

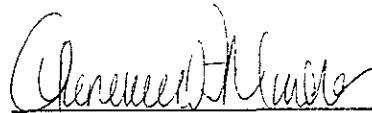
**Risk-Based Corrective Action (RBCA)
Evaluation
Housewives Marketplace
801 Clay Street
Oakland, California**

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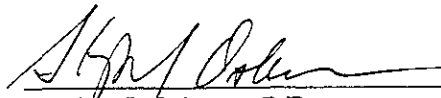
Prepared for

City of Oakland
Public Works Agency
Environmental Services Division
250 Frank H. Ogawa Plaza, Suite 5301
Oakland, California 94612

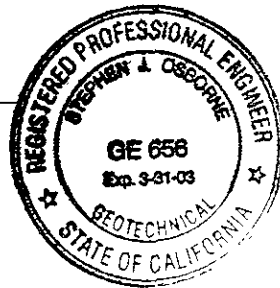
Harding ESE Project No. 52901 5



Genevieve DiMundo
Project Environmental Scientist



Stephen J. Osborne, P.E.
Geotechnical Engineer



May 4, 2001



Engineering and Environmental Services
383 Fourth Street, Suite 300
Oakland, CA 94607 - (510) 451-1001

**Risk-Based Corrective Action (RBCA) Evaluation
Housewives Marketplace
801 Clay Street
Oakland, California**

Harding ESE Project No. 52901.5

This document was prepared by Harding ESE (formerly Harding Lawson Associates {HLA}) at the direction of the City of Oakland's Public Works Agency for the sole use of City of Oakland and the Alameda County Health Agency, the only intended beneficiaries of this work. No other party should rely on the information contained herein without the prior written consent of Harding ESE. This report and the interpretations, conclusions, and recommendations contained within are based in part on information presented in other documents that are cited in the text and listed in the references. Therefore, this report is subject to the limitations and qualifications presented in the referenced documents.

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DISTRIBUTION

1.0 INTRODUCTION

Harding ESE, Inc., formerly known as Harding Lawson Associates (HLA), has prepared this Risk-Based Corrective Action (RBCA) Evaluation on behalf of the City of Oakland for the Housewives Marketplace at 801 Clay Street (the Site), Oakland, California (Plate 1). The RBCA Evaluation was conducted to assess whether releases of petroleum hydrocarbons and chlorinated solvents at the Site could be classified as a "low-risk groundwater case" according to San Francisco Bay Regional Water Quality Control Board (RWQCB) criteria. The study also evaluated soil and groundwater conditions and potential impacts on human health and ecological receptors from petroleum hydrocarbons and volatile organic compounds (VOCs) detected in soil and groundwater at the Site.

In the *Interim Guidance on Required Cleanup at Low-Risk Fuel Sites*, the RWQCB (1996a) published the following criteria for defining a fuel release site as a "low-risk groundwater site":

1. The leak has been stopped and sources including free product, have been removed or remediated
2. The site has been adequately characterized
3. The dissolved plume is not migrating
4. No water wells, deeper drinking water aquifers, surface water, or other sensitive [environmental] receptors are likely to be impacted
5. The site presents no significant risk to human health
6. The site presents no significant risk to the environment

The first four points are addressed in Section 3 of this report and the 6th point in Section 5. To address the 5th criterion in Section 4, Harding ESE conducted a health risk evaluation (HRE) using a risk-based approach consistent with the

City of Oakland's RBCA guidance titled *Oakland Urban Land Redevelopment Program: Guidance Document (Oakland, 2000a)*, which is based on methods developed by the American Society of Testing and Materials (ASTM) in *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites (ASTM, 1995)*. The application of these guidance documents to the HRE is discussed in the section below.

1.1 RBCA Approach

The U.S. Environmental Protection Agency (U.S. EPA) and RWQCB (1996a) have endorsed the ASTM (1995) RBCA approach. The ASTM RBCA is not a risk assessment *per se*, but a tiered, risk-based site investigation that may or may not include a baseline risk assessment. Tiers 1 and 2 are semi-quantitative screening steps in which chemical concentrations detected in soil and groundwater at the site are compared to risk-based screening levels. Tier 1 Risk-Based Screening Levels (RBSLs) are the least site-specific, most conservative (i.e., lowest), and health-protective. Generally, if detected soil and/or groundwater concentrations are lower than Tier 1 screening levels, the site is considered unlikely to pose a human health risk. In such a case, a Tier 2 evaluation in which detected chemical concentrations are compared to less conservative, Site-Specific Target Levels (SSTLs), is not required. However, if detected concentrations exceed Tier 1 RBSLs, then the more refined Tier 2 evaluation is conducted on the basis of site-specific information such as exposure assumptions and parameters used to estimate rates of volatilization from soil and groundwater. If site concentrations are lower than Tier 2 SSTLs, then the site is considered unlikely to pose a significant health risk and further risk evaluations are not conducted. In situations where Tier 2 SSTLs are still exceeded by site concentrations, further risk evaluations, such as a Tier 3 evaluation which may include

additional site assessment, probabilistic evaluations, and fate/transport modeling, may be conducted, or Tier 2 SSTLs may be adopted as remedial goals.

The Oakland RBCA methodology, which is described in detail in the *Oakland Risk-Based Corrective Action: Technical Background Document (2000b)*, was developed under the auspices of the Urban Land Redevelopment Program. It is based on the ASTM RBCA approach and provides a technical basis for conducting RBCA evaluations specific to the City of Oakland. The Oakland RBCA approach has been peer-reviewed and incorporates input from the Alameda County Department of Environmental Health, California EPA Department of Toxic Substances Control (Cal/EPA-DTSC), RWQCB, and U.S. EPA (*Oakland, 2000a,b*). In addition, substantial input and feedback was solicited from a citizens' review panel representing various community organizations.

The Oakland RBCA approach employs a tiered, risk-based analysis similar to that presented by ASTM. Tier 1 RBSLs were developed using Oakland-specific input parameters such as soil- and non-soil-specific chemical transport parameter values that reflect the geology that may be found at any site in Oakland in lieu of the default Tier 1 values provided by ASTM. In addition, EPA- and Cal/EPA-recommended exposure assumptions and toxicity values were utilized. Tier 1 RBSLs are considered to be the least site-specific and most conservative (i.e. health-protective) screening levels. If chemical concentrations exceed Tier 1 levels, a Tier 2 analysis may be undertaken and site concentrations compared with Tier 2 SSTLs. The Oakland Tier 2 SSTLs differ from Tier 1 RBSLs in the use of more site-specific soil parameters and a less-conservative cancer risk level. Exposure and other parameters are the same as for Tier 1.

Oakland (*2000a,b*) has developed SSTLs for three predominant types of soil found in Oakland

- Merritt sands, which are characterized by low moisture content and high permeability and consist of fine-grained, silty-sand with some sandy clay and clay. Merritt sands are found in the vicinity of Lake Merritt in the Oakland area and generally apply to the downtown area.
- Sandy silts, which are located throughout Oakland and consist of moderately sorted sand, silt and clay sediments. They have moderate permeability and average moisture content.
- Clayey silts, which are found along San Francisco Bay and estuary and in landfills. They can be made of small lenses of sand, organic materials and peaty layers. They have high moisture content and low permeability.

If chemical concentrations exceed Tier 2 values, a Tier 3 analysis may be necessary. A Tier 3 analysis incorporates more complex and detailed site investigations, including site-specific fate and transport modeling and exposure evaluation. Further risk evaluation (such as a baseline risk assessment) may be conducted, or Tier 2 SSTLs may be adopted as remedial goals.

As described above, the Oakland (*2000a,b*) RBCA methodology follows the same basic approach as ASTM (*1995*). However, in addition to incorporating Oakland-specific input parameters, the Oakland RBCA approach differs from the ASTM RBCA approach in the following ways:

- A combined residential child/adult receptor (six years for child and 24 years for adult) is used to evaluate potential carcinogenic health effects. ASTM assumes an entirely adult exposure. Using a child/adult receptor scenario results in more conservative (i.e., lower) screening levels.
- To evaluate non-cancer health effects, the residential receptor is assumed to be a child throughout the entire exposure duration whereas ASTM assumes an adult residential receptor. This results in a more

conservative, health-protective screening level.

In the absence of specific state recommendations for conducting RBCA evaluations of fuel release sites within California, Oakland adapted ASTM-recommended methods on the basis of general risk assessment guidance provided by Cal/EPA and U.S. EPA. The Oakland (2000a,b) RBCA guidance provides RBSLs and SSTLs for a number of chemicals unrelated to fuel releases, such as metals and chlorinated VOCs. This approach is consistent with more recent ASTM (1998) recommendations for the general application of RBCA methods to sites with chemical releases to soil and groundwater.

In August 2000, the RWQCB introduced an interim guidance document which presents Tier 1 RBSLs to be applied at small- and medium-size hazardous substance release sites in the San Francisco Bay Area under a tiered approach similar to those described above (RWQCB, 2000). These RBSLs are currently Interim Final and were primarily developed based on U.S. EPA's Preliminary Remediation Goals (PRGs; U.S. EPA, 2000) and the Oakland (2000a,b) RBCA guidance but reflect additional environmental concerns of the RWQCB, such as protection of groundwater quality, ecological impacts, drinking water taste and odor concerns, and total petroleum hydrocarbon (TPH) levels. The RWQCB RBSLs are only recommended screening values and are not required "cleanup levels".

In this assessment, the City of Oakland RBCA values were used in lieu of the ASTM and RWQCB values because they are specific to the geology of Oakland and represent final values that have undergone a substantial review process. In the first step of the evaluation, Oakland Tier 1 values were applied. Where Oakland Tier 1 values were exceeded, Oakland Tier 2 values for Merritt sands (which corresponds to the soil type at the Site) were used.

1.2 Report Organization

The report is divided into the following sections:

- Section 1 – Introduction
- Section 2 – Site Background
- Section 3 – Site Specific Considerations
- Section 4 – Health Risk Evaluation
- Section 5 – Ecological Evaluation
- Section 6 – Conclusions and Recommendations
- Section 7 – References.

2.0 SITE BACKGROUND

The Site (referred to as Housewives Marketplace) is the Oakland city block bounded by 8th and 9th Streets, Jefferson Street and Clay Street (Plates 1 and 2) and is located in a retail/commercial area within the City of Oakland. The Site is occupied by three buildings and a parking lot. All of the buildings are currently vacant and the parking lot currently provides paid parking.

Several studies have been conducted at the Site to evaluate past Site uses and potential environmental impacts to soil and groundwater.

The *Phase I Environmental Site Assessment Report* conducted by Secor International Inc. (Secor, 1997a), indicated two gasoline service stations at the southwest and northeast corners of the Site (former underground storage tank [UST] locations are shown on Plate 2) and further identified other facilities in the immediate vicinity where chemicals were used over a period of time and where releases to soil and groundwater had occurred. As part of the SROCA Evaluation,

Harding ESE also reviewed a 1975 aerial photograph in an attempt to identify the locations of the former USTs and other potential sources.

However, the quality of the aerial was too poor to identify any distinct features, such as former UST locations, pump islands, or piping. (See Plate 6).

Because of the potential for impacts to soil and groundwater at the Site, the City of Oakland (the City) authorized three subsurface investigations. These investigations are detailed in the following reports:

- *Report of Soil and Groundwater Sampling Results - The Housewives Market and Retail Office Space (Secor 1997b)*
- *Report of Additional Soil and Groundwater Sampling Results - The Housewives Market and Retail Office Space (Secor 1998)* and

- *Soil and Groundwater Assessment Report, Housewives Marketplace (Chow, 2000)*, conducted by Chow Engineering, Inc., (Chow) under contract to Harding ESE.

The locations for the borings are shown on Plate 2 and a cross-section drawn diagonally across the Site is shown on Plate 3. Plates 4 and 5 present the compiled soil and groundwater concentrations, respectively, for the borings along this cross-section. All of the plates are at the same scale.

Secor collected a total of 21 soil samples at depths ranging from 10 to 23 feet and analyzed them for total petroleum hydrocarbons (TPH) and for benzene, toluene, ethylbenzene, and xylenes (BTEX) in accordance with EPA Test Methods 8015 and 8020, respectively. The TPH analyses were quantified relative to some of the following standards: stoddard solvent, kerosene, jet fuel, mineral spirits, diesel, bunker oil, motor oil, unknown hydrocarbons, and gasoline. No TPH or BTEX concentrations were detected in any of the soil samples; the results of the soil sample analyses are shown on Plate 3. Chow analyzed two soil samples for TPH, one sample for BTEX, and the soil sample with the highest PID reading for volatile organic compounds (VOCs) in accordance with EPA Test Method 8260, but again, no detections were reported. Chow also analyzed five soil samples for lead in accordance with EPA Test Method 6010. Concentrations ranged from 1.9 to 400 milligrams per kilogram (mg/kg). These lead concentrations are at or below PRGs established by U.S. EPA (2000) for both residential and industrial site use. PRGs are health-based screening levels that are often used by the regulatory agencies to evaluate the need for additional investigation.

Table 1 presents a summary of data for chemicals detected in groundwater at the Site. Plate 5 shows the groundwater concentrations as

measured in the Secor and Chow borings. Note that the presumed direction of groundwater flow is to the west (Secor, 1997a), in the same direction as the cross-section.

Secor collected groundwater samples from each of their 10 borings and analyzed them for the same analytes as the soil samples. One sample (at GP-4) contained BTEX compounds at concentrations of 3.2, 1.3, 1.3, and 53 milligrams per liter (mg/L), respectively. At GP-4, TPH as gasoline and mineral spirits were detected at 1,700 and 210 mg/L, respectively. The boring GP-4 is located in the northeast corner of the Site. TPH as motor oil was also detected at 0.67 mg/L at GP-1. This low detection of TPH as motor oil was located at the southwest corner. The absence of detectable concentrations in GP-5 further to the northeast in the presumed upgradient direction may indicate that the petroleum hydrocarbons in the groundwater are the result of releases at the former gasoline station in the northeast corner.

The Chow investigation (Chow, 2000) included the drilling and sampling of five borings in the same two corners of the Site. Their study identified BTEX, TPH, and VOCs in the northeast corner of the site with the highest concentrations at SB-3, as shown on Plate 5 and in Table 1. The results of these analyses indicated that trichloroethene (TCE) is present in groundwater at concentrations between 0.023 and 0.068 mg/L and BTEX compounds at concentrations of 0.67, 0.45, 0.1, and 0.48 mg/L, respectively, in the northeast corner of the Site. TPH as gasoline and mineral spirits were detected at 2.9 and 0.088 to 0.29 mg/L, respectively. TPH as mineral spirits was detected at 0.1 mg/L in the southeast portion of the site (SB-4). SB-5 met refusal before encountering the groundwater surface, and therefore no groundwater sample was collected from this boring.

The greatest impact of petroleum hydrocarbons and solvents to groundwater was observed at SB-3 and GP-4 in the northeast corner. SB-3 also corresponds to the boring where the strongest odors and highest concentrations of petroleum hydrocarbons and VOCs were observed.

3.0 SITE SPECIFIC CONSIDERATIONS

This section addresses criteria 1 through 4 of the *Interim Guidance on Required Cleanup at Low-Risk Fuel Sites*, listed in Section 1.0 of this document.

3.1 Ongoing Sources

The Secor report dated September 10, 1997 reviewed Sanborn Maps that indicated the presence of USTs in the northeast and southwest corners of the Site. There is no indication that the USTs were removed.

To investigate the potential release of VOCs at the Site, Secor and Chow drilled and collected soil and groundwater samples from 15 borings at the Site. The investigations have not identified any free product or high concentrations of petroleum hydrocarbons or VOCs that could indicate its potential presence. The presence of abandoned USTs at the Site was not identified during the installation of the 15 borings.

3.2 Site Characterization

Soil samples were collected and analyzed from borings at 15 locations across the Site. The borings extended to between 25 and 30 feet below ground surface. Plate 3 presents a scaled cross-section of subsurface conditions; the cross-section extends diagonally across the Site. The cross-section indicates that the Site is underlain by a yellowish brown sand to silty sand, becoming an olive brown sand to silty sand at a depth of about 20 feet. The Secor borings lying outside of the cross-section indicates the same stratigraphy. The sand deposits are part of the Merritt sands and are dense and moist. The groundwater table was found at a depth of 20 to 25 feet across the Site.

The single exception to the consistent stratigraphy of yellow brown sand to silty sand is at Boring GP-3 where fill material was encountered to a depth of approximately 5.5 feet.

The material was logged as dark brown sand, fine-grained, medium dense, moist, with pieces of broken brick and wood. With the single exception of the fill material at GP-3, the Site is underlain by the yellow brown sand to silty sand. Because of the consistent nature of this sand deposit, it is believed that the Site has been adequately characterized. According to the *Phase I Environmental Site Assessment (Secor, 1997a)*, the presumed groundwater flow direction is west-southwest towards the Oakland Inner Harbor. A *Groundwater Quality Monitoring Report* by Woodward-Clyde Consultants dated April 7, 1993 for the adjacent 901 Jefferson property (*Woodward-Clyde, 1993*) indicated a flow direction to the southeast. Another assessment report by AGI/Uribe & Associates dated November 14, 1994 for the 901 Jefferson property (*AGI/Uribe, 1994*) indicated that groundwater flow directions varied. Harding ESE believes that the groundwater is most likely to flow toward the Oakland Inner Harbor. In Plate 4, chemical concentrations in the soil are superimposed onto the cross-section. Areas where organic odors were noted during the investigation are shown as well. As noted in Section 2.0, no detectable concentrations of petroleum hydrocarbons were found, despite the odors. Secor analyzed three soil samples from Boring GP-4 within the zone of slight to strong organic odors, and the measured constituents were not detected. Similarly, Chow analyzed one sample from SB-3 in the zone of slight to strong organic odors and found that TPH and BTEX were also not detected. Harding ESE has found at other sites that sandy soils with low VOC concentrations can have relatively strong vapors or odors, but the measured concentrations in the laboratory can be below the reporting limits.

Plate 5 shows the detectable concentrations of petroleum hydrocarbons and VOCs in groundwater. With the exception of the 0.67 mg/L of TPH as motor oil at GP-1 and the 0.1 mg/L of TPH as mineral spirits at SB-4, all of

the detections are in the northeast portion of the Site. The borings from the perimeter of the Site (GP 6, 7, 8, and 10) show no detectable concentrations of COPCs and are not shown on the cross-section on Plate 5. Based on this information, the data show a very limited impact of petroleum hydrocarbons and VOCs at the northeast corner of the Site. In summary, the studies completed by Secor, Chow and Harding ESE indicate a relatively minor impact of petroleum hydrocarbons and VOCs only at the former UST locations. On this basis, Harding ESE believes that the existing information characterizes Site conditions.

3.3 Dissolved Plume

As discussed previously, the analytical results indicate an impact to groundwater in the northeast corner of the Site of petroleum hydrocarbons and VOCs. The petroleum hydrocarbons are present at low concentrations at GP-1, indicating that they do not significantly extend in the presumed downgradient direction across the Site. Similarly, the VOCs do not appear to have migrated to the southwest corner of the Site as evidenced by the absence of VOCs in the groundwater at borings SB-4. Plate 5 also shows the decreasing TCE and petroleum hydrocarbon concentrations in the presumed downgradient direction along Cross-Section A-A'. As a result, Harding ESE considers the contaminant plume to be relatively stable and believes that the petroleum hydrocarbons and VOCs emanating from the Site are probably contained on-Site

3.4 Other Potential Receptors

The City of Oakland receives its drinking water from the Sierra Nevada Mountains. The nearest surface water bodies are Lake Merritt, located approximately 0.8 miles to the east and the Oakland Inner Harbor, located approximately 0.6 mile to the south. The groundwater gradient direction is presumed to be towards the Oakland Inner Harbor. As stated above, petroleum hydrocarbons are unlikely to migrate via the groundwater for long distances. Recent studies by Lawrence Livermore National Laboratory (*Rice et al., 1997*) found that petroleum hydrocarbon plumes rarely migrate more than 300 feet from a source area. The concentrations of VOCs detected are low and do not appear to extend off-Site. Harding ESE has made a detailed tour of the Site and found no public water wells. We therefore conclude that no water wells will be impacted by the petroleum hydrocarbons or VOCs released at the Site.

The Merritt sands are underlain by the Alameda Formation that consists of interlayered and discontinuous sandy soils within a clay matrix. The interlayered depositional features will mitigate vertical migration of the petroleum hydrocarbons and VOCs to the underlying aquifers.

Sections 4 and 5 address the final two RWQCB criteria discussed in Section 1.

4.0 HEALTH RISK EVALUATION

This section describes the HRE conducted for the Site. In the HRE, potential impacts on human health from exposure to chemicals detected in soil and groundwater at the Site were evaluated, in accordance with requirements of the San Francisco RWQCB (1996a) and consistent with guidance provided by the City of Oakland (2000a,b). The objective of the HRE was to address the 5th criterion for a low-risk groundwater site: "The site presents no significant risk to human health."

This HRE provides the following: a summary of chemicals detected at the Site and selection of chemicals of potential concern (COPCs; Section 4.1), an exposure assessment (Section 4.2), a RBCA evaluation (Section 4.3), and a summary of the conservative assumptions employed (Section 4.4).

4.1 Hazard Identification

This section includes a summary of soil and groundwater data and a comparison of the data to regulatory screening values to select COPCs. The sampling and analytical programs that were conducted at the Site are described in detail in Section 2.0.

4.1.1 Soil Data

Soil samples were collected at the Site and analyzed for TPH, BTEX, and lead. Of these, lead was the only chemical detected in soil (at a maximum concentration of 400 mg/kg, which is equal to the residential PRG); therefore, it is expected that exposure to chemicals in soil at the Site would not pose a risk to human health and soil was not evaluated further in this HRE.

4.1.2 Groundwater Data

Grab groundwater samples were collected at the Site from October 1997 through December 2000. Typically, grab groundwater samples have higher

detected chemical concentrations than monitoring well samples because well samples are collected after purging the well. As such, well samples more accurately represent groundwater concentrations. However, in the absence of monitoring wells, grab samples were collected for site evaluation.

A statistical data summary of all chemicals detected in groundwater at the Site is provided in Table 1 and includes the following values: minimum and maximum detected concentrations, frequency of detection (FOD), arithmetic mean, standard deviation, and 95 percent upper confidence limit (95% UCL) on the arithmetic mean. In the statistical calculations, for analytes with at least one detection, a concentration equal to one-half the reporting limit was used for results reported as non-detect. Per U.S. EPA (1989) risk assessment guidance, where one-half the reporting limit for a non-detect value exceeded the maximum detected concentration, the half-non-detect value was not used in the statistical calculations. In this HRE, only one result (for TPH as motor oil) was excluded based on this criterion.

According to Cal/EPA (1992) and ASTM (1995) guidance, the 95% UCL may be used to evaluate chemicals for risk, except when there are less than 10 samples analyzed. For several chemicals, less than 10 groundwater samples were analyzed. Consequently, 95% UCL concentrations were not calculated for those chemicals, as indicated in Table 1, and maximum detected concentrations were used instead. This is a very conservative approach that likely overestimates exposure.

4.1.3 Selection of Chemicals of Potential Concern

To select COPCs for further evaluation in the HRE, maximum chemical concentrations in groundwater were compared to Maximum

Contaminant Levels (MCLs) or Action Levels (ALs) provided by the California Department of Health Services (DHS: 2001). MCLs are enforceable drinking water goals developed on the basis of both protection of human health and the technical feasibility of attaining the standards. An exceedance of a MCL does not disqualify a fuel site from classification as a "low-risk groundwater case" according to RWQCB guidance (1996a), as long as the "low-risk" criteria are satisfied. According to the RWQCB, fuel sites where MCLs are exceeded can still qualify for closure as low-risk cases (RWQCB, 1996b). ALs, which are non-enforceable health-based advisory levels, were developed by the State for chemicals without MCLs.

Table I provides a comparison of maximum detected concentrations to MCLs or ALs. The maximum detected concentrations for the following chemicals exceeded MCLs or ALs and were identified as COPCs in the HRE: BTEX, 1,2-dichloroethane, and TCE. In the absence of MCLs or ALs, 1,2,4 - and 1,3,5 - trimethylbenzene were also retained for further evaluation as COPCs. Typically, TPH mixtures are not evaluated *per se* in risk assessments because they lack U.S. EPA and Cal/EPA toxicity criteria by which to evaluate them. Instead, they are evaluated by their more toxic constituents, BTEX. ~~TPH compounds were not selected as COPCs in this HRE.~~

4.2 Exposure Assessment

In this section, potential receptors and exposure pathways are presented, followed by a discussion of exposure point concentrations (EPCs). The selection of exposure pathways and receptors was based on the planned use of the Site.

4.2.1 Potential Receptors and Exposure Pathways

For an exposure pathway to be considered complete, four elements are necessary (USEPA 1987)

- A source and mechanism of chemical release
- An environmental transport medium
- A point of potential human contact with the medium
- An exposure route at the contact point.

These criteria are discussed below with respect to the Site.

The Site is located in downtown Oakland, a predominantly commercial area. The vacant Housewives Marketplace occupies a portion of the Site, and the remainder includes a vacant office building and a parking lot. ~~The City's development plans for the Site include a 6-story building on the site, which would consist of a parking lot surrounded by commercial offices on the bottom two floors and residential apartments/lofts on the upper four floors.~~

Based on these plans, the following potential receptors may be present at the Site in the future:

- Adult and child residents (apartment/loft style living)
- Commercial worker
- Parking lot attendant
- Construction worker.

None of these receptors is likely to be exposed to chemicals in groundwater at the Site. Groundwater is approximately 20 to 25 feet below ground surface. Construction workers and other receptors are not expected to directly contact groundwater at these depths. The City of Oakland currently obtains drinking water from the East Bay Municipal Utility District (EBMUD); there are no drinking water wells on the Site that could be impacted by the on-Site presence of petroleum hydrocarbons or VOCs. Future use of groundwater for domestic or beneficial purposes is unlikely because the unconfined, shallow groundwater is not used as a drinking water source. Based on these attributes, direct contact with groundwater at the Site is not a complete exposure pathway for receptors.

VOCs detected in groundwater at the Site, however, can potentially migrate in the vapor phase from groundwater to ambient air (although the presence of paving and building foundations is expected to substantially retard this process). The vapors can then be inhaled by receptors.

Accordingly, the following receptors and pathways are potentially complete at the Site:

- Future adult and child residents – inhalation of vapors from groundwater in indoor and outdoor air
- Future commercial workers/parking lot attendant – inhalation of vapors from groundwater in indoor and outdoor air
- Future construction workers – inhalation of vapors from groundwater in outdoor air.

Oakland (2000a) provides screening values for residents and commercial workers only. Therefore, screening values for commercial workers were used to evaluate construction and parking lot attendant receptors in the HRE. The commercial worker exposure assumptions are very conservative, such as a 25-year exposure duration at the Site. This assumption is highly conservative for construction workers because they are expected to be present at the Site for less than one year. Also, the commercial RBSL/SSTLs are protective of a future parking lot attendant because the scenario assumes that a receptor is exposed to chemicals in indoor air in the ground floor of a building with limited ventilation. The residential RBSL/SSTLs are also conservative in this HRE, given that they are based on single-family dwellings where substantial vapor intrusion into buildings can occur. Future residential plans at the Site include apartments and lofts, beginning on the third floor, where groundwater vapor intrusion is expected to be minimal to none. Accordingly, RBSLs and SSTLs used in this assessment are considered to be protective of all future receptors evaluated and lower than strictly necessary to protect the health of residents and construction workers.

4.2.2 Exposure Point Concentrations

EPCs are concentrations of COPCs at locations where receptor exposure is assumed to take place (i.e., exposure points). For each COPC, the EPC used for the evaluation was the lesser of the 95% UCL (where available) and the maximum detected concentration. Application of the 95% UCL (an upper-bound measure of the average concentration) reflects the fact that receptors are expected to move around the Site rather than stay permanently at the location of maximum potential exposure. In reality, receptors are likely to incur exposure to an average concentration, so use of the 95% UCL or the maximum detected concentration is a conservative approach. Accordingly, the EPCs provided in Table 1 were compared to RBSLs and SSTLs, where applicable.

As shown on Table 1, Secor analyzed for BTEX by EPA Method 8020 in ten groundwater samples. Chow analyzed four groundwater samples for BTEX by both EPA Methods 8020 and 8260, because Method 8260 incorporates a full suite of VOC analyses. For the four Chow samples, the results for Method 8020 were used to calculate EPCs for BTEX because these results were higher than the 8260 results.

4.3 RBCA Evaluation

This section describes the results of the tiered RBCA evaluation. As described in Section 1.1, Oakland (2000a) Tier 1 values were compared with Site EPCs. If EPCs exceeded the Oakland Tier 1 RBSLs, EPCs were compared with Oakland Tier 2 values for Merritt sands, the soil type predominantly found at the Site.

Toxic effects of chemicals are generally divided into two categories – carcinogenic (cancer causing) and noncarcinogenic. Accordingly, Oakland (2000a) developed screening levels for carcinogenic and noncancer health effects. Chemicals may have both a cancer and noncancer screening level or only one of these. In this assessment, the lower of the carcinogenic

and noncarcinogenic RBSL/SSTL for each chemical was selected.

4.3.1 Tier 1 Evaluation

Table 2 provides Oakland Tier 1 RBSLs for all COPCs at the Site. For the Tier 1 analysis, RBSLs for residential and commercial receptors based on inhalation of indoor air vapors were compared to EPCs. RBSLs for commercial receptors based on inhalation of outdoor vapors (for the construction worker exposure scenario) were also compared to EPCs. Results are summarized as follows:

- The EPC for benzene exceeded the residential Tier 1 RBSL for inhalation of indoor air.
- 1,2,4- and 1,3,5-trimethylbenzene lack RBSLs.
- EPCs for all other chemicals did not exceed Tier 1 RBSLs.

Based on these results, benzene was carried forward to the more site-specific Tier 2 assessment in Section 4.3.2 below. Because 1,2,4- and 1,3,5-trimethylbenzene lack screening values, these compounds were qualitatively evaluated in Section 4.3.3 below. These results indicate that potential exposure to COPCs in groundwater is unlikely to pose unacceptable health risks and hazards for all receptors at the Site.

4.3.2 Tier 2 Evaluation

The EPC for benzene was compared with the Tier 2 SSTL for Merritt sands for a residential receptor exposed to benzene vapors in indoor air emanating from groundwater. The results are described as follows:

- The EPC for benzene did not exceed the residential Tier 2 SSTL for inhalation of indoor air

These results indicate that adverse health effects are unlikely to occur to future receptors exposed to groundwater vapors at the Site.

4.3.3 COPCs without Screening Levels

MCLs and RBSLs are not available for 1,2,4- and 1,3,5-trimethylbenzene. However, it is unlikely that these compounds pose a risk to human health for the following reasons:

- 1,2,4- and 1,3,5-trimethylbenzene were only detected in one sample (SB-3) at the Site.
- 1,2,4- and 1,3,5-trimethylbenzene were detected approximately one order of magnitude below the EPC for benzene which is a more toxic chemical.
- Benzene was evaluated in the HRE and no potential risks were predicted. Benzene is more toxic than 1,2,4- and 1,3,5-trimethylbenzene because benzene is a known human carcinogen, whereas 1,2,4- and 1,3,5-trimethylbenzene are not carcinogens.
- 1,2,4- and 1,3,5-trimethylbenzene are not expected to significantly volatilize more rapidly from groundwater than benzene because vapor pressures and Henry's Law constants for these compounds are roughly equivalent (*U.S. EPA, 2000*).

4.3.4 Summary of Conservative Assumptions

The following factors contribute to the conservatism of the HRE:

- Use of commercial screening levels for the construction worker receptor was very conservative given that construction workers would likely not be present onsite longer than one year, whereas commercial workers were evaluated under a 25-year exposure period

- Use of residential screening levels for future loft/apartment residents was very conservative because vapor intrusion into residential apartments, which are anticipated to be three floors above ground surface, would be minimal.
- It was assumed that concentrations of chemicals in groundwater do not decrease over the exposure duration (i.e., up to 30 years for residential receptors), when in fact they are likely to decrease due to natural attenuation processes such as biodegradation, dispersion, and volatilization.
- Grab groundwater samples, which tend to have higher chemical concentrations than monitoring well samples, were applied.
- Only an upper-bound exposure scenario was evaluated for both Tiers 1 and 2 of the RBCA evaluation. A more conservative maximum detected concentration was used in lieu of the 95% UCL concentration for several chemicals. A more realistic, average exposure was not evaluated for the receptors.
- Cal/EPA and U.S. EPA toxicity factors used to evaluate the COPCs are developed using conservative methods and tend to result in conservative risk evaluations.
- Cal/EPA and U.S. EPA exposure assumptions used to evaluate the receptors are conservative and tend to result in conservative RBSLs and SSTLs. For instance, commercial workers are assumed to work at the Site for 250 days every year for 25 years for both Tiers 1 and 2.
- Tier 1 RBSLs were developed using volatilization factors (VFs) that were based on default, non-site-specific parameters, leading to conservative VFs that likely represent an overestimate of vapor emissions from Site groundwater.

Use of these conservative factors result in a conservative and health-protective HRE. Tier 1 RBSLs and Tier 2 SSTLs compiled for the Site are, therefore, likely lower than necessary to reasonably protect human health.

5.0 ECOLOGICAL EVALUATION

The City's developer proposes to construct a 6-story building onsite, consisting of a parking lot and commercial offices on the bottom two floors and residential apartments/lofts on the upper four floors. The Site is located approximately 0.8 miles west of Lake Merritt and approximately 0.6 miles north of the Oakland Inner Harbor that leads to San Francisco Bay. The direction of flow in the uppermost aquifer is presumed to be to the southwest, as described in Section 2.0.

For reasons discussed in Section 3.4, Harding ESE believes that the analytes detected in groundwater at the Site are unlikely to migrate off-site or to reach the Bay. In the very unlikely event that analytes detected at the Site were transported to the Bay, they would be expected to be at much lower concentrations due to attenuation and would undergo substantial, instantaneous dilution upon entering the Bay. Terrestrial ecological receptors will not be exposed to site media under the planned uses.

The presence of complete exposure pathways for chemicals in groundwater at the Site for either terrestrial or aquatic receptors is considered unlikely. Adverse health effects on ecological receptors from chemicals at the Site are, therefore, considered unlikely.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following sections present the findings and conclusions as well as recommendations for future site activities.

6.1 Conclusions

Harding ESE has evaluated Site conditions in comparison to the RWQCB's *Interim Guidance on Required Cleanup at Low-Risk Fuel Sites*. Site-specific data have been evaluated to determine if the Site complies with the six criteria for designating the Site as a "low risk groundwater site." Section 2 presents and compiles the background information available on Site conditions, and Section 3 shows that the data generally satisfy the first four criteria: no ongoing sources are present; the Site has been adequately characterized; the dissolved plume appears to be contained within the Site boundary; and drinking water and other sensitive receptors are not likely to be impacted by the chemicals encountered at the Site. However, the City has committed to the acquisition of additional data, including installation and monitoring of groundwater monitoring wells, a geophysical survey to evaluate the presence of product piping or USTs, and soil sampling and lead testing to identify fill materials. The City is committed to the acquisition of other field data to confirm the presumption that the first four criteria have been satisfied.

Section 4 presents the Health Risk Evaluation (HRE) which uses a tiered Risk-Based Corrective Action approach endorsed by the City of Oakland (2000a,b) to evaluate potential human health risks from exposure to chemicals detected in soil and groundwater at the Site. This evaluation demonstrates that the Site is unlikely to present significant risk to human health. We summarize below the basis for this conclusion.

Maximum detected groundwater concentrations were screened against State drinking water levels. Chemicals with EPCs exceeding these levels were

selected as groundwater COPCs for further evaluation. Chemicals in soil were determined to not pose a risk to human health because the only chemical detected was lead, which had a maximum concentration equal to the U.S. EPA (2000) residential PRG of 400 mg/kg.

Based on planned use, the following potential receptors and exposure pathways were evaluated:

- Future adult and child residents – inhalation of vapors from groundwater in indoor and outdoor air
- Future commercial workers/parking lot attendant – inhalation of vapors from groundwater in indoor and outdoor air
- Future construction workers – inhalation of vapors from groundwater in outdoor air.

An initial Tier 1 evaluation was conducted in which EPCs in groundwater were compared to Oakland Tier 1 RBSLs. Only the EPC for benzene exceeded the residential RBSL for inhalation of indoor air. Therefore, the EPC for benzene was compared to the Tier 2 SSTL for Merritt sands for future residents potentially exposed to benzene vapors emanating from groundwater. Results of the Tier 2 RBCA evaluation indicate that potential exposure to benzene in groundwater via vapor inhalation is considered unlikely to result in unacceptable health risks at the Site.

The chemicals 1,2,4- and 1,3,5-trimethylbenzene, which lack RBSLs, were considered to not pose a threat to human health because (1) they were detected in only one groundwater sample (2) they are less toxic than benzene which was not found to pose adverse risks (3) they were detected at concentrations much lower than the EPC for benzene, and (4) they are not expected to substantially volatilize from groundwater more rapidly than benzene.

To summarize, the RBCA evaluation of detected chemicals at the Site demonstrated that unacceptable cancer risks and noncancer health effects are unlikely to occur for future receptors potentially exposed to chemicals in soil and groundwater at the Site.

Section 5 showed that the Site does not present a risk to the environment, thereby completing the compliance with the six criteria for a "low risk groundwater site."

6.2 Recommendations

Harding ESE recommends that the Alameda County Health Agency approve Site Closure for the Housewives Marketplace contingent on the completion of the following:

- A geophysical survey to evaluate the presence of metallic anomalies below the ground surface. These metallic anomalies could be product piping and USTs that may contain free product. If metallic anomalies are identified by the geophysical survey, then the City will authorize excavation to determine the nature of the metallic anomaly.
- The preparation of a soil management plan to direct the developer on how the existing soils can be used on-Site and off-Site.

In addition, the City has proposed additional work that includes the following:

- The installation of three groundwater monitoring wells and measurement of water levels in these wells on two occasions to confirm the direction of groundwater flow at the Site.
- Monitoring of the three wells for selected parameters, including total dissolved solids, electrical conductivity, and chloride to evaluate groundwater quality.

Harding ESE requests that the Alameda County Health Agency send a Site Closure letter to Mr. Odili Ojukwu of the City of Oakland Public Works Agency at 250 Frank Ogawa Plaza, Suite 5301, Oakland, California 94612, with a copy to Harding ESE at 383 Fourth Street, Suite 300, Oakland, California 94607.

7.0 REFERENCES

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Woodward-Clyde Consultants letter to
Mr. Dennis Bryne of Alameda County
Department of Environmental Health.
Quarterly Monitoring Report dated April 2,
1991

_____, letter to Mr. Douglas Salter,
Groundwater Quality Monitoring Report,
dated April 7, 1993.

TABLES

**Table 1. Groundwater Data Summary
RBCA Evaluation
Housewives Marketplace
Oakland, California**

Analyte	Borehole Number Date	Sample Results (mg/L)													
		GP-1 10/21/97	GP-2 10/21/97	GP-3 10/21/97	GP-4 10/21/97	GP-5 01/22/98	GP-6 01/22/98	GP-7 01/23/98	GP-8 01/23/98	GP-9 01/23/98	GP-10 01/23/98	SB-1-GW 12/08/00	SB-2-GW 12/08/00	SB-3-GW 12/08/00	SB-4-GW 12/08/00
BTEX (EPA Method 8020)															
Benzene		< 0.0005	< 0.0005	< 0.0005	3.2	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.67	< 0.0005
Toluene		< 0.0005	< 0.0005	< 0.0005	13	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.45	< 0.0005
Ethylbenzene		< 0.0005	< 0.0005	< 0.0005	13	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.1	< 0.0005
Xylenes total		< 0.0005	< 0.0005	< 0.0005	53	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.48	0.0005
Volatile Organic Compounds (EPA Method 8260)															
Benzene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.51	< 0.001
1,2-Dichloroethane		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.009	< 0.001
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.099	< 0.001
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.0064	< 0.001
Naphthalene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.0089	< 0.001
n-Propylbenzene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.014	< 0.001
Toluene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.35	< 0.001
Trichloroethene		--	--	--	--	--	--	--	--	--	--	0.068	0.023	0.03	< 0.001
1,2,4-Trimethylbenzene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.082	< 0.001
1,3,5-Trimethylbenzene		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.019	< 0.001
Xylenes total		--	--	--	--	--	--	--	--	--	--	< 0.001	< 0.001	0.37	< 0.001
Total Petroleum Hydrocarbons (EPA Method 8015 Modified)															
TPH _g		< 0.5	< 0.5	< 0.5	1,700	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2.9	< 0.05
TPH _{ms}		< 0.05	< 0.05	< 0.05	210	NA	NA	NA	NA	NA	NA	0.088	< 0.05	0.29	0.1
TPH _{no}		0.67	< 0.5	< 0.5	< 100 ^c	NA	NA	NA	NA	NA	NA	NA	NA	NA	< 0.05
mg/L	Milligrams per liter.														
%	Percent														
95% UCL	95 Percent upper confidence limit on the arithmetic mean.														
EPIC	Exposure point concentration (i.e., lesser of 95% UCL and maximum detected value)														
MCL	Maximum contaminant level (DHS, 2001).														
COPC	Chemical of potential concern.														
BTEX	Benzene, toluene, ethylbenzene, and xylenes.														
TPH _g	Total petroleum hydrocarbons as gasoline.														
TPH _{ms}	Total petroleum hydrocarbons as mineral spirits.														
TPH _{no}	Total petroleum hydrocarbons as motor oil.														
	Chemical retained for further evaluation as a COPC.														
< 0.5	Not detected at a laboratory reporting limit of 0.5 mg/L.														
Bold	Detected value.														
--	Not available														
N/A	Not applicable.														
^a	95% UCL not calculated for data sets with less than 10 samples														
^b	Chemicals with maximum detected value exceeding the MCL or those lacking a MCL were selected as COPCs. For TPH compounds, see text Section 4.1.2.														
^c	Value not included in statistical calculations because half-reporting limit exceeds maximum detected value														
^d	Action level presented because chemical lacks a MCL.														
Note:	Only detected chemicals are presented														

Table 2. RBCA Tiers 1 and 2 Evaluation
RBCA Evaluation
Housewives Marketplace
Oakland, California

COPC ¹	EPC (mg/L)	Oakland RBSL/SSTLs (mg/L) ^a			EPC	EPC	EPC
		Residential Receptor (Inhalation of Indoor Air Vapors)	Commercial Receptor (Inhalation of Indoor Air Vapors)	Commercial Receptor (Inhalation of Outdoor Air Vapors)	Exceeds Residential Indoor Air RBSL/SSTL?	Exceeds Commercial Indoor Air RBSL/SSTL?	Exceeds Commercial Outdoor Air RBSL/SSTL?
Tier 1 Analysis							
BTEX							
Benzene	0.68	0.11	1.8	21	Yes	No	No
Toluene	2.6	210	> Sol.	> Sol.	No	No	No
Ethylbenzene	2.6	> Sol.	> Sol.	> Sol.	No	No	No
Xylenes total	11	> Sol.	> Sol.	> Sol.	No	No	No
Volatile Organic Compounds							
1,2-Dichloroethane	0.009	0.72	11	69	No	No	No
Trichloroethene	0.068	0.69	11	150	No	No	No
1,2,4-Trimethylbenzene	0.082	--	--	--	N/A	N/A	N/A
1,3,5-Trimethylbenzene	0.019	--	--	--	N/A	N/A	N/A
Tier 2 Analysis (Soil Type: Merritt Sands)^b							
Benzene	0.68	1.4	N/A	N/A	No	N/A	N/A

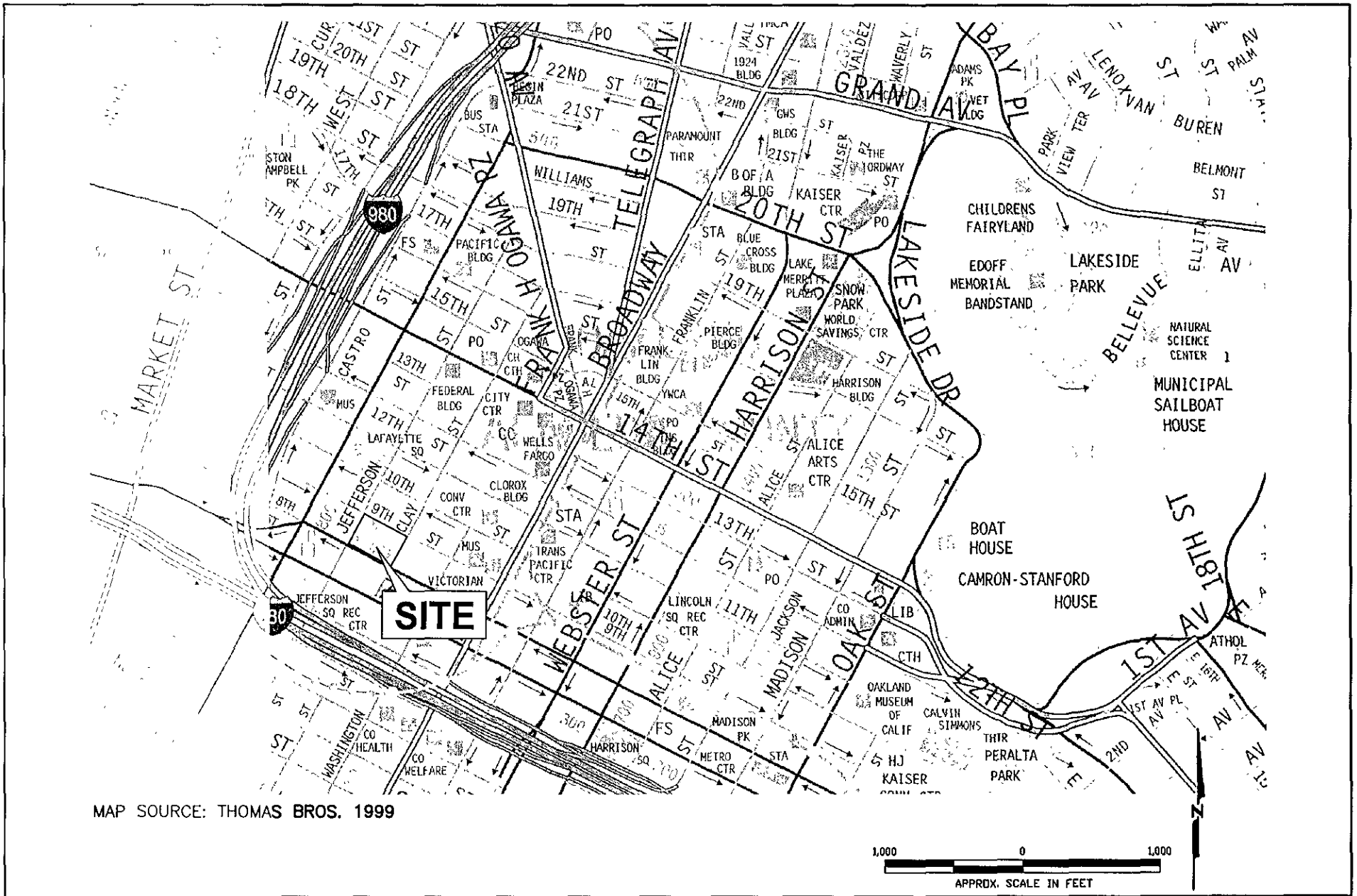
- COPC Chemical of potential concern.
- RBSL Risk-based screening level.
- mg/L Milligrams per liter.
- EPC Exposure point concentration (from Table 1).
- PRG Preliminary Remediation Goal (U.S. EPA, 2000)
- BTEX Benzene, toluene, ethylbenzene, and xylenes.
- > Sol Screening level exceeds solubility threshold of chemical in water.
- Not available.
- N/A Not applicable.

^a From *Oakland 2000a* - recommended RBSLs assuming groundwater is not a current or potential drinking water resource.

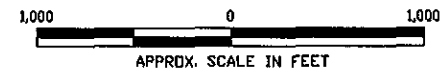
For carcinogenic chemicals, the lower of the carcinogenic and noncarcinogenic values is presented.

¹ Only benzene for a residential receptor was evaluated in Tier 2 because it did not pass the Tier 1 analysis.

PLATES



MAP SOURCE: THOMAS BROS. 1999



Harding ESE

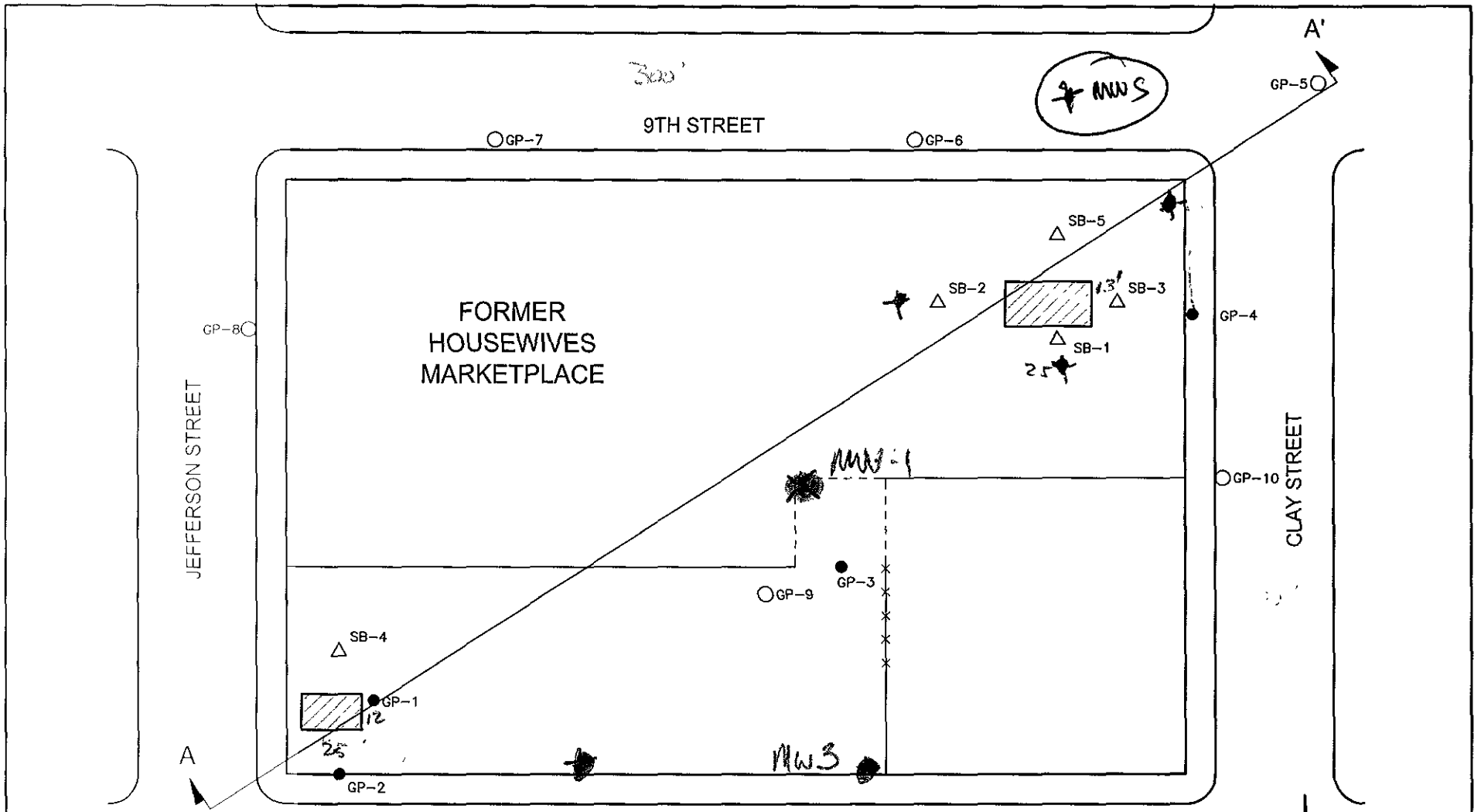
Vicinity Map
Houswives Marketplace
Oakland, California

PLATE

1

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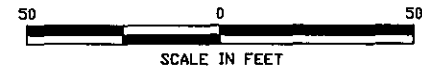


EXPLANATION:

- MEASURED LOCATION OF SECOR BORING
- ESTIMATED LOCATION OF SECOR BORING
- △ ACTUAL LOCATION OF HARDING/ESE BORING

□ ESTIMATED LOCATION OF FORMER USTs

↔ CROSS-SECTION A-A'
(SEE PLATES 3 THRU 5)



Harding ESE

Site Plan
Locations of Borings and USTs
Housewives Marketplace
Oakland, California

PLATE

2

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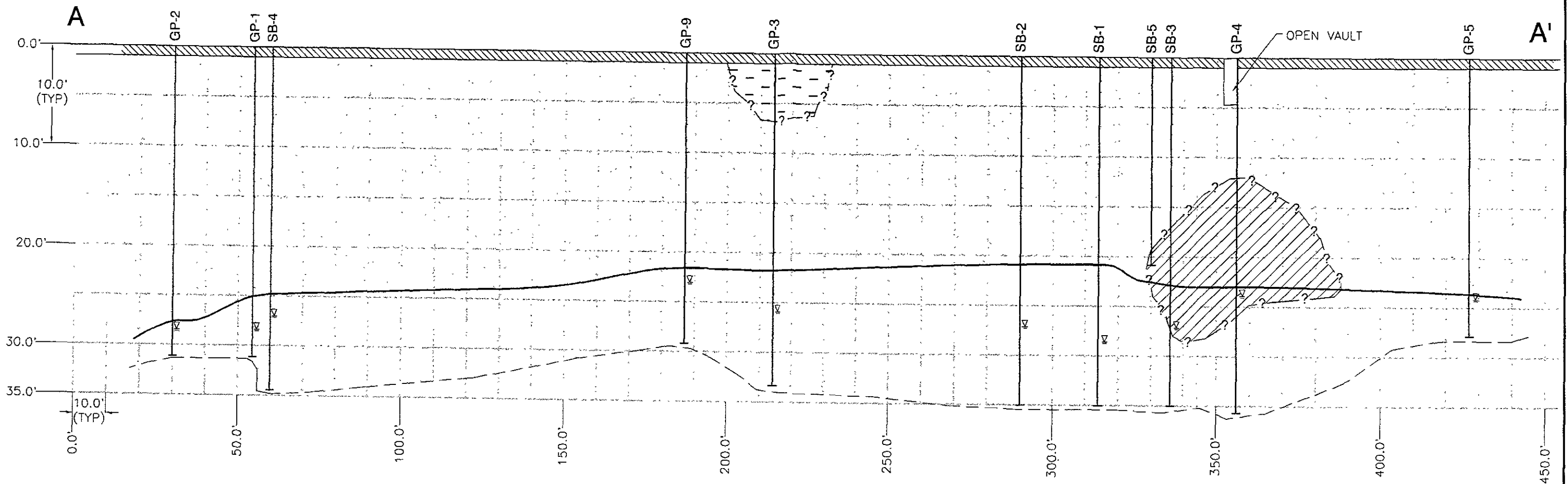
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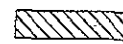






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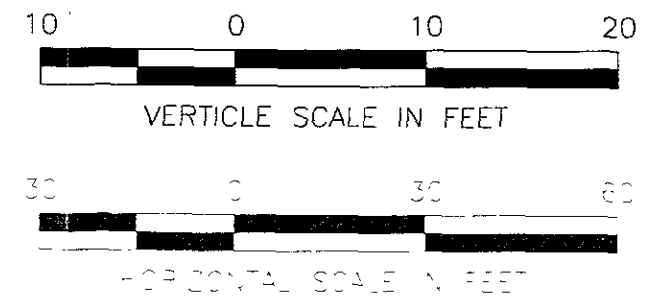
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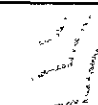


EXPLANATION

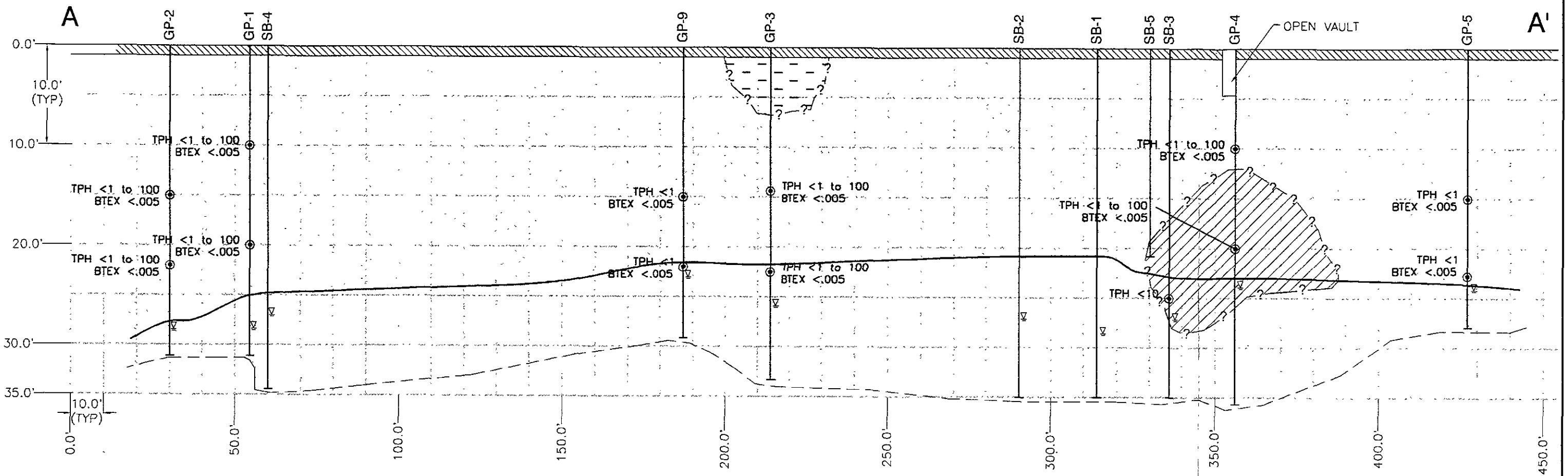
-  ASPHALT, CONCRETE AND AGGREGATE BASE ROCK
-  YELLOWISH BROWN SAND TO SILTY SAND, MOIST, DENSE
-  OLIVE BROWN SAND TO SILTY SAND, DENSE, MOIST TO SATURATED
-  DARK BROWN SAND WITH DEBRIS, ETC.
-  SLIGHT TO STRONG SILTY CLAY OF ORGANIC COMPOUNDS
-  UNSTABILIZED WATER LEVEL MEASUREMENT
- GP-2  SOIL BORING

NOTE:
FOR LOCATION OF CROSS SECTION SEE PLATE 2.

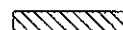








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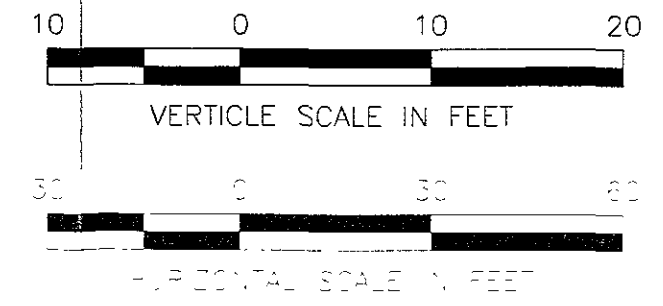
Cross Section A-A'
Subsurface Conditions
Housewives Marketplace
Oakland, California

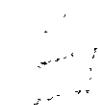


EXPLANATION

-  ASPHALT, CONCRETE AND AGGREGATE BASE ROCK
-  YELLOWISH BROWN SAND TO SILTY SAND, MOIST, DENSE
-  OLIVE BROWN SAND TO SILTY SAND, DENSE, MOIST TO SATURATED
-  DARK BROWN SAND WITH DEBRIS (FILL)
-  SLIGHT TO STRONG ODORS OF ORGANIC COMPOUNDS
-  UNSTABILIZED WATER LEVEL MEASUREMENT
- GP-2 SOIL BORING
-  LOCATION OF SOIL SAMPLE

NOTES:
 FOR LOCATION OF CROSS SECTION SEE PLATE 2.
 ALL SOIL CONCENTRATIONS IN MG/KG.
 REPORTING LIMITS FOR TPH VARIED BETWEEN
 1 AND 100 MG/KG.
 NO VOCs WERE DETECTED BY THE LABORATORY.



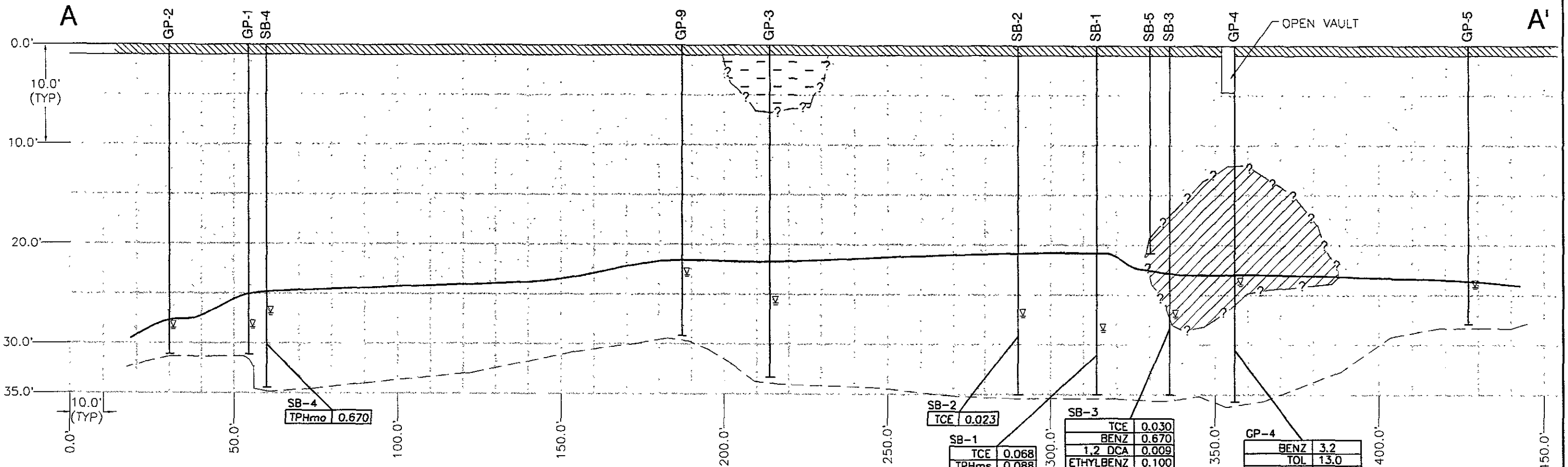


Harding ESE

Cross Section A-A
 Soil Concentrations
 Housewives Marketplace
 Oakland California

4

SS
329
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04201



EXPLANATION

- ASPHALT, CONCRETE AND AGGREGATE BASE ROCK
- YELLOWISH BROWN SAND TO SILTY SAND, MOIST, DENSE
- OLIVE BROWN SAND TO SILTY SAND, DENSE, MOIST TO SATURATED
- DARK BROWN SAND WITH DEBRIS (FILL)
- SLIGHT TO STRONG ODORS OF ORGANIC COMPOUNDS
- UNSTABILIZED WATER LEVEL MEASUREMENT

GP-2 SOIL BORING

TPH MINERAL SPIRITS

TPH GASOLINE

TPH MOTOR OIL

NOTES:
 FOR LOCATION OF CROSS SECTION SEE PLATE 2.
 ONLY DETECTED CONCENTRATIONS ARE SHOWN.
 ALL CONCENTRATIONS IN MG/L.
 NO GROUNDWATER ENCOUNTERED AT SB-5.

SB-2

TCE	0.023
-----	-------

SB-1

TCE	0.068
TPHms	0.088

SB-3

TCE	0.030
BENZ	0.670
1,2 DCA	0.009
ETHYLBENZ	0.100
IPB	0.006
NAPTH	0.009
W-PB	0.014
TOL	0.450
1,2,4 TMB	0.082
1,3,5 TMB	0.019
XYLENES	0.480

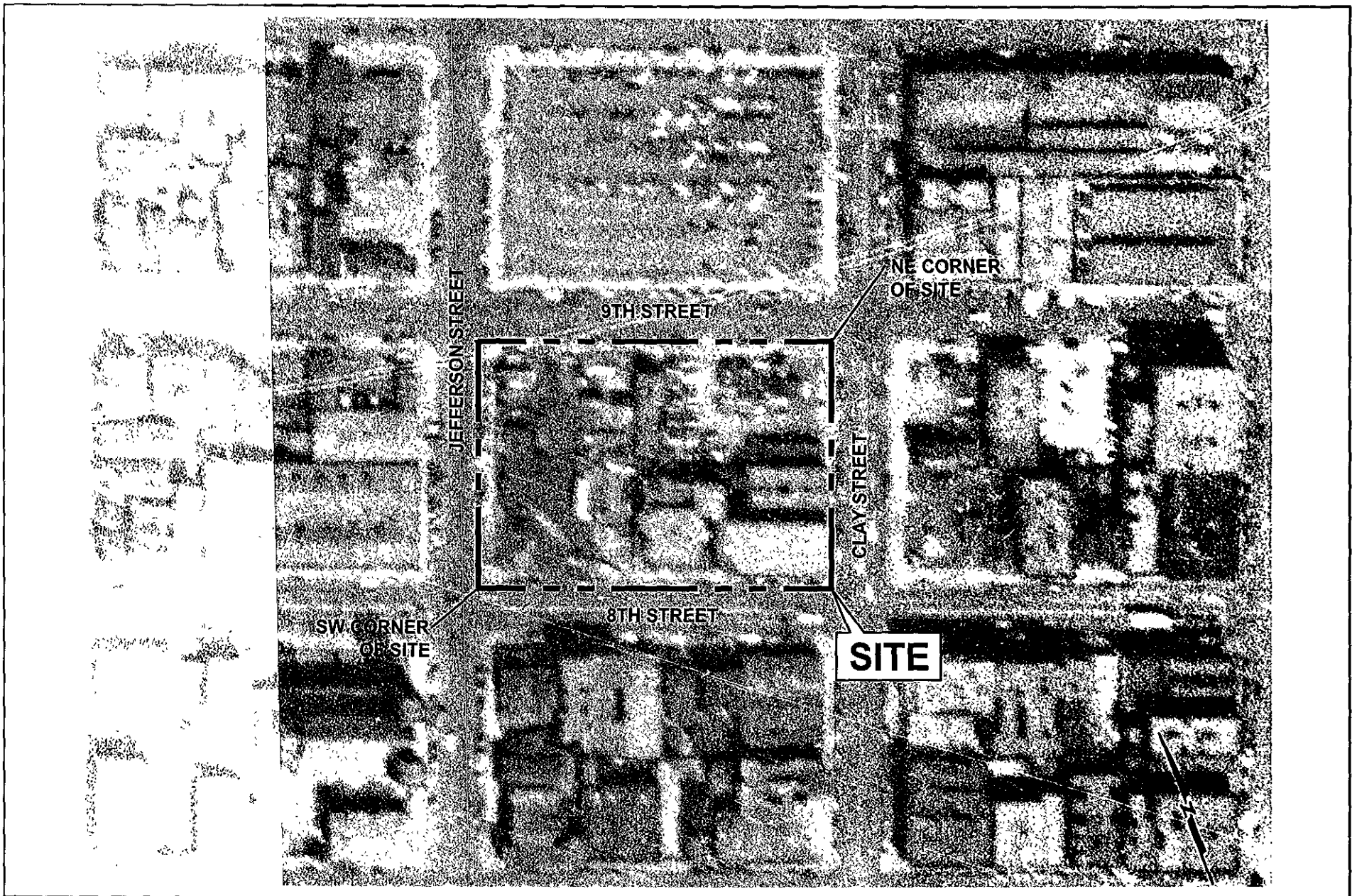
GP-4

BENZ	3.2
TOL	13.0
ETHYLBENZ	13.0
XYLENES	53.0
TPHms	210.0
TPHg	1700.0



Harding ESE

Cross Section A-A'
 Groundwater Concentrations
 Housewives Marketplace
 Oakland, California



Harding ESE

Aerial Photograph of 1947
Houswives Marketplace
Oakland, California

PLATE

6

DRAWN
SS

JOB NUMBER
52901

APPROVED
1/10

DATE
03/2001

REVISED DATE

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DISTRIBUTION

Risk-Based Corrective Action (RBCA) Evaluation
Housewives Marketplace
801 Clay Street
Oakland, California

May 4, 2001

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Mr. Odili Ojukwu, P.E.
City of Oakland
Public Works Agency
Environmental Services Division
250 Frank H. Ogawa Plaza, Suite 5301
Oakland, California 94612

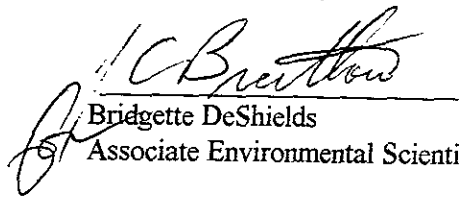
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Associate Environmental Scientist

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