HYDROSOLUTIONS OF CALIFORNIA, INC.

LETTER OF TRANSMITTAL

TO: Alameda Co. Environmental Health
1131 Harbor Bay Parkway
Alameda, CA 94502
ATT: Susan Hugo

DATE: 10-22-97
SUBJECT: 4800 San Pablo Ave.
Emeryville, CA

We are enclosing: ☒ Herewith ☐ Under Separate Cover

No. of Copies	Description
1	RRSP: 95286-06-48, Request for Closure

STATUS	SENT FOR YOUR	PLEASE NOTE
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☐ Reviewed	☐ File	☐ Corrections
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Remarks:

cc: Maria Poncelli
City of Emeryville
Richard Heitt, RWQCB

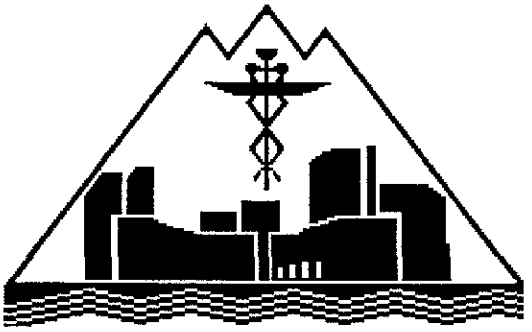
By: [signature]

97 OCT 24 PM 3:52
ENVIRONMENTAL PROTECTION

P.O. Box 922, 13975 Wings of Morning, Nevada City, California 95959
(916)478-1260, FAX (916)478-1264, e-mail; HSCI@gv.net

530 530

REQUEST FOR CLOSURE
AS LOW RISK SITE
4800 SAN PABLO AVENUE
EMERYVILLE, CALIFORNIA



Prepared for:
City of Emeryville
2200 Powell Street
Emeryville, California

Prepared by:
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RRSP: 95286-06-48

October 1997

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and low levels of TPH-G/BTXE in the subsurface, it is assumed that source removal has been achieved. Regrading of the subject property will ultimately confirm this assumption.

Based on the boring/well investigations, soil-gas surveys, geophysical survey and correspondence with Alameda County Department of Environmental Health, it is evident that an adequate level of characterization has been completed.

No fire or explosion hazards exist on the subject property and the majority of petroleum is found below the eight foot depth. Groundwater has been impacted however conditions conducive for intrinsic bioremediation exist beneath the subject property (table 2).

A soil-gas survey was completed under the observation of Alameda County Environmental Health for the purpose of identifying the existence of detectable benzene concentrations at various sediment depths. Based on six locations, three depths and two sampling events, no completed exposure pathways were identified. This data supersedes conclusions made by the RBCA quantitative analysis of environmental risk. Subsurface volatilization to ambient and indoor air were evaluated.

No surface water or other known sensitive receptors are likely to be impacted by TPH in the subsurface. Temescal Creek flows into a large underground culvert immediately north of the subject property and likely losses water, intermittently, to the shallow groundwater zone (figure 5). Location of the culvert is higher than the most shallow saturated zone.

No water wells exist within proximity of the site and it is unlikely that future water sources will include shallow groundwater beneath the subject property (figure 15). Exposure pathways between receptors (groundwater well users) and the contaminant plume are not complete therefore no exposure to municipal/domestic users exist.

Due to the location and concentration of benzene in the subsurface and evidence of intrinsic bioremediation, it is unlikely that the environment is exposed to significant pollution risk.

Estimated cost to remediate, by removal, existing detectable TPH-G and BTXE range between $102,000 and $218,000 (table 3). These expenditures, however, do not guarantee a successful groundwater cleanup. Economic feasibility appears unreasonable considering the low degree of environmental risk to present and future groundwater

use and exposure to public. Intrinsic bioremediation is capable of remediating low TPH levels without significant enhancements induced by man (table 2).

Demonstration of a stable (non-migrating) plume and a reduction of benzene within the affected groundwater was achieved through groundwater monitoring on a quarterly basis for one year.

2.0 INTRODUCTION

The City of Emeryville Redevelopment Agency (City Agency) has been evaluating the subject property located at 4800 San Pablo Avenue (northeast corner of 48th Street and San Pablo Avenue [subject property]) with respect to petroleum contamination for the last four years, approximately. Previous land use on the property had included a gasoline service station. Aerial photographs from 1950 through 1969 illustrate dispenser island-like locations and an old building. The previous property owner also confirmed that the property had operated as a service station.

Documentation with respect to the removal of the underground storage tank system is not available within public domain records. Attempts to locate these records were made by HydroSolutions of California, Inc.. In addition, a soil-gas survey, geophysical survey, aerial photo search and two soil and groundwater drilling programs were

completed to assess the likely presence of tanks and petroleum hydrocarbon contaminated soil and groundwater beneath the subject property.

During the initial field drilling program, two water bearing zones were encountered. A shallow (topmost ten feet of sediment) zone of perched groundwater adjacent B-6/WB-14 was found within a limited area. Depth to the top of perched groundwater was seven feet. The primary shallow groundwater zone, as depicted in WB-7, WB-8, WB-9 and WB-12, was located approximately 20 feet below groundsurface and exists as a semi-confined aquifer. The piezometric surface in wells perforating this groundwater zone were located approximately 10 feet below groundsurface.

Based on the many methods of site evaluation, the subject property does not appear to contain underground tanks however shallow pipes are likely to exist (figure 4). Limited soil and groundwater contamination were identified beneath the subject property adjacent B-1, B-2, B-6, WB-9, WB-8 and WB-14. Detectable TPH-gasoline (TPH-G) concentrations in sediment ranged between 0.96 and 350 mg/kg. Detectable TPH-G in groundwater ranged between 220 and 1,900 mg/kg. Benzene ranged from <0.3 ug/l to 65 ug/l during the June 1994 sampling event.

In light of; 1) known adverse groundwater quality in the Emeryville area, 2) lack of groundwater usage in the Emeryville area, 3) low concentrations of TPH-G, benzene, toluene, xylene, and ethylbenzene (BTXE) in soils, 4) localized presence of low levels of BTXE in groundwater, 5) apparent removal of the UGSTs and 6) appropriate site characterization, the subject property was appropriate for consideration as a containment zone (a low risk site designation had not been formulated by California regulators at this time). A meeting was held December 8, 1994 with the Alameda County Environmental Health, HSCI and City of Emeryville Redevelopment Agency. It was concluded at this meeting that the site is likely to be appropriate for the non-attainment provision (containment zone) however several issues require attention. These issues include; 1) addressing health and safety concerns during construction, 2) establishing a soil sampling program for excavation and 3) demonstration of minimal contaminated groundwater migration.

Letter correspondence from Alameda County Health Care Services (County) was received September 11, 1995. This letter stated several additional items were needed to effectively utilize the non-attainment provision. In addition to the above mentioned issues, the County requested the following:

> A qualitative risk assessment should address the future land use for the site;

The plume management plan should include institutional controls such as deed notification, contingency plan etc.

Target analyses for the groundwater monitoring program should include TPH-diesel (TPH-D) and TPH as motor oil (TPHR) if these contaminants were detected in soil samples.

Verification soil samples collected after completion of the excavation activities must be analyzed for TPH-D and TPHR in addition to TPH-G and BTXE.

Stockpiled soil maybe used as backfill with prior approval from the County.

Site health and safety plan shall be submitted to the County prior to implementing the remedial action.

Notification of any field work must be made with the County office 72 hours in advance.

Any waste (hazardous or non-hazardous) generated from this investigation shall be disposed appropriately. Documentation of all waste disposal must be provided to the County.

HydroSolutions of California, Inc. was contracted by the City of Emeryville in December 1995 to prepare a document which evaluates the applicability of utilizing the containment provision or other mechanisms to obtain closure of the subject property.

A conference call was completed November 14, 1996 to discuss the results of the groundwater monitoring program and comments regarding the draft request for closure submitted March 1996. Maryann Leshin, City of Emeryville, Susan Hugo (ACEH) and Stephen Baker (HSCI) were participants in this telephone meeting. In light of recent regulatory reform, Susan Hugo suggested the City of Emeryville request closure

based on the low risk of the subject property. Based on site assessment and monitoring data, the subject property appears to represent low risk. It was suggested that a RBCA evaluation of two exposure pathways be completed and the original draft request for closure be written based on the low risk of the site.

This evaluation includes site activities, the quarterly groundwater sampling program, RBCA assessment of two exposure pathways and an appraisal of potential intrinsic bioremediation.

3.0 EVALUATION CRITERIA

The applicable category for the subject property is described as a site which has groundwater pollution and residual soil pollution with limited water quality, environmental, and human health risks. Sites with this degree of pollution risk require minimal to no remedial response.

The evaluation criteria utilized for the subject property are based on guidelines described in State Water Resources Control Board December 8, 1995 interim guidance on required cleanup at low risk fuel sites.

3.1 Source Removal

Source removal is defined in this request as; 1) the removal of the underground storage tank system and 2) the removal of any obvious soil contamination.

A significant amount of time and effort has been allotted to identifying the presence of an UGST system and preparing for the mitigation of leaked petroleum. The following discussion reviews work completed to date regarding the preparation for source removal.

Due to past land usage as a gasoline service station and the location of concrete slabs and asphalt patches on the subject property, HSCI completed an electromagnetic survey, soil-gas survey, aerial photo survey and geoprobe drilling program for the purpose of evaluating if the tank system had been removed. No closure documentation has been located in public domain sources. In addition, UGSTs or data suggesting the presence of UGSTs was not observed. The following paragraphs discuss source removal activities completed on-site.

Several sources of aerial photographs and insurance maps were reviewed to evaluate the likely presence and location of the UGST system. Sanborn maps from 1950 through 1969 appear to illustrate dispenser island locations and an old building. Present building and concrete slab locations are illustrated in similar positions as

aerial photographs and Sanborn maps. Information obtained from maps and aerial photographs were compared with current asphalt and concrete patches noted on-site (figure 2). The three north trending concrete slabs were broken in the center (3-4 foot wide breaks) which may indicate past usage as a dispenser island. An asphalt patch located near WB-14 may represent the location of a previously removed UGST or piping. Soil-gas probes were also noted as easily penetrating the groundsurface near boring, B-5. The sand fill in this area suggested that an excavation may have existed at this location. All soil-gas samples measured for organic vapors indicated very low to non-detectable concentrations. No gasoline-like odors were noted during the survey.

A geophysical survey was completed on December 22, 1993. Two geophysical tools were utilized for surveying the site; 1) Schonstadt MAC 51-B Magnetic and Cable Locator and 2) Metrotech Model 810 Radio Frequency Line Tracer. The surveyor concluded that measurement at the subject property did not depict the typical signature of a buried UGST. Large metal objects are suspected in the center area however their appearance is discontinuous. The most significant anomaly was noted near B-3.

A limited geoprobe soil sampling program was initiated after the geophysical survey. The sampling program incorporated six borings, B-1 through B-6. The basis for choosing each boring location included; 1) anomalies detected during the geophysical survey, 2) material encountered beneath concrete slabs or asphalt patch and 3) location in areas which unusual observations were made during the soil-gas survey (e.g. shallow refusal during drilling, low induced vacuum).

Based on data generated by work described above, it is not likely that an UGST system is present beneath the subject property. Ultimate confirmation will be obtained when grading activities begin. Associated piping, however, is likely to be present. Source removal will include the removal of subsurface piping from the topmost several feet of sediment during regrading of the subject property.

The remaining low TPH concentrations in sediment beneath the subject property (8-10.5 feet depth) are not considered a "source material" and will therefore remain beneath the subject property. Justification for this action will be explained in later sections (3.4 Probability of Effecting a Drinking Water Source, 3.5 Qualitative Risk Assessment, 3.6 RBCA Analysis of Ambient Air and Indoor Air Exposure Pathways and 3.2.5 Intrinsic Bioremediation Potential).

3.2 Limited Migration Potential

Classification of a site as "low risk" requires that existing presence of TPH-G must be limited in aerial extent.

Migration potential of the plume are influenced by sorption of sediment, intrinsic bioremediation, diffusion, dispersion, hydraulic gradient of the water table and aquifer characteristics such as hydraulic conductivity, porosity and heterogeneity.

The following subsections discuss the general lay of the land and geology, extent of TPH/BTXE in sediment of the vadose zone, extent of TPH and BTXE dissolved in groundwater and potential pathways of migration.

3.2.1 Geography & Hydrogeology

The subject property is located in a topographically low area approximately 4,500 feet east of the Bay. Elevation of the property is approximately 40 feet above mean sea level and ground surface slopes gently to the west.

The subject property is presently vacant. An old shed, approximately 20 feet by 20 feet was recently removed from the northeast corner of the lot. Ground cover consists of asphalt and several concrete slabs.

The subject property is bordered by a drainage channel (Temescal Creek) along the northern perimeter. Land surface of the subject property is flat. The drainage located to the north appears to be 2-3 feet lower than the subject property. The Temescal Creek is illustrated on a 7.5 minute U.S.G.S. topographic map as originating in the vicinity of Adeline Street and 52nd Street and flows west to the high school then approximately one mile north. Presently, this drainage appears to be a typical surface water drainage up to the northern property boundary. The drainage then discharges into an underground culvert.

The subject property is located on a broad alluvial plain bordered by the Berkeley Hills on the east and San Francisco Bay to the west. Underlying the property is an alluvial fan deposit consisting of sandy silty clay and clayey gravels. Due to the dark gray color and sediment composition, material in the topmost portion of land is likely overbank stream deposits. Shallowmost groundwater is commonly found at approximately a 20 foot depth.

The water-bearing material in the minor aquifers of the area are usually silty sand. These deposits yield small quantities of water, generally less than 35 gallons per minute.

Groundwater recharge to the shallowmost aquifer results from direct infiltration from precipitation, irrigation returns, sewer leaks and streamflow. Confined aquifers of the area have strata above and below the permeable water bearing zone. The permeable zones are filled by subsurface inflow from adjacent aquifers and leakage between aquifers.

Subject property water bearing zones are likely to be effected by seasonality caused by the precipitation cycle and urban irrigation activities. Figure 6 illustrates water levels measured at WB-8.

3.2.2 Extent of Contamination

Minor concentrations of TPH-G and BTXE have been identified in shallow sediment and groundwater. Figures 4 and 5 illustrate the lateral dimensions of known contamination in each medium.

Sediment containing TPH-G/BTXE is based on the analysis of 24 soil samples. Four of the 24 samples contain detectable TPH-G. TPH-G is detected primarily in sediment located between the 8.5 foot and fifteen foot depths. Detectable concentrations range between 0.96 - 350 mg/kg TPH-G. Detectable benzene concentrations ranged between 15 ug/kg and 960 ug/kg (mean is 292 ug/kg).

Figure 4 illustrates two areas which TPH-G, including benzene, exist. A larger area, approximately 2,900 square feet, contains TPH-G at the 8.5 foot to 15 foot depth (approximately 700 cubic yards). This zone of sediment is located in the upper confining zone of the shallowmost semi-confined aquifer. Sediment is a clayey silt and groundwater is approximately five feet below the contaminated sediment.

The second contaminated area is illustrated with cross hatches and occurs in the top ten feet of sediment. Lateral dimensions are not known however it is assumed that a 20 foot by 18 foot by ten foot deep area has been impacted (133 cubic yards). Unlike the remainder of the property, this sediment is a very fine to fine grained sand material and is characterized by one sample with respect to TPH-G and benzene. A soil sample from the 8.5 foot to ten foot depth contained 40 mg/kg TPH-G and 63 ug/kg benzene.

Based on the January 1996 groundwater sampling event, TPH-G and BTXE exist in shallowmost groundwater above the detectable limits. TPH-G was detected in WB-8 (230 ug/l), WB-9 (300 ug/l) and WB-14 (220 ug/l). Toluene, xylene and ethylbenzene were not detected above the maximum contaminant levels (MCL). Benzene concentrations range between 2.2 ug/l and 10 ug/l (MCL for benzene is 1 ug/l). Assuming groundwater flow perpendicular to groundwater level contour lines,

porosity of 15%, a saturated thickness of five feet and water quality data generated during January 1996, approximately an 1,800 square foot area may be effected and 10,100 gallons of groundwater.

A smaller area surrounding WB-14 also contains perched groundwater of approximately a 3.5 foot saturated thickness. During the January 1996 sampling event, a TPH-G concentration of 220 ug/l and benzene level of 3.2 ug/l were detected. Assuming a 20 foot by 18 foot by 3.5 foot dimension to the saturated zone and a porosity of 20%, approximately 250 gallons of groundwater may be impacted.

3.2.3 Horizontal Pathways

Horizontal pathways are typically associated with underground utilities intersecting the saturated zone of a contaminated aquifer or movement into a significantly more permeable sediment.

Water and sewer lines servicing the vicinity of the subject property are located beneath 48th Street and San Pablo Avenue. TPH-G effected groundwater however are located on the central part of the subject property and appear to have migrated north. Due to no apparent intersection of water and sewer lines (typically 6-8 foot depth) and the saturated zone (+20 feet), it is not likely that these utilities would act as a horizontal pathway for groundwater to travel off-site.

The Temescal Creek is located immediately down-gradient from the subject property and has been reconstructed as an underground conduit. The beginning of this culvert begins half way along the northern boundary of the subject property and continues west. According to the City of Emeryville Public Works department, the culvert begins as a ten foot by fifteen foot box with a 9.5 foot diameter culvert. Based on this information, the depth of the saturated zone and the existence of the culvert and adjacent sediment, minimal impact of lateral TPH migration is likely.

3.2.4 Vertical Pathways

Currently, the subject property is abandoned. Artificial structures which penetrate vertically are not likely to exist. Assuming the tanks were removed in years past, one would expect the backfilled excavation to act as a preferential vertical pathway to possibly a 10 to 12 foot depth. The sandy zone identified adjacent WB-14 and B-6 suggests that a sandy backfill material may have been used.

Temescal Creek was reconstructed as a surface water drainage and buried culvert. Presently, no surface water flow is apparent along the groundsurface. The hydrogeologic significance of the creek is its likely vertical heterogeneity and coarse grained zones of sediment that may exist near the old drainage. Sediment identified beneath the subject property is typically a clayey silt. Wells, WB-7 and WB-8,

encountered a silty gravel at the 25 to 30 foot depth which suggests more permeable deposits do exist in some localities. Leakage to surrounding sediment may also occur as a result of fractures in the conduit.

Data suggests possible recharge of groundwater to the subject property from creek drainage. A groundwater anomaly was noted in groundwater table maps generated from June 1994 and January 1996 water level data. In addition, dissolved oxygen (DO) increases as nearness to the creek increases.

A vertical pathway of unsaturated flow may exist however no data suggests continuous vertical migration beneath the bottom of the impacted shallow aquifer. The impact of a source of DO along the down-gradient portion of the subject property will be discussed in the next section.

3.2.5 Intrinsic Bioremediation Potential

Electron acceptors and nutrient availability were evaluated with water quality data collected during one sampling event (January 1996). Table 1 summarizes these data. Electron acceptors investigated in this evaluation include; dissolved oxygen (DO), nitrate and sulfate. By-products indicators of biodegradation have also been

investigated. These include pH, alkalinity, iron and ammonia nitrogen. Phosphate concentration was measured to evaluate the degree of its presence in groundwater.

Intrinsic bioremediation is evaluated for the shallow perched groundwater system as well as the semi-confined aquifer. Generally, background water quality of the perched water is different from the lower, more laterally extensive aquifer. It appears that the perched water zone contains significantly greater dissolved solids (as depicted by specific conductance measurements) and sulfate. Due to water sources of different water quality, it also appears that intrinsic bioremediation is occurring in a different manner. Electron acceptors and by-product measurements were evaluated for both aquifer zones. Background concentration for each constituent are taken from up-gradient wells, WB-7 and WB-12.

Figure 7 illustrates the distribution of DO in groundwater. Up-gradient DO concentration is 1.4 mg/l. Areas within groundwater containing elevated TPH/BTXE concentrations appear to increase in DO. This is an indicator that aerobic biodegradation of BTXE is not significant across portions of the site.

The perched zone however contains significantly less DO than background (0.6 mg/l). In light of depleted levels of DO concentrations, the perched groundwater zone indicates limited aerobic degradation is occurring.

The following equation describes the overall stoichiometry of BTXE degradation caused by aerobic biodegradation. In the absence of microbial cell production, the biodegradation of benzene to carbon dioxide and water is given by:

$$C_6H_6 + 7.5O_2 \quad ---> 6CO_2 + 3H_2O$$

Based on this equation, the ratio of oxygen to benzene is 3:1, approximately. In the absence of microbial cell production and 1.4-3.0 mg/l DO detected in the primary groundwater zone, the subject property has the capacity to assimilate 0.5 mg/l total BTXE.

Figure 8 illustrates the distribution of nitrates in groundwater. Background nitrate concentration ranges from <0.05 mg/l to 7 mg/l. Areas with elevated TPH/BTXE concentrations and areas directly down-gradient from elevated TPH/BTXE concentrations have nondetectable levels of nitrate. Based on nondetectable nitrate

levels beneath the area of the site which groundwater flows into the plume, it is likely that nitrate is a minor electron acceptor at this site.

Figure 10 illustrates the distribution of sulfate in groundwater. Background sulfate concentrations range from 35 mg/l to 40 mg/l. Areas with elevated TPH/BTXE concentrations and areas directly down-gradient from elevated TPH/BTXE concentrations have depleted levels of sulfate. Sulfate concentrations were 8 mg/l at WB-8 and 12 mg/l at WB-9. This is a strong indicator that anaerobic biodegradation of BTXE is occurring at the site.

The following equation describes the overall stoichiometry of BTXE degradation caused by anaerobic biodegradation by sulfate. In the absence of microbial cell production, the biodegradation of benzene to carbon dioxide and water is given by:

$$C_6H_6 + 3.75SO_4 + 7.5H \rightarrow 6CO_2 + 3H_2O + 3.75H_2S$$

Based on this equation, the ratio of sulfate to BTXE is 4.6 : 1. In the absence of microbial cell production and existing background sulfate levels, the shallow groundwater at this site has the capacity to assimilate 8.7 mg/l total BTXE. The perched groundwater zone has the capacity to assimilate 35 mg/l BTXE.

It must be recognized that the kinetics of sulfate utilizing bacteria are significantly slower than aerobic degradation therefore a slow migrating groundwater flow can enhance the exposure time for complete degradation. The estimated average seepage velocity of groundwater migrating across the anaerobic portion of the plume is less than one foot per year.

Nutrient availability was evaluated from field data. Data was then compared with published information in professional journals. Based on these comparisons, the following statements can be made:

pH at the site is good to excellent;
Available nitrogen is low; and
Phosphate levels are low (based on an optimum CNP ratio: 120:10:1).

It must also be recognized that present day literature suggests that nutrient availability does not correlate with the success of intrinsic or enhanced bioremediation. Indigenous bacteria acquire nutrients in other ways.

In some cases iron is used as an electron acceptor during anaerobic biodegradation of TPH. During this process, ferric iron is reduced to the ferrous form which may be soluble in water. Ferrous iron concentrations are used as an indicator of anaerobic degradation of

fuel compounds. Each 1.0 mg/l of ferrous iron produced during microbial iron oxidation results in the degradation of 0.047 mg/l BTXE.

Research in the field of microbial degradation under sufate-reducing conditions have recognized a high correlation between organic degradation, sulfate reduction and ferric iron reduction. Ferric iron reduction may not be directly responsible for biodegradation of petroleum (toluene) but as a secondary abiotic reaction between ferric iron and biogenic hydrogen sulfide. Iron is included in this evaluation as a parameter which indirectly suggests the existence of sulfate-reducing bacteria.

The highest concentration of iron was measured at WB-9 (2.4 mg/l). Lateral distribution of iron appears to increase in the down-gradient direction. This increasing concentration trend suggests that iron may also be an electron acceptor involved in sulfate reduction.

Nitrogen fixation refers to the reduction of nitrogen from N_2 to the ammonia level. Ammonia nitrogen levels likely exceed background ammonia concentrations due to biological activities occurring within the contaminant plume. Nitrate reducing microorganisms convert nitrate and nitrite to N_2 by denitrification. Background concentration of ammonia nitrogen is 0.2 mg/l. Areas within the

contaminant plume are higher in ammonia nitrogen than the non-contaminated areas. This distribution of ammonia nitrogen suggests a limited area of nitrate reduction. Figure 6 illustrates the distribution of ammonia nitrogen. The lack of nitrates may exist due to their relatively quick metabolic degradation as compared to nutrients replenishment from slow moving groundwater.

Alkalinity many times increases in areas where oxidation of organic matter occurs. Localized sources include biologically mediated aerobic or anaerobic reactions with organic matter. Furthermore, as carbon dioxide is released through microbial respiration, pH can become more acidic unless groundwater is capable of neutralizing. Alkalinity is an indicator of this capability. Figure 13 illustrates the lateral distribution of alkalinity in groundwater.

Based on the distribution of alkalinity (220-372 mg/l $CaCO_3$), an increase in alkalinity is noted in groundwater within the TPH-G affected area as compared with up-gradient unaffected areas. This trend is consistent with expected chemical responses in a microbiologically active area.

Perched groundwater contains significantly more alkalinity (592 mg/l Ca Co_3) than the primary groundwater zone. Elevated alkalinity of perched groundwater suggest conditions favorable in a microbially active area.

The perched groundwater zone is undergoing aerobic degradation. This is prevalent due to concentrations of DO existing at 0.6 mg/l, less than half the concentration of the lowest DO measurement in the primary groundwater zone. Sulfate is exceedingly higher (160 mg/l) which suggests an abundant supply of sulfate that may not be currently used in great quantities. Phosphate and nitrates which can be used as nutrients, are non-detectable in this zone. Alkalinity is exceedingly high. Each of these conditions suggest consumption of nutrients and absorption of carbon dioxide into perched groundwater.

The primary groundwater zone appears to be effected by anaerobic degradation. DO increases across the property suggest a potential source of DO originates near the drainage (Temescal Creek). Nitrates are nondetectable with exception to WB-12 (7.0 mg/l) and sulfates diminish in concentration with down-gradient migration. Each of these anaerobic conditions would result in increased alkalinity, increased iron, and decreased ammonium nitrogen. These trends are observed at the subject property. Based on an evaluation of inorganic chemical

parameters, anaerobic conditions prevail across the greater portion of the site. Aerobic conditions are generated along the down-gradient portion of the plume.

An adequate supply of electron acceptors is currently available to assimilate BTXE concentrations measured on-site. Table 2 illustrates the contribution of each electron acceptor. Availability of nutrients may limit the rate of degradation however may not significantly restrict degradation.

Intrinsic biodegradation in the primary shallow aquifer is a metabolic rate-limited condition. Rates of degradation under anaerobic conditions are typically slower than those under aerobic conditions.

3.3. Technical Feasibility of Best Available Technologies

There are many ways to aggressively attempt to remediate the subject property. Each method includes an element of risk to accomplish stringent drinking water cleanup goals (groundwater) or non-detection levels required for soil. Bioventing, vapor extraction and use of emulsifiers can be used however the success of total cleanup is not predictable. Time required to achieve cleanup also varies and can continue for many years.

One approach would be to simply excavate sediment in the area depicted in figure 4. An area approximately 80 feet by 35 feet by 15 feet deep (1,556 cubic yards) would require removal, disposal and backfilling. Assuming moderately low TPH concentrations which are allowable at a Class III disposal facility and a $76 per cubic yard cost for all work (including verification samples, geologist, permits, workplans), the estimated cost is $118,500. This remedial effort does not include addressing groundwater contamination at the 20 foot depth.

An alternative source removal strategy is to remove only known localities containing the higher concentration of TPH. The area around perched groundwater has been discussed in past meetings. Cost for this degree of source removal is estimated to be $42,100. This alternative does not include addressing groundwater contamination at the 20 foot depth.

Groundwater containing TPH exists in two zones; 1) perched groundwater and 2) shallowmost groundwater encountered at the 20 foot depth. Mitigation of perched groundwater is accomplished by removing source material (sediment) as described above.

Mitigation of the primary groundwater zone can be achieved by constructing a line of recovery wells on the down-gradient end of the plume. Due to the low permeability and small saturated thickness of the aquifer, spacing of wells would be 2-3 feet, center to center. Assuming a 37 foot line of interception, 15-17 wells would be required. A pump intake would be installed in each well and above ground treatment of water would be accomplished with GAC or other means. Cost for expediting this alternative is estimated to be $31,000 plus approximately $5,700 per year for operation and maintenance. This scenario assumes that a NPDES permit can be obtained for discharging treated water into the Temescal Creek drainage. Seepage velocity may be 1-2 feet per year under current conditions. The time required to pump and treat one plume volume would likely exceed several years. Depending on the amount of organic matter (not including petroleum hydrocarbons) and clay size particles in the aquifer matrix, attenuation effects would create a significantly more lengthy cleanup and greater volume of recovered groundwater to be removed.

Effectiveness of groundwater recovery can be improved by injecting nutrients and electron acceptors along the up-gradient side of the plume. To sufficiently inject nutrient additives, a twenty foot line of injection wells would be constructed (10 wells) for a cost of approximately $10,000. Discharged water along the bottom of the plume

would be reinjected into up-gradient wells after nutrients were added. Cost to maintain the injection portion of the cleanup is estimated to be $500 per month. The total cost for groundwater cleanup (assuming 5 years of operation) is estimated to be $100,000.

Disadvantages in expediting groundwater cleanup is the lengthy time for TPH recovery and the probability for achieving total cleanup. Complete success is typically not achieved for many years.

The economic impact in procuring $102,000 to $218,500 for remediation of low concentrations of TPH in soil and groundwater is significant. Added improvement and protection to off-site and on-site areas is minimal. The next several sections discuss the vulnerability of nearby water resources, results of a qualitative risk assessment of present subsurface conditions, a RBCA evaluation of two exposure pathways existing on the subject property and soil-gas measurements for pathway screening.

3.4 Probability of Effecting a Drinking Water Source

Presently, municipal water supplies are provided by East Bay MUD. Sources of water are obtained from surface water located outside the Emeryville area. No groundwater wells operated by East Bay MUD exist within the city of Emeryville.

A well database generated by the County of Alameda Public Works Agency contains four permitted wells within a mile radius, approximately, from the subject property (figure 15). Three of these wells are located at up-gradient locations. One well is located approximately one mile northwest of the subject property.

Recorded beneficial uses of these wells are industrial, irrigation and domestic. Based on the low inventory of wells in the area, distance of the above four wells from the subject property and lack of municipal uses of groundwater, present beneficial uses of shallow groundwater are negligible.

The city of Emeryville contains numerous sites which have experienced unauthorized releases of petroleum and other contaminants. Most of these releases have effected the topmost aquifer (water table or semi-confined). Based on the many chemical releases in Emeryville, current water quality conditions and lack of deeper, high yielding aquifers, future beneficial uses of shallowmost groundwater are not likely.

A pathway from the subject property to waters utilized for drinking water is not complete therefore the probability of effecting drinking water sources is negligible.

3.5 Qualitative Risk Assessment

In this document, qualitative means the common sense review of pertinent information on existing and probable exposure pathways and receptors.

A qualitative assessment of risk has been completed in two parts. Immediate threats to land users such as fire hazard, explosions or environmental exposure to harmful levels of BTXE (health impairment) will be examined. Secondly, long-term hazards to life, health and environment will be evaluated. Long-term hazards are usually associated with low concentrations of BTXE which adverse effects are not immediately evident. Due to the qualitative nature of this evaluation, a conservative mode of assessment is taken.

Potential short-term hazards evaluated in this section include explosive vapor levels, utility impacts and the presence of free-phase hydrocarbon liquid on the ground surface, surface water or groundwater.

Approximately 20 soil-gas probes were penetrated to a 4-4.5 foot depth as well as two probes penetrating an 8.5-10 foot depth. The majority of the probes detected no organic vapors (OV) utilizing a photoionization detector (Hnu meter) in the field. Maximum OV

concentration detected was 2.3 ppm. Based on soil-gas survey results, concentrations of OV are significantly under the lower explosive level (LEL) of gasoline.

Drill cuttings were recently transported and disposed at an off-site facility. A part of the disposal procedure was the profiling of the sediment. Ignitability was tested by EPA Method 1010. Based on these results, the flash point of the material exceeded 140 degrees fahrenheit (reporting range is 65-140 F). Sediment (drill cuttings) from the worst case boring were sampled and used for this test. Based on this test, fire hazard as related to residual petroleum contamination is not likely.

Site observation and geologic logs were used to evaluate the presence of a free-phase hydrocarbon liquid. Fourteen exploratory borings ranged in depth from 10 to 31 feet. The majority of the soil samples had no noticeable petroleum-like odors. TPH-G analysis of samples detected maximum concentrations of 350 mg/kg and 17 samples with nondetectable TPH. A total of 24 samples were analyzed. Based on laboratory results, it is unlikely that free petroleum product exists beneath the subject property. Impact to utilities are also unlikely due to the relatively low TPH concentration detected in sediment, depth of contamination (8-10 feet) and lack of on-site utilities which penetrate the 8-10 foot depth.

Long-term hazards include inhalation of petroleum vapors by workers during redevelopment of the subject property and stability and continued degradation of BTXE in groundwater. Based on soil-gas survey results, minimal exposure to inhalation of BTXE exists. It is expected that the entire site will undergo, at a minimum, removal and redistribution of the top several feet of sediment for development purposes. Old metal pipes related to the UGST system will also be removed. Based on the soil-gas survey (22 probes) and 14 boring/wells, and the relatively small size of the subject property, the likelihood of encountering a significant zone of contamination is minimal.

Indicators of intrinsic bioremediation were evaluated from groundwater samples to confirm the tendency of natural subsurface processes to reduce levels of TPH-G and BTXE. Section 3.2.5 discusses the processes in more detail. According to available dissolved oxygen and sulfate in groundwater, the primary groundwater zone is capable of assimilating 9.1-9.7 mg/l BTXE. A BTXE concentration of 0.0251 mg/l and TPH-G concentration of 0.300 mg/l were measured in January 1996.

Areas along the down-gradient side of the contaminant plume appear to be a DO source area which would act as an aerobic zone of degradation. Groundwater conditions beneath the site itself appear to support primarily a sulfate-reducing bacteria environment. Groundwater contamination is assimilated at a relatively slower rate within the subject property and relatively faster along the down-gradient end of the plume (kinetics of aerobic degradation are considered significantly faster than bacteria utilizing sulfate electron acceptors).

Perched groundwater appears deficient in DO but plentiful in sulfate. This condition and the presence of high alkalinity suggest anaerobic degradation is active within this zone. The level of sulfate within the perched groundwater is 160 mg/l, greater than 4 times sulfate concentration in the primary groundwater zone. The assimilative capacity of this zone is approximately 35 mg/l. A BTXE concentration of 0.0054 mg/l and 0.220 mg/l TPH-G were measured in January 1996.

Based on intrinsic bioremediation potential, groundwater will likely contain diminishing TPH concentrations with time. This assumes levels of electron acceptors continue in similar concentrations measured during January 1996. In addition, the City of Emeryville and East Bay MUD do not utilize its groundwater resources for municipal or domestic purposes. It is also very unlikely that these shallow

groundwater zones will be used for future beneficial uses. Ultimately groundwater beneath the subject property would be expected to recharge to the Bay, not deeper aquifers. According to public works records, no water wells are located within 2,000 feet down-gradient, approximately, of the subject property. Lack of groundwater use, depth to groundwater and the presence of natural biodegradation processes suggest negligible risk to groundwater end-users and exposure to the public.

Due to the distance from the subject property to the bay, levels of BTXE, average seepage velocity and intrinsic bioremedial potential of shallowmost groundwater, it is expected that BTXE will have degraded prior to reaching the bay. A recent study completed by the Lawrence Livermore National Laboratory stated that petroleum hydrocarbon groundwater contamination rarely exceed a distance of 250 feet from its source due to attenuation mechanisms such as intrinsic bioremediation.

A soil sample was collected from the 10 foot depth of WB-8 and analyzed by the TCLP zero headspace extraction method and analyzed by EPA Method 8015. A TPH-G concentration of 0.96 mg/l was detected by this analysis. Based on this result, TPH is likely to be available for migration. Subsurface sediment therefore eventually can transmit TPH to groundwater where it is degraded to carbon dioxide and water.

Concentrations of TPH and BTXE detected below the eight foot depth of the vadose zone are not likely a significant source but will act as an exposure pathway to deeper groundwater. Upward mobility of BTXE to soil zones likely to be regraded (topmost 3 feet) are minimal due to BTXE concentration at the 8-10 foot depth, solubility of BTXE, heterogeneity of the vadose zone, moisture content and type of sediment (silty clay).

TPH presence in the vadose zone sediment does not have the potential to significantly impact surface water, wetlands or the bay. This is due to the distance to each receptor area, low concentrations at the source area and average rate migration.

3.6 RBCA Analysis of Ambient Air and Indoor Air Exposure Pathways

A Risk Based Corrective Action (RBCA) evaluation was utilized as suggested in the State Water Resource Control Board interim guidance document on required cleanup at low risk fuel sites (December 8, 1995). RBCA was completed in two parts; 1) Tier 1 calculations and 2) Tier 2 (site-specific parameter input calculations). Calculations for both levels of screening considered four exposure pathways:

Groundwater to Ambient Air;

Groundwater to Enclosed-space Accumulation;

Subsurface Soil (>3ft. Depth) to Ambient Air; and

Subsurface Soil (>3ft. Depth) to Enclosed-space Accumulation.

Benzene was chosen as the constituent of concern due to its carcinogenic impact to human receptors. Due to more stringent health guidelines enforced in California, the slope factor for benzene was changed from 0.029 to 0.1.

RBCA Tier 1 calculation input is based on USEPA RME parameters and current toxicological information given in IRIS and HEAST and peer-reviewed sources. Generic risk based screening levels were first applied to evaluate the need to complete a more site-specific mode of evaluation.

Two Tier 1 evaluations were completed for the subject property. The first evaluation examined risk from shallowmost groundwater (existing at the twenty foot depth) and benzene in subsurface sediment (located at the eight foot to fifteen foot depth). Default parameters for a Tier 1 evaluation assumes groundwater depth to be 9.84 feet and benzene detectable at the 3.28 foot to 9.84 foot interval. Based on the weighted average benzene concentration detected in sediment (0.221 mg/kg) and the weighted average benzene concentration detected in groundwater during the October 1996

sampling event (0.C034 mg/l), the risk based screening levels (RBSL) were exceeded for soil volatilization to indoor air only (Contaminant reduction factor [CRF] is 25).

Weighted average benzene concentrations were calculated based on the Thiessen Polygon Method. This method is an estimation of an area-weighted concentration. This method does not represent actual locations of benzene in the subsurface.

The second Tier 1 evaluation examined risk from perched groundwater (existing at the 7.5 foot depth) and benzene in subsurface sediment (located at the eight foot to ten foot depth). Based on the benzene concentration detected in sediment (0.063 mg/kg) and the benzene concentration detected in perched groundwater during the October 1996 sampling event (0.0268 mg/l), conditions within the perched zone result in exceedance of soil volatilization to indoor air (CFR is 7) and groundwater volatilization to indoor air (CFR is 4).

RBCA Tier 2 Site-Specific Target Levels (SSTLs) were then recalculated after adjusting several parameters to better represent site-specific conditions. A Tier 2 analysis was completed for shallowmost groundwater conditions and perched groundwater adjacent WB-14. These parameters include:

Depth to saturated sediment (groundwater at 20 ft, shallow groundwater) and (groundwater at 7.5 feet, perched groundwater);

Thickness of the vadose zone (17 ft for shallow groundwater, 3 foot capillary fringe and 7.5 feet for perched groundwater adjacent WB-14);

Contaminant between 8-15 foot depth for unsaturated zone above shallowmost groundwater and 7.5 foot depth for perched groundwater;

Contaminated sediment area (1,067 ft^2 above shallowmost groundwater) and (310 ft^2 above perched groundwater adjacent WB-14);

Benzene concentration in subsurface sediment (average concentration as estimated using the Thiessen Polygon Methodology [0.221 mg/kg]) and 0.0268 mg/kg in perched groundwater area;

Benzene in Groundwater (average concentration as estimated using the Thiessen Polygon Methodology [0.0034 mg/kg) and 0.063 mg/l in perched zone;

Based on the RBCA Tier 2 analysis of the shallowmost groundwater aquifer, site specific target levels (SSTL) of subsurface soil volatilization to indoor air exposure were exceeded. SSTL values were exceeded by a factor of 8.

Based on the RBCA Tier 2 analysis of the perched groundwater area, site specific target levels (SSTL) were not exceeded.

The above Tier 2 analysis concluded the potential for risk (based on residential land usage) to receptors occupying indoor areas immediately above the contaminant source may exist. HSCI recommends direct measurement of soil-gas along the exposure pathway (sediment profile) as a means to confirm the actual presence/absence of the exposure route and estimate maximum exposure concentrations.

3.7 Direct Measurements for Pathway Screening

Sediment and groundwater contamination is known to exist below the 8 to 10 foot depth. The primary exposure pathway to indoor air may be described as upward movement of vapors through subsurface sediment, penetration of asphalt or concrete grading material and

ultimate entrance into the air space of a commercial/residential building. Inhalation of benzene by the occupants would ultimately result.

Observations made during the soil-gas survey and drilling programs did not encounter noticeable presence of petroleum. These observations, however, are not based on laboratory analysis for benzene. It is noteworthy to recognize that heterogeneities of subsurface sediment typically existing in overbank stream deposits (regional geologic condition of site) restrict upward migration of vapors to the groundsurface.

Measurements of soil-gas is a means to directly evaluate the existence of benzene migration along the exposure pathway. It is assumed that the duration of time gasoline has had to diffuse into groundwater and the unsaturated zone has resulted in a steady state condition. HSCI recommended direct measurement of soil-gas along the exposure pathway (sediment profile) as a means to confirm the actual presence/absence of the exposure route and estimate maximum exposure concentrations. The Alameda County Environmental Health (County) requested that direct measurements be collected at different depths and locations. Three locations; 1) adjacent B-2, 2)

adjacent B-3 and 3) adjacent WB-14 were sampled twice. Ravi, Madhulla and yourself were present during the first sampling event (August 21, 1997). The second sampling event was completed August 28, 1997.

A geoprobe sampling rig was utilized to penetrate a probe to a 3, 6 and 9 foot depth. At each depth interval, a soil-gas sample was extracted by inducing 40 kPa to 60 kPa vacuum to the sampling probe. A vacuum pump was used to induce a vacuum great enough to remove soil-gas. The majority of sediment encountered during this sampling event was silt and silty clay. Actual soil-gas was sampled by turning off a valve which de-activated the vacuum pump and attached a three liter summa canister to the probe. The valve of the summa canister was then opened to facilitate soil-gas sample collection. The canister filled until the vacuum induced in the sample location was equal to the vacuum inside the canister.

Subsequent to completing sample collection at each sample interval, the hose was disposed, probe tip cleaned with soap and water and distilled water rinse and a new hose re-attached to the collection mechanism.

Figure 16 illustrates the location of each soil-gas sampling point. A soil-gas chemical data table (table 7) illustrates laboratory results from each sample location. Sample locations, SG-15, SG-16 and SG-17 were sampled August 21, 1997. Sample locations, SG-18, SG-19 and SG-20 were sampled August 28, 1997.

Presence of benzene in soil-gas is not detectable above the nine foot depth. Due to no detectable benzene existing at the six and three foot depths, it is apparent that there is no recognized completed exposure pathway to ambient and in-door air. Confirmation in this conclusion is supported by consistent laboratory results spatially (six locations) and at different times (August 21 and 28, 1997).

Based on the above soil-gas data, conclusions of the RBCA evaluation previously completed (RRSP: 96286-06-42) do not represent actual conditions. Due to no detectable levels of benzene at the three and six foot depth, HSCI recommends no further assessment or remedial action at the subject property.

4.0 Current/Anticipated Land and Water Use

The subject property is currently vacant. The Planning Department of the City of Emeryville has designated the subject property as general commercial. Future land use for the subject property however is to be residential with a potential for minimal ground floor commercial space.

5.0 CONTAINMENT MANAGEMENT PLAN

The plan to manage environmental risk includes further source removal within the vadose zone (if identified during the regrading process), land use planning, notification to prospective purchasers and lesees of the subject property and from the Agency.

5.1 Notification to Current and Future Landowners, Lessees and/or Renters

The City of Emeryville Redevelopment Agency will notify prospective purchasers and lesees of the subject property of low levels of TPH present in sediment and groundwater. This document will be available to the public for review during City office hours.

The following reports may be reviewed by the public by appointment. The location of reports is the City of Emeryville Redevelopment Agency, 12th Floor, 2200 Powell Street in Emeryville, California.

HydroSolutions of California, Inc., November 17, 1993, "Soil-gas Survey, 4800 San Pablo Avenue, Emeryville, California".

HydroSolutions of California, Inc., January 18, 1994, "Preliminary Site Assessment, 4800 San Pablo Avenue, Emeryville, California".

HydroSolutions of California, Inc., August 1994, "Site Characterization, 4800 San Pablo Avenue, Emeryville, California".

Contact person within the City for answering questions regarding the subject property is Maria Poncel (510)596-4354.

5.2 Regrading Activities

It is anticipated that limited regrading of the subject property will be necessary to facilitate redevelopment. Although detectable TPH concentrations in sediment are primarily located deeper than eight feet, it is possible that limited sediment containing TPH may be present in small zones above the ten foot depth (adjacent WB-14 and dispenser islands).

Regrading will include backfilling excavated areas with clean sediment. Overlying clean sediment will provide an additional level of protection against exposure to TPH existing in underlying areas.

5.3 Contingency Plan

The contingency program will be utilized in the event significant contamination is detected during regrading of the site. An environmental consultant will be present to detect potential soil contamination during regrading activities.

In the event contaminated sediment is detected during regrading activities, strategic excavations will be completed to remove contaminated sediment. Excavated sediment will be stockpiled on site and allowed to aerate. After a period of time, aerated stockpiled material will be analyzed to determine whether it satisfies County cleanup action levels for sediment. If the material meets the requirements, it will be used as backfill in a portion of the subject property. If soil cleanup standards are not met, sediment will be disposed at an appropriate landfill. A signed manifest will be obtained for the disposal of sediment and submitted to the County.

During remedial excavation, sediment samples will be collected to verify that only uncontaminated sediment remains on the excavation walls and floor. Analysis of each sample will include TPH-D, TPH-G, TPHR and BTXE.

ANALYSIS	WB-7	WB-8	WB-9	WB-12	WB-14
pH	6.4	6.8	6.4	7.0	6.7
Specific Conductance, uhos/cm	580	620	660	540	1300
Dissolved Oxygen, mg/l	1.4	2.4	3.0	1.4	0.6
Nitrate, mg/l	<0.05	<0.05	<0.05	7.0	<0.05
Iron, mg/l *	0.25	0.75	2.4	<0.1	0.9
Sulfate, mg/l	35	8	12	40	160
Ammonia Nitrogen, mg/l	0.15	0.30	0.7	0.2	0.45
Phosphate, mg/l	0.4	0.2	0.25	0.3	<0.1
Alkalinity, mg/l	372	320	332	220	592
Oil & Grease, mg/l	-	160	-	- **	6.9
TPH-D, ug/l	-	<50	-	- **	<50
TPH-G, ug/l	<50	230	300	<50	220
Benzene, ug/l	<0.5	2.2	10	<0.5	3.2
Toluene, ug/l	<0.5	<0.5	1.1	<0.5	<0.5
Xylene, ug/l	<0.5	2.0	4.4	<0.5	1.4
Ethylbenzene, ug/l	<0.5	5.5	9.6	<0.5	0.8

NOTE:

INORGANIC ANALYSIS COMPLETED BY COLORIMETRIC METHODOLOGIES (LA MOTTE TEST).
TOTAL PETROLEUM HYDROCARBONS (GASOLINE) AND BENZENE, TOLUENE, XYLENE AND ETHYLBENZENE ANALYZED BY EPA METHODS 8015 AND 8020.

SHADED AREAS IDENTIFY RESULTS WHICH EXCEED THE MCLs.

* UNFILTERED SAMPLE

SAMPLES COLLECTED JANUARY 1996

** SAMPLE COLLECTED FEBRUARY 16, 1996

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California 95628-2714
(916)967-1222

Title: GROUNDWATER CHEMICAL ANALYSIS
Site: 4800 SAN PABLO AVENUE EMERYVILLE, CALIFORNIA

Project Number: 95286
Date: 01-22-96
Scale: NONE

TABLE 1

ELECTRON ACCEPTOR	Expressed BTXE (ug/L) Assimilative Capacity	
	PRIMARY WATER ZONE	PERCHED WATER ZONE
Dissolved Oxygen	450-955	191
Nitrate	0	0
Sulfate	8700	34780
Express Assimilative Capacity	9150	34971
Highest observed BTXE Conc.	25.1	5.4

On a mass basis, the ratio of oxygen consumption during BTXE metabolism is 3.14 mg oxygen to 1 mg BTXE.

On a mass basis, the ratio of ntirate consumption during BTXE metabolism is 4.9 mg nitrate to 1 mg BTXE.

On a mass basis, the ratio of sulfate consumption during BTXE metabolism is 4.6 mg to 1 mg BTXE.

The above ratios assume the absence of microbial cell production.

There is likely to be a small contribution of degradation resulting from nitrates however concentrations are not consistently detected in background wells (i.e. WB-7, WB-12).

Title: TABLE 2. EXPRESSED ASSIMILATIVE CAPACITY OF SITE

Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 SAN PABLO AVENUE EMERYVILLE, CALIFORNIA

Scale: NONE

Date: 02-02-96

TABLE 3. COST ESTIMATE OF BEST AVAILABLE TECHNOLOGY

SEDIMENT	
Alternative A. Soil Remediation by excavation (does not include shoring)	$118,500
Alternative B. Soil Remediation by Strategic Removal of Perched Groundwater Zone	$ 42,100
GROUNDWATER	
Alternative A. Construction of Interceptor Wells ..... Operation and Maintenance, $5,700/year	$ 31,000
Alternative B. Alternative A plus Injection of Nutrients ..... Operation and Maintenance, $6,000/year	$ 41,000

Assuming a 5-year recovery period for the achievement of the groundwater cleanup goals, cost may range from $59,500 to $99,500.

Total cost of cleanup can potentially range from $101,600 to $218,000. These cost estimates are not economically feasible considering the limitations of best available technologies and historic cleanup goals (MCL). The low risk of the subject property does not warrant this effort. Natural conditions are capable of reducing existing contaminants to low levels. Other attenuation mechanisms contribute to immobilizing the contaminant to the subject property.

	TPHR	TPH-G	BENZENE	TOLUENE	XYLENES	ETHYL-BENZENE
WB-7-10	-	<1	<0.005	<0.005	<0.015	<0.005
WB-7-20	-	<1	<0.005	<0.005	<0.015	<0.005
WB-8-15	<50	<1	<0.005	<0.005	<0.015	<0.005
WB-8-20	<50	<1	<0.005	<0.005	<0.015	<0.005
WB-9-15	<50	2.5	0.015	0.007	0.12	0.084
WB-9-20	<50	<1	<0.005	<0.005	<0.015	<0.005
B-10-10	-	1.5	<0.005	0.007	0.017	0.008
B-10-20	-	<1	<0.005	<0.005	<0.015	<0.005
B-11-10	-	<1	<0.005	<0.005	<0.015	<0.005
B-11-20	-	<1	<0.005	<0.005	<0.015	<0.005
WB-12-10	<50	<1	<0.005	<0.005	<0.015	<0.005
WB-12-20	<50	<1	<0.005	<0.005	<0.015	<0.005
B-13-10	-	<1	<0.005	<0.005	<0.015	<0.005
B-13-20	-	<1	<0.005	<0.005	<0.015	<0.005
WB-8-10	24	0.96	-	-	-	-

TPHR analyzed by EPA Method 418.1, oil & grease by IR spectrophotometer. Detectable limit is 50 mg/kg.
TPH-G analysis by EPA Method 5030 Purge & Trap. Detectable limit is 1 mg/kg.
Benzene, toluene, xylene and ethylbenzene analysis by EPA Method 8020. Detectable limit for benzene, toluene and ethylbenzene is 0.005 mg/kg and xylene is 0.015 mg/kg.
WB-8-10 was analyzed by TPH Volatile analysis utilizing a TCLP zero headspace extract.

Title: TABLE 5. SOIL LABORATORY DATA (PG. 1)

Project No: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 SAN PABLO AVENUE
EMERYVILLE, CALIFORNIA

Scale: NONE

Date: 02-2-96

TABLE 5. LABORATORY ANALYSIS

Sample Location	B	T	X	E	TPH-G	418.1
B-1-(6-7)	ND	ND	ND	ND	ND	ND
B-1-(10-10.5)	ND	0.019	0.36	0.044	7.1	3900
B-2-(8-10)	0.13	0.4	1.8	0.63	220	ND
B-2-(13-15)	ND	ND	ND	ND	ND	ND
B-3-(8-10)	0.96	ND	1.6	0.64	350	ND
B-3-(13-15)	ND	ND	ND	ND	ND	ND
B-4A-(8-10)	ND	ND	ND	ND	ND	ND
B-6-(4-5)	ND	ND	ND	ND	ND	990
B-6-(8.5-10)	0.063	ND	0.75	0.32	40	ND

Results reported in mg/kg (ppm).
No detectable levels of TPH-D and STLC Lead were detected in the above samples.
BTXE is benzene, toluene, xylene, and ethylbenzene.
BTXE analysis by EPA Method 8020. Reporting limit is 0.005 mg/kg.
TPH-Gasoline analysis by EPA Method 5030 Purge-and-trap, Reporting limit is 1 mg/kg.
TPH-Diesel analysis by modified EPA Method 8015. Reporting limit is 1 mg/kg.
Oil & Grease analysis by EPA Method 418.1 (IR Spectrophotometer). Reporting limit is 50 mg/kg.
Soluble Lead analysis by Lead STLC. Reporting limit is 0.05 mg/kg.
Lowest reporting limits are listed above. If sample extraction is diluted, reported limit increases accordingly (see laboratory reports).

TABLE 6. MONITOR WELL DATA
4800 SAN PABLO AVENUE, EMERYVILLE, CALIFORNIA
OCTOBER, 1996

WELL DESIGNATION	WB-8	WB-9	WB-14	WB-12	WB-7
TOTAL DEPTH	31	31	11	31	31
SCREENED INTERVAL	20-30	20-30	7-12	20-30	20-30
SAMPLE DATE	6-20-94				
DEPTH TO WATER	10.87	13.48	7.00	10.40	9.62
GROUNDWATER ELEVATION	83.45	80.42	87.42	84.16	83.95
TPH-G	230	270	1900	ND	ND
TPHR	ND	ND	1100	1700	ND
BENZENE	3	2.8	65	ND	ND
TOLUENE	1	1.3	3.2	ND	ND
XYLENE	ND	ND	10	ND	ND
ETHYLBENZENE	0.6	ND	ND	ND	ND
SAMPLE DATE	1-11-96				
DEPTH TO WATER	10.08	12.67	6.52	9.85	8.88
GROUNDWATER ELEVATION	84.24	81.23	87.90	84.71	84.69
TPH-G	230	300	220	ND	ND
TPH-D	ND	-	ND	ND	-
TPH-motor oil	-	-	-	ND	-
TPHR	160000	-	6900	-	-
BENZENE	2.2	10	3.2	ND	ND
TOLUENE	ND	1.1	ND	ND	ND
XYLENE	2	4.4	1.4	ND	ND
ETHYLBENZENE	5.5	9.6	0.8	ND	ND
DISSOLVED OXYGEN	2.4	3.0	0.6	1.4	1.4
SULFATE	8	12	160	35	40
SAMPLE DATE	4-05-96				
DEPTH TO WATER	10.87	13.48	7.00	9.79	7.98
GROUNDWATER ELEVATION	85.04	82.02	88.78	84.77	85.59
TPH-G	200	420	130		
TPH-D	ND	---	ND		
TPH-motor oil	ND	---	ND		
BENZENE	3.5	11	1.9		
TOLUENE	ND	ND	ND		
XYLENE	0.9	11	1.4		
ETHYLBENZENE	1.6	3.0	ND		
DISSOLVED OXYGEN	3.1	2.4	0.9		
SULFATE	10	44	2		

TABLE 6. MONITOR WELL DATA (CONTINUED)
4800 SAN PABLO AVENUE, EMERYVILLE, CALIFORNIA
JULY 16, 1996

WELL DESIGNATION	WB-8	WB-9	WB-14	WB-12	WB-7
TOTAL DEPTH	31	31	11	31	31
SCREENED INTERVAL	20-30	20-30	7-12	20-30	20-30
SAMPLE DATE	7-03-96				
DEPTH TO WATER	9.62	12.70	6.58	9.50	8.21
GROUNDWATER ELEVATION	84.70	81.20	87.84	85.06	85.36
TPH-G	289	2930	71		
TPH-D	ND	---	ND		
TPH-motor oil	ND	---	ND		
BENZENE	2.6	62.5	0.8		
TOLUENE	0.6	4.0	ND		
XYLENE	0.7	131	ND		
ETHYLBENZENE	ND	153	ND		
DISSOLVED OXYGEN	1.8	<0.2	3.4		
SULFATE	12	<1	4		
SAMPLE DATE	10-02-96				
DEPTH TO WATER	10.32	13.51	7.49	10.42	8.86
GROUNDWATER ELEVATION	84.00	880.39	87.07	84.00	84.71
TPH-G	56	250	415		
TPH-D	ND	---	ND		
TPH-motor oil	ND	---	ND		
BENZENE	1.0	6.4	26.8		
TOLUENE	ND	ND	ND		
XYLENE	ND	1.0	2.7		
ETHYLBENZENE	ND	1.5	ND		
DISSOLVED OXYGEN	0.4	0.3	0.3		
SULFATE	24	29	<4		

- Results reported in ug/l.
  NA means is not applicable or no data generated
- ND means nondetectable
- Petroleum analysis completed by Excelchem Environmental Labs during last three quarterly groundwater sampling events
- TPH-G reported in ug/l (ppb). Analyzed by EPA Method 5030 purge and trap. Detectable limit is 50 ug/l.
- Benzene, toluene, xylene, and ethylbenzene reported in ug/l (ppb). Analyzed by EPA Method 602. Detectable limit is 0.5 ug/l.
- TPH-D analyzed by EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with a FID detector. Detectable limit is 0.050 ug/l.
- TPH-motor oil analyzed by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with a FID. Detectable limit is 500 ug/l.
- TPHR analyzed by Modified EPA Method 418.1. Detectable limit is 10 mg/l.

		TPH-G	BENZENE	TOLUENE	XYLENES	ETHYL-BENZENE
SG-15-3		ND	ND	ND	ND	ND
SG-15-6		ND	ND	ND	ND	ND
SG-15-9		376	ND	ND	ND	ND
SG-16-3		ND	ND	ND	ND	ND
SG-16-6		ND	ND	ND	ND	ND
SG-16-9		644	5.6	ND	ND	ND
SG-17-3		ND	ND	ND	ND	ND
SG-17-5.5		ND	ND	ND	ND	ND
SG-18-3		ND	ND	ND	ND	ND
SG-18-6		ND	ND	ND	ND	ND
SG-18-9		ND	ND	ND	ND	ND
SG-19-3		ND	ND	ND	ND	ND
SG-19-6		ND	ND	ND	ND	ND
SG-19-9		103	ND	10.6	2.5	14.4
SG-20-3		ND	ND	ND	ND	ND
SG-20-5		240	ND	1.1	1.2	4.2
REPORT LIMIT		200	5.0	5.0	5.0	5.0

NOTE:

SOIL-GAS SAMPLES COLLECTED IN 6 LITER SUMMA CANISTERS. GENERALLY, A 40-60 kPa VACUUM. SAMPLES WERE DELIVERED THE SAME DAY TO A CALIFORNIA CERTIFIED LABORATORY. ANALYSES INCLUDED TO3 (GC EQUIPPED WITH A PID) FOR BTXE AND TO3 (GC EQUIPPED WITH A FID) FOR TPH-G.

SG-15, 16 AND 17 SAMPLED AUGUST 21, 1997. SG-18, 19 AND 20 SAMPLED AUGUST 28, 1997.

Title: SOIL-GAS CHEMICAL DATA

Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 SAN PABLO AVENUE
EMERYVILLE, CALIFORNIA

Scale: NONE

Date: 10-14-97

SUBJECT PROPERTY

Reproduced from USGS 7.5 Minute Series V895 (topographic)

Title: SUBJECT PROPERTY LOCATION MAP		Project No.: 93286-01	FIGURE 1
HydroSolutions of California, Inc. 11470 Sunrise Gold Circle, Suite 4 Rancho Cordova, California 95742 (916) 852-0188	Site: 4800 San Pablo Avenue Emeryville, California		
	Scale: 1 inch=2,000 feet	Date: 11-16-93	

1.0 REQUEST FOR CLOSURE AS LOW RISK SITE

The City of Emeryville Redevelopment Agency requests the assignment of a parcel of land located on the northeast corner of San Pablo Avenue and 48th Street (4800 San Pablo Avenue) as a low risk site (figure 1).

The contaminant is gasoline. Low levels of benzene (maximum is 65 ug/kg) have been detected in soil. Extent of contamination is illustrated in figures 4 (sediment) and 5 (groundwater). Benzene in groundwater is detectable in concentrations ranging from 2.2 ug/l to 10 ug/l.

Historically, the subject property was operated as a gasoline service station. A leak likely occurred many years ago during the operation of the service station. Removal of the tank(s) had apparently occurred after the gasoline station terminated service. No documentation of closure has been found and subsurface investigations have not resulted in the discovery of a presently existing underground storage tank (UGST) system with exception to piping. Shallow probing was completed at 20 foot spacing, a geophysical survey was completed across the entire site and 14 exploratory borings (figure 2) were completed at ten foot to 30 foot depths. No UGSTs have been found. Based on the lack of discovered on-site tanks

NOTES:

Exploratory drilling completed December 23, 1993 and June 16–17, 1994.

A Geoprobe system was used as the coring device for B–1 through B–6. A hollow stem augur was utilized for WB–7 through B–13.

Groundwater was encountered in boring, B–6, at 8.5 feet. Borings, B–1 through B–5 did not penetrate groundwater.

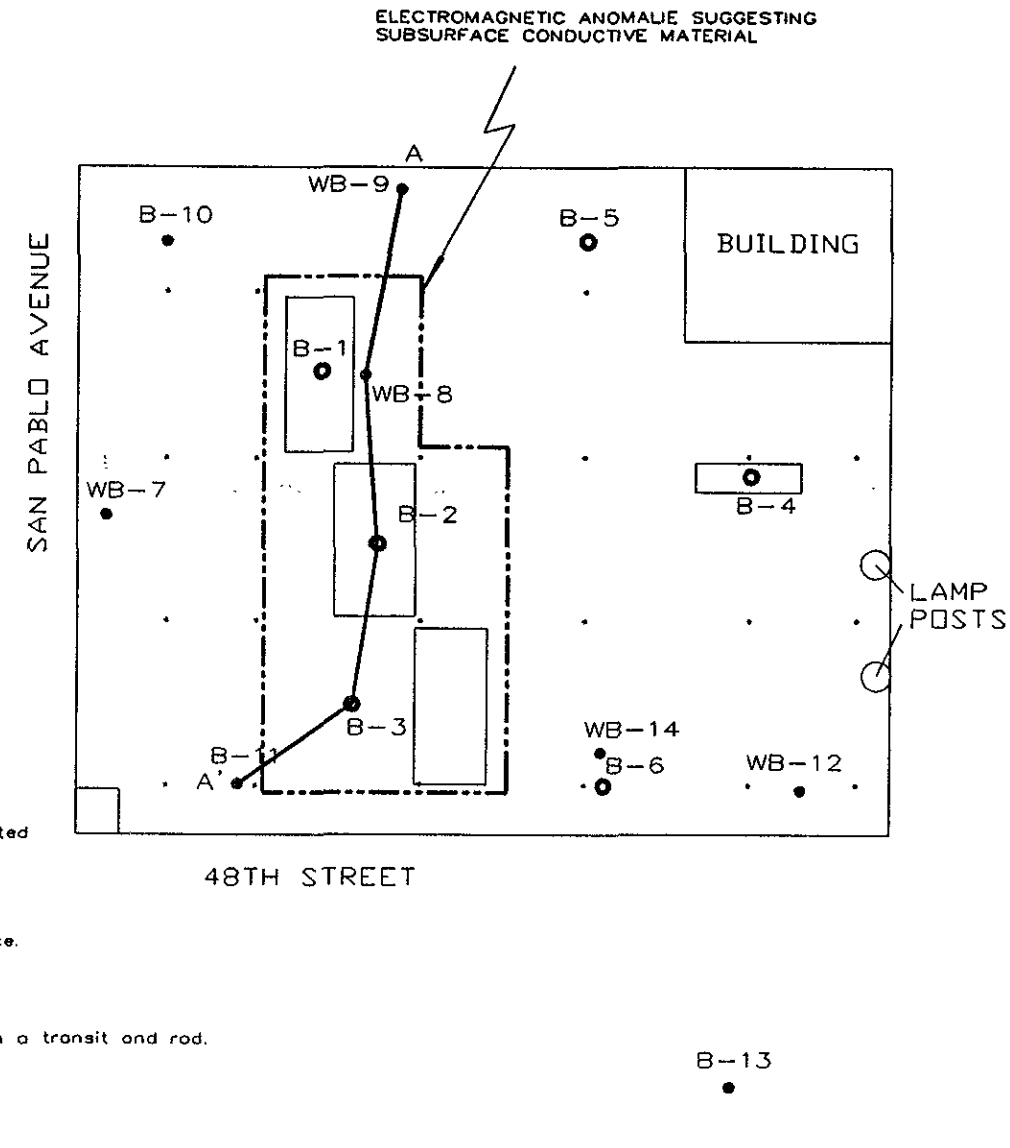
Soil–gas probes are illustrated as small dots. Twenty two probes were inserted to a 4.5–10.5 foot depth. Probes were removed after use.

Soil samples analyzed for total petroleum hydrocarbons, benzene, toluene, xylene, ethylbenzene, oil & grease, and soluble lead (B–1 through B–6).

Ground water monitoring wells designated as WB–___ . All wells except WB–14 are 30 feet deep, perforated between the 20 and 30 foot depths, gravel pack to 18 foot depth and grouted to the ground surface. A locking well head is constructed at grade for each well.

Well, WB–14, is 12 feet in depth, perforated between 7 and 12 feet, gravel packed to a 5 foot depth and grouted to the ground surface.

Borings, WB–7 through B–13, were surveyed with a transit and rod.



EXPLANATION

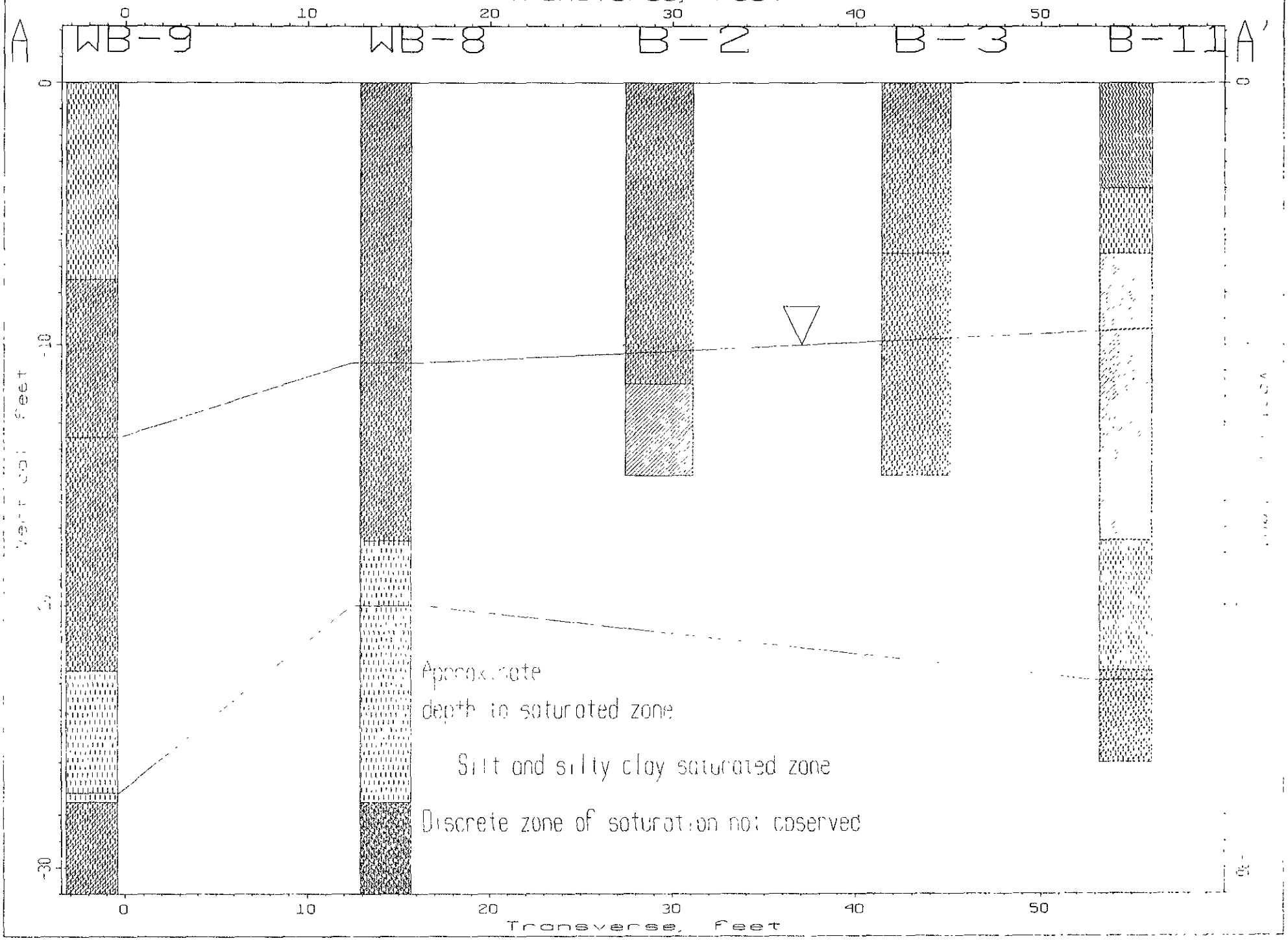
- B–5 — BORING
- WB–7 — GROUNDWATER MONITOR WELL
- SOIL–GAS SAMPLE

0 20 40 feet

APPROXIMATE SCALE

HydroSolutions of California, Inc. 5917 Moss Creek Circle, Suite 2 Fair Oaks, California 95628–2714 (916) 967–1222	Title: BORING/WELL LOCATION MAP	Project Number: 95286	FIGURE 2
	Site: 4800 SAN PABLO AVENUE EMERYVILLE, CALIFORNIA	Date: 01–22–96	
		Scale: AS SHOWN	

FIGURE 3 NORTH-SOUTH CROSS-SECTION
4800 SAN PABLO AVENUE, SACRAMENTO



NOTES:

Exploratory drilling completed December 23, 1993 and June 16-17, 1994.

A Geoprobe system was used as the coring device for B-1 through B-6. A hollow stem augur was utilized for WB-7 through B-13.

Groundwater was encountered in boring, B-6, at 8.5 feet. Borings, B-1 through B-5 did not penetrate groundwater.

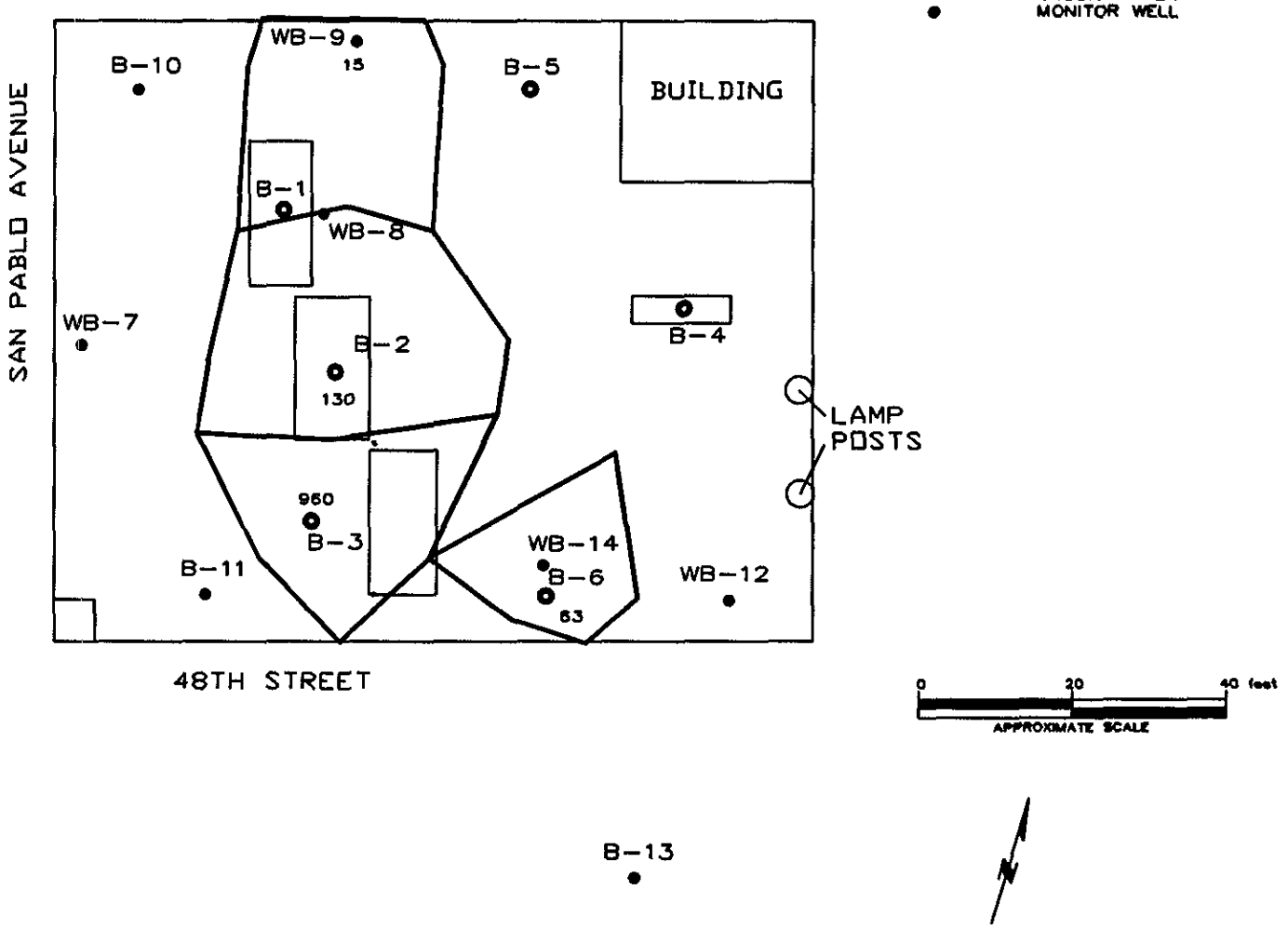
Soil samples analyzed for total petroleum hydrocarbons, benzene, toluene, xylene, ethylbenzene, oil & grease, and soluble lead (B-1 through B-6).

Ground water monitoring wells designated as WB-__ . All wells except WB-14 are 30 feet deep, perforated between the 20 and 30 foot depths, gravel pack to 18 foot depth and grouted to the ground surface. A locking well head is constructed at grade for each well.

Well, WB-14, is 12 feet in depth, perforated between 7 and 12 feet, gravel packed to a 5 foot depth and grouted to the ground surface.

Lateral distribution of benzene in subsurface sediment estimated by the Thiessen Polygon Method. Average benzene concentration by this method is estimated to be 291 ug/kg.

Four out of 24 soil samples contained detectable levels of benzene. The mean concentration is 292 ug/kg.



HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California 95628-2714
(916) 967-1222

Title	EXTENT OF SOIL CONTAMINATION (BENZENE)
Site	4800 SAN PABLO AVENUE EMERYVILLE, CALIFORNIA
Project Number	95286
Date	12-11-96
Scale	AS SHOWN
FIGURE	4

NOTES:

Exploratory drilling completed December 23, 1993 and June 16-17, 1994.

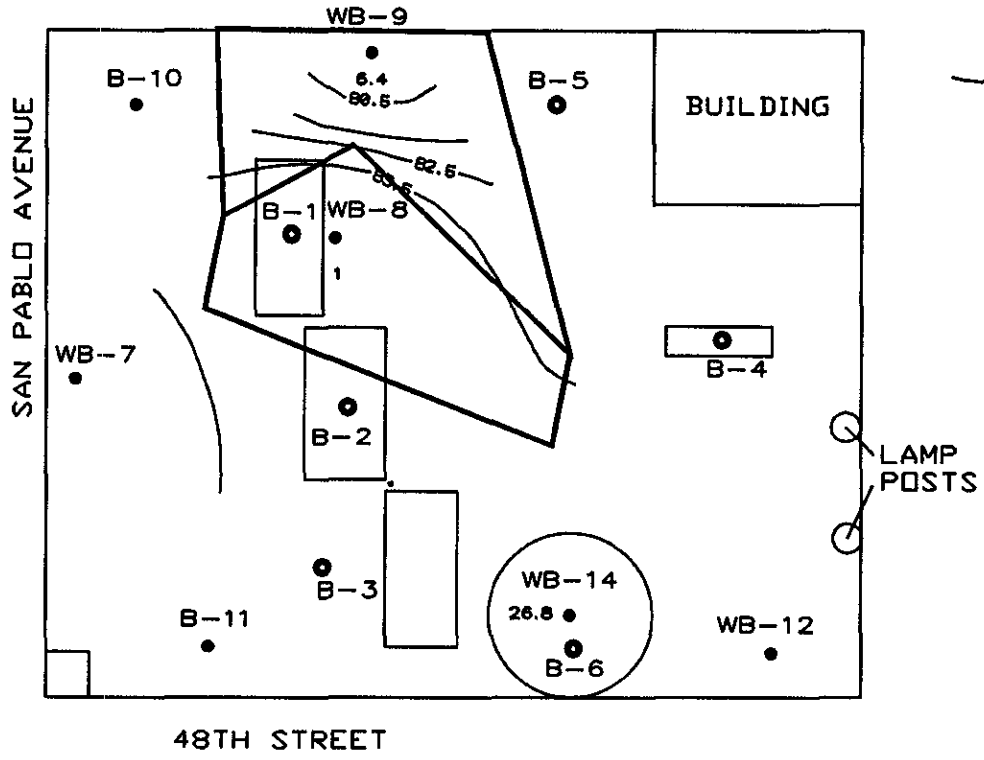
A Geoprobe system was used as the coring device for B-1 through B-6. A hollow stem augur was utilized for WB-7 through B-13.

Groundwater was encountered in boring, B-6, at 8.5 feet. Borings, B-1 through B-5 did not penetrate groundwater.

Soil samples analyzed for total petroleum hydrocarbons, benzene, toluene, xylene, ethylbenzene, oil & grease, and soluble lead (B-1 through B-6).

Ground water monitoring wells designated as WB-__ . All wells except WB-14 are 30 feet deep, perforated between the 20 and 30 foot depths, gravel pack to 18 foot depth and grouted to the ground surface. A locking well head is constructed at grade for each well.

Well, WB-14, is 12 feet in depth, perforated between 7 and 12 feet, gravel packed to a 5 foot depth and grouted to the ground surface.



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 GROUNDWATER TABLE CONTOUR LINE AND RELATIVE ELEVATION (FT)

0 20 40 feet

APPROXIMATE SCALE

Direction of groundwater table slope is to the north.

Ground water level elevations are relative elevations.

Borings, WB-7 through B-13, were surveyed with a transit and rod.

Groundwater contour lines calculated by inverse distance method. Data includes WB-7,8,9 and 12.

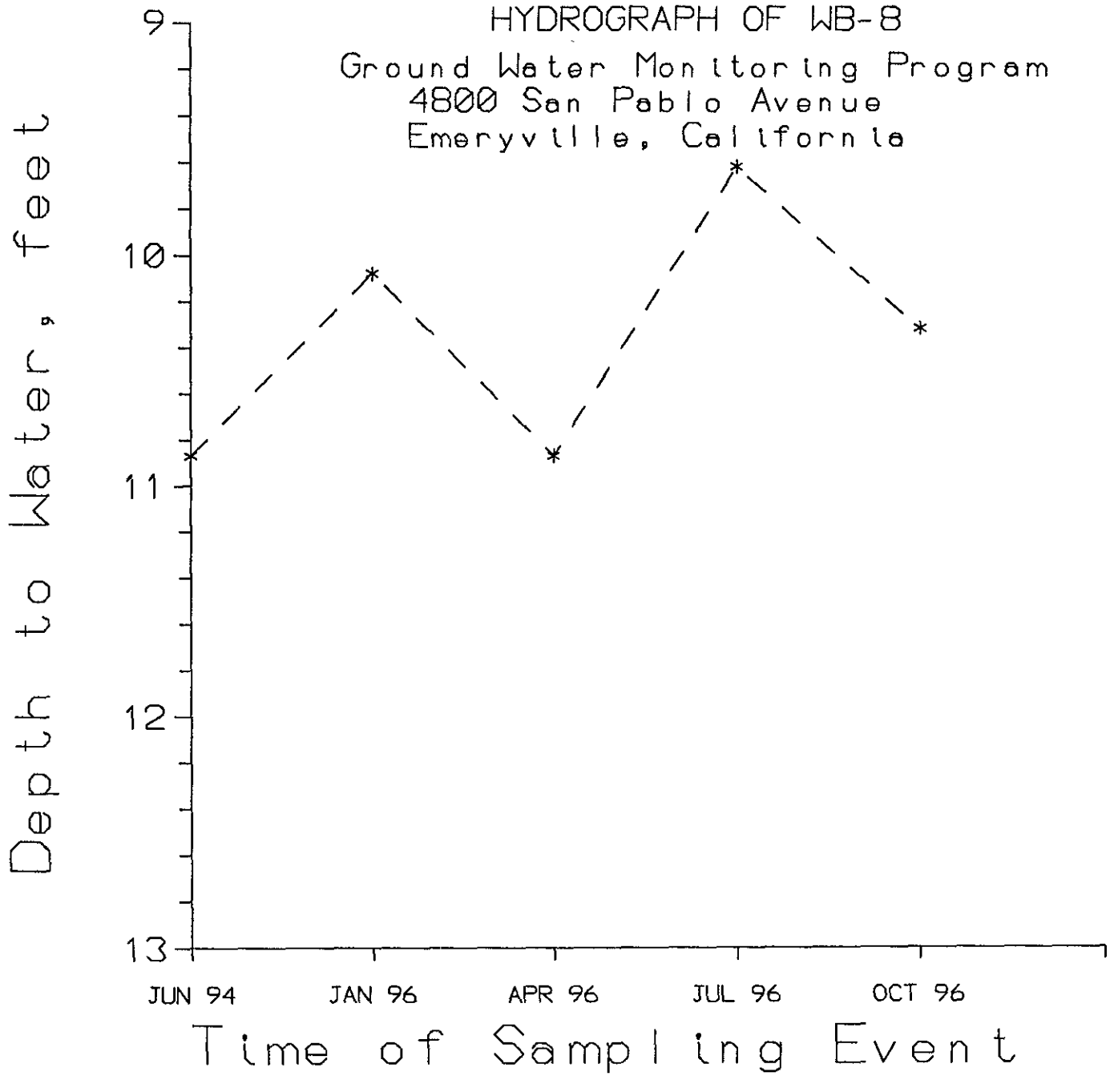
Water level measurements collected October 1996.

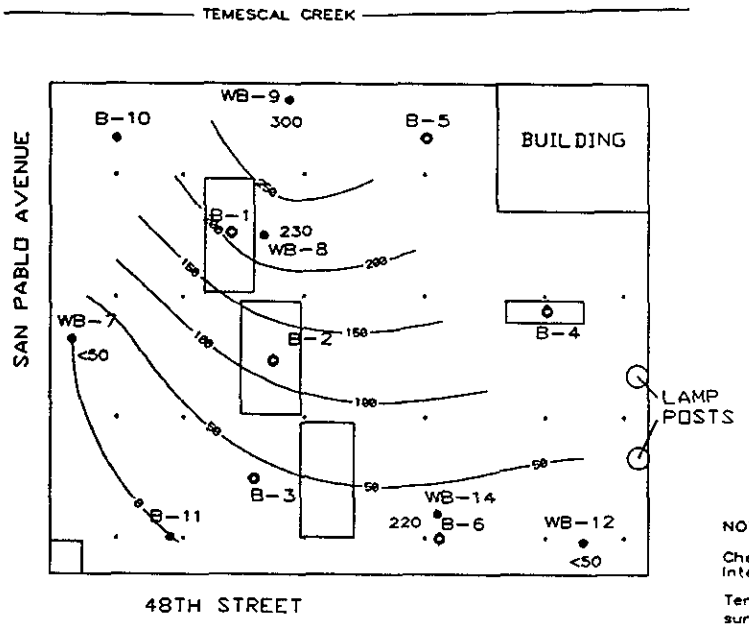
B-13

HydroSolutions of California, Inc.
5817 Moss Creek Circle, Suite 2
Fair Oaks, California 95628-2714
(916) 967-1222

Title	EXTENT OF GROUNDWATER CONTAMINATION (BENZENE)
Site	4600 SAN PABLO AVENUE EMERYVILLE, CALIFORNIA
Project Number	95286
Date	12-11-96
Scale	AS SHOWN
FIGURE	5

FIGURE 6.


HYDROGRAPH OF WB-8
Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
Depth to Water, feet
9
10
11
12
13
JUN 94
JAN 96
APR 96
JUL 96
OCT 96
Time of Sampling Event



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

SOIL-GAS SAMPLE

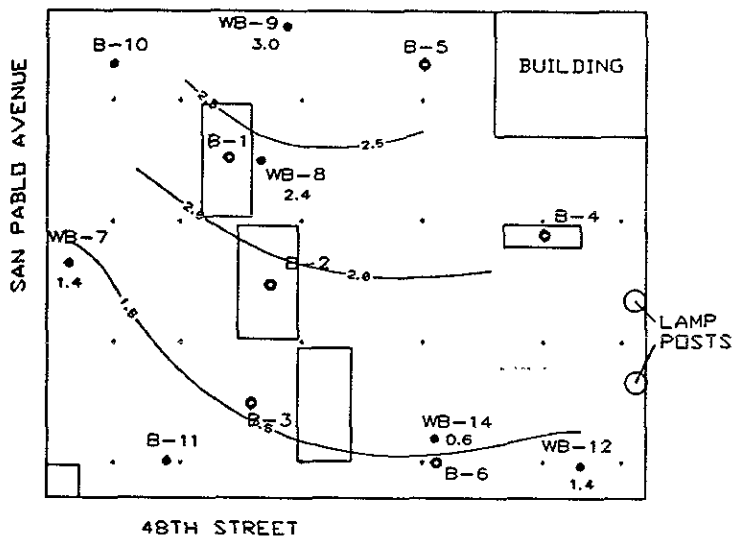
0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996.

B-13



80 DISSOLVED OXYGEN (MG/L) CONTOUR LINE AND CONCENTRATION

NOTE.

Dissolved oxygen measured in the field by a modified Winkler Method (titration). A LaMotte kit was used (accepted by EPA).

WB-14 not included in interpretation due to representing a perched water condition.

B-13

Title: FIGURE 7. DISSOLVED OXYGEN IN GROUNDWATER

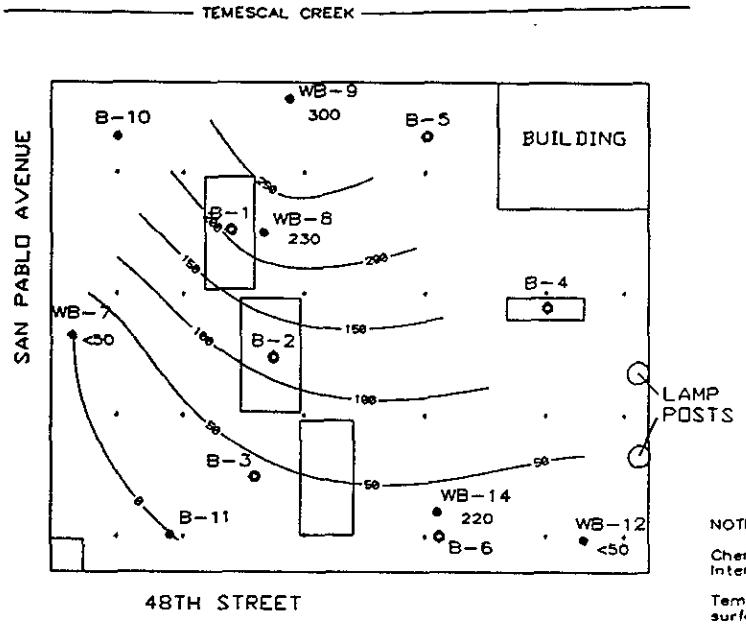
Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



EXPLANATION

- B-5 — BORING
- WB-7 — GROUNDWATER MONITOR WELL
- 80 — PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION
- SOIL-GAS SAMPLE

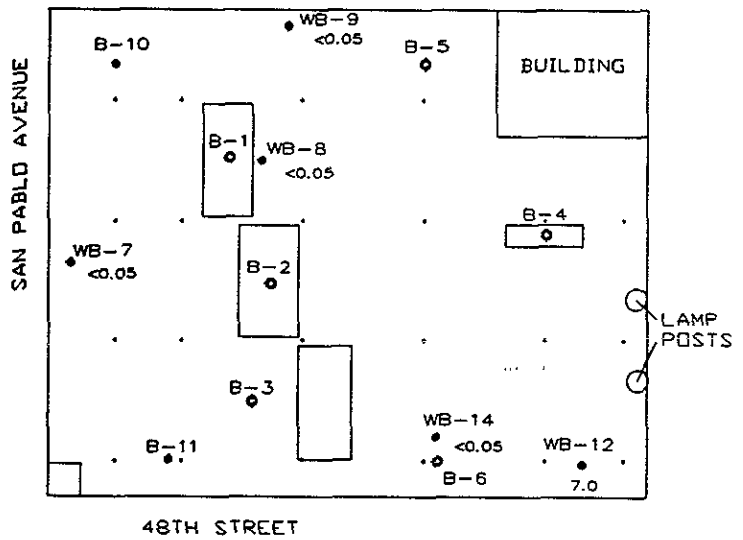
0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996.

B-13



- WB-7 — GROUNDWATER MONITOR WELL & NITRATE CONCENTRATION (MG/L)

Analysis completed by LaMotte field kit.

B-13

Title: FIGURE 8. NITRATES IN GROUNDWATER

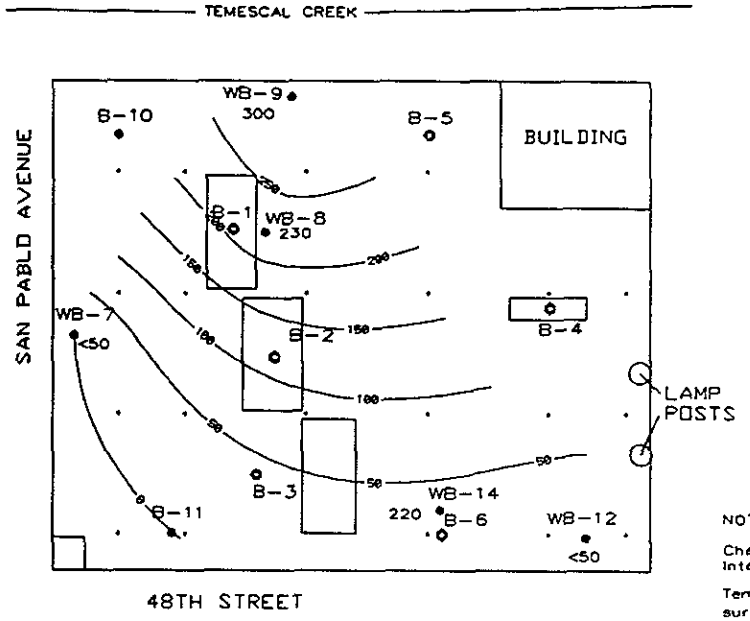
Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue
Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

SOIL-GAS SAMPLE

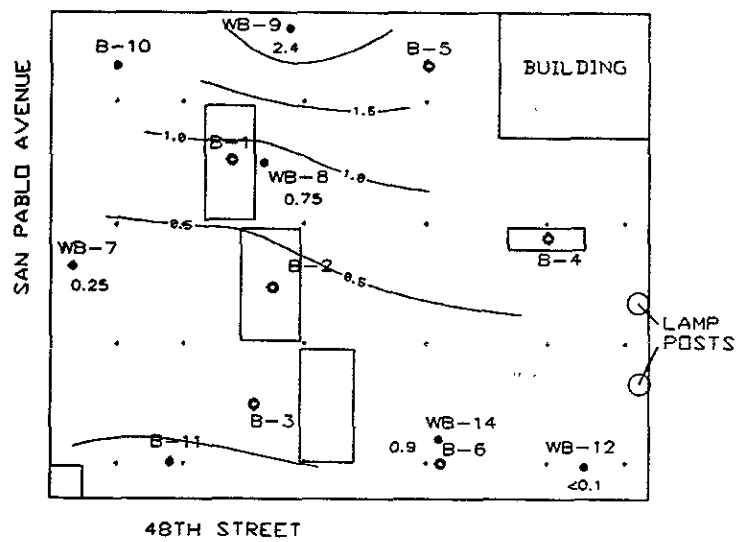
0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996

B-13



80 IRON (MG/L) CONTOUR LINE AND CONCENTRATION

Analysis completed by LaMotte field kit.

WB-14 not included in interpretation due to representing a perched water condition.

B-13

Title: FIGURE 9. IRON IN GROUNDWATER

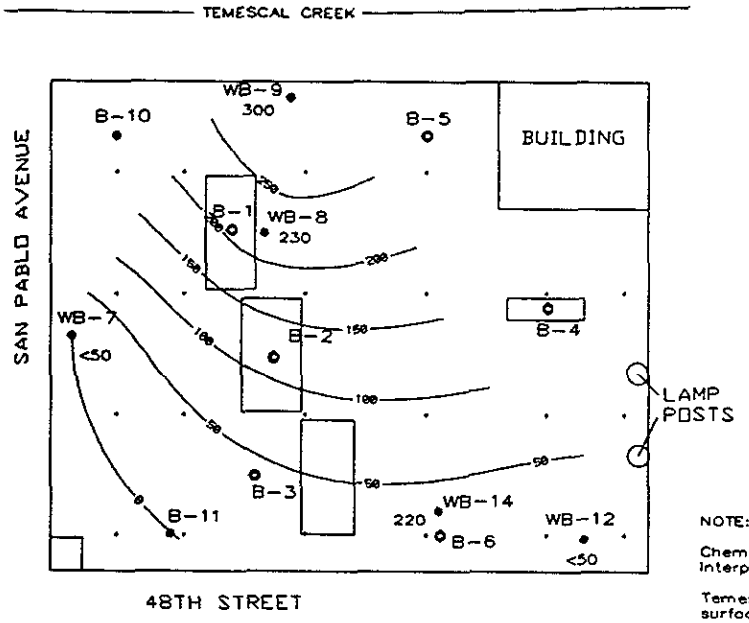
Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue
Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

SOIL-GAS SAMPLE

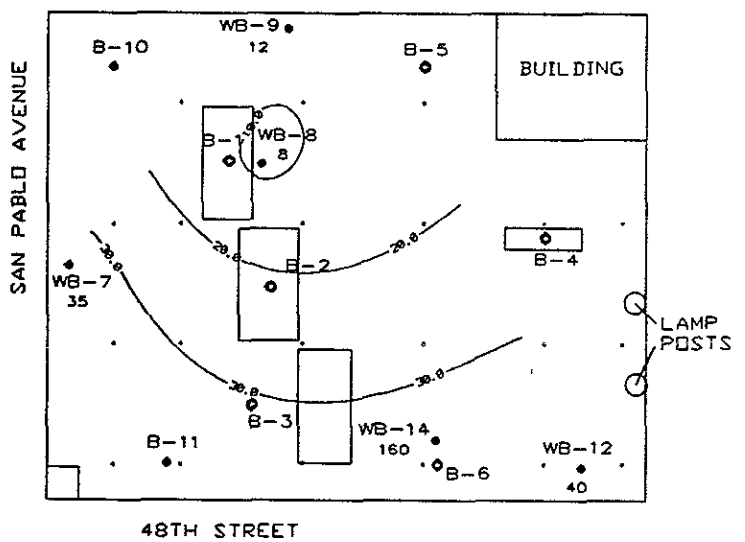
0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996.

B-13



80 SULFATE (MG/L) CONTOUR LINE AND CONCENTRATION

Analysis completed by LaMotte field kit.

WB-14 not included in interpretation due to representing a perched water condition.

B-13

Title: FIGURE 10. SULFATE IN GROUNDWATER

Project No.: 95286

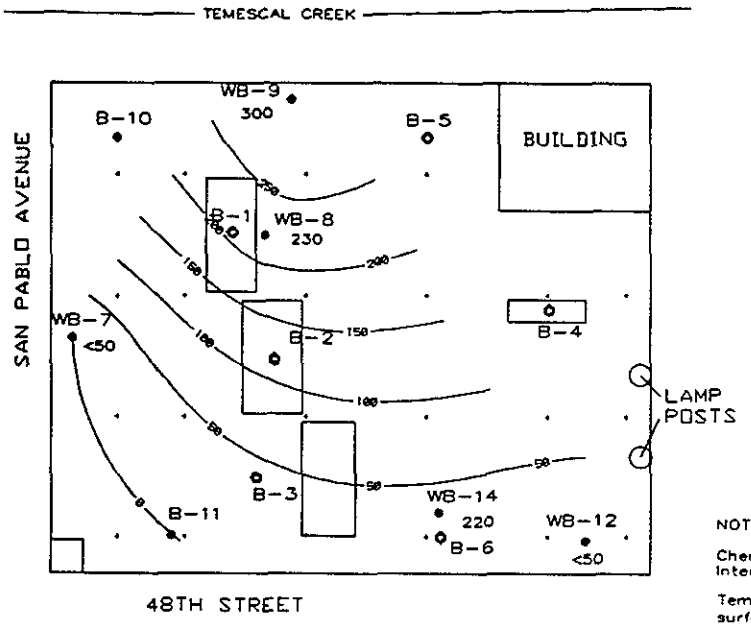
HydroSolutions of California, Inc.

5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue
Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

SOIL-GAS SAMPLE

0 20 40 feet
APPROXIMATE SCALE

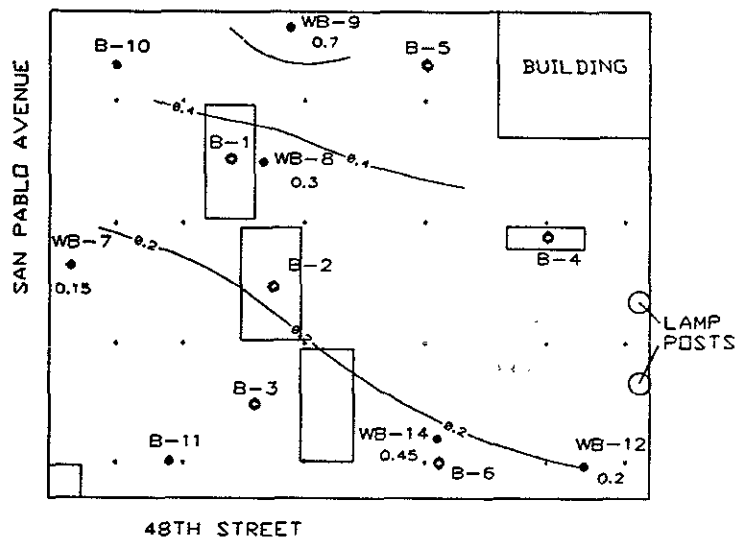
N

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996

B-13



80 AMMONIA NITROGEN (MG/L) CONTOUR LINE AND CONCENTRATION

Analysis completed by LaMotte field kit.

WB-14 not included in interpretation due to representing a perched water condition.

B-13

Title:
FIGURE 11. AMMONIA NITROGEN IN GROUNDWATER

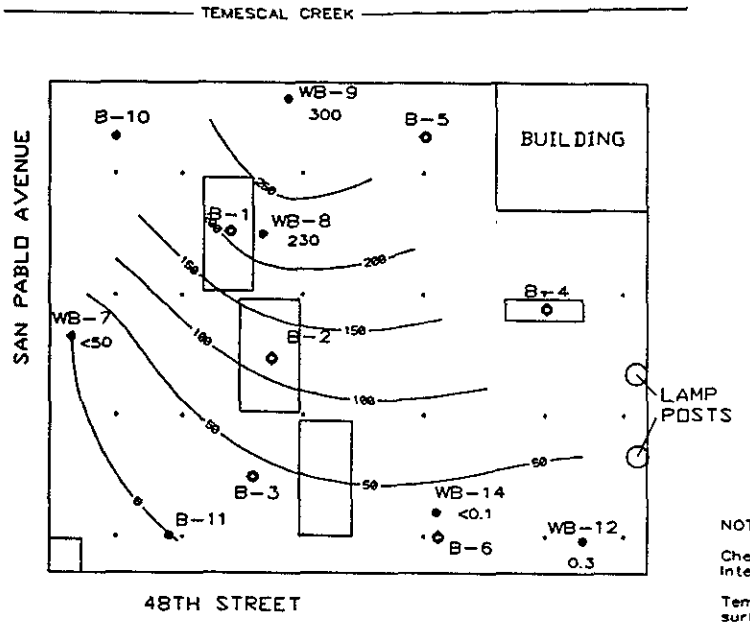
Project No.:
95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site:
4800 San Pablo Avenue
Emeryville, California

Scale:
AS SHOWN

Date:
01-22-96



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

SOIL-GAS SAMPLE

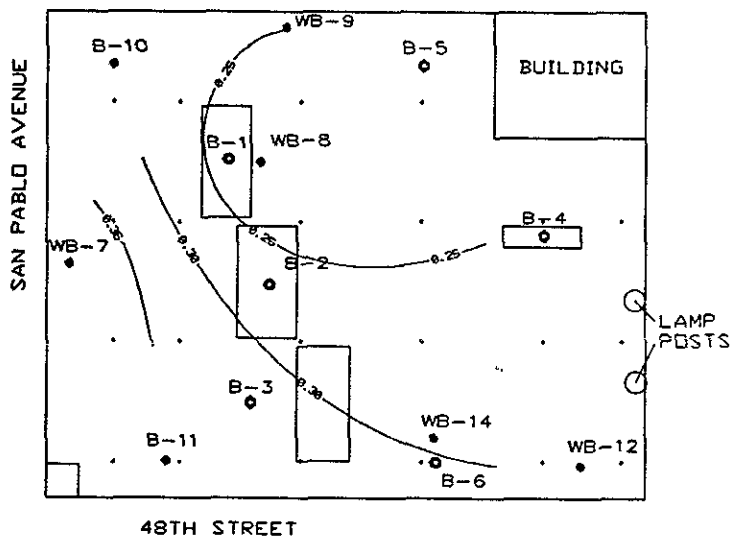
0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996.

B-13



80 PHOSPHATE (MG/L) CONTOUR LINE AND CONCENTRATION

Analysis completed by LaMotte field kit.

B-13

Title: PHOSPHATE IN GROUNDWATER

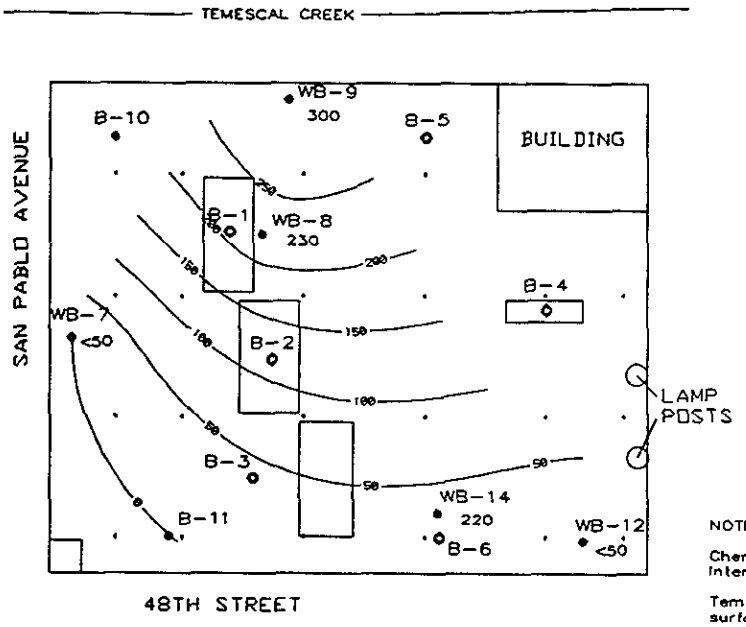
Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue
Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

SOIL-GAS SAMPLE

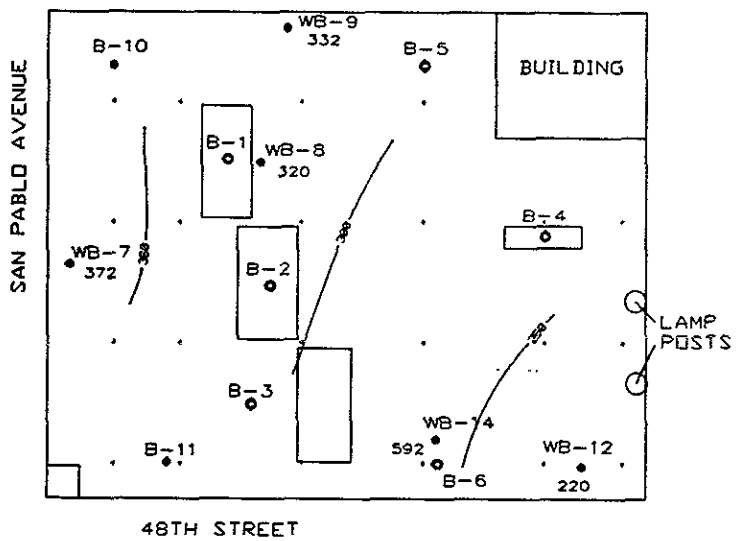
0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996.

B-13



80 ALKALINITY (MG/L) CONTOUR LINE AND CONCENTRATION

Analysis completed by LaMotte field kit.

WB-14 not included in interpretation due to representing a perched groundwater condition.

B-13

Title: FIGURE 13. ALKALINITY IN GROUNDWATER

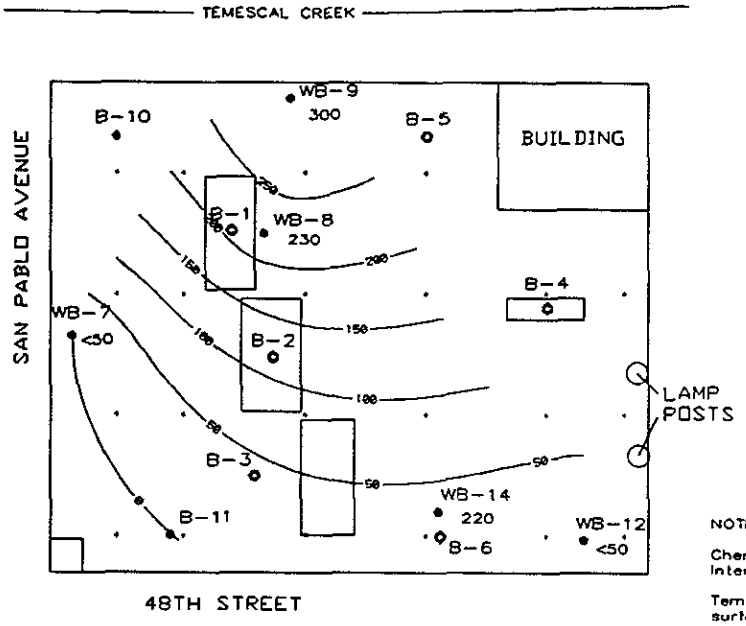
Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue
Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



EXPLANATION

B-5 BORING

WB-7 GROUNDWATER MONITOR WELL

80 PETROLEUM HYDROCARBONS (TPH-G) CONTOUR LINE AND CONCENTRATION

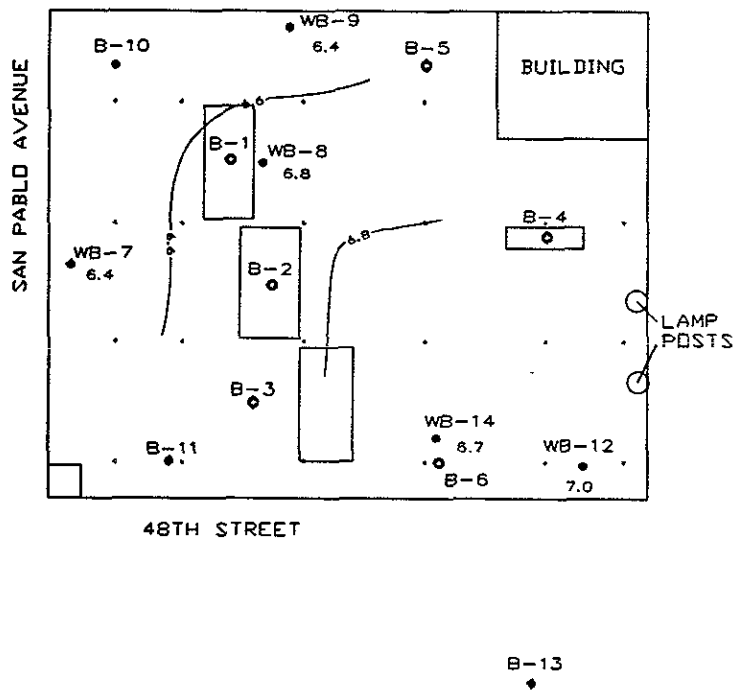
SOIL-GAS SAMPLE

0 20 40 feet
APPROXIMATE SCALE

NOTE:

Chemical concentrations interpolated by kriging methodology. Interpretation only used to illustrate trend in concentration gradient.

Temescal Creek drainage appears abandoned. Area is backfilled. No visible surface water flow was present in January 1996.



80 pH CONTOUR LINE AND CONCENTRATION

Measurement made with a Myron L field meter.

WB-14 not included in interpretation due to representing a perched groundwater condition.

Title: FIGURE 14. PH IN GROUNDWATER

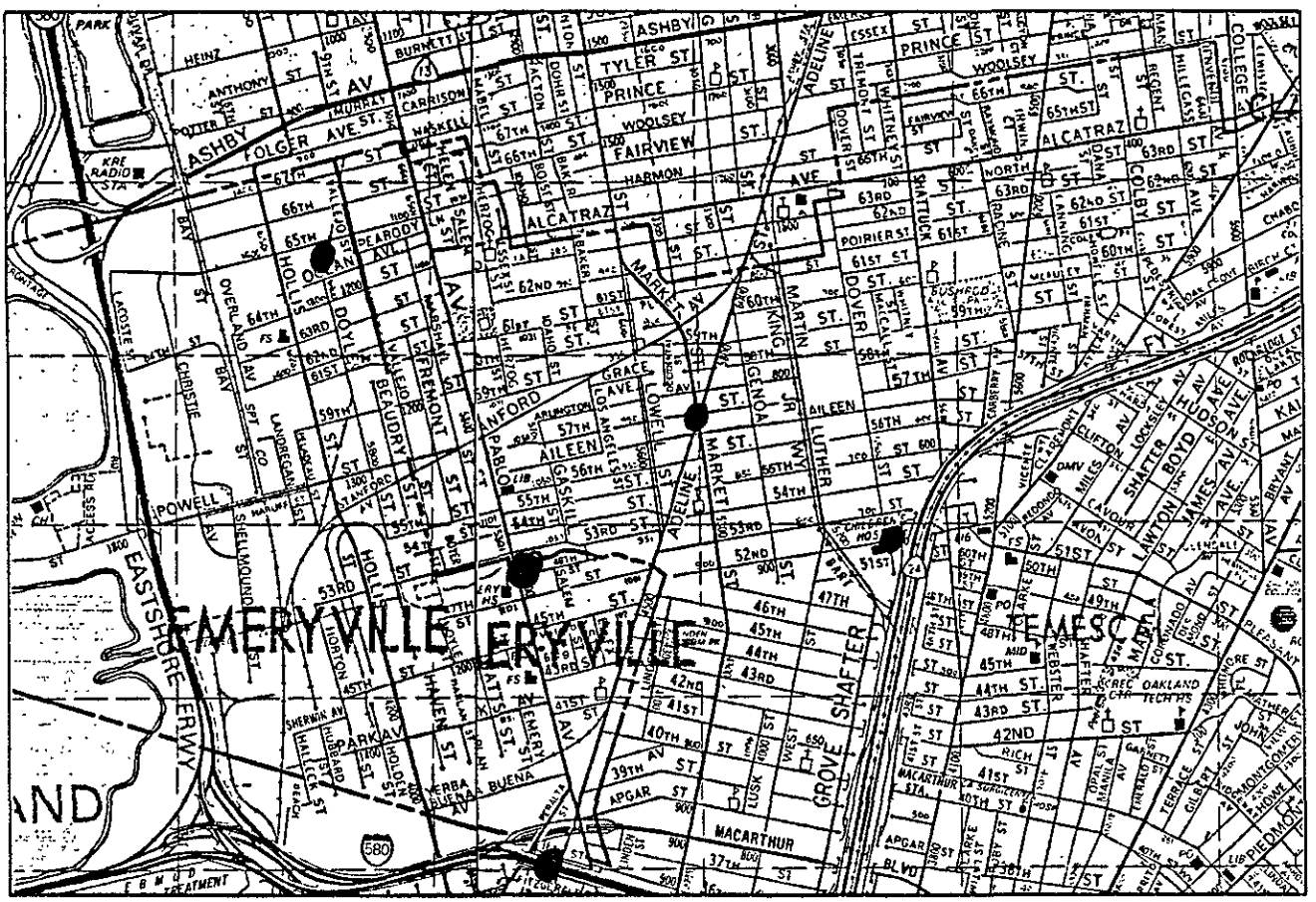
Project No.: 95286

HydroSolutions of California, Inc.
5917 Moss Creek Circle, Suite 2
Fair Oaks, California
(916) 967-1222

Site: 4800 San Pablo Avenue
Emeryville, California

Scale: AS SHOWN

Date: 01-22-96



● SUBJECT PROPERTY

NOTE:

Well data obtained from database generated by the County of Alameda, Public Works Agency.

Wells illustrated above include industrial, irrigation and domestic beneficial uses only. Monitoring, piezometers, borings, destroyed or abandoned wells are not included.

Title: DOMESTIC, IRRIGATION & INDUSTRIAL WELLS ADJACENT SUBJECT PROPERTY		Project No.: 95286	FIGURE 15
HydroSolutions of California, Inc. 5917 Moss Creek Circle, Suite 2 Fair Oaks, California 95628-2714 (916) 987-1222	Site: 4800 San Pablo Avenue Emeryville, California		
	Scale: NONE	Date: 01-22-96	

NOTES:

Exploratory drilling completed December 23, 1993 and June 16–17, 1994.

A Geoprobe system was used as the coring device for B–1 through B–6. A hollow stem augur was utilized for WB–7 through B–13.

Groundwater was encountered in boring, B–6, at 8.5 feet. Borings, B–1 through B–5 did not penetrate groundwater.

Soil samples analyzed for total petroleum hydrocarbons, benzene, toluene, xylene, ethylbenzene, oil & grease, and soluble lead (B–1 through B–6).

Ground water monitoring wells designated as WB–___ . All wells except WB–14 are 30 feet deep, perforated between the 20 and 30 foot depths, gravel pack to 18 foot depth and grouted to the ground surface. A locking well head is constructed at grade for each well.

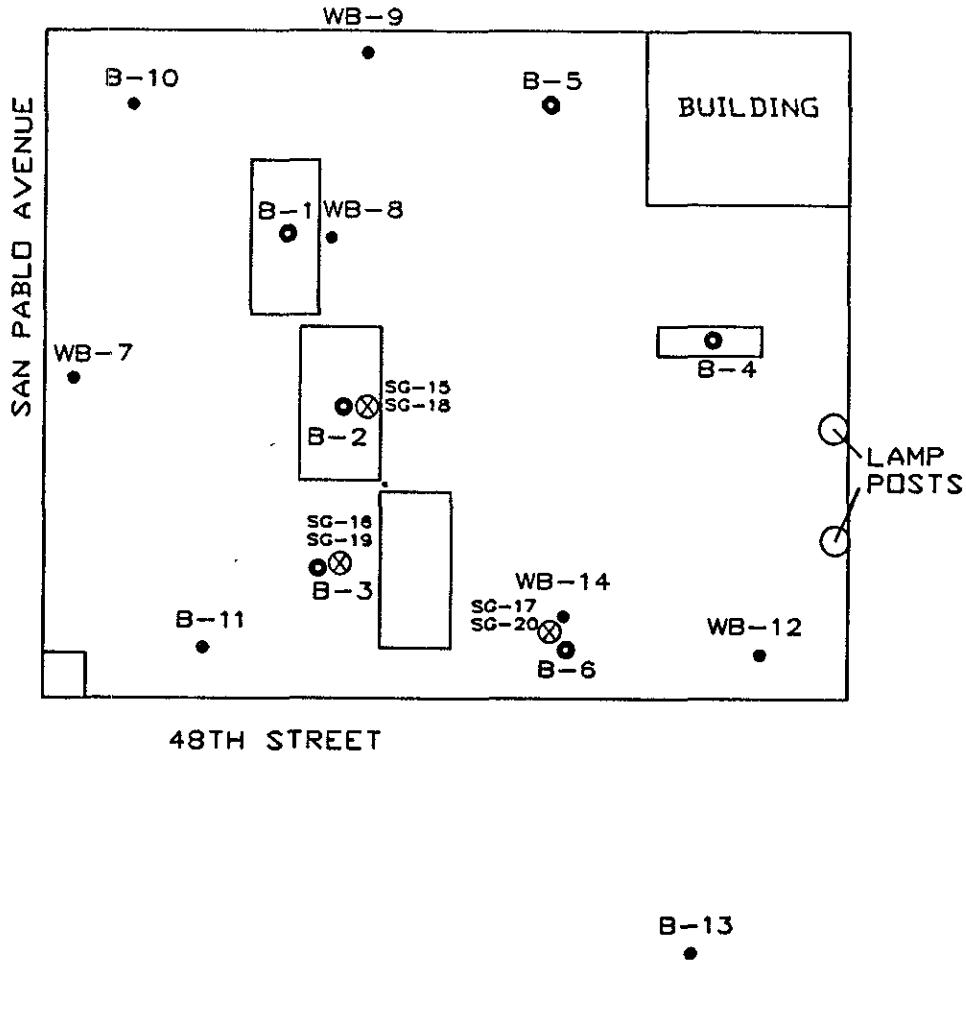
Well, WB–14, is 12 feet in depth, perforated between 7 and 12 feet, gravel packed to a 5 foot depth and grouted to the ground surface.

Collected soil–gas samples from the 3, 6 and 9 foot depth intervals in probes placed adjacent B–2 sand B–3.

Collected soil–gas samples from the 3 and 5–5.5 foot depth intervals in probes placed adjacent WB–14.

Probes SG–15, SG–16 and SG–17 were placed August 21, 1997.

Probes SG–18, SG–19 and SG–20 were placed August 28, 1997.



EXPLANATION

B–5 BORING

WB–7 GROUNDWATER MONITOR WELL

SG–15 SG–18 SOIL–GAS SAMPLING POINTS

0 20 40 feet

APPROXIMATE SCALE

HydroSolutions of California, Inc. 5617 Moss Creek Circle, Suite 2 Fair Oaks, California 95628–2714 (916) 967–1222	Title: SOIL–GAS CONFIRMATION SAMPLES	Project Number: 95286	FIGURE 16
	Site: 4800 SAN PABLO AVENUE EMERYVILLE, CALIFORNIA	Date: October 14, 1997	
		Scale: AS SHOWN	

APPENDICES

Appendix A.
Soil-gas Measurements for Direct Pathway Screening

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention: Mr. Steve Baker
Hydrosolutions
P.O. Box 922
Nevada City, CA 95959

Date Sampled: 08-28-97
Date Received: 08-28-97
BTEX Analyzed: 08-29,09-04-97
TPHg Analyzed: 08-29,09-04-97

Project : 95286/PABLO

Matrix: Air

	Benzene mg/M^3	Toluene mg/M^3	Ethyl-benzene mg/M^3	Total Xylenes mg/M^3	TPHg mg/M^3
Reporting Limit:	0.5	0.5	0.5	0.5	20
SAMPLE Laboratory Identification					
S6-18-3 A0897627	ND	ND	ND	ND	ND
S6-18-9 A0897629	ND	ND	ND	ND	ND
S6-19-3 A0897630	ND	ND	ND	ND	ND
S6-19-9 A0897632	ND	10.6	2.5	14.4	103
S6-20-3 A0897633	ND	ND	ND	ND	ND
S6-20-5 A0897634	ND	1.1	1.2	4.2	240

mg/M^3 = milligrams per cubic meter.
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, total xylene isomers are analyzed by using TO3 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using TO3, which utilizes a GC equipped with an FID.

Laboratory Representative

09-10-97
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention: Mr. Steve Baker
Hydrosolutions
P.O. Box 922
Nevada City, CA 95959

Date Sampled: 08-21-97
Date Received: 08-21-97
BTEX Analyzed: 08-21,22-97
TPHg Analyzed: 08-21,22-97

Project : 96286/PABLO

Matrix: Air

Reporting Limit:	Benzene mg/M^3 5.0	Toluene mg/M^3 5.0	Ethyl-benzene mg/M^3 5.0	Total Xylenes mg/M^3 5.0	TPHg mg/M^3 200
SAMPLE Laboratory Identification					
S6-15-3 A0897505	ND	ND	ND	ND	ND
S6-15-6 A0897506	ND	ND	ND	ND	ND
S6-15-9 A0897507	ND	ND	ND	ND	376
S6-16-3 A0897508	ND	ND	ND	ND	ND
S6-16-6 A0897509	ND	ND	ND	ND	ND
S6-16-9 A0897510	5.6	ND	ND	ND	644
S6-17-3 A0897511	ND	ND	ND	ND	ND
S6-17-5.5 A0897512	ND	ND	ND	ND	ND

mg/M^3 = milligrams per cubic meter.
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, total xylene isomers are analyzed by using TO3 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using TO3, which utilizes a GC equipped with an FID.

Laboratory Representative

09-10-97
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention:	Mr. Steve Baker	Date Sampled:	08-28-97
	Hydrosolutions	Date Received:	08-28-97
	P.O. Box 922	BTEX Analyzed:	09-09-97
	Nevada City, CA 95959	TPHg Analyzed:	09-09-97
Project :	95286/PABLO	Matrix:	Air

	Benzene mg/M^3	Toluene mg/M^3	Ethyl-benzene mg/M^3	Total Xylenes mg/M^3	TPHg mg/M^3
Reporting Limit:	2.7	2.7	2.7	2.7	109
SAMPLE Laboratory Identification					
S6-18-6 A0897628	ND	ND	ND	ND	ND

mg/M^3 = milligrams per cubic meter.
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, total xylene isomers are analyzed by using TO3 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using TO3, which utilizes a GC equipped with an FID.

Laboratory Representative

09-10-97
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention:	Mr. Steve Baker	Date Sampled:	08-28-97
	Hydrosolutions	Date Received:	08-28-97
	P.O. Box 922	BTEX Analyzed:	09-09-97
	Nevada City, CA 95959	TPHg Analyzed:	09-09-97
Project :	95286/PABLO	Matrix:	Air

	Benzene mg/M^3	Toluene mg/M^3	Ethyl-benzene mg/M^3	Total Xylenes mg/M^3	TPHg mg/M^3
Reporting Limit:	6.0	6.0	6.0	6.0	239
SAMPLE Laboratory Identification					
S6-19-6 A0897631	ND	ND	ND	ND	ND

mg/M^3 = milligrams per cubic meter.
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, total xylene isomers are analyzed by using TO3 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using TO3, which utilizes a GC equipped with an FID.

Laboratory Representative

09-10-97
Date Reported

Excelchem
Environmental Labs

500 Giuseppe Court, Suite 9
Roseville, CA 95678
(916) 773-3664

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

897111

Project Manager: S. BAKER
Phone #: 916-478-1260

Company/Address: PO-Box 922, Nevada City CA
FAX #: 1264

Project Number: 96286
P.O.#:
Project Name: PABLO

Project Location: 4800 SAN PABLO AVE, Emeryville
Sampler Signature: [signature]

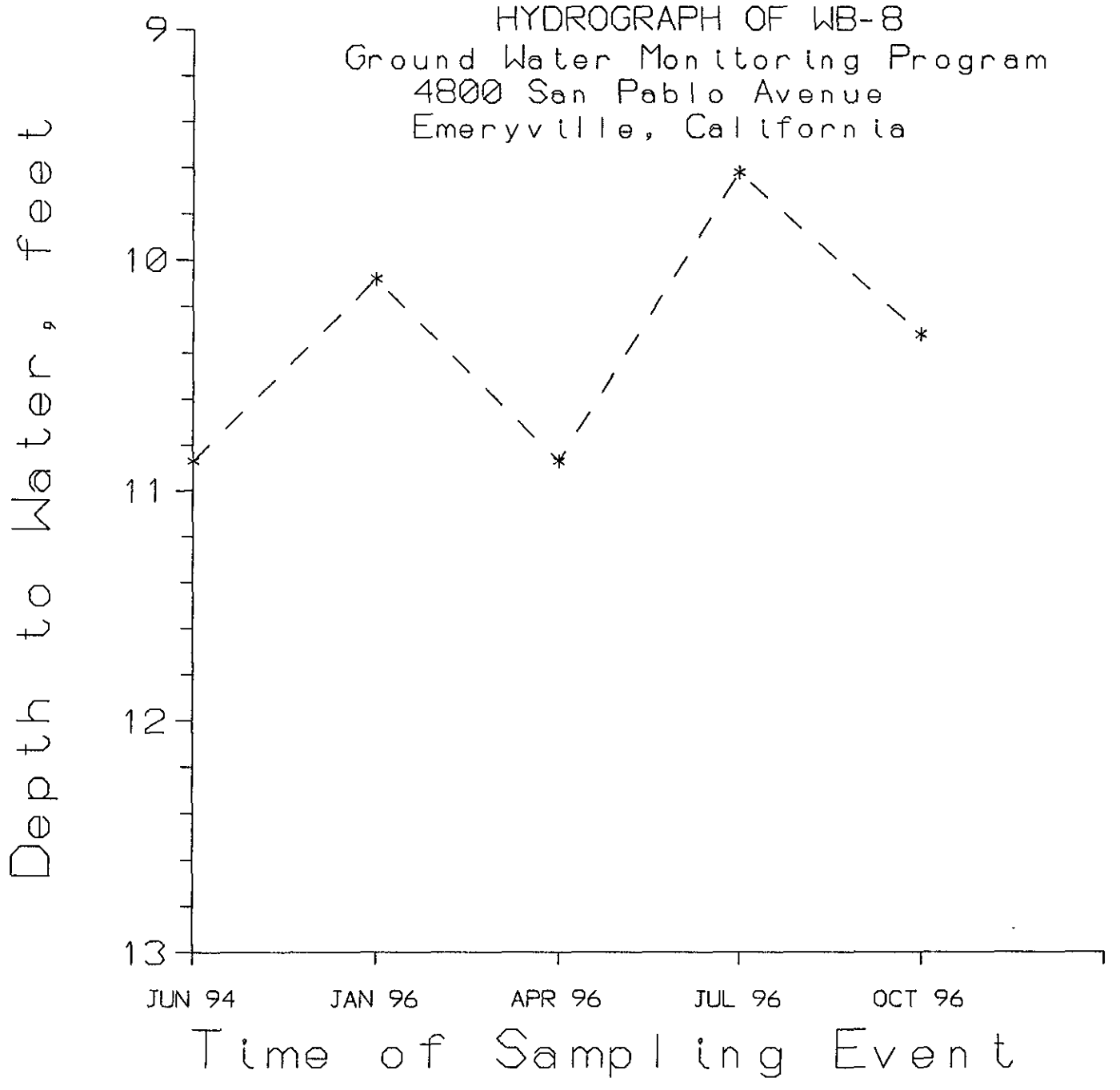
Sample ID	Sampling DATE	Sampling TIME	Container: VOA	SLEEVE	1L GLASS	1L PLASTIC	Summa canister	Method Preserved: HCl	HNO3	ICE	NONE	Matrix: WATER	SOIL	Soil-GAS
SG-15-3	8/21/97						X				X			X
SG-15-6	↓						↓				↓			↓
SG-15-9	↓						↓				↓			↓
SG-16-3	↓						↓				↓			↓
SG-16-6	↓						↓				↓			↓
SG-16-9	↓						↓				↓			↓
SG-17-3	↓						↓				↓			↓
SG-17-5.5	↓						↓				↓			↓

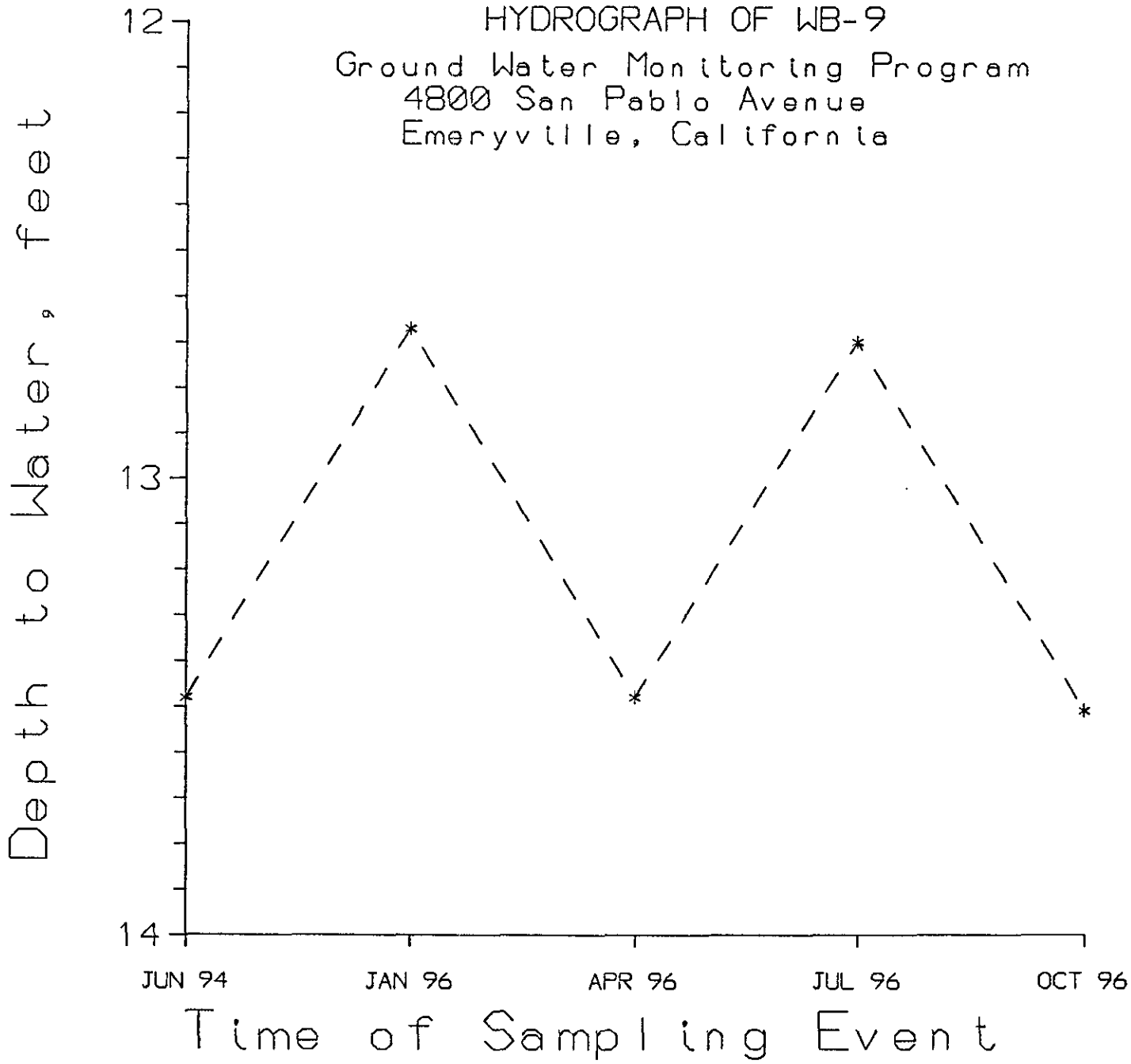
ANALYSIS REQUEST / TAT

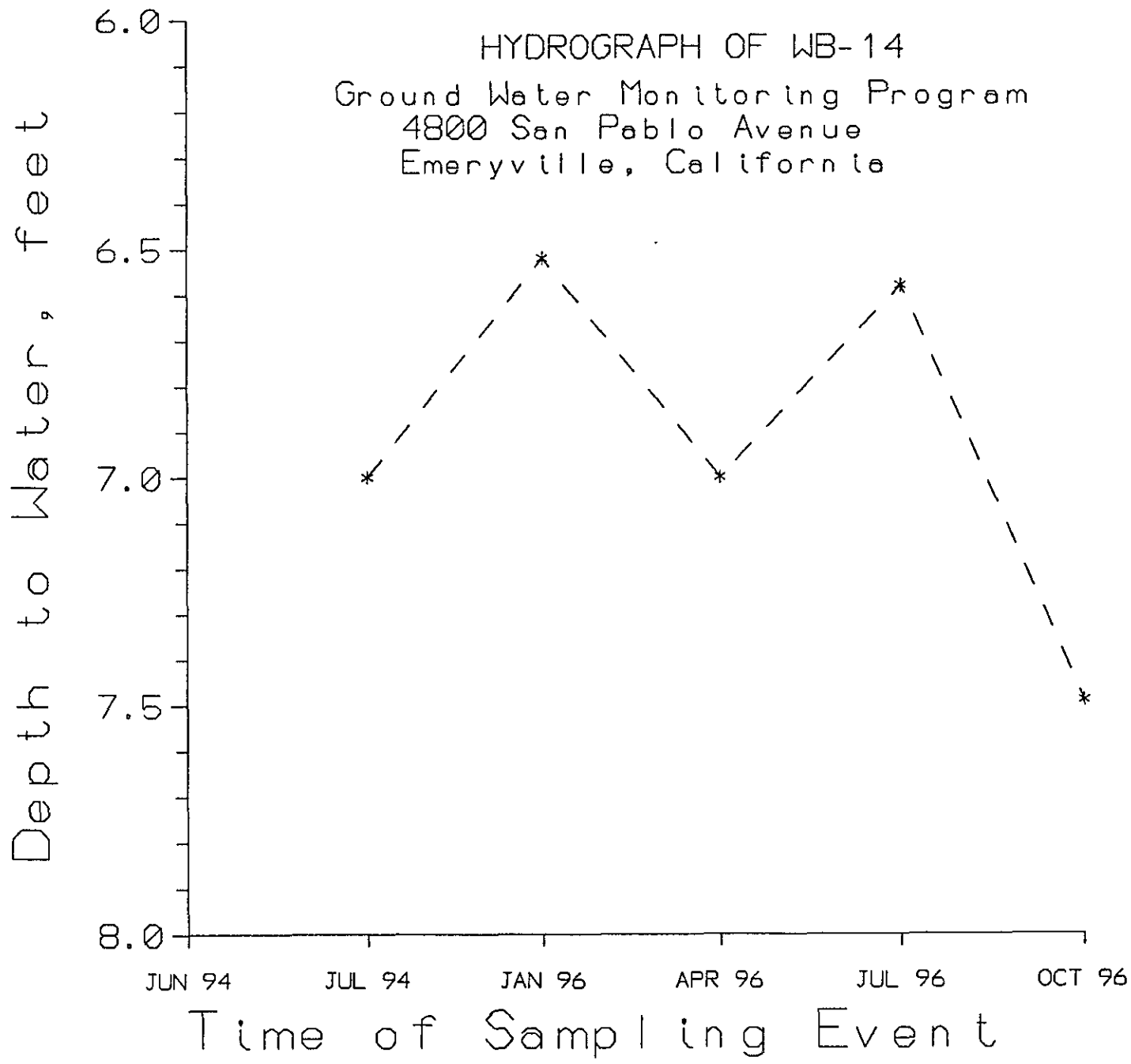
Sample ID	BTEX (602/8020)	BTEX/TPH as Gasoline (602/8020/8015) (TO14)	TPH as Diesel (8015)	TPH as Oil (8015)	Total Oil & Grease (5520 B/E,F)	Total Oil & Grease IR (5520 B/E,F,C)	96 - Hour Fish Bioassay	EPA 601/8010	EPA 602/8020	EPA 615/8150	EPA 608/8080 - Pesticides	EPA 608/8080-PCBs	EPA 624/8240	EPA 625/8270	ORGANIC LEAD	Reactivity, Corrosivity, Ignitibility	CAM - 17 Metals (W.E.T./TOTAL)	EPA - Priority Pollutant Metals	LEAD(7420/7421/239.2)	Cd, Cr, Pb, Zn, Ni	RUSH SERVICE (12 hr) or (24 hr)	EXPEDITED SERVICE (48 hr) or (1 wk)	STANDARD SERVICE (2wk)
SG-15-3		X									A0897505												X
SG-15-6		↓									506												↓
SG-15-9		↓									507												↓
SG-16-3		↓									508												↓
SG-16-6		↓									509												↓
SG-16-9		↓									510												↓
SG-17-3		↓									511												↓
SG-17-5.5		↓									A0897512												↓

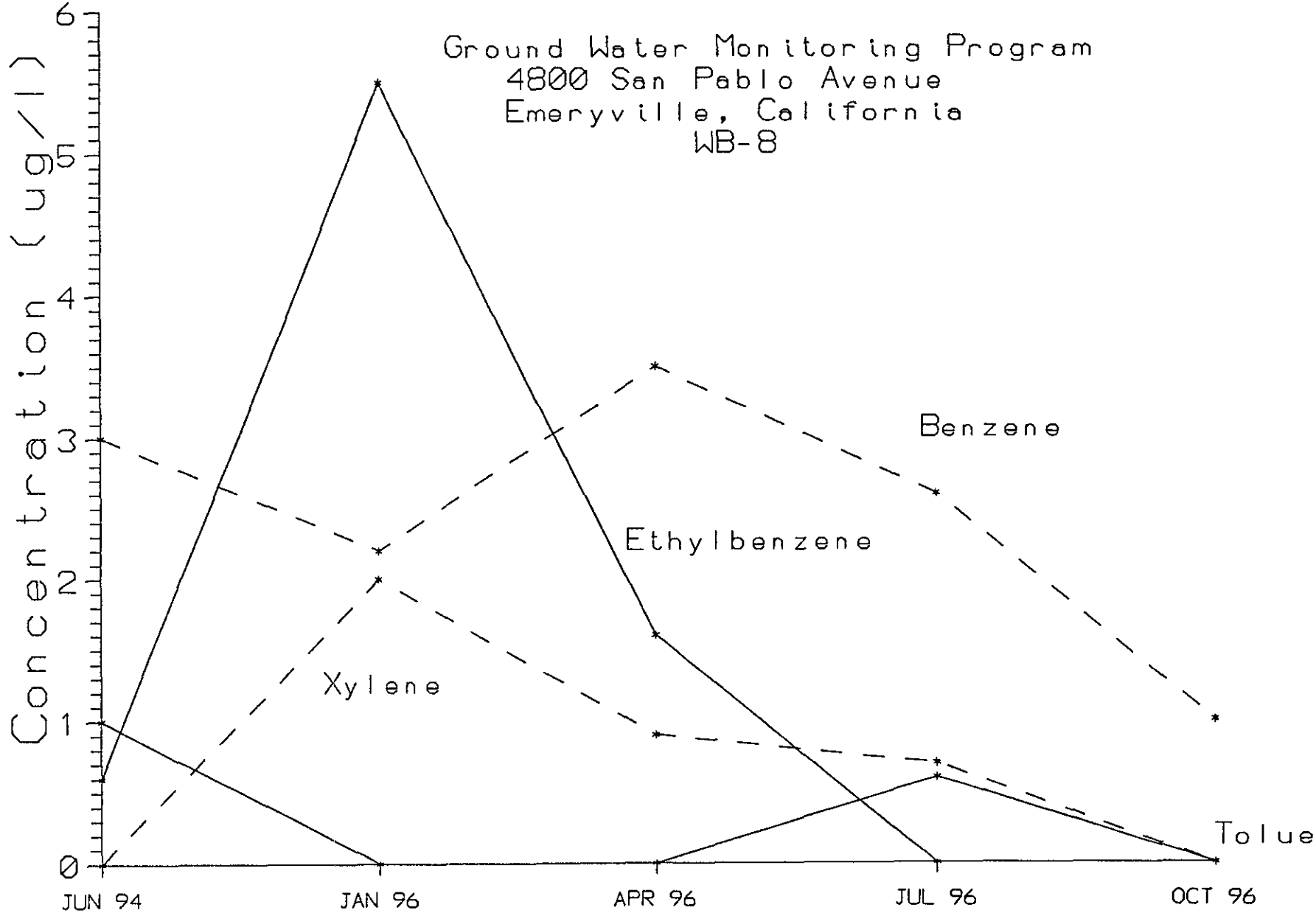
Relinquished by	Date / Time	Received by	
Relinquished by: [signature]	8/21/97 1408	Received by:	Remarks: Please fax results
Relinquished by	Date Time	Received by:	
Relinquished by	8/21/97 14:08	Received by Laboratory: Nandy Reece	Bill To: HSCI

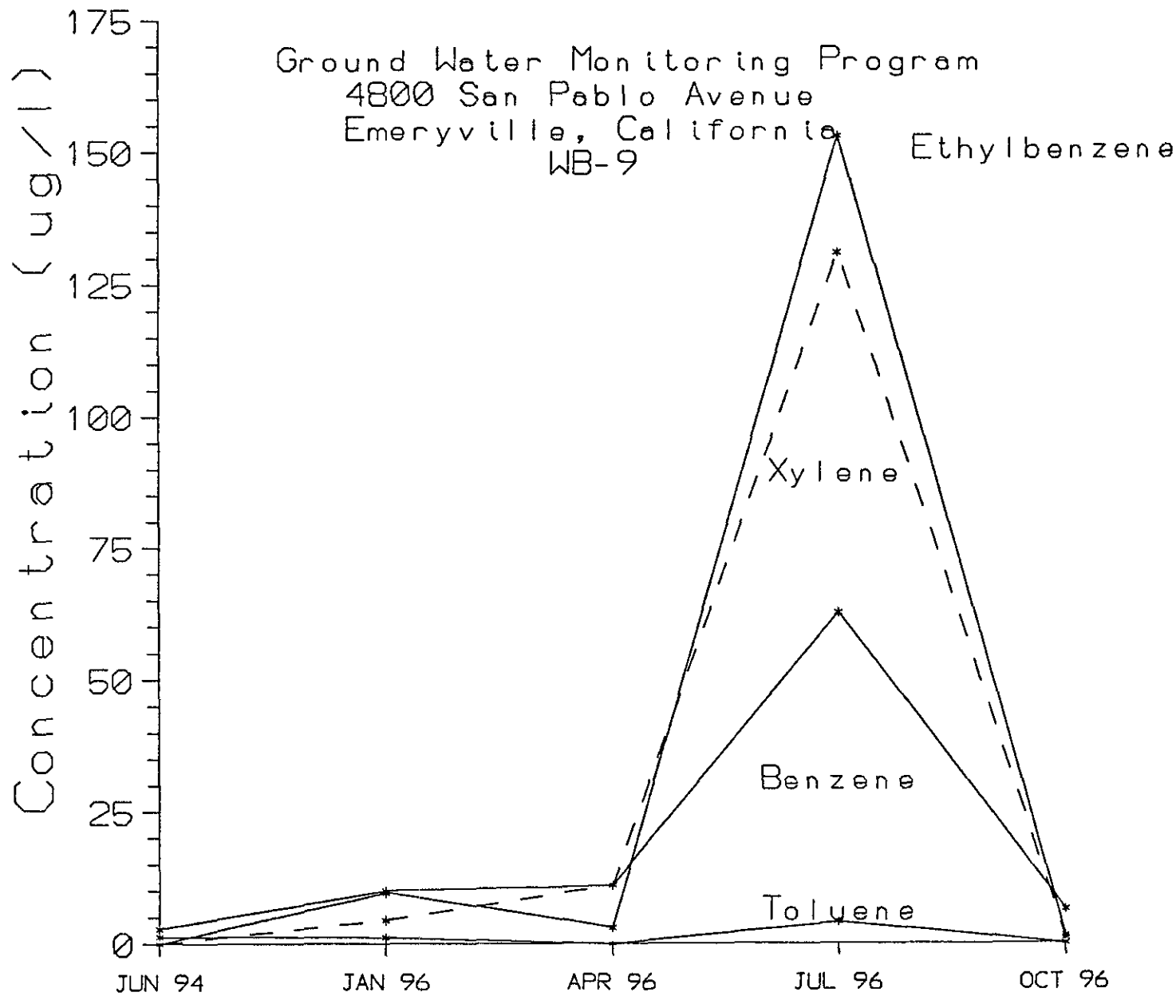
Appendix B. Groundwater Data Graphs

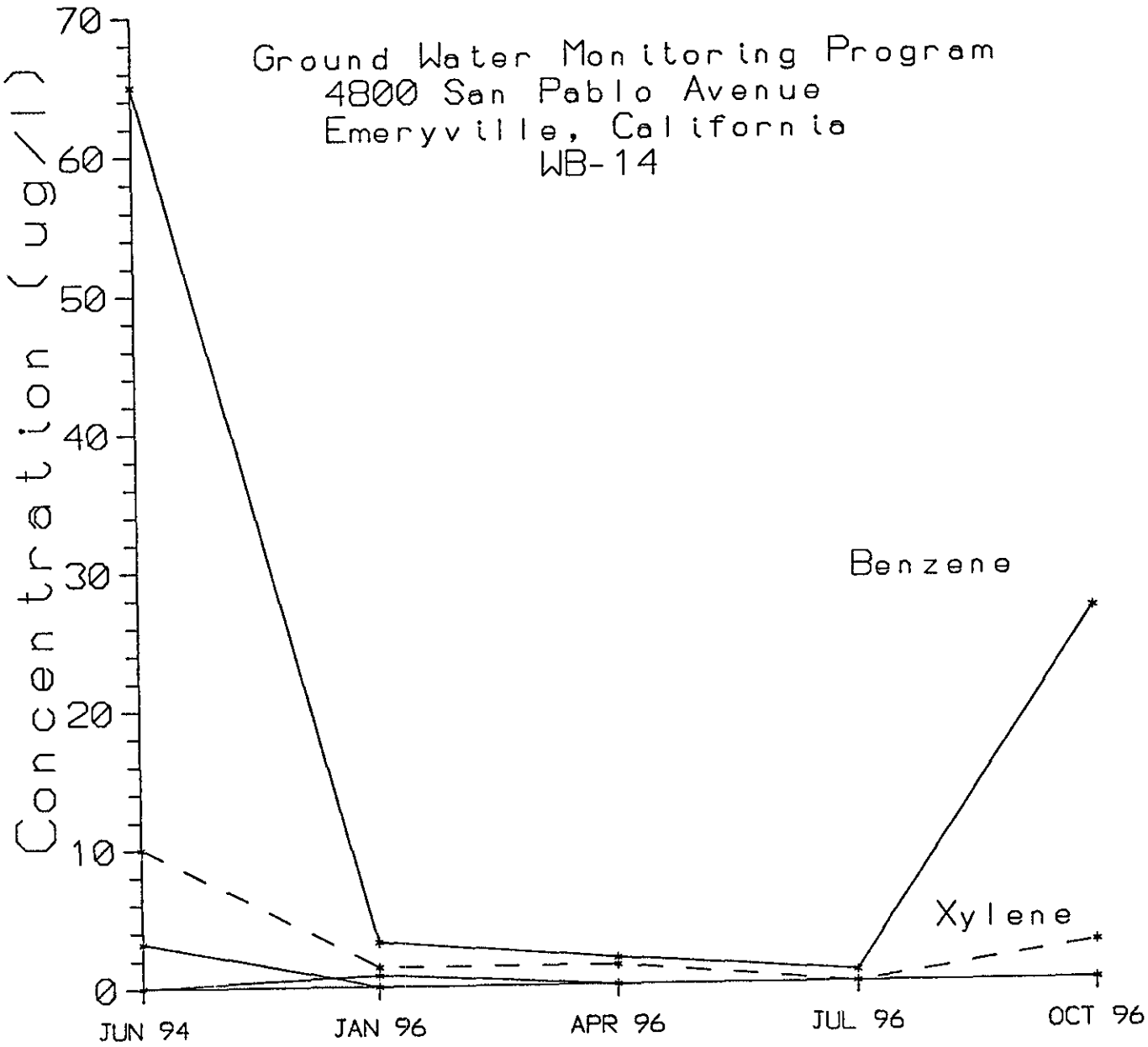

HYDROGRAPH OF WB-8
Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
Depth to Water, feet
9
10
11
12
13
JUN 94
JAN 96
APR 96
JUL 96
OCT 96
Time of Sampling Event


HYDROGRAPH OF WB-9
Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
Depth to Water, feet
12
13
14
JUN 94
JAN 96
APR 96
JUL 96
OCT 96
Time of Sampling Event


HYDROGRAPH OF WB-14
Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
Depth to Water, feet
6.0
6.5
7.0
7.5
8.0
JUN 94
JUL 94
JAN 96
APR 96
JUL 96
OCT 96
Time of Sampling Event


Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
WB-8
Concentration (ug/l)
0
1
2
3
4
5
6
JUN 94
JAN 96
APR 96
JUL 96
OCT 96
Benzene
Ethylbenzene
Xylene
Tolue
Time of Sampling Event


Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
WB-9
Ethylbenzene
Xylene
Benzene
Toluene
Concentration (ug/l)
175
150
125
100
75
50
25
0
JUN 94
JAN 96
APR 96
JUL 96
OCT 96
Time of Sampling Event


Ground Water Monitoring Program
4800 San Pablo Avenue
Emeryville, California
WB-14
Concentration (ug/l)
70
60
50
40
30
20
10
0
Benzene
Xylene
JUN 94
JAN 96
APR 96
JUL 96
OCT 96
Time of Samoling Event

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention:	Mr. Steve Baker	Date Sampled:	10-02-96
	HydroSolutions of CA, Inc.	Date Received:	10-02-96
	P.O. Box 922	BTEX Analyzed:	10-09-96
	Nevada City, CA 95959	TPHg Analyzed:	10-09-96
		Matrix:	Water
Project :	96286		

	Benzene PPB	Toluene PPB	Ethyl-benzene PPB	Total Xylenes PPB	TPHg PPB
Reporting Limit:	0.5	0.5	0.5	0.5	50
SAMPLE Laboratory Identification:					
WB-8 W1096063	1.0	ND	ND	ND	56
WB-9 W1096064	6.4	ND	1.5	1.0	250

ppb= Parts per billion = ug/L = microgramm per liter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are analyzed by using EPA Method 602 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).
TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using modified EPA Method 8015, which utilizes a GC equipped with an FID.

Laboratory Representative

10-14-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention:	Mr. Steve Baker	Date Sampled :	10-02-96
	HydroSolutions of CA, Inc.	Date Received:	10-02-96
	P.O. Box 922	BTEX Analyzed:	10-09-96
	Nevada City, CA 95959	TPHg Analyzed:	10-09-96
		Matrix:	Water
Project :	96286		

	Benzene PPB	Toluene PPB	Ethyl-benzene PPB	Total Xylenes PPB	TPHg PPB
Reporting Limit:	5.0	5.0	5.0	5.0	500
SAMPLE Laboratory Identification:					
WB-14 W1096065	26.8	ND	ND	2.7	415

ppb= Parts per billion = ug/L = micrograms per liter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are analyzed by using EPA Method 602 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID)
TPHg--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using modified EPA Method 8015, which utilizes a GC equipped with an FID.

Laboratory Representative

10-14-96
Date Reported

ANALYSIS REPORT

Attention:	Mr. Steve Baker	Date Sampled:	10-02-96
	HydroSolutions of CA, Inc.	Date Received:	10-02-96
	P.O. Box 922	Date Analyzed:	10-08-96
	Nevada City, CA 95959	Matrix:	Water

Project : 96286

	TPHd
	PPB
Reporting Limit:	50
SAMPLE Laboratory Identification	
WB-8 W1096063	ND
WB-14 W1096065	ND

PPB = Parts per billion = ug/L = micrograms per Liter
ND = Not detected Compound(s) may be present at concentrations below the reporting limit.

ANALYTICAL PROCEDURES

TPHd--Total petroleum hydrocarbons as gasoline (low-to-medium boiling points) are analyzed by using modified EPA Method 8015 which utilizes a GC equipped with an FID

Laboratory Representative

10-14-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

ANALYSIS REPORT

Attention:	Mr. Steve Baker	Date Sampled :	10-02-96
	HydroSolutions of CA, Inc.	Date Received:	10-02-96
	P.O. Box 922	Date Analyzed:	10-08-96
	Nevada City, CA 95959	Matrix:	Water

Project : 96286

	TPHo
	PPB
Reporting Limit:	500
SAMPLE Laboratory Identification	
WB-8 W1096063	ND
WB-14 W1096065	ND

PPB = Parts per billion = ug/L = micrograms per Liter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit

ANALYTICAL PROCEDURES

TPHo–Total petroleum hydrocarbons as oil (high boiling points) are measured by extraction using EPA Method 3510 followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID

Laboratory Representative

10-14-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

QA/QC REPORT

Attention:	Mr. Steve Baker HydroSolutions of CA, Inc. P.O. Box 922 Nevada City, CA 95959	Date Analyzed: Matrix:	10-08-96 Water
Project :	96286		

	TPHd PPB
Reporting Limit:	50
QA/QC PARAMETER	
Matrix Blank	ND
PERCENT RECOVERIES	
Laboratory Control Spike	87%
Laboratory Control Spike Duplicate	77%

ppb = parts per billion = ug/L = microgram per liter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

Spikes & Spike Duplicates were each spiked with 5000 ug of diesel standard.

ANALYTICAL PROCEDURES

TPHd--Total petroleum hydrocarbons as diesel (high boiling points) are measured by extraction using EPA Method 3510, followed by modified EPA Method 8015 with direct sample injection into a GC equipped with an FID

Laboratory Representative

10-14-96
Date Reported

EXCELCHEM
ENVIRONMENTAL LABS

500 Giuseppe Court, Suite 9
Roseville, CA 95678
Phone#: (916) 773-3664 Fax#: (916) 773-4784

QA/QC REPORT

Attention: Mr. Steve Baker
HydroSolutions of CA, Inc.
P.O. Box 922
Nevada City, CA 95959

Date Analyzed: 10-09-96
Matrix: Water

Project : 96286

	Benzene PPB	Toluene PPB	Ethyl-benzene PPB	Total Xylenes PPB
Reporting Limit:	0.5	0.5	0.5	0.5
QA/QC PARAMETER				
Matrix Blank	ND	ND	ND	ND
PERCENT RECOVERIES				
Matrix Spike	100%	99%	97%	98%
Matrix Spike Duplicate	93%	92%	91%	92%

ppb = parts per billion = ug/L = microgram per liter
ND = Not detected. Compound(s) may be present at concentrations below the reporting limit.

All surrogate recoveries were within 30% of target values.
Spikes & Spike Duplicates were each spiked with 250 ng BTEX standard.

ANALYTICAL PROCEDURES

BTEX-- Benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction using EPA Method 5030 followed by analysis using EPA Method 602 which utilizes a gas chromatograph (GC) equipped with a photoionization detector (PID).

Laboratory Representative

10-14-96
Date Reported

Phone - 478-1260

Chain of Custody Record

HydroSolutions Of California, Inc.

PROJECT NO.: 96286

SAMPLERS: (Signature) S. Baker

DATE	TIME	SAMPLE NUMBER		ANALYSES: General Minerals	Priority Pollutant Metals	EPA Method 625	EPA Method 515	EPA Method 608	TPH-G	BTEX	TPH-D (Silica Gel)		NUMBER OF CONTAINERS	REMARKS (Sample preservation, handling procedures, etc.)
12/29		WS-8	W1096063						X	X	X		3	(2) 40 ml VOAs
		WS-9	064						X	X			2	(1) 1 l amber
		WS-14	W1096065						X	X	X		3	

Standard turnaround

Faxed results to 916-478-1264

TOTAL NUMBER OF CONTAINERS: 8

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
	12/29/94	Joseph Bella 12/30/94 5:2			

METHOD OF SHIPMENT:	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME

Appendix C. RBCA Evaluation Forms

PERCHED GROUNDWATER

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: 4800 SAN PABLO AVENUE Job Identification: 95286
Site Location: EMERYVILLE, CALIFORNIA Date Completed: 10/10/97
Completed By: Steve Baker

Software: GSI RBCA Spreadsheet
Version: v 1.0

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined

DEFAULT PARAMETERS

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (l/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing rate (mg*yr/kg*d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m^3/day)	15			20	
IRa.out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5 8E+03		2 0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2*yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	FALSE	
GW.v	Volatilization to Outdoor Air	TRUE	FALSE	
GW.b	Vapor Intrusion to Buildings	TRUE	FALSE	
Soil Pathways				
S.v	Volatiles from Subsurface Soils	TRUE	FALSE	
SS.v	Volatiles and Particulate Inhalation	FALSE	FALSE	FALSE
SS.d	Direct Ingestion and Dermal Contact	FALSE	FALSE	FALSE
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	
S.b	Intrusion to Buildings - Subsurface Soils	TRUE	FALSE	

Matrix of Receptor Distance and Location on- or off-site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		FALSE		FALSE
S	Inhalation receptor (cm)		TRUE		FALSE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Commercial/Industrial Chronic	Commercial/Industrial Construction
t	Exposure duration (yr)	30	25	1
A	Contaminated soil area (cm^2)	***2.9E+05***		1.0E+06
W	Length of affected soil parallel to wind (cm)	1.5E+03		1.0E+03
W gw	Length of affected soil parallel to groundwater (c	1.5E+03		
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02		
delta	Air mixing zone height (cm)	2.0E+02		
Lss	Definition of surficial soils (cm)	1.0E+02		
Pe	Particulate areal emission rate (g/cm^2/s)	2.2E-10		

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3 0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater Transport velocity (cm/yr)	6 6E+03
Ks	Saturated Hydraulic Conductivity(cm/s)	
grad	Groundwater Gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
BC	Biodegradation Capacity (mg/L)	
BIO?	Is Bioattenuation Considered	FALSE
phi eff	Effective Porosity in Water-Bearing Unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03

Soil	Definition (Units)	Value	capillary	vadose	foundation
hc	Capillary zone thickness (cm)	***3.0E+01***			
hv	Vadose zone thickness (cm)	***2.0E+02***			
rho	Soil density (g/cm^3)	1.7			
foc	Fraction of organic carbon in vadose zone	0 01			
phi	Soil porosity in vadose zone	0 38			
Lgw	Depth to groundwater (cm)	***2.3E+02***			
Ls	Depth to top of affected soil (cm)	***2.3E+02***			
Lsubs	Thickness of affected subsurface soils (cm)	***1.5E+01***			
pH	Soil/groundwater pH	6.5			
phi.w	Volumetric water content		0.342	0.12	0.12
phi.a	Volumetric air content		0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	***1.0E+00***	
eta	Foundation crack fraction	0.01	

Dispersive Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersion coefficient (cm)		
ay	Transverse dispersion coefficient (cm)		
az	Vertical dispersion coefficient (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

PERCHED GROUNDWATER

RBCA SITE ASSESSMENT | Tier 2 Worksheet 9.3

Site Name: 4800 SAN PABLO AVENUE
Site Location: EMERYVILLE, CALIFORNIA

Completed By: Steve Baker
Date Completed: 10/10/1997

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration		Groundwater Ingestion			X	Groundwater Volatilization to Indoor Air		X	Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)	Residential: (on-site)	Commercial (on-site)	Regulatory(MCL): (on-site)		Residential: (on-site)	Commercial: (on-site)		Residential (on-site)	Commercial (on-site)	(mg/L	"■" If yes	Only if "yes" left
71-43-2	Benzene	2.7E-2	NA	NA	NA		7.2E-2	NA		5.7E+1	NA	7.2E-2	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: 0

PERCHED GROUNDWATER

RBCA SITE ASSESSMENT — Tier 2 Worksheet 9.2

Site Name: 4800 SAN PABLO AVENUE
Site Location: EMERYVILLE, CALIFORNIA

Completed By: Steve Baker
Date Completed: 10/10/1997

SUBSURFACE SOIL SSTL VALUES (> 3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration		Soil Leaching to Groundwater			X	Soil Volatilization to Indoor Air		X	Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL) (on-site)		Residential: (on-site)	Commercial (on-site)		Residential: (on-site)	Commercial. (on-site)	(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	6.3E-2	NA	NA	NA		4.0E-1	NA		3 2E+2	NA	4.0E-1	☐	<1

Software: GSI RBCA Spreadsheet Serial: 0
Version: v 1.0

SHALLOW GROUND WATER

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: 4800 SAN PABLO AVENUE Job Identification: 95286
Site Location: EMERYVILLE, CALIFORNIA Date Completed: 10/10/97
Completed By: Steve Baker

Software: GSI RBCA Spreadsheet
Version: v 1 0

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined

DEFAULT PARAMETERS

Exposure Parameter	Definition (Units)	Residential Adult	Residential (1-6yrs)	Residential (1-16 yrs)	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (l/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m^3/day)	15			*20*	
IRa out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5 8E+03		2 0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2-yr/kg)	2 1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	*Use EPA tox data for air (or PEL based)*	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial Chronic	Commercial/Industrial Constrctn
Groundwater Pathways:				
GW.I	Groundwater Ingestion	FALSE	FALSE	
GW.v	Volatilization to Outdoor Air	TRUE	FALSE	
GW.b	Vapor Intrusion to Buildings	TRUE	FALSE	
Soil Pathways				
S.v	Volatiles from Subsurface Soils	TRUE	FALSE	
SS.v	Volatiles and Particulate Inhalation	FALSE	FALSE	FALSE
SS.d	Direct Ingestion and Dermal Contact	FALSE	FALSE	FALSE
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	
S.b	Intrusion to Buildings - Subsurface Soils	TRUE	FALSE	

Matrix of Receptor Distance and Location on- or off-site		Residential Distance	Residential On-Site	Commercial/Industrial Distance	Commercial/Industrial On-Site
GW	Groundwater receptor (cm)		FALSE		FALSE
S	Inhalation receptor (cm)		TRUE		FALSE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1 0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Commercial/Industrial Chronic	Commercial/Industrial Construction
t	Exposure duration (yr)	30	25	1
A	Contaminated soil area (cm^2)	***9 9E+05***		1.0E+08
W	Length of affected soil parallel to wind (cm)	1.5E+03		1.0E+03
W.gw	Length of affected soil parallel to groundwater (c	1.5E+03		
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02		
delta	Air mixing zone height (cm)	2.0E+02		
Lss	Definition of surficial soils (cm)	1.0E+02		
Pe	Particulate areal emission rate (g/cm^2/s)	2.2E-10		

Groundwater	*Definition (Units)*	Value
delta gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3 0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw tr	Groundwater Transport velocity (cm/yr)	6.6E+03
Ks	Saturated Hydraulic Conductivity(cm/s)	
grad	Groundwater Gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
BC	Biodegradation Capacity (mg/L)	
BIO?	Is Bioattenuation Considered	FALSE
phi.eff	Effective Porosity in Water-Bearing Unit	3.8E-01
foc sat	Fraction organic carbon in water-bearing unit	1.0E-03

Soil	Definition (Units)	Value	capillary	vadose	foundation
hc	Capillary zone thickness (cm)	***9.1E+01***			
hv	Vadose zone thickness (cm)	***5.2E+02***			
rho	Soil density (g/cm^3)	1.7			
foc	Fraction of organic carbon in vadose zone	0.01			
phi	Soil porosity in vadose zone	0.38			
Lgw	Depth to groundwater (cm)	***6.1E+02***			
Ls	Depth to top of affected soil (cm)	***2.4E+02***			
Lsubs	*Thickness of affected subsurface soils (cm)*	***2.1E+02***			
pH	Soil/groundwater pH	6.5			
phi.w	Volumetric water content		0.342	0 12	0.12
phi.a	Volumetric air content		0.038	0 26	0 26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	***1.0E+00***	
eta	Foundation crack fraction	0.01	

Dispersive Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersion coefficient (cm)		
ay	Transverse dispersion coefficient (cm)		
az	Vertical dispersion coefficient (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

SHALLOW GROUNDWATER

RBCA SITE ASSESSMENT — Tier 2 Worksheet 9.3

Site Name: 4800 SAN PABLO AVENUE
Site Location: EMERYVILLE, CALIFORNIA
Completed By: Steve Baker
Date Completed: 10/10/1997

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration		Groundwater Ingestion			X	Groundwater Volatilization to Indoor Air		X	Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)	Residential (on-site)	Commercial (on-site)	Regulatory(MCL) (on-site)		Residential (on-site)	Commercial (on-site)		Residential (on-site)	Commercial (on-site)	(mg/L	"■" If yes	Only if "yes" left
71-43-2	Benzene	3.4E-3	NA	NA	NA		2.1E-1	NA		1.7E+2	NA	2.1E-1	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: 0

SHALLOW GROUND WATER

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 9.2**

Site Name: 4800 SAN PABLO AVENUE
Site Location: EMERYVILLE, CALIFORNIA

Completed By: Steve Baker
Date Completed: 10/10/1997

SUBSURFACE SOIL SSTL VALUES (> 3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ *MCL exposure limit?*
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration		Soil Leaching to Groundwater			X	Soil Volatilization to Indoor Air		X	Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL) (on-site)		Residential: (on-site)	Commercial. (on-site)		Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" if yes	Only if "yes" left
71-43-2	Benzene	2.2E-1	NA	NA	NA		2.9E-2	NA		2.3E+1	NA	2.9E-2	■	8.0E+00

Software: GSI RBCA Spreadsheet Serial: 0
Version: v 1.0