Unocal Corporation
San Luis Obispo, California

Corrective Action Plan (revised)

Former Unocal Bulk Plant #762248
359 Main Street
Fortuna, California

ENSR Corporation

September 2005

06940-407

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Prepared for

Unocal Corporation

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359 Main Street
Fortuna, California

This report was prepared consistent with currently and generally accepted environmental consulting principals and practices. The material and data in this report were prepared under the supervision and direction of the undersigned.

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1.0 INTRODUCTION

Union Oil Company of California (Unocal) has retained ENSR Corporation (ENSR) to prepare this Corrective Action Plan (CAP) for the former Unocal bulk plant located at 359 Main Street in Fortuna, California (the "Site") as depicted in **Figure 1-1** – Site Location Map and **Figure 1-2** – Site Map. The objective of this CAP is to identify and evaluate a comprehensive remedial action alternative that will adequately protect human health, safety, the environment and will restore or protect current or potential beneficial uses of water. This CAP is being submitted pursuant to a request from the North Coast Water Board (NCWB). The original CAP dated October 10, 2003 was prepared and submitted by SCS Engineers. In response to a review of the October 2003 CAP, NCWB issued a letter requiring that a work plan be prepared to provide details such as aquifer pumping tests, slug tests, laboratory bench tests, and treatability tests recommended in the 2003 CAP. ENSR prepared a Work Plan dated July 14, 2004 that found some of the recommendations from SCS to be inconsistent with the site conceptual model. ENSR detailed further field investigations to be conducted. The Work Plan was approved by the NCWB on August 31, 2004 and additional site investigations were conducted from December 2004 through March 2005. The results of the investigations are summarized in this report. This CAP Report has been prepared in accordance with California Water Code and Resolution 92-49 "Policies and Procedures for Investigation and Cleanup and Abatement Under Section 13304 of the California Water Code". As such, this CAP includes the following elements:

- An assessment of Site conditions and the residual contamination impacts including: physical and chemical characteristics of the hazardous substance (toxicity, persistence, and potential for migration);
- A description of each remedial alternative applicable to Site conditions that have the potential to achieve background concentration levels or the proposed cleanup criteria as presented herein;
- A focused feasibility study to evaluate alternatives for remediating or mitigating the actual or potential adverse effects of a release; and
- Identification of a remedial alternative most applicable to Site conditions, and the approximate schedule to implement the selected remedial alternative.

This CAP is presented in the following sections:

Section 2.0 - SITE STATUS provides a summary of the historical investigations and remedial actions taken at the Site.

Section 3.0 – SOIL AND GROUNDWATER INVESTIGATIONS presents results from the soil and groundwater investigations conducted between December 2004 and March 2005.

Section 4.0 – QUARTERLY GROUNDWATER SAMPLING presents results from the quarterly monitoring event conducted in February 2005.

Section 5.0 - CONCEPTUAL MODEL AND EXTENT OF CONTAMINANT IMPACT provides an interpretation of the data and evaluates and defines the vertical and horizontal extent of contamination in soils and groundwater.

Section 6.0 – FOCUSED FEASIBILTY EVALUATION presents remedial technologies that have the potential of being applied at this Site, a screening of those technologies, and identifies a technology appropriate for the Site.

Section 7.0 – RECOMMENDED REMEDIAL ACTION summarizes the recommended remedial alternative and identifies the next steps to implement the selected approach.

2.0 SITE STATUS

Soil and groundwater investigations conducted for this Site provide comprehensive details for evaluating the extent and distribution of petroleum hydrocarbon concentrations in the soil and groundwater beneath the Site. It is not the intention of this CAP to document all activities performed on the Site; rather focus on the Site conditions important to the selection of an appropriate remedial action for the Site. Prior reports and correspondence will be cited, as appropriate, to provide a link to the original source of information being discussed.

2.1 Site Location and Description

The Site is currently vacant and consists of an approximately 1-acre lot located at 359 Main Street in an industrial section of Fortuna, California. The Site is bordered to the north by Main Street, to the south by the Northwest Pacific Railroad tracks, to the east by vacant land, and to the west by a former Chevron bulk plant. The former Chevron bulk plant is on file with the NCWB as a closed case. The Site is situated in the northern portion of the Eel River Valley (refer to Site Location Map, **Figure 1-1**). The pertinent site features are depicted on the Site Plan, **Figure 1-2**. According to previous reports, the Site was utilized as a bulk storage facility from approximately 1924 through 1984. Petroleum impacts were detected when subsequent site owners were redeveloping the site in 1988. Since 1988 several subsurface investigations, corrective action plans, remedial action plans, and feasibility studies have been performed.

2.2 Site History

While under Unocal's ownership, five aboveground storage tanks (ASTs) were located on site. Based on information from previous reports, four of the ASTs had capacities of 19,450 gallons each, and one had a capacity of 20,270 gallons. Kerosene, diesel fuel, and regular and unleaded gasoline were stored in these tanks. Reportedly, petroleum products were distributed from the AST area through an underground product piping system to two truck loading racks and a truck loading area associated with the on-site warehouse. Bulk loads of fuel were delivered to the site by rail, with a dedicated rail spur located in the southwestern portion of the Site.

Gasoline and diesel-related constituents have impacted the soil and groundwater at the Site as a result of two documented releases in 1974 and 1978 and from suspected miscellaneous releases due to the use of the property as a bulk storage facility. The volume of gasoline released in 1974 was estimated at 1,000 gallons and was due to an overfill event. In addition, another release of petroleum hydrocarbons was reported and documented in 1978. On January 17, 2003, personnel at the NCWB provided SCS of Dublin, California (Unocal's environmental consultant at the time) with information regarding two incidents relating to the Site that reportedly took place in 1978. Apparently, the Fortuna Department of Public Works determined that two explosions that occurred at a bowling alley and the North Main Street lift stations on February 11 and 19, 1978 were related to gasoline vapors emanating

from the Unocal site along sewer lines beneath Main Street. Following investigations on the Unocal property, a leak was discovered and repaired in a gasoline product line approximately 20 to 30 feet east of the retaining wall surrounding the former AST area. The volume of gasoline released from this leaking line is unknown.

In the late 1980s, the ASTs and associated appurtenances were removed from the site. With the redevelopment of the Site, the discovery of hydrocarbon impacts to soil beneath the site was reported to regulatory agencies. Subsequently, Unocal and the site owner at the time received a letter response from the NCWB, dated August 15, 1990. This letter notified the two respective parties that a hydrogeological assessment was required at the Site to evaluate the possible impacts to groundwater from an apparent release of hydrocarbons to soil previously discovered on site during site construction activities. As a result of this letter and subsequent on-site investigation activities, approximately 2,700 tons of impacted soil were removed and disposed off site between 1997 and 2000.

2.2.1 Well Installation and Groundwater Sampling – 1991

In response to the request from the NCWB for a subsurface site investigation, Applied Geosystems, Inc. (Applied Geosystems), of Rancho Cordova, California, performed a limited hydrogeologic investigation in March 1991. This hydrogeologic investigation involved the installation of six soil borings (B-1 through B-6) which were subsequently completed as groundwater monitoring wells (MW-1 through MW-6).

As part of this investigation, soil samples were collected for visual and olfactory inspection at 5-foot intervals during installation. Boring B-1 was advanced to 39 feet below surface grade (bgs) and borings B-2 through B-6 were advanced to depths ranging from 21 to 26 feet bgs. Soil cuttings generated during advancement of the borings were stockpiled on site for off-site disposal. Soil samples collected from 5 and 10 feet bgs from each boring were submitted for laboratory analyses of total petroleum hydrocarbons as gasoline (TPHg) and TPH as diesel (TPHd) by EPA Method 8015, and for benzene, toluene, ethylbenzene and xylenes (BTEX) by EPA Method 602. In addition, the samples collected from 10 feet bgs in borings B-1 and B-4 were analyzed for organic lead.

Laboratory analytical results indicated concentrations of TPHg and TPHd less than or equal to 15 parts-per-million (ppm) and 88 ppm, respectively in borings with the exception of the sample submitted from boring B-5 from a depth of 10 feet bgs. This sample, which was collected downgradient of the former AST area, exhibited concentrations of TPHg (290 ppm) and TPHd (310 ppm). Total concentrations of BTEX were detected at levels ranging from below laboratory detection limits (BDL) in boring B-2 to 61 ppm in boring B-5 (10 feet bgs). Concentrations of organic lead were not detected in any of the soil samples submitted for analysis.

On March 26, 1991, Applied Geosystems measured depths to water in the newly installed wells and collected groundwater samples for laboratory analyses. Depth to groundwater was approximately 5-10

feet bgs in the shallow wells and 23.7 feet bgs in the deep well (MW-1). Groundwater was observed to flow in a southwesterly direction. Prior to sample collection, the wells were purged and examined for presence of separate-phase hydrocarbons (SPH). No SPH was observed in any of the site wells. Groundwater samples were collected from wells MW-1 through MW-6 for analyses of TPHg and TPHd by EPA Method 8015, and for BTEX by EPA Method 602. Laboratory analytical results indicated concentrations of TPHg ranging from BDL in well MW-2 to 64,000 parts-per-billion (ppb) in well MW-5 and total concentrations of BTEX ranging from BDL in well MW-2 to 53,000 ppb in well MW-5. Concentrations of TPHd were not detected in any of the groundwater samples submitted for analysis.

Based on the results of the investigation conducted by Applied Geosystems, groundwater beneath the Site was apparently impacted with dissolved gasoline hydrocarbons. Applied Geosystems indicated that the impacts appeared to be attributable to two on-site areas: the area surrounding the truck loading rack and the AST complex.

2.2.2 Soil and Groundwater Investigation and Well Installation – 1992

Between June 23 and July 1, 1992, RESNA Industries (RESNA), of Rancho Cordova, California, provided oversight for the installation of 21 soil borings (B-7 through B-15 and B-17 through B-22), four of which were completed as monitoring wells. Proposed boring B-16 was not advanced as a result of the proximity of overhead lines. Drilling activities were performed by Groundwater Resources, Inc. (GRI) of Bakersfield, California. Borings B-10 through B-15, B-17 through B19, B-21 and B-22 were completed on Site, while borings B-7, B-8, B-9 and B-20 were completed off site. Borings were advanced to depths ranging from 8.5 to 26 feet bgs. Borings B-7, B-8, B-9 and B-20 were completed as groundwater monitoring wells MW-7 through MW-10, respectively. In addition, eight borings (HP-2 through HP-9) were advanced to the off-site water table using Hydropunch technology in order to collect soil and groundwater samples.

Soil samples were collected during soil boring advancement for visual and olfactory inspection and possible submittal for laboratory analysis. Soil cuttings generated during advancement of the borings were stockpiled on-site for off-site disposal. A total of 24 soil samples were collected from various depths from the soil borings. These soil samples were submitted for laboratory analysis of TPHg and TPHd by EPA Method 8015, and for BTEX by EPA Method 602. Select samples were also analyzed for Volatile Organic Compounds (VOCs) by EPA Method 8240 and/or Organic Lead.

Laboratory analytical results indicated concentrations of TPHg in soil samples submitted from borings B-10 through B-14, and B-17 through B-22, ranging from 1.5 ppm (B-11 at 13.5 feet) to 60,000 ppm (B-17 at 12 feet). No concentrations of TPHg were detected in soil samples submitted from borings B-7 through B-9 and B-15. Concentrations of BTEX were detected in borings B-10 through B-15, B-17 through B-19, B-21, and B-22; the highest of which was detected in boring B-17 at a depth of 12 feet bgs. Concentrations of TPHd were detected in soil samples submitted from borings B-7 through B-9 and B-17 through B22, ranging from 1.6 ppm (B-20 at 10.2 feet) to 2,200 ppm (B-22 at 4 feet).

Soil was collected from three of the Hydropunch borings (HP-2, HP-3 and HP-9) and submitted for laboratory analysis of TPHg and TPHd by EPA Method 8015, and for BTEX by EPA Method 602. Laboratory analytical results of soil samples submitted from the Hydropunch borings did not indicate concentrations of TPHg, TPHd or BTEX above laboratory method detection limits with the exception of the soil sample submitted from boring HP-3 from a depth of 10 feet bgs. This sample indicated concentrations of TPHg at 16 ppm.

Groundwater samples collected from Hydropunch borings HP-2 through HP-9 were also submitted for analysis of TPHg and TPHd by EPA Method 8015, and for BTEX by EPA Method 602. In the June/July 1992 sampling event, concentrations of TPHg were detected in groundwater submitted from wells MW-1 and MW-3 through MW-6 and Hydropunch boring HP-3 at concentrations ranging from 50 to 72,000 ppb. Concentrations of TPHg were not detected in groundwater submitted from upgradient and/or off-site wells MW-2 and MW-7 through MW-10 or Hydropunch borings HP-2 and HP-4 through HP-9. The highest concentrations of TPHg were detected in wells MW-4 and MW-5, located in the vicinity of the former AST area. Concentrations of BTEX were detected in wells MW-1 through MW-6 and Hydropunch boring HP-3. The remaining groundwater samples did not exhibit concentrations of BTEX above laboratory method detection limits. Concentrations of TPHd were detected in groundwater collected from wells MW-1, and MW-3 through MW-6 and borings HP-2 through HP-5, ranging from 120 to 12,000 ppb. TPHd was not detected in any of the remaining samples. The highest concentrations of TPHd were detected in wells MW-4 and MW-5, located in the vicinity of the former AST area.

RESNA indicated that the highest concentrations of gasoline constituents appeared to be located downgradient of the abandoned product piping lines and the highest concentrations of diesel constituents appeared to be located downgradient of the product lines and AST area.

2.2.3 Quarterly Groundwater Monitoring – 1991 through the present

According to various reports, quarterly groundwater monitoring events were conducted at the Site beginning with monitoring wells MW-1 through MW-6 since March 1991 and MW-7 through MW-10 since July 1992. Prior to groundwater sample collection, the wells were purged and examined for the presence of SPH. SPH was detected periodically in wells MW-4 (0.02 to 0.08 feet) and MW-5 (0.01 to 0.25 feet). As part of the groundwater monitoring activities, the groundwater samples were submitted for analysis of TPHg and TPHd by EPA Method 8015, and for BTEX by EPA Method 602. The laboratory results of these groundwater monitoring events are summarized in **Table 2-1**. According to the groundwater data reviewed, concentrations of gasoline and diesel range compounds have fluctuated over time with an overall trend suggesting no significant change, despite the excavation activities conducted on the Site. The exception is that measurable SPH has not been observed in on-site wells since 2000. SCS did report, however, the presence of measurable SPH during their soil and groundwater investigation in 2002 in the vicinity of well MW-4. Therefore, isolated pockets of SPH may be present in the vicinity of MW-4.

2.2.4 Biotreatability Investigation – 1992

On November 15, 1992, RESNA collected soil samples from impacted areas of the site via hand-augering. The soil samples were collected as part of a biotreatability investigation, and were analyzed for baseline physiochemistry parameters, microbial enumeration and composition, preliminary biodegradation screening, effects of pH, temperature and hydrogen peroxide, effects of nutrient additives, synergistic/antagonistic effects, and specific-degrader identification and characterization.

Groundwater modeling was also performed using finite difference grid software and data from slug tests. Three scenarios were evaluated: extracting groundwater from a single well, from two wells and from a trench. Results indicated that the maximum estimated extraction rate from a single well was 0.3 gallons per minute (gpm), from two wells was 0.2 gpm per well, and from the extraction trench was 0.32 gpm. Resultant capture zones predicted by the model were insignificant.

Based on the results of the biotreatability investigation and groundwater modeling, RESNA found that biostimulation methods would be efficient at cleaning the residual petroleum impacts at the Site. However, a significant increase in permeability of the soils would be required for successful in-situ treatment at the site.

2.2.5 Vapor Extraction and Air Sparge Field Demonstration – 1993

In July 1993, Unocal Corporate Environmental Remediation and Technology (C.E.R.T.) and RESNA performed a field demonstration of air sparging, hydraulic fracturing, and vapor extraction technologies.

Between July 6 and 9, 1993, three horizontal wells were installed at the Site, one of which was installed in a hydraulic fracture generated by a soil boring in three places. Horizontal wells were installed by UTILX using FlowMole technology, a fluid jet cutting system. Air sparge horizontal well HB-1 consisted of 50 feet of unslotted 2-inch PVC casing, followed by 60 feet of casing drilled with 1/16-inch diameter holes at 4-inch intervals The two vapor extraction wells (HB-2 and HB-3) were constructed of 12 feet of unslotted 2-inch PVC casing on either end with 50 feet of 0.01-inch slotted casing in the center. Vapor extraction horizontal well HB-2 was fractured in three places, whereas horizontal vapor extraction well HB-3 was unfractured.

On July 12 and 13, 1993, twelve soil-gas monitoring points (VW-1 through VW-12) were installed at the Site to a depth of eight feet bgs in the vicinity of the newly installed sparge and extraction wells. Between July 26 and 28, a soil gas survey and soil vapor extraction/air sparge (SVE/AS) test was performed. Results of the air sparge test indicated that the sparge well had a radius of influence of approximately 9 to 20 feet at the west end and midpoint of the fractured well; however, the flow was not evenly distributed at the western end of the well. Significant mass transport of hydrocarbons from the groundwater to the soil vapor was observed during the test, however, as a result of the short

duration of the test, biodegradation of the hydrocarbons was not observed. Results of the vapor extraction test indicated that air flow increased by an average of 22 times, and VOC removal increased by 35 times in the fractured well compared to the unfractured well. An average radius of influence of 15 feet was observed in the fractured SVE well and a radius of three feet was observed in the unfractured SVE wells.

RESNA concluded that hydraulic fracturing increased permeability near the well, however, the fracture density was low. Furthermore, RESNA concluded that even though fracturing increased the rate of extraction, the volume (mass) of VOC removal was insufficient to allow for SVE to be an economically viable remedial technology at the site. However, in conjunction with bioremediation, it was suggested that this approach may be feasible. Additional longer-term testing was recommended.

2.2.6 Biovent Test Results - 1994 through 1995

Between October 1994 and February 1995, Pacific Environmental Group, Inc. (PEG) of San Jose, California conducted a biovent test at the Site in order to 1) evaluate the feasibility of bioventing at the site and 2) estimate the biodegradation rates in the vadose zone beneath the site.

As part of the biovent test, ambient air was injected into the vadose zone via monitoring well MW-2, horizontal well NF-A, horizontal air sparge well SP-B and fracture well F-C. Upon terminating the air injections, oxygen utilization was monitored. Monitoring of parameters affecting biodegradation was conducted prior to the biovent test (baseline) on September 29 and October 1 and 2, 1994 and periodically following the test. The parameters monitored included air flow and pressure; soil vapor and groundwater hydrocarbon concentration; dissolved oxygen concentration; groundwater elevation; and soil vapor oxygen concentration. Carbon dioxide concentrations were not monitored during these tests.

Results of the biovent test indicated that hydrocarbon degradation did occur in the vadose zone during the test period. Soil vapor hydrocarbon concentrations initially increased following air injection, which was explained by some of the vapor phase hydrocarbons migrating due to the testing. Furthermore, dissolved hydrocarbons were being effectively stripped from the groundwater in the vicinity of the sparge well and dissolved oxygen levels increased in this area.

The biovent test to determine oxygen utilization rates was conducted between November 9 and 19, 1994. Results indicated that biodegradation of hydrocarbons was likely occurring at the Site, compared to background levels, with the highest degree of oxygen utilization occurring in the area of highest hydrocarbon concentrations.

2.2.7 Off-site Soil and Groundwater Assessment, Chevron Property - 1995

On August 22, 1995, PEG oversaw the advancement of three soil borings (G-1, G-2 and G-3) via direct-push methodologies in the northeastern portion of the former Chevron bulk plant, abutting the Site to the west. The borings were installed to a depth of 20 feet bgs with soil samples collected from each boring at depths of 7 and 16 feet bgs. Groundwater was encountered in the borings at approximately 18 feet bgs. Groundwater samples were collected from each boring following installation. SPH was not observed on the groundwater table in any of the borings. The soil and groundwater samples were submitted for laboratory analyses of TPHg, TPHd, and BTEX. Laboratory analytical results indicated concentrations of gasoline and diesel constituents in soil and groundwater collected from the three borings.

In addition, figures attached to the PEG report (PEG, October 1995) summarizing the results of the soil boring investigation indicated the presence of several wells located on the Chevron property not previously discussed in any of the reports provided to ENSR for review. Notes on the figures indicated that these wells were designated M-1 through M-4 by Chevron and were located in the western portion of the property. Additional notes indicated that groundwater was collected for analysis from these wells on March 21, 1994. Concentrations of gas and diesel compounds were not detected above laboratory detection limits in wells M-1 and M-2. Concentrations of TPH-g were detected in wells M-3 and M-4 (200 ppb and 130 ppb, respectively). Concentrations of TPH-d were detected in well M-4 (280 ppb). Two piezometer wells, designated PZ-1 and PZ-2 were identified in the center of the subject site; however, no additional information regarding these piezometers was identified.

2.2.8 Off-site Soil and Groundwater Investigation, Friedenbach property - 1996

On April 15, 1996, PEG conducted an assessment of soil and groundwater quality on the Friedenbach property, which is abutting the former Unocal property to the east. This investigation was performed in response to a request from the NCWB. Four soil borings (GP-1 through GP-4) were advanced via direct-push methodologies during this assessment. The borings were installed to a depth of 10 feet bgs with soil collected from each boring at depths of 5 and 10 feet bgs. Groundwater was encountered in the borings between 6 and 9 feet bgs. Groundwater samples were collected from each boring following installation. SPH was not observed on the groundwater table in any of the borings. The soil and groundwater samples were submitted for laboratory analyses of TPHg, TPHd, BTEX, and total recoverable petroleum hydrocarbons (TRPH). In addition, on April 23, 1996 a groundwater sample was collected from monitoring well MW-2 on the Unocal property, which had previously been obstructed due to piping associated with the biovent test.

Laboratory analytical results for soil indicated concentrations of TPHg at 10 feet bgs in boring GP-1 at 12 milligrams per kilograms (mg/kg). TPHg was not detected in any of the remaining soil samples. Concentrations of BTEX were not detected in any of the samples, with the exception of the sample submitted from boring GP-1 at 10 feet bgs in which trace concentrations of ethylbenzene and total

xylenes were detected. Concentrations of TPHd were detected in samples at concentrations between 1.3 and 6.2 mg/kg. Concentrations of TRPH were only detected in boring GP-3 at a maximum concentration of 160 mg/kg.

Laboratory analytical results for groundwater collected from the borings indicated TPHg and BTEX constituents were only detected in groundwater collected from boring GP-4. Concentrations of TPHd were detected in the groundwater samples submitted from borings GP-1, GP-3, and GP-4 at levels ranging from 53 to 670 μg/L. Concentrations of TRPH were not detected in any of these samples.

Based on the results of the soil and groundwater investigation, it was the opinion of PEG that the impacts detected on the Friedenbach property were not related to the Unocal release. This conclusion was based on three opinions. First, the Friedenbach property was located upgradient to cross-gradient from the former Unocal property. Second, according to the laboratory reports, the diesel-range hydrocarbons detected "do not appear to be related to diesel impact" and therefore, were most likely due to a localized source area on the Friedenbach property. No additional documentation supporting this statement was provided. Third, the gasoline related impacts detected in groundwater were low to below detectable limits and might be attributed to a source area on the Friedenbach property, or, if they have migrated from the Unocal property, they were detected only in well GP-4 at 430 μg/L TPHg. In the opinion of PEG, at the time of investigation these concentrations delineated the edge of the plume. The NCWB, however, did not agree with the conclusions of PEG and requested the installation of additional wells or borings in the vicinity of monitoring well MW-3 prior to site closure.

Laboratory analytical results for groundwater collected from well MW-2 on the Unocal property indicated concentrations of TPHd only, at 63 μg/L. The remaining analyzed constituents were not detected above laboratory detection limits.

2.2.9 Product Recovery – 1996

Unocal reportedly installed product recovery skimmers in wells MW-4 and MW-5 in early 1996 in order to remove SPH previously observed in the wells. However, as of August 1996, the skimmers had not accumulated a measurable amount of product.

2.2.10 Soil Excavation – 1997

As part of a Remedial Action Plan (RAP) prepared for the Site, PEG recommended the excavation and treatment of impacted soil exhibiting concentrations of TPH greater then 250 ppm to a depth of 3 feet bgs in the shallow excavation areas and a depth of 13 feet bgs in the deeper excavation areas. Additionally, PEG recommended the installation of lateral perforated piping, crushed rock, and a geotextile liner in the deeper excavations in preparation for possible air/biosparging. As a threshold segregation level for the excavation activities, a target soil level of 250 ppm for TPH for on-site soils

was proposed in the RAP. Cleanup criteria other than background levels have not yet been determined for the Site.

In July 1997, PEG oversaw the excavation activities presented in the RAP. B&T Service Station Contractors excavated the designated on-site areas. Soil samples were collected during excavation activities for analysis of total purgeable petroleum hydrocarbons calculated as gasoline (TPPH-g), total extractable petroleum products calculated as diesel (TEPH-d), BTEX and total lead. The following is a summary of observations from each specific excavation area.

Aboveground Tank Area (A-1 and A-2) – The AST area excavation was completed in the vicinity of the former AST area and well MW-4.

Area A-1: Since the shallow soils of Area A-2, which was located within the south side of Area A-1, did not exhibit olfactory or visual indications of petroleum impacts, the proposed shallow excavation Area A-1 was not performed as proposed in the RAP.

Area A-2: The final dimensions of excavation Area A-2 were approximately 22 feet by 21 feet by 13 feet deep. A total of five soil samples (four from the sidewalls and one from the base of the excavation) were collected for laboratory analyses. Laboratory analytical results indicated that confirmatory soil samples exhibited concentration of TPPH-g and TEPH-d less than 250 ppm, with the exception of sample A2E1-6 which exhibited a concentration of TEPH-d at 330 ppm.

Product Line Area (B-1, B-2 and B-3) – The product line excavation was completed in the vicinity of the former product piping lines and consisted of shallow trenches (Area B-1) and two deep excavations in the unloading area (B-2) and the truck loading rack area (B-3).

Area B-1: The final dimensions of Area B-1 were approximately 10-feet wide by 85-feet long by 3 feet deep. One sidewall and one base confirmatory soil sample were collected from the excavation for laboratory analysis. Concentrations of TPPH-g and TEPH-d were below 250 ppm. No visual evidence of petroleum impacts was observed.

Area B-2: The final dimensions of Area B-2 were approximately 27 feet by 18 feet by 12 feet deep. Visual and olfactory evidence of petroleum impacts were observed at depth in the excavation; therefore a portion of the excavation was extended to 16.5 feet deep. However, as a result of on-site constraints, the majority of the excavation was limited to 12 feet deep. A total of six confirmatory soil samples were submitted from the limits of the excavation. The soil samples exhibited concentrations of TPPH-g and TEPH-d less than 250 ppm, with the exception of sample B2S1-7 which exhibited concentrations of TPPH-g at 320 ppm and TEPH-d at 520 ppm.

Area B-3: The final dimensions of Area B-3 were approximately 43 feet by 43 feet by 12 feet deep. Five of the eight confirmatory soil samples analyzed from Area B-3 exhibited concentrations of TPPH-g

and/or TEPH-d greater then 250 ppm. However, as a result of limited stockpile area, the excavation was not extended.

Furthermore, heavy visual and olfactory indications of petroleum impacts were observed in an area just south of Area B-1. It was unknown whether this area had been impacted by a new release or was a merely an extension of Area B-1. However, this area was not investigated further.

Rail Spur Area *(C-1 and C-2)* – The former railroad spur line was excavated in two areas.

Area C-1: The final dimensions of Area C-1 were approximately 10 feet by 120 feet by 3 feet deep. Two soil samples were collected from the northern portion of the trench which exhibited no concentrations of TPPH-g or TEPH-d above 250 ppm. Five sidewall samples and three base confirmatory soil samples were collected from the southern portion of the trench. Concentrations of TPPH-g were not detected above 250 ppm in any of the samples. However, four samples contained concentrations of TEPH-d above 250 ppm (250 ppm to 7,500 ppm).

Area C-2: The final dimensions of Area C-2 were approximately 22 feet by 18 feet by 13 feet deep. A total of five confirmatory soil samples and one excavation pit water sample were collected from the excavation. Three of the sidewall samples exhibited concentrations of TPPH-g and/or TEPH-d greater than 250 ppm. The other two soil sample results were below 250 ppm. The excavation pit water sample exhibited concentrations of TPPH-g (180 ppb) and TEPH-d (1,100 ppb).

Soils removed from the excavations were placed into a treatment pile. The pile was placed on, and covered by, plastic. This pile was constructed to allow for the on-site treatment of the soil via vapor extraction. Following treatment, the soils were intended for use as backfill in the excavations. However, as reported in historical documents, the excavated and stockpiled soils were eventually transported for off-site disposal.

Confirmatory soil samples indicated that residual petroleum impacts were present in some of the excavations, which would require further treatment. These areas were identified as the southwestern portion of Areas C-1 and C-2 and beyond the north and east sidewalls of Area C-2; beyond the south and west sidewalls and beyond the southern part of the east sidewall of Area B-3; and beyond the south sidewall of Area B-2, across the southern part of Area B-1 and into the potential new source area. Based upon subsequent report, these soils were eventually transported for off-site disposal.

2.2.11 Soil Boring Investigation – 1998

In an effort to further delineate residual petroleum impacts at the Site, a soil boring survey was conducted on August 4 and 5, 1998 during which 24 soil borings (HA-1 through HA-24) were advanced at the site via a combination of handheld drilling, hand-augering and/or a hollow stem auger drill rig, to

depths ranging from 3 to 26 feet bgs. Eel River Drilling of Fortuna, California conducted the drilling activities under the oversight of PEG. Soil samples were collected at varying depths in each boring.

Soil samples were submitted for analysis of TEPH-d with a silica gel cleanup. Concentrations of TEPH-d ranged from 2.6 to 2,700 mg/kg. Additionally, five soil samples were subjected to leachability testing in accordance with the procedures identified in EPA Method 1312. The leachate obtained from this leachability testing was analyzed for TEPH-d. The concentrations of TEPH-d in the leachate obtained from the soil samples ranged from BDL to 1,500 µg/L. Based on the soil analytical results, PEG determined that the lateral extent of TEPH-d in soil beneath the site had been defined to below the excavation threshold of 250 ppm with the exception of the vicinity of the potential new source area. Working area constraints related to the treatment stockpile location resulted in the southern extent of the new source area not being defined.

PEG also submitted several soil samples from the treatment stockpile for analysis to determine if cleanup objectives had been met. Although the majority of the samples exhibited concentrations that met cleanup objectives, PEG recommended that the soil pile continue to be treated through the winter months.

2.2.12 Additional Soil Excavation - 2000

On May 17, 2000, after IT Corporation (IT) purchased PEG, additional on-site excavation activities were performed. Two additional areas were excavated, one area was in the vicinity of well MW-5 and the second excavation area was located in the vicinity of the former warehouse area north and east of well MW-1.

The excavation activities performed around well MW-5 involved the excavation of an exploratory trench that surrounded MW-5 approximately 10 to 15 feet out from the well. The final dimensions of this exploratory trench were approximately 30 feet long by 4 feet wide and 12 to 15 feet deep. Based on visual observations of this trench, petroleum impacts were not observed in the sidewall nor bottom soils. A small amount of SPH was observed on infiltrating water that briefly entered the eastern portion of the trench. However, the SPH dissipated after several hours. Approximately 200 cubic yards of soil were removed from this excavation.

The final dimensions of the excavation in the vicinity of the warehouse were approximately 34 feet by 46 feet by 13 feet deep. In addition, a small excavation was completed west and south of well MW-1 to a depth of 4 feet bgs. Excavations were continued until visual and olfactory indications of petroleum impacts dissipated. Approximately 788 cubic yards (~1,100 tons) of soil were removed from these two excavations.

A total of 13 confirmatory soil samples were submitted for TEPH-d, BTEX, and lead analysis from the sidewalls and/or base of the excavations. Concentrations of TEPH-d were detected up to 300 mg/kg,

BTEX was detected up to 5.4 mg/kg, and lead was detected up to 140 mg/kg in these soil samples. All excavated soil was stockpiled and covered by plastic sheeting, and a bioventing system was installed similar to the previously excavated larger soil stockpile.

A residual layer of potentially impacted soil two to four feet thick near the surface remained along the west, east, and southwestern portions of the warehouse excavation area. Additionally, a layer approximately one to three feet thick was observed to have a moderate petroleum odor. A series of investigatory test pits were dug in these questionable areas in order to inspect soil for visual and olfactory indications of petroleum impacts. The first pit (ET-1) was excavated approximately 10 feet east of the eastern sidewall of the excavation. The second and third test pits (ST-1 and ST-2, respectively) were excavated approximately 25 and 50 feet south of the southern sidewall of the excavation. Test pits were completed to approximately two feet bgs. Soils were dark gray/black in this area; however, petroleum odor was only noted in the upper 12 inches of pit ST-1. Soil samples from the test pits submitted for laboratory analyses indicated the presence of TEPH-d in each of the three samples (between 2.9 and 130 ppm in each sample), however, at concentrations that were below the cleanup objectives. TPPH-g was not detected in any sample above laboratory method detection limits. Low levels of BTEX were detected in pit ST-1. Based on the laboratory analytical results, soils from this area were left in place.

2.2.13 Soil Removal and Excavation Backfill - 2002

In 2002, SCS took over consulting activities from IT. Based on laboratory analytical results of the on-site treatment stockpile and subsequent conversations with the NCWB, SCS determined that the treatment stockpile soils were inappropriate to be used as backfill and the excavations should be backfilled with clean material. These activities were conducted in April 2002, and approximately 1,600 tons of the petroleum impacted soil was removed from the site on April 19, 2002.

2.2.14 Soil Boring Investigation – 2002

On November 4 and 5, 2002, SCS oversaw the advancement of 11 Geoprobe soil borings (SS-1 through SS-11) in the northwestern portion of the Site for the purpose of investigating the source of SPH observed in a well upgradient of the former AST area. The Geoprobe survey was conducted by Fisch Environmental Exploration Services of Valley Springs, California. Borings were advanced to a depth of 27 feet bgs. Soil samples were collected from approximate five-foot intervals in each boring with a plastic sleeve sampler. A total of 32 soil samples were submitted for analysis of TPH-g, TPH-d and VOCs by EPA Method 8260B. Groundwater was generally encountered in the borings at depths greater than 20 feet bgs. Therefore, a total of 8 groundwater samples were collected from select borings that reached that depth and contained sufficient water for sampling (SS-1 through SS-4, SS-6, and SS-9 through SS-11) and submitted for analysis of TPH-g, TPH-d and VOCs by EPA Method 8260B. The sample collected from boring SS-8 exhibited evidence of SPH present on the water table; therefore, it was not submitted for laboratory analysis.

Laboratory analytical results of soil indicated concentrations of TPH-g between 1.6 and 3,300 mg/kg and TPH-d between 1.4 and 610 mg/kg. VOCs were also detected in each of the 11 locations, with the highest concentrations in samples collected from borings SS-3, SS-6, SS-8 and SS-9 at depths of 15 to 20 feet bgs.

Laboratory analytical results of groundwater indicated the presence of petroleum constituents in eight samples submitted for analysis. The highest concentration of TPH-g was observed in the sample submitted from boring SS-9 (380,000 micrograms per liter [μg/L]), and the highest concentrations of TPH-d (360,000 μg/L) were observed in the samples submitted from boring SS-3.

Five groundwater samples and seven soil samples were also submitted for analysis of bioremediation parameters. Generally, analytical results indicated the presence of biological activity in substrate beneath the site.

2.2.15 Additional Groundwater investigation and Well Installation – 2003

Between May 12 and 16, 2003, SCS oversaw the advancement of 13 borings (SS-12 through SS-24) and the installation of three monitoring wells (MW-13 through MW-15). This soil investigation was performed for several reasons:

- SCS had reason to believe that the deeper groundwater level observed in MW-1 represented a deeper water bearing zone than monitored in the other site wells. Therefore, part of this investigation was to characterize the groundwater conditions of this deeper zone;
- Characterize groundwater conditions in the central portion of the Site;
- Assess soil and groundwater conditions along utility lines beneath Main Street;
- Evaluate soil and groundwater conditions along the southern boundary of the Site; and
- Further evaluate soil and groundwater condition in the vicinity of the Site's septic tank and former product lines.

Well MW-13 was completed to a depth of 18.5 feet bgs, whereas wells MW-14 and MW-15 were completed to a depth of 39.5 feet bgs using a combination of Geoprobe direct push methodologies and hollow-stem auger. Soil samples were collected at three-foot intervals between 10 and 20 feet bgs in well MW-13 and between 20 and 40 feet bgs in wells MW-14 and MW-15. Well MW-13 was screened between 13.5 and 18.5 feet bgs and wells MW-14 and MW-15 were screened between 34.5 and 39.5 feet bgs.

Additionally, 13 soil borings (SS-12 through SS-24) were installed using Geoprobe direct push methodologies. Soil samples were collected continuously throughout the borings to a depth of 20 feet

bgs. Borings SS-12 through SS-16 were advanced north of the Site in Main Street, borings SS-17 through SS-21 were advanced in the vicinity of the former product lines, and borings SS-22 through SS-24 were advanced along the southern boundary of the Site. Eighteen soil samples were submitted for analysis of TPH-g, TPH-d, and/or BTEX.

According to laboratory analytical results, concentrations of TPH-g ranged from 0.24 to 10,000 mg/kg, the highest concentration of which was detected in the sample submitted from boring SS-17 at a depth of 15 feet bgs. This sample also exhibited the highest concentrations of BTEX. Two soil samples were analyzed for TPH-d, both of which exhibited concentrations of 2.5 mg/kg.

Grab groundwater samples were also obtained from the 13 soil borings and submitted for analysis of TPH-g, TPH-d, and/or BTEX. According to laboratory analytical results, concentrations of TPH-g were detected in groundwater submitted from borings SS-14, SS-15, and SS-17 through SS-23 at concentrations ranging from 940 to 230,000 μg/L. The highest concentration was observed in the sample collected from boring SS-20. The remaining samples did not exhibit concentrations of TPH-g. Concentrations of TPH-d were detected in submitted samples between 82 and 72,000 μg/L with the exception of SS-13, where concentrations of TPH-d were below laboratory detection limits. The highest concentration of TPH-d, benzene and toluene were detected in the sample submitted from boring SS-17.

2.2.16 Quarterly Groundwater Monitoring Events – 1990s through 2003

According to various reports, quarterly groundwater monitoring events were conducted at the site throughout the 1990s. The laboratory results of these groundwater monitoring events are summarized in **Table 2-1**. According to the groundwater data reviewed, concentrations of gasoline and diesel range compounds have fluctuated over time with an overall trend suggesting no significant change, despite the excavation activities conducted on the Site. The exception is that measurable SPH has not been observed in on-site wells since 2000. SCS did report, however, the presence of measurable SPH during their soil and groundwater investigation in 2002 in the vicinity of well MW-4. Therefore, isolated pockets of SPH may be present in the vicinity of MW-4.

2.2.17 ENSR Site Investigations – 2004 through 2005

ENSR conducted additional field investigations, beginning in December 2004, pursuant to the July 2004 work plan. The following investigation activities are described in further detail in the **Section 3.0**:

- Installation of 14 soil borings, in select locations on the Site, was completed in December 2004. Seven borings were completed as monitoring wells. Continuous soil samples were collected from each boring and select samples were submitted to the analytical laboratory for analysis of TPH-d, TPH-g, and BTEX compounds.

- In January 2005, a topographic survey was conducted on the site and monitoring wells location coordinates were recored.
- A bench-scale treatability test was conducted for the site's soil and groundwater.
- A multi-phase extraction pilot test was conducted on the site in March 2005.

Additionally, the most recent quarterly groundwater sampling event occurred on February 8, 2005 and the results are reported in **Section 4.0**.

2.3 Local Groundwater and Surface Water Use

Groundwater at the Site historically occurs between 3 and 14 feet bgs in the shallow zone with low yield. According to a letter from the NCWB, dated December 15, 2003, the shallow groundwater at the site has a designated beneficial use as a drinking water supply in the Water Quality Control Plan, North Coast Region.

According to previous reports, Fortuna is supplied by municipal water from three wells located on Eel River Drive, approximately 2 to 3 miles from the Site. Previous reports have also identified three domestic wells in Fortuna, however distances from the site were not provided. Reportedly, two of these wells are screened 200 feet below ground surface and the other well is screened at 65 feet below ground surface.

Based on the USGS topographic map for this area, the nearest surface water body is Rohner Creek, approximately 500 feet northeast of the Site. The Eel River is located approximately 600 feet to the southwest of the Site.

3.0 SOIL AND GROUNDWATER INVESTIGATIONS

Additional field investigations were conducted in 2004 and 2005 in accordance with the July 14, 2004 Work Plan/Response to Corrective Action Plan Comments as approved by the NCWB on August 31, 2004. The objective of the field work was to provide data to select the most feasible final remedial alternative for the Site by:

- better delineating the extent of residual source material;
- obtaining chemical and physical parameters for the site soils to assist in evaluating the appropriateness of in-situ chemical oxidation (ISCO) for the Site; and
- conducting a multi-phase extraction (MPE) pilot test to assess feasibility of this technology to remove SPH and impacted groundwater as well as treating impacted soils at and just below the static water table.

3.1 Soil Boring Activities

Prior to conducting soil boring activities, well permits were obtained from the Humboldt County Health Department. From December 20 through December 22, 2004, a geologist from ENSR observed Woodward Drilling Company of Rio Vista, California advance 14 soil borings (SB-1 through SB-7, MW-16A, MW-16B, and MW-17 through MW-21). Prior to drilling, each boring was cleared for utilities by hand digging to a depth of 5-feet. The borings were subsequently advanced using a truck mounted drill rig equipped with 8.25-inch or 16.25-inch diameter hollow stem auger. Soil borings MW-16A, MW-16B, and MW-17 through MW-21 were completed as monitoring wells. Borings were advanced to depths ranging from 20 to 40 feet bgs. The locations of the borings and wells are shown on **Figure 1-2**.

Soil samples were collected from each boring using a California modified split spoon sampler at a minimum of 5-foot intervals and at changes in lithology to the total depth of each boring. Materials encountered in the borings were logged using the Unified Soil Classification System (USCS) visual and manual methods, in accordance with ASTM Standard D2488-00. ENSR's use of the USCS visual and manual methods does not imply conformance with other related ASTM standards referenced therein. The intent of this field program was to field screen each soil sample for VOC levels with a portable photoionization detector (PID). However, complications with the PID instrument in the field resulted in soil screening VOC levels obtained by the PID not being considered valid. Soil boring logs containing USCS descriptions and other pertinent drilling information are included in **Appendix A**.

The soil borings were backfilled through a tremie pipe with neat cement grout from total depth of the boring to surface grade.

3.2 Monitoring Well Installation Activities

Deep groundwater monitoring wells MW-16B and MW-17 were installed with steel conductor casings to depths of 25 feet bgs. The casings were grouted in place using neat cement emplaced by a tremie pipe. Following a 24-hour minimum curing of the grout for the conductor casing, both wells were installed. The wells were constructed using 2-inch diameter, flush threaded, Schedule 40 PVC casing and 2-inch diameter Schedule 40 PVC 0.020 inch screen. The wells were placed to a total depth of approximately 40 feet bgs. The wells are screened from approximately 30 to 40 feet bgs. Number 2/12 Monterey sand filter pack was placed from the base of the borings to approximately two feet above the top of the well screen. A 3-foot thick bentonite seal was emplaced above each filter pack, and the remaining annular space was filled with neat cement grout to within 4-inches bgs. The top of each well was completed with a flush grade traffic rated vault box set in concrete. Well completion logs for wells MW-16B and MW-17 are presented in **Appendix A**.

Shallow groundwater monitoring wells MW-16A and MW-18 through MW-21 were constructed to total depths of approximately 20 feet bgs. The wells are screened from approximately 5 to 20 feet bgs. Well completion logs for wells MW-16A and MW-18 through MW-21 are presented in **Appendix A**. Groundwater monitoring wells MW-16A, MW-16B, MW-17 through MW-21 were developed by Blaine Tech Services, of Sacramento, California on January 12 and 13, 2005. Purge water was disposed of in accordance with local, state and federal regulations.

3.2.1 Soil Sample Analytical Results

Based on visual observations, proximity to the soil-water interface, soil type and professional judgment, select soil samples collected from the soil boring activities were submitted for laboratory analysis to California Laboratory Services (CLS) in Rancho Cordova, California under chain-of-custody protocol. The field observation data was reviewed by remediation engineers prior to sending out the final set of samples for analyses. Soil samples were analyzed for TPHd by EPA Method 8015M-DRO and TPHg by EPA Method 8015M-GRO; and BTEX using EPA Method 8021B.

The TPHd analytical results ranged from non-detect to 1,400 mg/kg in MW-18 at a depth of approximately 6 feet bgs. The TPHg analytical results ranged from non-detect to 330 mg/kg in SB-4 at approximately 12 feet bgs. The benzene ranged from non-detect to 2.6 mg/kg in SB-4 at approximately 12 feet bgs. The non-detect results are generally located at borings along the perimeter of the source areas. The analytical results for toluene, ethylbenzene and xylene were either non-detect or at low levels. Elevated concentrations were mainly detected in the northwest corner of the Site. The highest detected concentrations of TPHg, TPHd and benzene were at depths ranging from 10 to 18 feet bgs. Soil sample analytical results are summarized in **Table 3-1**, and copies of the laboratory analytical reports are included in **Appendix B**.

3.2.2 Well Survey

Groundwater monitoring wells MW-1 through MW-21 were surveyed by Morrow Surveying (a California licensed land surveyor) in accordance with State of California Assembly Bill AB2886 on January 13, 2005. The top-of-casing elevation, well road box elevation, and latitude and longitude were surveyed. Elevations were surveyed relative to mean sea level within 0.01 foot. Latitude and longitude were surveyed using North American Datum (NAD 83).

3.2.3 Investigation Derived Waste

Drilling activities generated approximately five cubic yards of soil cuttings. The cuttings were stockpiled on, and covered with, plastic sheeting for temporary, on-site storage. Four samples collected from the soil borings were selected based on results of highest concentrations of benzene and TPHg analytical results. These samples were re-analyzed by CLS for total lead using EPA Method 6010B. The soil drill cuttings were transported as non-hazardous waste within 90-days to an approved facility upon receipt of CAM-17 metals analysis as required by the disposal facility.

3.3 Bench-Scale Treatability Test

A bench-scale test was conducted on soil and groundwater samples collected from the December 2004 soil investigation activities. Portions of the samples obtained from the borings exhibiting the greatest potential contamination were composited together into one sample and utilized to test for the effectiveness of Fenton's reagent and un-activated and activated persulfate to achieve the clean-up criteria in the subsurface soils. The results from the treatability test indicated that both Fenton's reagent and persulfate could destroy petroleum hydrocarbons in the Site's soil and groundwater. The Fenton's reagent and activated persulfate affected several water quality parameters (chromium, iron, nickel, sulfate, and pH) while the un-activated persulfate affected a few parameters (sulfate and pH). The rate of reaction with the persulfate is anticipated to be slower than the Fenton's reagent, which could indicate that the oxidant will persist in the subsurface for a longer duration and allow for greater interaction/influence with the compounds present in the soil. Although the bench-scale test can potentially indicate the chemical-soil interactions, the practicality of field implementation would require further investigation. A pilot test at the Site would determine the feasibility of effectively delivering the oxidants to the impacted soil and groundwater. For further details refer to **Appendix C** for the report of findings.

3.4 Multi-Phase Extraction Pilot Test

A MPE pilot test was performed at the Site in March 2005. Prior to the pilot test, eight temporary, vapor, monitoring points, or piezometers (PZ-1 to PZ-8), were installed in February 2005 with a hollow stem auger rig and completed with a 1-inch diameter temporary polyvinyl chloride (PVC) well riser and well screen. Each of these temporary, monitoring points was installed to a maximum depth of 10 feet

below grade and completed with a five foot long 10-slot screen installed from 5 to 10 feet below grade. An existing shallow well (MW-4, screened 5-25 feet bgs) and a deep well (MW-1, screened 20-39 feet bgs) were utilized as extraction wells to perform the limited pilot test. Well construction logs of the temporary, vapor monitoring points are included in **Appendix A** along with the soil boring and monitoring well construction logs. Following the completion of the pilot test, the piezometers were destroyed on March 14, 2005.

Three activities were completed during the pilot test and consisted of: (1) a zero vacuum drawdown test (pump test), (2) a step test and, (3) a constant rate test. The results from the zero vacuum test indicated that groundwater could be extracted from the shallow and deep aquifers at a sustained rate between 1 and 1.4 gallons per minute (gpm) and induce a limited (less than 0.5 feet) cone of depression in the shallow aquifer up to 12 feet from the well, and a slight (less than 0.25 feet) cone of depression in the deeper aquifer at a distance of up to 8 feet from the well. No significant, sustainable airflow was measured and/or observed from either of the extraction wells during the completion of the step test.

Four vacuums (3 inches of mercury (in-Hg), 5 in-Hg, 7.5 in-Hg and 10 in-Hg) were selected for use during the vacuum step tests performed at each extraction well location. Airflows measured from MW-1 during the performance of the step test ranged from not measurable to 0.6 standard cubic feet per minute (SCFM). The airflow 0.6 SCFM was recorded while a vacuum of 10 in-Hg was being applied to the extraction well MW-1. A fifth vacuum, 13 in-Hg was applied to well MW-1 in order to assess whether greater vacuum was required in order to induce flow to the treatment unit. Airflows with the applied 13 in-Hg vacuum measured around 0.6 with an instantaneous maximum airflow of 0.86 SCFM.

The results from the step test performed at well MW-4 were slightly higher than the results from MW-1. Airflows ranging from 1 to 1.8 SCFM were measured during the MW-4 step test. A maximum air flowrate of 1.8 SCFM was recorded with an applied vacuum of 5.5 in-Hg at MW-4. Based on the information obtained during the step test, it appears that a limited radial influence could be expected for a distance up to 15 feet from the extraction well, with applied vacuums of 5.5 in-Hg or greater. A limited duration constant rate test was also performed at MW-4. The constant rate test was run at an applied vacuum of 10 in-Hg. Air flowrates recorded during the constant rate test ranged from 0.6 to 1.45 SCFM, however the average airflow sustained during the constant rate test was less than 1 SCFM.

Based on the results from the pilot test, specifically the limited amount of air flow that can be obtained from the native soils on site without any costly soil fracturing measures, MPE does not appear to be a feasible means to remove the residual contaminants present in the on-site soils. For additional details regarding the MPE pilot test, refer to **Appendix D** for the report of findings.

4.0 QUARTERLY GROUNDWATER SAMPLING

Groundwater sampling was conducted in February 2005 at monitoring wells MW-1 through MW-21. Refer to **Figure 1-2** for monitoring well locations. Depths to groundwater measurements were recorded, and groundwater elevation contour maps of the shallow and deep aquifer zones were constructed (**Figures 4-1** and **4-2**). On February 8, 2005, the groundwater flow direction was toward the south/southwest with a hydraulic gradient of approximately 0.02 feet per foot (ft/ft) in the shallow aquifer zone and generally towards the east (northeast to southeast) with a hydraulic gradient of approximately 0.0021 ft/ft in the deep aquifer zone. A summary of groundwater elevations measured to date is presented in **Table 2-1**.

Groundwater samples collected from monitoring wells MW-1 through MW-21 on February 8, 2004 were submitted for laboratory analysis to CLS under chain of custody protocol. Samples were analyzed for TPHd by EPA Method 8015M-DRO and TPHg by EPA Method 8015M-GRO; and BTEX using EPA Method 8021B. Refer to **Table 2-1** for the groundwater analytical results. Refer to **Appendix E** for the laboratory analytical reports.

The analytical results detected TPHd ranging from non-detect to 4,500 µg/L in MW-13, TPHg from non-detect to 32,000 µg/L in MW-4, and benzene from non-detect to 4,100 µg/L in MW-4. The concentrations of toluene, ethylbenzene and xylene were generally low except in wells corresponding with elevated benzene concentrations, generally in excess of 1,000 µg/L. In general, high concentrations of benzene, TPHd, and TPHg in the shallow aquifer zone are located in the northwest corner of the Site beginning at approximately MW-4 and extending southerly to MW-13. Refer to **Figures 4-3** and **4-4** for TPHg and benzene isopleths in the shallow aquifer zone.

Elevated concentrations of TPHg and benzene are present in the deep aquifer zone in MW-1 and MW-17; TPHd is only present at low levels (53 µg/L in MW-17 and 87 µg/L in MW-1) or is non-detect. Refer to **Figures 4-5** and **4-6** for TPHg and benzene isopleths in the deep aquifer zone. The concentrations in the deep overburden aquifer drop off more quickly than in the shallow aquifer.

During the February 2005 groundwater sampling event, SPH was not observed in any monitoring wells. Historic SPH thickness and removal data is presented in **Table 4-1**.

5.0 CONCEPTUAL MODEL AND EXTENT OF CONTAMINANT IMPACT

The following section discusses the evaluation of the results from investigation activities conducted to date to further delineate contaminant extent (LNAPL/source materials).

5.1 Geology and Hydrogeology

5.1.1 Geology

The site is situated in the northern portion of the Eel River Valley. Subsurface geology in the area includes quarternary-aged nonmarine alluvial fan deposits of siltstone, sandstone and mudstone that comprise the overlying marine terrace deposits of Hookton Formation. Underlying the alluvial fan deposits are marine and nonmarine overlap deposits of sands, silts and clays that comprise the Rohnerville Formation. Underlying the Rohnerville Formation are undivided sedimentary rocks (conglomerates, sandstones, siltstones, and mudstones) (Department of Mines and Geology Open-File Report 85-01).

Soil types encountered beneath the Site during subsurface investigations conducted to date consist of interbedded silts and clays (i.e., clayey silt, silty clay, silt) from ground surface to approximately 12 feet bgs with pockets of fill in select areas from ground surface to approximately 5 feet bgs; that is underlain by lenses of sandy silts, silts with sand, silty sand and sands to approximately 20 feet bgs; that is underlain by a layer of silts and clays to a depth of approximately 32 feet bgs; which is subsequently underlain by sand to the maximum depth explored to date of approximately 40 feet bgs. Refer to **Figures 5-1** through **5-3** for the geologic cross-sections.

Variations to the above detail are present in the southwest portion of the Site near MW-18/SS-22, where silty sands and silt and clays are present from ground surface to approximately 20 feet bgs and near MW-19 where silt extends from the ground surface to the top of the bottom silt and clay layer at approximately 30 feet bgs.

5.1.2 Hydrogeology

The geology at the Site as described above and illustrated on **Figures 5-1** and **5-3**, indicates there are two confined water bearing zones at the Site, a shallow and a deep zone. The shallow zone is present at the uppermost silty sand/sand/sandy silty lenses located from approximately 12 to 20 feet bgs. The deep zone is present at the bottom sandy layer located from approximately 32 to 40 ft bgs. Both layers are confined by the silt and clay layer overlying each sandy layer. During the most recent groundwater monitoring and sampling event performed on February 8, 2005, depth to shallow groundwater ranged

between 1 foot bgs in MW-7 and 9.28 feet bgs in MW-4 and flowed in a south/southwesterly direction at a gradient of 0.02 feet/foot. Depth to deep groundwater ranged between 19.56 feet bgs in MW-15 and 27.65 feet bgs in MW-16B and flowed in an east by northeast direction at an average gradient of 0.0021 feet/foot.

Historical data and recently obtained data on the Site indicate that the depth to shallow groundwater has ranged from approximately 3 to 14 feet bgs, and shallow groundwater has flowed in a south/southwest direction at an average gradient of 0.02 feet/foot. The depth to deep groundwater has ranged from approximately 20 to 28 feet, and the deep groundwater has flowed in a northeast direction at an average gradient of 0.0019 feet/foot. Historical groundwater monitoring and sampling data are included in **Table 2-1**.

Based on previous reports, (RESNA 1992) slug testing data from ten on-site monitoring wells produced an average hydraulic conductivity of 1.3 feet per day or 4.6×10^{-4} centimeters per second (cm/sec). In addition, flex wall permeability testing of soil samples collected in the vadose zone resulted in permeability values ranging from 1.5×10^{-7} to 2×10^{-8} cm/sec. In ENSR's opinion, the permeability values obtained through analytical testing are most likely indicative of actual conditions when compared against the slug test results. Limited groundwater modeling was performed, resulting in an anticipated flow of 0.3 gallons per minute, which is consistent with earlier reports of the Site.

5.2 Contaminant Distribution

5.2.1 Soil

Gasoline and diesel impacted soils are located on the northwest portion of the Site in the area of the former AST tanks and associated product lines and in two isolated areas on the southern portion of the Site. The isolated areas are located around MW-20 on the southeast side of the Site, around MW-18 on the southwest side of the Site, and around MW-5 on the northwest side of the Site. None of the isolated areas are located in the immediate vicinity of a former site structure. The area around MW-18 is impacted by diesel, and the areas around MW-20 and MW-5 are both impacted by gasoline and diesel fuels. The area of soil contamination in the northwest corner is approximately 5,100 square feet. The areas of impacted soil in each isolated area are approximately 400 square feet for both MW-18 and MW-20 together, and approximately 60 square feet for MW-5. The extent of the impacted soil areas is depicted on **Figure 5-4**.

The depth of impacted soils in the northwest corner of the property extends from approximately 7 to 20 feet bgs. Soils in the deep water bearing zone are not impacted. The top portion (approximately 1 to 3 feet) of the depth of soil impact is in the silt and clay layer, but the main impacted soils are located in the silt/sandy silty/sand lenses where the water table, under confining conditions, is located (about 12 to 15 ft bgs). The depth of impacted soils in the isolated areas is approximately 5-15 feet bgs. Silts and clays extend from ground surface to about 12 feet bgs around MW-18 and from ground surface to

approximately 10 feet bgs around MW-20. These estimates are based on soil analytical results from borings completed in 2002 and 2003 (SS series) and borings and monitoring wells completed in 2004; available PID readings from the SS series borings and wells installed in 1991; historical SPH observations; depth to water encountered in boring installation and quarterly groundwater monitoring events; and soil type.

The soil investigation in December 2004 indicated that the borings with the non-detect results (SB-5, SB-6, SB-7) were generally located along the perimeter of the source areas. In the northeast portion of the Site and in the vicinity of MW-3, the soil boring SB-5 contained non-detectable concentrations of TPHd, TPHg and BTEX.

5.2.2 Groundwater

The groundwater investigations indicate that the highly impacted groundwater contamination area in the shallow zone is located around MW-4 and extends to the south/southwest in the direction of groundwater flow. The TPHg, benzene and TPHd plume concentrations decrease to non-detect or low levels within the south property boundary of the Site, as depicted in **Figures 4-3** and **4-4** for the shallow zone TPHg and benzene isopleths. The relative magnitude of TPHd groundwater concentrations corresponds to the relative magnitude of TPHg concentrations in that the TPHd concentration of 4,000 μg/L in a well with a TPHg concentration of 32,000 μg/L is similar to a TPHd concentration of 2,000 μg/L in a well with TPHg concentration of 24,000 μg/L.

Separate phase hydrocarbons were detected only in the shallow zone; in MW-4 up through 2000, in groundwater from boring SS-8 in 2002, in MW-5 up through 1999, and in MW-3 through 1995. Groundwater concentrations of certain petroleum-related compounds in the deep zone were detected in MW-1 and MW-17, with remaining concentrations in the deep wells reported as non-detect. Both TPHg and benzene were detected in MW-1 and only benzene was detected in MW-17. The plumes for both extend in a northeast to southwest direction and are located on the northeast portion of the Site. **Figures 4-5** and **4-6** depict the TPHg and benzene isopleths for the deep zone.

In the past, the NCWB has expressed concern over the elevated levels of hydrocarbon constituents in groundwater from monitoring well MW-3. Following the 1996 investigation on the Friedenbach property, NCWB directed the installation of soil borings or wells east of monitoring well MW-3, to further evaluate the potential of groundwater contamination in that area before site closure would be considered. While MW-3 has had elevated levels of THPg concentrations (a high of 27,000 μg/L in March 1993), the concentrations in MW-3 have decreased an order of magnitude to 2,100 μg/L in February 2005. Additionally, free product has not been observed in MW-3 as it has been in MW-4. TPHg concentrations in MW-4 were at a high of 170,000 μg/L in September 1997, and although free product has not been present since 1995, MW-4 continues to have highly impacted concentrations of TPHg in the groundwater (32,000 μg/L in February 2005).

5.2.3 Summary

Gasoline and diesel-related constituents have impacted the soil and groundwater at the Site as a result of two documented releases in 1974 and 1978 and from suspected miscellaneous releases due to the use of the property as a bulk storage facility. In 1990, petroleum hydrocarbon impacts were encountered in on-site soils and groundwater during site redevelopment activities.

Based upon soil and groundwater analytical results, the releases appear to have occurred on the ground surface and shallow subsurface due to historical operations and migrated with groundwater both laterally across the Site and vertically into the shallow zone. Soil and groundwater impacts appear to be fairly consistent with the former location of ASTs, pipelines, and loading/unloading areas throughout the Site. A major portion of the impacted surficial soils and select deeper areas were removed during the 1997 and 2000 excavation activities. The majority of the remaining saturated soil and groundwater impacts appear to be associated with the former ASTs and associated piping in the northwest portion of the Site (MW-4), in a select area (MW-18) in the vicinity of the former railroad spur located in the southwest portion of the Site, and in a select area (MW-20) on the southeast portion of the Site. Soil impacts extend to approximately 20 feet bgs in the sandy silt/sand layer.

Based on Site investigations, it appears that the petroleum hydrocarbons migrated downward to the water table through channels in the silt/clay layer (i.e., gravel, root system or cracks). The mass of residual product had been sufficient for SPH to develop on the Site and potentially remain, currently, in the vicinity of MW-3, MW-4, and MW-5.

While the water table is generally located 3 to 14 feet bgs, indicating it is predominantly located within the low permeability silt and clay layer, recent investigations demonstrate confining conditions in the shallow water bearing zone due to the presence of the upper silt/clay layer across the Site. This indicates that the water table is present within the more permeable layers and the observed water levels of the monitoring wells are piezometric head. Any potential remaining light non-aqueous phase liquid (LNAPL) and elevated contaminant concentrations are mainly present in the more permeable sandy silty/sand layers and somewhat embedded into the bottom of the upper clay layer resulting from fluctuations in the water table. Any location, where LNAPL is present or elevated soil quality concentrations were detected, should be considered a potential residual source area.

6.0 FOCUSED FEASIBILITY EVALUATION

The following section provides an evaluation of potential remedial technologies applicable for use at the Site. Those remedial technologies that are determined to be applicable for remediation of the site contaminants, or combinations of those technologies given the site-specific conditions, are then developed into remedial alternatives that could be utilized to address the site contaminants. The presented alternatives are screened against one another to determine the alternative which appears to provide the most cost effective and technically sound approach for addressing the residual contamination.

The purpose of the following feasibility evaluation is to evaluate alternatives for remediating or mitigating the actual or potential adverse effects of the residual contaminants identified on site and reduce the concentrations of the residual contaminants to the concentrations identified in **Tables 6-1** and **6-2**. Residual contamination to be addressed by the selected alternative consists of both residual source and dissolved phase constituents of concern which occur at concentrations above the applicable cleanup levels in soils (saturated and unsaturated and groundwater). In accordance with Resolution 88-63, the goal of the remediation activities at this Site is to restore surface and groundwaters on and beneath the Site to a point where the water is considered suitable for use as a municipal or domestic water supply.

6.1 Cleanup Criteria Objectives

The following tables (**Tables 6-1** and **6-2**) present potential groundwater and soil cleanup criteria applicable to the Site. For the groundwater cleanup criteria, the Maximum Contaminant Level (MCL) or applicable water quality objectives identified by the NCWB in a letter dated August 12, 2005 are provided in **Table 6-1**. For the soil cleanup criteria, background concentration levels are not available and the process of deviating from the background concentration for each contaminant of concern has not been completed. Therefore, **Table 6-2** presents the proposed cleanup criteria, which references the environmental screening levels (ESLs) prepared by the San Francisco Bay Water Board (SFBWB).

Table 6-1 Groundwater Cleanup Criteria

Chemical Constituent	Cleanup Criteria (µg/L)	Reference
Benzene	1	California Primary MCL
Toluene	42	US EPA Secondary MCL
Ethylbenzene	29	US EPA Secondary MCL
Xylenes	17	US EPA Secondary MCL

Chemical Constituent	Cleanup Criteria (µg/L)	Reference
Total Petroleum Hydrocarbons as gasoline	5	NCWB Water Quality Objective (TASTE and ODOR)
Total Petroleum Hydrocarbons as diesel	100	NCWB Water Quality Objective (TASTE and ODOR)

Table 6-2 Proposed Soil Cleanup Criteria

Chemical Constituent	Cleanup Criteria (mg/kg)	Reference
Benzene	0.044	ESLs
Toluene	2.9	ESLs
Ethylbenzene	3.3	ESLs
Xylenes	2.3	ESLs
Total Petroleum Hydrocarbons as gasoline	100	ESLs
Total Petroleum Hydrocarbons as diesel	100	Proposed site criteria

ESLs – Environmental Screening Levels from the SFBWB's *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Volume 1: Summary Tier 1 Lookup Tables*, Interim Final, February 2005 (SFBWB, 2005).

6.2 Remedial Action Technologies

This evaluation is limited to several in-situ and ex-situ technologies that were determined to be applicable to address the residual contamination within the site-specific constraints. Technologies have been identified below that have been shown to efficiently and effectively remediate petroleum hydrocarbons that have impacted soil and groundwater in lower permeability soils and under conditions of limited groundwater recharge. The in-situ technologies presented typically require less aboveground equipment such as pumps and piping and do not generate large quantities of waste products. The ex-situ technology, while requiring limited amounts of equipment, will result in the generation of a significant amount of material that must be disposed off site, but has a high probability of achieving the clean-up criteria within a relatively short timeframe when compared to the in-situ technologies. Note that historical excavation events have occurred in 1997 and 2000 that removed significant quantities of impacted soils, but several of the excavation areas were not completely excavated, therefore impacted soils remain at the Site.

The timeframe required to achieve the clean-up criteria was also considered when evaluating potential technologies and identifying possible alternatives for this Site. One of the goals for remediating this Site is achieve the clean-up criteria, within a three year or less time period (if possible), from the time that approval is achieved for implementation of a remedial approach at this site. For the purposes of this evaluation, the proposed concentrations in **Table 6-2** were considered as the soil clean-up criteria. A description of each technology is provided below, followed by an evaluation of each technology.

6.2.1 In-situ Chemical Oxidation (ISCO)

In-Situ Chemical Oxidation (ISCO) is a remedial approach that utilizes subsurface injection of a chemical oxidant for the treatment of impacted soil and groundwater. ISCO has also been used, although less commonly, to destroy small amounts of residual LNAPL. Oxidation is a process whereby electrons are transferred from one substance to another. When oxidants are used to break down organic compounds, such as petroleum hydrocarbons, electrons are transferred from the hydrocarbons to the oxidizing compound. If the oxidation of organic compounds is complete, the end products would be carbon dioxide and water; however, incomplete oxidation may yield smaller (i.e., short-chained) organic compounds that are more amenable to biological degradation. Oxidants considered for this Site include sodium persulfate, unactivated and activated by agricultural iron, and Fenton's Reagent (i.e., an acidified mixture of hydrogen peroxide and ferrous iron catalyst).

The end products of the oxidation process are innocuous materials. Since the entire process is performed in-situ, no wastes would be generated from the treatment process, and no wastes would be brought to the surface. The process is highly reactive with hydroxyl radicals (Fenton's Reagent), potentially generating steam and vapors, and consideration to proximity of sensitive receptors must be factored into determining if and where it is feasible to apply it. ISCO has been identified as a potential remedial technology for treatment of dissolved contaminants and residual source areas. Appropriate precautions and safety must be applied when applying the treatment in the vicinity of neighboring commercial and private buildings.

To confirm the potential for using ISCO, as described in **Section 3.0**, a bench-scale test was conducted on soil and groundwater samples collected from the December 2004 soil sampling activities.

6.2.2 Multi Phase Extraction (MPE)

MPE is an in-situ remedial technique that involves the extraction of soil vapor, groundwater, and LNAPL (if present) simultaneously through the use of high-vacuum pump or blower systems. In comparison, soil vapor extraction (SVE) technology treats only the VOCs present in soil. The VOCs are volatilized and extracted from the subsurface by vacuum, which is created by a regenerative blower that is connected to vertical subsurface slotted piping installed in the impacted subsurface area. The air flow is directed to aboveground vapor treatment prior to

discharge to the atmosphere. MPE is used to maximize extraction rates of both vapor and liquids, especially in soils of low permeability. If effective, MPE may rapidly remove petroleum impacted groundwater and LNAPL (if present) while exposing the impacted vadose and capillary fringe zone to airflow through dewatering, enhancing volatilization and natural biodegradation of residual contamination. MPE is most effective in the remediation of relatively volatile petroleum concentrations (e.g., gasoline) that are present in soils of lower permeability (e.g., silt and glacial till with permeabilities of $1x\ 10^{-3}$ to $1x10^{-4}$ cm/sec).

To confirm the potential for MPE, as described in **Section 3.0**, a pilot test was conducted at the Site in March 2005.

6.2.3 Steam Enhanced Vapor Extraction

Conventional remediation technologies, such as SVE, MPE, and groundwater pump and treat, can be thermally enhanced to achieve remedial closure objectives that might otherwise be infeasible or too slow. Thermal enhancement can help mobilize LNAPL that is otherwise too viscous to be effectively recovered by the previously mentioned means; can increase the volatility of target compounds to increase the mass rate of vapor extraction; and can accelerate in-situ biodegradation. Thermal enhancement can be distinguished from thermal remediation (a primary mode of remediation) by the scale and cost of the heating processes and where the active treatment primarily occurs, i.e. - in the subsurface or recovery on the surface. Full-scale thermal remediation tends to add hundreds to thousands of kilowatt-hours of energy per cubic yard (KWH/yd^3) of soil to increase subsurface temperatures in the treatment volume to greater than 212°F. These high temperatures and aggressive heat input are often required to reach very stringent treatment goals and/or destroy contaminants in-situ, typically in low permeability soil. In contrast, thermally-enhanced remediation tend to require heat inputs of tens to hundreds KWH/yd^3 and may only increase subsurface temperatures by 20° to 100°F. The lower energy input for thermally-enhanced remediation often has lower capital and operational costs than full-scale thermal remediation. However, thermal enhancement is most appropriate for a more select range of soil conditions and more flexible remedial objectives.

6.2.4 Soil Excavation and Disposal

The excavation of petroleum-impacted soils may be a feasible remedial approach at sites where a discrete area of affected vadose or capillary fringe soil has been well defined and is readily accessible using standard excavation techniques (i.e. <20 feet below grade). The primary factors limiting the feasibility of soil excavation as an effective remedial technique are soil depth, depth to groundwater, impact to groundwater, and the presence of aboveground or underground structures (buildings, conduits, etc.). Soil excavation has been identified as a potential technology to be used at this Site for either the entire Site or select source areas since there are impacted soils and/or the potential for residual free-phase LNAPL in the low permeability silt and clay layer, as other techniques cannot treat this mass in a timely manner.

6.2.5 Enhanced Biodegradation

Enhanced bioremediation is a process in which indigenous (biostimulation) or injected (bioaugmentation) microorganisms (e.g., fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants found in soil and/or groundwater, converting them to benign end products. Bioremediation can be adapted to both saturated and unsaturated environments, and groundwater is typically recovered through recovery wells or trenches and re-injected and circulated through the affected area. In the presence of sufficient oxygen (aerobic conditions), and other nutrient elements, microorganisms will ultimately convert organic contaminants to carbon dioxide, water, and microbial cell mass. Nutrients, oxygen, or other amendments may be used to enhance natural bioremediation. Oxygenation may be achieved through the use of oxygen release compounds such as magnesium or calcium peroxide, or via injection of air or oxygen to enhance the productivity of indigenous microbes present in the aquifer which assist in the breakdown of petroleum constituents. This approach enhances three separate in-situ systems, hydrogeological, microbiological, and geochemical, to stimulate biodegradation. Bioremediation techniques have been successfully used to remediate soils, sludges, and groundwater contaminated with petroleum hydrocarbons, solvents, pesticides, wood preservatives, and other organic chemicals.

Another form of enhanced bioremediation is in-situ bioventing. This technology focuses primarily on the unsaturated (vadose zone) above the groundwater table. In this application, naturally occurring microorganisms present in the vadose zone are stimulated by the flow of air circulation designed in a manner similar to soil vapor extraction. Bioventing requires much less air flow than vapor extraction since the goal is merely to provide oxygen to the subsurface microbes to enhance biodegradation. It may be necessary under certain conditions to provide nutrients through injection into the vadose zone from the surface.

6.2.6 Natural Attenuation and Monitoring

Natural attenuation is a reduction in the concentration of contaminants through natural processes including biodegradation, volatilization, dilution, adsorption, and/or chemical reactions with other materials. It has been demonstrated at other similar sites that the detected VOCs may degrade readily in the presence of sufficient oxygen. If it can be demonstrated through analytical data and/or modeling that contaminant concentrations are decreasing over time, natural attenuation and monitoring may be a valid and non-invasive remedial alternative.

Natural attenuation is typically not a method of source area remediation when LNAPL is present, since the timeframe required for enhanced biodegradation to achieve site cleanup goals is most likely greater than desirable.

6.3 Evaluation of Remedial Action Technologies

The above identified technologies were evaluated against the clean-up objectives and site-specific constraints (site subsurface stratigraphy, nature and extent of residual contamination, and geographic, legal, and physical site constraints) to determine if the technology was technically feasible and implementable to meet the cleanup criteria (either the water quality objectives or the proposed soil cleanup objectives in **Tables 6-1** and **6-2**, respectively). The technologies that were determined to be technically feasible and implementable at this Site as a stand alone remedial approach or in conjunction with one or more other technologies were carried forward and incorporated into one of the remedial alternatives described below.

6.3.1 ISCO

This technology is potentially feasible to address the dissolved-phase portions of the plume and residual soil contamination, as well as potentially addressing localized areas where LNAPL may be present. Based on the recently completed bench-scale testing of various ISCO reagents, it appears that the use of Fenton's reagent or sodium persulfate would be effective at reducing the dissolved phase contaminant concentrations, if the oxidant can effectively be delivered to the impacted areas. Based on the number of injection points that would be required, site-specific data suggests that the soils are too impermeable for this technology to be cost effective as an aggressive remedial approach. However, this technology is feasible as a secondary or polishing treatment step and would occur after the implementation of a more aggressive remedial approach to stimulate/enhance the natural attenuation that may be occurring at various locations on site currently. This technology has been retained for inclusion as a secondary remedial approach.

6.3.2 Multi-Phase Extraction

This technology is not considered to be feasible to address the residual contaminations at this site based on the results from an earlier vapor extraction/air sparging feasibility test (RESNA 1993) as well as the results from the March 2005 MPE pilot test. The results from these two pilot tests suggest that the maximum induced vapor flowrate (less than 1 SCFM from the shallow extraction point and less than 5 SCFM from the deep extraction point) is significantly less than flow rates (15 to 20 SCFM per extraction point) that are typically considered necessary to make MPE/SVE an efficient and cost-effective means to remove contaminants from the subsurface environment. Therefore, based on the results from the past pilot test, specifically the limited amount of air flow that can be obtained from the native soils on site without any costly soil fracturing measures, MPE does not appear to be a feasible means to remove the residual contaminants present in the on-site soils. This technology has not been carried forward for inclusion as a comprehensive remedial alternative.

6.3.3 Steam Enhanced Vapor Extraction

This technology is potentially feasible for addressing the source areas and dissolved-phase portions of the plume. Implementation of the remedial technology would require the use of SVE to collect and treat the contaminated vapors that are generated by the heat and limited groundwater extraction to remove liberated residual hydrocarbon mass. The results from the recent MPE pilot test indicate that air flow in the subsurface environment is very limited. Based on the number of extraction wells required and the heat input that will be required in order to liberate/volatilize the residual product present, this remedial approach may not be cost effective. This technology has not been carried forward for inclusion as a comprehensive remedial alternative.

6.3.4 Soil Excavation and Disposal

This technology is potentially applicable to remove the impacted soils and source areas or selectively remove highly impacted soils down to approximately 15-20 feet bgs. Excavation and off-site disposal of the impacted soils would have a high degree of certainty in achieving the identified clean-up criteria. This technology could be readily implemented within the property boundaries of the former Unocal site. Limited shoring/sheeting will be required along the excavation boundaries. Benching of the excavation will be required around the remainder of the excavated area. Dewatering and treatment of the water will be required throughout the excavation activities. Disposal of the treated water may pose a logistical issue if authorization to discharge the treated water to the local sewer or storm sewer system is not obtained. Construction worker and work-site perimeter monitoring will be required during the excavation activities to ensure that no adverse exposures to volatile petroleum hydrocarbons occur. Mitigative measures to address the potential for significant releases of volatile hydrocarbon vapors will be required on site throughout the excavation and soil loading process. Excavation of the impacted soil areas, as shown in **Figure 5-4**, while requiring means/measures to remove and treat groundwater and potential vapors is considered a viable approach. Therefore, excavation is included as a comprehensive alternative to address the residual contamination at this site.

6.3.5 Enhanced Bioremediation

As mentioned above, this technology is not traditionally utilized at locations where residual LNAPL has been identified (LNAPL has been observed in well MW-4 and MW-5 periodically), however given the limited nature of this material, enhanced bioremediation is applicable to this Site. Application of enhanced bioremediation has been shown to effectively reduce dissolved concentrations of petroleum hydrocarbons in reasonable timeframes. One issue for the implementation of this technology at the site in question, is that successful treatment would require effective distribution of water, nutrients, bacteria, etc via pumping in either the saturated or unsaturated environment. The Site information suggests that the soils are too impermeable to expect that this approach would be effective in the short term. This technology is potentially feasible as a secondary or polishing treatment step. Implementation of enhanced bioremediation would occur after the completion of a more aggressive

remedial approach and would likely involve the injection of nutrients/supplements to stimulate/enhance the limited amount of natural attenuation that may be occurring at various locations on site currently. This technology has been retained for inclusion as a secondary remedial approach.

6.3.6 Natural Attenuation

At this time, based on the data reviewed, the petroleum hydrocarbon concentrations in groundwater are too high to maintain a condition of no significant risk, and groundwater concentrations may increase before they start attenuating. However, given the fact that various remedial technologies are not feasible and/or cost-effective, natural attenuation may be suitable for this Site until a time when additional technologies exist to address the impacted soil and groundwater. Based on the low permeability of soils present at this site, the migration or fate and transport of the petroleum hydrocarbons is limited. If the fate and transport system of the petroleum hydrocarbons is at steady-state, then the concentrations at a given point are holding steady with time – not increasing or decreasing. The Eel River is 600 feet downgradient from the Site and constitutes the nearest receptor. By the continuation of groundwater monitoring, natural attenuation can be a reliable means to cost-effectively protect the Eel River from petroleum hydrocarbon impacts. This approach would achieve the clean-up criteria, not in three years or less, but rather in a 20-year period. Natural attenuation will not be considered as the primary, comprehensive, remedial alternative, but will be retained for inclusion as a secondary remedial approach to be considered following the implementation of a more aggressive technology.

6.4 Identification and Screening of Remedial Action Alternatives

The following presents three remedial alternatives – 1) Excavation of impacted soils with Construction Dewatering, 2) Limited excavation with ISCO and Enhanced Bioremediation, and 3) Limited excavation with natural attenuation -- that have been developed to address the residual contamination at this site in a comprehensive manner. Each of these three alternatives is considered to be technically feasible to achieve the clean-up criteria identified for this site and is implementable based on the availability of the necessary expertise and equipment for the respective technology.

- **Alternative 1: <u>Excavation of Impacted Soils with Construction Dewatering and Treatment</u>**. **Figure 5-4** presents the areas (MW-4, MW-18, MW-20, and MW-5) to be excavated in order to achieve the clean-up criteria. Potential LNAPL and impacted groundwater encountered during the excavation activities will be removed via temporary dewatering equipment and treated via mobile on-site treatment equipment. LNAPL recovered by the dewatering equipment will be shipped off site for disposal in accordance with applicable requirement and regulations. Treated groundwater will be discharged to either the local sanitary or storm water system under a site-specific discharge permit to be obtained prior to the start of remediation activities at this site. The excavation would extend to a depth of approximately 18 feet on average for a total area of

approximately 6,000 square feet. The estimated volume of impacted soil to be excavated is estimated to be 4,000 cubic yards (CY). Assuming four feet of the fill material is suitable for reuse as backfill, a total of 3,110 CY of material is estimated for disposed. The estimated cost to implement excavation, disposal, and construction dewatering of the impacted areas is approximately $832,000. This price is inclusive of groundwater depression and treatment, shoring installation at select areas, soil transport and disposal, post-excavation monitoring, and site cleanup and restoration.

- **Alternative 2: Limited Excavation to Selectively Remove Source Area Soils with ISCO and Enhanced Bioremediation**. Currently, it is estimated that the source area immediately around MW-4 will be excavated to remove the highly impacted soils with residual LNAPL. The depth of the excavation will extend to a depth of approximately 18 feet bgs. The volume for the area around MW-4, is approximately 2,510 CY (approximately 20% less material to be excavated than Alternative 1), assuming again that the top four feet of unsaturated soil is backfill material. Construction dewatering and groundwater treatment, along with LNAPL collection and disposal, will be performed concurrently with the limited excavation activities. Upon completion of excavation and site restoration, ISCO would be applied to dissolved contaminants and residual source areas around wells MW-18, MW-20 and MW-5 (approximately 900 square feet). Approximately 2-3 injections in up to 30 temporary injection points would be conducted over a 1 – 2 year period. The injection points would be screened in two discrete depths. One set (15 injectors) would be screened in the silt and sand layer (shallow aquifer) and the second set would be screened in the sand layer (deeper aquifer). Soil vapor extraction would be installed in select areas to collect vapors generated from the treatment. if necessary. Once contaminant concentrations have been reduced to acceptable levels on the Site by ISCO, enhanced bioremediation would be implemented to treat the residual contamination. The cost to implement this alternative is estimated to be $700,000. The estimated cost for each portion, source area excavation, limited ISCO, and the enhanced bioremediation of residual is $400,000; $170,000; and $130,000; respectively.

Alternative 3: Limited Excavation with a Phased Approach to Natural Attenuation. Similar to Alternative 2, this alternative would include the limited source area excavation. Construction dewatering and groundwater treatment, along with LNAPL collection and disposal, will be performed concurrently with the limited excavation activities. Monitoring of the groundwater would follow for one year to determine if the source removal resulted in decreasing concentrations of petroleum hydrocarbons. Through potential modeling and a risk-based assessment, if natural attenuation could be shown through absorption of the silty clays and clayey silts, minimal or no contamination would reach the Eel River. Following a risk-based approach to natural attenuation, monitoring of the groundwater would extend for approximately 20 years. The cost to implement this alternative over 20 years is estimated to be $780,000. The estimated cost for the source area excavation and natural attenuation monitoring for 20 years is $400,000 and $380,000, respectively.

6.5 Screening Criteria

Table 6-3 presents a summary of the technology screening with high, medium and low relative rankings for each technology and criteria.

Table 6-3 Technology Screening Summary

Screening Criteria	Excavation	Limited Excavation with ISCO and Enhanced Bioremediation	Limited Excavation with Phased Approach to Natural Attenuation
Applicability to the Site	High	High to Medium	High
Effectiveness	High	Medium	High
Implementability	High to Medium	Medium	High
Capital and O&M Cost	High	High	Medium to Low

High, Medium, and Low evaluations are relative to the other technologies considered in the table, and where appropriate, reflect considerations such as impacts the existing businesses and public access ways adjacent to the Site during implementation.

7.0 RECOMMENDED REMEDIAL ACTION

Based on the evaluations described above, the most feasible and cost-effective remedial alternative for this Site appears to be Alternative #3 (Limited Excavation with a Phased Approach to Natural Attenuation). This alternative encompasses localized/focused excavation of suspected source areas on the former Unocal bulk plant, which will address the residual LNAPL source areas. Removal of this highly impacted source area material is expected to reduce the impact to the groundwater and allow for the natural attenuation of the petroleum hydrocarbons. However, based on the results from the limited excavation, Unocal may request a modification to the CAP to incorporate other remedial technologies, including, but not limited to, ISCO, enhanced bioremediation, and additional excavations.

Implementation of the proposed remedial alternative will require the following activities to be completed:

- Acceptance of the proposed remedial approach by the North Coast Water Board.
- Collection of data and preparation of a Remedial Action Plan which presents the detailed approach, sequencing, and schedule for implementing the selected alternative.
- Completion of contracts and schedules for the various specialized subcontractors that will be utilized to implement the selected remedial alternative.

It is estimated that once regulatory approval of the proposed remedial alternative is received, completion of the necessary design and subsequent RAP is expected to require two to four months. Once approval of a RAP presenting the details of the implementation of this alternative is received, completion of the subcontractor contracting and scheduling activities associated with implementing this alternative are expected to require three to four months. Depending on any access constraints, availability of key subcontractors, and the weather, implementation of this remedial alternative could commence anytime after the preceding activities were complete. Once initiated, completion of the initial component of the remedial alternative, the limited excavation, is expected to require up to three months, including a post-implementation monitoring and disposal, and then one year of groundwater monitoring to determine if the source removal resulted in decreasing concentrations of petroleum hydrocarbons. If no other action is necessary, approximately 20 years of natural attenuation and monitoring would follow, demonstrating achievement of the clean-up criteria.

8.0 REFERENCES

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TABLES

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-1												
45.62	03/26/91	23.66	21.96	0.00	ND	5,600	200	750	150	1,100	--	--
	05/01/91	24.54	21.08	0.00	--	--	--	--	--	--	--	--
	07/08/91	25.89	19.73	0.00	ND	150	40	ND	4.0	5.1	--	--
	10/21/91	26.90	18.72	0.00	ND	400	86	5.4	5.3	15	--	--
	01/23/92	26.29	19.33	0.00	ND	390	5.7	6.8	1.6	2.9	--	--
	05/01/92	25.15	20.47	0.00	ND	3,300	1,500	570	190	490	--	--
	07/02/92	26.77	18.85	0.00	--	--	--	--	--	--	--	--
	07/17/92	26.95	18.67	0.00	120	60	10	1.7	ND	1.6	--	--
	10/02/92	27.79	17.83	0.00	ND	60	1.0	1.4	ND	0.7	--	ND[3]
	03/03/93	23.48	22.14	0.00	ND	11,000	1,200	410	94	490	--	ND[3]
	06/22-23/93	24.54	21.08	0.00	1,500	3,800	1,300	210	120	390	--	--
	09/22-23/93	26.90	18.72	0.00	450	58	ND	ND	ND	ND	--	--
	12/22/93	26.45	19.17	0.00	68[7]	56	1.9	4.2	4.3	16	--	--
	03/28-29/94	25.40	20.22	0.00	150	ND	0.72	0.54	ND	1.1	--	--
	06/23-24/94	26.43	19.19	0.00	650[7]	2,500	1,100	ND	36	ND	--	--
	09/21/94	27.45	18.17	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/21/94	26.13	19.49	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/02-03/95	24.15	21.47	0.00	190[7]	ND	ND	ND	ND	ND	--	--
	06/01/95	25.05	20.57	0.00	860[7]	3,000	130	20	76	550	--	--
	09/05-06/95	26.65	18.97	0.00	130[8]	ND	ND	ND	ND	ND	--	--
	12/10-11/95	26.62	19.00	0.00	150[8]	ND	ND	ND	ND	ND	--	--
	03/11/96	24.87	20.75	0.00	140	94[9]	0.78	ND	ND	ND	--	--
	06/03-04/96	24.88	20.74	0.00	ND	60[9]	ND	ND	ND	ND	--	--
	09/04-05/96	26.45	19.17	0.00	90[8]	ND	ND	ND	ND	ND	--	--
	12/02-03/96	25.65	19.97	0.00	82	ND	ND	ND	ND	ND	--	--
	03/10-11/97	22.60	23.02	0.00	410[8]	ND	ND	ND	ND	ND	--	--
	06/09-10/97	24.00	21.62	0.00	160	ND	ND	ND	ND	ND	ND	--
	09/08-09/97	25.42	20.20	0.00	ND	ND	ND	ND	ND	ND	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-1	12/03-04/97	23.86	21.76	0.00	160[8]	ND	ND	ND	ND	ND	--	--
(Cont.)	03/23-24/98	19.45	26.17	0.00	140	120	33	1.3	ND	5.1	--	--
	06/07-08/98	22.47	23.15	0.00	220	420	180	ND[11]	ND[11]	4.7	--	--
	09/16/98	24.75	20.87	0.00	170	ND	ND	ND	ND	1.1	ND	--
	12/16/98	23.11	22.51	0.00	150	ND	ND	ND	ND	ND	--	--
	03/23/99	21.31	24.31	0.00	150	530	160	ND[11]	ND[11]	22	ND[22]	--[23]
	06/14/99	23.25	22.37	0.00	210[27]	140	79	ND	ND	0.93	--	--
	09/13-14/99	25.10	20.52	0.00	110[15]	ND	ND	ND	ND	ND	--	--
	12/16/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/16-17/00	21.80	23.82	0.00	120[15]	180[28]	73	ND	1.0	7.1	--	--
	06/26-27/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	09/21/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/08/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/08/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/09/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	08/07/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/27/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/05/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/07/02	23.61	22.01	0.00	5,000/3,700[38,43]	560	41	89	3.6	92	--	--
	08/14/02	25.51	20.11	0.00	2,000/1,000[38]	77	<0.50	3.1	<0.50	3.4	--	--
	11/12/02	25.64	19.98	0.00	6,200/91[38]	3,800	160	1,400	34	530	--	--
	02/12/03	22.72	22.90	0.00	5,000/130[38]	2,300	25	400	3.8	410	--	--
45.62	06/09-10/03	23.22	22.40	0.00	4,400/1,700[38]	14,000[45]	1,300[45]	2,800[45]	41[45]	2,700[45]	--	--
	08/14/03	25.00	20.62	0.00	430/150[38]	550	56	9.7	3.6	85	--	--
	12/11/03	24.20	21.42	0.00	1,700	99	2.8	18	1.8	17	--	--
	03/23/04	22.40	23.22	0.00	8,100[49]/470[38,49]	26,000	2,400	6,700	430	4,400	--	--
	08/10/04	25.60	20.02	0.00	270 [49]	310 [50]	40	7.2	7.2	37	--	--
47.41	**02/08/05**	**23.22**	**24.19**	**0.00**	**87 [49]**	**570**	**14**	**90**	**6.3**	**150**	**--**	**--**

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Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-2												
48.59	03/26/91	7.12	41.47	0.00	ND	ND	ND	ND	ND	ND	--	--
	05/01/91	7.37	41.22	0.00	--	--	--	--	--	--	--	--
	07/08/91	8.28	40.31	0.00	ND	ND	ND	ND	ND	ND	--	--
	10/21/91	10.76	37.83	0.00	ND	ND	ND	0.5	ND	1.0	--	--
	01/23/92	10.36	38.23	0.00	ND	ND	ND	0.5	ND	ND	--	--
	05/01/92	8.80	39.79	0.00	ND	ND	ND	0.9	ND	ND	--	--
	07/02/92	8.77	39.82	0.00	--	--	--	--	--	--	--	--
	07/17/92	8.97	39.62	0.00	ND	ND	ND	ND	ND	ND	--	--
	10/02/92	11.29	37.30	0.00	ND	ND	ND	ND	ND	ND	--	ND
	03/03/93	8.35	40.24	0.00	ND	ND	ND	ND	ND	ND	--	ND
	06/22-23/93	7.20	41.39	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/22-23/93	10.04	38.55	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/22/93	10.45	38.14	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/28-29/94	7.82	40.77	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/23-24/94	8.32	40.27	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/21/94	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	12/21/94	INACCESSIBLE (CONNECTED TO REMEDIATION SYSTEM)					--	--	--	--	--	--
	03/02-03/95	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	06/01/95	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	09/05-06/95	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	12/10-11/95	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	03/11/96	INACCESSIBLE (CONNECTED TO REMEDIATION SYSTEM)					--	--	--	--	--	--
	06/03-04/96	7.48	41.11	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/04-05/96	10.54	38.05	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/02-03/96	10.72	37.87	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/10-11/97	7.13	41.46	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/09-10/97	7.91	40.68	0.00	ND	ND	ND	ND	ND	ND	ND	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-2	09/08-09/97	11.39	37.20	0.00	ND	ND	ND	ND	ND	ND	--	--
(Cont.)	12/03-04/97	10.09	38.50	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/23-24/98	6.25	42.34	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/07-08/98	6.49	42.10	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/16/98	9.33	39.26	0.00	ND	ND	ND	ND	ND	ND	ND	--
	12/16/98	7.86	40.73	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/23/99	6.22	42.37	0.00	ND	ND	ND	0.54	ND	ND	2.6[22]	--[24]
	06/14/99	7.34	41.25	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/13-14/99[31]	10.18	38.41	0.00	57[15]	ND	ND	ND	ND	ND	--	--
	12/16/99	9.30	39.29	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/16-17/00	6.84	41.75	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/26-27/00	8.21	40.38	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/21/00	10.42	38.17	0.00	ND	ND	ND	ND	ND	ND	--	--
	11/08/00	10.88	37.71	0.00	ND	ND	ND	ND	ND	ND	--	--
	02/08/01	8.22	40.37	0.00	ND	ND	ND	ND	ND	ND	--	--
	05/09/01	7.22	41.37	0.00	ND	ND	ND	ND	ND	ND	--	--
	08/07/01	9.47	39.12	0.00	<50	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/27/01	10.53	38.06	0.00	<50	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/05/02	7.04	41.55	0.00	<50	<50	<0.50	<0.50	<0.50	<0.50	--	--
	05/07/02	7.06	41.53	0.00	[43]670/690[38,43]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/02	9.35	39.24	0.00	<56	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/12/02	11.19	37.40	0.00	<50[38,44]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/12/03	8.03	40.56	0.00	<56	<50	<0.50	<0.50	<0.50	<0.50	--	--
48.80	06/09-10/03	6.96	41.84	0.00	71/<54[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/03	9.14	39.66	0.00	<54	<50	<0.50	<0.50	<0.50	<0.50	--	--
	12/11/03	9.75	39.05	0.00	89/88[38]	<50	<0.50	<0.50	<0.50	<0.50	**--**	**--**
	03/23/04	7.05	41.75	0.00	360[49]/170[38,49]	--	--	--	--	--	--	--
	08/10/04	9.95	38.85	0.00	--	--	--	--	--	--	--	--
50.60	**02/08/05**	**7.22**	**43.38**	**0.00**	**<50**	--	--	--	--	--	--	--

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Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-3												
46.59	03/26/91	6.27	40.32	0.00	ND	11,000	1,900	2,600	470	2,200	--	--
	05/01/91	6.93	39.66	0.00	--	--	--	--	--	--	--	--
	07/08/91	7.62	38.97	0.00	ND	10,000	1,600	2,000	330	1,400	--	--
	10/21/91	9.95	36.64	0.00	ND	3,100	550	420	77	470	--	--
	01/23/92	9.20	37.39	0.00	ND	19,000	690	760	180	960	--	--
	05/01/92	6.52	40.07	0.00	ND	11,000	1,700	1,800	450	1,700	--	--
	07/02/92	7.86	38.73	0.00	--	--	--	--	--	--	--	--
	07/17/92	7.95	38.64	0.00	680	4,600	860	800	200	930	--	--
	10/02/92	10.70	35.89	0.00	160[4]	2,000	350	290	52	400	--	ND[5]
	03/03/93	7.12	39.47	Sheen	ND	27,000	820	1,700	320	1,700	--	ND[5]
	06/22-23/93	6.21	40.38	0.00	--	--	--	--	--	--	--	--
	09/22-23/93	9.40	37.19	0.00	--	--	--	--	--	--	--	--
	12/22/93	9.51	37.08	0.00	1,600[7]	9,700	1,500	1,300	300	2,300	--	--
	03/28-29/94	6.78	39.81	Sheen	1,900[7]	19,000	2,300	1,800	530	3,500	--	--
	06/23-24/94	7.42	39.17	0.00	1,700[7]	14,000	1,500	760	400	2,900	--	--
	09/21/94	10.50	36.09	0.00	7,800[7]	13,000	1,000	860	1,800	270	--	--
	12/21/94	INACCESSIBLE (CONNECTED TO REMEDIATION SYSTEM)					--	--	--	--	--	--
	03/02-03/95	1.15	45.44	0.00	490[7]	2,200	ND	9.6	ND	230	--	--
	06/01/95	6.58	40.01	Sheen	17,000[7]	20,000	1,400	3,300	570	4,300	--	--
	09/05-06/95	9.60	36.99	0.00	4,400[8]	26,000	580	740	620	7,200	--	--
	12/10-11/95	9.57	37.02	0.00	200[8]	260	5.8	ND	ND	ND	--	--
	03/11/96	3.11	43.48	0.00	1,300[8]	7,700	36	15	ND	1,700	--	--
	06/03-04/96	7.01	39.58	0.00	1,400[7]	1,000	70	2.8	28	140	--	--
	09/04-05/96	10.00	36.59	0.00	23,000[8]	17,000	87	ND	160	1,400	--	--
	12/02-03/96	9.90	36.69	0.00	1,600[7]	3,200	68	31	75	1,000	--	--
	03/10-11/97	6.35	40.24	0.00	3,000[7]	11,000	190	130	400	2,300	--	--

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Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
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Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-3	06/09-10/97	7.15	39.44	0.00	3,000[7]	10,000	120	ND	140	960	ND	--
(Cont.)	09/08-09/97	11.80	34.79	0.00	450[7]	5,300	100	21	97	580	--	--
	12/03-04/97	9.34	37.25	0.00	1,100[7]	6,200	120	ND	57	700	--	--
	03/23-24/98	5.51	41.08	0.00	4,400[10]	4,200	21	ND[11]	20	240	--	--
	06/07-08/98	5.99	40.60	0.00	80[14]	540	10	ND[11]	5.7	41	--	--
	09/16/98	8.68	37.91	0.00	3,400[17]	1,400[18]	26	ND[11]	14	130	ND[11]	--
	12/16/98	7.65	38.94	0.00	9,100[10]	4,200	31	ND[11]	17	170	--	--
	03/23/99	5.65	40.94	0.00	610[21]	1,900	27	2.6	21	130	ND[22]	--[25]
	06/14/99	6.66	39.93	0.00	1,700[21]	3,500	44	ND[11]	20	170	--	--
	09/13-14/99[31]	9.91	36.68	0.00	6,500[21]	1,200[28]	10	ND	3.8	35	--	--
	12/16/99	8.91	37.68	0.00	4,400[33]	1,790[28]	27.3	ND[11]	9.55	81.4	--	--
	03/16-17/00	5.58	41.01	0.00	440[21]	1,300[28]	ND[11]	ND[11]	ND[11]	73	--	--
	06/26-27/00	8.25	38.34	0.00	470[14]	2,000[28]	22	ND[11]	10	120	--	--
	09/21/00	10.92	35.67	0.00	96.2[37]	210[28]	2.2	0.64	0.99	8.4	--	--
	11/08/00	11.27	35.32	0.00	215[21]	880[28]	21	ND[11]	8.0	52	--	--
	02/08/01	7.93	38.66	0.00	[21]82/58[14,38]	933[28]	41.1	14.3	7.51	38.4	--	--
	05/09/01	6.23	40.36	0.00	[15]80/ND[38]	390[28]	20	4.6	20	68	--	--
	08/07/01	8.90	37.69	0.00	<50	120	3.3	<0.50	<0.50	4.0	--	--
	11/27/01	9.95	36.64	0.00	[41]100/100[38,41]	170	2.0	<0.50	0.65	5.5	--	--
	02/05/02	5.51	41.08	0.00	[41]510/300[38,41]	480	21	<0.50	2.1	29	--	--
	05/07/02	INACCESSIBLE - TRACTOR OVER WELL				--	--	--	--	--	--	--
	08/14/02	8.37	38.22	0.00	[41]2,300/2,000[38,41]	5,800	120	11	65	280	--	--
	11/12/02	9.94	36.65	0.00	1,900/570[38]	1,800	70	1.1	26	110	--	--
	02/12/03	5.64	40.95	0.00	1,800/410[38]	1,400	54	0.67	19	95	--	--
46.57	06/09-10/03	5.62	40.95	0.00	2,900/1,600[38]	5,000	320	6.9	170	650	--	--
	08/14/03	7.96	38.61	0.00	[41]1,900/990[38,41]	4,000	220	6.7	110	460	--	--
	12/11/03	8.25	38.32	0.00	1,100	340	6.8	<0.50	1.4	16	--	--
	03/23/04	6.00	40.57	0.00	1,200[49]/260[38,49]	1,800[50]	150	130	40	310	--	--
	08/10/04	9.20	37.37	0.00	610 [49]	1,300 [50]	49	2.5	18	140	--	--
48.35	**02/08/05**	**24.70**	**23.65**	**0.00**	**580 [49]**	**2,100 [51]**	**150**	**3.1**	**12**	**160**	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-4												
50.31	03/26/91	9.85	40.46	0.00	ND	55,000	13,000	16,000	2,000	13,000	--	--
	05/01/91	10.13	40.18	0.00	--	--	--	--	--	--	--	--
	07/08/91	11.08	39.23	0.00	ND	33,000	7,900	3,900	1,400	3,900	--	--
	10/21/91	13.45	36.86	0.06	--	--	--	--	--	--	--	--
	01/23/92	13.25	37.06	0.08	--	--	--	--	--	--	--	--
	05/01/92	10.41	39.90	0.00	14,000[4]	29,000	5,400	12,000	1,900	750	--	--
	07/02/92	11.62	38.69	0.02	--	--	--	--	--	--	--	--
	07/17/92	11.79	38.52	0.00	12,000	68,000	5,900	9,700	2,400	9,900	--	--
	10/02/92	13.67	36.64	0.25/Sheen	--	--	--	--	--	--	--	--
	03/03/93	10.69	39.62	0.54/Sheen	--	--	--	--	--	--	--	--
	06/22-23/93	7.65	42.66	0.00	--	--	--	--	--	--	--	--
	09/22-23/93	12.85	37.46***	0.30	--	--	--	--	--	--	--	--
	12/22/93	13.20	37.30**	0.25	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/28-29/94	10.31	40.00	<0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/23-24/94	101.96	-51.65	<0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/21/94	13.81	36.50	<0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/21/94	12.32	38.33**	0.44	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/02-03/95	10.96	39.35	0.00	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/01/95	10.38	39.93	Sheen	2,500[8]	27,000	3,600	7,000	730	400	--	--
	09/05-06/95	13.35	36.98**	0.02	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/10-11/95	13.38	36.95**	0.03	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/11/96	INACCESSIBLE (CONNECTED TO REMEDIATION SYSTEM)					--	--	--	--	--	--
	06/03-04/96	6.83	43.48	Sheen	19,000[7]	81,000	4,600	15,000	2,300	13,000	--	--
	09/04-05/96	12.80	37.51	Sheen	4,500[8]	100,000	7,600	5,300	1,200	7,200	--	--
	12/02-03/96	12.36	37.95	Sheen	4,200[7]	46,000	4,500	15,000	1,900	11,000	--	--
	03/10-11/97	9.53	40.78	Sheen	3,400[7]	36,000	1,400	7,400	1,100	8,000	--	--
	06/09-10/97	10.60	39.71	Sheen	3,900[7]	94,000	1,800	7,700	1,100	9,100	ND	--
	09/08-09/97	13.76	36.55	Sheen	8,200[7]	170,000	1,700	6,400	2,900	18,000	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248

359 Main Street

Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-4	12/03-04/97	12.10	38.21	Sheen	6,100[7]	100,000	4,800	12,000	2,300	15,000	--	--
(Cont.)	03/23-24/98	8.07	42.24	0.00	3,400[10]	100,000	12,000	21,000	2,000	11,000	--	--
	06/07-08/98	8.90	41.43**	0.02/Sheen	4,900[12]	83,000	8,500	14,000	1,900	13,000	--	--
	09/16/98	11.34	38.99**	0.02/Sheen	4,200[12]	110,000	9,000	12,000	1,900	12,000	ND[11]	--
	12/16/98	9.40	40.91	Sheen	1,900[10]	64,000	10,000	12,000	1,500	7,900	--	--
	03/23/99	8.25	42.06	Sheen	2,500[21]	51,000	6,600	9,100	1,100	5,500	ND[22]	--[26]
	06/14/99	9.42	40.89	0.00	2,300[21]	49,000	6,400	6,700	1,100	5,200	--	--
	09/13-14/99	11.83	38.48	0.00	1,400[21]	39,000[28,30]	1,800	900	220	920	--	--
	12/16/99	11.01	39.30	0.00	7,700[14]	61,100[28]	6,670	6,870	1,280	6,130	--	--
	03/16-17/00	8.88	41.43	0.00	2,500[14]	35,000[28]	7,100	7,500	1,400	6,400	--	--
	06/26-27/00[36]	10.89	39.42	0.00	1,400[14]	19,000[28]	5,800	6,400	930	4,900	--	--
	09/21/00	12.77	37.54	Sheen	2,160[37]	30,000[28]	4,900	4,000	730	3,600	--	--
	11/08/00	13.12	37.19	0.00	1,760[21]	57,000[28]	6,200	7,100	1,100	6,400	--	--
	02/08/01	10.62	39.69	0.00	[14]2,800/2,300[14,38]	48,600[28]	6,930	6,630	1,020	5,370	--	--
	05/09/01	9.73	40.58	0.00	[39]4,100/3,700[14,38]	48,000[28]	4,800	10,000	1,400	7,200	--	--
	08/07/01	11.86	38.45	0.00	[41]2,100/2,700[38,41]	28,000[40]	9,600[40]	6,400[40]	1,000[40]	5,000[40]	--	--
	11/27/01	12.03	38.28	0.00	[41]1,000/1,000[38,41]	43,000	9,800	6,700	1,200	5,400	--	--
	02/05/02	8.56	41.75	0.00	--[42]	56,000	9,700	10,000	1,500	7,000	--	--
	05/07/02	9.37	40.94	0.00	[43]19,000/14,000[38,43]	81,000	2,200	6,300	1,700	13,000	--	--
	08/14/02	11.56	38.75	0.00	[41]3,100/3,600[38,41]	56,000	3,900	10,000	1,800	12,000	--	--
	11/12/02	12.73	37.58	0.00	8,000[38,44]	110,000	7,400	22,000	3,900	22,000	--	--
	02/12/03	8.98	41.33	0.00	3,800/2,000[38]	67,000	7,800	12,000	2,000	11,000	--	--
50.29	06/09-10/03	9.34	40.95	0.00	9,000/6,700[38]	48,000	1,900	5,100	1,400	10,000	--	--
	08/14/03	11.26	39.03	0.00	[41]2,000/1,900[38,41]	46,000	2,200	5,400	1,100	7,500	--	--
	12/11/03	11.54	38.75	0.00	2,800	24,000	3,900	2,800	890	4,200	--	--
	03/23/04	9.10	41.19	0.00	5200[49]/2,000[38,49]	24,000	5,300	3,800	580	2,400	--	--
	08/10/04	12.00	38.29	0.00	2,600 [49]	17,000 [50]	2,800	1,600	370	2,000	--	--
52.07	**02/08/05**	**9.28**	**42.79**	**0.00**	**4,000 [49]**	**32,000**	**4,100**	**4,500**	**860**	**5,100**	--	--

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-5												
47.57	03/26/91	9.22	38.35	0.00	ND	64,000	22,000	16,000	2,000	13,000	--	--
	05/01/91	9.01	38.56	0.00	--	--	--	--	--	--	--	--
	07/08/91	10.00	37.57	Sheen	ND	120,000	25,000	18,000	1,400	15,000	--	--
	10/21/91	12.05	35.52***	0.25/Sheen	--	--	--	--	--	--	--	--
	01/23/92	11.05	36.52***	0.02/Sheen	--	--	--	--	--	--	--	--
	05/01/92	9.13	38.44	0.00	ND	89,000	18,000	16,000	3,200	13,000	--	--
	07/02/92	10.23	37.34***	0.01/Sheen	--	--	--	--	--	--	--	--
	07/17/92	10.49	37.08	0.00	12,000	72,000	14,000	12,000	2,700	8,700	--	--
	10/02/92	11.97	35.60***	0.95/Sheen	--	--	--	--	--	--	--	--
	03/03/93	9.70	37.87***	1.22/Sheen	--	--	--	--	--	--	--	--
	06/22-23/93[6]	8.06	39.51***	0.75/Sheen	--	--	--	--	--	--	--	--
	09/22-23/93	11.35	36.22***	0.10/Sheen	--	--	--	--	--	--	--	--
	12/22/93	11.10	36.53**	0.08	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/28-29/94	9.05	38.52	<0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/23-24/94	10.02	37.55	<0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/21/94	11.85	35.73**	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/21/94	10.32	37.50**	0.32	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/02-03/95	9.02	38.55	0.00	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/01/95	9.32	38.33**	0.10	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/05-06/95	12.36	35.33**	0.16	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/10-11/95	12.40	35.25**	0.11	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/11/96	INACCESSIBLE (CONNECTED TO REMEDIATION SYSTEM)					--	--	--	--	--	--
	06/03-04/96	7.11	40.48**	0.02	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/04-05/96	11.33	36.25**	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/02-03/96	10.25	37.33**	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/10-11/97	8.45	39.13**	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/09-10/97	9.76	37.82**	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/08-09/97	12.51	35.07**	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-5	12/03-04/97	10.12	37.45	Sheen	43,000[7]	480,000	13,000	16,000	3,700	21,000	--	--
(Cont.)	03/23-24/98	7.80	41.16**	1.80	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/07-08/98	9.65	38.88**	1.25	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/16/98	12.10	35.53**	0.08	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/16/98	8.25	39.35**	0.04	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	03/23/99	7.19	40.56**	0.24	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/14/99	8.61	39.35**	0.51	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/13-14/99	10.76	36.99**	0.24	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	12/16/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/16-17/00	7.01	40.56	0.00	18,000[34]	41,000[28]	720	2,700	950	6,600	--	--
	06/26-27/00	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	09/21/00	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	11/08/00	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	02/08/01	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	05/09/01	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	08/07/01	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	11/27/01	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	02/05/02	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	05/07/02	7.20	40.37	0.00	25,000/21,000[38]	84,000	6,500	7,400	1,800	15,000	--	--
	08/14/02	9.80	37.77	0.00	29,000/15,000[38]	75,000	8,200	11,000	750	16,000	--	--
	11/12/02	8.83	38.74	0.00	24,000[38,44]	57,000	5,400	6,300	410	14,000	--	--
	02/12/03	5.79	41.78	0.00	36,000/4,600[38]	30,000	2,100	2,200	230	8,300	--	--
47.45	06/09-10/03	7.03	40.42	0.00	12,000/8,000[38]	45,000	3,300	6,500	490	11,000	--	--
	08/14/03	9.33	38.12	0.00	[41]9,100/6,100[38,41]	44,000	2,600	4,200	460	8,300	--	--
	12/11/03	7.58	39.87	0.00	130,000	55,000	4,500	4,800	810	14,000	--	--
	03/23/04	6.20	41.25	0.00	19,000[49]/2,200[38,49]	16,000	1,300	3,900	270	8,500	--	--
	08/10/04	10.13	37.32	0.00	7,700 [49]	40,000	2,000	3,000	560	9,400	--	--
49.27	**02/08/05**	**6.09**	**43.18**	**0.00**	**2,200 [49]**	**24,000**	**950**	**1,000**	**310**	**5,300**	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-6												
42.89	03/26/91	4.61	38.28	0.00	ND	2,400	310	13	63	210	--	--
	05/01/91	6.58	36.31	0.00	--	--	--	--	--	--	--	--
	07/08/91	7.68	35.21	0.00	ND	410	97	1.1	1.2	1.9	--	--
	10/21/91	9.65	33.24	0.00	ND	ND	11	1.6	ND	1.6	--	--
	01/23/92	7.60	35.29	0.00	ND	2,900	180	32	6.3	32	--	--
	05/01/92	4.50	38.39	0.00	870[1]	2,000	94	79	15	79	--	--
	07/02/92	6.40	36.49	0.00	--	--	--	--	--	--	--	--
	07/17/92	7.74	35.15	0.00	730[2]	50	5.4	ND	ND	ND	--	--
	10/02/92	7.35	35.54	0.00	ND	90	7.5	1.8	ND	2.0	--	ND[13]
	03/03/93	4.60	38.29	0.00	ND	8,500	460	2.0	130	86	--	ND[13]
	06/22-23/93	6.16	36.73	0.00	2,300	1,900	300	ND	93	59	--	--
	09/22-23/93	8.00	34.89	0.00	170	ND	ND	ND	ND	ND	--	--
	12/22/93	5.70	37.19	0.00	440[7]	1,200	350	15	120	150	--	--
	03/28-29/94	5.22	37.67	0.00	2,000[7]	9,900	1,300	9.2	240	410	--	--
	06/23-24/94	6.39	36.50	0.00	5,900[7]	29,000	3,500	3,000	1,000	3,400	--	--
	09/21/94	9.06	33.83	0.00	200[7]	220	7.2	ND	0.83	5.8	--	--
	12/21/94	5.41	37.48	0.00	1,200[7]	5,700	550	ND	70	58	--	--
	03/02-03/95	5.51	37.38	0.00	2,600[7]	6,400	350	ND	38	24	--	--
	06/01/95	6.03	36.86	0.00	130[8]	4,100	490	ND	50	14	--	--
	09/05-06/95	9.12	33.77	0.00	7,000[8]	25,000	540	680	600	6,900	--	--
	12/10-11/95	9.13	33.76	0.00	3,300[7]	8,900	1,600	ND	280	430	--	--
	03/11/96	6.12	36.77	0.00	2,200[7]	4,000	290	0.57	66	81	--	--
	06/03-04/96	6.98	35.91	0.00	1,600[7]	4,400	690	ND	100	89	--	--
	09/04-05/96	8.11	34.78	0.00	580[7]	720	36	ND	7.3	4.0	--	--
	12/02-03/96	4.85	38.04	0.00	2,300[7]	1,800	290	8.2	50	24	--	--
	03/10-11/97	5.10	37.79	0.00	2,100[7]	3,000	300	5.7	56	22	--	--
	06/09-10/97	6.38	36.51	0.00	1,000[7]	2,000	240	10	23	8.6	25	--
	09/08-09/97	9.12	33.77	0.00	110[7]	520	10	0.61	ND	6.0	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-6	12/03-04/97	5.99	36.90	0.00	2,900[7]	11,000	990	11	230	430	--	--
(Cont.)	03/23-24/98	4.06	38.83	0.00	820[12]	1,700	130	ND[11]	23	14	--	--
	06/07-08/98	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	09/16/98	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	12/16/98	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	03/23/99	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	06/14/99	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	09/13-14/99	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	12/16/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/16-17/00	4.05	38.84	0.00	2,600[21]	1,900[28]	150	11	10	ND[11]	--	--
	06/26-27/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	09/21/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/08/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/08/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/09/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	08/07/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/27/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/05/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/07/02	8.51	34.38	0.00	3,300/56[38]	1,900	160	6.6	8.8	1.9	--	--
	08/14/02	7.15	35.74	0.00	2,100/310[38]	710	36	2.7	3.6	<1.2	--	--
	11/12/02	6.51	36.38	0.00	3,200[38,44]	1,900	60	<2.5	5.8	<2.5	--	--
	02/12/03	4.60	38.29	0.00	7,300/910[38]	2,900	450	6.8	26	4.7	--	--
42.73	06/09-10/03	5.75	36.98	0.00	2,300/760[38]	820	98	4.1	6.0	0.90	--	--
	08/14/03	7.07	35.66	0.00	880/510[38,41]	480	21	1.6	2.8	1.5	--	--
	12/11/03	5.44	37.29	0.00	4,500	350	48	0.69[46]	2.0	<0.50	--	--
	03/23/04	5.61	37.12	0.00	610[49]/200[38,49]	680	88	16	7.4	20	--	--
	08/10/04	8.00	34.73	0.00	340 [49]	<50	<0.50	<0.50	<0.50	<1.0	--	--
44.55	**02/08/05**	**5.19**	**39.36**	**0.00**	**54 [49]**	**81 [51]**	**6.4**	**0.77**	**0.66**	**1.1**	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-7												
35.66	07/02/92	2.90	32.76	0.00	--	--	--	--	--	--	--	--
	07/17/92	--	--	--	--	--	--	--	--	--	--	--
	10/02/92	5.02	30.64	0.00	220	ND	ND	ND	ND	ND	--	--
	03/03/93	0.82	34.84	0.00	ND	ND	ND	ND	ND	ND	--	ND
	06/22-23/93	3.07	32.59	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/22-23/93	4.35	31.31	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/22/93	1.70	33.96	0.00	58[7]	ND	ND	ND	ND	0.66	--	--
	03/28-29/94	1.50	34.16	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/23-24/94	3.22	32.44	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/21/94	6.25	29.41	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/21/94	0.69	34.97	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/02-03/95	1.08	34.58	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/01/95	3.45	32.21	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/05-06/95	6.32	29.34	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/10-11/95	6.27	29.39	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/11/96	3.57	32.09	0.00	ND	320	ND	ND	ND	0.8	--	--
	06/03-04/96	5.77	29.89	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/04-05/96	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	12/02-03/96	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/10-11/97	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	06/09-10/97	2.49	33.17	0.00	ND	ND	ND	ND	ND	ND	ND	--
	09/08-09/97	4.25	31.41	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/03-04/97	1.20	34.46	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/23-24/98	0.00	35.66	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/07-08/98	1.60	34.06	0.00	52[15]	ND	ND	ND	ND	ND	--	--
	09/16/98	3.94	31.72	0.00	58	ND	ND	0.84	ND	1.2	ND	--
	12/16/98	0.31	35.35	0.00	ND[11]	ND	ND	ND	ND	ND	--	--
	03/23/99	0.50	35.16	0.00	ND	ND	ND	0.98	ND	1.7	ND[22]	--[24]

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-7	06/14/99	2.55	33.11	0.00	67[15]	ND	ND	ND	ND	ND	--	--
(Cont.)	09/13-14/99	3.95	31.71	0.00	100[15,29]	ND	ND	ND	ND	ND	--	--
	12/16/99	0.68	34.98	0.00	54[15]	ND	ND	ND	ND	ND	--	--
	03/16-17/00	0.00	35.66	0.00	120[15]	ND	ND	ND	ND	ND	--	--
	06/26-27/00	3.41	32.25	0.00	90[15]	ND	ND	ND	ND	ND	--	--
	09/21/00	4.52	31.14	0.00	134[37]	82[29]	ND	38	ND	ND	--	--
	11/08/00	2.45	33.21	0.00	149[21]	ND	ND	0.99	ND	ND	--	--
	02/08/01	1.65	34.01	0.00	[15]91/ND[38]	ND	ND	ND	ND	ND	--	--
	05/09/01	2.39	33.27	0.00	[15]68/ND[38]	ND	ND	ND	ND	ND	--	--
	08/07/01	4.86	30.80	0.00	[41]78/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
35.66	11/27/01	0.97	34.69	0.00	[41]69/69[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/05/02	1.13	34.53	0.00	[41]180/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	05/07/02	1.56	34.10	0.00	[41]120/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/02	4.53	31.13	0.00	[41]110/<56[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/12/02	2.50	33.16	0.00	210[38,44]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/12/03	1.21	34.45	0.00	240/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	06/09-10/03	2.39	33.27	0.00	200/<51[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/03	3.64	32.02	0.00	[41]160/75[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	12/11/03	0.05	35.61	0.00	180/130[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	03/23/04	1.85	33.81	0.00	<50/<50 [38]	--	--	--	--	--	--	--
	08/10/04	3.72	31.94	0.00	--	--	--	--	--	--	--	--
37.41	**02/08/05**	**1.00**	**36.41**	**0.00**	**<50**	--	--	--	--	--	--	--
MW-8												
42.49	07/02/92	8.50	33.99	0.00	--	--	--	--	--	--	--	--
	07/17/92	9.11	33.38	0.00	ND	ND	ND	ND	ND	ND	--	--
	10/02/92	11.19	31.30	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/03/93	5.55	36.94	0.00	ND	ND	ND	ND	ND	ND	--	ND
	06/22-23/93	7.85	34.64	0.00	ND	ND	ND	ND	ND	ND	--	--

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-8	09/22-23/93	10.40	32.09	0.00	ND	ND	ND	ND	ND	ND	--	--
(Cont.)	12/22/93	9.45	33.04	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/28-29/94	7.55	34.94	0.00	ND	ND	ND	0.59	ND	0.82	--	--
	06/23-24/94	8.86	33.63	0.00	58[7]	ND	ND	ND	ND	ND	--	--
	09/21/94	11.27	31.22	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/21/94	5.70	36.79	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/02-03/95	6.03	36.46	0.00	73[7]	ND	ND	ND	ND	ND	--	--
	06/01/95	9.21	33.28	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/05-06/95	12.08	30.41	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/10-11/95	12.10	30.39	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/11/96	7.80	34.69	0.00	ND	ND	ND	ND	ND	0.65	--	--
	06/03-04/96	7.96	34.53	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/04-05/96	10.13	32.36	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/02-03/96	5.83	36.66	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/10-11/97	6.37	36.12	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/09-10/97	7.70	34.79	0.00	ND	ND	ND	ND	ND	ND	ND	--
	09/08-09/97	10.58	31.91	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/03-04/97	6.23	36.26	0.00	70[8]	ND	ND	ND	ND	ND	--	--
	03/23-24/98	5.33	37.16	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/07-08/98	7.33	35.16	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/16/98	10.16	32.33	0.00	ND	ND	ND	ND	ND	ND	ND	--
	12/16/98	6.67	35.82	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/23/99	6.79	35.70	0.00	ND	ND	ND	ND	ND	ND	ND[22]	--[24]
	06/14/99	9.79	32.70	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/13-14/99	10.30	32.19	0.00	57[15]	ND	ND	ND	ND	ND	--	--
	12/16/99	6.26	36.23	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/16-17/00	5.64	36.85	0.00	68[15]	ND	ND	ND	ND	ND	--	--
	06/26-27/00	8.03	34.46	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/21/00	10.32	32.17	0.00	ND	ND	ND	ND	ND	ND	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-8	11/08/00	9.46	33.03	0.00	91.2[21]	ND	ND	ND	ND	ND	--	--
(Cont.)	02/08/01	7.27	35.22	0.00	ND	ND	ND	ND	ND	ND	--	--
	05/09/01	9.83	32.66	0.00	ND	ND	ND	ND	ND	ND	--	--
	08/07/01	11.40	31.09	0.00	<50	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/27/01	7.44	35.05	0.00	[41]52/52[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/05/02	7.49	35.00	0.00	[41]150/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	05/07/02	7.02	35.47	0.00	[41]73/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/02	10.31	32.18	0.00	[41]98/<56[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/12/02	8.30	34.19	0.00	180/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/12/03	6.55	35.94	0.00	170/<56[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	06/09-10/03	8.25	34.24	0.00	150/<51[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
42.49	08/14/03	9.76	32.73	0.00	[41]110/120[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	12/11/03	7.74	34.75	0.00	160/92[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	03/23/04	6.42	36.07	0.00	<50/<50 [38]	--	--	--	--	--	--	--
	08/10/04	7.25	35.24	0.00	--	--	--	--	--	--	--	--
44.21	**02/08/05**	**5.42**	**38.79**	**0.00**	**<50**	--	--	--	--	--	--	--
MW-9												
35.20	07/02/92	4.50	30.70	0.00	--	--	--	--	--	--	--	--
	07/17/92	5.45	29.75	0.00	ND	ND	ND	ND	ND	ND	--	--
	10/02/92	5.69	29.51	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/03/93	3.71	31.49	0.00	ND	ND	ND	ND	ND	ND	--	ND
	06/22-23/93	4.88	30.32	0.00	120	ND	ND	ND	ND	ND	--	--
	09/22-23/93	6.70	28.50	0.00	70	ND	ND	ND	ND	ND	--	--
	12/22/93	INACCESSIBLE		--	--	--	--	--	--	--	--	--
	03/28-29/94	4.39	30.81	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/23-24/94	5.09	30.11	0.00	58[7]	ND	ND	ND	ND	ND	--	--
	09/21/94	7.12	28.08	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/21/94	3.90	31.30	0.00	140[7]	ND	ND	ND	ND	ND	--	--

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-9	03/02-03/95	1.35	33.85	0.00	ND	ND	ND	ND	ND	ND	--	--
(Cont.)	06/01/95	3.83	31.37	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/05-06/95	7.04	28.16	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/10-11/95	7.08	28.12	0.00	230[7]	ND	ND	ND	ND	ND	--	--
	03/11/96	3.69	31.51	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/03-04/96	5.92	29.28	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/04-05/96	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	12/02-03/96	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/10-11/97	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	06/09-10/97	4.89	30.31	0.00	62	ND	ND	ND	ND	ND	ND	--
	09/08-09/97	7.04	28.16	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/03-04/97	3.08	32.12	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/23-24/98	3.31	31.89	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/07-08/98	4.42	30.78	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/16/98	7.29	27.91	0.00	75	ND	ND	ND	ND	ND	ND	--
	12/16/98	4.14	31.06	0.00	83[20]	ND	ND	ND	ND	ND	--	--
	03/23/99	4.11	31.09	0.00	ND	ND	ND	1.0	ND	1.1	ND[22]	--[24]
	06/14/99	5.55	29.65	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/13-14/99	7.85	27.35	0.00	71[15]	ND	ND	ND	ND	ND	--	--
	12/16/99	3.77	31.43	0.00	440[21]	63.4[32]	ND	31.8	ND	ND	--	--
	03/16-17/00	3.47	31.73	0.00	180[15]	120[29]	0.60	160	ND	ND	--	--
	06/26-27/00	5.17	30.03	0.00	100[15]	ND	ND	ND	ND	ND	--	--
	09/21/00	6.90	28.30	0.00	103[37]	ND	ND	ND	ND	ND	--	--
	11/08/00	4.06	31.14	0.00	159[21]	ND	ND	ND	ND	ND	--	--
	02/08/01	4.14	31.06	0.00	[15]160/ND[38]	436[29]	ND[11]	274	ND[11]	ND[11]	--	--
	05/09/01	4.71	30.49	0.00	[15]85/53[15,38]	ND	ND	ND	ND	ND	--	--
	08/07/01	7.16	28.04	0.00	[41]150/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/27/01	3.85	31.35	0.00	[41]200/200[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/05/02	4.23	30.97	0.00	[41]420/170[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--

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Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-9	05/07/02	4.01	31.19	0.00	[41]100/<50[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
(Cont.)	08/14/02	7.02	28.18	0.00	[41]130/<56[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/12/02	3.78	31.42	0.00	240[38,44]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/12/03	4.15	31.05	0.00	570/160[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	06/09-10/03	4.87	30.33	0.00	300/120[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
35.20	08/14/03	5.87	29.33	0.00	[41]98/98[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	12/11/03	4.75	30.45	0.00	1,500	<50	<0.50	<0.50	<0.50	<0.50	--	--
	03/23/04	4.05	31.15	0.00	<50/<50 [38]	--	--	--	--	--	--	--
	08/10/04	6.45	28.75	0.00	--	--	--	--	--	--	--	--
37.03	**02/08/05**	**3.99**	**33.04**	**0.00**	**<50**	--	--	--	--	--	--	--
MW-10												
49.43	07/02/92	7.67	41.76	0.00	--	--	--	--	--	--	--	--
	07/17/92	7.95	41.48	0.00	ND	ND	ND	ND	ND	ND	--	--
	10/02/92	10.73	38.70	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/03/93	1.89	47.54	0.00	ND	ND	ND	ND	ND	ND	--	ND
	06/22-23/93	2.65	46.78	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/22-23/93	9.20	40.23	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/22/93	7.09	42.34	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/28-29/94	2.03	47.40	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/23-24/94	6.51	42.92	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/21/94	10.31	39.12	0.00	ND	ND	ND	0.92	ND	1.3	--	--
	12/21/94	3.57	45.86	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/02-03/95	2.08	47.35	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/01/95	6.95	42.48	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/05-06/95	10.11	39.32	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/10-11/95	10.05	39.38	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/11/96	1.97	47.46	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/03-04/96	3.30	46.13	0.00	ND	ND	ND	ND	ND	ND	--	--

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-10	09/04-05/96	8.99	40.44	0.00	ND	ND	ND	ND	ND	ND	--	--
(Cont.)	12/02-03/96	5.51	43.92	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/10-11/97	1.23	48.20	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/09-10/97	4.80	44.63	0.00	ND	ND	ND	ND	ND	ND	ND	--
	09/08-09/97	9.20	40.23	0.00	ND	ND	ND	ND	ND	ND	--	--
	12/03-04/97	3.26	46.17	0.00	58[8]	ND	ND	ND	ND	ND	--	--
	03/23-24/98	0.04	49.39	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/07-08/98	1.23	48.20	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/16/98	7.18	42.25	0.00	ND	ND	ND	ND	ND	ND	ND	--
	12/16/98	1.47	47.96	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/23/99	0.68	48.75	0.00	ND	ND	ND	1.6	ND	1.5	ND[22]	--[24]
	06/14/99	2.92	46.51	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/13-14/99	8.24	41.19	0.00	62[15]	ND	ND	ND	ND	ND	--	--
	12/16/99	3.06	46.37	0.00	ND	ND	ND	ND	ND	ND	--	--
	03/16-17/00	1.29	48.14	0.00	ND	ND	ND	ND	ND	ND	--	--
	06/26-27/00	5.55	43.88	0.00	ND	ND	ND	ND	ND	ND	--	--
	09/21/00	8.97	40.46	0.00	ND	ND	ND	ND	ND	ND	--	--
	11/08/00	9.87	39.56	0.00	63.6[21]	ND	ND	ND	ND	ND	--	--
	02/08/01	2.31	47.12	0.00	ND	ND	ND	ND	ND	ND	--	--
	05/09/01	2.71	46.72	0.00	ND	ND	ND	ND	ND	ND	--	--
	08/07/01	7.93	41.50	0.00	<50	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/27/01	9.15	40.28	0.00	[41]78/78[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/05/02	1.76	47.67	0.00	[41]100/53[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	05/07/02	2.16	47.27	0.00	<50	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/02	8.30	41.13	0.00	<56	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/12/02	10.78	38.65	0.00	60[38,44]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/12/03	1.67	47.76	0.00	370/220[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
49.43	06/09-10/03	3.30	46.13	0.00	280/190[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/03	8.15	41.28	0.00	<55	<50	<0.50	<0.50	<0.50	<0.50	--	--

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-10	12/11/03	8.00	41.43	0.00	110	<50	<0.50	<0.50	<0.50	<0.50	--	--
(Cont.)	03/23/04	1.95	47.48	0.00	<50/<50 [38]	--	--	--	--	--	--	--
	08/10/04	8.58	40.85	0.00	--	--	--	--	--	--	--	--
51.26	**02/08/05**	**1.55**	**49.71**	**0.00**	**<50**	--	--	--	--	--	--	--
MW-11	12/22/93	--	--	--	--	--	--	--	--	--	--	--
	03/28/94	7.22	--	0.04	--	--	--	--	--	--	--	--
	NOT MONITORED/SAMPLED											
MW-12	12/22/93	--	--	--	--	--	--	--	--	--	--	--
	03/28/94	7.35	--	0.00	--	--	--	--	--	--	--	--
	NOT MONITORED/SAMPLED											
MW-13												
45.99	06/09-10/03	6.55	39.44	0.00	6,400/5,000[38]	32,000	1,600	400	1,500	4,100	--	--
	08/14/03	7.87	38.12	0.00	[41]3,300/2,600[38,41]	28,000	1,000	540	1,300	5,100	--	--
	12/11/03	7.00	38.99	0.00	4,900	18,000	800	360	1,300	4,900	--	--
	03/23/04	6.32	39.67	0.00	6,900[49]/410[38,49]	14,000	930	320	1,100	4,100	--	--
	05/18/04	7.05	38.94	0.00	10 [49]	14,000	840	200	970	4,700	--	--
	08/10/04	8.68	37.31	0.00	1,500 [49]	16,000 [50]	850	130	920	3,400	--	--
	11/09/04	8.03	37.96	0.00	4,400 [49]	24,000 [50]	1,200	290	1,300	4,500	--	--
47.79	**02/08/05**	**6.20**	**41.59**	**0.00**	**4,500 [49]**	**17,000 [51]**	**1,000**	**210**	**1,100**	**3,800**	--	--
MW-14												
44.24	06/09-10/03	21.90	22.34	0.00	200/83[38]	<50	1.2	<0.50	<0.50	<0.50	--	--
	08/14/03	23.92	20.32	0.00	[41]93/<58[38]	<50	0.54	<0.50	<0.50	<0.50	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-14	12/11/03	22.65	21.59	0.00	230	<50	<0.50	<0.50	<0.50	1.7	--	--
(Cont.)	03/23/04	21.15	23.09	0.00	<50/<50 [38]	<50	<0.50	<0.50	0.71	1.3	--	--
	05/18/04	22.55	21.69	0.00	<50	68	1.8	1.2	4.6	14	--	--
	08/10/04	24.20	20.04	0.00	<50	<50	<0.50	<0.50	<0.50	1.1	--	--
	11/09/04	24.11	20.13	0.00	<50	<50	0.88	<0.50	0.91	2.0	--	--
46.02	**02/08/05**	**21.97**	**24.05**	**0.00**	**<50**	**<50**	**<0.50**	**0.57**	**<0.50**	**<1.0**	--	--
MW-15												
41.79	06/09-10/03	19.47	22.32	0.00	220/73[38]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/03	21.18	20.61	0.00	[41]120/70[38,41]	<50	<0.50	<0.50	<0.50	<0.50	--	--
	12/11/03	20.23	21.56	0.00	230	<50	<0.50	<0.50	<0.50	<0.50	--	--
	03/23/04	18.75	23.04	0.00	<50/<50 [38]	<50	<0.50	<0.50	0.76	1.3	--	--
	05/18/04	20.11	21.68	0.00	<50	100	2.2	2.1	7.7	22	--	--
	08/10/04	21.80	19.99	0.00	<50	<50	<0.50	<0.50	<0.50	1.3	--	--
	11/09/04	21.77	20.02	0.00	<50	<50	0.83	0.71	<0.50	<1.0	--	--
43.58	**02/08/05**	**19.56**	**24.02**	**0.00**	**<50**	**<50**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	--	--
MW-16A												
51.66	**02/08/05**	**8.88**	**42.78**	**0.00**	**490 [49]**	**3,000 [51]**	**200**	**220**	**68**	**520**	--	--
MW-16B												
51.72	**02/08/05**	**27.65**	**24.07**	**0.00**	**<50**	**<50**	**<0.50**	**0.58**	**<0.50**	**1.7**	--	--
MW-17												
50.41	**02/08/05**	**26.42**	**23.99**	**0.00**	**53 [49]**	**60 [51]**	**3.0**	**2.7**	**1.9**	**7.0**	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
MW-18												
43.81	**02/08/05**	**3.33**	**40.48**	**0.00**	**<50**	**4,500 [51]**	**2,300**	**4.5**	**47**	**89**	--	--
MW-19												
45.77	**02/08/05**	**5.94**	**39.83**	**0.00**	**310 [49]**	**4,400 [51]**	**1,500**	**2.0**	**43**	**150**	--	--
MW-20												
43.87	**02/08/05**	**3.30**	**40.57**	**0.00**	**510 [49]**	**4,200 [51]**	**700**	**220**	**110**	**590**	--	--
MW-21												
48.46	**02/08/05**	**6.08**	**42.38**	**0.00**	**2,500 [49]**	**29,000 [51]**	**2,800**	**1,300**	**1,300**	**5,200**	--	--
PZ-1	06/23-24/94	8.61	--	0.70	--	--	--	--	--	--	--	--
	09/21/94	10.58	--	1.10	--	--	--	--	--	--	--	--
	12/21/94	8.90	--	0.02	--	--	--	--	--	--	--	--
	03/02-03/95	8.45	--	--[16]	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	05/31/95	9.58	--	0.40	--	--	--	--	--	--	--	--
	09/05-06/95	12.56	--	0.30	--	--	--	--	--	--	--	--
	12/10-11/95	12.55	--	0.02	--	--	--	--	--	--	--	--
	03/11/96	8.21	--	0.01	--	--	--	--	--	--	--	--
	06/03-04/96	8.46	--	0.05	--	--	--	--	--	--	--	--
	09/04-05/96	9.55	--	0.00	--	--	--	--	--	--	--	--
	12/02-03/96	7.84	--	0.00	--	--	--	--	--	--	--	--
	03/10-11/97	6.30	--	0.02	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	06/09-10/97	7.74	--	0.01	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT					--	--	--
	09/08-09/97	INACCESSIBLE DUE TO CONSTRUCTION				--	--	--	--	--	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
PZ-1	12/03-04/97	INACCESSIBLE DUE TO CONSTRUCTION				--	--	--	--	--	--	--
(Cont.)	03/23-24/98	INACCESSIBLE DUE TO CONSTRUCTION				--	--	--	--	--	--	--
	06/07-08/98	INACCESSIBLE DUE TO CONSTRUCTION				--	--	--	--	--	--	--
	09/16/98[19]	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	12/16/98	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/23/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	06/14/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	09/13-14/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	12/16/99	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	03/16-17/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	06/26-27/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	09/21/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/08/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/08/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/09/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	08/07/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/27/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/05/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/07/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	08/14/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/12/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	UNABLE TO LOCATE											
PZ-2	06/23-24/94	8.68	--	0.00	--	--	--	--	--	--	--	--
	09/21/94	10.65	--	0.00	--	--	--	--	--	--	--	--
	12/21/94	7.67	--	0.00	--	--	--	--	--	--	--	--
	03/02-03/95	7.60	--	0.00	1,900[7]	1,600	16	44	20	100	--	--
	05/31/95	8.64	--	0.00	--	--	--	--	--	--	--	--
	09/05-06/95	11.58	--	0.00	--	--	--	--	--	--	--	--

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
PZ-2	12/10-11/95	11.53	--	0.00	--	--	--	--	--	--	--	--
(Cont.)	03/11/96	7.38	--	0.00	--	--	--	--	--	--	--	--
	06/03-04/96	7.61	--	0.00	--	--	--	--	--	--	--	--
	09/04-05/96	10.18	--	0.00	--	--	--	--	--	--	--	--
	12/02-03/96	7.67	--	0.00	--	--	--	--	--	--	--	--
	03/10-11/97	6.55	--	0.00	--	--	--	--	--	--	--	--
	06/09-10/97	8.05	--	0.00	--	--	--	--	--	--	--	--
	09/08-09/97	11.13	--	0.00	--	--	--	--	--	--	--	--
	12/03-04/97	8.25	--	0.00	4,500[7]	8,500	69	400	150	1,000	--	--
	03/23-24/98	5.01	--	0.00	--	--	--	--	--	--	--	--
	06/07-08/98	6.11	--	0.00	--	--	--	--	--	--	--	--
	09/16/98	8.54	--	0.00	--	--	--	--	--	--	--	--
	12/16/98	5.68	--	0.00	--	--	--	--	--	--	--	--
	03/23/99	5.35	--	0.00	--	--	--	--	--	--	--	--
	06/14/99	6.60	--	0.00	--	--	--	--	--	--	--	--
	09/13-14/99	9.03	--	0.00	--	--	--	--	--	--	--	--
	12/16/99	UNABLE TO LOCATE		0.00	--	--	--	--	--	--	--	--
	03/16-17/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	06/26-27/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	09/21/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/08/00	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/08/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/09/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	08/07/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/27/01	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	02/05/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	05/07/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	08/14/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--
	11/12/02	UNABLE TO LOCATE		--	--	--	--	--	--	--	--	--

UNABLE TO LOCATE

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID / TOC*(ft.)	DATE	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPHd (ug/L)	TPHg (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MtBE (ug/L)	VOCs (ug/L)
Trip Blank												
TB-LB												
	03/23-24/98	--	--	--	ND	ND	ND	ND	ND	ND	--	--
	06/07-08/98	--	--	--	--	ND	ND	ND	ND	ND	--	--
	09/16/98	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	12/16/98	--	--	--	--	ND	ND	ND	ND	ND	--	--
	03/23/99	--	--	--	--	ND	ND	ND	ND	ND	--	--
	06/14/99	--	--	--	--	ND	ND	ND	ND	ND	--	--
	09/13-14/99	--	--	--	--	ND	ND	ND	ND	ND	--	--
	12/16/99	--	--	--	--	ND	ND	ND	ND	ND	--	--
	03/16-17/00	--	--	--	--	ND	ND	ND	ND	ND	--	--
	06/26-27/00[35]	--	--	--	--	ND	ND	ND	ND	ND	--	--
	09/21/00	--	--	--	--	ND	ND	ND	ND	ND	--	--
	11/08/00	--	--	--	--	ND	ND	ND	ND	ND	--	--
	02/08/01	--	--	--	--	ND	ND	ND	ND	ND	--	--
	05/09/01	--	--	--	--	ND	ND	ND	ND	ND	--	--
	08/07/01	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/27/01	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/05/02	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
QA	05/07/02	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	08/14/02	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	11/12/02	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	02/12/03	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	06/09-10/03	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
QA	08/14/03	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
(Cont.)	12/11/03	--	--	--	--	<50	<0.50	<0.50	<0.50	<0.50	--	--
	05/18/04	--	--	--	--	<50	<0.50	<0.50	<0.50	<1.0	--	--
	08/10/04	--	--	--	--	<50	<0.50	<0.50	<0.50	<1.0	--	--
	11/09/04	--	--	--	--	<50	<0.50	<0.50	<0.50	<1.0	--	--
	02/08/05	**--**	**--**	**--**	**--**	**<50**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	**--**	**--**

Table 2-1

Groundwater Monitoring Data and Analytical Results

Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

EXPLANATIONS:

Groundwater monitoring data and laboratory analytical results prior to December 11, 2003, were compiled from reports prepared by Gettler-Ryan, Inc.

TOC = Top of Casing
(ft.) = Feet
DTW = Depth to Water
GWE = Groundwater Elevation
(msl) = Mean sea level
TPHd = Total Petroleum Hydrocarbons as Diesel by EPA Method 8015B-SVOA
MtBE = Methyl tertiary butyl ether

TPHg = Total Petroleum Hydrocarbons as Gasoline by EPA Method 8015B/8021B
B = Benzene by EPA Method 8015B/8021B
T = Toluene by EPA Method 8015B/8021B
E = Ethylbenzene by EPA Method 8015B/8021B
X = Xylenes by EPA Method 8015B/8021B

VOCs = Volatile Organic Compounds
(ug/L) = Micrograms per Liter
ND = Not Detected
-- = Not Measured/Not Analyzed
QA = Quality Assurance/Trip Blank

* TOC elevations for the following wells (MW-1 through MW-6 and MW-13, MW-14, & MW-15) were surveyed on 05/14/03, by Oscar Larsen & Associates. TOC elevations have been surveyed relative to msl. Data provided by RESNA, Inc.

** GWE was corrected for the presence of free product; correction factor: (TOC - DTW) + (Product Thickness x 0.77).

*** GWE was not corrected for the presence of free product.

[1] Hydrocarbons detected as TPHd appear to be both heavier and lighter hydrocarbons than diesel.
[2] Hydrocarbons detected as TPHd appear to be heavier hydrocarbons than diesel.
[3] On 10/02/92 and 03/03/93, 1,2-Dichloroethane (1,2-DCA) was detected at 94 ppb and 300 ppb, respectively.
[4] Hydrocarbons detected as TPHd appear to be lighter hydrocarbons than diesel.
[5] On 10/02/92, acetone was detected at 46 ppb and on 03/03/93 1,2-DCA was detected at 13 ppb.
[6] Skimmers installed. Could not get accurate product thickness.
[7] Laboratory report indicates the hydrocarbons detected appeared to be a diesel and non-diesel mixture.
[8] Laboratory report indicates the hydrocarbons detected did not appear to be diesel.
[9] Laboratory report indicates the hydrocarbons detected did not appear to be gasoline.
[10] Laboratory report indicates diesel and unidentified hydrocarbons <C16.
[11] Detection limit raised. Refer to analytical reports.
[12] Laboratory report indicates diesel and unidentified hydrocarbons <C14.
[13] On 10/02/92, acetone was detected at 11 ppb and on 03/03/93, 1,2-DCA was detected at 2.2 ppb.
[14] Laboratory report indicates unidentified hydrocarbons <C16.
[15] Laboratory report indicates unidentified hydrocarbons >C16.
[16] Product was present but thickness could not be measured.
[17] Laboratory report indicates diesel and unidentified hydrocarbons <C15.
[18] Laboratory report indicates gasoline and unidentified hydrocarbons C6-C12.
[19] Unable to locate well (with metal detector).
[20] Laboratory report indicates unidentified hydrocarbons >C14.

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

EXPLANATIONS: (cont)

21 Laboratory report indicates unidentified hydrocarbons C9-C24.

22 MtBE by EPA Method 8260.

23 All Volatile Organic Compounds (VOCs) by EPA Method 8260 were ND except for the following: benzene at 220 ppb; 1,2-DCA at 13 ppb; total Xylenes at 22 ppb; and 1-ethyl-2-methyl-benzene at 16 ppb.

24 All VOCs by EPA Method 8260 were ND.

25 All VOCs by EPA Method 8260 were ND except for the following: benzene at 30 ppb; n-Butylbenzene at 12 ppb; sec-Butylbenzene at 5.2 ppb; 1,2-DCA at 7.3 ppb; Ethyl Benzene at 21 ppb; Isopropylbenzene at 8.7 ppb; Naphthalene at 27 ppb; n-Propylbenzene at 17 ppb; 1,2-4-Trimethylbenzene at 160 ppb; 1,3-5 Trimethylbenzene at 54 ppb; Total-Xylenes at 130 ppb; methyl-cyclohexane at 17 ppb; 1-ethyl-3-methyl-Benzene at 130 ppb; 1-ethyl-4-methyl-Benzene at 65 ppb; 1-ethyl-2-methyl-Benzene at 95 ppb; 1-ethyl-2,3-dimethyl-Benzene at 43 ppb; 1-ethyl-1,3-dimethyl-Benzene at 45 ppb; 2,3-Dihydro-1-methylindene at 24 ppb; 1,2,3,5-tetramethyl-Benzene at 29 ppb.

26 All VOCs by EPA Method 8260 were ND except for the following: benzene at 8,100 ppb; 1,2-DCA at 110 ppb; Ethyl Benzene at 1,500 ppb; Naphthalene at 310 ppb; n-Propylbenzene at 220 ppb; Toluene at 11,000 ppb; 1,2,4-Trimethylbenzene at 1,200 ppb; 1,3,5-Trimethylbenzene at 340 ppb; Total-Xylenes at 7,700 ppb; 2-methyl-Propane at 340 ppb; Butane at 360 ppb; 2-methyl-Butane at 380 ppb; 1-ethyl-2-methyl-Benzene at 910 ppb; 1-ethyl-4-methyl-Benzene at 310 ppb.

27 Laboratory report indicates unidentified hydrocarbons >C12.

28 Laboratory report indicates gasoline C6-C12.

29 Laboratory report indicates discrete peaks.

30 Laboratory report indicates BTEX and TFT one third of expected due to IS peak coelution.

31 Initial results reported by laboratory did not correlate with historical data. Requested sample be re-analyzed (past hold time).

32 Laboratory report indicates unidentified hydrocarbons C6-C12.

33 Laboratory report indicates diesel C9-C24.

34 Laboratory report indicates diesel C9-C24 + unidentified hydrocarbons <C16.

35 Laboratory report indicates that this sample was analyzed outside of the EPA recommended holding time.

36 Laboratory report indicates that this sample was originally analyzed within EPA recommended holding time above maximum calibration range. The sample was re-analyzed past EPA recommended holding time.

37 Laboratory report indicates unidentified hydrocarbons C10-C24.

38 TPHd with silica gel cleanup.

39 Laboratory report indicates unidentified hydrocarbons C9-C40.

40 Laboratory report indicates sample was originally analyzed within holding time. Re-analysis for confirmation or dilution was performed past the recommended holding time.

Table 2-1
Groundwater Monitoring Data and Analytical Results
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

EXPLANATIONS: (cont)

41 Laboratory report indicates hydrocarbon pattern is present in the requested fuel quantitation range but does not resemble the pattern of the requested fuel.

42 TPHd results for MW-4 are unavailable due to loss of extract during extraction process.

43 Laboratory report indicates diesel + unidentified hydrocarbons C10-C28.

44 Laboratory report indicates sample was analyzed as TPHd with silica gel cleanup on the original extraction, although the chain of custody indicated otherwise.

45 Laboratory confirmed results.

46 Primary and confirmation results varied by greater than 40% RPD. The results may still be useful for their intended purpose.

47 The surrogate recovery for this sample cannot be accuratley quantified due to interference from coeluting organic compounds present in the sample extract.

48 The surrogate recovery was outside control limits. The result may still be useful for its intended purpose.

49 Although sample contains compounds in the retention time range associated with diesel, the chromatogram was not consistent with the expected chromatographic pattern or "fingerprint". However, the reported concentration is based on diesel.

50 Although sample contains compounds in the retention time range associated with gasoline, the chromatogram was not consistent with the expected chromatographic pattern or "fingerprint". However, the reported concentration is based on gasoline.

51 Weathered gasoline.

NOTE: All EPA Method 8010 constituents were ND, except as noted above.

Table 3-1
Soil Analytical Data
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna California

SAMPLE ID	SAMPLE DATE	DEPTH *(ft)*	PID *(ppm)*	TPHd *(mg/kg)*	TPHg *(mg/kg)*	B *(mg/kg)*	T *(mg/kg)*	E *(mg/kg)*	X *(mg/kg)*
SOIL BORINGS									
SB-1-6-6.5	12/21/04	6-6.5	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-1-11-11.5	12/21/04	11-11.5	NA	17	56.00	<0.100	0.740	0.700	3.60
SB-2-6-6.5	12/22/04	6-6.5	NA	<1.0	<1.0	0.013	<0.005	0.0077	0.032
SB-2-11.5-12	12/22/04	11.5-12	NA	<1.0	3.50	0.540	0.990	0.090	0.360
SB-3-11.5-12	12/22/04	11.5-12	67	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-3-16.5-17	12/22/04	16.5-17	0	<1.0	<1.0	0.030	<0.005	<0.005	<0.01
SB-4-6.5-7	12/22/04	6.5-7	NA	9.5	150.00	0.280	4.30	3.00	14.00
SB-4-11.5-12	12/22/04	11.5-12	NA	210	330.00	2.60	31.00	8.30	42.00
SB-5-6.5-7	12/22/04	6.5-7	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-5-16-16.5	12/22/04	16-16.5	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-6-6.5	12/22/04	6.5	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-6-7	12/22/04	7.0	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-6-17	12/22/04	17.0	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-7-7	12/22/04	7.0	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
SB-7-11.5	12/22/04	11.5	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01

Table 3-1
Soil Analytical Data
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna California

SAMPLE ID	SAMPLE DATE	DEPTH *(ft)*	PID *(ppm)*	TPHd *(mg/kg)*	TPHg *(mg/kg)*	B *(mg/kg)*	T *(mg/kg)*	E *(mg/kg)*	X *(mg/kg)*
MONITORING WELLS									
MW16A-11	12/20/04	11.0	>9999	460	130.00	0.140	0.034	2.30	5.00
MW16B-34	12/21/04	34.0	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
MW17-13.5	12/20/04	13.5	45.0	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
MW-17-15	12/20/04	15.0	48.0	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
MW-17-36.5	12/22/04	36.5	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
MW18-6-6.5	12/21/04	6-6.5	NA	1,400	38.00	<0.050	0.057	0.300	0.530
MW19-7	12/21/04	7	NA	33	15.00	<0.005	0.081	0.120	0.160
MW19-12	12/21/04	12	NA	<1.0	<1.0	<0.005	<0.005	<0.005	<0.01
MW-20-11-11.5	12/21/04	11-11.5	NA	610	320.00	<2.50	2.80	6.60	28.00
MW-20-17	12/21/04	17	NA	<1.0	<1.0	0.0085	<0.005	<0.005	<0.01
MW-21-6-6.5	12/21/04	6-6.5	NA	2.0	9.60	0.450	1.40	0.280	1.70
MW-21-11-12	12/21/04	11-12	NA	15	81.00	1.50	7.70	2.20	12.00

Table 3-1
Soil Analytical Data
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

Explanations:

(ft) = Feet
(mg/kg) = milligrams per kilogram

TPHg = Total Petroleum Hydrocarbons as Gasoline
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes

[1] = Weathered gasoline
[2] = The sample was diluted due to the presence of high levels of non-target analytes resulting in elevated reporting limits.
[3] = Although sample contains compounds in the retention range associated with gasoline, the chromatogram was not consistent with the expected chromatographic pattern or "fingerprint". However, the reported concentration is based on gasoline.
[4] = Result in the Gasoline Range are primarily due to overlap from a heavier fuel hydrocarbon product.

Table 4-1
Product Thickness and Removal Data
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID	DATE	DTW *(ft.)*	Product Thickness *(ft.)*	Amount Bailed (Product + Water) *(gallons)*
MW-4	03/10/97	9.53	0.00	0.00
	06/09/97	10.60	0.00	0.00
	09/08/97	13.76	0.00	0.00
	12/03/97	12.10	0.00	0.00
	03/23/98	8.07	0.00	0.00
	06/07/98	8.90	0.02	0.25
	09/16/98	11.34	0.02	0.25
	03/23/99	8.25	0.00	0.00
	06/14/99	9.42	0.00	0.00
	09/13-14/99	11.83	0.00	0.00
	12/16/99	11.01	0.00	0.00
	03/16-17/00	8.88	0.00	0.00
	06/26-27/00	10.89	0.00	0.00
	09/21/00	12.77	Sheen	0.00
	11/08/00	13.12	0.00	0.00
	02/08/01	10.62	0.00	0.00
	05/09/01	9.73	0.00	0.00
	08/07/01	11.86	0.00	0.00
	11/27/01	12.03	0.00	0.00
	02/05/02	8.56	0.00	0.00
	05/07/02	9.37	0.00	0.00
	08/14/02	11.56	0.00	0.00
	11/12/02	12.73	0.00	0.00
	02/12/03	8.98	0.00	0.00
	06/09-10/03	9.34	0.00	0.00
	08/14/03	11.26	0.00	0.00
	12/11/03	11.54	0.00	0.00
	03/23/04	**9.1**	**0.00**	**0.00**
MW-5	03/10/97	8.45	0.01	0.00
	06/09/97	9.76	0.01	0.00
	09/08/97	12.51	0.01	0.00
	12/03/97	10.12	0.00	0.00
	03/23/98	7.80	1.80	1.5
	06/07/98	9.65	1.25	1.0
	09/16/98	12.10	0.08	0.00
	12/16/98	8.25	0.04	0.25
	03/23/99	7.19	0.24	0.25
	06/14/99	8.61	0.51	0.50
	09/13-14/99[1]	10.76	0.24	0.50
	12/16/99	UNABLE TO LOCATE	--	--
	03/16-17/00	7.01	0.00	0.00
	06/26-27/00	INACCESSIBLE	--	--
	09/21/00	INACCESSIBLE	--	--
	11/08/00	INACCESSIBLE	--	--

Table 4-1
Product Thickness and Removal Data
Former Unocal Bulk Plant # 762248
359 Main Street
Fortuna, California

WELL ID	DATE	DTW *(ft.)*	Product Thickness *(ft.)*	Amount Bailed (Product + Water) *(gallons)*
MW-5	02/08/01	INACCESSIBLE	--	--
(cont)	05/09/01	INACCESSIBLE	--	--
	08/07/01	INACCESSIBLE	--	--
	11/27/01	INACCESSIBLE	--	--
	02/05/02	INACCESSIBLE	--	--
	05/07/02	7.20	0.00	0.00
	08/14/02	9.80	0.00	0.00
	11/12/02	8.87	0.00	0.00
	02/12/03	5.79	0.00	0.00
	06/09-10/03	7.03	0.00	0.00
	08/14/03	9.33	0.00	0.00
	12/11/03	7.58	0.00	0.00
	03/23/04	**6.20**	**0.00**	**0.00**

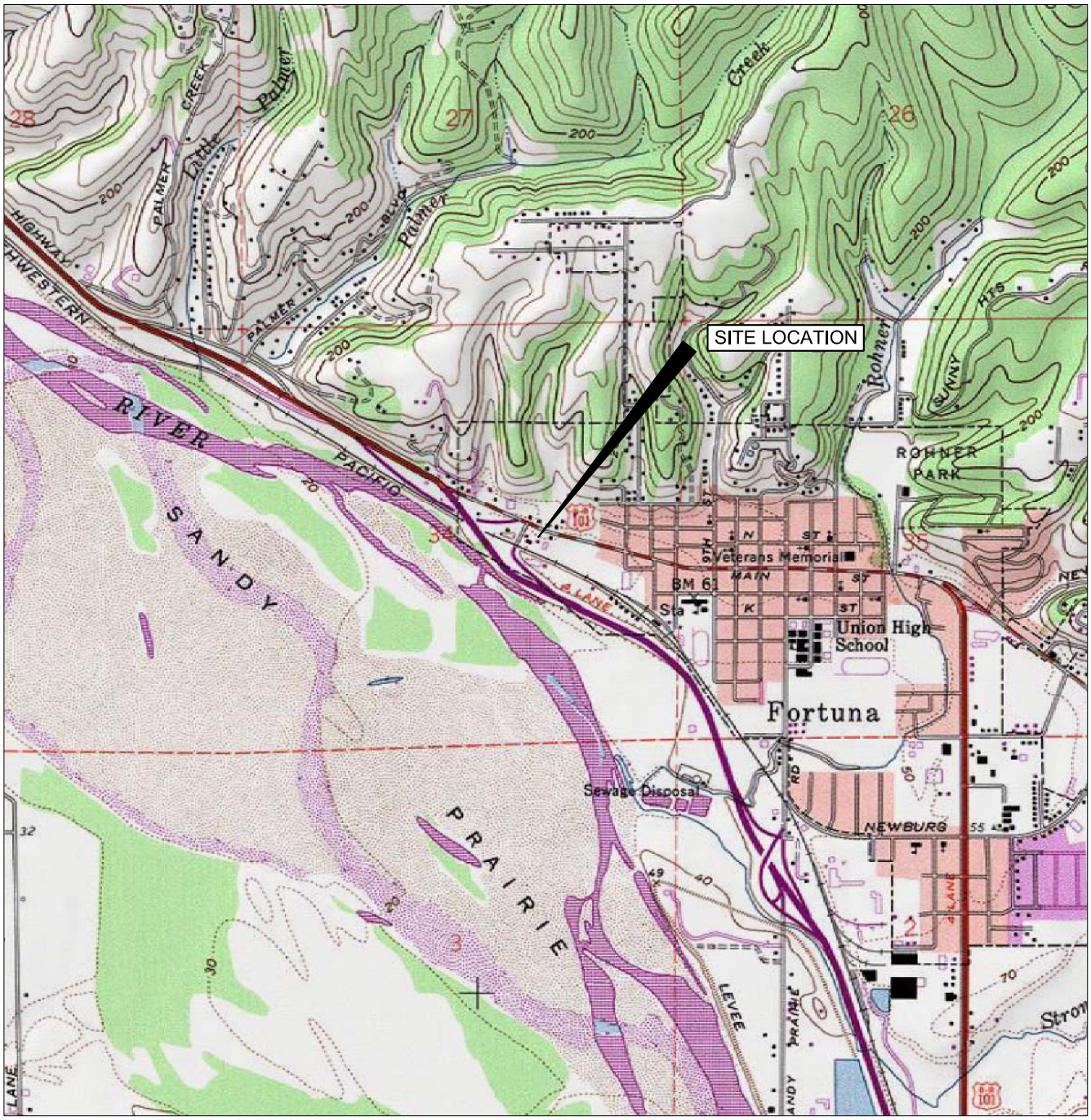
EXPLANATIONS:

Product thickness/removal data prior to March 23, 1998, were compiled from reports prepared by MPDS Services, Inc.

DTW = Depth to Water
(ft.) = Feet
-- = Not Analyzed

[1] Skimmer in well.

FIGURES



Map created with TOPO - 2003 National Geographic

MAP LOCATION

N

0 2000

Approximate Scale in Feet

ENSR INTERNATIONAL
10411 Old Placerville Road Ste 210
Sacramento, California 95827
Phone: (916) 362-7100
Fax: (916) 362-8100
Web: WWW.ENSR.COM

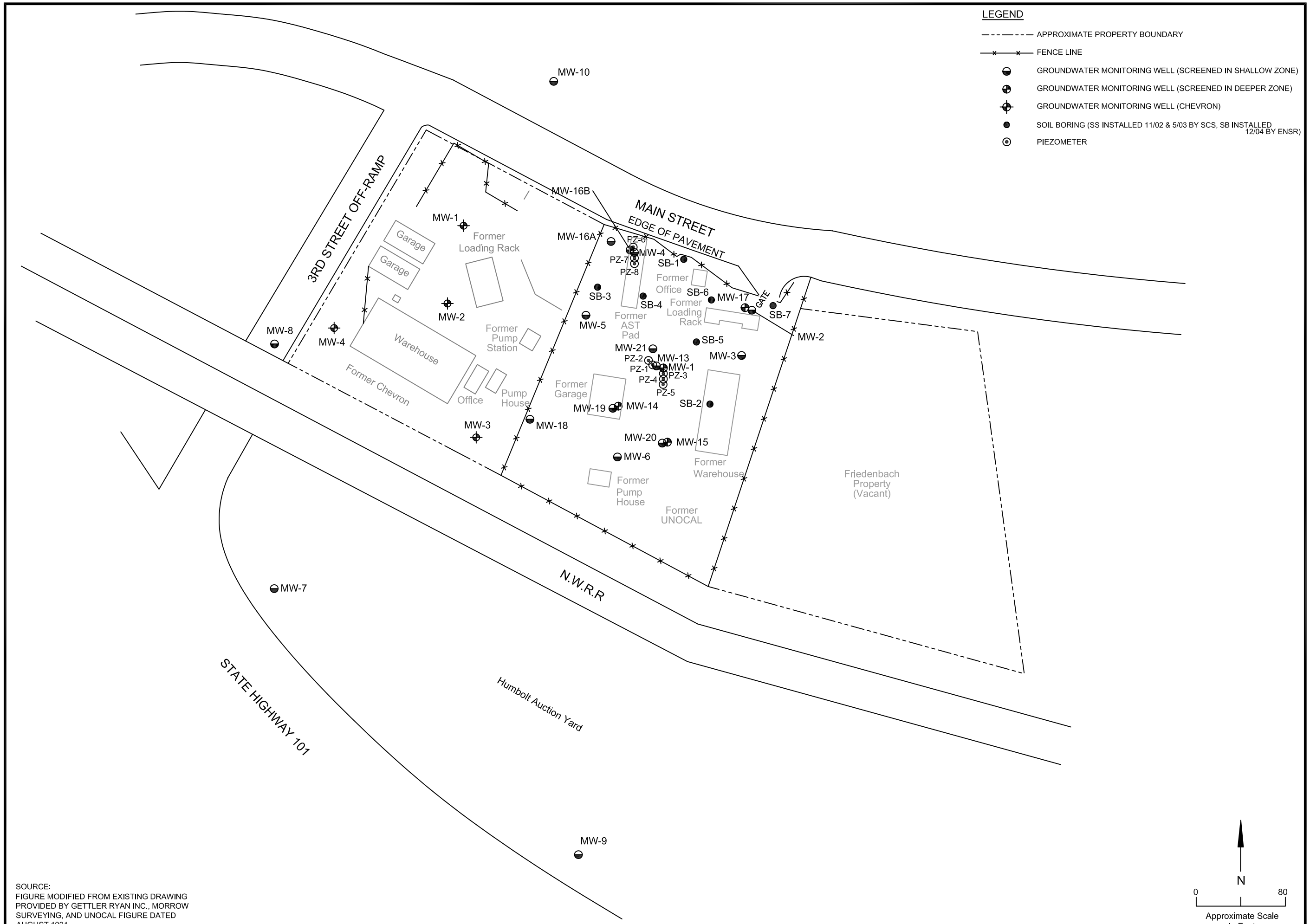
SITE LOCATION MAP

Former UNOCAL Bulk Plant 762248
359 Main Street
Fortuna, California

DRAWN BY	DATE	PROJECT NUMBER
G BORCHARDT	4/12/2004	06940-407

FIGURE

1-1



SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924

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REVISIONS			
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DESIGNED BY:	X
DRAWN BY:	K.P.B.
CHECKED BY:	S.W.
APPROVED BY:	X

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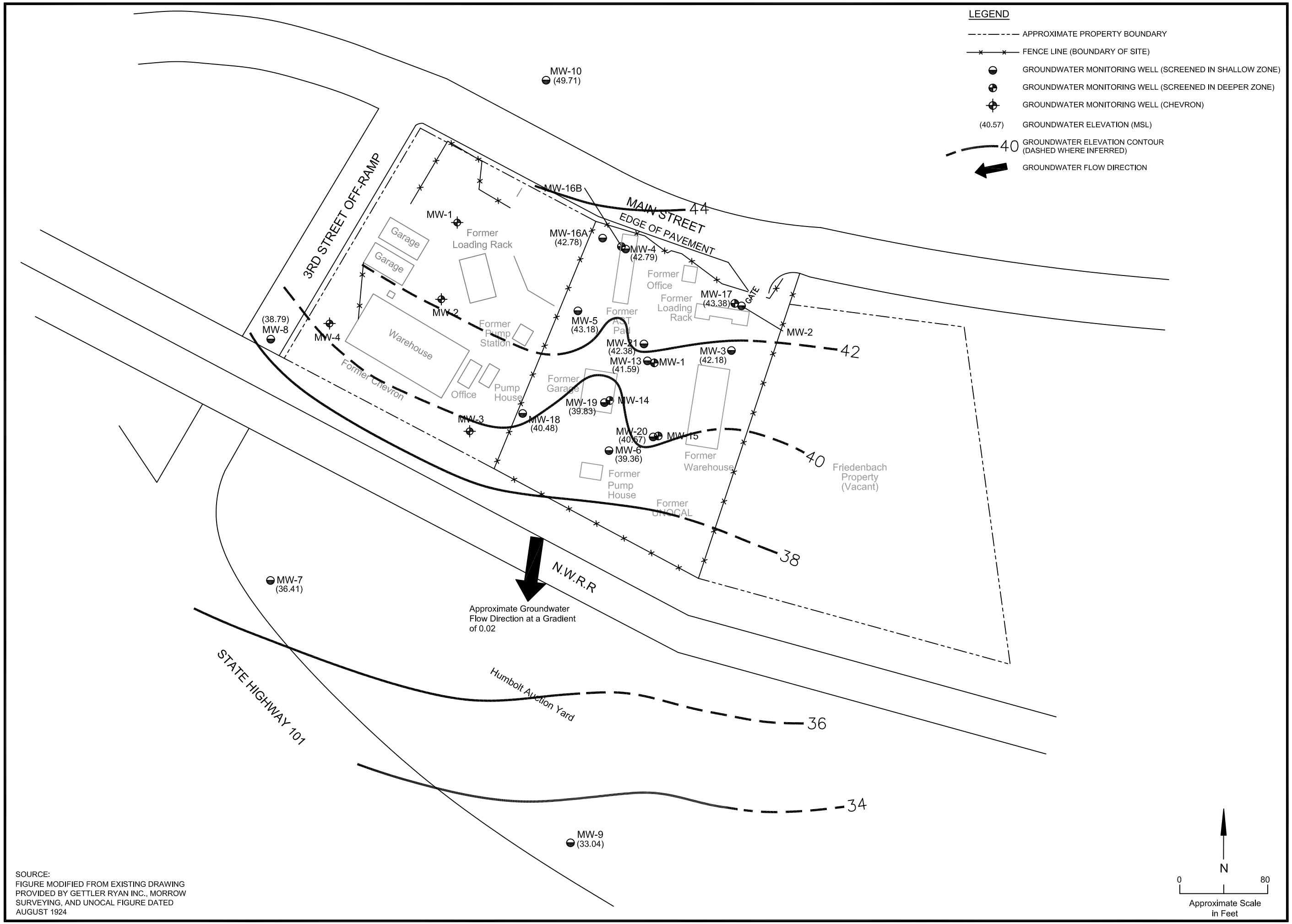
SITE MAP
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1"=80'	4/05	06940-407-130

FIGURE NUMBER:
1-2

SHEET NUMBER:
1



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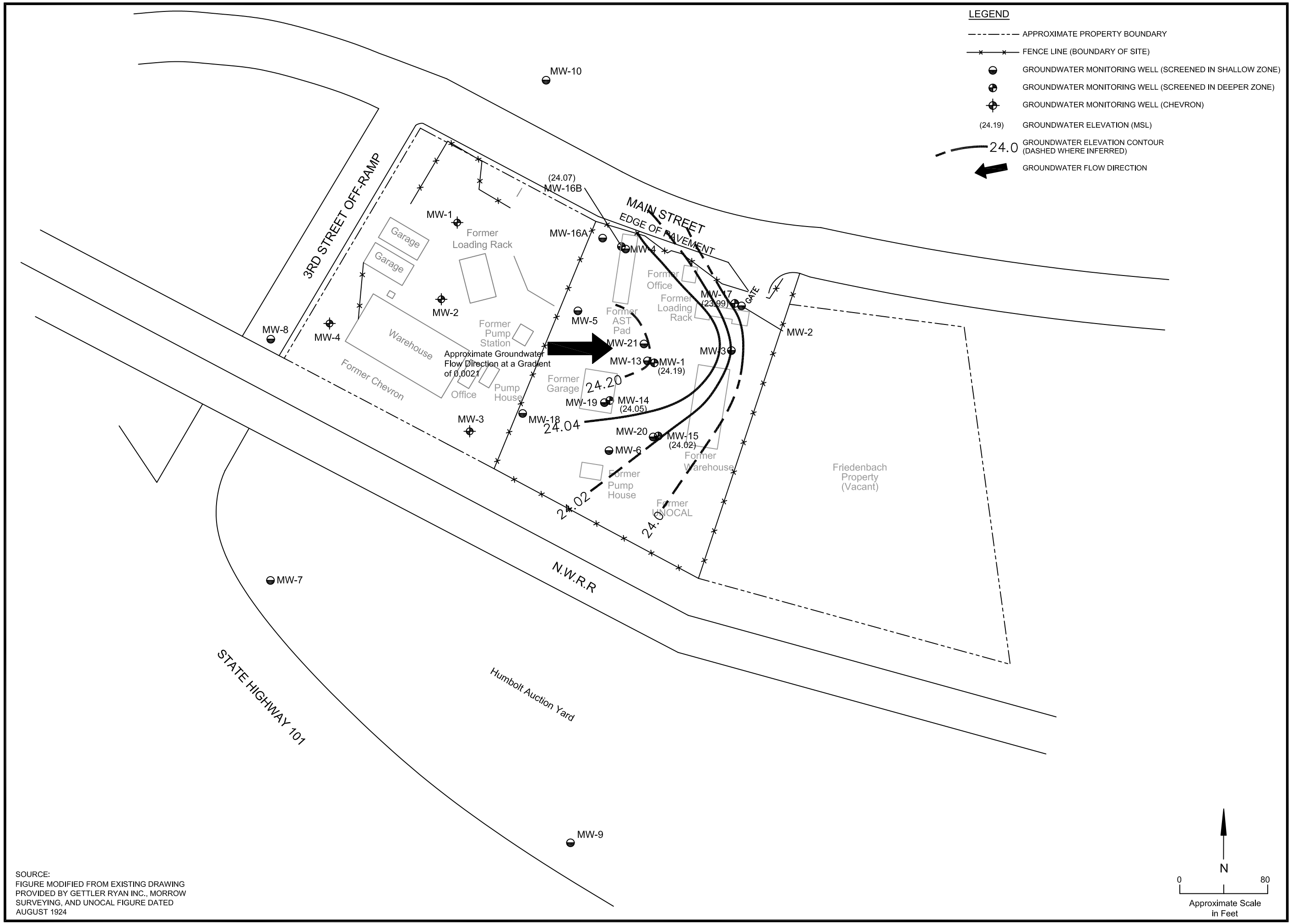
SHALLOW GROUNDWATER ELEVATION CONTOUR
(FEBRUARY 2005 DATA)
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE: 1"=80'
DATE: 4/05
PROJECT NUMBER: 06940-407-130

FIGURE NUMBER: 4-1

SHEET NUMBER: 1



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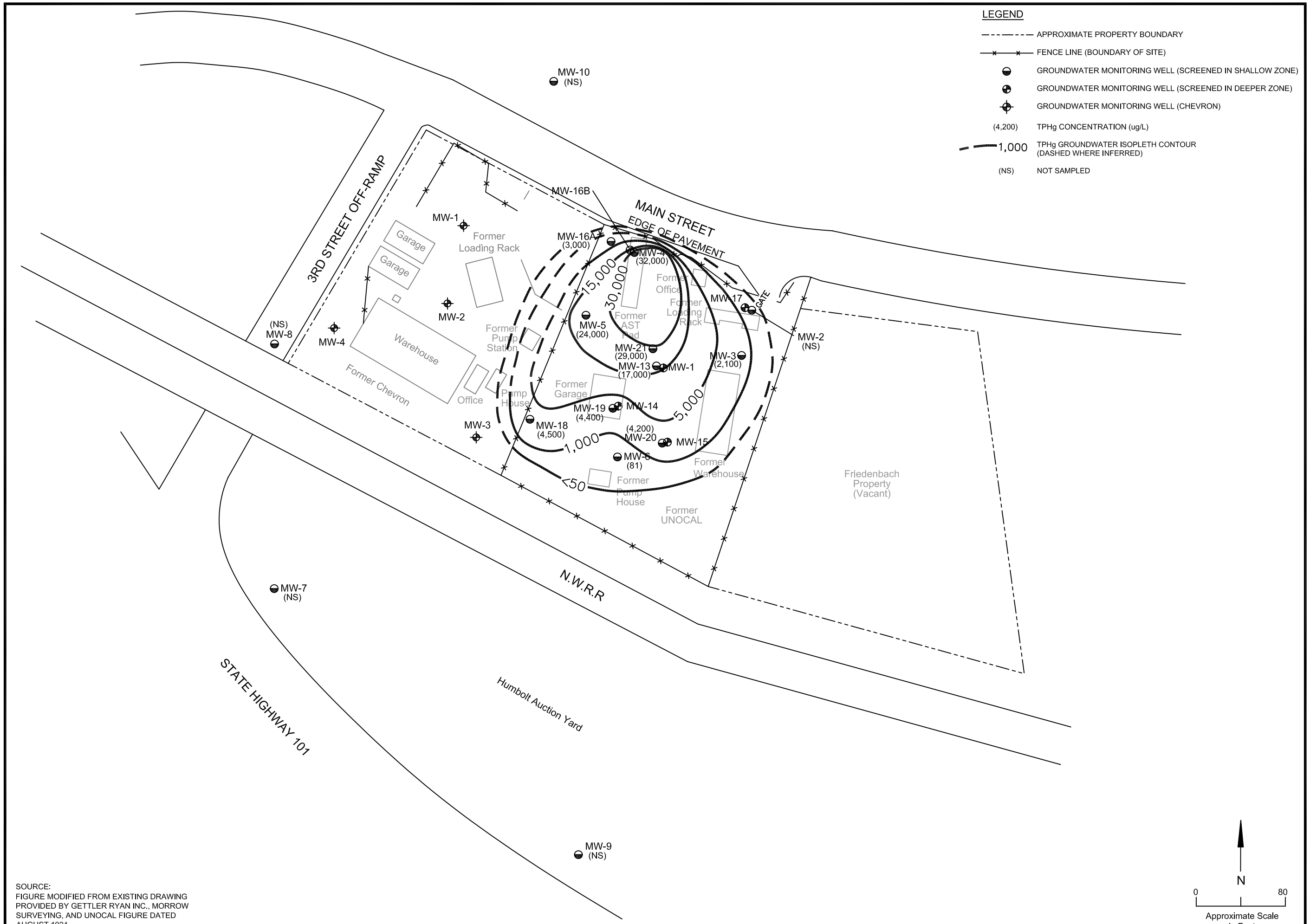
DEEP GROUNDWATER ELEVATION CONTOUR
(FEBRUARY 2005 DATA)
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE: 1"=80'
DATE: 4/05
PROJECT NUMBER: 06940-407-130

FIGURE NUMBER: 4-2

SHEET NUMBER: 1



SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924

FILENAME: 06940-407-04B.DWG

REVISIONS			
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DESIGNED BY: S.W.
DRAWN BY: K.P.B.
CHECKED BY: S.W.
APPROVED BY: X

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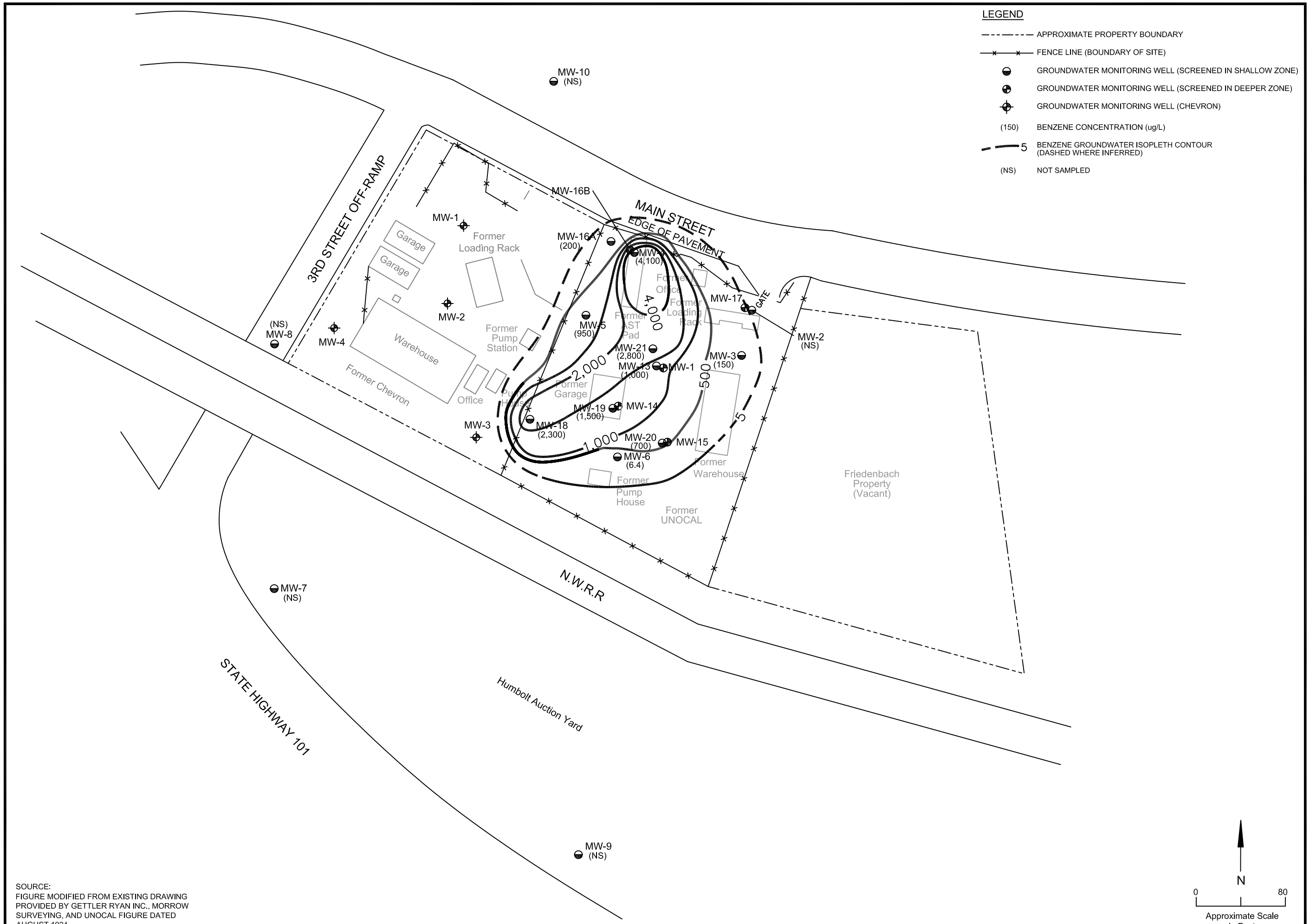
SHALLOW TPHg GROUNDWATER ISOPLETH
(FEBRUARY 2005 DATA)
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE: 1"=80'
DATE: 4/05
PROJECT NUMBER: 06940-407-130

FIGURE NUMBER: 4-3

SHEET NUMBER: 1



SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924

FILENAME: 06940-407-04B.DWG

REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
S.W.	K.P.B.	S.W.	X

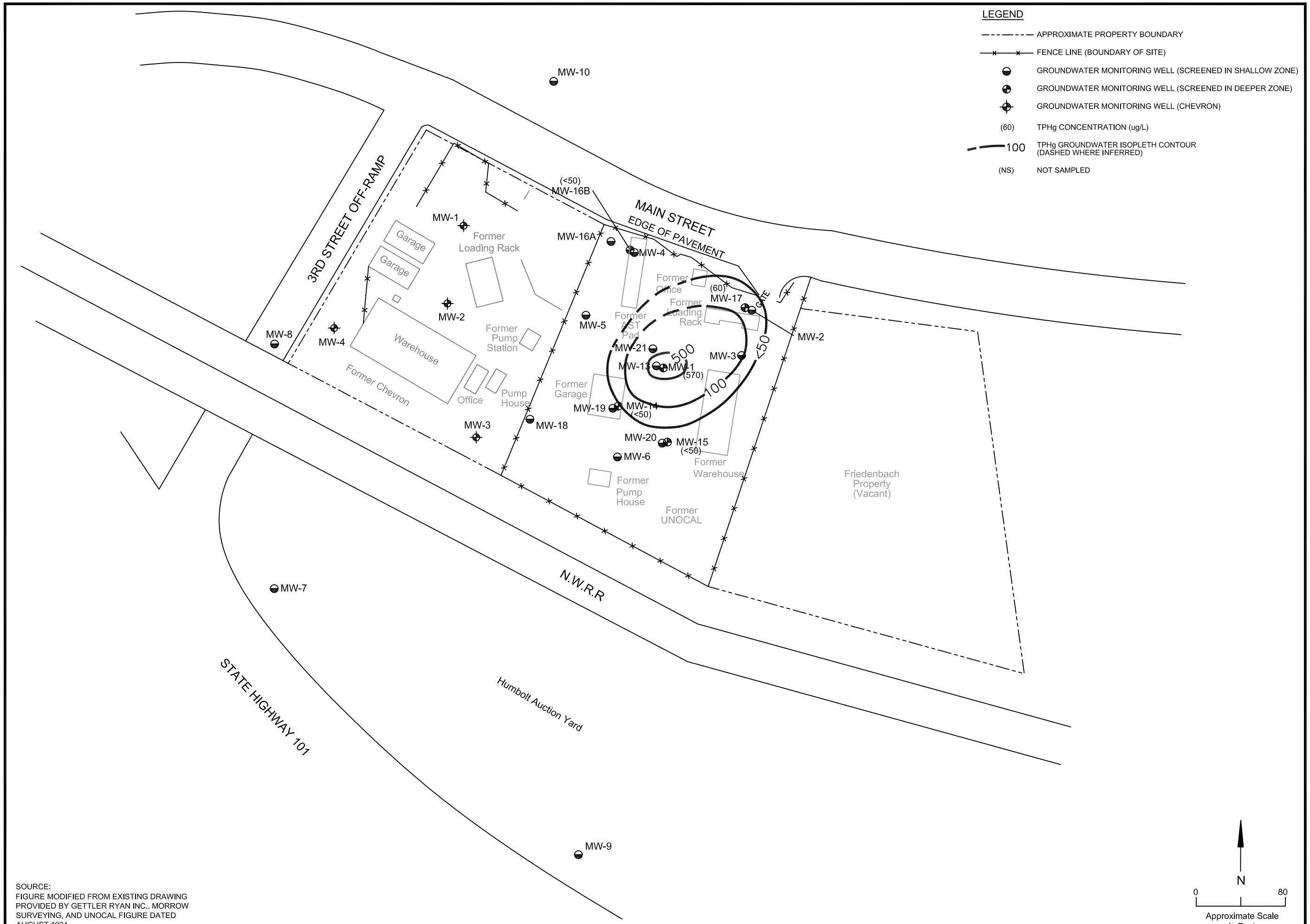
ENSR INTERNATIONAL
2 TECHNOLOGY PARK DRIVE
WESTFORD, MASSACHUSETTS 01886
PHONE: (978) 589-3000
FAX: (978) 589-3100
WEB: HTTP://WWW.ENSR.COM

SHALLOW BENZENE GROUNDWATER ISOPLETH
(FEBRUARY 2005 DATA)
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1"=80'	4/05	06940-407-130

FIGURE NUMBER:
4-4

SHEET NUMBER:
1



SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924

FILENAME: 06940-407-04B.DWG

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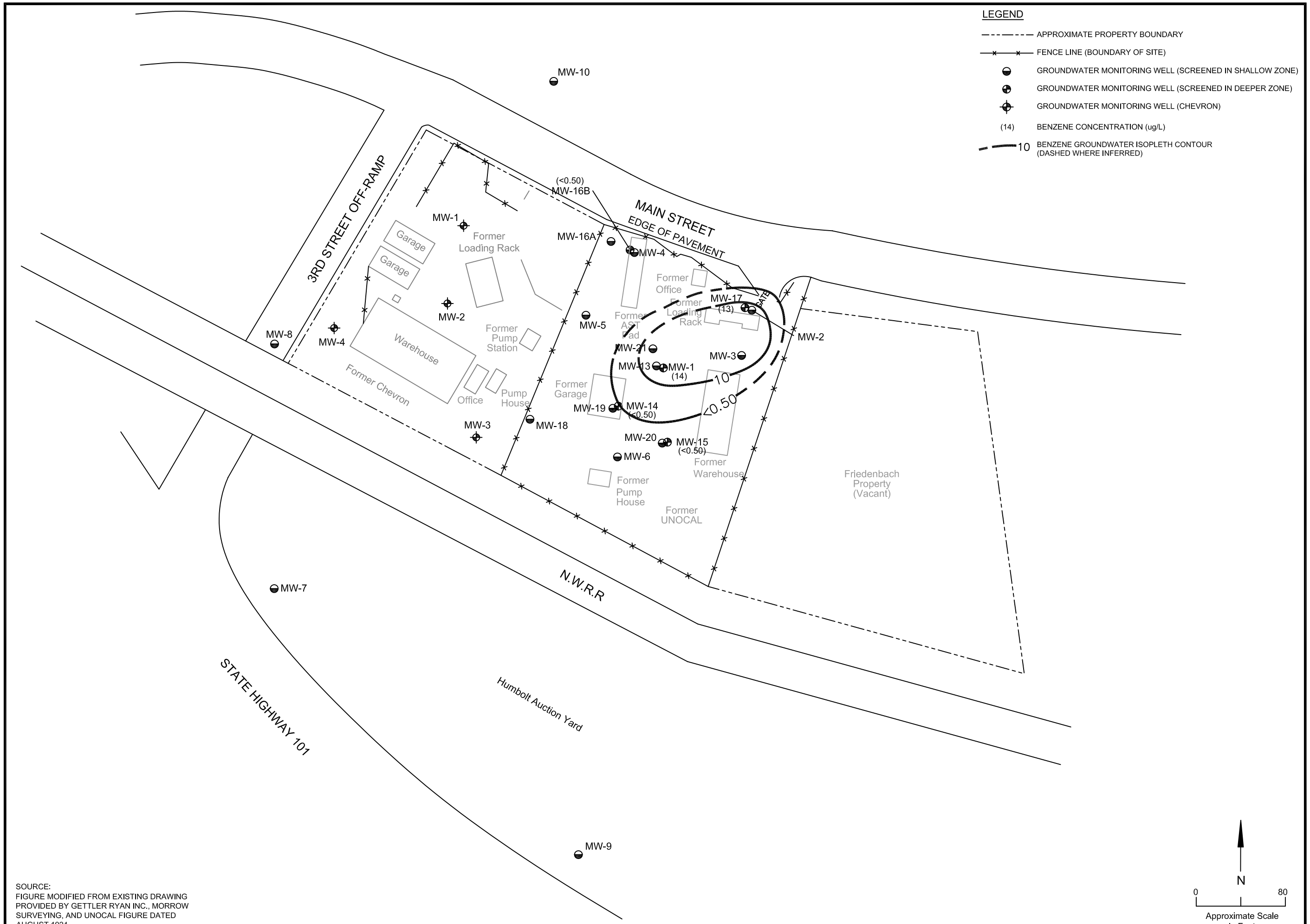
DEEP TPHg GROUNDWATER ISOPLETH
(FEBRUARY 2005 DATA)
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE: 1"=80'
DATE: 4/05
PROJECT NUMBER: 06940-407-130

FIGURE NUMBER: 4-5

SHEET NUMBER: 1



SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924

FILENAME: 06940-407-04B.DWG

REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY: S.W.
DRAWN BY: K.P.B.
CHECKED BY: S.W.
APPROVED BY: X

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DEEP BENZENE GROUNDWATER ISOPLETH
(FEBRUARY 2005 DATA)
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

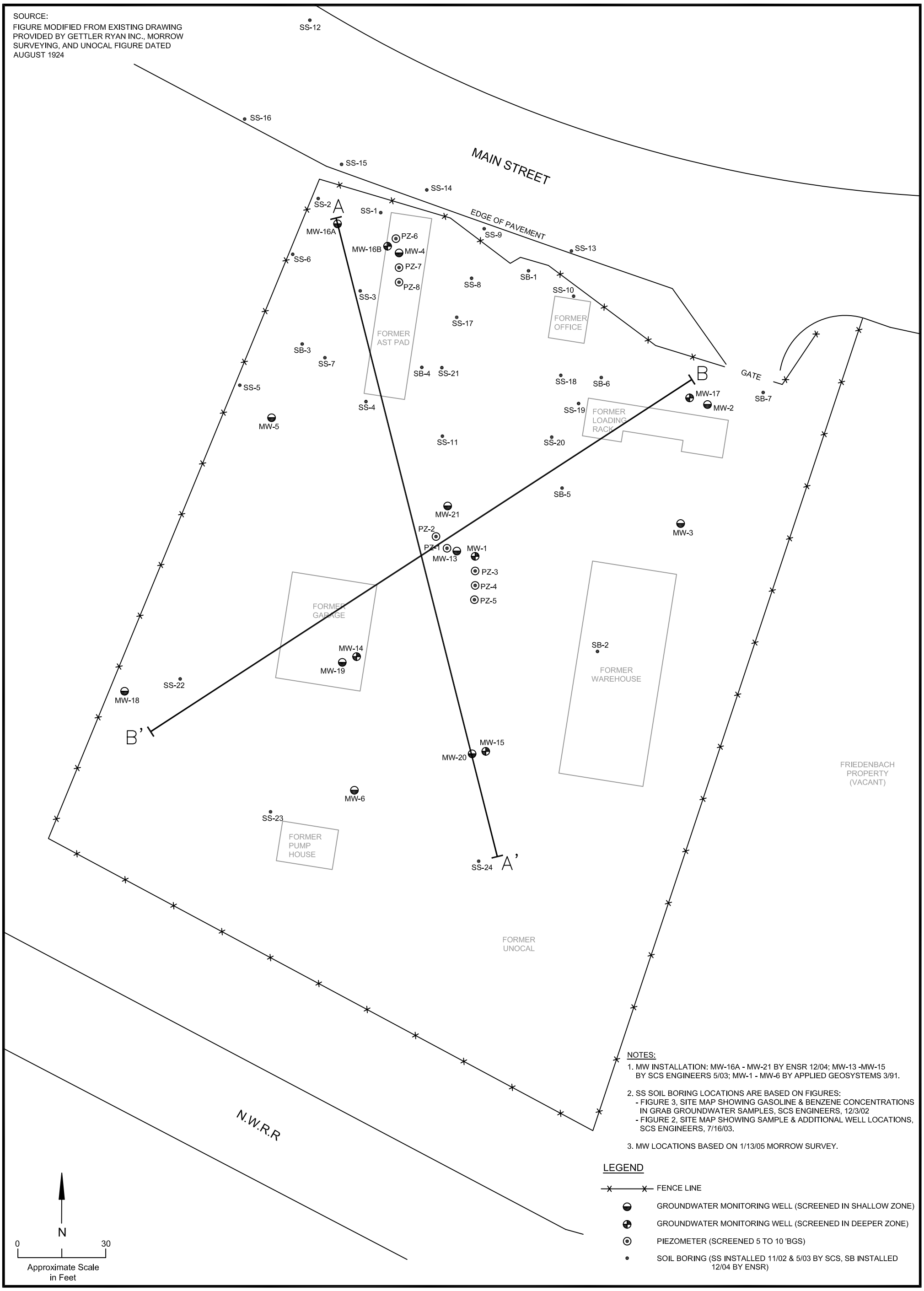
SCALE: 1"=80'
DATE: 4/05
PROJECT NUMBER: 06940-407-130

FIGURE NUMBER: 4-6

SHEET NUMBER: 1

FILENAME: 06940-407-03B.DWG

SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924



NOTES:

1. MW INSTALLATION: MW-16A - MW-21 BY ENSR 12/04; MW-13 -MW-15 BY SCS ENGINEERS 5/03; MW-1 - MW-6 BY APPLIED GEOSYSTEMS 3/91.
2. SS SOIL BORING LOCATIONS ARE BASED ON FIGURES:
   - FIGURE 3, SITE MAP SHOWING GASOLINE & BENZENE CONCENTRATIONS IN GRAB GROUNDWATER SAMPLES, SCS ENGINEERS, 12/3/02
   - FIGURE 2, SITE MAP SHOWING SAMPLE & ADDITIONAL WELL LOCATIONS, SCS ENGINEERS, 7/16/03.
3. MW LOCATIONS BASED ON 1/13/05 MORROW SURVEY.

LEGEND

- FENCE LINE
- GROUNDWATER MONITORING WELL (SCREENED IN SHALLOW ZONE)
- GROUNDWATER MONITORING WELL (SCREENED IN DEEPER ZONE)
- PIEZOMETER (SCREENED 5 TO 10 'BGS)
- SOIL BORING (SS INSTALLED 11/02 & 5/03 BY SCS, SB INSTALLED 12/04 BY ENSR)

FIGURE NUMBER: 5-1

SHEET NUMBER: 1

GEOLOGIC CROSS-SECTION TRANSECT
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1"=30'	4/05	06940-407-130

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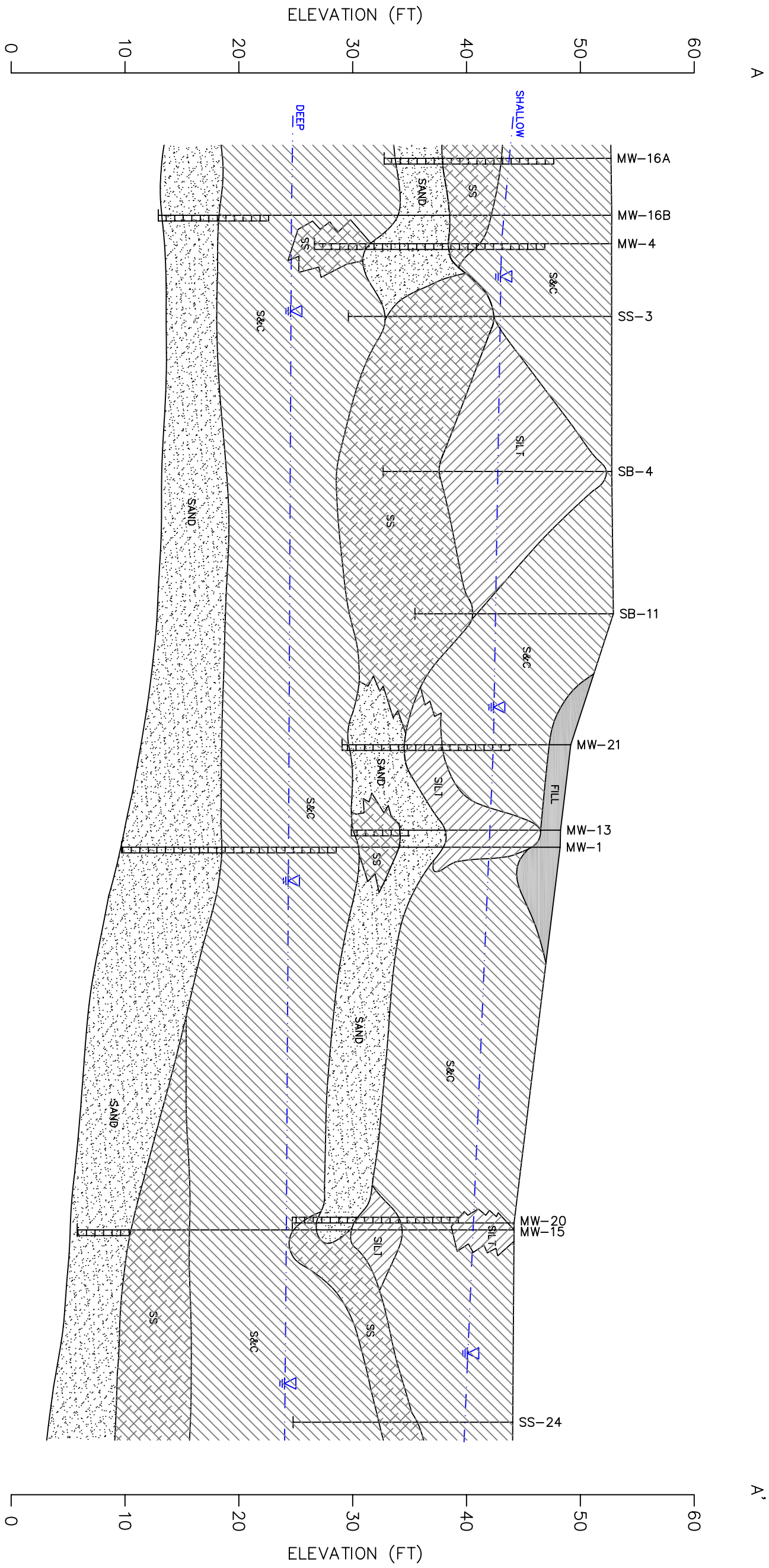
K.P.B.				
CHECKED BY:				
S.W.				
APPROVED BY:				
X				

FILENAME: 06940-407-05B.DWG



LEGEND

- FILL
- SILT
- SILTS & CLAYS (S&C)
- SILT WITH SAND/SANDY SILT (SS)
- SAND

SS - BORING COMPLETED BY SCS ENGINEERS 11/02 & 5/03

SB - BORING COMPLETED BY ENSR 12/04

MW - WELL INSTALLATION COMPLETED BY ENSR 12/04

SCALE IN FEET: 0 10 20

FIGURE NUMBER:	SHEET NUMBER:
5-2	1

GEOLOGIC CROSS-SECTION A-A'
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	4/05	06940-407-130

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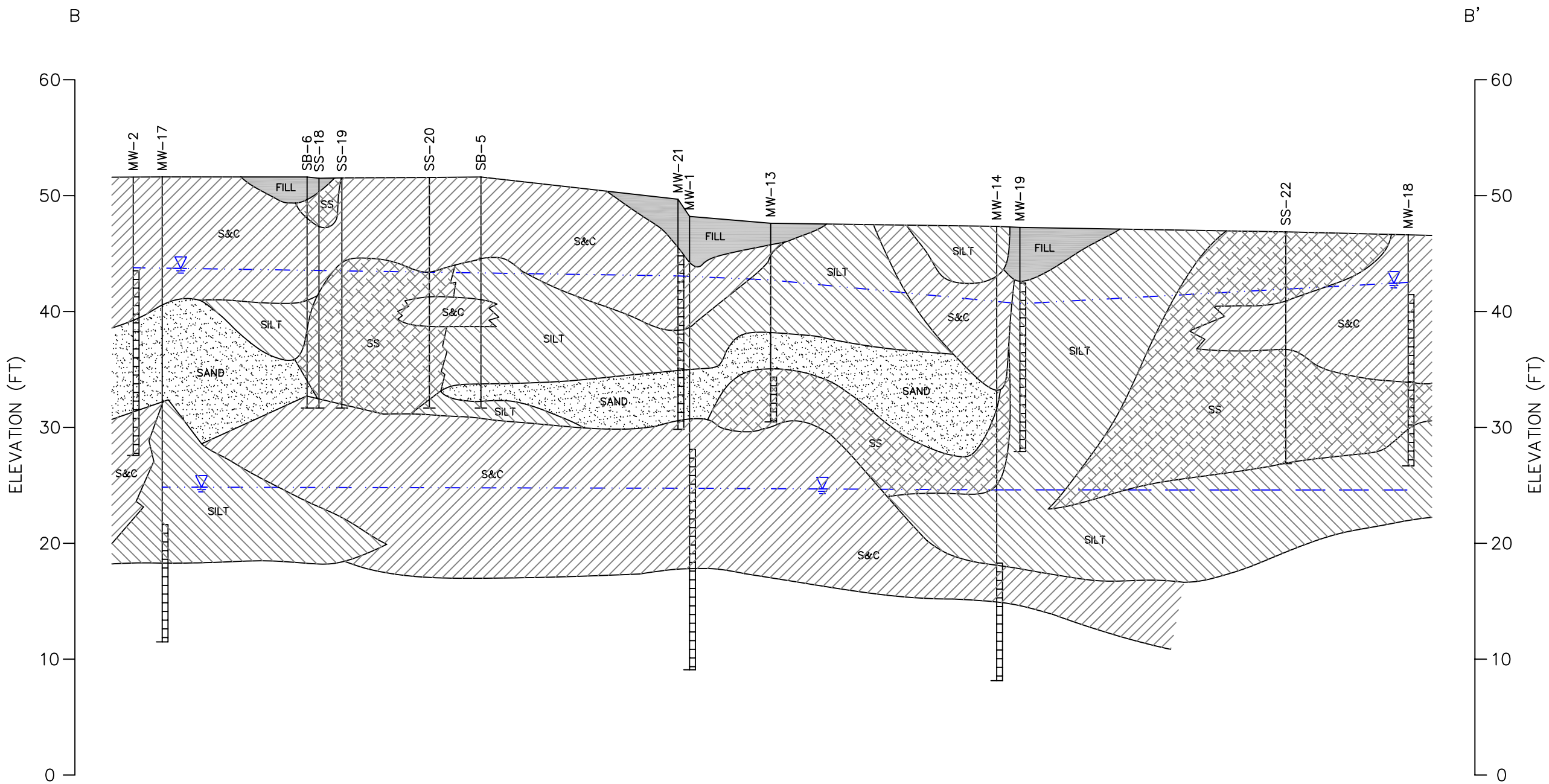
WEB: HTTP://WWW.ENSR.COM

DESIGNED BY:	REVISIONS			
X	NO.:	DESCRIPTION:	DATE:	BY:
DRAWN BY: K.P.B.				
CHECKED BY: S.W.				
APPROVED BY: X				



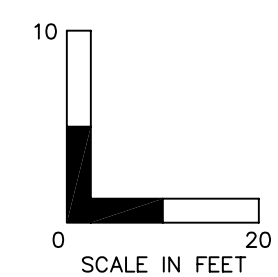
LEGEND

- FILL
- SILT
- SILTS & CLAYS (S&C)
- SILT WITH SAND/SANDY SILT (SS)
- SAND

SS – BORING COMPLETED BY SCS ENGINEERS 11/02 & 5/03

SB – BORING COMPLETED BY ENSR 12/04

MW – WELL INSTALLATION COMPLETED BY ENSR 12/04



FILENAME: 06940-407-06B.DWG

REVISIONS		
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY: X
DRAWN BY: K.P.B.
CHECKED BY: S.W.
APPROVED BY: X

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GEOLOGIC CROSS-SECTION B-B'
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

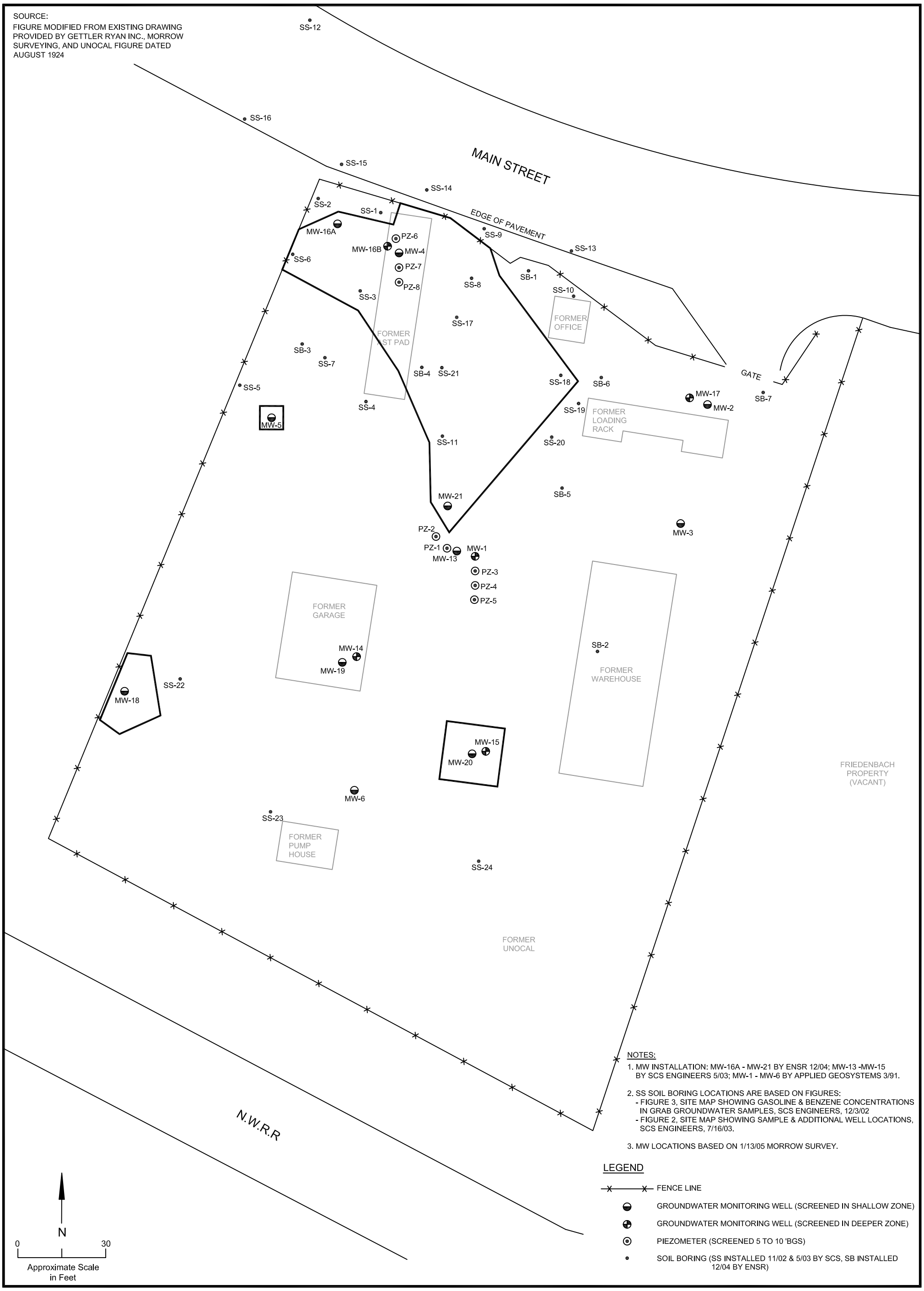
SCALE: AS SHOWN
DATE: 4/05
PROJECT NUMBER: 06940-407-130

FIGURE NUMBER: 5-3

SHEET NUMBER: 1

FILENAME: 06940-407-07B.DWG

SOURCE:
FIGURE MODIFIED FROM EXISTING DRAWING PROVIDED BY GETTLER RYAN INC., MORROW SURVEYING, AND UNOCAL FIGURE DATED AUGUST 1924



NOTES:

1. MW INSTALLATION: MW-16A - MW-21 BY ENSR 12/04; MW-13 -MW-15 BY SCS ENGINEERS 5/03; MW-1 - MW-6 BY APPLIED GEOSYSTEMS 3/91.
2. SS SOIL BORING LOCATIONS ARE BASED ON FIGURES:
   - FIGURE 3, SITE MAP SHOWING GASOLINE & BENZENE CONCENTRATIONS IN GRAB GROUNDWATER SAMPLES, SCS ENGINEERS, 12/3/02
   - FIGURE 2, SITE MAP SHOWING SAMPLE & ADDITIONAL WELL LOCATIONS, SCS ENGINEERS, 7/16/03.
3. MW LOCATIONS BASED ON 1/13/05 MORROW SURVEY.

LEGEND

- FENCE LINE
- GROUNDWATER MONITORING WELL (SCREENED IN SHALLOW ZONE)
- GROUNDWATER MONITORING WELL (SCREENED IN DEEPER ZONE)
- PIEZOMETER (SCREENED 5 TO 10 'BGS)
- SOIL BORING (SS INSTALLED 11/02 & 5/03 BY SCS, SB INSTALLED 12/04 BY ENSR)

FIGURE NUMBER: 5-4

SHEET NUMBER: 1

AREAS OF IMPACTED SOILS
FORMER UNOCAL STATION 762248
359 MAIN STREET
FORTUNA, CALIFORNIA

SCALE:	DATE:	PROJECT NUMBER:
1"=30'	4/05	06940-407-130

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S.W.	NO.:	DESCRIPTION:	DATE:	BY:
DRAWN BY:				
K.P.B.				
CHECKED BY:				
S.W.				
APPROVED BY:				
X				

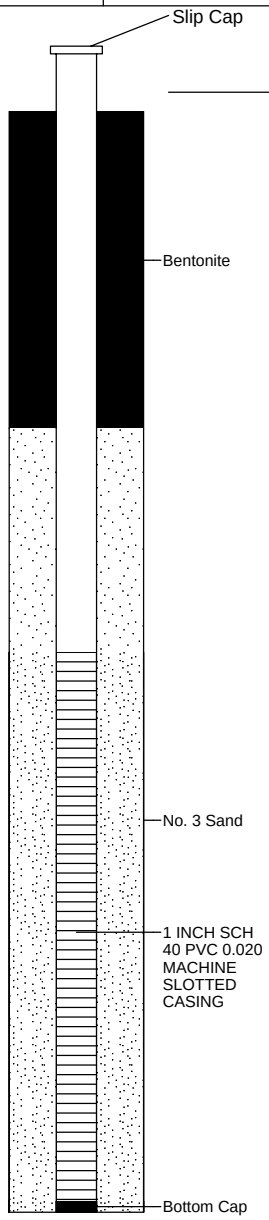
APPENDIX A

Soil Boring and Well Construction Logs

WELL CONSTRUCTION LOG

ENSR Corporation, Inc.
10411 Old Placerville Road
Suite 210
Rancho Cordova, Ca. 95827
916-362-7100
www.ensr.com

BOREHOLE NUMBER **PZ-1**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN
GW SURFACE	DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE
DATUM			



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2 in., fine to medium sand, subrounded to rounded, some silt.				
	CLAYEY SILT (ML) - reddish grey, moist, low plasticity.				
5		11	5		
		14			1021
		15			
	SILTY SAND (SM) - brown and grey, moist, non-plastic, fine sand, little clay, trace of fine gravel to 0.25 in.				
		8			
		8			437
		10			
10	Bottom of borehole at 10 feet.		10		

WELL CONSTRUCTION LOG

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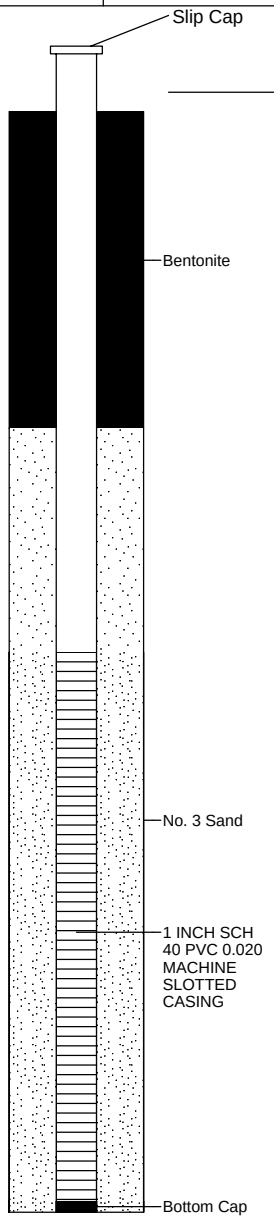
BOREHOLE NUMBER **PZ-2**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE
NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2 in., fine to medium sand, subrounded to rounded, some silt.				
	CLAYEY SILT (ML) - brown, moist, low plasticity.				
5		10	5		456
		13			
		16			
	SILTY SAND (SM) - brown and grey, moist, non-plastic, fine sand, subangular to rounded, little clay, trace of fine gravel to 0.25 in.				
		7			
		9			410
10		12	10		

Bottom of borehole at 10 feet.

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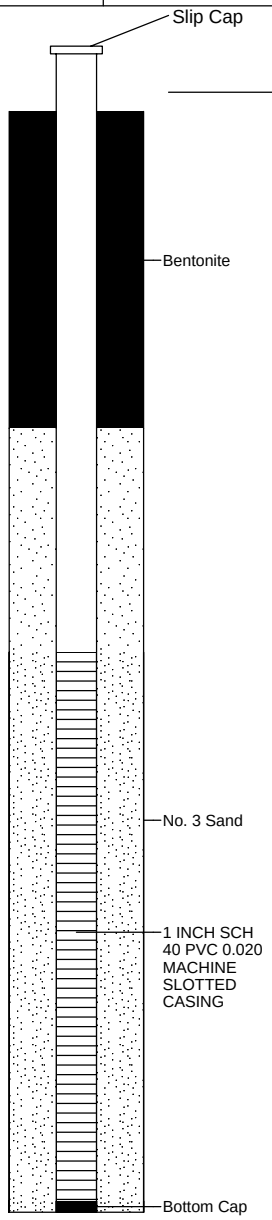
BOREHOLE NUMBER **PZ-3**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN
GW SURFACE	DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE
DATUM			



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2 in., fine to medium sand, subrounded to rounded, some silt.				
5			5		
	SILTY SAND (SM) - brown, wet, non-plastic, fine to medium sand, subrounded to rounded, trace of fine gravel to 0.2 in.	10			
		14			Water
		16			
		2			
		2			
		3			
10			10		

Bottom of borehole at 10 feet.

WELL CONSTRUCTION LOG

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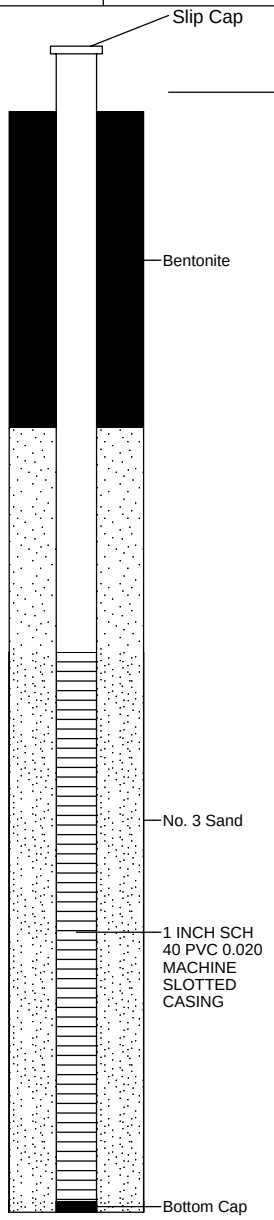
BOREHOLE NUMBER **PZ-4**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE
NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2 in., fine to medium sand, subrounded to rounded, little silt.				
5	SANDY SILT (ML) - grey brown, wet, non-plastic, fine to medium sand, little clay.	2	5		0
		2			
		4			
	SILTY SAND (SM) - reddish grey, wet, non-plastic, fine to medium sand, subrounded to rounded, little clay, trace of fine gravel to 0.2 in.				
		1			0
		2			
10		4	10		

Bottom of borehole at 10 feet.

WELL CONSTRUCTION LOG

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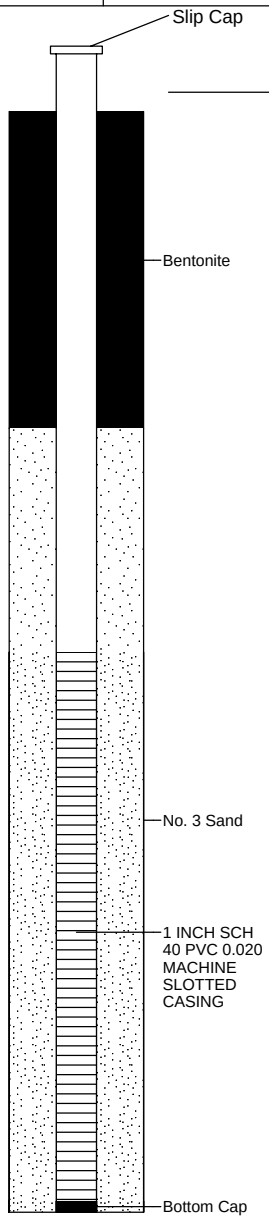
BOREHOLE NUMBER **PZ-5**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN
GW SURFACE	DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE
DATUM			



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2.5 in., fine to medium sand, subrounded to rounded, some silt.				
	SILT (ML) - grey brown, moist, non-plastic, some clay.				
5			5		
		13			1400
		16			
		18			
	SANDY SILT (ML) - reddish brown, moist, non-plastic, fine to medium sand, subrounded to rounded, some clay, trace of fine gravel to 0.25 in.				
		7			656
		9			
		12			
10	Bottom of borehole at 10 feet.		10		

WELL CONSTRUCTION LOG

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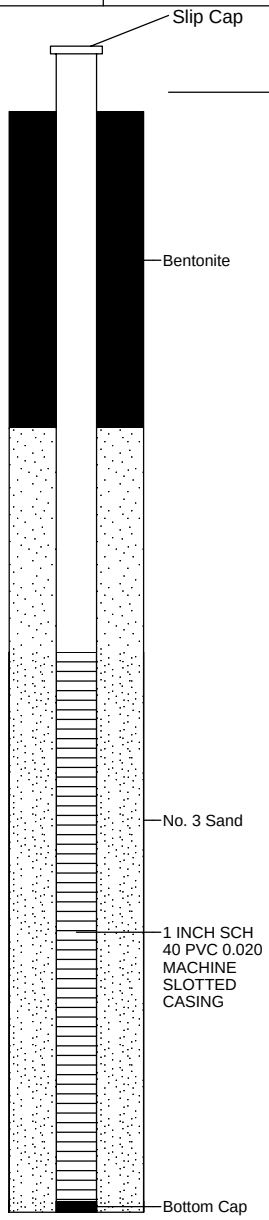
BOREHOLE NUMBER **PZ-6**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN
GW SURFACE	DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE
DATUM			



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	SILTY CLAY (CL-ML) - reddish brown, moist, low density, low plasticity, some fine sand.				
5	CLAYEY SILT (ML) - reddish brown, moist, low plasticity, little fine sand.	6	5		0
		7			
		8			
	SILTY SAND (SM) - reddish brown, moist, non-plastic, fine sand, subrounded to rounded, little fine gravel to 0.5 in.				
		10			
		24			146
10	Bottom of borehole at 10 feet.	26	10		

WELL CONSTRUCTION LOG

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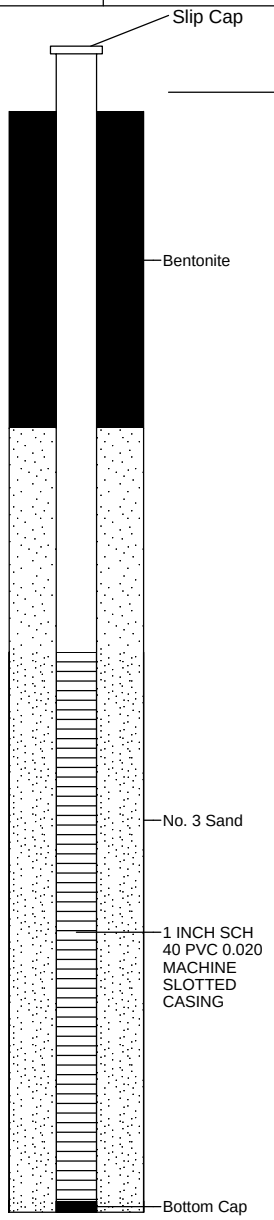
BOREHOLE NUMBER **PZ-7**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN
GW SURFACE	DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE
DATUM			



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2.5 in., fine to medium sand, subrounded to rounded, some silt.				
	SILTY CLAY (CL-ML) - reddish brown, moist, low density, low plasticity, some fine sand.				
5	SANDY SILT (ML) - reddish brown, moist, non-plastic, fine sand, subrounded to rounded, trace of gravel and clay.	6 7 9	5		164
	SILTY SAND (SM) - reddish grey, moist, non-plastic, fine to medium sand, subrounded to rounded, little fine to medium gravel to 1 in.	12 12 14			0
10	Bottom of borehole at 10 feet.		10		

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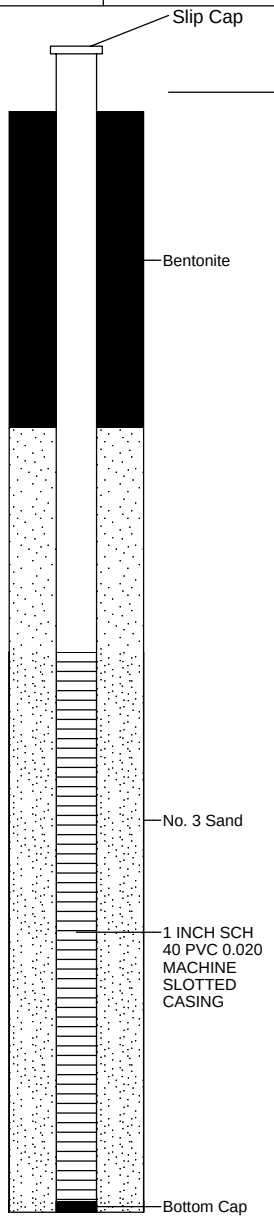
BOREHOLE NUMBER **PZ-8**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Goldsmith**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **2/24/05 - 2/24/05**
CASING MATL. / DIAMETER **SCH 40 PVC/1-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC**	TOTAL LENGTH **5**	DIA. **1-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN
GW SURFACE	DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE
DATUM			



Depth (feet)	Graphic Log	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
		POORLY GRADED GRAVEL WITH SAND (GP) - grey, dry, non-plastic, fine to coarse gravel to 2 in., fine to medium sand, subrounded to rounded, some silt.				
		SANDY SILT (ML) - reddish brown, moist, non-plastic, fine sand, subrounded to rounded, trace of gravel and clay.				
5				5		
			6			
			8			
			10			
		SILTY SAND (SM) - reddish grey, moist, non-plastic, fine to medium sand, subrounded to rounded, little fine to medium gravel to 1 in.				
			10			
			12			
			13			
10		Bottom of borehole at 10 feet.		10		

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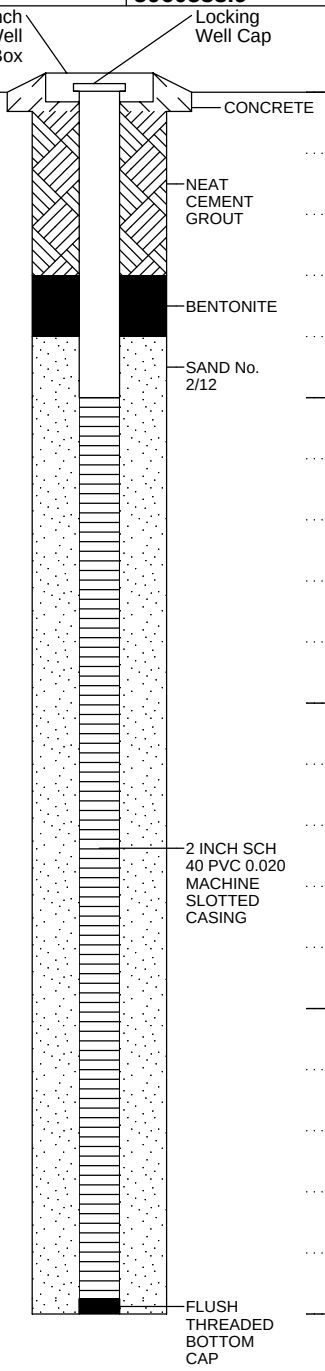
BOREHOLE NUMBER	**MW-16A**
PROJECT NAME	**Unocal No. 762248**
PROJECT NUMBER	**06940-407-120**
LOCATION	**359 Main Street, Fortuna, California**
DRILLING CONTRACTOR / DRILLER	**Woodward Drilling Co. / V. Lenoard**
LOGGED BY	**W. Speth**
DRILLING EQUIPMENT / METHOD	**B-81 / Hollow Stem Auger**
BIT SIZE / BIT TYPE	**8.25-Inch / Auger**
SAMPLING METHOD	**Split Spoon**
START-FINISH DATE	**12/21/04 - 12/21/04**
CASING MATL. / DIAMETER	**SCH 40 PVC/2-Inch**
SCREEN: TYPE	**Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE / TOP OF WELL CASING / TOP & BOTTOM SCREEN / GW SURFACE / DATE
NORTHING	**2108984.5**
EASTING	**5960538.9**
LATITUDE	**40.5991796**
LONGITUDE	**-124.1651045**
DATUM	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	SILTY CLAY: yellowish-brown to reddish-brown, low plasticity, moist, very stiff. (CL-ML) BARE SOIL SURFACE				
5	SILT WITH CLAY: yellowish-brown to reddish-brown, trace subangular to subrounded medium grained sand, low plasticity, moist, hard. (ML)	25 50-5"	5		
				MW-16A-7	>9,999
		12 18 18 20 22		MW-16A-9	921
10	SILT WITH SAND: blueish-green, subangular to subrounded medium to coarse grained sand, trace 3/4-inch diameter gravel, non plastic, moist, hard. (ML)	50-5"	10		
				MW-16A-11	>9,999
		23 25 50-5"			
				MW-16A-13	>9,999
		26 50-6"			
15	POORLY GRADED SAND: blueish-green to medium brown, fine and medium grained sand, non plastic, wet, very dense. (SP)	50-6"	15	MW-16A-15	>9,999
				MW-16A-17	>9,999
		12 14 20			
	CLAYEY SILT: yellowish-brown to reddish-brown, low plasticity, moist, hard. (ML)	20		MW-16A-19	>9,999
20	Bottom of borehole at 20 feet.		20		

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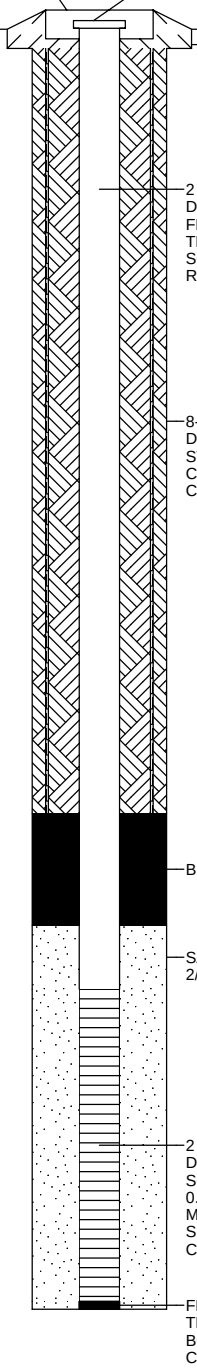
BOREHOLE NUMBER	**MW-16B**
PROJECT NAME	**Unocal No. 762248**
PROJECT NUMBER	**06940-407-120**
LOCATION	**359 Main Street, Fortuna, California**
DRILLING CONTRACTOR / DRILLER	**Woodward Drilling Co. / V. Lenoard**
LOGGED BY	**W. Speth**
DRILLING EQUIPMENT / METHOD	**B-81 / Hollow Stem Auger**
BIT SIZE / BIT TYPE	**14.25-Inch / Auger**
SAMPLING METHOD	**Split Spoon**
START-FINISH DATE	**12/20/04 - 12/22/04**
CASING MATL. / DIAMETER	**SCH 40 PVC/2-Inch**
SCREEN:	TYPE **Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE / TOP OF WELL CASING / TOP & BOTTOM SCREEN / GW SURFACE / DATE
NORTHING	**2108976.9**
EASTING	**5960556**
LATITUDE	**40.5991598**
LONGITUDE	**-124.1650423**
DATUM	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	SILTY CLAY: yellowish-brown to reddish-brown, low plasticity, moist, very stiff. (CL-ML) BARE SOIL SURFACE				
5	SILT WITH CLAY: yellowish-brown to reddish-brown, trace subangular to subrounded medium grained sand, low plasticity, moist, hard. (ML)		5		
10	SILT WITH SAND: blueish-green, subangular to subrounded medium to coarse grained sand, trace 3/4-inch diameter gravel, non plastic, moist, hard. (ML)		10		
15	POORLY GRADED SAND: blueish-green to medium brown, fine and medium grained sand, non plastic, wet, very dense. (SP)		15		
20	CLAYEY SILT: yellowish-brown to reddish-brown, low plasticity, moist, hard. (ML)		20		
25	Soil lithology from 0-feet to 20-feet taken from boring log MW-16A		25		
30	SILTY CLAY: yellowish-brown to reddish-brown, weakly cemented, low plasticity, moist, hard. (CL-ML)	11 23 25 30 10 22 25 25	30	MW-16B-34	
35	POORLY GRADED SAND: dark brown-black, fine to medium grained sand, saturated, very dense. (SP)	25 40 50-4"	35	MW-16B-37	
40	SANDY SILT: dark brown, non-plastic, moist, hard. (ML) Bottom of borehole at 40 feet.	10 15 20 20	40	MW-16B-40	

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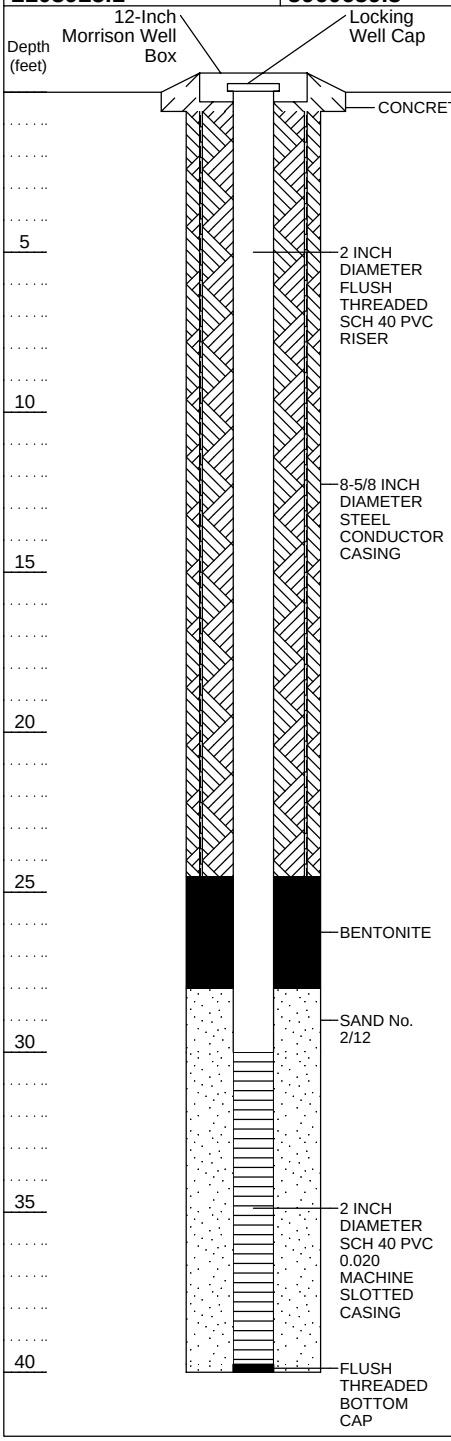
BOREHOLE NUMBER: **MW-17**			
PROJECT NAME: **Unocal No. 762248**	LOCATION: **359 Main Street**		
PROJECT NUMBER: **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER: **Woodward Drilling Co. / V. Lenoard**	LOGGED BY: **W. Speth**		
DRILLING EQUIPMENT / METHOD: **B-81 / Hollow Stem Auger**	BIT SIZE / BIT TYPE: **14.25-Inch / Auger**	SAMPLING METHOD: **Split Spoon**	START-FINISH DATE: **12/20/04 - 12/22/04**
CASING MATL. / DIAMETER: **SCH 40 PVC/2-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**		
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE
NORTHING: **2108925.1**	EASTING: **5960659.3**	LATITUDE: **40.5990247**	LONGITUDE: **-124.164666**	DATUM:	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	SILTY CLAY: yellowish-brown to reddish-brown, low plasticity, moist, very stiff. (CL-ML)				
5	FAT CLAY: tan to reddish-brown, medium to high plasticity, moist, hard. (CH)		5		
10	SILTY SAND WITH GRAVEL: yellowish-brown fine to medium grained sand, 1/4 to 3/8 inch diameter subangular to subrounded gravel, wet, very dense. (SM)	10 50 50-5"	10	MW-17-11.5	386
		15 30 50-4"		MW-17-12.5	45.2
15	CLAYEY SAND: yellowish-brown, to reddish-brown, fine to medium grained sand, non-plastic, moist, very dense. (SC)		15	MW-17-15	48
	SILT: yellowish-brown to reddish-brown, non-plastic, moist to wet, hard. (ML)	10 15 16 30 12 12		MW-17-17	47
20	CLAYEY SAND: tan to brown with oxide stained mottling fine to medium grained sand, trace coarse sand and gravel 3/8 diameter, non-plastic, moist, very dense. (SC)	12 23 12 18 24		MW-17-19	47.6
	SILT: yellowish-brown to reddish-brown, non-plastic, moist to wet, hard. (ML)	50 12 15 15 26 12 20 50-4"	20	MW-17-21 MW-17-23	117
25			25	MW-17-25	37
30		12 17 20 30	30	MW-17-32	
35	CLAYEY SAND: yellowish-brown to reddish-brown, fine and coarse grained sand, 3/8 to 3/4 inch diameter subangular to subrounded gravels, saturated, very dense. (SC)	15 38 50-5"	35	MW-17-36.5	
	POORLY GRADED SAND: dark brown-black, fine to medium grained sand, saturated, very dense. (SP)	10 12 15 30			
40	Bottom of borehole at 40 feet.		40	MW-17-40	

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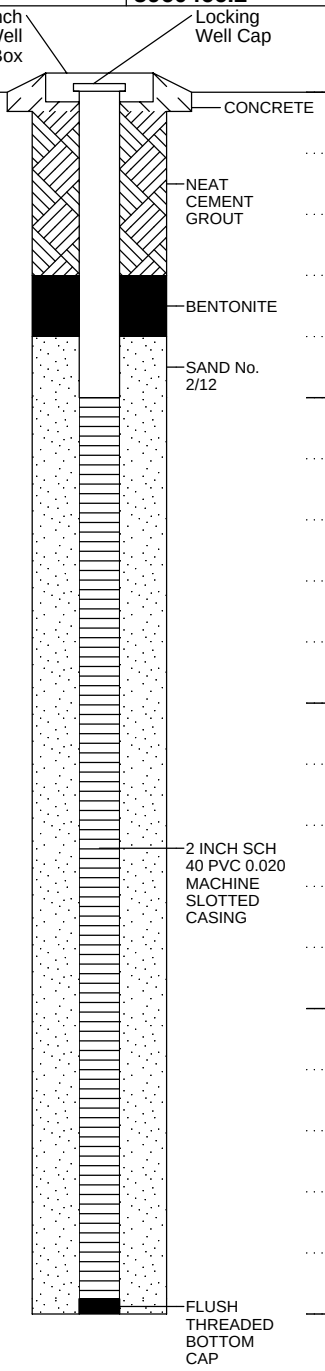
BOREHOLE NUMBER	**MW-18**
PROJECT NAME	**Unocal No. 762248**
PROJECT NUMBER	**06940-407-120**
LOCATION	**359 Main Street, Fortuna, California**
DRILLING CONTRACTOR / DRILLER	**Woodward Drilling Co. / V. Lenoard**
LOGGED BY	**W. Speth**
DRILLING EQUIPMENT / METHOD	**B-81 / Hollow Stem Auger**
BIT SIZE / BIT TYPE	**8.25-Inch / Auger**
SAMPLING METHOD	**Split Spoon**
START-FINISH DATE	**12/21/04 - 12/21/04**
CASING MATL. / DIAMETER	**SCH 40 PVC/2-Inch**
SCREEN: TYPE	**Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE / TOP OF WELL CASING / TOP & BOTTOM SCREEN / GW SURFACE / DATE
NORTHING	**2108824.9**
EASTING	**5960466.2**
LATITUDE	**40.5987365**
LONGITUDE	**-124.1653521**
DATUM	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	CLAYEY SILT: yellowish-brown to reddish-brown with green mottling, low plasticity, wet, hard. (ML)				
5		12, 22, 27, 25	5	MW-18-7	
10	CLAYEY SILT WITH GRAVEL: yellowish brown to reddish-brown with gray mottling, 1/4 to 3/4 inch diameter subangular to subrounded gravel, fine grained sand, low plasticity, moist, hard. (ML)	30, 50-6"	10	MW-18-12	
	SANDY SILT: yellowish-brown to reddish-brown, non-plastic, interbedded fine grained sands1/8 to 1/2 thick, wet, hard. (ML)				
15		18, 22, 22, 20	15	MW-18-17	
	SILT: yellowish-brown to reddish-brown, non-plastic, moist, hard. (ML)				
		18, 20, 25, 50-5"		MW-18-19	
20	Bottom of borehole at 20 feet.		20		

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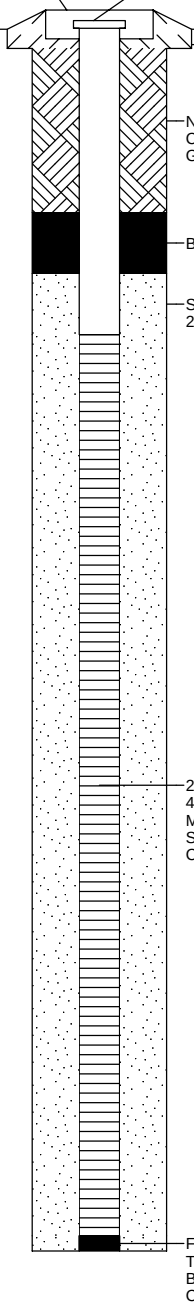
BOREHOLE NUMBER	**MW-19**
PROJECT NAME	**Unocal No. 762248**
PROJECT NUMBER	**06940-407-120**
LOCATION	**359 Main Street, Fortuna, California**
DRILLING CONTRACTOR / DRILLER	**Woodward Drilling Co. / V. Lenoard**
LOGGED BY	**W. Speth**
DRILLING EQUIPMENT / METHOD	**B-81 / Hollow Stem Auger**
BIT SIZE / BIT TYPE	**8.25-Inch / Auger**
SAMPLING METHOD	**Split Spoon**
START-FINISH DATE	**12/21/04 - 12/21/04**
CASING MATL. / DIAMETER	**SCH 40 PVC/2-Inch**
SCREEN: TYPE	**Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE / TOP OF WELL CASING / TOP & BOTTOM SCREEN / GW SURFACE / DATE
NORTHING	**2108834.7**
EASTING	**5960540.6**
LATITUDE	**40.5987687**
LONGITUDE	**-1241650853**
DATUM	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	FILL MATERIAL				
5	SILT: greenish-blue, non-plastic trace 3/8 to 1 inch diameter subangular gravel, moist, hard. (ML)	22, 20, 50-6"	5	MW-19-7	
10	wet	12, 12, 15, 20	10	MW-19-12	
15	saturated, color change to yellowish-brown to reddish-brown	12, 10, 15, 18	15	MW-19-17	
	moist, color change to reddish-brown with green to gray mottling	12, 15, 15, 28			
20	Bottom of borehole at 20 feet.		20	MW-19-20	

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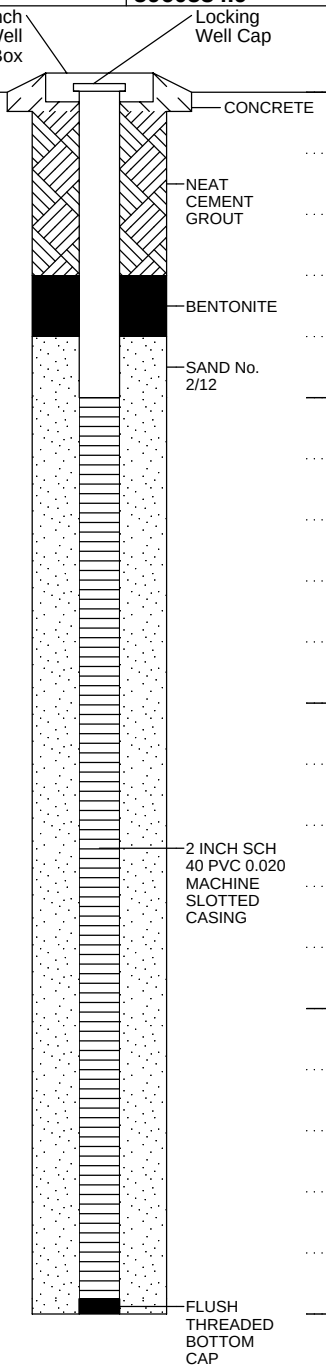
BOREHOLE NUMBER **MW-20**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / V. Lenoard**	LOGGED BY **W. Speth**		
DRILLING EQUIPMENT / METHOD **B-81 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **12/21/04 - 12/21/04**
CASING MATL. / DIAMETER **SCH 40 PVC/2-Inch**	SCREEN: TYPE **Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**		
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE
NORTHING **2108803.5**	EASTING **5960584.9**	LATITUDE **40.5986859**	LONGITUDE **-1241649228**	DATUM



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	CLAYEY SILT: yellowish-brown to reddish-brown with oxide staining and black nodules present, trace 1/4 inch diameter subangular to subrounded gravel, trace fine grained sand, non-plastic, moist, hard. (ML)				
5		9, 12, 16, 17	5	MW-20-7	
10		12, 17, 17, 22	10	MW-20-12	
	SILTY SAND: tan to reddish-brown, fine grained sand, with poorly graded sand stringers between 14 and 17 feet below grade, saturated, medium dense. (SM)				
15		9, 14, 14, 21	15	MW-20-17	
	SILTY CLAY: reddish-brown with greenish-blue mottling, medium plasticity, moist, hard. (CL-ML)	12, 16, 17, 22	20	MW-20-20	
20	Bottom of borehole at 20 feet.				

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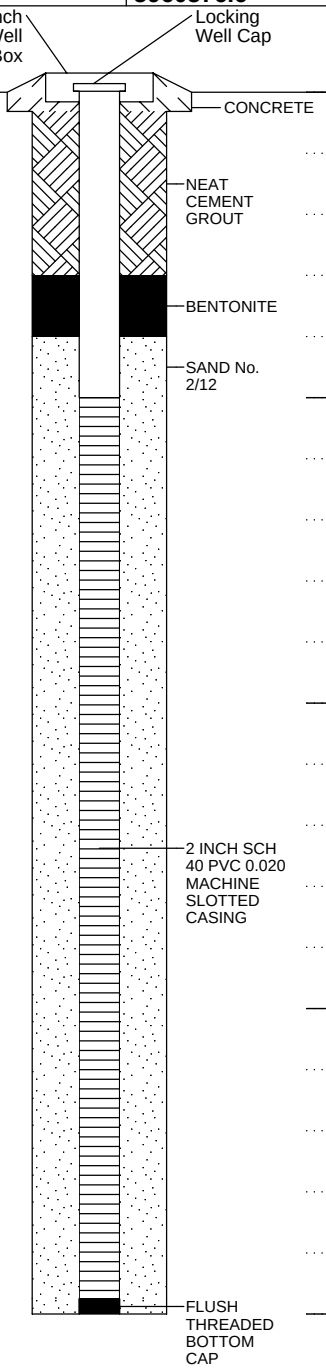
BOREHOLE NUMBER	**MW-21**
PROJECT NAME	**Unocal No. 762248**
PROJECT NUMBER	**06940-407-120**
LOCATION	**359 Main Street, Fortuna, California**
DRILLING CONTRACTOR / DRILLER	**Woodward Drilling Co. / V. Lenoard**
LOGGED BY	**W. Speth**
DRILLING EQUIPMENT / METHOD	**B-81 / Hollow Stem Auger**
BIT SIZE / BIT TYPE	**8.25-Inch / Auger**
SAMPLING METHOD	**Split Spoon**
START-FINISH DATE	**12/21/04 - 12/21/04**
CASING MATL. / DIAMETER	**SCH 40 PVC/2-Inch**
SCREEN:	TYPE **Machine Slot** MATL. **PVC** TOTAL LENGTH **10** DIA. **2-Inch** SLOT SIZE **0.020**
ELEVATION OF: (FT.)	GROUND SURFACE / TOP OF WELL CASING / TOP & BOTTOM SCREEN / GW SURFACE / DATE
NORTHING	**2108888.1**
EASTING	**5960576.6**
LATITUDE	**40.5989177**
LONGITUDE	**-1241649605**
DATUM	



Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	BARE SOIL SURFACE				
	SILTY CLAY: yellowish-brown to reddish-brown, low plasticity, moist, very stiff. (CL-ML)				
5		10	5		
		12			
		24			
		25		MW-21-7	
	SILTY CLAY: reddish-brown with greenish gray mottling, weakly cemented, low plasticity, trace 3/8 to 3/4 inch diameter subangular gravel, moist, hard. (CL-ML)				
10		12	10		
		15			
	SILT: yellowish-brown to reddish-brown with greenish-blue mottling, weakly cemented silt, low plasticity, trace 3/8 to 3/4 inch diameter subrounded gravel, moist, hard. (ML)	19			
		23		MW-21-12	
15	SILTY SAND WITH GRAVEL: blueish-green, non-plastic, medium grained sand, fine grained gravel subangular to subrounded, wet, very dense. (SM)	12	15		
		19			
		50-5"			
				MW-21-17	
		10			
		10			
	SILTY CLAY: yellowish-brown to reddish-brown,trace fine grained sand, low plasticity, wet, very stiff. (CL-ML)	18			
20		22	20	MW-21-20	
	Bottom of borehole at 20 feet.				

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BOREHOLE NUMBER **SB-1**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Grant**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **12/22/04 - 12/22/04**
CASING MATL. / DIAMETER	SCREEN: TYPE / MATL. / TOTAL LENGTH / DIA. / SLOT SIZE		
ELEVATION OF: (FT.)	GROUND SURFACE / TOP OF WELL CASING / TOP & BOTTOM SCREEN / GW SURFACE / DATE		
NORTHING	EASTING	LATITUDE	LONGITUDE / DATUM

Depth (feet)	Graphic Log	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
		SILTY CLAY TO CLAYEY SILT: yellowish brown, trace 3/4 inch diameter subangular to subrounded gravel, low plasticity, moist, hard. (CL-ML) BARE SOIL SURFACE				
5			10, 12, 10, 22	5	SB-1-7	
10	NEAT CEMENT GROUT	yellowish-brown to brown with oxide staining and 1 to1 1/2 inch fine grained sand stringers present	20, 22, 40, 46	10	SB-1-11	
15		SILT WITH SAND: brown to reddish-brown, non-plastic, fine grained sand, trace fine grained gravel up to 1/2 inch diameter, moist, hard. (ML)	10, 26, 36, 40	15	SB-1-16.5	
20		SILT: yellowish-brown to reddish-brown, non-plastic, trace fine grained sand and gravel, wet, hard. (ML)	10, 15, 20, 22	20	SB-1-19.5	

Bottom of borehole at 20 feet.

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BOREHOLE NUMBER **SB-2**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / Dave**	LOGGED BY **B. Grant**		
DRILLING EQUIPMENT / METHOD **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **12/22/04 - 12/22/04**

CASING MATL. / DIAMETER | SCREEN: TYPE | MATL. | TOTAL LENGTH | DIA. | SLOT SIZE

ELEVATION OF: (FT.) | GROUND SURFACE | TOP OF WELL CASING | TOP & BOTTOM SCREEN | GW SURFACE | DATE

NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM

Depth (feet)	Graphic Log	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
		SILTY CLAY: yellowish brown, trace 3/4 inch diameter subangular to subrounded gravel, low plasticity, moist, hard. (CL-ML) BARE SOIL SURFACE				
5			16, 18, 20, 25	5	SB-2-7	
		CLAYEY SILT: yellowish-brown to reddish-brown with oxide staining, low plasticity, moderately cemented silt, wet, very stiff. (ML)				
10	NEAT CEMENT GROUT		12, 13, 13, 15	10	SB-2-12	
15		CLAYEY SILT: brown to yellowish-brown, low to medium plasticity, wet, hard. (ML)	10, 12, 13, 14	15		
		SILTY CLAY: blueish-gray medium to high plasticity, moist, hard. (ML)	12, 18, 18, 19			
20		Bottom of borehole at 20 feet.		20	SB-2-20	

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BOREHOLE NUMBER: **SB-3**			
PROJECT NAME: **Unocal No. 762248**	LOCATION: **359 Main Street**		
PROJECT NUMBER: **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER: **Woodward Drilling Co. / Dave**	LOGGED BY: **B. Grant**		
DRILLING EQUIPMENT / METHOD: **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE: **8.25-Inch / Auger**	SAMPLING METHOD: **Split Spoon**	START-FINISH DATE: **12/22/04 - 12/22/04**

CASING MATL. / DIAMETER	SCREEN: TYPE	MATL.	TOTAL LENGTH	DIA.	SLOT SIZE

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE

NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM

Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	SILTY WITH CLAY: brown to dark brown, black nodules, organics present, low plasticity, dry, very stiff. (ML) BARE SOIL SURFACE				
5		10 12 13 13	5	SB-3-7	0
	SILT: brown with intervals of brownish-gray, non-plastic, trace 1 to 1 1/2 inch diameter subrounded gravel, layers of black gray silt, wet, hard. (ML)				
10	NEAT CEMENT GROUT	16 18 30 22	10	SB-3-12	67
	SILT WITH SAND: brown to reddish-brown, non-plastic, fine to coarse grained sand, highly cemented silt nodules, wet, hard. (ML)				
15		22 22 25 26	15	SB-3-17	0
	SILT: yellowish-brown with black nodules, non-plastic, highly cemented silt, trace gravel up to 3/4 inch diameter, wet, very stiff. (ML)	6			
20	Bottom of borehole at 20 feet.	12 12 14	20	SB-3-20	0

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BOREHOLE NUMBER: **SB-4**			
PROJECT NAME: **Unocal No. 762248**	LOCATION: **359 Main Street**		
PROJECT NUMBER: **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER: **Woodward Drilling Co. / Dave**	LOGGED BY: **B. Grant**		
DRILLING EQUIPMENT / METHOD: **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE: **8.25-Inch / Auger**	SAMPLING METHOD: **Split Spoon**	START-FINISH DATE: **12/22/04 - 12/22/04**

CASING MATL. / DIAMETER	SCREEN: TYPE	MATL.	TOTAL LENGTH	DIA.	SLOT SIZE

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE

NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM

Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	BARE SOIL SURFACE				
5	SILT: brown to yellowish-brown with black nodules, non-plastic, trace clay, moist, hard. (ML)	10, 12, 16, 18	5	SB-4-7	
10	NEAT CEMENT GROUT SILT: greenish-gray to reddish-brown, non-plastic, some coarse grained sand white in color, some fine to coarse gravel up to 1-inch in diameter, moist, stiff. (ML)	5, 8, 9, 12	10	SB-4-12	
15	POORLY GRADED SAND; greensih-gray fine to coarse grained, trace fine grained gravel up to 3/4 inch diameter, wet, very dense. (SP) SILT: reddish-brown to yellowish-brown, non-plastic, wet, hard. (ML)	12, 16, 18, 20	15	SB-4-17	
20	POORLY GRADED SAND: reedish brown to yellowish brown, non-plastic, medium to coarse grained sand, some fine grained gravel up to 1/2 inch diameter, wet, very dense. (SP) SILT: reddish-brown to yellowish-brown, non-plastic, wet, hard. (ML) Bottom of borehole at 20 feet.	14, 16, 20, 22	20	SB-4-20	

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BOREHOLE NUMBER: **SB-5**			
PROJECT NAME: **Unocal No. 762248**	LOCATION: **359 Main Street**		
PROJECT NUMBER: **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER: **Woodward Drilling Co. / Dave**	LOGGED BY: **B. Grant**		
DRILLING EQUIPMENT / METHOD: **B-57 / Hollow Stem Auger**	BIT SIZE / BIT TYPE: **8.25-Inch / Auger**	SAMPLING METHOD: **Split Spoon**	START-FINISH DATE: **12/22/04 - 12/22/04**

CASING MATL. / DIAMETER | SCREEN: TYPE | MATL. | TOTAL LENGTH | DIA. | SLOT SIZE

ELEVATION OF: (FT.) GROUND SURFACE | TOP OF WELL CASING | TOP & BOTTOM SCREEN | GW SURFACE | DATE

NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM

Depth (feet)	Graphic Log	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
		SILTY CLAY: yellowish-brown with green gray mottling, medium to high plasticity, dry, very stiff. (CL-ML) BARE SOIL SURFACE				
5			10 12 15 16	5	SB-5-7	
		SILT: reddish-brown, non-plastic, trace fine grained subrounded gravel up to 1/2 inch diameter, dry, hard. (ML)				
10	NEAT CEMENT GROUT		18 24 25 26	10	SB-5-12	
15		SILT: reddish-brown, low to medium plasticity, dry, hard. (ML)	18 20 25 26	15	SB-5-17	
		POORLY GRADED GRAVEL WITH SAND: reddish-brown to yellowish-brown, non-plastic, fine and coarse grained sand, fine and coarse grained gravel up to 1 inch diameter, wet, very dense. (GP)	15 17 18			
20		SILT: reddish-brown to yellowish-brown, low to medium plasticity, trace fine grained sand, moist, hard. (ML) Bottom of borehole at 20 feet.	20	20	SB-5-20	

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BOREHOLE NUMBER **SB-6**			
PROJECT NAME **Unocal No. 762248**	LOCATION **359 Main Street**		
PROJECT NUMBER **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER **Woodward Drilling Co. / V. Lenoard**	LOGGED BY **W. Speth**		
DRILLING EQUIPMENT / METHOD **B-81 / Hollow Stem Auger**	BIT SIZE / BIT TYPE **8.25-Inch / Auger**	SAMPLING METHOD **Split Spoon**	START-FINISH DATE **12/22/04 - 12/22/04**

CASING MATL. / DIAMETER	SCREEN: TYPE	MATL.	TOTAL LENGTH	DIA.	SLOT SIZE
ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	DATE

NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM

Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	BARE SOIL SURFACE				
	CLAYEY SILT: black brown low plasticity, moist, very stiff. (ML)				
	color change to tan brown				
5	CLAYEY SILT: tan to gray, low plasticity, trace coarse sand, moist, hard. (ML)	12 15 23 18	5	SB-6-7	
10	NEAT CEMENT GROUT	10 12 12 32	10	SB-6-12	
	color change to reddish-brown with oxide stained mottling				
	SILT: reddish-brown with oxide stained mottling, non-plastic, weakly cemented, dry, hard. (ML)				
15		11 16 16 18	15	SB-6-17	
	SILTY SAND: reddish-brown heavily oxide stained, non-plastic, coarse subangular sand, wet, very dense. (SM)				
		12 12 28 35			
	SILTY CLAY: reddish-brown to yellowish-brown with black nodules, low plasticity, moist, hard. (CL-ML)				
20	Bottom of borehole at 20 feet.		20	SB-6-20	

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BOREHOLE NUMBER: **SB-7**			
PROJECT NAME: **Unocal No. 762248**	LOCATION: **359 Main Street**		
PROJECT NUMBER: **06940-407-120**	**Fortuna, California**		
DRILLING CONTRACTOR / DRILLER: **Woodward Drilling Co. / V. Lenoard**	LOGGED BY: **W. Speth**		
DRILLING EQUIPMENT / METHOD: **B-81 / Hollow Stem Auger**	BIT SIZE / BIT TYPE: **8.25-Inch / Auger**	SAMPLING METHOD: **Split Spoon**	START-FINISH DATE: **12/22/04 - 12/22/04**

CASING MATL. / DIAMETER | SCREEN: TYPE | MATL. | TOTAL LENGTH | DIA. | SLOT SIZE

ELEVATION OF: (FT.) | GROUND SURFACE | TOP OF WELL CASING | TOP & BOTTOM SCREEN | GW SURFACE | DATE

NORTHING	EASTING	LATITUDE	LONGITUDE	DATUM

Depth (feet)	Visual Description	Blow Counts	Depth (feet)	Sample ID	OVM Values (ppm)
	ASPHALT SURFACE 2.5-inches thick				
5	SILTY CLAY WITH GRAVEL: yellowish-brown, low plasticity, subangular to subrounded gravel 1 to1 1/2 inch diameter, moist, hard. (CL-ML)	10 10 12 12	5	SB-7-7	
10	SILT WITH CLAY: tan to gray, medium plasticity, trace gravel 3/4 to 1 inch diameter, moist, hard. (ML)	10 10 19 20	10	SB-7-12	
15	CLAYEY SILT to SILTY CLAY: reddish-brown, interbedded layers of clays and silts with fine to medium grained sand, clay and silt are heavily oxide stained with black mottling, sand is wet. (ML)	25 25 50-3"	15	SB-7-17	
	SILTY SAND: reddish-brown with oxide and black mottling, non-plastic, fine grained sand, wet, medium dense. (SM)	28 12 12			
20	SILTY CLAY: reddish-brown with oxide mottling, medium plasticity, trace coarse grained sand, moist, hard. (CL-ML) Bottom of borehole at 20 feet.	24	20	SB-6-20	

NEAT CEMENT GROUT

APPENDIX B

Soil Analytical Results

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

April 19, 2005

CLS Work Order #: CNL0816
COC #: Various

Jeff Wendt
ENSR - Sacramento
10411 Old Placerville Rd., Suite 210
Sacramento, CA 95827-2508

Project Name: Frmr. Unocal 762248-359 Main St.
Fortuna,CA-2

Enclosed are the results of analyses for samples received by the laboratory on 12/23/04 15:52. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,

James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

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04/19/05 11:14

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Extractable Petroleum Hydrocarbons by EPA Method 8015M

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
SB-2-6-6 1/2 (CNL0816-01) Soil Sampled: 12/22/04 09:35 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-2-11 1/2 - 12 (CNL0816-03) Soil Sampled: 12/22/04 09:45 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-3-16 1/2 - 17 (CNL0816-05) Soil Sampled: 12/22/04 10:40 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-3-11 1/2 - 12 (CNL0816-06) Soil Sampled: 12/22/04 10:30 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-4 - 6 1/2 - 7 (CNL0816-08) Soil Sampled: 12/22/04 11:30 Received: 12/23/04 15:52									
Diesel	**9.5**	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	DSL-1
SB-4 - 11 1/2 - 12 (CNL0816-09) Soil Sampled: 12/22/04 11:40 Received: 12/23/04 15:52									
Diesel	**210**	5.0	mg/kg	5	CN10002	12/29/04	12/30/04	EPA 8015M	DSL-1
SB - 5 - 6 1/2 - 7 (CNL0816-13) Soil Sampled: 12/22/04 12:25 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB - 5 - 16 - 16 1/2 (CNL0816-15) Soil Sampled: 12/22/04 12:35 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-6-6 1/2 (CNL0816-19) Soil Sampled: 12/22/04 10:50 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	

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Extractable Petroleum Hydrocarbons by EPA Method 8015M

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
SB-6- 17 (CNL0816-21) Soil Sampled: 12/22/04 10:59 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-6- 7 (CNL0816-24) Soil Sampled: 12/22/04 10:50 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-7- 7 (CNL0816-26) Soil Sampled: 12/22/04 09:55 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
SB-7- 11 1/2 (CNL0816-27) Soil Sampled: 12/22/04 10:01 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
MW - 20 - 11 - 11 1/2 (CNL0816-34) Soil Sampled: 12/21/04 09:56 Received: 12/23/04 15:52									
Diesel	**610**	10	mg/kg	10	CN10002	12/29/04	12/30/04	EPA 8015M	
MW - 20 - 17 (CNL0816-36) Soil Sampled: 12/21/04 10:01 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10002	12/29/04	12/30/04	EPA 8015M	
MW - 17B - 13 1/2 (CNL0816-42) Soil Sampled: 12/21/04 11:43 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 19 - 12 (CNL0816-43) Soil Sampled: 12/21/04 09:04 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 19 - 7 (CNL0816-45) Soil Sampled: 12/21/04 09:00 Received: 12/23/04 15:52									
Diesel	**33**	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	

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Extractable Petroleum Hydrocarbons by EPA Method 8015M

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW - 17B - 15 (CNL0816-47) Soil Sampled: 12/20/04 11:45 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 17B - 36 1/2 (CNL0816-51) Soil Sampled: 12/22/04 07:55 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 16A - 11 (CNL0816-65) Soil Sampled: 12/20/04 14:37 Received: 12/23/04 15:52									
Diesel	**460**	10	mg/kg	10	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 18 - 6 - 6 1/2 (CNL0816-72) Soil Sampled: 12/21/04 08:01 Received: 12/23/04 15:52									
Diesel	**1400**	25	mg/kg	25	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 16B - 34 (CNL0816-75) Soil Sampled: 12/21/04 14:11 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	
MW - 21 - 11 - 12 (CNL0816-79) Soil Sampled: 12/21/04 11:15 Received: 12/23/04 15:52									
Diesel	**15**	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	DSL-1
MW - 21 - 6 - 6 1/2 (CNL0816-80) Soil Sampled: 12/21/04 11:11 Received: 12/23/04 15:52									
Diesel	**2.0**	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	DSL-1
SB-1 6 - 6 1/2 (CNL0816-84) Soil Sampled: 12/21/04 00:00 Received: 12/23/04 15:52									
Diesel	ND	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	
SB-1 11 - 11 1/2 (CNL0816-86) Soil Sampled: 12/21/04 00:00 Received: 12/23/04 15:52									
Diesel	**17**	1.0	mg/kg	1	CN10032	12/30/04	01/03/05	EPA 8015M	DSL-1

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Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
SB-2-6-6 1/2 (CNL0816-01) Soil Sampled: 12/22/04 09:35 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CN10006	12/29/04	12/29/04	8015M/8021B	
Benzene	**13**	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	**7.7**	5.0	"	"	"	"	"	"	
Xylenes (total)	**32**	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*101 %*	*70-130*		"	"	"	"	
SB-2-11 1/2 - 12 (CNL0816-03) Soil Sampled: 12/22/04 09:45 Received: 12/23/04 15:52									
Gasoline	**3500**	1000	µg/kg	1	CN10006	12/29/04	12/29/04	8015M/8021B	GAS-1
Benzene	**540**	50	"	10	"	"	12/30/04	"	
Toluene	**990**	50	"	"	"	"	"	"	
Ethylbenzene	**90**	5.0	"	1	"	"	12/29/04	"	
Xylenes (total)	**360**	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*102 %*	*70-130*		"	"	"	"	
SB-3-16 1/2 - 17 (CNL0816-05) Soil Sampled: 12/22/04 10:40 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CN10006	12/29/04	12/29/04	8015M/8021B	
Benzene	**30**	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*90.2 %*	*70-130*		"	"	"	"	
SB-3-11 1/2 - 12 (CNL0816-06) Soil Sampled: 12/22/04 10:30 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CN10006	12/29/04	12/29/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*96.2 %*	*70-130*		"	"	"	"	

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Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
SB-4 - 6 1/2 - 7 (CNL0816-08) Soil Sampled: 12/22/04 11:30 Received: 12/23/04 15:52									
Gasoline	**150000**	20000	µg/kg	20	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	**280**	100	"	"	"	"	"	"	
Toluene	**4300**	100	"	"	"	"	"	"	
Ethylbenzene	**3000**	100	"	"	"	"	"	"	
Xylenes (total)	**14000**	200	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*112 %*	*70-130*		"	"	"	"	
SB-4 - 11 1/2 - 12 (CNL0816-09) Soil Sampled: 12/22/04 11:40 Received: 12/23/04 15:52									
Gasoline	**330000**	100000	µg/kg	100	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	**2600**	500	"	"	"	"	"	"	
Toluene	**31000**	1000	"	200	"	"	01/03/05	"	
Ethylbenzene	**8300**	500	"	100	"	"	12/30/04	"	
Xylenes (total)	**42000**	1000	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*107 %*	*70-130*		"	"	"	"	
SB - 5 - 6 1/2 - 7 (CNL0816-13) Soil Sampled: 12/22/04 12:25 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*88.4 %*	*70-130*		"	"	"	"	
SB - 5 - 16 - 16 1/2 (CNL0816-15) Soil Sampled: 12/22/04 12:35 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*93.0 %*	*70-130*		"	"	"	"	

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ENSR - Sacramento	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2	
10411 Old Placerville Rd., Suite 210	Project Number: 06940-407-120	**CLS Work Order #: CNL0816**
Sacramento, CA 95827-2508	Project Manager: Jeff Wendt	COC #: Various

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
SB-6-6 1/2 (CNL0816-19) Soil Sampled: 12/22/04 10:50 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*92.9 %*	*70-130*		"	"	"	"	
SB-6- 17 (CNL0816-21) Soil Sampled: 12/22/04 10:59 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*92.5 %*	*70-130*		"	"	"	"	
SB-6- 7 (CNL0816-24) Soil Sampled: 12/22/04 10:50 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*93.4 %*	*70-130*		"	"	"	"	
SB-7- 7 (CNL0816-26) Soil Sampled: 12/22/04 09:55 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*90.8 %*	*70-130*		"	"	"	"	

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ENSR - Sacramento	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2	
10411 Old Placerville Rd., Suite 210	Project Number: 06940-407-120	**CLS Work Order #: CNL0816**
Sacramento, CA 95827-2508	Project Manager: Jeff Wendt	COC #: Various

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
SB-7- 11 1/2 (CNL0816-27) Soil Sampled: 12/22/04 10:01 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*91.6 %*	*70-130*		"	"	"	"	
MW - 20 - 11 - 11 1/2 (CNL0816-34) Soil Sampled: 12/21/04 09:56 Received: 12/23/04 15:52									
Gasoline	**320000**	250000	µg/kg	500	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	2500	"	"	"	"	"	"	
Toluene	**2800**	2500	"	"	"	"	"	"	
Ethylbenzene	**6600**	2500	"	"	"	"	"	"	
Xylenes (total)	**28000**	5000	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*88.1 %*	*70-130*		"	"	"	"	
MW - 20 - 17 (CNL0816-36) Soil Sampled: 12/21/04 10:01 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	**8.5**	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*91.7 %*	*70-130*		"	"	"	"	
MW - 17B - 13 1/2 (CNL0816-42) Soil Sampled: 12/21/04 11:43 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*88.1 %*	*70-130*		"	"	"	"	

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ENSR - Sacramento	Project: Frmr. Unocal 762248-359 Main St, Fortuna CA-2	
10411 Old Placerville Rd., Suite 210	Project Number: 06940-407-120	**CLS Work Order #: CNL0816**
Sacramento, CA 95827-2508	Project Manager: Jeff Wendt	COC #: Various

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW - 19 - 12 (CNL0816-43) Soil Sampled: 12/21/04 09:04 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*91.2 %*	*70-130*		*"*	*"*	*"*	*"*	
MW - 19 - 7 (CNL0816-45) Soil Sampled: 12/21/04 09:00 Received: 12/23/04 15:52									
Gasoline	**15000**	2000	µg/kg	2	CO00004	12/30/04	01/03/05	8015M/8021B	GAS-1
Benzene	ND	5.0	"	1	"	"	12/30/04	"	
Toluene	**81**	5.0	"	"	"	"	"	"	
Ethylbenzene	**120**	5.0	"	"	"	"	"	"	
Xylenes (total)	**160**	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*229 %*	*70-130*		*"*	*"*	*01/03/05*	*"*	*S-04*
MW - 17B - 15 (CNL0816-47) Soil Sampled: 12/20/04 11:45 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*90.3 %*	*70-130*		*"*	*"*	*"*	*"*	
MW - 17B - 36 1/2 (CNL0816-51) Soil Sampled: 12/22/04 07:55 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00004	12/30/04	12/30/04	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*94.0 %*	*70-130*		*"*	*"*	*"*	*"*	

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento	Project: Frmr. Unocal 762248-359 Main St, Fortuna CA-2	
10411 Old Placerville Rd., Suite 210	Project Number: 06940-407-120	**CLS Work Order #: CNL0816**
Sacramento, CA 95827-2508	Project Manager: Jeff Wendt	COC #: Various

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW - 16A - 11 (CNL0816-65) Soil Sampled: 12/20/04 14:37 Received: 12/23/04 15:52									
Gasoline	**130000**	20000	µg/kg	20	CO00031	01/03/05	01/03/05	8015M/8021B	GAS-1
Benzene	**140**	10	"	2	"	"	"	"	
Toluene	**34**	10	"	"	"	"	"	"	
Ethylbenzene	**2300**	100	"	20	"	"	"	"	
Xylenes (total)	**5000**	200	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*136 %*	*70-130*		*"*	*"*	*"*	*"*	*S-04*
MW - 18 - 6 - 6 1/2 (CNL0816-72) Soil Sampled: 12/21/04 08:01 Received: 12/23/04 15:52									
Gasoline	**38000**	10000	µg/kg	10	CO00031	01/03/05	01/03/05	8015M/8021B	GAS-1
Benzene	ND	50	"	"	"	"	"	"	
Toluene	**57**	50	"	"	"	"	"	"	
Ethylbenzene	**300**	50	"	"	"	"	"	"	
Xylenes (total)	**530**	100	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*140 %*	*70-130*		*"*	*"*	*"*	*"*	*S-04*
MW - 16B - 34 (CNL0816-75) Soil Sampled: 12/21/04 14:11 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00031	01/03/05	01/03/05	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*90.7 %*	*70-130*		*"*	*"*	*"*	*"*	
MW - 21 - 11 - 12 (CNL0816-79) Soil Sampled: 12/21/04 11:15 Received: 12/23/04 15:52									
Gasoline	**81000**	50000	µg/kg	50	CO00031	01/03/05	01/03/05	8015M/8021B	
Benzene	**1500**	250	"	"	"	"	"	"	
Toluene	**7700**	250	"	"	"	"	"	"	
Ethylbenzene	**2200**	250	"	"	"	"	"	"	
Xylenes (total)	**12000**	500	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*75.8 %*	*70-130*		*"*	*"*	*"*	*"*	

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento	Project: Frmr. Unocal 762248-359 Main St, Fortuna CA-2	
10411 Old Placerville Rd., Suite 210	Project Number: 06940-407-120	**CLS Work Order #: CNL0816**
Sacramento, CA 95827-2508	Project Manager: Jeff Wendt	COC #: Various

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW - 21 - 6 - 6 1/2 (CNL0816-80) Soil Sampled: 12/21/04 11:11 Received: 12/23/04 15:52									
Gasoline	**9600**	1000	µg/kg	1	CO00031	01/03/05	01/03/05	8015M/8021B	GC-25
Benzene	**450**	50	"	10	"	"	"	"	
Toluene	**1400**	50	"	"	"	"	"	"	
Ethylbenzene	**280**	50	"	"	"	"	"	"	
Xylenes (total)	**1700**	100	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*103 %*	*70-130*		"	"	"	"	
SB-1 6 - 6 1/2 (CNL0816-84) Soil Sampled: 12/21/04 00:00 Received: 12/23/04 15:52									
Gasoline	ND	1000	µg/kg	1	CO00031	01/03/05	01/03/05	8015M/8021B	
Benzene	ND	5.0	"	"	"	"	"	"	
Toluene	ND	5.0	"	"	"	"	"	"	
Ethylbenzene	ND	5.0	"	"	"	"	"	"	
Xylenes (total)	ND	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*90.5 %*	*70-130*		"	"	"	"	
SB-1 11 - 11 1/2 (CNL0816-86) Soil Sampled: 12/21/04 00:00 Received: 12/23/04 15:52									
Gasoline	**56000**	20000	µg/kg	20	CO00031	01/03/05	01/03/05	8015M/8021B	GC-25
Benzene	ND	100	"	"	"	"	"	"	
Toluene	**740**	100	"	"	"	"	"	"	
Ethylbenzene	**700**	100	"	"	"	"	"	"	
Xylenes (total)	**3600**	200	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*103 %*	*70-130*		"	"	"	"	

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Extractable Petroleum Hydrocarbons by EPA Method 8015M - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CN10002 - LUFT-DHS GCNV										
Blank (CN10002-BLK1)				Prepared: 12/29/04		Analyzed: 12/30/04				
Diesel	ND	1.0	mg/kg							
Motor Oil	ND	1.0	"							
Hydraulic Oil	ND	1.0	"							
Mineral Oil	ND	1.0	"							
Kerosene	ND	1.0	"							
LCS (CN10002-BS1)				Prepared: 12/29/04		Analyzed: 12/30/04				
Diesel	45.6	1.0	mg/kg	50.0		91.2	65-135			
LCS Dup (CN10002-BSD1)				Prepared: 12/29/04		Analyzed: 12/30/04				
Diesel	45.4	1.0	mg/kg	50.0		90.8	65-135	0.440	30	
Matrix Spike (CN10002-MS1)		**Source: CNL0886-02**		Prepared: 12/29/04		Analyzed: 12/30/04				
Diesel	47.0	1.0	mg/kg	50.0	ND	94.0	59-138			
Matrix Spike Dup (CN10002-MSD1)		**Source: CNL0886-02**		Prepared: 12/29/04		Analyzed: 12/30/04				
Diesel	46.7	1.0	mg/kg	50.0	ND	93.4	59-138	0.640	37	
Batch CN10032 - LUFT-DHS GCNV										
Blank (CN10032-BLK1)				Prepared: 12/30/04		Analyzed: 01/03/05				
Diesel	ND	1.0	mg/kg							
Motor Oil	ND	1.0	"							
Hydraulic Oil	ND	1.0	"							
LCS (CN10032-BS1)				Prepared: 12/30/04		Analyzed: 01/03/05				
Diesel	46.7	1.0	mg/kg	50.0		93.4	65-135			

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Extractable Petroleum Hydrocarbons by EPA Method 8015M - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CN10032 - LUFT-DHS GCNV										
LCS Dup (CN10032-BSD1)				Prepared: 12/30/04		Analyzed: 01/03/05				
Diesel	45.5	1.0	mg/kg	50.0		91.0	65-135	2.60	30	
Matrix Spike (CN10032-MS1)		**Source: CNL0822-03**		Prepared: 12/30/04		Analyzed: 01/03/05				
Diesel	47.9	1.0	mg/kg	50.0	ND	95.8	59-138			
Matrix Spike Dup (CN10032-MSD1)		**Source: CNL0822-03**		Prepared: 12/30/04		Analyzed: 01/03/05				
Diesel	47.3	1.0	mg/kg	50.0	ND	94.6	59-138	1.26	37	

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CN10006 - EPA 5030 Soil GC										
Blank (CN10006-BLK1)				Prepared & Analyzed: 12/29/04						
Gasoline	ND	1000	µg/kg							
Benzene	ND	5.0	"							
Toluene	ND	5.0	"							
Ethylbenzene	ND	5.0	"							
Xylenes (total)	ND	10	"							
Surrogate: o-Chlorotoluene (BTEX)	*101*		*"*	*100*		*101*	*70-130*			
Surrogate: o-Chlorotoluene (Gas)	*91.8*		*"*	*100*		*91.8*	*70-130*			
LCS (CN10006-BS1)				Prepared & Analyzed: 12/29/04						
Gasoline	2630	1000	µg/kg	2500		105	65-135			
Surrogate: o-Chlorotoluene (Gas)	*101*		*"*	*100*		*101*	*70-130*			
LCS Dup (CN10006-BSD1)				Prepared & Analyzed: 12/29/04						
Gasoline	2500	1000	µg/kg	2500		100	65-135	5.07	30	
Surrogate: o-Chlorotoluene (Gas)	*100*		*"*	*100*		*100*	*70-130*			
Matrix Spike (CN10006-MS1)		**Source: CNL0587-36**		Prepared & Analyzed: 12/29/04						
Gasoline	2220	1000	µg/kg	2500	ND	88.8	63-124			
Surrogate: o-Chlorotoluene (Gas)	*88.5*		*"*	*100*		*88.5*	*70-130*			
Matrix Spike Dup (CN10006-MSD1)		**Source: CNL0587-36**		Prepared & Analyzed: 12/29/04						
Gasoline	2310	1000	µg/kg	2500	ND	92.4	63-124	3.97	35	
Surrogate: o-Chlorotoluene (Gas)	*98.6*		*"*	*100*		*98.6*	*70-130*			
Batch CO00004 - EPA 5030 Soil GC										
Blank (CO00004-BLK1)				Prepared & Analyzed: 12/30/04						
Gasoline	ND	1000	µg/kg							
Benzene	ND	5.0	"							
Toluene	ND	5.0	"							
Ethylbenzene	ND	5.0	"							
Xylenes (total)	ND	10	"							

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO00004 - EPA 5030 Soil GC										
Blank (CO00004-BLK1)				Prepared & Analyzed: 12/30/04						
Surrogate: o-Chlorotoluene (BTEX)	*103*		*µg/kg*	*100*		*103*	*70-130*			
Surrogate: o-Chlorotoluene (Gas)	*92.2*		*"*	*100*		*92.2*	*70-130*			
LCS (CO00004-BS1)				Prepared & Analyzed: 12/30/04						
Gasoline	2540	1000	µg/kg	2500		102	65-135			
Surrogate: o-Chlorotoluene (Gas)	*101*		*"*	*100*		*101*	*70-130*			
LCS Dup (CO00004-BSD1)				Prepared & Analyzed: 12/30/04						
Gasoline	2430	1000	µg/kg	2500		97.2	65-135	4.43	30	
Surrogate: o-Chlorotoluene (Gas)	*99.9*		*"*	*100*		*99.9*	*70-130*			
Matrix Spike (CO00004-MS1)		**Source: CNL0816-65**		Prepared & Analyzed: 12/30/04						**QM-4X**
Gasoline	2350	1000	µg/kg	2500	130000	NR	63-124			
Surrogate: o-Chlorotoluene (Gas)	*97.5*		*"*	*100*		*97.5*	*70-130*			
Matrix Spike Dup (CO00004-MSD1)		**Source: CNL0816-65**		Prepared & Analyzed: 12/30/04						**QM-4X**
Gasoline	2370	1000	µg/kg	2500	130000	NR	63-124	0.847	35	
Surrogate: o-Chlorotoluene (Gas)	*106*		*"*	*100*		*106*	*70-130*			
Batch CO00031 - EPA 5030 Soil GC										
Blank (CO00031-BLK1)				Prepared & Analyzed: 01/03/05						
Gasoline	ND	1000	µg/kg							
Benzene	ND	5.0	"							
Toluene	ND	5.0	"							
Ethylbenzene	ND	5.0	"							
Xylenes (total)	ND	10	"							
Surrogate: o-Chlorotoluene (Gas)	*91.2*		*"*	*100*		*91.2*	*70-130*			

CALIFORNIA LABORATORY SERVICES

04/19/05 11:14

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO00031 - EPA 5030 Soil GC										
LCS (CO00031-BS1)				Prepared & Analyzed: 01/03/05						
Gasoline	2400	1000	µg/kg	2500		96.0	65-135			
Surrogate: o-Chlorotoluene (Gas)	*96.6*		*"*	*100*		*96.6*	*70-130*			
LCS Dup (CO00031-BSD1)				Prepared & Analyzed: 01/03/05						
Gasoline	2470	1000	µg/kg	2500		98.8	65-135	2.87	30	
Surrogate: o-Chlorotoluene (Gas)	*106*		*"*	*100*		*106*	*70-130*			
Matrix Spike (CO00031-MS1)		**Source: CNL0816-75**		Prepared & Analyzed: 01/03/05						
Gasoline	2360	1000	µg/kg	2500	ND	94.4	63-124			
Surrogate: o-Chlorotoluene (Gas)	*101*		*"*	*100*		*101*	*70-130*			
Matrix Spike Dup (CO00031-MSD1)		**Source: CNL0816-75**		Prepared & Analyzed: 01/03/05						
Gasoline	2240	1000	µg/kg	2500	ND	89.6	63-124	5.22	35	
Surrogate: o-Chlorotoluene (Gas)	*95.0*		*"*	*100*		*95.0*	*70-130*			

CALIFORNIA LABORATORY SERVICES

04/19/05 11:14

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA-2 Project Number: 06940-407-120 Project Manager: Jeff Wendt	**CLS Work Order #: CNL0816** COC #: Various

Notes and Definitions

S-04	The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.
QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
GC-25	Weathered gasoline.
GAS-1	Although sample contains compounds in the retention time range associated with gasoline, the chromatogram was not consistent with the expected chromatographic pattern or "fingerprint". However, the reported concentration is based on gasoline.
DSL-1	Although sample contains compounds in the retention time range associated with diesel, the chromatogram was not consistent with the expected chromatographic pattern or "fingerprint". However, the reported concentration is based on diesel.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNL0816 Page 1 of 1

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
MW-6B-34	12/21/04	1411	SOIL	1	X												ice
MW-6B-40	12/21/04	1427		1											X		ice
MW-6B-37	12/21/04	1419		1											X		ice
MW-6B-36-36½	12/21/04	1419		1											X		ice
MW-21-21-12	12/21/04	1115		1	X												ice
MW-21-6-6½	12/21/04	1111		1	X												ice
MW-21-17	12/21/04	1118		1													ice
																	ice
																	ice
																	ice
																	ice

Collected by: WILLSPETH **Date/Time** 12/21/04 **Collector's Signature:** **Date/Time** 12/23/04

Relinquished by: **Date/Time** 12/23/04 1532 **Received by:** **Date/Time**

Relinquished by: **Date/Time** **Received by:** **Date/Time** 12-23-04 1535

Method of Shipment: **Sample Condition on Rcpt:**

*

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNC0816 Page 1 of 1

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
MW-16A-13	12/20/04	1491	SOIL	1											X		ice
MW-16A-11	12/20/04	1437		1	X										X	RTP	ice
MW-16A-8 8½	12/20/04	1434		1											X		ice
MW-16A-7	12/20/04	1429		1											X		ice
MW-16A-9	12/20/04	1439		1											X		ice
MW-18-16 16½	12/21/04	0813		1											X		ice
MW-18-11	12/21/04	0813		1											X		ice
MW-18-7	12/21/04	0801		1											X		ice
MW-18-6-6½	12/21/04	0801		1	X										X	RTP	ice
MW-19 -20	12/21/04	0915		1											X		ice
MW-19-16½	12/21/04	0908	SOIL	1											X		ice

Collected by: WILL SPETH **Date/Time** 12/20/21/04 **Collector's Signature:** [signature] **Date/Time** 12/23/04

Relinquished by: WILL SPETH [signature] **Date/Time** 12/23/04 12:32 **Received by:** [signature] **Date/Time**

Relinquished by: **Date/Time** **Received by:** [signature] **Date/Time** 12-23/04 1535

Method of Shipment: **Sample Condition on Rcpt:**

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNL0816

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
MW-17B-25	12/20/04	1205	SOIL	1											X		ice
MW-17B-24½-25		1205		1											X		ice
MW-17B-23		1202		1											X		ice
MW-17B-22½-23		1202		1											X		ice
MW-17B-11-11½		1139		1											X		ice
MW-17B-13-13½		1145		1											X		ice
MW-17B-20½-21		1127		1											X		ice
MW-17B-19		1154		1											X		ice
MW-17B-21		1157		1											X		ice
MW-17B-18½-19	12/20/04	1154	SOIL	1											X		ice
				5													ice

Collected by: [illegible] **Date/Time** 12/20/04 **Collector's Signature:** [signature] **Date/Time** 12/20/04

Relinquished by: [signature] **Date/Time** 12/20/04 @ 1532 **Received by:** [signature] **Date/Time**

Relinquished by: **Date/Time** **Received by:** **Date/Time**

Method of Shipment: **Sample Condition on Rcpt:** 1.05 C

122304575

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNL0816

Lab: CLS

TAT: Standard

Report results to:

Name	Jeff Wendt
Company	ENSR
Mailing Address	10411 Old Placerville Road, Suite 210
City, State, Zip	Sacramento, CA 95827-2508
Telephone No.	916-362-7100
Fax No.	916-362-8100

Project Information

Site Address:	359 Main Street FORTUNA, CA.
ENSR Job#:	06940-407-120
Unocal Job#:	762248
Global ID#:	

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
MW-173-40	12/22/04	0800	Soil	1											X		Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice
				1													Ice

Collected by: [signature] **Date/Time** 12/20/04

Collector's Signature: [signature] **Date/Time** 12/23/04

Relinquished by: [signature] **Date/Time** 12/23/04 @1532

Received by: **Date/Time**

Relinquished by: **Date/Time**

Received by: **Date/Time**

Method of Shipment:

Sample Condition on Rcpt:

[signature]

12-23-04
1575

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNL0816

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
MW-19-12	12/21/04	0904	soil	1	X												ice
MW-19-19-19½	12/21/04	0915	soil	1											X		ice
MW-19-7	12/21/04	0900	soil	1	X												ice
MW-19-17	12/21/04	0908	soil	1											X		ice
MW-17B-15	12/20/04	1145	soil	1	X												ice
MW-17B-14½-15	12/20/04	1145		1											X		ice
MW-17B-17	12/20/04	1150		1											X		ice
~~MW-17B-12~~				1													ice
MW-17B-16½-17	12/20/04	1150		1											X		ice
MW-17B-36½	12/22/04	0755		1	X												ice
MW-17B-32	12/22/04	0745		1													ice

Collected by: WILL SETH **Date/Time** 12/20/04 **Collector's Signature:** [signature] **Date/Time** 12/23/04

Relinquished by: [signature] **Date/Time** 12/23/04 @ 1532 **Received by:** [signature] **Date/Time**

Relinquished by: **Date/Time** **Received by:** [signature] **Date/Time** 12-23-04 1535

Method of Shipment: **Sample Condition on Rcpt:**

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNL0816

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
MW-20-7	12/21/01	0950	SOIL	1											X		ice
MW-20-6-6½		0950		1											X		ice
MW-20-11-11½		0956		1	X												ice
MW-20 11½-12		0956	SOIL	1											X		ice
MW-20-17		1001		1	X												ice
MW-20-19-19½		1006		1											X		ice
MW-20-20'		1006		1											X		ice
MW-18-19-19½		0818		1											X		ice
MW-18-20	12/21/01	0818		1											X		ice
MW-17B-11½		1139	SOIL	1											X		ice
MW-17B-13½	12/21/01	1143	SOIL	1	X												ice

Collected by: [illegible] **Date/Time** 12/20/01 **Collector's Signature:** [illegible] **Date/Time** 12/23/01

Relinquished by: [illegible] **Date/Time** 12/23/01 1532 **Received by:** [illegible] **Date/Time**

Relinquished by: [illegible] **Date/Time** **Received by:** [illegible] **Date/Time**

Method of Shipment: **Sample Condition on Rcpt:** [illegible]

12-23-01
1535

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNL0816

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
SB-6-20	12/22/01	1103	Soil	1											X		ice
SB-6-7		1050	Soil	1	X												ice
SB-7-6½		0955	Soil	1											X		ice
SB-7-7		0955	Soil	1	X												ice
SB-7-11½'		1001	Soil	1	X												ice
SB-7-12		1001	Soil	1											X		ice
SB-7-17		1007	Soil	1											X		ice
SB-7-19½		1101	Soil	1											X		ice
SB-7-20'	12/22/01	1101	Soil	1											X		ice
				*													ice
				*													ice

Collected by: [illegible] **Date/Time** 12/20/01 **Collector's Signature:** [illegible] **Date/Time** 12/20/01

Relinquished by: [illegible] **Date/Time** 12/21/01 1532 **Received by:** [illegible] **Date/Time**

Relinquished by: **Date/Time** **Received by:** [illegible] **Date/Time**

Method of Shipment: **Sample Condition on Rcpt:** [illegible]

12-23-01 1535

*

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNC 0816 Page 1 of 1

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
SB-4-19½-20'	12/22/04	1155	SOIL	1											X		ice
SB-5-6½-7'		1225		1	X												ice
SB-5-11½-12'		1230		1											X		ice
SB-5-16-16½'		1235		1	X												ice
SB-5 16½-17'		1235		1													ice
SB-5-19-19½'		1250		1											X		ice
SB-5-19½-20		1250		1											X		ice
SB-6-6½		1050		1	X												ice
SB-6-11½		1055		1											X		ice
SB-6-17'		1059		1	X												ice
SB-6-19½	12/22/04	1103	SOIL	1											X		ice

Collected by: Wal Sprit **Date/Time** 12/20/04 **Collector's Signature:** [signature] **Date/Time** 12/23/04

Relinquished by: [signature] **Date/Time** 12/23/04 1532 **Received by:** **Date/Time**

Relinquished by: **Date/Time** **Received by:** [signature] **Date/Time** 12-23-04 1535

Method of Shipment: **Sample Condition on Rcpt:**

*

ENSR INTERNATIONAL

CHAIN OF CUSTODY

CNC0816

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main Street FORTUNA, CA.
ENSR Job#: 06940-407-120
Unocal Job#: 762248
Global ID#:

Special instructions and/or specific regulatory requirements:

Analyses Requested

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	BTEX (8021) TPHg & TPHd (8015)										HOLD	Sample Condition/Comments	Preservative
SB-2 -6-6½	12/22/04	0935	Soil	1	X												ice
SB-2-6½-7	12/22/04	0935		1											X		ice
SB-2 -11½-12		0945		1	X												ice
SB-2 - 19½-20		0955		1											X		ice
SB-3 16½-17		1040		1	X												ice
SB-3 - 11½-12		1030		1	X												ice
SB-3 - 19½-20	12/22/04	1055	Soil	1											X		ice
SB-4 -6½-7		1130		1	X												ice
SB-4 - 11½-12		1140		1	X												ice
SB-4 16½-17		1145		1											X		ice
SB-4 - 19½	12/22/04	1155	Soil	1											X		ice

Collected by: [illegible] **Date/Time** 12/20/04 **Collector's Signature:** [signature] **Date/Time** 12/23/04

Relinquished by: [signature] **Date/Time** 12/23/04 1532 **Received by:** [signature] **Date/Time**

Relinquished by: **Date/Time** **Received by:** [signature] **Date/Time** 1530

Method of Shipment: **Sample Condition on Rcpt:** 12-23-04 1535

CLS LABS

SAMPLE RECEIVING EXCEPTION REPORTS

C.L.S Labs Job No.: CN0816

Problem discovered by: SMITH Date 12/23/06

Nature of problem:

① MW-21-~~12~~ 21-12 on COC LABel STATES MW-21-11-12 Correct

② RCVD SAMPLES: MW-21-7 Here, SB-1 6½-7, SB-1 6-6½, SB-1 (11½-12) SB-1 (11-11½), SB-1 (16½-17) SB-1 (16-16½), SB-1 (19½-20), SB-1 (19-19½) not on COC.

Client contacted? Yes ✓ Visited No ____ Spoke With: J Wendt

By whom: RO Date: 12-27-06 Time: 1350

Client instructions:

① Correct MW-21-11-12

② Hold MW-21-7

ⓑ Run SB1 (6-6½), SB1 (11-11½) for GRO/BTEX TPH-D

ⓒ archive balance

Resolution of problem:

① Logged as MW-21-11-12.

② Logged in according to Clients Directions.

APPENDIX C

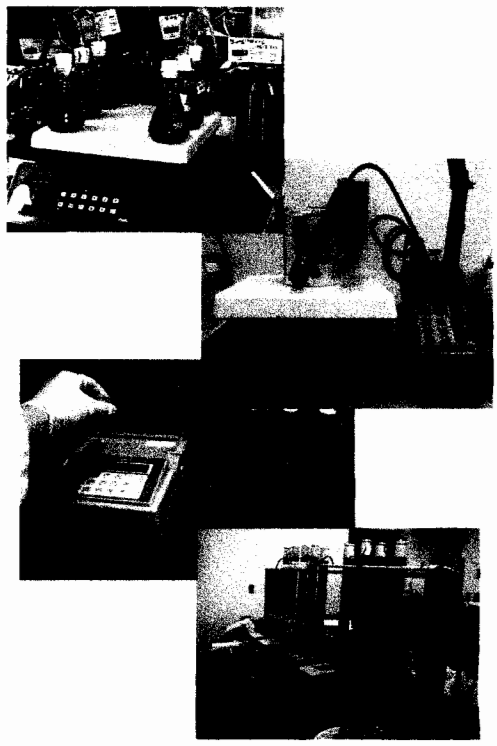
Bench-Scale Test Results

Report of Findings

EVALUATION OF FENTON'S REAGENT AND PERSULFATE FOR THE DESTRUCTION OF PETROLEUM HYDROCARBONS

ENSR
Unocal 762248

May 19, 2005



Reported by

PRIMA Environmental
An Applied Sciences and Technology Laboratory

10265 Old Placerville Road, Suite 15
Sacramento, CA 95827-3042
www.primaenvironmental.com

PRIMA Environmental
An Applied Sciences and Technology Laboratory

May 19, 2005

Jennifer Johnston
ENSR
10411 Old Placerville Rd., Ste 210
Sacramento, CA 95827

RE: Final Report of Findings, Bench testing for Unocal #762248

Dear Jennifer:

Enclosed is the final report of findings "Evaluation of Fenton's Reagent and Persulfate for the Destruction of Petroleum Hydrocarbons" that describes bench testing conducted on soil and groundwater from the Unocal #762248 site. If you have any questions, please give me a call. Thank you for the opportunity to be of service

Sincerely,
PRIMA Environmental

Cindy G.Schreier, Ph.D.
Principal

10265 Old Placerville Road, Suite 15 • Sacramento, CA 95827-3042 • Ph (916) 363-8798 • Fax (916) 363-8829
www.PRIMAEnvironmental.com

Report of Findings

Evaluation of Fenton's Reagent and Persulfate for the Destruction of Petroleum Hydrocarbons

Unocal 762248

May 19, 2005

Submitted to

Jennifer Johnston
ENSR
10411 Old Placerville Road, Suite 210
Sacramento, CA 95827

Submitted by
Cindy G. Schreier, Ph.D.
PRIMA Environmental
10265 Old Placerville Road, Suite 15
Sacramento, CA 95827

Cindy G. Schreier, Ph.D., Principal

May 19, 2005
Date

EXECUTIVE SUMMARY

Bench-scale testing was conducted on soil (cores MW-18-12; MW-18-151/2-16, MW-16A-12-121/2; MW-16A-15; MW-16A-17; MW-16A-19; SB-4-16-161/2) and groundwater (MW-16A-W) from the Unocal #762248 site at 359 Main Street in Fortuna, California to evaluate the ability of Fenton's reagent and persulfate to oxidize petroleum hydrocarbons. The hydrocarbons at this site were gasoline range total petroleum hydrocarbons (TPH-g), BTEX (benzene, toluene, ethylbenzene, and xylenes), and methyl t-butyl ether (MTBE). Tests assessed the effectiveness of each oxidant, and determined the effect of each treatment on selected water quality parameters.

Bench-scale treatability testing demonstrated that Fenton's reagent and persulfate could destroy TPH-g and xylenes present in site soil and groundwater. Fenton's reagent using 1-3% hydrogen peroxide and 250 mg/L acidified ferrous iron destroyed TPH-g and all BTEX compounds present in site soil and groundwater. For most compounds, less than about 20% was volatilized, though the exact degree of volatilization versus destruction could not be determined due to uncertainty in the initial hydrocarbons concentrations. Both unactivated and activated persulfate destroyed TPH-g and xylenes, but the effect on benzene, toluene and ethylbenzene was inconclusive due to uncertainty in the initial concentrations. The uncertainty in initial conditions is most likely due to concentration variations among the groundwater sample bottles received for testing because the variability in analyte concentrations between untreated groundwater and control tests could not be explained by strict biodegradation or volatilization (see Sections 3.1, 3.2.1 and 3.3.2 for details).

Fenton's affected several inorganic water quality parameters. Small amounts of Cr(VI)—on the order of 10 μg/L—were generated. This is much lower than typically observed with other oxidants such as permanganate. Dissolved iron and sulfate increased while pH decreased. These changes were expected due to the nature of Fenton's reagent. The concentration of nickel increased, presumably due to the low pH of Fenton's reagent. Cadmium and zinc were not affected.

Complete decomposition of H_2O_2 in the presence of soil occurred within about 24 hours regardless of the initial concentration of H_2O_2, but about 5 times more gas was generated from when the initial H_2O_2 concentration was 1% than when it was 3%.

Treatment with activated persulfate affected several water quality parameters, while treatment with unactivated persulfate affected only a few. Both treatments decreased pH by about 0.5 pH units and increased the concentration of sulfate to about 1,000 mg/L. These changes were due to decomposition of persulfate. Dissolved iron increased in the activated persulfate test due to the activator. Nickel and lead also increased, while cadmium and zinc were not detected. None of the metals were detected in the untreated persulfate test.

The persulfate SOD ranged from 0.5 to 3.5 g $Na_2S_2O_8$/kg soil and was generally lower for activated persulfate than for unactivated persulfate.

The buffering curves for the soil indicated that < 10 mmoles of acid (H^+) can be added to soil without causing long-term adverse effects.

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1.0 INTRODUCTION

Bench-scale testing was conducted on soil (cores MW-18-12; MW-18-151/2-16, MW-16A-12-121/2; MW-16A-15; MW-16A-17; MW-16A-19; SB-4-16-161/2) and groundwater (MW-16A-W) from the Unocal #762248 site at 359 Main Street in Fortuna, California to evaluate the ability of Fenton's reagent and persulfate to oxidize petroleum hydrocarbons. The hydrocarbons at this site were gasoline range total petroleum hydrocarbons (TPH-g), BTEX (benzene, toluene, ethylbenzene, and xylenes), and methyl t-butyl ether (MTBE). Tests were conducted to assess the effectiveness of each oxidant, as well as determine the effect of each treatment on selected water quality parameters.

1.1 Technology Background

Fenton's reagent and persulfate are oxidants that are known to react with petroleum hydrocarbons under some conditions. In situ chemical oxidation (ISCO) using Fenton's reagent is relatively well-established, while the persulfate is an emerging technology. This section provides a brief description of Fenton's reagent and persulfate.

1.1.1 Fenton's Reagent

Fenton's reagent is an acidified mixture of hydrogen peroxide (H_2O_2) and ferrous iron that is believed to generate hydroxyl and other radicals. The hydroxyl radical is a strong oxidizing agent that may react with available substrates in solution. In principal, compounds may be converted to carbon dioxide and water. For MTBE and TPH-g, possible intermediates include acetone or t-butyl alcohol (TBA).

Fenton's reagent is non-selective and may react not only with the target contaminant, but also with soil particles and natural organic matter. In addition, it is possible for the reactants—H_2O_2 and ferrous iron—to be regenerated, making the system catalytic. For these reasons, it is not possible to write a stoichiometric reaction for the oxidation of a specific compound or to determine *a priori* the amount of H_2O_2 and catalyst that will be needed to convert a specific contaminant to carbon dioxide and water. Bench testing was performed to confirm removal of hydrocarbons from site materials and estimate the concentration of hydrogen peroxide needed to achieve removal.

Like all strong oxidants, Fenton's reagent may potentially have long term or short term secondary affects such as oxidation of soil-bound chromium to Cr(VI) or mobilization of metals (due to low pH of reagent). Bench-scale testing was performed to identify which parameters, if any, might be of concern during full-scale application of Fenton's Reagent

Fenton's reagent decomposes to generate oxygen gas. At standard temperature and pressure one liter of 1% H_2O_2 generates about 3.3 L of oxygen gas, while 1L of 5% H_2O_2 generates about 16 L of gas. Thus, management of off-gases may be necessary depending upon the amount of H_2O_2 added and the rate at which it decomposes. Bench-testing was

performed to measure the rate of off-gas formation, which in turn can be used as a first approximation of the longevity of Fenton's reagent in the sub-surface.

1.1.2 Persulfate

Persulfate is an emerging technology for the oxidation of organic compounds. It is a strong oxidant that has been widely used in the manufacturing industry to initiate polymerization reactions, etch and clean printed circuit boards, remove dyes, and enhance hair bleaches. Laboratory testing conducted by the University of Connecticut and others has shown that persulfate can also oxidize a wide range of environmental contaminants, including BTEX and MTBE. Persulfate can be used at near-neutral pH, but must be activated to be effective toward some reagents. (In general, BTEX compounds do not require activation, but MTBE and possibly TPH-g may.) Common catalysts include heat, transitions metals, reducing agents, and mercaptans. Both unactivated persulfate and persulfate activated with agricultural iron (iron chelated with EDTA) were evaluated in this study.

Persulfate decomposes to produce sulfate and acid (that is, sulfuric acid) per Eqn. 1. The affect of acid production on pH in the sub-surface will depend upon the amount of persulfate used, the rate at which it decomposes, and the buffering ability of site soil and groundwater.

$$S_2O_8^{2-} + H_2O \rightarrow 2SO_4^{2-} + 2H^+ + \tfrac{1}{2} O_2 \qquad \text{Eqn. 1}$$

Persulfate may potentially have secondary affects such as oxidation of soil-bound chromium to Cr(VI), mobilization of metals (due to changes in pH and/or the presence of a chelating agent in the activator) or formation of halogenated intermediates. The magnitude of any such affects is site specific and presumably depends upon the concentration of persulfate and the type of activator used.

1.2 Study Objectives

The goals of the bench testing were to

- confirm hydrocarbon removal for each oxidant
- evaluate the effect of treatment on secondary water quality parameters
- measure soil oxidant demand for persulfate
- measure rate of off-gas generation for Fenton's reagent, and
- generate buffering curves for the soil

The results of the tests, and PRIMA Environmental's assessment of the results, are presented in this report. However, it is the responsibility of ENSR to review this report and use its knowledge and expertise to determine which, if either, of the oxidants may be practically and cost-effectively applied at the site.

2.0 EXPERIMENTAL PROCEDURES

Batch tests were conducted to achieve the goals listed in Section 1.2. This section describes the procedures used.

2.1 Preparation and Characterization of Soil and Groundwater

The following soil cores were received for testing on December 27, 2004:

- MW-18-12
- MW-18-151/2-16
- MW-16A-12-121/2
- MW-16A-15
- MW-16A-17
- MW-16A-19
- SB-4-16-161/2

Prior to testing, the soil cores were sieved to remove particles > 4 mesh, then composited by mixing by hand. Untreated, composited soil was then analyzed for BTEX, TPH-g, MTBE, TBA, acetone Cr(VI), and LUFT metals (cadmium, chromium, lead, nickel and zinc).

Site groundwater sample MW-16A was received in 9 1L-amber bottles, which were assumed to be identical, though this assumption may not be correct (see Sections 3.1, 3.2.1, and 3.3.2). Untreated groundwater from one bottle was analyzed for volatile organic compounds (VOCs, EPA 8260) TPH-g, MTBE, TBA, acetone, Cr(VI), pH, and sulfate.

2.2 Evaluation of Fenton's Reagent

Tests to evaluate the effectiveness of Fenton's reagent, estimate the dose requirements, assess the effect secondary water quality, and measure the rate of off-gas formation were performed. The iron source used in the Fenton's tests was ferrous sulfate heptahydrate ($FeSO_4 \cdot 7H_2O$).

2.2.1 Hydrocarbon Removal / Effect on Secondary Water Quality

Batch tests were conducted. Concentrated (30%) H_2O_2, 20,000 mg/L ferrous iron (added as $FeSO_4 \cdot 7H_2O$), and acid were added to site 100 g soil and 350 mL groundwater in an Erlenmeyer flask to achieve the initial conditions listed in Table 1. Deionized water was added as needed to bring the total aqueous volume to 400 mL. (The amount of acid added—8 mmol H^+/L of solution—was determined in a preliminary test in which acid was added to soil and groundwater until the pH was between 2 and 3.) Each flask was connected to a Tedlar bag in order to collect off-gases. After mixing with a magnetic

stirrer for approximately 24 hours, the aqueous and gases phases were analyzed for TPH-g, BTEX, MTBE, acetone and TBA. Aqueous samples were also analyzed for pH, iron, Cr(VI), sulfate, and LUFT metals (Cd, Cr, Pb, Ni, Zn). Analysis of the gas phase was necessary in order to confirm that contaminant losses were due to destruction and not volatilization. The concentrations of hydrocarbons in the soil phase were not measured because significant losses of volatile hydrocarbons are expected due to sample handling when the soil and aqueous phases are separated.

Table 1. Reaction Conditions for Modified Fenton's Tests.

Test ID	Initial H_2O_2	Initial Fe, mg/L
Control	0%	0
1% Fenton's	1%	280
3% Fenton's	3%	280

2.2.2 Rate of Off-Gas Formation

Tests 2 and 3 in Section 2.2.1 were repeated on a smaller scale and the rate of formation of off-gases measured. In these tests, each Erlenmeyer flask was connected to an inverted container filled with water. As H_2O_2 decomposed, the off-gases formed displaced the water in the container. The amount of water displaced was recorded as a function of time. This information can be used to estimate the longevity of the modified Fenton's reagent in the field.

2.3 Evaluation of Persulfate

Tests were conducted to measure the soil oxidant demand of persulfate and to evaluate removal of hydrocarbons. Sodium persulfate ($Na_2S_2O_8$) was used in these tests. Unless otherwise noted, "persulfate" refers to sodium persulfate. The source of iron used in these tests was Grow-More® agricultural iron, a commercially available chelated iron that 13% iron.

2.3.1 Activated Persulfate Soil Oxidant Demand

The soil oxidant demand (SOD) of persulfate was estimated for both unactivted persulfate and persulfate activated with agricultural iron. Soil and reagents were combined in amber bottles, then the concentration of residual persulfate was measured over time. The initial conditions used are given in Table 2. For Tests 1, 2, 5 and 6, reagents were placed in a reactor, which was capped and periodically sampled for residual persulfate. For each of Tests 3, 4, 7, and 8, a series of four replicate bottles were prepared, each containing 90 g soil and 90 mL $Na_2S_2O_8$ solution. The bottles were capped and mixed intermittently by hand. Periodically, one bottle from each series was sacrificed and analyzed for residual

persulfate. The sampling schedule was 3, 7, 14 and 28 days. SOD was calculated according to

$$SOD = \left([Na_2S_2O_8]_{Nosoil,t} - [Na_2S_2O_8]_{withsoil,t}\right) \bullet \frac{V_{aq}}{M_{so}} \qquad \text{Eqn. 2}$$

where

SOD = the soil oxidant demand, in g $Na_2S_2O_8$/kg soil

$[Na_2S_2O_8]_{No\ soil,\ t}$ = the concentration of sodium persulfate in the absence of soil at time, *t, in g/L*

$[Na_2S_2O_8]_t$ = the concentration of sodium persulfate in the presence of soil at time, *t, in g/L*

V_{aq} = the volume of the aqueous phase, in L

M_{so} = the mass of soil, in kg

Table 2. Estimated Initial conditions for SOD test.

Test #	Description	Soil:Water	$Na_2S_2O_8$, mg/L	Activator, mg/L Fe*
1	Unactivated Persulf Low	No soil	2,000	0
2	Unactivated Persulf High	No soil	10,000	0
3	Unactivated Persulf+Soil Low	1:1	2,000	0
4	Unactivated. Persulf+Soil High	1:1	10,000	0
5	Activated Persulf Low	No soil	2,000	100
6	Activated Persulf High	No soil	10,000	100
7	Activated Persulf+Soil Low	1:1	2,000	100
8	Activated Persulf+Soil High	1:1	10,000	100

* Added as agricultural iron

2.3.2 COC Removal / Effect on Secondary Water Quality Parameters

Batch tests were performed to determine whether unactivated and activated persulfate could remove petroleum hydrocarbons and to determine the effect of persulfate treatment on selected water quality parameters. Hydrocarbon concentrations were measured over time in an effort to obtain empirical rate constants because reactions with persulfate are relatively slow.

The initial conditions for the persulfate tests are shown in Table 3. For each condition, a series of three reactors (labeled A, B, and C) containing 50 g soil, 480 mL groundwater, 1.5 mL 150 g/L-$Na_2S_2O_8$, and 0-7.7 mL 50 g/L-Grow-More® agricultural iron were prepared. Deionized water was added as needed to bring the total aqueous volume to 500 mL. The reactors were mixed 1-2 times per day by hand. Periodically, one replicate from

each series was destructively sampled and the aqueous phase analyzed for TPH-g and volatile organic compounds (EPA 8260, including BTEX, MTBE, acetone and TBA), pH, persulfate, and sulfate. The final replicate of each series was also analyzed for iron, and LUFT metals (Cd, Cr, Pb, Ni, Zn). Analysis of VOCs was performed because these compounds could potentially be intermediates in persulfate oxidation. Soil was not analyzed due to the difficulty of obtaining soil samples without significant loss of analytes due to volatilization. Replicates A, B, and C were sampled at 7, 14, and 28 days, respectively.

The persulfate concentration used in this test was determined from the SOD test and was chosen so that there would be persulfate remaining after about 14 days.

Table 3. Initial Conditions for Persulfate Hydrocarbon Removal Tests

Test	$Na_2S_2O_8$, g/L	Fe*, mg/L
Control	0	0
Unactivated	1.5	0
Activated	1.5	100

* Added as agricultural iron

2.4 Buffering Curves

Buffering curves for site soil were generated by combining 50 g soil and 50 mL dilute sulfuric acid, then measuring the pH over time. Two concentrations of acid were used: 100 mmol H^+/L (pH 1) and 10 mmol H^+/L (pH 2), which correspond to 100 mmol H^+/kg soil and 10 mmol H^+/kg soil, respectively. A control using deionized water and soil was also run. This information can be used to estimate the amount of acid that can be added to the soil (either as Fenton's reagent, or from decomposition of persulfate) without causing long term changes in pH.

2.5 Analytical Procedures

The analytical procedures used and the laboratory performing each analysis are summarized in Table 4.

Table 4. Summary of Analytical Procedures

Analyte	Method	Lab Performing Test*
TPH-g	8015M	Alpha Analytical
BTEX, MTBE, Acetone, TBA, VOCs	8260B	Alpha Analytical
Hexavalent chromium	EPA 7199/Hach**	Excelchem/PRIMA
LUFT Metals	EPA 6020	Alpha Analytical
Persulfate	Titration	PRIMA
pH	Probe	PRIMA
Sulfate	Hach kit**	PRIMA

* Alpha analytical (Sparks, NV), Excelchem (Roseville, CA), PRIMA Environmental
** Hach DR/2010 Spectrophotometer and appropriate Hach test reagents

3.0 RESULTS AND DISCUSSION

The results of the Fenton's and persulfate tests are presented. Fenton's reagent destroyed TPH-g and BTEX compounds present in site soil and groundwater, though the exact degree of destruction versus volatilization could not be determined due to uncertainty in the initial hydrocarbons concentrations. Both unactivated and activated persulfate destroyed TPH-g and xylenes, but their effect on benzene, toluene and ethylbenzene was inconclusive due to uncertainty in the initial concentrations. Fenton's reagent generated small amounts of Cr(VI)—on the order of 10 μg/L. Sulfate increased and pH decreased in both the Fenton's tests and persulfate tests. Dissolved iron and nickel increased in the Fenton's tests and in the activated persulfate test. Cadmium, lead, and zinc were not significantly affected. In the Fenton's tests, complete decomposition of H_2O_2 in the presence of soil occurred within about 24 hours. The persulfate SOD ranged from 0.5 to 3.5 g $Na_2S_2O_8$/kg soil and was generally lower for activated persulfate than for unactivated persulfate.

3.1 Sample Characterization

The concentration of hydrocarbons and select inorganic parameters in untreated soil and groundwater are given in Table 5. TPH-g and all BTEX compounds except toluene were detected in both the soil and groundwater. No VOCs, including MTBE, TBA and acetone were detected. Detection limits were elevated due to the high concentrations of some hydrocarbons. Complete analytical reports are included in the Appendix.

The groundwater concentrations in Table 5 may not be representative of the groundwater used in the Fenton's and persulfate bench tests. Groundwater was received in 9 1L-amber bottles, which were treated as identical. The bottles each had less than about 5 mL of headspace. The sub-sample used to obtain the results reported in Table 5 was collected by pouring a sample from one bottle directly into HCl-preserved VOA vials, which were then sent to Alpha Analytical for analysis. However, the concentrations in Table 5 vary greatly from those in several of the controls. The pattern of variation is not consistent with volatilization or biodegradation during laboratory testing. In addition, PRIMA Environmental has thoroughly reviewed potential sources of contamination and can find no plausible source. The pattern of variation and possible explanations are discussed in detail in Sections 3.2.1 and 3.3.2.

3.2 Fenton's Reagent

The results of the Fenton's testing are presented. Fenton's reagent destroyed TPH-g and BTEX compounds present in site soil and groundwater. Treatment with Fenton's reagent generated small amounts of Cr(VI)—on the order of 10 μg/L. Dissolved iron and sulfate increased while pH decreased. These changes were expected due to the nature of Fenton's reagent. Nickel also increased, while cadmium and zinc were unaffected. Complete decomposition of H_2O_2 in the presence of soil occurred within about 24 hours.

Table 5. Selected Characteristics of Untreated Soil and Groundwater.

Analyte	Units	Untreated Soil	Untreated GW
Hydrocarbons			
TPH-g	ppm	16	37
Acetone	ppb	< 200	< 600
TBA	ppb	< 500	< 300
MTBE	ppb	< 5	< 15
Benzene	ppb	< 5	1,800
Toluene	ppb	12	< 15
Ethylbenzene	ppb	39	330
m,p-Xylene	ppb	110	4,000
o-Xylene	ppb	110	1,600
Hexavalent chromium	ppb	< 1	< 1
Metals			
cadmium	ppb	< 1,000	< 5
chromium	ppb	61,000	< 5
iron	ppb	n.m.	150
lead	ppb	4,300	5.4
nickel	ppb	60,000	6.5
zinc	ppb	55,000	< 100
pH	--	n.m.	7.35
Sulfate	mg/L	n.m.	55

* ppm = mg/L for groundwater and mg/kg for soil; ppb = μg/L for groundwater and μg/kg for soil

**n.m. = not measured

3.2.1 Hydrocarbon Removal

The concentrations of hydrocarbons in the aqueous phase and in the off-gases after treatment with Fenton's reagent are shown in Table 6. Complete removal of TPH-g and BTEX compounds from the aqueous phase was achieved with both the 1% Fenton's test (initial H_2O_2 = 1%) and the 3% Fenton's test (initial H_2O_2 = 3%). Some acetone (34-49 μg/L) was seen the aqueous phase, but the source is unknown—it may be a by-product of Fenton oxidation or it may have been present initially but below the detection limit, which was elevated in the control and untreated water samples due to high concentrations of other compounds.

TPH-g and BTEX compounds were seen in the off-gases from both tests. The exact degree of volatilization versus destruction could not be calculated due to uncertainty in the initial concentration of hydrocarbons (see below and Section 3.3.2), but was estimated to range from < 0.1% to about 20% for most compounds (Table 7). (Note: For the calculations in Table 7, the mass of COCs in soil was assumed to be negligible because the concentration of each COC in the soil phase was about an order of magnitude lower in the soil than in the groundwater and because 4 times as much groundwater than soil was used in the tests.) In addition, for all compounds, the concentration of a specific

Table 6. Hydrocarbon Concentrations After Treatment with Fenton's Reagent

		Aqueous Phase			Off-Gases	
Analyte	Units	Control	1% Fenton's	3% Fenton's	1% Fenton's	3% Fenton's
TPH-g	mg/L	3.5	< 0.05	< 0.05	0.15	0.24
Acetone	µg/L	< 100	34	49	< 2	< 4
TBA	µg/L	< 50	< 10	< 10	< 5	< 10
MTBE	µg/L	< 2.5	< 0.5	< 0.5	< 0.1	< 0.1
Benzene	µg/L	180	< 0.5	< 0.5	1.2	2.3
Toluene	µg/L	7.3	< 0.5	< 0.5	0.38	3.7
Ethylbenzene	µg/L	< 2.5	< 0.5	< 0.5	< 0.1	1.2
m,p-Xylene	µg/L	400	< 0.5	< 0.5	0.16	3.6
o-Xylene	µg/L	320	< 0.5	< 0.5	< 0.1	1.4
Off-gas volume	L	n.a.	n.a.	n.a.	1.5	4.00

n.a. = not applicable

Table 7. Volatilization of Hydrocarbons by Fenton's Reagent

Analyte	% Volatilized Compared to Untreated GW*		% Volatilized Compared to Fenton's Control*	
	1% Fenton's	3% Fenton's	1% Fenton's	3% Fenton's
TPH-g	1.7	7.4	16.1	68.6
Acetone	n.a.	n.a.	n.a.	n.a.
TBA	n.a.	n.a.	n.a.	n.a.
MTBE	n.a.	n.a.	n.a.	n.a.
Benzene	0.3	1.5	2.5	12.8
Toluene	n.a.	n.a.	19.5	506.8
Ethylbenzene	< 0.1	4.2	n.a.	n.a.
m,p-Xylene	0.02	1.0	0.2	9.0
o-Xylene	< 0.1	1.0	< 0.1	4.4

* See Table 5 for concentrations in untreated groundwater. See Table 6 for concentrations in Fenton's control.

--Concentrations in soil assumed to be negligible when calculating initial mass. See text for discussion.

--n.a. = not applicable

compound in the off-gases was greater when the initial concentration of H_2O_2 was higher (ie, in the 3% Fenton's test). This is reasonable because the higher concentration of H_2O_2 generates off-gases more quickly (see Section 3.2.3), resulting in more effective sparging of volatile compounds. The degree of volatilization in this lab test is probably greater than what would be observed during in situ chemical oxidation using Fenton's reagent because the off-gases will be more confined (and stripping less efficient) in the sub-surface than in the laboratory reactors.

The exact degree of volatilization versus destruction could not be determined due to uncertainty in the initial amount of each hydrocarbon. The concentrations of TPH-g, benzene, and xylenes were an order of magnitude lower in the Fenton control test (Table 6) than in untreated water (Table 5). This might suggest dilution or volatilization had occurred, except that the concentration of ethylbenzene was about 2 orders of magnitude lower in the control than in untreated water, while toluene was similar or higher in the control than in untreated water. Biodegradation is also unlikely because it is unlikely that benzene, ethylbenzene and xylenes would biodedgrade to such a large extent, but toluene would not. PRIMA Environmental has looked for possible sources of contamination of the untreated water sample sent for analysis, but can find none. The only other explanation is that the 9 bottles received for testing did not contain identical concentrations of COCs, but this could not be confirmed.

Despite uncertainty in the initial concentration of hydrocarbons, it is still clear that Fenton's reagent effectively destroyed many of these compounds. Untreated groundwater and the control contained 180-4000 μg/L of BTEX compounds and 3.4-37 mg/L TPH-g, yet none of these were detected in the aqueous phase of treated samples. Most of the losses were apparently due to destruction because in most cases, < 20% of each compound was volatilized, regardless of whether the initial mass present was based on the concentrations in untreated groundwater or in the control.

3.2.2 Effect of Fenton's Reagent on Secondary Water Quality

The effect of Fenton's reagent on secondary water quality parameters is illustrated in Table 8. The concentration of Cr(VI) was < 10 μg/L in the Control and 10 μg/L in both of the Fenton's tests. In both Fenton's tests, the Cr(VI) concentrations are lower than the total Cr concentrations of 25 μg/L. This is possible due to the low pH in the Fenton's tests, which can solubilize trivalent chromium. (Note: the Cr(VI) results reported in Table 8 were measured using the Hach test kit. Analyses were also performed using EPA Method 7199, but the values were much higher than total Cr values and Cr(VI) measurements made with the Hach kit. This suggests either matrix interference or contamination of the samples. PRIMA Environmental has observed matrix interference in some cases in the past when using EPA Method 7199 to analyze low pH samples containing residual peroxide.)

Treatment with Fenton's reagent affected most other water quality parameters evaluated except for cadmium and zinc. The pH decreased to about pH 3, while iron increased from 20 μg/L in the control to 36,000-51,000 μg/L in the Fenton's tests and sulfate increased from 22 mg/L in the control to 1,000-1,100 mg/L in the Fenton's tests. These changes were expected due to the composition of Fenton's reagent. The concentration of nickel increased from 6.8 μg/L in the control to 240-270 μg/L in the Fenton's tests, presumably due to the low pH of the samples. Cadmium and zinc were not detected in any test above their respective detection limits of 5 μg/L and 100 μg/L.

Table 8. Effect of Fenton's Reagent on Inorganic Parameters

Analyte	Units	Control	1% Fenton's	3% Fenton's
Hexavalent chromium	μg/L	< 10*	10*	10*
Metals				
cadmium	μg/L	< 5	< 5	< 5
chromium	μg/L	< 5	25	25
iron	μg/L	20	51,000	36,000
lead	μg/L	< 5	< 5	< 5
nickel	μg/L	6.8	240	270
zinc	μg/L	< 100	< 100	< 100
pH		7.37	2.94	3.07
Sulfate	mg/L	22	1,100	1,000

* analyzed using Hach DR/2010 spectrophotometer and appropriate reagents

3.2.3 Rate of Off-gas Formation

The rate of off-gas formation is an indirect measure of the rate of decomposition of the H_2O_2 in Fenton's reagent. The rate of off-gas formation during treatment of site soil and groundwater with Fenton's reagent is shown in Figure 1. Fenton's reagent decomposes quickly (within hours) in the presence of site materials. These rates are probably the maximum rates because the mixtures were stirred during the test. The volume of gas produced in the 1% Fenton's tests (about 2L gas/L solution) was slightly lower than the expected volume of 3-4 L gas/L solution, while the volume produced by the 3% Fenton's test (11-12 L gas/L solution) was as expected.

3.3 Persulfate

The results of the persulfate testing are discussed in this section. The persulfate SOD ranged from 0.5 to 3.5 g $Na_2S_2O_8$/kg soil and was lower for activated persulfate than for unactivated persulfate. Both unactivated and activated persulfate destroyed TPH-g and xylenes, but the effect on benzene, toluene and ethylbenzene was inconclusive. Unactivated persulfate did not affect the concentration of the LUFT metals, while activated persulfate increased the concentrations of chromium, iron, nickel and lead. Both persulfate tests increased the concentrations of sulfate and decreased pH.

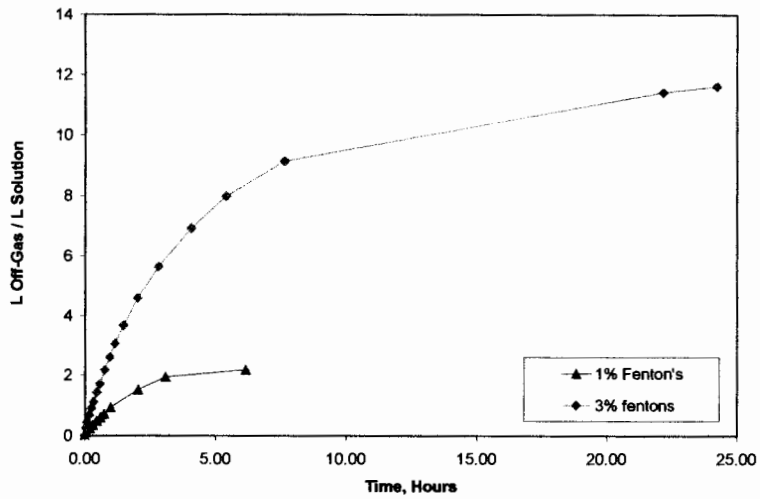

Figure 1. Rate of Off-gas Formation from Fenton's Tests.

3.3.1 Activated Persulfate Soil Oxidant Demand

The concentrations of $Na_2S_2O_8$ over time in the unactivated and activated persulfate SOD tests are shown in Figures 2 and 3. The SOD's, calculated using Eqn. 1, are summarized in Table 9. The SOD ranged from 1.9-3.5 g $Na_2S_2O_8$/kg soil for unactivated persulfate and 0.5-1.2 g/L $Na_2S_2O_8$ for persulfate activated with agricultural iron. The reason for the lower apparent SOD for activated persulfate compared to unactivated persulfate appears to be faster degradation of activated persulfate in the *absence* of soil. This suggests that during field application of activated persulfate, persulfate and activator should be stored separately and combined immediately before injection in order to prevent premature decomposition of persulfate.

3.3.2 Hydrocarbon Removal by Sodium Persulfate

The concentration of hydrocarbons in the aqueous phase over time is presented in Table 10. Only detected VOCs are reported in the table. Detection limits were elevated due to the high concentrations of some hydrocarbons. Complete analytical reports are provided in the Appendix.

Unactivated persulfate and persulfate activated with chelated iron dramatically decreased the concentrations of xylenes and TPH-g compared to the controls. Activated persulfate completely removed m,p-xylenes and o-xylene within 7 days, while unactivated persulfate completely removed these compounds by 28 days. TPH-g concentrations were lower in the persulfate samples than in the controls, though complete removal was not achieved. PRIMA Environmental is confidant that the persulfate destroyed at least

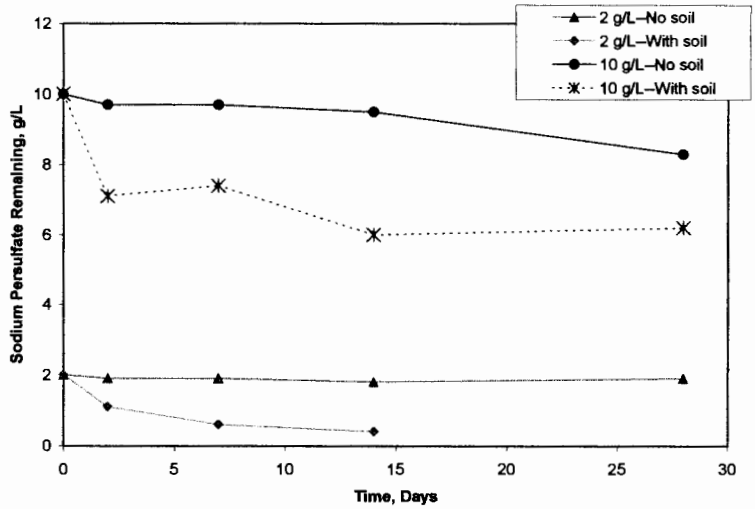

Figure 2. Unactivated Persulfate SOD Test. $Na_2S_2O_8$ Concentration over Time.

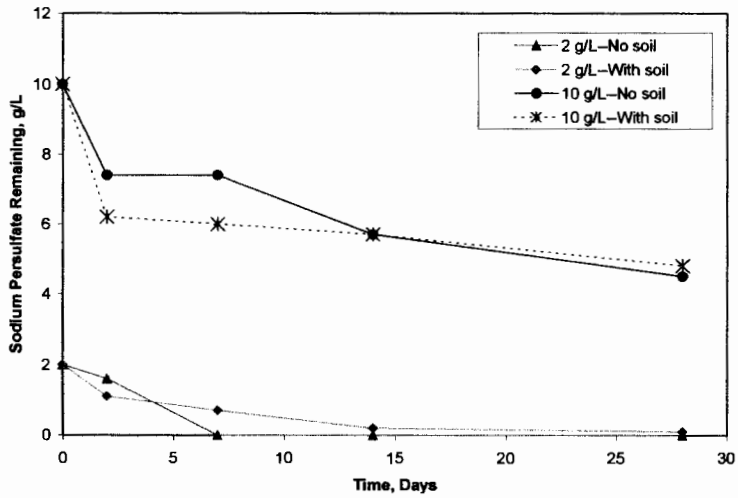

Figure 3. Activated Persulfate SOD Test. $Na_2S_2O_8$ Concentration over Time.

Table 9. Summary of Persulfate SOD Results.

Initial $Na_2S_2O_8$, g/L	Soil Oxidant Demand, g $Na_2S_2O_8$/kg soil	
	Unactivated Persulfate	Activated Persulfate*
2	1.9	0.5
10	2.1-3.5	1.2

*Activated with agricultural iron.

Table 10. Concentration of Hydrocarbons After Treatment with Persulfate

Time (Days)	Concentration Remaining		
	Control	Unactivated Persulfate	Activated Persulfate
TPH-g, mg/L			
7	15	8.7	0.57
14	22	2.6	2
28	3.4	0.16	1
Acetone, µg/L			
7	< 400	< 200	< 20
14	< 800	< 200	< 200
28	170	67	< 100
MTBE, µg/L			
7	< 10	< 5	< 0.5
14	< 20	6.9	< 20
28	< 2.5	< 0.5	< 2.5
TBA, µg/L			
7	< 200	< 100	< 10
14	< 400	< 100	< 100
28	< 50	< 10	< 50
Benzene, µg/L			
7	1100	190	76
14	480	910	960
28	13	14	390
Toluene, µg/L			
7	870	7.3	< 0.5
14	1400	99	230
28	< 2.5	< 0.5	< 2.5
Ethylbenzene, µg/L			
7	480	< 5	< 0.5
14	350	79	5.7
28	< 2.5	< 0.5	< 2.5
m,p-Xylenes, µg/L			
7	1700	1100	< 0.5
14	4000	80	6.2
28	290	< 0.5	< 2.5
o-Xylene, µg/L			
7	1000	690	< 0.5
14	2000	180	15
28	420	< 0.5	< 2.5
1,2-Dichloroethane, µg/L			
0			
7	< 20	< 10	3.1
14	< 40	< 10	< 10
28	< 5	< 1.0	< 5

some of the xylenes and TPH-g becasue the concentrations i the treated samples (< 0.5 – 1,100 µg/L m,p-xylenes, < 0.5-690 µg/L o-xylene, and 0.16-8.7 mg/L TPH-g) were typically well below the range of concentrations seen in the controls or untreated groundwater (290–4,000 µg/L m,p-xylenes; 420-2,000 µg/L o-xylene, and 3.4-37 mg/L TPH-g).

Both persulfate treatments appear to have had a significant effect on toluene and ethylbenzene, but due to the uncertainty of the initial concentration of each hydrocarbon (see Section 3.1, 3.2.1 and discussion below), this cannot be confirmed. For example, the toluene concentrations at Days 7 and 14 ranged from < 0.5 μg/L to 230 μg/L, which was much lower than the 870-1,400 μg/L seen in the controls. However, untreated groundwater contained < 15 μg/L toluene (Table 5) and the Fenton's control contained 7.3 μg/L, so it is unclear whether the concentrations in the persulfate treatments reflect degradation or variation in the initial concentration. Similar results were observed for ethylbenzene.

The effect of persulfate treatment on benzene is unclear. For both persulfate treatments, the benzene concentration was low on Day 7 (76-190 μg/L), high on Day 14 (900 μg/L) then lower by Day 28 (14-390 μg/L). In contrast, the concentration in the controls steadily declined. This may be due to variation in the initial concentration in each reactor bottle, or possibly benzene is a reaction intermediate (for example, of xylenes).

The effect of persulfate treatment on benzene, toluene and ethylbenzene is inconclusive due to the uncertainty of the starting concentration of each hydrocarbon. As discussed in Section 3.2.2, this uncertainty may be due to concentration variations in the multiple sample containers received for testing. This hypothesis is supported by the persulfate test results. For example, the concentration of toluene in the persulfate controls was 870 μg/L, 1,400 μg/L and < 2.5 μg/L for Days 7, 14, and 28, respectively. At first glance, this trend might suggest aerobic biodegradation stimulated by the presence of air in the headspace of the reactors. However, the concentration of toluene was < 15 μg/L in untreated groundwater and 7.3 μg/L in the Fenton's control, implying instead that there was significant variation in toluene concentration among the sample bottles received for testing. Similar variations in ethylbenzene concentration were also observed. In the Persulfate controls, the ethylbenzene concentration decreased slowly over the 28 day test, implying biodegradation. However, biodegradation is probably not the only factor because the ethylbenzene concentration was in the Fenton's control test, which ran for 24 hours, was < 2.5 μg/L. If biodegradation was solely responsible for the ethylbenzene results in Table 10, then ethylbenzene should have been completely removed by Day 7 in the Persulfate control.

3.3.3 Effect of Persulfate on Secondary Water Quality

The effect of persulfate treatment on secondary water quality parameters is shown in Table 11. The pH decreased by about 0.5 pH units in the persulfate tests compared to the controls. A decrease in pH was expected due to decomposition of persulfate. The concentration of sulfate increased, though the amount was lower than that predicted based on the amount of persulfate consumed. Probably, persulfate reacted with other components of the groundwater (such as barium or calcium) to form insoluble salts.

Table 11. Effect of Persulfate on Secondary Water Quality.

Time (Days)	Control	Unactivated Persulfate	Activated Persulfate
Cadmium, µg/L			
28	< 5	< 5	< 5
Chromium (Total), µg/L			
28	32	< 10	48.0
Iron, µg/L			
28	32	< 20	82,000
Lead, µg/L			
28	< 10	< 10	11
Nickel, µg/L			
28	< 10	< 10	86.0
Zinc, µg/L			
28	< 20	< 20	32
pH			
0	--	--	--
7	6.93	6.84	6.79
14	7.03	6.59	6.53
28	7.06	6.7	6.5
Sodium Persulfate, g/L			
0	0	1.5	1.5
7	0	1.3	1.3
14	0	1.1	1.4
28	0	1.3	1.0
Sulfate (measured), mg/L			
0	22	22	22
7	26	90	106
14	35	115	125
28	36	125	165
Sulfate (predicted*), mg/L			
0	22	22	22
7	26	188	188
14	35	353	105
28	36	188	436

* predicted based on the amount of persulfate consumed

Dissolved iron, lead and nickel concentrations were higher in the activated persulfate test than in the control. The increase in iron was due to the addition of the activating agent, while the increases in lead and nickel were probably due to chelation of these metals by the chelating agent in the activator. The concentration of nickel increased from < 10 µg/L in the control to 86 µg/L in the activated persulfate test. The concentration of lead increased from < 10 µg/L to 11 µg/L. Cadmium and zinc were not detected in the activated persulfate test. None of the metals were detected in the unactivated persulfate test.

3.4 Buffering Curves

The buffering curves for untreated soil are presented in Figure 4. Addition of up to 100 mmol H^+/kg soil initially decreased the pH to about 1.5, which rebounded to pH ~2.7 within 2 days. Addition of 10 mmol H^+/kg decreased the pH to about 3.3, which rebounded to pH 4.8 within 2 days. In the sub-surface, the pH should eventually return to pre-treatment levels as upgradient groundwater enters the treatment zone.

The buffering curve information can be used in conjunction with soil porosity and density to estimate the amount of acidified solution or the amount of persulfate that can be added without causing significant long-term change in pH. ***For example,*** if the buffering capacity of the soil is 10 mmol/kg, then up to1 L of pH 2 (10 mmol H^+/L) solution or 1 L of 1.2 g/L $Na_2S_2O_8$ (assuming all of the persulfate decomposes to acid) can be added to each kilogram of soil. If the soil porosity is 30% and the density is 1.0 g/cm^3 (pore volume = 300 mL), this is equal to 3.3 pore volumes of solution. Note that these calculations do not take into account the effect of influx of groundwater on the soils after treatment. As untreated groundwater upgradient of the treatment zone flows into the treated area, soil pH will tend to return to pretreatment levels.

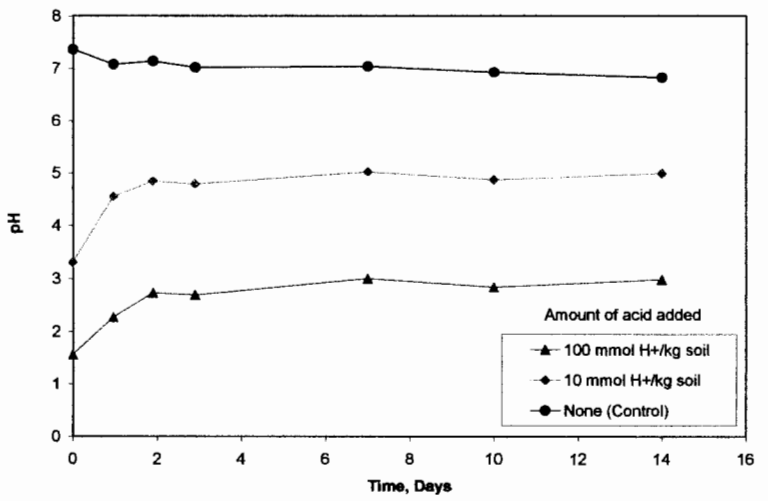

Figure 4. Soil Buffering Curves

4.0 ENGINEERING IMPLICATIONS

Bench testing demonstrated that both Fenton's reagent and persulfate could remove some hydrocarbons from site materials. Some points to consider when evaluating these technologies for full-scale implementation are provided below.

Fenton's Reagent

Hydrogen peroxide concentration. The concentration of hydrogen peroxide used should be relatively low. Bench tests indicated that 1% H_2O_2 and 3% H_2O_2 removed hydrocarbons to a similar degree, but greater volatilization seems to have occurred when 3% H_2O_2 was used.

Hydrocarbon Volatilization. The concentrations of hydrocarbons in the off-gases seen in this study are probably higher than what would be seen in the field. This is because gases in the sub-surface are confined and therefore less able to strip hydrocarbons. Lower concentrations of H_2O_2 would also reduce the degree of volatilization because the amount of off-gas formed is less.

Persulfate

Rate of Reaction. Rate constants could not be calculated for the removal of hydrocarbons by persulfate. However, it is clear that the rate of reaction is slow, especially compared to the rate of reaction by Fenton's reagent. However, this could be an advantage because persulfate will persist in the sub-surface, potentially resulting in a greater range of influence of a well and also enabling persulfate to react with compounds that may slowly desorb from soil or diffuse out of micropores in the soil.

5.0 CONCLUSIONS

Bench-scale treatability testing clearly demonstrated that Fenton's reagent and persulfate could destroy TPH-g and xylenes present in site soil and groundwater. Fenton's reagent destroyed TPH-g and BTEX compounds. For most compounds, less than about 20% was volatilized, though the exact degree of volatilization versus destruction could not be determined due to uncertainty in the initial hydrocarbon concentrations. Both unactivated and activated persulfate destroyed TPH-g and xylenes, but the effect on benzene, toluene and ethylbenzene was inconclusive due to uncertainty in the initial concentrations. The uncertainty in initial conditions is most likely due to concentration variations among the groundwater sample bottles received for testing since the variability in analyte concentrations between untreated groundwater and control tests was inconsistent with strict biodegradation or volatilization (see Sections 3.1, 3.2.1 and 3.3.2 for details).

Fenton's affected several inorganic water quality parameters. Small amounts of Cr(VI)—on the order of 10 μg/L—were generated. This is much lower than typically observed with other oxidants such as permanganate. Dissolved iron and sulfate increased while pH decreased. These changes were expected due to the nature of Fenton's reagent. The concentration of nickel increased, presumably due to the low pH of Fenton's reagent. Cadmium and zinc were not affected.

Complete decomposition of H_2O_2 in the presence of soil occurred within about 24 hours during Fenton's testing regardless of the initial concentration of H_2O_2. About 5 times more gas was generated when the initial H_2O_2 concentration was 1% than when it was 3%.

Treatment with activated persulfate affected several water quality parameters, while treatment with unactivated persulfate affected only a few. Both treatments decreased pH by about 0.5 pH units and increased the concentration of sulfate to about 1,000 mg/L. These changes were due to decomposition of persulfate. Dissolved iron increased in the activated persulfate test due to the activator. Nickel and lead also increased, while cadmium and zinc were not detected. None of the metals were detected in the untreated persulfate test.

The persulfate SOD ranged from 0.5 to 3.5 g $Na_2S_2O_8$/kg soil and was generally lower for activated persulfate than for unactivated persulfate.

The buffering curves for the soil indicated that < 10 mmoles of acid (H^+) can be added to soil without causing long-term adverse effects.

APPENDIX
Analytical Reports
(Alpha Analytical, Excelchem)

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA AMENDED

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES05011422

Report Due By : 5:00 PM On : 28-Jan-05

Client:
Prima Environmental
10265 Old Placerville Rd.
Suite 15
Sacramento, CA 95827-3042

Cindy Schreier
TEL : (916) 363-8798
FAX : (916) 363-8829
EMail iron@primaenvironmental.com

EDD Required : **Yes** PDF Required : **No**

Sampled by : Beth

Report Attention : Cindy Schreier
CC Report :

Job : ENSR 762248
PO :
Client's COC # : 06570

Cooler Temp : **4 °C** **04-Apr-05**

QC Level : 2 = Final Rpt ,MBLK

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles ORG	SUB	TAT	PWS #	METALS_AQ	METALS_SO	TPH/P_A	TPH/P_S	TPH/P_W	VOC_A	VOC_S	VOC_W	Sample Remarks
								Requested Tests								
PES05011422-01A	ENSR 762248-GW	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-02A	ENSR 762248-Fentons Control	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-03A	ENSR 762248-1% Fentons	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-04A	ENSR 762248-3% Fentons	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-05A	ENSR 762248-Unt Soil	SO	01/13/05 15:00	1	0	10			LUFT 5		BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C		
PES05011422-06A	1% Fenton's Off-Gas	AR	01/13/05 09:30	1	0	10				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C			Tedlar
PES05011422-07A	3% Fenton's Off-Gas	AR	01/13/05 09:30	1	0	10				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C			Tedlar

Comments: No security seals intact, ice frozen. Ca samples. Tedlars supplied by Prima. Amended 04/04/05 per Roger to add MTBE to all samples. LE :

	Signature	Print Name	Company	Date/Time
Received by:	Patricia Edrosa	Patricia Edrosa	Alpha Analytical, Inc.	4/4/05 4:34

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic Other

Billing Information:

Name _____
Address _____
City, State, Zip _____
Phone Number _____ Fax _____

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State?
AZ ___ CA X NV ___ WA ___
ID ___ OR ___ OTHER _____

Page # 1 of 1

06570

Client Name: PRIMA ENV.
Address: 10265 Old Placerville Rd Suite 15
City, State, Zip: Sacramento CA 95827
P.O. #:
Job #: ENSR 762248
EMail Address:
Phone #: 916-363-8788
Fax #: 363-8229
Sampled by: Both
Report Attention:

Required QC Level? I (II) III IV
EDD / EDF? YES ___ NO ___
Global ID # _____

Time Sampled	Date Sampled	Matrix* See Key Below	Office Use Only / Lab ID Number	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	TPH-g	BTEX	TBA	Acetone	Metals* (Lab Filt)	[illegible]	[illegible] 1/13/05	REMARKS
0750	1-13	AQ	05011422-01	ENSR 762248-GW			2 VOA 1P	X	X	X	X	X	X	X	
↓	↓	↓	-02	ENSR 762248-Fentons Control			↓	X	X	X	X	X	X	X	
			-03	ENSR 762248-1% Fentons				X	X	X	X	X	X	X	
			-04	ENSR 762248-3% Fentons				X	X	X	X	X	X	X	
1500	1-13	SO	-05	ENSR 762248-Unt Soil			1-J	X	X	X	X	X			
930	1-13	OT	-06	1% Fenton's Off Gas			1-T	X	X	X	X				Tedlars Supplied by PRIMA
930	1-13	OT	-07	3% Fenton's Off Gas			1-T	X	X	X	X				

ADDITIONAL INSTRUCTIONS:

*Cd, Cr, Pb, Ni, Zn

Signature	Print Name	Company	Date	Time
Relinquished by: [signature]	Cindy Schreier	PRIMA	1/13/05	~1800
Received by: [signature]	G. Navarrete	FedEx 8457 9016 9044	1/13/05	~1800
Relinquished by:				
Received by:		Alpha	1-14-05	9:35
Relinquished by:				
Received by:				

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: Samples discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The report for the analysis of the above samples is applicable only to the samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Total Petroleum Hydrocarbons - Purgeable (TPH-P) EPA Method SW8015B/DHS LUFT Manual
Volatile Organic Compounds (VOCs) EPA Method SW8260B

	Parameter	Concentration		Reporting Limit	Date Sampled	Date Analyzed
Client ID :	TPH Purgeable	37		3.0 mg/L	01/13/05	01/17/05
ENSR 762248-GW	Acetone	ND	V	600 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	V	300 µg/L	01/13/05	01/17/05
PES05011422-01A	Methyl tert-butyl ether (MTBE)	ND	V	15 µg/L	01/13/05	01/17/05
	Benzene	1,800		15 µg/L	01/13/05	01/17/05
	Toluene	ND	V	15 µg/L	01/13/05	01/17/05
	Ethylbenzene	330		15 µg/L	01/13/05	01/17/05
	m,p-Xylene	4,000		15 µg/L	01/13/05	01/17/05
	o-Xylene	1,600		15 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	3.5		0.50 mg/L	01/13/05	01/17/05
ENSR 762248-Fentons Control	Acetone	ND	V	100 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	V	50 µg/L	01/13/05	01/17/05
PES05011422-02A	Methyl tert-butyl ether (MTBE)	ND	V	2.5 µg/L	01/13/05	01/17/05
	Benzene	180		2.5 µg/L	01/13/05	01/17/05
	Toluene	7.3		2.5 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND	V	2.5 µg/L	01/13/05	01/17/05
	m,p-Xylene	400		2.5 µg/L	01/13/05	01/17/05
	o-Xylene	320		2.5 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	ND		0.050 mg/L	01/13/05	01/17/05
ENSR 762248-1% Fentons	Acetone	34		10 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		10 µg/L	01/13/05	01/17/05
PES05011422-03A	Methyl tert-butyl ether (MTBE)	ND		0.50 µg/L	01/13/05	01/17/05
	Benzene	ND		0.50 µg/L	01/13/05	01/17/05
	Toluene	ND		0.50 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND		0.50 µg/L	01/13/05	01/17/05
	m,p-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
	o-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	ND		0.050 mg/L	01/13/05	01/17/05
ENSR 762248-3% Fentons	Acetone	49		10 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		10 µg/L	01/13/05	01/17/05
PES05011422-04A	Methyl tert-butyl ether (MTBE)	ND		0.50 µg/L	01/13/05	01/17/05
	Benzene	ND		0.50 µg/L	01/13/05	01/17/05
	Toluene	ND		0.50 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND		0.50 µg/L	01/13/05	01/17/05
	m,p-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
	o-Xylene	ND		0.50 µg/L	01/13/05	01/17/05

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

nt ID :	TPH Purgeable	16		1.0 mg/Kg	01/13/05	01/14/05
ENSR 762248-Unt Soil	Acetone	ND		200 µg/Kg	01/13/05	01/14/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		500 µg/Kg	01/13/05	01/14/05
PES05011422-05A	Methyl tert-butyl ether (MTBE)	ND		5.0 µg/Kg	01/13/05	01/14/05
	Benzene	ND		5.0 µg/Kg	01/13/05	01/14/05
	Toluene	12		5.0 µg/Kg	01/13/05	01/14/05
	Ethylbenzene	39		5.0 µg/Kg	01/13/05	01/14/05
	m,p-Xylene	110		5.0 µg/Kg	01/13/05	01/14/05
	o-Xylene	110		5.0 µg/Kg	01/13/05	01/14/05
Client ID :	TPH Purgeable	150	*	10 mg/m³	01/13/05	01/17/05
1% Fenton's Off-Gas	Acetone	ND	*	2.0 mg/m³	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	*	5.0 mg/m³	01/13/05	01/17/05
PES05011422-06A	Methyl tert-butyl ether (MTBE)	ND	*	0.10 mg/m³	01/13/05	01/17/05
	Benzene	1.2	*	0.10 mg/m³	01/13/05	01/17/05
	Toluene	0.38	*	0.10 mg/m³	01/13/05	01/17/05
	Ethylbenzene	ND	*	0.10 mg/m³	01/13/05	01/17/05
	m,p-Xylene	0.16	*	0.10 mg/m³	01/13/05	01/17/05
	o-Xylene	ND	*	0.10 mg/m³	01/13/05	01/17/05
Client ID :	TPH Purgeable	240	*	20 mg/m³	01/13/05	01/17/05
3% Fenton's Off-Gas	Acetone	ND	*	4.0 mg/m³	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	*	10 mg/m³	01/13/05	01/17/05
PES05011422-07A	Methyl tert-butyl ether (MTBE)	ND	*	0.20 mg/m³	01/13/05	01/17/05
	Benzene	2.3	*	0.20 mg/m³	01/13/05	01/17/05
	Toluene	3.7	*	0.20 mg/m³	01/13/05	01/17/05
	Ethylbenzene	1.2	*	0.20 mg/m³	01/13/05	01/17/05
	m,p-Xylene	3.6	*	0.20 mg/m³	01/13/05	01/17/05
	o-Xylene	1.4	*	0.20 mg/m³	01/13/05	01/17/05

*Note: Concentrations of air in Tedlar Bags are at 23 degrees Celsius and 25.38 inches of mercury.
Note: Sample 05A extracted on 1/14/05.
This replaces the report signed 1/27/05, due to a change in the analyte list, per client request.
V = Reporting Limits were increased due to high concentrations of target analytes.
ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

4/7/05
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Metals by ICPMS
EPA Method SW6020

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**ENSR 762248-GW**					
Lab ID :	PES05011422-01A	Chromium (Cr)	ND	0.0050 mg/L	01/13/05	01/19/05
		Nickel (Ni)	0.0065	0.0050 mg/L	01/13/05	01/19/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/19/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/19/05
		Lead (Pb)	0.0054	0.0050 mg/L	01/13/05	01/19/05
Client ID :	**ENSR 762248-Fentons Control**					
Lab ID :	PES05011422-02A	Chromium (Cr)	ND	0.0050 mg/L	01/13/05	01/20/05
		Nickel (Ni)	0.0068	0.0050 mg/L	01/13/05	01/20/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/20/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/20/05
		Lead (Pb)	ND	0.0050 mg/L	01/13/05	01/20/05
Client ID :	**ENSR 762248-1% Fentons**					
Lab ID :	PES05011422-03A	Chromium (Cr)	0.025	0.0050 mg/L	01/13/05	01/20/05
		Nickel (Ni)	0.24	0.0050 mg/L	01/13/05	01/20/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/20/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/20/05
		Lead (Pb)	ND	0.0050 mg/L	01/13/05	01/20/05
Client ID :	**ENSR 762248-3% Fentons**					
Lab ID :	PES05011422-04A	Chromium (Cr)	0.025	0.0050 mg/L	01/13/05	01/20/05
		Nickel (Ni)	0.27	0.0050 mg/L	01/13/05	01/20/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/20/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/20/05
		Lead (Pb)	ND	0.0050 mg/L	01/13/05	01/20/05

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

1/27/05
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Metals by ICPMS
EPA Method SW6020 / SW6020A

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**ENSR 762248-Unt Soil**					
Lab ID :	PES05011422-05A	Chromium (Cr)	61	1.0 mg/Kg	01/13/05	01/19/05
		Nickel (Ni)	60	1.0 mg/Kg	01/13/05	01/19/05
		Zinc (Zn)	55	20 mg/Kg	01/13/05	01/19/05
		Cadmium (Cd)	ND	1.0 mg/Kg	01/13/05	01/19/05
		Lead (Pb)	4.3	1.0 mg/Kg	01/13/05	01/19/05

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

1/27/05
Report Date

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA AMENDED

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES05011422

Report Due By : 5:00 PM On : 28-Jan-05

Client:
Prima Environmental
10265 Old Placerville Rd.
Suite 15
Sacramento, CA 95827-3042

Cindy Schreier
TEL : (916) 363-8798
FAX : (916) 363-8829
EMail iron@primaenvironmental.com

EDD Required : Yes PDF Required : No

Sampled by : Beth

Report Attention : Cindy Schreier
CC Report :

Job : ENSR 762248
PO :
Client's COC # : 06570

Cooler Temp : 4 °C **04-Apr-05**

QC Level : 2 = Final Rpt ,MBLK

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles ORG	SUB	TAT	PWS #	METALS_A Q	METALS_S O	TPH/P_A	TPH/P_S	TPH/P_W	VOC_A	VOC_S	VOC_W	Sample Remarks
								Requested Tests								
PES05011422-01A	ENSR 762248-GW	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-02A	ENSR 762248-Fentons Control	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-03A	ENSR 762248-1% Fentons	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-04A	ENSR 762248-3% Fentons	AQ	01/13/05 09:30	3	0	10		LUFT 5				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C	
PES05011422-05A	ENSR 762248-Unt Soil	SO	01/13/05 15:00	1	0	10			LUFT 5		BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C		
PES05011422-06A	1% Fenton's Off-Gas	AR	01/13/05 09:30	1	0	10				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C			Tedlar
PES05011422-07A	3% Fenton's Off-Gas	AR	01/13/05 09:30	1	0	10				BTXE/GAS/TBA/Acetone/MTBE_C			BTXE/GAS/TBA/Acetone/MTBE_C			Tedlar

Comments: No security seals intact, ice frozen. Ca samples. Tedlars supplied by Prima. Amended 04/04/05 per Roger to add MTBE to all samples. LE :

	Signature	Print Name	Company	Date/Time
Received by:	Patricia Edrosa	Patricia Edrosa	Alpha Analytical, Inc.	4/4/05 4:24

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Billing Information:

Name _____
Address _____
City, State, Zip _____
Phone Number _____ Fax _____

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State?
AZ ___ CA X NV ___ WA ___
ID ___ OR ___ OTHER _____

06570

Client Name: PRIMA ENV.
Address: 10265 Old Placerville Rd Suite 15
City, State, Zip: Sacramento, CA 95827
P.O. #:
Job #: ENSR 762248
EMail Address:
Phone #: 916-363-8798
Fax #: 363-8229
Sampled by: Both
Report Attention:

Required QC Level? I (II) III IV
EDD / EDF? YES ___ NO ___
Global ID # _____

Analyses Required

Time Sampled	Date Sampled	Matrix* See Key Below	Office Use Only Lab ID Number	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	TPH-g	BTEX	TBA	Acetone	Metals (Left)	CGS	DEF 1/13/05	REMARKS
0930	1-13-05	AQ	05011422-01	ENSR 762248-GW			2VOA, 2P	X	X	X	X	X	X	X	
↓	↓	↓	-02	ENSR 762248-Fentons Control			↓	X	X	X	X	X	X	X	
			-03	ENSR 762248-1% Fentons				X	X	X	X	X	X	X	
			-04	ENSR 762248-3% Fentons				X	X	X	X	X	X	X	
1500	1-13	SO	-05	ENSR 762248-Unit Soil			1-J	X	X	X	X	X			
930	1-13	OT	-06	1% Fenton's Off-Gas			1-T	X	X	X	X				Tedlars supplied by PRIMA
930	1-13	OT	-07	3% Fenton's Off-Gas			1-T	X	X	X	X				

ADDITIONAL INSTRUCTIONS:

*Cd, Cr Pb, Ni Zn

	Signature	Print Name	Company	Date	Time
Relinquished by	C. Schreier	Cindy Schreier	PRIMA	1/13/05	~1800
Received by	Lidia G. Navarrete	G. Navarrete	FedEx 8457 9016 9044	1/13/05	~1800
Relinquished by					
Received by			Alpha	1-14-05	9:35
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: Samples discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The report of the analysis of the above samples is applicable only to those samples received by the laboratory with this coc. The liability of the laboratory is limited to the amount paid for the report.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Total Petroleum Hydrocarbons - Purgeable (TPH-P) EPA Method SW8015B/DHS LUFT Manual
Volatile Organic Compounds (VOCs) EPA Method SW8260B

	Parameter	Concentration		Reporting Limit	Date Sampled	Date Analyzed
Client ID :	TPH Purgeable	37		3.0 mg/L	01/13/05	01/17/05
ENSR 762248-GW	Acetone	ND	V	600 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	V	300 µg/L	01/13/05	01/17/05
PES05011422-01A	Methyl tert-butyl ether (MTBE)	ND	V	15 µg/L	01/13/05	01/17/05
	Benzene	1,800		15 µg/L	01/13/05	01/17/05
	Toluene	ND	V	15 µg/L	01/13/05	01/17/05
	Ethylbenzene	330		15 µg/L	01/13/05	01/17/05
	m,p-Xylene	4,000		15 µg/L	01/13/05	01/17/05
	o-Xylene	1,600		15 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	3.5		0.50 mg/L	01/13/05	01/17/05
ENSR 762248-Fentons Control	Acetone	ND	V	100 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	V	50 µg/L	01/13/05	01/17/05
PES05011422-02A	Methyl tert-butyl ether (MTBE)	ND	V	2.5 µg/L	01/13/05	01/17/05
	Benzene	180		2.5 µg/L	01/13/05	01/17/05
	Toluene	7.3		2.5 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND	V	2.5 µg/L	01/13/05	01/17/05
	m,p-Xylene	400		2.5 µg/L	01/13/05	01/17/05
	o-Xylene	320		2.5 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	ND		0.050 mg/L	01/13/05	01/17/05
ENSR 762248-1% Fentons	Acetone	34		10 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		10 µg/L	01/13/05	01/17/05
PES05011422-03A	Methyl tert-butyl ether (MTBE)	ND		0.50 µg/L	01/13/05	01/17/05
	Benzene	ND		0.50 µg/L	01/13/05	01/17/05
	Toluene	ND		0.50 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND		0.50 µg/L	01/13/05	01/17/05
	m,p-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
	o-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	ND		0.050 mg/L	01/13/05	01/17/05
ENSR 762248-3% Fentons	Acetone	49		10 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		10 µg/L	01/13/05	01/17/05
PES05011422-04A	Methyl tert-butyl ether (MTBE)	ND		0.50 µg/L	01/13/05	01/17/05
	Benzene	ND		0.50 µg/L	01/13/05	01/17/05
	Toluene	ND		0.50 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND		0.50 µg/L	01/13/05	01/17/05
	m,p-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
	o-Xylene	ND		0.50 µg/L	01/13/05	01/17/05

Alpha Analytical, Inc.

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Client ID :	TPH Purgeable	16		1.0 mg/Kg	01/13/05	01/14/05
ENSR 762248-Unt Soil	Acetone	ND		200 µg/Kg	01/13/05	01/14/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		500 µg/Kg	01/13/05	01/14/05
PES05011422-05A	Methyl tert-butyl ether (MTBE)	ND		5.0 µg/Kg	01/13/05	01/14/05
	Benzene	ND		5.0 µg/Kg	01/13/05	01/14/05
	Toluene	12		5.0 µg/Kg	01/13/05	01/14/05
	Ethylbenzene	39		5.0 µg/Kg	01/13/05	01/14/05
	m,p-Xylene	110		5.0 µg/Kg	01/13/05	01/14/05
	o-Xylene	110		5.0 µg/Kg	01/13/05	01/14/05
Client ID :	TPH Purgeable	150	*	10 mg/m³	01/13/05	01/17/05
1% Fenton's Off-Gas	Acetone	ND	*	2.0 mg/m³	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	*	5.0 mg/m³	01/13/05	01/17/05
PES05011422-06A	Methyl tert-butyl ether (MTBE)	ND	*	0.10 mg/m³	01/13/05	01/17/05
	Benzene	1.2	*	0.10 mg/m³	01/13/05	01/17/05
	Toluene	0.38	*	0.10 mg/m³	01/13/05	01/17/05
	Ethylbenzene	ND	*	0.10 mg/m³	01/13/05	01/17/05
	m,p-Xylene	0.16	*	0.10 mg/m³	01/13/05	01/17/05
	o-Xylene	ND	*	0.10 mg/m³	01/13/05	01/17/05
Client ID :	TPH Purgeable	240	*	20 mg/m³	01/13/05	01/17/05
3% Fenton's Off-Gas	Acetone	ND	*	4.0 mg/m³	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	*	10 mg/m³	01/13/05	01/17/05
PES05011422-07A	Methyl tert-butyl ether (MTBE)	ND	*	0.20 mg/m³	01/13/05	01/17/05
	Benzene	2.3	*	0.20 mg/m³	01/13/05	01/17/05
	Toluene	3.7	*	0.20 mg/m³	01/13/05	01/17/05
	Ethylbenzene	1.2	*	0.20 mg/m³	01/13/05	01/17/05
	m,p-Xylene	3.6	*	0.20 mg/m³	01/13/05	01/17/05
	o-Xylene	1.4	*	0.20 mg/m³	01/13/05	01/17/05

*Note: Concentrations of air in Tedlar Bags are at 23 degrees Celsius and 25.38 inches of mercury.

Note: Sample 05A extracted on 1/14/05.

This replaces the report signed 1/27/05, due to a change in the analyte list, per client request.

V = Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer

Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

4/7/05

Report Date

Alpha Analytical, Inc
255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

VOC pH Report

Work Order PES05011422 **Project:** ENSR 762248

Alpha's Sample ID	Client's Sample ID	Matrix	pH
05011422-01A	ENSR 762248-GW	Aqueous	2
05011422-02A	ENSR 762248-Fentons Control	Aqueous	2
05011422-03A	ENSR 762248-1% Fentons	Aqueous	2
05011422-04A	ENSR 762248-3% Fentons	Aqueous	2

1/27/05
Report Date

Alpha Analytical, Inc
255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Metals by ICPMS
EPA Method SW6020

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**ENSR 762248-GW**					
Lab ID :	PES05011422-01A	Chromium (Cr)	ND	0.0050 mg/L	01/13/05	01/19/05
		Nickel (Ni)	0.0065	0.0050 mg/L	01/13/05	01/19/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/19/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/19/05
		Lead (Pb)	0.0054	0.0050 mg/L	01/13/05	01/19/05
Client ID :	**ENSR 762248-Fentons Control**					
Lab ID :	PES05011422-02A	Chromium (Cr)	ND	0.0050 mg/L	01/13/05	01/20/05
		Nickel (Ni)	0.0068	0.0050 mg/L	01/13/05	01/20/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/20/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/20/05
		Lead (Pb)	ND	0.0050 mg/L	01/13/05	01/20/05
Client ID :	**ENSR 762248-1% Fentons**					
Lab ID :	PES05011422-03A	Chromium (Cr)	0.025	0.0050 mg/L	01/13/05	01/20/05
		Nickel (Ni)	0.24	0.0050 mg/L	01/13/05	01/20/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/20/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/20/05
		Lead (Pb)	ND	0.0050 mg/L	01/13/05	01/20/05
Client ID :	**ENSR 762248-3% Fentons**					
Lab ID :	PES05011422-04A	Chromium (Cr)	0.025	0.0050 mg/L	01/13/05	01/20/05
		Nickel (Ni)	0.27	0.0050 mg/L	01/13/05	01/20/05
		Zinc (Zn)	ND	0.10 mg/L	01/13/05	01/20/05
		Cadmium (Cd)	ND	0.0050 mg/L	01/13/05	01/20/05
		Lead (Pb)	ND	0.0050 mg/L	01/13/05	01/20/05

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

1/27/05
Report Date

Alpha Analytical, Inc

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Metals by ICPMS
EPA Method SW6020 / SW6020A

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**ENSR 762248-Unt Soil**					
Lab ID :	PES05011422-05A	Chromium (Cr)	61	1.0 mg/Kg	01/13/05	01/19/05
		Nickel (Ni)	60	1.0 mg/Kg	01/13/05	01/19/05
		Zinc (Zn)	55	20 mg/Kg	01/13/05	01/19/05
		Cadmium (Cd)	ND	1.0 mg/Kg	01/13/05	01/19/05
		Lead (Pb)	4.3	1.0 mg/Kg	01/13/05	01/19/05

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

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ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 01/14/05

Job#: ENSR 762248

Total Petroleum Hydrocarbons - Purgeable (TPH-P) EPA Method SW8015B/DHS LUFT Manual
Volatile Organic Compounds (VOCs) EPA Method SW8260B

	Parameter	Concentration		Reporting Limit	Date Sampled	Date Analyzed
Client ID :	TPH Purgeable	37		3.0 mg/L	01/13/05	01/17/05
ENSR 762248-GW	Acetone	ND	V	600 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	V	300 µg/L	01/13/05	01/17/05
PES05011422-01A	Benzene	1,800		15 µg/L	01/13/05	01/17/05
	Toluene	ND	V	15 µg/L	01/13/05	01/17/05
	Ethylbenzene	330		15 µg/L	01/13/05	01/17/05
	m,p-Xylene	4,000		15 µg/L	01/13/05	01/17/05
	o-Xylene	1,600		15 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	3.5		0.50 mg/L	01/13/05	01/17/05
R 762248-Fentons Control	Acetone	ND	V	100 µg/L	01/13/05	01/17/05
ID :	Tertiary Butyl Alcohol (TBA)	ND	V	50 µg/L	01/13/05	01/17/05
S05011422-02A	Benzene	180		2.5 µg/L	01/13/05	01/17/05
	Toluene	7.3		2.5 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND	V	2.5 µg/L	01/13/05	01/17/05
	m,p-Xylene	400		2.5 µg/L	01/13/05	01/17/05
	o-Xylene	320		2.5 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	ND		0.050 mg/L	01/13/05	01/17/05
ENSR 762248-1% Fentons	Acetone	34		10 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		10 µg/L	01/13/05	01/17/05
PES05011422-03A	Benzene	ND		0.50 µg/L	01/13/05	01/17/05
	Toluene	ND		0.50 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND		0.50 µg/L	01/13/05	01/17/05
	m,p-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
	o-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
Client ID :	TPH Purgeable	ND		0.050 mg/L	01/13/05	01/17/05
ENSR 762248-3% Fentons	Acetone	49		10 µg/L	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		10 µg/L	01/13/05	01/17/05
PES05011422-04A	Benzene	ND		0.50 µg/L	01/13/05	01/17/05
	Toluene	ND		0.50 µg/L	01/13/05	01/17/05
	Ethylbenzene	ND		0.50 µg/L	01/13/05	01/17/05
	m,p-Xylene	ND		0.50 µg/L	01/13/05	01/17/05
	o-Xylene	ND		0.50 µg/L	01/13/05	01/17/05

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Client ID :	TPH Purgeable	16		1.0 mg/Kg	01/13/05	01/14/05
ENSR 762248-Unt Soil	Acetone	ND		200 µg/Kg	01/13/05	01/14/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND		500 µg/Kg	01/13/05	01/14/05
PES05011422-05A	Benzene	ND		5.0 µg/Kg	01/13/05	01/14/05
	Toluene	12		5.0 µg/Kg	01/13/05	01/14/05
	Ethylbenzene	39		5.0 µg/Kg	01/13/05	01/14/05
	m,p-Xylene	110		5.0 µg/Kg	01/13/05	01/14/05
	o-Xylene	110		5.0 µg/Kg	01/13/05	01/14/05
Client ID :	TPH Purgeable	150	*	10 mg/m³	01/13/05	01/17/05
1% Fenton`s Off-Gas	Acetone	ND	*	2.0 mg/m³	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	*	5.0 mg/m³	01/13/05	01/17/05
PES05011422-06A	Benzene	1.2	*	0.10 mg/m³	01/13/05	01/17/05
	Toluene	0.38	*	0.10 mg/m³	01/13/05	01/17/05
	Ethylbenzene	ND	*	0.10 mg/m³	01/13/05	01/17/05
	m,p-Xylene	0.16	*	0.10 mg/m³	01/13/05	01/17/05
	o-Xylene	ND	*	0.10 mg/m³	01/13/05	01/17/05
Client ID :	TPH Purgeable	240	*	20 mg/m³	01/13/05	01/17/05
3% Fenton`s Off-Gas	Acetone	ND	*	4.0 mg/m³	01/13/05	01/17/05
Lab ID :	Tertiary Butyl Alcohol (TBA)	ND	*	10 mg/m³	01/13/05	01/17/05
PES05011422-07A	Benzene	2.3	*	0.20 mg/m³	01/13/05	01/17/05
	Toluene	3.7	*	0.20 mg/m³	01/13/05	01/17/05
	Ethylbenzene	1.2	*	0.20 mg/m³	01/13/05	01/17/05
	m,p-Xylene	3.6	*	0.20 mg/m³	01/13/05	01/17/05
	o-Xylene	1.4	*	0.20 mg/m³	01/13/05	01/17/05

*Note: Concentrations of air in Tedlar Bags are at 23 degrees Celsius and 25.38 inches of mercury.

Note: Sample 05A extracted on 1/14/05.

V = Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer

Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

1/27/05

Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

VOC pH Report

Work Order PES05011422 **Project:** ENSR 762248

Alpha's Sample ID	Client's Sample ID	Matrix	pH
05011422-01A	ENSR 762248-GW	Aqueous	2
05011422-02A	ENSR 762248-Fentons Control	Aqueous	2
05011422-03A	ENSR 762248-1% Fentons	Aqueous	2
05011422-04A	ENSR 762248-3% Fentons	Aqueous	2

1/27/05

Report Date

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES05020125

Report Due By : 5:00 PM On : 15-Feb-05

EDD Required : **Yes** PDF Required : **No**

Sampled by : Client

Cooler Temp : **4 °C**

01-Feb-05

Client:
Prima Environmental
10265 Old Placerville Rd.
Suite 15
Sacramento, CA 95827-3042

Cindy Schreier
TEL : (916) 363-8798
FAX : (916) 363-8829
EMail

Report Attention : Cindy Schreier
CC Report :

Job : ENSR 762248
PO :
Client's COC # : 06573

QC Level : 1 = Final Rpt Only

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles ORG	SUB	TAT	PWS #	Requested Tests TPH/P_W	VOC_W							Sample Remarks
PES05020125-01A	E762248-PA-A	AQ	01/28/05 09:00	2	0	10		GAS-C	8260s/ Mtbe/ Acetone/ TBA_C							
PES05020125-02A	E762248-PU-A	AQ	01/28/05 09:00	2	0	10		GAS-C	8260s/ Mtbe/ Acetone/ TBA_C							
PES05020125-03A	E762248-PC-A	AQ	01/28/05 09:00	2	0	10		GAS-C	8260s/ Mtbe/ Acetone/ TBA_C							

Comments: No security seals intact, ice frozen. Ca samples. :

	Signature	Print Name	Company	Date/Time
Received by:	Graciela Navarrete	G. Navarrete	Alpha Analytical, Inc.	2-01-05 12:30

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.

Matrix Tyr AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Othe) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Pla)T-Other

Billing Information:

Name _____
Address _____
City, State, Zip _____
Phone Number _____ Fax _____

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State?
AZ ___ CA X NV ___ WA ___
ID ___ OR ___ OTHER _____

Page # 1 of 1

06573

Client Name: PRIMA ENV
Address: 10245 Old Placerville Rd #15
City, State, Zip: Sacramento CA 95827
P.O. #:
Job #: ENSR 762248
EMail Address:
Phone #: 916-363-8798
Fax #: 916-363-8829
Report Attention:
Sampled by:
Office Use Only

Required QC Level? I II III IV
EDD / EDF? YES ___ NO ___
Global ID # _____

Time Sampled	Date Sampled	Matrix* See Key Below	Lab ID Number	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	TPH-g	8260	Acetone	MTBE	TBA				REMARKS
0700	1/28	AQ	05020125-01	E762248-PA-A	std	N	2V	X	X	X	X	X				
0800	1/28	↓	-02	E762248-PU-A	↓	N	2V	X	X	X	X	X				
0900	1/28	↓	-03	E762248-PC-A	↓	N	2V	X	X	X	X	X				

ADDITIONAL INSTRUCTIONS:

	Signature	Print Name	Company	Date	Time
Relinquished by	C. Schreier	Cindy Schreier	PRIMA	1/31/05	~1800
Received by	G. Navarrete	G. Navarrete	Alpha	2-01-05	12:30
Relinquished by					
Received by					
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plasti OT-Other

NOTE: Samp) discarded 60 days after results are reported unless other arrangements are ma) zardous samples will be returned to client or disposed of at client expense. The) for the analysis of the above san . is applicable only to those samples received by the laboratory with this coc. The ility of the laboratory is limited to the amount paid for the report.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 02/01/05

Job#: ENSR 762248

Total Petroleum Hydrocarbons - Purgeable (TPH-P) EPA Method SW8015B/DHS LUFT Manual

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**E762248-PA-A**					
Lab ID :	PES05020125-01A	TPH Purgeable	0.57	0.10 mg/L	01/28/05	02/02/05
Client ID :	**E762248-PU-A**					
Lab ID :	PES05020125-02A	TPH Purgeable	15	2.0 mg/L	01/28/05	02/02/05
Client ID :	**E762248-PC-A**					
Lab ID :	PES05020125-03A	TPH Purgeable	8.7	1.0 mg/L	01/28/05	02/02/05

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

2/14/05
Report Date

Alpha Analytical, Inc.

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ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05020125-01A
Client I.D. Number: E762248-PA-A

Sampled: 01/28/05
Received: 02/01/05
Analyzed: 02/02/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	4.0 µg/L
2	Vinyl chloride	ND	1.0 µg/L
3	Chloroethane	ND	1.0 µg/L
4	Bromomethane	ND	4.0 µg/L
5	Trichlorofluoromethane	ND	1.0 µg/L
6	Acetone	ND	20 µg/L
7	1,1-Dichloroethene	ND	1.0 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	10 µg/L
9	Dichloromethane	ND	4.0 µg/L
	·ans-1,2-Dichloroethene	ND	1.0 µg/L
	Methyl tert-butyl ether (MTBE)	ND	0.50 µg/L
12	1,1-Dichloroethane	ND	1.0 µg/L
13	cis-1,2-Dichloroethene	ND	1.0 µg/L
14	Chloroform	ND	1.0 µg/L
15	1,2-Dichloroethane	3.1	1.0 µg/L
16	1,1,1-Trichloroethane	ND	1.0 µg/L
17	Carbon tetrachloride	ND	1.0 µg/L
18	Benzene	76	0.50 µg/L
19	1,2-Dichloropropane	ND	1.0 µg/L
20	Trichloroethene	ND	1.0 µg/L
21	Bromodichloromethane	ND	1.0 µg/L
22	cis-1,3-Dichloropropene	ND	1.0 µg/L
23	trans-1,3-Dichloropropene	ND	1.0 µg/L
24	1,1,2-Trichloroethane	ND	1.0 µg/L
25	Toluene	ND	0.50 µg/L
26	Dibromochloromethane	ND	1.0 µg/L
27	Tetrachloroethene	ND	1.0 µg/L
28	Chlorobenzene	ND	1.0 µg/L
29	Ethylbenzene	ND	0.50 µg/L
30	m,p-Xylene	ND	0.50 µg/L
31	Bromoform	ND	1.0 µg/L
32	o-Xylene	ND	0.50 µg/L
33	1,1,2,2-Tetrachloroethane	ND	1.0 µg/L
34	1,3-Dichlorobenzene	ND	1.0 µg/L
35	1,4-Dichlorobenzene	ND	1.0 µg/L
36	1,2-Dichlorobenzene	ND	1.0 µg/L

Some Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

2/14/05
Report Date

Alpha Analytical, Inc.

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(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05020125-02A
Client I.D. Number: E762248-PU-A

Sampled: 01/28/05
Received: 02/01/05
Analyzed: 02/02/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	80 µg/L
2	Vinyl chloride	ND	20 µg/L
3	Chloroethane	ND	20 µg/L
4	Bromomethane	ND	80 µg/L
5	Trichlorofluoromethane	ND	20 µg/L
6	Acetone	ND	400 µg/L
7	1,1-Dichloroethene	ND	20 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	200 µg/L
9	Dichloromethane	ND	80 µg/L
	rans-1,2-Dichloroethene	ND	20 µg/L
	Methyl tert-butyl ether (MTBE)	ND	10 µg/L
12	1,1-Dichloroethane	ND	20 µg/L
13	cis-1,2-Dichloroethene	ND	20 µg/L
14	Chloroform	ND	20 µg/L
15	1,2-Dichloroethane	ND	20 µg/L
16	1,1,1-Trichloroethane	ND	20 µg/L
17	Carbon tetrachloride	ND	20 µg/L
18	Benzene	1,100	10 µg/L
19	1,2-Dichloropropane	ND	20 µg/L
20	Trichloroethene	ND	20 µg/L
21	Bromodichloromethane	ND	20 µg/L
22	cis-1,3-Dichloropropene	ND	20 µg/L
23	trans-1,3-Dichloropropene	ND	20 µg/L
24	1,1,2-Trichloroethane	ND	20 µg/L
25	Toluene	870	10 µg/L
26	Dibromochloromethane	ND	20 µg/L
27	Tetrachloroethene	ND	20 µg/L
28	Chlorobenzene	ND	20 µg/L
29	Ethylbenzene	480	10 µg/L
30	m,p-Xylene	1,700	10 µg/L
31	Bromoform	ND	20 µg/L
32	o-Xylene	1,000	10 µg/L
33	1,1,2,2-Tetrachloroethane	ND	20 µg/L
34	1,3-Dichlorobenzene	ND	20 µg/L
35	1,4-Dichlorobenzene	ND	20 µg/L
36	1,2-Dichlorobenzene	ND	20 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

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2/14/05
Report Date

Alpha Analytical, Inc.

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ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05020125-03A
Client I.D. Number: E762248-PC-A

Sampled: 01/28/05
Received: 02/01/05
Analyzed: 02/02/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	40 µg/L
2	Vinyl chloride	ND	10 µg/L
3	Chloroethane	ND	10 µg/L
4	Bromomethane	ND	40 µg/L
5	Trichlorofluoromethane	ND	10 µg/L
6	Acetone	ND	200 µg/L
7	1,1-Dichloroethene	ND	10 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	100 µg/L
9	Dichloromethane	ND	40 µg/L
	rans-1,2-Dichloroethene	ND	10 µg/L
	Methyl tert-butyl ether (MTBE)	ND	5.0 µg/L
12	1,1-Dichloroethane	ND	10 µg/L
13	cis-1,2-Dichloroethene	ND	10 µg/L
14	Chloroform	ND	10 µg/L
15	1,2-Dichloroethane	ND	10 µg/L
16	1,1,1-Trichloroethane	ND	10 µg/L
17	Carbon tetrachloride	ND	10 µg/L
18	Benzene	190	5.0 µg/L
19	1,2-Dichloropropane	ND	10 µg/L
20	Trichloroethene	ND	10 µg/L
21	Bromodichloromethane	ND	10 µg/L
22	cis-1,3-Dichloropropene	ND	10 µg/L
23	trans-1,3-Dichloropropene	ND	10 µg/L
24	1,1,2-Trichloroethane	ND	10 µg/L
25	Toluene	7.3	5.0 µg/L
26	Dibromochloromethane	ND	10 µg/L
27	Tetrachloroethene	ND	10 µg/L
28	Chlorobenzene	ND	10 µg/L
29	Ethylbenzene	ND	5.0 µg/L
30	m,p-Xylene	1,100	5.0 µg/L
31	Bromoform	ND	10 µg/L
32	o-Xylene	690	5.0 µg/L
33	1,1,2,2-Tetrachloroethane	ND	10 µg/L
34	1,3-Dichlorobenzene	ND	10 µg/L
35	1,4-Dichlorobenzene	ND	10 µg/L
36	1,2-Dichlorobenzene	ND	10 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

2/14/05
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

VOC pH Report

Work Order PES05020125 **Project:** ENSR 762248

Alpha's Sample ID	Client's Sample ID	Matrix	pH
05020125-01A	E762248-PA-A	Aqueous	2
05020125-02A	E762248-PU-A	Aqueous	2
05020125-03A	E762248-PC-A	Aqueous	2

2/14/05
Report Date

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES05020923

Report Due By : 5:00 PM On : 22-Feb-05

Client:
Prima Environmental
10265 Old Placerville Rd.
Suite 15
Sacramento, CA 95827-3042

Cindy Schreier
TEL : (916) 363-8798
FAX : (916) 363-8829
EMail

EDD Required : **Yes** PDF Required : **No**

Sampled by : Client

Report Attention : Cindy Schreier
CC Report :

Job : ENSR 762248
PO :
Client's COC # : 05621

Cooler Temp : 4 °C **09-Feb-05**

QC Level : 1 = Final Rpt Only

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles ORG	SUB	TAT	PWS #	Requested Tests TPH/P_W	VOC_W							Sample Remarks
PES05020923-01A	E762248-Pers-Control B	AQ	02/04/05 08:00	2	0	9		GAS-C	8260s/ Mtbe/ TBA/ Acetone_C							
PES05020923-02A	E762248-Pers-Unact-B	AQ	02/04/05 08:00	2	0	9		GAS-C	8260s/ Mtbe/ TBA/ Acetone_C							
PES05020923-03A	E762248-Pers-Act.-B	AQ	02/04/05 08:00	2	0	9		GAS-C	8260s/ Mtbe/ TBA/ Acetone_C							

Comments: Samples picked up by Alpha Employee, ice frozen. Ca samples. :

	Signature	Print Name	Company	Date/Time
Received by:	Graciela Navarrete	G Navarrete	Alpha Analytical, Inc.	2-9-05 9:25

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Ty AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Othe Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Pla OT-Other

Billing Information:

Name _____
Address _____
City, State, Zip _____
Phone Number _____ Fax _____

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State?
AZ ___ CA X NV ___ WA ___
ID ___ OR ___ OTHER _____

Page # 1 of ___

05621

Client Name: PRIMA Environmental
Address: 1265 Old Placerville Rd #15
City, State, Zip: Sacramento, CA 95827
P.O. #:
Job #: ENSR762248
EMail Address:
Phone #: 916-363-8798
Fax #: 916-363-8229

Required QC Level? I II III IV
EDD / EDF? YES ___ NO ___
Global ID # _____

Analyses Required

Time Sampled	Date Sampled	Matrix* See Key Below	Office Use Only Lab ID Number	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	TPH-g	MTBE	TBA	Acetone	EPA 8260				REMARKS
0800	2/4	AQ	0502 0923-01	E762248-Pers Control B	std	N	2V	X	X	X	X	X				
0800	2/4	AQ	-02	E762248-Pers Unact-B	↓	N	2V	X	X	X	X	X				
0800	2/4	AQ	-03	E762248-Pers-Act B	↓	N	2V	X	X	X	X	X				

Sampled by:
Report Attention:

ADDITIONAL INSTRUCTIONS:

	Signature	Print Name	Company	Date	Time
Relinquished by	C. G. Schreier	Cindy G. Schreier	PRIMA Env	2/8/05	1230
Received by	Lisa Bryla	Lisa Bryla	ALPHA	2-8-05	1230
Relinquished by					
Received by	Gracielita Navarrete	G Navarrete	Alpha	2-9-05	9:25
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: Samples discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense. The analysis of the above samples is applicable only to those samples received by the laboratory with this coc. The liability of the laboratory is limited to the amount paid for the report.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 02/09/05

Job#: ENSR 762248

Total Petroleum Hydrocarbons - Purgeable (TPH-P) EPA Method SW8015B/DHS LUFT Manual

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**E762248-Pers-Control B**					
Lab ID :	PES05020923-01A	TPH Purgeable	22	4.0 mg/L	02/04/05	02/10/05
Client ID :	**E762248-Pers-Unact-B**					
Lab ID :	PES05020923-02A	TPH Purgeable	2.6	1.0 mg/L	02/04/05	02/10/05
Client ID :	**E762248-Pers-Act.-B**					
Lab ID :	PES05020923-03A	TPH Purgeable	2.0	1.0 mg/L	02/04/05	02/10/05

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

2/21/05
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
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ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05020923-01A
Client I.D. Number: E762248-Pers-Control B

Sampled: 02/04/05
Received: 02/09/05
Analyzed: 02/10/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	160 µg/L
2	Vinyl chloride	ND	40 µg/L
3	Chloroethane	ND	40 µg/L
4	Bromomethane	ND	160 µg/L
5	Trichlorofluoromethane	ND	40 µg/L
6	Acetone	ND	800 µg/L
7	1,1-Dichloroethene	ND	40 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	400 µg/L
9	Dichloromethane	ND	160 µg/L
	ans-1,2-Dichloroethene	ND	40 µg/L
	Methyl tert-butyl ether (MTBE)	ND	20 µg/L
12	1,1-Dichloroethane	ND	40 µg/L
13	cis-1,2-Dichloroethene	ND	40 µg/L
14	Chloroform	ND	40 µg/L
15	1,2-Dichloroethane	ND	40 µg/L
16	1,1,1-Trichloroethane	ND	40 µg/L
17	Carbon tetrachloride	ND	40 µg/L
18	Benzene	480	20 µg/L
19	1,2-Dichloropropane	ND	40 µg/L
20	Trichloroethene	ND	40 µg/L
21	Bromodichloromethane	ND	40 µg/L
22	cis-1,3-Dichloropropene	ND	40 µg/L
23	trans-1,3-Dichloropropene	ND	40 µg/L
24	1,1,2-Trichloroethane	ND	40 µg/L
25	Toluene	1,400	20 µg/L
26	Dibromochloromethane	ND	40 µg/L
27	Tetrachloroethene	ND	40 µg/L
28	Chlorobenzene	ND	40 µg/L
29	Ethylbenzene	350	20 µg/L
30	m,p-Xylene	4,000	20 µg/L
31	Bromoform	ND	40 µg/L
32	o-Xylene	2,000	20 µg/L
33	1,1,2,2-Tetrachloroethane	ND	40 µg/L
34	1,3-Dichlorobenzene	ND	40 µg/L
35	1,4-Dichlorobenzene	ND	40 µg/L
36	1,2-Dichlorobenzene	ND	40 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

2/21/05
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05020923-02A
Client I.D. Number: E762248-Pers-Unact-B

Sampled: 02/04/05
Received: 02/09/05
Analyzed: 02/10/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	40 µg/L
2	Vinyl chloride	ND	10 µg/L
3	Chloroethane	ND	10 µg/L
4	Bromomethane	ND	40 µg/L
5	Trichlorofluoromethane	ND	10 µg/L
6	Acetone	ND	200 µg/L
7	1,1-Dichloroethene	ND	10 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	100 µg/L
9	Dichloromethane	ND	40 µg/L
	·ans-1,2-Dichloroethene	ND	10 µg/L
	Methyl tert-butyl ether (MTBE)	6.9	5.0 µg/L
12	1,1-Dichloroethane	ND	10 µg/L
13	cis-1,2-Dichloroethene	ND	10 µg/L
14	Chloroform	ND	10 µg/L
15	1,2-Dichloroethane	ND	10 µg/L
16	1,1,1-Trichloroethane	ND	10 µg/L
17	Carbon tetrachloride	ND	10 µg/L
18	Benzene	910	5.0 µg/L
19	1,2-Dichloropropane	ND	10 µg/L
20	Trichloroethene	ND	10 µg/L
21	Bromodichloromethane	ND	10 µg/L
22	cis-1,3-Dichloropropene	ND	10 µg/L
23	trans-1,3-Dichloropropene	ND	10 µg/L
24	1,1,2-Trichloroethane	ND	10 µg/L
25	Toluene	99	5.0 µg/L
26	Dibromochloromethane	ND	10 µg/L
27	Tetrachloroethene	ND	10 µg/L
28	Chlorobenzene	ND	10 µg/L
29	Ethylbenzene	79	5.0 µg/L
30	m,p-Xylene	80	5.0 µg/L
31	Bromoform	ND	10 µg/L
32	o-Xylene	180	5.0 µg/L
33	1,1,2,2-Tetrachloroethane	ND	10 µg/L
34	1,3-Dichlorobenzene	ND	10 µg/L
35	1,4-Dichlorobenzene	ND	10 µg/L
36	1,2-Dichlorobenzene	ND	10 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

2/21/05
Report Date

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05020923-03A
Client I.D. Number: E762248-Pers-Act.-B

Sampled: 02/04/05
Received: 02/09/05
Analyzed: 02/10/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	40 µg/L
2	Vinyl chloride	ND	10 µg/L
3	Chloroethane	ND	10 µg/L
4	Bromomethane	ND	40 µg/L
5	Trichlorofluoromethane	ND	10 µg/L
6	Acetone	ND	200 µg/L
7	1,1-Dichloroethene	ND	10 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	100 µg/L
9	Dichloromethane	ND	40 µg/L
	·ans-1,2-Dichloroethene	ND	10 µg/L
	Methyl tert-butyl ether (MTBE)	ND	5.0 µg/L
12	1,1-Dichloroethane	ND	10 µg/L
13	cis-1,2-Dichloroethene	ND	10 µg/L
14	Chloroform	ND	10 µg/L
15	1,2-Dichloroethane	ND	10 µg/L
16	1,1,1-Trichloroethane	ND	10 µg/L
17	Carbon tetrachloride	ND	10 µg/L
18	Benzene	960	5.0 µg/L
19	1,2-Dichloropropane	ND	10 µg/L
20	Trichloroethene	ND	10 µg/L
21	Bromodichloromethane	ND	10 µg/L
22	cis-1,3-Dichloropropene	ND	10 µg/L
23	trans-1,3-Dichloropropene	ND	10 µg/L
24	1,1,2-Trichloroethane	ND	10 µg/L
25	Toluene	230	5.0 µg/L
26	Dibromochloromethane	ND	10 µg/L
27	Tetrachloroethene	ND	10 µg/L
28	Chlorobenzene	ND	10 µg/L
29	Ethylbenzene	5.7	5.0 µg/L
30	m,p-Xylene	6.2	5.0 µg/L
31	Bromoform	ND	10 µg/L
32	o-Xylene	15	5.0 µg/L
33	1,1,2,2-Tetrachloroethane	ND	10 µg/L
34	1,3-Dichlorobenzene	ND	10 µg/L
35	1,4-Dichlorobenzene	ND	10 µg/L
36	1,2-Dichlorobenzene	ND	10 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

2/21/05
Report Date

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

VOC pH Report

Work Order PES05020923 **Project:** ENSR 762248

Alpha's Sample ID	Client's Sample ID	Matrix	pH
05020923-01A	E762248-Pers-Control B	Aqueous	2
05020923-02A	E762248-Pers-Unact-B	Aqueous	2
05020923-03A	E762248-Pers-Act.-B	Aqueous	2

2/21/05
Report Date

Billing Information :

CHAIN-OF-CUSTODY RECORD

CA

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21 Sparks, Nevada 89431-5778
TEL: (775) 355-1044 FAX: (775) 355-0406

WorkOrder : PES05022430

Report Due By : 5:00 PM On : 10-Mar-05

Client:
Prima Environmental
10265 Old Placerville Rd.
Suite 15
Sacramento, CA 95827-3042

Cindy Schreier
TEL : (916) 363-8798
FAX : (916) 363-8829
EMail

EDD Required : **Yes** PDF Required : **No**

Sampled by : BB

Report Attention : Cindy Schreier
CC Report :

Job : ENSR 762248
PO :

Client's COC # : 05636

Cooler Temp : 4 °C

24-Feb-05

QC Level : 1 = Final Rpt Only

Alpha Sample ID	Client Sample ID	Matrix	Collection Date	No. of Bottles ORG	SUB	TAT	PWS #	Requested Tests TPH/P_W	VOC_W							Sample Remarks
PES05022430-01A	E762248 Pers Cont (PC)-C	AQ	02/17/05 07:30	2	0	10		GAS-C	8260s/ Mtbe/ Acetone/ TBA_C							
PES05022430-02A	E762248 Pers Unact (PU)-C	AQ	02/17/05 07:30	2	0	10		GAS-C	8260s/ Mtbe/ Acetone/ TBA_C							
PES05022430-03A	E762248 Pers Act (PA)-C	AQ	02/17/05 07:30	2	0	10		GAS-C	8260s/ Mtbe/ Acetone/ TBA_C							

Comments: Samples picked up by Alpha Employee, Ice frozen. Samples are 7days into their holding time. :

	Signature	Print Name	Company	Date/Time
Received by:	Graciela Navarrete	G. Navarrete	Alpha Analytical, Inc.	2/24/05 5:45

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.
The report for the analysis of the above samples is applicable only to those samples received by the laboratory with this COC. The liability of the laboratory is limited to the amount paid for the report.
Matrix Type : AQ(Aqueous) AR(Air) SO(Soil) WS(Waste) DW(Drinking Water) OT(Other) Bottle Type: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

Billing Information:

Name _____
Address _____
City, State, Zip _____
Phone Number _____ Fax _____

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431-5778
Phone (775) 355-1044
Fax (775) 355-0406

Samples Collected From Which State?
AZ ___ CA ___ NV ___ WA ___
ID ___ OR ___ OTHER _____

Page # ___ of ___

05636

Client Name: PRIMA ENV.
Address: 10265 Old Placerville Rd Suite 15
City, State, Zip: Sacramento, CA 95827
P.O. #:
Job #: ENSR 762248
EMail Address:
Phone #: 916-363-8798
Fax #: 916-363-8829
Sampled by: BB
Report Attention:

Required QC Level? I II III IV

EDD / EDF? YES ___ NO ___

Global ID # _____

Time Sampled	Date Sampled	Matrix* See Key Below	Office Use Only Lab ID Number	Sample Description	TAT	Field Filtered	Total and type of containers ** See below	TPH(g)	8260	MTBE	Acetone	TBA				REMARKS
0730	2/2/05	AQ	00022430-01	E762248 Pers Cont (PC) -C	std	NO	2xV	X	X	X	X	X				
↓	↓	↓	-02	E762248 Pers Unact (PU) -C	↓	↓	2xV	X	X	X	X	X				
			-03	E762248 Pers. Act (PA) -C			2xV	X	X	X	X	X				

ADDITIONAL INSTRUCTIONS:

	Signature	Print Name	Company	Date	Time
Relinquished by	C. Schreier	Cindy Schreier	PRIMA	2-2-05	1030
Received by	Lisa Bryan	Lisa Bryan	ALPHA	2-2-05	1030
Relinquished by					
Received by	Graciela Navarrete	G. Navarrete	Alpha	2-2-05	5:45
Relinquished by					
Received by					

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other **: L-Liter V-Voa S-Soil Jar O-Orbo T-Tedlar B-Brass P-Plastic OT-Other

NOTE: San[illegible] re discarded 60 days after results are reported unless other arrangements are made [illegible] rdous samples will be returned to client or disposed of at client expense. The repor[illegible] analysis of the above sa[illegible] s is applicable only to those samples received by the laboratory with this coc. The [illegible] of the laboratory is limited to the amount paid for the report.

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829
Date Received 02/24/05

Job#: ENSR 762248

Total Petroleum Hydrocarbons - Purgeable (TPH-P) EPA Method SW8015B/DHS LUFT Manual

		Parameter	Concentration	Reporting Limit	Date Sampled	Date Analyzed
Client ID :	**E762248 Pers Cont (PC)-C**					
Lab ID :	PES05022430-01A	TPH Purgeable	3.4	0.50 mg/L	02/17/05	02/28/05
Client ID :	**E762248 Pers Unact (PU)-C**					
Lab ID :	PES05022430-02A	TPH Purgeable	0.16	0.050 mg/L	02/17/05	02/28/05
Client ID :	**E762248 Pers Act (PA)-C**					
Lab ID :	PES05022430-03A	TPH Purgeable	1.0	0.50 mg/L	02/17/05	03/01/05

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
Sacramento, CA • (916) 366-9089 / Las Vegas, NV • (702) 281-4848 / info@alpha-analytical.com

3/9/05
Report Date

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778
(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05022430-01A
Client I.D. Number: E762248 Pers Cont (PC)-C

Sampled: 02/17/05
Received: 02/24/05
Analyzed: 02/28/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	20 µg/L
2	Vinyl chloride	ND	5.0 µg/L
3	Chloroethane	ND	5.0 µg/L
4	Bromomethane	ND	20 µg/L
5	Trichlorofluoromethane	ND	5.0 µg/L
6	Acetone	170	100 µg/L
7	1,1-Dichloroethene	ND	5.0 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	50 µg/L
9	Dichloromethane	ND	20 µg/L
10	trans-1,2-Dichloroethene	ND	5.0 µg/L
	Methyl tert-butyl ether (MTBE)	ND	2.5 µg/L
12	1,1-Dichloroethane	ND	5.0 µg/L
13	cis-1,2-Dichloroethene	ND	5.0 µg/L
14	Chloroform	ND	5.0 µg/L
15	1,2-Dichloroethane	ND	5.0 µg/L
16	1,1,1-Trichloroethane	ND	5.0 µg/L
17	Carbon tetrachloride	ND	5.0 µg/L
18	Benzene	13	2.5 µg/L
19	1,2-Dichloropropane	ND	5.0 µg/L
20	Trichloroethene	ND	5.0 µg/L
21	Bromodichloromethane	ND	5.0 µg/L
22	cis-1,3-Dichloropropene	ND	5.0 µg/L
23	trans-1,3-Dichloropropene	ND	5.0 µg/L
24	1,1,2-Trichloroethane	ND	5.0 µg/L
25	Toluene	ND	2.5 µg/L
26	Dibromochloromethane	ND	5.0 µg/L
27	Tetrachloroethene	ND	5.0 µg/L
28	Chlorobenzene	ND	5.0 µg/L
29	Ethylbenzene	ND	2.5 µg/L
30	m,p-Xylene	290	2.5 µg/L
31	Bromoform	ND	5.0 µg/L
32	o-Xylene	420	2.5 µg/L
33	1,1,2,2-Tetrachloroethane	ND	5.0 µg/L
34	1,3-Dichlorobenzene	ND	5.0 µg/L
35	1,4-Dichlorobenzene	ND	5.0 µg/L
36	1,2-Dichlorobenzene	ND	5.0 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
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3/9/05
Report Date

Alpha Analytical, Inc.

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(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05022430-02A
Client I.D. Number: E762248 Pers Unact (PU)-C

Sampled: 02/17/05
Received: 02/24/05
Analyzed: 02/28/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit		Compound	Concentration	Reporting Limit
1	Chloromethane	ND	2.0 µg/L	26	Dibromochloromethane	ND	1.0 µg/L
2	Vinyl chloride	ND	1.0 µg/L	27	Tetrachloroethene	ND	1.0 µg/L
3	Chloroethane	ND	1.0 µg/L	28	Chlorobenzene	ND	1.0 µg/L
4	Bromomethane	ND	2.0 µg/L	29	Ethylbenzene	ND	0.50 µg/L
5	Trichlorofluoromethane	ND	1.0 µg/L	30	m,p-Xylene	ND	0.50 µg/L
6	Acetone	67	10 µg/L	31	Bromoform	ND	1.0 µg/L
7	1,1-Dichloroethene	ND	1.0 µg/L	32	o-Xylene	ND	0.50 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	10 µg/L	33	1,1,2,2-Tetrachloroethane	ND	1.0 µg/L
9	Dichloromethane	ND	2.0 µg/L	34	1,3-Dichlorobenzene	ND	1.0 µg/L
10	trans-1,2-Dichloroethene	ND	1.0 µg/L	35	1,4-Dichlorobenzene	ND	1.0 µg/L
[illegible]	Methyl tert-butyl ether (MTBE)	ND	0.50 µg/L	36	1,2-Dichlorobenzene	ND	1.0 µg/L
12	1,1-Dichloroethane	ND	1.0 µg/L				
13	cis-1,2-Dichloroethene	ND	1.0 µg/L				
14	Chloroform	ND	1.0 µg/L				
15	1,2-Dichloroethane	ND	1.0 µg/L				
16	1,1,1-Trichloroethane	ND	1.0 µg/L				
17	Carbon tetrachloride	ND	1.0 µg/L				
18	Benzene	14	0.50 µg/L				
19	1,2-Dichloropropane	ND	1.0 µg/L				
20	Trichloroethene	ND	1.0 µg/L				
21	Bromodichloromethane	ND	1.0 µg/L				
22	cis-1,3-Dichloropropene	ND	1.0 µg/L				
23	trans-1,3-Dichloropropene	ND	1.0 µg/L				
24	1,1,2-Trichloroethane	ND	1.0 µg/L				
25	Toluene	ND	0.50 µg/L				

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
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3/9/05
Report Date

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ANALYTICAL REPORT

Prima Environmental
10265 Old Placerville Rd.
Sacramento, CA 958273042
Job#: ENSR 762248

Attn: Cindy Schreier
Phone: (916) 363-8798
Fax: (916) 363-8829

Alpha Analytical Number: PES05022430-03A
Client I.D. Number: E762248 Pers Act (PA)-C

Sampled: 02/17/05
Received: 02/24/05
Analyzed: 03/01/05

Volatile Organics by GC/MS
EPA Method SW8260B

	Compound	Concentration	Reporting Limit
1	Chloromethane	ND	20 µg/L
2	Vinyl chloride	ND	5.0 µg/L
3	Chloroethane	ND	5.0 µg/L
4	Bromomethane	ND	20 µg/L
5	Trichlorofluoromethane	ND	5.0 µg/L
6	Acetone	ND	100 µg/L
7	1,1-Dichloroethene	ND	5.0 µg/L
8	Tertiary Butyl Alcohol (TBA)	ND	50 µg/L
9	Dichloromethane	ND	20 µg/L
10	trans-1,2-Dichloroethene	ND	5.0 µg/L
	Methyl tert-butyl ether (MTBE)	ND	2.5 µg/L
12	1,1-Dichloroethane	ND	5.0 µg/L
13	cis-1,2-Dichloroethene	ND	5.0 µg/L
14	Chloroform	ND	5.0 µg/L
15	1,2-Dichloroethane	ND	5.0 µg/L
16	1,1,1-Trichloroethane	ND	5.0 µg/L
17	Carbon tetrachloride	ND	5.0 µg/L
18	Benzene	390	2.5 µg/L
19	1,2-Dichloropropane	ND	5.0 µg/L
20	Trichloroethene	ND	5.0 µg/L
21	Bromodichloromethane	ND	5.0 µg/L
22	cis-1,3-Dichloropropene	ND	5.0 µg/L
23	trans-1,3-Dichloropropene	ND	5.0 µg/L
24	1,1,2-Trichloroethane	ND	5.0 µg/L
25	Toluene	ND	2.5 µg/L
26	Dibromochloromethane	ND	5.0 µg/L
27	Tetrachloroethene	ND	5.0 µg/L
28	Chlorobenzene	ND	5.0 µg/L
29	Ethylbenzene	ND	2.5 µg/L
30	m,p-Xylene	ND	2.5 µg/L
31	Bromoform	ND	5.0 µg/L
32	o-Xylene	ND	2.5 µg/L
33	1,1,2,2-Tetrachloroethane	ND	5.0 µg/L
34	1,3-Dichlorobenzene	ND	5.0 µg/L
35	1,4-Dichlorobenzene	ND	5.0 µg/L
36	1,2-Dichlorobenzene	ND	5.0 µg/L

Reporting Limits were increased due to high concentrations of target analytes.

ND = Not Detected

Roger Scholl Randy Gardner Walter Hinchman

Roger L. Scholl, Ph.D., Laboratory Director • • Randy Gardner, Laboratory Manager • • Walter Hinchman, Quality Assurance Officer
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3/9/05
Report Date

Alpha Analytical, Inc.

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(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

VOC pH Report

Work Order PES05022430 **Project:** ENSR 762248

Alpha's Sample ID	Client's Sample ID	Matrix	pH
05022430-01A	E762248 Pers Cont (PC)-C	Aqueous	2
05022430-02A	E762248 Pers Unact (PU)-C	Aqueous	2
05022430-03A	E762248 Pers Act (PA)-C	Aqueous	2

3/9/05

Report Date

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Date: *10-Mar-05*

QC Summary Report

Work Order: 05022430

Method Blank

Type **MBLK** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022805.D** Batch ID: **MS10W0228B** Analysis Date: **02/28/2005 08:43**

Sample ID: **MBLK MS10W0228B** Units : **mg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	ND	0.05								
Surr: 1,2-Dichloroethane-d4	0.00897		0.01		90	76	128			
Surr: Toluene-d8	0.00997		0.01		99.7	84	113			
Surr: 4-Bromofluorobenzene	0.00966		0.01		97	79	119			

Laboratory Control Spike

Type **LCS** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022803.D** Batch ID: **MS10W0228B** Analysis Date: **02/28/2005 08:02**

Sample ID: **GLCS MS10W0228B** Units : **mg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	0.373	0.05	0.4		93	78	127			
Surr: 1,2-Dichloroethane-d4	0.00865		0.01		87	76	128			
Surr: Toluene-d8	0.0101		0.01		101	84	113			
Surr: 4-Bromofluorobenzene	0.00984		0.01		98	79	119			

Sample Matrix Spike

Type **MS** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022810.D** Batch ID: **MS10W0228B** Analysis Date: **02/28/2005 10:29**

Sample ID: **05022430-02AGS** Units : **mg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	3.43	0.25	4	0.159	82	70	139			
Surr: 1,2-Dichloroethane-d4	0.0484		0.05		97	76	128			
Surr: Toluene-d8	0.0465		0.05		93	84	113			
Surr: 4-Bromofluorobenzene	0.045		0.05		90	79	119			

Sample Matrix Spike Duplicate

Type **MSD** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022811.D** Batch ID: **MS10W0228B** Analysis Date: **02/28/2005 10:50**

Sample ID: **05022430-02AGSD** Units : **mg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	1.67	0.25	2	0.159	76	70	139	3.427	68.7(12)	R5
Surr: 1,2-Dichloroethane-d4	0.0473		0.05		95	76	128			
Surr: Toluene-d8	0.0473		0.05		95	84	113			
Surr: 4-Bromofluorobenzene	0.0467		0.05		93	79	119			

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

R5 = MS/MSD RPD exceed the laboratory control limit. Recovery met acceptance criteria.

Alpha Analytical, Inc.

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Date: *10-Mar-05*

QC Summary Report

Work Order: 05022430

Method Blank

Type **MBLK** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030106.D** Batch ID: **MS10W0301B** Analysis Date: **03/01/2005 09:21**

Sample ID: **MBLK MS10W0301B** Units : **mg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	ND	0.05								
Surr: 1,2-Dichloroethane-d4	0.00895		0.01		90	76	128			
Surr: Toluene-d8	0.0099		0.01		99	84	113			
Surr: 4-Bromofluorobenzene	0.00982		0.01		98	79	119			

Laboratory Control Spike

Type **LCS** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030103.D** Batch ID: **MS10W0301B** Analysis Date: **03/01/2005 08:18**

Sample ID: **GLCS MS10W0301B** Units : **mg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	0.383	0.05	0.4		96	78	127			
Surr: 1,2-Dichloroethane-d4	0.00863		0.01		86	76	128			
Surr: Toluene-d8	0.00995		0.01		100	84	113			
Surr: 4-Bromofluorobenzene	0.0101		0.01		101	79	119			

Sample Matrix Spike

Type **MS** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030111.D** Batch ID: **MS10W0301B** Analysis Date: **03/01/2005 11:05**

Sample ID: **05022624-01AGS** Units : **mg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	1.96	0.25	2	0	98	70	139			
Surr: 1,2-Dichloroethane-d4	0.0449		0.05		90	76	128			
Surr: Toluene-d8	0.0484		0.05		97	84	113			
Surr: 4-Bromofluorobenzene	0.049		0.05		98	79	119			

ample Matrix Spike Duplicate

Type **MSD** Test Code: **EPA Method SW8015B/DHS LUFT Manual**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030112.D** Batch ID: **MS10W0301B** Analysis Date: **03/01/2005 11:26**

Sample ID: **05022624-01AGSD** Units : **mg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
TPH Purgeable	1.98	0.25	2	0	99	70	139	1.961	1.0(12)	
Surr: 1,2-Dichloroethane-d4	0.0456		0.05		91	76	128			
Surr: Toluene-d8	0.0492		0.05		98	84	113			
Surr: 4-Bromofluorobenzene	0.0485		0.05		97	79	119			

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

Alpha Analytical, Inc.

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Date: *10-Mar-05*

QC Summary Report

Work Order: 05022430

Method Blank

Type **MBLK** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022805.D** Batch ID: **MS10W0228A** Analysis Date: **02/28/2005 08:43**

Sample ID: **MBLK MS10W0228A** Units : **µg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
Chloromethane	ND	2								
Vinyl chloride	ND	1								
Chloroethane	ND	1								
Bromomethane	ND	2								
Trichlorofluoromethane	ND	1								
Acetone	ND	10								
1,1-Dichloroethene	ND	1								
Tertiary Butyl Alcohol (TBA)	ND	10								
Dichloromethane	ND	2								
trans-1,2-Dichloroethene	ND	1								
Methyl tert-butyl ether (MTBE)	ND	0.5								
1,1-Dichloroethane	ND	1								
cis-1,2-Dichloroethene	ND	1								
Chloroform	ND	1								
1,2-Dichloroethane	ND	1								
1,1,1-Trichloroethane	ND	1								
Carbon tetrachloride	ND	1								
Benzene	ND	0.5								
1,2-Dichloropropane	ND	1								
Trichloroethene	ND	1								
Bromodichloromethane	ND	1								
cis-1,3-Dichloropropene	ND	1								
trans-1,3-Dichloropropene	ND	1								
1,1,2-Trichloroethane	ND	1								
Toluene	ND	0.5								
Dibromochloromethane	ND	1								
Tetrachloroethene	ND	1								
Chlorobenzene	ND	1								
Ethylbenzene	ND	0.5								
m,p-Xylene	ND	0.5								
Bromoform	ND	1								
o-Xylene	ND	0.5								
1,1,2,2-Tetrachloroethane	ND	1								
1,3-Dichlorobenzene	ND	1								
1,4-Dichlorobenzene	ND	1								
1,2-Dichlorobenzene	ND	1								
Surr: 1,2-Dichloroethane-d4	8.97		10		90	76	127			
Surr: Toluene-d8	9.97		10		99.7	84	113			
Surr: 4-Bromofluorobenzene	9.66		10		97	79	119			

Laboratory Control Spike

Type **LCS** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022804.D** Batch ID: **MS10W0228A** Analysis Date: **02/28/2005 08:23**

Sample ID: **LCS MS10W0228A** Units : **µg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
1,1-Dichloroethene	9.28	1	10		93	80	120			
Benzene	8.94	0.5	10		89	81	122			
Trichloroethene	9.49	1	10		95	74	125			
Toluene	9	0.5	10		90	80	120			
Chlorobenzene	9.61	1	10		96	79	124			
Ethylbenzene	9.66	0.5	10		97	80	120			
m,p-Xylene	9.28	0.5	10		93	80	129			
o-Xylene	9.07	0.5	10		91	80	129			
Surr: 1,2-Dichloroethane-d4	9.03		10		90	76	127			
Surr: Toluene-d8	10.3		10		103	84	113			
Surr: 4-Bromofluorobenzene	10.2		10		102	79	119			

Alpha Analytical, Inc.

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Date: *10-Mar-05*

QC Summary Report

Work Order: 05022430

Sample Matrix Spike

Type **MS** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022812.D** Batch ID: **MS10W0228A** Analysis Date: **02/28/2005 11:11**

Sample ID: **05022430-02AMS** Units : **µg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
1,1-Dichloroethene	44.6	2.5	50	0	89	65	127			
Benzene	63	1.3	50	14.47	97	74	125			
Trichloroethene	47.5	2.5	50	0	95	66	126			
Toluene	38.8	1.3	50	0	78	76	120			
Chlorobenzene	48.7	2.5	50	0	97	76	124			
Ethylbenzene	42.8	1.3	50	0	86	77	124			
m,p-Xylene	33.2	1.3	50	0	66	73	130			M2
o-Xylene	34.2	1.3	50	0	68	74	131			M2
Surr: 1,2-Dichloroethane-d4	46.7		50		93	76	127			
Surr: Toluene-d8	48.9		50		98	84	113			
Surr: 4-Bromofluorobenzene	47.5		50		95	79	119			

Sample Matrix Spike Duplicate

Type **MSD** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050228\05022813.D** Batch ID: **MS10W0228A** Analysis Date: **02/28/2005 11:33**

Sample ID: **05022430-02AMSD** Units : **µg/L** Run ID: **MSD_10_050228A** Prep Date: **02/28/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
1,1-Dichloroethene	44.4	2.5	50	0	89	65	127	44.6	0.4(17)	
Benzene	63.6	1.3	50	14.47	98	74	124	62.96	1.0(13)	
Trichloroethene	48.5	2.5	50	0	97	66	126	47.48	2.2(13)	
Toluene	38.8	1.3	50	0	78	76	119	38.82	0.2(13)	
Chlorobenzene	50.4	2.5	50	0	101	76	120	48.69	3.4(12)	
Ethylbenzene	43.2	1.3	50	0	86	77	124	42.75	1.0(13)	
m,p-Xylene	32.2	1.3	50	0	64	73	130	33.16	3.0(14)	M2
Xylene	33.9	1.3	50	0	68	74	131	34.2	0.8(13)	M2
Surr: 1,2-Dichloroethane-d4	47.5		50		95	76	127			
Surr: Toluene-d8	49.1		50		98	84	113			
Surr: 4-Bromofluorobenzene	47.6		50		95	79	119			

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

M2 = Matrix spike recovery was low, the method control sample recovery was acceptable.

Alpha Analytical, Inc.

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Date: *10-Mar-05*

QC Summary Report

Work Order: 05022430

Method Blank

Type **MBLK** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030106.D** Batch ID: **MS10W0301A** Analysis Date: **03/01/2005 09:21**

Sample ID: **MBLK MS10W0301A** Units : **µg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
Chloromethane	ND	2								
Vinyl chloride	ND	1								
Chloroethane	ND	1								
Bromomethane	ND	2								
Trichlorofluoromethane	ND	1								
Acetone	ND	10								
1,1-Dichloroethene	ND	1								
Tertiary Butyl Alcohol (TBA)	ND	10								
Dichloromethane	ND	2								
trans-1,2-Dichloroethene	ND	1								
Methyl tert-butyl ether (MTBE)	ND	0.5								
1,1-Dichloroethane	ND	1								
cis-1,2-Dichloroethene	ND	1								
Chloroform	ND	1								
1,2-Dichloroethane	ND	1								
1,1,1-Trichloroethane	ND	1								
Carbon tetrachloride	ND	1								
Benzene	ND	0.5								
1,2-Dichloropropane	ND	1								
Trichloroethene	ND	1								
Bromodichloromethane	ND	1								
cis-1,3-Dichloropropene	ND	1								
trans-1,3-Dichloropropene	ND	1								
1,1,2-Trichloroethane	ND	1								
Toluene	ND	0.5								
Dibromochloromethane	ND	1								
Tetrachloroethene	ND	1								
Chlorobenzene	ND	1								
Ethylbenzene	ND	0.5								
m,p-Xylene	ND	0.5								
Bromoform	ND	1								
o-Xylene	ND	0.5								
1,1,2,2-Tetrachloroethane	ND	1								
1,3-Dichlorobenzene	ND	1								
1,4-Dichlorobenzene	ND	1								
1,2-Dichlorobenzene	ND	1								
Surr: 1,2-Dichloroethane-d4	8.95		10		90	76	127			
Surr: Toluene-d8	9.9		10		99	84	113			
Surr: 4-Bromofluorobenzene	9.82		10		98	79	119			

Laboratory Control Spike

Type **LCS** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030104.D** Batch ID: **MS10W0301A** Analysis Date: **03/01/2005 08:39**

Sample ID: **LCS MS10W0301A** Units : **µg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
1,1-Dichloroethene	10.2	1	10		102	80	120			
Benzene	9.49	0.5	10		95	81	122			
Trichloroethene	10.4	1	10		104	74	125			
Toluene	9.61	0.5	10		96	80	120			
Chlorobenzene	10.7	1	10		107	79	124			
Ethylbenzene	10.3	0.5	10		103	80	120			
m,p-Xylene	9.82	0.5	10		98	80	129			
o-Xylene	9.59	0.5	10		96	80	129			
Surr: 1,2-Dichloroethane-d4	8.9		10		89	76	127			
Surr: Toluene-d8	10.3		10		103	84	113			
Surr: 4-Bromofluorobenzene	10.1		10		101	79	119			

Alpha Analytical, Inc.

255 Glendale Ave. • Suite 21 • Sparks, Nevada 89431-5778

(775) 355-1044 • (775) 355-0406 FAX • 1-800-283-1183

Date: *10-Mar-05*

QC Summary Report

Work Order: 05022430

Sample Matrix Spike

Type **MS** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030109.D** Batch ID: **MS10W0301A** Analysis Date: **03/01/2005 10:23**

Sample ID: **05022502-01AMS** Units : **µg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
1,1-Dichloroethene	44.9	2.5	50	1.1	88	65	127			
Benzene	44.9	1.3	50	0	90	74	125			
Trichloroethene	51.9	2.5	50	6.54	91	66	126			
Toluene	44.1	1.3	50	0	88	76	120			
Chlorobenzene	47.6	2.5	50	0	95	76	124			
Ethylbenzene	48.7	1.3	50	0	97	77	124			
m,p-Xylene	45.3	1.3	50	0	91	73	130			
o-Xylene	45.2	1.3	50	0	90	74	131			
Surr: 1,2-Dichloroethane-d4	44.4		50		89	76	127			
Surr: Toluene-d8	50		50		100	84	113			
Surr: 4-Bromofluorobenzene	51		50		102	79	119			

Sample Matrix Spike Duplicate

Type **MSD** Test Code: **EPA Method SW8260B**

File ID: **D:\HPCHEM\MS10\DATA\050301\05030110.D** Batch ID: **MS10W0301A** Analysis Date: **03/01/2005 10:44**

Sample ID: **05022502-01AMSD** Units : **µg/L** Run ID: **MSD_10_050301A** Prep Date: **03/01/2005**

Analyte	Result	PQL	SpkVal	SpkRefVal	%REC	LowLimit	HighLimit	RPDRefVal	%RPD(Limit)	Qual
1,1-Dichloroethene	46.5	2.5	50	1.1	91	65	127	44.85	3.7(17)	
Benzene	47.2	1.3	50	0	94	74	124	44.9	5.0(13)	
Trichloroethene	54.9	2.5	50	6.54	97	66	126	51.85	5.7(13)	
Toluene	46.6	1.3	50	0	93	76	119	44.07	5.5(13)	
Chlorobenzene	50.2	2.5	50	0	100	76	120	47.6	5.3(12)	
Ethylbenzene	50.7	1.3	50	0	101	77	124	48.73	3.9(13)	
m,p-Xylene	47.5	1.3	50	0	95	73	130	45.26	4.8(14)	
-Xylene	47.6	1.3	50	0	95	74	131	45.19	5.3(13)	
urr: 1,2-Dichloroethane-d4	44.8		50		90	76	127			
Surr: Toluene-d8	50.3		50		101	84	113			
Surr: 4-Bromofluorobenzene	50.7		50		101	79	119			

Comments:

Calculations are based off of raw (non-rounded) data. However, for reporting purposes, all QC data is rounded to three significant figures. Therefore, hand calculated values may differ slightly.

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 3
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention: Cindy Schreier
Prima Environmental
10265 Old Placerville Rd #15
Sacramento, CA 95827

Project: ENSR 762248
Method: EPA 300.0

Date Sampled: 01/13/05
Date Received: 01/13/05
Date Analyzed: 01/19/05

Client Sample I.D.	GW		Fenton's Control		1% Fenton's		3% Fenton's	
LAB. NO.	0501048-01		0501048-03		0501048-04		0501048-05	
ANALYTE	R/L	Results	R/L	Results	R/L	Results	R/L	Results
Chloride	2.5	310	1.0	140	1.0	140	2.5	280

QA/QC %RECOVERY		
	LCS	LCSD
Chloride	85	85

QA/QC Analyzed: 01/19/05

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.
R/L = Reporting Limit
Water samples reported in mg/L

Laboratory Representative

01/20/05
Date Reported

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DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. 2119)

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 3
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention: Cindy Schreier
Prima Environmental
10265 Old Placerville Rd #15
Sacramento, CA 95827

Project: ENSR 762248
Method: EPA 7199

Date Sampled: 01/13/05
Date Received: 01/13/05
Date Analyzed: 01/14/05

Client Sample I.D.	GW		Unt Soil		Fenton's Control		1% Fenton's		3% Fenton's	
LAB. NO.	0501048-01		0501048-02		0501048-03		0501048-04		0501048-05	
ANALYTE	R/L	Results	R/L	Results	R/L	Results	R/L	Results	R/L	Results
Chromium VI	1.0	ND	0.001	ND	1.0	ND	1.0	36	5.0	340

Soil QA/QC %RECOVERY		
	LCS	LCSD
Chromium VI	89	87

QA/QC Analyzed: 01/14/05

Water QA/QC %RECOVERY		
	LCS	LCSD
Chromium VI	95	91

QA/QC Analyzed: 01/14/05

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.
R/L = Reporting Limit
Water samples reported in µg/L
Soil samples reported in mg/kg

Laboratory Representative

01/20/05
Date Reported

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DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. 2119)

Excelchem
Environmental Labs

500 Giuseppe Court, Suite 3
Roseville, CA 95678
Ph: 916-773-3664 Fx: 916-773-4784

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Cindy Schreier

Phone #: 916-363-8798

Company/Address: PRIMA Env
10265 Old Placerville Rd #15
Sacramento CA 95827

Fax #:

Electronic Data Deliverables Request:

Email Address: 105007

Project Number/P.O#:

Project Name: ENSR 762248

Project Location:

Sampler Signature:

ANALYSIS REQUEST

Page 1 of 1

Bin# 43

Due Date: Jan. 20

Sample ID	Sampling Date	Sampling Time	Container VOA	Container SLEEVE	Container GLASS	Container PLASTIC	Container SUMMA/TEDLAR	Method Preserved HCl	Method Preserved HNO3	Method Preserved ICE	Method Preserved NONE	Matrix WATER	Matrix SOIL	Matrix AIR	BTEX/TPH as Gasoline (602/8020/8015)	TPH as Diesel (8015m)	TPH as Oil (8015m)	Total Oil & Grease (SM-18th 5520B)/1664	PCBs (8082)	Pesticides (608/8081A)	VOC Full list (8260B)	Methanol (8015M) Ethanol (8260)	MTBE (8020/8260B) circle method	5 Oxygenates (8260B)	Lead Scavengers DCA/EDB (8260B)	Tphg/BTEX/5 Oxygenates (8260B)	Semi VOC Full List (8270C)	CAM 17 Metals (Wet / Total)	Lead (Wet / Total)	Cd, Cr, Pb, Zn, Ni (CAM 5) (Wet / Total)	Nitrate, Nitrite, Ammonia, Kjeldahl	Chloride, Sulfate, Sulfide, ph, conductance	Cr(VI) - 7199			Requested TAT: 12hr/24hr/48hr/72hr/1wk	LAB USE ONLY:
GW	1/13/05	930				X					X	X																					X	X			X	0501048-01
Unt Soil		1500			X						X		X																					X			X	0501048-02
Fenton's Control		930				X					X	X																					X	X			X	0501048-03
1% Fenton's		930				X					X	X																					X	X			X	0501048-04
3% Fenton's		930				X					X	X																					X	X			X	0501048-05

Relinquished by:	Date	Time	Received by:
[signature]	1/13/05	16:05	
	1/13/05	16:05	S. Beale

Remarks/Condition of Sample:

Bill To:

Excelchem
Environmental Labs

500 Giuseppe Court, Suite 3
Roseville, CA 95678
Ph: 916-773-3664 Fx: 916-773-4784

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Prima Env. Cindy Schreier
Phone #: 916-363-8798
Company/Address: 10265 Old Placerville Rd Suite 15 Sacramento
Fax #: 916-363-8829
Project Number/P.O#:
Project Name: ENSR-762248
Project Location:
Sampler Signature:

Electronic Data Deliverables Request:
Email Address:
405067

ANALYSIS REQUEST

Page 1 of 1

Bin# H8
Due Date: 4/11/05

Sample ID	Sampling Date	Sampling Time	Container: VOA	SLEEVE	1L GLASS	PLASTIC	SUMMA/TEDLAR	Method Preserved: HCl	HNO3	ICE	NONE	Matrix: WATER	SOIL	AIR	BTEX/TPH as Gasoline (602/8020/8015)	TPH as Diesel (8015m)	TPH as Oil (8015m)	Total Oil & Grease (SM-18th 5520B)/1664	PCBs (8082)	Pesticides (608/8081A)	VOC Full list (8260B)	Methanol (8015M) Ethanol (8260)	MTBE (8020/8260B) circle method	5 Oxygenates (8260B)	Lead Scavengers DCA/EDB (8260B)	Tphg/BTEX/5 Oxygenates (8260B)	Semi VOC Full List (8270C)	CAM 17 Metals (Wet/Total)	Lead (Wet/Total)	Cd, Cr, Pb, Zn, Ni (CAM 5) (Wet/Total)	Nitrate, Nitrite, Ammonia, Kjeldahl	Chloride, Sulfate, Sulfide, ph, conductance	Iron (total) by ICP			Requested TAT: 12hr/24hr/48hr/72hr/1wk	LAB USE ONLY:
PCOC762248A-C	4-7-05	0900				X			X			X																		X			X				0504028-01
PCOC762248U-C						X			X			X																		X			X				0504028-02
PCOC762248C-C						X			X			X																		X			X				0504028-03

Relinquished by:	Date	Time	Received by:
Beth Brewer	4-8-05	1045	
Relinquished by:	Date	Time	Received by:
	4/8/05	1045	
Relinquished by:	Date	Time	Received by Laboratory:

Remarks/Condition of Sample: Rush - ASAP

Bill To:

EXCELCHEM
ENVIRONMENTAL LABS

300 Broadway Street
Eureka, CA 95501
Phone#: (707) 444-0120 Fax#: (707) 444-0560

ANALYSIS REPORT

Attention: Cindy Schreier
Prima Environmental
10265 Old Placerville Rd #15
Sacramento, CA 95827
Project: ENSR / 762248
Method: EPA 6010B

Date Sampled: 04/07/05
Date Received: 04/08/05
Date Analyzed: 04/08/05

Client Sample I.D.	PCOC762248 A-C		PCOC762248 U-C		PCOC762248 C-C	
LAB. NO.	0504028-01		0504028-02		0504028-03	
ANALYTE	R/L	Results	R/L	Results	R/L	Results
Cadmium	5.0	ND	5.0	ND	5.0	ND
Chromium	10	48	10	ND	10	32
Iron	20	82000	20	ND	20	32
Lead	10	11	10	ND	10	ND
Nickel	10	86	10	ND	10	ND
Zinc	20	32	20	ND	20	ND

QA/QC %RECOVERY				
	LCS	LCSD	MS	MSD
Cadmium	110	112	91	95
Chromium	112	115	90	96
Iron	113	115	91	97
Lead	111	114	93	100
Nickel	110	112	92	96
Zinc	110	109	89	95

QA/QC Anlayzed: 04/08/05

ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.
R/L = Reporting Limit
Water samples reported in µg/L

Laboratory Representative

04/08/05
Date Reported

Analyses completed at Excelchem Roseville facility. Please call 916.773.3664 with any questions.

EXCELCHEM ENVIRONMENTAL LABS IS CERTIFIED BY THE STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES AS A HAZARDOUS WASTE TESTING LABORATORY
(Certification No. 2119)

APPENDIX D

MPE Pilot Test Results

MPE Pilot Testing Results

FORMER UNOCAL BULK PLANT # 762248
359 Main Street.
FORTUNA, CALIFORNIA

Prepared for:

Union Oil Company of California
267 Tank Farm Road,
San Luis Obispo, California 93406

Prepared by:

ENSR Corporation
10411 Old Placerville Road, Suite 210
Sacramento, California 95827

April 2005
Project No. 06940-407-130

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Table 2B - Summary of Vacuum Enhanced Pilot Test at MW-1 - Steady State Extraction Well Data

Table 2C - Summary of Vacuum Enhanced Pilot Test at MW-1 - Monitoring Point Data

1.0 INTRODUCTION

The following letter report presents the results from a multi-phase extraction (MPE) pilot test performed at the former Unocal Bulk Plant # 762248 located at 359 Main Street, Fortuna, California (hereinafter referred to as the Site). This pilot test was performed in accordance with the procedures presented in a July 14, 2004 work plan entitled "Work Plan/Response to Corrective Action Plan Comments Former Unocal Bulk Plant No. 762248" that was submitted to the North Coast Water Board (NCWB) and approved on August 31, 2004.

MPE is an in-situ remedial technique that involves the extraction of soil vapor, groundwater, and light non-aqueous phase liquid (LNAPL), if present, simultaneously through the use of high vacuum pump or blower system. This technique is used to maximize extraction rates of both vapor and liquids, especially in soils of low permeability. If effective, MPE may rapidly remove petroleum impacted groundwater and LNAPL, if present, while exposing the impacted vadose and capillary fringe zone to airflow through dewatering, enhancing volatilization and natural biodegradation of residual contaminants. MPE is most effective in the remediation of relatively volatile hydrocarbon contaminants (e.g., gasoline) that are present in soils of lower permeability (e.g., silt).

In 1993 RESNA Industries, Inc. (RESNA) performed a limited vapor extraction and air sparging feasibility evaluation. The objectives of this evaluation were to demonstrate the feasibility of using hydraulic fracturing of soils to increase the permeability of vadose zone soils and enhance the ability of in-situ remedial approaches such as soil vapor extraction with (and without) air sparging to remove residual mass in a cost effective and time efficient manner. The 1993 RESNA evaluation involved the use of horizontal wells to collect and remove volatile organic compounds (VOCs) from the subsurface environment. The results from this 1993 study indicated that hydraulic fracturing of vadose zone soils was possible and did result in limited increases in radial influence and increased air flow. However, based on the results from the feasibility evaluation it was determined that even when hydraulic fracturing of the vadose zone soils was successfully implemented, the volume of air and concentrations of volatile organic contaminants being extracted from the subsurface soils was not sufficient enough to make soil vapor extraction (SVE) a viable remedial approach to addressing residual site contaminants. The 1993 RESNA feasibility evaluation did demonstrate that for short periods of time in-situ air sparging did result in significant increases in the concentrations of VOCs in soil vapor being extracted by the SVE system. However the duration of the increased VOC concentrations was short lived and the limited amount of vapors being extracted by the SVE system reduced any advantage gained by increasing the VOC concentrations in the soil vapor. ENSR evaluated the results from the 1993 RESNA feasibility evaluation and identified a number of potential issues/concerns associated with the RESNA work. Based on the identification of these questions and concerns, ENSR determined that a limited duration MPE pilot test was needed in order to determine the viability of this remedial approach for addressing impacts in the more permeable subsurface water bearing strata. The proposed MPE pilot test approach was presented in the July 14, 2004 work plan.

This report presents the results from a March 2005 MPE pilot test completed at this Site. The primary objective of this recent MPE pilot test was to demonstrate whether or not MPE could effectively address the contaminants present at the site. A second objective of this test was to provide the data necessary for properly designing and installing an MPE system in the event that the data obtained during this MPE pilot test indicated that MPE would be effective at addressing the residual contaminants. The determination of MPE's success or failure as a remedial approach at this site was based on the pilot systems ability to remove LNAPL (if encountered) at a rate equal to or greater than 0.5 gallons per day and to remove volatile contaminants in the form of soil vapors at a daily mass loading of 1 pound per day.

As presented in the July 2004 work plan, the main objective for implementing MPE at this Site would be to remove any residual LNAPL and impacted groundwater while treating impacted subsurface soils in suspected remaining source areas. Based on site-specific data collected to date, five on-site residual source areas have been identified. The five identified areas are:

1. the northeast corner of the Site (vicinity of well MW-4),

2. the downgradient edge of the former aboveground storage tank (AST) containment dike (vicinity of well MW-5),

3. vicinity of a former septic tank and cesspool (vicinity of well MW-18),

4. a former truck loading location (vicinity of well MW-1) and,

5. the general vicinity of well MW-20/MW-15.

Based on site-specific data collected to date these five locations represent on-site areas where significant residual petroleum hydrocarbon mass remains in the unsaturated and saturated soils. Removal of the residual petroleum hydrocarbon mass from these five suspected remaining source areas will be necessary if the impacts to groundwater need to be addressed.

2.0 CONCEPTUAL SITE MODEL

2.1 Site Geology

The Site is situated in the northern portion of the Eel River Valley. Subsurface geology in the area includes quarternary-aged non-marine terrace deposits composed of unconsolidated gravels, sand, silt and clay. Underlying the terrace deposits are sedimentary rock (siltstone, sandstone and shale) of the Carlotta Formation (1996 Pacific Environmental Group (PEG) report).

Soil types encountered beneath the Site during subsurface investigations conducted to date consist of interbedded silts and clays (i.e., clayey silt, silty clay, silt) from ground surface to approximately 12 feet bgs with pockets of fill in select areas from ground surface to approximately 5 feet bgs; that is underlain by lenses of sandy silts, silts with sand, silty sand and sands to approximately 20 feet bgs; that is underlain by a layer of silts and clays to a depth of approximately 32 feet bgs; which is subsequently underlain by sand to the maximum depth explored to date of approximately 40 feet bgs.

Variations to the above detail are present in the southwest portion of the Site near MW-18/SS-22, where silty sands and silt and clays are present from ground surface to approximately 20 feet bgs and near MW-19 where silt extends from the ground surface to the top of the bottom silt and clay layer at approximately 30 feet bgs.

2.2 Site Hydrogeology

The geology at the Site as described above indicates there are two confined water bearing zones at the Site, a shallow and a deep zone. The shallow zone is present at the uppermost silty sand/sand/sandy silty lenses located from approximately 12 to 20 feet bgs. The deep zone is present at the bottom sandy layer located from approximately 32 to 40 ft bgs. Both layers are confined by a silt and clay layer overlying each sandy layer. During the most recent groundwater monitoring and sampling event performed on February 8, 2005, depth to shallow groundwater ranged between 1 foot bgs in MW-7 and 9.28 feet bgs in MW-4 and flowed in a south/southwesterly direction at a gradient of 0.02 feet/foot. Depth to deep groundwater ranged between 19.56 feet bgs in MW-15 and 27.65 feet bgs in MW-16B and flowed in an east by northeast direction at an average gradient of 0.0021 feet/foot.

Historical data and recently obtained data on the Site indicates that the depth to shallow groundwater has ranged from approximately 3 to 14 feet bgs, has flowed in a south/southwest direction at an average gradient of 0.02 feet/foot and that the depth to deep groundwater has ranged from approximately 20 to 28 feet, has flowed in a northeast direction at an average gradient of 0.0019 feet/foot.

Based on previous reports, (RESNA 1992) slug testing data from ten on-site monitoring wells produced an average hydraulic conductivity of 1.3 feet per day or 4.6 X 10^{-4} centimeters per second (cm/sec). In addition, flex wall permeability testing of soil samples collected in the vadose zone resulted in permeability values ranging from 1.5 X 10^{-7} to 2 X 10^{-8} cm/sec. In ENSR's opinion, the permeability values obtained through analytical testing are most likely indicative of actual conditions when compared against the slug test results. Limited groundwater modeling was performed, resulting in an anticipated flow of 0.3 gallons per minute, which is consistent with earlier reports of the Site.

2.3 Extent of Impacted Soil and Groundwater

Gasoline and diesel-related constituents have impacted the soil and groundwater at the Site as a result of two documented releases in 1974 and 1978 and from suspected miscellaneous releases due to the use of the property as a bulk storage facility. The volume of gasoline released in 1974 was estimated at 1,000 gallons and was due to an overfill event. The volume of gasoline and/or diesel fuel released in 1978 and the other miscellaneous releases are not known. In 1990 petroleum hydrocarbon impacts were encountered in on-site soils and groundwater during site redevelopment activities.

Based upon soil and groundwater analytical results, the releases appear to have occurred on the ground surface and shallow subsurface due to historical operations and migrated with groundwater both laterally across the Site and vertically into the shallow zone. Soil and groundwater impacts appear to be fairly consistent with the former location of ASTs, pipelines, and loading/unloading areas throughout the Site. A major portion of the impacted surficial soils and select deeper areas were removed during 1997 and 2000 excavation activities. The majority of the remaining saturated soil and groundwater impacts appear to be associated with the former ASTs and associated piping in the northwest portion of the Site, in a select area (MW-18) in the vicinity of the former railroad spur located in the southwest portion of the Site, and in a select area (MW-20) on the southeast portion of the Site. Soil impacts extend to approximately 20 feet bgs in the sandy silt/sand layer.

Based on Site investigations, it appears that the petroleum migrated downward to the water table through channels in the silt/clay layer (i.e., gravel, root system or cracks). The mass of residual product has been sufficient for SPH to develop on the Site and potentially remain currently in the vicinity of MW-4.

While the water table is generally located 3 to 14 feet bgs, indicating it is predominantly located within the low permeability silt and clay layer, recent investigations demonstrate confining conditions in the shallow water bearing zone due to the presence of the upper silt/clay layer across the Site. This indicates that the water table is present within the more permeable layers and the observed water levels of the monitoring wells are piezometric head. Any potential remaining LNAPL and elevated contaminant concentrations are mainly present in the more permeable sandy silty/sand layers and somewhat embedded into the bottom of the upper clay layer resulting from fluctuations in the water

table. Any location where LNAPL is present or elevated soil quality concentrations were detected should be considered a potential residual source area.

3.0 MPE PILOT TEST PROCEDURES

3.1 Extraction and Monitoring Point Installation

From December 20 through December 22, 2004, a geologist from ENSR observed Woodward Drilling Company of Rio Vista, California advance soil borings SB-1 through SB-7 and MW-16A, MW-16B, and MW-17 through MW-21. Soil borings MW-16A, MW-16B, and MW-17 through MW-21 were completed as monitoring wells. Borings were advanced to depths ranging from 20 to 40 feet bgs. Based on the results from these soil borings and the historic site-specific soil and groundwater contamination information it was determined that a limited duration MPE pilot test would be performed on each of the suspected on-site aquifers. Existing monitoring well MW-4 was selected as the location where the MPE test would be performed to determine whether or not MPE could effectively address residual contamination in the shallow aquifer. MW-4 was a logical choice for testing of the shallow aquifer due to the location (within the footprint of the former AST pad), the depth and screened interval (6 to 26 feet bgs), and the presence of adjacent existing monitoring points (MW-16A and MW-16B).

In order to collect sufficient data and information regarding the propagation of vacuum and development of airflow within the shallow aquifer and associated soils, three shallow vapor monitoring points (designated PZ-6, PZ-7 and PZ-8) were installed in the vicinity of MW-4. These three vapor monitoring points were installed in the immediate vicinity of MW-4 and MW-16B to provide additional vacuum and air flow measurement points to be utilized during the MPE pilot test. A total of eight temporary vapor monitoring points were installed with a hollow stem auger rig and completed with a 1-inch diameter temporary polyvinyl chloride (PVC) well riser and well screen. Each of these temporary monitoring points was installed to a maximum depth of 10 feet below grade and completed with a five foot long 10-slot screen installed from 5 to 10 feet below grade. For the pilot test, the vapor monitoring points were modified with a 1-inch PVC cap fitted with a miniature ball valve enabling it to be monitored for vacuum and concentrations of oxygen, methane, and volatile gases.

Well MW-1 was selected as the extraction well for the portion of the MPE pilot test designed to evaluate the deeper aquifer. This location was selected based on the screened interval within the well (MW-1 screened from 20 to 39 feet bgs), the historic presence of LNAPL in the well and on-going presence of elevated concentrations of dissolved phase contamination in the well, and the proximity to other existing wells screened at depths which would allow them to be used as vacuum and airflow monitoring points (MW-13 and MW-21). Five vapor monitoring points (designated PZ-1, 2, 3, 4 and 5) were installed in the immediate vicinity of well MW-1. These vapor monitoring points were installed to aid in the evaluation of vacuum and air flow influences in the shallower soil/groundwater. The existing wells MW-13 and 21 were utilized to evaluate radial vacuum influences from the extraction well and allow for the identification of air flow from any of the areas being influenced by the MPE pilot scale system.

3.2 MPE Pilot Testing Equipment

Pilot testing equipment consisted of the following:

- A 300-cubic foot per minute (CFM) liquid ring pump valved for variable vacuum/flow control for vapor extraction;
- A propane-powered thermal oxidizer for treatment of extracted vapors;
- One (per extraction well) air driven QED Environmental AP-4TL (top loading) bladder pumps;
- A 300-gallon tank for collection of liquid removed from EX-1 and separation of any LNAPL recovered from the well; and
- Miscellaneous gages and monitoring equipment for measuring applied vacuum, induced air flow, water flow, and vacuum influence.

3.3 Pilot Test Procedures

3.3.1 Pilot Testing Planned Procedure

In accordance with the approved work plan, the MPE pilot test was conducted in the following three steps:

- Zero Vacuum Drawdown Test – This test was to be run for a minimum of up to four hours and was designed to determine the maximum groundwater extraction rate under ambient conditions. Prior to the start of the zero vacuum tests, baseline data was collected which consisted of groundwater table elevation in the extraction well and surrounding piezometers, vapor concentrations in the piezometers, and vacuum measurements.
- Vacuum Step Test – Once the zero vacuum tests was completed, a step test consisting of applying a series of increasing vacuums to the extraction well was completed. During the step test, measurements of vacuum, depth to water, and headspace vapor concentration were obtained from the extraction well and surrounding monitoring points.
- Constant Rate Test – Based on the results from the step test, a vacuum was selected at which a significant contaminant vapor flow (concentration of contaminant and flow rate) with a maximized radius of vacuum influence could be obtained. A four-hour steady state test was run at this vacuum. The objective of this constant rate test was to determine the maximum

vapor flow and contaminant mass removal per unit time that could be achieved by the MPE system given the subsurface conditions.

4.0 MPE PILOT TESTING ACTIVITIES

4.1 Baseline Monitoring

Prior to initiation of the pilot test, baseline monitoring of subsurface conditions was performed and the integrity of all systems and connections was confirmed via inspection and testing. Baseline conditions for VOC's, oxygen, methane, and vacuum/pressure were obtained from wells MW-1, MW-4, MW-13, MW-21, PZ-1, PZ-2, PZ-3, PZ-4, and PZ-5 on March 7, 2005. Baseline readings for carbon dioxide (CO_2) were not obtained due to a CO_2 detector not calibrating properly and not zeroing.

4.2 Zero Vacuum Drawdown Test

The first stage of the pilot test was a zero-vacuum (drawdown/skimmer) test designed to evaluate LNAPL and groundwater recovery from each of the extraction wells, MW-4 and MW-1, in the absence of vacuum. These tests were performed utilizing an air driven submersible bladder pumps installed in each well. Based on the construction (total depth of each well, screened interval of each extraction well and the zone of impact being evaluated during each respective MPE pilot test), the extraction pumps installed in each well were installed so that the pump intake would be set at the maximum estimated depth of impacted soils within the respective aquifer. The intake for the pump installed in well MW-4 was set at a depth of approximately 14 feet bgs. Prior to the start of the zero vacuum drawdown tests, the static water table in well MW-4 was at 8.7 feet bgs. The pump intake in well MW-1 was set at 34 feet bgs. The static water table prior to the start of the zero vacuum drawdown tests in well MW-1 was 23.06 feet bgs.

The zero vacuum drawdown tests in well MW-4 were performed on March 8, 2005 and on March 9, 2005 at well MW-1. Continuous monitoring during the zero-vacuum test provided information regarding groundwater recharge and recovery rates for both the shallow and deeper aquifers on-site. Although no LNAPL was recovered or detected in the extraction wells or the surrounding monitoring points during the zero vacuum drawdown tests, a sheen and heavy odors were detected in MW-4.

4.3 Vacuum Step Test

The vacuum step test followed the zero vacuum drawdown test at each extraction well and was performed in order to obtain the information necessary to determine what effect increasing an applied vacuum would have on the rate of groundwater and LNAPL recovery and to evaluate the relationship between applied vacuum and induced air flow from the formation. The results from the step test performed at each extraction well was used to determine the optimum applied vacuum (i.e., the applied vacuum at which the greatest volume of extracted vapors and recovered LNAPL would be obtained) for the constant rate test to be performed at each extraction well.

The vacuum step test was designed to be performed at wellhead vacuums of approximately 3 inches of mercury (in-Hg), 5 in-Hg, 7.5 in-Hg, 10 in-Hg, and 13 in-Hg.

During operation of the vacuum step tests at each extraction well, ENSR monitored the following parameters as frequently as time and system operational activities allowed: vacuum at the extraction wellhead and surrounding wells and piezometers, VOC concentrations in the surrounding wellheads and piezometers and in the extracted vapor stream, depth to water in the surrounding wells and piezometers, presence and thickness of LNAPL in the surrounding wells and piezometers, and groundwater extraction rate from each respective extraction well. Based on the stratiographic information obtained from the vapor monitoring points and the lack of air flow and vacuum data obtained from these points, it appears that the presence of silts and clays within the upper 10 to 20 feet across the Site prevents any measurable air flow and propagation of vacuum.

4.4 Constant Rate Test

The constant rate test followed the vacuum step test in each extraction well and was designed to obtain aquifer specific information to be used to select the optimum vacuum for the respective formation that when applied would result in the optimum air flow and vacuum influence for each respective formation. The results from each constant rate test were evaluated to determine an optimum vacuum rate for the entire Site.

Throughout each of the constant rate tests, the groundwater table in each extraction well was maintained at the respective extraction pump intake.

5.0 MPE PILOT TEST RESULTS

5.1 Baseline Conditions

Baseline data collected prior to the start of the MPE pilot test indicated the average depth to water across the MW-4 test area ranged from 8.7 to 9.17 feet bgs. Oxygen measurements obtained from the various monitoring points ranged from 17.6 (monitoring point PZ-7) to 20.9 percent (monitoring points PZ-6 and PZ-8). Methane was observed to be zero in all of the monitoring points. Baseline data collected from the MW-1 extraction well test area indicated that the depth to water ranged from 5 (PZ-5) to 6.85 feet bgs (monitoring point MW-21) while the static water table elevation in well MW-1 was 23.05 feet bgs. The static water table elevation recorded in well MW-16B (screened from 30 to 40 feet bgs) was 27.3 feet bgs. This elevation was considered more representative of the actual water table elevation in the deeper aquifer. Oxygen and methane readings obtained from the various shallow monitoring points (PZ-1 through PZ-5 and MW-13 and MW-21) were not considered representative of the actual conditions within the deeper aquifer. The results obtained from well MW-16B; oxygen level of 19.1 and methane concentration of 0 percent, along with the results from well MW-1 were considered representative of the deeper aquifer conditions.

Neither NAPL nor sheens were identified in any of the monitoring points checked as part of the data collection efforts completed as part of the baseline conditions evaluation. The results from the baseline data collection efforts indicated that reduced oxygen levels were present in both impacted aquifers while it did not appear that any measurable quantities of gases were being generated by any on-going indigenous bioremediation of residual petroleum hydrocarbons.

5.2 Results from Zero Vacuum Drawdown Test

Based on the data obtained from the zero vacuum test, a sustained rate of groundwater extraction/recharge from well MW-4 of approximately 0.40-0.48 gallons per minute (gpm) resulted in an apparent drawdown of five feet within the extraction well. A sustained groundwater extraction rate of approximately 0.84 gpm was obtained from well MW-1 with an apparent drawdown of 11 feet within the extraction well. No LNAPL was detected in any of the wells/monitoring points nor was any LNAPL recovered in the collection tank. The lack of LNAPL in the extraction wells at the beginning and end of the two zero vacuum drawdown tests indicates that under zero-vacuum conditions and with the existing groundwater table conditions/elevations, the amount of LNAPL present in the surrounding suspected source areas may not be sufficient enough to allow for horizontal movement of the residual LNAPL through the saturated soils into void spaces such as monitoring wells.

5.3 Results from Vacuum Step Test

The results of the vacuum step tests performed at each of the extraction wells indicated that minimum air flow was obtained from either formation at the applied vacuums. Significant increases in groundwater extraction rates were obtained at the higher vacuums in both formations. Minimum radial influence was seen in either formation at the applied vacuums. The specific results obtained from the step tests performed at each extraction well are presented below.

Step test results from extraction well MW-4 (shallow aquifer) were:

- 3 in-Hg applied vacuum yielded approximately 1 SCFM of soil vapor extraction, with no measurable vacuum influence in the surrounding monitoring points. The groundwater extraction rate increased from 0.48 gpm to 1.1 gpm at this vacuum. Concentrations of VOCs measured in the influent vapor stream to the MPE system reached 75 parts per million (ppm).

- 5 in-Hg applied vacuum yielded approximately 1.1 SCFM of soil vapor extraction, and the groundwater extraction rate did not increase beyond the 1.1 gpm which was achieved with the 3 in-Hg vacuum. A slight vacuum influence (0.9 inches water) was measured in well MW-16A at this applied vacuum while MW-4 had 23.3 inches of water. VOC concentrations measured on the influent vapor stream to the MPE system reached 110 ppm.

- 10 in-Hg applied vacuum yielded approximately 1.4 SCFM of soil vapor. The groundwater extraction rate increased slightly again to approximately 1.5 gpm, and vacuum influence (0.9 inches of water) was observed in monitoring point MW-16A. Influent vapor VOC concentrations reached 230 ppm.

- 11 in-Hg applied vacuum yielded a slight decrease in vapor flow to a flow rate of approximately 1.3 SCFM. The groundwater extraction rate from well MW-4 remained at 1.5 gpm. VOC influent concentrations to the MPE system were measured at approximately 300 ppm with a one time spike of 775 ppm. No change in the radius of vacuum influence was observed.

- 13.5 in-Hg applied vacuum yielded a slight decrease from the previously measured flow rate. A rate of 1.3 SCFM was measured at this applied vacuum. No change in the radial influence was observed at this applied vacuum, but the groundwater extraction rate from MW-4 increased slightly and was observed at a range of 1.8 to 2 gpm. The VOC concentration of the vapor stream from the extraction well was measured at 348 ppm.

Step test results from extraction well MW-1(deeper aquifer) were:

- 3 in-Hg applied vacuum yielded approximately 0.5 to 0.75 SCFM of soil vapor extraction, with no measurable vacuum influence in the surrounding monitoring points. The groundwater

extraction rate increased from 0.8 gpm to approximately 1.3 gpm at this vacuum. Concentrations of VOCs measured in the influent vapor stream to the MPE system reached 8.3 ppm.

- 5 in-Hg applied vacuum yielded approximately 0.49 SCFM of soil vapor extraction; a slight decrease from the airflow achieved with an applied vacuum of 3 in-Hg. The groundwater extraction rate increased slightly to approximately 1.42 gpm. A slight vacuum influence (0.1 inches of water) was briefly observed in well MW-21, located approximately 19.6 feet from MW-1. VOC concentrations measured on the influent vapor stream to the MPE system were negligible with a maximum reading of 6.8 ppm.

- 7.5 in-Hg applied vacuum did not result in a change in the air flow from the extraction well from that achieved with the 5 in-Hg applied vacuum. No measurable change in the groundwater extraction rate or radial extent of vacuum influence was noted from the values recorded at the 5 in-Hg applied vacuum. Influent VOC concentrations to the MPE system reached a maximum recorded value of 7.0 ppm.

- 10.5 in-Hg applied vacuum resulted in a very slight increase in air flow from the extraction well. The recorded air flow from the well reached 0.65 SCFM. The groundwater extraction rate increased to 1.68 gpm. No significant increase in the VOC concentrations in the vapor influent to the MPE system was recorded. A maximum VOC concentration of 6 ppm was recorded at this applied vacuum.

- 13 in-Hg applied vacuum resulted in a maximum recorded vapor flow rate of 0.86 SCFM. The groundwater extraction rate increased to a recorded maximum rate of 1.9 gpm. No vacuum influence was observed in any of the monitoring points at this applied vacuum. The maximum recorded VOC concentration in the influent vapor stream to the MPE system reached 6.2 ppm.

Based on the results from the two step tests, it appeared that the maximum air flow and mass removal rate are achieved at applied vacuums between 7.5 and 10 in-Hg. In addition, with the drawdown of the groundwater table at approximately 11 feet in well MW-1, no significant groundwater depression was observed in well MW-13, which is located approximately 6.5 feet away and screened above MW-1 in a sand and clayey sand strata. The majority of the screen in MW-1 was exposed for air/vapor flow, however, no significant air flow or mass removal was achieved at any of the applied vacuums. Based on the results from the step test at well MW-1 (deeper aquifer), it appeared that MPE is not an effective means to remove contaminant mass and stimulate biological degradation activity by increasing airflow/oxygen in the subsurface within the deeper impacted aquifer areas on-site.

5.4 Results from Constant Rate Test

A constant rate test was performed at extraction well MW-4 at an applied vacuum of approximately 10 in-Hg for three hours and at an applied vacuum of 11 in-Hg for an additional two hours. The results from this test are summarized below.

- 10 in-Hg applied vacuum yielded approximately 0.6 to 1.7 SCFM of soil vapor extraction. The constant rate test was run after the formation had been undergoing dewatering for an additional 24 hours, yet no significant increase in the vapor extraction rate was observed during this test.

- The groundwater elevations in the surrounding monitoring points were observed to not drop a measurable amount, indicating that with a sustained drawdown of up to eight feet in the extraction well, no significant groundwater depression is experienced in the surrounding formation.

- The groundwater extraction/recharge rate at the extraction well with 10 in-Hg applied vacuum was approximately 1.9 gpm. LNAPL was not observed to flow into the recovery well at any point during the constant rate test however, a sheen was observed on the liquid recovered from the extraction well and collected in the collection tank.

- Influent vapor VOC concentrations to the MPE system ranged from 212 to 370 ppm.

- 11 in-Hg applied vacuum yielded 0.76 to 1.08 SCFM of soil vapor extraction from well MW-4. No measurable change in the groundwater extraction, radial groundwater depression, or vacuum influence was noted from the results achieved at an applied vacuum of 10 in-Hg. Influent vapor VOC concentrations remained in the same range as those measured at an applied vacuum of 10 in-Hg.

Since groundwater depression and vacuum influence at small (6 to 10 feet) distances from the extraction well were not observed, and the vapor flow from the extraction well was minimal, the use of MPE is not recommended to address residual contamination present in the shallow soils and groundwater.

A constant rate extraction rate test was performed on the deeper soils and groundwater by applying a constant vacuum of 10 in-Hg to MW-1 for a period of 1.5 hours. The results from this test are summarized below.

- 10 in-Hg applied vacuum yielded approximately 0.63 to 0.77 SCFM of soil vapor extraction. Although the constant rate test was run after the formation had been undergoing dewatering

for an additional 24 hours, no significant increase in the vapor flow rate was observed during this constant rate test when compared to the step test results.

- The groundwater elevations in the surrounding monitoring points were observed to not drop in a measurable amount, indicating that with a sustained drawdown of up to 11 feet in the extraction well, no significant groundwater depression is experienced in the surrounding formation.

- A slight vacuum influence (0.1 inches of water) was observed in monitoring point MW-21, which is located at a distance of approximately 19.5 feet from the extraction well. This slight vacuum measurement indicates that a radial influence can be exerted at higher vacuums in the deeper aquifer/soil formation at a distance of at least 15 feet from the extraction well. However, it should be noted that with this radial influence, no significant VOC concentrations were detected in the vapor flow being removed from the subsurface.

- The groundwater extraction/recharge rate at the extraction well with 10 in-Hg applied vacuum was approximately 0.6 to 0.7 gpm. LNAPL was not observed to flow into the recovery well at any point during the constant rate test. No visual evidence of petroleum impacted groundwater was observed during the constant rate test performed at MW-1.

- Influent vapor VOC concentrations to the MPE system ranged from 7.4 to 10.6 ppm. No significant mass was removed via the vapor phase during this constant rate test. However, analytical results from groundwater samples obtained from MW-1 indicate that significant concentrations of dissolved phase VOCs exist within the general vicinity of MW-1. Thus, it would appear the introduction of air flow through the impacted soils in the deeper aquifer is not a viable means to remove the residual mass present in the deeper saturated soils.

Pilot testing data is presented in **Tables 1A, 1B, 1C,** and **1D** for MW-4 and in **Tables 2A, 2B,** and **2C** for MW-1.

6.0 CONCLUSIONS

The following conclusions can be drawn from the multi phase extraction pilot test:

- Soil vapor extraction at the applied vacuums utilized during this pilot test did not appear to be sufficient to warrant the use of MPE as a method for rapid VOC removal from the subsurface soils within either impacted strata. The maximum induced flow rate of 1.7 SCFM during the testing period in the shallower soils is lower than what is typically viewed as efficient (15 to 30 SCFM) per point for soil mass removal rates in SVE applications. The soil vapor VOC measurements taken during the performance of the pilot test in well MW-4 do indicate that some VOC removal via soil vapor extraction appeared to be occurring. However, given the very low vapor extraction rates and the VOC readings recorded during the test; the size, complexity, and operational duration that would be required for an MPE system to address the residual contamination present within the shallow soils and groundwater would likely make utilization of this remedial technology at this Site cost prohibitive.

- No significant vapor flow was realized at the higher applied vacuum from the deeper soils/aquifer. Moreover, the lack of contaminant mass in the extracted vapors indicates that the removal of residual mass in this strata via vapor flow is likely not be feasible regardless of the presence of the higher permeability sandy soils and lower permeability impacted silts and clays.

- Based on the presence of two impacted zones and the lack of evidence of vapor/groundwater connection between the two impacted zones, implementation of MPE at this Site to address the two zones would require two separate sets of extraction wells (one set per impacted zones), which, given an estimated radial influence of 15 feet,, would require up to 60 extraction wells per zone. This number of wells and the required complexity of an MPE system to address both zones would make this approach cost prohibitive for achieving closure at this Site.

Based on the results from this MPE pilot test and the 1993 limited SVE and air sparging test performed by RESNA, it does not appear that MPE is a cost effective means for removing residual contaminant mass nor achieving closure at this Site.

Table 1A - Summary of Vacuum Enhanced Pilot Test at MW-4 - Step Test Extraction Well Data
Fortuna 762248
359 Main Street
Fortuna , CA
MW-4 Screened: 6-26'

Time	Vacuum (" Hg)	Flow (scfm)	Air Effluent (ppmv)	Air Influent (ppmv)	Water Flow (gpm)
1101	3.5	2.20	NM	75	1.10
1115	3.0	1.00	NM	71	NM
1130	5.0	1.11	NM	110	1.09
1238	5.5	1.80	NM	NM	NM
1300	10.0	10.50*	7	271	1.65
1400	10.0	1.40	8	230	1.50
1410	11.0	1.10	8	294	1.50
1435	11.0	1.18	7	300	1.50
1445	11.0	1.40	7	775	1.50
1525	13.5	1.30	0	348	1.89
1540	13.5	1.00	0	305	2.00
1605	14.0	1.00	0	330	1.82

Notes:

VAC - vacuum applied to interstitial space of extraction well
"Hg - inches of mercury
Air Effluent - soil vapor sample measured after vapor abatement with a PID to read total VOC as isobutylene.
ppm_v -parts per million per unit volume
Air Influent - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutylene.
Water Flow - rate of water extracted from the extraction well in gallons per minute (gpm)
SCFM - standard cubic feet per minute
NM - not monitored
***** - Measurement was collected while bladder pump was discharging and is likely not accurate.

Table 1B - Summary of Vacuum Enhanced Pilot Test at MW-4 - Step Test Monitoring Point Data

Fortuna 762248
359 Main Street
Fortuna, CA
3/7-8/2005
MW-4: Screened 5-25'

Time	Elapsed Time (min)	P8 Screened: 5-10' Distance to MW-4 :12.46 ft						P6 Screened: 5-10' Distance to MW-4 : 5.96 ft						P7 Screened 5-10' Distance to MW-4 : 7.08 ft					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
1235	0	0	NM	NM	NM	9.15	NM	0	NM	NM	NM	6.25	0.00	0	NM	NM	NM	9.17	0.00
0903	0	0	NM	NM	NM	9.15	0.00	0	NM	NM	NM	6.25	0.00	0	NM	NM	NM	9.15	0.02
1000	57	0	0	19.1	0	9.11	0.04	0	0	19.3	0	6.22	0.03	0	15.8	17.1	0	9.19	-0.02
1040	97	0	0	21.3	0	9.18	-0.03	0	0	21.2	0	6.23	0.02	0	0	21.3	0	9.16	0.01
1120	137	0	0	22.1	1	9.14	0.01	0	0	21.8	0	6.24	0.01	0	0	22.0	0	9.13	0.04
1200	177	0	0	22.1	0	9.15	0.00	0	0	21.4	0	6.26	-0.01	0	0	22.0	0	9.15	0.02
1230	207	0.01	0	20.6	0	9.13	0.02	0	0	21.3	0	6.25	0.00	0	0	17.2	0	9.17	0.00
1320	257	0	23.2	22.2	0	9.12	0.03	0	6.3	21.9	0	6.27	-0.02	0	14.5	22.1	0	9.20	-0.03
1400	297	0	2.6	21.4	0	9.13	0.02	0	0	22.0	0	6.25	0.00	0	0	22.0	0	9.19	-0.02
1425	322	0	0	22.0	0	9.11	0.04	0	0	22.1	0	6.24	0.01	0	0	22.0	0	9.19	-0.02
1455	352	0	1.6	22.3	0	9.11	0.04	0	0	22.3	0	6.24	0.01	0.03	0	22.3	0	9.18	-0.01
1520	377	0	0.6	20.9	0	9.13	0.02	0	1.0	20.9	0	6.26	-0.01	0	0.6	20.9	0	9.15	0.02
1541	398	0	0.3	20.9	0	9.13	0.02	0	0.8	20.9	0	6.24	0.01	0	0.3	20.9	0	9.18	-0.01
1610	427	0	0.2	20.9	0	9.14	0.01	0	0	20.9	0	6.27	-0.02	0	2.3	20.9	0	9.18	-0.01

Notes: **Elapsed Time** - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-4 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutylene.
O_2 - Oxygen reported in ppm_v.
CH_4 - Methane reported in ppm_v.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
NM - not measured

Table 1B - Summary of Vacuum Enhanced Pilot Test at MW-4 - Step Test Monitoring Point Data

Fortuna 762248
359 Main Street
Fortuna, CA
3/7-8/2005
MW-4: Screened 6-26'

Time	Elapsed Time (min)	MW-16A Screened: 5-20' Distance to MW-4 : 23.25 ft						MW-16B Screened: 30-40' Distance to MW-4 : 4.58 ft					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	: (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
1235	0	0	NM	NM	NM	8.89	-	0	NM	NM	NM	27.30	0.00
0903	0	0	NM	NM	NM	9.87	-0.98	0	NM	NM	NM	27.45	-0.15
1000	57	0.1	64.2	17.5	0	9.79	-0.90	0	16.4	19.1	0	27.45	-0.15
1040	97	0.01	74.5	20.3	0	9.83	-0.94	0	5.1	21.2	0	27.44	-0.14
1120	137	0.15	0.0	21.2	0	10.09	-1.20	0	0.5	21.7	0	27.43	-0.13
1200	177	0.9	14.8	21.4	0	NM		0	7.5	21.8	0	27.42	-0.12
1230	207	0.25	0.0	21.4	0	10.50	-1.61	0	0	21.4	0	27.42	-0.12
1320	257	4.08	4.9	21.8	0	11.00	-2.11	0	17.2	21.9	0	27.41	-0.11
1400	297	0.84	2.5	21.8	0	11.36	-2.47	0	2.8	22.0	0	27.40	-0.10
1425	322	0.9	0.0	22.1	0	11.54	-2.65	0	0	22.1	0	27.39	-0.09
1455	352	0.1	0.0	22.3	0	11.71	-2.82	0	0	22.4	0	27.23	0.07
1520	377	0.524	9.0	20.9	0	11.76	-2.87	0	3.4	20.9	0	27.40	-0.10
1541	398	0.472	8.3	20.9	0	12.08	-3.19	0	2.5	20.9	0	27.42	-0.12
1610	427	0.125	5.7	20.9	0	12.22	-3.33	0	2.7	20.9	0	27.40	-0.10

Notes: **Elapsed Time** - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-4 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutylene.
O_2 - Oxygen reported in ppm_v.
CH_4 - Methane reported in ppm_v.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
NM - not measured

Table 1C - Summary of Vacuum Enhanced Pilot Test at MW-4 - Steady State Extraction Well Data

Fortuna 762248
359 Main Street
Fortuna, CA
3/9/05

Time	Elapsed Time (min)	System Parameters					Off-Gas Treatment	
		VAC (" Hg)	Velocity (fpm)	Air Flow (scfm - calculated)	Water Flow (gpm)	Totalizer (Total Gal)	Influent (ppm_v)	Effluent (ppm_v)
1055	0	0.00	NM	0.00	NM	1,641	0.7	0.0
1132	0	10.00	43	1.12	NM	NM	241	1.8
1150	45	10.00	NM	1.25	NM	1,732	230	4.0
1200	70	10.50	40	0.60	0.60	1,762	500	0.8
1225	95	10.50	40	0.77	1.80	1,807	397	0.7
1300	160	10.25	50	0.78	NM	NM	404	0.7
1335	180	10.25	38	0.86	NM	1,955	370	0.0
1350	205	10.00	60	1.45	2.07	1,986	212	0.0
1415	230	10.00	74	1.70	0.75	2,035	NM	0.0
1430	250	10.00	40	0.87	2.20	2,068	348	0.0
1455	270	11.00	43	0.90	2.40	2,128	336	0.0
1535	295	11.00	40	0.76	1.18	2,222	328	0.0
1555	310	11.00	49	1.04	1.60	2,254	157	0.0
1620	335	11.25	44	0.87	0.62	2,294	130	0.0
1640	350	11.00	52	1.08	2.55	2,345	448	0.0

Notes: **Elapsed Time** - time from beginning of pilot test in minutes (min)
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
"Hg - inches of mercury
VAC - vacuum applied to interstitial space of extraction well
Velocity - air velocity in feet per minute (fpm).
scfm - standard cubic feet per minute
Water Flow - flow rate of water extracted from the extraction well in gallons per minute (gpm)
Totalizer - amount of water extracted from well in gallons (gal).
Influent - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutylene.
ppm_v - parts per million per unit volume
Effluent - soil vapor sample measured after vapor abatement with a PID to read total VOC as isobutylene.
NM - not monitored

Table 1D - Summary of Vacuum Enhanced Pilot Test at MW-4 - Steady State Monitoring Point Data

Fortuna 762248
359 Main Street
Fortuna , CA
3/9/05
MW-4: Screened 6-26'

Time	Elapsed Time (min)	P8 Screened: 5-10' Distance to MW-4 :12.46 ft						P6 Screened: 5-10' Distance to MW-4 : 5.96 ft						P7 Screened: 5-10' Distance to MW-4 : 7.08 ft					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
0835	0	NM	NM	NM	NM	9.14	NM	NM	NM	NM	NM	8.27	0.00	-0.3	NM	NM	NM	9.22	0.00
1050	0	-0.1	0.4	20.9	0	9.11	0.03	-0.44	11.1	20.9	0	8.34	-0.07	-0.30	5.5	19.6	0	9.22	0.00
1135	45	0	1.4	20.9	0	9.12	0.02	-0.02	7.4	20.9	0	8.27	0.00	-0.03	4.4	20.3	0	9.22	0.00
1200	70	-0.04	1.2	20.5	0	9.11	0.03	-0.05	11.9	20.9	0	8.27	0.00	-0.30	4.1	20.1	0	9.21	0.01
1225	95	-0.01	1.1	20.3	0	9.10	0.04	0	8.0	20.9	0	8.24	0.03	-0.10	4.0	19.9	0	9.21	0.01
1330	160	0	0.5	20.5	0	9.09	0.05	-0.04	6.7	20.9	0	8.23	0.04	-0.12	2.4	20.1	0	9.21	0.01
1350	180	0	0	20.6	0	9.09	0.05	0	4.0	20.9	0	8.22	0.05	-0.10	1.0	20.5	0	9.21	0.01
1415	205	0	0	20.5	0	9.08	0.06	0	5.2	20.6	0	8.24	0.03	0.54	3.0	19.8	0	9.21	0.01
1440	230	0	0	20.6	0	9.08	0.06	0	5.0	20.7	0	8.24	0.03	-0.21	2.4	20.0	0	9.21	0.01
1500	250	0	0	20.4	0	9.08	0.06	0	5.4	20.6	0	8.23	0.04	-0.21	1.3	20.6	0	9.21	0.01
1520	270	0	0	20.9	0	9.08	0.06	0	0.7	20.9	0	8.23	0.04	-0.21	0.0	20.9	0	9.21	0.01
1545	295	0	0	20.9	0	9.09	0.05	0	0	20.9	0	8.22	0.05	0.00	0.0	20.9	0	9.22	0.00
1600	310	0	0	20.9	0	9.09	0.05	0	0	20.9	0	8.22	0.05	0.00	0.0	20.9	0	9.22	0.00
1625	335	0	0	20.9	0	9.09	0.05	-0.02	0	20.9	0	8.21	0.06	0.03	0.6	20.7	0	9.22	0.00
1640	350	0	0	20.9	0	9.09	0.05	0	0	20.9	0	8.21	0.06	0.05	1.6	20.2	0	9.22	0.00

Notes: **Elapsed Time** - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-4 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutylene.
O_2 - Oxygen reported in ppm_v.
CH_4 - Methane reported in ppm_v.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
DTP - depth to product
NM - not measured

Table 1D - MW-4 Steady State Test - Monitoring Point Data

Fortuna 762248
359 Main Street
Fortuna , CA
3/9/05
MW-4: Screened 6-26'

Time	Elapsed Time (min)	MW-16A Screened: 5-20' Distance to MW-4 : 23.25 ft						MW-16B Screened: 30-40' Distance to MW-4 :					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
0835	0	NM	NM	NM	NM	10.39	0.00	NM	NM	NM	NM	27.52	0.00
1050	0	-0.05	172.0	17.6	10.0	10.41	-0.02	-0.01	10.1	20.9	0	27.85	-0.33
1135	45	2.39	75.2	19.6	0	10.73	-0.34	-0.01	8.6	20.9	0	27.83	-0.31
1200	70	2.47	15.7	20.9	0	10.97	-0.58	-0.01	6.4	20.9	0	27.54	-0.02
1225	95	1.98	15.4	20.9	0	11.29	-0.90	0.00	7.0	20.9	0	27.50	0.02
1330	160	2.44	11.4	20.9	0	11.83	-1.44	-0.12	6.7	20.9	0	27.51	0.01
1350	180	0.29	11.6	20.9	0	11.91	-1.52	0.00	2.4	20.9	0	27.51	0.01
1415	205	0.25	11.8	20.6	0	11.99	-1.60	0.00	3.4	20.9	0	27.52	0.00
1440	230	0.32	41.9	20.5	0	12.09	-1.70	0.00	3.6	20.9	0	27.52	0.00
1500	250	0.24	10.6	20.9	0	12.23	-1.84	0.00	2.7	20.9	0	27.50	0.02
1520	270	0.18	8.3	20.9	0	12.31	-1.92	0.00	1.7	20.9	0	27.50	0.02
1545	295	0.15	57.2	20.4	0	12.32	-1.93	0.00	0.5	20.9	0	27.51	0.01
1600	310	0.10	1.0	20.9	0	12.35	-1.96	0.00	0.6	20.9	0	27.51	0.01
1625	335	0.33	33.5	20.6	0	12.43	-2.04	0.00	1.6	20.9	0	27.51	0.01
1640	350	0.42	36.2	20.5	0	12.44	-2.05	0.00	2.0	20.9	0	27.51	0.01

Notes: **Elapsed Time** - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-4 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutylene.
O_2 - Oxygen reported in ppm_v.
CH_4 - Methane reported in ppm_v.
ppm_v -parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
DTP - depth to product
NM - not measured

Table 2A - Summary of Vacuum Enhanced Pilot Test at MW-1 - Step Test Extraction Well Data
Fortuna 762248
359 Main Street
Fortuna , CA
MW-1 Screened: 20-39'

Time	Wellhead Vacuum (" Hg)	System Vacuum (" Hg)	Air Flow Rate (scfm)	Air Velocity (ft/min)	Air Influent (ppmv)	Air Effluent (ppmv)	Water Flow Rate (gpm)	Water Headspace (ppmv)
920	0.00	0.00	0.000	0	0.0	0.0	0.81	0.0
935	3.00	4.00	0.505	23	NM	0.0	NM	NM
1030	3.00	3.50	0.765	27	8.3	0.0	1.33	0.7
1040	3.00	3.50	0.340	14	2.8	1.2	1.28	0.4
1050	3.00	3.75	0.270	15	6.3	0.7	1.43	0.1
1100	3.00	3.75	0.485	11	5.7	0.9	1.27	0.1
1110	5.00	6.00	0.740	26	6.8	0.4	1.60	0.4
1120	5.00	6.00	0.490	18	3.7	0.4	1.42	0.1
1200	5.00	6.00	0.460	15	4.7	0.7	1.33	0.2
1240	8.25	8.75	0.635	32	7.0	0.4	2.18	0.1
1255	7.75	8.25	0.530	29	6.4	0.7	1.41	0.0
1310	7.50	8.10	0.380	15	5.3	0.9	1.36	0.0
1320	7.50	8.10	0.420	24	4.1	0.4	1.40	2.5
1330	7.50	8.00	0.490	24	4.5	0.3	1.42	0.6
1340	10.40	11.00	0.690	27	6.0	0.4	1.55	0.1
1400	10.50	10.75	0.605	26	6.0	0.6	1.49	0.1
1425	10.50	10.75	0.650	39	1.9	0.3	1.51	0.2
1440	10.50	10.75	0.590	36	5.8	0.4	1.68	0.0
1515	13.00	14.00	0.670	32	4.5	0.4	1.90	0.0
1525	13.00	13.50	0.600	36	6.2	0.4	1.78	0.0
1535	13.00	13.40	0.860	41	6.0	0.2	1.75	0.0

Notes: **Wellhead Vacuum** - vacuum observed at extraction well in inches of mercury (" Hg).
System Vacuum - vacuum observed at SVE system control manifold in "Hg.
Air Flow Rate - Volumetric flow rate of air measured at the wellhead in standard cubic feet per minute (scfm).
Air Velocity - Speed of air measured at the wellhead in feet per minute (ft/min).
Air Influent - Concentration of volatile organic compounds (VOCs) measured to be in influent air stream using a photoionization detector (PID) in parts per million volume (ppmv).
Air Effluent - Concentration of volatile organic compounds (VOCs) measured to be in effluent air stream using a photoionization detector (PID) in parts per million volume (ppmv).
Water Flow Rate - Rate of water extracted from MW-1 in gallons per minute (gpm).
Water Headspace - Concentration of VOCs (in ppmv) measured to be in headspace of water extracted from MW-1.
NM - not measured.

Table 2B - Summary of Vacuum Enhanced Pilot Test at MW-1 - Steady State Extraction Well Data
Fortuna 762248
359 Main Street
Fortuna , CA
MW-1 Screened: 20-39'
Steady State Tests (7.0" Hg and 10.0"Hg)
3/11/2005

	Manifold	Well Head			Dilution		Off Gas Treatment		Fluid Recovery	
Time	Vacuum ("Hg)	Vacuum ("Hg)	Air Influent (ppmv)	Air Flow Rate (scfm)	Pressure (" H_2O)	Air Flow Rate (scfm)	Pressure (" H_2O)	Air Effluent (ppmv)	Flow Rate (gpm)	Headspace (ppmv)
0925	0.00	0.00	NM	NM	0	100.0	0	NM	0.84	NM
1045	7.25	7.00	9.6	NM	-0.045	62.0	0	1.6	1.26	0.3
1125	7.25	6.75	8.8	0.39	-0.06	60.0	0	0.9	1.22	0.0
1245	7.25	6.90	NM	0.6	-0.06	57.5	0	1.1	NM	NM
1330	10.75	10.00	11.3	0.63	-0.02	36.0	0	0.5	1.48	0.5
1400	10.75	10.00	10.6	0.62	-0.02	32.0	0	0.8	1.56	0.5
1420	10.40	10.00	8.8	0.66	-0.02	34.0	0	0.9	1.55	0.0
1450	10.20	10.00	7.4	0.77	-0.03	32.5	0	0.6	NM	NM

Notes: **Manifold Vacuum** - vacuum observed at SVE system control manifold in "Hg.
Wellhead Vacuum - vacuum observed at extraction well in inches of mercury (" Hg).
Air Influent - Concentration of volatile organic compounds (VOCs) measured to be in influent air stream using a photoionization detector (PID) in parts per million volume (ppmv).
Dilution Pressure - Air pressure measured in dilution (fresh air) stream in inches of water (" H_2O).
Air Flow Rate - Volumetric flow rate of air measured in standard cubic feet per minute (scfm).
Air Effluent - Concentration of volatile organic compounds (VOCs) measured to be in effluent air stream using a photoionization detector (PID) in parts per million volume (ppmv).
Water Flow Rate - Rate of water extracted from MW-1 in gallons per minute (gpm).
Water Headspace - Concentration of VOCs (in ppmv) measured to be in headspace of water extracted from MW-1.
NM - not measured.

Table 2C - Summary of Vacuum Enhanced Pilot Test at MW-1 - Monitoring Point Data
Fortuna 762248
359 Main Street
Fortuna , CA
MW-1 Screened: 20-39'

Time	Elapsed Time (min)	P1 Screened: 5-10' Distance to MW-1 : 8.08 ft						P2 Screened: 5-10' Distance to MW-1: 12.67 ft					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
3/10/2005													
0900	0	0.03	12.6	20.9	0	8.76	NM	0	0.0	20.9	0	5.47	0.00
0940	40	0.04	NM	NM	NM	NM	NM	0	21.5	20.9	0	NM	NM
1030	90	0	4.2	20.9	0	8.51	0.25	0	123	20.9	0	5.71	-0.24
1050	110	0	10	20.9	0	8.50	0.26	0	9.4	20.9	0	5.75	-0.28
1115	135	0	3.8	20.9	0	8.50	0.26	0	129.0	20.9	0	5.79	-0.32
1135	155	0	36.0	20.9	0	8.47	0.29	0	4.5	20.9	0	5.82	-0.35
1245	225	0	54.6	20.9	0	8.41	0.35	0	8.9	20.9	0	5.88	-0.41
1300	240	0	75.3	20.9	0	8.39	0.37	0.02	24.9	20.9	0	5.90	-0.43
1325	265	0	81.9	20.9	0	8.38	0.38	-0.2	69.6	20.9	0	5.92	-0.45
1350	290	0	151	20.9	0	8.37	0.39	-0.21	7.3	20.9	0	5.90	-0.43
1410	320	0	220	20.1	0	8.37	0.39	0	7.1	20.9	0	5.91	-0.44
1430	340	0	792	20.9	0	8.36	0.40	0	48.4	20.9	0	5.91	-0.44
1450	360	0	294	20.4	4	8.31	0.45	0.04	9.1	20.9	0	5.95	-0.48
1515	385	0	225	20.3	4	8.31	0.45	0	11.6	20.9	0	5.97	-0.50
1535	405	0	271	19.4	10	8.30	0.46	-0.10	53.2	20.9	0	5.97	-0.50
3/10/2005													
0925	0.00	-0.05	262	19.0	11	7.78	0.00	0.133	11.3	20.9	0	5.97	0.00
1055	90	0	565	18.1	17	7.74	0.04	-0.03	11.2	21.3	0	5.97	0.00
1125	120	0	394	19.9	6	7.76	0.02	-0.023	26.6	20.9	0	5.99	-0.02
1245	200	0	449	19.2	11	7.69	0.09	-0.014	31.5	20.9	0	5.94	0.03
1410	285	0	639	16.0	35	7.66	0.12	-0.017	12.2	20.9	0	5.94	0.03
1450	325	0.01	477	18.2	14	7.66	0.12	-0.008	96	20.9	0	5.94	0.03

Notes: **Elapsed Time** - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-1 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v - parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
DTP - depth to product
ND - not detected
NM - not measured

Table 2C - Summary of Vacuum Enhanced Pilot Test at MW-1 - Monitoring Point Data
Fortuna 762248
359 Main Street
Fortuna , CA
MW-1 Screened: 20-39'

Time	Elapsed Time (min)	P3 Screened: 5-10' Distance to MW-1 : 6.08 ft						P4 Screened: 5-10' Distance to MW-1 : 11.17 ft						P5 Screened: 5-10' Distance to MW-1 : 16.83 ft					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
3/10/2005																			
0900	0	0	20.0	20.9	0	3.66	0.00	-0.86	43.1	20.9	0	3.65	NM	0	205	19.6	8	5.00	0.00
0940	40	0	NM	NM	NM	NM	NM	1.03	NM	NM	NM	NM	NM	0	NM	NM	NM	NM	NM
1030	90	0	4.9	20.9	0	3.65	0.01	0.28	1.0	20.9	0	3.66	-0.01	0	183	20.9	0	5.15	-0.15
1050	110	0	1.6	20.9	0	3.67	-0.01	-0.92	2.8	20.9	0	3.67	-0.02	0	130	20.9	0	5.26	-0.26
1115	135	0	5.3	20.9	0	3.80	-0.14	-1.01	34.0	20.9	0	3.80	-0.15	0.04	173	20.9	0	5.25	-0.25
1135	155	0	3.3	20.9	0	3.73	-0.07	0	11.5	20.9	0	3.73	-0.08	0	301	20.1	0	5.23	-0.23
1245	225	0	2.0	20.9	0	3.67	-0.01	0	8.7	20.9	0	3.67	-0.02	-0.02	109	20.9	0	5.25	-0.25
1300	240	0	2.7	20.9	0	3.75	-0.09	0.98	19.4	20.9	0	3.75	-0.10	0	177.4	20.9	0	5.26	-0.26
1325	265	-0.07	2.4	20.9	0	3.26	0.40	2.29	0.0	20.9	0	3.26	0.39	-0.04	63.8	20.9	0	5.27	-0.27
1350	290	-0.04	4.3	20.9	0	3.66	0.00	-0.94	29.9	20.9	0	3.66	-0.01	0	2.5	20.9	0	5.28	-0.28
1410	320	0	15.2	20.9	0	3.67	-0.01	0	27.0	20.9	0	3.67	-0.02	0	33.9	20.9	0	5.29	-0.29
1430	340	0	14.7	20.9	0	3.67	-0.01	0	15.5	20.9	0	3.67	-0.02	0	96.6	20.9	0	5.30	-0.30
1450	360	0	19.8	20.9	0	3.70	-0.04	-0.87	0.0	20.9	0	3.70	-0.05	0.02	159	20.4	4	5.36	-0.36
1515	385	0	9.1	20.9	0	3.67	-0.01	-0.66	7.7	20.9	0	3.63	0.02	0.02	31.1	20.9	0	5.37	-0.37
1535	405	-0.40	3.2	20.9	0	3.67	-0.01	-1.32	16.1	20.9	0	3.68	-0.03	-0.36	34.0	20.9	0	5.36	-0.36
3/11/2005																			
0925	0.00	0.041	2.9	20.9	0	3.77	0.00	-0.16	1.00	20.9	0	3.82	0.00	0.011	11.70	20.9	0	5.48	0.00
1055	90	-0.013	1.3	20.9	0	3.78	-0.01	0	0.0	20.9	0	3.80	0.02	0.090	0.0	20.9	0	5.44	0.04
1125	120	-0.246	3.7	20.9	0	3.78	-0.01	0.256	3.7	20.9	0	3.79	0.03	0.020	45.3	21.3	0	5.42	0.06
1245	200	0.034	0	20.9	0	3.78	-0.01	-0.16	23.3	20.9	0	3.83	-0.01	0.040	222	20.9	3	5.39	0.09
1410	285	-0.018	1.5	20.9	0	3.78	-0.01	-0.017	2.0	20.9	0	3.80	0.02	-0.020	79.7	20.9	0	5.45	0.03
1450	325	-0.022	4.4	20.9	0	3.81	-0.04	-0.01	3.6	20.9	0	3.81	0.01	0.063	51.9	20.9	0	5.50	-0.02

Notes:
Elapsed Time - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-1 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v - parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
DTP - depth to product
ND - not detected
NM - not measured

Table 2C - Summary of Vacuum Enhanced Pilot Test at MW-1 - Monitoring Point Data
Fortuna 762248
359 Main Street
Fortuna , CA
MW-1 Screened: 20-39'

Time	Elapsed Time (min)	MW-13 Screened 13.5-18.5' Distance to MW-1 : 6.54 ft						MW-21 Screened: 5-20' Distance to MW-1 : 19.63 ft					
		VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)	VAC (" H_2O)	VOC (ppm_v)	O_2 (ppm_v)	CH_4 (ppm_v)	DTW (ft)	D DTW (ft)
3/10/2005													
0900	0	0	38.3	20.9	0	6.26	0.00	0	45	19.4	19	6.54	0.00
0940	40	0	NM	NM	NM	NM	NM	NM	40	11.8	>100	NM	NM
1030	90	NM	40	20.9	0	6.22	0.04	-0.03	37.4	18.8	35	6.52	0.02
1050	110	0	15.4	20.9	0	6.24	0.02	0	53	17.5	56	6.52	0.02
1115	135	0	19.8	20.9	0	6.32	-0.06	-0.03	66	18.7	36	6.52	0.02
1135	155	0	13.0	20.9	0	6.29	-0.03	-0.11	63	17.7	45	6.52	0.02
1245	225	0	27.2	20.9	0	6.24	0.02	0	49	18.9	54	6.52	0.02
1300	240	0	7.5	20.9	0	6.24	0.02	0.08	45	18.9	64	6.50	0.04
1325	265	-0.06	10.1	20.9	0	6.24	0.02	-0.10	121	18.0	39	6.51	0.03
1350	290	-0.03	1.0	20.9	0	6.24	0.02	-0.10	110	17.4	37	6.51	0.03
1410	320	0	34.4	20.9	0	6.24	0.02	-0.04	68	18.1	32	6.51	0.03
1430	340	0	9.6	20.9	0	6.24	0.02	-0.01	113	14.4	>100	6.51	0.03
1450	360	0	4.6	20.9	0	6.24	0.02	-0.01	68	19.7	36	6.50	0.04
1515	385	0	11.3	20.9	0	6.24	0.02	-0.03	71.1	19.5	27	6.50	0.04
1535	405	0	8.5	20.9	0	6.24	0.02	0	66.6	18.9	27	6.50	0.04
3/11/2005													
0925	0.00	0.006	34.3	20.9	0	6.27	-0.01	0.013	50.60	17.90	37.0	6.53	0.01
1055	90	0.005	30.1	20.9	0	6.25	0.01	0.013	94.6	19.1	25	6.53	0.01
1125	120	-0.004	26.8	20.9	0	6.26	0.00	-0.007	93.7	18.9	23	6.51	0.03
1245	200	0	19.1	20.9	0	6.25	0.01	0.41	81.9	18.9	26	6.48	0.06
1410	285	-0.060	18.9	20.9	0	6.25	0.01	-0.017	85.4	19.5	14	6.47	0.07
1450	325	0	11.7	20.9	0	6.25	0.01	0	29.1	20.7	2	6.46	0.08

Notes:
Elapsed Time - time from beginning of pilot test in minutes (min)
VAC - vacuum observed at monitoring well
Distance to MW-1 - distance from monitoring well to extraction well measured in feet (ft)
" H_2O - inches of water column
VOC - soil vapor samples measured with a photoionization detector (PID) calibrated to read total volatile organic compounds (VOC) as isobutalene.
ppm_v - parts per million per unit volume
DTW - depth to water measured in monitoring point using an electronic interface probe (EIP) measured in feet (ft)
D DTW - change in depth to water
DTP - depth to product
ND - not detected
NM - not measured

APPENDIX E

Groundwater Analytical Results

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

April 15, 2005

CLS Work Order #: COB0433
COC #: None

John Warren
ENSR - Sacramento
10411 Old Placerville Rd., Suite 210
Sacramento, CA 95827-2508

Project Name: Frmr. Unocal 762248-359 Main St.
Fortuna,CA

Enclosed are the results of analyses for samples received by the laboratory on 02/12/05 11:10. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,

James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-16A (COB0433-14) Water Sampled: 02/09/05 18:10 Received: 02/12/05 11:10									
Total Alkalinity	**110**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**110**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**2.3**	1.0	"	"	CO01247	02/17/05	02/17/05	EPA 415.1	
MW-16B (COB0433-15) Water Sampled: 02/09/05 12:20 Received: 02/12/05 11:10									
Total Alkalinity	**140**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**140**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**5.3**	1.0	"	"	CO01247	02/17/05	02/17/05	EPA 415.1	
MW-17 (COB0433-16) Water Sampled: 02/09/05 09:34 Received: 02/12/05 11:10									
Total Alkalinity	**170**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**170**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**4.9**	1.0	"	"	CO01247	02/17/05	02/21/05	EPA 415.1	
MW-18 (COB0433-17) Water Sampled: 02/09/05 17:58 Received: 02/12/05 11:10									
Total Alkalinity	**520**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**520**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**13**	1.0	"	"	CO01247	02/17/05	02/21/05	EPA 415.1	

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA	
10411 Old Placerville Rd., Suite 210	Project Number: 06940-407-100	**CLS Work Order #: COB0433**
Sacramento, CA 95827-2508	Project Manager: John Warren	COC #: None

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-19 (COB0433-18) Water Sampled: 02/09/05 14:07 Received: 02/12/05 11:10									
Total Alkalinity	**340**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**340**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**14**	1.0	"	"	CO01247	02/17/05	02/21/05	EPA 415.1	
MW-20 (COB0433-19) Water Sampled: 02/09/05 08:11 Received: 02/12/05 11:10									
Total Alkalinity	**360**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**360**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**20**	1.0	"	"	CO01247	02/17/05	02/21/05	EPA 415.1	
MW-21 (COB0433-20) Water Sampled: 02/09/05 09:00 Received: 02/12/05 11:10									
Total Alkalinity	**360**	5.0	mg/L	1	CO01319	02/18/05	02/18/05	EPA 310.1	
Bicarbonate as CaCO3	**360**	5.0	"	"	"	"	"	"	
Carbonate as CaCO3	ND	5.0	"	"	"	"	"	"	
Hydroxide as CaCO3	ND	5.0	"	"	"	"	"	"	
Total Organic Carbon	**13**	1.0	"	"	CO01247	02/17/05	02/21/05	EPA 415.1	

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Extractable Petroleum Hydrocarbons by EPA Method 8015M

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-1 (COB0433-01) Water	**Sampled: 02/09/05 17:34**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.087**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-2 (COB0433-02) Water	**Sampled: 02/09/05 12:39**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-3 (COB0433-03) Water	**Sampled: 02/09/05 14:53**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.58**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-4 (COB0433-04) Water	**Sampled: 02/09/05 17:09**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**4.0**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-5 (COB0433-05) Water	**Sampled: 02/09/05 15:48**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**2.2**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-6 (COB0433-06) Water	**Sampled: 02/09/05 13:41**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.054**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-7 (COB0433-07) Water	**Sampled: 02/08/05 17:11**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-8 (COB0433-08) Water	**Sampled: 02/08/05 17:39**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-9 (COB0433-09) Water	**Sampled: 02/08/05 16:49**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Extractable Petroleum Hydrocarbons by EPA Method 8015M

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-10 (COB0433-10) Water	**Sampled: 02/08/05 18:02**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-13 (COB0433-11) Water	**Sampled: 02/09/05 15:09**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**4.5**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-14 (COB0433-12) Water	**Sampled: 02/09/05 07:08**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-15 (COB0433-13) Water	**Sampled: 02/09/05 07:52**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-16A (COB0433-14) Water	**Sampled: 02/09/05 18:10**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.49**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-16B (COB0433-15) Water	**Sampled: 02/09/05 12:20**	**Received: 02/12/05 11:10**							
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-17 (COB0433-16) Water	**Sampled: 02/09/05 09:34**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.053**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-18 (COB0433-17) Water	**Sampled: 02/09/05 17:58**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	ND	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	
MW-19 (COB0433-18) Water	**Sampled: 02/09/05 14:07**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.31**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Extractable Petroleum Hydrocarbons by EPA Method 8015M

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-20 (COB0433-19) Water	**Sampled: 02/09/05 08:11**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**0.51**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1
MW-21 (COB0433-20) Water	**Sampled: 02/09/05 09:00**	**Received: 02/12/05 11:10**							**C-03C**
Diesel	**2.5**	0.050	mg/L	1	CO01141	02/14/05	02/16/05	EPA 8015M	DSL-1

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-1 (COB0433-01) Water Sampled: 02/09/05 17:34 Received: 02/12/05 11:10									
Gasoline	**570**	50	µg/L	1	CO01191	02/15/05	02/15/05	8015M/8021B	
Benzene	**14**	0.50	"	"	"	"	"	"	
Toluene	**90**	2.5	"	5	"	"	02/16/05	"	
Ethylbenzene	**6.3**	0.50	"	1	"	"	02/15/05	"	
Xylenes (total)	**150**	5.0	"	5	"	"	02/16/05	"	
Surrogate: o-Chlorotoluene (Gas)		*102 %*	*65-135*		*"*	*"*	*02/15/05*	*"*	
MW-3 (COB0433-03) Water Sampled: 02/09/05 14:53 Received: 02/12/05 11:10									
Gasoline	**2100**	250	µg/L	5	CO01191	02/15/05	02/15/05	8015M/8021B	GC-25
Benzene	**150**	2.5	"	"	"	"	"	"	
Toluene	**3.1**	2.5	"	"	"	"	"	"	
Ethylbenzene	**12**	2.5	"	"	"	"	"	"	
Xylenes (total)	**160**	5.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*90.5 %*	*65-135*		*"*	*"*	*"*	*"*	
MW-4 (COB0433-04) Water Sampled: 02/09/05 17:09 Received: 02/12/05 11:10									
Gasoline	**32000**	5000	µg/L	100	CO01191	02/15/05	02/15/05	8015M/8021B	
Benzene	**4100**	50	"	"	"	"	"	"	
Toluene	**4500**	50	"	"	"	"	"	"	
Ethylbenzene	**860**	50	"	"	"	"	"	"	
Xylenes (total)	**5100**	100	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*95.5 %*	*65-135*		*"*	*"*	*"*	*"*	
MW-5 (COB0433-05) Water Sampled: 02/09/05 15:48 Received: 02/12/05 11:10									
Gasoline	**24000**	5000	µg/L	100	CO01191	02/15/05	02/15/05	8015M/8021B	
Benzene	**950**	50	"	"	"	"	"	"	
Toluene	**1000**	50	"	"	"	"	"	"	
Ethylbenzene	**310**	50	"	"	"	"	"	"	
Xylenes (total)	**5300**	100	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*98.0 %*	*65-135*		*"*	*"*	*"*	*"*	

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-6 (COB0433-06) Water Sampled: 02/09/05 13:41 Received: 02/12/05 11:10									
Gasoline	**81**	50	µg/L	1	CO01246	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**6.4**	0.50	"	"	"	"	"	"	
Toluene	**0.77**	0.50	"	"	"	"	"	"	
Ethylbenzene	**0.66**	0.50	"	"	"	"	"	"	
Xylenes (total)	**1.1**	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*97.0 %*	*65-135*		"	"	"	"	
MW-13 (COB0433-11) Water Sampled: 02/09/05 15:09 Received: 02/12/05 11:10									
Gasoline	**17000**	2500	µg/L	50	CO01246	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**1000**	25	"	"	"	"	"	"	
Toluene	**210**	25	"	"	"	"	"	"	
Ethylbenzene	**1100**	25	"	"	"	"	"	"	
Xylenes (total)	**3800**	50	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*97.5 %*	*65-135*		"	"	"	"	
MW-14 (COB0433-12) Water Sampled: 02/09/05 07:08 Received: 02/12/05 11:10									
Gasoline	ND	50	µg/L	1	CO01246	02/16/05	02/16/05	8015M/8021B	
Benzene	ND	0.50	"	"	"	"	"	"	
Toluene	**0.57**	0.50	"	"	"	"	"	"	
Ethylbenzene	ND	0.50	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*96.5 %*	*65-135*		"	"	"	"	
MW-15 (COB0433-13) Water Sampled: 02/09/05 07:52 Received: 02/12/05 11:10									
Gasoline	ND	50	µg/L	1	CO01246	02/16/05	02/16/05	8015M/8021B	
Benzene	ND	0.50	"	"	"	"	"	"	
Toluene	ND	0.50	"	"	"	"	"	"	
Ethylbenzene	ND	0.50	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*93.0 %*	*65-135*		"	"	"	"	

CALIFORNIA LABORATORY SERVICES

04/15/05 13:24

ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-16A (COB0433-14) Water Sampled: 02/09/05 18:10 Received: 02/12/05 11:10									
Gasoline	**3000**	500	µg/L	10	CO01246	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**200**	5.0	"	"	"	"	"	"	
Toluene	**220**	5.0	"	"	"	"	"	"	
Ethylbenzene	**68**	5.0	"	"	"	"	"	"	
Xylenes (total)	**520**	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*95.0 %*	*65-135*		"	"	"	"	
MW-16B (COB0433-15) Water Sampled: 02/09/05 12:20 Received: 02/12/05 11:10									
Gasoline	ND	50	µg/L	1	CO01246	02/16/05	02/16/05	8015M/8021B	
Benzene	ND	0.50	"	"	"	"	"	"	
Toluene	**0.58**	0.50	"	"	"	"	"	"	
Ethylbenzene	ND	0.50	"	"	"	"	"	"	
Xylenes (total)	**1.7**	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*92.0 %*	*65-135*		"	"	"	"	
MW-17 (COB0433-16) Water Sampled: 02/09/05 09:34 Received: 02/12/05 11:10									
Gasoline	**60**	50	µg/L	1	CO01244	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**3.0**	0.50	"	"	"	"	"	"	
Toluene	**2.7**	0.50	"	"	"	"	"	"	
Ethylbenzene	**1.9**	0.50	"	"	"	"	"	"	
Xylenes (total)	**7.0**	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*101 %*	*65-135*		"	"	"	"	
MW-18 (COB0433-17) Water Sampled: 02/09/05 17:58 Received: 02/12/05 11:10									
Gasoline	**4500**	500	µg/L	10	CO01244	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**2300**	50	"	100	"	"	02/17/05	"	
Toluene	**4.5**	0.50	"	1	"	"	02/16/05	"	
Ethylbenzene	**47**	0.50	"	"	"	"	"	"	
Xylenes (total)	**89**	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*98.0 %*	*65-135*		"	"	"	"	

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Gas/BTEX by GC PID/FID

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-19 (COB0433-18) Water Sampled: 02/09/05 14:07 Received: 02/12/05 11:10									
Gasoline	**4400**	500	µg/L	10	CO01244	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**1500**	50	"	100	"	"	02/17/05	"	
Toluene	**2.0**	0.50	"	1	"	"	02/16/05	"	
Ethylbenzene	**43**	0.50	"	"	"	"	"	"	
Xylenes (total)	**150**	10	"	10	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*98.0 %*	*65-135*		*"*	*"*	*"*	*"*	
MW-20 (COB0433-19) Water Sampled: 02/09/05 08:11 Received: 02/12/05 11:10									
Gasoline	**4200**	500	µg/L	10	CO01244	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**700**	50	"	100	"	"	02/17/05	"	
Toluene	**220**	5.0	"	10	"	"	02/16/05	"	
Ethylbenzene	**110**	5.0	"	"	"	"	"	"	
Xylenes (total)	**590**	10	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*98.5 %*	*65-135*		*"*	*"*	*"*	*"*	
MW-21 (COB0433-20) Water Sampled: 02/09/05 09:00 Received: 02/12/05 11:10									
Gasoline	**29000**	2500	µg/L	50	CO01244	02/16/05	02/16/05	8015M/8021B	GC-25
Benzene	**2800**	250	"	500	"	"	"	"	
Toluene	**1300**	25	"	50	"	"	"	"	
Ethylbenzene	**1300**	25	"	"	"	"	"	"	
Xylenes (total)	**5200**	500	"	500	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*91.0 %*	*65-135*		*"*	*"*	*"*	*"*	
QA (COB0433-21) Water Sampled: 01/25/05 12:00 Received: 02/12/05 11:10									**HT-1**
Gasoline	ND	50	µg/L	1	CO01244	02/16/05	02/16/05	8015M/8021B	
Benzene	ND	0.50	"	"	"	"	02/17/05	"	
Toluene	ND	0.50	"	"	"	"	"	"	
Ethylbenzene	ND	0.50	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	
Surrogate: o-Chlorotoluene (Gas)		*108 %*	*65-135*		*"*	*"*	*02/16/05*	*"*	

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO01247 - General Preparation										
Blank (CO01247-BLK1)				Prepared & Analyzed: 02/17/05						
Total Organic Carbon	ND	1.0	mg/L							
LCS (CO01247-BS1)				Prepared & Analyzed: 02/17/05						
Total Organic Carbon	9.89	1.0	mg/L	10.0		98.9	75-125			
LCS Dup (CO01247-BSD1)				Prepared & Analyzed: 02/17/05						
Total Organic Carbon	10.2	1.0	mg/L	10.0		102	75-125	3.09	25	
Matrix Spike (CO01247-MS1)		**Source: COB0470-01**		Prepared & Analyzed: 02/17/05						
Total Organic Carbon	26.4	1.0	mg/L	10.0	17	94.0	75-125			
Matrix Spike Dup (CO01247-MSD1)		**Source: COB0470-01**		Prepared & Analyzed: 02/17/05						
Total Organic Carbon	26.6	1.0	mg/L	10.0	17	96.0	75-125	0.755	25	
Batch CO01319 - General Preparation										
Blank (CO01319-BLK1)				Prepared & Analyzed: 02/18/05						
Total Alkalinity	ND	5.0	mg/L							
Bicarbonate as CaCO3	ND	5.0	"							
Carbonate as CaCO3	ND	5.0	"							
Hydroxide as CaCO3	ND	5.0	"							
Blank (CO01319-BLK2)				Prepared & Analyzed: 02/18/05						
Total Alkalinity	ND	5.0	mg/L							
Bicarbonate as CaCO3	ND	5.0	"							
Carbonate as CaCO3	ND	5.0	"							
Hydroxide as CaCO3	ND	5.0	"							

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Extractable Petroleum Hydrocarbons by EPA Method 8015M - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO01141 - EPA 3510B GCNV										
Blank (CO01141-BLK1)				Prepared: 02/14/05	Analyzed: 02/16/05					
Diesel	ND	0.050	mg/L							
Motor Oil	ND	0.050	"							
Hydraulic Oil	ND	0.050	"							
Mineral Oil	ND	0.050	"							
Kerosene	ND	0.050	"							
JP-5/JP-8	ND	0.050	"							
Stoddard Solvent	ND	0.050	"							
Total Extractable Hydrocarbons	ND	0.050	"							
Transformer Oil	ND	0.050	"							
LCS (CO01141-BS1)				Prepared: 02/14/05	Analyzed: 02/16/05					
Diesel	2.38	0.050	mg/L	2.50		95.2	65-135			
LCS Dup (CO01141-BSD1)				Prepared: 02/14/05	Analyzed: 02/16/05					
Diesel	2.35	0.050	mg/L	2.50		94.0	65-135	1.27	30	

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Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO01191 - EPA 5030 Water GC										
Blank (CO01191-BLK1)				Prepared & Analyzed: 02/15/05						
Gasoline	ND	50	µg/L							
Benzene	ND	0.50	"							
Toluene	ND	0.50	"							
Ethylbenzene	ND	0.50	"							
Xylenes (total)	ND	1.0	"							
Surrogate: o-Chlorotoluene (BTEX)	*20.2*		*"*	*20.0*		*101*	*65-135*			
Surrogate: o-Chlorotoluene (Gas)	*19.9*		*"*	*20.0*		*99.5*	*65-135*			
LCS (CO01191-BS1)				Prepared & Analyzed: 02/15/05						
Gasoline	549	50	µg/L	500		110	65-135			
Surrogate: o-Chlorotoluene (Gas)	*22.2*		*"*	*20.0*		*111*	*65-135*			
LCS Dup (CO01191-BSD1)				Prepared & Analyzed: 02/15/05						
Gasoline	485	50	µg/L	500		97.0	65-135	12.4	30	
Surrogate: o-Chlorotoluene (Gas)	*19.4*		*"*	*20.0*		*97.0*	*65-135*			
Matrix Spike (CO01191-MS1)		**Source: COB0432-09**		Prepared & Analyzed: 02/15/05						
Gasoline	492	50	µg/L	500	ND	98.4	65-135			
Surrogate: o-Chlorotoluene (Gas)	*20.8*		*"*	*20.0*		*104*	*65-135*			
Matrix Spike Dup (CO01191-MSD1)		**Source: COB0432-09**		Prepared & Analyzed: 02/15/05						
Gasoline	520	50	µg/L	500	ND	104	65-135	5.53	30	
Surrogate: o-Chlorotoluene (Gas)	*21.7*		*"*	*20.0*		*108*	*65-135*			
Batch CO01244 - EPA 5030 Water GC										
Blank (CO01244-BLK1)				Prepared & Analyzed: 02/16/05						
Gasoline	ND	50	µg/L							
Benzene	ND	0.50	"							
Toluene	ND	0.50	"							
Ethylbenzene	ND	0.50	"							
Xylenes (total)	ND	1.0	"							

CALIFORNIA LABORATORY SERVICES

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Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO01244 - EPA 5030 Water GC										
Blank (CO01244-BLK1)				Prepared & Analyzed: 02/16/05						
Surrogate: o-Chlorotoluene (BTEX)	*20.0*		*µg/L*	*20.0*		*100*	*65-135*			
Surrogate: o-Chlorotoluene (Gas)	*17.8*		*"*	*20.0*		*89.0*	*65-135*			
LCS (CO01244-BS1)				Prepared & Analyzed: 02/16/05						
Benzene	16.7	0.50	µg/L	20.0		83.5	70-140			
Toluene	20.1	0.50	"	20.0		100	70-140			
Ethylbenzene	21.2	0.50	"	20.0		106	70-140			
Xylenes (total)	63.2	1.0	"	60.0		105	70-140			
Surrogate: o-Chlorotoluene (BTEX)	*20.7*		*"*	*20.0*		*104*	*65-135*			
LCS Dup (CO01244-BSD1)				Prepared & Analyzed: 02/16/05						
Benzene	15.6	0.50	µg/L	20.0		78.0	70-140	6.81	30	
Toluene	18.4	0.50	"	20.0		92.0	70-140	8.83	30	
Ethylbenzene	19.5	0.50	"	20.0		97.5	70-140	8.35	30	
Xylenes (total)	58.0	1.0	"	60.0		96.7	70-140	8.58	30	
Surrogate: o-Chlorotoluene (BTEX)	*18.7*		*"*	*20.0*		*93.5*	*65-135*			
Matrix Spike (CO01244-MS1)		**Source: COB0453-03**		Prepared & Analyzed: 02/16/05						
Benzene	21.5	0.50	µg/L	20.0	ND	108	60-140			
Toluene	20.9	0.50	"	20.0	ND	104	60-140			
Ethylbenzene	20.5	0.50	"	20.0	ND	102	60-140			
Xylenes (total)	60.0	1.0	"	60.0	ND	100	60-140			
Surrogate: o-Chlorotoluene (BTEX)	*20.5*		*"*	*20.0*		*102*	*65-135*			
Matrix Spike Dup (CO01244-MSD1)		**Source: COB0453-03**		Prepared & Analyzed: 02/16/05						
Benzene	21.2	0.50	µg/L	20.0	ND	106	60-140	1.41	30	
Toluene	20.8	0.50	"	20.0	ND	104	60-140	0.480	30	
Ethylbenzene	20.6	0.50	"	20.0	ND	103	60-140	0.487	30	
Xylenes (total)	60.9	1.0	"	60.0	ND	102	60-140	1.49	30	
Surrogate: o-Chlorotoluene (BTEX)	*21.1*		*"*	*20.0*		*106*	*65-135*			

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO01246 - EPA 5030 Water GC										
Blank (CO01246-BLK1)				Prepared & Analyzed: 02/16/05						
Gasoline	ND	50	µg/L							
Benzene	ND	0.50	"							
Toluene	ND	0.50	"							
Ethylbenzene	ND	0.50	"							
Xylenes (total)	ND	1.0	"							
Surrogate: o-Chlorotoluene (BTEX)	*20.3*		*"*	*20.0*		*102*	*65-135*			
Surrogate: o-Chlorotoluene (Gas)	*19.6*		*"*	*20.0*		*98.0*	*65-135*			
LCS (CO01246-BS1)				Prepared & Analyzed: 02/16/05						
Benzene	21.7	0.50	µg/L	20.0		108	70-140			
Toluene	21.0	0.50	"	20.0		105	70-140			
Ethylbenzene	20.4	0.50	"	20.0		102	70-140			
Xylenes (total)	62.2	1.0	"	60.0		104	70-140			
Surrogate: o-Chlorotoluene (BTEX)	*19.7*		*"*	*20.0*		*98.5*	*65-135*			
LCS Dup (CO01246-BSD1)				Prepared & Analyzed: 02/16/05						
Benzene	22.1	0.50	µg/L	20.0		110	70-140	1.83	30	
Toluene	20.9	0.50	"	20.0		104	70-140	0.477	30	
Ethylbenzene	20.4	0.50	"	20.0		102	70-140	0.00	30	
Xylenes (total)	62.7	1.0	"	60.0		104	70-140	0.801	30	
Surrogate: o-Chlorotoluene (BTEX)	*19.9*		*"*	*20.0*		*99.5*	*65-135*			
Matrix Spike (CO01246-MS1)		**Source: COB0457-04**		Prepared & Analyzed: 02/16/05						
Benzene	22.0	0.50	µg/L	20.0	ND	110	60-140			
Toluene	21.2	0.50	"	20.0	0.63	103	60-140			
Ethylbenzene	20.3	0.50	"	20.0	ND	102	60-140			
Xylenes (total)	61.5	1.0	"	60.0	ND	102	60-140			
Surrogate: o-Chlorotoluene (BTEX)	*19.7*		*"*	*20.0*		*98.5*	*65-135*			

CALIFORNIA LABORATORY SERVICES

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ENSR - Sacramento 10411 Old Placerville Rd., Suite 210 Sacramento, CA 95827-2508	Project: Frmr. Unocal 762248-359 Main St, Fortuna,CA Project Number: 06940-407-100 Project Manager: John Warren	**CLS Work Order #: COB0433** COC #: None

Gas/BTEX by GC PID/FID - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CO01246 - EPA 5030 Water GC										
Matrix Spike Dup (CO01246-MSD1)		**Source: COB0457-04**		Prepared & Analyzed: 02/16/05						
Benzene	22.3	0.50	µg/L	20.0	ND	112	60-140	1.35	30	
Toluene	21.0	0.50	"	20.0	0.63	102	60-140	0.948	30	
Ethylbenzene	20.6	0.50	"	20.0	ND	103	60-140	1.47	30	
Xylenes (total)	62.4	1.0	"	60.0	ND	104	60-140	1.45	30	
Surrogate: o-Chlorotoluene (BTEX)	*19.8*		*"*	*20.0*		*99.0*	*65-135*			

CALIFORNIA LABORATORY SERVICES

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Notes and Definitions

HT-1	The sample was received outside of the EPA recommended holding time.
GC-25	Weathered gasoline.
DSL-1	Although sample contains compounds in the retention time range associated with diesel, the chromatogram was not consistent with the expected chromatographic pattern or "fingerprint". However, the reported concentration is based on diesel.
C-03C	Per customer request, the sample extract has undergone silica-gel clean-up, EPA Method 3630, which is specific to polar compound contamination.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

ENSR INTERNATIONAL

CHAIN OF CUSTODY

COB0433

Lab: CLS

TAT: Standard

Report results to:

Name: Jeff Wendt
Company: ENSR
Mailing Address: 10411 Old Placerville Road, Suite 210
City, State, Zip: Sacramento, CA 95827-2508
Telephone No.: 916-362-7100
Fax No.: 916-362-8100

Project Information

Site Address: 359 Main St., Fortuna, CA
ENSR No.: 06940-407-100
Unocal No.: 762248
Global ID No.: T0602393213

Special instructions and/or specific regulatory requirements:
***Run TPHd w/ Silica Gel Cleanup on ALL TPHd HITS**

Sample Identification	Date Sampled	Time Sampled	Matrix/ Media	No. of Conts.	TPHg 8015	BTEX 8021	TPHd 8015 w/SGC	Total Organic Carbon (TOC)	Alkalinity as $CaCO_3$							Sample Condition/Comments	Preservative
MW-1	2/9/05	1734	GW	4	X	X	X										Ice/HCL
MW-2	2/9/05	1239	GW	1			X										Ice/HCL
MW-3	2/9/05	1453	GW	4	X	X	X										Ice/HCL
MW-4	2/9/05	1709	GW	4	X	X	X										Ice/HCL
MW-5	2/9/05	1548	GW	4	X	X	X										Ice/HCL
MW-6	2/9/05	1341	GW	4	X	X	X										Ice/HCL
MW-7	2/8/05	1711	GW	1			X										Ice/HCL
MW-8	2/8/05	1739	GW	1			X										Ice/HCL
MW-9	2/8/05	1649	GW	1			X										Ice/HCL
MW-10	2/8/05	1802	GW	1			X										Ice/HCL
MW-13	2/9/05	1509	GW	4	X	X	X										Ice/HCL
MW-14	2/9/05	0708	GW	4	X	X	X										Ice/HCL
MW-15	2/9/05	0752	GW	4	X	X	X										Ice/HCL
MW-16A	2/9/05	1810	GW	6	X	X	X	X	X								Ice/HCL
MW-16B	2/9/05	1220	GW	6	X	X	X	X	X								Ice/HCL
MW-17	2/9/05	0934	GW	6	X	X	X	X	X							No preservatives	Ice/HCL
MW-18	2/9/05	1758	GW	6	X	X	X	X	X								Ice/HCL
MW-19	2/9/05	1407	GW	6	X	X	X	X	X								Ice/HCL
MW-20	2/9/05	0811	GW	6	X	X	X	X	X								Ice/HCL
MW-21	2/9/05	0900	GW	6	X	X	X	X	X								Ice/HCL
~~Trip Blank~~ QA	2/5/05	12:00	water	1	X	X											Ice

Collected by: Tanya Aboual *Date/Time* 2/9/05 0:00 *Collector's Signature:* Tanya Aboual *Date/Time* 2/9/05 18:10

Relinquished by: [signature] *Date/Time* 2/12/05 0845 *Received by:* [signature] *Date/Time* 2/11/05 0845

Relinquished by: [signature] *Date/Time* 2/11/05 1110 *Received by:* [signature] *Date/Time* 2-11-05 1110

Method of Shipment: *Sample Condition on Rcpt:*