to aid in stratigraphic correlation and is not intended for geotechnical characterization of soils.

KLEINFELDER

DRAFTED BY: L. Sue DATE: 9-15-97

CHECKED BY: N. Siler DATE: 9-15-97

BORING LOG LEGEND

CHILDREN'S HOSPITAL FOUNDATION
FRIESMAN RANCH PROPERTY
LIVERMORE, CALIFORNIA

PROJECT NO. 10-300613-005

PLATE

CAD FILE: C:_KA-PROJ\PLEAS\10300613\005\B-LEGEND.dwg

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-1
Number: 10-300613-005	
Total Depth: 25 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
5				0 0 80 100	2.3	CL	CLAY, silty – dark grayish brown (10YR 4/2), moist, medium stiff, medium to high plasticity, trace fine grained sand (~5%)		
10				90 100 100 100	2.9	CL	CLAY, silty – very dark grayish brown (10YR 3/2), moist, medium stiff, medium plasticity, trace fine to medium grained sand (~5%), no odor		
15				90 100 100 100	40.3	CL	as above, strong odor	1030 hrs ▽	
20				90 100 100 100	0.0	CL	CLAY, silty – grayish brown (2.5Y 5/2), moist, stiff to very stiff, high plasticity, no odor		
25				100 100 100 100		SM	SAND, silty – dark grayish brown (10YR 4/2), saturated, low plasticity, fine grained		
28								Boring terminated at 28.0 feet.	

Designated Purpose(s) of Log: Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-2
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–24								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1158 hrs ▽	
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	8/28/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-3
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
5				0 0 70 80	0.0	CL	CLAY, silty – very dark gray (7.5YR 3/1), moist, stiff, medium to high plasticity, trace fine grained sand (~5%), no odor		
10				90 100 100 100	0.0	CL	CLAY, silty – dark brown (7.5YR 3/2), moist, stiff, high plasticity, no odor		
15				95 100 100 100	0.0		as above	1545 hrs ▽	
20				95 100 100 100	0.0		as above		
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-4
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–28								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1350 hrs ▽	
28–30								Boring terminated at 28.0 feet.	

Designated Purpose(s) of Log

Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-5
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–27								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1430 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-6
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–28								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1525 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by: R. Silva	Date: 8/28/97	Plate
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-7
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–27								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1625 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by: R. Silva	Date: 8/28/97	Plate
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-8
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–28								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1700 hrs ▽	
28–29								Boring terminated at 28.0 feet.	
30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-9
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
1–9				0 50 100 100	0.9	CL	CLAY, silty – very dark gray (10YR 3/2), stiff, medium to high plasticity, trace fine grained sand (~5%), no odor		
10–14				95 100 100 100	0.9	CL	CLAY, silty – dark grayish brown (140YR 4/2), moist, stiff, medium to high plasticity, no odor		
15–19				95 100 100 100	1.8	CL	CLAY, silty – brown (7.5YR 4/2), moist, stiff to very stiff, high plasticity, no odor	0935 hrs ▽	
20–28				100 100 100 100	1.2		as above	Boring terminated at 28.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	8/28/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-10
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–28								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1040 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/29/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-11
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–27								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1300 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/29/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-12
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–27								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1410 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/29/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-13
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–27								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1520 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/29/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-14
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
5				0 0 90 100	2.7	CL	CLAY, silty – dark grayish brown (10YR 4/2), moist, stiff, medium plasticity, trace fine grained sand (~5%), no odor		
10				95 100 100 100	1.1	CL	CLAY, silty – dark brwon (10YR 3/3), moist, sstiff, medium to high plasticity, no odor		
15				95 100 100 100	1.0		as above	1220 hrs ▽	
20				95 100 100 100	0.7	CL	CLAY, silty – BROWN (7.5yr 4/2), moist, stiff, medium plasticity, no odor		
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log

Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

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KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-15
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
1–9				0 0 0 0	0.9	CL	CLAY, silty – dark grayish brown (10YR 4/2), moist, stiff, medium to high plasticity, trace fine grained sand (~5%), no odor		
10–14				95 100 100 100	1.6	CL	CLAY, silty – dark brown (10YR 3/3), moist, stiff, medium plasticity, no odor		
15–23				90 100 100 100	2.1	CL	CLAY, silty – brown (7.5YR 4/2), moist, medium to high plasticity, no odor	1225 hrs ▽	
24–30								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	8/29/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

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KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-16
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑ PID ☐ FID	USCS	Description	Remarks	Well Construction
1–9				0 0 90 100	0.0	CL	CLAY, silty – very dark gray (10YR 3/1), moist, stiff, medium plasticity, no odor		
10–14				95 100 100 100	0.0	CM	GRAVEL, silty – light brownish gray (10YR 6/2), moist, loose, low plasticity, with rocks, some silt (~10%), no odor	1440 hrs ▽	
15–17				90 100 100 100	0.0	CL	CLAY, silty – dark brown (10YR 3/3). moist, stiff, medium plasticity, no odor		
28								Boring terminated at 28.0 feet.	

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/28/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

CAD FILE: C:_KA-PROJ\PLEAS\10300613\005\ KB-16.dwg

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-17
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
5				0 50 90 100	0.7 100 100 100	CL	CLAY, silty – very dark gray (10YR 3/1), moist, stiff, medium to high plasticity, trace fine grained sand (~5%), no odor		
10				95 100 100 100	1.1 100 100 100	CL	CLAY, silty – very dark graysh brown (10YR 3/2), moist, stiff, medium to high plasticity, no odor	1500 hrs ▽	
15				90 100 100 100	0.9 100 100 100	CL	CLAY, silty – grayish brown (2.5Y 5/2), moist, stiff to very stiff, high plasticity, no odor		
28								Boring terminated at 28.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	8/29/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

CAD FILE: C:_KA-PROJ\PLEAS\10300613\005\ KB-17.dwg

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-18
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☑PID ☐FID	USCS	Description	Remarks	Well Construction
1-4									
5-9				95 100 100 100	0.0	CL	CLAY, silty - very dark gray (10YR 3/1), moist, stiff, meidum to high plasticity, trace fine grained sand (~5%), no odor		
10-14				90 100 100 100	0.0	CL	CLAY, silty - very dark grayish brown (10YR 3/2), moist, stiff to very stiff, medium to high plasticity, no odor		
15-19				100 100 100 100	20.9	CL	CLAY, silty - grayish brown (2.5Y 5/2), moist, stiff to very stiff, high plasticity, slight odor		
20-27				100 100 100 100	12.9	CL	CLAY, silty - grayish brown (2.5Y 5/2), moist, stiff, high plasticity, slight odor	1515 hrs ▽	
28-30								Boring terminated at 28.0 feet.	

Designated Purpose(s) of Log

Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/29/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

CAD FILE: C:_KA-PROJ\PLEAS\10300613\005\ KB-18.dwg

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-19
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–27								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1610 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	8/29/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

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KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KB-20
Number: 10-300613-005	
Total Depth: 28 feet	Sheet: 1 of 1

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1–28								Boring not logged. No soil samples collected. Grab groundwater samples collected for TPH-d, TPH-g and BTEX analyses. 1550 hrs ▽	
28								Boring terminated at 28.0 feet.	
29–30									

Designated Purpose(s) of Log

Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	8/29/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

CAD FILE: C:_KA-PROJ\PLEAS\10300613\005\ KB-20.dwg

KLEINFELDER

ENVIRONMENTAL BORING AND MONITORING WELL DATA SHEET

Project	Boring No.
Friesman Ranch Property	KMW-1
Number 10-300613-005	
Total Depth 24 feet	**Sheet** 1 of 2

Location

Well Location	Section, Range, Township	Owner and Mailing Information
See Site Plan	APN 904-0001-001-10 Local Permit # 97448	Children's Hospital Foundation 747 52nd Street Oakland, CA 94609-1815

Drilling Operations

Drilling Company Spectrum	**Logged By** Richard Silva	**Task**	**Start**	**Finish**
Rig Make/Model CME-458	**Driller/Crew** Robert Duvall/Art Castaneda	**Drilling**	9/2/97	9/2/97
Bit Type/Diameter Hollow stem auger, 10"ø	**Inspector**	**Completion**	9/3/97	6/3/97
Hammer Data 140 pounds, 30 inches	**Agency** Zone 7 Water Agency	**Development**	9/4/97	9/4/97

Boring Completion

Monumentation	Well Design	Material and Size	Top	Bottom
Reference Point Description Top of Casing	**Surface Casing**	Christie Box	0 feet	0 feet
Northing **Easting**	**Casing**	4"ø Sched 40 PVC	3 inches	9 feet
Elevation	**Screen**	4"ø Sch 40 PVC, 0.02"-slot	9 feet	24 feet
Reference Point **Ground**	**Filter Pack**	2/12 Lonestar	8 feet	24 feet
Datum Mean Sea Level	**Bentonite**	3/8" Pellets	6 feet	8 feet
Surveyed By **Date**	**Surface Seal**	2-5% Cement/Bentonite Grout	0.5 feet	6 feet

Field Hydrologic Conditions and Observations

Weather	Other Observations	Ground Water			
Temperature Max. 95°F Min. 75°F	**Recent Rainfall/Precipitation** None	**Sym.**	**Date**	**Time**	**Level**
Humidity --	**Nearby Wells Pumping** Unknown	▽	9/2/97		21 feet
Windspeed/Direction Slight breeze, westerly	**Nearby Surface Water** Stream, outer edge and through site	▼	9/4/97	0915 hrs	12.72 feet
Cloud Cover Clear skies	**Nearby Utilities** Water and storm drains	▼	9/12/97	1004 hrs	12.84 feet

Surface Conditions

Landscape

Development Information

Total Gallons Purged =
pH = 7.2
Temperature (°C) = 18
Color =
Conductivity (µmhos/cm) = 1500
Salinity (0/00) =
Turbidity (NTUs) =

Additional Remarks

PLATE

Date: 9/12/97

Revision Date: _____

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KMW-2
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 2 of 2

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
0							Fill – GRAVEL – moist, subangular, medium to fine grained, poorly graded, no odor		
2						CL	CLAY, silty – very dark brown (7.5YR 2.5/2), moist, medium stiff, medium plasticity, trace medium to fine grained sand (~5%), no odor		
8						CL	CLAY, silty – dark brown (7.5YR 3/3), moist, medium to very sitff, medium to high plasticity, no odor	9/12/97,1007 ▼	
15						CL	CLAY, silty – brown (7.5YR 4/2), moist, very stiff, medium to high plasticity, no odor		
20							as above, saturated	9/2/97 ▽	
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	9/4/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

KLEINFELDER

ENVIRONMENTAL BORING AND MONITORING WELL DATA SHEET

Project	Boring No.
Friesman Ranch Property	KMW-3
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 2

Location

Well Location	Section, Range, Township	Owner and Mailing Information
See Site Plan	APN 904-0001-001-10 Local Permit # 97448	Children's Hospital Foundation 747 52nd Street Oakland, CA 94609-1815

Drilling Operations

Drilling Company	Logged By	Task	Start	Finish
Spectrum	Richard Silva			
Rig Make/Model: CME-458	Driller/Crew: Robert Duvall/Art Castaneda	Drilling	9/2/97	9/2/97
Bit Type/Diameter: Hollow stem auger, 10"ø	Inspector	Completion	9/3/97	6/3/97
Hammer Data: 140 pounds, 30 inches	Agency: Zone 7 Water Agency	Development	9/4/97	9/4/97

Boring Completion

Monumentation	Well Design	Material and Size	Top	Bottom
Reference Point Description: Top of Casing	Surface Casing	Christie Box	0 feet	0 feet
Northing / Easting	Casing	4"ø Sched 40 PVC	3 inches	9 feet
Elevation	Screen	4"ø Sch 40 PVC, 0.02"-slot	9 feet	24 feet
Reference Point / Ground	Filter Pack	2/12 Lonestar	8 feet	24 feet
Datum: Mean Sea Level	Bentonite	3/8" Pellets	6 feet	8 feet
Surveyed By / Date	Surface Seal	2-5% Cement/Bentonite Grout	0.5 feet	6 feet

Field Hydrologic Conditions and Observations

Weather	Other Observations	Ground Water			
Temperature: Max. 95°F, Min. 75°F	Recent Rainfall/Precipitation: None	Sym.	Date	Time	Level
Humidity: --	Nearby Wells Pumping: Unknown	▽	9/2/97		21.5 feet
Windspeed/Direction: Slight breeze, westerly	Nearby Surface Water: Stream, outer edge and through site	▼	9/4/97	0920 hrs	12.22 feet
Cloud Cover: Clear skies	Nearby Utilities: Water and storm drains	▼	9/12/97	1009 hrs	12.36 feet

Surface Conditions

Asphalt

Development Information

Total Gallons Purged =
pH = 7.2
Temperature (°C) = 19
Color =
Conductivity (μmhos/cm) = 1310
Salinity (0/00) =
Turbidity (NTUs) =

Additional Remarks

PLATE

Date: 9/12/97

Revision Date:

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KMW-3
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 2 of 2

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐ PID ☐ FID	USCS	Description	Remarks	Well Construction
0							Fill – GRAVEL – moist, no odor		
1–6						SM	SAND, silty – grayish brown (10YR 5/2), moist, medium to fine grained, poorly graded, with some subangular to round gravel (~10%), no odor		
7–19						SM	SAND, silty – yellowish brown (10YR 5/4), moist, medium to coarse grained, poorly graded, with cobbles, no odor	9/12/97,1009 ▼	
19–24						SM	SAND, silty – dark grayish brown (10YR 4/2), moist, medium to coarse grained, poorly graded, with subangular gravel, no odor as above, saturated	9/2/97 ▽	
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log: Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	9/2/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

KLEINFELDER

ENVIRONMENTAL BORING AND MONITORING WELL DATA SHEET

Project	Boring No.
Friesman Ranch Property	KMW-4
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 2

Location

Well Location	Section, Range, Township	Owner and Mailing Information
See Site Plan	APN 904-0001-001-10 Local Permit # 97448	Children's Hospital Foundation 747 52nd Street Oakland, CA 94609-1815

Drilling Operations

Drilling Company	Logged By	Task	Start	Finish
Spectrum	Richard Silva			
Rig Make/Model: CME-458	Driller/Crew: Robert Duvall/Art Castaneda	Drilling	9/3/97	9/3/97
Bit Type/Diameter: Hollow stem auger, 10"ø	Inspector:	Completion	9/3/97	9/3/97
Hammer Data: 140 pounds, 30 inches	Agency: Zone 7 Water Agency	Development	9/4/97	9/4/97

Boring Completion

Monumentation	Well Design	Material and Size	Top	Bottom
Reference Point Description: Top of Casing	Surface Casing	Christie Box	0 feet	0 feet
Northing: Easting:	Casing	4"ø Sched 40 PVC	3 inches	9 feet
Elevation	Screen	4"ø Sch 40 PVC, 0.02"-slot	9 feet	24 feet
Reference Point: Ground:	Filter Pack	2/12 Lonestar	8 feet	24 feet
Datum: Mean Sea Level	Bentonite	3/8" Pellets	6 feet	8 feet
Surveyed By: Date:	Surface Seal	2-5% Cement/Bentonite Grout	0.5 feet	6 feet

Field Hydrologic Conditions and Observations

Weather	Other Observations	Ground Water			
Temperature: Max. 95°F, Min. 75°F	Recent Rainfall/Precipitation: None	Sym.	Date	Time	Level
Humidity: --	Nearby Wells Pumping: Unknown	▽	9/3/97		21.5 feet
Windspeed/Direction: Slight breeze, westerly	Nearby Surface Water: Stream, outer edge and through site	▼	9/4/97	0924 hrs	13.00 feet
Cloud Cover: Clear skies	Nearby Utilities: Water and storm drains	▼	9/12/97	1011 hrs	13.81 feet

Surface Conditions

Asphalt

Development Information

Total Gallons Purged =
pH = 7.3
Temperature (°C) = 21
Color =
Conductivity (µmhos/cm) = 1600
Salinity (0/00) =
Turbidity (NTUs) =

Additional Remarks

PLATE

Date: 9/12/97

Revision Date: _____

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KMW-4
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 2 of 2

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐ PID ☐ FID	USCS	Description	Remarks	Well Construction
0							Fill – GRAVEL – moist, no odor		
1						SM	SAND, silty – dark brown (7.5YR 3/3), moist, low plasticity, medium grained, no odor		
2–8						CL	CLAY, silty – very dark brown (7.5YR 2.5/2), moist, medium stiff, medium plasticity, trace fine grained sand (~5%), no odor		
9–15						CL	CLAY, silty – dark brown (7.5YR 3/3), moist, medium stiff, medium to high plasticity, trace fine to medium grained sand (~2%), no odor	9/12/97,1011 ▼	
16–23						CL	CLAY, silty – brown (7.5YR 4/2), moist, medium stiff, medium to high plasticity, no odor as above, saturated	9/3/97 ▽	
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log
Site Characterization

Note: Logs are to be used only for designated purpose(s).

Logged by	Date	Plate
R. Silva	9/3/97	
Drafted by: L. Sue	Date: 9/15/97	
Reviewed by: N. Siler	Date: 10/16/97	

CAD FILE: C:\...KMW-4.dwg

KLEINFELDER

ENVIRONMENTAL BORING AND MONITORING WELL DATA SHEET

Project	Boring No.
Friesman Ranch Property	KMW-5
Number 10-300613-005	
Total Depth 24 feet	**Sheet** 1 of 2

Location

Well Location	Section, Range, Township	Owner and Mailing Information
See Site Plan	APN 904-0001-001-10 Local Permit # 97448	Children's Hospital Foundation 747 52nd Street Oakland, Ca 94609-1815

Drilling Operations

		Task	Start	Finish
Drilling Company Spectrum	**Logged By** Richard Silva			
Rig Make/Model CME-458	**Driller/Crew** Robert Duvall/Art Castaneda	**Drilling**	9/3/97	9/3/97
Bit Type/Diameter Hollow stem auger, 10"ø	**Inspector**	**Completion**	9/3/97	9/3/97
Hammer Data 140 pounds, 30 inches	**Agency** Zone 7 Water Agency	**Development**	9/4/97	9/4/97

Boring Completion

Monumentation	Well Design	Material and Size	Top	Bottom
Reference Point Description Top of Casing	**Surface Casing**	Christie Box	0 feet	0 feet
Northing **Easting**	**Casing**	4"ø Sched 40 PVC	3 inches	9 feet
Elevation	**Screen**	4"ø Sch 40 PVC, 0.02"-slot	9 feet	24 feet
Reference Point **Ground**	**Filter Pack**	2/12 Lonestar	8 feet	24 feet
Datum Mean Sea Level	**Bentonite**	3/8" Pellets	6 feet	8 feet
Surveyed By **Date**	**Surface Seal**	2-5% Cement/Bentonite Grout	0.5 feet	6 feet

Field Hydrologic Conditions and Observations

Weather	Other Observations	Ground Water			
Temperature Max. 95°F Min. 75°F	**Recent Rainfall/Precipitation** None	**Sym.**	**Date**	**Time**	**Level**
Humidity --	**Nearby Wells Pumping** Unknown	▽	9/3/97		21.0 feet
Windspeed/Direction Slight breeze, westerly	**Nearby Surface Water** Stream, outer edge and through site	▼	9/4/97	0935 hrs	14.14 feet
Cloud Cover Clear skies	**Nearby Utilities** Water and storm drains	▼	9/12/97	1012 hrs	14.30 feet

Surface Conditions

Asphalt

Development Information

Total Gallons Purged =
pH = 7.3
Temperature (°C) = 21
Color =
Conductivity (µmhos/cm) = 1590
Salinity (0/00) =
Turbidity (NTUs) =

Additional Remarks

PLATE

Date: 9/12/97

Revision Date:

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KMW-5
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 2 of 2

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐ PID ☐ FID	USCS	Description	Remarks	Well Construction
0							Fill – GRAVEL – moist, subangular to angular, poorly graded, no odor		
1–6						CL	CLAY, silty – very dark brown (7.5YR 2.5/2), moist, medium stiff, medium to high plasticity, trace fine grained sand (~5%), no odor		
7–13						CL	CLAY, silty – very dark brown (7.5YR 3/3), moist, medium to very stiff, medium to high plasticity, trace fine grained sand (~5%), no odor	9/12/97,1012 ▼	
17–20						CL	CLAY, silty – brown (7.5YR 4/2), moist, medium to very stiff, medium to high plasticity, no odor		
20–21							as above, saturated	9/3/97 ▽	
24								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	9/3/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

KLEINFELDER

ENVIRONMENTAL BORING AND MONITORING WELL DATA SHEET

Project	Boring No.
Friesman Ranch Property	KMW-6
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 1 of 2

Location

Well Location	Section, Range, Township	Owner and Mailing Information
See Site Plan	APN 904-0001-001-10 Local Permit # 97448	Children's Hospital Foundation 747 52nd Street Oakland, CA 94609-1815

Drilling Operations

Drilling Company	Logged By	Task	Start	Finish
Spectrum	Richard Silva			
Rig Make/Model: CME-458	Driller/Crew: Robert Duvall/Art Castaneda	Drilling	9/3/97	9/3/97
Bit Type/Diameter: Hollow stem auger, 10"ø	Inspector	Completion	9/3/97	9/3/97
Hammer Data: 140 pounds, 30 inches	Agency: Zone 7 Water Agency	Development	9/4/97	9/4/97

Boring Completion

Monumentation	Well Design	Material and Size	Top	Bottom
Reference Point Description: Top of Casing	Surface Casing	Christie Box	0 feet	0 feet
Northing / Easting	Casing	4"ø Sched 40 PVC	3 inches	9 feet
Elevation	Screen	4"ø Sch 40 PVC, 0.02"-slot	9 feet	24 feet
Reference Point / Ground	Filter Pack	2/12 Lonestar	8 feet	24 feet
Datum: Mean Sea Level	Bentonite	3/8" Pellets	6 feet	8 feet
Surveyed By / Date	Surface Seal	2-5% Cement/Bentonite Grout	0.5 feet	6 feet

Field Hydrologic Conditions and Observations

Weather	Other Observations	Ground Water			
Temperature: Max. 95°F, Min. 75°F	Recent Rainfall/Precipitation: None	Sym.	Date	Time	Level
Humidity: ---	Nearby Wells Pumping: Unknown	▽	9/3/97		21.0feet
Windspeed/Direction: Slight breeze, westerly	Nearby Surface Water: Stream, outer edge and through site	▼	9/4/97	0928 hrs	14.19 feet
Cloud Cover: Clear skies	Nearby Utilities: Water and storm drains	▼	9/12/97	1014 hrs	14.33 feet

Surface Conditions

Asphalt

Development Information

Total Gallons Purged =
pH = 6.9
Temperature (°C) = 23
Color =
Conductivity (μmhos/cm) = 1900
Salinity (0/00) =
Turbidity (NTUs) =

Additional Remarks

PLATE

Date: 9/12/97

Revision Date:

KLEINFELDER

Project	Boring No.
Friesman Ranch Property	KMW-6
Number: 10-300613-005	
Total Depth: 24 feet	Sheet: 2 of 2

LOG OF BORING

Depth (feet)	Sample Number	Sample Type	Blows/Foot	Recovery (%)	OVA (ppm) ☐PID ☐FID	USCS	Description	Remarks	Well Construction
1-24							Fill – GRAVEL – moist, subangular medium to fine grained, poorly graded, no odor		
						CL	CLAY, silty – very dark brown (7.5YR 2.5/2), moist, medium stiff, medium to high plasticity, no odor		
						CL	CLAY, silty – dark brown (7.5YR 3/3), moist, medium stiff, medium to high plasticity, trace fine grained sand (~5%), no odor	9/12/97,1014 ▼	
						CL	CLAY, silty – dark brown (7.5YR 4/2), moist, medium stiff, medium to high plasticity, trace fine grained sand (~5%), no odor		
							as above, saturated	9/3/97 ▽	
24-30								Boring terminated at 24.0 feet.	

Designated Purpose(s) of Log	Logged by	Date	Plate
Site Characterization	R. Silva	9/4/97	
	Drafted by: L. Sue	Date: 9/15/97	
	Reviewed by: N. Siler	Date: 10/16/97	

Note: Logs are to be used only for designated purpose(s).

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CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

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STATE OF CALIFORNIA DWR
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STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

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CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

September 12, 1997
Job No. 97602

Table of Elevations & Coordinates on Monitoring Wells

Friesman Ranch Project
1660 Friesman Road
Pleasanton, California

Well No.	Northing	Easting	Elevation	
KMW1	4106.85	5999.31	370.12	Top north side of PVC casing
			370.65	Top north side of well box
KMW2	4260.75	5958.08	370.72	Top north side of PVC casing
			371.15	Top north side of well box
KMW3	4009.77	5875.27	369.10	Top north side of PVC casing
			369.64	Top north side of well box
KMW4	4041.34	5786.50	369.80	Top north side of PVC casing
			370.11	Top north side of well box
KMW5	4128.32	5724.09	369.52	Top north side of PVC casing
			369.94	Top north side of well box
KMW6	4144.29	5842.23	370.08	Top north side of PVC casing
			370.61	Top north side of well box

Basis of Bearings and Coordinates

The bearing South 2° 44' 51" West taken on the easterly line of that certain 194.988 +/- acre parcel of land designated as "Reynold C. Johnson Co." on that certain Record of Survey Number 667 filed for record on March 16, 1984, in Book 12 of Records of Survey at pages 17 & 18 was taken as the basis of bearings for this survey. The northerly terminus of said line (designated as "S 2° 44' 51" W 1,533.43' " on said survey) was held at coordinate value northing 5000 / easting 5000.

Benchmark

City of Pleasanton Benchmark #V1257 NGS benchmark disk stamped V 1257 1974 located 5.05 miles east along Interstate Highway 580 from the junction of Foothill Road at Dublin, 5.65 miles west of Livermore, 0.35 mile east of the junction of El Charro Road, 42 feet south of the south most center line of the east bound highway lanes, 83 feet east of light pole D9382, in the top of the southeast corner of a 3-by 4-foot concrete catch basin with a metal grate, 3.2 feet north of the south right of way fence, 0.3 foot northwest of the southeast corner of the catch basin, and about 2 feet lower in elevation than the east bound lanes.

Elevation = 356.455 M.S.L.

KIER & WRIGHT CIVIL ENGINEERS & SURVEYORS, INC.
5880 WEST LAS POSITAS BOULEVARD, SUITE 34 ♦ PLEASANTON, CALIFORNIA 94588 ♦ (510) 734-8060 ♦ (510) 734-8064

APPENDIX D

FIELD MONITORING NOTES

WELL DEVELOPMENT AND SAMPLING LOGS
SEPTEMBER 4, 1997

KA KLEINFELDER

RECORD OF WATER LEVEL MEASUREMENTS

Date: 9-4-97 Weather: CLEAR SKIES, WARM, ~80°F Sheet 1 of 1

Project: FREISMAN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3006-13605 Reviewed By: Date:

Instrument Number: 12185

Well Number	Time (opened/measured)	Sensitivity Setting	Measuring Point	Measurement	Replicate Measurements (if requested)		Notes			(locked?)
	(24-hr)	(est. %)	(M.P.)	1	2	3	TOTAL DEPTH			
KMW-1	0840/0915		TOC	12.72			23.74			✓
KMW-2	0843/0917			14.19			23.84			✓
KMW-3	0845/0920			12.22			23.87			✓
KMW-4	0847/0924			13.00			23.85			✓
KMW-5	0849/0935			14.14			23.87			✓
KMW-6	0851/0938		↓	14.19			23.80			✓

M.P.: (TOC) GS, Cover ring, Other: All Wells Locked – (YES) NO

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-1

Date: 9-4-97 Weather: CLEAR SKIES, WARM, SLIGHT BREEZE Sheet 1 of 1

Project: FREISMAN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3066-13/005 Reviewed By: Date:

Purpose of Log ☒ Development ☐ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	(Submersable Pump)	Dedicated Pump	Other:
Sampling Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-4/0800	9-4/0815	

Decontamination Methods	Wash	Rinse I	Rinse II	Rinse III
TSP / Alconox / Other:	DI, Tap, Other / Steam, Hot, Cool	DI, Tap, Other / Steam, Hot, Cool	DI, Tap, Other / Steam, Hot, Cool	DI, Tap, Other / Steam, Hot, Cool
Vol. (gal):		N/A		
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: yes (no)

Purge Volume (CV) T.D. – DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.74 ft. – 12.72 ft. × (2"=0.175, 4"=0.663) × 7.38 = gal

Free Product?: Odor: no yes Floating Product: none sheen film feet thick

								Replicate Goals
Time (24-hr)		1240	1245	1247	1249	1251	1253	
Gallons Purged	0	15	30	45	60	75		(dev. only)
Surged (minutes)	↑							±0.10
pH	S	7.16	7.19	7.20	7.10	7.09		±1°C
Temperature (°C)	T	20.9	19.9	19.1	19.1	19.0		±10%
Cond. (µmhos/cm)	A	1910	1780	1610	1560	1550		±10%
Salinity (‰)	R	1.3	1.2	1.1	1.0	1.0		<50 NTUs
Turbidity (NTU's)	T							Colorless
Color	↓	BROWNISH SILT	→		CLOUDY	CLOUDY		±0.01'
Depth to Water								

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab

Misc

Other Observations:

Final Check: VOAs free of bubbles? yes / no / NA Well Locked? yes / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-2

Date: 9-4-97 Weather: CLEAR SKIES, WARM, SLIGHT BREEZE Sheet 1 of 1

Project: FREISMAN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☒ Development ☐ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submers-able Pump	Dedicated Pump	(Other: TRASH PUMP)
Sampling Equipment	Bailer	Disposable Bailer	Suction Pump	Submers-able Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9/4-0800	9/4-0815	

Decontamination Methods	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
TSP Alconox Other:				
Vol. (gal):		NA		
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: yes (no)

Purge Volume (CV) T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.84 ft. − 14.19 ft. × (2"=0.175, 4"=0.663) ×6.47 = gal

Free Product?: Odor: no yes Floating Product: none sheen film feet thick

									Replicate Goals
Time (24-hr)	1315	1317	1319	1321	1323				
Gallons Purged	0	15	30	45	65				(dev. only)
Surged (minutes)	↑								±0.10
pH	S	7.38	7.35	7.33	7.33				±1°C
Temperature (°C)	T	20.0	19.1	18.9	18.8				±10%
Cond. (µmhos/cm)	A	1790	1680	1610	1590				±10%
Salinity (‰)	R	1.3	1.1	1.0	1.0				<50 NTUs
Turbidity (NTU's)	T								Colorless
Color	↓	BROWNISH SILTY →		CLOUDY	CLOUDY				±0.01'
Depth to Water									

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab

Misc

Other Observations:

Final Check: VOAs free of bubbles? yes / no / NA Well Locked? yes / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-3

Date: 9-4-97 Weather: CLEAR SKIES, WARM, SLIGHT BREEZE Sheet 1 of 1

Project: FREISMAN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☒ Development ☐ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submers-able Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	Disposable Bailer	Suction Pump	Submers-able Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-4/0800	9-4/0815	

Decontamination Methods (TSP, Alconox, Other:)	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
Vol. (gal):		NA		
Source:				

Decon. Notes:

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: yes (no)

Purge Volume (CV) = T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.67 ft. − 12.22 ft. × (2"=0.175, 4"=0.663) × 7.81 = gal

Free Product?: Odor: no yes Floating Product: none sheen film feet thick

Time (24-hr)	1342	1345	1402	1403	1415		1425	Replicate Goals
Gallons Purged	0	10	20		30		40	(dev. only)
Surged (minutes)	↑	D A		D		D A		
pH	S	E F	7.37	B A	7.39	E F	7.39	±0.10
Temperature (°C)	T	W T	25.3	W F	25.5	W T	25.5	±1°C
Cond. (µmhos/cm)	A	A B	2100	A T	1910	A E	1900	±10%
Salinity (‰)	R	T R	1.2	T E	1.1	T R	1.2	±10%
Turbidity (NTU's)	T	E		E R		E		<50 NTUs
Color	↓	R 10	BROWN	R 20	BROWN	R 30	BROWN	Colorless
Depth to Water		E D 6	SILTY	E D 6	SILTY	E D 6	SILTY	±0.01'

Reference Point: (TOC) Other: GL D kz D AL.

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab

Misc

Other Observations:

Final Check: VOAs free of bubbles? yes / no / NA Well Locked? yes / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-4

Date: 9-7-97 Weather: CLEAR SKIES, WARM, SLIGHT BREEZE Sheet 1 of 1

Project: FRIESEN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☒ Development ☐ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	(Submersable Pump)	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-4/0800	9-4/0815	

Decontamination Methods	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
TSP Alconox Other:		NA		
Vol. (gal):				
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: yes (no)

Purge Volume (CV) = T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.85 ft. − 13.00 ft. × (2"=0.375, 4"=0.663) ×7.27 = gal

Free Product?: Odor: no yes Floating Product: none sheen film feet thick

									Replicate Goals
Time (24-hr)	1519	1521		1535	D	1545	D		
Gallons Purged	0	10	D	20	E		E A		(dev. only)
Surged (minutes)	↑		E A		W		W E		±0.10
pH	S	7.44	W E	7.30	A T	7.26	A T		±1°C
Temperature (°C)	T	23.2	A T	22.1	T E	21.1	T E		±10%
Cond. (µmhos/cm)	A	2490	T E	2950	E R	2090	E R		±10%
Salinity (‰)	R	1.5	E R	1.2	R	1.1	R 30		<50 NTUs
Turbidity (NTU's)	T		R		E 20		E		Colorless
Color	↓	BROWNISH	E 10	BROWNISH	D	BROWNISH	D G		±0.01'
Depth to Water		SILTY	D G	SILTY		SILTY	A L		

Reference Point: (TOC) Other: ALS

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab

Misc

Other Observations:

Final Check: VOAs free of bubbles? yes / no / NA Well Locked? yes / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-5

Date: 9-4-97 Weather: CLEAR SKIES, WARM, ~80°F Sheet 1 of 1

Project: FREUDMAN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☒ Development ☐ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9/4-0800	9/4-0815	

Decontamination Methods	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
TSP Alconox Other:		NA		
Vol. (gal):				
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: yes (no)

Purge Volume (CV) T.D. – DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.87 ft. – 14.14 ft. × (2"=0.175, 4"=0.663) ×6.52 = gal

Free Product?: Odor: no yes Floating Product: none sheen film feet thick

								Replicate Goals
Time (24-hr)	1555	1558	D A	1604	D A	1612	D A	
Gallons Purged	0	15	B E	30	E A	40	B F	(dev. only)
Surged (minutes)	↑		W T		D F		W T	±0.10
pH	S	7.43	A B	7.36	A E	7.28	A E	±1°C
Temperature (°C)	T	22.4	T R	22.0	T R	21.1	T R	±10%
Cond. (µmhos/cm)	A	2610	E (15)	2210	E (30)	1820	E (40)	±10%
Salinity (‰)	R	1.9	R G	1.3	R G	1.1	R G	<50 NTUs
Turbidity (NTU's)	T		E K		E G		E K	Colorless
Color	↓	BROWNISH	D L	BROWNISH	D K	BROWNISH	D L	±0.01'
Depth to Water		SILTY	S	SILTY	S	SILTY	S	

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab

Misc

Other Observations:

Final Check: VOAs free of bubbles? yes / no / NA Well Locked? yes / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-6

Date: 9-4-97 Weather: CLEAR SKIES, WARM, ~80°F Sheet 1 of 1

Project: FREEMAN Submitted By: R. SILVA Date: 9-4-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☒ Development ☐ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	(Other: TRASH PUMP)
Sampling Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-4/0800	9/4/0815	

Decontamination Methods	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
TSP Alconox Other:		NA		
Vol. (gal):				
Source:				

Decon. Notes:

Development / Purge Record

Well Security: (good) fair poor | Well Integrity: (good) fair poor | Locked: yes (no)

Purge Volume (CV) T.D. 23.80 ft. − DTW 14.19 ft. × Factor (2"=0.175, 4"=0.663) × 1 C.V (×6.44) = gal

Well Diam.: ☐ 2" ☒ 4" = gal

Free Product?: Odor: no (yes) Floating Product: none (sheen) film feet thick

Time (24-hr)	1623	1626		1635		1642		Replicate Goals
Gallons Purged	0	15		25		35		(dev. only)
Surged (minutes)	↑							±0.10
pH	S	7.06		6.83		6.81		±1°C
Temperature (°C)	T	23.1		22.9		22.5		±10%
Cond. (µmhos/cm)	A	3590		2350		2050		±10%
Salinity (‰)	R	2.5		1.8		1.5		<50 NTUs
Turbidity (NTU's)	T							Colorless
Color	↓	GRAYISH SILTY		GRAYISH SILTY		GRAYISH SILTY		±0.01'
Depth to Water								

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab

Misc

Other Observations:

Final Check: VOAs free of bubbles? yes / no / NA Well Locked? yes / no / NA

RECORD OF WATER LEVEL MEASUREMENTS
SEPTEMBER 8, 1997

KA KLEINFELDER

RECORD OF WATER LEVEL MEASUREMENTS

Date: 9-8-97 Weather: CLEAR SKIES, WARM, ~80°F Sheet 1 of 1

Project: FRESNAL Submitted By: R-SIWA Date: 9-8-97

Project No.: 10-3006-13005 Reviewed By: Date:

Instrument Number:

Well Number	Time (opened/measured)	Sensitivity Setting	Measuring Point	Measurement	Replicate Measurements (if requested)		Notes			Locked?
	(24-hr)	(est. %)	(M.P.)	1	2	3	T.D.			
KMW-1	0852/0920		TOC	12.82			23.72			Y
KMW-2	0855/0923			14.28			23.85			Y
KMW-3	0859/0928			12.39			23.86			Y
KMW-4	0905/0930			13.76			23.84			Y
KMW-5	0909/0934			14.24			23.83			Y
KMW-6	0915/0937			14.28			23.81			Y

M.P. (TOC) GS, Cover ring, Other:

All Wells Locked (YES) NO

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WELL DEVELOPMENT AND SAMPLING LOGS
SEPTEMBER 8, 1997

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-1

Date: 9-8-97 Weather: SLIGHTLY CLOUDY, COOL, ~70°F Sheet 1 of 1

Project: FRESNO Submitted By: R. SILVA Date: 9-8-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☐ Development ☒ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	(Disposable Bailer)	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-8-97	9-8-97	

Decontamination Methods (TSP, Alconox, Other:)	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
Vol. (gal):		NA		
Source:				

Decon. Notes:

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: (yes) no

Purge Volume (CV) = T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.72 ft. − 12.82 ft. × (2"=0.163, 4"=0.653) × 7.23 = gal

Free Product?: Odor: (no) yes Floating Product: (none) sheen film feet thick

								Replicate Goals
Time (24-hr)	0946	0948	0950	0951				
Gallons Purged	0	8	16	24				(dev. only)
Surged (minutes)	↑							
pH	S	7.15	7.18	7.16				±0.10
Temperature (°C)	T	18.9	18.8	18.1				±1°C
Cond. (µmhos/cm)	A	1500	1560	1480				±10%
Salinity (‰)	R	1.0	1.0	1.0				±10%
Turbidity (NTU's)	T							<50 NTUs
Color	↓	BROWNISH	CLOUDY	CLOUDY				Colorless
Depth to Water		SILTY						±0.01'

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab
KMW-1	1000	3	40 mls	VOA	HCl		TPH-G, BTEX, MTBE	
KMW-1	1000	2	LITER	AMBER	—		TPH-D, PAH	

Misc

Other Observations:

Final Check: VOAs free of bubbles? (yes) no / NA Well Locked? (yes) no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-2

Sheet 1 of 1

Date: 9-8-97 Weather: CLEAR SKIES, WARM

Project: FREISMAN Submitted By: R. SILVA Date: 9-8-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☐ Development ☒ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	(Disposable Bailer)	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-8-97	9-8-97	

Decontamination Methods (TSP, Alconox, Other:)	Wash	Rinse I	Rinse II	Rinse III
	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
Vol. (gal):		NA		
Source:				

Decon. Notes:

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: (yes) no

Purge Volume (CV): T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.85 ft. − 14.28 ft. × (2"=0.175 / 4"=0.663) ×6.35 = gal

Free Product?: Odor: (no) yes Floating Product: (none) sheen film feet thick

								Replicate Goals
Time (24-hr)	1033	1036	1038	1040				
Gallons Purged	0	7	14	21				(dev. only)
Surged (minutes)	↑							
pH	S	7.42	7.45	7.43				±0.10
Temperature (°C)	T	18.3	18.7	18.7				±1°C
Cond. (µmhos/cm)	A	1530	1550	1560				±10%
Salinity (‰)	R	0.9	1.0	1.0				±10%
Turbidity (NTU's)	T	BROWNISH	CLOUDY	CLOUDY				<50 NTUs
Color	↓	SILTY						Colorless
Depth to Water								±0.01'

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab
KMW-2	1050	3	40 MLS	VOA	HCl		TPH-G, BTEX, MTBE	
KMW-2	1050	2	LITER	AMBER	—		TPH-D, PAH	

Misc

Other Observations:

Final Check: VOAs free of bubbles? (yes) / no / NA Well Locked? (yes) / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-3

Sheet 1 of

Date: 9-8-97 Weather: CLEAR SKIES, WARM, ~75°F

Project: FREISMAN Submitted By: R. SILVA Date: 9-8-97

Project No.: 10-3006-13/605 Reviewed By: Date:

Purpose of Log ☐ Development ☒ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	(Disposable Bailer)	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-8-97	9-8-97	

Decontamination Methods (TSP, Alconox, Other:)	Wash (DI Tap Other / Steam Hot Cool)	Rinse I (DI Tap Other / Steam Hot Cool)	Rinse II (DI Tap Other / Steam Hot Cool)	Rinse III (DI Tap Other / Steam Hot Cool)
Vol. (gal):		HK		
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor | Well Integrity: (good) fair poor | Locked: (yes) no

Purge Volume (CV): T.D. 23.86 ft. − DTW 12.34 ft. × Factor (2"=0.175, 4"=0.663) × 1 C.V. (×7.64) = gal = gal

Well Diam.: ☐ 2" ☒ 4" | Free Product?: Odor: (no) yes | Floating Product: (none) sheen film feet thick

														Replicate Goals
Time (24-hr)		1114	1117	D		1132	D		1144	D				
Gallons Purged	0	8		E		16	E		24	E	A			(dev. only)
Surged (minutes)	↑			W	A		W	A		W	E			
pH	S	7.40		A	F	7.24	A	F	7.25	A	T			±0.10
Temperature (°C)	T	19.9		T	E	19.7	T	E	19.5	T	E			±1°C
Cond. (µmhos/cm)	A	1340		E	R	1320	E	R	1310	E	R			±10%
Salinity (‰)	R	0.9		R	10	1.0	R	~17	0.9	R				±10%
Turbidity (NTU's)	T			E	GAL		E	GAL		E	~25			<50 NTUs
Color	↓	Brownish Silty		D		BROWNISH	D		BROWNISH	D	GAL			Colorless
Depth to Water						SILTY			SILTY					±0.01'

Reference Point: TOC Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab
KMW-3	1155	3	40mLs	VOA	HCl		TPH-G, ~~BTEX, MTBE~~	
KMW-3	1155	2	LITER	AMBER	—		TPH-D, PAH	

Misc

Other Observations: 80% = 14.62 GALS SAMPLES COLLECTED AFTER WATER REACHED ~14.5 FT.

Final Check: VOAs free of bubbles? (yes) / no / NA Well Locked? (yes) / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-4

Sheet 1 of 1

Date: 9-8-97 Weather: CLEAR SKIES, WARM, ~85°F

Project: FREISMAN Submitted By: R. SILVA Date:

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☐ Development ☒ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	(Disposable Bailer)	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-8-97	9-8-97	

Decontamination Methods	Wash	Rinse I	Rinse II	Rinse III
TSP / Alconox / Other:	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool	DI Tap Other / Steam Hot Cool
Vol. (gal):		NA		
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: (yes) no

Purge Volume (CV) = T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.84 ft. − 13.76 ft. × (sheen ~0.663 / film ~0.125) × 6.68 = gal

Free Product?: Odor: (no) yes Floating Product: (none) feet thick

									Replicate Goals
Time (24-hr)	1254	1256	PURGE	1308	DEPTH	1320	DEPTH		
Gallons Purged	0	7		14		21			(dev. only)
Surged (minutes)	↑				WATER		WATER		
pH	S	7.38	AFTER	7.37	AFTER	7.31	AFTER		±0.10
Temperature (°C)	T	21.4		21.2		20.9			±1°C
Cond. (µmhos/cm)	A	1710		1630		1590			±10%
Salinity (‰)	R	1.1		1.1		1.2			±10%
Turbidity (NTU's)	T							~22	<50 NTUs
Color	↓	BROWNISH SILTY		BROWNISH SILTY		BROWNISH SILTY			Colorless
Depth to Water									±0.01'

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab
KMW-4	1330	3	40 mls	VOA	HCl		TPH-G, BTEX, MTBE	
KMW-4	1330	2	LITER	AMBER	—		TPH-D, PAH	

Misc

Other Observations: 80% = 15.76 FT.; WATER SAMPLES TAKEN AT WATER LEVEL ≈ 15.0 FT.

Final Check: VOAs free of bubbles? (yes) / no / NA Well Locked? (yes) / no / NA

KA KLEINFELDER

WELL DEVELOPMENT & SAMPLING LOG

WELL NO. KMW-5

Date: 9-8-97 Weather: CLEAR SKIES, HOT, ~90°F Sheet 1 of

Project: FREISMAN Submitted By: R. SILVA Date: 9-8-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Purpose of Log ☐ Development ☒ Sampling

Equipment & Decontamination

Purging Equipment	Bailer	Disposable Bailer	Suction Pump	Submersable Pump	Dedicated Pump	Other: TRASH PUMP
Sampling Equipment	Bailer	(Disposable Bailer)	Suction Pump	Submersable Pump	Dedicated Pump	Other:

Test Equipment	Water Level	pH	Conductivity	Turbidity
Meter No.	12185	90575	90293	
Calibration Date/Time	NA	9-8-97	9-8-97	

Decontamination Methods (TSP, Alconox, Other:)	Wash (DI, Tap, Other / Steam, Hot, Cool)	Rinse I (DI, Tap, Other / Steam, Hot, Cool)	Rinse II (DI, Tap, Other / Steam, Hot, Cool)	Rinse III (DI, Tap, Other / Steam, Hot, Cool)
Vol. (gal):		HK		
Source:				
Decon. Notes:				

Development / Purge Record

Well Security: (good) fair poor Well Integrity: (good) fair poor Locked: (yes) no

Purge Volume (CV) = T.D. − DTW × Factor × 1 C.V = gal

Well Diam.: ☐ 2" ☒ 4" 23.83 ft. − 14.24 ft. × (2"=0.175, 4"=0.663) × 6.36 = gal

Free Product?: Odor: (no) yes Floating Product: (none) sheen film feet thick

									Replicate Goals
Time (24-hr)	1352	1354		1408		1416			
Gallons Purged	0	7	DISCHARGE	14	DISCHARGE				(dev. only)
Surged (minutes)	↑		WATER		WATER				±0.10
pH	S	7.32	AT	7.31	AT	7.28			±1°C
Temperature (°C)	T	21.0	TIME	22.0	TIME	21.0			±10%
Cond. (µmhos/cm)	A	1630	ELAPSED	1610	ELAPSED	1590			±10%
Salinity (‰)	R	1.1	RATE	1.1	RATE	1.2			<50 NTUs
Turbidity (NTU's)	T		GAL						Colorless
Color	↓	BROWNISH	DISCHARGE	BROWNISH	DISCHARGE	BROWNISH			±0.01'
Depth to Water		SILTY		SILTY		SILTY			

Reference Point: (TOC) Other:

Sample Log

Sample #	Time	Quantity	Volume	Type	Preserv.	Filtration	Analysis	Lab
KMW-5	1425	3	40mL	40mL	HCl		TPH-G, BTEX, MTBE	
KMW-5	1425	2	LITER	AMBER	—		TPH-D, PAH	

Misc

Other Observations: 80% ≅ 16.16 FT. WATER SAMPLES TAKEN AT WATER LEVEL = 15.5 FT. DUPLICATE SAMPLES TAKEN AT 1430.

Final Check: VOAs free of bubbles (yes) / no / NA Well Locked? (yes) / no / NA

RECORD OF WATER LEVEL MEASUREMENTS
SEPTEMBER 12, 1997

KA KLEINFELDER

RECORD OF WATER LEVEL MEASUREMENTS

Date: SEPT. 12, 1997 Weather: CLEAR SKIES, WARM, ~80°F Sheet 1 of 1

Project: FREISMAN Submitted By: R. SILVA Date: 9-12-97

Project No.: 10-3006-13/005 Reviewed By: Date:

Instrument Number:

Well Number	Time (opened/measured)	Sensitivity Setting	Measuring Point	Measurement	Replicate Measurements (if requested)		Notes			Locked? (Y)
	(24-hr)	(est. %)	(M.P.)	1	2	3				
KMW-1	0815 1004		TOC	12.84						Y
KMW-2	0817 1007			14.35						Y
KMW-3	0820 1009			12.36						Y
KMW-4	0823 1011			13.81						Y
KMW-5	0825 1012			14.30						Y
KMW-6	0830 1014		↓	14.33						Y

M.P. (TOC, GS, Cover ring, Other:

All Wells Locked -- (YES) / NO

jet b:\WL-FORM.XLS, 6/20/95, DRAFT FINAL

APPENDIX E

CHAIN-OF-CUSTODY RECORDS
AND
CERTIFIED ANALYTICAL LABORATORY REPORTS

[redacted] 04 X [redacted] 5

PROJECT NO.	PROJECT NAME
10-3006-13/004	Friesman Ranch RI

L.P. NO. (P.O. NO.)	SAMPLERS: (Signature/Number)
	Richard Silva Michele Mahoney

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CONTAINERS	TYPE OF CONTAINERS	ANALYSIS PAH	Metals	Pesticides	PCBs								
1	8-28-97	1004	KB-1 AT 15 FT	SOIL	1	PLASTIC	X											
2	"	1045	KB-1	WATER	1	LITER	X											
3	"	10:05	KS-1	soil	1	BRASS		X	X									
4	"	10:20	KS-2	soil	1	BRASS		X	X									
5	"	10:30	KS-3	soil	1	BRASS		X	X									
6	"	10:45	KS-4	soil	1	BRASS		X	X									
7	"	11:00	KS-5	soil	1	BRASS		X	X									
8	"	11:15	KS-6	soil	1	BRASS		X	X									
9	"	11:40	KW-1	wipe	1	VOA				X								
10	"	11:45	KW-2	wipe	1	VOA				X								
11	"	11:50	KW-3 FB	wipe	1	VOA				X								
12	"	12:35	KB-3 AT 20 FT	SOIL	1	PLASTIC	X											
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

RECEIVING LAB:

80303

80304

80305

80306

80307

Composite INTO ONE SAMPLE

80308

80309

ICE/T ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ✓

VOAS | O&G | METALS | OTHER
PRESERVATION APPROPRIATE CONTAINERS ✓

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Richard Silva	8/29/97 0700	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	8/29/97 0945	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)
	8/29/97 11:45	

Instructions/Remarks:
Composite KS-1, KS-2, KS-3, KS-4, KS-5, KS-6

Send Results To:

KLEINFELDER
1362 RIDDER PARK DRIVE
SAN JOSE, CA 95131-1571
(408) 436-1155

Attn:

M-60 White – Sampler Canary – Return Copy To Shipper Pink – Lab Copy

CHAIN OF CUSTODY

№ 878

McCAMPBELL ANALYTICAL INC.
110 Second Avenue South, #D7, Pacheco, CA 94553
Telephone : 510-798-1620 Fax : 510-798-1622
http://www.mccampbell.com E-mail: main@mccampbell.com

Kleinfelder, Inc. 7133 Koll Center Pkwy, #100 Pleasanton, CA 94566	Client Project ID: #10-3006-13/004; Friesman Ranch, RI	Date Sampled: 08/28/97
		Date Received: 08/29/97
	Client Contact: John Adams	Date Extracted: 08/29/97
	Client P.O:	Date Analyzed: 08/29-09/04/97

Polychlorinated Biphenyls (PCB)

EPA method 608 and 3510 or 8080 and 3550

Lab ID	Client ID	Matrix	PCB+	% Recovery Surrogate
80306	KW-1	Wipe	ND<10,j,o,m	99
80307	KW-2	Wipe	ND<10,j,o,m	102
80308	KW-3	Wipe	ND	79
Reporting Limit unless otherwise stated; ND means not detected above the reporting limit		Wipe	0.5 ug/L	
		S	50 ug/kg	

* water and vapor samples are reported in ug/L, oils in mg/L, soil and sludge samples in ug/kg, wipes in ug/wipe and all TCLP / SPLP /STLC extracts in ug/L.

ND means not detected above the reporting limit

surrogate diluted out of range or surrogate coelutes with another peak

+ PCB aroclors - the first two digits of the aroclor number convey general structural information, where 12 and 10 denote biphenyl compounds with the latter having one phenyl group that is Cl-free; the last two aroclor digits specify its Cl weight %; (a) PCB aroclor 1016; (b) PCB aroclor 1221; (c) PCB aroclor 1232; (d) PCB aroclor 1242; (e) PCB aroclor 1248; (f) PCB aroclor 1254; (g) PCB aroclor 1260; (h) a lighter than water immiscible sheen is present; (i) liquid sample that contains >~5 vol. % sediment; (j)sample diluted due to high organic content; (l) florisil (EPA 3620) cleanup; (m) silica-gel (EPA 3630) cleanup; (n) elemental sulfur (EPA 3660) cleanup; (o) sulfuric acid-permanganate (EPA 3665) cleanup.

DHS Certification No. 1644

Edward Hamilton, Lab Director

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

QC REPORT FOR CHLORINATED PESTICIDES and PCB (EPA 8080/608)

Date: 08/29/97-08/30/97 Matrix: Soil

Analyte	Concentration (ug/L,mg) Sample #(77621)	MS	MSD	Amount Spiked	% Recovery MS	MSD	RPD
PCB	0	205	209	250	82	84	1.9
Lindane	0.0	8.4	8.4	10	84	84	0.9
Heptachlor	0.0	8.4	8.7	10	84	87	3.5
Aldrin	0.0	9.8	9.9	10	98	99	1.0
Dieldrin	0.0	21.1	21.6	25	85	86	2.0
Endrin	0.0	21.9	22.4	25	87	90	2.4
4,4'-DDT	0.0	22.9	23.6	25	92	95	3.0

% Rec. = (MS - Sample) / amount spiked x 100

RPD = (MS - MSD) / (MS + MSD) x 2 x 100

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

QC REPORT FOR CHLORINATED PESTICIDES and PCB (EPA 8080/608)

Date: 08/29/97-08/30/97 Matrix: Wipe

Analyte	Concentration (ug/L,mg) Sample #(77621)	MS	MSD	Amount Spiked	% Recovery MS	MSD	RPD
PCB	0	205	209	250	82	84	1.9
Lindane	0.0	8.4	8.4	10	84	84	0.9
Heptachlor	0.0	8.4	8.7	10	84	87	3.5
Aldrin	0.0	9.8	9.9	10	98	99	1.0
Dieldrin	0.0	21.1	21.6	25	85	86	2.0
Endrin	0.0	21.9	22.4	25	87	90	2.4
4,4'-DDT	0.0	22.9	23.6	25	92	95	3.0

% Rec. = (MS - Sample) / amount spiked x 100

RPD = (MS - MSD) / (MS + MSD) x 2 x 100

SURFACE SOIL SAMPLES

KLEINFELDER

9543XRF54

PROJECT NO.	PROJECT NAME
10-3006-13/004	Friesman Ranch RI

L.P. NO. (P.O. NO.)	SAMPLERS: (Signature/Number)
	Richard Silva Michele Mahoney

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CON-TAINERS	TYPE OF CON-TAINERS	ANALYSIS: BTEX	Nitrates	Pesticides	PCBs
1	8-28-97	1004	KB-1 AT 15 FT	SOIL	1	PLASTIC	X			
2	"	1045	KB-1	WATER	1	LITER	X			
3	"	10:05	KS-1	soil	1	BRASS		X	X	
4	"	10:20	KS-2	soil	1	BRASS		X	X	
5	"	10:30	KS-3	soil	1	BRASS		X	X	
6	"	10:45	KS-4	soil	1	BRASS		X	X	
7	"	11:00	KS-5	soil	1	BRASS		X	X	
8	"	11:16	KS-6	soil	1	BRASS		X	X	
9	"	11:40	KW-1	wipe	1	~~LEAD~~ VOA				X
10	"	11:45	KW-2	wipe	1	VOA				X
11	"	11:50	KW-3FB	wipe	1	VOA				X
12	"	12:35	KB-3 AT 20FT	SOIL	1	PLASTIC	X			
13										
14										
15										
16										
17										
18										
19										
20										

RECEIVING LAB:

80303
80304
80305
80306
80307

Composite into one sample

80308
80309

	VOAS	O&G	METALS	OTHER
PRESERVATION APPROPRIATE				
CONTAINERS	✓			

ICE/T ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ✓

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Richard Silva	8/29/97 0700	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	8/29/97 0945	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)
	8/29/97 11:45	

Instructions/Remarks:
Composite KS-1, KS-2, KS-3, KS-4, KS-5, KS-6

Send Results To:

KLEINFELDER
1362 RIDDER PARK DRIVE
SAN JOSE, CA 95131-1571
(408) 436-1155

Attn:

M-60 White – Sampler Canary – Return Copy To Shipper Pink – Lab Copy

CHAIN OF CUSTODY

№ 878

McCAMPBELL ANALYTICAL INC.
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Telephone : 510-798-1620 Fax : 510-798-1622
http://www.mccampbell.com E-mail: main@mccampbell.com

Kleinfelder, Inc. 7133 Koll Center Pkwy, #100 Pleasanton, CA 94566	Client Project ID: #10-3006-13/004; Friesman Ranch, RI	Date Sampled: 08/28/97
		Date Received: 08/29/97
	Client Contact: John Adams	Date Extracted: 08/29/97
	Client P.O:	Date Analyzed: 08/29-09/05/97

Chlorinated Pesticides (including PCBs)

EPA method 608 and 3510 or 8080 and 3550

Lab ID	80305				Reporting Limit	
Client ID	KS-1 to 6				S	Wipe
Matrix	S					
Compound	Concentration*				ug/kg	ug/wipe
Aldrin	ND				5	0.75
α-BHC	ND				1	0.1
β-BHC	ND				5	0.5
γ-BHC (Lindane)	ND				5	2
σ-BHC	ND				5	0.5
Chlordane	ND				5	1
p,p'-DDD(k)	ND				1	0.2
p,p'-DDE(k)	ND				1	0.1
p,p'-DDT(k)	ND				1	0.2
Dieldrin	ND				1	0.2
Endosulfan I	ND				1	0.1
Endosulfan II	ND				1	0.1
Endosulfan Sulfate	ND				5	0.5
Endrin	ND				5	1
Endrin Aldehyde	ND				5	0.5
Heptachlor	ND				1	0.1
Heptachlor Epoxide	ND				1	0.1
p,p'-Methoxychlor(k)	ND				50	100
PCB-Total(+)	ND				50	5
Toxaphene	ND				100	5
% Recovery Surrogate	101					
Comments						

* water and vapor samples are reported in ug/L, oils in mg/L, soil and sludge samples in ug/kg, wipes in ug/wipe and all TCLP / SPLP extracts in ug/L.

ND means not detected above the reporting limit; N/A means analyte not applicable to this analysis

surrogate diluted out of range or surrogate coelutes with another peak

+(a) PCB aroclor 1016; (b) PCB aroclor 1221; (c) PCB aroclor 1232; (d) PCB aroclor 1242; (e) PCB aroclor 1248; (f) PCB aroclor 1254; (g) PCB aroclor 1260; (h) a lighter than water immiscible sheen is present; (i) liquid sample that contains >~5 vol. % sediment; (j) sample diluted due to high organic content; (k) p,p'- is the same as 4,4'-; (l) florisil (EPA 3620) cleanup; (m) silica-gel (EPA 3630) cleanup.

DHS Certification No. 1644

/H/ Edward Hamilton, Lab Director

McCAMPBELL ANALYTICAL

SAMPLE ID: KS-1-6
AEN LAB NO: 9708364-03
AEN WORK ORDER: 9708364
CLIENT PROJ. ID: 9345

DATE SAMPLED: 08/28/97
DATE RECEIVED: 08/29/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Anion Sample Prep.		-		Prep date	09/07/97
Soluble Nitrate-N	EPA 300	17 *		1 mg/kg as N	09/07/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

SUBSURFACE SOIL SAMPLES
AND
RECONNAISSANCE GROUNDWATER SAMPLES

KLEINFELDER

PROJECT NO.: 10-3006-13/004
PROJECT NAME: Friesman Ranch RI
L.P. NO. (P.O. NO.):
SAMPLERS: (Signature/Number): Richard Silva, Michele Mahoney

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CONTAINERS	TYPE OF CONTAINERS	ANALYSIS: PAH	VHalos	Pesticides	PCBs
1	8-28-97	1004	KB-1 AT 15 FT	SOIL	1	PLASTIC	X			
2	"	1045	KB-1	WATER	1	LITER	X			
3	"	10:05	KS-1	soil	1	Brass		X	X	
4	"	10:20	KS-2	soil	1	Brass		X	X	
5	"	10:30	KS-3	soil	1	Brass		X	X	
6	"	10:45	KS-4	soil	1	Brass		X	X	
7	"	11:00	KS-5	soil	1	Brass		X	X	
8	"	11:15	KS-6	soil	1	Brass		X	X	
9	"	11:40	KW-1	wipe	1	VOA				X
10	"	11:45	KW-2	wipe	1	VOA				X
11	"	11:50	KW-3FB	wipe	1	VOA				X
12	"	12:35	KB-3 AT 20FT	SOIL	1	PLASTIC	X			
13										
14										
15										
16										
17										
18										
19										
20										

RECEIVING LAB:
80303
80304
80305
80306
80307
Composite INTO ONE SAMPLE
80308
80309

ICE/T ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ✓
PRESERVATION APPROPRIATE CONTAINERS ✓

VOAS	O&G	METALS	OTHER

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Richard Silva	8/29/97 0700	
	8/29/97 0945	
	8/27/97 1140	Received for Laboratory by: (Signature)

Instructions/Remarks: Composite KS-1, KS-2, KS-3, KS-4, KS-5, KS-6

Send Results To:
KLEINFELDER
1362 RIDDER PARK DRIVE
SAN JOSE, CA 95131-1571
(408) 436-1155
Attn:

M-60 White - Sampler Canary - Return Copy To Shipper Pink - Lab Copy

CHAIN OF CUSTODY

№ 878

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

ONSITE ENVIRONMENTAL LABORATORIES, INC.
[redacted]
5500 Boscell Common Fremont, CA 94538 Tel. (510) 490-8571 Fax. (510) 490-8572

Project Manager:	RICHARD SILVA
Client Name:	KLEINFELDER
Address:	
City, State ZIP	
Phone:	
Fax:	

Bill to:	
Company:	
Address:	
City, State ZIP	
Phone:	
Fax:	

Date:	8-28-97
Page:	1 of
Laboratory:	
Lab Number:	

Project Name:	FREISMAN RANCH
Project Number:	10-3006-13/004

P.O. No.:	

Analysis Requested

Sample Identification	Date Sampled	Time Sampled	Matrix	Sampled & Relinquished By:	Time Relinquished:	Received By:	Lab ID	BTEX (8021)	TPH - Gas (8015M)	TPH - Diesel (8015M)	MTBE				No. Containers	Remarks
KB-1 AT 10FT	8-28-97	0945	SOIL	RS	1030	NW	40645-01	X	X	X					1	
KB-1 AT 15FT	8-28-97	1004	SOIL	RS	1030	NW	-02	X	X	X	X				1	
KB-1		1045	WATER	RS	1107	NW	-03	X	X	X					3	
KB-2		1205	WATER	RS	1211	NW	-04	X	X	X					3	
KB-3 at 15		1228	soil	MM	1305	NW	-05	X	X	X					1	
KB-3 at 20		1235	soil	MM	1305	NW	-06	X	X	X					1	
KB-4		1407	Water	RS	1407	EVE	-07	X	X	X					3	
KB-5		1435	water	MM	1457	NW	-08	X	X	X					3	
KB-6		1530	water	MM	1536	NW	-09	X	X	X					3	
KB-3		1555	water	MM	1610	NW	-10	X	X	X					3	
KB-7		1630	water	MM	1650	NW	-11	X	X	X					3	
KB-8		1710	water	RS	1720	NW	-12	X	X	X					3	

Initials:	Printed Name:	Signature:		
RS	RICHARD SILVA	Richard Silva	Date:	
MM	Michele Mahoney	Michele Mahoney	Start Time:	
NW	Nathalie Weicker	Nathalie Weicker	Stop Time:	
			Hours:	
			Client Sign-off:	

Total Containers:	
Received Intact:	
Received Cold:	
Custody Seals:	

ONSITE ENVIRONMENTAL LABORATORIES, INC.
[redacted]
5500 Boscell Common Fremont, CA 94538 Tel. (510) 490-8547 Fax. (510) 490-8547

Project Manager:	
Client Name:	Kleinfelder
Address:	
City, State ZIP	
Phone:	
Fax:	

Bill to:	
Company:	
Address:	
City, State ZIP	
Phone:	
Fax:	

Date:	8/29/97
Page:	1 of 2
Laboratory:	3
Lab Number:	3D046

Project Name:	Freisman Ranch, Livermore
Project Number:	

P.O. No.:	

Analysis Requested

Sample Identification	Date Sampled	Time Sampled	Matrix	Sampled & Relinquished By:	Time Relinquished:	Received By:	Lab ID	BTEX (8021)	TPH - Gas (8015M)	TPH - Diesel (8015M)	MTBE					No. Containers	Remarks
KB-9	8/29/97	0940	water	MM	1000	NW		X	X	X	X					6	
KB-9 at 15ft		0910	soil	MM	1000		3D046-01	X	X	X						1	
KB-9 at 20 ft		0920	soil	MM	1000		-02	X	X	X						1	
KB-14 at 10 ft		0907	soil	MM	1000		-03	X	X	X						1	
KB-14 at 15 ft		0920	soil	MM	1000		-04	X	X	X						1	
KB-10		1050	water	MM	1102	EVE	-05	X	X	X	X					3	
KB-10D		1055	water	MM	1102	EVE	-07	X	X	X	X					3	
KB-15 at 10ft		1035	soil	MM	1102	EVE	-06	X	X	X						1	
KB-15 at 15ft		1040	soil	MM	1102	EVE	-09	X	X	X						1	
KB-14		1225	Water	MM	1245	NW	-10	X	X		X					2	
KB-15		1235	Water	MM	1250	NW	-11	X	X							2	
KB-11		1300	WATER	MM	1310	EVE	-12	X	X	X						3	
KB-17 at 5ft		1305	soil	RS	1350	EVE	-13	X	X	X						1	
KB-17 at 15ft		1305	soil	RS	1350	EVE	-14	X	X	X	X					1	

Initials:	Printed Name:	Signature:		
MM	Michele Mahoney	Michele Mahoney	Date:	8/29/97
NW	Nathalie Weicker	Nathalie Weicker	Start Time:	
EVE	Elliot Van Ekkendorf	Elliot Van Ekkendorf	Stop Time:	
RS	Richard Silva	Richard Silva	Hours:	
			Client Sign-off:	

Total Containers:	
Received Intact:	
Received Cold:	
Custody Seals:	

White Copy - Admin/Lab Yellow - Mobile Lab Pink - Client

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

ONSITE ENVIRONMENTAL LABORATORIES, INC.
[redacted]
5500 Boscell Common Fremont, CA 94538 Tel. (510) 490-8571 Fax. (510) 490-8572

Project Manager:	
Client Name:	Kleinfelder
Address:	
City, State ZIP	
Phone:	
Fax:	

Bill to:	
Company:	
Address:	
City, State ZIP	
Phone:	
Fax:	

Date:	8/29/07
Page:	2 of 2
Laboratory:	3
Lab Number:	3D046

Project Name:	Freisman Ranch, Livermore
Project Number:	

P.O. No.:	

Analysis Requested

Sample Identification	Date Sampled	Time Sampled	Matrix	Sampled & Relinquished By:	Time Relinquished:	Received By:	Lab ID	BTEX (8021)	TPH - Gas (8015M)	TPH - Diesel (8015M)	MTBE					No. Containers	Remarks
KB-18 at 15ft	8/24/07	1335	Soil	MM	1400	NW	3D046-14	X	X	X						1	
KB-18 at 20ft		1350	Soil	MM	1400	NW	NW-15	X	X	X	X					1	
KB-12		1420	Water	RS	1430	NW	NW-16	X	X	X						3	
KB-13		1535	WATER	RS	1550	NW	NW-18	X	X	X						3	
KB-16		1450	WATER	RS	1552	NW	NW-19	X	X	X						3	
KB-17		1510	WATER	RS	1553	NW	NW-20	X	X	X	X					3	
KB-18		1520	WATER	RS	1554	NW	NW-21	X	X	X						3	
KB-19		1615	WATER	RS	1630	NW	-22	X	X	X						3	
KB-20		1600	WATER	RS	1630	NW	-23	X	X	X						3	

Initials:	Printed Name:	Signature:		
NW	Nathalie Weicker		Date:	
RS	RICHARD SILVA		Start Time:	
			Stop Time:	
			Hours:	
			Client Sign-off:	

Total Containers:	
Received Intact:	
Received Cold:	
Custody Seals:	

McCAMPBELL ANALYTICAL

110 2nd AVENUE, # D7
PACHECO, CA 94553

(510) 798-1620 FAX (510) 798-1622

CHAIN OF CUSTODY RECORD

TURN AROUND TIME: ☐ RUSH ☐ 24 HOUR ☐ 48 HOUR ☒ 5 DAY ☐ ROUTINE

REPORT TO: ED HAMILTON BILL TO: MAI

PROJECT NUMBER: 9345 PROJECT NAME: KF-10-3006-13/004

PROJECT LOCATION:

SAMPLE ID	LOCATION	SAMPLING DATE	SAMPLING TIME	# CONTAINERS	TYPE CONTAINERS	MATRIX: WATER	MATRIX: SOIL	MATRIX: AIR	MATRIX: SLUDGE	MATRIX: OTHER	METHOD PRESERVED: HCL	METHOD PRESERVED: HNO3	METHOD PRESERVED: ICE	METHOD PRESERVED: OTHER	ANALYSIS REQUEST: EPA 601/8010	EPA 602/8020	EPA 608/8080	EPA 608/8080 – PCBs Only	EPA 624/8240/8260	EPA 625/8270 PAH by 8270	CAM – 17 Metals	EPA – Priority Pollutant Metals	LUFT Metals	LEAD (7240/7421/239.2/6010)	ORGANIC LEAD	RCI	OTHER: NITRATES	COMMENTS
KB-1@15'	01A	8/28	1004	1	VOA		X						X							XX								80303
KB-1	02A	↓	1045	↓	LTR	X							↓							X								80304
KS-1-6	03A		1005-1115		VOA		X																			X		80305
~~KS-2~~			—																									
KB-3@20'	04A	↓	1235	↓	VOA		X						↓							X								80309

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Jamillenic	8/29	13:30	Rick Gilmore
Rick Gilmore	8-29-97	13:55	Ronald C. Jensen

RECEIVED BY LABORATORY:

REMARKS:

McCAMPBELL ANALYTICAL

110 2nd AVENUE, # D7
PACHECO, CA 94553

(510) 798-1620 FAX (510) 798-1622

CHAIN OF CUSTODY RECORD

TURN AROUND TIME: ☐ RUSH ☐ 24 HOUR ☐ 48 HOUR ☒ 5 DAY ☐ ROUTINE

REPORT TO: Ed Hamilton
BILL TO: MAI
PROJECT NUMBER: 9353
PROJECT NAME: K-10-3006-13/004 F.R.
PROJECT LOCATION:

AB #	SAMPLE ID	LOCATION	SAMPLING DATE	SAMPLING TIME	# CONTAINERS	TYPE CONTAINERS	MATRIX: WATER	SOIL	AIR	SLUDGE	OTHER	METHOD PRESERVED: HCL	HNO3	ICE	OTHER	ANALYSIS REQUEST: EPA 601/8010	EPA 602/8020	EPA 608/8080	EPA 608/8080 – PCBs Only	EPA 624/8240/8260	EPA 625/8270	CAM – 17 Metals	EPA – Priority Pollutant Metals	LUFT Metals	LEAD (7240/7421/239.2/6010)	ORGANIC LEAD	RCI	OTHER: PAH's	COMMENTS
1A	KB-9@	20'	8-29-97		1	VOA		X						X														X	80363
2A	KB-9				1	Ltr	X							X														X	80364
3A	KB-14@	15'			1	VOA		X						X														X	80365
4A	KB-15@	15'			1	VOA		X						X														X	80366
5A	KB-16				1	Ltr	X							X														X	80367
6A	KB-17@	15'			1	VOA		X						X														X	80368
7A	KB-18@		↓		1	VOA		X						X														X	80369

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Judi Rocca	9/2/97	510	Rick Gilmore
Rick Gilmore	9-2-97	17:30	
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
			RECEIVED BY LABORATORY: 09/02/97 17:18

REMARKS:

[redacted] K[redacted]N[redacted]D[redacted] [redacted] XKF55

PROJECT NO.	PROJECT NAME	RECEIVING LAB
10-3006-13/004	FREISMAN RANCH	McCampbell

L.P. NO. (P.O. NO.)

SAMPLERS: (Signature/Number) Richard [signature] / #3389

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CON-TAINERS	TYPE OF CON-TAINERS	ANALYSIS: PAH	INSTRUCTIONS/REMARKS
1	8-29-97	0920	KB-9 AT 20FT	SOIL	1	PLASTIC	X	80363
2	"	0940	KB-9	WATER	1	AMBER	X	80364
3	"	0920	KB-14 AT 15FT	SOIL	1	PLASTIC	X	80365
4	"	1035	KB-15 AT 15FT	SOIL	1	PLASTIC	X	80366
5	"	1450	KB-16	WATER	1	AMBER	X	80367
6	"	1225	KB-17 AT 15FT	SOIL	1	PLASTIC	X	80368
7	"	1350	KB-18 AT 20FT	SOIL	1	PLASTIC	X	80369
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

ICE/I° ✓ GOOD CONDITION ✓ HEAD SPACE ABSENT ✓

PRESERVATION | VOAS | O&G | METALS | OTHER

APPROPRIATE CONTAINERS ✓

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Richard [signature]	9-2-97 0800	[signature] E[signature] / [signature] D. Freeman
[signature] E[signature]	9/2/97 0920	[signature]
[signature]	9/2/97 1040	Received for Laboratory by: (Signature) [signature]

Instructions/Remarks:

Send Results To:

KLEINFELDER
7133 KOLL CENTER PARKWAY
SUITE 100
PLEASANTON, CA 94566
(510) 484-1700

Attn.

M-60 White – Sampler Canary – Return Copy To Shipper Pink – Lab Copy

CHAIN OF CUSTODY

№ 2156

ONSITE
ENVIRONMENTAL
LABORATORIES, INC.

Analytical Laboratory Report
MTBE, BTEX
EPA Method 8020

Date Sampled: 8/28/97
Date Received: 8/28/97
Report Number: 3D045B.RPT
Lab Number: 3D045
Date Reported: 8/29/97

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Units Soil: mg/Kg
Units Water: ug/L

Lab ID No.	Field ID No.	Date Analyzed	MTBE	Benzene	Toluene	Ethyl-benzene	Xylenes total	BTEX Sur. %	BTEX DF	Matrix
3D045-01	KB-1 at 10ft	8/28/97	NR	ND	ND	ND	ND	108	1	Soil
3D045-02	KB-1 at 15ft	8/28/97	**0.065**	**0.056**	**0.0025**	**0.043**	**0.071**	105	2	Soil
3D045-03	KB-1	8/28/97	NR	ND	ND	ND	ND	130	1	Water
3D045-04	KB-2	8/28/97	NR	**7.9**	**1.7**	**10**	**3.4**	91	1	Water
3D045-05	KB-3 at 15ft	8/28/97	NR	ND	ND	ND	ND	122	1	Soil
3D045-06	KB-3 at 20ft	8/28/97	NR	ND	ND	ND	ND	116	1	Soil
3D045-07	KB-4	8/28/97	NR	ND	ND	**0.63**	ND	127	1	Water
3D045-08	KB-5	8/28/97	NR	ND	ND	ND	ND	116	1	Water
3D045-09	KB-6	8/28/97	NR	ND	ND	ND	ND	104	1	Water
3D045-10	KB-3	8/28/97	NR	ND	ND	ND	ND	109	1	Water
3D045-11	KB-7	8/28/97	NR	ND	ND	ND	ND	112	1	Water
3D045-12	KB-8	8/28/97	NR	ND	ND	ND	ND	116	1	Water
Reporting Limits SOIL mg/Kg			0.005	0.005	0.005	0.005	0.005			
Reporting Limits WATER ug/L			0.5	0.5	0.5	0.5	0.5			

NOTES:
NR - Not requested
NC - Not confirmed
COC - Chain of custody
ND - Analytes not detected at, or above the reporting limit
Sur. % - Percent surrogate recovery
mg/Kg - Milligrams per kilogram (PPM)
ug/L - Micrograms per liter (PPB)
PQL - Practical Quantitation Limit. Equals detection limit times the dilution factor.
D - Surrogate was diluted out
M - Matrix effects
DF - Dilution Factor
E - Sample results out of calibration range, need to be rerun

PROCEDURES:
MTBE, BTEX, Naphthalene - This analysis was performed using EPA Method 8020 and EPA Method 5030

CERTIFICATION:
California Department of Health Services ELAP
Onsite Environmental Laboratories, 5500 Boscell Common, Fremont, CA 94538 (510) 490-8571

David Voight
Laboratory Director

SEP - 3 1997
Date

ONSITE
ENVIRONMENTAL
LABORATORIES, INC.

Analytical Laboratory Report
TPH-P Gasoline
EPA Method 8015 Modified

Date Received: 8/28/97
Report Number: 3D045G.RPT
Lab Number: 3D045
Date Reported: 8/28/97

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Units Soil: mg/Kg
Units Water: ug/L

Lab ID No.	Field ID No.	Date Sampled	Date Analyzed	TPH-P Gas	Gas Sur. %	Gas DF	Matrix
3D045-01	KB-1 at 10ft	8/28/97	8/28/97	ND	100	1	Soil
3D045-02	KB-1 at 15ft	8/28/97	8/28/97	28	106	2	Soil
3D045-03	KB-1	8/28/97	8/28/97	ND	115	1	Water
3D045-04	KB-2	8/28/97	8/28/97	850	103	1	Water
3D045-05	KB-3 at 15ft	8/28/97	8/28/97	ND	115	1	Soil
3D045-06	KB-3 at 20ft	8/28/97	8/28/97	ND	111	1	Soil
3D045-07	KB-4	8/28/97	8/28/97	91	119	1	Water
3D045-08	KB-5	8/28/97	8/28/97	ND	105	1	Water
3D045-09	KB-6	8/28/97	8/28/97	ND	99	1	Water
3D045-10	KB-3	8/28/97	8/28/97	ND	105	1	Water
3D045-11	KB-7	8/28/97	8/28/97	ND	108	1	Water
3D045-12	KB-8	8/28/97	8/28/97	ND	115	1	Water

Reporting Limits SOIL mg/Kg	1.0
Reporting Limits WATER ug/L	50

NOTES:
NR - Not requested
NC - Not confirmed
COC - Chain of custody
ND - Analytes not detected at, or above the reporting limit
Sur. % - Percent surrogate recovery
mg/Kg - Milligrams per kilogram (PPM)
ug/L - Micrograms per liter (PPB)
PQL - Practical Quantitation Limit. Equals detection limit times the dilution factor.
D - Surrogate was diluted out
M - Matrix effects
DF - Dilution Factor
TPH-P Gas - Total petroleum hydrocarbons purgeable quantitated as gasoline
* - Sample chromatogram does not match standard chromatogram.
E - Sample results out of calibration range, need to be rerun.

PROCEDURES:
TPH-P Gasoline - This analysis was performed using EPA Method 8015 Mod. and EPA Method 5030

CERTIFICATION:
California Department of Health Services ELAP
Onsite Environmental Laboratories, 5500 Boscell Common, Fremont, CA 94538 (510) 490-8571

Gareth Voight
Laboratory Director

SEP - 5 1997
Date

ONSITE ENVIRONMENTAL LABORATORIES, INC.

[redacted]

Analytical Laboratory Report
TPH-P Gasoline
EPA Method 8015 Modified

Date Received: 8/29/97
Report Number: 3D046G.RPT
Lab Number: 3D046
Date Reported: 9/2/97

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Units Soil: mg/Kg
Units Water: ug/L

Lab ID No.	Field ID No.	Date Sampled	Date Analyzed	TPH-P Gas	Gas Sur. %	Gas DF	Matrix
3D046-01	KB-9	8/29/97	8/29/97	ND	110	1	Water
3D046-02	KB-9 at 15ft	8/29/97	8/29/97	ND	113	1	Soil
3D046-03	KB-9 at 20ft	8/29/97	8/29/97	ND	107	1	Soil
3D046-04	KB-14 at 10ft	8/29/97	8/29/97	ND	99	1	Soil
3D046-05	KB-14 at 15ft	8/29/97	8/29/97	ND	101	1	Soil
3D046-06	KB-10	8/29/97	8/29/97	7100	119	1	Water
3D046-07	KB-10D	8/29/97	8/29/97	10,000	124	1	Water
3D046-08	KB-15 at 10ft	8/29/97	8/29/97	ND	107	1	Soil
3D046-09	KB-15 at 15ft	8/29/97	8/29/97	ND	100	1	Soil
3D046-10	KB-14	8/29/97	8/29/97	57*	104	1	Water
3D046-11	KB-15	8/29/97	8/29/97	ND	110	1	Water
3D046-12	KB-11	8/29/97	8/29/97	9900	124	5	Water
3D046-13	KB-17 at 5ft	8/29/97	8/29/97	ND	89	1	Soil
3D046-14	KB-17 at 15ft	8/29/97	8/29/97	ND	97	1	Soil
3D046-15	KB-18 at 15ft	8/29/97	8/29/97	2100*	112	1	Soil
3D046-16	KB-18 at 20ft	8/29/97	8/29/97	4000*	103	1	Soil
3D046-17	KB-12	8/29/97	8/29/97	ND	104	1	Water
3D046-18	KB-13	8/29/97	8/29/97	38,000	111	10	Water
3D046-19	KB-16	8/29/97	8/29/97	ND	96	1	Water
3D046-20	KB-17	8/29/97	8/29/97	ND	108	1	Water
3D046-21	KB-18	8/29/97	8/29/97	320*	100	1	Water
3D046-22	KB-19	8/29/97	8/29/97	ND	108	1	Water
3D046-23	KB-20	8/29/97	8/29/97	ND	85	1	Water

Reporting Limits SOIL mg/Kg	1.0
Reporting Limits WATER ug/L	50

NOTES:
NR - Not requested
NC - Not confirmed
COC - Chain of custody
ND - Analytes not detected at, or above the reporting limit
Sur. % - Percent surrogate recovery
mg/Kg - Milligrams per kilogram (PPM)
ug/L - Micrograms per liter (PPB)
PQL - Practical Quantitation Limit. Equals detection limit times the dilution factor.
D - Surrogate was diluted out
M - Matrix effects
DF - Dilution Factor
TPH-P Gas - Total petroleum hydrocarbons purgeable quantitated as gasoline
* - Sample chromatogram does not match standard chromatogram.
E - Sample results out of calibration range, need to be rerun.

PROCEDURES:
TPH-P Gasoline - This analysis was performed using EPA Method 8015 Mod. and EPA Method 5030

CERTIFICATION:
California Department of Health Services ELAP
Onsite Environmental Laboratories, 5300 Boscell Common, Fremont, CA 94538 (510) 490-8571

Gareth Voight
Laboratory Director

SEP - 3 1997
Date

ONSITE ENVIRONMENTAL LABORATORIES, INC.

QC DATA REPORT
TPH-E
EPA Method 8015 Modified

Date Sampled:	8/28/97	**Proj Mgr:**	Richard Silva
Date Received:	8/28/97	**Client:**	Kleinfelder
Date Analyzed:	8/28/97, 8/29/97	**Project:**	Freisman Ranch
Date Extracted:	8/28/97		
Report Number:	0828SD.QAC	**Matrix:**	Soil
Lab Number:	3D045-01, KB-1-10ft	**Units:**	mg/Kg

Parameter	Blank Result mg/Kg	Spike Level mg/Kg	LCS Result mg/Kg	LCS Recov. %	Sample Result mg/Kg	MS Result mg/Kg	MS Recov. %	MSD Result mg/Kg	MSD Recov. %	RPD %
TPH-E diesel	ND	51.5	50.0	97	ND	42.7	83	43.0	83	0.7
surr %rec dies.	92	-	-	114	81	-	82	-	94	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-E	65%	to	135%
%RPD	0%	to	35%

ONSITE
ENVIRONMENTAL
LABORATORIES, INC.

QC DATA REPORT
TPH-E
EPA Method 8015 Modified

Date Sampled:	8/28/97	**Proj Mgr:**	Richard Silva
Date Received:	8/28/97	**Client:**	Kleinfelder
Date Analyzed:	8/28/97	**Project:**	Freisman Ranch
Date Extracted:	8/28/97		
Report Number:	0828SD.QAC	**Matrix:**	Water
		Units:	ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	LCSD Result ug/L	LCSD Recov. %	RPD %
TPH-E diesel	ND	1030	1000	97	1130	110	12.2
surr %rec dies.	81	-	-	102	-	108	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-E	65%	to	135%
%RPD	0%	to	35%

ONSITE
ENVIRONMENTAL
LABORATORIES, INC.

QC DATA REPORT
TPH-P
EPA Method 8015 Modified

Date Sampled:	8/28/97	**Proj Mgr:**	Richard Silva
Date Received:	8/28/97	**Client:**	Kleinfelder
Date Analyzed:	8/28/97	**Project:**	Freisman Ranch
Report Number:	0828SG.QAC		
Lab Number:	3D045-03, KB-1	**Matrix:**	Soil / Water
		Units:	ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Recov. %	RPD %
TPH-P gasoline	ND	2000	1960	98	ND	1950	98	1980	99	3.1
surr %rec gas	112	-	-	74	115	-	85	-	82	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate
M - Matrix effects

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-P	70%	to	130%
%RPD	0%	to	30%

ONSITE ENVIRONMENTAL LABORATORIES, INC.

QC DATA REPORT
MTBE, BTEX
EPA Method 8020

Date Sampled: 8/28/97
Date Received: 8/28/97
Date Analyzed: 8/28/97
Report Number: 0828sB.QAC
Lab Number: 3D045-03, KB-1

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch

Matrix: Soil/Water
Units: ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Reov. %	RPD %
MTBE	ND	20.0	24.0	120	3.6	21.1	88	23.0	97	10.3
Benzene	ND	20.0	15.1	76	ND	20.5	103	20.3	102	1.0
Toluene	ND	20.0	15.7	79	ND	21.4	107	21.2	106	0.9
Ethyl benzene	ND	20.0	15.7	79	ND	21.6	108	21.2	106	1.9
total Xylenes	ND	60.0	47.8	80	ND	64.5	108	63.7	106	1.2
surr %rec BTEX	125			115	130		116		111	

DEFINITION OF TERMS:
ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
Benzene	70%	to	130%
Toluene	70%	to	130%
Ethylbenzene	70%	to	130%
Xylenes Total	70%	to	130%
%RPD	0%	to	30%

ONSITE ENVIRONMENTAL LABORATORIES, INC.

QC DATA REPORT
TPH-P
EPA Method 8015 Modified

Date Sampled:	8/28/97	**Proj Mgr:**	Richard Silva
Date Received:	8/28/97	**Client:**	Kleinfelder
Date Analyzed:	8/28/97	**Project:**	Freisman Ranch
Report Number:	0828WG.QAC		
Lab Number:	3D045-03, KB-1	**Matrix:**	Water
		Units:	ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Recov. %	RPD %
TPH-P gasoline	ND	2000	1960	98	ND	1950	98	1980	99	3.1
surr %rec gas	101	-	-	74	115	-	85	-	82	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate
M - Matrix effects

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-P	70%	to	130%
%RPD	0%	to	30%

ONSITE ENVIRONMENTAL LABORATORIES, INC.

QC DATA REPORT
MTBE, BTEX
EPA Method 8020

Date Sampled: 8/28/97
Date Received: 8/28/97
Date Analyzed: 8/28/97
Report Number: 0828WB.QAC
Lab Number: 3D045-03, KB-1

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Matrix: Water
Units: ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Reov. %	RPD %
MTBE	ND	20.0	24.0	120	3.6	21.1	88	23.0	97	10.3
Benzene	ND	20.0	15.1	76	ND	20.5	103	20.3	102	1.0
Toluene	ND	20.0	15.7	79	ND	21.4	107	21.2	106	0.9
Ethyl benzene	ND	20.0	15.7	79	ND	21.6	108	21.2	106	1.9
total Xylenes	ND	60.0	47.8	80	ND	64.5	108	63.7	106	1.2
surr %rec BTEX	114			115	130		116		111	

DEFINITION OF TERMS:
ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
Benzene	70%	to	130%
Toluene	70%	to	130%
Ethylbenzene	70%	to	130%
Xylenes Total	70%	to	130%
%RPD	0%	to	30%

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Analytical Laboratory Report
MTBE, BTEX
EPA Method 8020

Date Sampled: 8/29/97
Date Received: 8/29/97
Report Number: 3D046B.RPT
Lab Number: 3D046
Date Reported: 8/29/97

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Units Soil: mg/Kg
Units Water: ug/L

Lab ID No.	Field ID No.	Date Analyzed	MTBE	Benzene	Toluene	Ethyl-benzene	Xylenes total	BTEX Sur. %	BTEX DF	Matrix
3D046-01	KB-9	8/29/97	5.1	ND	ND	ND	ND	108	1	Water
3D046-02	KB-9 at 15ft	8/29/97	NR	ND	ND	ND	ND	109	1	Soil
3D046-03	KB-9 at 20ft	8/29/97	NR	ND	ND	ND	ND	107	1	Soil
3D046-04	KB-14 at 10ft	8/29/97	NR	ND	ND	ND	ND	97	1	Soil
3D046-05	KB-14 at 15ft	8/29/97	NR	ND	ND	ND	ND	101	1	Soil
3D046-06	KB-10	8/29/97	27	41	26	17	16	125	5	Water
3D046-07	KB-10D	8/29/97	33	53	38	21	29	110	5	Water
3D046-08	KB-15 at 10ft	8/29/97	NR	ND	ND	ND	ND	104	1	Soil
3D046-09	KB-15 at 15ft	8/29/97	NR	ND	ND	ND	ND	100	1	Soil
3D046-10	KB-14	8/29/97	6.5	ND	ND	ND	ND	108	1	Water
3D046-11	KB-15	8/29/97	NR	ND	ND	ND	ND	109	1	Water
3D046-12	KB-11	8/29/97	NR	160	22	380	530	101	5	Water
3D046-13	KB-17 at 5ft	8/29/97	NR	ND	ND	ND	ND	95	1	Soil
3D046-14	KB-17 at 15ft	8/29/97	ND	ND	ND	ND	ND	99	1	Soil
3D046-15	KB-18 at 15ft	8/29/97	NR	ND	ND	0.006	0.006	110	1	Soil
3D046-16	KB-18 at 20ft	8/29/97	ND	ND	ND	0.007	0.020	107	1	Soil
3D046-17	KB-12	8/29/97	NR	ND	ND	ND	ND	106	1	Water
3D046-18	KB-13	8/29/97	NR	390	120	890	4200	116	10	Water
3D046-19	KB-16	8/29/97	NR	0.6	1.0	ND	1.1	94	1	Water
3D046-20	KB-17	8/29/97	4.5	ND	ND	ND	0.6	101	1	Water
3D046-21	KB-18	8/29/97	NR	ND	ND	1.0	2.2	99	1	Water
3D046-22	KB-19	8/29/97	NR	ND	0.7	ND	0.9	104	1	Water
3D046-23	KB-20	8/29/97	NR	0.7	0.8	0.7	2.1	80	1	Water
Reporting Limits SOIL mg/Kg			0.005	0.005	0.005	0.005	0.005			
Reporting Limits WATER ug/L			0.5	0.5	0.5	0.5	0.5			

NOTES:
NR - Not requested
NC - Not confirmed
COC - Chain of custody
ND - Analytes not detected at, or above the reporting limit
Sur. % - Percent surrogate recovery
mg/Kg - Milligrams per kilogram (PPM)
ug/L - Micrograms per liter (PPB)
PQL - Practical Quantitation Limit. Equals detection limit times the dilution factor.
D - Surrogate was diluted out
M - Matrix effects
DF - Dilution Factor
E - Sample results out of calibration range, need to be rerun

PROCEDURES:
MTBE, BTEX, Naphthalene - This analysis was performed using EPA Method 8020 and EPA Method 5030

CERTIFICATION:
California Department of Health Services ELAP
Onsite Environmental Laboratories, 1500 Boscell Common, Fremont, CA 94538 (510) 490-8571

Gareth Voight
Laboratory Director

SEP - 3 1997
Date

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Analytical Laboratory Report
TPH-E Diesel
EPA Method 8015 Modified

Date Sampled: 8/28/97
Date Received: 8/28/97
Report Number: 3D045D.RPT
Lab Number: 3D045
Date Reported: 8/29/97

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Units Soil: mg/Kg
Units Water: ug/L

Lab ID No.	Field ID No.	Date Extracted	Date Analyzed	TPH-E Diesel	TPH-E Sur. %	TPH-E DF	Matrix
3D045-01	KB-1 at 10ft	8/28/97	8/28/97	ND	81	1	Soil
3D045-02	KB-1 at 15ft	8/28/97	8/28/97	ND	66	1	Soil
3D045-03	KB-1	8/28/97	8/28/97	120*	96	1	Water
3D045-04	KB-2	8/28/97	8/28/97	180*	116	1	Water
3D045-05	KB-3 at 15ft	8/28/97	8/28/97	ND	78	1	Soil
3D045-06	KB-3 at 20ft	8/28/97	8/28/97	ND	89	1	Soil
3D045-07	KB-4	8/28/97	8/28/97	74*	107	1	Water
3D045-08	KB-5	8/28/97	8/28/97	250*	105	1	Water
3D045-09	KB-6	8/28/97	8/28/97	210*	96	1	Water
3D045-10	KB-3	8/28/97	8/28/97	320*	95	1	Water
3D045-11	KB-7	8/28/97	8/28/97	190*	95	1	Water
3D045-12	KB-8	8/28/97	8/28/97	ND	87	1	Water

Reporting Limits SOIL mg/Kg	10
Reporting Limits WATER ug/L	50

NOTES:
NR - Not requested
NC - Not confirmed
COC - Chain of custody
ND - Analytes not detected at, or above the reporting limit
Sur. % - Percent surrogate recovery
mg/Kg - Milligrams per kilogram (PPM)
ug/L - Micrograms per liter (PPB)
PQL - Practical Quantitation Limit. Equals detection limit times the dilution factor.
D - Surrogate was diluted out
M - Matrix effects
DF - Dilution Factor
* - Sample chromatogram does not match standard chromatogram.
TPH-E Diesel - Total petroleum hydrocarbons extractable quantitated as Diesel
TPH-E Motor Oil - Total petroleum hydrocarbons extractable quantitated as Motor Oil

PROCEDURES:
TPH-E - This analysis was performed using EPA Method 8015 Mod. and EPA Method 3550B

CERTIFICATION:
California Department of Health Services ELAP
Onsite Environmental Laboratories, 5500 Boscell Common, Fremont, CA 94538 (510) 490-8571

Gareth Voight
Laboratory Director

SEP - 5 1997
Date

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Analytical Laboratory Report
TPH-E Diesel
EPA Method 8015 Modified

Date Sampled: 8/29/97
Date Received: 8/29/97
Report Number: 3D046D.RPT
Lab Number: 3D046
Date Reported: 9/2/97

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch
Units Soil: mg/Kg
Units Water: ug/L

Lab ID No.	Field ID No.	Date Extracted	Date Analyzed	TPH-E Diesel	TPH-E Sur. %	TPH-E DF	Matrix
3D046-01	KB-9	8/29/97	8/29/97	113*	93	1	Water
3D046-02	KB-9 at 15ft	8/29/97	8/29/97	ND	63	1	Soil
3D046-03	KB-9 at 20ft	8/29/97	8/29/97	ND	76	1	Soil
3D046-04	KB-14 at 10ft	8/29/97	8/29/97	ND	72	1	Soil
3D046-05	KB-14 at 15ft	8/29/97	8/29/97	ND	51	1	Soil
3D046-06	KB-10	8/29/97	8/29/97	1500*	103	1	Water
3D046-07	KB-10D	8/29/97	8/29/97	2700*	86	1	Water
3D046-08	KB-15 at 10ft	8/29/97	8/29/97	ND	60	1	Soil
3D046-09	KB-15 at 15ft	8/29/97	8/29/97	ND	40	1	Soil
3D046-10	KB-14	8/29/97	8/29/97	NR		1	Water
3D046-11	KB-15	8/29/97	8/29/97	NR		1	Water
3D046-12	KB-11	8/29/97	8/29/97	6700*	103	1	Water
3D046-13	KB-17 at 5ft	8/29/97	8/29/97	ND	61	1	Soil
3D046-14	KB-17 at 15ft	8/29/97	8/29/97	ND	68	1	Soil
3D046-15	KB-18 at 15ft	8/29/97	8/29/97	ND	71	1	Soil
3D046-16	KB-18 at 20ft	8/29/97	8/29/97	ND	81	1	Soil
3D046-17	KB-12	8/29/97	8/29/97	97*	95	1	Water
3D046-18	KB-13	8/29/97	8/29/97	13,000*	111	1	Water
3D046-19	KB-16	8/29/97	8/29/97	91*	82	1	Water
3D046-20	KB-17	8/29/97	8/29/97	90*	86	1	Water
3D046-21	KB-18	8/29/97	8/29/97	490*	103	1	Water
3D046-22	KB-19	8/29/97	8/29/97	ND	96	1	Water
3D046-23	KB-20	8/29/97	8/29/97	ND	89	1	Water

Reporting Limits SOIL mg/Kg	10
Reporting Limits WATER ug/L	50

NOTES:
NR - Not requested
NC - Not confirmed
COC - Chain of custody
ND - Analytes not detected at, or above the reporting limit
Sur. % - Percent surrogate recovery
mg/Kg - Milligrams per kilogram (PPM)
ug/L - Micrograms per liter (PPB)
PQL - Practical Quantitation Limit. Equals detection limit times the dilution factor.
D - Surrogate was diluted out
M - Matrix effects
DF - Dilution Factor
* - Sample chromatogram does not match standard chromatogram.
TPH-E Diesel - Total petroleum hydrocarbons extractable quantitated as Diesel
TPH-E Motor Oil - Total petroleum hydrocarbons extractable quantitated as Motor Oil

PROCEDURES:
TPH-E - This analysis was performed using EPA Method 8015 Mod. and EPA Method 3550B

CERTIFICATION:
California Department of Health Services ELAP
Onsite Environmental Laboratories, 5300 Boscell Common, Fremont, CA 94538 (510) 490-8571

Gareth Voight
Laboratory Director

SEP 2 3 1997
Date

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QC DATA REPORT
MTBE, BTEX
EPA Method 8020

Date Sampled: 8/29/97
Date Received: 8/29/97
Date Analyzed: 8/29/97
Report Number: 0829SB.QAC
Lab Number: 3D046-02, KB-9 at 15ft

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch

Matrix: Soil
Units: ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Reov. %	RPD %
MTBE	ND	20.0	20.1	101	ND	26.0	130	21.1	106	20.8
Benzene	ND	20.0	17.8	89	ND	16.1	81	16.5	83	2.5
Toluene	ND	20.0	18.0	90	ND	17.4	87	17.6	88	1.1
Ethyl benzene	ND	20.0	19.0	95	ND	17.3	87	17.9	90	3.4
total Xylenes	ND	60.0	57.0	95	ND	51.9	87	53.5	89	3.0
surr %rec BTEX	100			95	109		84		91	

DEFINITION OF TERMS:
ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
Benzene	70%	to	130%
Toluene	70%	to	130%
Ethylbenzene	70%	to	130%
Xylenes Total	70%	to	130%
%RPD	0%	to	30%

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QC DATA REPORT
TPH-P
EPA Method 8015 Modified

Date Sampled: 8/29/97
Date Received: 8/29/97
Date Analyzed: 8/29/97
Report Number: 0829WG.QAC
Lab Number: 3D046-01, KB-9

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch

Matrix: Water
Units: ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Recov. %	RPD %
TPH-P gasoline	ND	2000	1990	100	ND	1870	94	1820	91	5.4
surr %rec gas	112	-	-	90	110	-	80	-	83	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate
M - Matrix effects

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-P	70%	to	130%
%RPD	0%	to	30%

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QC DATA REPORT
TPH-E
EPA Method 8015 Modified

Date Sampled:	8/29/97	**Proj Mgr:**	Richard Silva
Date Received:	8/29/97	**Client:**	Kleinfelder
Date Analyzed:	8/29/97	**Project:**	Freisman Ranch
Date Extracted:	8/29/97		
Report Number:	0829WD.QAC	**Matrix:**	Water
		Units:	ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	LCSD Result ug/L	LCSD Recov. %	RPD %
TPH-E diesel	ND	1030	1150	112	1100	107	4.4
surr %rec dies.	104	-	-	120	-	108	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-E	65%	to	135%
%RPD	0%	to	35%

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QC DATA REPORT
MTBE, BTEX
EPA Method 8020

Date Sampled: 8/29/97
Date Received: 8/29/97
Date Analyzed: 8/29/97
Report Number: 0829B.QAC
Lab Number: 3D046-01, KB-9

Proj Mgr: Richard Silva
Client: Kleinfelder
Project: Freisman Ranch

Matrix: Water
Units: ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Reov. %	RPD %
MTBE	ND	20.0	20.1	101	5.1	23.2	91	26.8	109	18.1
Benzene	ND	20.0	17.8	89	ND	18.8	94	18.2	91	3.2
Toluene	ND	20.0	18.0	90	ND	20.0	100	19.5	98	2.5
Ethyl benzene	ND	20.0	19.0	95	ND	20.1	101	19.5	98	3.0
total Xylenes	ND	60.0	57.0	95	ND	60.0	100	58.3	97	2.9
surr %rec BTEX	109			95	108		96		94	

DEFINITION OF TERMS:
ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
Benzene	70%	to	130%
Toluene	70%	to	130%
Ethylbenzene	70%	to	130%
Xylenes Total	70%	to	130%
%RPD	0%	to	30%

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QC DATA REPORT
TPH-E
EPA Method 8015 Modified

Date Sampled:	8/29/97	**Proj Mgr:**	Richard Silva
Date Received:	8/29/97	**Client:**	Kleinfelder
Date Analyzed:	8/29/97	**Project:**	Freisman Ranch
Date Extracted:	8/29/97		
Report Number:	0829SD.QAC	**Matrix:**	Soil
Lab Number:	3D046-04, KB-14-10ft	**Units:**	mg/Kg

Parameter	Blank Result mg/Kg	Spike Level mg/Kg	LCS Result mg/Kg	LCS Recov. %	Sample Result mg/Kg	MS Result mg/Kg	MS Recov. %	MSD Result mg/Kg	MSD Recov. %	RPD %
TPH-E diesel	ND	51.5	45.4	88	ND	52.9	103	44.3	86	17.7
surr %rec dies.	86	-	-	94	72	-	106	-	15.9	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-E	65%	to	135%
%RPD	0%	to	35%

ONSITE
ENVIRONMENTAL
LABORATORIES, INC.

QC DATA REPORT
TPH-P
EPA Method 8015 Modified

Date Sampled:	8/29/97	**Proj Mgr:**	Richard Silva
Date Received:	8/29/97	**Client:**	Kleinfelder
Date Analyzed:	8/29/97	**Project:**	Freisman Ranch
Report Number:	0829SG.QAC		
Lab Number:	3D046-02, KB-9 at 15ft	**Matrix:**	Soil
		Units:	ug/L

Parameter	Blank Result ug/L	Spike Level ug/L	LCS Result ug/L	LCS Recov. %	Sample Result ug/L	MS Result ug/L	MS Recov. %	MSD Result ug/L	MSD Recov. %	RPD %
TPH-P gasoline	ND	2000	1990	100	ND	1810	91	1790	90	2.2
surr %rec gas	107	-	-	90	113	-	109	-	114	-

DEFINITION OF TERMS:

ND - Analytes not detected at, or above the reporting limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative Percent Difference: (MS - MSD) /((MS + MSD)/2) X 100
LCS - Laboratory Control Spike
LCSD- Laboratory Control Spike Duplicate
M - Matrix effects

LABORATORY QC CRITERIA

Parameter	Acceptable % Recoveries		
TPH-P	70%	to	130%
%RPD	0%	to	30%

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

McCAMPBELL ANALYTICAL
110 2ND AVE. SOUTH, #D7
PACHECO, CA 94553

ATTN: EDWARD HAMILTON
CLIENT PROJ. ID: 9345
CLIENT PROJ. NAME: KF-10-3006-13

REPORT DATE: 09/10/97

DATE(S) SAMPLED: 08/28/97

DATE RECEIVED: 08/29/97

AEN WORK ORDER: 9708364

PROJECT SUMMARY:

On August 29, 1997, this laboratory received 4 (1 water and 3 soil) sample(s).

Client requested sample(s) be analyzed for chemical parameters. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Larry Klein
Laboratory Director

McCAMPBELL ANALYTICAL

SAMPLE ID: KB1 @ 15'
AEN LAB NO: 9708364-01
AEN WORK ORDER: 9708364
CLIENT PROJ. ID: 9345

DATE SAMPLED: 08/28/97
DATE RECEIVED: 08/29/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	08/29/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/05/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/05/97
Anthracene	120-12-7	ND	330	ug/kg	09/05/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/05/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/05/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/05/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/05/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/05/97
Chrysene	218-01-9	ND	330	ug/kg	09/05/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/05/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/05/97
Fluorene	86-73-7	ND	330	ug/kg	09/05/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/05/97
Naphthalene	91-20-3	ND	330	ug/kg	09/05/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/05/97
Pyrene	129-00-0	ND	330	ug/kg	09/05/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-1
AEN LAB NO: 9708364-02
AEN WORK ORDER: 9708364
CLIENT PROJ. ID: 9345

DATE SAMPLED: 08/28/97
DATE RECEIVED: 08/29/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	08/29/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/03/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/03/97
Anthracene	120-12-7	ND	10	ug/L	09/03/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/03/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/03/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/03/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/03/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/03/97
Chrysene	218-01-9	ND	10	ug/L	09/03/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/03/97
Fluoranthene	206-44-0	ND	10	ug/L	09/03/97
Fluorene	86-73-7	ND	10	ug/L	09/03/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/03/97
Naphthalene	91-20-3	ND	10	ug/L	09/03/97
Phenanthrene	85-01-8	ND	10	ug/L	09/03/97
Pyrene	129-00-0	ND	10	ug/L	09/03/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-3 @ 20'
AEN LAB NO: 9708364-04
AEN WORK ORDER: 9708364
CLIENT PROJ. ID: 9345

DATE SAMPLED: 08/28/97
DATE RECEIVED: 08/29/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	08/29/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/05/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/05/97
Anthracene	120-12-7	ND	330	ug/kg	09/05/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/05/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/05/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/05/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/05/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/05/97
Chrysene	218-01-9	ND	330	ug/kg	09/05/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/05/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/05/97
Fluorene	86-73-7	ND	330	ug/kg	09/05/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/05/97
Naphthalene	91-20-3	ND	330	ug/kg	09/05/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/05/97
Pyrene	129-00-0	ND	330	ug/kg	09/05/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9708364
CLIENT PROJECT ID: 9345

Quality Control and Project Summary

All laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates: Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I: Interference.

!: Indicates result outside of established laboratory QC limits.

ANALYSIS: Anion Scan in Soil by IC

MATRIX: Soil/Bulk

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: Dionex ion chromatograph
UNITS: mg/kg
METHOD:

LAB ID: MD08364-03A
PREPARED:
ANALYZED: 09/07/97

INSTR RUN: IC\970907000000/14/12
BATCH ID: IC090797
DILUTION: 1.000000

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrate, NO3-N	27.8	16.6	1	10.0	112	75	125		

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: Dionex ion chromatograph
UNITS: mg/kg
METHOD:

LAB ID: MS08364-03A
PREPARED:
ANALYZED: 09/07/97

INSTR RUN: IC\970907000000/13/12
BATCH ID: IC090797
DILUTION: 1.000000

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrate, NO3-N	27.2	16.6	1	10.0	106	75	125		

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: Dionex ion chromatograph
UNITS: mg/kg
METHOD:

LAB ID: MR08364-03A
PREPARED:
ANALYZED: 09/07/97

INSTR RUN: IC\970907000000/15/13
BATCH ID: IC090797
DILUTION: 1.000000

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrate, NO3-N	27.8	27.2	1					2.18	20

ANALYSIS: PNAs by EPA 8270

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: BLNK 0829
PREPARED: 08/29/97
ANALYZED: 09/04/97

INSTR RUN: GCMS10\970904000000/3/
BATCH ID: BNAW082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	84.4			110	76.7	58	109		
2-Fluorobiphenyl	(surr)	86.4			101	85.5	62	133		
Terphenyl-d14	(surr)	94.8			101	93.9	59	135		
Acenaphthene		ND								
Pyrene		ND								
Acenaphthylene		ND								
Anthracene		ND								
Benzo(a)anthracene		ND								
Benzo(b)fluoranthene		ND								
Benzo(k)fluoranthene		ND								
Benzo(g,h,i)perylene		ND								
Benzo(a)pyrene		ND								
Chrysene		ND								
Dibenzo(a,h)anthracene		ND								
Fluoranthene		ND								
Fluorene		ND								
Indeno(1,2,3-cd)pyrene		ND								
Naphthalene		ND								
Phenanthrene		ND								

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: LCDW 0829
PREPARED: 08/29/97
ANALYZED: 09/04/97

INSTR RUN: GCMS10\970904000000/8/3
BATCH ID: BNAW082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	86.0	84.4		110	78.2	58	109		
2-Fluorobiphenyl	(surr)	85.2	86.4		101	84.4	62	133		
Terphenyl-d14	(surr)	92.9	94.8		101	92.0	59	135		
Acenaphthene		83.1	ND		100	83.1	58	139		
Pyrene		91.6	ND		100	91.6	40	130		

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: LCSW 0829
PREPARED: 08/29/97
ANALYZED: 09/04/97

INSTR RUN: GCMS10\970904000000/4/3
BATCH ID: BNAW082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	86.7	84.4		110	78.8	58	109		
2-Fluorobiphenyl	(surr)	87.6	86.4		101	86.7	62	133		
Terphenyl-d14	(surr)	95.6	94.8		101	94.7	59	135		
Acenaphthene		83.7	ND		100	83.7	58	139		
Pyrene		92.7	ND		100	92.7	40	130		

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: 9708364-02A
PREPARED: 08/29/97
ANALYZED: 09/03/97

INSTR RUN: GCMS10\970903000000/9/
BATCH ID: BNAW082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	81.6			110	74.2	58	109		
2-Fluorobiphenyl	(surr)	81.7			101	80.9	62	133		

ANALYSIS: PNAs by EPA 8270

MATRIX: Water

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: 9708364-02A
PREPARED: 08/29/97
ANALYZED: 09/03/97

INSTR RUN: GCMS10\970903000000/9/
BATCH ID: BNAW082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Terphenyl-d14	(surr)	91.6			101	90.7	59	135		

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: BLNK 0829
PREPARED: 08/29/97
ANALYZED: 09/04/97

INSTR RUN: GCMS10\970904000000/28/
BATCH ID: BNAS082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	52.3			110	47.5	43	100		
2-Fluorobiphenyl	(surr)	51.6			101	51.1	49	126		
Terphenyl-d14	(surr)	77.4			101	76.6	61	125		
Acenaphthene		ND								
Pyrene		ND								
Acenaphthylene		ND								
Anthracene		ND								
Benzo(a)anthracene		ND								
Benzo(b)fluoranthene		ND								
Benzo(k)fluoranthene		ND								
Benzo(g,h,i)perylene		ND								
Benzo(a)pyrene		ND								
Chrysene		ND								
Dibenzo(a,h)anthracene		ND								
Fluoranthene		ND								
Fluorene		ND								
Indeno(1,2,3-cd)pyrene		ND								
Naphthalene		ND								
Phenanthrene		ND								

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: LCSS 0829
PREPARED: 08/29/97
ANALYZED: 09/04/97

INSTR RUN: GCMS10\970904000000/29/28
BATCH ID: BNAS082997
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	55.7	52.3		110	50.6	43	100		
2-Fluorobiphenyl	(surr)	55.8	51.6		101	55.2	49	126		
Terphenyl-d14	(surr)	74.1	77.4		101	73.4	61	125		
Acenaphthene		2450	ND		3330	73.57	50	129		
Pyrene		3270	ND		3330	98.20	40	130		

ANALYSIS: PNAs by EPA 8270

MATRIX: Soil/Bulk

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: MD08364-01A
PREPARED: 08/29/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/3/1
BATCH ID: BNAS082997
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	62.0	58.7		100	62.0	43	100		
2-Fluorobiphenyl	(surr)	62.7	58.0		100	62.7	49	126		
Terphenyl-d14	(surr)	83.2	84.3		100	83.2	61	125		
Acenaphthene		2110	ND		3330	63.36	50	129		
Pyrene		2810	ND		3330	84.38	40	130		

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: MS08364-01A
PREPARED: 08/29/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/2/1
BATCH ID: BNAS082997
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	73.0	58.7		100	73.0	43	100		
2-Fluorobiphenyl	(surr)	70.8	58.0		100	70.8	49	126		
Terphenyl-d14	(surr)	85.2	84.3		100	85.2	61	125		
Acenaphthene		2320	ND		3330	69.67	50	129		
Pyrene		2720	ND		3330	81.68	40	130		

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: MR08364-01A
PREPARED: 08/29/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/4/2
BATCH ID: BNAS082997
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	62.0	73.0		100	62.0	43	100		
2-Fluorobiphenyl	(surr)	62.7	70.8		100	62.7	49	126		
Terphenyl-d14	(surr)	83.2	85.2		100	83.2	61	125		
Acenaphthene		2310	2320						0.4320	40
Pyrene		2810	2720						3.255	40

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9708364-01A
PREPARED: 08/29/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/1/
BATCH ID: BNAS082997
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	58.7			100	58.7	43	100		
2-Fluorobiphenyl	(surr)	58.0			100	58.0	49	126		
Terphenyl-d14	(surr)	84.3			100	84.3	61	125		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9708364-04A
PREPARED: 08/29/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/5/
BATCH ID: BNAS082997
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	89.0			100	89.0	43	100		
2-Fluorobiphenyl	(surr)	89.4			100	89.4	49	126		
Terphenyl-d14	(surr)	116			100	116	61	125		

---------- End of Quality Control Report ----------

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

McCAMPBELL ANALYTICAL
110 2ND AVE. SOUTH, #D7
PACHECO, CA 94553

ATTN: EDWARD HAMILTON
CLIENT PROJ. ID: 9353
CLIENT PROJ. NAME: K-10-3006-13

REPORT DATE: 09/10/97

DATE(S) SAMPLED: 08/29/97

DATE RECEIVED: 09/02/97

AEN WORK ORDER: 9709017

PROJECT SUMMARY:

On September 2, 1997, this laboratory received 7 (5 soil and 2 water) sample(s).

Client requested sample(s) be analyzed for chemical parameters. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Larry Klein
Laboratory Director

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-9 @ 20'
AEN LAB NO: 9709017-01
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/08/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/08/97
Anthracene	120-12-7	ND	330	ug/kg	09/08/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/08/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/08/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/08/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/08/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/08/97
Chrysene	218-01-9	ND	330	ug/kg	09/08/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/08/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/08/97
Fluorene	86-73-7	ND	330	ug/kg	09/08/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/08/97
Naphthalene	91-20-3	ND	330	ug/kg	09/08/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/08/97
Pyrene	129-00-0	ND	330	ug/kg	09/08/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-9
AEN LAB NO: 9709017-02
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/05/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/05/97
Anthracene	120-12-7	ND	10	ug/L	09/05/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/05/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/05/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/05/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/05/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/05/97
Chrysene	218-01-9	ND	10	ug/L	09/05/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/05/97
Fluoranthene	206-44-0	ND	10	ug/L	09/05/97
Fluorene	86-73-7	ND	10	ug/L	09/05/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/05/97
Naphthalene	91-20-3	ND	10	ug/L	09/05/97
Phenanthrene	85-01-8	ND	10	ug/L	09/05/97
Pyrene	129-00-0	ND	10	ug/L	09/05/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-14 @ 15'
AEN LAB NO: 9709017-03
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/08/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/08/97
Anthracene	120-12-7	ND	330	ug/kg	09/08/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/08/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/08/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/08/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/08/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/08/97
Chrysene	218-01-9	ND	330	ug/kg	09/08/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/08/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/08/97
Fluorene	86-73-7	ND	330	ug/kg	09/08/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/08/97
Naphthalene	91-20-3	ND	330	ug/kg	09/08/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/08/97
Pyrene	129-00-0	ND	330	ug/kg	09/08/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-15 @ 15'
AEN LAB NO: 9709017-04
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/08/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/08/97
Anthracene	120-12-7	ND	330	ug/kg	09/08/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/08/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/08/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/08/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/08/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/08/97
Chrysene	218-01-9	ND	330	ug/kg	09/08/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/08/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/08/97
Fluorene	86-73-7	ND	330	ug/kg	09/08/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/08/97
Naphthalene	91-20-3	ND	330	ug/kg	09/08/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/08/97
Pyrene	129-00-0	ND	330	ug/kg	09/08/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-16
AEN LAB NO: 9709017-05
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/05/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/05/97
Anthracene	120-12-7	ND	10	ug/L	09/05/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/05/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/05/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/05/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/05/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/05/97
Chrysene	218-01-9	ND	10	ug/L	09/05/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/05/97
Fluoranthene	206-44-0	ND	10	ug/L	09/05/97
Fluorene	86-73-7	ND	10	ug/L	09/05/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/05/97
Naphthalene	91-20-3	ND	10	ug/L	09/05/97
Phenanthrene	85-01-8	ND	10	ug/L	09/05/97
Pyrene	129-00-0	ND	10	ug/L	09/05/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-17 @ 15'
AEN LAB NO: 9709017-06
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/08/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/08/97
Anthracene	120-12-7	ND	330	ug/kg	09/08/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/08/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/08/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/08/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/08/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/08/97
Chrysene	218-01-9	ND	330	ug/kg	09/08/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/08/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/08/97
Fluorene	86-73-7	ND	330	ug/kg	09/08/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/08/97
Naphthalene	91-20-3	ND	330	ug/kg	09/08/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/08/97
Pyrene	129-00-0	ND	330	ug/kg	09/08/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KB-18 @
AEN LAB NO: 9709017-07
AEN WORK ORDER: 9709017
CLIENT PROJ. ID: 9353

DATE SAMPLED: 08/29/97
DATE RECEIVED: 09/02/97
REPORT DATE: 09/10/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3550	-		Extrn Date	09/03/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	330	ug/kg	09/08/97
Acenaphthylene	208-96-8	ND	330	ug/kg	09/08/97
Anthracene	120-12-7	ND	330	ug/kg	09/08/97
Benzo(a)anthracene	56-55-3	ND	330	ug/kg	09/08/97
Benzo(b)fluoranthene	205-99-2	ND	330	ug/kg	09/08/97
Benzo(k)fluoranthene	207-08-9	ND	330	ug/kg	09/08/97
Benzo(g,h,i)perylene	191-24-2	ND	330	ug/kg	09/08/97
Benzo(a)pyrene	50-32-8	ND	330	ug/kg	09/08/97
Chrysene	218-01-9	ND	330	ug/kg	09/08/97
Dibenzo(a,h)anthracene	53-70-3	ND	330	ug/kg	09/08/97
Fluoranthene	206-44-0	ND	330	ug/kg	09/08/97
Fluorene	86-73-7	ND	330	ug/kg	09/08/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	330	ug/kg	09/08/97
Naphthalene	91-20-3	ND	330	ug/kg	09/08/97
Phenanthrene	85-01-8	ND	330	ug/kg	09/08/97
Pyrene	129-00-0	ND	330	ug/kg	09/08/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9709017
CLIENT PROJECT ID: 9353

Quality Control and Project Summary

All laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates: Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I: Interference.

!: Indicates result outside of established laboratory QC limits.

ANALYSIS: PNAs by EPA 8270

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: BLNK 0903
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/6/
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	73.0			100	73.0	58	109		
2-Fluorobiphenyl	(surr)	75.0			100	75.0	62	133		
Terphenyl-d14	(surr)	91.7			100	91.7	59	135		
Acenaphthene		ND								
Pyrene		ND								
Acenaphthylene		ND								
Anthracene		ND								
Benzo(a)anthracene		ND								
Benzo(b)fluoranthene		ND								
Benzo(k)fluoranthene		ND								
Benzo(g,h,i)perylene		ND								
Benzo(a)pyrene		ND								
Chrysene		ND								
Dibenzo(a,h)anthracene		ND								
Fluoranthene		ND								
Fluorene		ND								
Indeno(1,2,3-cd)pyrene		ND								
Naphthalene		ND								
Phenanthrene		ND								

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: LCD 0903
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/8/6
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	65.8	73.0		100	65.8	58	109		
2-Fluorobiphenyl	(surr)	68.2	75.0		100	68.2	62	133		
Terphenyl-d14	(surr)	93.6	91.7		100	93.6	59	135		
Acenaphthene		76.6	ND		100	76.6	58	139		
Pyrene		94.8	ND		100	94.8	40	130		

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: LCS 0903
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/7/6
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	69.3	73.0		100	69.3	58	109		
2-Fluorobiphenyl	(surr)	73.0	75.0		100	73.0	62	133		
Terphenyl-d14	(surr)	89.1	91.7		100	89.1	59	135		
Acenaphthene		74.1	ND		100	74.1	58	139		
Pyrene		82.7	ND		100	82.7	40	130		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Laboratory Control Sample Duplicate
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: LCR 0903
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/9/7
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	65.8	69.3		100	65.8	58	109		
2-Fluorobiphenyl	(surr)	68.2	73.0		100	68.2	62	133		

ANALYSIS: PNAs by EPA 8270

MATRIX: Water

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Laboratory Control Sample Duplicate
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: LCR 0903
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/9/7
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Terphenyl-d14	(surr)	93.6	89.1		100	93.6	59	135		
Acenaphthene		76.6	74.1		100				3.32	30
Pyrene		94.8	82.7		100				13.6	30

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: 9709017-02A
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/10/
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	69.6			100	69.6	58	109		
2-Fluorobiphenyl	(surr)	72.9			100	72.9	62	133		
Terphenyl-d14	(surr)	89.5			100	89.5	59	135		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: 9709017-05A
PREPARED: 09/03/97
ANALYZED: 09/05/97

INSTR RUN: GCMS10\970905000000/11/
BATCH ID: BNAW090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	70.9			100	70.9	58	109		
2-Fluorobiphenyl	(surr)	74.6			100	74.6	62	133		
Terphenyl-d14	(surr)	87.9			100	87.9	59	135		

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: BLNK 0903
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/3/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	57.7			100	57.7	43	100		
2-Fluorobiphenyl	(surr)	60.7			100	60.7	49	126		
Terphenyl-d14	(surr)	96.2			100	96.2	61	125		
Acenaphthene		ND								
Pyrene		ND								
Acenaphthylene		ND								
Anthracene		ND								
Benzo(a)anthracene		ND								
Benzo(b)fluoranthene		ND								
Benzo(k)fluoranthene		ND								
Benzo(g,h,i)perylene		ND								
Benzo(a)pyrene		ND								
Chrysene		ND								
Dibenzo(a,h)anthracene		ND								
Fluoranthene		ND								
Fluorene		ND								
Indeno(1,2,3-cd)pyrene		ND								
Naphthalene		ND								

ANALYSIS: PNAs by EPA 8270

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: BLNK 0903
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/3/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Phenanthrene	ND								

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: LCS 0903
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/4/3
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	49.8	57.7		100	49.8	43	100		
2-Fluorobiphenyl	(surr)	61.1	60.7		100	61.1	49	126		
Terphenyl-d14	(surr)	94.7	96.2		100	94.7	61	125		
Acenaphthene		2130	ND		3330	63.96	50	129		
Pyrene		2790	ND		3330	83.78	40	130		

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9709017-01A
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/5/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	63.7			100	63.7	43	100		
2-Fluorobiphenyl	(surr)	68.8			100	68.8	49	126		
Terphenyl-d14	(surr)	94.6			100	94.6	61	125		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9709017-03A
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/6/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	71.0			100	71.0	43	100		
2-Fluorobiphenyl	(surr)	74.7			100	74.7	49	126		
Terphenyl-d14	(surr)	102			100	102	61	125		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9709017-04A
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/7/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	71.7			100	71.7	43	100		
2-Fluorobiphenyl	(surr)	78.0			100	78.0	49	126		
Terphenyl-d14	(surr)	104			100	104	61	125		

ANALYSIS: PNAs by EPA 8270

MATRIX: Soil/Bulk

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9709017-06A
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/8/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	72.7			100	72.7	43	100		
2-Fluorobiphenyl	(surr)	77.9			100	77.9	49	126		
Terphenyl-d14	(surr)	106			100	106	61	125		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/kg
METHOD: EPA 8270

LAB ID: 9709017-07A
PREPARED: 09/03/97
ANALYZED: 09/08/97

INSTR RUN: GCMS10\970908000000/9/
BATCH ID: BNAS090397
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	72.6			100	72.6	43	100		
2-Fluorobiphenyl	(surr)	78.1			100	78.1	49	126		
Terphenyl-d14	(surr)	108			100	108	61	125		

---------- End of Quality Control Report ----------

GROUNDWATER MONITORING WELL SAMPLES

KLEINFELDER

9397-xKF56

PROJECT NO.	PROJECT NAME
10-3006-13/005	FREISMAN RANCH
L.P. NO. (P.O. NO.)	SAMPLERS: (Signature/Number)
	Richard Silva #3389

RECEIVING LAB:
McCAMPBELL LABORATORY
110 2nd. AVE. SOUTH, #D7
PACHECO, CA 94553

INSTRUCTIONS/REMARKS
VOAS ARE PRESERVED WITH HCl

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CONTAINERS	TYPE OF CONTAINERS	ANALYSIS: TPH-G (8015)	BTEX, MTBE (8020)	TPH-D (8015)	PAH (8270)	
1	9-8-97	1000	KMW-1	WATER	5	VOA AMBER	X	X	X	X	80583
2		1050	KMW-2	WATER	5	VOA AMBER	X	X	X	X	80584
3		1155	KMW-3	WATER	5	VOA AMBER	X	X	X	X	80585
4		1330	KMW-4	WATER	5	VOA AMBER	X	X	X	X	80586
5		1425	KMW-5	WATER	5	VOA AMBER	X	X	X	X	80587
6		1430	KMW-5D	WATER	5	VOA AMBER	X	X	X	X	80588
7		1520	KMW-6	WATER	5	VOA AMBER	X	X	X	X	80589
8	↓	0800	TRIP BLANK	WATER	2	VOA AMBER	X	X	X		80590
9	9-8-97	1630	FIELD BLANK	WATER	2	VOA AMBER	X	X	X		80591
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

VOAS | O&G | METALS | OTHER

ICE/T ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ✓
PRESERVATION APPROPRIATE ✓
CONTAINERS ✓

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Richard Silva	9/9/97 0940	Rocco 624 / CMP
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Rocco 624 / CMP	9/9/97 1100	Heidi Ricca
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)

Instructions/Remarks:

Send Results To:

KLEINFELDER
7133 KOLL CENTER PARKWAY
SUITE 100
PLEASANTON, CA 94566
(510) 484-1700

Attn: MR. NEAL SILAR

M-60 White - Sampler Canary - Return Copy To Shipper Pink - Lab Copy

CHAIN OF CUSTODY

№ 2251

McCAMPBELL ANALYTICAL

110 2nd AVENUE, # D7
PACHECO, CA 94553

(510) 798-1620 FAX (510) 798-1622

CHAIN OF CUSTODY RECORD

TURN AROUND TIME: ☐ RUSH ☐ 24 HOUR ☐ 48 HOUR ☒ 5 DAY ☐ ROUTINE

REPORT TO: ED HAMILTON BILL TO: MAI

PROJECT NUMBER: 9397 PROJECT NAME: KF-10-3006-13/005

PROJECT LOCATION:

SAMPLE ID	LOCATION	SAMPLING DATE	SAMPLING TIME	# CONTAINERS	TYPE CONTAINERS	MATRIX: WATER	SOIL	AIR	SLUDGE	OTHER	METHOD PRESERVED: HCL	HNO_3	ICE	OTHER	ANALYSIS REQUEST: EPA 601/8010	EPA 602/8020	EPA 608/8080	EPA 608/8080 – PCBs Only	EPA 624/8240/8260	EPA 625 (8270) PAHs by 8270	CAM – 17 Metals	EPA – Priority Pollutant Metals	LUFT Metals	LEAD (7240/7421/239.2/6010)	ORGANIC LEAD	RCI	OTHER						COMMENTS
KMW-1	01A	9/8	1000	1	LTR	X							X							X													80583
KMW-2	02A		1050																														80584
KMW-3	03A		1155																														80585
KMW-4	04A		1330																														80586
KMW-5	05A		1425																														80587
KMW-5D	06A		1430																														80588
KMW-6	07A		1520																														80589

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
Milenic	9/9	13:40	Rick Gilmore
Rick Gilmore	9-9-97	13:50	
			RECEIVED BY LABORATORY: 9/9/97 1350 Anna Gillespie

REMARKS:

PLEASE FAX RESULTS WHEN AVAILABLE

McCAMPBELL ANALYTICAL INC.
110 Second Avenue South, #D7, Pacheco, CA 94553
Telephone : 510-798-1620 Fax : 510-798-1622
http://www.mccampbell.com E-mail: main@mccampbell.com

Kleinfelder, Inc. 7133 Koll Center Pkwy, #100 Pleasanton, CA 94566	Client Project ID: #10-3006-13/005; Freisman Ranch	Date Sampled: 09/08/97
		Date Received: 09/09/97
	Client Contact: Neal Silar	Date Extracted: 09/09-09/10/97
	Client P.O:	Date Analyzed: 09/09-09/10/97

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline*, with Methyl tert-Butyl Ether* & BTEX*

EPA methods 5030, modified 8015, and 8020 or 602; California RWQCB (SF Bay Region) method GCFID(5030)

Lab ID	Client ID	Matrix	TPH(g)+	MTBE	Benzene	Toluene	Ethylben-zene	Xylenes	% Recovery Surrogate
80583	KMW-1	W	ND	ND	ND	ND	ND	ND	104
80584	KMW-2	W	ND	ND	ND	ND	ND	ND	105
80585	KMW-3	W	ND	ND	ND	ND	ND	ND	105
80586	KMW-4	W	ND	ND	ND	ND	ND	ND	95
80587	KMW-5	W	ND	ND	ND	ND	ND	ND	105
80588	KMW-5D	W	ND	ND	ND	ND	ND	ND	106
80589	KMW-6	W	13,000,a	ND<150	250	14	560	490	97
80590	Trip Blank	W	ND	ND	ND	ND	ND	ND	97
80591	Field Blank	W	ND	ND	ND	ND	ND	ND	97
Reporting Limit unless otherwise stated; ND means not detected above the reporting limit		W	50 ug/L	5.0	0.5	0.5	0.5	0.5	
		S	1.0 mg/kg	0.05	0.005	0.005	0.005	0.005	

* water and vapor samples are reported in ug/L, wipe samples in ug/wipe, soil and sludge samples in mg/kg, and all TCLP and SPLP extracts in ug/L

cluttered chromatogram; sample peak coelutes with surrogate peak

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (?); f) one to a few isolated peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen is present; i) liquid sample that contains greater than ~5 vol. % sediment; j) no recognizable pattern.

DHS Certification No. 1644

Edward Hamilton, Lab Director

McCAMPBELL ANALYTICAL INC.
110 Second Avenue South, #D7, Pacheco, CA 94553
Telephone : 510-798-1620 Fax : 510-798-1622
http://www.mccampbell.com E-mail: main@mccampbell.com

Kleinfelder, Inc. 7133 Koll Center Pkwy, #100 Pleasanton, CA 94566	Client Project ID: #10-3006-13/005; Freisman Ranch	Date Sampled: 09/08/97
		Date Received: 09/09/97
	Client Contact: Neal Silar	Date Extracted: 09/09/97
	Client P.O:	Date Analyzed: 09/09/97

Diesel Range (C10-C23) Extractable Hydrocarbons as Diesel *

EPA methods modified 8015, and 3550 or 3510; California RWQCB (SF Bay Region) method GCFID(3550) or GCFID(3510)

Lab ID	Client ID	Matrix	TPH(d)+	% Recovery Surrogate
80583	KMW-1	W	ND	96
80584	KMW-2	W	ND	96
80585	KMW-3	W	ND	95
80586	KMW-4	W	ND	96
80587	KMW-5	W	ND	96
80588	KMW-5D	W	ND	98
80589	KMW-6	W	3200,d	102
80590	Trip Blank	W	ND	98
80591	Field Blank	W	ND	99
Reporting Limit unless otherwise stated; ND means not detected above the reporting limit		W	50 ug/L	
		S	1.0 mg/kg	

* water and vapor samples are reported in ug/L, wipe samples in ug/wipe, soil and sludge samples in mg/kg, and all TCLP / STLC / SPLP extracts in ug/L

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel? is significant); d) gasoline range compounds are significant; e) medium boiling point pattern that does not match diesel (?); f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen is present; i) liquid sample that contains greater than ~5 vol. % sediment.

DHS Certification No. 1644

Edward Hamilton, Lab Director

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

QC REPORT FOR HYDROCARBON ANALYSES

Date: 09/09/97 Matrix: Water

Analyte	Concentration (mg/L) Sample #(80000)	MS	MSD	Amount Spiked	% Recovery MS	MSD	RPD
TPH (gas)	0.0	99.2	110.9	100.0	99.2	110.9	11.2
Benzene	0.0	9.9	10.3	10.0	99.0	103.0	4.0
Toluene	0.0	10.0	10.7	10.0	100.0	107.0	6.8
Ethyl Benzene	0.0	10.1	10.7	10.0	101.0	107.0	5.8
Xylenes	0.0	30.4	32.2	30.0	101.3	107.3	5.8
TPH(diesel)	0	158	156	150	105	104	1.0
TRPH (oil & grease)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

% Rec. = (MS - Sample) / amount spiked x 100

RPD = (MS - MSD) / (MS + MSD) x 2 x 100

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

QC REPORT FOR HYDROCARBON ANALYSES

Date: 09/10/97 Matrix: Water

Analyte	Concentration (mg/L) Sample #(80538)	MS	MSD	Amount Spiked	% Recovery MS	MSD	RPD
TPH (gas)	0.0	106.8	100.2	100.0	106.8	100.2	6.3
Benzene	0.0	10.6	10.4	10.0	106.0	104.0	1.9
Toluene	0.0	10.6	10.5	10.0	106.0	105.0	0.9
Ethyl Benzene	0.0	10.7	10.4	10.0	107.0	104.0	2.8
Xylenes	0.0	32.1	31.2	30.0	107.0	104.0	2.8
TPH(diesel)	0	158	156	150	105	104	1.1
TRPH (oil & grease)	0	22900	22500	23700	97	95	1.8

% Rec. = (MS - Sample) / amount spiked x 100

RPD = (MS - MSD) / (MS + MSD) x 2 x 100

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

McCAMPBELL ANALYTICAL
110 2ND AVE. SOUTH, #D7
PACHECO, CA 94553

ATTN: EDWARD HAMILTON
CLIENT PROJ. ID: 9397

REPORT DATE: 09/19/97
DATE(S) SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
AEN WORK ORDER: 9709118

PROJECT SUMMARY:

On September 9, 1997, this laboratory received 7 water sample(s).

Client requested sample(s) be analyzed for chemical parameters. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Larry Klein
Laboratory Director

McCAMPBELL ANALYTICAL

SAMPLE ID: KMW-1
AEN LAB NO: 9709118-01
AEN WORK ORDER: 9709118
CLIENT PROJ. ID: 9397

DATE SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
REPORT DATE: 09/19/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/10/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/12/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/12/97
Anthracene	120-12-7	ND	10	ug/L	09/12/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/12/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/12/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/12/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/12/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/12/97
Chrysene	218-01-9	ND	10	ug/L	09/12/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/12/97
Fluoranthene	206-44-0	ND	10	ug/L	09/12/97
Fluorene	86-73-7	ND	10	ug/L	09/12/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/12/97
Naphthalene	91-20-3	ND	10	ug/L	09/12/97
Phenanthrene	85-01-8	ND	10	ug/L	09/12/97
Pyrene	129-00-0	ND	10	ug/L	09/12/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KMW-2
AEN LAB NO: 9709118-02
AEN WORK ORDER: 9709118
CLIENT PROJ. ID: 9397

DATE SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
REPORT DATE: 09/19/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/10/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/12/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/12/97
Anthracene	120-12-7	ND	10	ug/L	09/12/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/12/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/12/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/12/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/12/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/12/97
Chrysene	218-01-9	ND	10	ug/L	09/12/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/12/97
Fluoranthene	206-44-0	ND	10	ug/L	09/12/97
Fluorene	86-73-7	ND	10	ug/L	09/12/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/12/97
Naphthalene	91-20-3	ND	10	ug/L	09/12/97
Phenanthrene	85-01-8	ND	10	ug/L	09/12/97
Pyrene	129-00-0	ND	10	ug/L	09/12/97

ND = Not detected at or above the reporting limit
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McCAMPBELL ANALYTICAL

SAMPLE ID: KMW-3
AEN LAB NO: 9709118-03
AEN WORK ORDER: 9709118
CLIENT PROJ. ID: 9397

DATE SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
REPORT DATE: 09/19/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/10/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/12/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/12/97
Anthracene	120-12-7	ND	10	ug/L	09/12/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/12/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/12/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/12/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/12/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/12/97
Chrysene	218-01-9	ND	10	ug/L	09/12/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/12/97
Fluoranthene	206-44-0	ND	10	ug/L	09/12/97
Fluorene	86-73-7	ND	10	ug/L	09/12/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/12/97
Naphthalene	91-20-3	ND	10	ug/L	09/12/97
Phenanthrene	85-01-8	ND	10	ug/L	09/12/97
Pyrene	129-00-0	ND	10	ug/L	09/12/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KMW-4
AEN LAB NO: 9709118-04
AEN WORK ORDER: 9709118
CLIENT PROJ. ID: 9397

DATE SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
REPORT DATE: 09/19/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/10/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/12/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/12/97
Anthracene	120-12-7	ND	10	ug/L	09/12/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/12/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/12/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/12/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/12/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/12/97
Chrysene	218-01-9	ND	10	ug/L	09/12/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/12/97
Fluoranthene	206-44-0	ND	10	ug/L	09/12/97
Fluorene	86-73-7	ND	10	ug/L	09/12/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/12/97
Naphthalene	91-20-3	ND	10	ug/L	09/12/97
Phenanthrene	85-01-8	ND	10	ug/L	09/12/97
Pyrene	129-00-0	ND	10	ug/L	09/12/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KMW-5
AEN LAB NO: 9709118-05
AEN WORK ORDER: 9709118
CLIENT PROJ. ID: 9397

DATE SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
REPORT DATE: 09/19/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/12/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/15/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/15/97
Anthracene	120-12-7	ND	10	ug/L	09/15/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/15/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/15/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/15/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/15/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/15/97
Chrysene	218-01-9	ND	10	ug/L	09/15/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/15/97
Fluoranthene	206-44-0	ND	10	ug/L	09/15/97
Fluorene	86-73-7	ND	10	ug/L	09/15/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/15/97
Naphthalene	91-20-3	ND	10	ug/L	09/15/97
Phenanthrene	85-01-8	ND	10	ug/L	09/15/97
Pyrene	129-00-0	ND	10	ug/L	09/15/97

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

McCAMPBELL ANALYTICAL

SAMPLE ID: KMW-5D
AEN LAB NO: 9709118-06
AEN WORK ORDER: 9709118
CLIENT PROJ. ID: 9397

DATE SAMPLED: 09/08/97
DATE RECEIVED: 09/09/97
REPORT DATE: 09/19/97

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Extraction for PNAs	EPA 3520	-		Extrn Date	09/12/97
PNAs by EPA 8270	EPA 8270				
Acenaphthene	83-32-9	ND	10	ug/L	09/15/97
Acenaphthylene	208-96-8	ND	10	ug/L	09/15/97
Anthracene	120-12-7	ND	10	ug/L	09/15/97
Benzo(a)anthracene	56-55-3	ND	10	ug/L	09/15/97
Benzo(b)fluoranthene	205-99-2	ND	10	ug/L	09/15/97
Benzo(k)fluoranthene	207-08-9	ND	10	ug/L	09/15/97
Benzo(g,h,i)perylene	191-24-2	ND	10	ug/L	09/15/97
Benzo(a)pyrene	50-32-8	ND	10	ug/L	09/15/97
Chrysene	218-01-9	ND	10	ug/L	09/15/97
Dibenzo(a,h)anthracene	53-70-3	ND	10	ug/L	09/15/97
Fluoranthene	206-44-0	ND	10	ug/L	09/15/97
Fluorene	86-73-7	ND	10	ug/L	09/15/97
Indeno(1,2,3-cd)pyrene	193-39-5	ND	10	ug/L	09/15/97
Naphthalene	91-20-3	ND	10	ug/L	09/15/97
Phenanthrene	85-01-8	ND	10	ug/L	09/15/97
Pyrene	129-00-0	ND	10	ug/L	09/15/97

Duplicate analyses showed surrogate recoveries outside of QC limits. Results are estimated concentrations.

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9709118
CLIENT PROJECT ID: 9397

Quality Control and Project Summary

All laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates: Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I: Interference.

!: Indicates result outside of established laboratory QC limits.

ANALYSIS: PNAs by EPA 8270

MATRIX: Water

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Laboratory Control Sample Duplicate
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270
LAB ID: LCR 0910
PREPARED: 09/10/97
ANALYZED: 09/12/97
INSTR RUN: GCMS10\970912000000/8/6
BATCH ID: BNAW091097
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Acenaphthene	91.8	91.0		100				0.875	30
Pyrene	81.4	99.5		100				20.0	30

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270
LAB ID: 9709118-01A
PREPARED: 09/10/97
ANALYZED: 09/12/97
INSTR RUN: GCMS10\970912000000/1/
BATCH ID: BNAW091097
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	73.4			100	73.4	58	109		
2-Fluorobiphenyl	(surr)	80.0			100	80.0	62	133		
Terphenyl-d14	(surr)	91.4			100	91.4	59	135		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270
LAB ID: 9709118-02A
PREPARED: 09/10/97
ANALYZED: 09/12/97
INSTR RUN: GCMS10\970912000000/2/
BATCH ID: BNAW091097
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	81.7			100	81.7	58	109		
2-Fluorobiphenyl	(surr)	83.7			100	83.7	62	133		
Terphenyl-d14	(surr)	96.2			100	96.2	59	135		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270
LAB ID: 9709118-03A
PREPARED: 09/10/97
ANALYZED: 09/12/97
INSTR RUN: GCMS10\970912000000/3/
BATCH ID: BNAW091097
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	80.6			100	80.6	58	109		
2-Fluorobiphenyl	(surr)	87.4			100	87.4	62	133		
Terphenyl-d14	(surr)	96.9			100	96.9	59	135		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270
LAB ID: 9709118-04A
PREPARED: 09/10/97
ANALYZED: 09/12/97
INSTR RUN: GCMS10\970912000000/4/
BATCH ID: BNAW091097
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	77.3			100	77.3	58	109		
2-Fluorobiphenyl	(surr)	82.8			100	82.8	62	133		
Terphenyl-d14	(surr)	98.8			100	98.8	59	135		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270
LAB ID: 9709118-05A
PREPARED: 09/12/97
ANALYZED: 09/15/97
INSTR RUN: GCMS10\970915000000/3/
BATCH ID: BNAW091297
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	78.6			100	78.6	58	109		
2-Fluorobiphenyl	(surr)	86.0			100	86.0	62	133		
Terphenyl-d14	(surr)	100			100	100	59	135		

ANALYSIS: PNAs by EPA 8270

MATRIX: Water

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: 9709118-06A
PREPARED: 09/12/97
ANALYZED: 09/15/97

INSTR RUN: GCMS10\970915000000/4/
BATCH ID: BNAW091297
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	15.4			100	15.4 !	58	109		
2-Fluorobiphenyl	(surr)	19.5			100	19.5 !	62	133		
Terphenyl-d14	(surr)	23.5			100	23.5 !	59	135		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP-5890 for Semi-volatiles
UNITS: ug/L
METHOD: EPA 8270

LAB ID: 9709118-07A
PREPARED: 09/12/97
ANALYZED: 09/15/97

INSTR RUN: GCMS10\970915000000/5/
BATCH ID: BNAW091297
DILUTION: 2.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Nitrobenzene-d5	(surr)	87.5			100	87.5	58	109		
2-Fluorobiphenyl	(surr)	86.0			100	86.0	62	133		
Terphenyl-d14	(surr)	92.0			100	92.0	59	135		

---------- End of Quality Control Report ----------

APPENDIX F

TIER 2 RBCA EQUATIONS

APPENDIX F

EQUATIONS USED IN THE RBCA TIER 2 SPREADSHEET MODEL

EQUATION F-1

The following equations were used to estimate the SSTLs for contaminant leaching from subsurface soils to groundwater (GSI, 1995):

$$SSTL_{soil}\ (mg/kg-soil) = \frac{SSTL_{water}(mg/L-water)}{Lf_{sw}}$$

For carcinogens:

$$SSTL_{water} = \frac{TR * BW * At_c * 365\ d/yr}{Sf_o\ IRw * EF * ED}$$

where:

TR	=	Target excess individual lifetime cancer risk (unitless)
BW	=	Adult body weight (kg)
At_C	=	Averaging time for carcinogens (yrs)
Sf_O	=	Oral cancer slope factor $(mg/kg-day)^{-1}$
IR_W	=	Daily water ingestion rate (L/day)
EF	=	Exposure frequency (day/yr)
ED	=	Exposure duration (yrs)

For non-carcinogens:

$$SSTL_{water} = \frac{THQ * RfD_o * BW * At_n * 365\ d/yr}{IR_w * EF * ED}$$

where:

THQ	=	Target hazard quotient for individual constituents (unitless)
RfD_O	=	Oral chronic reference dose (mg/kg-day)
At_n	=	Averaging time for non-carcinogens (yrs)

Soil Leaching Factor (Lf_{sw}):

$$LF_{sw} = \frac{K_{sw}}{LDF}$$

where:

$$K_{sw} = \frac{\rho_s}{\theta_{ws} + k_s * \rho_s + H * \theta_{as}}$$

K_{SW}	=	Soil leachate partition factor (mg/L-H_20)/(mg/kg-soil)
ρ_S	=	Soil bulk density (g-soil/cm^3-soil)
θ_{WS}	=	Volumetric water content in vadose zone soils (cm^3-water/cm^3soil)
k_S	=	Soil water sorption coefficient (g-water/g-soil)
H	=	Henry's law constant (cm^3-water/cm^3-air)
θ_{as}	=	Volumetric air content in vadose zone soils (cm^3-air/cm^3-soil)

$$LDF = 1 + \frac{V_{gw} * \delta_{gw}}{I * W}$$

LDF	=	Leachate groundwater dilution factor (dimensionless)
V_{gw}	=	Groundwater Darcy velocity (cm/yr)
δ_{gw}	=	Groundwater mixing zone thickness (cmg)
I	=	Infiltration rate of water through soil (cm/yr)
W	=	Width of source area parallel to groundwater flow direction (cm)

EQUATION F-2

The following equations were used to estimate the SSTLs for contaminant volatilizing from subsurface soils to ambient air (GSI, 1995):

$$SSTL_{soil}(mg/kg-soil) = \frac{SSTL_{air}\left(\mu g/m^3-air\right)}{VF_{samb}} * 10^{-3}\ mg/\mu g$$

For carcinogens:

$$SSTL_{air} = \frac{TR * BW * At_c * 365\,d/yr * 10^{-3(\mu g/mg)}}{Sf_o\ IR_{air} * EF * ED}$$

where:

TR	=	Target excess individual lifetime cancer risk (unitless)
BW	=	Adult body weight (kg)
At_C	=	Averaging time for carcinogens (yrs)
Sf_O	=	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IR_{air}	=	Daily outdoor inhalation rate (m^3/day)
EF	=	Exposure frequency (day/yr)
ED	=	Exposure duration (yrs)

For non-carcinogens:

$$SSTL_{water} = \frac{THQ * RfD_i * BW * At_n * 365\left(d/yr\right) * 10^3\ \left(\mu g/mg\right)}{IR_{air} * EF * ED}$$

where:

THQ	=	Target hazard quotient for individual constituents (unitless)
RfD_i	=	Inhalation chronic reference dose (mg/kg-day)
At_n	=	Averaging time for non-carcinogens (yrs)

Subsurface Soil Volatilization Factor (Vf_{samb})

$$VF_{samb}\ \frac{mg/m^3 - air}{(mg/kg - soil)} = \frac{W\rho_s d_s}{U_{air}\ \delta_{air}\ \tau}$$

where:

W	=	Width of source area parallel to wind direction (cm)
ρ_S	=	Soil bulk density (g-soil/cm^3-soil)
d_S	=	Thickness of affected subsurface soils (cm)
U_{air}	=	Wind speed above ground surface in ambient mixing zone (cm/s)
δ_{air}	=	Ambient air mixing zone height (cm)
τ	=	Averaging time for vapor flux (s)

EQUATION F-3

The following equations were used to estimate the SSTLs for contaminant volatilizing from subsurface soils to enclosed space (GSI, 1995):

$$SSTL_{soil}\left(mg/kg-soil\right) = \frac{SSTL_{air}\left(\mu g/m^3-air\right)}{VF_{sesp}} * 10^{-3}\ mg/\mu g$$

For carcinogens:

$$SSTL_{air} = \frac{TR * BW\ At_c * 365\ d/yr * 10^3\ (\mu g/mg)}{Sf_o * IR_{air} * EF * ED}$$

where:

TR	=	Target excess individual lifetime cancer risk (unitless)
BW	=	Adult body weight (kg)
At_C	=	Averaging time for carcinogens (yrs)
Sf_O	=	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IR_{air}	=	Daily outdoor inhalation rate (m^3/day)
EF	=	Exposure frequency (day/yr)
ED	=	Exposure duration (yrs)

For non-carcinogens:

$$SSTl_{water} = \frac{THQ * RfD_i * BW * At_n * 365\left(d/yr\right) * 10^3\ (\mu g/mg)}{IR_{air} * EF * ED}$$

where:

THQ	=	Target hazard quotient for individual constituents (unitless)
RfD_i	=	Inhalation chronic reference dose (mg/kg-day)
At_n	=	Averaging time for non-carcinogens (yrs)

Subsurface Soil to Enclosed Space Volatilization Factor (Vf_{sesp})

$$VF_{samb}\frac{\left(mg/m^3-air\right)}{\left(mg/kg-soil\right)} = \frac{\rho_s d_s}{L_B ER\tau} * 10^3$$

where:

ρ_S	=	Soil bulk density (g-soil/cm^3-soil)
d_S	=	Thickness of affected subsurface soils (cm)
L_B	=	Enclosed space volume/infiltration area ratio (cm)
ER	=	Enclosed space air exchange rate (L/s)
τ	=	Averaging time for vapor flux (s)

EQUATION F-4

The following equations were used to estimate the SSTLs for contaminant volatilizing from groundwater to ambient (GSI, 1995):

$$SSTL_w\left(mg/kg-soil\right) = \frac{SSTL_{air}\left(\mu g/m^3-air\right)}{VF_{wamb}} * 10^{-3}\ mg/\mu g$$

See Equation F-2 for Key to $SSTL_{air}$

Groundwater Volatilization Factor to Ambient Air(VF_{wamb})

$$VF_{wamb}\left(mg/m^3-air\right)/\left(mg/L-water\right) = \frac{H}{1+\left[U_{air}\ \delta_{air}\ L_{GW}/WD^{eff}_{ws}\right]} * 10^3$$

where:

H = Henry's law constant (cm^3-water)/(cm^3-air)
U_{air} = Wind speed above ground surface in ambient mixing zone (cm/s)
δ_{air} = Ambient air mixing zone height (cm)
L_{GW} = Depth to groundwater = $\mathbf{h_{cap} + h_v}$ (cm)
h_{cap} = thickness of capillary fringe (cm)
h_v = thickness of vadose zone (cm)
W = Width of source area parallel to wind (cm)
D^{eff}_{ws} = Effective diffusivity above the water table (cm/s)

$\mathbf{D^{eff}_{ws}} = \mathbf{(h_{cap} + h_v)[h_{cap}/D^{eff}_{cap} + h_v/D^{eff}_s]^{-1}}$
D^{eff}_{cap} = Effective diffusivity in the capillary zone (cm^2/s)
D^{eff}_s = Effective diffusivity in the vadose zone (cm^2/s)

$\mathbf{D^{eff}_{cap}} = \mathbf{D^{air}*(\theta^{3.33}_{acap}/\theta^2_T)+(D^{water}/H)*(\theta^{3.33}_{wcap}/\theta^2_T}$
D^{air} = Diffusion coefficient in air (cm^2/s)
D^{water} = Diffusion coefficient in water (cm^2/s)
θ_{acap} = Volumetric air content in capillary fringe soils (cm^3air/cm^3soil)
θ_{wcap} = Volumetric water content in capillary fringe soils (cm^3water/cm^3soil)
θ_T = Total soil porosity (cm^3-pore space/cm^3-soil)

$\mathbf{D^{eff}_{cap}} = \mathbf{D^{air}*(\theta^{3.33}_{acap}/\theta^2_T)+(D^{water}/H)*(\theta^{3.33}_{wcap}/\theta^2_T}$
θ_{as} = Volumetric air content in vadose zone soils (cm^3air/cm^3soil)

θ_{ws} = Volumetric water content in vadose zone soils (cm^3water/cm^3soil)

EQUATION F-5

The following equations were used to estimate the SSTLs for contaminant volatilizing from groundwater to enclosed space (GSI, 1995):

$$SSTL_w\left(mg/kg-soil\right) = \frac{SSTL_{air}\left(\mu g/m^3-air\right)}{VF_{wesp}} * 10^{-3}\ mg/kg$$

See Equation F-2 for Key to $SSTL_{air}$

Groundwater Volatilization Factor to Enclosed Space (VF_{wesp})

$$VF_{wesp}\left(mg/m^3-air\right)/\left(mg/L-water\right) = \frac{H*\left[\left(D_{ws}^{eff}/L_{GW}\right)/\left(ER*L_B\right)\right]}{1+\left[\left(D_{ws}^{eff}/L_{GW}\right)/\left(ER*L_B\right)\right]+\left[\left(D_{ws}^{eff}/L_{GW}\right)/\left(D_{crack}^{ef}/L_{crack}\right)\eta\right]}$$

where:

L_B = Enclosed space volume/infiltration ratio (cm)
L_{crack} = Enclosed space foundation or wall thickness (cm)
ER = Enclosed space air exchange rate (L/s)
η = Areal fraction of cracks in foundations/walls (cm^2cracks/cm^2-total area)
D^{eff}_{crack} = Effective diffusivity through foundation cracks

D_{crack}^{eff} = $\mathbf{D^{air}*(\theta^{3.33}_{acrack}/\theta^2_T)+(D^{water}/H)*(\theta^{3.33}_{wcrack}/\theta^2_T)}$
θ_{acrack} = Volumetric air content in foundation/wall cracks (cm^3air/cm^3total vol.)
θ_{wcrack} = Volumetric water content in foundation/wall cracks (cm^3water/cm^3total vol)

EQUATION F-6

The following equations were used to estimate the dilution and dispersion of contaminants in groundwater and air at the subject site (GSI, 1995):

Domenico Lateral Groundwater Dilution Attenuation Factor

$$\frac{C(x)_i}{C_{si}} = exp((x/2\alpha_x)*[1-sqrt(1+4\lambda_i\alpha_x R_i/v)])*erf[S_w/4*sqrt(\alpha_y x)]*erf[S_d/4*sqrt(\alpha_z x)]$$

where:

$C(x)_i$	=	Concentration of constituent i at distance x downstream of source (mg/L)
C_{si}	=	Concentration of constituent i in source zone (mg/L)
v	=	Transport velocity **(K*i)/θ_e**
K	=	Hydraulic conductivity (cm/day)
i	=	Hydraulic gradient (cm/day)
θ_e	=	Effective soil porosity (unitless)
x	=	Distance downgradient of source (cm)
α_x	=	Longitudinal groundwater dispersivity (cm)
α_y	=	Transverse groundwater dispersivity (cm)
α_z	=	Vertical groundwater dispersivity (cm)
λ_i	=	First-Order degradation rate (day^{-1}) for constituent i
R_i	=	Constituent retardation factor
S_w	=	Source width (cm)
S_d	=	Source depth (cm)

Lateral Air Dispersion Factor

$$\frac{C(x)_i}{C_{si}} = (Q/2\pi U_{air}\sigma_y\sigma_z)*exp(-y^2/2\sigma_y^2)(exp(-(z-\delta_{air})^2/2\sigma_z^2)+exp(-(z+\delta_{air})^2/2\sigma_z^2)$$

where:

Q	=	Air volumetric flow rate through mixing zone (cm3/s) **Uair(δ_{air})(A)/L**
U_{air}	=	Wind speed (cm/s)
δ_{air}	=	Ambient air mixing zone height (cm)
A	=	Cross sectional area of air emissions source (cm^2)
L	=	Length of air emissions source (cm) parallel to wind direction
x	=	Distance downgradient of source (cm)
α_y	=	Transverse air dispersion coefficient (cm)
α_z	=	Vertical air dispersion coefficient (cm)
y	=	Lateral distance from source zone (cm)

APPENDIX G

RBCA MODELING RESULTS

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Friesman Ranch Properties | Job Identification: 10-3006-13-006 | Software: GSI RBCA Spreadsheet
Site Location: Livermore, CA | Date Completed: 10/8/97 | Version: 1.0.1
Completed By: kleinfelder

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m^3/day)	15			20	
IRa.out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	***TRUE***			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	TRUE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	FALSE	FALSE	FALSE
S.v	Volatilization from Subsurface Soils	TRUE	FALSE	
GW.v	Volatilization from Groundwater	TRUE	FALSE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	TRUE	FALSE	
GW.b	Vapors from Groundwater	TRUE	FALSE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	FALSE	FALSE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	TRUE	FALSE	
S.l	Leaching to Groundwater from all Soils	TRUE	FALSE	

Matrix of Receptor Distance and Location On- or Off-Site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		TRUE		FALSE
S	Inhalation receptor (cm)		TRUE		FALSE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)	***1.6E+07***	***1.6E+07***
W	Length of affect. soil parallel to wind (cm)	***6.7E+03***	***6.7E+03***
W.gw	Length of affect. soil parallel to groundwater (cm)	***2.4E+03***	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	1.0E+02	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater Infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater seepage velocity (cm/yr)	6.6E+03
Ks	Saturated hydraulic conductivity(cm/s)	
grad	Groundwater gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Soil	Definition (Units)	Value	capillary	vadose	foundation
hc	Capillary zone thickness (cm)	5.0E+00			
hv	Vadose zone thickness (cm)	***6.0E+02***			
rho	Soil density (g/cm^3)	1.7			
foc	Fraction of organic carbon in vadose zone	0.01			
phi	Soil porosity in vadose zone	0.38			
Lgw	Depth to groundwater (cm)	***6.1E+02***			
Ls	Depth to top of affected subsurface soil (cm)	***4.6E+02***			
Lsubs	Thickness of affected subsurface soils (cm)	***1.2E+02***			
pH	Soil/groundwater pH	6.5			
phi.w	Volumetric water content		0.342	0.12	0.12
phi.a	Volumetric air content		0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

Site Name: Friesman Ranch Properties
Site Location: Livermore, CA

Completed By: kleinfelder
Date Completed: 10/8/1997

SUBSURFACE SOIL SSTL VALUES (> 3.3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

■ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	X Soil Leaching to Groundwater			X Soil Volatilization to Indoor Air		X Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	5.6E-2	3.2E-3	NA	3.8E-3	1.5E-2	NA	2.6E+0	NA	3.8E-3	■	1.5E+01
100-41-4	Ethylbenzene	0.0E+0	3.1E+1	NA	5.9E+0	>Res	NA	>Res	NA	5.9E+0	☐	<1
1634-04-4	Methyl t-Butyl Ether	0.0E+0	2.8E-1	NA	NA	5.3E+2	NA	>Res	NA	2.8E-1	☐	<1
91-20-3	Naphthalene	0.0E+0	1.5E+1	NA	NA	NA	NA	NA	NA	1.5E+1	☐	<1
108-88-3	Toluene	0.0E+0	8.3E+1	NA	1.7E+0	7.1E+1	NA	>Res	NA	1.7E+0	☐	<1
1330-20-7	Xylene (mixed isomers)	0.0E+0	>Res	NA	3.4E+1	1.2E+2	NA	>Res	NA	3.4E+1	☐	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: Friesman Ranch Properties
Site Location: Livermore, CA

Completed By: kleinfelder
Date Completed: 10/8/1997

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

■ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" If Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	X Groundwater Ingestion			X Groundwater Volatilization to Indoor Air		X Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)	(mg/L	"■" If yes	Only if "yes" left
71-43-2	Benzene	3.9E-1	8.5E-4	NA	1.0E-3	7.5E-3	NA	8.1E-1	NA	1.0E-3	■	3.9E+02
100-41-4	Ethylbenzene	8.9E-1	3.7E+0	NA	7.0E-1	8.4E+1	NA	>Sol	NA	7.0E-1	■	1.0E+00
1634-04-4	Methyl t-Butyl Ether	3.3E-2	1.8E-1	NA	NA	1.7E+3	NA	>Sol	NA	1.8E-1	☐	<1
91-20-3	Naphthalene	1.4E-1	1.5E-1	NA	NA	NA	NA	NA	NA	1.5E-1	☐	<1
108-88-3	Toluene	1.2E-1	7.3E+0	NA	1.5E-1	3.6E+1	NA	>Sol	NA	1.5E-1	☐	<1
1330-20-7	Xylene (mixed isomers)	4.2E+0	7.3E+1	NA	1.8E+0	6.7E+1	NA	>Sol	NA	1.8E+0	■	2.0E+00

>Sol indicates risk-based target concentration greater than constituent solubility

Software: GSI RBCA Spreadsheet
Version: 1.0.1

Serial: g-409-uix-112

RBCA ALTERNATE POINT OF COMPLIANCE

Groundwater Pathway

CAS No.	Constituent	Source Zone Groundwater SSTL (mg/L)	SSTLs at Alternate Points of Compliance Enter Distance From Source Below (feet) 10 (ft)	50 (ft)	100 (ft)	POE Exposure Limit Off-Site Receptor 1600 (ft)
71-43-2	Benzene	5.2E-2	1.0E-3	3.6E-2	2.1E-2	1.0E-3
100-41-4	Ethylbenzene	3.6E+1	7.0E-1	2.6E+1	1.4E+1	7.0E-1
1634-04-4	Methyl t-Butyl Ether	9.5E+0	1.8E-1	6.7E+0	3.8E+0	1.8E-1
91-20-3	Naphthalene	7.6E+0	1.5E-1	5.3E+0	3.0E+0	1.5E-1
108-88-3	Toluene	7.8E+0	1.5E-1	5.5E+0	3.1E+0	1.5E-1
1330-20-7	Xylene (mixed isomers)	9.1E+1	1.8E+0	6.4E+1	3.6E+1	1.8E+0

Serial: g-409-uix-112

Software: GSI RBCA Spreadsheet
Version: 1.0.1