CLEARWATER
GROUP, INC.
Environmental Services

SOIL AND GROUNDWATER INVESTIGATION WORKPLAN

Eagle Gas Station
4301 San Leandro Street
Oakland, California 94601
LOP StID# 2118
Clearwater Group Project # ZP046C

Prepared for:

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

Prepared by:

Clearwater Group

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1. INTRODUCTION

The Alameda County Environmental Health Services (ACEHS) has reviewed the First Quarter 2005 Groundwater Monitoring Report and the Interim Remedial Action Plan (IRAP) that Clearwater Group (Clearwater) submitted for the LUFT site located at 4301 San Leandro Street, Oakland, California. Based on the groundwater monitoring results and the information contained in the fuel leak case file, ACEHS asked Mr. Muhammad Jamil, the owner and responsible party for the subject site (Eagle Gas Station), to complete a soil and groundwater investigation, conduct an interim remedial action, and prepare a Corrective Action Plan. In ACEHS' opinion, use of a Site Conceptual Model (SCM) is necessary in order to identify the data gaps for site/contaminant characteristics and to develop a cost-effective remedial action for the site. As a result, ACEHS requested Mr. Jamil to submit a *Soil and Groundwater Investigation Workplan* to initiate the development procedure for the SCM and the characterization the site/plume prior to the development of remedial action for site closure. The above requests were made by an ACEHS letter dated on May 26, 2005.

On behalf of Mr. Jamil, Clearwater has prepared this *Soil and Groundwater Investigation Workplan*. The content of this workplan includes the information on the regional geologic and hydrogeologic setting, an initial Site Conceptual Model of the subject site, the results of Utility Survey and Well Survey used to supplement the *Sensitive Receptor Survey and Workplan for Continuing Investigation* submitted on August 3, 2001 as well as the scope of work for the following tasks requested by the ACEHS:

- Characterize the lateral and vertical extent of contamination;
- Characterize local hydrogeology and groundwater flow conditions;
- Determine the approximate time frame of the Methyl Tertiary-Butyl Ether (MTBE) release; and
- Propose approaches used to estimate the MTBE mass and flux.

In addition to this *Soil and Groundwater Investigation Workplan*, Clearwater will conduct an interim remedial action based on the conceptual design presented in the letter submitted on June 13, 2005 entitled *Recommendations for Interim Remedial Actions*. This conceptual design modified the IRAP submitted on January 14, 2004. The modified conceptual design was accepted by ACEHS in a letter dated June 24, 2005. Therefore, this *Soil and Groundwater Investigation Workplan* also includes the system design, operation, and performance evaluation of the proposed interim remedial action. The performance of the interim remedial system will be included in the *Soil and Groundwater Investigation Report* due 120 days after ACEHS' approval of the *Soil and Groundwater Investigation Workplan* and reports for future quarterly groundwater monitoring requested by ACEHS.

In addition to the soil and groundwater investigation and interim remedial action as well as an initiation of SCM development, other tasks including quarterly groundwater monitoring, preparation of a Corrective Action Plan (CAP), and the Geotracker EDF submittals are also requested for the subject site. The schedule of these tasks is detailed in

ACEHS' May 26, 2005 letter. The initial SCM included in this *Soil and Groundwater Investigation Workplan* will be modified and verified in the future if additional site investigation results are available. The Geotracker EDF data submittal has already begun on June 27, 2005.

2. SITE DESCRIPTION

The site is located in the southern portion of Oakland, Alameda County, California at the southern corner of the intersection of San Leandro Street and High Street, and is approximately 1,000 feet east of Interstate Highway 880. The site is bounded by commercial property to the southeast, southwest and northwest and by the Bay Area Rapid Transit (BART) tracks to the northeast (Figure 1). The site is underlain predominantly by clays with some clayey gravel and clayey sand in shallow depths to approximately 10 feet below ground surface (bgs), and silty sand below 20 feet bgs in some areas.

3. SITE INVESTIGATION HISTORY

On April 21 and 22, 1999, Clearwater oversaw the removal from the site 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. Strong petroleum odors were detected from soils near the former UST locations during field observation. A total of five soil samples and three groundwater samples were collected from the UST excavations for confirmation. Laboratory analysis confirmed that an unauthorized release of petroleum had occurred. The former UST excavation area is shown in Figure 2.

In a letter dated 10 May 1999, the ACEHS 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 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 petroleum and MTBE concentrations still existed.

On August 4 and 5, 1999, approximately 100 linear feet of product piping was removed. Vent piping from between the former USTs and the south corner of the on-site building was also removed. All piping was cut up and disposed of as scrap metal. On August 5, 1999, confirmation soil samples were collected along the piping trench. Six samples were collected from approximately three feet bgs. An additional four samples were collected, one for each of the four former fuel dispensers. 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.

These three borings were converted to groundwater-monitoring wells MW-1 through MW-3 (see Figure 2) using clean, flush-threaded, 2-inch diameter polyvinyl chloride (PVC) for well casing. Construction data of these wells are presented in Table 1.

On 3 and 10 October 2000, Clearwater surveyed the top of the casing elevation for each of the well relative to an arbitrary datum; and developed the wells for monitoring purpose. Initial groundwater samples collected from these wells contained 83,000 micrograms per liter (µg/L) to 250,000 µg/L TPH-g and 33,000 µg/L to 400,000 µg/L MTBE. The historical groundwater monitoring and sampling results are listed in Table 2.

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, at that time, 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 monitoring wells around the site to delineate the MTBE plume in groundwater. In response to Clearwater's workplan, the ACEHS, in a correspondence dated 18 October 2001, recommended not to install off-site monitoring wells for the time being. Instead, the ACEHS requested that further characterization of subsurface soils and groundwater on site be completed prior to the installation of any off-site wells.

Quarterly monitoring did not occur after the third quarter 2001 event that took place on August 3, 2001. Quarterly monitoring resumed in July 2003 and has continued every quarter since then.

On January 9, 2004, after completing its review of the Third Quarter 2003 Groundwater Monitoring Report, ACEHS requested a workplan to address additional on-site and off-site subsurface investigations and the extent of groundwater impact on site. Clearwater, then, submitted an IRAP on 14 January 2004.

In order to expedite the implementation of the IRAP, Clearwater formally requested Oakland Fire Department to review the IRAP and the Fourth Quarter 2004 groundwater monitoring report as well as to oversee the project. The Fire Department verbally agreed to oversee this project. The correspondence was shown in letters to the Fire Department dated on 3 and 15 December 2004. Fire Department probably had returned the project back to ACEHS. As a result, ACEHS provided its review comments for the IRAP and the *First Quarter 2005 Groundwater Monitoring Report* on 26 May 2005.

4. REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING

Regional Geologic Setting

San Francisco Bay rests in the core of a broad Franciscan (basement rock) synform. Depth to bedrock ranges from 0 to 1,000 feet below sea level (S. Figuers, 1998). The Hayward Fault and the San Andreas Fault form the current eastern and western boundaries of the synform. Two distinct depositional basins are located within this

synform, the San Pablo and San Francisco Basins. The San Francisco Basin extends north from the Dumbarton Bridge to the shoreline south of Richmond and the San Pablo Basin extends north of the San Francisco Basin (S. Figuers, 1998). Both basins are tectonic depressions that filled primarily with a sequence of coalescing alluvial fans. These units consist of irregular lenses of sands, silts, and gravels eroded from the surrounding hills. During interglacial periods, sea entered the central part of the basin sand deposited widespread estuarine muds. These muds are the primary aquitards that bound the major aquifers and control the vertical flow of groundwater. The eastern margin of the San Francisco Basin was divided into the Berkeley, Oakland, San Leandro, and San Lorenzo sub-areas.

Regional Hydrogeologic Setting

Hydrogeologically, the sub-areas are distinct. The Oakland sub-area is also filled with alluvial fan material. It contains two main aquifers, the Merritt Sand and the deeper gravels. Both were primary sources of groundwater for over 60 years. A series of historical municipal well fields extended from the eastern end of Alameda, through the Oakland Coliseum, to 98th Street, and these mark a major hydrogeologic trend.

The site is located in a transitional margin characterized by unconsolidated fine-grained Quaternary marine sediments of the San Francisco Bay margin and Quaternary alluvial fan and fluvial deposits derived from the uplifted highlands of the Hayward Fault zone to the east (Figure 3). The youngest fine-grained marine sediment unit is the Young Bay Mud (Newark Aquitard). This unit is an estuarine mud being deposited today in San Francisco Bay. It is black, unconsolidated, saturated, and organic rich clay, containing occasional gravel and sand layers, shell fragments/layers, peat, and organic debris. It ranges in thickness between 50 to 75 feet, but can be up to 150 feet thick in channels (S. Figuers, 1998). A unit of the Alameda Formation, The San Antonio (Newark Aquifer), is a sequence of alluvial fans (0 to 120 feet thick) deposited between the overlying Young Bay Mud and the underlying Yerba Buena Mud (Irvington Aquitard). The Merritt and Posey are considered members of the San Antonio Unit of the Alameda Formation (Figuers, 1998).

The Merritt Sand, extending from Alameda Island to 1-1/2miles east of the estuary in West Oakland, was the primary source of groundwater for west Oakland for over 60 years. A series of historical municipal well fields extended from the south side of Alameda Island, through the Oakland Coliseum, to 98th Street (the Fruitvale area). This high producing water zone marks a major hydrogeologic trend. All of the municipal well fields were shut down in 1930, when water derived from the Sierra Nevada was imported into the area. Since then, groundwater levels have recovered, and it is likely that they are now at 1880 levels or higher (Figuers, 1998).

5. WEL SURVEY

State of California, Department of Water Resources (DWR) has been contacted to assist Clearwater conduct a record search for wells within a one-half mile radius of the subject

site. The well survey and the utility survey to be presented in the following section are used to assist an identification of preferential pathway for potential receptor. A sensitive receptor survey has been performed in 2001. The results are presented in the report entitled "*Sensitive Receptor Survey and Workplan for Continuing Investigation*" dated August 3, 2001. Although populations within the half-mile radius range of the site likely have increased, local land uses and characters of local community have not been significantly changed since 2001. The local community is primarily industrial for warehouses with few residents. No schools, day care centers, and medical facilities are found within the search radius. Although a reservoir operated by the East Bay Municipal Utilities District (EBMUD) is located approximately 1.75 miles to the northwest of the site, both regional and local groundwater has not been pumped for domestic use due to its high salinity. In addition to a tidal canal of the San Francisco Bay located 2,800 feet southeast of the subject site, no other surface water bodies such as creeks, streams, rivers, and lakes are located within the search radius. Storm drains and sewers nearby the subject site are discussed in the following section.

Based on the DWR search results, only seven water wells are located within the search radius. Four wells are located across the tidal canal on the island of Alameda. Three wells are located in Oakland. Two of them are located at an abandoned power station and their use was discontinued because the water from the well was too salty for the boiler. The only active water well is located at 499 High Street approximately 0.4 miles to the southwest of the subject site. It is used for industrial purposes.

The Water Well Drillers Reports obtained from DWR are included in Appendix A. The associated water well locations are shown in Figure 4.

6. UTILITY SURVEY

Clearwater has contacted the Underground Service Alert (USA) North to identify all the existing utility services at or near the subject site. The following companies have been contacted: PG&E, AT&T, MCI, Comcast, Kinder Morgan Energy Partners, Qwest Communications, Pacific Bell/SBC, and Time Warner.

PG&E did not release design plans for their gas pipes and electric cable trenches for security reasons. However, based on the *Groundwater Monitoring Report - Second Quarter 2001* and *Sensitive Receptor Survey and Workplan for Continuing Investigation*, there are no electric trenches within 250 feet of the subject site. Comcast has only overhead lines. No subsurface trenches exist. Clearwater could not get hold of any contacts from AT&T, MCI, and Time Warner. Thus, not information was obtained from those companies. Both Qwest Communications and Kinder Morgan Energy Partners either have underground lines following the Union Pacific right-of-way or have a line running east of the railway tracks. Thus, they do not have any lines close to the subject site.

Pacific Bell/SBC has six ducts along the High Street and one duct along the San Leandro Street nearby the subject site. Although the depth of ducts is not given, they are likely

above the water table, which is seven to 15 feet bgs. Thus, the cable trenches of Pacific Bell/SBC do not constitute a preferential migration pathway for on-site contaminants.

A sanitary sewer and storm conduit map was also obtained from the City of Oakland. Three sanitary sewer lines are installed under the High Street northwest of the subject site. These sewer lines are made of 8-inch, 18-inch and 24-inch diameter reinforced concrete pipes. The nearest sewer line (24-inch diameter) is located at 17 feet from the property line. The base of the 8-inch and 18-inch sewer line trench is approximately seven feet bgs, and the 24-inch sewer line trench is approximately 13 feet bgs. The Adams Creek (Peralta), runs from north to south and leads to the San Francisco Bay, is located approximately 150 feet southeast of the subject site. It has been converted to a under ground storm drain. Also, a 15-inch diameter storm drain located in the middle of the San Leandro Street is connected to the Peralta. This 15-inch storm drain is located at a distance of 60 feet from the east property boundary of the subject site and parallel to the San Leandro Street. The base of the storm drains is approximately ten feet bgs. According to the historical data, local groundwater ranged approximately from ten to 16 feet bgs for monitoring wells MW-2 and MW-3. Groundwater in monitoring well MW-1 is approximately ten feet bgs in 2005, although high water condition of seven feet bgs had occurred for monitoring well MW-1 in years 2000 and 2001. Therefore, both the sanitary sewer and storm drains may constitute a preferential migration pathway for contaminants if the groundwater is higher than ten feet bgs. Although the Adams Creek is not considered as a surface water body, it may also become a preferential pathway for contaminant migration if elevation of the impacted groundwater is higher than ten feet bgs.

7. INITIAL SITE CONCEPTUAL MODEL

An initial site conceptual model has been developed. The model will be used to help identify the data gap and to assist the design of remedial action. Due to the existence of data gaps, the developed site-specific conceptual model is currently at its preliminary stage. The initial site conceptual model will be modified once additional data are available from the effort of soil and groundwater investigation included in this workplan, interim remediation activities, and other additional investigations, if needed. The major components of the initial site conceptual model are discussed below:

Local Geology and Hydrogeology

The regional geologic and hydrogeologic setting has been discussed in Section 4. The information in regards to local lithology is limited because only three boring logs obtained from the drilling of monitoring wells MW-1 through MW-3 are available. Those boring logs are included in Appendix B. Based on the available boring logs; the lithology of the subject site is predominantly constituted by sandy clay with clayey gravel and clayey sand in shallow depths to approximately 10 feet to 20 feet bgs, and silty sand and silty clay below 20 feet bgs in some areas.

The soil investigation proposed in this workplan will provide additional data to characterize the local lithology by creating new soil borings and lithologic cross-sections.

Site-Specific Hydrocarbon Release History

A hydrocarbon release was first reported on May 4, 1999. The leak was confirmed in October 2000 following the removal of a 6,000-gallon gasoline tank, two 4,000-gallon diesel tank, and a 300-gallon waste oil tank. No earlier information is available regarding hydrocarbon releases.

Source Area

Following the removal of the UST's took place on April 21 and 22, 1999, soil and groundwater sampling was conducted. Elevated concentrations of hydrocarbons were reported at several locations within the UST excavation area. Confirmation sampling after tank removal showed that the highest concentrations of residual hydrocarbons (TPH-g and TPH-d) in the soil were found at sampling locations CS6-3 and CS11-3, which were located at the northeastern and northwestern corner of the dispenser islands. Significant residual MTBE concentration ranged from 0.08 mg/Kg to 310 mg/Kg was detected in the soil. Most residual MTBE concentrations in the soil were above ten mg/Kg. Groundwater sampled in the excavation area also reported significantly elevated concentrations of hydrocarbons and MTBE. Grab groundwater sample GW-3 obtained from the borehole for MW-3 reported the highest TPH-d and MTBE concentrations at 82,000 µg/L and 880,000 µg/L, respectively. Grab groundwater sample GW-1 obtained from the borehole for MW-1 reported the highest TPH-g concentrations (22,000 µg/L). As part of the tank removals, 800 tons of contaminated soil was excavated and removed and 1,000 gallons of contaminated water was pumped from the excavation.

In September 2000, three monitoring wells were installed at a depth of 25 feet. In January 2001, the first groundwater monitoring event was conducted. High concentrations of TPH-g, TPH-d, benzene and MTBE were detected in all three wells. The highest concentrations of MTBE (1,000,000 µg/L), TPH-g (740,000 µg/L), benzene (3,800 µg/L) and TPH-d (6,000 µg/L) were detected in MW-2. This well is located down gradient of the former UST excavation area. Therefore, it is clear that the "source area" is likely located in the former UST location. The excavation and removal of soil as well as extraction of groundwater from the former tank pit area did not completely remediate the site. A "source area" with residual contaminants may still exist.

Contaminant Mass and Flux Estimation

In addition to the previously-described concentrations of residual hydrocarbons and MTBE detected in soil and groundwater, the aerial extend of the "source area", the associated plume in groundwater, and the amount of residual mass of hydrocarbons and MTBE in soil and groundwater have not been delineated and calculated. The above information will be available after the soil and groundwater investigation proposed in this workplan is implemented.

Delineation of Sensitive Receptors and Preferential Pathways

Based on the well survey discussed in Sections 5, only one active water well located at 499 High Street and approximately 0.4 miles to the southwest of the subject site may be considered as a receptor. However, this well is only used for industrial purposes. No other sensitive receptors have been identified.

Subsurface lithology under the site is predominantly composed of silty/sandy/gravelly clays to a depth of approximately 20 - 25 ft bgs. Discontinuous clayey/silty sands with a limited lateral range are imbedded within the 25 ft clay layer. Elevation of these sandy or silty lenses varies within the depth interval of 25 ft bgs. Since permeability of sandy or silty materials tends to be higher than permeability of clay, sandy or silty lenses may become preferential pathways for the migration of dissolved hydrocarbons or fuel oxygenates. The existence of preferential path under the site can be identified when the subsurface lithology is characterized by the effort described in this workplan.

In addition, the imported fill material within the former UST excavation area has replaced most of the natural clay under the site. Since the permeability of the fill material tends to be higher than the permeability of natural clays, contaminated groundwater can migrate more easily due to the existence of fill material. The change of lithologic condition by the fill material coupled with the southerly groundwater flow direction likely is part of the reasons that causes the elevated MTBE and hydrocarbon concentrations in monitoring well MW-2. Also, approximately 100 linear feet of product piping was removed on August 4 and 5, 1999. Laboratory analytical results indicated that hydrocarbon-related contamination existed along the piping trenches. The abandoned and refilled trenches may constitute additional migration pathways for accelerating the contaminant migration and redistributing the contaminant mass under the site. Therefore, UST piping trenches that were routed to the two dispensers may have provided pathways for the contaminated groundwater. It should be noted that one of these routes ran in a northeasterly line towards MW-3. Comparing the sampled hydrocarbons and MTBE concentrations from MW2 and MW-3, the lowest groundwater contaminant concentrations have been reported at MW-1 because this well is up gradient from the UST excavation area.

Based on the utility survey discussed in Section 6, backfill and bedding material within the trenches for the 24-inch sewer line installed under the High Street and the 15-inch storm drain parallel to the San Leandro Street and located near the east property boundary of the subject site may constitute preferential migration pathways for the impacted groundwater if the groundwater elevation is higher than ten feet bgs. Additionally, the Adams Creek (Peralta) may also become a preferential pathway for contaminant migration if the elevation of the impacted groundwater is higher than ten feet bgs.

8. DESIGNS AND OPERATION OF THE INTERIM REMEDIAL SYSTEM

Clearwater will conduct an interim remedial action to prevent the off-site migration of MTBE and Tertiary Butyl Alcohol (TBA) and reduce the local groundwater impact. Based on the conceptual design presented in a letter submitted to the ACEHS on June 13,

2005, this section describes the system design, scope of work, and schedule for the interim remedial action.

8.1 Design of Interim Remedial System

The interim remedial system will include two components: a groundwater pump-and-treat system and an enhanced biodegradation system that include iSOC® air/oxygen diffusers.

Groundwater Pump-and-Treat System

To prevent the off-site migration of the contaminants, two extraction wells will be installed at the down gradient direction of the site. The approximate locations of these two extraction wells were shown in Figure 1 attached with the June 13, 2005 letter (Appendix C). Each extraction well will have a four-inch diameter casing made of PVC with a screen interval from ten feet to 25 feet below ground surface (bgs).

Prior to the availability of a sustainable groundwater pumping rate at the site, a one horsepower and two-inch diameter submersible pump capable of pumping a maximum rate of 15 gallons per minute (gpm) will be installed within each extraction well. Due to the presence of potentially high TBA and MTBE concentrations in extracted groundwater before the on-site enhanced biodegradation system becomes effective, the treatment system will split into two independent flow streams. Each flow stream will handle an average flow of 10 gpm from a single extraction well. Each treatment array will contain the following components: two sediment filter, a fiberglass 200-pound carbon vessel, and two 2,000-lb carbon vessels in series. The 22-inch-diameter and 50-inch-height fiberglass vessel will be used to let biological sludge grow within the vessel and knock down the inflow TBA and MTBE concentrations before the effluent passed through the two 2,000-lb carbon vessels. Use of fiberglass for the 200-lb "sacrificing" vessel will sustain higher pressure due to the growth of biomass. The footing of each 2,000-lb carbon vessel is four feet in diameter. Each 2,000-lb carbon vessel is approximately 8-ft tall. The flow diagram of the groundwater pump-and-treat system is presented in Figure 5.

Enhanced Biodegradation System

To enhance the on-site aerobic biodegradation, additional oxygen is added in dissolved form into the impacted groundwater. To reach the maximum dissolved oxygen concentration and improve the mass transfer efficiency from the gaseous phase to the groundwater, the following methods are employed:

- Using 100% (industrial grade) oxygen, instead of atmospheric air, to increase the oxygen content in the gas phase;
- Using a patented gas diffuser - iSOC (see Appendix D) to improve the mass transfer efficiency between the gas-liquid interface;
- Using the maximum hydraulic pressure (static water column) within the oxygen diffusion well to increase the concentration of dissolved concentration.

The on-site enhanced oxygen delivery system will contain six oxygen injection wells, in which gas diffusers - iSOC are installed within six inches of the bottom of the screen interval. Each iSOC well will have a two-inch diameter PVC casing. Each iSOC well will have a screen interval approximately from ten to 15 feet bgs and a filter pack from six feet to 25 feet bgs. A bentonite seal will be installed from three feet to six feet bgs. Cement will be filled from the ground surface to three feet bgs. The approximate locations of the oxygen diffusion wells (iSOC wells) were shown in Figure 2 attached with the June 13, 2005 letter (Appendix C). Pressurized oxygen tanks will be placed within the fenced treatment compound area to supply oxygen required by the iSOC diffusers.

System Monitoring and Performance Evaluation

Since cumulative groundwater quarterly monitoring data has been obtained from October 2000 to May 2005 and the purpose of the interim remedial system is to reduce the groundwater impact under the site as well as to prevent the off-site migration, the existing monitoring wells MW-1 through MW-3 have generated sufficient baseline data and will be indicative to evaluate the performance of the enhanced bioremediation system. It should be noted that additional monitoring wells and soil borings have been proposed in this workplan to characterize the on-site source and plume, these new monitoring wells and existing monitoring wells MW-1 through MW-3 also will be used to evaluate the performance of the interim remedial system.

8.2 Scope of Work for Interim Remedial Action

Completion of the Interim Remedial Action will include the following tasks:

- Apply well installation permit and sewer discharge permit;
- Drill and install two groundwater extraction wells and six iSOC wells;
- Determine the sustainable groundwater extraction rate – performing a step draw down test after the installation of the extraction well;
- Complete the design of the groundwater pump-and-treat system including the size of submersible pump, treatment compound, size of carbon vessels, piping/trenching, and control panel;
- Obtain permit for the construction of groundwater treatment compound;
- Install the groundwater pump-and-treat system and the iSOC system;
- System inspection, startup, and initial sampling; and
- System operation and maintenance (O&M) and quarterly monitoring.

Soil and groundwater sampling should be performed during the installation of extraction wells and iSOC wells. Both the soil/groundwater sampling data and the step draw down test results will be included in the Soil and Groundwater Investigation Report and also will be used to update the SCM.

8.3 Schedule of Interim Remedial Action

ACHES requested Clearwater to initiate the interim remedial action according to the letters dated May 26, 2005 and June 24, 2005. Based on the scope of work described in Section 6.2 and the reporting schedule specified in ACHES' May 26, 2005 and June 24, 2005 letters, the tentative schedule of the interim remedial action is presented below:

Tasks	Description	Timeline	Duration
1	Well installation and sewer discharge permits application	August 17	Ten working days
2	Well Installation and completion	September 1	Four days
3	Step draw down test	September 12	One day
4	System design (including drawings)	September 2	Eight working days
5	Building permit application and contractor soliciting	September 19	Four weeks
6	System installation	October 17	Five days
7	System star up and sampling	October 24	Two days
8	System O&M and 4Q05 quarterly monitoring	November 11	Monthly O&M

The above schedule is subject to changes if permits are not available on time according to the expected timeline.

9. SCOPE OF WORK FOR SOIL AND GROUNDWATER INVESTIGATION

This workplan has discussed the regional geologic and hydrogeologic setting, status of an initial Site Conceptual Model for the subject site, and the results of Utility Survey and Well Survey requested by an ACEHS letter dated May 26, 2005. Other requests included in the same letter for soil and groundwater investigation will be accomplished by the following tasks:

- Task 1 - Characterize the lateral and vertical extent of contamination;
- Task 2 - Characterize local lithology and hydrogeology;
- Task 3 - Determine the approximate time frame of the MTBE release;
- Task 4 - Estimate the MTBE mass and flux; and
- Task 5 - Preparation of soil and groundwater investigation report.

Each task is described in detail in the following subsections:

9.1 Characterize the Lateral and Vertical Extent of Contamination

A soil confirmation sampling was performed after USTs and product line removal conducted on April 21 and 22, 1999 and August 4 and 5, 1999, respectively. Soil sampling was again also performed during the installation of monitoring wells MW-1 through MW-3 on September 26, 2000. The above historical soil sampling results are summarized in Table 3. Historical soil sampling indicated that elevated concentrations of TPH-g, TPH-d, and MTBE were found in residual soil after pit and trench excavation. Elevated MTBE, TPH-g, and TPH-d concentrations identified from monitoring wells MW-2 and MW-3, and high TBA concentration detected from well MW-1 likely is a result of residual soil remained in the former excavation areas. In addition, results of historical groundwater elevation monitoring indicated that local groundwater primarily flows in the southeast direction. The calculated flow direction and hydraulic gradient data are summarized in Table 4.

In order to characterize the range and level of soil and groundwater impact under the subject site in the horizontal and vertical directions, seven soil boreholes will be drilled and sampled. These boreholes will be converted into groundwater monitoring wells. Prior to monitoring well installation, soil will be sampled using a Geoprobe® rig and modified split-spoon sampler. The proposed locations for soil borings are presented in Figure 6.

New monitoring wells MW-4 through MW-6 will be used to define the boundary of the local contaminant plume, and new monitoring wells MW-7 and MW-8 will be used to delineate the range of potential source area in the shallow groundwater. Two additional monitoring wells MW-4D and MW-5D will be used to delineate the level of groundwater impact in deeper groundwater.

After soil sampling, every borehole will be over drilled to an eight-inch diameter hole by a hallow stem auger rig to install a monitoring well with two-inch diameter PVC casings. For shallow monitoring wells, well will be screened with slot size of 0.01 inches or 0.02 inches in the interval from ten feet to 25 feet bgs. For deeper monitoring wells MW-4D and MW-5D, well screen will be located in the interval from 35 feet to 45 feet bgs. Two-inch PVC casing with slot size of 0.02 inches will be used for these two deeper wells. The proposed locations for new monitoring wells are also presented in Figure 6.

The boreholes used to install interim remediation wells mentioned in Section 8 will also be sampled. The soil sampling results will be combined with the data to be obtained from borings for new monitoring wells MW-4 through MW-8, MW-4D, and MW-5D to characterize the lateral and vertical extent of soil impact.

9.2 Characterize Local Lithology and Hydrogeology

The initial SCM presented in Section 7 is primitive because only three soil boreholes have been drilled during the installation of existing monitoring wells MW-1 through MW-3. Thus, no subsurface cross-sections have been generated for the subject site. The initial SCM will be updated and/or modified by incorporating the soil borings and

sampling results to be obtained during the interim remedial action discussed in Section 8 and the soil and groundwater characterization activity discussed in Section 9.1.

To assist the characterization of site lithology and level of soil impact, Geoprobe® rig will be advanced to perform continuous soil coring and sampling at the selected well locations of all the proposed new monitoring wells MW-4 through MW-8, MW-4D, and MW-5D. A PID will be used to screen every 5-foot continuous soil coring in the field. Selected soil samples will be collected using EPA 5035 Method and sent to a California certified laboratory for total petroleum hydrocarbons and oxygenate analyses using EPA Methods 8260 and 8015. Groundwater encountered during drilling will be sampled for total petroleum hydrocarbons and oxygenates analyses.

As described in Section 8, the interim remedial system will include six enhanced bioremediation iSOC wells ISOC-1 through ISCO-6 and two groundwater extraction wells EW-1 and EW-2. The casing diameter will be two inches and four inches for iSOC wells and extraction wells, respectively. The depth of boreholes of these wells will be 25 feet bgs. Like the seven proposed new monitoring wells MW-4 through MW-8, MW-4D, and MW-5D described in Section 9.1, the above interim remedial wells will also be pre-drilled by a Geoprobe® to perform continuous soil coring and sampling to assist the site characterization. The same soil sampling and chemical analysis methods described above will be used for the interim remedial wells. Groundwater encountered during drilling will be sampled for total petroleum hydrocarbons and oxygenates analyses. After soil coring and sampling, a hollow-stem auger rig will be used to install the iSOC wells and groundwater extraction wells. The boring logs and soil sampling results to be obtained from the interim remedial action and monitoring well installation activities will be used to characterize the subsurface lithology and upgrade the initial SCM.

The quarterly groundwater monitoring has been performed since October 2000. Based on the monitoring results, both groundwater flow direction and associated gradient are summarized in Table 4. A rose diagram will be presented in the Soil and Groundwater Investigation Report.

To characterize the groundwater transmissivity in water bearing zones, both 48-hr pumping tests and slug tests will be performed. Both extraction wells EW-1 and EW-2 will be individually pumped each for 48 hours. Groundwater elevation in monitoring wells MW-1 through MW-3, iSOC wells ISOC-1 through ISCO-6, and extraction wells EW-1 and EW-2 will be measured. The pumping test data will be used to determine the horizontal hydraulic conductivity in the shallow groundwater zone under the site. A one horsepower and two-inch diameter submersible pump capable of pumping a maximum rate of 15 gallons per minute (gpm) will be used to pump groundwater from EW-1 and EW-2, individually, for 48 hours each. The extracted groundwater will be treated by the activated carbon treatment system installed for the interim remedial action described in Section 8.1. During pumping of EW-1, transducers will be installed in wells EW-1, MW-2, EW-2, and ISCO-5. Water elevation of other available wells will be measured using water level indicator. Likewise, during pumping of EW-2, transducers will be installed in

wells EW-2, EW-1, ISOC-5, and ISOC-6. Water elevation of other available wells will be measured using a water level indicator.

In addition, slug tests will be performed for monitoring wells MW-4D and MW-5D to estimate the hydraulic conductivity in the deeper groundwater-bearing zone. Slug tests will also be performed in iSOC wells ISOC-1 through ISCO-6 to establish the correlation of hydraulic conductivities determined from the pumping tests and the slug tests. A one-inch diameter PVC slug of five feet long will be inserted into the test well. Both the falling-head and rising-head data recorded by the transducer will be analyzed to estimate the hydraulic conductivity of the formation nearby the test well.

9.3 Determine the Approximate Time Frame of the MTBE Release

Soil confirmation sampling results included in Table 3 show that a maximum MTBE concentration of 310 mg/Kg was found at a location near a fuel dispense at a depth of three feet bgs. Elevated MTBE concentration was also found in other areas near the dispensers as well as from soil remained within the former USTs area after soil excavation at various depths of three feet, six and half feet, and seven feet bgs. Data included in Table 3 also suggests that there is no obvious correlation between the MTBE concentration and the TPH concentration. This finding suggests that MTBE had been released into the soil before 1999. Although it is very likely that elevated MTBE concentration in groundwater was caused by the residual MTBE in impacted soil, the approximate time frame of the development of MTBE plume is undetermined. This information is critical for the purpose of contaminant transport modeling and remedial design. In order to estimate the approximate time frame of the MTBE release, an extensive records and reports search for information and data in regards to tank installation time, tank and product line material, results of pressure tests, if performed, and historical site conditions should be collected. The search results will be presented in the Soil and Groundwater Investigation Report.

9.4 Estimate the MTBE Mass and Flux

Data of residual MTBE mass in soil and groundwater as well as the mass flux of MTBE migrating off site are critical to the design of effective remedial actions and the determination of goal for site remediation and closure. Information of contaminant concentration distribution and plume boundary, subsurface lithology, water transmitting characteristics of water bearing zones, groundwater flow regime, characteristics of contaminant source, source release history, and an upgraded SCM will be obtained from the soil and groundwater investigation described in this workplan. The above information will be useful to the estimation of residual MTBE mass and flux of MTBE migration in groundwater.

The residual mass of MTBE remained in the source area and the plume will be estimated based on the soil and groundwater investigation described in this workplan. A quasi-three-dimensional MTBE fate and transport model also will be developed based on the lithologic, hydrogeologic, and groundwater contamination data mentioned above. The

site-specific contaminant transport model will be used to estimate the flux of the MTBE mass migrating off site, and to assist the design of the final phase site remediation.

Software MODFLOW (MacDonald and Harbaugh, 1986) and MT3D (Zheng, 1996) will be used to perform simulation of the developed site-specific transport model for MTBE.

10. SCHEDULE OF SOIL AND GROUNDWASTER INVESTIGATION

The schedule associated with the proposed tasks for soil and groundwater investigation is listed below:

Tasks	Description	Timeline	Duration
1	Characterize lateral and vertical contamination	Pending upon the approval of Workplan	Four weeks
2	Characterize local lithology and hydrogeology (including two 48-hr pumping test, eight slug tests, and cross-sections)	To be determined (TBD)	Four weeks
3	Determine time of MTBE release	TBD	3 days
4	Estimate MTBE mass and flux (including computer modeling)	TBD	Four weeks
5	Reporting	TBD	Three weeks

11. REFERENCES

Figuers, S., 1998. Groundwater Study and Water Supply History of the East Bay Plain, Alameda and Contra Costa Counties, CA, Norfleet Consultants, Livermore, California. Norfleet Consultants Project Number 971102.

McDonald, M. G. and Harbaugh, A. W., 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, Techniques of Water Resources Investigations of the United States Geological Survey, Book 6, Chapter A1.

Zheng, C., 1996. MT3D - A Modular Three-Dimensional Transport Model. Version 1.5, Documentation and User's Guide, S. S. Papadopulos & Associates, Inc., Bethesda, Maryland 20814.

CLEARWATER
GROUP, INC.
Environmental Services

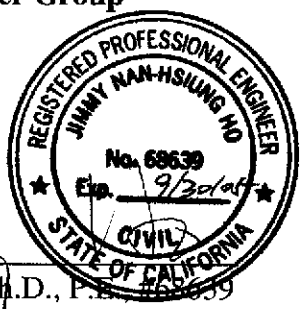
12. CERTIFICATION

This report was prepared under the supervision of a State of California Registered Geologist at Clearwater Group. All statements, conclusions and recommendations are based solely upon published results from previous consultants, field observations by Clearwater Group and laboratory analysis performed by a California DHS-certified laboratory related to the work performed by Clearwater Group.

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

Sincerely,
Clearwater Group



Jim Ho, Ph.D., P.E. #68639
Principal Engineer

Olivia Jacobs for JJ
James A. Jacobs, RG# 4815, CHG #88
Chief Hydrogeologist

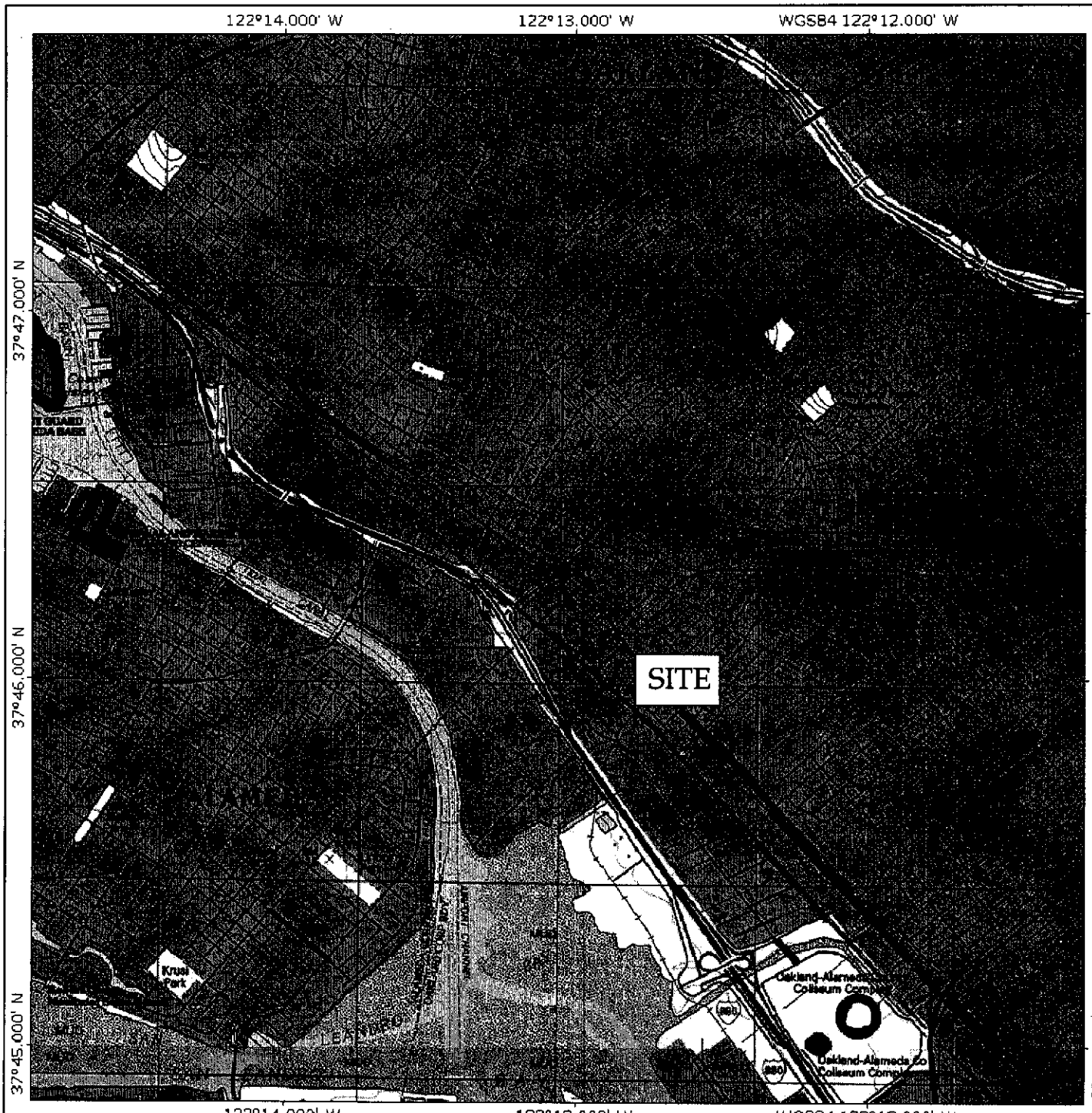
ATTACHMENTS: FIGURES, TABLES AND APPENDICES

Figure 1:	Site Vicinity Map
Figure 2:	Site Plan
Figure 3:	Geologic Map of Oakland Region
Figure 4:	Sensitive Receptor Locations
Figure 5:	Flow Diagram of the Groundwater Pump-and-Treat System
Figure 6:	Proposed Monitoring Wells
Table 1:	Well Construction Data
Table 2:	Historical Groundwater Elevations and Analytical Data
Table 3:	Historical Soil Sampling Data
Table 4:	Summary of Groundwater Flow Direction and Gradient
Appendix A:	Water Well Drillers Reports (obtained from DWR)
Appendix B:	Boring Logs
Appendix C:	Clearwater June 13, 2005 Letter Report ACEHS June 24, 2005 Response Letter
Appendix D:	iSOC Product Information

Cc: Mr. Muhammad Jamil
40092 Davis Street
Fremont, CA 94538

San Francisco Bay Regional
Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

FIGURES

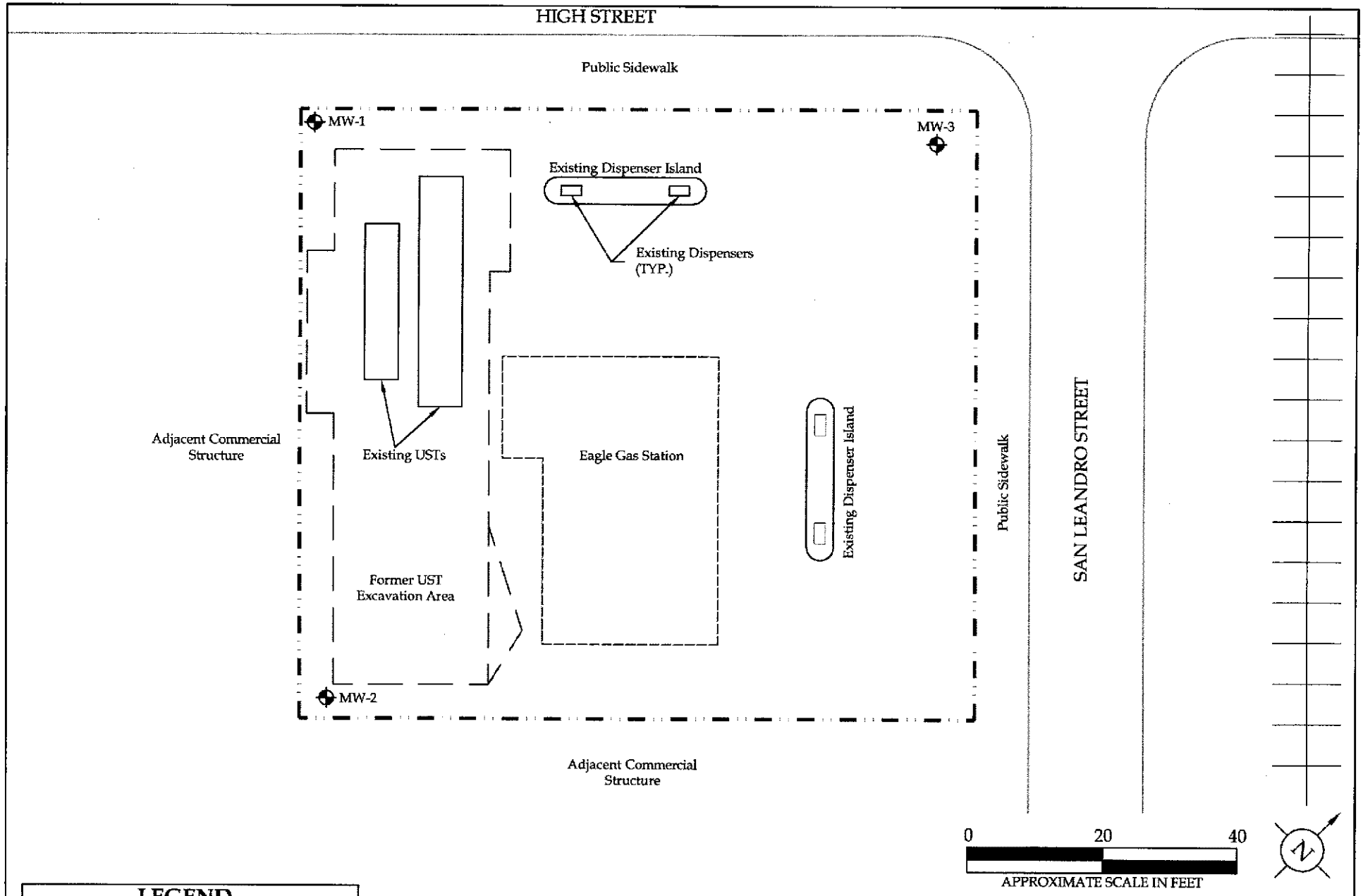


Map created with TOPO!® ©2002 National Geographic (www.nationalgeographic.com/topo)

N

SITE VICINITY MAP
Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP		
Project No. **ZP046C**	Figure Date **6/05**	Figure **1**



LEGEND

PROPERTY LINE

MW-1 MONITORING WELL

SITE PLAN
Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046C	**6/05**	**2**

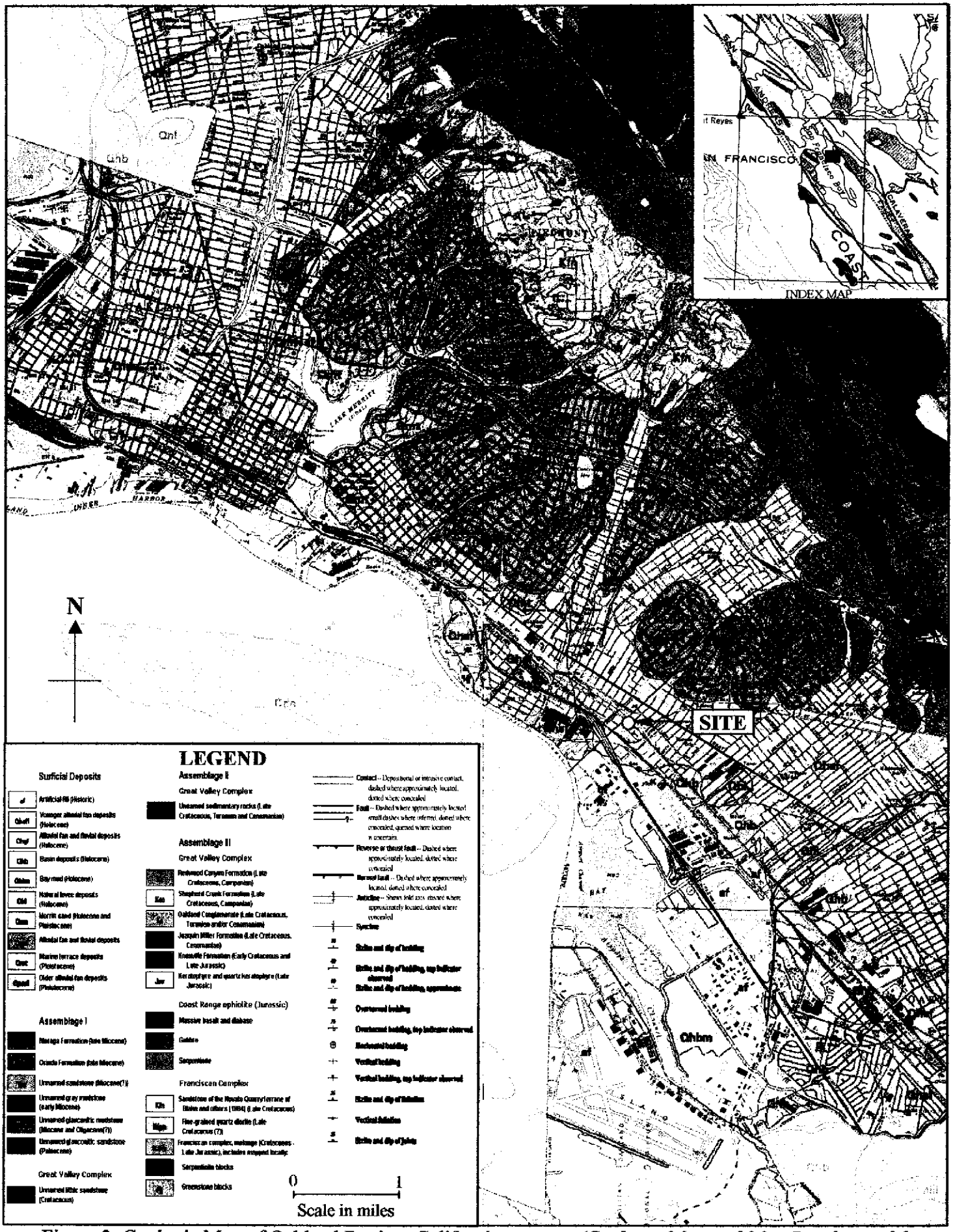
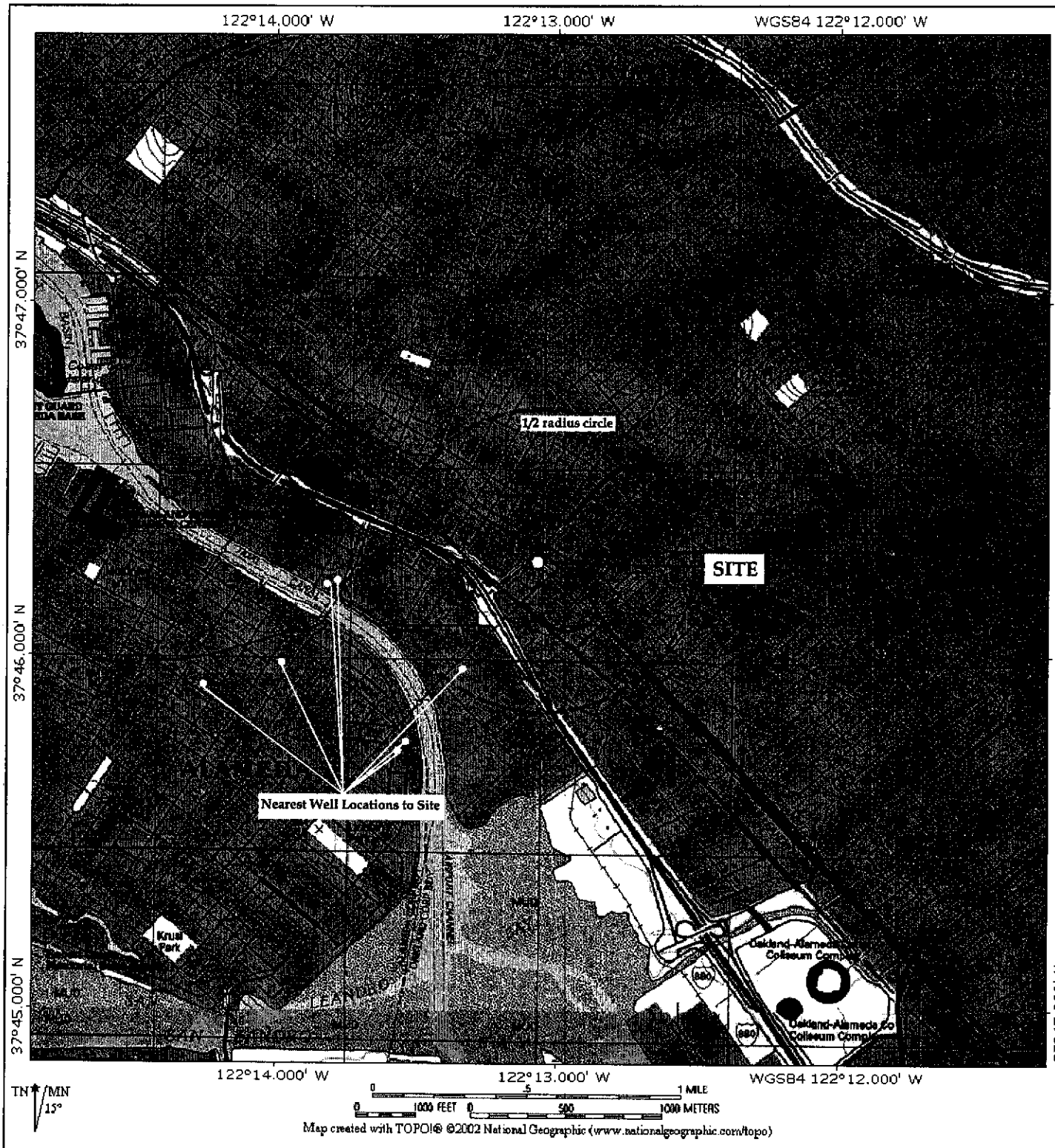
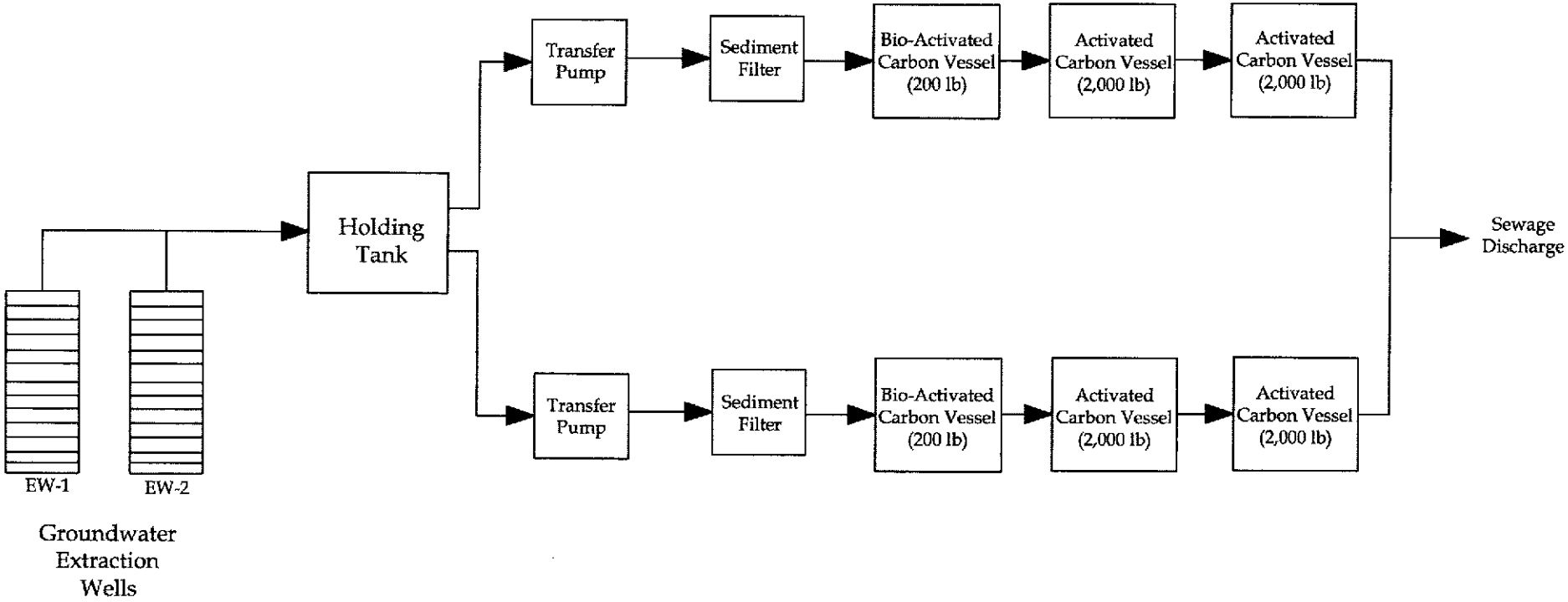


Figure 3. Geologic Map of Oakland Region, California. *source: (Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California, by R.W.*



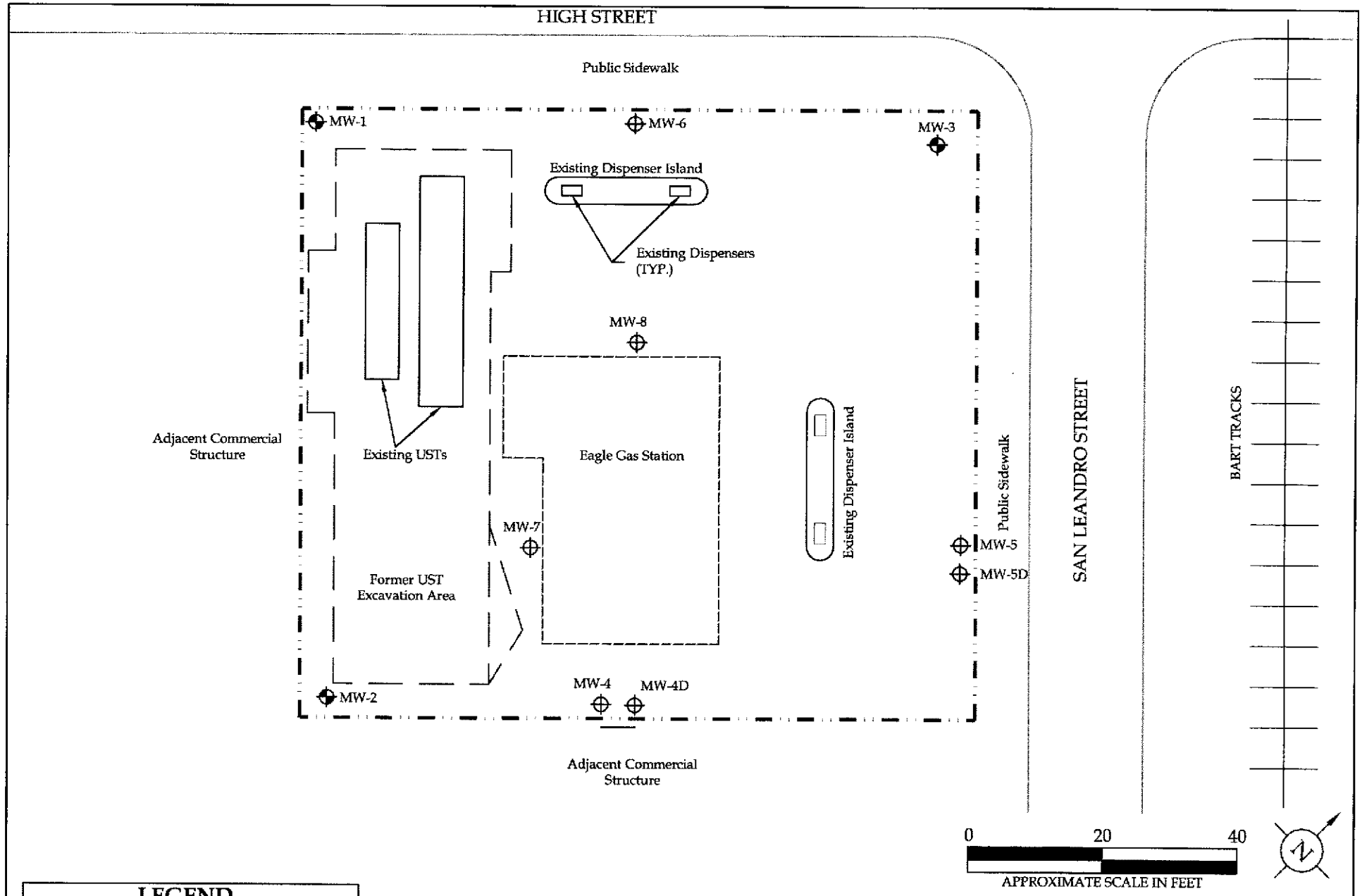
SENSITIVE RECEPTOR LOCATIONS	CLEARWATER GROUP		
Eagle Gas 4301 San Leandro Street Oakland, California	Project No. **ZP046D**	Figure Date **7/05**	Figure **4**



Flow Diagram of Groundwater Pump-and-Treat System

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046C	**8/05**	**5**



Proposed Boring and New Monitoring Wells

Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046C	**7/05**	**6**

TABLES

Table 1
WELL CONSTRUCTION DATA
Eagle Gas
4301 San Leandro Street
Oakland, California
Clearwater Group Project No. ZP046A

Well I.D.	Date Intstalled	Borehole Diameter (inches)	Depth of Borehole (feet)	Casing Diameter (inches)	Screened Interval (feet)	Filter Pack (feet)	Bentonite Seal (feet)	Cement (feet)
MW-1	9/26/2000	8	25	2	10-25	6-25	3-6	0-3
MW-2	9/26/2000	8	25	2	10-25	6-25	3-6	0-3
MW-3	9/26/2000	8	25	2	10-25	6-25	3-6	0-3

Note: All depths and Intervals are below ground surface

TABLE 2
GROUNDWATER ELEVATIONS AND SAMPLE ANALYTICAL RESULTS
Eagle Gas
4301 San Leandro Street
Oakland, California

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)
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	11.1	---	---	---	---	---	---	---	---	---	---	---
	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**
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 ANALYTICAL RESULTS
Eagle Gas
4301 San Leandro Street
Oakland, California

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)
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**

NOTES:

TOC	Top of well casing referenced to arbitrary datum
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
(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"

TABLE 3
SOIL SAMPLE ANALYTICAL RESULTS
Eagle Gas
4301 San Leandro Street
Oakland, California
Clearwater Group Project No. ZP046B

Sample ID	Sample Date	TPH-d mg/Kg	TPH-g mg/Kg	B mg/Kg	T mg/Kg	E mg/Kg	X mg/Kg	MTBE mg/Kg	EDB mg/Kg	1,2-DCA mg/Kg	DIPE mg/Kg	ETBE mg/Kg	TAME mg/Kg	TBA mg/Kg
CS1-7	4/21/1999	840	770	8.9	4.8	5.8	16	86	---	---	---	---	---	---
CS2-7	4/21/1999	1900	880	3.3	5.7	15	45	16	---	---	---	---	---	---
CS3-7	4/22/1999	780	1600	4.3	110	42	220	92	---	---	---	---	---	---
CS5-6.5	4/22/1999	33	20	0.22	1.8	0.54	3	52	---	---	---	---	---	---
Stockpile 1	4/22/1999	770	610	0.28	4.7	6.9	36	ND	---	---	---	---	---	---
Stockpile 2	4/22/1999	670	480	0.23	2.3	3.9	18	ND	---	---	---	---	---	---
CS4-13	4/22/2000	ND	ND	ND	ND	ND	ND	0.08	---	---	---	---	---	---
CS6-3	8/5/1999	1300	4300	11	130	82	420	70	---	---	---	---	---	---
CS7-3	8/5/1999	200	50	ND	2.4	0.85	4	14	---	---	---	---	---	---
CS8-3	8/5/1999	3400	250	0.32	0.72	0.81	1	3.8	---	---	---	---	---	---
CS9-3	8/5/1999	1900	380	ND	ND	ND	ND	9.5	---	---	---	---	---	---
CS10-3	8/5/1999	350	930	ND	78	17	99	310	---	---	---	---	---	---
CS11-3	8/5/1999	5200	1400	3.2	13	25	90	62	---	---	---	---	---	---
MW1-10'bgs	9/26/2000	87	310	0.062	0.022	1.3	3.4	6.9	ND	ND	ND	ND	0.019	2.9
MW2-10'bgs	9/26/2000	210	630	0.053	0.052	2	14	1.00	ND	ND	ND	ND	ND	3.5
MW3-10'bgs	9/26/2000	ND	32	ND	ND	ND	ND	4.5	ND	ND	ND	ND	0.043	0.58

NOTES:

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
1,2-DCA	1,2-Dichloroethane by EPA Method 8260B
EDB	Ethylene dibromide by EPA Method 8260B
TBA	Tertiary butyl alcohol by EPA Method 8260B
mg/Kg	miligrams per kilogram
---	no samples collected, no data available
ND	Not detected in concentrations above laboratory reporting limit

Table 4. Summary of Groundwater Flow Directions and Gradient

Oakland, California
Clearwater Group Project No. ZP046B
4301 San Leandro Street

Time	Directions	Gradient (ft/ft)
5/9/2005	South East	0.024
2/15/2005	South East	0.028
11/12/2004	South East	0.020
8/6/2004	South East	0.070
5/17/2004	South West	0.022
2/13/2004	South East	0.037
10/1/2003	South East	0.084
7/1/2003	South East	0.045
8/3/2001	South East	0.078
5/8/2001	Northeast-east	0.050
1/26/2001	South East	0.032
10/27/2000	South East	0.013
10/3/2000	N/A	N/A

Appendix A

Water Well Drillers Reports (obtained from DWR)

STATE OF CALIFORNIA - THE RESOURCES AGENCY
GRAY DAVIS, *Governor*

DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
3251 S STREET
SACRAMENTO, CA 95816-7017

2P046A

JUL 5 2001

FILE COPY
well search

Mr. Andrew M. Galeani
Clearwater Group
520 Third Street, Suite 104
Oakland, California 94607

Dear Mr. Galeani:

In response to your request, enclosed is the well location information for the water wells in the following area:

A one-half mile radius of 4301 San Leandro Avenue, Oakland
Township 02 South, Range 03 West, Sections 7, 8, and 17

Your data request required one hour of staff time. We located seven well drillers reports as a result of this search. The total charge to produce the copies is $50. Your remittance should be made payable to the Department of Water Resources, General Accounting Office, Post Office Box 942836, Sacramento, California 94236-0001. Please show **"Invoice JUL 3-2"** on your remittance and return it with the enclosed copy of this letter to our Accounting Office.

If you need additional information or have any questions, please contact Anne Roth at (916) 227-7632 or fax (916) 227-7600.

Sincerely,

Robert L. Niblack, Chief
Geology and Groundwater Section

Enclosures

STATE OF CALIFORNIA - THE RESOURCES AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
3251 S STREET
SACRAMENTO, CA 95816-7017

JUL 5 2001

Mr. Andrew M. Galeani
Clearwater Group
520 Third Street, Suite 104
Oakland, California 94607

Dear Mr. Galeani:

In response to your request, enclosed is the well location information for the water wells in the following area:

A one-half mile radius of 4301 San Leandro Avenue, Oakland
Township 02 South, Range 03 West, Sections 7, 8, and 17

Your data request required one hour of staff time. We located seven well drillers reports as a result of this search. The total charge to produce the copies is $50. Your remittance should be made payable to the Department of Water Resources, General Accounting Office, Post Office Box 942836, Sacramento, California 94236-0001. Please show **"Invoice JUL 3-2"** on your remittance and return it with the enclosed copy of this letter to our Accounting Office.

If you need additional information or have any questions, please contact Anne Roth at (916) 227-7632 or fax (916) 227-7600.

Sincerely,

Original Signed By

Robert L. Niblack, Chief
Geology and Groundwater Section

Enclosures

SAP #15204, FY 2001-02, Section 6203

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

REGION

COUNTY Alameda

NEAR Fruitvale

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

BASIN

DWR NO. 02S/03W-7J

OTHER NOS. No. 1

WELL LOG

01-1421

LOCATION West side of Fruitvale Avenue at Estuary at Fruitvale Power House (Power house torn down 1955)

OWNER Southern Pacific ADDRESS

DRILLED BY John P. Murphey ADDRESS

DRILLING METHOD Cable GRAVEL PACKED DATE COMPLETED 1911

SIZE OF CASING DEPTH STRUCK WATER AT

PERFORATIONS 117-124, 155-157, 169-173 SIZE ½" x 3" No.

WATER LEVEL BEFORE PERFORATING AFTER Static at 19'6"

TEST DATA: DISCHARGE G. P. M. DRAWDOWN FT. HOURS RUN

OTHER DATA AVAILABLE: WATER LEVEL RECORD ANALYSIS

SURFACE ELEV. DATUM SOURCE OF INFORMATION Murphy

DEPTH	ELEV. OF BOTTOM OF STRATUM	MATERIAL	THICKNESS	SP. YIELD %	
0-2		Black adobe			
2-10		Yellow clay			
10-18		Sandy clay			
18-22		Sand and clay			
22-29		Clay and sand			
29-39		Clay			
39-42		Sand and clay			
42-45		Clay			
45-88		Sand and clay			
88-96		Blue clay			
96-98		Blue sand and cemented gravel			
98-103		Blue clay			
103-111½		Yellow sandy clay			
111½-117		Yellow cemented gravel			
117-123½		Loose gravel			
123½-147		Yellow sandy clay			
147-152		Yellow clay, small gravel			
152-154		Yellow sand and clay			
154-156		Gravel			
156-159½		Yellow sandy clay			
159½-161½		Yellow sand			
161½-162		Gravel			
162-166		Yellow sandy clay			
166-168		Yellow clay			
168-173		Gravel			
173-218		Yellow clay			
218-239		Blue-gray clay			
239-260		Yellow sandy clay			
260-277		Blue clay			
277-279		Cemented gravel			
279-283		Blue clay and gravel			
283-305		Blue clay			
305-316		Blue sand			
316-321		Blue sand and clay			
321-331		Blue clay			
331-334		Yellow clay and gravel			
334-336		Cemented sand with clay			
336-356		Yellow clay and gravel			
356-464		Blue clay			

FOR FIELD COPIES USE ALTERNATE LINES

LOG OBTAINED BY DATE SHEET 1 OF 2

FORM 263

REGION

COUNTY Alameda

NEAR Fruitvale

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

WELL LOG

BASIN

DWR No. 02S/03W-07J

OTHER Nos. No. 2

01-1422

LOCATION (See Well No. 1)

OWNER Fruitvale Power House ADDRESS Oakland

DRILLED BY ADDRESS

DRILLING METHOD GRAVEL PACKED DATE COMPLETED May 25, 1910

SIZE OF CASING DEPTH STRUCK WATER AT

PERFORATIONS 116-125, 158-159, 170-175 SIZE ½" x 3" No.
Too salty in 1932 for boiler

WATER LEVEL BEFORE PERFORATING AFTER Static at 20'2"

TEST DATA: DISCHARGE G. P. M. 8.00 DRAWDOWN FT. HOURS RUN

OTHER DATA AVAILABLE: WATER LEVEL RECORD ANALYSIS

SURFACE ELEV. DATUM SOURCE OF INFORMATION

DEPTH	ELEV. OF BOTTOM OF STRATUM	MATERIAL	THICK-NESS	SP. YIELD %
0-12		Yellow clay		
12-20		Yellow sandy clay		
20-23		Yellow sand and clay		
23-34		Yellow sandy clay		
34-45		Yellow clay		
45-49		Sandy yellow clay		
49-91		Yellow clay		
91-97		Blue clay		
97-98		Cemented gravel		
98-102		Yellow sandy clay		
102-104		Cemented gravel		
104-111½		Yellow sandy clay		
111½-116		Cemented gravel		
116-125		Loose gravel		
125-137		Yellow sandy clay		
137-146		Yellow clay		
146-151½		Yellow clay and gravel		
151½-159		Gravel		
159-167		Yellow sandy clay		
167-169		Yellow sand		
169-175		Loose gravel		
175-180		Yellow clay		

FOR FIELD COPIES USE ALTERNATE LINES

LOG OBTAINED BY DATE SHEET 1 OF 1

FORM 263

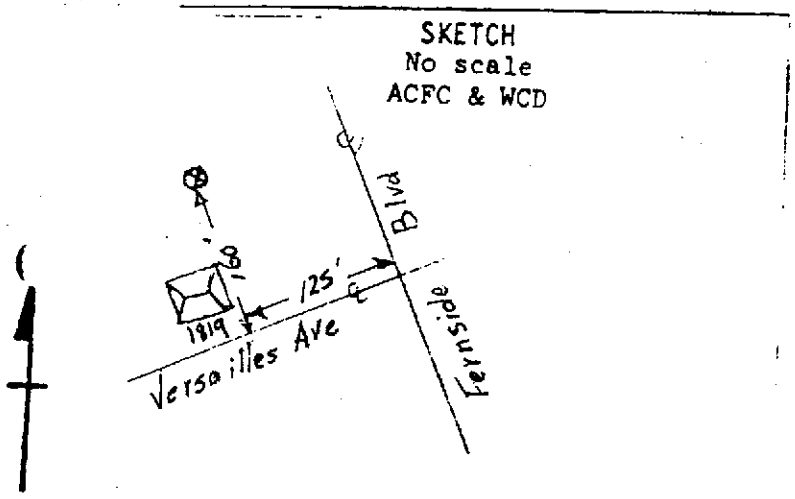
CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

32158

SKETCH
No scale
ACFC & WCD



CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

Appendix B

Boring Logs

BORING/WELL CONSTRUCTION LOG

CLEARWATER GROUP, INC.
Environmental Services
229 Tewksbury Ave, Point Richmond, California 94801

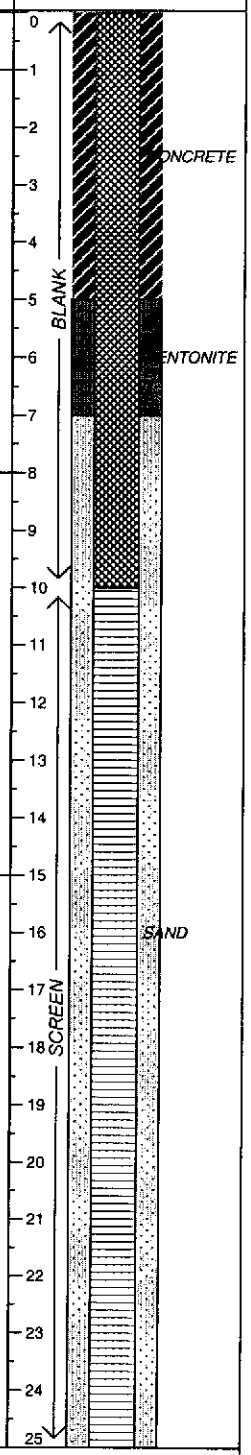
CLIENT/ **Eagle Gas**
LOCATION **4301 San Leandro St**
Oakland, CA

DRILLING CONTRACTOR	**Western Hazmat**
DRILL RIG OPERATOR	**Oscar Gonzales**
DRILL RIG TYPE	**CME 75**
LOGGED BY	
REVIEWED BY	**Jim Ho**
PLANNED USE	**Monitoring**
DATES DRILLED:	**9/26/00**
DRILLING START	**N/A**
DRILLING FINISH	**N/A**
▽ Approximate First Encountered Water Depth	
▼ Approximate Stabilized Water Depth	

BORING/WELL NUMBER	**MW-1**
PROJECT NUMBER	**ZP046**
BORING DEPTH	**25'**
WELL DEPTH	**25'**
SCREEN SLOT SIZE	**0.01"**
BORE/CASE DIAMETER	**2"**
FILTER PACK	**2/12 sand**
WELL MATERIAL	**pvc**
DEPTH TO WATER	**17'**

DEPTH (feet)	SAMPLING: BLOWS/ 6" INTERVAL	INTERVAL	RECOVERY	ANALYTICAL	WATER LEVEL	OVM READING (ppm)	ESTIMATED PERCENT: GRAVEL	SAND	FINES	LITHOLOGY	USCS SYMBOL	LITHOLOGIC DESCRIPTION/ NOTES
0												(0.0- 1.0) Concrete and fill
1												
2												(1.0- 8.0) Clayey Sand, some gravel, tan, stiff, sand poorly graded, gravel 5-18mm, dry to damp
3												
4	21					9.7	10	70	20		SC	
5	35											
6	17											
7												
8												
9	18											(8.0- 15.0) Clayey Gravel with sand, blue grey, poorly graded, 5-22mm gravel, moist
10	18					1995	60	10	30		GC	
11	26											
12												
13												
14	16					20.8						
15	19											(15.0- 25.0) Silty Clay, green/tan, medium stiff, moderate plasticity, black mottles, moist to wet
16	30											
17					▽							
18												
19	9					143.8						
20	11										CH	
21	20											
22												
23												
24												
25												

WELL CONSTRUCTION DETAILS



BORING/WELL CONSTRUCTION LOG

CLEARWATER GROUP, INC.
Environmental Services
229 Tewksbury Ave, Point Richmond, California 94801

CLIENT/ **Eagle Gas**
LOCATION **4301 San Leandro St**
Oakland, CA

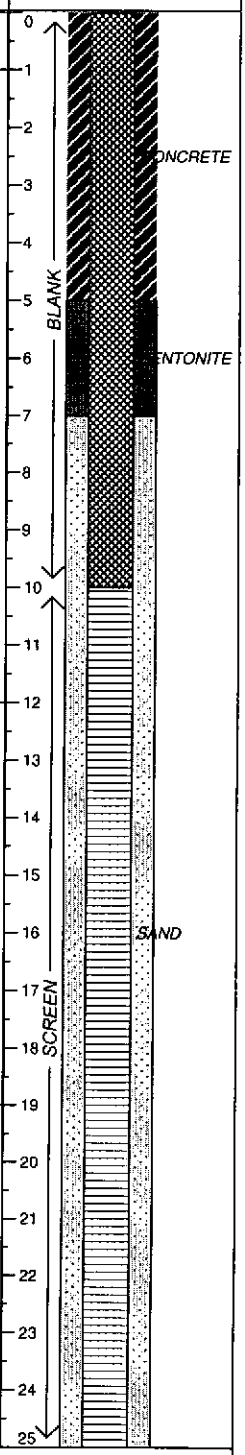
DRILLING CONTRACTOR	**Western Hazmat**
DRILL RIG OPERATOR	**Oscar Gonzales**
DRILL RIG TYPE	**CME 75**
LOGGED BY	
REVIEWED BY	**Jim Ho**
PLANNED USE	**Monitoring**
DATES DRILLED:	**9/26/00**
DRILLING START	**N/A**
DRILLING FINISH	**N/A**

▽ Approximate First Encountered Water Depth
▼ Approximate Stabilized Water Depth

BORING/WELL NUMBER	**MW-2**
PROJECT NUMBER	**ZP046**
BORING DEPTH	**25'**
WELL DEPTH	**25'**
SCREEN SLOT SIZE	**0.01"**
BORE/CASE DIAMETER	**2"**
FILTER PACK	**2/12 sand**
WELL MATERIAL	**pvc**
DEPTH TO WATER	**19'**

DEPTH (feet)	SAMPLING: BLOWS/ 6" INTERVAL	SAMPLING: INTERVAL	SAMPLING: RECOVERY	SAMPLING: ANALYTICAL	WATER LEVEL	OVM READING (ppm)	ESTIMATED PERCENT: GRAVEL	ESTIMATED PERCENT: SAND	ESTIMATED PERCENT: FINES	LITHOLOGY	USCS SYMBOL	LITHOLOGIC DESCRIPTION/ NOTES
0												(0.0- 1.0) Concrete and fill
4	12											(1.0- 12.0) Clayey Gravel with sand, blue/green
5	18					8.7						
	22											
9	10										GC	
10	18					1609						
	29											
14	8											(12.0- 19.0) Silty Clay, black/green mottles
15	16					135.6						
	26										CH	
19					▽							
20	12					43.2						(19.0- 25.0) Silty Sand, poorly graded, tan, moist
	13											
	23										SM	

WELL CONSTRUCTION DETAILS



BORING/WELL CONSTRUCTION LOG

CLEARWATER GROUP, INC.
Environmental Services

229 Tewksbury Ave, Point Richmond, California 94801

CLIENT/ **Eagle Gas**
LOCATION **4301 San Leandro St**
Oakland, CA

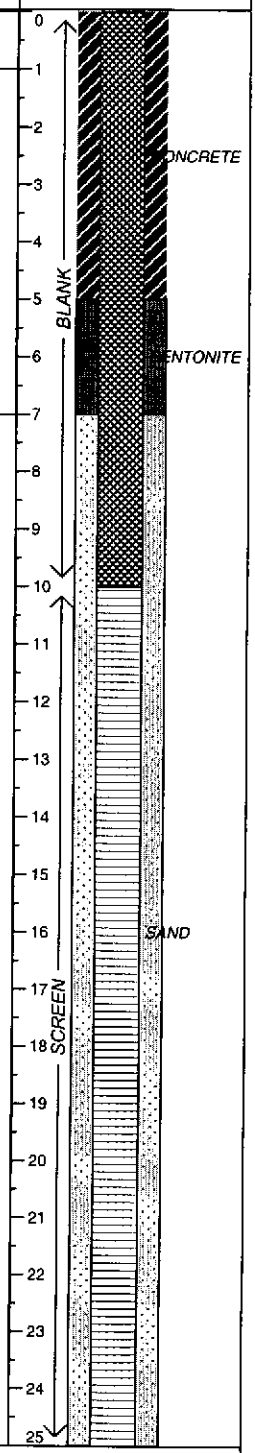
DRILLING CONTRACTOR	**Western Hazmat**
DRILL RIG OPERATOR	**Oscar Gonzales**
DRILL RIG TYPE	**CME 75**
LOGGED BY	
REVIEWED BY	**Jim Ho**
PLANNED USE	**Monitoring**
DATES DRILLED:	**9/26/00**
DRILLING START	**N/A**
DRILLING FINISH	**N/A**

▽ Approximate First Encountered Water Depth
▼ Approximate Stabilized Water Depth

BORING/WELL NUMBER	**MW-3**
PROJECT NUMBER	**ZP046**
BORING DEPTH	**25'**
WELL DEPTH	**25'**
SCREEN SLOT SIZE	**0.01"**
BORE/CASE DIAMETER	**2"**
FILTER PACK	**2/12 sand**
WELL MATERIAL	**pvc**
DEPTH TO WATER	**18'**

DEPTH (feet)	SAMPLING: BLOWS/ 6" INTERVAL	SAMPLING: INTERVAL	SAMPLING: RECOVERY	SAMPLING: ANALYTICAL	WATER LEVEL	OVM READING (ppm)	ESTIMATED PERCENT: GRAVEL	ESTIMATED PERCENT: SAND	ESTIMATED PERCENT: FINES	LITHOLOGY	USCS SYMBOL	LITHOLOGIC DESCRIPTION/ NOTES
0												(0.0- 1.0) Concrete and fill
3							5	10	85		CL	(1.0- 7.0) Sandy Clay, some gravel, green/grey, medium to coarse sand,
4	8											
5	18					1735						
6	14											
9							10	1	89		CH	(7.0- 25.0) Silty Clay with some gravel, green/tan, pea-size gravel, plastic, stiff, moist, black mottles, decreasing gravel and sand towards base
10	10					1035						
11	13											
12	20											
14	9						0	0	100			
15	18					43.3						
16	25											
18					▽							
20	12					10.7						
21	21											
25	30											

WELL CONSTRUCTION DETAILS



Appendix C

Clearwater June 13, 2005 Letter Report

ACEHS June 24, 2005 Response Letter

CLEARWATER
GROUP
Environmental Services

13 June 2005

FILE

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

RE: Recommendations for Interim Remedial Actions
Eagle Gas Station
4301 San Leandro Street
Oakland, California 94601
LOP StID# 2118
USTCF Claim No. 014551

Dear Mr. Wickham,

Based on the historical groundwater monitoring results presented in the *Second Quarter 2005 Groundwater Monitoring Report,* a significant groundwater gradient and high concentrations of MTBE and TBA have been confirmed at the site. To prevent or reduce the off-site migration of MTBE and TBA very likely already exists; the Clearwater Group (Clearwater) recommends implementing a fast-track interim site remediation.

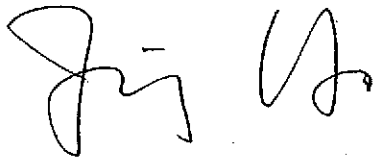
The interim remediation will include two 4-inch-diameter and 25-feet-deep groundwater extraction wells and an aerobic enhanced biodegradation system, which has been described in the Interim Remedial Action Plan (IRAP) submitted by Clearwater on 14 January 2004. The proposed locations for the extraction wells and oxygen diffusion iSOC wells are presented in Figures 1 and 2. Clearwater strongly suggests that an interim remediation such as the one described above should be implemented for the site before or together with the investigation activities requested by ACEHS in a letter dated 26 May 2005.

229 Tewksbury Avenue ◆ Point Richmond, California 94801 ◆ Telephone: 510-307-9943 ◆ Fax: 510-232-2823

CLEARWATER
GROUP
Environmental Services

Please consider and respond to this request. If you any questions regarding the site conditions, please do not hesitate to contact our office at (510) 307-9943 ext 231.

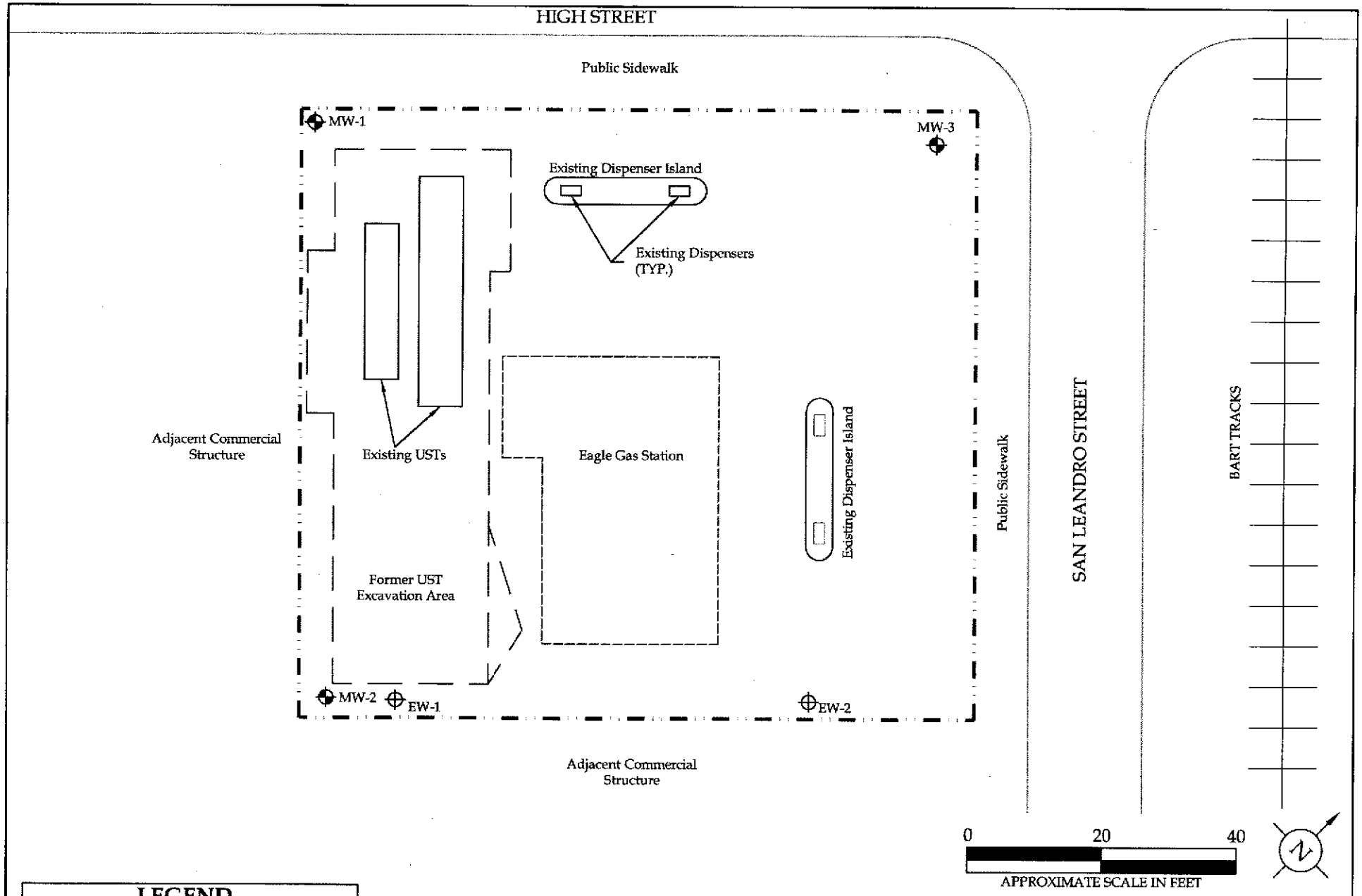
Sincerely,
Clearwater Group



Jim Ho, Ph.D., P.E., CGWP
Principal Engineer

Enclosure

229 Tewksbury Avenue ◆ Point Richmond, California 94801 ◆ Telephone: 510-307-9943 ◆ Fax: 510-232-2823



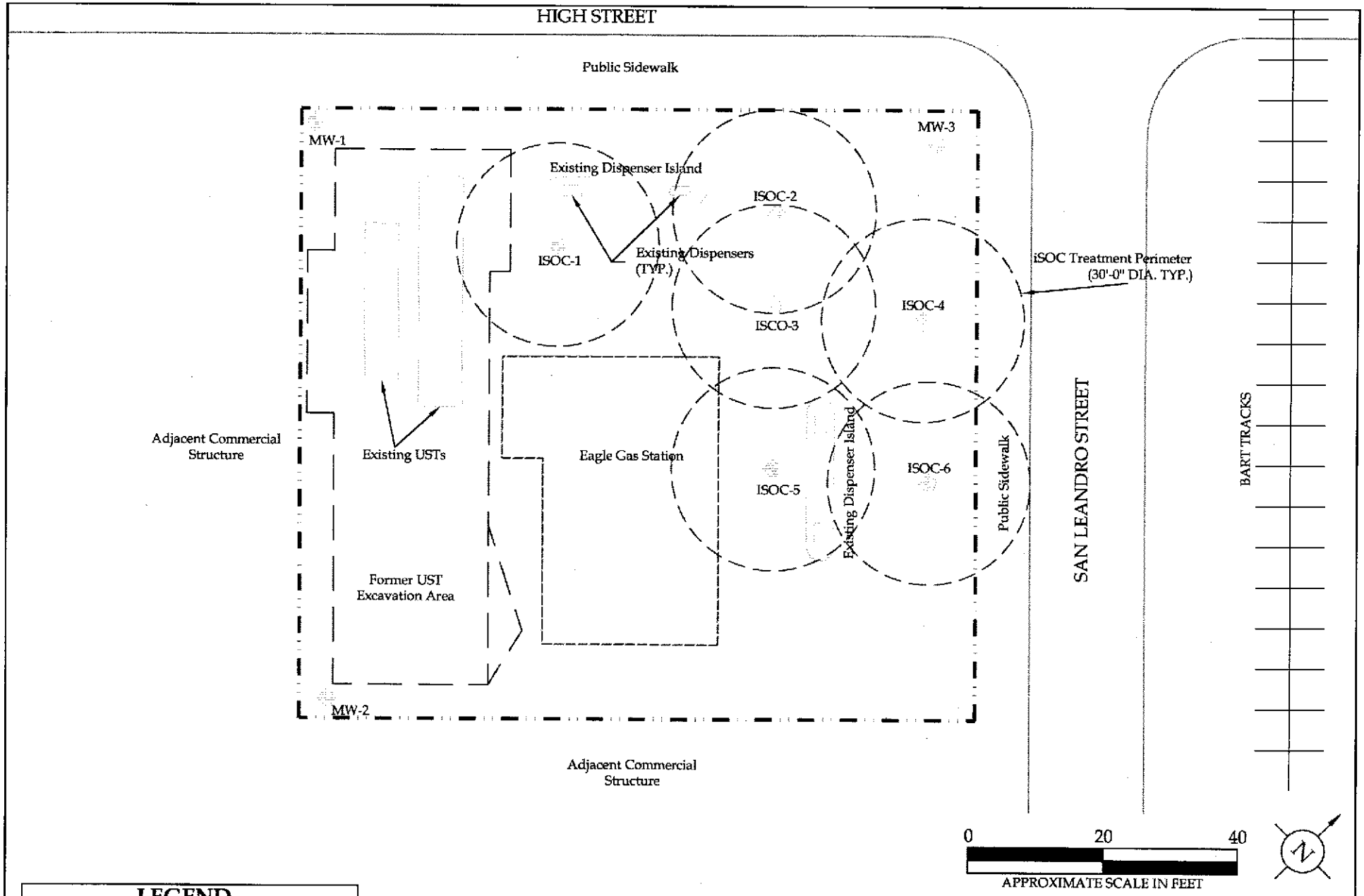
LEGEND

- PROPERTY LINE
- MW-1 MONITORING WELL
- EW-1 PROPOSED EXTRACTION WELL

Proposed Extraction Well Locations
Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046C	**6/05**	**1**



LEGEND

- PROPERTY LINE
- MW-1 MONITORING WELL
- ISOC-1 PROPOSED ISOC WELL

iSOC WELL LOCATIONS AND TREATMENT ZONES
Eagle Gas
4301 San Leandro Street
Oakland, California

CLEARWATER GROUP

Project No.	Figure Date	Figure
ZP046C	**6/05**	**2**

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 24, 2005

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 94601

Dear Ms. Naz:

Alameda County Environmental Health (ACEH) staff has reviewed correspondence received from Clearwater Group regarding "Recommendations for Interim Remedial Actions," dated June 13, 2005. The correspondence suggests that interim remediation be implemented before or together with the investigation activities requested by ACEH in a letter dated May 26, 2005. Figures 1 and 2, which were attached to the June 13, 2005 correspondence, showed proposed locations for groundwater extraction wells and oxygen diffusion iSoc wells, respectively. Please note that the ACEH letter dated May 26, 2005 requested that interim remediation be implemented at the site. ACEH has no objection to implementation of the proposed groundwater extraction well and oxygen diffusion iSOC well locations prior to implementing the investigation requested in ACEH's May 26, 2005 correspondence. However, the proposed operation of the interim remediation system and the proposed verification sampling for the interim remediation system are to be fully described in the Work Plan requested below.

Please note that all work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party as described in the section entitled "Perjury Statement," below. The June 13, 2005 correspondence from Clearwater Group and the most recent report entitled, "Quarterly Groundwater Monitoring Report – Second Quarter 2005," did not include cover letters from you.

TECHNICAL REPORT REQUEST

As previously requested in our May 26, 2005 correspondence, please submit technical reports to Alameda County Environmental Health (Attention: Mr. Jerry Wickham), according to the following schedule:

- **August 10, 2005** - Work Plan for Soil and Groundwater Investigation and Interim Remedial Action with initial SCM
- **120 days after ACEH approval of Work Plan** – Soil and Groundwater Investigation Report (to include interim remediation start-up report)
- **60 days after ACEH comments on the Soil and Groundwater Investigation Report** - Corrective Action Plan

- **September 30, 2005** - Quarterly Report for the Third Quarter 2005
- **December 30, 2005** - Quarterly Report for the Fourth Quarter 2005

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.

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, P.G.
Hazardous Materials Specialist

cc: James Ho
Clearwater Group
229 Tewksbury Avenue
Point Richmond, CA 94801

Donna Drogos, ACEH
Jerry Wickham, ACEH
File

Appendix D

iSOC Product Information

iSOC®info

iSOC® YOUR ULTIMATE MANAGED ATTENUATION TOOL

iSOC® UPDATES

iSOC® has become a very popular bioremediation tool for remediating a wide range of contaminants, including recalcitrant compounds in groundwater and saturated porous media. iSOC® has already been used at hundreds of sites for effective hydrocarbon remediation, but we are continuing to improve and extend the technology.

A New Application of iSOC® Technology: Chlorinated Sites

Recently, iSOC® technology has been applied to sites contaminated with chlorinated hydrocarbons using oxygen and other gases to treat chlorinated sites under both anaerobic and aerobic conditions. Our website has been updated to reflect these bioremediation alternatives and various processes and soon our microcosm studies will provide more information to optimize delivery of combinations of gases to best stimulate the biological degradation of harmful substances.

A Micro-sized Control Panel

iSOC® is often used in individual wells with a small access box covering the well. While this set-up is cost-efficient and convenient, requiring no major site disruption or costly installation, the size of the access box is very limiting. Using innovative technology originally developed by NASA and successfully proven on our other Gas inFusion devices, we developed a small gas flow control device to sit in the top of the iSOC® unit. The result is a much simpler and easier installation that benefits the consultant and site owner both.

iSOC® AND BIOREMEDIATION ENHANCEMENT

iSOC® is an ingenious gas delivery system based on inVenture's patented Gas inFusion technology - a unique method of infusing supersaturated levels of dissolved gas into liquids. At the heart of iSOC®, the proprietary structured polymer mass transfer device is filled with micro-porous hollow fiber that provides an enormous surface area for mass transfer - in excess of 7000 m^2/m^3. It is hydrophobic and therefore excludes water. Maintaining gas pressure less than the surrounding liquid pressure ensures that ultra efficient mass transfer takes place without sparging.

In an aerobic bioremediation application, the iSOC® supersaturates the monitoring well with low decay dissolved oxygen (DO), typically 40-200 PPM depending on depth in groundwater. A natural convection current and a designed release bubble from the top of the iSOC® fills the well with a uniform DO curtain. The supersaturated DO curtain of water disperses around the well into the adjacent groundwater and enhanced bioremediation removes organics through natural attenuation. Placement of injection wells depends on site-specific conditions. The system is installed in a few hours and easily moved from well to well to optimize performance and remediation strategies.

CLEARWATER
GROUP
Environmental Services

August 10, 2005

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

RE: Soil and Groundwater Investigation Workplan
Eagle Gas Station
4301 San Leandro Street
Oakland, California 94601
LOP StID# 2118
USTCF Claim No. 014551
Clearwater Group Project # ZP046C

Dear Mr. Wickham,

On behalf of Mr. Muhammad Jamil, Clearwater Group (Clearwater) has prepared the *Soil and Groundwater Investigation Workplan* for the above referenced property. This document was requested in an Alameda County Environmental Health Services (ACEHS) letter dated May 26, 2005. We will perform the proposed tasks and submit a soil and groundwater investigation report 120 days after ACEHS' approval of this *Workplan.*

If there are any questions regarding the information as it is presented in the *Workplan*, please do not hesitate to contact me at 510-307-9943 ext 231.

Sincerely,
Clearwater Group

Jim Ho, Ph.D., P.E., CGWP
Principal Engineer

Enclosure