URS

October 7, 2002

Mr. Amir K. Gholami, REHS
Hazardous Materials Specialist
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-65777

Re: Corrective Action Plan
ARCO Service Station No. 2111
1156 Davis Street
San Leandro, California
for Atlantic Richfield Company

Dear Mr. Gholami:

URS Corporation (URS) is submitting the attached Corrective Action Plan (CAP) on behalf of the Atlantic Richfield Company (ARCO, an affiliate of the Group Environmental Management Company) for ARCO Site No. 2111, located at 1156 Davis Street, San Leandro, California. The Alameda County Health Care Services Agency (ACHCSA) requested this CAP in a letter dated June 26, 2002 (Appendix A).

The following CAP presents the site background, a summary of previous investigations and corrective actions, feasibility studies, and corrective action alternatives. After evaluation of historic and current data, we recommend monitoring for natural attenuation and continued risk assessment for the site. Furthermore, we recommend the installation of one or more downgradient wells to further delineate the impacted area and to assist in the monitoring program.

The observations presented in your letter of June 26, 2002 are discussed below:

- The most significant concentrations of methyl tertiary butyl ether (MTBE) exist in Well MW-7. However, concentrations have decreased from the third quarter of 2001 to the second quarter of 2002 (370,000 micrograms per liter [µg/L] to 67,000 µg/L).

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- We agree that MW-2 has concentrations of TPH-g, benzene, and MTBE. Well MW-5, however, may not have significant concentrations of TPH-g or benzene. The exact amounts of these constituents can not be determined due to elevated detection limits from MTBE. The fourth quarter 2001 detection limits for MW-5 were <10,000 µg/L for TPH-g and <100 µg/L for benzene. Well MW-1 does not contain significant concentrations of total petroleum hydrocarbons as gasoline (TPH-g) or benzene. In the first and second quarters of 2002, concentrations of TPH-g and benzene compounds in this well were non-detect (<50 µg/L and <0.5 µg/L, respectively).
- The concentrations of TPH-g (31,000 µg/L), benzene (1,500 µg/L), and MTBE (9,300 µg/L) in MW-2 were correct as listed, but they are below the historic high detections for this well (160,000 µg/L for TPH-g, 6,900 µg/L for benzene, and 91,700 µg/L for MTBE).
- The values of 500 µg/L for TPH-g, 5 µg/L for benzene, and 9,400 µg/L for MTBE cited for MW-5 are incorrect. The actual detections are cited in Item 2 of the same letter.
- The observation about the groundwater flow direction was correct. Delta Environmental, Inc. (Delta) incorrectly labeled the direction in Table 2. It should have been to the southwest. URS will correct this in the next Quarterly Monitoring Report.

1.0 SITE BACKGROUND

1.1 Description

The site is an active ARCO service station located at the northwest corner of the intersection of Preda Street and Davis Street in San Leandro, California (Figure 1). The area surrounding the site consists primarily of commercial and residential properties. The site is located in the East Bay Plain, a relatively flat alluvial plain that lies between San Francisco Bay to the west and the Diablo Range to the east.

1.2 Soil Types

The subsurface consists of unconsolidated alluvial sediments predominantly composed of clays to silty clays, which are underlain locally by clayey sands to sandy gravels to the total explored depth of 40 feet below ground surface (ft bgs). The typical stratigraphic relationships of the sediments are depicted on geologic cross sections located in Appendix B (EMCON 1996).

1.3 Groundwater Depth, Flow Direction and Rate

Groundwater beneath the ARCO site is typically measured at 14.10 to 16.83 ft bgs. The subsurface groundwater flow direction was westward at a horizontal hydraulic gradient of 0.006 feet per foot (ft/ft) during the second quarter 2002 monitoring event (Figure 2). The

historic groundwater flow direction beneath the site is generally westward but has ranged from the northwest to the southwest. The gradient has historically ranged from 0.003 to 0.006 ft/ft. Regionally, groundwater in the East Bay Plain tends to flow toward the San Francisco Bay to the west and southwest. Historic groundwater elevation data for the site is summarized in Tables 1 and 2.

1.4 Water Supply Wells

EMCON reviewed information provided by the County of Alameda Public Works Agency regarding water wells located within the site vicinity (EMCON 1996). Wells that are located downgradient of the site include several irrigation, monitoring, and industrial wells. The nearest domestic supply well (#2S/3W 27R-7) is located approximately 650 feet west-southwest of the site. EMCON determined that wells located hydraulically downgradient of the site are not impacted by the ARCO facility (EMCON 1996).

1.5 Groundwater Monitoring and Monitoring Well Network

Groundwater has been monitored at the ARCO site since 1995. Five on-site groundwater monitoring wells (MW-1 to MW-4 and MW-7), four on-site vapor extraction wells (VW-1 to VW-4), and two off-site groundwater monitoring wells (MW-5 and MW-6) are associated with the site (Figures 2 and 3). The off-site wells are located east and west of the site. Monitoring wells MW-1 through MW-4 were installed on July 12 and 13, 1995 (EMCON 1996). Wells MW-5 through MW-7 and vapor extraction wells VW-1 through VW-4 were installed between February 28 and March 1, 1996. With the approval of the Alameda County Public Works Agency, VW-4 was destroyed on October 19, 2000, during an underground storage tank (UST) removal (Delta 2001a). The groundwater monitoring wells are typically screened from 12 to 26 and 10 to 25 feet below grade (ft bg), and the vapor extraction wells are screened from 5 to 20 ft bg (EMCON 1996).

During the second quarter of 2002, benzene was detected in groundwater samples from wells MW-2, MW-4, and MW-7 at concentrations of 220 µg/L, 2.8 µg/L, and 530 µg/L, respectively (Figure 3). MTBE was detected in all of the wells sampled at concentrations ranging from 3.1 µg/L in well MW-6 to 67,000 µg/L in well MW-7. TPH-g was only detected in MW-2, at a concentration of 9,000 µg/L. Although, two other wells had raised detection limits for TPH-g: MW-7 at <20,000 µg/L and MW-5 at <5,000 µg/L. Current and historic monitoring results are presented in Tables 1 and 2.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND CORRECTIVE ACTIONS

Several phases of equipment upgrades, site investigations, and corrective actions have been conducted at the site. The following briefly summarizes these activities.

2.1 Source Evaluation

Hydrocarbon-impacted soils at the site are limited to the capillary-fringe zone and appear to be confined to areas around the dispenser islands and the existing USTs (EMCON 1996). Impacted soil appears to have been removed during the activities described in Section 2.2.

The extent of the impacted groundwater was thought to have been delineated during the initial assessment (EMCON 1996), but since August 25, 1999, MTBE has been detected at significant concentrations in downgradient well MW-5. The highest concentrations of constituents in groundwater are found in MW-2, located downgradient and slightly cross-gradient of the UST basins and dispenser islands (source area), and MW-7 located cross-gradient of the source area.

2.2 Equipment Upgrades and Source Removal Activities

In August 1993 (EMCON 1996), a hydraulic hoist was removed from one of the station service bays. Geostrategies, Inc. (GSI) collected four soil samples from the bottom of the excavation. Total extractable petroleum hydrocarbons (TEPH) were detected at concentrations up to 27,000 milligrams per kilogram (mg/kg). In March 1994, two samples were taken from soil borings on the northwestern side of the fomer hydraulic hoist excavation. Hydraulic oil was detected at concentrations up to 11 mg/kg.

In August 1994, one 280-gallon waste oil UST was removed. It was replaced in September 1994 with a new 600-gallon waste oil UST (EMCON 1996). Total petroleum hydrocarbons as motor oil (TPH-o), diesel (TPH-d), gasoline (TPH-g), and total recoverable petroleum hydrocarbons (TRPH) were detected in soil samples from the bottom of the excavation. Impacted soil was removed (and disposed off-site) from the base of the excavated area.

During October 2000 (Delta 2001b), three 12,000-gallon USTs were removed and dispose of off-site. Soil samples were collected during the product line and dispenser removal and following the removal of the three USTs. Soil samples were collected beneath the product lines and dispenser islands at depths ranging from 4 to 8 ft bgs (Delta 2001b). The results were as follows:

- TPH-g concentrations ranged from 1.3 mg/kg in sample PL-4 to 2,100 mg/kg in sample DP-1
- Benzene concentrations ranged from 0.0056 mg/kg in sample DP-4 to 2.0 mg/kg in sample DP-1
- MTBE concentrations ranged from 0.17 mg/kg in sample PL-3 to 13 mg/kg in sample DP-1

Approximately 23 cubic yards of soil was overexcavated around dispenser pumps DP-1 and DP-2. Overexcavation samples were taken at depths 10 ft bgs (OX-1) and 9.5 ft bgs (OX-2). The results were as follows:

- Benzene was detected at 0.18 mg/kg (OX-2) and 0.4 mg/kg (OX-1).
- MTBE was detected at 1.5 mg/kg (OX-1) and 7.7 mg/kg (OX-2).
- TPH-g was detected at 2.7 mg/kg (OX-1) and 19 mg/kg (OX-2).
- Total lead was detected at 9.7 mg/kg (OX-1) and 11 mg/kg (OX-2).

Samples collected from the north and south ends of the three USTs had the following results (Delta 2001b):

- TPH-g detections ranged from 110 mg/kg to 4,400 mg/kg.
- Benzene concentrations in samples ranged from 0.21 mg/kg to 7.7 mg/kg.
- MTBE ranged from 6.5 mg/kg to 89 mg/kg.

A total of approximately 1,376 tons (930 cubic yards) of overburden soil was excavated from the gasoline UST, dispensers, and lines before the removal of the three tanks, and a total of approximately 170 tons (115 cubic yards) of overexcavated soil was removed from the site after analysis and segregation.

Remediation piping was installed during the tank upgrade activities in November and December 2000.

On May 5, 2001, Delta removed and replaced a sump at the site (Delta 2001c). A soil sample was collected 2 feet beneath the sump. Some of the constituents detected above the laboratory detection levels were ethylbenzene (0.0616 mg/kg), total xylenes (0.209 mg/kg), TPH-g (305 mg/kg), and TPH-d (465 mg/kg).

In conclusion, impacted soils at the site appear to be confined to areas around the dispenser islands and UST excavations. The primary area of impacted soil appears to have been removed during the excavations and overexcavations as part of the historical equipment upgrades to the USTs, dispensers, and associated piping.

2.3 Interim Corrective Actions

Liquid phase hydrocarbons (LPH) have historically been checked and recovered monthly in wells MW-2 and MW-7. Beginning in the third quarter of 2000 the groundwater in these wells has been pumped out intermittenly, as approved in the ACHCSA letter dated October 12, 2000. Approximately 22,300 gallons has been pumped from MW-2, and 300 gallons has been pumped from MW-7. On occasion, MW-7 is not pumped due to low recovery.

From November 15 to 19, 1999 (IT 2000), a high vacuum, dual phase extraction (HVE) test was performed on MW-2 to evaluate the effectiveness of this corrective action methodology for this site. The results of this test are discussed further in Section 4.1. A total of 3,889 gallons of groundwater was pumped and removed from the site. The test removed an

estimated 34.6, 2.73, and 0.828 pounds of TPH-g, BTEX, and MTBE, respectively, from the vapor phase. For the liquid phase an estiamted, 0.262, 0.117, and 0.195 pounds of TPH-g, BTEX, and MTBE were removed.

From January 7 to 10, 2001 (Delta 2002), Delta performed a dual phase extraction (DPE) pilot test on vapor well V-2 and limited pilot tests on wells MW-2 and MW-7. The results are discussed further in Section 4.1. A total groundwater volume of 7,120 gallons was recovered from V-2. A total of 38 pounds of TPH-g vapor was extracted (an average rate of 11.6 pounds per day). No LPH was encountered during this test. The MW-7 pilot test was estimated to have removed 1,900 gallons of groundwater and 6.1 pounds of vapor-phase TPH-g. No LPH was encountered during the test. The MW-2 pilot test ran for 5 hours and yielded 5,960 gallons of groundwater. No groundwater or vapor samples were taken since this well had been previously tested.

2.4 Assessment of Impact and Site Conceptual Model

In 1997, EMCON submitted a Risk-based Corrective Action (RBCA) Evaluation for the site (EMCON 1997). The evaluation used ASTM RBCA guidelines and groundwater monitoring data from the third quarter 1995 to the third quarter 1996. The conclusions were that the BTEX in the soil and groundwater at the site did not exceed levels that correspond to an acceptable level of risk. The site was designated as a "low risk" site where no additional remedial measures were necessary to protect the health of current or future on-site and off-site receptors. MTBE was not evaluated. The deepest soil samples (and TPH-g dectection) taken around the source area were as follows:

TPH-G & MTBE?

- V-1 at 19.5 ft bgs (40 mg/kg),
- V-2 at 19.5 ft bgs(230 mg/kg) bgs,
- V-3 at 19.5 ft bgs (76 mg/kg),
- V-4 at 19.5 ft bgs (420 mg/kg),
- MW-2 at 21 ft bgs (320 mg/kg), and
- MW-7 at 33 ft bgs (non-detect < 1 mg/kg).

2.5 Groundwater Monitoring and Trend Analysis

As part of this evaluation, URS reviewed previous and recent benzene and MTBE data from groundwater monitoring wells MW-2, MW-5, and MW-7 (Table 1, Charts 1 to 6). From the source area, MW-7 is cross-gradient, MW-2 is downgradient, and MW-5 is farther downgradient and off-site. The highest detection of MTBE in MW-2 (91,700 µg/L by EPA Method 8020; see Table 1 and Chart 1) was measured during the sampling event on March 13, 2001 (first quarter). Since then, concentrations have dropped by an order of magnitude

(8,500 µg/L during the last event on April 23, 2002). Wells MW-7 and MW-5 (Table 1, Charts 2 and 3) both had their highest historical detections of MTBE (190,000 µg/L and 22,000 µg/L) during the sampling event on September 18, 2001 (third quarter). Since then, detected concentrations have dropped by an order of magnitude (67,000 µg/L and 8,900 µg/L during the last event on April 23, 2002). For benzene, MW-2 had its highest detection (6,900 µg/L; see Table 2 and Chart 4) during the sampling event on June 25, 1999 (third quarter) and has since decreased (220 µg/L during the last event on April 23, 2002). MW-7 (Table 1, Chart 5) has decreased from a high of 1,900 µg/L on September 18, 2001, to 530 µg/L on April 23, 2002. Benzene concentrations in MW-5 have consistently been low or below the laboratory detection limits. The highest detected concentration was 8 µg/L on January 28, 1999. In summary, the constituents concentrations appear to be decreasing from the historic high detections.

3.0 REDMEDIATION OBJECTIVE AND CLEANUP GOALS

3.1 Constituents of Concern

MTBE is considered the primary constituent of concern at the site. TPH-g and BTEX compounds are also present. Based on investigation and monitoring results, achieving acceptable levels of MTBE and benzenein soil and groundwater are considered the primary objectives of corrective action for the site.

3.2 Beneficial Uses of Groundwater

One goal of corrective action is to protect public health by protecting existing and potential beneficial uses of surface water and groundwater. The San Francisco Bay Region, Region 2, Water Quality Control Plan (Basin Plan) recognizes the following existing and potential uses of groundwater (SFBRWQCB 1995).

- **Municipal and Domestic Supply.** Defined as water use for community water systems, military water systems, and individual water systems. Items of principal concern regarding water supply quality are protection of public health and aesthetic acceptability of the water.
- **Agricultural Supply.** All uses of water for farming and ranch operations. Quality considerations are similar to those identified for municipal and domestic supply.
- **Industrial Supply.** Includes process and service water supply related to manufacturing. Water quality requirements of industry vary, therefore no meaningful quality considerations exist. Current water treatment technology can produce specific-use water quality.

3.3 Water Quality Goals

Comprehensive water quality goals have been developed to protect the groundwater uses identified above. It is recognized that protecting the beneficial use with the most stringent numeric water quality goals will protect all other uses. In general, water quality goals focus on protecting the existing water quality, whenever water quality is better than that required to protect all present and potential beneficial uses (State Water Resources Control Board Resolution 68-16). Numeric water quality goals based on Resolution 68-16 are associated with background levels, which in turn are subject to the limits of detection for residual constituents of concern.

The proposed site water quality goals apply to the site during corrective action and beyond; however, they may be modified at any time if it can be shown that changes are consistent with the maximum benefit to the people of the state and will not unreasonably affect present or probable future beneficial uses of groundwater.

For example, groundwater quality goals may be modified to protect the beneficial water use with the most stringent numeric water quality goals, those for municipal and domestic supply. These water quality goals are:

- MTBE: 5 µg/L — Title 22 California Code of Regulations (22 CCR) Secondary Maximum Contaminant Limit (MCL)
- Benzene: 1 µg/L — 22 CCR Primary MCL
- Toluene: 150 µg/L — 22 CCR Primary MCL
- Ethylbenzene: 700 µg/L — 22 CCR Primary MCL
- Xylenes: 1,750 µg/L — 22 CCR Primary MCL

Potential use of shallow groundwater from the vicinity of this site as a drinking water source would likely require treatment, regardless of impact attributable to the site. In our opinion, shallow groundwater from the vicinity of this site is not likely to be used as a source of drinking water in the foreseeable future.

3.4 Protection of Human Health

Ingestion of MTBE-impacted groundwater has been identified as the primary concern at the site with respect to human health. However, shallow groundwater in the vicinity of the site is not used as a drinking water source. A drinking water standard of 13 µg/L has been adopted (22 CCR Primary MCL). Note that the human health standard is higher than the Secondary MCL based on aesthetic (taste and odor) standards. Primary MCLs for BTEX compounds are listed in Section 3.3. No Primary MCL for TPH-g has been established.

3.5 Corrective Action Objectives

Corrective action objectives are proposed to maintain beneficial uses of groundwater resources and to be protective of human health. They also serve as a baseline for measuring achievement. Factors considered in development of the corrective action objectives include:

- The lack of sensitive receptors, such as active domestic/municipal water supply wells, within 650 feet.
- The extent of dissolved hydrocarbons and MTBE (although unknown) appears to be limited to the vicinity and slightly downgradient of the site.
- Groundwater monitoring has demonstrated the relative stability of dissolved hydrocarbons and MTBE.

Based on these factors, corrective action objectives can be distinguished as groundwater-based or soil-based:

- **Groundwater-based.** Within physical and economic constraints, eliminate hazardous and nuisance conditions associated with the presence of dissolved hydrocarbons and MTBE in the subsurface environment at the site. Specifically, groundwater-based corrective action objectives include reduction of the dissolved-phase mass and migration control.
- **Soil-based.** To the extent economically feasible using established technology, prevent migration and hazardous or nuisance conditions associated with the presence of hydrocarbons and MTBE in site soils.

To facilitate corrective action design, objectives were formulated with attention to site characteristics, public health and safety, and protection of beneficial water uses. These objectives are explained below:

- **Groundwater**: Within technical and economic constraints, minimize the exposure of groundwater to petroleum hydrocarbon and MTBE concentrations in excess of the proposed water cleanup levels, and protect the potential use of the water-bearing zones underlying the vicinity of the site.
- **Soil**: Within technical and economic constraints, reduce residual concentrations that may serve as a significant secondary source for further impact to groundwater in the vicinity of the site, and prevent exposure of the public to impacted soils.

4.0 CORRECTIVE ACTION ALTERNATIVES EVALUATION AND COMPARISON

4.1 Feasibility Testing

From November 15 to 19, 1999 (IT Group 2000), the IT Group performed a HVE pilot test on Well MW-2 using a liquid ring pump and catalytic oxidizer for vapor abatement. HVE systems are typically used for remediating low-permeability formations with limited groundwater. The high vacuum dewaters the area, which enhances soil vapor extraction. During the pilot test, MW-2 had higher-than-anticipated groundwater production rates. The geologic log of MW-2 (EMCON 1996) shows a sand lens at the bottom of the well. This sand lens may be the source of the high groundwater recharge experienced during the HVE pilot test. Most of the data showed negligible influence (vacuum pressure) on the monitoring well from the applied vacuum on MW-2. The data from this pilot test suggest that soil vapor extraction is a more efficient means of extracting petroleum hydrocarbons than groundwater extraction. Additionally, the cost of storing, treating, and disposing of the extracted groundwater exceeds the cost of operating the catalytic oxidizer on an equivalent extracted mass basis. Therefore, the IT Group concluded that using HVE on MW-2 was neither an efficient nor cost-effective corrective action alternative for this site.

From January 7 to 10, 2001 (Delta 2002), Delta performed a DPE pilot test on vapor well V-2. Limited pilot tests were also performed on wells MW-2 and MW-7. The DPE system used a 20-horsepower, 350-cubic-feet-per-minute (CFM) liquid ring pump to remove both groundwater and soil vapor simultaneously using a down-hole pump connected to the monitoring well.

The pilot test on V-2 ran for approximately 78 hours. A hydraulic influence was observed across the site with the greatest drawdown in wells immediately adjacent to the extraction point. The average effective radius of influence was calculated to be 32 feet. Groundwater analytical results showed a decreasing trend in petroleum hydrocarbons throughout the test. The MW-7 pilot test ran for 20 hours and yielded 1,900 gallons of groundwater with an average flow rate of 1.58 gallons per minute (gpm). The total TPH-g vapor extracted was 6.1 pounds (average rate of 7.32 pounds/day). No significant groundwater influence was noticed in surrounding wells. The MW-2 pilot test ran for 5 hours, yielding 5,960 gallons of groundwater at an average rate of 20 gpm. A slight hydraulic influence was observed in local wells.

Delta concluded that DPE is limited in its ability to quickly lower groundwater levels at this site to expose impacted soils for soil vapor extraction. However, based on data demonstrating that the decreasing water levels did not reach steady state before the end of the three-day test on V-2, DPE could be an effective solution in the long term. Significant hydrocarbon vapor recovery rates may not be expected from DPE due to the fine-grained

soils on-site. It was also concluded that only those wells screened in finer-grain materials would be effective in a DPE system.

4.2 Technology Screening

Several technologies were identified for potential use as corrective action alternatives. Technologies were qualitatively screened and applicable technologies were used to develop appropriate corrective action alternatives. During the screening process, technologies were eliminated from further consideration on the basis of technical implementability. Both in-situ and ex-situ technologies were considered. Technologies that passed the screening process were combined to create alternatives that address the corrective action objectives.

4.3 Evaluation of Alternatives

The selection of an appropriate corrective action for mitigating benzene and MTBE at the site is based on the following criteria:

- **Regulatory Agency Acceptance.** This criterion is used to assess the likelihood of acceptance of the various alternatives by regulatory agencies that have jurisdiction over the corrective action.
- **Reduction of Toxicity, Mobility, or Volume.** This criterion establishes preference for alternatives that will produce permanent and significant reductions. The evaluation focuses on the amount of chemicals to be destroyed or treated, the irreversibility of the treatment, and the type and quantity of residual that will remain after treatment.
- **Technical Feasibility.** Technical feasibility refers to the ease of construction given the site constraints, the reliability of the technology, and the ability to monitor the effectiveness of an alternative.
- **Cost.** This criterion is used to assess capital and operation and maintenance (O&M) costs on a conceptual level only. Capital costs include direct costs such as equipment, site development, and relocation expenses. Indirect costs include engineering, permits, and start-up costs. O&M costs include labor, materials, repairs, disposal, administrative fees, and reporting costs.

4.4 Comparison of Corrective Action Alternatives

As previously noted, the following three corrective action alternatives for protecting or restoring the beneficial use of groundwater are considered in this CAP:

- Alternative 1 - Monitored Natural Attenuation
- Alternative 2 - Groundwater Extraction

- Alternative 3 – Dual Phase Extraction

4.4.1 Alternative 1: Monitored Natural Attenuation (MNA)

This alternative would rely on natural attenuation rather than active remediation to achieve corrective action objectives. Natural attenuation processes include biodegradation, dispersion, dilution, sorption, volatilization, chemical or biological stabilization, transformation or destruction of contaminants. Under this alternative, groundwater monitoring would be continued until cleanup goals are reached or will likely be achieved within a relatively short time frame. MNA would fulfill the evaluation criteria as follows:

- **Regulatory Agency Acceptance:** This alternative is likely to be accepted by the regulatory agencies because the concentrations of MTBE and benzene have been decreasing in the monitoring wells.
- **Reduction of Toxicity, Mobility, and Volume:** In the long term, the toxicity, mobility, and volume of benzene and MTBE in soil and groundwater would be reduced through natural attenuation processes.
- **Technical Feasibility:** Recent monitoring data indicates that the area impacted by MTBE and benzene have not been completely defined horizontally and vertically for the site. Additional wells would be required to define the downgradient extent of the impacted area and to continue to monitor the affects of natural attenuation. Recent decreasing MTBE trends in monitoring wells indicate that natural attenuation is occurring. This alternative is considered technically feasible.
- **Cost:** The cost of this alternative includes continued groundwater monitoring, installation of downgradient monitoring wells, and future abandonment of monitoring wells. The cost to implement this alternative is expected to be low to moderate compared with other alternatives because no treatment system would need to be constructed. However, costs may be higher than anticipated if a prolonged monitoring period is required.

4.4.2 Alternative 2: Groundwater Extraction (GWE)

This alternative consists of the design, installation, and operation of a GWE system. Quarterly GWE has been used in the past at this site with mixed success due to the fine-grained sediments. Groundwater monitoring would be continued as part of this alternative. A GWE system would fulfill the evaluation criteria as follows:

- **Regulatory Agency Acceptance:** This alternative is likely to gain regulatory acceptance because it actively addresses removal of MTBE and benzene from the shallow water-bearing zone.

- **Reduction of Toxicity, Mobility, and Volume:** The residual dissolved mass may be reduced using this alternative.
- **Technical Feasibility:** GWE feasibility tests have not been conducted at the site. Wells MW-2 and MW-7 have had batch extractions in the past. MW-2 is a highly productive well, but MW-7 could not be pumped on occasion because of its low recovery rates. Due to the site's fine-grained soils, GWE alone would not be effective for the mass removal of petroleum hydrocarbons at the site.
- **Cost:** Future costs would include construction, O&M costs, groundwater monitoring costs, and abandonment costs. The future costs to implement this alternative are considered moderate to high as compared with the other alternatives.

4.4.3 Alternative 3: Dual-Phase Extraction (DPE)

This alternative consists of the design, installation, and operation of a DPE system. Groundwater monitoring would be continued as part of this alternative. A DPE system would fulfill the evaluation criteria as follows:

- **Regulatory Agency Acceptance:** This alternative is likely to gain regulatory acceptance because it actively addresses removal of MTBE and benzene from both the vapor and liquid phases.
- **Reduction of Toxicity, Mobility, and Volume:** DPE would likely achieve some mass removal of MTBE and benzene from the saturated and unsaturated zone. But, due to the fine-grained sediments, residual source would mostly remain in the subsurface.
- **Technical Feasibility:** Pilot tests have shown that DPE has limited potential at this site due to the fine-grained sediments. These sediments limit the ability of DPE to quickly lower groundwater levels in the short term and expose the capillary fringe.
- **Cost:** Implementation costs for this alternative would include design, permit, and installation costs; O&M costs; groundwater monitoring costs; and abandonment costs. The costs to implement this alternative are expected to be relatively high compared with other alternatives.

5.0 Recommended Corrective Action Alternative

After evaluating site conditions and comparing corrective action alternatives, URS has concluded that natural attenuation would be the most cost-effective approach to corrective action. The installation of one or more downgradient wells is recommended to further delineate the area of impact, to augment the monitoring of natural attenuation and to assist in the continued assessment of risk.

6.0 LIMITATIONS

This report is based on data, site conditions, and other information that is generally applicable as of the date of the report, and the conclusions and recommendations herein are therefore applicable only to that time frame. Background information used in preparing this report, including but not limited to previous field measurements, analytical results, site plans, and other data, was furnished to URS by Group Environmental Management Company, its previous consultants, and/or third parties. URS relied on this information as furnished and is neither responsible for nor has confirmed the accuracy of this information.

If you have any questions regarding this CAP, please contact us at (510) 893-3600.

Sincerely,

URS CORPORATION

Scott Robinson,
Project Manager

REGISTERED PROFESSIONAL ENGINEER
AMY BRECKENRIDGE
No. C057141
Exp. 12/31/03
CIVIL
STATE OF CALIFORNIA

Amy Breckenridge, PE
Portfolio Manager

cc: Mr. Paul Supple – Atlantic Richfield Company
Mr. Mike Bakaldin – San Leandro Fire Department, Hazardous Materials Program

Attachments

Figure 1	Site Topographic Map
Figure 2	Groundwater Elevation Contour Map (June 21, 2002)
Figure 3	Groundwater Analytical Summary (June 21, 2002)
Table 1	Summary of Recent Groundwater Elevation and Analytical Data
Table 2	Historical Groundwater Elevation and Analytical Data
Chart 1	MW-2 MTBE Historic Concentrations
Chart 2	MW-7 MTBE Historic Concentrations
Chart 3	MW-5 MTBE Historic Concentrations
Chart 4	MW-2 Benzene Historic Concentrations
Chart 5	MW-7 Benzene Historic Concentrations
Chart 6	MW-5 Benzene Historic Concentrations
Appendix A	Letter from Alameda County Health Care Services Agency (ACHCSA), June 26, 2002
Appendix B	Stratigraphic Cross Sections

References

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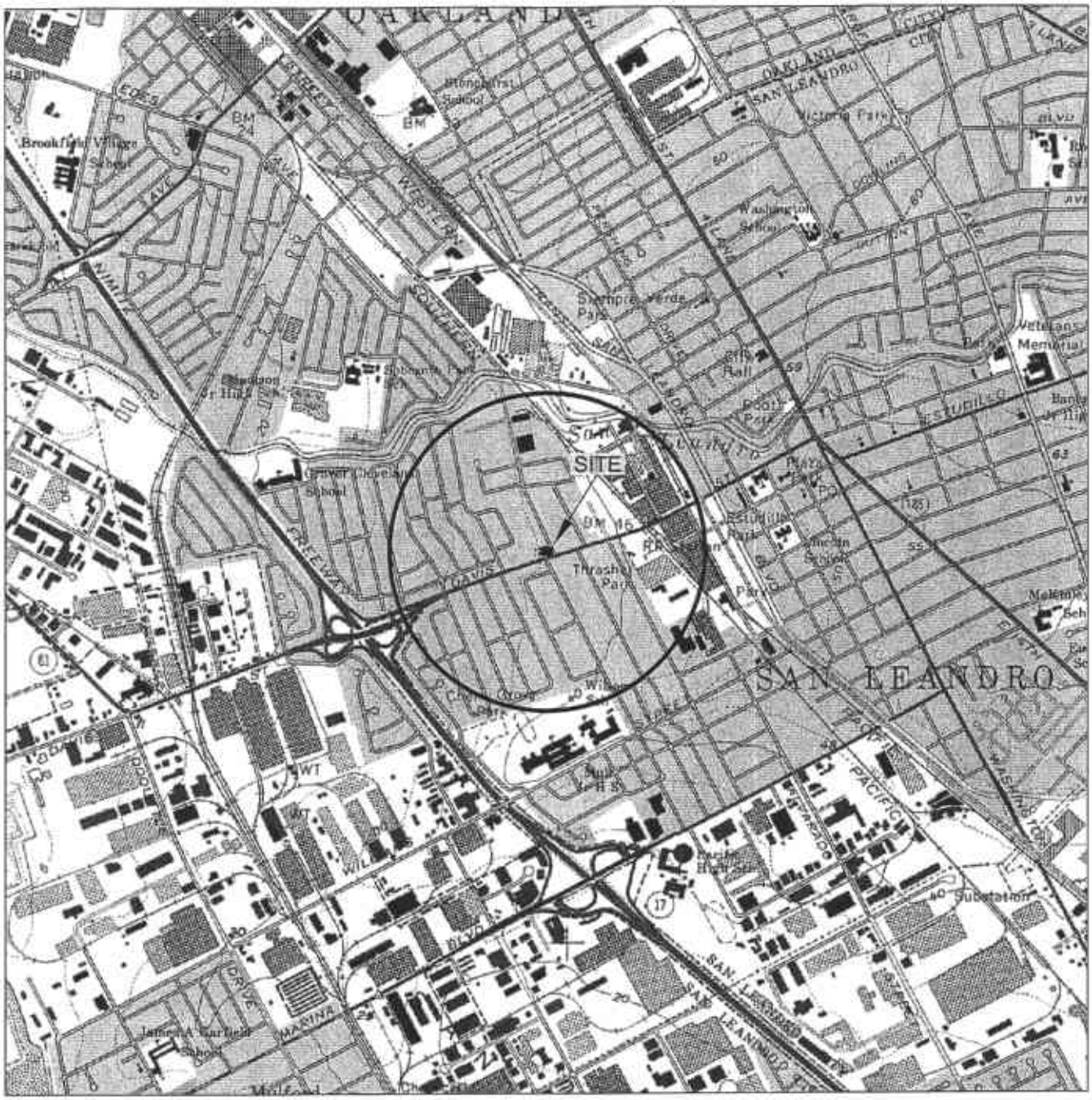


North

0 2000 FT

SCALE 1:24,000

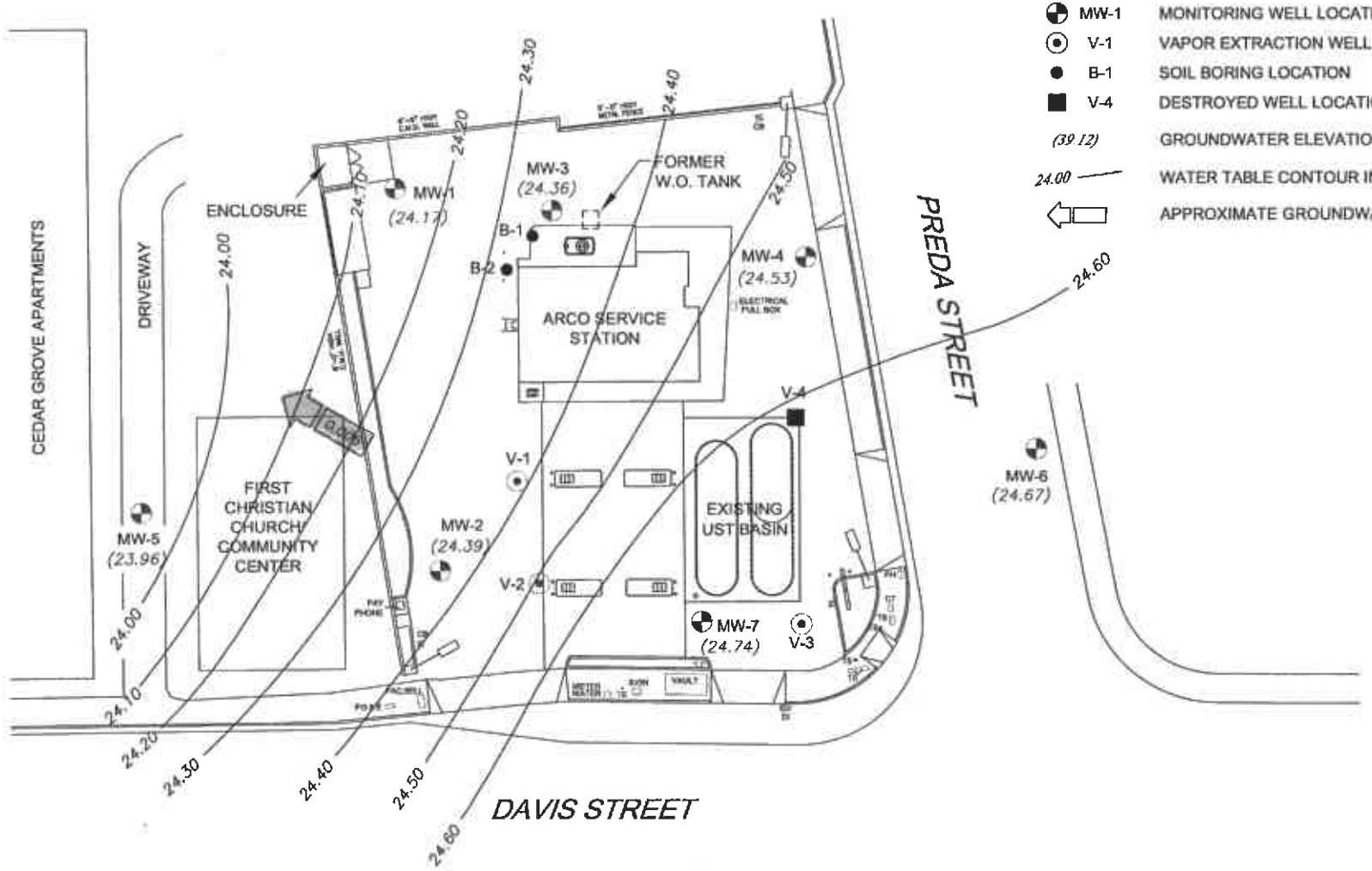
GENERAL NOTES:
BASE MAP FROM U.S.G.S.
SAN LEANDRO, CA.
7.5 MINUTE TOPOGRAPHIC
PHOTOREVISED 1980

QUADRANGLE LOCATION

URS	Project No. 38485939.00236 Arco Service Station 2111 1156 Davis Street San Leandro, California	SITE TOPOGRAPHIC MAP	FIGURE 1

X:\a_env\waste\BP GEM\Sites\Scott Robinson\Paul Supple\2111\Reports\Monitoring\Qtr. 2, 2002\Drawings\1_TOPOMAP.dwg

X:\x_env\waste\BP GEM\Sites\Scott Robinson\Paul Supple\2111\Reports\Monitoring\Qtr. 2, 2002\Drawings\2_GWEC_6-21.dwg



NORTH

0 40 80

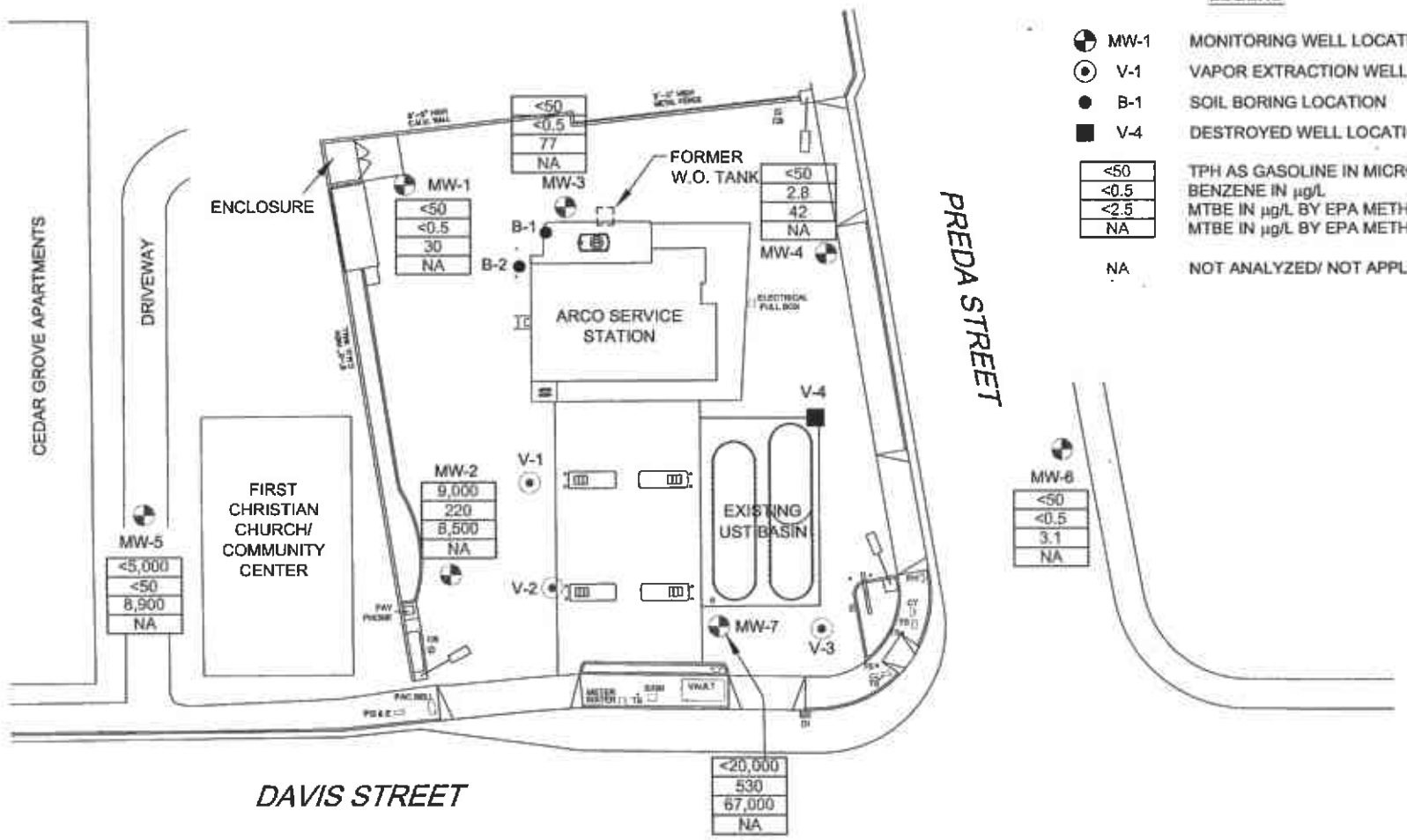
SCALE IN FEET

URS	Project No. 38465919.00436 Arco Service Station 2111 1156 Davis Street San Leandro, California	**GROUNDWATER ELEVATION CONTOUR MAP** **June 21, 2002**

FIGURE

2

X:\x_env\waste\BP GEM\Sites\Scott Robinson\Paul Supple\2111\Reports\Monitoring\Qtr. 2, 2002\Drawings\3_GWAS_6-21.dwg



LEGEND

MW-1	MONITORING WELL LOCATION
V-1	VAPOR EXTRACTION WELL LOCATION
B-1	SOIL BORING LOCATION
V-4	DESTROYED WELL LOCATION
<50	TPH AS GASOLINE IN MICROGRAMS PER LITER (µg/L)
<0.5	BENZENE IN µg/L
<2.5	MTBE IN µg/L BY EPA METHOD 8020
NA	MTBE IN µg/L BY EPA METHOD 8260
NA	NOT ANALYZED/ NOT APPLICABLE

NORTH

0 40 80

SCALE IN FEET

URS

Project No. 38465919.00436

Arco Service Station 2111
1156 Davis Street
San Leandro, California

GROUNDWATER ANALYTICAL SUMMARY
June 21, 2002

FIGURE
3

TABLE 1

SUMMARY OF RECENT GROUNDWATER ELEVATION AND ANALYTICAL DATA

ARCO Service Station No. 2111
1156 Davis Street
San Leandro, California

Well Number	Date Sampled	Top of Riser Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)	Benzene (µg/L)	Toluene (µg/L	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	TPH as Gasoline (µg/L)	MTBE (8020) (µg/L)	MTBE (8260) (µg/L)
MW-1	06/26/00	39.60	16.46	23.14	NA	NA	NA	NA	NA	NA	NA
	07/20/00		16.89	22.71	110	<0.5	<0.5	2.7	360	2,100	NA
	09/19/00		17.62	21.98	76	<0.5	<0.5	2.3	290	1,500	NA
	12/21/00		17.39	22.21	64	2.89	1.31	4.57	257	1,080	1,060
	03/13/01		15.7	23.9	52.5	<5.0	<5.0	<5.0	<500	1,430	1,370
	09/18/01		18.24	21.36	64	7.3	<5.0	52	<500	810	1,100
	12/28/01		15.95	23.65	<5.0	<5.0	5.00	22	<500	1,200	1,100
	03/14/02		16.01	23.59	<0.5	<0.5	<0.5	<0.5	<50	34	40
	04/23/02[c]		15.43	24.17	<0.5	<0.5	<0.5	<0.5	<50	30	NA
MW-2	06/26/00	37.99	14.60	23.39[a]	NA	NA	NA	NA	NA	NA	NA
	07/20/00		15.14	22.85	2,300	18,000	2,500	19,000	95,000	13,000	NA
	09/19/00		15.95	22.04	1,200	6,300	2,000	14,000	63,000	19,000	NA
	12/21/00		15.60	22.39		2,130	1,160	9,460	45,900	22,400	24,700
	12/21/00[b]		NM	NC	360	189	213	626	5,010	54,300	89,200
	03/13/01		13.77	23.9	98.1	<5.0	<5.0	6.42	3,650	3,590	3,260
	3/13/2001[b]		NM	NC	525	466	408	1,460	<20,000	91,700	76,000
	9/18/2001[a]		16.86	21.13	NS	NS	NS	NS	NS	NS	NS
	12/28/01		14.28	23.71	1,500	3,800	1,300	4,800	31,000	9,300	8,800
	03/14/02		14.15	23.84	25	43	43	270	1,800	990	960
	04/23/02[c]		13.60	24.39	220	110	470	2,500	9,000	8,500	NA
MW-3	06/26/00	39.32	15.96	23.36	NA	NA	NA	NA	NA	NA	NA
	07/20/00		16.42	22.90	<0.5	<0.5	<0.5	<1.0	<50	130	NA
	09/19/00		17.18	22.14	17	<0.5	1.4	2.4	190	160	NA
	12/21/00		16.97	22.35	17.8	<0.5	2.47	2.5	187	143	125
	03/13/01		15.17	24.15	2.83	<0.5	<0.5	<0.5	72.4	126	122
	09/18/01		17.81	21.51	6.4	<0.5	3.5	1.6	140	110	75
	12/28/01		15.44	23.88	5.9	<0.5	0.99	0.55	130	90	63
	03/14/02		15.50	23.82	<0.5	<0.5	<0.5	<0.5	<50	100	88
	04/23/02[c]		14.96	24.36	<0.5	<0.5	<0.5	<0.5	<50	77	NA

TABLE 1

SUMMARY OF RECENT GROUNDWATER ELEVATION AND ANALYTICAL DATA

ARCO Service Station No. 2111
1156 Davis Street
San Leandro, California

Well Number	Date Sampled	Top of Riser Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)	Benzene (µg/L)	Toluene (µg/L	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	TPH as Gasoline (µg/L)	MTBE (8020) (µg/L)	MTBE (8260) (µg/L)
MW-4	06/26/00	38.10	14.59	23.51	NA	NA	NA	NA	NA	NA	NA
	07/20/00		15.04	23.06	7.9	<0.5	<0.5	1.1	97	51	NA
	09/19/00		15.83	22.27	7.0	<0.5	<0.5	<1.0	110	60	NA
	12/21/00		15.59	22.51	5.6	<0.5	1.72	<0.5	120	46.3	48.6
	03/13/01		13.73	24.37	0.796	<0.5	<0.5	<0.5	76	53.7	50.0
	09/18/01		16.50	21.59	<0.5	<0.5	<0.5	<0.5	<50	25	26.0
	12/28/01		14.03	24.07	<0.5	<0.5	<0.5	<0.5	<50	15	11.0
	03/14/02		14.10	24.00	<0.5	<0.5	<0.5	<0.5	<50	31	28
	04/23/02[c]		13.57	24.53	3	<0.5	<0.5	<0.5	<50	42	NA
MW-5	06/26/00	37.21	14.27	22.94	NA	NA	NA	NA	NA	NA	NA
	07/20/00		14.69	22.52	<0.5	<0.5	<0.5	<1.0	55	14,000	NA
	09/19/00		15.36	21.85	<0.5	<0.5	<0.5	<1.0	54	13,000	NA
	12/21/00		15.15	22.06	2.51	<0.5	<0.5	0.961	72.9	19,200	21,200
	03/13/01		13.5	23.71	<5	<5	<5	<5	<500	15,900	20,000
	09/18/01		15.94	21.27	<100	<100	<100	<1,000	<10,000	22,000	20,000
	12/28/01		13.45	23.76	<100	<100	<100	<100	<10,000	10,000	10,000
	03/14/02		13.82	23.39	<50	<50	<50	<50	<5,000	7,100	7,700
	04/23/2002[c]		13.25	23.96	<50	<50	<50	<50	<5,000	8,900	NA
MW-6	06/26/00	37.11	13.46	23.65	NA	NA	NA	NA	NA	NA	NA
	07/20/00		13.94	23.17	<0.5	<0.5	<0.5	<1.0	<50	<3.0	NA
	09/19/00		14.41	22.70	<0.5	<0.5	<0.5	<1.0	<50	<3.0	NA
	12/21/00		14.53	22.58	<0.5	<0.5	<0.5	<0.5	<50	<2.5	NA
	03/13/01		12.67	24.44	<0.5	<0.5	<0.5	<0.5	<50	<2.5	NA
	09/18/01		15.42	21.69	<0.5	<0.5	<0.5	<0.5	<50	<2.5	<2.0
	12/28/01		12.96	24.15	<0.5	<0.5	<0.5	<0.5	<50	12	<0.5
	03/14/02		12.98	24.13	<0.5	<0.5	<0.5	<0.5	<50	<2.5	NA
	04/23/02[c]		12.44	24.67	<0.5	<0.5	<0.5	<0.5	<50	3	NA

TABLE 1

SUMMARY OF RECENT GROUNDWATER ELEVATION AND ANALYTICAL DATA

ARCO Service Station No. 2111
1156 Davis Street
San Leandro, California

Well Number	Date Sampled	Top of Riser Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)	Benzene (µg/L)	Toluene (µg/L	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	TPH as Gasoline (µg/L)	MTBE (8020) (µg/L)	MTBE (8260) (µg/L)
MW-7	06/26/00	38.68	14.34	24.34	NA	NA	NA	NA	NA	NA	NA
	07/20/00		15.26	23.42	5.4	<0.5	2.8	5.9	14,000	71,000	NA
	09/19/00		15.70	22.98	420	38	470	220	8,400	5,600	NA
	12/21/00		16.02	22.66	NS[a]	NS[a]	NS[a]	NS[a]	NS[a]	NS[a]	NS[a]
	03/13/01		14.18	24.50	154	63	46.3	127	<2,000	175,000	160,000
	09/18/01		17.02	21.66	1,900	<1,000	<1,000	2,800	<100,000	190,000	370,000
	12/28/01		14.81	23.87	<200	<200	<200	<200	<20,000	84,000	72,000
	03/14/02		14.60	24.08	<500	<500	<500	<500	<50,000	85,000	85,000
	04/23/02[c]		13.94	24.74	530	200	220	800	<20,000	67,000	NA

[a] Product sheen noted
[b] Well was sampled after batch extraction event.
[c] URS Corporation took over the quaterly monitoring program from Delta Environmental, Inc.

TPH = Total Petroleum Hydrocarbons
MTBE = Methyl tertiary butyl ether analyzed by EPA Method 8021B unless otherwise noted
µg/L = Micrograms per liter
NM = Not measured
NC = Not calculated
Note: Please refer to Table 2 for Historical Groundwater Elevation and Analytical Data Tables developed by IT

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents

ARCO Service Station 2111
1156 Davis Street, San Leandro, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Free Product Thickness	Groundwater Elevation	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8021B*	Toluene EPA 8021B*	Ethylbenzene EPA 8021B*	Total Xylenes EPA 8021B*	MTBE EPA 8021B*	MTBE EPA 8260	TRPH EPA 418.1	TPHD LUFT Method	Dissolved Oxygen	Purged/ Not Purged
		ft-MSL	feet	feet	ft-MSL		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	P/NP
MW-1	08-01-95	39.60	17.45	ND	22.15	08-01-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--		
MW-1	12-14-95	39.60	17.09	ND	22.51	12-14-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	03-21-96	39.60	14.72	ND	24.88	03-21-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	05-24-96	39.60	15.94	ND	23.66	05-24-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	08-09-96	39.60	17.89	ND	21.71	08-09-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	11-06-96	39.60	18.66	ND	20.94	11-06-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	03-24-97	39.60	16.13	ND	23.47	03-24-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	05-27-97	39.60	17.23	ND	22.37	05-28-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	08-07-97	39.60	18.68	ND	20.92	08-07-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	11-10-97	39.60	19.19	ND	20.41	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	02-16-98	39.60	12.61	ND	26.99	02-16-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	04-15-98	39.60	14.30	ND	25.30	04-15-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	07-24-98	39.60	16.40	ND	23.20	07-24-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	10-19-98	39.60	17.90	ND	21.70	10-19-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-1	01-28-99	39.60	16.85	ND	22.75	01-28-99	<20,000	580	<200	<200	320	14,000	--	--	--		
MW-1	06-25-99	39.60	17.35	ND	22.25	06-25-99	730	140	5	3	2	7,700	--	--	--	0.79	NP
MW-1	08-25-99	39.60	18.20	ND	21.40	08-25-99	390	66	8.5	<2.5	8.6	3,700	--	--	--	1.56	NP
MW-1	11-10-99	39.60	17.77	ND	21.83	11-10-99	360	70	13	2.2	13	980	--	--	--	0.30	NP
MW-1	02-09-00	39.60	16.25	ND	23.35	02-09-00	190	4.5	0.9	<0.5	12	3,500	--	--	--	0.53	NP
MW-2	08-01-95	37.99	15.67	ND	22.32	08-01-95	23,000	1,300	310	500	3,500	--	--	--	--		
MW-2	12-14-95	37.99	15.36	ND	22.63	12-14-95	7,300	900	25	180	1,000	<200	--	--	--		
MW-2	03-21-96	37.99	12.84	ND	25.15	03-21-96	9,600	850	30	280	1,400	250	--	--	--		
MW-2	05-24-96	37.99	14.03	ND	23.96	05-24-96	2,300	300	<5	73	310	<25	--	--	--		
MW-2	08-09-96	37.99	16.10	ND	21.89	08-09-96	2,800	290	6	75	320	50	--	--	--		

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents

ARCO Service Station 2111
1156 Davis Street, San Leandro, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Free Product Thickness	Groundwater Elevation	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8021B*	Toluene EPA 8021B*	Ethylbenzene EPA 8021B*	Total Xylenes EPA 8021B*	MTBE EPA 8021B*	MTBE EPA 8260	TRPH EPA 418.1	TPHD LUFT Method	Dissolved Oxygen	Purged/ Not Purged
		ft-MSL	feet	feet	ft-MSL		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	P/NP
MW-2	11-06-96	37.99	16.98	ND	21.01	11-06-96	750	76	<1	15	51	110	--	--	--		
MW-2	03-24-97	37.99	14.22	ND	23.77	03-24-97	790	18	<1	2	6	280	--	--	--		
MW-2	05-27-97	37.99	15.42	ND	22.57	05-28-97	750	14	<1	<1	10	150	--	--	--		
MW-2	08-07-97	37.99	16.92	ND	21.07	08-07-97	360	31	<2.5	<2.5	15	260	--	--	--		
MW-2	11-10-97	37.99	17.52	ND	20.47	11-10-97	1,300	82	<5	14	49	550	--	--	--		
MW-2	02-16-98	37.99	12.04	ND	25.95	02-16-98	<2,500	<25	<25	<25	<25	4,200	--	--	--		
MW-2	04-15-98	37.99	12.34	ND	25.65	04-15-98	<10,000	<100	<100	<100	<100	7,300	--	--	--		
MW-2	07-24-98	37.99	14.45	ND	23.54	07-24-98	<2,500	<25	<25	<25	<25	1,500	--	--	--		
MW-2	10-19-98	37.99	16.08	ND	21.91	10-19-98	<1,000	18	<10	<10	<10	1,100	--	--	--		
MW-2	01-28-99	37.99	15.59	0.02	22.41 [1]	01-28-99	160,000	3,000	24,000	4,400	31,000	23,000	--	--	--		
MW-2	06-25-99	37.99	19.20	3.73[4]	21.51 [1]	06-25-99	120,000	6,900	21,000	2,600	19,000	18,000	17,000[3]	--	--	0.49	NP
MW-2	08-25-99	37.99	16.49	0.02	21.51 [1]	08-25-99	92,000	2,200	16,000	3,200	19,000	11,000	9,400[3]	--	--	0.84	NP
MW-2	11-10-99	37.99	16.08	ND	21.91	11-10-99	56,000	2,400	5,900	1,500	10,000	17,000	21,000[3]	--	--	0.41	NP
MW-2	02-09-00	37.99	14.85	ND	23.14	02-09-00	1,700	270	14	17	21	70,000	55,000[3]	--	--	0.97	NP
MW-3	08-01-95	39.32	17.00	ND	22.32	08-01-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	600	76[2]		
MW-3	12-14-95	39.32	16.70	ND	22.62	12-14-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	<500	<50		
MW-3	03-21-96	39.32	14.17	ND	25.15	03-21-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	<500	<50		
MW-3	05-24-96	39.32	15.30	ND	24.02	05-24-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	<500	<50		
MW-3	08-09-96	39.32	17.58	ND	21.74	08-09-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	<500	--		
MW-3	11-06-96	39.32	18.33	ND	20.99	11-06-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	03-24-97	39.32	15.44	ND	23.88	03-24-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	05-27-97	39.32	16.75	ND	22.57	05-28-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	08-07-97	39.32	18.35	ND	20.97	08-07-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	11-10-97	39.32	18.83	ND	20.49	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		

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Petroleum Hydrocarbons and Their Constituents

ARCO Service Station 2111
1156 Davis Street, San Leandro, California

Well Designation	Water Level Field Date	Top of Casing Elevation	Depth to Water	Free Product Thickness	Groundwater Elevation	Water Sample Field Date	TPHG LUFT Method	Benzene EPA 8021B*	Toluene EPA 8021B*	Ethylbenzene EPA 8021B*	Total Xylenes EPA 8021B*	MTBE EPA 8021B*	MTBE EPA 8260	TRPH EPA 418.1	TPHD LUFT Method	Dissolved Oxygen	Purged/ Not Purged
		ft-MSL	feet	feet	ft-MSL		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	P/NP
MW-3	02-16-98	39.32	11.99	ND	27.33	02-16-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	04-15-98	39.32	13.75	ND	25.57	04-15-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	07-24-98	39.32	15.90	ND	23.42	07-24-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	10-19-98	39.32	17.45	ND	21.87	10-19-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-3	01-28-99	39.32	16.40	ND	22.92	01-28-99	<100	14	4	<1	6	100	--	--	--		
MW-3	06-25-99	39.32	17.92	ND	21.40	06-25-99	83	9.0	1.4	<0.5	2.5	220	--	--	--	1.11	NP
MW-3	08-25-99	39.32	17.79	ND	21.53	08-25-99	240	41	12	3.7	9.9	160	--	--	--	1.13	NP
MW-3	11-10-99	39.32	17.37	ND	21.95	11-10-99	620	100	9.7	4.1	21	150	--	--	--	0.24	NP
MW-3	02-09-00	39.32	15.77	ND	23.55	02-09-00	<50	<0.5	0.7	<0.5	<1	180	--	--	--	0.62	NP
MW-4	08-01-95	38.10	15.65	ND	22.45	08-01-95	<50	<0.5	<0.5	<0.5	<0.5	--	--	--	--		
MW-4	12-14-95	38.10	15.35	ND	22.75	12-14-95	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	03-21-96	38.10	12.74	ND	25.36	03-21-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	05-24-96	38.10	14.03	ND	24.07	05-24-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	08-09-96	38.10	16.10	ND	22.00	08-09-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	11-06-96	38.10	17.00	ND	21.10	11-06-96	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	03-24-97	38.10	14.21	ND	23.89	03-24-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	05-27-97	38.10	15.38	ND	22.72	05-28-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	08-07-97	38.10	16.95	ND	21.15	08-07-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	11-10-97	38.10	17.53	ND	20.57	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	02-16-98	38.10	10.65	ND	27.45	02-16-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	04-15-98	38.10	12.20	ND	25.90	04-15-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	07-24-98	38.10	14.47	ND	23.63	07-24-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	10-19-98	38.10	16.20	ND	21.90	10-19-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-4	01-28-99	38.10	15.02	ND	23.08	01-28-99	340	52	5.5	<0.5	74	31	--	--	--		

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents

ARCO Service Station 2111
1156 Davis Street, San Leandro, California

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Free Product Thickness feet	Groundwater Elevation ft-MSL	Water Sample Field Date	TPHG LUFT Method µg/L	Benzene EPA 8021B* µg/L	Toluene EPA 8021B* µg/L	Ethylbenzene EPA 8021B* µg/L	Total Xylenes EPA 8021B* µg/L	MTBE EPA 8021B* µg/L	MTBE EPA 8260 µg/L	TRPH EPA 418.1 µg/L	TPHD LUFT Method µg/L	Dissolved Oxygen mg/L	Purged/ Not Purged P/NP
MW-4	06-25-99	38.10	15.57	ND	22.53	06-25-99	510	78	4.1	0.5	18	94	--	--	--	0.90	NP
MW-4	08-25-99	38.10	16.43	ND	21.67	08-25-99	660	130	21	6.4	39	110	--	--	--	1.01	NP
MW-4	11-10-99	38.10	16.02	ND	22.08	11-10-99	510	98	5.1	3.1	15	69	--	--	--	0.28	NP
MW-4	02-09-00	38.10	14.30	ND	23.80	02-09-00	<50	<0.5	0.9	<0.5	<1	55	--	--	--	0.67	NP
MW-5	03-21-96	37.21	12.60	ND	24.61	03-22-96	<50	<0.5	<0.5	<0.5	<0.5	82	--	--	--		
MW-5	05-24-96	37.21	13.71	ND	23.50	05-24-96	<50	<0.5	<0.5	<0.5	<0.5	7	--	--	--		
MW-5	08-09-96	37.21	15.60	ND	21.61	08-09-96	<50	<0.5	<0.5	<0.5	<0.5	8	--	--	--		
MW-5	11-06-96	37.21	16.36	ND	20.85	11-06-96	<50	<0.5	<0.5	<0.5	<0.5	100	--	--	--		
MW-5	03-24-97	37.21	13.87	ND	23.34	03-24-97	<50	<0.5	<0.5	<0.5	<0.5	460	--	--	--		
MW-5	05-27-97	37.21	14.71	ND	22.50	05-28-97	<100	<1	<1	<1	<1	120	--	--	--		
MW-5	08-07-97	37.21	16.90	ND	20.31	08-07-97	<250	<2.5	<2.5	<2.5	<2.5	250	--	--	--		
MW-5	11-10-97	37.21	16.88	ND	20.33	11-10-97	<1,000	<10	<10	<10	<10	770	--	--	--		
MW-5	02-16-98	37.21	10.56	ND	26.65	02-16-98	<200	<2	<2	<2	<2	230	--	--	--		
MW-5	04-15-98	37.21	12.20	ND	25.01	04-15-98	<500	<5	<5	<5	<5	900	--	--	--		
MW-5	07-24-98	37.21	14.20	ND	23.01	07-24-98	<500	<5	<5	<5	<5	570	--	--	--		
MW-5	10-19-98	37.21	15.74	ND	21.47	10-19-98	<250	<2.5	<2.5	<2.5	<2.5	300	--	--	--		
MW-5	01-28-99	37.21	14.60	ND	22.61	01-28-99	<500	8	<5	<5	<5	290	--	--	--		
MW-5	06-25-99	37.21	15.10	ND	22.11	06-25-99	<50	<0.5	<0.5	<0.5	<0.5	1,300	--	--	--	0.76	NP
MW-5	08-25-99	37.21	15.91	ND	21.30	08-25-99	<50	<0.5	<0.5	<0.5	<0.5	6,700	--	--	--	0.98	NP
MW-5	11-10-99	37.21	15.52	ND	21.69	11-10-99	130	2.0	7.0	1.3	21	5,000	--	--	--	0.21	NP
MW-5	02-09-00	37.21	14.03	ND	23.18	02-09-00	92	<0.5	0.8	<0.5	1.0	7,900	--	--	--	0.51	NP
MW-6	03-21-96	37.11	11.55	ND	25.56	03-22-96	<50	<0.5	1.9	<0.5	<0.5	<3	--	--	--		
MW-6	05-24-96	37.11	12.80	ND	24.31	05-24-96	<50	<0.5	<0.5	<0.5	<0.5	6	--	--	--		

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents

ARCO Service Station 2111
1156 Davis Street, San Leandro, California

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Free Product Thickness feet	Groundwater Elevation ft-MSL	Water Sample Field Date	TPHG LUFT Method µg/L	Benzene EPA 8021B* µg/L	Toluene EPA 8021B* µg/L	Ethylbenzene EPA 8021B* µg/L	Total Xylenes EPA 8021B* µg/L	MTBE EPA 8021B* µg/L	MTBE EPA 8260 µg/L	TRPH EPA 418.1 µg/L	TPHD LUFT Method µg/L	Dissolved Oxygen mg/L	Purged/ Not Purged P/NP
MW-6	08-09-96	37.11	Not surveyed			08-09-96	Not sampled: Car parked on well										
MW-6	11-06-96	37.11	Not surveyed			11-06-96	Not sampled: Car parked on well										
MW-6	03-24-97	37.11	13.06	ND	24.05	03-24-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	05-27-97	37.11	14.30	ND	22.81	05-28-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	08-07-97	37.11	16.40	ND	20.71	08-07-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	11-10-97	37.11	16.53	ND	20.58	11-10-97	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	02-16-98	37.11	Not surveyed			02-16-98	Not sampled: Car parked on well										
MW-6	04-15-98	37.11	10.95	ND	26.16	04-15-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	07-24-98	37.11	13.30	ND	23.81	07-24-98	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	10-19-98	37.11	Not surveyed			10-19-98	Not sampled: Car parked on well										
MW-6	01-28-99	37.11	13.92	ND	23.19	01-28-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--		
MW-6	06-25-99	37.11	15.47	ND	21.64	06-25-99	<50	<0.5	<0.5	<0.5	<0.5	<3	--	--	--	0.74	NP
MW-6	08-25-99	37.11	15.39	ND	21.72	08-25-99	<50	<0.5	3.4	0.6	3.7	<3	--	--	--	0.92	NP
MW-6	11-10-99	37.11	14.92	ND	22.19	11-10-99	<50	<0.5	<0.5	<0.5	<1	<3	--	--	--	0.31	NP
MW-6	02-09-00	37.11	13.30	ND	23.81	02-09-00	<50	<0.5	0.9	<0.5	1.3	<3	--	--	--	0.79	NP
MW-7	03-21-96	38.68	13.32	ND	25.36	03-22-96	32,000	870	450	970	4,900	280	--	--	--		
MW-7	05-24-96	38.68	14.58	ND	24.10	05-24-96	22,000	570	40	42	1,900	<200[2]	--	--	--		
MW-7	08-09-96	38.68	15.33	ND	23.35	08-09-96	14,000	390	<10	180	470	<200[2]	--	--	--		
MW-7	11-06-96	38.68	16.95	ND	21.73	11-06-96	9,500	440	<10	210	150	<100[2]	--	--	--		
MW-7	03-24-97	38.68	14.65	ND	24.03	03-24-97	6,400	420	<10	260	13	480	--	--	--		
MW-7	05-27-97	38.68	15.58	ND	23.10	05-28-97	5,000	420	<5	230	10	460	--	--	--		
MW-7	08-07-97	38.68	17.10	ND	21.58	08-07-97	3,900	350	<5	200	10	330	--	--	--		
MW-7	11-10-97	38.68	18.05	ND	20.63	11-10-97	5,600	590	10	370	43	540	--	--	--		
MW-7	02-16-98	38.68	12.03	ND	26.65	02-16-98	<5,000	390	<50	<50	61	4,300	--	--	--		

Table 2
Historical Groundwater Elevation and Analytical Data
Petroleum Hydrocarbons and Their Constituents

ARCO Service Station 2111
1156 Davis Street, San Leandro, California

Well Designation	Water Level Field Date	Top of Casing Elevation ft-MSL	Depth to Water feet	Free Product Thickness feet	Groundwater Elevation ft-MSL	Water Sample Field Date	**TPHG** LUFT Method µg/L	**Benzene** EPA 8021B* µg/L	**Toluene** EPA 8021B* µg/L	**Ethylbenzene** EPA 8021B* µg/L	**Total Xylenes** EPA 8021B* µg/L	**MTBE** EPA 8021B* µg/L	**MTBE** EPA 8260 µg/L	**TRPH** EPA 418.1 µg/L	**TPHD** LUFT Method µg/L	Dissolved Oxygen mg/L	Purged/ Not Purged P/NP
MW-7	04-15-98	38.68	13.02	ND	25.66	04-15-98	<10,000	<100	<100	<100	<100	8,900	--	--	--		
MW-7	07-24-98	38.68	14.18	ND	24.50	07-24-98	5,800	180	<50	74	<50	4,200	--	--	--		
MW-7	10-19-98	38.68	15.99	ND	22.69	10-19-98	<2,500	54	<25	72	<25	3,000	--	--	--		
MW-7	01-28-99	38.68	15.69	ND	22.99	01-28-99	4,500	560	250	<50	94	6,200	--	--	--		
MW-7	06-25-99	38.68	15.36	ND	23.32	06-25-99	3,900	520	160	46	100	45,000	63,000[3]	--	--	0.56	NP
MW-7	08-25-99	38.68	16.71	ND	21.97	08-25-99	3,400	730	77	51	110	62,000	76,000[3]	--	--	0.90	NP
MW-7	11-10-99	38.68	16.76	ND	21.92	11-10-99	15,000	340	19	13	20	55,000	91,000[3]	--	--	0.37	NP
MW-7	02-09-00	38.68	14.45	0.03	24.25 [1]	02-09-00	Not sampled: free product present										

ft-MSL: elevation in feet, relative to mean sea level
TPHG: total petroleum hydrocarbons as gasoline, California DHS LUFT Method
MTBE: Methyl tert-butyl ether
TRPH: total recoverable petroleum hydrocarbons
TPHD: total petroleum hydrocarbons as diesel, California DHS LUFT Method
*: EPA method 8020 prior to 11/10/99
EPA: United States Environmental Protection Agency
µg/L: micrograms per liter
mg/L: milligrams per liter
ND: none detected
- -: not available or not analyzed
<: less than laboratory detection limit stated to the right
[1]: [corrected elevation (Z')] = Z + (h * 0.73) where: Z = measured elevation, h = floating product thickness, 0.73 = density ratio of oil to water
[2]: chromatogram fingerprint is not characteristic of diesel
[3]: also analyzed for fuel oxygenates
[4]: this value is suspected to be erroneous based on subsequent check by bailer (following day). See discussion

CHART 1: MW-2 MTBE Historic Concentrations

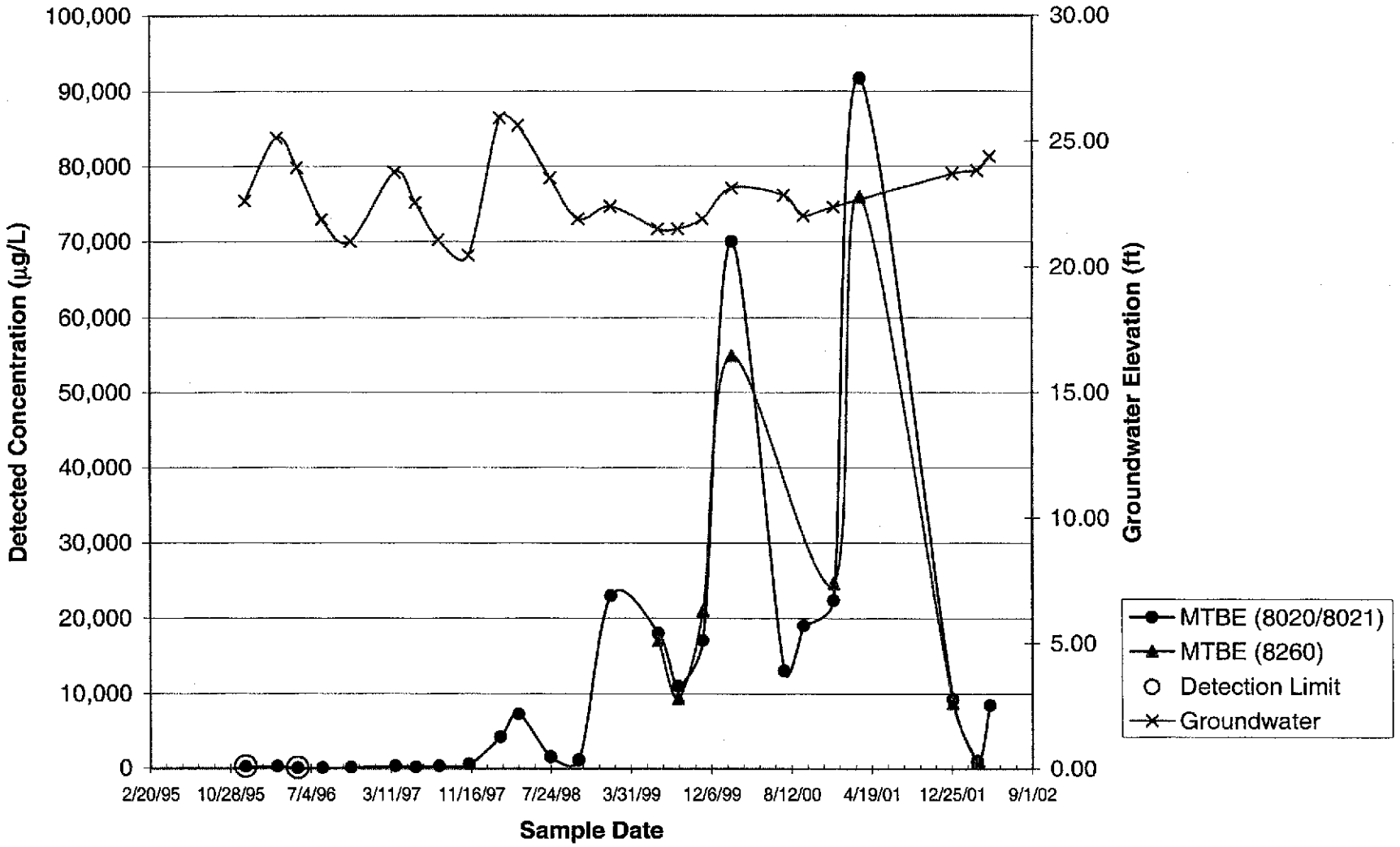


CHART 2: MW-7 MTBE Historic Concentrations

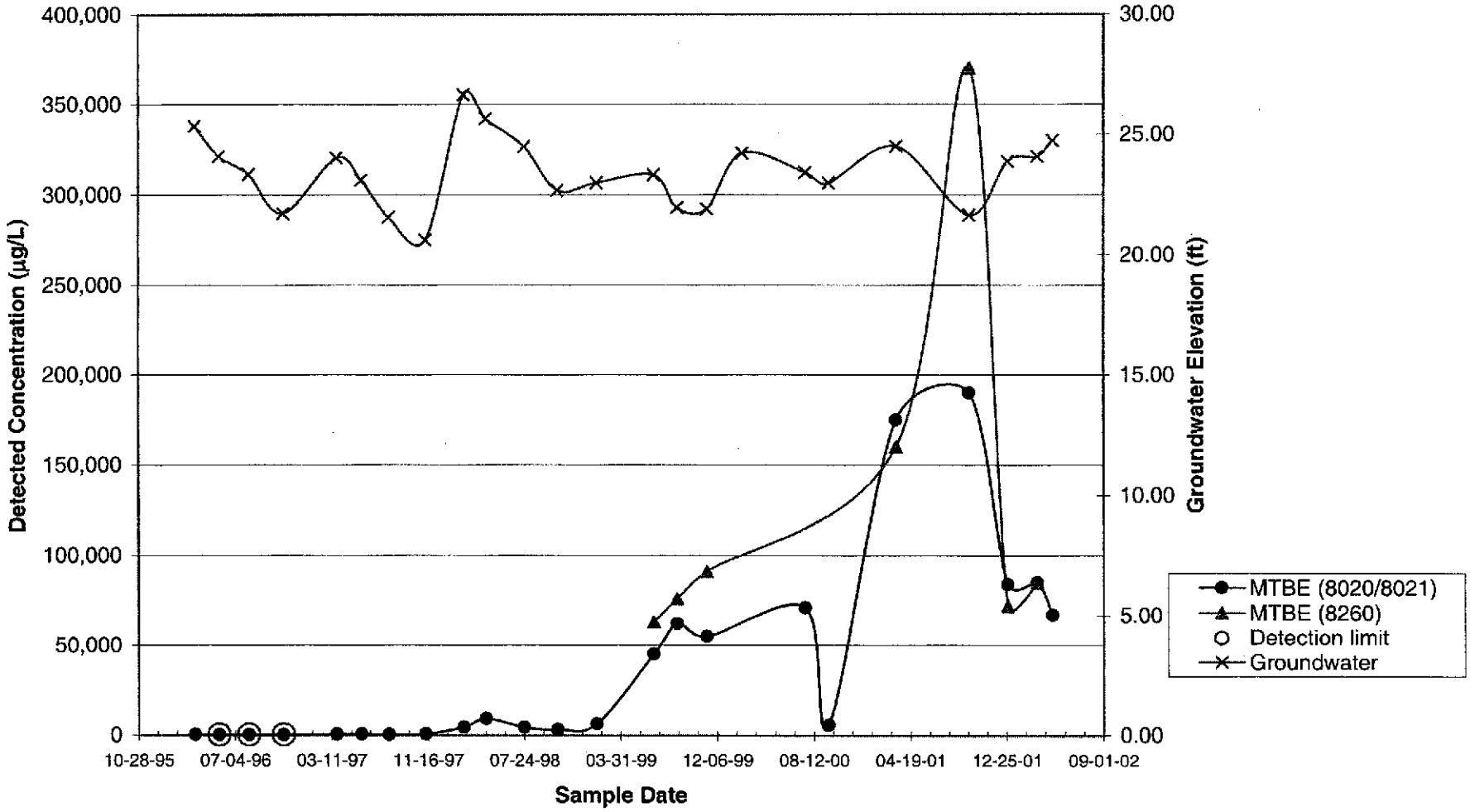


CHART 3: MW-5 MTBE Historic Concentrations

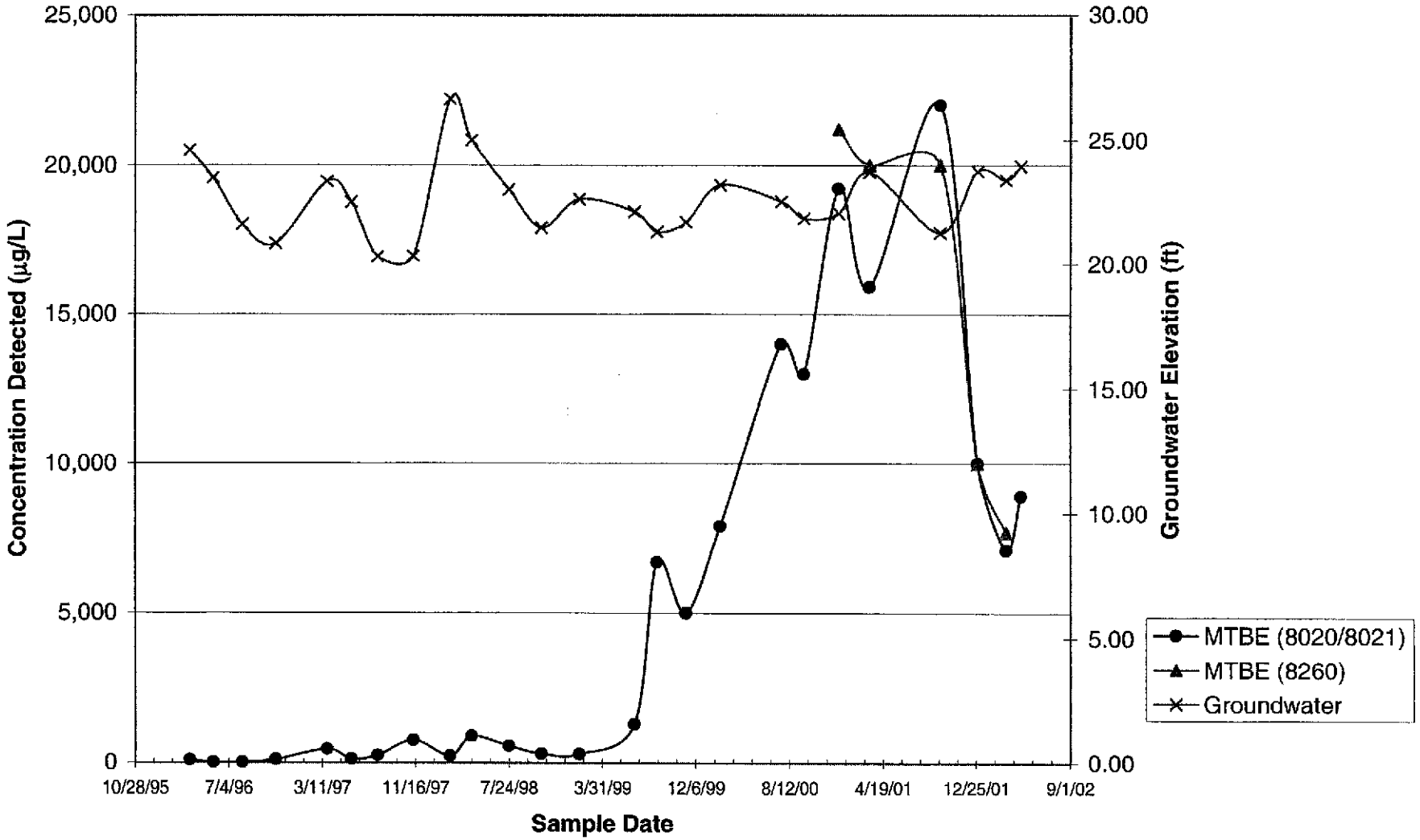


CHART 4: MW-2 Benzene Historic Concentrations

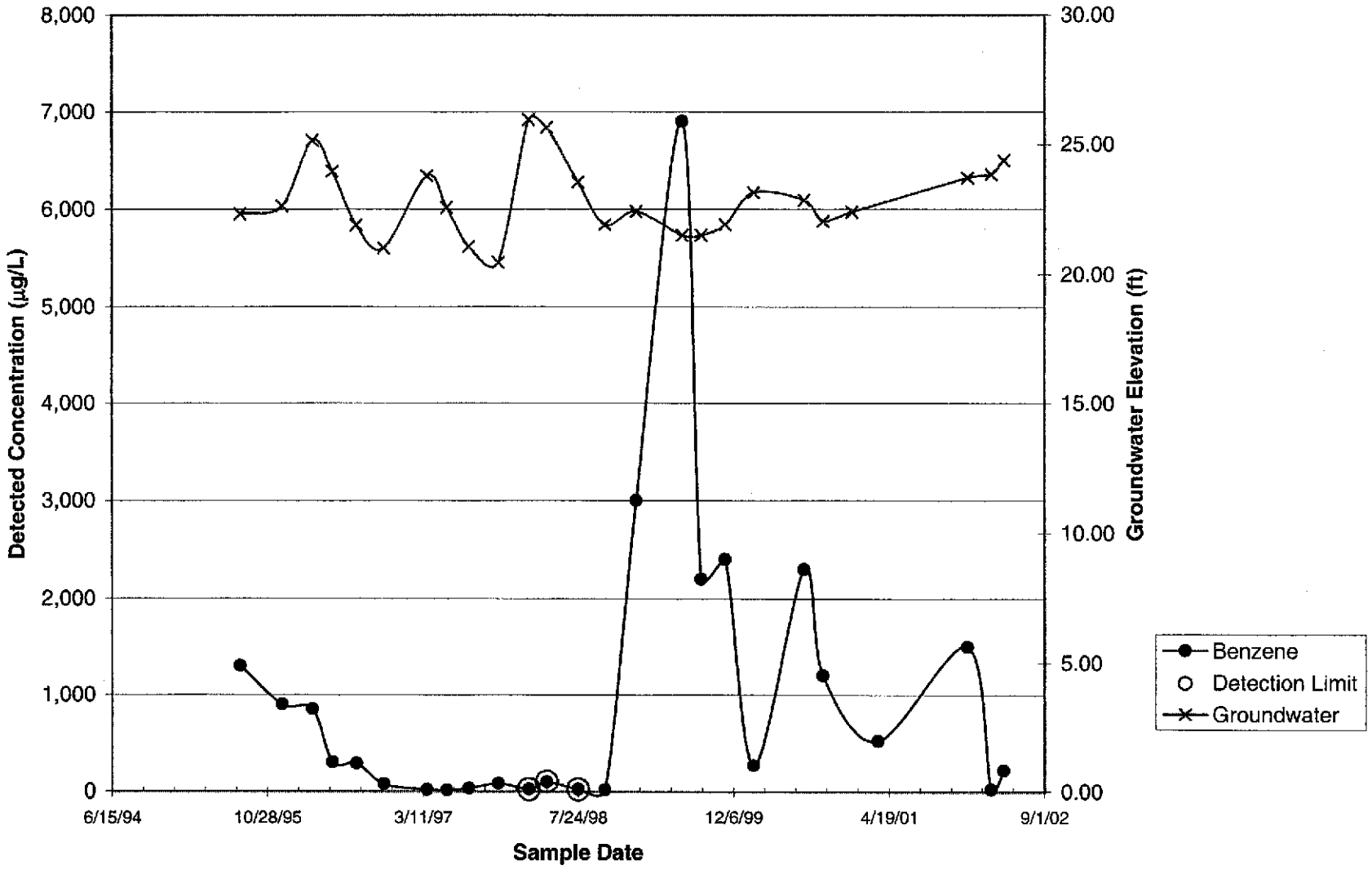


CHART 5: MW-7 Benzene Historic Concentrations

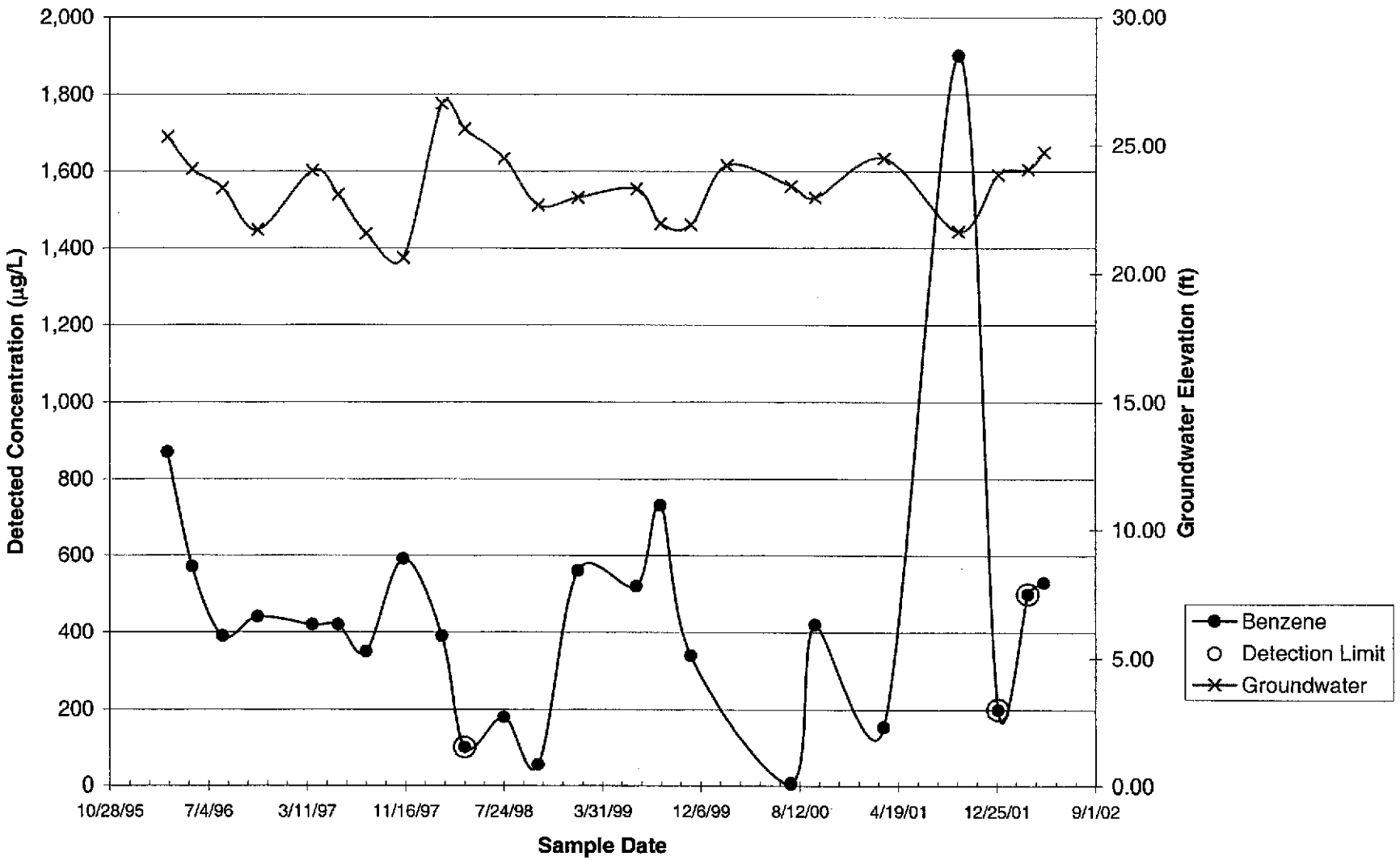
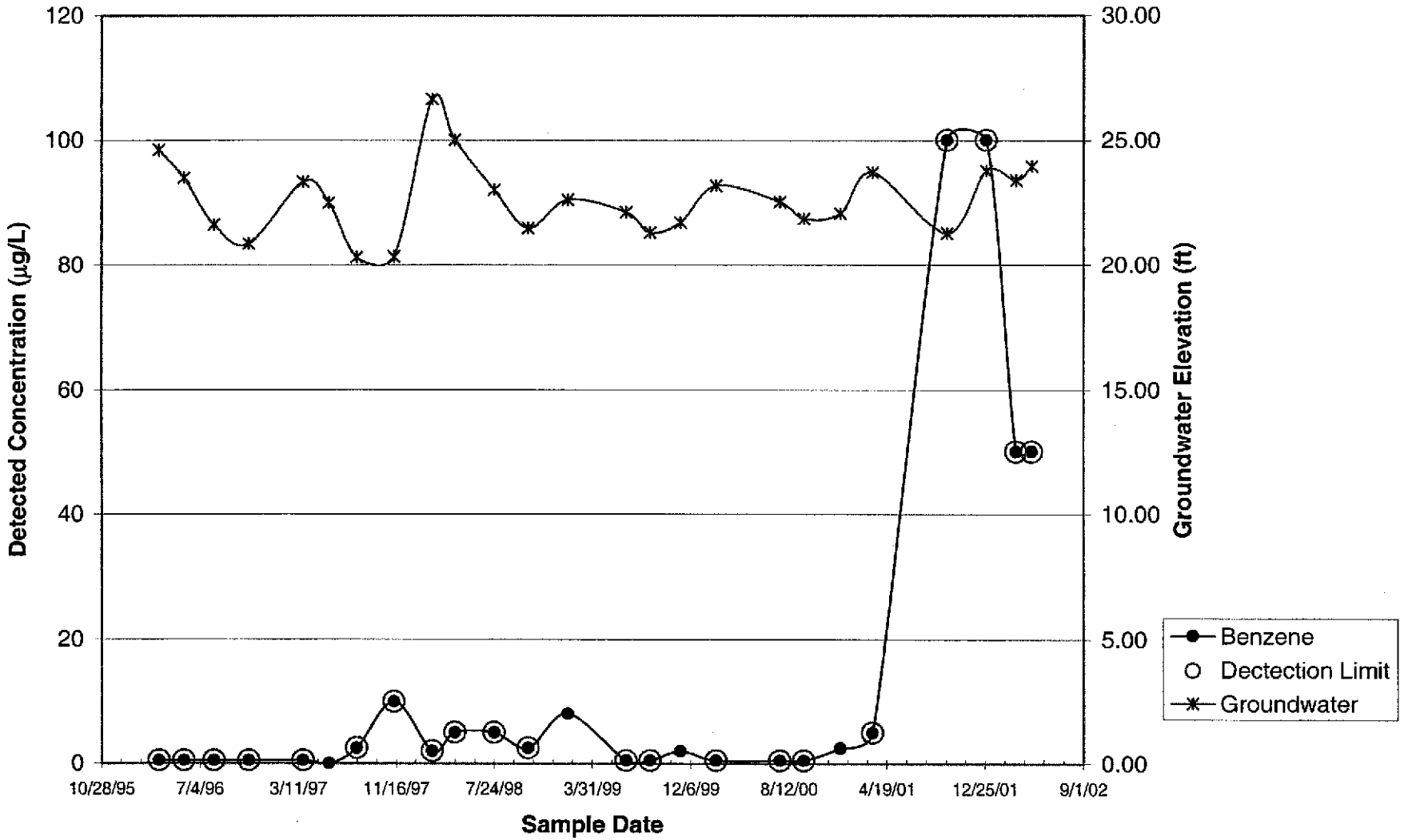


CHART 6: MW-5 Benzene Historic Conentrations



Appendix A

Letter from Alameda County Health Care Services Agency (ACHCSA), June 26, 2002

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

STID 744

June 26, 2002

Mr. Paul Supple
Arco Product Company
PO Box 6549
Moraga, CA 94570

RE: Arco Station # 2111 located at 1156 Davis Street, San Leandro, CA

Dear Mr. Supple:

I have received and reviewed the "Quarterly Groundwater Monitoring Report, Fourth Quarter 2001 ", dated March 19, 2002, submitted by Mr. Steven Meeks of Delta Environmental Consultants, Inc. regarding the above referenced site. Please note the following:

1. The most significant concentration still resides within MW-7 well with MTBE at 72,000ppb by EPA method 8260. You must address the increase in the concentrations of the constituents by providing some possible appropriate active remediation plan.

2. MW-1, MW-2, and MW-5 wells also contain significant concentrations of the constituents with MW-5 revealing the highest at up to 10,000ppb, up to 100ppb, and up to 10,000ppb of TPHG, Benzene, and MTBE respectively.

3. The concentration of the constituents detected in MW-2 well revealed up to 31,000, 1,500ppb, and 9,300ppb of TPHG, Benzene and MTBE respectively.

4. MW-5 well revealed up to 500ppb, up to 5ppb, and 9,400ppb of TPHG, Benzene and MTBE respectively. Some wells indicate an increase in concentrations of some of the constituents while revealing a decrease in the concentration of some others simultaneously.

5. Per figure 2 within this document, groundwater flow gradient is mostly to the southwesterly at 0.003 ft/ft. However, the second page of this document indicates a West –Northwesterly direction.

Please submit a plan, to address the high concentrations of the constituent, by July 26, 2002. I concur with the work proposed for the next quarter by Mr. Trevor Atkinson of Delta Environmental Consultants, Inc.

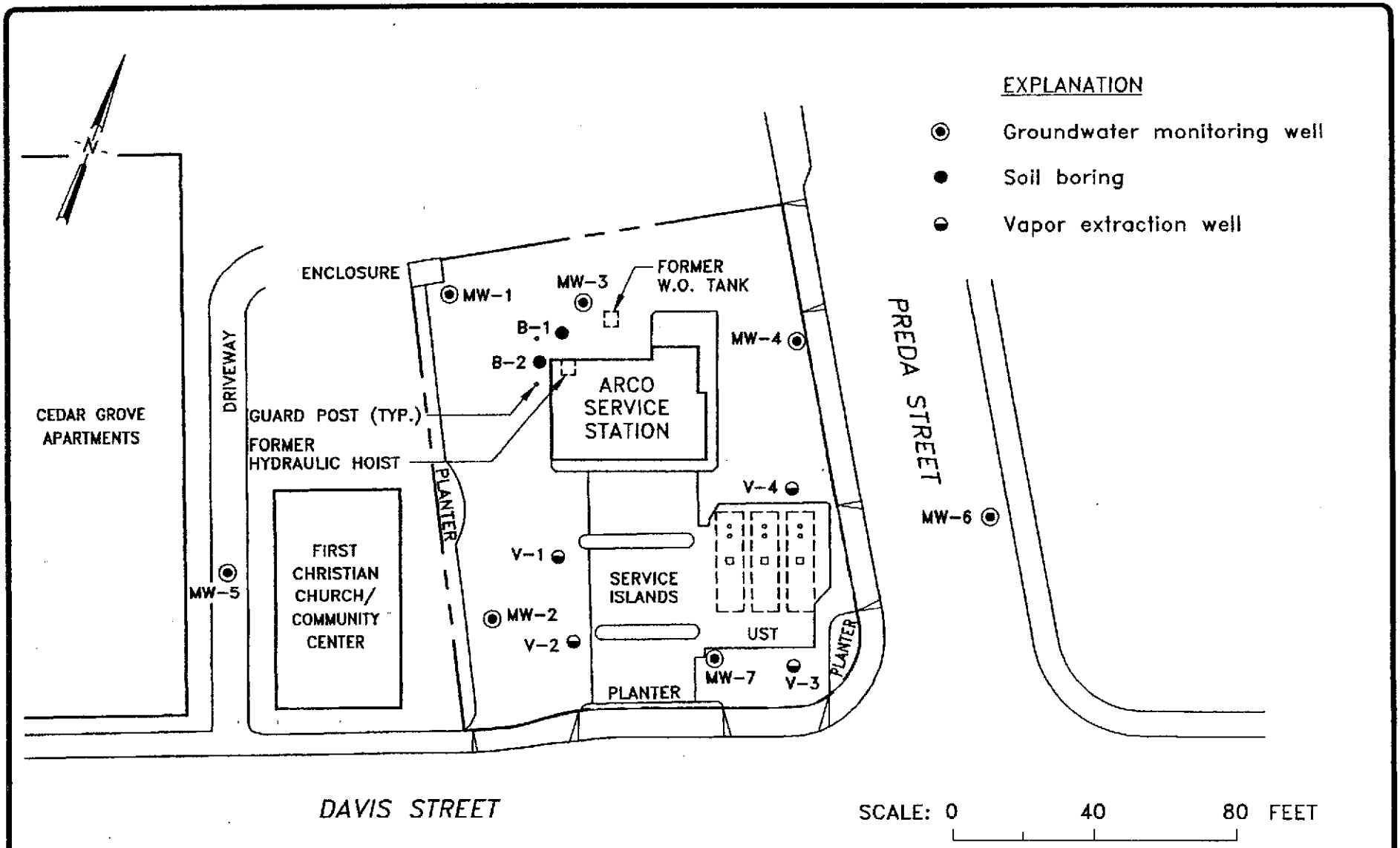
Please call me at (510) 567-6876, if you have any questions.

Sincerely,

Amir K. Gholami, REHS
Hazardous Materials Specialist

C: Mr. Mr. Trevor Atkinson of Delta Environmental Consultants, Inc., 3164 Gold Camp Drive, Suite 200, Rancho Cordova, CA 95670-6021
Mr. Mike Bakaldin, City of San Leandro, Environmental Services Division, 835 East 14th Street, San Leandro, CA 94577
Files

Appendix B
Stratigraphic Cross Sections



emcon

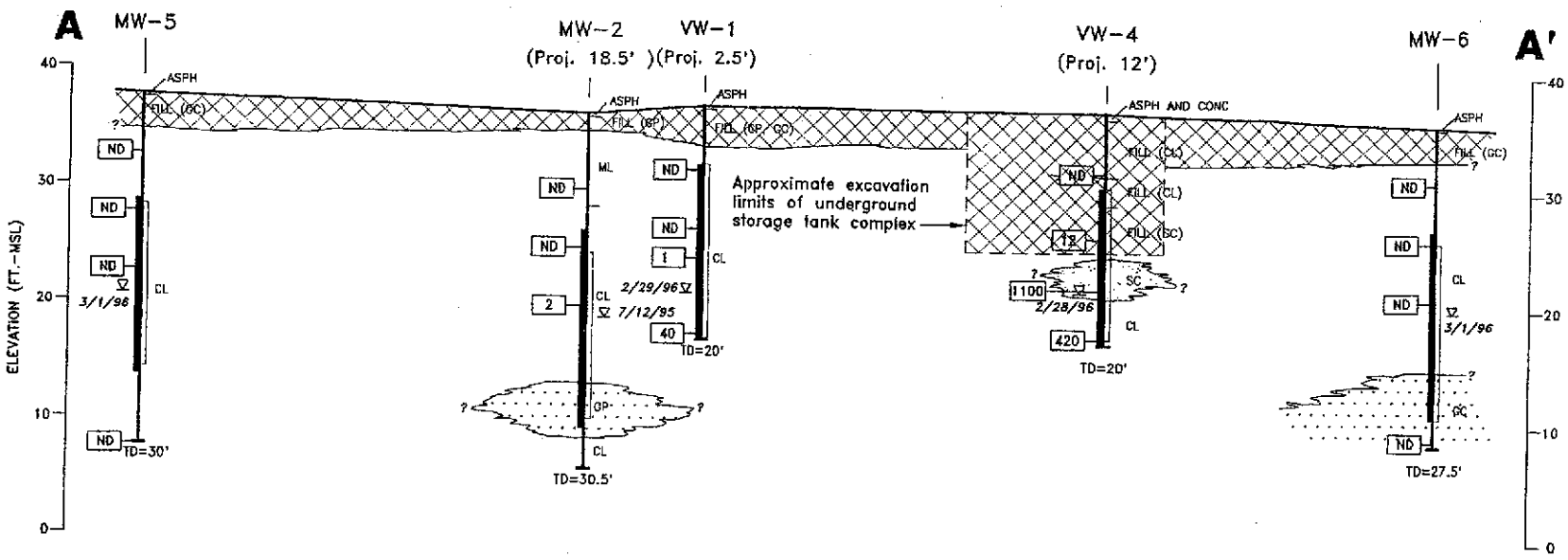
ARCO PRODUCTS COMPANY
SERVICE STATION 2111, 1156 DAVIS STREET
SAN LEANDRO, CALIFORNIA

SITE PLAN

FIGURE
2
PROJECT NO.
805-127.01

SOUTHWEST

NORTHEAST



EXPLANATION

- FILL
- SILTS AND CLAYS (ML, CL)
- SANDS, SILTY AND CLAYEY SANDS (SP, SM, SC)
- GRAVELS, SILTY AND CLAYEY GRAVELS (GP, GM, GC)
- ? Geologic contact; dashed where approximate, queried where uncertain

- VW-4 Well/boring designation
- Borehole
- <1.0 TPH as gasoline (ppm)
- Sand pack interval
- ▽ First encountered groundwater (showing date measured)
- Screened interval
- TD=23.5' Total depth of boring

NOTES:

1. See figure 2 for location of cross section.
2. See Appendix F for soil symbol explanation.

EMCON

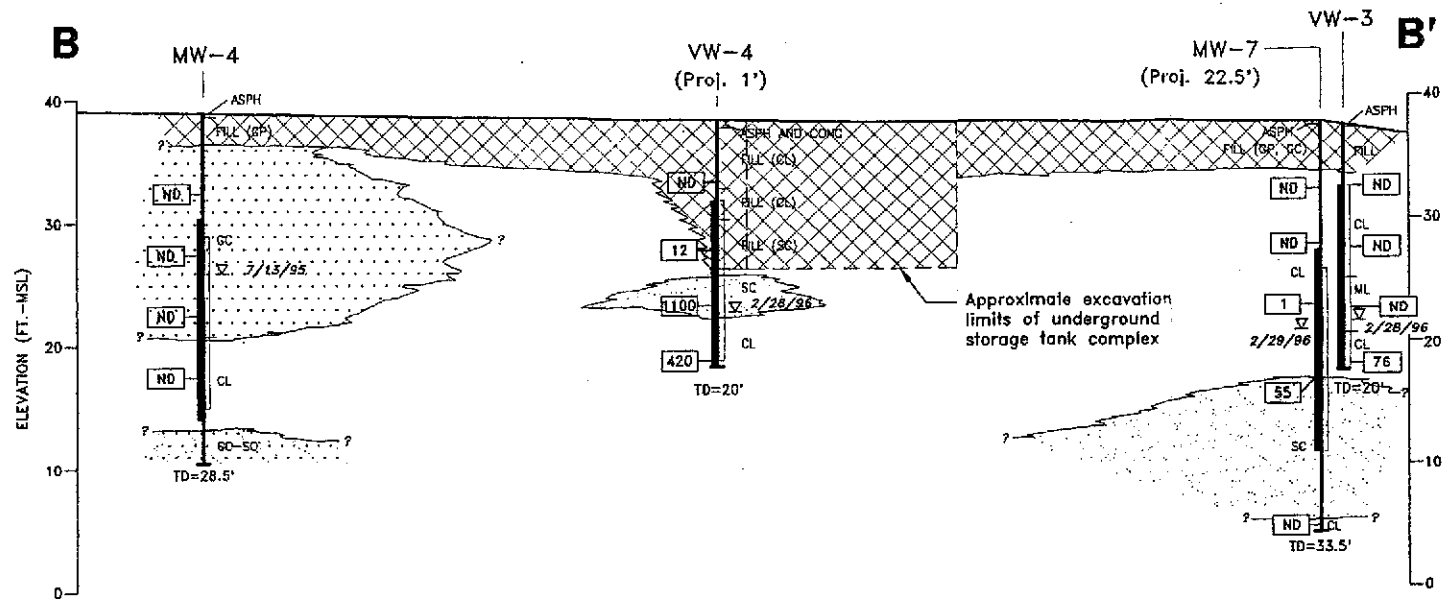
SCALE: 0 20 40 FEET (Horizontal)

ARCO PRODUCTS COMPANY
SERVICE STATION 2111, 1156 DAVIS STREET
SOIL AND GROUNDWATER ASSESSMENT
SAN LEANDRO, CALIFORNIA

GEOLOGIC CROSS SECTION A-A'

FIGURE NO. 3

PROJECT NO. 805-127.001



EXPLANATION

- FILL
- SILTS AND CLAYS (ML, CL)
- SANDS, SILTY AND CLAYEY SANDS (SP, SM, SC)
- GRAVELS, SILTY AND CLAYEY GRAVELS (GP, GM, GC)
- ? — Geologic contact; dashed where approximate, queried where uncertain

VW-4 Well/boring designation

- Borehole
- <1.0 TPH as gasoline (ppm)
- Sand pack interval
- ▽ First encountered groundwater (showing date measured)
- Screened interval
- TD=23.5' Total depth of boring

NOTES:

1. See Figure 2 for location of cross section.
2. See Appendix F for soil symbol explanation.

emcon

SCALE: 0 10 20 FEET
(Horizontal)

ARCO PRODUCTS COMPANY
SERVICE STATION 2111, 1156 DAVIS STREET
SOIL AND GROUNDWATER ASSESSMENT
OAKLAND, CALIFORNIA

GEOLOGIC CROSS SECTION B-B'

FIGURE NO. 4

PROJECT NO. 805-127.001