Mr. Jerry Wickham
Hazardous Materials Specialist
Alameda County Health Care Services Agency
Environmental Health Services
Environmental Protection
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

RE: Eagle Gas Station
4301 San Leandro Street
Oakland, California 94601
LOP StID# 2118
Fuel Leak Case No. RO0000096
USTCF Claim No. 014551
Clearwater Group Project # ZP046D

Dear Mr. Wickham,

As the legally authorized representative of the above-referenced project location, I have reviewed the ***Additional Subsurface Investigation Work Plan*** prepared by my consultant of record, Clearwater Group, Inc. I declare, under penalty of perjury, that the information and/or recommendations contained in this report are true and correct to the best of my knowledge.

Sincerely,

Muhammad Jamil

Mr. Muhammad Jamil

CLEARWATER
GROUP
Environmental Services

October 6, 2006

Mr. Jerry Wickham, P.G.
Alameda County Environmental Health Services
Environmental Protection Division
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

RE: Additional Subsurface Investigation Work Plan
Eagle Gas Station
4301 San Leandro Street
Oakland, California 94601

ACEH #RO0000096
LOP St ID #2118
USTCF Claim No. 014551
Clearwater Group Project #ZP046D

Dear Mr. Wickham,

Clearwater Group (Clearwater) has reviewed your August 11, 2006 *Technical Comments* and June 27, 2006 letter reviewing Clearwater's June 1, 2006, *Soil and Groundwater Investigation Report, Eagle Gas, 4301 San Leandro Street, Oakland, California.* This *Additional Subsurface Investigation Work Plan* presents site background followed by Clearwater's plan to; 1) fully characterize/further define the extent of on-site and off-site soil, groundwater and soil vapor contamination; 2) determine realistic groundwater gradient(s), 3) test for water and sewer pipe leaks; 4) search for additional on-site contaminants of concern (COC) sources; 5) establish a baseline of microbial parameters

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for a bioremediation feasibility study; 6) review inclusion of 1,2-dibromoethane (EDB), ethylenedichloride (EDC), methanol and ethanol in the sampling protocol; 7) follow-up the fast-track interim remediation pilot test with high vacuum dual phase extraction (HVDPE), 8) match the data results with a cost-effective interim remediation system; 9) propose an investigation schedule and 10) report on the investigation and interim remedial efforts.

1.0 BACKGROUND

The site is located in the southern portion of the city of Oakland, Alameda County, California. The site is located approximately 1,100 feet east of Interstate Highway 880, at the southern corner of the intersection of San Leandro Street and High Street, see Site Location Map **Figure 1**. It is bounded by commercial properties to the southeast and southwest and by High Street to the northwest and San Leandro Street to the northeast.

1.1 Site Investigation History

On April 21 and 22, 1999, Artesian Environmental (now Clearwater) oversaw the removal of five underground storage tanks (USTs) consisting of two 6,000-gallon gasoline tanks, two 4,000-gallon diesel tanks, and one 300-gallon used-oil tank from the site. Strong petroleum odors were detected from soils near the former UST locations during the UST removals. Five soil samples were collected from the UST excavation for confirmation sampling. The results suggest that an unauthorized release of petroleum had occurred. The former UST excavation area is shown on **Figure 2** (Site Plan with Resurveyed Well Locations).

In a letter dated May 10, 1999, Alameda County Environmental Health Services (ACEH) recommended that soil be remediated by over-excavation and "as much groundwater as possible" be pumped from the excavation. Approximately 800 tons of petroleum-impacted soils were excavated and disposed of as Class II non-hazardous waste; and approximately 1,000 gallons of petroleum-impacted groundwater was pumped from the excavation and removed from the site. Groundwater did not recharge quickly after the initial pumping. Existing on and off-site structures limited the amount of soil that could be safely excavated. Soil samples collected from the excavation walls and product-piping trenches indicated that residual concentrations of petroleum hydrocarbons and methyl tert-butyl ether (MTBE) remained.

On August 4 and 5, 1999, approximately 100 linear feet of subsurface product piping was removed. Vent piping from between the former USTs and the south corner of the on-site building was also removed. All the piping was cut up and disposed of as scrap metal. On August 5, 1999, six confirmation soil samples were collected along the piping trench from approximately three feet below ground surface (bgs). Laboratory analytical results indicated that hydrocarbon-related contamination existed along the piping trenches.

On September 26, 2000, West Hazmat of Rancho Cordova, California, used a CME 75 drill rig to advance three borings to approximately 25 feet bgs and collect soil samples. The three borings were converted into groundwater monitoring wells MW-1 through MW-3 (**Figure 2**). Initial groundwater samples collected from these wells contained 83,000 micrograms per liter (µg/L) to 250,000 µg/L Total Petroleum Hydrocarbons as gasoline (TPH-g) and 33,000 µg/L to 400,000 µg/L MTBE.

On August 3, 2001, Clearwater submitted its *Groundwater Monitoring Report - Second Quarter 2001* and *Sensitive Receptor Survey and Workplan for Continuing Investigation.* It was determined that there were no major ecological receptors, permanent surface waters or domestic-use wells within a 2,000-foot radius of the site. The proposed scope of the workplan included the installation of eight groundwater monitoring wells around the site to delineate the MTBE groundwater plume. In response to Clearwater's workplan, the ACEH, in a correspondence dated October 18, 2001, recommended that the installation of additional off-site wells not be performed for the time being. Instead, the

ACEH requested that further characterization of subsurface soils and groundwater on the site be completed prior to the installation of any off-site wells.

Quarterly monitoring was suspended after the Third Quarter 2001 event of August 3, 2001. Quarterly monitoring resumed in July 2003 (Third Quarter 2003) and has continued quarterly since then. After completing its review of the Third Quarter 2003 groundwater monitoring report, the ACEH requested a work plan to include additional on-site and off-site subsurface investigations and address the extent of on-site groundwater impact. Clearwater submitted an Interim Remedial Action Plan (IRAP) on January 14, 2004. In order to expedite the implementation of the IRAP, Clearwater formally requested that the Oakland Fire Department review the IRAP and the Fourth Quarter 2004 groundwater monitoring report and oversee the project. The Fire Department verbally agreed to oversee the project then subsequently turned the project over to ACEH. ACEH provided its review comments for the IRAP and the *First Quarter 2005 Groundwater Monitoring Report* in a letter dated May 26, 2005. Clearwater submitted its *Soil and Groundwater Investigation Workplan* on August 10, 2005. In review letters dated September 21, 2005, and November 1, 2005, ACEH approved the implementation of a modified IRAP proposed in Clearwater's June 13, 2005 letter entitled *Recommendations for Interim Remedial Actions* and the August 10, 2005 *Soil and Groundwater Investigation Workplan*. An evolution of designs culminated in a remediation compound design, which was proposed with combined granulated activated carbon (GAC) filtering of discharge groundwater and an in situ submerged oxygen curtain (iSOC®). A limited groundwater pump test in well MW-2 (November 2005) determined an extremely low recharge rate in the shallow groundwater zone.

Groundwater monitoring wells MW-4 through MW-8, MW-4D, MW-5D, interim remediation wells IS-1 through IS-6, and extraction wells EW-1 and EW-2 were installed between December 15 and 21, 2005. The well locations are shown on **Figure 2**.

Groundwater monitoring wells MW-4, MW-6, MW-7, and MW-8 were screened in the "shallow zone" between 10 to 25 feet bgs. Monitoring wells MW-4D and MW-5D were screened in the "deep zone" between 35 to 45 feet bgs. "Shallow zone" and "deep zone" refer to apparent aquifer layers, but do not imply separate, discontinuous or confined aquifers.

Wells IS-1 through IS-6 were installed as iSOC® delivery wells. Wells EW-1 and EW-2 were installed as groundwater extraction wells. All of these wells were screened between 10 and 25 feet bgs, pending installation of the remediation compound. The iSOC® and groundwater extraction systems have not yet been installed in any of these wells.

Deep zone soil borings SB-4D through SB-8D were drilled to approximately 50 feet bgs to investigate the lithology and degree of contamination within the deep zone.

A total of 115 soil samples were collected during the installation of the borings and wells and analyzed for TPH-diesel (TPH-d), TPH-g, BTEX, oxygenated compounds including MTBE and tert-butyl alcohol (TBA), and lead scavengers 1,2-Dichloroethane (1,2-DCA) and 1,2-Dibromoethane (1,2-EDB). The groundwater samples were analyzed for TPH-d, TPH-g, BTEX, oxygenates compounds including MTBE and TBA, and lead scavengers 1,2-DCA and 1,2-EDB.

1.2 Recent Investigation Findings

Clearwater presented the results of its *Soil and Groundwater Investigation* to the ACEH on May 30, 2006. The results of this investigation are summarized below:

- The subsurface lithology is heterogeneous and is characterized by low permeability clays with occasional lenses of soil with moderate to high permeability.
- A relatively continuous clayey gravel layer, having moderate permeability and a thickness of approximately five to 15 feet, exists in the shallow zone under the site.

This moderately permeable layer is between two layers of low permeability clay. Clayey sand is found in a limited area within both clayey layers. The first clayey layer and the clayey gravel constitute the shallow groundwater zone, it is underlain by a second clayey layer.

- Underneath the permeable clayey gravel zone is another clayey layer of approximately 20 to 30 feet thick. Multiple sandy/silty lenses of limited depths exist within this thick clayey layer and impose heterogeneities. Underneath this thick clayey layer is another sandy/silty layer, or lens, with high to moderate permeability. The thickness of this sandy/silty layer or lens is undetermined. Both the low permeability, thick clayey layer and the permeable sandy/silty layer/lens constitute the deep groundwater zone.
- Based on the measured groundwater elevations from the deep monitoring wells and the bottom elevation of the thick clayey layer, the local groundwater in the deep zone may be under semi-confined or confined conditions.
- Comparison of the groundwater elevations in shallow/deep well pairs MW-4/MW-4D and MW-5/MW-5D indicates that the groundwater elevations are higher in the shallow wells relative to the deep wells, by an average of approximately 7.5 feet, and that a downward vertical gradient between the upper and lower zones exists.
- Groundwater with a principal flow in both the southwestern and northwestern directions was identified during the First Quarter 2006 monitoring event.
- Groundwater in the shallow zone is heavily impacted. The major axes of the hydrocarbon plume and the MTBE plume trend along the same north-south line. The center of the plumes is located near well MW-4/EW-1, and IS-3/IS-5. The TBA plume in the shallow zone is dissimilar to the hydrocarbon and MTBE plumes. The center of the TBA plume is near well IS-6.
- The distribution of TPH-g and MTBE in the soil of the shallow groundwater zone is very similar to the shallow groundwater plume distribution described above. Elevated soil TPH-d concentration in the shallow zone was found near soil borings SB-6D and

SB-8. However, an elevated soil TBA concentration was found near the current UST area and southwest of the on-site building.

- In the deep groundwater zone, only two of the borings were found to be impacted by petroleum hydrocarbons. Samples from soil boring SB-6D contained TPH-g and TPH-d and samples from soil boring SB-5D contained MTBE and TBA above the method detection limits.
- Based on the February 22, 2006 groundwater sampling results, the ranges of MTBE and TBA concentrations in the shallow groundwater zone were 21,000 to 770,000 μg/L and 24,000 to 210,000 μg/L, respectively. Concentrations of the above compounds in the deep groundwater zone ranged from 8.1 to 440 μg/L and less than the method reporting limit (MRL) of 5.0 μg/L to 5.5 μg/L, respectively. Concentrations of TPH-g, TPH-d, and benzene in the deep groundwater zone were less than their associated MRLs, of 90, 50 and 0.9 μg/L, respectively.
- As a result of the interference of high concentrations of MTBE and TBA, TPH-g and TPH-d analyses of groundwater samples from the shallow groundwater zone had relatively high MRLs, at 150,000 and 8,000 μg/L, respectively.
- MTBE, TBA, and TPH-g have been identified as the COCS for the subject site. Although elevated hydrocarbon concentrations have been detected, the concentration of the petroleum hydrocarbons is generally lower than the concentration of the oxygenates.
- The subsurface impact primarily exists in the shallow groundwater zone (depth interval to 25 feet bgs). Although a downward hydraulic gradient has been identified the observed impact in the deep groundwater zone is relatively low.
- Since a clayey gravel layer with moderate permeability exists in the shallow zone, and the shallow groundwater has been greatly impacted, the potential of off-site migration of contaminated groundwater is high. Although a high to moderate permeability sandy/silty layer exists in the deep groundwater zone, the deep zone has not been significantly impacted.

The second quarter 2006 groundwater monitoring event was performed on May 18 and 19, 2006. The groundwater elevation contours and groundwater sample analytical results from the May event were consistent with the February 2006 sampling results presented in the May 30, 2006, *Soil and Groundwater Investigation Report*. The results of the second 2006 quarterly groundwater monitoring event were presented in Clearwater's July 27, 2006, *Quarterly Groundwater Monitoring Report – Second Quarter 2006.*

2.0 INTERIM SITE INVESTIGATIVE ACTIVITY

The ACEH has requested that Clearwater investigate the cause of the steep groundwater gradient reported in the Clearwater June 1, 2006, *Soil and Groundwater Investigation Report* and the Clearwater July 27, 2006, *Quarterly Groundwater Monitoring Report – Second Quarter 2006*. The steep gradients may be caused by singular or multiple causes. Potential causes of the steep groundwater gradients include: 1) leakage from the on-site domestic water supply system (Section 3.1 following), 2) perched water bearing zones (Section 2.2 following), 3) on-site flow of shallow groundwater from an off-site, up-gradient direction (Section 3.3.1 following), or 4) an error in surveying the well locations or top of well casing elevations (Section 2.3 following).

Clearwater has recently completed the following tasks in an effort to investigate potential on-site USTs and to identify the cause(s) of the calculated steep groundwater gradients observed on-site.

2.1 Ground Penetrating Radar Search for Four Sidewalk USTs

The fill ports for four historic USTs were drawn on the October 1968 survey *Topographic and Boundary Survey of Property at the Southern Corner of High Street and San Leandro Street by John A. Mancini, Survey No. 6163*. This survey was acquired by Clearwater staff at the City of Oakland Building Department counter. A search for the four possible removed USTs was conducted on August 15, 2006. Norcal Geophysical

Consultants (Norcal), of Cotati, California, was contracted to perform a ground penetrating radar (GPR) survey of the property sidewalk along High Street. Norcal also GPR surveyed around well MW-4D to investigate the cause of this well's collapse discovered during its well development. In January 2006 the well seal collapsed approximately 4 feet. The well was repaired prior to development. A GPR survey was performed around two proposed deep groundwater monitoring well locations to clear these locations for underground utilities. No USTs, voids, or buried objects were noted during the GPR survey at these three areas of interest. A copy of the Norcal GPR report is presented in **Attachment A**. Note that on Plate 1 of the Norcal GPR report the north arrow is misaligned.

2.2 Review of Soil Boring Logs and Well Construction Data

The soil boring logs and well construction data were reviewed to identify possible causes for the significant differences in groundwater elevations across the site. No causes for the steep gradient were apparent from the review of this data. **Table 1** presents the well construction details for the site wells. **Attachment B** presents site cross sectional views with the well screen intervals.

2.3 Well Location and Elevation Confirmation

Clearwater field-checked the well locations of all of the groundwater monitoring wells on August 18, 2006, using a 100-foot long cloth tape. The horizontal distances between wells were measured in order to triangulate the well positions. The well's horizontal positions were originally determined using a Trimble model TSC1 GPS (global positioning system) survey in 2005. The top of casing (TOC) elevations of all of the wells was checked on September 12, 2006 using a survey level and survey staff, accurate to within 1/100 of a foot. Depth to groundwater measurements were also collected from all of the wells on September 12, 2006. The TOC elevation for well MW-1 (northwest corner of site) was assumed correct and the TOC elevation for all of the other wells was calculated as the relative difference from MW-1's TOC elevation. The surveyed TOC elevations were compared with the previously used TOC elevations, which were determined using a laser level. The relative difference in TOC elevation for each well was determined. The maximum TOC elevation difference was found to be 0.012 feet for well IS-3. **Table 2** presents the original TOC elevations followed by the resurveyed TOC elevations, which will be used going forward. The revised base map with the resurveyed well locations is shown in **Figure 2**. Calculation of the site's groundwater gradient for September 12, 2006 (**Figure 3**) using the revised well locations and TOC elevations shows a refined schematic of the same pattern; the steep groundwater gradient pattern persists.

3.0 ADDITIONAL SUBSURFACE INVESTIGATION WORK PLAN

This work plan was prepared following receipt of ACEH's June 27 and August 11, 2006 letters (**Attachment C**) reviewing Clearwater's June 1, 2006 *Soil and Groundwater Investigation Report* and Clearwater's July 7, 2006 *Response to Technical Comments* to the ACEH. This Work Plan integrated ACEH comments into the investigation report recommendations.

3.1 Additional Data Collection Required to Investigate the Causes of Steep Groundwater Gradients on Site

Recent field work and recalculations of TOC elevations performed to refine the site groundwater elevation contour pattern (GPR survey and resurvey of well locations and TOC elevations) have not significantly altered the contour elevation pattern.

A possible cause of the groundwater mounding near the center of the site is leaking pipes, including water supply and sewer pipes. Groundwater samples from wells IS-3, IS-5, MW-7, MW-4, and MW-8 will be analyzed for water treatment chemicals and coliform bacteria to determine if an on-site domestic water supply or sewer leak is contributing to the site's groundwater mounding observed near the center of the site. The analytical test methods will include trihalomethane by Standard Method 4500 CLF, chlorine residual by

EPA Method 524.2 and E. coli and total coliform bacteria by Standard Method 9223. *Standard Methods for the Examination of Water and Wastewater* are published by the American Public Health Association. The samples will be collected during the next quarterly groundwater monitoring event and analyzed by a California certified analytical laboratory.

If water treatment chemicals or coliform bacteria are detected, Clearwater will request that the leak be isolated and repaired. If the leakage is found and repaired, subsequent groundwater elevation measurements collected during the next several quarterly groundwater monitoring events may reveal a changed groundwater elevation contour pattern and the elimination of the steep gradients.

Leakage from on-site piping is a possible scenario to explain the site's steep groundwater gradients. If leakage is eliminated as a cause of the steep gradients, Clearwater will propose additional methods to investigate other potential causes to the step gradients, such as perched water layers.

3.2 Bioremediation Feasibility Study

A bioremediation feasibility study will be performed to determine if enhanced biological degradation of site contaminants is feasible. Diffusion of oxygen into the groundwater using iSOC® wells is a proposed interim measure.

Groundwater Sample Collection for Bioremediation Feasibility

During the next regularly scheduled quarterly groundwater monitoring event (November 2006) additional groundwater will be collected from select wells to perform a bioremediation feasibility study to determine the efficiency of site remediation using enhanced bioremediation techniques. Groundwater samples will be collected from wells IS-5, MW-4, and MW-8 to perform the study. These wells are chosen based on their degree of contamination. Prior to sample collection, the following parameters will be measured in these wells; dissolved oxygen (DO), pH, temperature, conductivity, oxidation-reduction potential (ORP), ferrous iron (Fe 2+) reduced form, and total iron. The samples collected for the microbial study will be sent to Cytoculture, a microbial laboratory in Point. Richmond, California, for bacterial counts of total heterotrophs and hydrocarbon specific degraders. **Attachment D** presents an enhanced aerobic bioremediation work plan.

The additional groundwater samples collected from wells IS-5, MW-4 and MW-8 will also be analyzed by a California-certified analytical laboratory for biological oxygen demand (BOD) by EPA Method 405.1, alkalinity by EPA Method 310.1, o-phosphate by EPA Method 300.0, total dissolved solids (TDS) by EPA Method 160.1, sulfate by EPA Method 300.1, nitrate by EPA Method 300.0, total inorganic carbon (TIC) by EPA Method 415.2, ammonia as nitrogen by EPA Method 350.3, chemical oxygen demand (COD) by EPA Method 410.4, and total organic carbon (TOC) by EPA Method 415.2. These efforts will be made to acquire information on the quantity and quality of microbial activity in the current subsurface, coupled with acquiring the parameters which contribute to the efficacy of microbial remediation.

3.3 Subsurface Investigation

Clearwater will install on-site "deep" wells MW-7D and MW-1D. "Deep" means a well installed to depths below 25 bgs and does not infer the existence of a separate lower aquifer. Clearwater will also drill eight off-site borings to investigate off-site groundwater conditions and install five permanent on-site soil vapor wells.

<u>Boring and Well Permitting</u>

Soil boring and groundwater monitoring installation permits will be obtained from the Alameda County Public Works (ACPWA), Water Resources Agency. Prior to any subsurface investigation, the proposed boring and well locations will be marked with white paint on the ground and Underground Service Alert (USA) will be notified to have those utility companies with underground utilities in the investigation area mark their utilities. In addition, a private underground utility locating service will be contracted to locate and mark the underground utilities.

3.3.1 Off-Site Investigation Using Step Out Borings

Clearwater proposes to drill and sample eight off-site soil borings (borings SB-9 through SB-16, **Figure 4**). The off-site borings have three purposes: 1) they are designed to investigate the extent of off-site contamination to the shallow groundwater zone and will be sampled to a depth of approximately 25 feet bgs, 2) they are designed to evaluate the potential for the plume to affect off-site receptors, and 3) characterize the off-site lithology. The borings will be continuously cored, logged, and sampled using a Geoprobe® soil sampling system. Representative soil samples will be collected for analysis from distinct lithologic intervals. If the field evidence (photoionization detector [PID] readings on soil cores, odor, staining, or sheen) indicates that contamination extends beneath 25 feet bgs, the borings may be driven deeper to a depth of up to 50 feet bgs to determine the vertical extent of contamination. One grab groundwater sample will be collected from the top of the groundwater from each boring, using a disposable bailer. Additional depth-discrete grab ground water samples will be obtained if field observations indicate that deeper layers contain highly contaminated soil or groundwater. The depth discrete grab ground water samples will be collected using a Snap Sampler® or similar device. The grab groundwater and soil samples will be analyzed for same suite as the groundwater samples collected during the quarterly groundwater monitoring event (BTEX, MTBE, TPH-g, TPH-d, oxygenates). **Attachment E** presents the Clearwater Soil Boring Procedures.

The objective in drilling off-site borings includes delineating the plume with regard to preferential pathways and delineating the plume in the direction of potential discharge to Peralta (Adams) Creek (sensitive receptor). Two borings (SB-9 and SB-10) will be drilled in the presumed up-gradient direction from the site, at the locations shown on

Figure 4. Three borings (SB-11 through SB-13) will be drilled down-gradient and southwest of the site, in the sidewalk or gutter along High Street and three soil borings (SB-14 through SB-16) will be drilled to the southeast, in the sidewalk, gutter, or parking lane along San Leandro Street, as shown on **Figure 4**.

The final location of the borings will be determined after each location has been marked out by USA and inspected by a utility clearance contractor. The spacing of the borings along High Street and San Leandro Street will be adjusted in the field, based upon the field indicators of contamination detected during drilling. **Figure 4** shows the proposed starting locations and proposed step-out locations. The borings will start near the site and step-out increasingly further distances, at the field geologist's discretion until apparent non-detect conditions are encountered, or it becomes apparent that an off-site source is involved. In order to be able to drill three or more step out borings per street, Clearwater will obtain soil boring permits from the ACPWA for six or more borings per street, spaced at approximate 50 foot intervals. After the soil borings have been performed, the ACPWA will be notified of which boring locations were not drilled. The soil borings will be drilled and sampled according to Clearwater's Soil Boring Procedures (**Attachment E**). In addition, Clearwater will obtain permits for sidewalk or traffic lane closure from the City of Oakland Public Works Agency, Transportation Service Division.

Based on the step-out boring contaminant data, the report will provide recommendations regarding the placement of groundwater monitoring wells for a permanent groundwater monitoring well network. The lithologic logs from the borings will be used to design the screen placement in the off-site wells.

3.3.2 Installation of Two On-Site Deep Monitoring Wells

Clearwater will install two on-site groundwater monitoring wells to intercept groundwater within the "deep layer" between 35 and 45 feet bgs. Well MW-7D will be located near boring SB-7D and MW-7, to monitor "deep layer" groundwater migrating to the southwest. Well MW-1D will be located along the southwest property boundary and installed to monitor groundwater migrating to the west. **Figure 5** presents the wells' proposed locations.

The well boreholes will be conventionally logged by a field geologist working under the direction of a California Professional Geologist. The bore holes will be logged using a pilot boring (typically a Geoprobe® boring) using a continuous soil conductivity recording, or a cone penetrometer test (CPT) boring log, in order to construct each well with its screen interval across more permeable lithologic intervals. The boreholes will be over-drilled with a hollow stem auger drill to install the wells. The well screen lengths will be no more than five feet, the screen locations will be based on the pilot boring logs.

The groundwater elevation data from the four on-site deep wells (existing wells MW-4 and MW-5D and planned wells MW-7D and MW-1D) will be used to calculate the groundwater flow direction and gradient of the "deep layer". In addition the configuration of wells MW-1D, MW-4D, MW-7D will provide data for drawing a "deep zone" cross sectional view of the site.

Well MW-1D will be located along the southwest property boundary and will be installed to monitor groundwater migrating to the west.

<u>Well Screen Intervals</u>

The selection of the well screen intervals will also be based upon analysis of depth discrete grab groundwater samples from field-identified permeable zones and review of the boring logs. Clearwater's Depth Discrete Grab Groundwater Sample Collection Protocol is presented in **Attachment F.**

Well Construction

The pilot borings will be grouted following their completion. The grouted pilot borings will be over-drilled at a later date with a hollow-stem auger drill rig, without soil logging, to install the wells. In general, the screen intervals will not exceed 5 feet, unless thick, continuous, permeable layers are encountered.

Wells MW-1D and MW-7D will be constructed with 2-inch diameter, Schedule 40 PVC well casings. Each well will have a 5-foot long slotted screened section. The screen slots will be 0.010-inch diameter and #30 sand will be used for the filter packs. The filter packs will extend approximately two feet above the screened section. An approximately 2-foot thick well seal consisting of bentonite pellets will be set above the sand. As these are deep wells, the pellets will be placed below the site's groundwater level and added water should not be needed to hydrate the pellets. The pellets will be allowed to hydrate for at least 45 minutes before grouting the well. Each well will be grouted using lean cement mixed with approximately 5% bentonite powder. The grout will be brought up to near the ground surface. Grout will be added to the borehole to bring the grout up to the bottom of the well box excavation prior to setting the well box in concrete. A steel well completion box will be set in concrete with its lid approximately one-inch above the surrounding concrete surface, to prevent rainwater or surface drainage from entering the well. The top of the well casing will be sealed with a locking watertight expansion plug and a padlock. **Attachment G** presents Clearwater's Well Installation Procedures.

Well Development

The two new groundwater wells will be developed 48 hours, or more, after their installation. The wells will be surged, bailed and then pumped until the discharged water is free of sediment and clear. Approximately ten well volumes will be purged from each well.

Soil Boring and Well Survey

The soil borings and groundwater monitoring well locations will be surveyed using a global positioning system (GPS) and measuring tape, and a survey level and survey staff. Several existing wells and site features with previously surveyed locations will be included in the survey to confirm the validity of the survey.

Incorporation of Two New Deep Wells Into Quarterly Groundwater Monitoring Program

The two new wells will be incorporated into the current quarterly groundwater monitoring program comprised of 18 groundwater wells. The new wells will be sampled and analyzed for the same suite as the other wells, except that during the initial monitoring of the new wells the analytical suite will include EDB, EDC, methanol and ethanol, which is planned for discontinuation in the existing wells.

Investigation Derived Waste

Soil derived from the soil borings and well installations will be pre-profiled for acceptance at the landfill previously used for soil disposal for this site. The soil will be temporarily stored on-site in sealed and labeled 55-gallon steel drums and transported off-site following the event. Disposal water will consist of decontaminate rinsate, and water generated by well development and purging. The water will be stored in an internal tank in the sampling van and disposed of at a licensed disposal facility.

3.3.3 Soil Vapor Sampling

Soil vapor monitoring will be performed adjacent to the off-site buildings and the on-site building to determine whether subsurface petroleum hydrocarbon vapors could pose a health risk to the workers at the on-site building or at any of the adjacent buildings. The soil vapor samples will be collected from beneath the "planter strip", asphalt or concrete slab at depths of 3, 6 and 9 feet bgs. The soil vapor sample collection and analysis will follow the protocols provided in the California EPA, Department of Toxic Substances Control, Interim Final document, *Guidance for the Evaluation and Mitigation of*

Subsurface Vapor Intrusion to Indoor Air, December 15, 2004 (Vapor Intrusion Guidance Document).

Two soil vapor sampling events are planned, six months apart, to account for seasonal and temporal changes. At this time Clearwater will collect only subsurface vapor samples, due to the abundance of interfering compounds within these above ground structures such as gas fumes from automobiles, stored petroleum products and solvents. The property to the southeast of the site is used for vehicle smog testing.

3.3.3.1 Permanent Soil Vapor Well Installations

In order to investigate the concentration of constituents of concern in the subsurface, five permanent soil vapor monitoring wells will be installed adjacent to the off-site buildings and one permanent soil vapor monitoring well will be installed on-site directly adjacent to the on-site building at the locations shown on **Figure 6** (Proposed Permanent Soil Vapor Monitoring Well Locations). The vapor wells will be placed as close as possible and adjacent to the off-site buildings to minimize the costs associated with obtaining access agreements from the off-site landowners and to obtain sound data prior to including additional parties in the site investigation.

At each soil vapor monitoring well, separate sample ports will be installed at depths of 3, 6 and 9 feet bgs. Each well will be installed using either a hollow stem auger drill or a Geoprobe drill. If the wells are installed using an auger drill, all of the sample points and tubing will be installed in the same borehole. If a Geoprobe® drill is used to install the sample points, the sample points and tubing may be installed using a separate push drive for each sample point.

Figure 7 (Typical Soil Vapor Monitoring Well Installation) presents a typical soil vapor monitoring well construction diagram. The sample points will be constructed using ¼" Teflon® tubing connected to a short (4 inch or less) screened interval, such as a

Geoprobe® Implant. Each vapor sample interval will consist of a one foot thick layer of #3 sand separated by hydrated bentonite pellets. Each sample interval will be sealed against surface breakthrough or bypass by the bentonite pellet bentonite layer, which will be hydrated with clean water and allowed to hydrate for at least 3/4 hour before placing the next sand layer. The end of the tubing for each sample port will be sealed with a gas and water-tight cover when the sample port is not in use. A ground level well box will be set in concrete over each soil vapor monitoring well to protect the sample ports. The well box will have a steel "bolt-on" well cover to protect the sample ports.

3.3.3.2 Vapor Sample Collection Using SUMMA® Canisters

The soil vapor samples will be collected from the vapor monitoring wells according to EPA Method TO-15 using a specially prepared stainless steel canister (Summa canister or similar). The canister is provided by and prepared by the analytical laboratory.

A 6-liter sub-atmospheric pressure SUMMA® canister will be used to collect the soil vapor sample. The 6-liter canister will be attached to the Geoprobe® gas sampling device using Teflon® tubing which is connected to an flow controller capable of regulating the sample flow at 200 milliliters per minute. The sample line is purged prior to collecting the sample. The SUMMA® canister is then connected to the flow regulator. Since the sub-atmospheric pressure canister is an evacuated canister, the soil vapor sample is collected without the use of a sample pump and the final canister pressure will be below atmospheric pressure. After the recommended sample duration of approximately 30 minutes the canister valve is closed. Following sample collection, the canister is sealed, labeled and the sample name recorded on a Chain-of-Custody (COC) document. The sample canisters will be sent under COC documentation to a California certified analytical laboratory and analyzed for TPH-d, TPH-g, TPH-motor oil (mo), and MTBE. The soil vapor well installation and sampling procedures are presented in **Attachment H.**

3.3.3.3 Use of Soil Vapor Sample Results

Results of the soil vapor monitoring will be used to determine the potential for constituents of concern vapor intrusion into the on-site and off-site buildings. The Vapor Intrusion Guidance Document will be used to calculate the risk associated with the results obtained.

3.4 Redirection of Fast Track Interim Remediation Plans

Clearwater has redirected the previous proposed Fast Track Interim Remediation based on data collected from November 2005 to April 2006. The site's low permeability (as determined by the groundwater extraction during the UST removals, extraction rate during the November 2005 pilot test, and field observations during well purging) makes groundwater extraction extremely inefficient. Given the low permeability, bioremediation and high vacuum dual phase extraction (HVDPE) are interim measures which can be performed quickly. Until the on-site and off-site groundwater flow direction and gradient is clearly established, extraction from wells EW-1 and EW-2 will not be performed. However, interim remediation is clearly warranted. The proposed data collection will be used to plan an amended fast-track remediation.

3.4.1.1 High Vacuum Dual Phase Extraction Pilot Test

High concentrations of soil and groundwater contamination are known to occur on-site. However, the site is a small active gasoline service station, the site and business owners have financial responsibilities and the business must remain in service during site interim remediation. Therefore, an in situ interim remediation with minimal disruption to the facilities site and business is required. In order to minimize site disruption and reduce remediation costs, Clearwater proposes performing a mobile HVDPE System pilot test to evaluate the potential for using HVDPE in addition to other technologies for site remediation. HVDPE uses an extremely high vacuum to extract both gaseous and liquid phases of hydrocarbons. See **Attachment I** for the Clearwater Soil Vapor Extraction Pilot Test Field Procedures.

The advantages of a HVDPE system are:

- The system extracts both groundwater and vapor and turns the saturated groundwater zone into a vadose zone to facilitate a higher hydrocarbon mass removal.
- It creates a high range of influence and requires a lesser number of extraction wells.
- There is no structural impact to the site and the HVDPE system does not cause a noticeable disturbance to the business.
- HVDPE may prove to be most cost effective in terms of cost per unit mass of hydrocarbons removed.
- HVDPE has proven effective on clay-rich sites with very low porosity.

The proposed HVDPE pilot test will consists of using a 25-horse power (hp), water-sealed, liquid ring vacuum pump to extract the subsurface liquid and vapor. The pump generates a maximum vacuum of 29 inch-Hg and a maximum vapor flow rate of 450 standard cubic feet per minute. It also pumps liquids at a maximum flow rate of 50 gallons per minute. A thermal oxidizer is used to treat the extracted and separated hydrocarbon vapors. The oxidizer generates 400,000 British Thermal Units (BTU) per hour and has a vapor hydrocarbon destruction efficiency of at least 99.9%. The extracted liquid can be burned off as excess liquid or stored in an on-site water storage tank pending transport and disposal at a licensed disposal facility

3.4.1.2 HVDPE Pilot Test Vapor Sampling Frequency

The pilot test would be run on several wells to determine their extraction rate and rebound effects. Clearwater is in contact with a HVDPE contractor who would select the wells to be tested. HVDPE pilot tests will be run for at least six hours on each well. A vapor sample will be collected after the system is turned on. At the same time as the sample collection, a field measurement of the vapor concentration will be made from the same vapor sampling port, using a photoionization detector. Additional field vapor concentration measurements will be made approximately every half-hour during the pilot test. Separate vapor samples will be collected from each well used for the pilot test. The vapor samples will be sent under Chain-of-Custody documentation to a California-certified analytical laboratory and analyzed for TPH-g, TPH-d, BTEX and MTBE. Calculations of contaminant mass reduction will be supplied by the HVDPE subcontractor.

3.4.2 iSOC® System Installation

As an interim remedial measure, Clearwater proposes to install in-situ oxygen curtain (iSOC®) delivery systems in infusion wells IS-1 through IS-6 (**Figure 2**). ISOC® will be used to reduce contamination levels at the source area of the contamination plume. ISOC® supersaturates the groundwater within the infusion well with low decay dissolved oxygen (DO), typically 40-200 parts per million (ppm), depending on depth of installation into groundwater. A natural convection current within the infusion well and a designed release bubble from the top of the iSOC® fills the groundwater within the well with a uniform DO curtain. The supersaturated DO curtain of water displaces around the infusion well into the adjacent groundwater and enhanced bioremediation removes organic compounds through natural attenuation. The higher the oxygen concentration in the infusion well, the greater the infusion of oxygen into the site's groundwater. Nutrients may also be added to stimulate microbial growth.

Clearwater will construct stand-alone iSOC® system wells as shown on **Figure 1** in **Attachment J**. At each well a 24" by 24" steel vault will be set over the well. The vault will contain a tank(s) of compressed oxygen gas and a flow regulator connected to the iSOC® unit. Each iSOC® unit will be suspended below the groundwater level in the well, as shown on **Figure 2** in **Attachment J**. Each iSOC® unit will be self-contained and there will be no need for trenching, piping, or control units between the individual wells. Clearwater's experience on similar sites is that each well uses approximately 60 standard cubic feet of oxygen per quarter and the tanks are replaced quarterly. The vaults will have bolted-on, traffic-rated, steel, lids to prevent vandalism and address safety issues.

3.5 Review of Historic Analyses for EDB, EDC, Methanol and Ethanol

Review of the previous groundwater sample analytical results (**Table 2**) indicates that EDB, EDC, methanol and ethanol concentrations have historically been below the method reporting limits for these compounds, with the exception of the groundwater samples from "deep" wells MW-4D and MW-5D. However, the reporting limits have been typically elevated due to the presence of interfering compounds. For example, the detection limit for methanol has been elevated to as much as 150,000 ug/l for the groundwater samples from wells IS-2 and MW-4 collected in February 2006 (First Quarter 2006 Monitoring Event). The deep wells have greatly decreased concentrations of petroleum hydrocarbons and correspondingly lower detection limits.

Due to the elevated reporting limits, Clearwater recommends that the analysis of EDB, EDC, methanol and ethanol be discontinued until interim or long-term soil and groundwater remedial measures have lowered the site's overall level of petroleum hydrocarbon contamination enough that meaningful EDB, EDC, methanol and ethanol reporting limits are obtainable. The two new deep wells (MW-1D and MW-7D) will be initially sampled for EDB, EDC, methanol and ethanol. If these contaminants of concern are detected their analysis will be included in future quarterly groundwater monitoring events.

4.0 SCHEDULE – YEAR 2006

Description	Start Date	Duration	Notes/Agency
Submit Workplan	October 6,		
Review Workplan	October 18,	2 – 4 weeks	ACEH
Obtain driller bids	November 6	5 day	
Schedule driller	November 13	1 day	
Obtain Boring and Well Permits	November 13	4 Weeks	Alameda County Public Works Agency, Water Resources Section
Collection of extra water samples for coliform bacteria and water treatment chemicals analysis	November 15 & 16	2 day	Collected during next regularly scheduled quarterly groundwater monitoring
Collection of extra water samples for Bioremediation Feasibility Study (5 wells)	November 15 & 16	2 day	Collected during next regularly scheduled quarterly groundwater monitoring
Analysis of coliform bacteria and water treatment chemical samples	November 17	2 weeks	Analytical laboratory
Produce Bioremediation Feasibility Study Report	November 20	1 month	Analytical laboratory and report
Purchase iSOC equipment	November 20	3 weeks	
Drill 8 off-site borings	December 4	2 day	
Install 2 deep on-site wells	December 7	1 day	
Install 5 permanent soil vapor monitoring wells	December 8,	1 day	
Sample soil vapor monitoring wells	December 11	1 day	
Develop deep wells	December 11	2 day	
Survey wells and borings	December 12	1 day	
ISOC installation	December 12	6 days	
Verify iSOC operation	December 14	1 day	
Analyze samples from soil vapor monitoring wells	December 29	2 weeks	

SCHEDULE - YEAR 2007

Description	Start Date	Duration	Notes/Agency
Dispose of Soil Cuttings	January 3	20 day	
Schedule HVDPE Pilot Test	January 10	5 days	
HVDPE Pilot Test	January 17,	3 days	
Analyze samples from HVDPE Pilot Test	January 18	2 weeks	
Submit report to ACEH	March 1		ACEH

5.0 REPORT

The Additional Subsurface Investigation Report will present the results of the field investigation of the above sections and incorporate the results into a revised Site Conceptual Model. The original Site Conceptual Model was presented in Clearwater's June 1, 2006, *Soil and Groundwater Investigation Report.* The report may include the results of the concurrent November 2006 quarterly groundwater monitoring event. The report will also present the known extent of off-site migration of the constituents of concern, the soil vapor conditions, groundwater parameters and recommendations for site specific, efficient, remedial techniques.

6.0 LICENSED PROFESSIONALS

All projects are directed by in-house licensed professionals. These professionals, including geologists or engineers, shall be guided by the highest standards of ethics, honesty, integrity, fairness, personal honor, and professional conduct. To the fullest extent possible, the licensed professional shall protect the public health and welfare and property in carrying out professional duties. In the course of normal business, recommendations by the in-house professional may include the use of equipment, services or products in which the Company has an interest. Therefore, the Company is making full disclosure of potential or perceived conflicts of interest to all parties.

CLEARWATER GROUP
Environmental Services

CERTIFICATION

This work plan was prepared under the supervision of a Professional Geologist in the State of California. All statements, conclusions and recommendations are based solely upon published results from previous consultants, field observations by Clearwater staff and laboratory analyses performed by a State of California certified laboratory related to the work performed by Clearwater.

Information and interpretation presented herein are for the sole use of the client and regulating agency. The information and interpretation contained in this document should not be relied upon by a third party.

The service provided by Clearwater staff has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of this profession currently practicing under similar conditions in the area of the site. No other warranty, expressed or implied, is made.

If there are any questions regarding this *Additional Subsurface Investigation Work Plan*, please do not hesitate to contact me at 510-307-9943 ext 237.

Sincerely,

Clearwater Group

Robert L. Nelson

Robert L. Nelson, P.G. #6270, #C.E.G. 2087
Senior Geologist

REGISTERED GEOLOGIST
ROBERT L. NELSON
No. 2087
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Reviewed by: James A. Jacobs, P.G. #4815, C.H.G. #88
Principal Hydrogeologist

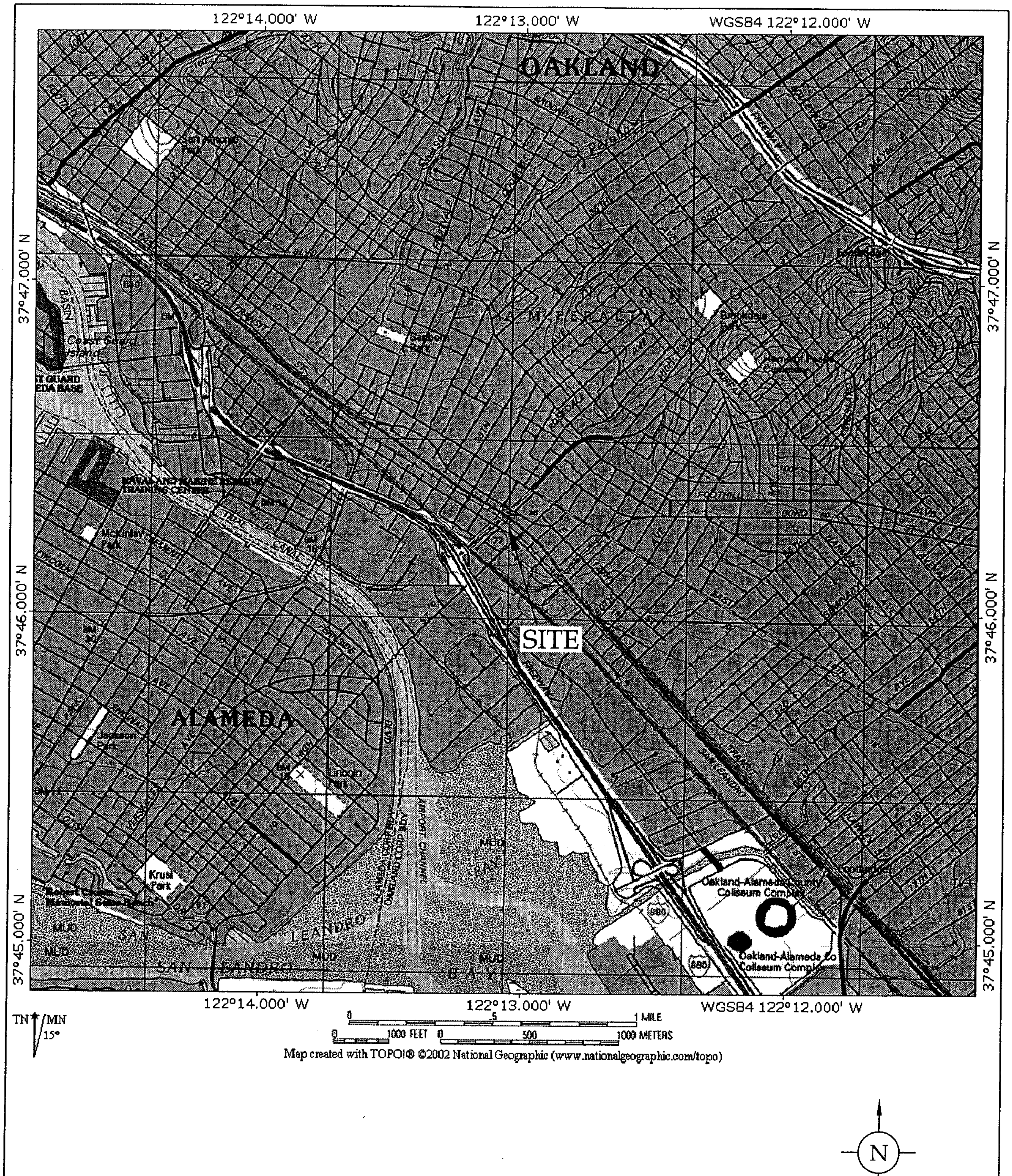
Cc: Muhammad Jamil

FIGURES:

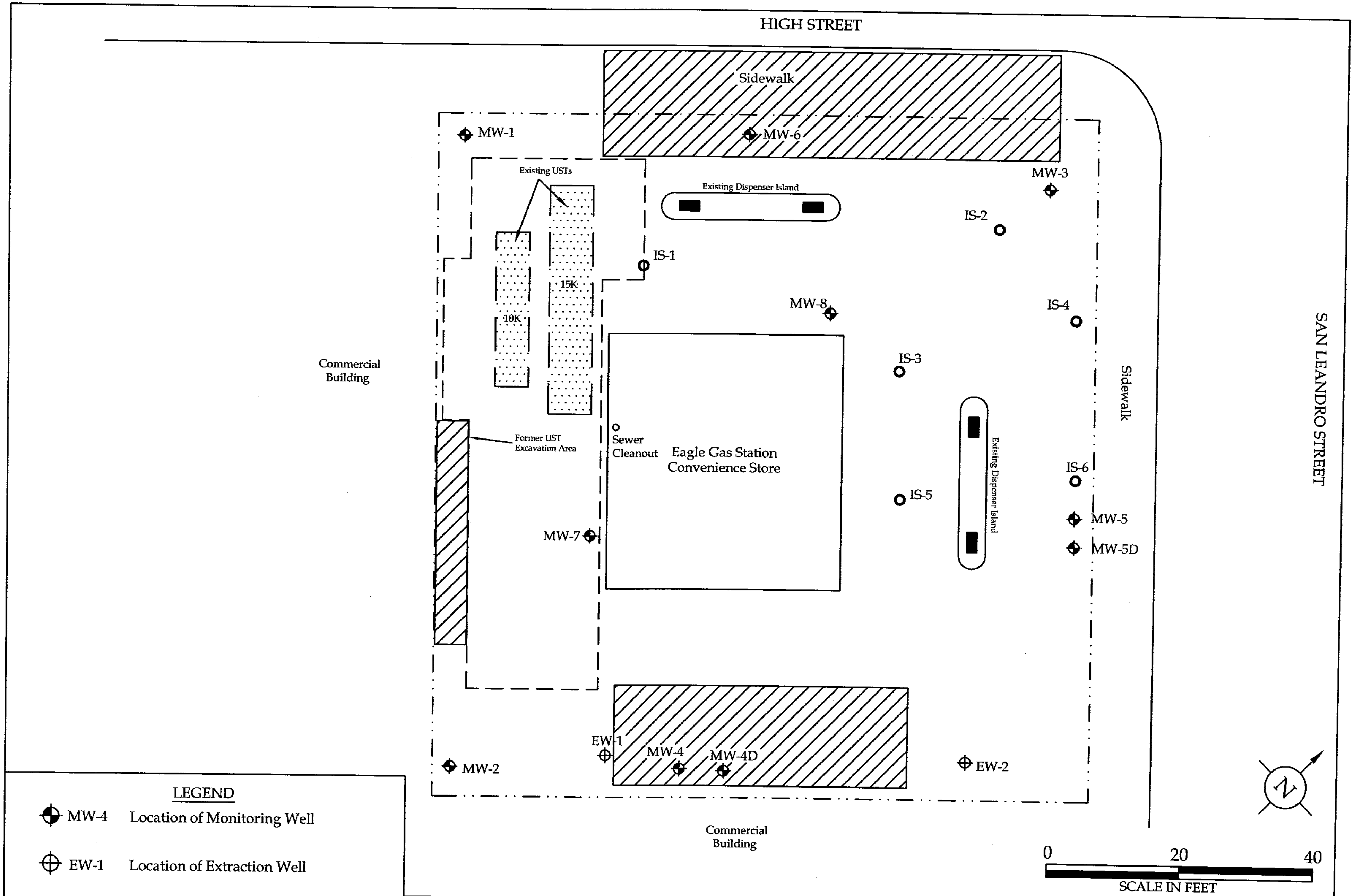
TABLES:

ATTACHMENTS:

FIGURES



SITE VICINITY MAP	CLEARWATER GROUP		
Eagle Gas 4301 San Leandro Street Oakland, California	Project No. ZP046	Figure Date 5/06	Figure 1



LEGEND

MW-4 Location of Monitoring Well

EW-1 Location of Extraction Well

IS-1 Location of iSOC Well

Property Line

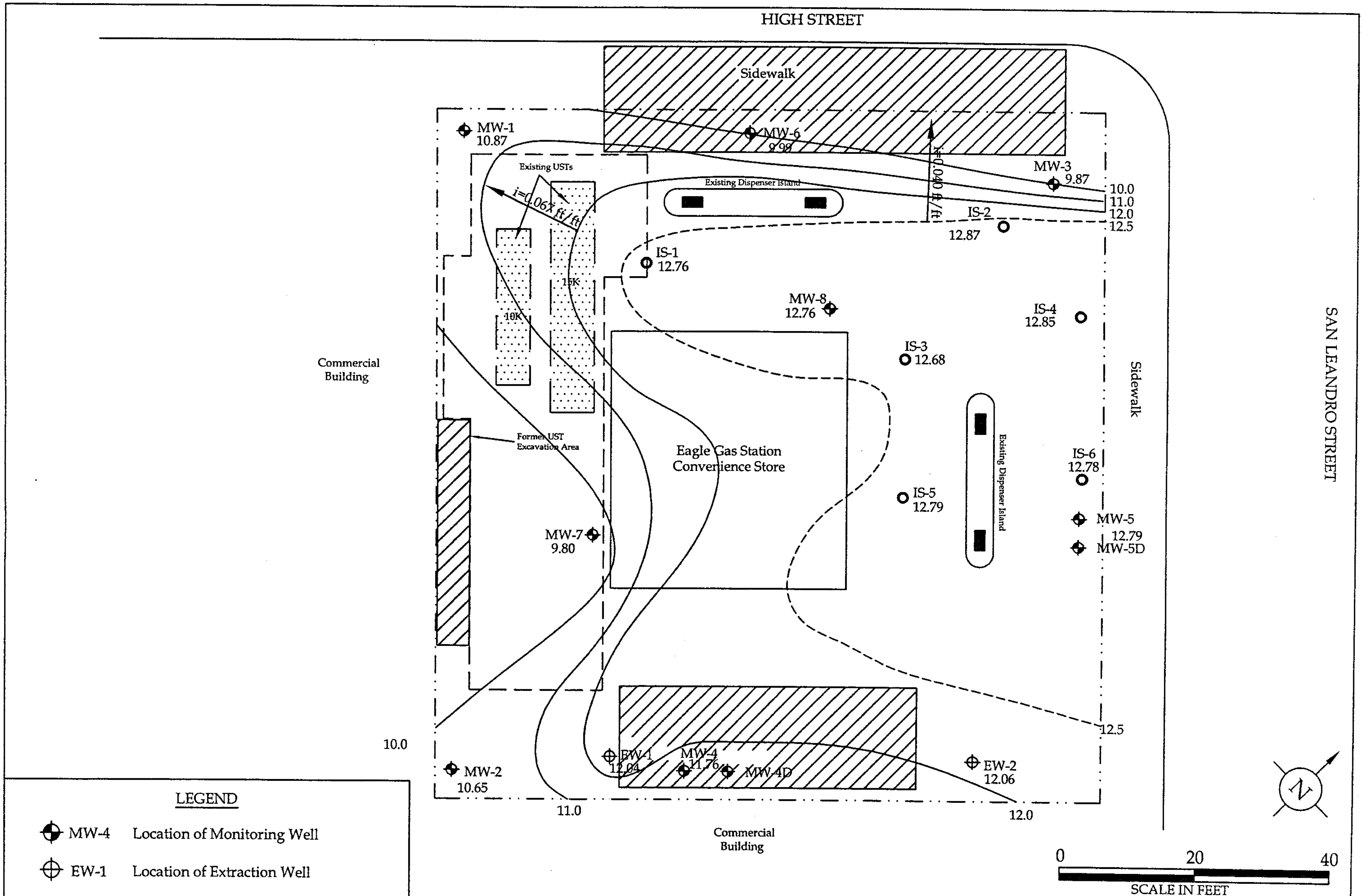
GPR Locations

Site Plan with Resurveyed Well Locations

Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046	**9/06**	**2**



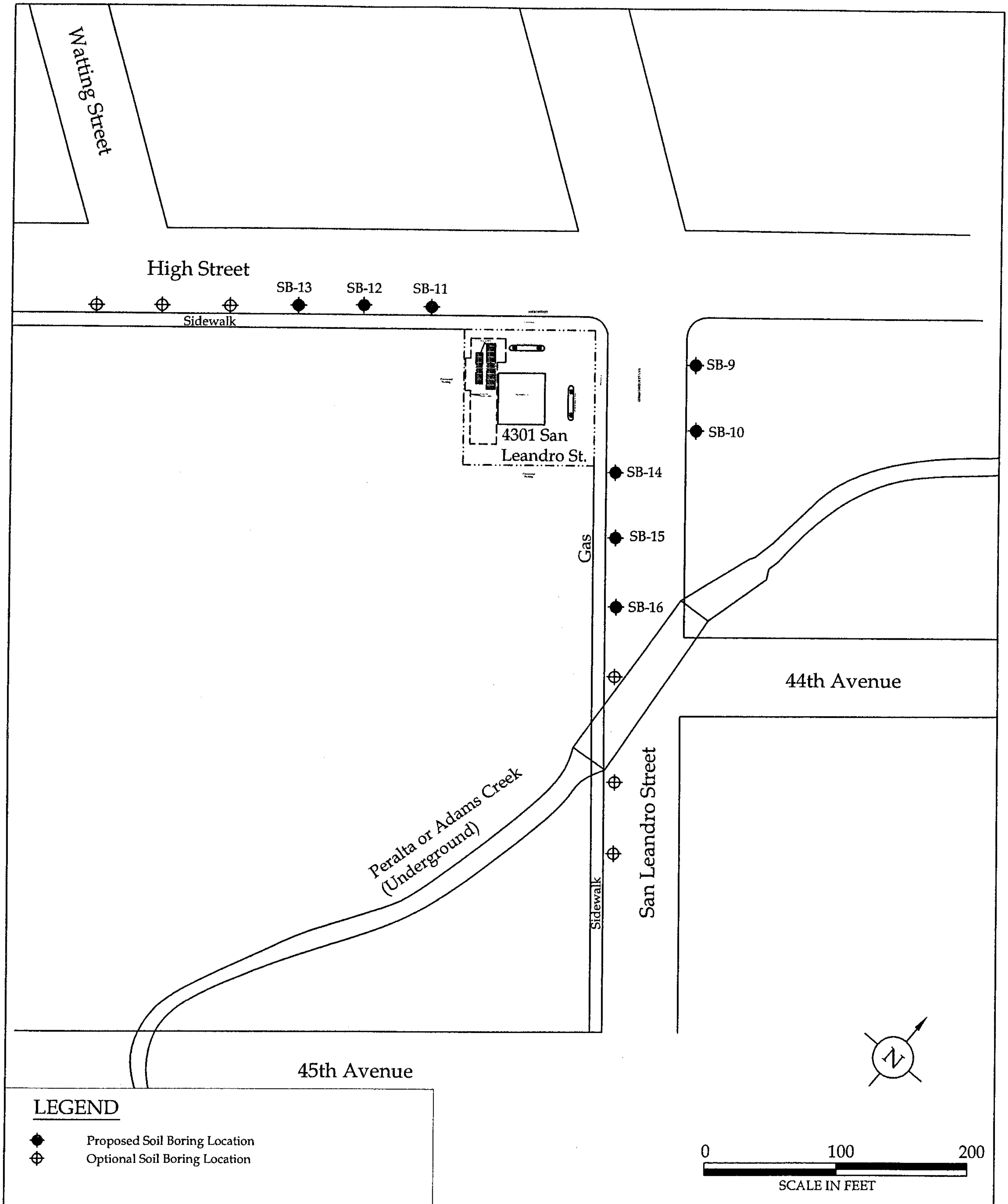
LEGEND

- MW-4 Location of Monitoring Well
- EW-1 Location of Extraction Well
- IS-1 Location of iSOC Well
- Property Line
- Groundwater Elevation Contour (feet above msl)

Groundwater Contour Elevation Map
September 12, 2006
Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

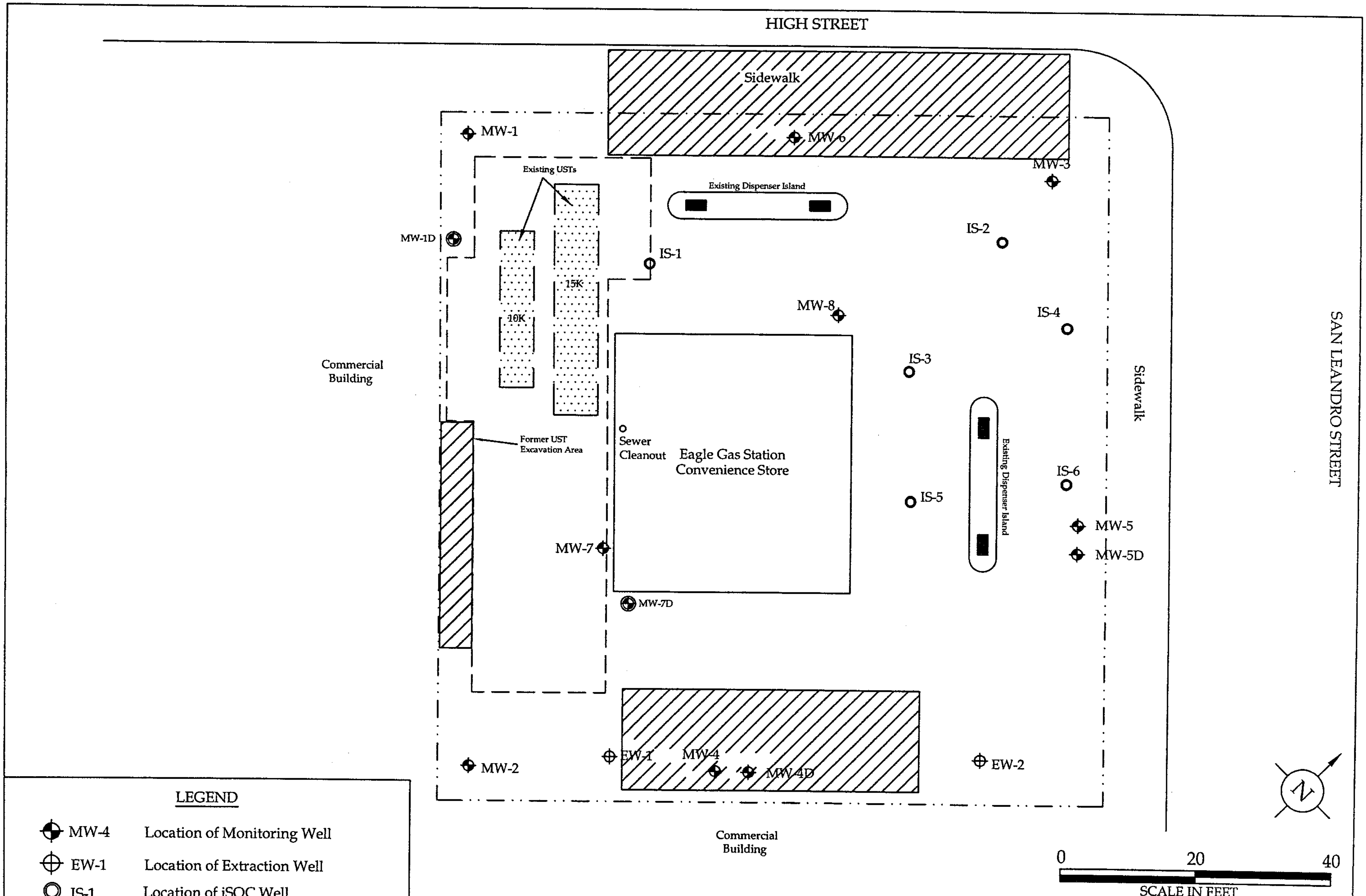
Project No.	Figure Date	Figure
ZP046D	**9/06**	**3**



Proposed Off-site Soil Boring Locations

Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP		
Project No.	Figure Date	Figure
ZP046D	**9/06**	**4**



LEGEND

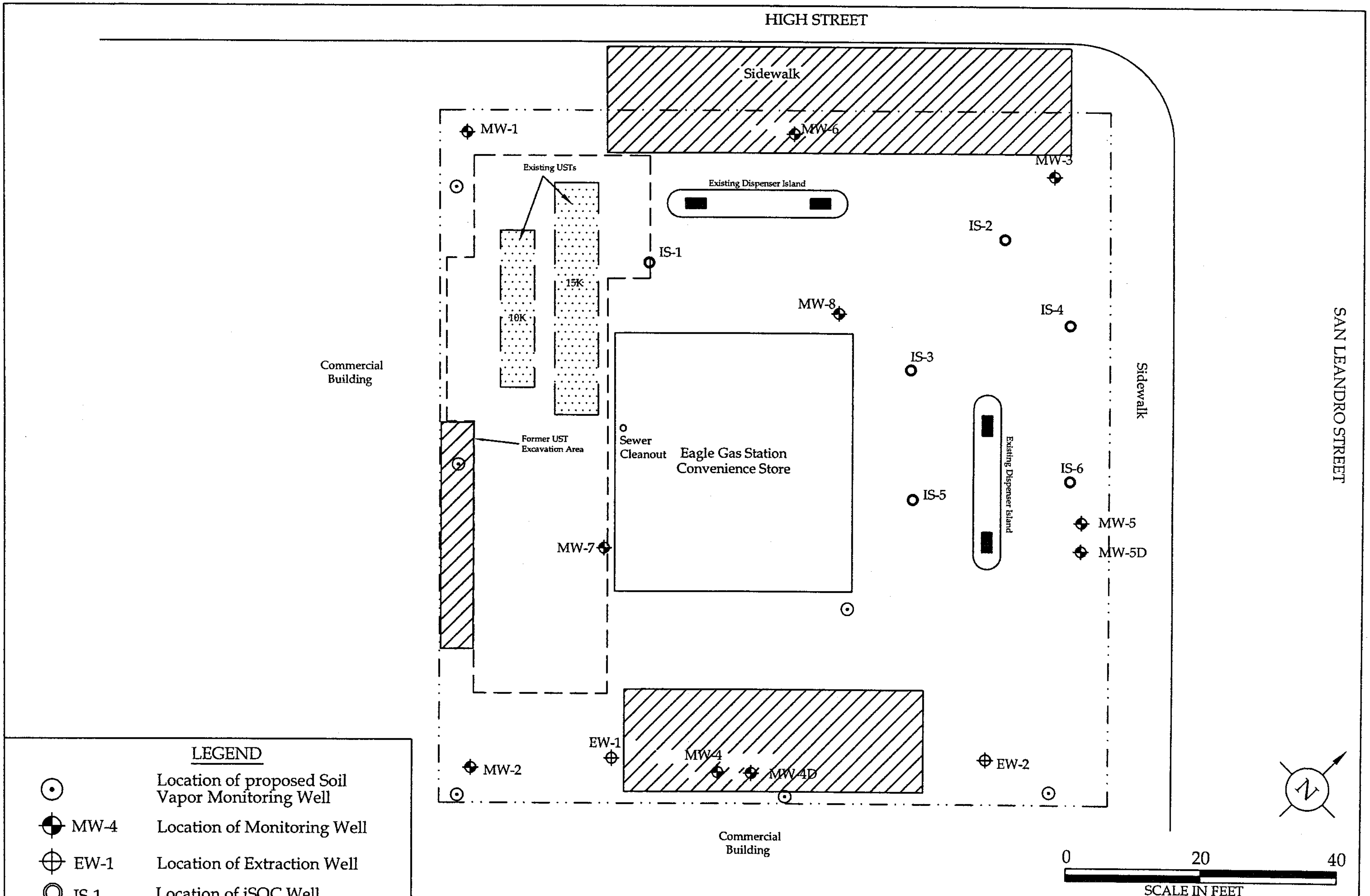
MW-4	Location of Monitoring Well
EW-1	Location of Extraction Well
IS-1	Location of iSOC Well
— · —	Property Line
MW-10D	Proposed Deep Well Location
(hatched)	GPR Locations

Existing and Proposed Deep Well Locations

Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046D	**9/06**	**5**



LEGEND

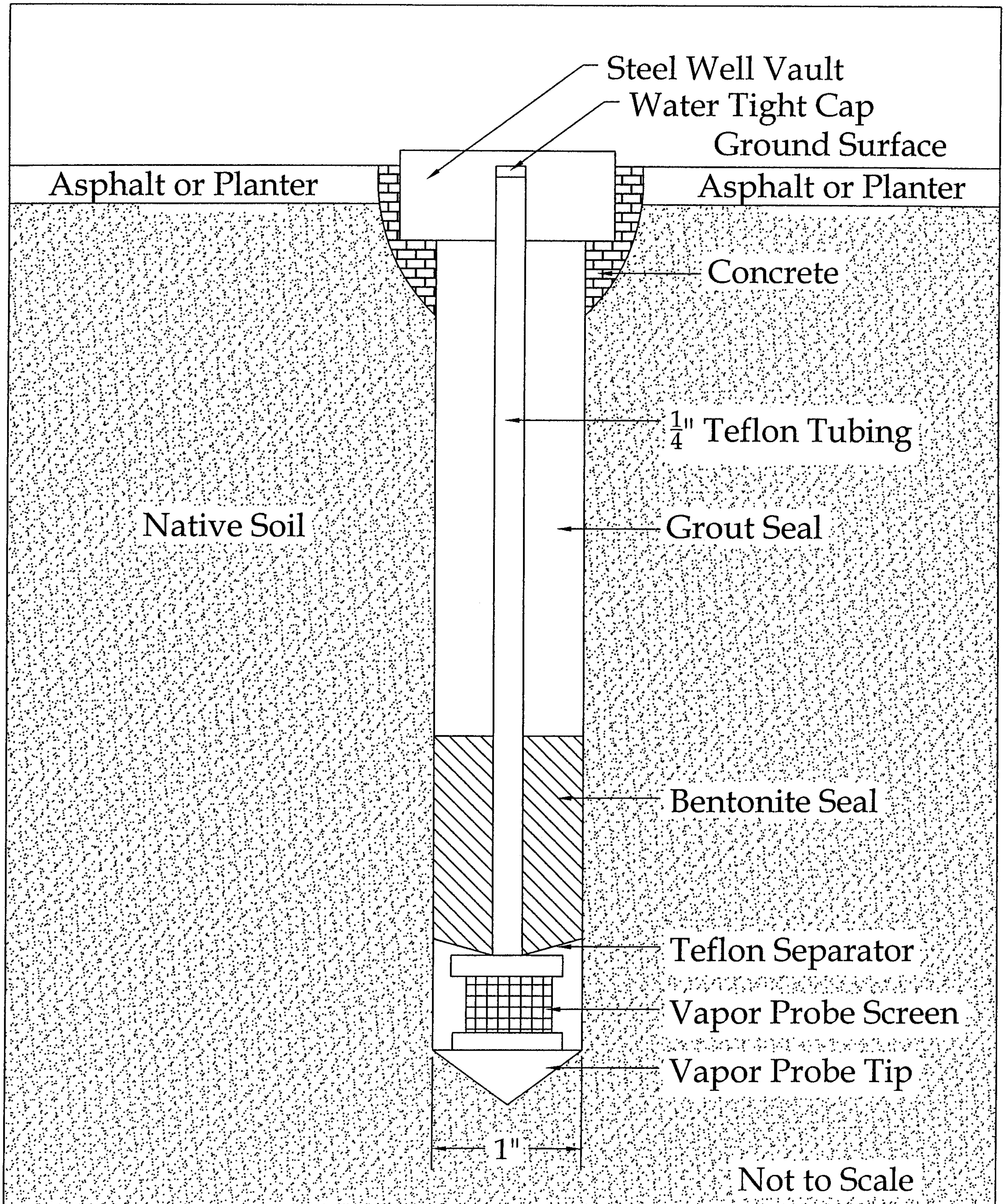
⊙	Location of proposed Soil Vapor Monitoring Well
MW-4	Location of Monitoring Well
EW-1	Location of Extraction Well
IS-1	Location of iSOC Well
— · · — · · —	Property Line
MW-10D	Proposed Deep Well Location
(hatched)	GPR Locations

Proposed Permanent Soil Vapor Monitoring Well Locations

Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046D	**9/06**	**6**



Typical Soil Vapor Monitoring Well Installation Eagle Gas 4301 San Leandro Street Oakland, California	**CLEARWATER GROUP**		
	Project No. **ZP046D**	Figure Date **9/06**	Figure **7**

TABLES

TABLE 1
WELL CONSTRUCTION DATA
Eagle Gas
4301 San Leandro Street
Oakland, California
Clearwater Group Project No. ZP046D

Well I.D.	Date Intstalled	Installed by	Borehole Diameter (inches)	Casing Diameter (inches)	Depth of Borehole (feet)	Cement (feet)	Bentonite Seal (feet)	Filter Pack (feet)	Filter Pack Material	Screened Interval (feet)	Slot Size (inches)	TOC Feet Above MSL
MW-1	9/26/2000	Western Hazmat	8	2	25	0-5	5-7	7-25	2/12 sand	10-25	0.01	20.077
MW-2	9/26/2000	Western Hazmat	8	2	25	0-5	5-7	7-25	2/12 sand	10-25	0.01	22.047
MW-3	9/26/2000	Western Hazmat	8	2	25	0-5	5-7	7-25	2/12 sand	10-25	0.01	20.727
MW-4	12/19/2005	HEW Drilling	8	2	25	0-5	5-8	8-25	#3 sand	10-25	0.02	21.627
MW-4D	12/19/2005	HEW Drilling	8	2	45	0-30	30-33	33-45	#3 sand	35-45	0.02	21.537
MW-5	12/15/2005	HEW Drilling	8	2	25	0-5	5-8	8-25	#3 sand	10-25	0.02	20.447
MW-5D	12/15/2005	HEW Drilling	8	2	45	0-30	30-33	33-45	#3 sand	35-45	0.02	21.127
MW-6	12/20/2005	HEW Drilling	8	2	25	0-5	5-8	8-25	#3 sand	10-25	0.02	21.027
MW-7	12/19/2005	HEW Drilling	8	2	25	0-5	5-8	8-25	#3 sand	10-25	0.02	21.737
MW-8	12/21/2005	HEW Drilling	8	2	25	0-5	5-8	8-25	#3 sand	10-25	0.02	20.457
IS-1	12/20/2005	HEW Drilling	8	2	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.477
IS-2	12/20/2005	HEW Drilling	8	2	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.317
IS-3	12/21/2005	HEW Drilling	8	2	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.567
IS-4	12/20/2005	HEW Drilling	8	2	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.867
IS-5	12/21/2005	HEW Drilling	8	2	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.987
IS-6	12/20/2005	HEW Drilling	8	2	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.787
EW-1	12/16/2005	HEW Drilling	10	4	25	0-3	3-6	6-25	#3 sand	10-25	0.02	21.017
EW-2	12/16/2005	HEW Drilling	10	4	25	0-3	3-6	6-25	#3 sand	10-25	0.02	20.557

Notes:
All depths and intervals are below ground surface
TOC Top of well casing
MSL Mean sea level

TABLE 2. GROUNDWATER ELEVATIONS AND SAMPLE ANATLYTICAL RESULTS

4301 San Leandro Street, Oakland, California 94601

Clearwater Group Project No. ZP046D

Sample ID	Sample Date	TOC (feet)	DTW (feet)	GWE (feet)	TPH-d (µg/L)	TPH-g (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)	DCA (µg/L)	EDB (µg/L)
MW-1	10/3/2000	18.37	8.96	9.41	460	93,000	<500	<500	<500	<500	130,000	<10,000	<10,000	<10,000	<2,000	---	---	---	---
	10/27/2000	18.37	7.27	11.10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1/26/2001	18.37	7.60	10.77	1,600*	51,000	270	<100	<100	<100	77,000	<5,000	<5,000	<5,000	<20,000	---	---	---	---
	5/8/2001	18.37	7.50	10.87	470*	36,000*	<100	<100	<100	<100	15,000	<5,000	<5,000	<5,000	<20,000	---	---	---	---
	8/3/2001	18.37	7.09	11.28	2,200*	19,000*	<50	59	<50	<50	96,000	<5,000	<5,000	<5,000	<20,000	---	---	---	---
	7/1/2003	18.37	7.59	10.78	3,000	<25,000	<250	<250	<250	<250	170,000	<250	<250	980	8700	---	---	---	---
	10/1/2003	18.37	8.36	10.01	2,600	<20,000	<200	<200	<200	<200	69,000	<200	<200	270	15,000	---	---	---	---
	2/13/2004	18.37	8.80	9.57	1,800	<10,000	<100	<100	<100	<100	85,000	<100	<100	390	79,000	---	---	---	---
	5/17/2004	18.37	10.92	7.45	5,400	<15,000	<150	<150	<150	<150	60,000	<150	<150	260	160,000	---	---	---	---
	8/6/2004	18.37	7.76	10.61	510	<10,000	<100	<100	<100	<100	26,000	<100	<100	100	250,000	---	---	---	---
	11/12/2004	18.37	9.25	9.12	3,500	<5,000	<50	<50	<50	<50	25,000	<50	<50	150	160,000	---	---	---	---
	2/15/2005	18.37	10.12	8.25	2,900	<5,000	<50	<50	<50	<50	12,000	<50	<50	70	160,000	---	---	---	---
	5/9/2005	18.37	9.58	8.79	1,700	<5,000	<50	<50	<50	<50	11,000	<50	<50	53	200,000	---	---	---	---
	8/8/2005**	20.08	10.09	9.99	2,000	<5,000	<50	<50	<50	<50	8,500	<50	<50	<50	250,000	---	---	---	---
	11/16/2005	20.08	9.81	10.27	3,600	<5,000	<50	<50	<50	<50	3,800	<50	<50	<50	140,000	<5,000	<500	<50	<50
	2/22/2006	20.08	9.58	10.50	2,600	<5,000	<50	<50	<50	<50	5,800	<50	<50	<50	120,000	<5,000	<500	<50	<50
	5/16/2006	**20.08**	**6.89**	**13.19**															
MW-2	10/3/2000	20.28	20.26	0.02	210	250,000	<1,250	<1,250	<1,250	<1,250	400,000	<25,000	<25,000	<25,000	<100,000	---	---	---	---
	10/27/2000	20.28	13.88	6.40	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1/26/2001	20.28	12.10	8.18	6,000*	740,000	3,800	<500	940	1,600	1,000,000	<50,000	<50,000	<50,000	<200,000	---	---	---	---
	5/8/2001	20.28	12.05	8.23	2,100*	140,000	2,800	<250	780	640	840,000	<50,000	<50,000	<50,000	<200,000	---	---	---	---
	8/3/2001	20.28	13.30	6.98	2,600*	42,000*	1,100	63	230	130	880,000	<25,000	<25,000	<25,000	<100,000	---	---	---	---
	7/1/2003	20.28	14.98	5.30	2,200	<200,000	<2,000	<2,000	<2,000	<2,000	790,000	<2,000	<2,000	3,400	<20,000	---	---	---	---
	10/1/2003	20.28	15.99	4.29	870	<100,000	<1,000	<1,000	<1,000	<1,000	620,000	<1,000	<1,000	2,700	<20,000	---	---	---	---
	2/13/2004	20.28	13.88	6.40	1200	<20,000	860	<200	260	<200	710,000	<200	<200	2,000	<25,000	---	---	---	---
	5/17/2004	20.38	14.68	5.70	2,500	<50000	860	<500	<500	<500	760,000	<500	<500	2,500	13000J	---	---	---	---
	8/6/2004	20.38	15.36	5.02	420	<50000	590	<500	<500	<500	810,000	<500	<500	3,600	17,000J	---	---	---	---
	11/12/2004	20.38	15.49	4.89	500	<150,000	<1500	<1500	<1500	<1500	700,000	<1500	<1500	2,800	25,000J	---	---	---	---
	2/15/2005	20.38	14.16	6.22	990	<150,000	<1,500	<1,500	<1,500	<1,500	630,000	<1,500	<1,500	2,600	32,000	---	---	---	---
	5/9/2005	20.38	13.62	6.76	1,100	<150,000	<1,500	<1,500	<1,500	<1,500	570,000	<1,500	<1,500	2,300	32,000	---	---	---	---

TABLE 2. GROUNDWATER ELEVATIONS AND SAMPLE ANATLYTICAL RESULTS

4301 San Leandro Street, Oakland, California 94601

Clearwater Group Project No. ZP046D

Sample ID	Sample Date	TOC (feet)	DTW (feet)	GWE (feet)	TPH-d (μg/L)	TPH-g (μg/L)	B (μg/L)	T (μg/L)	E (μg/L)	X (μg/L)	MTBE (μg/L)	DIPE (μg/L)	ETBE (μg/L)	TAME (μg/L)	TBA (μg/L)	Methanol (μg/L)	Ethanol (μg/L)	DCA (μg/L)	EDB (μg/L)
	8/8/2005**	22.05	13.36	8.69	770	<150,000	<1,500	<1,500	<1,500	<1,500	770,000	<1,500	<1,500	2,200	85,000	---	---	---	---
	11/16/2005	22.05	14.51	7.54	890	<70,000	<700	<700	<700	<700	430,000	<700	<700	2,100	130,000	<100,000	<7,000	<700	<700
	2/22/2006	22.05	12.69	9.36	<1,500	<70,000	800	<700	<700	<700	400,000	<700	<700	1,700	130,000	<70,000	<7,000	<700	<700
	5/16/2006	**22.05**	**12.01**	**10.04**															
MW-3	10/3/2000	18.98	---	---	120	83,000	<500	<500	<500	<500	33,000	<2,500	<2,500	<2,500	<10,000	---	---	---	---
	10/27/2000	18.98	18.75	0.23	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1/26/2001	18.98	13.38	5.60	900*	230,000	930	<500	<500	<500	330,000	<25,000	<25,000	<25,000	<100,000	---	---	---	---
	5/8/2001	18.98	11.82	7.16	1,100*	95,000	840	<250	<250	<250	390,000	<12,500	<12,500	<12,500	<50,000	---	---	---	---
	8/3/2001	18.98	13.44	5.54	290*	30,000*	<50	51	<50	<50	270,000	<12,500	<12,500	<12,500	<50,000	---	---	---	---
	7/1/2003	18.98	12.67	6.31	620	<50,000	<500	<500	<500	<500	230,000	<500	<500	1,800	<5,000	---	---	---	---
	10/1/2003	18.98	14.04	4.94	370	<20,000	<200	<200	<200	<200	120,000	<200	<200	1,200	<5,000	---	---	---	---
	2/13/2004	18.98	12.20	6.78	430	<20,000	280	<200	<200	<200	210,000	<200	<200	1,200	<5000	---	---	---	---
	5/17/2004	18.98	11.87	7.11	920	<25,000	<250	<250	<250	<250	150,000	<250	<250	1,100	5600J	---	---	---	---
	8/6/2004	18.98	13.07	5.91	78	<20,000	<200	<200	<200	<200	110,000	<200	<200	760	<2,500	---	---	---	---
	11/12/2004	18.98	12.83	6.15	120	<20,000	<200	<200	<200	<200	100,000	<200	<200	660	6,000	---	---	---	---
	2/15/2005	18.98	11.95	7.03	130	<25,000	<250	<250	<250	<250	110,000	<250	<250	760	12,000	---	---	---	---
	5/9/2005	18.98	10.51	8.47	320	<15,000	<150	<150	<150	<150	97,000	<150	<150	780	30,000	---	---	---	---
	8/8/2005**	20.73	10.98	9.75	180	<15,000	<150	<150	<150	<150	75,000	<150	<150	500	44,000	---	---	---	---
	11/16/2005	20.73	12.89	7.84	<200	<5,000	<50	<50	<50	<50	37,000	<50	<50	190	38,000	<5,000	<500	<50	<50
	2/22/2006	20.73	10.31	10.42	<600	<5,000	88	<50	<50	<50	57,000	<50	<50	420	65,000	<9,000	<500	<50	<50
	5/16/2006	**20.73**	**9.03**	**11.70**															
MW-4	2/22/2006	21.63	7.87	13.76	<8,000	<150,000	3,200	2,000	1,600	3,800	770,000	<1,500	<1,500	3,300	59,000	<150,000	<15,000	<1,500	<1,500
	5/16/2006	**21.63**	**8.04**	**13.59**															
MW-4D	2/21/2006	21.54	15.58	5.96	<50	<90	<0.90	<0.90	<0.90	<0.90	440	<0.90	<0.90	1.8	<5.0	<90	<9.0	<0.90	<0.90
	5/16/2006	**21.54**	**13.23**	**8.31**															
MW-5	2/21/2006	20.48	6.63	13.85	<3,000	<10,000	460	<100	170	<100	480,000	<100	<100	3,000	95,000	<90,000	<1,000	<100	<100
	5/16/2006	**20.48**	**6.62**	**13.86**															

TABLE 2. GROUNDWATER ELEVATIONS AND SAMPLE ANATLYTICAL RESULTS

4301 San Leandro Street, Oakland, California 94601

Clearwater Group Project No. ZP046D

Sample ID	Sample Date	TOC (feet)	DTW (feet)	GWE (feet)	TPH-d (µg/L)	TPH-g (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)	DCA (µg/L)	EDB (µg/L)
MW-5D	2/21/2006	20.32	13.68	6.64	<50	<50	<0.50	<0.50	<0.50	<0.50	8.1	<0.50	<0.50	<0.50	5.5	<50	<5.0	<0.50	<0.50
	5/16/2006	**20.32**	**12.72**	**7.60**															
MW-6	2/22/2006	20.45	9.88	10.57	2,900	<10,000	620	<100	<100	<100	50,000	<100	<100	210	24,000	<10,000	<1,000	<100	<100
	5/16/2006	**20.45**	**9.35**	**11.10**															
MW-7	2/22/2006	21.13	11.72	9.41	400	<10,000	<100	<100	<100	<100	88,000	<100	<100	430	90,000	<10,000	<1,000	<100	<100
	5/16/2006	**21.13**	**8.72**	**12.41**															
MW-8	2/22/2006	21.03	7.28	13.75	6,800	<10,000	1,200	<100	270	220	400,000	<100	<100	2,100	63,000	<300,000	<1,000	<100	<100
	5/16/2006	**21.03**	**7.48**	**13.55**															
IS-1	2/22/2006	20.57	6.91	13.66	4,400	<5,000	160	<50	<50	<50	21,000	<50	<50	64	130,000	<5,000	<500	<50	<50
	5/16/2006	**20.57**	**7.01**	**13.56**															
IS-2	2/22/2006	20.87	6.92	13.95	<4,000	8,600	1,200	<9.0	240	17	190,000	<9.0	9.4	1,700	29,000	<150,000	<90	<9.0	<9.0
	5/16/2006	**20.87**	**6.99**	**13.88**															
IS-3	2/22/2006	20.99	7.32	13.67	<4,000	29,000	2,700	820	1,100	2,900	750,000	<100	<100	3,400	40,000	<80,000	<1,000	<100	<100
	5/16/2006	**20.99**	**7.86**	**13.13**															
IS-4	2/22/2006	20.79	6.95	13.84	3,100	11,000	790	<100	120	<100	280,000	<100	<100	2,400	51,000	<10,000	<1,000	<100	<100
	5/16/2006	**20.79**	**7.77**	**13.02**															
IS-5	2/22/2006	21.02	7.17	13.85	35,000	66,000	4,100	<250	3,100	7,700	420,000	<250	<250	4,600	40,000	<25,000	<2,500	<250	<250
	5/16/2006	**21.02**	**6.81**	**14.21**															
IS-6	2/22/2006	20.56	6.89	13.67	3,000	11,000	1,000	<100	560	180	130,000	<100	<100	1,400	210,000	<15,000	<1,000	<100	<100
	5/16/2006	**20.56**	**6.44**	**14.12**															
EW-1	2/22/2006	21.74	8.06	13.68	3,200	<150,000	3,100	<1,500	<1,500	<1,500	700,000	<1,500	<1,500	5,100	59,000	<150,000	<15,000	<1,500	<1,500
	5/16/2006	**21.74**	**7.97**	**13.77**															

TABLE 2. GROUNDWATER ELEVATIONS AND SAMPLE ANATLYTICAL RESULTS

4301 San Leandro Street, Oakland, California 94601

Clearwater Group Project No. ZP046D

Sample ID	Sample Date	TOC (feet)	DTW (feet)	GWE (feet)	TPH-d (µg/L)	TPH-g (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)	DCA (µg/L)	EDB (µg/L)
EW-2	2/22/2006	20.46	7.31	13.15	<3,000	10,000	1,800	<100	700	670	120,000	<100	<100	1,200	36,000	<80,000	<1,000	<100	<100
	5/16/2006	**20.46**	**7.25**	**13.21**															

TABLE 2. GROUNDWATER ELEVATIONS AND SAMPLE ANATLYTICAL RESULTS

4301 San Leandro Street, Oakland, California 94601

Clearwater Group Project No. ZP046D

Sample ID	Sample Date	TOC (feet)	DTW (feet)	GWE (feet)	TPH-d (µg/L)	TPH-g (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)	MTBE (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	TBA (µg/L)	Methanol (µg/L)	Ethanol (µg/L)	DCA (µg/L)	EDB (µg/L)

NOTES:

TOC	Top of well casing referenced to arbitrary datum prior to 3Q2005
DTW	Depth to water
GWE	Groundwater elevation
TPHd	Total petroleum hydrocarbons as diesel by EPA Method 8015 (modified)
TPHg	Total petroleum hydrocarbons as gasoline by EPA Method 8260B
BTEX	Benzene, toluene, ethylbenzene, total xylenes by EPA Method 8260B
MTBE	Methyl tertiary butyl ether by EPA Method 8260B
DIPE	Di-isopropyl ether by EPA Method 8260B
ETBE	Ethyl tertary butyl ether by EPA Method 8260B
TAME	Tertiary amyl methyl ether by EPA Method 8260B
TBA	Tertiary butyl alcohol by EPA Method 8260B
DCA	1,2-Dichloroethane
EDB	1,2-Dibromoethane
(µg/L)	Micrograms per liter
<#	Not detected in concentrations above laboratory reporting limit
---	no samples collected, no data available
*	Laboratory note:"Results within quantitation range; chromatographic pattern not typical of fuel"
**	wells re-surveyed on 3/28/2005

ATTACHMENTS

ATTACHMENT A

September 22, 2006

Clearwater Group
229 Tewksbury Avenue
Point Richmond, CA 94801

NORCAL Project No. 06-826.02

Subject : Geophysical Survey
Eagle Gasoline Station
4301 San Leandro Street
Oakland, California

Attention : Mr. Robert Nelson,

The purpose of this letter report is to document the geophysical investigation conducted by NORCAL Geophysical Consultants, Inc. at the subject property on August 18, 2006. Using a combination of ground penetrating radar (GPR), hand-held metal-detection (MD), and electromagnetic line-locating (EMLL) methods, NORCAL geophysicist David Bissiri investigated portions of the gasoline station for evidence of undocumented underground storage tanks (USTs). According to information provided to NORCAL, the site has undergone several upgrades, including replacement of the product USTs. However, it is not known if the USTs associated with the earlier layout of the station are still present. Therefore, the reason of the survey was to determine if there is evidence of large buried objects suggestive of USTs and their associated piping. An additional purpose was to look for evidence of possible backfilled former tank cavities. A summary of our field activities and findings is presented below.

Horizontal Control

NORCAL sub-divided the accessible portions of the facility into four (4) sub-areas labeled Survey Areas A through D, as directed by Mr. Robert Nelson of the Clearwater Group (Plate 1). We then established survey grids within these areas in order to provide horizontal control for the acquisition of geophysical data. For the three largest survey areas (Areas A, B, and C), the grids consisted of a series of parallel lines spaced 1-foot apart oriented parallel to the long dimension of the area. For the smallest survey area (Area D) the gird consisted of a series of lines spaced 2-feet apart.

Data Acquisition

Survey Areas A, B, and C

Continuous GPR data were collected along each grid line using a cart-mounted Geophysical Surveys Systems 3000 radar unit equipped with a 400 Mhz antenna. Following acquisition the data was uploaded to a field computer contained within the GPR instrument and processed to produce a series of 3-dimensional "time-slice" maps of the subsurface. These maps were evaluated for GPR reflections suggestive of USTs and associated piping. Areas identified on the time-slice maps as having anomalous GPR reflections were then marked on the pavement surface with spray paint. Following the GPR data collection and field analysis we used MD and EMLL instruments to scan the survey areas for the presence of buried metal objects. The MD instrument consisted of a Fischer TW-6 M-scope and the EMLL instrument consisted of a Radio Detection RD 4000. These instruments were carried across the survey area along a series of bidirectional traverses spaced approximately 2-feet apart. Areas where the instruments audio and dial responses indicated buried objects were then marked on the pavement.

Survey Area D

The geophysical survey was limited to the MD and EMLL techniques. Because of the relatively small size of this survey, no 3-D GPR data were collected.

Additional Survey Area

In addition to the surveys described above, we collected 2-Dimensional GPR data along three radar traverses located in the northwest portion of the site. The locations of the traverses are depicted on Plate 1 as the solid red lines labeled I, II, and III. The purpose of these radar traverses was to look for evidence of the backfilled former tank cavities.

Results and Conclusions

Based on our interpretation of the GPR MD and EMLL surveys, we do not believe there are additional USTs or associated piping within the designated investigation areas. Furthermore, our interpretation of the geophysical results does not indicate any areas of backfill suggestive of a former tank-cavity. However, we did identify a single localized anomalous zone along the northern edge of Survey Area B. This anomaly appears to be approximately 3-feet wide and 5 feet long and is depicted as the shaded figure labeled "Anomalous GPR Zone". The anomaly exhibits reflection patterns that are more consistent with a concrete footing than a UST. In addition, the follow-up investigation with the hand-held metal detector indicated that this anomaly is most likely non-metallic.

Standard Care and Warranty

The scope of NORCAL's services for this project consisted of using geophysical methods to assess the area of investigation for buried metal objects. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. The services were performed in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the services or products delivered under this agreement, expressed or implied, is made by NORCAL.

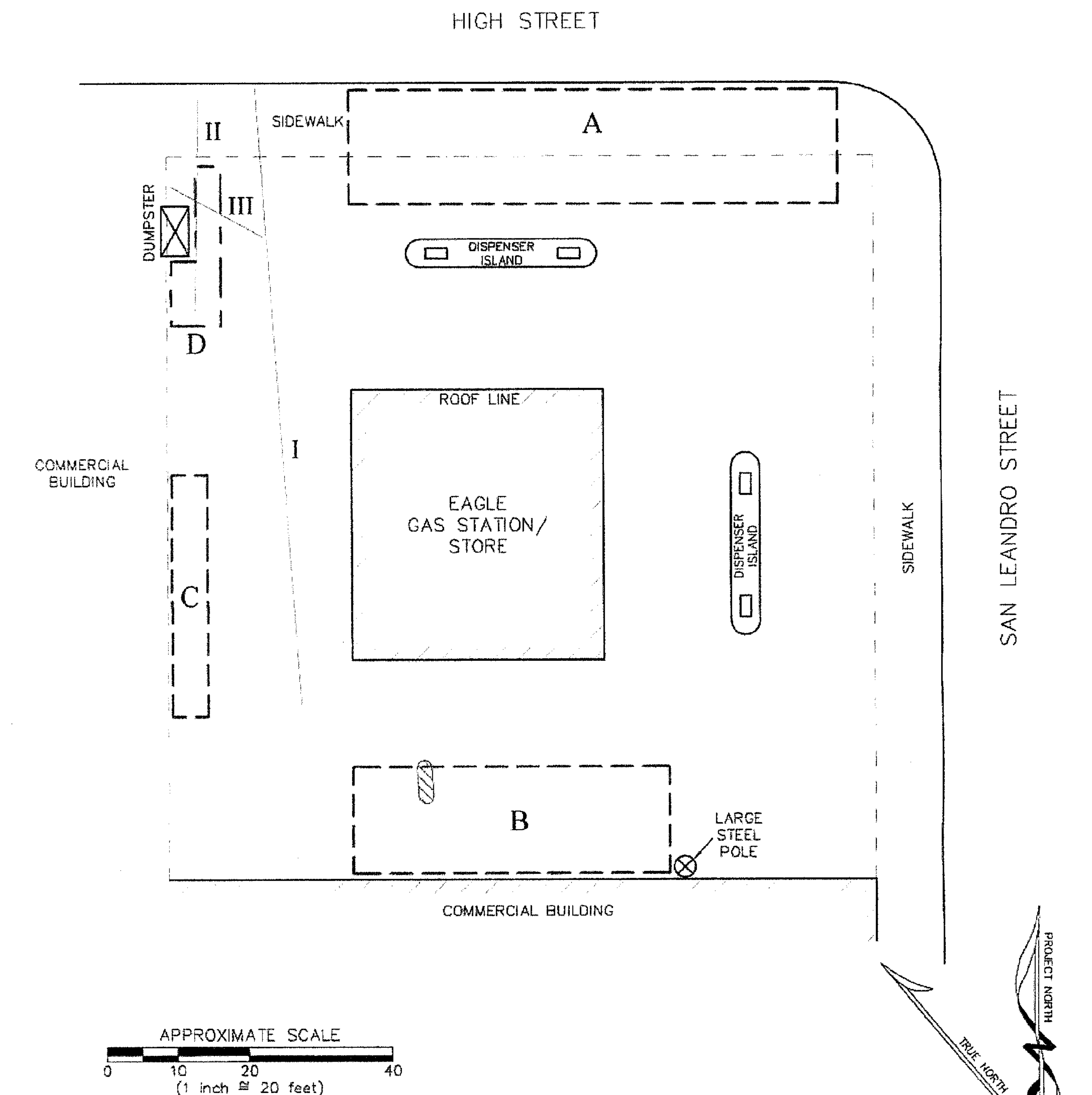
We appreciate having the opportunity to provide you with this information.

Respectfully,

NORCAL Geophysical Consultants, Inc.

David Bissiri
Geophysicist GP - 1009

DJB/WEB/tt



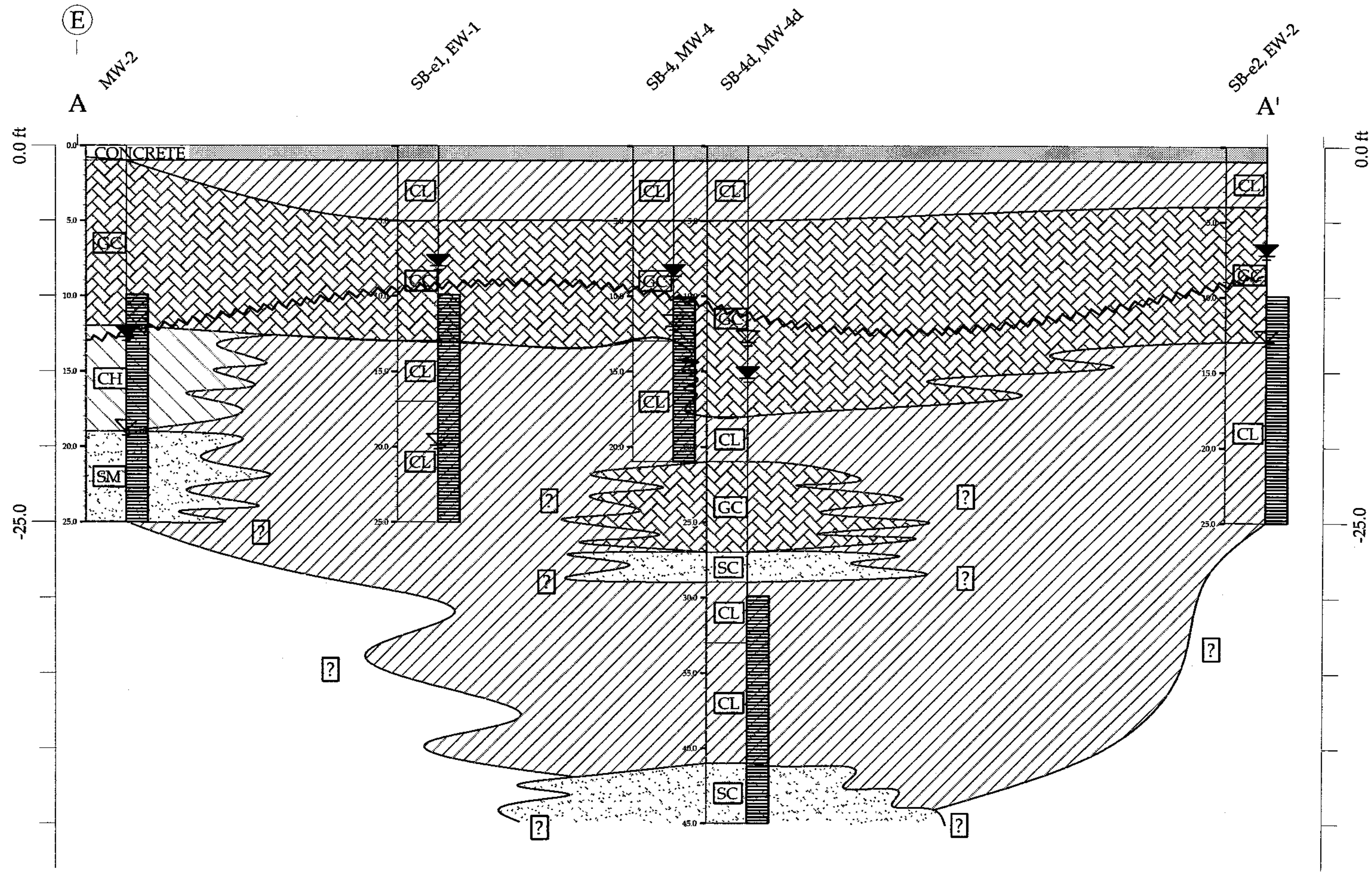
LEGEND

— — —	3D GPR/MD/EMLL SURVEY AREAS
— — —	MD & EMLL ONLY SURVEY AREA
———	GPR TRAVERSE
- - - -	PROPERTY LINE
(hatched ellipse)	ANOMALOUS GPR ZONE

NOTE: BASE MAP ADAPTED FROM MAP PROVIDED BY CLEARWATER GROUP

NORCAL	GEOPHYSICAL SURVEY MAP EAGLE GAS 4301 SAN LEANDRO STREET		
	LOCATION: OAKLAND, CALIFORNIA		
	CLIENT: CLEARWATER GROUP		PLATE 1
JOB #: 06-826.02	NORCAL GEOPHYSICAL CONSULTANTS INC.		
DATE: SEP. 2006	DRAWN BY: G.RANDALL	APPROVED BY: DJB	

ATTACHMENT B



0 12
SCALE IN FEET

LEGEND

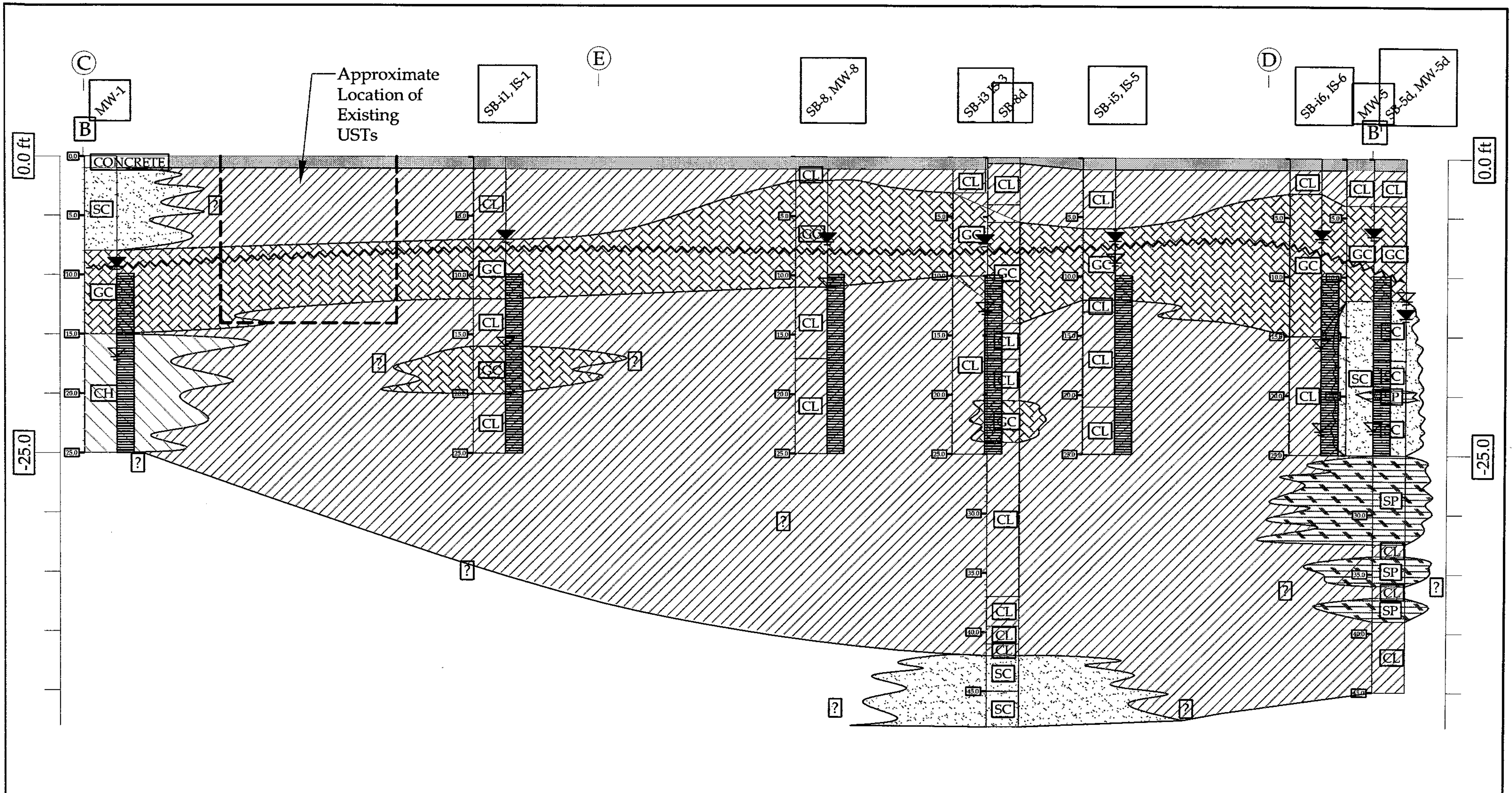
E	Denotes location of intersection of other line of cross-section
▽	Approximate first encountered water depth during drilling
▼	Approximate stabilized water depth measured February 22, 2006.
~~	Approximate water table February 22, 2006.
	Well Screen

Notes: -Boring Locations within ~10' perpedicular of Section Line are extrapolated to Section Line
-No Vertical Exaggeration

COARSE GRAINED SOILS					
Clean Gravels (little or no fines)	GW, GP	Clean Sand (little or no fines)	SW, SP
Gravels with Fines (appreciable amount of fines)	GM, GC	Sands with Fines (appreciable amount of fines)	SM, SC

FINED GRAINED SOILS	
Silts and Clays (liquid limit less than 50 %)	ML, CL
Silts and Clays (liquid limit greater than 50%)	MH, CH

CROSS SECTION A-A'	CLEARWATER GROUP		
4301 San Leandro Ave. Oakland, California	Project No. ZP046D	Figure Date 9/06	Figure 5



0 12
SCALE IN FEET

LEGEND

(E) Denotes location of intersection of other line of cross-section

Approximate first encountered water depth during drilling

Approximate stabilized water depth measured February 22, 2006.

Approximate water table February 22, 2006.

Well Screen

Notes: -Boring Locations within ~10' perpedicular of Section Line are extrapolated to Section Line
-No Vertical Exaggeration

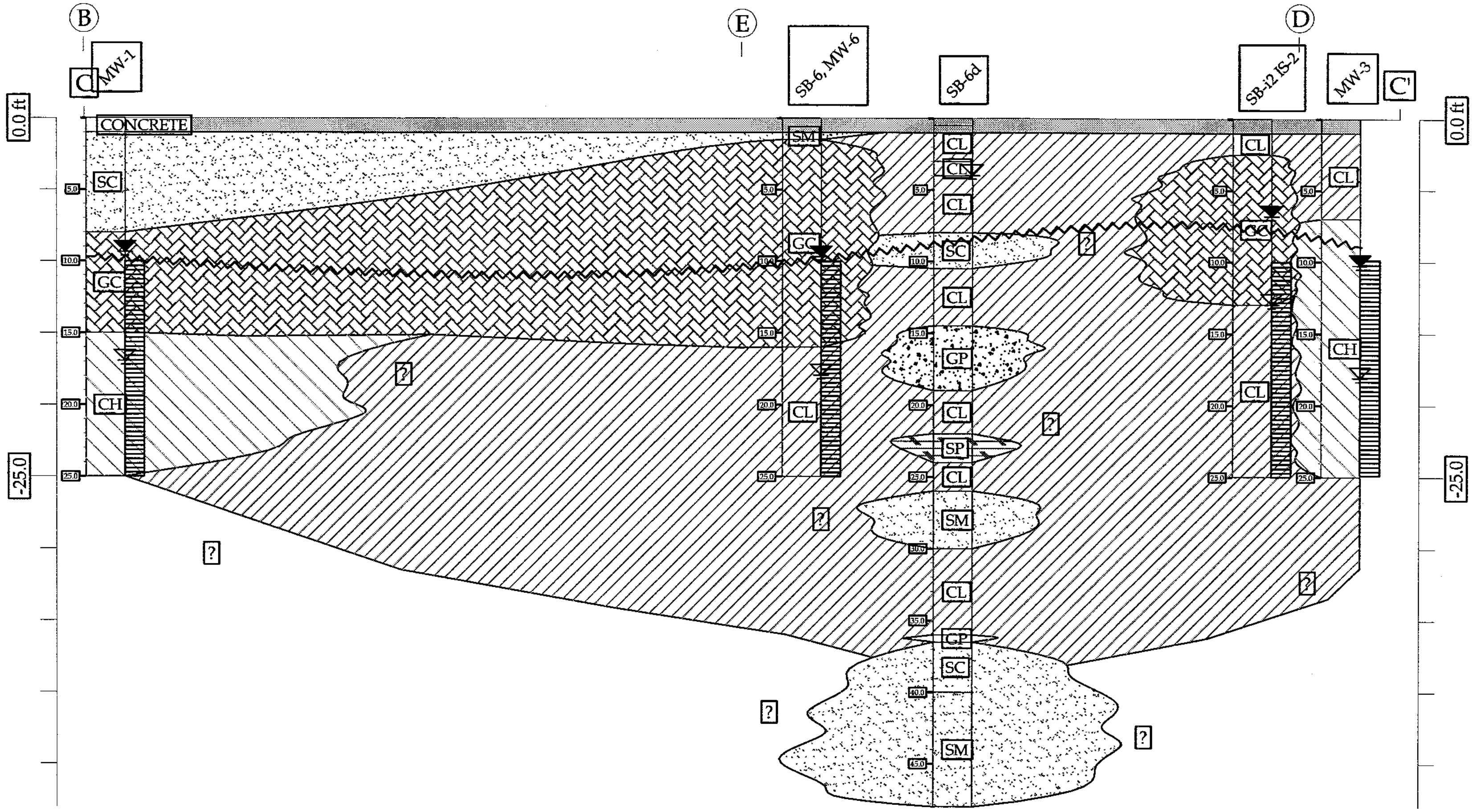
COARSE GRAINED SOILS

Clean Gravels (little or no fines)		GW GP
Gravels with Fines (appreciable amount of fines)		GM GC
Clean Sand (little or no fines)		SW SP
Sands with Fines (appreciable amount of fines)		SM SC

FINED GRAINED SOILS

Silts and Clays (liquid limit less than 50 %)		ML CL
Silts and Clays (liquid limit greater than 50%)		MH CH

CROSS SECTION B-B'	CLEARWATER GROUP		
4301 San Leandro Ave. Oakland, California	Project No. ZP046D	Figure Date 9/06	Figure 6



0 — 12

SCALE IN FEET

COARSE GRAINED SOILS

Clean Gravels (little or no fines)		GW GP
Gravels with Fines (appreciable amount of fines)		GM GC

Clean Sand (little or no fines)		SW SP
Sands with Fines (appreciable amount of fines)		SM SC

FINED GRAINED SOILS

Silts and Clays (liquid limit less than 50 %)		ML CL
Silts and Clays (liquid limit greater than 50%)		MH CH

LEGEND

(E) Denotes location of intersection of other line of cross-section

Approximate first encountered water depth during drilling

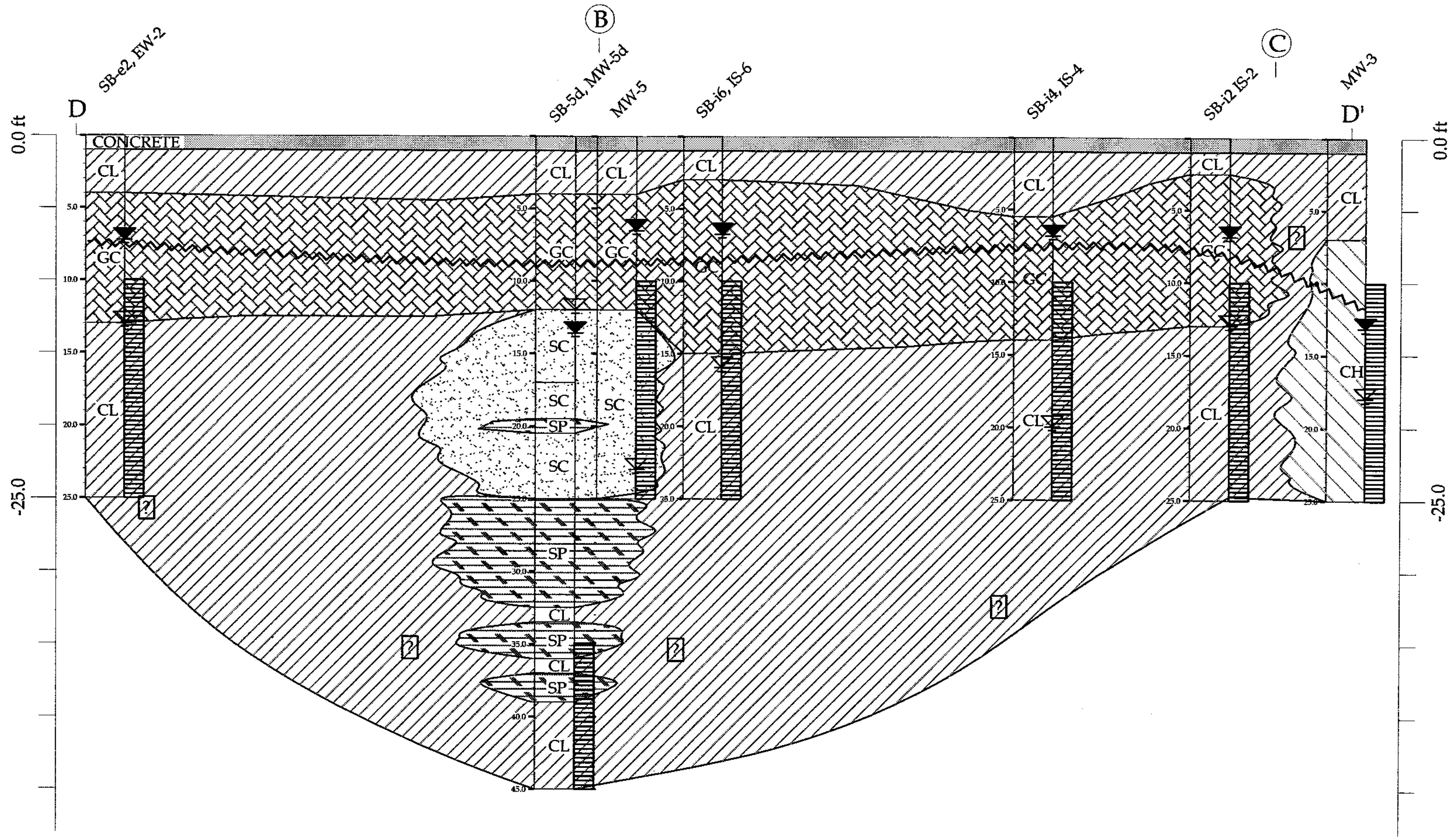
Approximate stabilized water depth measured February 22, 2006.

Approximate water table February 22, 2006.

Well Screen

Notes: -Boring Locations within ~10' perpedicular of Section Line are extrapolated to Section Line
-No Vertical Exaggeration

CROSS SECTION C-C'	CLEARWATER GROUP		
4301 San Leandro Ave. Oakland, California	Project No. ZP046D	Figure Date 9/06	Figure 7



0 12

SCALE IN FEET

COARSE GRAINED SOILS

Clean Gravels (little or no fines)	GW, GP
Gravels with Fines (appreciable amount of fines)	GM, GC
Clean Sand (little or no fines)	SW, SP
Sands with Fines (appreciable amount of fines)	SM, SC

FINED GRAINED SOILS

Silts and Clays (liquid limit less than 50 %)	ML, CL
Silts and Clays (liquid limit greater than 50%)	MH, CH

LEGEND

- Denotes location of intersection of other line of cross-section (E)
- Approximate first encountered water depth during drilling
- Approximate stabilized water depth measured February 22, 2006.
- Approximate water table February 22, 2006.
- Well Screen

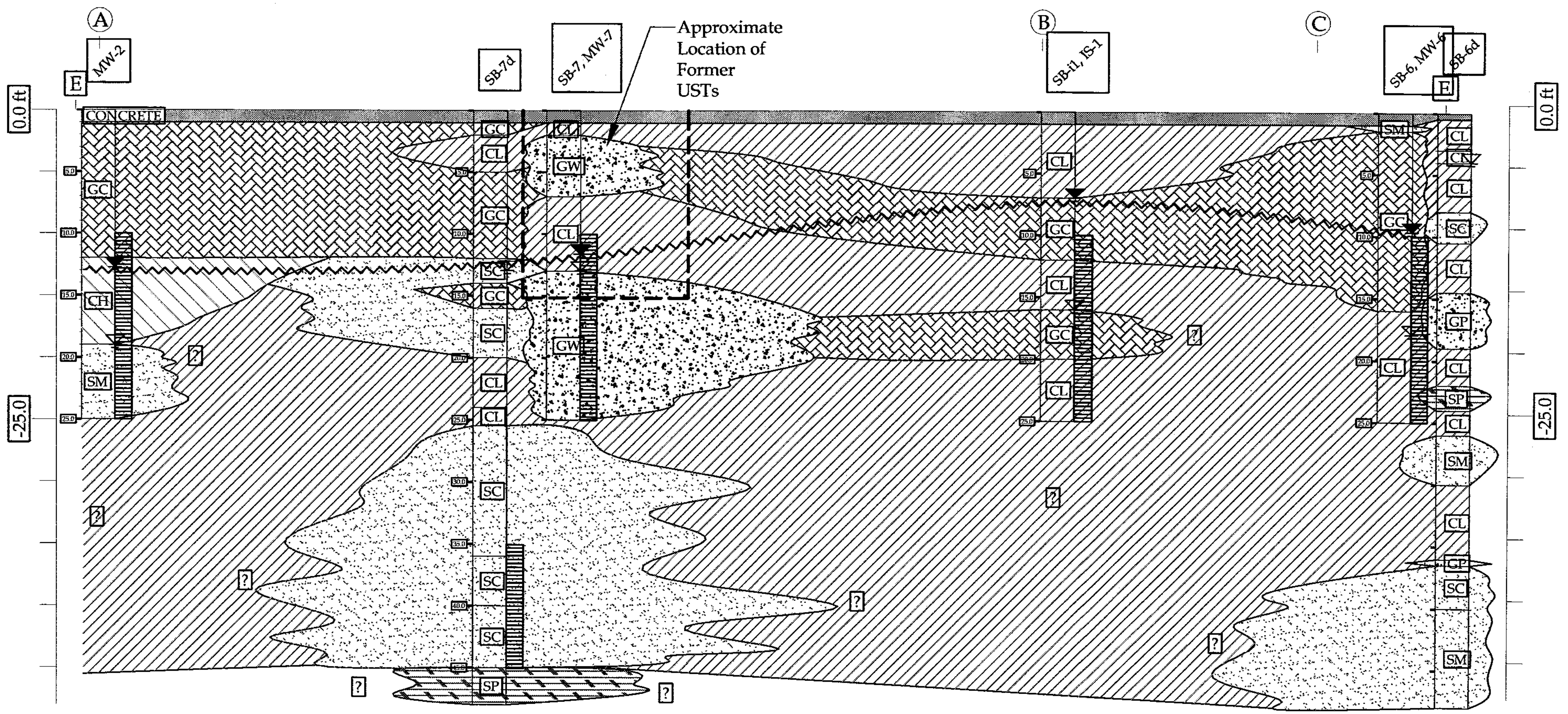
Notes: -Boring Locations within ~10' perpedicular of Section Line are extrapolated to Section Line
-No Vertical Exaggeration

CROSS SECTION D-D'

4301 San Leandro Ave.
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046D	9/06	8



0 — 12
SCALE IN FEET

LEGEND

Ⓔ Denotes location of intersection of other line of cross-section

Approximate first encountered water depth during drilling

Approximate stabilized water depth measured February 22, 2006.

Approximate water table February 22, 2006.

Well Screen

Notes: -Boring Locations within ~10' perpedicular of Section Line are extrapolated to Section Line
-No Vertical Exaggeration

COARSE GRAINED SOILS

Clean Gravels (little or no fines)	GW, GP
Gravels with Fines (appreciable amount of fines)	GM, GC
Clean Sand (little or no fines)	SW, SP
Sands with Fines (appreciable amount of fines)	SM, SC

FINED GRAINED SOILS

Silts and Clays (liquid limit less than 50 %)	ML, CL
Silts and Clays (liquid limit greater than 50%)	MH, CH

CROSS SECTION E-E'	CLEARWATER GROUP		
4301 San Leandro Ave. Oakland, California	Project No. ZP046D	Figure Date 9/06	Figure 9

ATTACHMENT C

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

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

August 11, 2006

Ms. Farah Naz c/o
Mr. Muhammad Jamil
40092 Davis Street
Fremont, CA 94538

Subject: Fuel Leak Case No. RO0000096, Eagle Gas, 4301 San Leandro Street, Oakland, CA

Dear Ms. Naz:

Alameda County Environmental Health (ACEH) staff has reviewed the fuel leak case file for the above-referenced site and the document entitled, "Response to Technical Comments," dated July 7, 2006 and received by ACEH on July 20, 2006. The document presents responses to technical comments in ACEH correspondence dated June 27, 2006. We request that you submit a Work Plan to conduct additional investigation **by September 22, 2006**. An additional response to comments should not be submitted.

We request that you address the following technical comments, perform the proposed work, and send us the reports described below.

TECHNICAL COMMENTS

1. **Grab Groundwater Sample Data Quality.** Plans for depth-discrete grab groundwater sampling are to be included in the Work Plan requested below.

2. **Water Level Differences and Unrealistic Hydraulic Gradients.** Our previous technical comment remains applicable. Please review the existing water level data, soil boring logs, and well construction data for the site to help identify possible causes for the significant differences in water levels between adjacent wells across the site. In the Work Plan requested below, please propose data collection to identify the most likely cause of the water level differences and assess the predominant groundwater flow direction.

3. **Deep Monitoring Wells.** No changes to our previous technical comments are required. Please present plans for well installation in the Work Plan requested below.

4. **Search for Additional USTs.** We concur with the proposal to conduct a geophysical survey to search for additional USTs under and near the sidewalk along High Street. Please present the results of the geophysical survey in the Work Plan requested below.

5. **Chromatograph/Dating of MTBE.** We have no objection to review of existing and future chromatographs to assess whether the hydrocarbons detected in separate wells may be from separate sources. However, dating of petroleum hydrocarbons and MTBE does not appear

to be justified. If dating of petroleum hydrocarbons and MTBE is conducted, we recommend that the UST Cleanup Fund not reimburse you for these costs.

6. **Vapor Intrusion.** Please review the December 15, 2004 DTSC *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* to plan the sequence for an investigation of potential vapor intrusion. Separate soil vapor samples should be collected around the perimeters or inside the off-site buildings to the southwest and southeast. Please present plans for soil vapor sampling in the Work Plan requested below.

7. **Leaking Water Lines.** We have no objection to analyzing selected groundwater samples for water treatment chemicals and coliform bacteria to look for water line or sewer leaks. Please present plans in the Work Plan requested below for analyzing selected groundwater samples for water treatment chemicals and coliform bacteria.

8. **Off-site Investigation.** We do not concur with the proposal to expand the investigation by installing wells in the upgradient direction. The technical comments regarding off-site investigation in our June 27, 2006 correspondence remain valid. Depth-discrete grab groundwater sampling provides a more cost effective means of plume delineation than installation of monitoring wells. Grab groundwater data should be used to delineate the off-site plume prior to well installation. Monitoring wells should not be installed at each grab groundwater sampling location. Therefore, two mobilizations will be required to delineate the plume and then install an appropriate monitoring well network. Please present plans to conduct the off-site investigation in the Work Plan requested below.

9. **Screened Intervals for Wells on Cross Sections.** In the future, please show the screened intervals for monitoring wells on the cross sections.

10. **Quarterly Groundwater Monitoring.** Please incorporate the newly installed wells into a quarterly monitoring program for the site. Analytical results for EDB, EDC, methanol, and ethanol are to be reviewed to assess whether analyses for these chemicals should be continued. Please present recommendations for quarterly monitoring in the Work Plan requested below.

11. **Interim Remediation.** Clearwater has on previous occasions emphasized the need to implement a "fast-track interim remediation," (June 13, 2005 correspondence entitled "Recommendations for Interim Remedial Action" from Clearwater to ACEH). The request for an extension and belief that interim remediation is not warranted at this time represents a significant change in site recommendations. In the Work Plan requested below, please include a discussion of how the proposed data collection will be used to plan interim remediation and propose a schedule for interim remediation.

TECHNICAL REPORT REQUEST

Please submit technical reports to Alameda County Environmental Health (Attention: Jerry Wickham), according to the following schedule:

- **August 30, 2006** – Quarterly Groundwater Monitoring Report – Second Quarter 2006

- **September 22, 2006** – Work Plan
- **November 30, 2006** – Quarterly Groundwater Monitoring Report – Third Quarter 2006

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

ELECTRONIC SUBMITTAL OF REPORTS

Effective **January 31, 2006**, the Alameda County Environmental Cleanup Oversight Programs (LOP and SLIC) require submission of all reports in electronic form to the county's ftp site. Paper copies of reports will no longer be accepted. The electronic copy replaces the paper copy and will be used for all public information requests, regulatory review, and compliance/enforcement activities. Instructions for submission of electronic documents to the Alameda County Environmental Cleanup Oversight Program ftp site are provided on the attached "Electronic Report Upload (ftp) Instructions." Please do not submit reports as attachments to electronic mail.

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PERJURY STATEMENT

All work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party that states, at a minimum, the following: "I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge." This letter must be signed by an officer or legally authorized representative of your company. Please include a cover letter satisfying these requirements with all future reports and technical documents submitted for this fuel leak case.

PROFESSIONAL CERTIFICATION & CONCLUSIONS/RECOMMENDATIONS

The California Business and Professions Code (Sections 6735, 6835, and 7835.1) requires that work plans and technical or implementation reports containing geologic or engineering evaluations and/or judgments be performed under the direction of an appropriately registered or certified professional. For your submittal to be considered a valid technical report, you are to present site specific data, data interpretations, and recommendations prepared by an appropriately licensed professional and include the professional registration stamp, signature, and statement of professional certification. Please ensure all that all technical reports submitted for this fuel leak case meet this requirement.

UNDERGROUND STORAGE TANK CLEANUP FUND

Please note that delays in investigation, later reports, or enforcement actions may result in your becoming ineligible to receive grant money from the state's Underground Storage Tank Cleanup Fund (Senate Bill 2004) to reimburse you for the cost of cleanup.

AGENCY OVERSIGHT

If it appears as though significant delays are occurring or reports are not submitted as requested, we will consider referring your case to the Regional Board or other appropriate agency, including the County District Attorney, for possible enforcement actions. California Health and Safety Code, Section 25299.76 authorizes enforcement including administrative action or monetary penalties of up to $10,000 per day for each day of violation.

If you have any questions, please call me at (510) 567-6791.

Sincerely,

Jerry Wickham

Jerry Wickham
Hazardous Materials Specialist

Enclosure: ACEH Electronic Report Upload (ftp) Instructions

cc: Robert Nelson, Clearwater Group, 229 Tewksbury Avenue, Point Richmond, CA 94801

Sunil Ramdass, SWRCB Cleanup Fund, 1001 I Street, 17th floor, Sacramento, CA 95814-2828

Shari Knierem, SWRCB Cleanup Fund, 1001 I Street, 17th floor, Sacramento, CA 95814-2828

Donna Drogos, ACEH
Jerry Wickham, ACEH
File

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

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

June 27, 2006

Ms. Farah Naz c/o
Mr. Muhammad Jamil
40092 Davis Street
Fremont, CA 94538

Subject: Fuel Leak Case No. RO0000096, Eagle Gas, 4301 San Leandro Street, Oakland, CA

Dear Ms. Naz:

Alameda County Environmental Health (ACEH) staff has reviewed the fuel leak case file for the above-referenced site and the report entitled, "Soil and Groundwater Investigation Report," received on June 1, 2006. The report summarizes the results of a field investigation conducted between December 6, 2005 and April 2, 2006. The results indicate that highly elevated concentrations of fuel hydrocarbons are present in soil and groundwater beneath the site. Methyl tert-butyl ether (MTBE) was detected in more than 90 percent of the soil samples collected at concentrations up to 97 milligrams per kilogram (mg/kg). MTBE was detected in all groundwater samples collected at concentrations up to 770,000 micrograms per liter (μg/L). Tert-butyl alcohol (TBA) was detected in more than 90 percent of the soil samples collected at concentrations up to 57 mg/kg. TBA was detected in all but one groundwater sample collected at concentrations up to 120,000 μg/L. Groundwater contamination has likely moved off-site through a clayey gravel layer that underlies the site to a depth of approximately 12 feet and possibly through preferential pathways such as utility trenches. The "Soil and Groundwater Investigation Report," recommends several additional investigation tasks. We generally concur that additional investigation is required to fully characterize the site and request that you submit a Work Plan to conduct additional investigation **by September 1, 2006.**

We request that you address the following technical comments, perform the proposed work, and send us the reports described below.

TECHNICAL COMMENTS

1. **Grab Groundwater Sample Data Quality.** The "Soil and Groundwater Investigation Report," states that the analytical results from a grab groundwater sample vary significantly from the analytical results from a groundwater sample collected from a monitoring well due primarily to suspended sediment in the grab groundwater sample. We disagree that the differences between analytical results for grab groundwater samples and groundwater samples collected from monitoring wells are due primarily to the suspended sediment in grab groundwater samples. Although analytical results can be affected by high turbidity, particularly for chemicals that are highly sorbed, it cannot be assumed that data from grab groundwater samples will be less accurate. Empirical studies as well as three-dimensional numerical simulations have shown that the groundwater samples collected from wells represent groundwater flux from the entire length of the well screen with higher permeability

zones having a higher flux. Water entering the well from different zones may have a range of contaminant concentrations. Therefore, the contaminant concentration measured in the sample represents the averaging effects due to vertical mixing throughout the screen interval. In addition, where a well partially penetrates an aquifer, the zone that is monitored extends above and below the screen. Grab groundwater samples are collected from shorter intervals and therefore, typically represent less vertical mixing. For volatile organic chemicals that are not highly sorbed, the contaminant concentrations measured in grab groundwater samples most likely are accurate with respect to the actual groundwater concentration within the targeted interval of the aquifer. Therefore, the concentrations measured in grab groundwater samples should not be discounted as less accurate when compared to concentrations measured in samples from monitoring wells. The vertical heterogeneity of the aquifer and the vertical distribution of water flowing into a well screen must be considered.

2. **Water Level Differences and Unrealistic Hydraulic Gradients.** Wells MW-1, MW-2, MW-3, MW-6, and MW-7 have significantly lower water levels than the remaining wells on site. The hydraulic gradients estimated from groundwater elevation contours shown on Figure 3 along the southwestern and northwestern portions of the site do not appear to be within the range of normal or realistic hydraulic gradients for the soil and groundwater conditions encountered at the site. As an example, wells EW-1 and MW-2, which are approximately 20 feet apart in the southern portion of the site, are constructed with similar screened intervals but the water level in well EW-1 is more than 4 feet higher than the water level in well MW-2, resulting in an apparent hydraulic gradient of more than 20 percent. A continuous gravel layer, which should be able to effectively transmit groundwater, is shown on cross section B-B' extending between the two wells. Please review the existing water level data, soil boring logs, and well construction data for the site to help identify possible causes for the significant differences in water levels between adjacent wells across the site. In the Work Plan requested below, please propose data collection to identify the most likely cause of the water level differences and assess the predominant groundwater flow direction.

3. **Deep Monitoring Wells.** Monitoring wells MW-4D and MW-5D ("deep wells") were both screened over the interval from 35 to 45 feet bgs. ACEH specifically requested (September 21, 2005) that pilot borings be continuously logged in order to identify and target permeable zones rather than install the wells at the fixed interval of 35 to 45 feet bgs. In addition, we requested that the filter pack and screen intervals for monitoring wells screened below the water table should not exceed 5 feet in length. Wells MW-4D and MW-5D were both screened across intervals of largely fine-grained CL soils and therefore, may not intersect coarse-grained layers that may be preferential pathways. In order to address this data gap, we request that one "deep" monitoring well be installed within the thick sequence of sands encountered between approximately 25 and 45 feet bgs in boring SB-7D and one "deep" monitoring well be installed along the southwestern boundary of the site. The well along the southwestern boundary of the site should be installed in order to intercept contamination migrating to the southwest from source areas at the site. Please review our previous technical comments on grab groundwater sampling and well installation in our September 21, 2005 correspondence. Please present plans for well installation in the Work Plan requested below.

4. **Search for Additional USTs.** We concur with the proposal to conduct a geophysical survey to search for additional USTs under and near the sidewalk along High Street. Please present the results of the geophysical survey in the Work Plan requested below.

5. **Chromatograph/Dating of MTBE.** Please provide further rationale in the Work Plan requested below on how the dating of MTBE at the site would be used.

6. **Vapor Intrusion.** We concur that an evaluation of potential vapor intrusion into on-site and off-site buildings should be performed. Please present plans in the Work Plan requested below to evaluate the potential for on-site and off-site indoor vapor intrusion.

7. **Leaking Water Lines.** We have no objection to analyzing selected groundwater samples for water treatment chemicals and coliform bacteria to look for water line or sewer leaks. However, please note that we request additional investigation of the anomalous water levels at the site as discussed in technical comment 2 above.

8. **Off-site Investigation.** The proposal to locate a total of four soil borings upgradient and downgradient of the site will not be sufficient for the off-site investigation. Given the known sources and high elevated levels of contamination on site, it is not clear why an off-site investigation would focus on the area upgradient of the site. The off-site investigation should focus on delineating the extent of groundwater contamination and the potential for the plume to affect off-site receptors. Therefore, the off-site investigation should delineate the plume in the downgradient regional groundwater flow direction, along preferential pathways, and in the direction of potential discharge to Peralta (Adams) Creek. Grab groundwater sampling must be considered to delineate the plume prior to installation of off-site wells. Given the uncertainty of the local hydraulic gradient at the site due to anomalous water levels in the on-site monitoring wells, the use of rapid characterization techniques such as grab groundwater sampling should be emphasized. Please present plans to conduct the off-site investigation in the Work Plan requested below.

9. **Screened Intervals for Wells on Cross Sections.** In the future, please show the screened intervals for monitoring wells on the cross sections.

10. **Quarterly Groundwater Monitoring.** Please incorporate the newly installed wells into a quarterly monitoring program for the site. Analytical results for EDB, EDC, methanol, and ethanol are to be reviewed to assess whether analyses for these chemicals should be continued. Please present recommendations for quarterly monitoring in the Work Plan requested below.

TECHNICAL REPORT REQUEST

Please submit technical reports to Alameda County Environmental Health (Attention: Jerry Wickham), according to the following schedule:

- **July 1, 2006** – Interim Remediation Start-up Report
- **August 15, 2006** – Quarterly Groundwater Monitoring Report – Second Quarter 2006
- **September 1, 2006** – Work Plan
- **November 15, 2006** – Quarterly Groundwater Monitoring Report – Third Quarter 2006

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If you have any questions, please call me at (510) 567-6791.

Sincerely,

Jerry Wickham
Hazardous Materials Specialist

Enclosure: ACEH Electronic Report Upload (ftp) Instructions

cc: Robert Nelson
Clearwater Group
229 Tewksbury Avenue
Point Richmond, CA 94801

Donna Drogos, ACEH
Jerry Wickham, ACEH
File

ATTACHMENT D

Enhanced Aerobic Bioremediation Workplan for Petroleum Hydrocarbons and MTBE

Terminal electron acceptors (TEAs) such as dissolved oxygen (DO) have been used to enhance natural attenuation of fuel hydrocarbons including gasoline constituents benzene, toluene, ethylbenzene and total xylenes (BTEX), methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA). In-situ bioremediation technology has been extensively studied since the mid 1990's. Significant documentation describes the details of microbial degradation processes of hydrocarbons, solvents and other substances. (Beek, 2001), Freeze and Cherry (1979), Chapelle (1993), Levin and Gealt (1993), McCarty, P.L., and de la Torre (2000), Suthersan (2002), and Wiedemeier et al., (1999).

Presently there are a variety of technologies available that will introduce low to moderate concentrations (10 to 20 parts per million [ppm]) of stable DO into groundwater. Once this elevated DO mixes with gasoline-contaminated groundwater, natural biodegradation occurs and aerobic microorganisms consume the gasoline constituents. Dissolved gasoline constituents in groundwater can be treated by mechanical technologies such as pump and treat systems or air sparging. These technologies are for the most part initially effective, but they can be both expensive and time consuming to operate until site closure is achieved. Sparging or bubbling air or oxygen into an aquifer will not create high DO concentrations. In fact, sparging has been shown in some cases to enhance the volatilization and migration of the volatile contaminants from the saturated zone into the vadose zone.

Enhanced bioremediation by the use of injected DO has been proven to be an effective technology to reduce both BTEX and MTBE. However, many groundwater environments that are high in ferrous iron and biochemical oxygen demand (BOD), for example, will consume large volumes of injected DO before aerobic bacteria can utilize the oxygen as part of the process of consuming BTEX and MTBE. Therefore, the efficient delivery of DO into groundwater is essential to insure that an abundance of oxygen will remain for the bioremediation of hydrocarbons.

There are a variety of diffusion methods. A Canadian spargeless technology called **in-situ Submerged Oxygen Curtain (iSOC)** infuses industrial-grade oxygen into groundwater through two-inch diameter groundwater monitoring wells. The proprietary structured polymer used in the diffusion tool provides a large surface area for gas transfer into a 15 inch by 1.75-inch probe, which is placed down an existing two-inch diameter or larger monitor well. The probe is connected to a regulated supply of industrial-grade compressed oxygen.

Experience in the field has shown that in each monitoring well where the diffusion tool is installed, DO levels of 30 to 60 ppm can easily be achieved depending on the height of the water column in the well. Oxygen is continuously infused into the aquifer over a period of several months to up to several years, as needed. During this time, the large and continuous supply of oxygen infused into the groundwater system is able to provide significant enhanced degradation of hydrocarbons, including BTEX and MTBE/TBA. The oxygen is infused from the diffusion tool into the monitoring well at a typical rate of 15 cubic centimeters per minute (cc/minute). The effective radius of influence of super-saturated groundwater leaving the monitoring wells with the diffusion tool is typically 10 to 15 feet, depending on the sediments. This technology is currently being used to remediate BTEX levels in excess of 100,000 part per billion (ppb).

PURPOSE OF WORKPLAN

This workplan summarizes the scope of work to be performed at a petroleum-impacted site to remediate groundwater contaminated with total petroleum hydrocarbons as gasoline (TPH-g), gasoline constituents, BTEX, and typical gasoline oxygenates such as MTBE and TBA.

Treatment Strategies

Strategies for applying the technology at a site include the following: (1) locating the infusion wells within the heart of the plume so as to allow high DO levels to disperse throughout the impacted area, (2) creating a DO barrier by locating the infusion wells along a line downgradient of the heart of the plume and upgradient of the point of compliance and (3) a combination of the above two strategies. What strategy is right for a particular site will depend on site-specific conditions and constraints.

SCOPE OF WORK

- The infusion wells will be placed within 24 inch by 24 inch traffic-rated, water-tight steel well boxes. Inside the box, one 150 cubic foot oxygen tank will be stored vertically in a ten-inch diameter steel or PVC cased, 48-inch deep storage area. The tank will be connect to a two-stage, 5 to 125 pounds per square inch (psi) oxygen regulator. The regulator will connect to ¼-inch flexible polyurethane tubing. The tubing will extend down the well to the diffusion tool. A water filter is placed approximately four inches above the diffusion tool. The diffusion tool is placed about two inches from the bottom of the well;

- Following startup of the oxygen infusion system, groundwater DO concentrations in the infusion wells will be monitored once every other day until relatively constant DO are reached in the infusion wells, DO monitoring will then be performed quarterly along with the groundwater sampling events;

- Sampling events will be conducted on a quarterly basis;

- After concentrations decline to levels amenable to remediation by natural attenuation, if the feasibility of natural attenuation as a remedial alternative needs to be evaluated, in addition to the above target analytes, the baseline sampling and compliance monitoring events should also include sampling of geochemical indicator parameters such as nitrate, sulfate, ferrous iron, and oxidation-reduction potential (ORP). In that case, an addendum work plan will be developed proposing wells and parameters to be sampled and analyzed and outlining the approach to be used for data evaluation and estimation of cost to site closure.

PROPOSED REMEDIAL ACTION

Remediation of the hydrocarbon-impacted groundwater will be accomplished by using a gas infusion technology. The following is a summary of the technology being proposed:

OXYGEN INFUSION

Oxygen infusion is a technology that uses proprietary diffusion equipment to enrich the DO content of groundwater without causing aeration and volatilization of organic compounds. The diffusion tools consist of a chamber containing micro-porous polymeric hollow fibers with micron size holes that create a large surface area for oxygen dispersion. The diffusion tools are suspended downhole in standard two-inch or larger diameter wells. The tools are connected to industrial grade oxygen cylinders located in the secured treatment compound. Elevated levels of DO can be achieved in the range of 40 to 80 milligrams per liter (mg/L), depending on the thickness of the water column in the well. The numbers are based on Henry's law of gas solubilities.

High DO levels have been related to increased rates of hydrocarbon, BTEX, MTBE, and TBA. This technology uses the pressure in the tank to operate the system. The remedial equipment consists only of a gas cylinder, two-stage, low flow regulator, ¼" polyurethane tubing and the diffusion tools. The system does not require external power.

At 10 to 15 cc/minute, one 250 cubic foot oxygen cylinder can supply a well at 0.77 cubic feet per day for a period of almost one year.

	5'	10'	15'	20'	50'
Aerobic gas:					
Oxygen	42	55	62	69	111

Dissolved gas concentrations (mg/L) in a water column are shown in the above chart. The water column height is analogous to the water height in a groundwater well. Gas infusion technology works in both high and low permeability sites. Sites dominated by silts and clays may take considerably more time to see results due to the low groundwater flow velocities. In addition, typically high carbon and organic content of silts and clays may provide large oxygen demand. This technology works well in the presence of dissolved phase concentrations of total volatile organic compounds (VOCs) and MTBE, however, enhanced bioremediation does not work well in the presence of liquid phase hydrocarbons (LPH). The estimated zone of influence for the infusion wells is about 10 to 15 feet.

Based on the manufacturer recommendations, the diffusion system should operate at an oxygen flow rate of 15 cc per minute or 0.77 cubic feet per day per well. The miniaturized built-in iSOC gas controller keeps the gas pressure at about two to five psi above the maximum static water pressure. This pressure is required so the air chamber within the diffusion tool does not flood.

Prior to system implementation, a baseline sampling event will be conducted on four wells; two within the plume, one well downgradient and one well upgradient or cross gradient. Field tests for indirect geochemical indicators include pH, DO, ORP, temperature, and conductivity. In addition, total iron and ferrous iron (Fe^{+2}) (reduced) will be measured using Hach colorimetric field kits. Ferric iron (Fe^{+3}) (oxidized) will be determined by subtracting the ferrous iron result from the total iron. These indirect indicators will be measured every quarter during the quarterly monitoring events.

INDIRECT GEOCHEMICAL INDICATOR STUDY

Enhanced bioremediation samples include the contaminants as well as nitrate and sulfate, the macronutrients, orthophosphate-phosphate and ammonia as nitrogen. Oxygen demand in the groundwater samples includes five-day BOD_5 and chemical oxygen demand (COD). Total inorganic carbon will also be evaluated. Additional analyses include total organic carbon, total dissolved solids, alkalinity (speciated). Total heterotrophic count and specific hydrocarbon degraders will be performed. A summary of analytical is shown below:

Direct Indicator	**Analyses**
Contaminant	TPH-g, TPH-d, BTEX, MTBE, TBA, etc.

Indirect Indicators	**Analyses**
Microbial Activity	Total Heterotrophic Plate Count Specific Hydrocarbon Degraders
Macronutrients	Ammonia as nitrogen Ortho-phosphate
Terminal Electron Acceptors	Oxygen, measured as dissolved oxygen (DO) in field Nitrate (lab analysis) Ferrous iron (Fe^{+2}) and Total iron (field kits) Sulfate (lab analysis)
Total Oxygen Demand	Water oxygen demand: Chemical Oxygen Demand (COD, lab) Biochemical Oxygen Demand (BOD_5, lab)

REDOX, Field Parameters	Dissolved Oxygen (DO) (downhole meter) Oxidation-Reduction Potential (ORP) (downhole meter) Temperature, pH, conductivity (field meter)
Carbon Status	Total organic carbon (TOC, lab) Total inorganic carbon (TIC, lab) Speciated Alkalinity (lab)
Other Analyses	Total dissolved solids (TDS, lab)

RECOMMENDED BOTTLE TYPES PER WELL FOR ENHANCED BIOREMEDIATION MICROBIAL STUDIES USING GROUNDWATER SAMPLES:

ANALYSES	BOTTLE TYPE
BIOLOGICAL ANALYSES:	
Heterotrophic Count	
Specific Degraders	1 Liter HDPE
CHEMICAL ANALYSES:	
pH, Speciated Alkalinity, o-Phosphate, Nitrate, Sulfate	1 Liter HDPE
Total Dissolved Solids (TDS)	1 Liter HDPE
Total Inorganic Carbon (TIC)	125 ml Amber Glass, HCl
Total Organic Carbon (TOC)	125 ml Amber Glass, HCl
Ammonia as nitrogen	1 Liter Amber
Biochemical Oxygen Demand (BOD)	1 Liter HDPE*
Chemical Oxygen Demand (COD)	250 ml Amber Glass, H_2SO_4
Ferrous Iron (Fe^{2+}) Reduced Form:	125 ML HDPE, HCl (see field)

HDPE = high density polyethylene

Field Tests:
Dissolved oxygen (DO), pH, temp,
Oxidation-Reduction Potential (ORP),
Ferrous Iron (Fe^{2+}) Reduced Form,
Total Iron,
Temperature, pH, conductivity

Calculations:
(Fe^{3+}) Oxidized Form,
Dissolved carbon dioxide (CO_2)

DATA INTERPETATION

This data will be used to assess whether sufficient nutrients exist at the site to provide the necessary conditions for biodegradation and to monitor geochemical conditions as the anaerobic gas is added to the subsurface. If it is concluded that the levels do not exist, then the optimum nutrient mix will be determined and regulatory approval will be obtained prior to any addition of nutrients. Based on the implementation of this technology at sites of similar lithology, the estimated time to reach the remedial objectives will be two to five years.

REFERENCES AND SUGGESTED READING

ENHANCED BIOREMEDIATION REFERENCES TEXTBOOKS

Beek, B., 2001, *Biodegradation and Persistence*, Springer-Verlag, New York, 324 p.

Freeze, R.A., and Cherry, J.A., 1979, *Groundwater*, Prentice-Hall, Englewood Cliffs, NJ, 604 p.

Chapelle, F.H., 1993, *Ground-Water Microbiology and Geochemistry*, John Wiley & Sons, Inc., New York, NY, 424 p.

Levin, M.A., and Gealt, M.A., 1993, *Biotreatment of Industrial and Hazardous Waste*, McGraw-Hill, Inc., New York, NY, 331 p.

McCarty, P.L., and de la Torre, J., 2000, *Environmental Biotechnology Principals and Applications*, McGraw Hill, New York, 768 p.

Suthersan, S.S., 2002, *Natural and Enhanced Remediation Systems*, CRC Press/Lewis Publishers, Boca Raton, FL, 419 p.

Wiedemeier, T., Rafai, H., Newell, C., and Wilson, J., 1999, *Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface*, J. Wiley & Sons, New York.

ARTICLES OR REPORTS

Carey, G.R., Van Geel, P.J., Weidemeier, T.H., and McBean, E.A., 2003, A Modified Radial Diagram Approach for Evaluating Natural Attenuation Trends for Chlorinated Solvents and Inorganic Redox Indicators, Groundwater Monitoring & Remediation, National Groundwater Association, Columbus, OH, p. 75 - 84.

Sloan, R., 2004, Aerobic and Anaerobic Bioremediation and Monitored Natural Attenuation of VOCs, National Groundwater Association Conference on MTBE and Perchlorate, Costa Mesa, June 3-4, 2004, 103 p.

U.S. Environmental Protection Agency, 1995, Chapter 10: In-Situ Groundwater Bioremediation, in How To Evaluate Alternate Cleanup Technologies for Underground Storage Tank Sites, EPA 5 1 O-R-04-002; updated May 2004.

Wiedemeier, T., Downey, D.C., Wilson, J.T., Kampbell, D.K, Miller, R.N., and Hansen, J.E., 1994, Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation of Fuel Contamination Dissolved in Groundwater, Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

ATTACHMENT E

CLEARWATER GROUP

Direct-Push Drilling Investigation Procedures

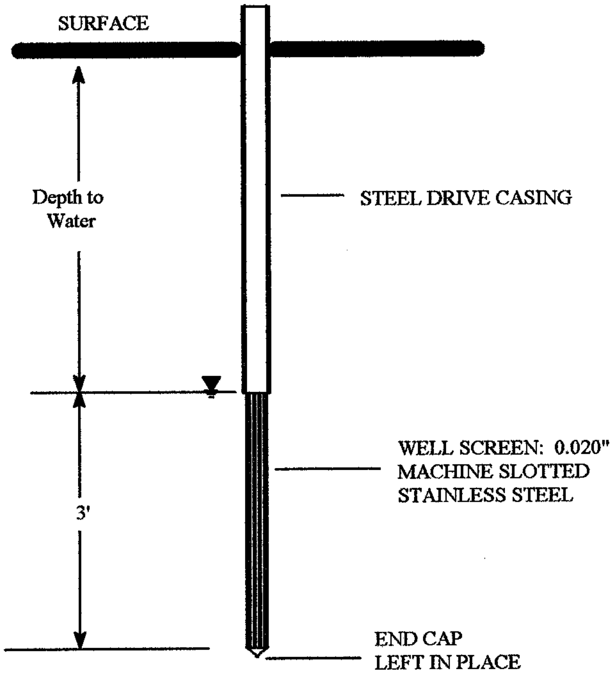
The direct push method of soil boring has several advantages over hollow-stem auger drill rigs. The direct push method produce no drill cuttings, is capable of 150 to 200 feet of boring or well installation per work day. Direct push can be used for soil gas surveys, soil sampling, groundwater sampling, installation of small-diameter monitoring wells, and components of remediation systems such as air sparge points. The equipment required to perform direct push work is varied ranging from a roto-hammer and operator to a pickup truck-mounted rig capable of substantial static downward force combined with percussion force. This method allows subsurface investigation work to be performed in areas inaccessible to conventional drill rigs such as in basements, beneath canopies, or below power lines. Direct push equipment is ideal at sites with unconsolidated soil or overburden, and sampling depths of less than 30 feet. This method is not appropriate for boring through bedrock or gravelly soils.

Permitting and Site Preparation
Prior to direct push boring work, Clearwater Group will obtain all necessary permits and locate all underground and above ground utilities through Underground Service Alert (USA) and a thorough site inspection. All drilling equipment will be inspected daily and will be maintained in safe operating condition. All down-hole drilling equipment will be cleaned prior to arriving on-site. Working components of the rig near the borehole, as well as driven casing and sampling equipment will be thoroughly decontaminated between each boring location by either steam cleaning or washing with an Alconox solution. All drilling and sampling methods will be consistent with ASTM Method D-1452-80 and county, state and federal regulations.

Boring Installation and Soil Sampling
Direct push uses a 1.5-inch outer barrel with an inner rod held in place during pushing. Soil samples are collected by penetrating to the desired depth, retracting the inner rod and attaching a spoon sampler. The sampler is then thrust beyond the outer barrel into native soil. Soil samples are recovered in brass or stainless containers lining the spoon.

Soil removed from the upper tube section is used for lithologic descriptions (according to the unified soil classification system) and for organic vapor field analysis. If organic vapors will be analyzed in the field, a portion of each soil sample will be placed in a plastic zip-lock bag. The bag will be sealed and warmed for approximately 10 minutes to allow vapors to be released from the soil sample and diffuse into the head space of the bag. The bag is then pierced with the probe of a calibrated organic vapor detector. The results of the field testing will be noted with the lithologic descriptions on field exploratory soil boring log. Soil samples selected for laboratory analysis will be covered on both ends with Teflon™ tape and plastic end caps. The samples will then be labeled, documented on a chain-of-custody form and placed in a cooler for transport to a state certified analytical laboratory.

Temporary Well Installation and Groundwater Sampling



Groundwater samples are collected by removing the inner rod and attaching a 4 foot stainless steel screen with a drive point at the end (Figure 1). The screen and rod is then inserted in the outer barrel and driven to the desired depth where the outer rod is retracted to expose the screen. If the stainless well screen does not produce enough water for sampling a 1-inch PVC screen can be installed in the boring and the outer rod retracted to leave a temporary well point for collecting groundwater samples or water levels.

Monitoring Well Installation and Development
Permanent small-diameter monitoring wells are installed by driving the outer barrel and inner rod as described above. Upon reaching the desired depth the system is removed and 2-inch OD (1/2-inch ID) pre-packed PCV piping is installed. The well plug is created using granular bentonite. The well seal is constructed of cement and sealed at the surface with a conventional "Christy Box" or similar vault. Monitoring wells are developed by surging the well with a small diameter bailer and removing 3 to 5 volumes until the produced water is clear.

Groundwater Sample Collection and Water Level Measurement
Prior to collecting groundwater from the wells the water levels are measured in all wells using an electronic water level gauge. Monitoring wells are prepared for sampling by purging three well bore volumes. Water is removed using small diameter bailers, a peristaltic pump, or manually using tubing with a check valve at the bottom. Once during removal of each volume the temperature, pH and conductivity are checked and noted on the field sampling form. Successive well volumes are removed until the parameters have stabilized or the well has gone dry. Prior to sampling the well is allowed to recover to within 90% of the stabilized water levels.

Groundwater samples[1] are collected using small diameter bailers. Groundwater samples are decanted into laboratory supplied containers. labeled, noted on a chain-of-custody form and placed on ice for transport to a laboratory.

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1 Small diameter wells often produce small quantity samples and are appropriate for analysis of volatile and aromatic compounds using VOA vials and dissolved metals analysis. Obtaining liter samples can be difficult and time consuming. Monitoring wells installed by the direct push method are most effective at sites where the subsurface soils are more coarse than silt, gasoline components are the key contaminants of concern, and water levels are not more than 25 feet below ground surface.

ATTACHMENT F

CLEARWATER GROUP

Grab Groundwater Sample Collection Protocol

Permits, Site Safety Plan, Utility Clearance

Clearwater Group obtains all the required permits, unless otherwise contractually directed. Clearwater prepares a site specific Site Safety Plan detailing site hazards, site safety and control, decontamination procedures, and emergency response procedures to be employed throughout the work. At least 48 hours prior to drilling, Underground Service Alert (USA) or an equivalent agency will be notified of the planned work. Clearwater, attempts to locate all underground and aboveground utilities by site inspection (in conjunction with its subcontractors and knowledgeable site managers, if available), and review of site as-built drawings. Clearwater may employ a private, professional utility locator, or ground penetrating survey subcontractor, to refine the site utility inspection. Some agencies may require notification prior to drilling in order to schedule a grouting inspection.

Drilling Equipment

All soil borings are drilled using a truck-mounted Geoprobe® drill rig, unless site conditions warrant a different drilling method. Subsurface conditions permitting, the first five feet of each boring is advanced using a hand-auger or post-hole digger. All drilling equipment will be inspected daily and maintained in safe working condition by the operator. All down-hole drilling equipment will be steam cleaned prior to arriving on site. Working components of the drill rig near the borehole, as well as probe rods, will be thoroughly steam cleaned between each boring location. All Clearwater drilling and sampling methods will be consistent with local, state and federal regulations.

Grab Groundwater Sample Collection

- Drive the soil boring to the depth zone(s) of interest. For petroleum hydrocarbons and floating compounds, the primary zone of interest is the top of static groundwater. For dense non-aqueous phase liquid (DNAPL) compounds the zone of interest will be below the top of static groundwater and above an aquitard.
- Retract the Geoprobe® rods from the boring and insert a short (5 foot long or less), 1" diameter PVC temporary well screen. Attach enough blank well casing above the well screen to reach the target depth.
- If the boring was drilled with a hollow stem auger it may be possible to collect the sample from within the augers without setting temporary well casing
- Lower a clean disposable bailer down the temporary well casing to collect a grab groundwater sample
- Decant the sample into laboratory provided containers
- Seal and label the containers and record the sample information on a Chain of Custody document
- Store the samples in a cooler chilled with ice
- Remove the temporary well casing
- Grout the boring with bentonite chips or cement grout according to agency regulations
- Hydrate the bentonite chips with clean water
- Patch the ground surface with concrete, asphalt cold patch, or other material to match the ground surface
- Measure sample location from known landmarks using a tape measure and/or a global positioning system (GPS). If a GPS is used, located nearby landmarks with the GPS and confirm the locations with a tape measure
- Sketch the sample location in the field notes with dimensions.
- Photograph the sample location with nearby landmarks visible in the photograph's background

Recordkeeping

Proper record keeping consists of recording the following information, at a minimum:

- Sample identification information (location, depth, sample indentifiers, data and time)
- Field personnel
- Weather conditions (temperature, wind speed, precipitation, etc.)
- Sampling method, devices and equipment used
- Shipment information, including chain of custody protocols and records.

Quality Assurance Procedures

To prevent contamination of the samples, Clearwater personnel adhere to the following procedures in the field:

- A new, clean pair of latex gloves will be put on prior to collecting each sample
- Samples will be collected in the expected order of increasing degree of contamination based on historical analytical results
- All sampling equipment will be thoroughly decontaminated between each boring.

Soil Waste Management

Soil cuttings are stockpiled on and covered with plastic sheeting to control runoff, or contained in 55-gallon D.O.T.-approved drums on site. Waste soil will be sampled to chemically profile it for disposable, and hauled by a licensed waste hauler to an appropriate landfill. All waste stored on site is properly labeled at the time of production.

ATTACHMENT G

CLEARWATER GROUP

Soil Borehole Drilling, Monitoring Well Installation and Development, and Groundwater Sampling Field Procedures

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Drilling and Soil Sampling

Permits, Site Safety Plan, Utility Clearance

Clearwater Group obtains all the required permits, unless otherwise contractually directed. Clearwater prepares a site specific Site Safety Plan detailing site hazards, site safety and control, decontamination procedures, and emergency response procedures to be employed throughout the defined phase of work. At least 48 hours prior to drilling, Underground Service Alert (USA) or an equivalent agency is notified of the planned work. Clearwater, attempts to locate all underground and above ground utilities by site inspection (in conjunction with its subcontractors and knowledgeable site managers, if available), and review of site as-built drawings. Clearwater may employ a private, professional utility locator to refine the site utility inspection.

Drilling Equipment

All soil borings are drilled using a truck-mounted hollow-stem auger drill rig, unless site conditions warrant a different drilling method. Subsurface conditions permitting, the first five feet of each boring is advanced using a hand-auger or post-hole digger. All drilling equipment is inspected daily and maintained in safe working condition by the operator. All down-hole drilling equipment is steam cleaned prior to arriving on site. Working components of the drill rig near the borehole, as well as augers and drill rods are thoroughly steam cleaned between each boring location. All CLEARWATER drilling and sampling methods are consistent with ASTM Method D-1452-80, and local, state and federal regulations.

Soil Sampling and Lithologic Description

Whenever possible, the first Clearwater boring to be drilled at a site is continuously cored to obtain a complete lithologic description. Otherwise, soil samples are typically collected every 5 feet to the total depth explored, using brass tubes fitted in a California-modified split spoon sampler. If copper or zinc contamination is the subject of the investigation, stainless steel liners are used instead of brass. Additional soil samples may be collected based upon significant changes in lithology or in areas of obvious soil contamination. During soil sample collection, the split spoon sampler is driven 18 to 24 inches past the lead auger by a 140-pound hammer falling a minimum of 30 inches. The number of blows necessary to drive the sampler and the amount of soil recovered is recorded on the Field Exploratory Soil Boring Log. The soil sampler and liners are cleaned with an Alconox® solution and rinsed with tap water prior to each sampling event. New liners are used whenever a soil sample may be retained for laboratory analysis.

Monitoring Well Installation

Well Casing, Screen and Filter Pack Construction

Monitoring wells are constructed with schedule 40, threaded, polyvinyl chloride (PVC) casing unless site geochemistry or contamination necessitates an alternative material. The wells are constructed with factory-slotted screen and threaded end caps.

A graded sand filter pack is placed in the annular space across the screened interval and extended approximately one to two feet above the screen, as site conditions permit, so as to prevent extension of the sand pack into an overlying water-bearing unit. The well screen slot size is the maximum size capable of retaining 90% of the filter pack. Typically, 0.010-inch screen is used where the formation is predominantly clay and/or silt or poorly-graded fine sand. 0.020-inch screen is used where the formation is predominantly well-graded or medium to coarse sand and/or gravel.

The filter pack grade (mean grain size) is selected according to native sediment type as follows: a) for poorly graded fine sand or silt/clay - 4 times the 70% retained grain size of the formation b) for medium to coarse sand, gravel or well graded sediments - 6 times the 70% retained grain size. Since results of particle size analysis are not always available, Clearwater often selects screen size and filter pack on the basis of general site stratigraphy, and specifically the finest significantly thick layer of sediment to be screened. Commonly selected grades are Lone Star® 3, 2/12 or 2/16 (or equivalent) with 0.020-inch slotted screen and Lone Star® 1/20 with 0.010-inch slotted screen.

Well Seal and Completion

A minimum two foot seal of bentonite is placed above the sand pack. The bentonite seal is hydrated by either formation water or potable water. Neat cement or a cement/bentonite grout mixture seals the remaining annular space to the surface. If bentonite is used in the grout mixture, it does not exceed 5% by weight. The grout is placed using a tremie pipe, if the top of the bentonite is more than 20 feet below grade, or if water is present in the boring above the bentonite seal. A watertight locking cap and protective traffic-rated vault box is installed on top of each well. Well construction details are presented on the Field Exploratory Soil Boring Log. Following completion of a well, Clearwater completes and submits, or ensures that the driller has sufficient information to complete and submit, the state-required Well Completion Report or equivalent document.

Quality Assurance Procedures

To prevent contamination of the samples, Clearwater personnel adhere to the following procedures in the field:

- A new, clean pair of latex gloves are put on prior to sampling each well.
- Wells are gauged, purged and groundwater samples are collected in the expected order of increasing degree of contamination based on historical analytical results.
- All purging equipment will be thoroughly decontaminated between each well, using the procedures previously described at the beginning of this section.

Soil Boring Abandonment

Soil borings which are not to be converted into monitoring wells are sealed to the ground surface using neat cement or sand-cement slurry in accordance with federal, state and local regulations. Native soil may be used to fill the top two to three feet for cosmetic purposes, as permitted.

ATTACHMENT H

CLEARWATER GROUP

Soil Vapor Monitoring Well Installation and Sampling Procedures

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Permits, Site Safety Plan, Utility Clearance

Clearwater Group obtains all the required permits, unless otherwise contractually directed. Clearwater prepares a site specific Site Safety Plan detailing site hazards, site safety and control, decontamination procedures, and emergency response procedures to be employed throughout the work. At least 48 hours prior to drilling, Underground Service Alert (USA) or an equivalent agency is notified of the planned work. Clearwater attempts to locate all underground and aboveground utilities by site inspection (in conjunction with its subcontractors and knowledgeable site managers, if available), and review of site as-built drawings. Clearwater may employ a private, professional utility locator and/or ground penetrating radar survey subcontractor to refine the site utility inspection.

Drilling Equipment

All soil borings are drilled using a truck-mounted Geoprobe® drill rig, unless site conditions warrant a different drilling method. Subsurface conditions permitting, the first five feet of each boring is advanced using a hand-auger or post-hole digger. All drilling equipment is inspected daily and maintained in safe working condition by the operator. All down-hole drilling equipment is steam cleaned prior to arriving on site. Working components of the drill rig near the borehole, as well as probe rods are thoroughly steam cleaned between each boring location. All Clearwater drilling and sampling methods will be consistent with local, state and federal regulations.

Soil Vapor Monitoring Well Installation

Soil vapor monitoring depths will be chosen to minimize the effects of change in barometric pressure, or breakthrough of ambient air from the surface, and to ensure that consistent and representative samples are collected. If groundwater is too shallow to allow soil gas sampling at the depths specified above, samples will be collected from immediately above the capillary fringe. Sampling points will be laterally spaced to adequately represent soil gas concentrations proximate to structures, taking into consideration the location of the contamination relative to the structures.

The borehole for the soil vapor well may be installed using direct push or hollow stem auger drilling equipment or hand driven using a rotary hammer or a hand auger. A soil vapor monitoring well example is shown on **Figure 1**. The sample probe consists of a probe tip through which the soil gas probe is collected, and probe tubing that extends from the probe tip to the ground surface. Sample probe tubing will be small diameter (1/8 to 1/4 inch). The sample probe and tubing will be constructed of material that will not react or interact with the target compounds. The tubing will be properly marked at the surface to identify the probe location and depth. The probe tip is placed midway between the top and bottom of the sampling interval, with a sand pack extending approximately 6 inches above and below the sampling interval. At least 1 foot of dry granular bentonite will be placed on top of the sand. The borehole will be grouted to the surface with hydrated bentonite. The surface seal will be a minimum of 2.5 feet thick. One foot of dry granular bentonite must be placed between the filter pack and the grout at each sampling location.

Surface Completion

The following components may be installed, as necessary:

- Gas-tight valve or fitting for capping the vapor point;
- Fitting for connection to above ground sampling equipment;
- Protective flush-mounted or above ground well vault and/or gaurd posts

Soil Gas Probe Equilibration

Soil gas sampling will not be conducted for at least 30 minutes following probe installation using the direct push method. For probes installed with hollow stem auger drilling methods, soil gas sampling will not be conducted for at least 48 hours following probe installation.

Soil Gas Probe Sampling

The volume of the sampling system will be calculated by summing the volume of the probe screened interval (including filter pack void space, accounting for the porosity of the sand pack), the volume of tubing from the probe tip to the ground surface, and the volume of the above ground tubing connecting the soil probe to the sample collection device. The monitoring point will be purged until at least three volumes of the full sampling system have been evacuated. Purging will be conducted at flow rates and vacuum conditions similar to those for sample collection.

An initial sampling rate of 200 milliliters per minute (mL/min) or less is recommended. The sampling flow rate will be adjusted using the flow regulator. Data for samples collected under a vacuum greater than 100 inches of water will be flagged.

The aboveground sampling equipment will be attached to the probe at the surface. All sampling system connections and fittings will be checked for tightness and obvious deterioration. Purge at least three volumes of air from the sampling system. After purging is complete, the valve to the purge line will be closed and/or disconnected from the purge apparatus. Connect the sample container to the sampling line, using quick-connect, airtight fittings. Open the valve and collect the sample into the container, measure and record the sample flow rate and vacuum every two to five minutes. Disconnect sample container and immediately label the container with the sample identification information. If Summa canisters are used, measure the final pressure of the canister using a pressure gauge and record the final canister pressure.

Recordkeeping

Proper record keeping consists of recording the following information, at a minimum:

- Sample identification information (location, depth, sample indentifiers, data and time)
- Field personnel
- Weather conditions (temperature, wind speed, barometric pressure, precipitation, etc.)
- Sampling method, devices and equipment used
- Purge volumes prior to sample collection
- Volume of soil gas extracted per sample
- Vacuum of canisters before and after samples were collected
- If observable, the apparent moisture content of the sampling zone
- Shipment information, including chain of custody protocols and records.

Leak Testing

A leak test is recommended each time a soil gas sample is collected. A leak check, or tracer, compound such as isopropanol is recommended to determine if leaks are present. Other compounds such as pentane, isobutene, propane and butane may be used. A leak check compound is selected that is not known or suspected to be site related or otherwise associated with the site or nearby properties.

Immediately before sampling, place the leak check compound at each location where ambient air could enter the sampling system or where cross contamination may occur. For liquid compounds, wet a paper towel with the leak compound and place the towel over each location where air could enter the system. The leak check compound must be included in the list of analytes looked for during laboratory analysis of each sample.

Quality Assurance Procedures

To prevent contamination of the samples, Clearwater personnel adhere to the following procedures in the field:

- A new, clean pair of latex gloves are put on prior to sampling each well.
- Wells are purged and samples are collected in the expected order of increasing degree of contamination based on historical analytical results.
- All purging equipment will be thoroughly decontaminated between each well.

Soil Waste Management

Soil cuttings are stockpiled on and covered with plastic sheeting to control runoff, or contained in 55-gallon D.O.T.-approved drums on site. Waste soil is sampled to chemically profile it for disposable, and is hauled by a licensed waste hauler to an appropriate landfill. All waste stored on site is properly labeled at the time of production.

ATTACHMENT I

CLEARWATER GROUP

Air Sparging, Soil Vapor Extraction, and Combined Air Sparging/Soil Vapor Extraction Pilot Tests Field Procedures

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Air Sparging Pilot Test
The air sparging test will be performed by applying air pressure to the sparging well. The flow of air from the sparge well will be monitored to determine it's extent and effect on the surrounding formation and ground water. The test will be performed at different levels of applied air pressure. The applied air pressure will be changed when the pressure influence in surrounding wells stabilizes. The initial applied air pressure will be 10 psig. The applied air pressure will not exceed 45 psig, the PVC pressure limit. The injected air pressure will not exceed 45 psi to provide a safety factor to prevent rupture of the well screen, and the flowrate will not exceed 60 cfm.

Air pressure will be applied to the sparging well using a towable, engine-driven air compressor. The compressed air will be filtered to remove any water, particles, and compressor oil. All above ground air pressurized piping will be metal or hose suitable to the application. No plastic pipe will be used.

Prior to beginning the test, the following measurements will be made at the surrounding observation wells:

- Depth to water will be measured to the nearest 0.01 foot with a Solinst electronic interface probe, or equivalent.
- Dissolved oxygen (DO) content of the well water will be measured.
- Hydrocarbon concentration in the air just above the water level in the observation wells will be measured with a flame ionization detector or a photo-ionization detector.

The test will be run in steps, each step at a different injected air pressure. During each step, the following parameters will be measured to monitor the surrounding formation and determine when flow through the formation has stabilized:

- The induced pressure on the surrounding wells will be measured by Magnehelic® gauges in inches of water.
- The injected air flowrate will be measured with a Kurz® Model 443 thermal anemometer, or equivalent.

Once the formation has stabilized, pressures will be increased and the next test step will begin. After the final step test, the depth to water, dissolved oxygen content in the well water, and the oxygen and volatile content of the air above the water in each observation well will be measured using the same instruments as above.

Soil Vapor Extraction Pilot Test
Prior to performing the test, any necessary air permits shall be obtained and the test will be performed in accordance with any requirements stated in the permit. The test will be performed by applying a vacuum to an existing vapor monitoring or extraction well or a soil vapor probe with a vacuum pump to extract soil vapor. The test will be run at different applied vacuums until the vacuum influence in surrounding wells or points has stabilized, or one pore volume has been extracted from the soil.

The following measurements will be made during the test for the different applied vacuums:

- Vacuum applied to the well will be measured with a vacuum gauge and adjusted with a bleeder valve on the vacuum side of the pump.
- Volatiles and oxygen content from the extraction well will be monitored during the test using a flame ionization detector or a photoionization detector.

- The vacuum influence in surrounding wells will be measured in inches of water (vacuum) with Magnehelic® gauges, or equivalent.

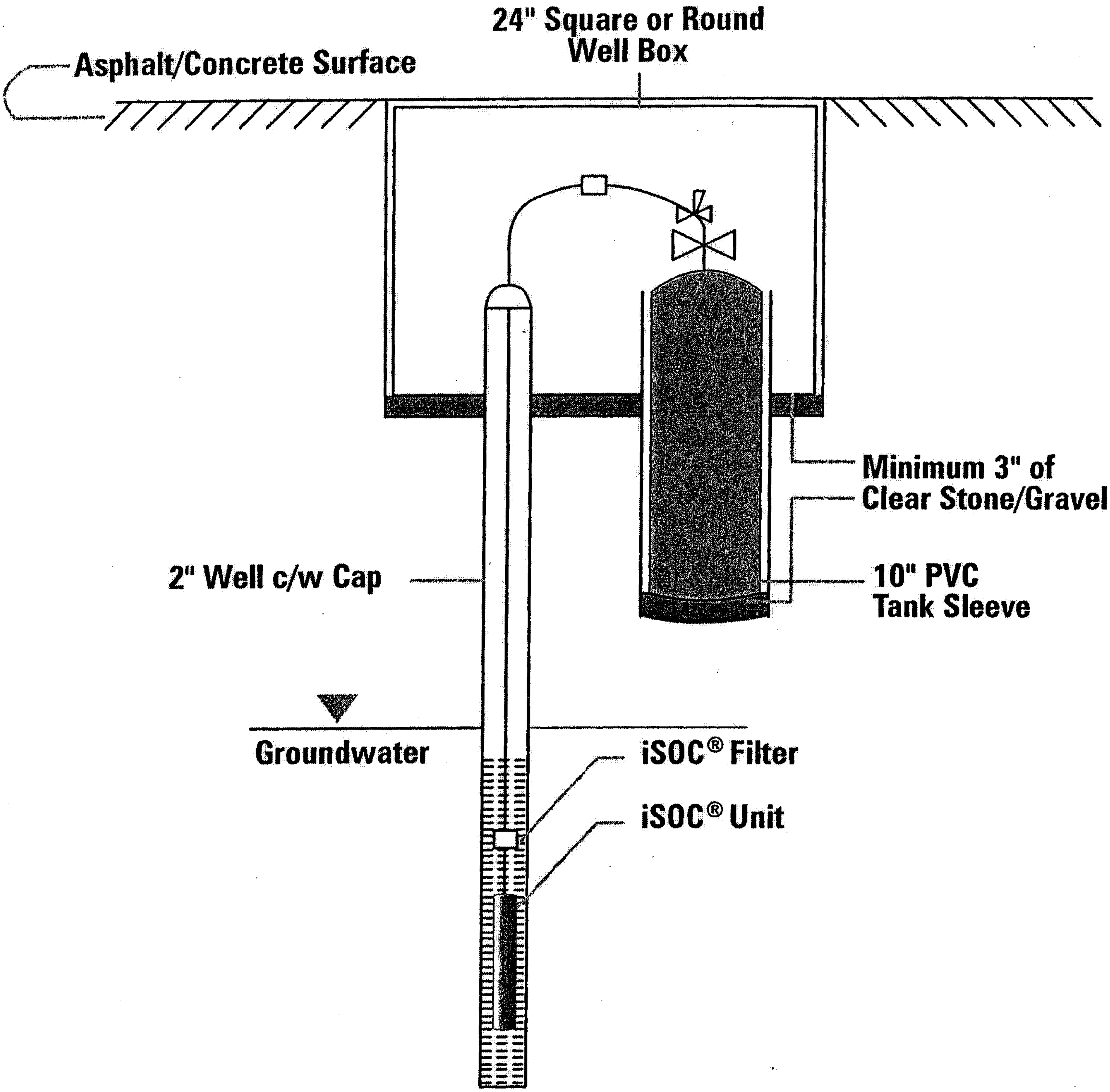
- Flow rate at the extraction well and at the monitoring wells will be measured once the vacuum has stabilized using a thermal anemometer or equivalent.

Bag samples of extracted soil vapor will be collected and analyzed for the presence of hydrocarbons at a California DHS-certified lab. If required, extracted soil vapor will be treated with an internal combustion engine before being discharged to the atmosphere. The engine will be rented from a company that has specially modified the engine to treat extracted soil vapor. Permits for the treated air discharge will be obtained by the supplier of the engine.

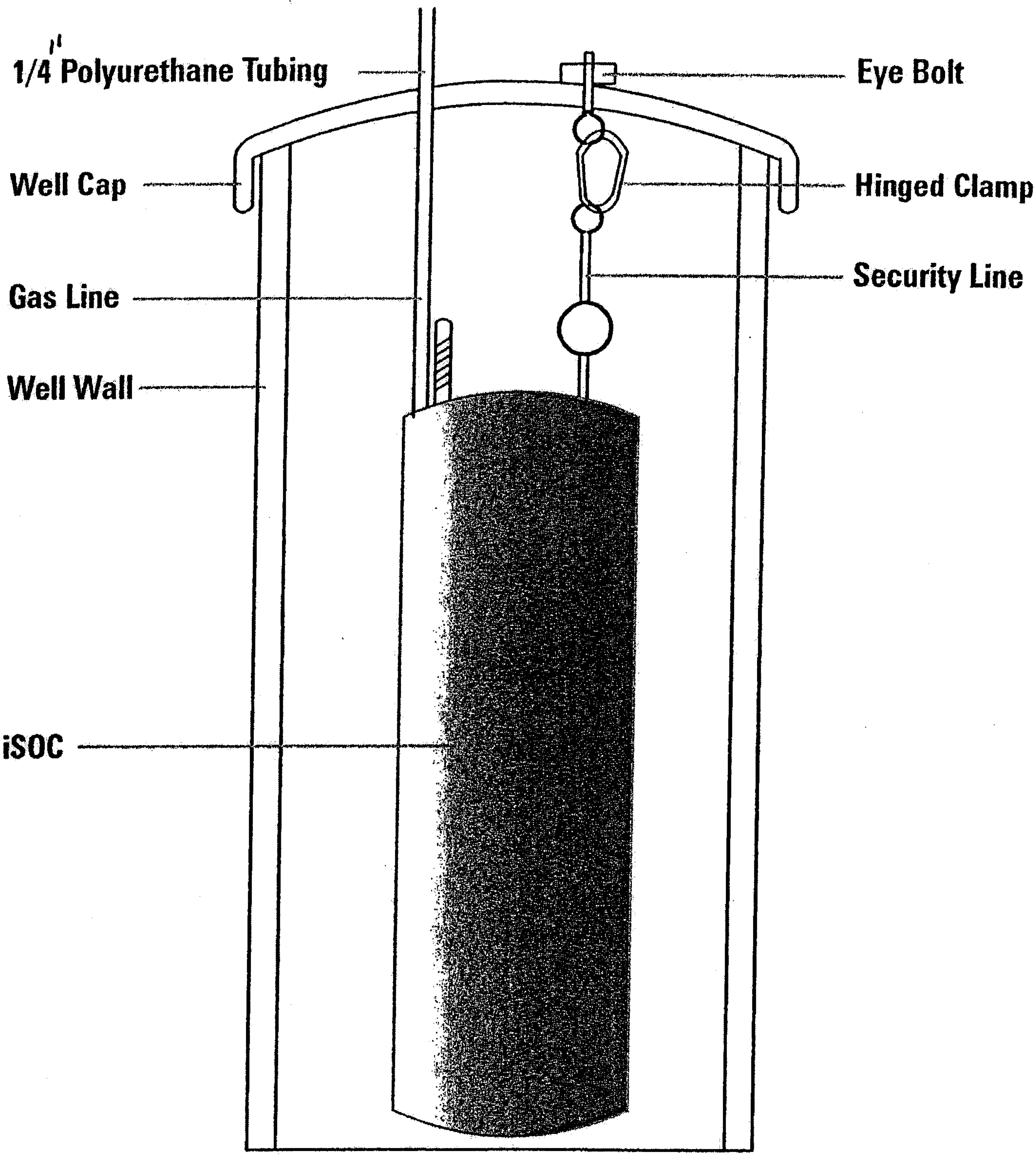
Combined Air Sparging/Vapor Extraction Pilot Test

Air injection and vacuum extraction will be operated simultaneously for the combined test. The measurements to be taken at the beginning, during and after the combined test are the same as those for the individual tests and will use the same instruments. The gauges used on the surrounding wells will be able to be easily switched over to read vacuum or pressure. The air sparging injection rate will not exceed 1/3 of the soil vapor extraction rate. Upon startup, the SVE system will be allowed to operate long enough so that soil vapor pressure in the surrounding wells and vapor points has been allowed to stabilize.

ATTACHMENT J



X-Section of Underground iSOC Vaulted Combined with Gas Tank Eagle Gas 4301 San Leandro Street Oakland, California	CLEARWATER GROUP		
	Project No. **ZP046**	Figure Date **9/06**	Figure **1**



Connection Detail for Security Line to Well Cap Eagle Gas 4301 San Leandro Street Oakland, California	CLEARWATER GROUP		
	Project No. ZP046	Figure Date 9/06	Figure 2