TERRA VAC

FINAL REMEDIATION REPORT AND REQUEST FOR NO FURTHER ACTIVE REMEDIATION FORMER CHEVRON STATION 9-4587 609 OAK STREET OAKLAND, CALIFORNIA

PROJECT 30-0219

FINAL REMEDIATION REPORT AND REQUEST FOR NO FURTHER ACTIVE REMEDIATION FORMER CHEVRON STATION 3-4587 609 OAK STREET OAKLAND, CALIFORNIA

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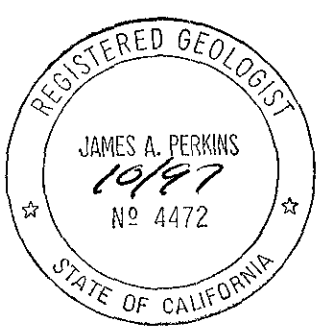

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FINAL REMEDIATION STATUS REPORT AND REQUEST FOR NO FURTHER ACTIVE REMEDIATION FORMER CHEVRON STATION 9-4587 609 OAK STREET OAKLAND, CALIFORNIA

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1.0 INTRODUCTION

At the request of Chevron Products Company (Chevron), Terra Vac Corporation (Terra Vac) is engaged in active remediation of the subject site. The Alameda County Health Care Services required that this work be performed in order to mitigate the impact of fuel hydrocarbons released during operation of a retail service station. The purpose of this report is to present the results of remediation work completed to date, and to request that no further active remediation be required at the site.

This report presents background information on environmental work completed at the site. A review of pre-remediation assessment data is made in order to define site specific environmental problems encountered. Next, implementation of active remediation and an evaluation of its effectiveness is discussed. Finally, current site conditions are evaluated on the basis of associated environmental and human health risks. The conclusion of this report is that no further active remediation is warranted. Additionally, a plan for managing future work at the site is presented.

2.0 BACKGROUND

The following background section provides a summary of work completed at the site. The summary is based on a review of documents provided to Terra Vac by Chevron which include copies of reports prepared by other consultants and previously submitted to ACHCS. The intent is to develop a timeline of site activities and to list sources of data pertinent to this report. In general, data used in this report is condensed from these sources and is not re-tabulated or appended.

The site is located at 609 Oak Street, Oakland, at the corner of 6th Street and Oak (Figure 1, Site location). San Francisco Bay is approximately one mile west and Lake Merritt is about 1/2 mile northeast of the site. The area is underlain by unconsolidated, Pleistocene-age silty and clayey sand of the Merritt Formation and at depth by the Alameda Formation. It was operated as a gasoline service station prior to the removal of underground storage tanks in 1994 (see Figure 2, Site Plan).

In April of 1982, IT Enviroscience installed, surveyed and measure groundwater elevations at two groundwater monitoring wells located adjacent to the tank pit. The wells were drilled in response to the discovery of a leak in one of the fiberglass tanks. Other than the notation of a gasoline odor at 7 feet below grade in one boring, the report states no evidence of gasoline impact during drilling or monitoring five days later in April nor again in May. Water levels ranged from 10.75 feet above mean sea level (MSL) to 9.82 feet MSL. (IT Enviroscience, *"Progress Report #1, Gasoline Leakage, Chevron Service Station #4587..."*, May 25, 1982)

In July of 1983, Gettler-Ryan installed three observation wells. Well C-1 is noted to have 1/16 inch of floating hydrocarbons on July 19, 1983. (Gettler-Ryan, Inc., transmittal of plot plan, boring logs, well survey, well section to Mr. W. R. Smith at Chevron U.S.A., July 19, 1983)

In April of 1987, after a product line leak was repaired, soil samples taken from 7 feet below product lines indicated 1,300 ppm TPH-gasoline and 150 mg/kg benzene. (Blaine Tech Services, *"Field Sampling at Chevron #4587"*, March 30, 1987)

In December of 1989, a quarterly monitoring and sampling program began. The initial sampling event indicated free product in C-1, 16,000 ppb TPH in C-2 and concentrations below detection limits in C-3.

In September and October of 1990, Geo-Strategies, Inc., installed three offsite, downgradient groundwater wells (C-4, C-5, C6) and one recovery well (CR-1)(see Figure 3, Extended Site Plan). The 15 foot sample in CR-1 indicated a low concentration of benzene, while all other samples were nondetectable for TPH-gas and benzene. Groundwater samples collected in October, 1990, reported concentrations ranging from 410 ppb to 31,000 ppb TPH-gasoline, with ND for TPH reported in the three new, offsite wells. C-5 did indicate 0.8 ppb benzene, while the other offsite wells were ND.(Geostrategies Inc., "Well Installation Report..., Report 7191-4, November 30, 1990)

In September 22, 1992, Geraughty & Miller, Inc., submits a groundwater remediation work plan, outlining installation and operation of a groundwater extraction and treatment system.

From December 1993 to January 1995, Gerraughty & Miller install and operate a groundwater extraction and treatment system, treating 460,000 gallons of water over the time period. Initial influent water concentrations were reported at 110,000 ppb TPH-gasoline, with concentrations of 9,900 ppb at the end of operations. (Gerraughty & Miller, System Startup Report and Quarterly Compliance Reports, December 1993 to January, 1995)

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In October of 1994,Touchstone Developments performed a tank removal and excavation. The report notes that three tanks were removed, that no holes were found, and a sheen was noted on water in the pit. Product line piping and dispensers were removed and a total of 300 cubic yards of soil was excavated, aerated and transported to a landfill. Soil samples taken from the sidewall of the tank excavation at 9-11 feet bgs, ranged from 2 to 3,700 ppm TPH-gasoline, and from ND to 1,400 ppm TPH-gasoline beneath the dispensers.(Touchstone Developments, *"Tank Removal and Excavation Report, Chevron Service Station Number 9-4587..."*, November 18, 1994)

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In July, 1995, Terra Vac Corporation installs wells for the dual vacuum extraction system, as per the remediation work plan submitted in April. The drilling report dated August 30, 1995, indicates only one soil sample with TPH-g and benzene above cleanup goals.

From September, 1995 to January, 1996, Terra Vac operates a dual vacuum extraction and sparging system at the site. Initial hydrocarbon extraction rates up to 200 pounds per day and

declined to two pounds per day at the end of DVE operations. Air sparging continues after January.(As per monthly reports)

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In December, 1995, Terra Vac drills interim remediation borings. A February 28, 1996, interim boring installation report indicates that all samples from boring SP-7 meet cleanup criteria, except for one from the saturated zone at 14. 3 feet containing 1.2 ppm benzene (vs 1.0 ppm goal).

3.0 EVALUATION OF PRE-REMEDIATION ASSESSMENT DATA

The following section develops an overall picture of site conditions prior to the start of remediation work. This defines the nature of the problem confronted at the site, develops a framework for understanding how the remedial action was implemented, and provides a basis for evaluating remedial effectiveness.

3.1 Lithology

Based on exploratory borings and well installations onsite, site lithology is characterized by interbedded silt, sand and clayey sand. Generally, a silt layer exists from just below surface to 5 to 10 feet below grade, overlaying a sand zone and then alternating between clayey sand and sand. Materials in this layer represent the extreme ends of fate and transport characteristics for each soil type. Silts have a very low permeability and a good ability to absorb hydrocarbon mass. Sands generally have a much higher permeability and a much lower absorption capacity.

Groundwater is currently encountered at a depth of approximately 8 feet bgs. Since 1990, groundwater elevations beneath the site have varied from about 4 feet MSL to 9 feet (12.5' dtw to 7.5' dtw). Average depth to water at wells C-2 and CR-1 since June of 1995 has been 8.6 feet bgs. For the purpose of this report, soils encountered above 8.5 feet bgs are considered to be unsaturated vadose zone soils, soils encountered below 8.5 feet bgs are considered to be located within the waterbearing zone. A capillary fringe of nominal thickness is assumed to be present at the interface of the vadose and saturated zones.

3.2 Distribution of Hydrocarbons

3.2.1 Point of Release

Because the groundwater level is from 8 to 12 feet depth bgs, any leak from the USTs directly impacted the water table. Most vadose zone soils are not directly impacted, but product will spread on the water surface, be carried with the gradient and smeared with the fluctuations of the water table. The tanks had been repaired for leaks in 1982 and some leakage had occurred in 1985 due to a loose fitting. The primary evidence that a leak had occurred was the intrusion of water into the tanks. Sidewall samples at 9-11 feet bgs taken during tank removal in 1994, indicated up to 3,700 ppm TPH-gasoline and confirm a leak into the pit had occurred. There is some indication another leak had occurred at the dispenser island but the installation of wells DVSP-5 and DVE-3 did not show indications of significant hydrocarbons in the vadose zone, leading to the conclusion that the leak was minor and did not significantly affect the site.

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3.2.2 Horizontal Distribution in Soil

Of the borings and monitoring wells installed, the only vadose zone samples submitted were those at about 5 foot depth from wells CR-1, DVSP-4, and DVSP-7, all of which were below detection limits for both benzene and TPH-gasoline. Well logs do not show any indication of significant hydrocarbon impact between ground surface and approximately 10 feet bgs, via PID field screening at any boring. Consequently, prior to remediation activities, it appears that the area at and around the dispenser island is the only area that showed significant hydrocarbon impact in the vadose zone.

The horizontal extent of impacted soils is modeled conservatively as a rectangular area 45 feet by 45 feet in dimension around the dispenser island (Figure 4, Horizontal Distribution of Hydrocarbons in Soil). The highest concentrations of fuel hydrocarbons was observed in a soil sample collected from 2.5 feet below the western end of the southern island. Any impacted soil above this depth was excavated and removed. Six samples were collected and concentrations ranged from ND to 1,400 ppm TPHg, and up to 5 ppm benzene. The average concentration is approximately 400 ppm TPH at this depth. A composite sample taken 7 feet below the dispenser in 1987 indicated 1,300 ppm TPH-g. Assuming an average of 1,000 ppm over the area, a conservative total of 1,300 pounds hydrocarbons can be modeled for the vadose zone in this area.

3.2.3 Vertical Distribution in Soil

As noted in the previous section, the only area to have confirmed hydrocarbon impact in the vadose zone is the area at the dispenser islands. Wells DVSP-5 and DVE-3, on each side of the islands, both indicated less than a 25 ppm PID reading at 5 feet bgs when drilled. These wells can reasonably be used as the outer boundary of a rectangle 45 x 45 feet for horizontal definition with a conservative vertical definition of the entire vadose zone of that area (2.5 feet to 8.5 feet bgs). The installation of these wells was precisely to target this area.

For an idealized site having uniform lithology and a stable water table, free phase hydrocarbons released into shallow soils will migrate vertically through the vadose zone until they reach the saturated zone. The hydrocarbons will collect at the capillary fringe and migration becomes controlled by diffusion into the saturated zone. The majority of hydrocarbon mass at a site like this is found below the capillary fringe due to direct release on the water and with nominal amounts present in the saturated zone.

Groundwater elevations during 1991-1992 were two to three feet lower than currently, and may have been even lower in previous years, especially during periods of drought. Elevated concentrations of hydrocarbons, and free product, have been observed in groundwater samples collected from recovery well CR-1. However, soil samples collected during drilling of the well, at depths of approximately 5, 10 and 15 feet bgs were not significantly impacted (<1 mg/kg TPH). The absence of significant amounts of hydrocarbons in soils at this depth indicate that the current capillary fringe is not the major source of hydrocarbons in groundwater. It is possible that soils located within what is now the upper part of the saturated zone were exposed to free phase hydrocarbons during a period of lowered

groundwater elevations. These soils would have been subsumed by rising groundwater and are likely to be the most significant source of hydrocarbons in the saturated zone.

3.2.4 Hydrocarbon Mass in Soil

Modeling of assessment data indicates that approximately 1,300 pounds of gasoline hydrocarbons (TPH) were present in vadose zone soils prior to the start of remediation. Impacted soil volume is based on the extent of impact modeled in the previous two sections. Assuming a bulk soil density of 106 pound per cubic foot, the 45 by 45 by 6 foot volume of impact contains 1,300,000 pounds of soil. This is a conservative estimate, utilizing a 1000 ppm average for the entire volume.

The presence of hydrocarbons in saturated soil is evident in groundwater quality data. Dissolved phase concentrations are a function of the concentration of hydrocarbons sorbed to saturated soils. Soil samples taken from the saturated zone show TPHg concentrations above 10 ppm only at DVSP-5 and DVSP-6. Averaging the concentrations found in the soil at 9 to 14 feet bgs at DVSP-5, DVSP-2, DVE-1, SP-6, and SP-7 gives a value of 1,673 ppm. Over an area of 120 x 45 feet and a thickness of 5 feet, this would give a total mass of 4,800 pounds of hydrocarbons at and below the capillary fringe. Samples taken in the saturated zone are generally not used in this manner because results are always suspect due to carryover of contaminated water, likely to give falsely high readings.

3.3 Groundwater Flow Direction and Distribution in Groundwater

Following the installation of offsite monitoring wells C-4, C-5 and C-6 in September of 1990, a groundwater monitoring event was conducted in October of 1990. Groundwater flow was found to be to the south-southeast, at an approximate gradient of 0.006. At that time it was noted that separate phase product was found in C-1, while C-2 contained 28000 ppb TPH-gas and C-3 had 410 ppb TPH-g. Monitoring well C-3 is located in an upgradient position and had probably been effected by a less significant leak from the pump island rather than the main release at the tanks. This well has not shown any further evidence of groundwater impact since 1991. In 1992, prior to any remediation activities, free product was present in C-1 and CR-1, with C-2 showing several thousand ppb benzene and offsite wells at or near detection limits (Figure 5, Pre-remediation Benzene Concentrations in Groundwater). With the installation and operation of a groundwater treatment system in 1992, gradient was effected so that local flow was toward recovery well CR-1. Operation of the dual vacuum extraction system after that continued to eliminate a normal gradient. Recent groundwater data shows TPHg and benzene concentrations in well C-1 were 790 and 22 ppb, respectively, while TPHg and benzene were non-detectable in well C-2 (Figure 6, December 19, 1995, Benzene Concentrations in Groundwater).

The horizontal extent of on-site groundwater impact is modeled as a 60 foot by 75 foot rectangle, emanating from the former tank pit (see Figure 4). The mixing zone of hydrocarbons within the saturated zone is assumed to be 6.5 feet in thickness. This is based on the fact that hydrocarbons may be present in the saturated zone as a result of direct exposure to free phase hydrocarbon during periods of depressed groundwater elevations. The modeled average groundwater concentrations within the extent of on-site groundwater impact were 31,000 ppb TPHg and 530 ppb benzene. These concentrations represent the 90th percent upper confidence limit on the average concentration of 10

samples collected from wells C-1, C-2 and CR-1 during third and fourth quarter 1995 and first and second quarter 1996.

4.0 ACTIVE REMEDIATION

This section describes active remediation work completed at the site. The goal of active remediation was to remove the bulk of hydrocarbon mass from beneath the site in a timely and economic manner. A period of passive bioremediation, effected by naturally occurring processes, will be required to completely restore soil and groundwater quality.

4.1 Remediation Work Plan

A remediation work plan was developed to outline steps that would be taken to implement active remediation at the site. The work plan proposed the use of dual vapor extraction (DVE) as the active remediation technology. DVE is a technology proven to be effective in removing hydrocarbons from vadose zone soils, while also removing groundwater and exposing the capillary fringe to vapor extraction.. Clean-up goals for vadose zone soils were established. The effectiveness of active remediation was to be evaluated using DVE operational data and documented by samples collected from confirmatory soil borings. The work plan predicated that concentrations of hydrocarbons in groundwater would be reduced through naturally occurring processes following the completion of active remediation. The work plan established that "No Further Active Remediation" status, based on Category II Non-Attainment Zone criteria, could be obtained following the submittal of a Management Plan for Residual Hydrocarbons (MPRH). The MPRH was to include a plan for on-going monitoring of the dissolved phase plume and an evaluation of human health risks associated with long term passive bioremediation of the plume.

The work plan was submitted to Alameda County Health Care Services for review in April 1995. Negotiation of specific details of the work plan was completed through verbal and written correspondence in July, 1995. ACHCS ultimately agreed with the concepts of the work plan and approved the start of work at the site.

4.1.1 Goals for Vadose Zone Soil

The work plan established goals for vadose zone soil clean-up, utilizing DVE. A reduction in vadose zone soil concentrations, and removal of free product, was to be accomplished through the operation of the DVE system. A reduction in concentration is required to insure that residual hydrocarbons will not leach out of the vadose zone and act as a continuing source of groundwater impact. The primary goals for soil boring samples were set at 100 ppm TPHg and 1 ppm benzene. A secondary method of validating the effectiveness of the DVE system was based on the system operational data. The rate at which hydrocarbons are removed from the subsurface tends to decrease over time and may ultimately level off at some point higher than zero pounds per day. When this occurs, the economic viability of operating the system is greatly reduced. Goals for DVE operations were set at individual wellhead extraction rates below five pounds per day and the development of asymptotic extraction rates over time. This goal was achieved by December of 1995, when removal rates dropped below 30 pounds

per day but continued operations to the end of January resulted in a decrease in extraction rates to 2 pounds per day.

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see Table 1

4.1.2 Goals for Groundwater

The work plan did not establish specific clean-up levels for groundwater as part of the active remediation goals. ACHCS maintained that groundwater must ultimately be remediated to concentrations below the Maximum Contaminant Levels (MCLs), specifically benzene concentrations must be below one ppb. Although some benefit to groundwater quality was likely to be achieved during active remediation of vadose zone soils, reduction of benzene concentrations to below MCLs was expected to occur during long-term passive bioremediation.

4.1.3 Interim and Confirmatory Borings

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The work plan called for the installation of interim and confirmatory borings during active remediation of the site. Interim borings are used to enhance the assessment of the site and to evaluate the progress of site clean-up. Interim borings can be completed as extraction wells, expanding the capacity of the treatment system when necessary. Confirmatory borings are installed prior to the completion of active remediation in order to document achievement of clean-up goals. The work plan called for the installation of two interim borings mid-way through active remediation and for two confirmatory borings when remediation appeared to be complete. As all borings generally indicate little or no vadose zone contamination, confirmatory borings are not necessary to terminate active remediation.

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4.1.4 No Further Active Remediation Status

The work plan allowed for transitioning the site to "No Further Active Remediation." Residual hydrocarbons would remain in the subsurface, but passive bioremediation would continue to remove residual hydrocarbons without posing the threat of further groundwater quality degradation or adverse human health effects. Award of "No Further Active Remediation" status was to be based on achievement of the active remediation goals and the development of criteria for a Residual Hydrocarbon Management Plan. The RHMP was to include an assessment of post-remediation site conditions, projected passive bioremediation rates, a groundwater quality monitoring plan, a contingency plan in case of adverse changes in site conditions, and an evaluation of human health risks and possible institutional controls on exposures.

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4.2 Remediation System

A dual vapor extraction system was installed and operated at the site in order to facilitate active remediation. The basic system design was outlined in the work plan developed for the site by Terra Vac. Following acceptance of the work plan, Terra Vac installed and operated the full scale DVE system.

4.2.1 System Design

DVE begins at the vapor extraction wells, designed to target and draw air through impacted soils. The wells are connected to a source of vacuum, which in turn discharges to a vapor abatement device. Applied vacuum causes airflow to develop within the vadose zone. Volatile hydrocarbons absorbed to vadose zone soils diffuse into the air stream and are transported out of the subsurface. Where groundwater has been impacted and vacuum must be applied to the capillary fringe area, the DVE installation includes entrainment tubes extending down the wells to entrain water out on the air stream to be treated and discharged. This allows vacuum and air flow to be applied at greater depth than SVE alone, which when located above the water table will result in loss of air flow due to the vacuum induced raising of water in the well and a covered screen interval. The hydrocarbon laden vapor stream is abated by a regenerative oxidizer under a BAAQMD permit.

High water production through the sands in the upper saturated zone limits air flow to the primarily vadose zone with some impact to the capillary fringe. The system includes five sparge wells for air injection 12-15 feet below the static water level. Air sparging will further accelerate remediation in the saturated zone by initially increasing volatilization of dissolved phase (insitu air stripping) but primarily by enhancing biodegradation. Maintaining dissolved oxygen levels in the water, and in the soils, overcomes the primary growth limiting factor for indigenous, hydrocarbon consuming bacteria.

Extracted soil vapor and water is conveyed through buried PVC piping to a gas-liquid separator located within the treatment system compound. Separated water is pumped out on a batch basis, and treated with carbon prior to discharge under an EBMUD permit. Soil vapor is routed to the regenerative oxidizer for destruction (Figure 7, DVE System)..

4.2.2 System Operations

Operation of the DVE system began on September 25, 1995. The system was operated through January 30, 1996 when a total of 110.5 days of operation had been logged. During this time the system removed approximately 4,500 pounds of petroleum hydrocarbons from the site subsurface. Initial extraction rates were as much as 200 pounds per day, remained above 75 pounds per day for the first 30 days of operations, then declined to a rate of only 2 pounds per day at the end of operations (Table 1, Remediation System Operations Data).

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Two interim borings were drilled in January and converted to sparge wells. At the end of January, the DVE system had achieved its work plan goals with removal rates at asymptotic and continued active remediation is now confined to air sparging. The total amount of water treated during DVE operations was 359,000 gallons.

5.0 EVALUATION OF REMEDIATION EFFECTIVENESS

Approximately 4,500 pounds of TPH have been removed from the subsurface during the 110 days of DVE system operation. While hydrocarbons remain in soil and groundwater beneath the site, a majority of the petroleum hydrocarbons originally impacting the site have been removed and cost effective operation of the DVE system has been completed.

5.1 Operations Data

During operation of the DVE system, the maximum mass extraction rates were observed at the beginning of operations. As significant amounts of TPH were removed from the subsurface, extracted soil vapor concentrations decreased while soil vapor extraction flow rates remained relatively constant. This caused an overall drop in mass extraction rates over time (see Figure 8).

Cumulative hydrocarbon mass removed by the DVE system has been plotted relative to days of operation (Figure 9, Cumulative Hydrocarbon Mass Extracted). Figure 9 shows that 2,600 pounds TPH, or approximately 58 percent of the extractable mass present, was removed during the first 30 days of operation. Less than ten percent of that amount was removed during the last 30 days of operation.

5.2 Results of Interim Soil Boring Installation

Two interim soil borings, DVSP-6 and DVSP-7 were drilled on December 20, 1995 and completed as sparge wells. Drilling of the boring occurred after 71 days of system operations when 3,900 pounds TPH had been removed by the system. The borings were drilled to a depth of 27 feet and samples were collected at five foot intervals. The concentrations of TPHg and benzene in every sample from DVSP-7, with the exception of 1.2 ppm benzene at 14.3 fbgs (in the saturated zone), were below the clean-up goal concentrations established in the work plan. According to the terms of the work plan, interim borings which meet the clean-up goals can be considered as confirmatory borings. Therefore, the results of this interim soil boring installation indicate that a significant amount of soil located within the impacted volume had been remediated to below clean-up goal concentrations. Soil sample results from DVSP-6 indicate hydrocarbons at the capillary fringe but no samples were submitted from the vadose zone, though the well log shows a PID reading of only 3 ppm, indicating minimal hydrocarbons.

5.3 Groundwater Quality Data

Groundwater quality data collected in 1996 indicates that operation of the DVE system has had a significant impact upon dissolved phase hydrocarbon concentrations. Upgradient well C-2 was non-detect for TPH-g and benzene for the first time since monitoring began in 1989. Both wells C-1 and CR-1 have shown a 99 percent decrease in benzene concentrations from a high of 11,000 ppb and 9,400 ppb respectively, to 22 and 38 ppb. Well C-3 remains below detection limits, as it has since 1991. TPH-g and benzene in offsite, downgradient wells C-4, C-5 and C-6 has been nondetectable since at least the end of 1995 through June 10, 1996.

6.0 REQUEST FOR NO FURTHER ACTIVE REMEDIATION

To date, work at the site has been guided by the remediation work plan. The work plan is a progressive document that embodies the concepts that the goal of active remediation is to remove a majority hydrocarbon mass in a cost effective manner; that residual hydrocarbons will be present in

soil and groundwater at the end of active remediation, and that groundwater quality will ultimately be restored during a period of passive bioremediation effected by naturally occurring processes.

Since the development of the work plan two major changes have occurred within the regulatory frame work governing the site. First, the Lawrence Livermore Report, "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks" was followed by Walt Pettit's December 8, 1995 letter, "Interim Guidance on Required Cleanup at Low-Risk Fuel Sites". The substance of these documents supports the efficacy of the basic concepts developed in the work plan. Second, the "Regional Board Supplemental Instructions to State Water Boards, January 5, 1996" letter developed a six point checklist for assigning low risk status to groundwater impacted sites. The supplemental instructions direct that "Passive bioremediation be the preferred remediation alternative unless there is a compelling reason to do otherwise." The subject site meets the definition of a low risk site and future remediation should be effected by passive bioremediation. The following is an evaluation of site conditions relative to the six points defining a low risk groundwater site.

6.1 On-Going Sources

All USTs and associated piping were removed from the site in November 1994. Cost effective removal of hydrocarbon mass from the vadose zone has been completed. Free product has not been observed in groundwater monitoring wells for almost one year and dissolved phase concentrations of TPH are well below saturation limits.

6.2 Site Characterization

Adequate, though limited, assessment work has been completed at the site. Pre-remediation assessment data defined the source and extent of impacted soil. DVE operations data and interim soil boring results indicate that soil impact has been significantly reduced, though little evidence existed to verify significant vadose zone impact. The groundwater flow direction and extent of plume migration has been defined by off-site assessment and quarterly groundwater monitoring.

6.3 Plume Stability

Routine groundwater monitoring began in 1989. Since 1992, well C-5, located directly downgradient and about 60 feet from the site property line, has not shown more than an order of magnitude variation in TPH-g in water samples and has been below detection limits in ten of the last 14 monitoring events. Well C-6, about 120 feet downgradient, has been below detection limits for TPH-g since 1993 and has only been above detection limits twice since monitoring began in 1989. Well C-4, slightly crossgradient and 60 feet away, has been above detection limits once since 1993. These data document a plume regression that is expected to continue.

6.4 Sensitive Receptors

A well survey for all wells within one-half mile of the site reveals that there are two possible producing wells. One domestic well is at about 1,500 feet north of the site, located on Twelfth Street, owned by Western Union and is up gradient. It is screened to 33 feet. There is one irrigation

well located at Laney College, at about 1000 feet away, screened at a depth of 190 feet and cross-gradient (see Figure 10). Neither well is a likely receptor. All other wells listed are monitoring wells, testing wells or cathodic wells.

The nearest surface water is the Lake Merrit channel, located approximately 1,500 feet away. Given that the nearest of these points is separated from the site by distances that are 10 times greater than the total distance that the plume has migrated in 10-14 years, it is reasonable to assume that they will not be impacted by hydrocarbons originating at the subject site.

6.5 Human Health Risks

The purpose of this section is to develop conservative models of exposures and health risks associated with residual hydrocarbon impacts and to show that no significant risk of adverse human health effects would be associated with long term passive bioremediation of the site. Evaluation of potential human health risks is made using Groundwater Services, Inc., ASTM Risk Based Corrective Action Software (GSI/RBCA). This risk assessment is based on current site conditions and uses. If the site use changes significantly in the future, the health risk assessment should be re-evaluated.

The GSI/RBCA evaluation begins with a defined target risk which is deemed to be protective of public health. This risk is the result of a receptor's exposure to constituents of concern (COC). The exposure is the result of transport of the COC from its source to the receptor. Each of these factors is modeled as being proportional to the concentrations of COCs in the source media. The GSI/RBCA works backwards from the acceptable risk to determine an acceptable concentration in the source media. This is the site specific threshold limit (SSTL) for concentrations of each COC in soil and groundwater. If existing soil or groundwater concentrations are below these limits, no significant health risk is present.

6.5.1 Assumptions and Defaults

A GSI/RBCA Tier Two assessment was performed for the site. Available site specific data was utilized in developing the risk models. Where site specific data were not available, conservative default variables were incorporated. Because benzene has the greatest toxicity of any gasoline constituent, it was the single COC used to drive the risk assessment. The California Environmental Protection Agency's toxicity value for benzene is more conservative than the default value used by GSI/ASTM. To reflect this, a factor of 0.29 was applied to the target risk for modeled exposures to benzene.

Other key assumptions made in developing the model were related to site use and exposure pathways. Since direct exposure to groundwater is not probable given current site use, the air exposure pathway and possibly soil exposure from surficial soil at the dispenser island, are the only complete exposure pathways for on-site receptors. Soil and air exposure pathways do not exist for off-site receptors. However, a complete groundwater pathway does exist for off-site receptors.

The site is currently zoned and developed for commercial use. A fast-food restaurant is being planned to occupy the site. On-site exposures and associated health risks are modeled accordingly. The

exposure pathway for workers at the site is volatilization from soil and groundwater to outdoor and indoor air. Of the two, indoor air exposure is the critical pathway. Because the site use is commercial in nature, the OSHA Permissible Exposure Limit for benzene was applied.

Modeling of off-site groundwater exposure pathways assumes that receptors are located 1,000 feet from the site. This distance is a conservative modeling of the distance to the irrigation well at Laney College. Realistically, this well is not a receptor due to its depth, but it is useful in continuing on a very conservative risk basis. The model assumes that these waters would be used as drinking water sources to which the MCL for benzene can be applied. A first order attenuation factor was applied to the groundwater model to reflect natural attenuation of hydrocarbons transported in the dissolved phase.

6.5.2 Data Set

Pre-remediation assessment data were used to develop the soil data set used in the risk assessment. These are the data presented previously in Section 3.2.4. The groundwater data set is based on the one year average of benzene concentrations in groundwater. These are the data presented previously in Section 3.3. These data sets represent a conservative model of current site conditions. The groundwater data incorporates data which reflects some improvement in groundwater quality in onsite wells due to operation of the DVE system. The soil data is more conservative because it does not reflect any reduction in soil concentrations effected by DVE.

6.5.3 Modeling Results

For soil volatilization to indoor air, the SSTL for benzene in subsurface soil at the site is 610 ppm. This SSTL is two orders of magnitude greater than the ~~modeled~~ soil concentration of 5 ppm benzene. For ingestion from surface soils, the SSTL is 0.97 ppm vs. the representative concentration of 0.54 ppm (note that soil was excavated and removed to the 2.5 foot depth in the impacted area). All soil concentrations utilized are pre-remediation data. The SSTL for benzene in groundwater for volatilization to indoor air is 380 mg/l, over two orders of magnitude greater than the ~~modeled~~ groundwater concentration of 0.53 mg/l benzene. Other risk pathways of groundwater volatilization to outdoor air and groundwater ingestion at the 1000 foot receptor location would require concentrations greater than the solubility limit of benzene. Appendix A includes output tables for the RBCA evaluation.

The results of the conservative GSI/RBCA modeling indicate at least two orders of magnitude margin between actual site conditions and conditions which would present a concern for adverse human health effects for any offsite receptor. This margin allows that site condition may vary somewhat over time but only a radical change in site conditions would raise a concern in the future.

6.6 Environmental Health Risks

Environmental impacts associated with the release of fuel hydrocarbons at the site is likely to be limited to subsurface soil and groundwater located within a few hundred feet of the site. Any surface waters, wetlands, or other sensitive environments are located well beyond this area of impact.

7.0 MANAGEMENT PLAN

Cost effective active remediation of the site has been completed. Major sources of petroleum hydrocarbon have been removed. Residual hydrocarbons do not present a significant threat to environmental quality or human health. The following is a plan for work to be completed at the site during a period of passive bioremediation.

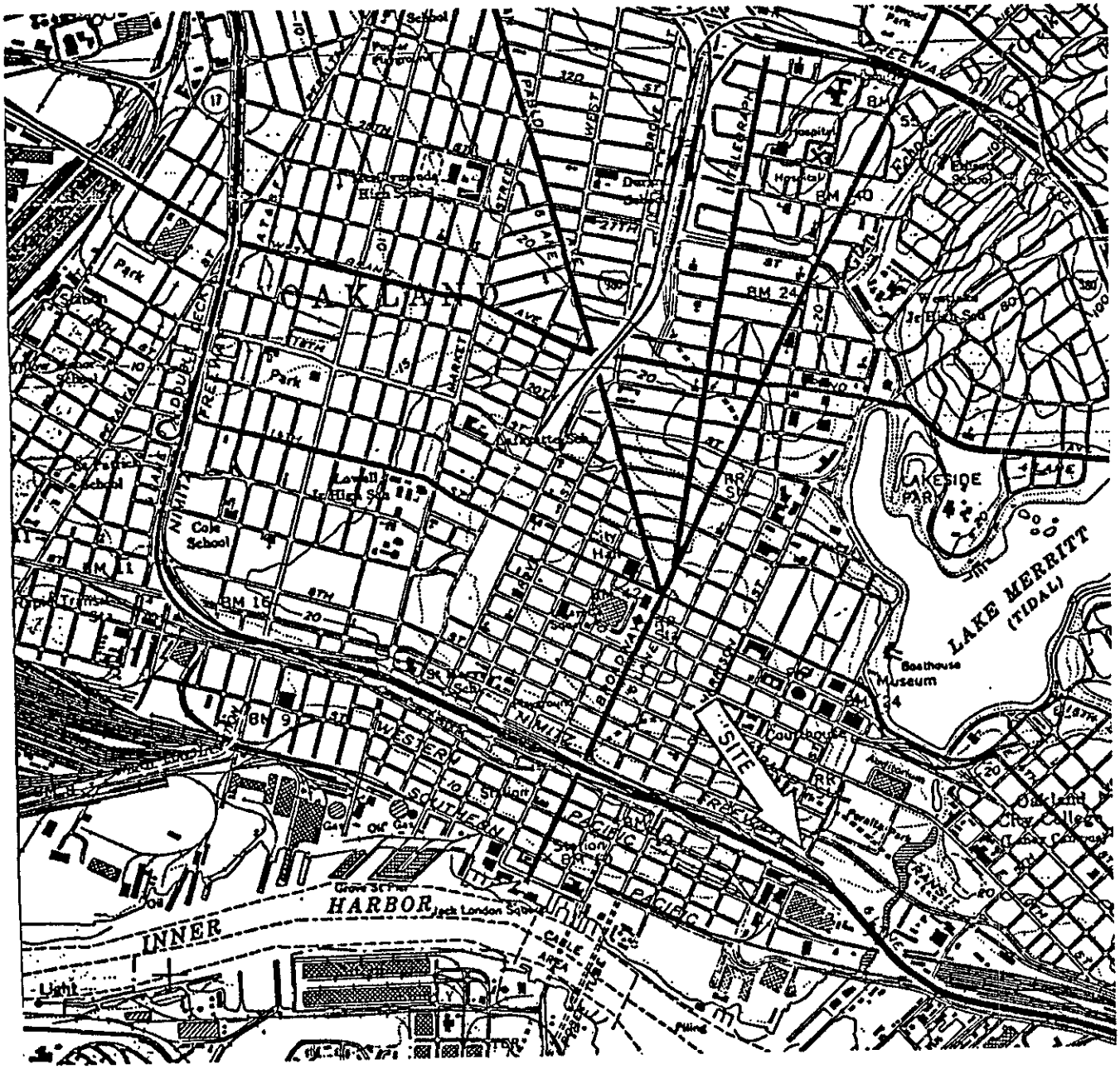
The existing treatment system will be removed from the site. System removal will include the destruction of vapor extraction wells DVE- 1 through DVE-5, dual completed sparge wells DVSP-1 through DVSP-5, and sparge wells SP-6 and SP-7.

On-going quarterly monitoring of existing onsite wells C-1, C-2, CR-1 and downgradient well C-5 will continue through 1997, after which monitoring will be reduced to an annual event for two more years. Wells C-3, C-4, C-6 and C-7 will be performed on an annual basis for the next three years. If, at the end of that time, a pattern of decreasing hydrocarbon concentrations is documented, the wells will be destroyed and the site will be closed to further environmental activity. If such a trend is not observed in the monitoring data, the need for additional work will be evaluated at that time.

During passive bioremediation, groundwater quality data will be evaluated to determine that adverse changes in site conditions have not occurred. Re-evaluation of site status would be required if dissolved phase concentrations of TPHg or Benzene increased significantly. The benzene threshold limits for wells are presented in the attached table (Table 2, Management Plan Threshold Limits). Since there has been shown to be no health risk even at the highest benzene concentrations found in groundwater at the site, the threshold limits are not risk based but intended to forewarn of a trend of increasing concentrations. The limits were derived by averaging dissolved benzene concentrations since December of 1993 to the present, and rounding up to the nearest hundred. This value then reflects both the recent decreases in dissolved concentrations but also the limited sample number and possible seasonal fluctuations while still remaining two orders of magnitude below the calculated SSTL for volatilization to indoor air. (based on air) 380 ppm benz.

If any of the threshold limits are exceeded in any given monitoring event, the site will be immediately re-sampled. If the existence of elevated concentrations is confirmed, the cause will be determined and appropriate steps taken to address the change in site conditions.

FIGURES



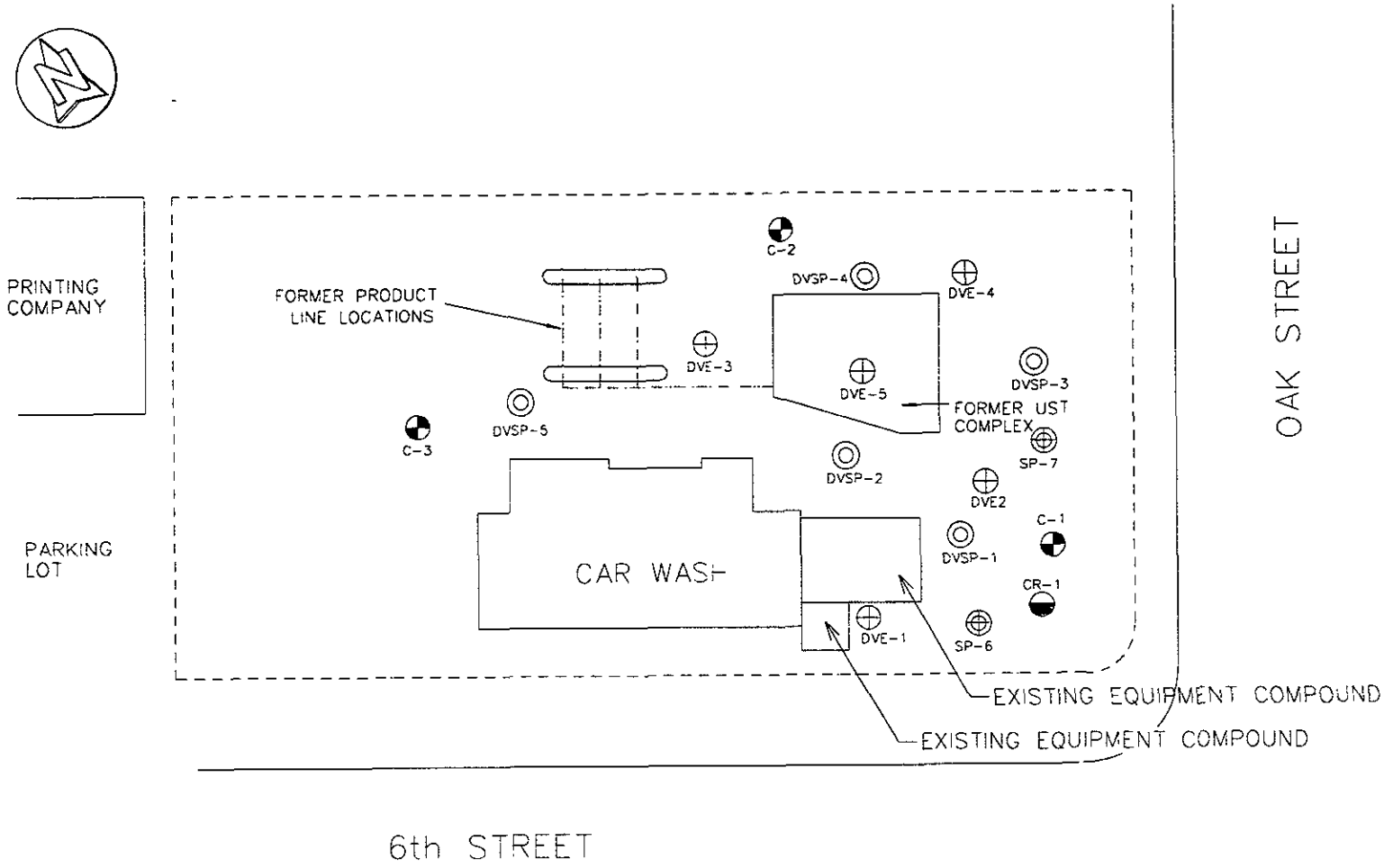
N

SITE VICINITY MAP
609 Oak Street
Oakland, California

Project	30-0219	Drawn by	APB
Date	4/14/95	Revision	
Scale	NTS	Checked	

TERRA VAC
14798 Wicks Boulevard
San Leandro, CA 94577
(510) 351-8900 Fax: -0221

Figure 1



LEGEND

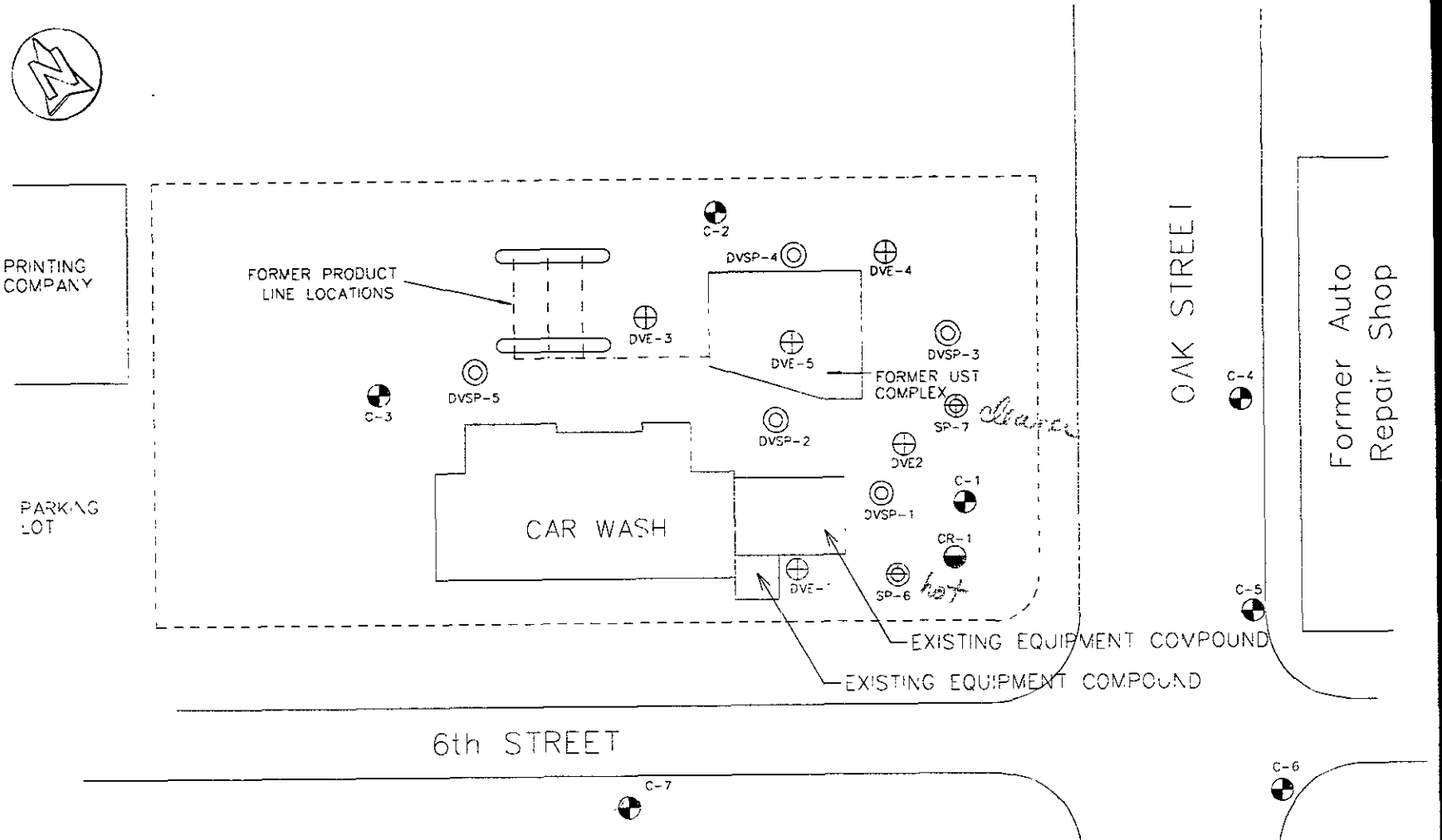
- = Groundwater Monitoring Well
- = Groundwater Recovery Well
- = Enrichment Extraction Well
- = Dual Completed Well
- = Sparge Well

SITE MAP
Former Chevron Station 9-4587
609 Oak Street
Oakland, California

Project	30-0219	Drawn	RJT
Date	8/28/96	Revision	
Scale	1" = 30'	Checked	

TERRA VAC
165 Alvarado Street
San Leandro, CA 94577
(510) 351-8900 Fax: -0221

Figure 2



LEGEND

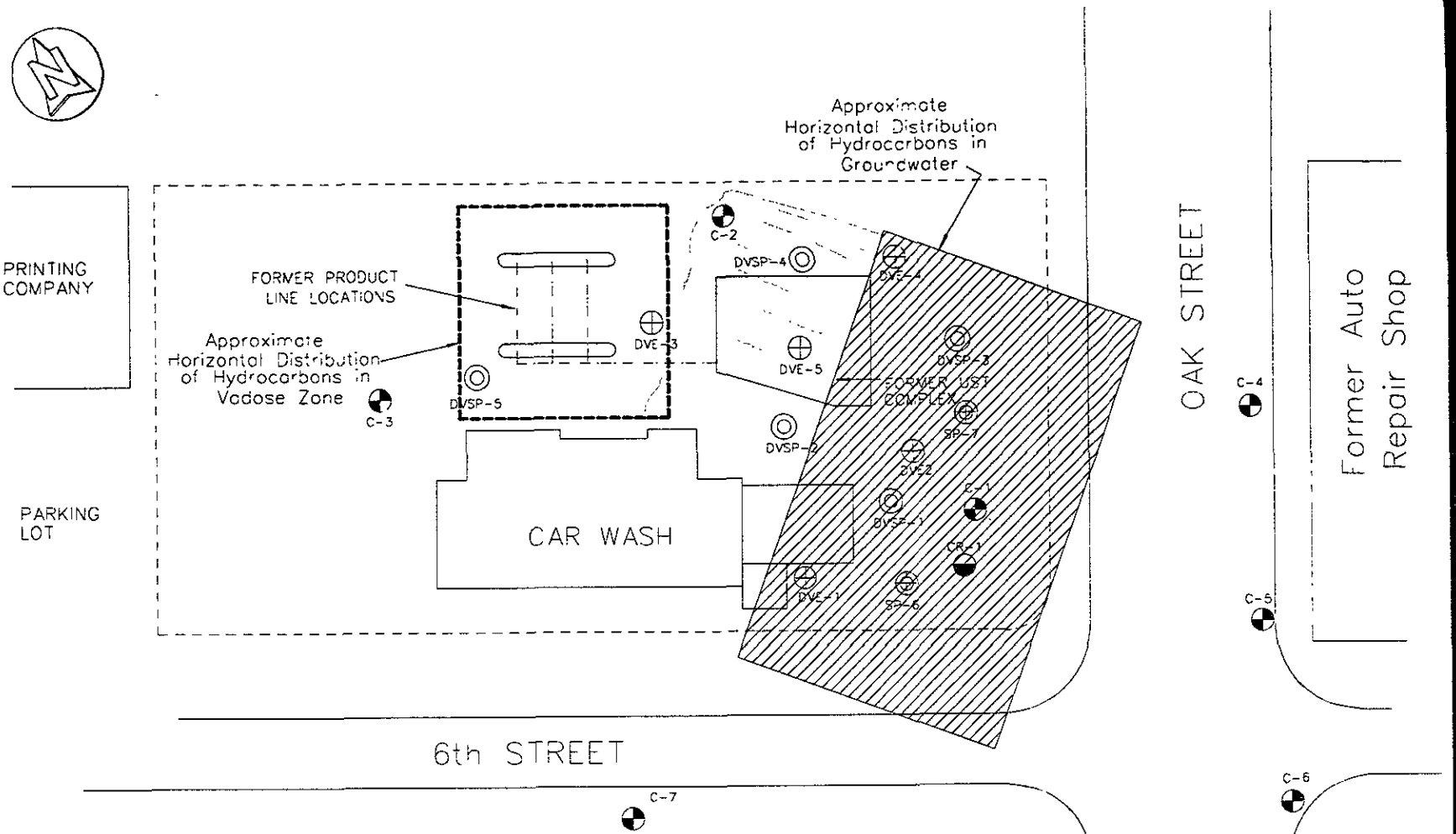
- = Groundwater Monitoring Well
- = Groundwater Recovery Well
- = Enhancement Extraction Well
- = Dual Completed Well
- = Sparge Well
- FP = Free Product

Extended Site Plan
Former Chevron Station 9-4587
609 Oak Street
Oakland, California

Project	30-0219	Drawn	RJT
Date	9/12/96	Revision	
Scale	1" = 30'	Checked	

TERRA VAC
1651 Alvarado Street
San Leandro, CA 94577
(510) 351-8910 Fax 351-0227

Figure 3



LEGEND

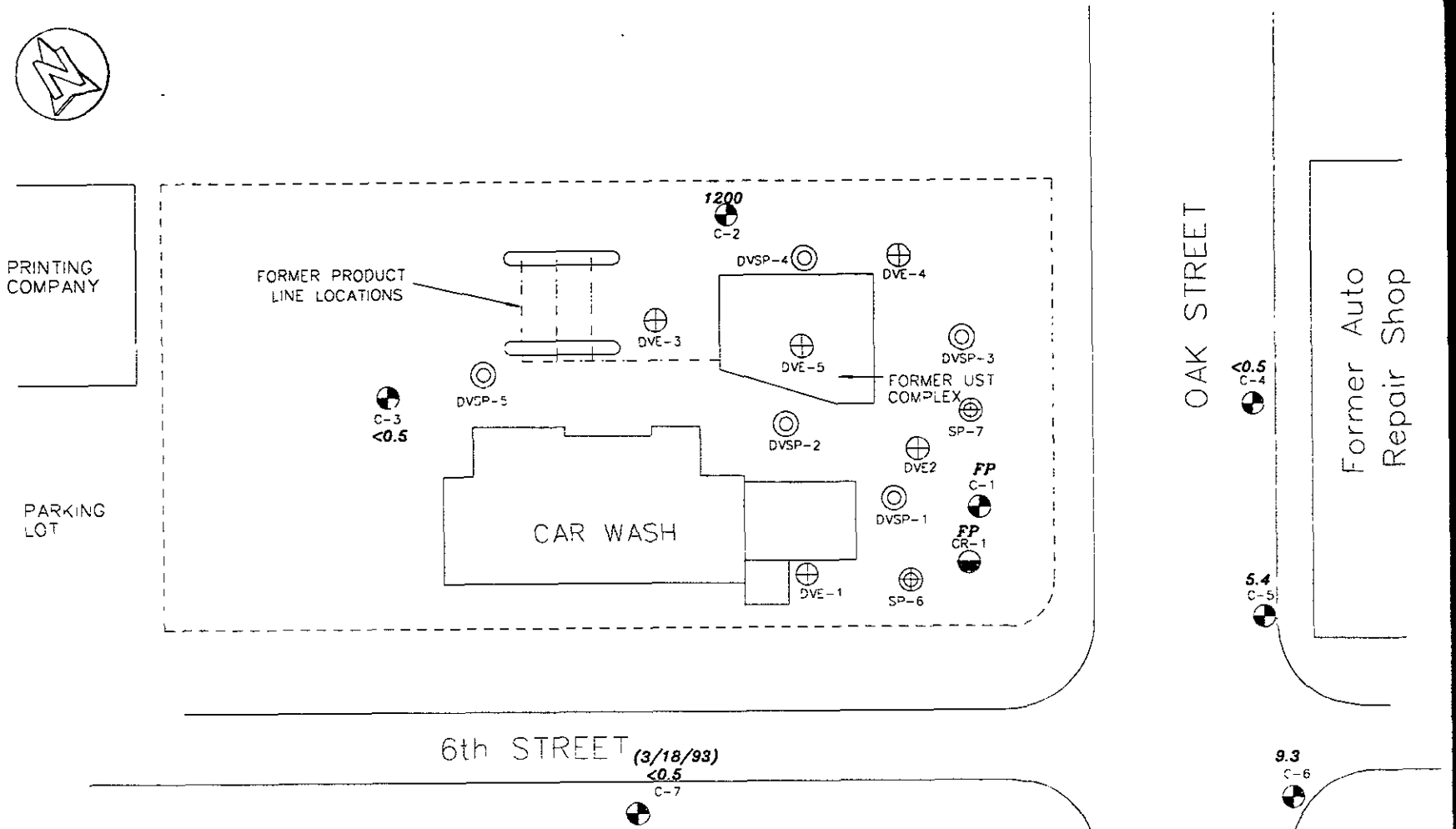
- = Groundwater Monitoring Well
- = Groundwater Recovery Well
- = Enhancement Extraction Well
- = Dual Completed Well
- = Sparge Well
- = Free Product

Approx. Horizontal HC Distribution
in Soil and Groundwater
Former Chevron Station 9-4587
609 Oak Street
Oakland, California

Project	30-0219	Drawn	RJT
Date	9/12/96	Revision	
Scale	1" = 30'	Checked	

Figure 2

TERRA VAC
1651 Alvarado Street
San Leandro, CA 94577
(510) 351-8900 Fax. -022



LEGEND

- = Groundwater Monitoring We
- = Groundwater Recovery We
- = Entrapment Extraction We
- = Dual Completed Well
- = Sparge We
- FP = Free Product

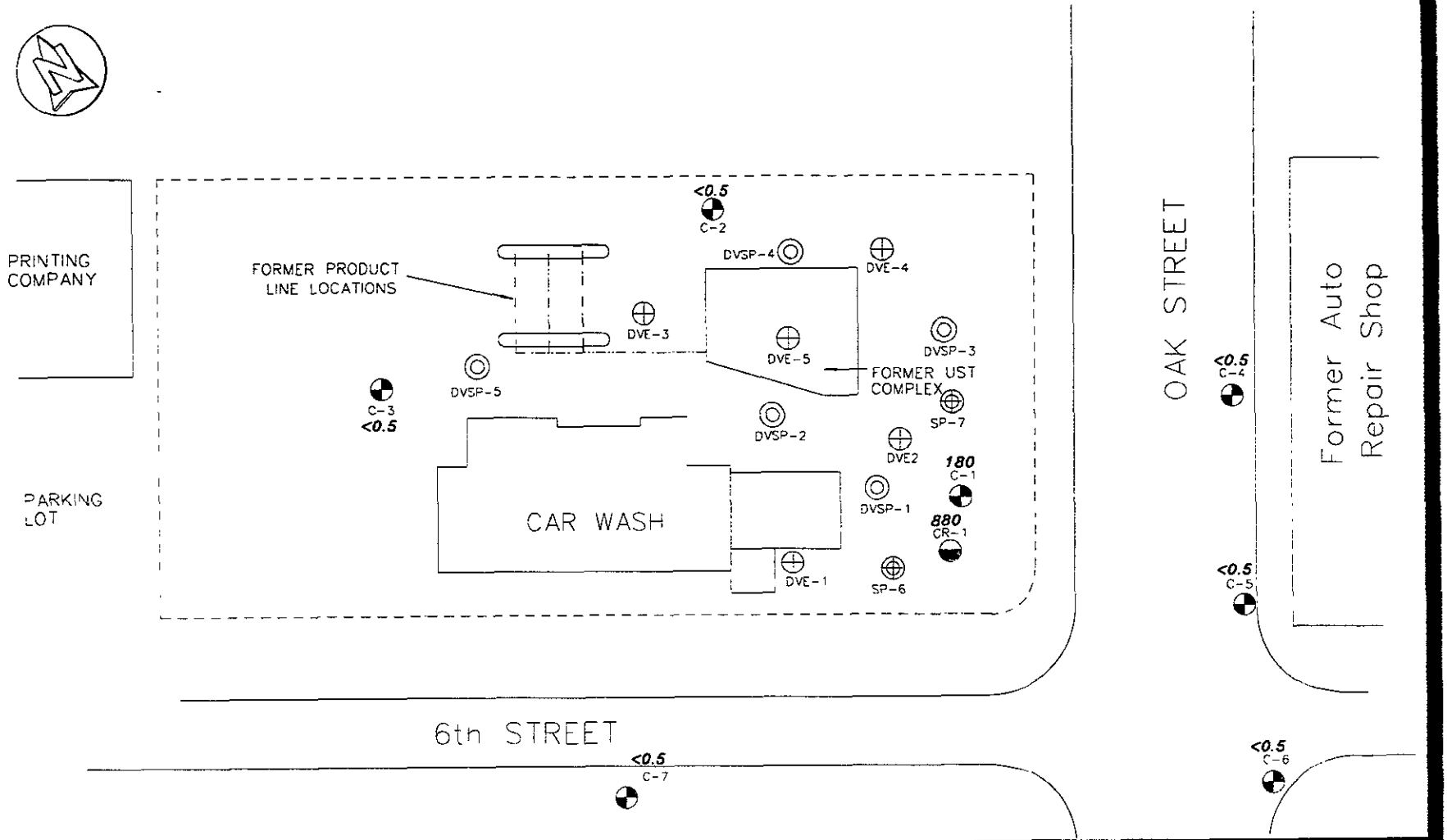
Benzene Concentrations in ppb (12/16/92)

Former Chevron Station 9-4587
609 Oak Street
Oakland, California

Project	30-0219	Drawn	RJT
Date	9/12/96	Revision	
Scale	1" = 30'	Checked	

TERRA VAC
1651 Alvarado Street
San Leandro, CA 94577
(510) 351-8900 Fax 351-0221

Figure 5



LEGEND

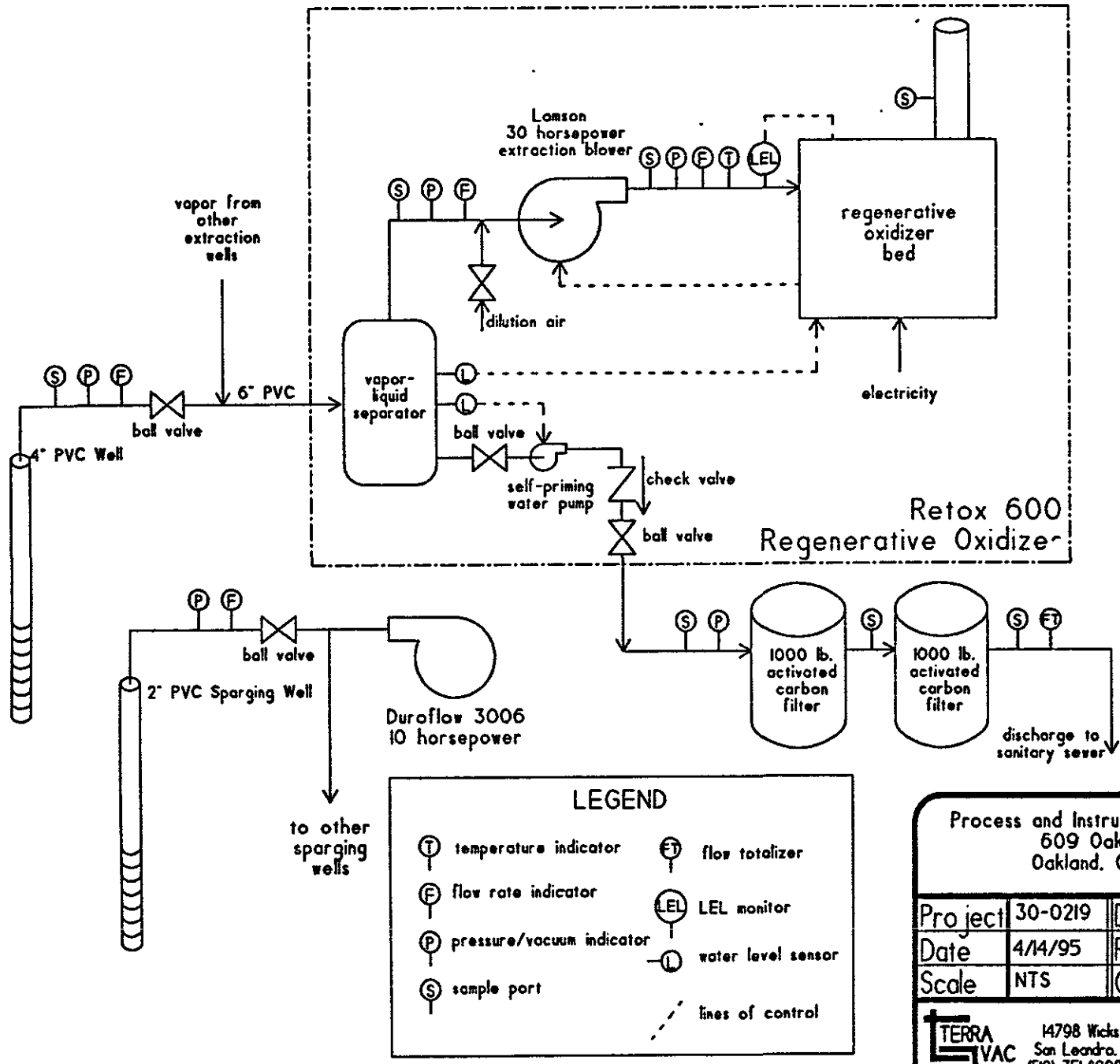
- = Groundwater Monitoring Well
- = Groundwater Recovery Well
- = Entrainment Extraction Well
- = Dual Completed Well
- = Sparge Well
- FP = Free Product

Benzene Concentrations in ppb (12/19/95)
Former Chevron Station 9-4587
609 Oak Street
Oakland, California

Project	30-0219	Drawn	RJT
Date	9/12/96	Revision	
Scale	1" = 30'	Checked	

TERRA VAC
1651 Alvarado Street
San Leandro, CA 94577
(510) 351-8900 Fax: (510)

Figure 6



Process and Instrumentation Diagram
609 Oak Street
Oakland, California

Project	30-0219	Drawn by	APB
Date	4/14/95	Revision	1
Scale	NTS	Checked	

TERRA VAC
14798 Wicks Boulevard
San Leandro, CA 94577
(510) 351-8900 fax -0221

Figure 7

Figure 8
Removal Rate
Former Chevron Station 9-4587
609 Oak Street
Oakland, CA

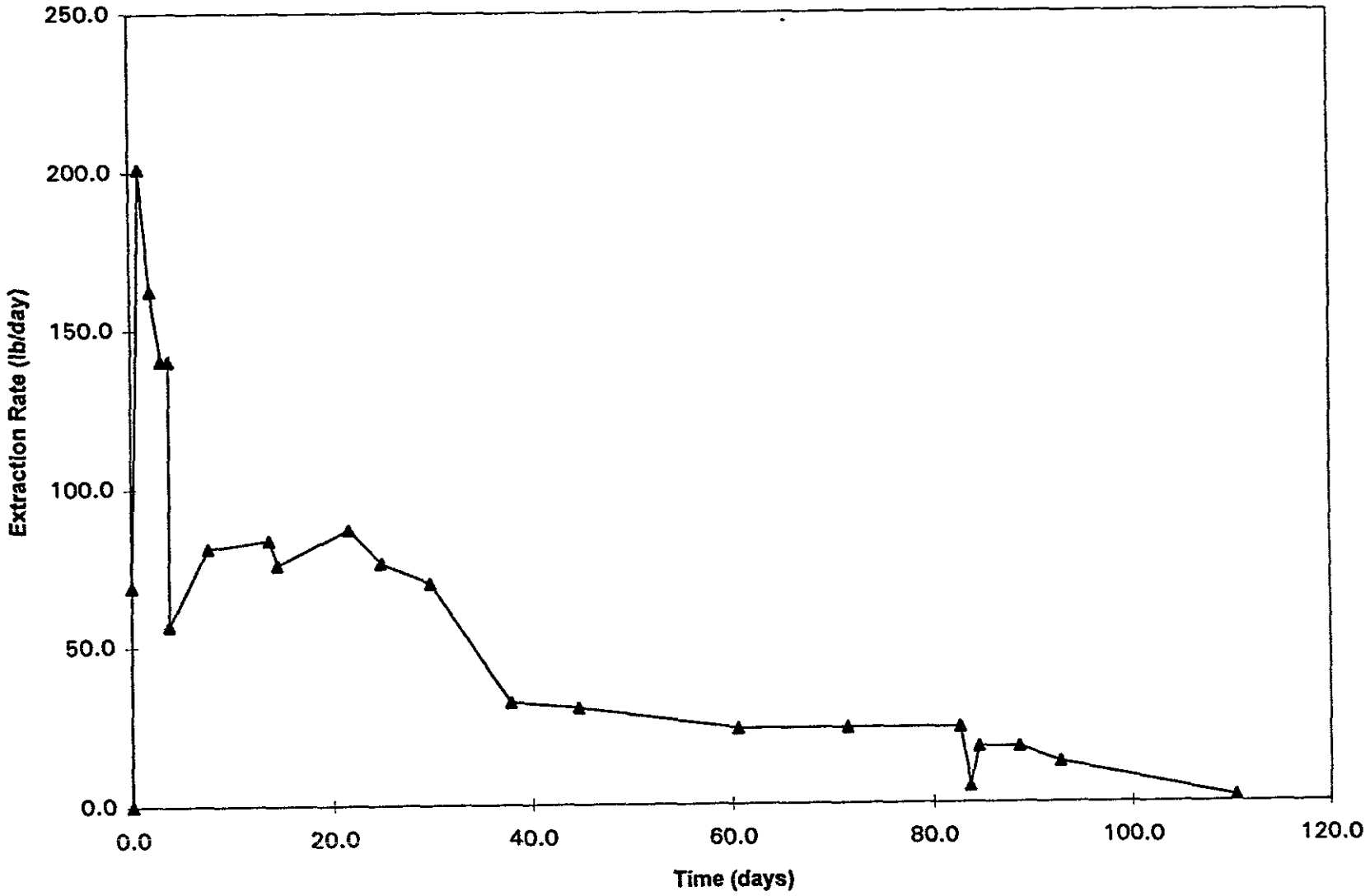
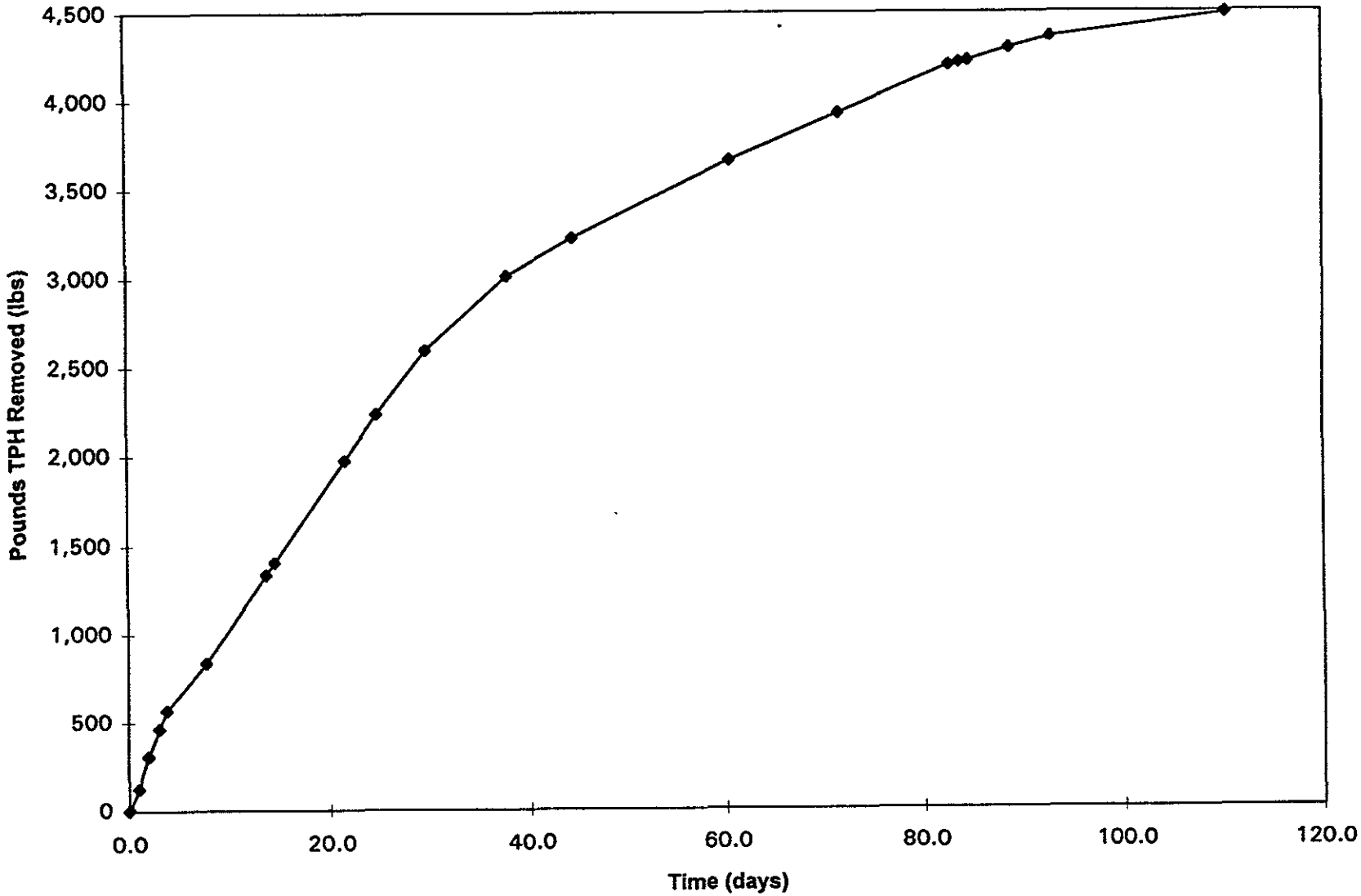
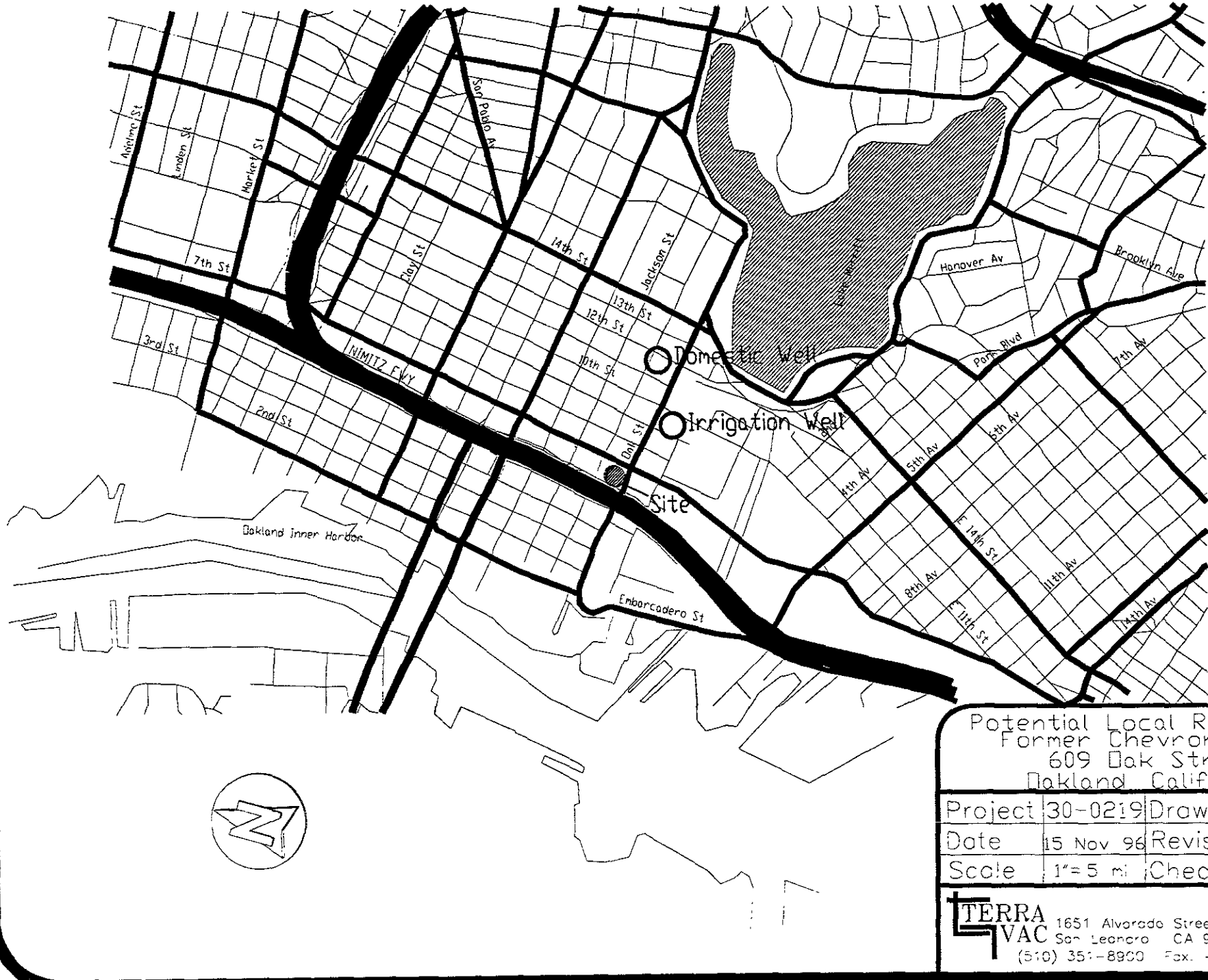


FIGURE 9
Cumulative Removal Rate

Former Chevron Station 9-4587
609 Oak Street
Oakland, CA





Potential Local Receptors
Former Chevron Station
609 Oak Street
Oakland, California

Project	30-0219	Drawn	RJT
Date	15 Nov 96	Revision	
Scale	1"=5 mi	Checked	

TERRA VAC
1651 Alvarado Street
San Leandro CA 94577
(510) 351-8900 Fax. -0221

Figure 10

TABLES

Table 1
Operation Summary
Former Chevron Station 9-4587
609 Oak Street
Oakland, CA

Date	Run Time (days)	Sample	Extracted Flow (scfm)	Extracted Conc. (mg/l)	Extracted Rate (lb/day)	Cumulative Extraction (lb)	Cumulative Water (gal)
09/25/95	0.0	start	353		0.0	0	
09/25/95	0.0	1	353	2.17	68.8	3	
09/26/95	1.0	3	272	8.23	201.1	127	9,680
09/27/95	2.0	16	294	6.15	162.4	308	19,910
09/28/95	3.0	18	303	5.15	140.1	464	29,950
09/29/95	3.7	stop	0		140.1	568	
09/29/95	3.7	start	0		140.1	568	
09/29/95	3.7	20	241	2.61	56.5	568	37,163
10/03/95	7.6	22	308	2.93	81.0	834	72,850
10/09/95	13.7	24	212	4.39	83.5	1,336	122,310
10/10/95	14.6	26	191	4.42	75.8	1,404	131,460
10/17/95	21.6	39	232	4.17	86.9	1,974	188,530
10/23/95	21.6	start	168		86.9	1,974	211,370
10/26/95	24.8	41	281	3.02	76.3	2,235	
10/31/95	29.7	55	524	1.48	69.8	2,596	229,930
11/08/95	37.8	56	524	0.69	32.5	3,012	230,269
11/15/95	44.6	58	524	0.65	30.6	3,224	230,450
12/01/95	60.6	71	536	0.50	24.1	3,662	231,577
12/12/95	71.5	stop	536		24.1	3,926	231,577
12/22/95	71.5	start	536		24.1	3,926	
01/02/96	82.7	nst	536		24.1	4,195	232,470
01/03/96	83.7	77	344	0.17	5.3	4,210	233,906
01/04/96	84.6	79	272	0.73	17.8	4,220	239,622
01/08/96	88.6	nst	272		17.8	4,292	
01/12/96	92.7	80	290	0.50	13.0	4,355	279,545
01/30/96	110.5	85	321	0.06	1.7	4,487	360,807
01/30/96	110.6	stop	321		1.7	4,487	360,807

Table 2
Management PlanThreshold Limits
Former Chevron Station 9-4587
609 Oak Street
Oakland, CA

Well ID	Benzene Concentration Highest Observed (ppb)	Benzene Concentration 12/19/95 (ppb)	Benzene Concentration Threshold Limit (ppb)
C-1	11,000	180	4,000
C-2	8,200	<0.5	400
C-5	330	<0.5	100
CR-1	9400	880	2,600

APPENDIX A

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Chevron 9-4587 | Job Identification: 30-0219 | Software: GSI RBCA Spreadsheet
Site Location: Oak Street, Oakland | Date Completed: 8/21/96 | Version: v 1.0
Completed By: R.A. Dahl

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)	***FALSE***				
gwMCL?	Use MCL as exposure limit in groundwater?	TRUE				

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

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)	3.0E+04	FALSE	3.0E+04	FALSE
S	Inhalation receptor (cm)		FALSE		TRUE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	***2.9E-07***	
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)	***1.9E+06***		1.0E+06
W	Length of affected soil parallel to wind (cm)	***1.2E+03***		1.0E+03
W.gw	Length of affected soil parallel to groundwater (c	***1.4E+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)	***9.1E+01***		
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)	***1.9E+02***
Ugw.tr	Groundwater Transport velocity (cm/yr)	***5.0E+02***
Ks	Saturated Hydraulic Conductivity(cm/s)	1.0E-03
grad	Groundwater Gradient (cm/cm)	6.0E-03
Sw	Width of groundwater source zone (cm)	1.8E+03
Sd	Depth of groundwater source zone (cm)	3.0E+02
BC	Biodegradation Capacity (mg/L)	
BIO?	Is Biattenuation Considered	TRUE
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		
hc	Capillary zone thickness (cm)	***3.0E+00***		
hv	Vadose zone thickness (cm)	***2.8E+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)	***2.6E+02***		
Ls	Depth to top of affected soil (cm)	***7.6E+01***		
Lsubs	Thickness of affected subsurface soils (cm)	***1.7E+02***		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
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)	1.5E+01	
eta	Foundation crack fraction	0.01	

Dispersive Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersion coefficient (cm)	3.0E+03	
ay	Transverse dispersion coefficient (cm)	1.0E+03	
az	Vertical dispersion coefficient (cm)	1.5E+02	
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

Tier 2 changed #s in underlined + italics
to conservative estimates
RBCA default

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: Chevron 9-4587
Site Location: Oak Street, Oakland

Completed By: R.A. Dahl
Date Completed: 8/21/1996

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 2.9E-7
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	X	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: 1000 feet	Commercial: (on-site)	Regulatory(MCL): 1000 feet		Residential: (on-site)	Commercial: (on-site) (PEL)		Residential (on-site)	Commercial: (on-site) (PEL)	(mg/L	"■" If yes	Only if "yes" left
71-43-2	Benzene	5.3E-1 = 530 ppb		>Sol	NA	>Sol		NA	3.8E+2 380 ppm = 380,000 ppb		NA	>Sol	3.8E+2	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: G-337-YAX-542

Result =

RBCA SITE ASSESSMENT | Tier 2 Worksheet 9.2

Site Name: Chevron 9-4587
Site Location: Oak Street, Oakland

Completed By: R.A. Dahl
Date Completed: 8/21/1996

SUBSURFACE SOIL SSTL VALUES (> 3 FT BGS)

Target Risk (Class A & B) 2.9E-7
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) (PEL)		Residential: (on-site)	Commercial: (PEL) (on-site)		(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	5.0E+0	NA	NA	NA		NA	6.1E+2		NA	>Res		6.1E+2	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: G-337-YAX-542

3-8.5' avg benzene concs. including NDs?

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 9.1**

Site Name: Chevron 9-4567
Completed By: R.A. Dahl
Site Location: Oak Street, Oakland
Date Completed: 8/21/1996

SURFACE SOIL SSTL VALUES (< 3 FT BGS)

Target Risk (Class A & B) 2.9E-7
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	Ingestion, Inhalation and Dermal Contact		Construction Worker	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: (PEL) (on-site)	Commercial: (on-site) (PEL)	(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	5.4E-1		NA	NA	NA		NA	9.7E-1	NA	9.7E-1	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: G-337-YAX-542