

FINAL REPORT

Mr. Daniel Helix and
Union Pacific Railroad Company

Remedial Investigation Report

Hookston Station Site

Pleasant Hill, California

August 2004

Environmental Resources Management
1777 Botelho Drive, Suite 260
Walnut Creek, CA 94596



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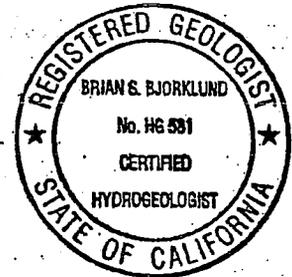
August 2004



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LIST OF ACRONYMS

| | |
|-------------|--|
| 1,1-DCA | 1,1-Dichloroethane |
| 1,2-DCA | 1,2-Dichloroethane |
| 1,1-DCE | 1,1-Dichloroethene |
| ARCH | Air-rotary casing hammer |
| ASTM | American Society for Testing and Materials |
| bgs | Below ground surface |
| C&T | Curtis & Tompkins, Ltd. |
| CCCRA | Contra Costa County Redevelopment Agency |
| COC | Compound of concern |
| COPC | Constituent of potential concern |
| CPT | Cone penetrometer testing |
| cis-1,2-DCE | cis-1,2-Dichloroethene |
| CSM | Conceptual Site Model |
| CTEH | Center for Toxicology and Environmental Health, L.L.C. |
| DNAPL | Dense nonaqueous-phase liquid |
| DWR | State of California Department of Water Resources |
| ERM | ERM-West, Inc. |
| ESL | Environmental Screening Level |
| FS | Feasibility Study |
| ft/day | Feet per day |
| ft/ft | Feet per foot |
| ft/yr | Feet per year |
| HLA | Harding Lawson Associates |
| IRM | Interim Remedial Measure |
| K | Hydraulic conductivity |
| LNAPL | Light nonaqueous-phase liquid |
| MCL | Maximum contaminant level |
| MTBE | Methyl tert-butyl ether |
| mg/kg | Milligram per kilogram |

| | |
|-------------------|---|
| mg/L | Milligrams per liter |
| NAPL | Nonaqueous-phase liquid |
| PCB | Polychlorinated biphenyl |
| PCE | Tetrachloroethene |
| PDB | Passive diffusion bag |
| PID | Photoionization detector |
| PVC | Polyvinyl chloride |
| RI | Remedial Investigation |
| RWQCB | Regional Water Quality Control Board |
| S | Storativity |
| SAP | Sampling and Analysis Plan |
| SPTCo | Southern Pacific Transportation Company |
| STL | Severn Trent Laboratories |
| SVOC | Semivolatile organic compound |
| T | Transmissivity |
| T&R | Treadwell & Rollo, Inc. |
| TCE | Trichloroethene |
| TPH | Total petroleum hydrocarbons |
| TPH-D | Total petroleum hydrocarbons as diesel |
| TPH-G | Total petroleum hydrocarbons as gasoline |
| UPRR | Union Pacific Railroad Company |
| USEPA | United States Environmental Protection Agency |
| USCS | Unified Soil Classification System |
| USGS | United States Geological Survey |
| VC | Vinyl chloride |
| VOC | Volatile organic compound |
| µg/kg | Microgram per kilogram |
| µg/L | Microgram per liter |
| µg/m ³ | Microgram per cubic meter |

EXECUTIVE SUMMARY

This *Remedial Investigation Report* has been prepared for the Hookston Station site, located at the intersection of Hookston and Bancroft Roads in Pleasant Hill, California. This report has been developed in accordance with Regional Water Quality Control Board Order No. R2-2003-0035.

Volatile organic compounds were initially detected in ground water at the site in 1990. Several phases of environmental investigations have been performed, including the more recent Phase I and Phase II Remedial Investigations, which were completed in 2004. These investigations have studied chemical impacts to soil, soil vapor, ground water, indoor and outdoor air, and surface water. Trichloroethene (TCE) is the most widespread chemical detected at the site, although chemicals that are commonly associated with the natural breakdown of TCE are also present. TCE impacts to ground water appear to originate near the southwest corner of the property, beneath a building where TCE was once used as a degreasing solvent.

TCE has been detected in ground water at concentrations above drinking water standards both on and off the site to depths of approximately 70 feet. Ground water flows beneath the site in a north to northeast direction. Organic chemicals, including TCE and other chemicals that are not associated with the Hookston Station site, have been detected in surface water samples from this creek. Ground water impacts from other (non-Hookston) sources have also been observed within the study area, but these off-site chemical impacts were not specifically evaluated as part of the Hookston Station Remedial Investigation.

Other studies have been performed to address specific exposure pathways, including the identification of privately owned irrigation wells and indoor air analyses within homes that overlie the highest TCE concentrations in ground water. The results of these studies are included in this report.

At this time, we believe that the site characterization completed for this Remedial Investigation is sufficient for the purposes of preparing the Feasibility Study. Future efforts should focus on the completion of the Feasibility Study and the subsequent implementation of the selected remedy.

1.0

INTRODUCTION

On behalf of Union Pacific Railroad Company (UPRR) and Mr. Daniel Helix, ERM-West, Inc. (ERM) has prepared this *Remedial Investigation Report* (report) for the Hookston Station site (site). The site is located at the intersection of Hookston and Bancroft Roads in Pleasant Hill, California (Figure 1-1). This report has been developed in accordance with Regional Water Quality Control Board (RWQCB) Order No. R2-2003-0035 (Order), dated 16 April 2003.

1.1

DOCUMENT ORGANIZATION

Following this introduction, this report is divided into the following sections:

- Section 2 – Site Description;
- Section 3 – Site Development History;
- Section 4 – Previous Investigations;
- Section 5 – Remedial Investigation Activities;
- Section 6 – Geology and Hydrogeology;
- Section 7 – Chemicals in Soil;
- Section 8 – Chemicals in Ground Water;
- Section 9 – Chemicals in Surface Water and Sediment;
- Section 10 – Chemicals in Air;
- Section 11 – RWQCB Comments to Risk Assessment;
- Section 12 – Conceptual Site Model;
- Section 13 – Conclusions; and
- Section 14 – References.

Attached to this report are the following appendices:

- Appendix A – Boring Logs;
- Appendix B – Geophysical Logs;
- Appendix C – Monitoring Well Completion Reports;
- Appendix D – Well Development Forms;

- Appendix E - Geotechnical Soil Analyses;
- Appendix F - Quality Assurance/Quality Control Summary; and
- Appendix G - Laboratory Data Summary Tables (all compounds/laboratory-qualified data) and laboratory reports.

1.2

REMEDIAL INVESTIGATION OBJECTIVES

The goal of the overall Remedial Investigation (RI) program was to characterize the geology, hydrogeology, and chemical impacts to soil, soil vapor, indoor and outdoor air, and ground water beneath the site and impacted areas downgradient of the site sufficient to prepare a Feasibility Study (FS). The RI program has been completed during a series of phased investigations; the first phase was completed between 2001 and 2002, and was followed by a second phase, which was generally divided into an on-site source area investigation (completed in 2003) and an off-site investigation (completed in 2004). The specific objectives of each phase of RI fieldwork are presented below.

1.2.1

Phase I Remedial Investigation

The scope of the Phase I RI was developed to address data gaps identified with the investigations conducted previously by other consultants. A summary of these initial site investigations is presented in Section 4 of this report. To accomplish this goal, the objectives of the Phase I RI were to:

- Identify the sources of chemicals in shallow soil, soil vapor, and ground water to the extent necessary to guide future source area investigations; and
- Evaluate the lateral and vertical distribution of chemicals in off-site ground water.

1.2.2

Phase II Remedial Investigation - Source Area Investigation

The primary goal of the source area investigation of the Phase II RI was to further define the lateral and vertical extent of impacted soils on site to evaluate the need for and scope of source area interim remedial measures (IRMs). The specific objectives of the source area investigation were to:

- Characterize the geology beneath the source area, including the vadose (unsaturated) zone, and the A-Zone and B-Zone aquifers (the first and second water-bearing zones beneath the site);
- Evaluate ground water occurrence and flow beneath the site;

- Estimate the three-dimensional distribution of volatile organic compounds (VOCs) in soil and ground water; and
- Characterize the presence of secondary constituents of potential concern (COPCs) that may be present in shallow site soil, including heavy metals, total petroleum hydrocarbons (TPH), semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs).

1.2.3

Phase II Remedial Investigation - Ground Water Characterization

The primary goal of the Phase II RI ground water characterization was to determine the distribution of trichloroethene (TCE) and related chemical breakdown products in A-Zone and B-Zone ground water that are the direct result of releases at the Hookston Station site. A secondary goal of the Phase II RI ground water characterization was to determine the impacts on the Hookston Station site from an apparent upgradient and off-site source area(s) identified during the Phase I RI fieldwork.

To accomplish these goals, the specific objectives of the Phase II RI were to:

- Complete a three-dimensional characterization of the Hookston Station ground water plume using fixed off-site monitoring wells; and
- Differentiate between Hookston Station impacts and off-site source impacts by installing two well clusters on Vincent Road.

1.3

PROJECT OVERVIEW

The site was previously occupied by the former Southern Pacific Transportation Company (SPTCo) and was used for a rail line and a station ("Hookston Station"). The property was transferred from SPTCo to Mr. Daniel Helix in 1983, and the Contra Costa County Redevelopment Agency (CCCRA) subsequently purchased the eastern portion of the site in 1989.

Environmental investigations were conducted between 1989 and 1996 by various environmental consulting firms on behalf of CCCRA and Mr. Helix. As described in Section 4, these investigations discovered the presence of both petroleum-based products and chlorinated solvents in the soil and ground water at the site.

The initial environmental investigations by Harding Lawson Associates (HLA, January and June 1990) were completed for the Contra Costa

County Public Works Department in support of the proposed purchase of the eastern portion of the property. Following the discovery of chemical impacts to soil and ground water at the site, Engeo, Inc. (1991 to 1992) and Treadwell & Rollo, Inc. (T&R) (1993 to 1996) performed additional investigations on behalf of Mr. Helix. UPRR became responsible for SPTCo's share of costs for this site following the merger with SPTCo in 1997.

UPRR and Mr. Helix contracted with ERM in April 2000 to perform environmental investigations at the site.

Regulatory oversight of this project is currently being performed by the RWQCB under the 16 April 2003 Order. The Order requires completion of the following 10 tasks:

- Task 1 - Source Area Investigation Workplan (completed);
- Task 2 - Community Relations Plan (completed);
- Task 3 - Risk Assessment Workplan (completed);
- Task 4 - Area Well Survey (completed);
- Task 5 - RI Workplan (completed);
- Task 6 - Source Area Investigation/IRM Workplan (completed);
- Task 7 - Implementation of Source Area IRM (completed [none required]);
- Task 8 - Risk Assessment (completed);
- Task 9 - RI (this report); and
- Task 10 - Feasibility Study.

The status of each task within the Order is described above. Tasks 1 through 6 and Task 8 have been completed. Based on the findings of the Source Area Investigation as presented in *Source Area Investigation and Interim Remedial Measures Analysis Report* (ERM, 2003h), it was determined that Task 7 was not warranted. This report fulfills the requirements of Task 9 of the Order.

2.0

SITE DESCRIPTION

2.1

SITE LOCATION

The site is located near the intersection of Hookston Road and Bancroft Road in Contra Costa County, Pleasant Hill, California. A Site Location Map is provided as Figure 1-1.

2.2

SITE PHYSICAL CHARACTERISTICS

The site covers approximately 8 acres, and the boundaries of the site form an elongated strip that runs north to south along the former railroad right-of-way. Four main structures are currently present at the site, which are situated at 199 Mayhew Way, 222 Hookston Road, 228 Hookston Road, and 230 Hookston Road (Figure 1-2). Two smaller structures, one of which is similar to a pole barn, are also present on the site, which are associated with the operations at 228 Hookston Road (currently hay bale and feed storage for a feed company). The eastern half of the site is mostly vacant, with only one structure present associated with a concrete batch plant operation at 230 Hookston Road.

The western portion of the site that is not covered by structures is covered with asphalt pavement and a few gravel areas. These areas are utilized for parking and driveways. The eastern portion of the site is mostly vacant and covered with gravel and overgrown vegetation; some asphalt pavement is present near 230 Hookston Road. The majority of the site is surrounded by chain-link fence, limiting pedestrian access. The City of Concord recently installed a pedestrian/bike path that extends the Iron Horse Trail along the eastern property boundary, and now diverts this local foot traffic away from the industrial and commercial operations on the site. Access to the site is limited to narrow alleyways that lead from Hookston Road to the north and Mayhew Way to the south.

2.3

CURRENT USES OF THE PROPERTY

Several business operations are present at the site. A feed and pet supply store occupies the majority of the northeast portion of the site, including the structures at 222 and 228 Hookston Road. The structure at

199 Mayhew Way is divided into several smaller suites, which are occupied by two automobile maintenance and body shops, a window and cabinet (woodworking) shop, and a wood recycling facility. Other spaces at 199 Mayhew Way are vacant. A concrete batch plant is present on a portion of the eastern half of the site. The vacant portions on the eastern half of the property were formerly operated as a lumberyard and a recycling facility.

2.4

SURROUNDING PROPERTIES

The properties surrounding the site include residential areas and mixed office/commercial/light industrial enterprises. Private residences, consisting of single-family homes, town homes, and apartment buildings, are located northeast, east, and south of the site. The site is bordered to the west by mixed-use operations, including business offices, commercial spaces, and some light-industry. A gasoline station (Haber Oil/Chevron Products) is also located immediately west of the site near the northwestern property boundary. A self-storage business and small community park are situated north of the site.

2.5

PHYSICAL SETTING

According to the Walnut Creek Quadrangle, California, United States Geological Survey (USGS) 7.5-minute series topographic quadrangle map, the site is situated at an approximate surface elevation of 65 to 70 feet. The ground surface gently slopes to the south at an approximate gradient of 0.007 feet vertical per foot horizontal (ft/ft).

The nearest surface water body is the Contra Costa County Flood Control District's Walnut Creek canal. The canal is located approximately 1,300 feet east of the site and flows in a northerly direction for several miles before emptying in to the Suisun Bay. The canal is unlined in the vicinity of the site.

SITE DEVELOPMENT HISTORY

The site was controlled by SPTCo from June 1891 until September 1983. SPTCo operated the site as a portion of the San Ramon Branch rail line until approximately 1965; this rail line once connected Avon to San Ramon, California. During that time, the site included a freight-loading platform with railroad sidings and was used as a station for loading fruit and lumber.

Between approximately 1965 and 1983, the land was developed into a mixed light-industrial business complex, and was occupied by auto-related businesses, lumber yards, furniture manufacturing and metal working shops, as well as masonry works. During this period, a company doing business as ET Mag Wheels operated out of the southern portion of 199 Mayhew Way, near the southwestern corner of the property. ET Mag Wheels reportedly used TCE as a cleaning solvent, and this former business operation is likely the primary contributor to the Hookston Station VOC plume. ET Mag Wheels is no longer in business; this portion of the building currently houses an auto body shop and woodworking and wood recycling shops. A summary of other historical business practices and chemical use on the property is described in the *Site History Data Summary* (ERM, 2003e).

The property was transferred from SPTCo to Mr. Daniel Helix in 1983, and the CCCRA subsequently acquired the eastern portion of the site from Mr. Helix in 1989. The western portion of the site has been sublet to various auto-related businesses including maintenance, repair, and body shops, as well as warehouse space, a lumber yard, an upholstery shop, a masonry shop, and a feed store. The eastern portion of the site was previously occupied by lumber yards, recycling facilities, auto-related businesses, machining repair shops, and a roofing company.

PREVIOUS INVESTIGATIONS

The first soil and ground water samples were collected from the site by HLA in January 1990. Three other environmental consultants have performed sampling at the site, including Engeo, T&R, and presently, ERM. Several of the previous sampling programs used duplicate sample identification for different data (i.e., multiple borings were labeled B-1 through B-13). To differentiate historical samples from each other, ERM adopted a sample naming convention that includes a short two- or three-letter extension that indicates the origin of the data (e.g., B-01-TR for T&R's boring B-1, and B-01-ENG for Engeo's boring B-1).

The data collected by other consultants during the previous investigations were used in the preparation of this report and may be found in the following documents:

- *Modified Phase I Preliminary Report* (HLA, 1990a).
- *Remedial Investigation* (HLA, 1990b).
- *Preliminary Site Characterization* (Engeo, 1991).
- *Report on Ground Water Sampling* (Engeo, 1992a).
- *Initial Soil Characterization Study* (Engeo, 1992b).
- *Subsurface Investigation* (T&R, 1993).
- *Supplemental Subsurface Investigation* (T&R, 1996).

It should be noted that this RI report relies on the data reported by HLA, Engeo, and T&R; however, ERM has not performed a quality control review of these historical field and laboratory data.

The subsections below summarize the scope of these previous environmental investigations. In addition, most of the Phase I/Phase II investigation data presented in this RI report have been previously reported in the following documents:

- *First Quarter 2001 Ground Water Monitoring Report* (ERM, 2001a).
- *Second Quarter 2001 Ground Water Monitoring Report* (ERM, 2001b).
- *Third Quarter 2001 Ground Water Monitoring Report* (ERM, 2002a).
- *Remedial Investigation Progress Report* (ERM, 2002c).
- *Preliminary Risk Evaluation* (ERM, 2002d).

- *Interim Data Submittal* (ERM, 2002e).
- *Second Quarter 2003 Ground Water Monitoring Report* (ERM, 2003c).
- *Third Quarter 2003 Ground Water Monitoring Report* (ERM, 2003g).
- *Source Area Investigation and Interim Remedial Measures Analysis Report* (ERM, 2003h).
- *Fourth Quarter 2003 Ground Water Monitoring Report* (ERM, 2004a).
- *Risk Assessment* (Center for Toxicology and Environmental Health, L.L.C. [CTEH], 2004).
- *First Quarter 2004 Ground Water Monitoring Report* (ERM, 2004b).

All of these documents have been placed within the project's information repository at the Pleasant Hill Public Library in Pleasant Hill, California, for public review.

4.1 *MODIFIED PHASE I PRELIMINARY REPORT, HLA, 1990*

This October 1989 investigation consisted of the collection of 10 surface soil samples, and focused solely on the presence of petroleum hydrocarbons. As a result of the high concentrations of petroleum hydrocarbons found in these samples, HLA recommended that a ground water investigation be conducted and additional soil samples be collected.

4.2 *REMEDIAL INVESTIGATION, HLA, 1990*

This April/May 1990 investigation consisted of the collection of soil and ground water samples. Four monitoring wells (MW-1, MW-2, MW-3 and MW-4) were installed on site and were subsequently sampled for petroleum hydrocarbons. The laboratory contracted for this investigation alerted HLA of the presence of VOCs, particularly TCE, in the ground water samples. Shallow soil samples collected during this investigation were not analyzed for VOCs, but HLA recommended additional soil and ground water samples be collected at the site.

4.3 *PRELIMINARY SITE CHARACTERIZATION, ENGEO, 1991*

The purpose of the Preliminary Site Characterization investigation was to further investigate the source and extent of ground water VOC impacts. This investigation consisted of the collection of soil and ground water

samples and the installation of two shallow monitoring wells (MW-5 and MW-6). In addition, 76 passive soil vapor probes (SV-01 to SV-76) were installed and analyzed. The soil vapor survey served to locate the areas with elevated VOC concentrations at the site. Ground water and soil vapor sampling activities confirmed elevated concentrations of TCE and tetrachloroethene (PCE) in shallow site ground water and soil vapor. Based on these findings, Engco recommended further soil and ground water investigation activities.

4.4

REPORT ON GROUND WATER SAMPLING, ENCO, 1992

This January 1992 investigation consisted of the collection of ground water samples from the six on-site monitoring wells. These samples provided further insight into the extent and concentration of PCE and TCE in ground water at the site.

4.5

INITIAL SOIL CHARACTERIZATION STUDY, ENCO, 1992

In June 1991, Engco suggested that further vertical delineation of VOCs in soil was needed at the site. This January 1992 investigation consisted of the collection of soil and ground water samples to provide an on-site characterization of VOCs. During this investigation, 21 soil borings were advanced and one grab ground water sample was collected. The 1992 report also discusses sanitary sewer video inspections that were performed in three phases between June 1991 and January 1992. Engco stated that data from the previous soil vapor study suggested that the most probable source for the VOCs reported in site ground water was leaks within the site sanitary sewer system.

4.6

SUBSURFACE INVESTIGATION, TREADWELL & ROLLO, 1993

This investigation consisted of the collection of 14 off-site grab ground water samples and installation of two on-site (MW-01D and MW-7) and two off-site (MW-02D and MW-03D) monitoring wells. This was the first off-site investigation; the results indicated that the ground water VOC plume was present up to 2,000 feet downgradient of the site. Three monitoring wells (MW-1D, MW-2D, and MW-3D) were installed in the deeper aquifer zone. Sample results from these wells demonstrated that TCE was also present in the deeper aquifer. This report also identified

several off-site private domestic and municipal water wells in the vicinity of the site.

4.7

SUPPLEMENTAL SUBSURFACE INVESTIGATION, TREADWELL & ROLLO, 1996

This November 1995 field investigation consisted of the collection of soil and ground water samples from numerous on- and off-site locations. Several shallow on-site soil samples were collected and analyzed for VOCs. In addition to collecting samples from the 10 existing monitoring wells, T&R advanced 10 shallow HydroPunch™ borings to further delineate the shallow ground water VOC plume. The report concluded that PCE and TCE were the most commonly detected VOCs in shallow ground water and that the presence of PCE in ground water at wells MW-1 and MW-7 might be caused by an off-site, upgradient contaminant source or unknown, on-site sources.

4.8

GROUND WATER MONITORING, ERM, 2000

In June 2000, ERM began performing quarterly ground water monitoring of nine monitoring wells at the site. Monitoring well MW-02 was damaged some time between 1995 and 2000 and is no longer accessible for sampling. Quarterly monitoring events continue to be conducted at the site in accordance with a monitoring and reporting program described within the RWQCB Order.

5.0

REMEDIAL INVESTIGATION ACTIVITIES

RI activities were conducted at the site in a phased approach between October 2001 and April 2004. These are described in the following sections.

5.1

PHASE I REMEDIAL INVESTIGATION

The Phase I RI activities were conducted at the site between September 2001 and September 2002 in accordance with the *Phase I Remedial Investigation Sampling and Analysis Plan* (Phase I RI SAP) (ERM, 2000). It should be noted that ERM developed this sampling plan at the request of UPRR and Mr. Helix in advance of any agency involvement on this project. The Phase I RI fieldwork was therefore performed voluntarily to support the RI/FS process in advance of any site cleanup orders from the RWQCB.

The activities of the Phase I RI were provided to the RWQCB in the *Remedial Investigation Report* (Progress Report) (ERM, 2002c) and are described below.

5.1.1

Passive Soil Vapor Sampling

A passive shallow soil vapor survey was conducted during October-November 2001 as a screening tool to identify the approximate limits of VOCs in site soil and ground water. During this survey, 122 soil vapor samples (V-01 through V-122) were collected in the following areas:

- Within and immediately south of the 199 Mayhew Way structure;
- The northeastern portion of the property, near the former Ashby Lumber and Tri-City Concrete leased areas; and
- Along Vincent Road for the purpose of identifying any upgradient VOC sources that may be contributing to the Hookston Station plume.

The locations of the passive soil vapor sampling points are shown in Figure 5-1.

To collect the passive soil vapor samples, an electric rotary hammer-drill was used to create a pilot hole approximately 1 inch in diameter and 3 feet in depth. Once the pilot hole was completed, a sampling module was tied

to nylon cord and inserted into the borehole using a stainless-steel insertion rod. The nylon cord was attached to a cork, which was then tamped flush with the ground surface to seal the annulus of the boring. Each sampling module was left in the borehole for approximately 23 days before being retrieved. The samples were submitted to W.L. Gore & Associates, Inc., in Elkton, Maryland, for laboratory analysis of 18 target VOCs by a modified United States Environmental Protection Agency (USEPA) Method 8260/8270.

The results of the passive soil vapor survey were submitted to the RWQCB in the Progress Report, and indicated that elevated levels of TCE were present in the soil vapor beneath the building located at 199 Mayhew (located on the southwestern portion of the site) and other areas toward the northeastern property boundary. The greatest concentrations of PCE in soil vapor were detected off site on Vincent Road, which appeared to be unrelated to any releases from the Hookston Station site. Section 7.1.1 provides a more complete discussion of all soil vapor analytical results collected to date.

5.1.2 *Shallow Site Perimeter Borings*

Between 24 September and 3 October 2001, ERM advanced 24 shallow soil borings (B-35 through B-58) around the perimeter of the site. The locations of the borings (Figure 5-2) were selected in order to identify the compounds of concern (COCs) in ground water and their sources and distribution, and to further investigate the on-site locations identified during the soil vapor survey with elevated levels of VOCs in soil vapor.

The borings were advanced with a direct-push sampling rig. Boring logs were prepared in the field by ERM geologists using the Unified Soil Classification System (USCS) to describe soils. The geologist recorded vertical changes in soil lithology, color, moisture content, grain size, and texture, as well as any observations of staining or odors. Boring logs are provided in Appendix A. Soil samples were screened in the field with a photoionization detector (PID) for the presence of VOCs to select samples for the chemical analyses. The field screening did not indicate that the soils were significantly impacted with VOCs; therefore, no soil samples were submitted for laboratory analysis during this task of the investigation, as specified in the Phase I RI SAP.

The borings were advanced into the first water-bearing zone and ground water samples were then collected with HydroPunch samplers. Ground water samples were submitted to Curtis & Tompkins, Ltd. (C&T) of

Berkeley, California, for laboratory analysis of VOCs by USEPA Method 8260. Once ground water samples were collected, the soil borings were abandoned by tremie grouting according to Contra Costa County regulations. All sampling activities were conducted in accordance with the Phase I RI SAP.

The results of this phase of the investigation indicated that elevated levels of PCE in ground water are present along the northwestern property boundary. TCE was the most widespread chemical detected, with the highest concentrations found along the eastern property boundary. The results were submitted to the RWQCB in the Progress Report and are also incorporated into the discussion provided below in Section 8.

5.1.3

Multilevel Cone Penetrometer Testing Sampling

Cone penetrometer testing (CPT) equipment was utilized to advance 17 boreholes (CPT-01 through CPT-17) at both on- and off-site locations between 23 October and 7 November 2001. The purpose of the CPT investigation was to further define site lithology and to vertically characterize the chemical impacts to water-bearing zones beneath the site. The CPT boreholes were therefore located approximately along, and perpendicular to, the presumed axis of the ground water VOC plume (Figure 5-3).

Several CPT borings were ultimately completed at each sampling location. The first CPT boring at a given location was advanced continuously to the total target depth of 100 feet below ground surface (bgs) for the purpose of characterizing the subsurface stratigraphy. The geophysical logs that were prepared for these boreholes are included in Appendix B. Based on the results of the stratigraphic analysis, selected water-bearing zones at each location were targeted for ground water sampling. To minimize the potential for cross contamination between sampling intervals, each of the ground water samples was collected from unique direct-push boreholes that were immediately sealed using retraction-grouting techniques once the aquifer zone was reached. Ground water samples were then sent to C&T for laboratory analysis of VOCs by USEPA Method 8260.

TCE and associated degradation products were detected in most of the CPT ground water samples, including concentrations of VOCs above the California maximum contaminant levels (MCLs) in the B-Zone aquifer at CPT-14, -15, -16, and -17.

Three additional CPT borings (CPT-18 through CPT-20) were advanced north of the Contra Costa Canal in March 2002 to evaluate the downgradient plume boundary. The borings were advanced following the same procedures described above. Ground water samples were submitted to C&T for VOC analysis by USEPA Method 8260. TCE was detected in two ground water samples collected at CPT-20 at concentrations of 1.1 and 1.8 micrograms per liter ($\mu\text{g}/\text{L}$). Additional VOCs were not detected in the other CPT borings on the northern side of the canal. The ground water analytical results for samples collected at CPT-1 through CPT-20 were provided in the Progress Report and are discussed in Section 8.

During September 2002, 11 additional CPT borings (CPT-21 through CPT-29, CPT-31, and CPT-32) were advanced to further evaluate the western plume margin, to identify potential off-site source areas that were indicated by the passive soil vapor survey, and characterize the downgradient plume boundary. The borings were advanced following the same procedures described above. Ground water samples were submitted to C&T for VOC analysis by USEPA Method 8260. The significant findings of this sampling event identified VOCs, including PCE and TCE, in ground water samples that were collected on Vincent Road (CPT-22, CPT-23, and CPT-24) and other locations downgradient of Vincent Road (CPT-25 and CPT-26). The Vincent Road samples correlate with the elevated concentrations of VOCs that were detected in soil vapor samples in this area. The soil vapor and ground water data further supported that VOCs emanating from one or more off-site locations are likely migrating to the north and northeast in ground water, impacting portions of the Hookston Station site, as well as the downgradient residential neighborhoods. The analytical results for CPT samples collected during September 2002 were provided to the RWQCB in ERM's *Interim Data Submittal* dated 5 November 2002 and are incorporated into the discussion in Section 8.

5.1.4

Well Survey

ERM completed a review of the existing well records on file with the State of California Department of Water Resources (DWR). The files were reviewed to identify water wells within a 1-mile radius of the site. The results of the survey indicated that one well, an irrigation well located at Len Hester Park, was present within the known footprint of the Hookston Station ground water plume. The well was used for landscape irrigation until 2000, when use was discontinued due to poor water quality that was unrelated to chemical releases at the site. The findings of the well survey

were documented in ERM's *Well Survey*, which was submitted to the RWQCB on 13 September 2002. This report has not been released to the public due to confidentiality requirements within the California Water Code, Division 7, Chapter 10, Article 3, Section 13752.

At the request of the RWQCB, a ground water sample was collected from the Len Hester Park well on 3 October 2002 and analyzed for VOCs by USEPA Method 8260 at Severn Trent Laboratories (STL) in Los Angeles, California. TCE and associated degradation compounds were detected in the ground water samples collected at this location. The results were provided to the RWQCB in the *Interim Data Submittal* (ERM, 2002e). The City of Concord abandoned this well in July 2003.

5.1.5

Ground Water Monitoring

During the Phase I RI fieldwork (First Quarter 2001 through the Second Quarter 2002), periodic ground water monitoring events were conducted at the site monitoring well network, which at the time consisted of nine site wells (MW-01, MW-03 through MW-07, and MW-01D through MW-03D). The locations of the monitoring wells are included on Figure 5-3. Note that well MW-02 was previously damaged and has not been sampled during recent quarterly events. Ground water elevation data were collected at each well prior to the collection of samples. All quarterly ground water monitoring events were conducted in accordance with the Phase I RI SAP.

The samples were submitted to C&T and STL for analysis by USEPA Method 8260. The results of the quarterly sampling events were submitted to the RWQCB in various quarterly reports and are discussed in Section 8.

5.1.6

Surface Water Monitoring

To support an evaluation of potential human health and ecological risks associated with the potential discharge of ground water to the Contra Costa County Flood Canal (an engineered segment of the Walnut Creek canal), surface water quality monitoring was conducted within the channel from June 2001 through June 2002. The activities and results associated with this task were previously documented in the *Preliminary Risk Evaluation* (ERM, 2002d).

The surface water samples were collected from 16 locations along an unlined portion of the channel; the locations are illustrated in Figure 5-4.

The samples are identified based on their downstream distance (in feet) from a fixed reference point (the start of the unlined portion of the stream near the Bancroft Road over crossing represents "FC-0"). At selected locations, two surface water samples were collected, one from the left bank and one from the right bank. An "L" or "R" suffix was added to the sample name to describe the bank from which the sample was collected, relative to the downstream heading.

The surface water samples were analyzed for VOCs by USEPA Method 8260 at both C&T and STL. The results of this phase of the investigation, which were provided to the RWQCB in the Progress Report, indicated low levels of VOCs were detected in surface water samples. The surface water sample results are discussed in greater detail in Section 8.

5.1.7 *Surface Flux Chamber Sampling*

Surface flux chamber sampling was conducted during 21 through 24 May 2002 as part of the preliminary risk evaluation to evaluate potential human health risks associated with vapor migration into indoor air and outdoor ambient air. The sampling activities and results were documented in the *Draft Technical Memorandum, Results of the Surface Flux Chamber Testing and Ambient Air Testing Conducted at the Hookston Station Site, Pleasant Hill, California* (Schmidt, 2002), which was included in as an appendix to the *Preliminary Risk Evaluation* (ERM, 2002d). The term "flux" is used to describe the mass of chemicals that rise up naturally from the subsurface soil vapor into the atmosphere per unit area per unit time.

Surface flux testing was conducted at seven on-site, open-soil locations and 20 off-site, open-soil locations. Two additional surface flux samples were collected from within two on-site structures with cement slab surface cover. The samples were tested for surface flux of selected VOCs by USEPA Method TO-15. Ambient air samples were also collected inside and outside the two structures in which cement slab surface flux samples were collected. The ambient air samples were tested for selected VOCs by USEPA Method TO-14. The flux testing was conducted using the USEPA-recommended *Measurement of Gaseous Emission Rates from Land Surfaces using an Emissions Isolation Flux Chamber, Users Guide* (USEPA, 1986). The results of the testing were presented to the RWQCB in the *Preliminary Risk Evaluation* (ERM, 2002d) and are discussed in Section 7.1.1.

5.2

PHASE II REMEDIAL INVESTIGATION

The RI activities described in this section were performed in accordance with the following RWQCB-approved documents:

- *Source Area Investigation Workplan* (ERM, 2003b), which was conditionally approved by the RWQCB in a letter dated 27 May 2003 in fulfillment of Task 1 of the Order;
- *Phase II Remedial Investigation Sampling and Analysis Plan* (ERM, 2003d);
- *Risk Assessment Workplan* (CTEH, 2003a) and *Risk Assessment Workplan Addendum* (CTEH, 2003b); and
- *Indoor Air Sampling Workplan* (ERM, 2003i) and *Indoor Air Sampling Workplan Addendum* (ERM, 2003j).

The Phase II RI fieldwork was completed after the adoption of the RWQCB Order.

5.2.1

Source Area Soil and Ground Water Investigation

During the Source Area Soil and Ground Water Investigation, 45 soil boring locations (B-59 through B-100) were advanced between 6 September and 3 October 2003. The locations of the soil borings, which are shown in Figure 5-2, were selected to evaluate the lateral and vertical distribution of VOCs in soil beneath the areas of elevated soil vapor detections, evaluate the vadose soil above previously identified areas of ground water impact, and characterize shallow site soils for secondary COPCs.

The soil borings were advanced with a direct-push sampling rig. Soil samples were generally retained from ground surface (or immediately below a concrete foundation), 2.5 feet bgs, 5 feet bgs, and at 5-foot intervals thereafter until ground water was encountered. Boring logs were prepared in the field by ERM geologists using the USCS to describe soils. The geologist recorded vertical changes in soil lithology, color, moisture content, grain size, and texture, as well as any observations of staining or odors. Boring logs are provided in Appendix A. Soil samples were screened in the field with a PID for the presence of VOCs to select samples for the chemical analyses.

Soil samples were submitted to STL for laboratory analysis of VOCs by USEPA Method 8260. In addition to VOCs, selected soil samples were also analyzed by STL for the following:

- Total extractable petroleum hydrocarbons and total purgeable petroleum hydrocarbons by USEPA Method 8015 Modified;
- SVOCs by USEPA Method 8270;
- PCBs by USEPA Method 8082; and
- Title 22 metals by USEPA Method Series 6010/7000.

Note that only the samples that reported more than 100 milligrams per kilogram TPH were analyzed for SVOCs and PCBs, as indicated on Table 1 of the *Source Area Investigation Workplan* (ERM, 2003b).

Soil samples collected from three locations (B-73, B-88, and MW-13A) were also analyzed for the following geotechnical parameters by STL to provide site-specific soil parameters for use within the Risk Assessment.

- Grain size distribution by American Society for Testing and Materials (ASTM) Method D422;
- Soil density by ASTM Method D2937;
- Moisture, ash, and organic matter by ASTM Method D2974;
- Specific gravity by ASTM Method D854; and
- Porosity.

Ground water samples were collected during the Source Area Investigation from select soil borings with HydroPunch samplers. In addition to the HydroPunch locations, seven permanent monitoring wells (MW-08A, MW-11A/B to MW-13A/B) were installed at on- and off-site locations between 24 September and 1 October 2003. Note that as of October 2003, existing monitoring wells MW-01D, MW-02D, and MW-03D were renamed to MW-08B, MW-09B, and MW-10B, respectively, to minimize future confusion regarding water-bearing zones.

At locations where monitoring wells were installed, soil samples were collected with a direct-push sampling rig until the desired total depth was reached. The boring was then over-drilled to the desired total depth with 4.25-inch, inner-diameter, hollow-stem augers attached to the direct-push unit. The monitoring wells were constructed of 1-inch-diameter, polyvinyl chloride (PVC) riser pipe and pre-packed well screens (10 to 15 feet in length). The monitoring wells were manually developed several days after installation. Boring logs, well completion reports, and well development forms were prepared for these locations and are included in Appendices A, C, and D, respectively.

Ground water samples were collected at the new monitoring wells in October 2003. The ground water samples were submitted to STL for laboratory analysis of VOCs by USEPA Method 8260. The monitoring wells have been incorporated into the site's monitoring program and will be sampled on a quarterly basis.

All Source Area Investigation sampling activities were conducted in accordance with the *Source Area Investigation Workplan* (ERM, 2003b), except as noted below and in Section 3.3 of the *Source Area Investigation and Interim Remedial Measures Analysis Report* (ERM, 2003h). The *Source Area Investigation Workplan* specified that the monitoring wells would be installed within the direct-push unit boreholes. However, the soil conditions that were encountered prohibited the use of the dual-tube sampling device and the wells could not be installed within the small-diameter boreholes due to borehole collapse. Therefore, the borings were over-drilled with hollow-stem augers to create 8-inch-diameter boreholes and the well completion materials were installed through the hollow-stem augers.

5.2.2

Private Well Survey

Beginning in February 2003, ERM conducted a multi-phase private well survey in the vicinity of the Hookston Station site. On 14 February 2003, ERM distributed 456 questionnaires to property owners within the survey area. The survey area, as shown in Figure 5-5, is roughly bound by Lisa Lane and Contra Costa County flood canal to the north; the flood canal to the east; Mayhew Way to the south; and Vincent Road, Elmira Drive, and Buskirk Avenue to the west. It should be noted that this original well survey area was very broad and included large areas that are not associated with chemical impacts from the Hookston Station site.

On 28 February 2003, 125 additional survey mailers were issued to the owners of town homes or condominiums within the survey area. On 24 March 2003, a second set of survey mailers (310 total) was mailed to properties within the survey area in which no responses had been received. At the conclusion of that second mailing, a total of 231 survey questionnaires were returned with responses. Based on the survey responses, only a small fraction of the responding homeowners used a backyard well, and none of the well owners use their wells for drinking water. All of the wells that were identified are either not currently used or are used only for landscape irrigation.

In an effort to close the data gaps within the most critical portions of the well survey area, 40 additional survey mailers were sent via certified mail on 27 June 2003 to selected properties within the presumed boundaries of the Hookston Station TCE plume. These 40 properties had not responded during the previous two survey mailing events. The 27 June 2003 letter specifically requested a response within a 10-day period. A total of 23 of those 40 survey questionnaires were returned, each of them stating that there are no wells on the respective properties. Of the 17 survey questionnaires that were not completed, three mailers were refused by the homeowners, one was returned by the U.S. Postal Service as being undeliverable, and the remaining 13 recipients have not responded.

At the request of UPRR and Mr. Helix, ERM completed door-to-door surveys on 20 August, 29 August, and 31 August 2003. The responses to this phase of the survey were mixed. Several residents claimed that no wells existed, some admitted the presence of a well, two households refused to participate in the survey, and two households did not answer the door. As shown on Table 5-1 and Figure 5-5, there are four active and eight inactive landscape irrigation wells within of the footprint of the Hookston Station TCE plume. During June 2004, five of the inactive wells were abandoned in place by pressure grouting. Additional wells are currently scheduled for abandonment.

5.2.3

Active Soil Vapor Investigation

Active soil vapor sampling was completed at 12 locations (ASV-01 to ASV-12) during 10 through 21 October 2003 to support the Risk Assessment. Unlike the passive soil vapor probes that were installed as part of the Phase I RI, "active" soil vapor samples are collected by drawing subsurface soil gas into a laboratory-provided sampling canister. One ambient air sample, AA-01, was also collected during this time. The active soil vapor sampling points were located within the suspected on-site source area and along the axis of the ground water plume; the locations are shown in Figure 5-6. The active soil vapor survey was conducted to evaluate the soil vapor intrusion pathway.

The active soil vapor samples were collected with the use of a direct-push sampling rig equipped with 1-inch-diameter steel vapor probes with 1/8-inch flexible nylon tubing. At each location, the vapor probe was advanced to 5 feet bgs and then slightly withdrawn to open the sampling tip and expose the vapor sampling port. Soil vapor was then withdrawn from the tubing using a vacuum pump. Prior to soil vapor sample collection at each location, a vacuum check was performed, the syringe

was leak-checked, and the tubing was purged to fill it with soil vapor. Samples were collected into a 6-liter Summa canister. During sampling, leak tests were performed using butane gas in accordance with recommendations presented in the Los Angeles Regional Water Quality Control Board Advisory *Active Soil Gas Investigations*, dated 28 January 2003.

The soil vapor and ambient air samples were analyzed for VOCs by Method TO-15 at STL in Los Angeles, California, and Air Toxics, Ltd., in Sacramento, California.

All soil vapor samples were collected in accordance with the *Risk Assessment Workplan* (CTEH, 2003a) and *Risk Assessment Workplan Addendum* (CTEH, 2003b). The results were incorporated into CTEH's *Risk Assessment*, dated April 2004. The results are discussed in Section 7.1.1.

5.2.4 *Ground Water Monitoring Wells*

Between January and June 2004, 28 permanent monitoring wells were installed at off-site locations during the Phase II RI activities. These wells included 12 A-Zone wells (MW-14A to MW-25A), 13 B-Zone wells (MW-14B to MW-26B), and 3 C-Zone wells (MW-15C, MW-19C, and MW-23C), as shown on Figure 5-3. The locations of these wells were primarily based on the analytical results for ground water samples collected during the Phase I RI activities from the shallow site perimeter soil borings and the CPT boreholes.

All monitoring wells completed within the A-Zone and B-Zone and one C-Zone well (MW-23C) were installed with hollow-stem auger drilling equipment. At these locations, soil samples were collected at 5-foot intervals with California-modified samplers until the aquifer zone was encountered; soil samples were collected continuously from the aquifer zones to determine the thickness of the unit. Boring logs were prepared in the field by ERM geologists using the USCS to describe soils. The geologist recorded vertical changes in soil lithology, color, moisture content, grain size, and texture, as well as any observations of staining or odors. Boring logs are provided in Appendix A. Soil samples were screened in the field with a PID for the presence of VOCs to select samples for the chemical analyses. Once the desired total depth was reached, monitoring well construction materials were installed in the boreholes through the hollow-stem augers. The wells were constructed of 2-inch-diameter PVC riser pipe and well screen (5- or 10-foot length, 0.010- or 0.020-inch slot size). The wells were completed at the surface with steel

protective covers and locking, expandable well caps. Well completion reports are provided in Appendix C.

C-Zone monitoring wells MW-15C and MW-19C were installed with air-rotary casing hammer (ARCH) equipment. Soil samples were not collected during the advancement of the C-Zone monitoring wells. Soil grab samples were collected with a wire basket held in the stream of cuttings at the base of the cuttings dispenser (cyclone). Grab samples were collected approximately every 5 feet to describe the soil lithology; the soil descriptions obtained from nearby A-Zone and B-Zone wells were also relied upon during advancement of C-Zone boreholes. Boring logs were prepared and are included in Appendix A. Once the desired depth was achieved, well construction materials were installed in the borehole through the ARCH drive casing. All C-Zone monitoring wells were completed with 2-inch-diameter PVC riser pipe and well screen (5- or 10-foot length, 0.020-inch slot size). The wells were completed at the surface with steel protective covers and locking, expandable well caps. Well completion reports are provided in Appendix C.

The monitoring wells were developed no sooner than 24 hours after well installation activities were completed. The wells were developed by a combination of surging and pumping. A minimum of 5 to 10 well volumes of ground water were removed during development activities and contained in 55-gallon drums for proper disposal.

During drilling activities at MW-15A, MW-15B, and MW-16A, soil samples were collected and analyzed for geotechnical soil parameters to obtain additional data needed for evaluation of human health risks for the Risk Assessment. These locations correspond to the active soil vapor sampling locations ASV-03 and ASV-06. These samples were analyzed for total organic carbon and grain-size distribution (by sieve and hydrometer analyses). Additional information is provided in Section 6.1.2.

5.2.5

Indoor Air Quality Investigation

On 12 December 2003, indoor air quality samples were collected from five on-site locations (IA-1 to IA-3, IA-5, and IA-6). All sampling activities were conducted in accordance with the *Indoor Air Sampling Workplan* (ERM, 2003i). The samples were collected within office and workspace areas of the building at 199 Mayhew; samples were collected from a height of 5 feet above the floor. The locations of these samples are shown on Figure 5-7. Samples were analyzed for VOCs by Method TO-15. Results

were presented in the *Risk Assessment* (CTEH, 2004a) and are discussed in Section 10.1.

Mr. Helix and UPRR requested permission to conduct indoor air sampling from the occupants of 41 private residences located along the axis of the A-Zone ground water plume. Indoor air samples and crawl space air samples were collected between January and March 2004 from the 16 residences for which access was granted. The locations are shown on Figure 5-7. Field data collected at the time of the indoor air sampling is presented on Table 5-2. For quality control purposes, indoor air samples were requested at residences that are not located above the footprint of the ground water plume; however, permission to access these selected off-plume residences was not granted by the occupants. All samples were collected in accordance with the *Indoor Air Sampling Workplan* (ERM, 2003i) and *Indoor Air Sampling Workplan Addendum* (ERM, 2003j). The results were included in the *Risk Assessment* (CTEH, 2004a) and are discussed in Section 10.1.

5.2.6

Ground Water Monitoring

Since June 2000, ERM has been conducting periodic ground water monitoring events of the nine pre-existing monitoring wells at the site. During the Phase II RI activities, 35 new monitoring wells were installed during September 2003 through June 2004, as described in previous sections. These new wells have been incorporated into the quarterly ground water monitoring program. The monitoring wells have been sampled through Second Quarter 2004, the results of which are incorporated into this report.

Ground water sampling activities are conducted in accordance with the *Phase II Remedial Investigation Sampling and Analysis Plan* (Phase II SAP) (ERM, 2003d). However, ground water samples collected during Fourth Quarter 2001 through First Quarter 2004 were collected with passive diffusion bags (PDBs) rather than with disposable bailers, as specified in the Phase II SAP. During these events, PDBs were filled with distilled water and lowered into each well to the approximate depth of the well screen mid-points. Ground water samples were collected directly from the PDBs, without well purging, no sooner than 2 weeks after the PDBs were installed. PDBs are passive sampling devices, in which VOCs within ground water diffuse across a polyethylene membrane, thereby allowing deionized water within the bag to equilibrate with the ground water outside of the bag. This sampling method has the advantage of allowing the collection of long-term average concentration data from discrete

sampling depths, without the production of large volumes of wastewater that are commonly associated with standard purge-and-sample techniques. PDBs are applicable for the sampling of VOCs that are commonly associated with the Hookston Station VOC plume. A description of the applications of PDBs on VOC sites is provided in *Technical and Regulatory Guidance for Using Polyethylene Diffusion Bag Samplers to Monitor Volatile Organic Compounds in Groundwater* (Interstate Technology & Regulatory Council, 2004).

Ground water samples collected during the Second Quarter 2004 event were collected with disposable bailers in accordance with the Phase II SAP. The Third Quarter 2004 ground water monitoring event will also utilize disposable bailers for sample collection.

Ground water samples are collected for laboratory analysis of VOCs by USEPA Method 8260 during the quarterly monitoring events. Ground water samples were also analyzed for general inorganic minerals and water quality parameters during the First Quarter 2004 sampling event.

6.0

GEOLOGY AND HYDROGEOLOGY

A discussion of the regional and site-specific geology, as well as the site-specific hydrogeology, is presented in the following sections.

6.1

GEOLOGY

6.1.1

Regional Geologic Setting

The site is situated approximately 3 miles west of the Briones Hills and approximately 1,200 feet west of the Walnut Creek canal. According to the *Preliminary Geologic Map of the Walnut Creek Quadrangle, Contra Costa County, California* (Dibblee, 1980), the site and immediate vicinity is underlain by geologically young alluvial (stream-derived) deposits (Figure 6-1). Sediments from the Briones Hills and other local hills derived from erosional activity were transported and deposited by streams to the valley floor where the site is situated. These deposits are generally composed of interbedded sands and gravels with fine-grained silts and clays.

6.1.2

Site Stratigraphy

Soils have been characterized to depths as great as 100 feet bgs during drilling activities at the site and nearby off-site locations. The information provided below is based on the data collected during the drilling activities conducted during the RI. Soil boring logs and geophysical logs are included in Appendices A and B, respectively. Geotechnical soil samples were collected during the RI for additional soil characterization; the results are summarized on Table 6-1 and are discussed below. The geotechnical laboratory reports are included in Appendix E.

Unconsolidated deposits extend to at least 100 feet bgs. Fine-grained clays, silts, silty clays, and clayey silts are present from the ground surface (or immediately below the ground surface cover materials) to depths ranging from 25 to 50 feet bgs. These deposits have generally been described as brown to gray, damp to moist, low to high plasticity, and low to high density. Soil samples collected from the fine-grained deposits for geotechnical testing indicate the soils are rich in silt (38.9 to 43.1 percent) and clay (18.1 to 56 percent) with secondary amounts of sand (4.2 to 38.1 percent). Discontinuous lenses of sands, silty sands, and gravelly

sands are interbedded in the fine-grained deposits. These lenses range in thickness from a few inches to approximately 11 feet, but are more commonly only a few feet in thickness. One soil sample was collected for grain-size distribution from one of the sand stringers at MW-15A; the results indicated the sample consisted of 60.2 percent sand, 15.6 percent gravel, 14.9 percent silt, and 9.3 percent clay. This zone of fine-grained deposits interbedded with discontinuous sands has been identified by ERM as the A-Zone.

Beneath the fine-grained silts and clays, a relatively continuous sand unit is present between the approximate depths of 30 and 70 feet bgs. These sands range from well-sorted sands, clayey sands, to gravelly sands; a few gravel zones are also encountered in this unit. The sands are generally 5 to 10 feet in thickness and have been identified by ERM as the B-Zone. Silt and clay lenses are interbedded within the B-Zone. One geotechnical soil sample was collected from one of the fine-grained interbeds at MW-15B; the grain-size distribution results indicate the sample was 46.9 percent silt, 26.9 percent clay, 25.5 percent sand, and 0.7 percent gravel.

A deeper sand unit, identified by ERM as the C-Zone, is initially encountered at depths ranging from 65 to 97 feet bgs. The C-Zone is also a continuous sand unit and is isolated from the B-Zone by fine-grained clays. The C-Zone sands are interbedded with silt and clay lenses. The C-Zone extends to approximately 100 feet bgs; the soils beneath this zone have not been characterized.

6.1.3

Ground Water Monitoring Zones

Drilling activities conducted during the RI have identified three hydrostratigraphic zones. The A-Zone consists of thin, discontinuous sand stringers found above a depth of approximately 30 feet bgs. The B-Zone is a relatively continuous sand interval found between approximately 30 and 70 feet bgs. The C-Zone consists of deeper sand units observed between approximately 70 and 100 feet bgs. Because the study area is broad and many natural geologic variations exist in the subsurface, the depth ranges described above are approximate and may differ from one area of the site to another area of the site. It is also important to note that although these aquifer zones were developed based on our preliminary stratigraphic observations at the site, they simply represent a naming convention for samples collected from general depth ranges. Based on the extensive geologic data collected to date, it is likely that all three of these ground water monitoring zones are hydraulically interconnected within the study area.

The current monitoring network includes 23 A-Zone monitoring wells (MW-01 through MW-07, MW-08A, and MW-11A through MW-25A), 19 B-Zone monitoring wells (MW-08B through MW-26B), and three C-Zone monitoring wells (MW-15C, MW-19C, and MW-23C).

6.2 GROUND WATER HYDROGEOLOGY

6.2.1 Ground Water Flow Patterns and Gradients

Ground water in the A-Zone, B-Zone, and C-Zone flows in northeasterly directions. Ground water elevation maps for the A-Zone, B-Zone, and C-Zone presenting data from the most recent monitoring events are included as Figures 6-2, 6-3, and 6-4, respectively.

Ground water elevations measured in the A-Zone on 30 July 2004 are illustrated on Figure 6-2. Based on this information, ground water in the A-Zone flows in a northeasterly direction with an overall horizontal gradient of approximately 0.004 feet vertical/foot horizontal.

Ground water elevations measured on 30 July 2004 in the B-Zone are shown on Figure 6-3. Ground water in the B-Zone also flows in a general northeasterly direction with an overall horizontal gradient of 0.004 ft/ft. The gradient beneath the southern portion of the site is steeper (as great as 0.032 ft/ft between MW-11B and MW-12B) than the observed gradient of the remaining portion of the monitored zone.

Ground water elevations measured in the C-Zone on 30 July 2004 are shown on Figure 6-4. This map indicates that C-Zone ground water flows in a northeasterly direction with a horizontal gradient of 0.002 ft/ft.

Vertical gradients were calculated at the nested well locations from the ground water elevation data collected during March and April 2004 (Table 6-3). Ground water elevations were compared between A-Zone and B-Zone wells at 14 locations, and between B-Zone and C-Zone wells at two locations. In general, the ground water elevations are very similar between the adjacent monitored zones, and both upward and downward vertical gradients were observed. Vertical gradients will continue to be evaluated as additional ground water elevation data are collected during quarterly monitoring events.

6.2.2

Aquifer Hydraulic Characteristics

Aquifer tests were performed at the site during T&R's 1993 subsurface investigation; aquifer testing has not been performed at the site by ERM. Constant-rate pumping tests were performed by T&R to evaluate hydraulic conductivity and ground water flow velocity of the shallow and deep aquifers, which have since been renamed by ERM to the A-Zone and B-Zone aquifers. The A-Zone aquifer test consisted of pumping ground water from MW-07 while monitoring the ground water response at wells MW-01 and MW-04. Ground water was pumped from MW-01D (now named MW-08B) while observing the ground water response at MW-03 and MW-07 during the B-Zone aquifer test. The methodology used by T&R was provided in the *Subsurface Investigation* (T&R, 1993), which was included as an appendix in the Phase I RI SAP.

According to T&R's report, the hydraulic conductivity of the A-Zone was estimated at 2.3 to 23 feet per day (ft/day) and the velocity was estimated to be 14 to 140 feet per year (ft/yr). The estimated B-Zone hydraulic conductivity ranged from 48 to 68 ft/day, while the estimated ground water velocity ranged from 320 to 450 ft/yr.

7.0

CHEMICALS IN SOIL

Soil and soil vapor samples were collected at the site during the RI and during previous investigations for laboratory analysis of VOCs, petroleum hydrocarbons, SVOCs, PCBs, and metals. The results are presented in the following sections. The analytical results of the samples have been compared to the RWQCB Environment Screening Levels (ESLs) for Commercial/Industrial Land Use for shallow and deep soils where ground water is a current or potential source of drinking water. Copies of the analytical reports are provided in Appendix G.

7.1

CHLORINATED VOLATILE ORGANIC COMPOUNDS

7.1.1

Soil Vapor

A total of 122 passive soil vapor samples and 12 active soil vapor samples were collected at on- and off-site locations during the RI. Engeo also collected 76 passive soil vapor samples at the site in 1991. Passive soil vapor sampling results are summarized on Table 7-1 and active soil vapor sampling results are summarized on Table 7-2.

ERM's passive soil vapor survey focused on site-wide locations as well as off-site locations west of the site along Vincent Road. The distribution of PCE, TCE, and cis-1,2-dichloroethene (cis-1,2-DCE) concentrations detected during the passive soil vapor survey are illustrated on Figures 7-1 through 7-3, respectively. Elevated concentrations of TCE in soil vapor are found beneath the 199 Mayhew structure (located near the southwest corner of the property) and other areas toward the northeast property boundary. The greatest concentrations of PCE in soil vapor are found off site on Vincent Road, which appear to be unrelated to any releases from the Hookston Station site.

The surface flux testing results identified 11 VOCs, which included PCE and TCE, in the collected samples. The data, which were presented as an appendix to the *Preliminary Risk Evaluation* (ERM, 2002d), generally indicated low flux of VOCs in the downgradient residential area. The highest flux measurements were collected at the site (within the on-site

source area at 199 Mayhew Way), where known soil vapor impacts had previously been identified.

The active soil vapor survey focused on evaluating the concentrations of VOCs in soil vapor at locations with the greatest concentrations in ground water (i.e., the suspected on-site source area and the axis of the off-site ground water plume). Concentrations of TCE in soil vapor greater than the RWQCB ESLs for Commercial/Industrial Use were detected at ASV-01, ASV-05, ASV-07, and ASV-11. The ESL was also exceeded at ASV-06 for 1,1,1-trichloroethane. The results are summarized in Table 7-2 and on Figure 7-4. Note that butane gas was used for leak checking during the active soil vapor sampling activities and an elevated concentration of butane was reported at ASV-11. The detection of butane may indicate a leak was present during sample collection at this location. Therefore, the reported concentrations of detected VOCs may be artificially low and the presence of VOCs reported as not detected cannot be ruled out.

7.1.2

Soil

A total of 192 soil samples for VOC analysis were collected from 52 locations during the RI. Prior to the RI, 81 soil samples were collected by others for VOC analysis from 34 on-site locations. The soil sampling locations are shown on Figure 5-2 and a summary of the results is presented in Table 7-3.

In general, VOC concentrations in soil throughout the site are low, with only a few sample concentrations exceeding the RWQCB ESLs. TCE is the most prevalent and widespread chemical detected in soil samples. The highest concentrations of TCE detected in vadose zone soil are in the low (1 to 3) milligram per kilogram (mg/kg) range. A summary of the soil concentration data is provided below:

- The highest concentrations of TCE detected in soil samples were found in samples collected at a depth of 2 to 5 feet bgs underneath or immediately adjacent to the 199 Mayhew structure near the southwestern corner of the property (e.g., B-60, B-62, B-67, B-71, and B-05-ENG), as shown on Figure 7-5. The concentrations of TCE detected at these locations exceed the ESL of 460 µg/kg TCE; the concentrations of cis-1,2-DCE detected at B-71 also exceed the ESL of 190 µg/kg cis-1,2-DCE. These sample locations generally coincide with the elevated concentrations of TCE in soil vapor. Soil samples collected beneath these elevated detections (and above the first encountered ground water) decreased rapidly with depth, as

illustrated on Figure 7-5. At locations where elevated levels of TCE are not present in shallow soil, elevated concentrations of TCE were frequently detected in the samples collected from deeper intervals within the vadose (unsaturated) zone. This distribution suggests that deeper soil sample concentrations are most likely the result of offgassing vapors from the ground water plume, and not representative of a vadose zone source.

- One additional elevated TCE concentration (1,100 µg/kg at boring B-74) was collected at a depth of 30 feet bgs. This deeper detection is likely reflective of ground water impacts rather than TCE in the vadose zone. Elevated concentrations of cis-1,2-DCE, a breakdown product of TCE, were also detected at boring B-71, coincident with elevated TCE detections.
- PCE was generally not detected in site soils. For the few soil samples that did detect PCE, most were below 10 µg/kg, and all were below the ESL of 250 µg/kg.
- Concentrations of benzene and xylenes that exceed the ESLs of 44 µg/kg and 1,500 µg/kg, respectively, have been detected in areas near the northwestern corner of the site at B-21-ENG and B-22-ENG. These elevated concentrations were detected in samples collected at a depth of approximately 16 feet bgs, just above the static water level in this area. The upgradient Haber Oil site, a commercial fuel distribution facility located west of the site, is currently under a separate RWQCB Order to investigate hydrocarbon impacts to soil and ground water. These sample results are consistent with impacts from hydrocarbons released at the adjacent commercial fuel distribution facility.

7.2

PETROLEUM HYDROCARBONS

Out of 50 soil samples that were analyzed for TPH as diesel (TPH-D), only seven samples reported positive detections, and only three samples contained concentrations greater than 100 mg/kg, the ESL for TPH-D (Table 7-4). TPH-D concentrations ranging from 166 to 2,080 mg/kg were reported in the surface soil samples (0.5 foot bgs) in borings B-70, B-73, and MW-13A. The laboratory qualified these detections as estimated because the results did not match the typical chromatographic pattern for a diesel fuel. These TPH-D detections are from widely spaced sample locations, and are limited to the ground surface samples; results for samples collected at a depth of 2.5 feet bgs at each location were non-detect for TPH-D.

Of the 40 soil samples that have been analyzed for TPH as gasoline (TPH-G), positive detections were reported in only six samples, and only two samples contained concentrations greater than 100 mg/kg, the TPH-G ESL (Table 7-4). These samples (S-04 and S-08) were reportedly collected from areas with visible staining, and were located within the business area that previously operated as a recycling facility. This entire area has been demolished and the surface soils have been reworked since the 1989 investigation; any surface staining that was present at that time is no longer present. The widely spaced TPH-G data collected during the RI found very low to non-detect concentrations of TPH-G across the site.

Heavier residual hydrocarbons, such as "TPH as waste oil" and "oil and grease," were detected during previous investigations. The concentrations detected at locations B-01-HLA, B-02-HLA, B-03-HLA, S-02, and S-04 through S-10 exceed the TPH-residual fuels ESL of 1,000 mg/kg. These samples were collected at depths less than 3 feet bgs. Most of these samples were collected from the former recycling facility, where isolated stained areas are no longer present.

Soil samples for motor oil analysis were collected during the RI and during previous investigations. Motor oil was detected at concentrations greater than 100 mg/kg in seven of 32 samples analyzed for motor oil. Concentrations ranged from 132 to 8,830 mg/kg in surface soil samples collected at B-69, B-70, B-73, B-75, B-94, B-95, and MW-13A. An ESL for motor oil has not been established.

7.3

SVOCs

Five soil samples were collected during the RI for SVOC analysis; soil samples were only analyzed for SVOCs at locations where TPH was detected at a concentration greater than 100 mg/kg. The results of the SVOC soil samples are summarized on Table 7-5. Concentrations of the detected SVOCs were generally low, with only one detection greater than the established ESL. Benzo(a)pyrene was detected at a concentration of 743 µg/kg in surficial soil at B-69; the benzo(a)pyrene ESL is 130 µg/kg.

7.4

PCBS

Five soil samples were collected during the RI for analysis of PCBs. Similar to the SVOC soil samples, samples were only analyzed for PCBs at locations where TPH was detected at a concentration greater than 100

mg/kg. PCBs were generally not detected in the soil samples. At locations where PCBs were detected, the concentrations were less than the ESL of 0.74 mg/kg. These results are summarized on Table 7-6.

7.5

METALS

Soils are composed of minerals that naturally contain metals. Nineteen soil samples were collected for metals analysis at the site during the RI and previous investigations. All samples for metals analysis were collected from the surficial soil. As shown in Table 7-7, most of the samples collected at the Hookston Station site contained concentrations of metals that are consistent with background concentrations of metals in California soils. A small number of soil samples exceeded the ESLs for arsenic, chromium, copper, and vanadium. It should be noted that although the arsenic ESL is 5.5 mg/kg, the ESL guidance document [RWQCB, 2003, p 2-12] notes that arsenic concentrations in soil ranging from 5 to 20 mg/kg are typical for much of the Bay Area. Only two of the soil samples collected throughout the site contained arsenic concentrations greater than 20 mg/kg.

8.0

CHEMICALS IN GROUND WATER

Ground water samples collected at the site have been analyzed for VOCs, SVOCs, petroleum hydrocarbons, dissolved metals, and general minerals/inorganic water quality parameters. Ground water samples have been collected from on-site locations as well as upgradient and downgradient locations. Sampling results are presented in the following sections.

8.1

VOLATILE ORGANIC COMPOUNDS

The most commonly detected VOCs in site ground water are chlorinated VOCs, particularly PCE, TCE, and associated degradation compounds (cis-1,2-DCE and 1,1-DCE). Additional VOCs, such as 1,2-dichloroethane (1,2-DCA), 1,1-dichloroethane (1,1-DCA), and benzene, have also been detected in select ground water samples above water quality goals. The following sections discuss the VOC detections in ground water during the RI and previous investigations. Because PCE, TCE, cis-1,2-DCE, and 1,1-DCE are the primary COCs identified at the site, Sections 8.1.1 through 8.1.5 focus primarily on these VOCs, while Section 8.1.6 presents the data for other VOCs detected at the site.

8.1.1

On-Site A-Zone Ground Water

Elevated concentrations of PCE, TCE, cis-1,2-DCE, and 1,1-DCE are present in the on-site A-Zone ground water. The ground water data collected to date at the site for these constituents are posted on Figures 8-1 to 8-4. The maximum concentrations detected in on-site A-Zone ground water were:

- 1,400 µg/L PCE (MW-01, Fourth Quarter 1995),
- 8,860 µg/L TCE (B-63, 35 feet bgs, Third Quarter 2003),
- 670 µg/L cis-1,2-DCE (MW-13A, Second Quarter 2004), and
- 341 µg/L 1,1-DCE (B-63, 35 feet bgs, Third Quarter 2003).

The maximum concentrations detected in the on-site A-Zone during the most recent (Second Quarter 2004) monitoring event were 740 µg/L PCE (MW-01), 2,800 µg/L TCE (MW-13A), 670 µg/L cis-1,2-DCE (MW-13A), and 110 µg/L 1,1-DCE (MW-13A). Additional chlorinated VOCs, such as

trans-1,2-dichloroethene, vinyl chloride (VC), and 1,1-DCA have also been detected in on-site A-Zone ground water at concentrations exceeding the established drinking water ESLs (Table 8-1). These chlorinated VOCs have been detected at significantly fewer locations and at relatively lower concentrations than PCE, TCE, cis-1,2-DCE, and 1,1-DCE.

The maximum PCE detections reported during the Phase I and II RIs and quarterly monitoring events were detected in HydroPunch locations and monitoring wells in the northern portion of the site (B-41, B-42, B-96, MW-01, MW-04, and MW-07). With the exception of B-96 and MW-07, these locations are all along the western (upgradient) property boundary; B-96 and MW-07 are in the central portion of the northern half of the site (Figure 8-1). PCE concentrations are non-detect or below the ESL at all locations in the southern portion of the site, with the exception of MW-13A (Figure 8-1). PCE was detected in MW-13A at a concentration of 8.83 µg/L during the Fourth Quarter 2003 monitoring event. PCE was not detected at this location during other more recent monitoring events, however, the laboratory reporting level has been greater than the ESL due to the elevated concentrations of other VOCs in this sample.

The highest detections of TCE, cis-1,2-DCE, and 1,1-DCE in on-site A-Zone ground water have occurred in HydroPunch locations and monitoring wells in the southern portion of the site (B-63, B-67, B-68, B-74, B-79, B-81, and MW-13A) and along the northern portion of the eastern property boundary (B-48, B-52, B-53, B-54, B-85, B-90, B-92, B-93, and B-97) (Figures 8-2 through 8-4). TCE was also detected at elevated concentrations along the western property boundary at B-42, B-43, B-44, B-75, MW-01, and MW-4 (Figure 8-2).

Isoconcentration maps for the Second Quarter 2004 analytical results have been prepared for PCE, TCE, cis-1,2-DCE, and 1,1-DCE and are included as Figures 8-5 through 8-8, respectively. Note that the contours on these maps are primarily based on Second Quarter 2004 analytical results, but also take into consideration the ground water results obtained from HydroPunch locations advanced during the Phase I and II RIs. The minimum concentration contour line used on these maps corresponds to the drinking water ESL. Therefore, all monitoring wells located within the contour lines have reported data that exceed the drinking water ESL. Based on Second Quarter 2004 isoconcentration maps, the width of the on-site A-Zone ground water impacts where concentrations exceed the drinking water ESLs are:

- PCE plume (greater than 5 µg/L) - approximately 400 feet wide;

- TCE plume (greater than 5 µg/L) - approximately 550 feet wide;
- cis-1,2-DCE plume (greater than 6 µg/L) - approximately 550 feet wide; and
- 1,1-DCE plume (greater than 6 µg/L) - approximately 75 to 200 feet wide.

The contours illustrate that the ground water plume extends downgradient from the site and identifies ground water impacts from an apparent upgradient source. The upgradient impacts are further discussed in Section 8.1.7.

8.1.2

Downgradient A-Zone Ground Water

Concentrations of PCE, TCE, cis-1,2-DCE, and 1,1-DCE that exceed drinking water standards are present in the A-Zone ground water downgradient of the site. The ground water data collected to date for these constituents are posted on Figures 8-1 to 8-4. The maximum concentrations detected to date in downgradient A-Zone ground water are:

- 420 µg/L PCE (B-24TR, 21.5 feet bgs, Fourth Quarter 1995);
- 12,000 µg/L TCE (CPT-04, 34 feet bgs, Fourth Quarter 2001);
- 750 µg/L cis-1,2-DCE (MW-14A, Second Quarter 2004); and
- 898 µg/L 1,1-DCE (MW-14A, First Quarter 2004).

The maximum concentrations detected during the Second Quarter 2004 monitoring event in the downgradient A-Zone ground water were 1.2 µg/L PCE (MW-23A), 5,300 µg/L TCE (MW-14A), 750 µg/L cis-1,2-DCE (MW-14A), and 580 µg/L 1,1-DCE (MW-14A). VC and 1,1-DCA have also been detected in the downgradient A-Zone ground water at concentrations exceeding the established drinking water ESLs, but at significantly fewer locations and lower concentrations (Table 8-1).

PCE has been detected at a limited number of downgradient locations during the Phase I and II RI activities and quarterly monitoring events (Figure 8-1). With the exception of the PCE detection at MW-23A during the Second Quarter 2004 monitoring event, PCE was only reported in downgradient A-Zone ground water during Treadwell and Rollo's November 1995 investigation at borings B-23, -24, and -25. However, note that elevated laboratory reporting levels were reported during the RIs and quarterly monitoring events for several of the locations immediately downgradient of the site, such as MW-14A, MW-15A, and CPT-04. At

these locations, PCE has not been reported at concentrations greater than 200, 20, and 50 µg/L, respectively.

TCE has been detected downgradient of the site in A-Zone ground water at concentrations exceeding the drinking water ESL. The elevated TCE detections have been generally observed within samples collected northeast (hydraulically downgradient) of the site, at concentrations ranging from 35 (B-22TR) to 12,000 µg/L (CPT-04 (Figure 8-2).

Detections of cis-1,2-DCE and 1,1-DCE at concentrations greater than the drinking water ESLs were reported during the Phase I and II RI activities and quarterly monitoring events at downgradient locations. These samples were obtained from northeast of the site and concentrations ranging from 9.1 to 750 µg/L cis-1,2-DCE and 10.3 to 898 µg/L 1,1-DCE have been reported (Figures 8-3 and 8-4).

Isoconcentration maps for the Second Quarter 2004 analytical results have been prepared for PCE, TCE, cis-1,2-DCE, and 1,1-DCE and are included as Figures 8-5 through 8-8, respectively. The minimum concentration contour line used on these maps corresponds to the drinking water ESL. Therefore, all the monitoring wells located within the contour lines have reported data that exceed the drinking water ESL. Based on the Second Quarter 2004 isoconcentration maps, the extent of impacts that exceed the drinking water ESLs in the downgradient A-Zone ground water are:

- The PCE plume (concentrations greater than 5 µg/L) appears to originate from an upgradient site, and commingles with the Hookston Station TCE plume. The PCE detections appear to extend downgradient across the Hookston Station site to the northeastern property boundary, although it is important to note that PCE naturally degrades to TCE, which is found further downgradient within the residential neighborhood.
- The TCE plume (concentrations greater than 5 µg/L) ranges in width from approximately 550 feet immediately downgradient of the site to 1,400 feet, near the northern extent of the residential neighborhood.
- The cis-1,2-DCE plume (concentrations greater than 6 µg/L) extends approximately 1,100 feet downgradient from the site to MW-16A and has a maximum width of approximately 500 feet.
- The 1,1-DCE plume (concentrations greater than 6 µg/L) extends at least 300 feet downgradient from the site to MW-15A, but likely extends approximately 1,300 feet downgradient based on recent

HydroPunch analytical results. The maximum downgradient width of the 1,1-DCE plume appears to be approximately 200 feet.

8.1.3

On-Site B-Zone Ground Water

Concentrations of TCE, cis-1,2-DCE, and 1,1-DCE that exceed drinking water standards are present in the on-site B-Zone ground water. In contrast to the on-site A-Zone ground water, PCE has only been detected in on-site B-Zone ground water to a very limited extent. The ground water data collected to date for these constituents are posted on Figures 8-9 to 8-12. The maximum concentrations detected in on-site B-Zone ground water were:

- 40 µg/L PCE (MW-8B, First Quarter 2002);
- 11,000 µg/L TCE (MW-11B, Second Quarter 2004);
- 896 µg/L cis-1,2-DCE (MW-13B, First Quarter 2004); and
- 670 µg/L 1,1-DCE (MW-11B, Second Quarter 2004).

The maximum concentrations detected in the on-site B-Zone monitoring wells during the Second Quarter 2004 monitoring event were 11,000 µg/L TCE (MW-11B), 390 µg/L cis-1,2-DCE (MW-13B), and 670 µg/L 1,1-DCE (MW-11B). Note that PCE was not detected above the laboratory reporting levels, which ranged from 1 to 100 µg/L, in the on-site B-Zone ground water during the Second Quarter 2004 monitoring event. The following chlorinated VOCs have also been detected in on-site B-Zone ground water at concentrations higher than the drinking water ESLs: VC; 1,1-DCA; 1,2-DCA; 1,2-dichloropropane; and 1,1,2-trichloroethane (Table 8-1).

PCE was only detected in at a limited number of on-site locations (MW-08B, MW-11B, and MW-13B) in the B-Zone ground water during the Phase I and II RIs and previous quarterly monitoring events. These wells are all situated in the southern portion of the site (Figure 8-9). Detections of PCE that exceed the drinking water ESL have only been reported at MW-08B, with the most recent ESL exceedances reported during First Quarter 2002. However, note that the laboratory reporting levels for many of the quarterly samples collected at this location since then have been greater than the ESL due to elevated concentrations of other VOCs (Table 8-1).

Concentrations of TCE and 1,1-DCE that exceed the drinking water ESL have been detected site-wide in on-site B-Zone ground water. The

greatest concentrations have generally been detected in the southeastern portion of the site at B-66, MW-11B, MW-12B, MW-13B, and CPT-02. Elevated detections have also been reported in the northern portion of the site at B-87, B-94, and B-96 (Figures 8-10 and 8-12).

Detections of cis-1,2-DCE have been reported in the southeastern portion of the site at concentrations that exceed the drinking water ESL. The elevated detections have only been reported at MW-11B, MW-12B, and MW-13B. Cis-1,2-DCE has also been detected in the northern portion of the site but at concentrations less than the drinking water ESL (Figure 8-11).

B-Zone ground water isoconcentration maps for Second Quarter 2004 analytical results have been prepared for PCE, TCE, cis-1,2-DCE, and 1,1-DCE and are included as Figures 8-13 through 8-16, respectively. Note that the contours on these maps are primarily based on Second Quarter 2004 analytical results but also take into consideration the ground water results obtained from recent borings and HydroPunch locations advanced during the Phase I and II RIs. The minimum concentration contour line used on these maps corresponds to the drinking water ESL. Therefore, all the monitoring wells located within the contour lines have reported data that exceed the drinking water ESL. Based on the Second Quarter 2004 isoconcentration maps, the width of the on-site B-Zone ground water impacts where concentrations exceed the drinking water ESLs are:

- TCE plume (greater than 5 µg/L) - entire width of the site;
- cis-1,2-DCE plume (greater than 6 µg/L) - approximately 350 feet wide; and
- 1,1-DCE plume (greater than 6 µg/L) - approximately 450 feet wide.

The contours illustrate that the ground water VOC plume extends downgradient from the site. Section 8.1.4 presents the downgradient B-Zone ground water analytical results.

Note that the data indicate on-site PCE impacts are not currently present; historical on-site detections greater than the ESL have only been identified at MW-08B. B-Zone ground water impacts appear to only be present upgradient of the site. The contours illustrate that TCE, cis-1,2-DCE, and 1,1-DCE impacts are also present upgradient of the site where PCE impacts have been identified. The upgradient impacts are further discussed in Section 8.1.7.

8.1.4

Downgradient B-Zone Ground Water

Concentrations of TCE and 1,1-DCE above drinking water standards are present in the down gradient B-Zone ground water. To a lesser extent than TCE and 1,1-DCE, elevated detections of cis-1,2-DCE and PCE have also been reported down gradient in the B-Zone ground water. The ground water data collected to date at the site for these constituents are posted on Figures 8-9 to 8-12. The maximum concentrations detected to date in downgradient B-Zone ground water are:

- 5.6 µg/L PCE (MW-10B, Second Quarter 2001);
- 4,600 µg/L TCE (CPT-04, 45 feet bgs, Fourth Quarter 2001);
- 120 µg/L cis-1,2-DCE (CPT-11, 43 to 73 feet bgs, Fourth Quarter 2001); and
- 310 µg/L 1,1-DCE (CPT-04, 45 feet bgs, Fourth Quarter 2001).

The maximum concentrations detected during Second Quarter 2004 monitoring event in downgradient B-Zone ground water were 1,400 µg/L TCE (MW-15B), 24 µg/L cis-1,2-DCE (MW-16B), and 92 µg/L 1,1-DCE (MW-15B). PCE was not detected downgradient of the site during the Second Quarter 2004 monitoring event; laboratory reporting levels ranged from 1 to 50 µg/L PCE. Detections of 1,1-DCA and 1,2-DCA have also been reported in downgradient B-Zone ground water at concentrations greater than drinking water ESLs; these chlorinated VOCs have each only been detected at elevated levels at one downgradient location (Table 8-1).

PCE has only been detected in one downgradient B-Zone location (MW-10B, previously named MW-03D) during the Phase I and II RI activities and quarterly monitoring events at a concentration greater than the drinking water ESL. Note that PCE has not been detected in downgradient wells above the ESL since Second Quarter 2001. Additionally, PCE has only been detected in one other downgradient B-Zone location at CPT-07, at an estimated concentration of 1.5 µg/L (Table 8-1). Well MW-10B is approximately 550 feet northeast of the northern property boundary and CPT-07 is approximately 250 feet east of the northeastern corner of the property (Figure 5-3). Note that during the Phase I and II RI activities and quarterly monitoring events, the laboratory reporting levels for PCE have ranged from 0.5 to 100 µg/L. Elevated concentrations of PCE in B-Zone ground water have also been observed upgradient and cross-gradient of the Hookston Station VOC plume. These off-site impacts are described in Section 8.1.7.

TCE has been detected downgradient of the site in B-Zone ground water at concentrations exceeding the drinking water ESL (5 µg/L TCE). Concentrations greater than 1,000 µg/L TCE have been reported at CPT-04, CPT-07, CPT-11, CPT-15, MW-10B (previously MW-03D), MW-14B, and MW-15B (Table 8-1, Figure 8-10). Downgradient B-Zone detections exceeding the TCE drinking water ESL have been reported at cross-gradient locations as far as MW-18B (south of the TCE plume) and MW-23B (north of the TCE plume) and as far downgradient as MW-17B and CPT-17. TCE has also been reported at a concentration of 5.9 µg/L on the eastern side of the Walnut Creek canal. However, based on historical ground water elevations measured at MW-26B and MW-17B, it appears that ground water east of the canal flows in a westerly direction, opposite of the ground water flow immediately downgradient of the site (Figure 6-3). Therefore, the TCE detections at MW-26B may be the result of a source located east of the canal (MW-26B also contained benzene, a chemical not associated with the Hookston Station VOC plume). It should be noted that MW-18B and MW-26B are new wells and have only been sampled twice; the first samples collected from these wells reported non-detectable concentrations of TCE. Continued monitoring of these plume perimeter wells will be necessary to confirm these results.

Few cis-1,2-DCE detections that exceed the drinking water ESL were reported during the Phase I and II RI activities and quarterly monitoring events at B-Zone locations downgradient of the site. The detections greater than the ESL were reported northeast of the site at CPT-07, CPT-11, CPT-15, and MW-16B and east of the site at MW-18B (Figure 8-11). The reported detection at MW-18B will need to be confirmed in future ground water monitoring events; the initial sample collected from this well reported non-detectable concentrations of cis-1,2-DCE.

During the Phase I and II RI activities and quarterly monitoring events, 1,1-DCE has been extensively detected at concentrations exceeding the ESL at downgradient B-Zone locations. The highest concentrations have been reported within 600 feet northeast of the property boundary at CPT-04, CPT-07, MW-10B, MW-14B, and MW-15B at concentrations ranging from 61 to 310 µg/L 1,1-DCE (Figure 8-12).

Isoconcentration maps for the Second Quarter 2004 analytical results have been prepared for PCE, TCE, cis-1,2-DCE, and 1,1-DCE and are included as Figures 8-13 through 8-16, respectively. The minimum concentration contour line used on these maps corresponds to the drinking water ESL. Therefore, all the monitoring wells located within the contour lines have

reported data that exceed the drinking water ESL. Based on Second Quarter 2004 isoconcentration maps, the extent of impacts that exceed the drinking water ESLs in the downgradient B-Zone ground water are:

- The PCE plume (concentrations greater than 5 µg/L) originates from an upgradient site on Vincent Road, and currently does not extend downgradient from the site beyond the nearest B-Zone monitoring wells: MW-22B, MW-15B, and MW-14B.
- The TCE plume (concentrations greater than 5 µg/L) extends approximately 1,800 feet downgradient from the site and is approximately 1,400 feet wide in the northern portion of the residential neighborhood.
- The cis-1,2-DCE plume (concentrations greater than 6 µg/L) extends approximately 1,200 feet downgradient from the site to MW-16B, and has a maximum width of approximately 600 feet (immediately downgradient from the site) that narrows to 150 feet wide downgradient of Hookston Road. As stated above, the recent detection of cis-1,2-DCE at MW-18B requires confirmation during future ground water monitoring events.
- The 1,1-DCE plume (concentrations greater than 6 µg/L) extends approximately 1,800 feet downgradient from the site and is approximately 800 feet wide.

8.1.5 C-Zone Ground Water

The C-Zone ground water at the site and downgradient from the site have relatively minor impacts of chlorinated VOCs. The ground water analytical results collected to date for C-Zone samples are posted on Figures 8-17 through 8-20. PCE has only been detected in one C-Zone location (MW-19C) at an estimated concentration of 0.33 µg/L in the Second Quarter 2004 (this was an estimated concentration below the laboratory's reporting limit) (Figure 8-17). TCE has only been detected above the drinking water ESL at MW-15C; TCE detections have also been reported on-site at CPT-02 and at four downgradient locations, but at concentrations less than 5 µg/L (Figure 8-18). Only one detection of cis-1,2-DCE has been reported in C-Zone ground water: in the Fourth Quarter 2004, cis-1,2-DCE was detected at 0.5 µg/L at CPT-02 (Figure 8-19). Detections of 1,1-DCE have not been reported in on-site or downgradient C-Zone ground water (Figure 8-20); however, 1,1-DCE was detected at one upgradient location (CPT-06) and is discussed in Section 8.1.7.

8.1.6

Additional VOCs

In addition to the chlorinated VOCs discussed in Sections 8.1.1 through 8.1.5, concentrations of benzene, toluene, and methyl tert-butyl ether (MTBE) above drinking water standards have been reported during the Phase I and II RI activities and quarterly monitoring events. These VOCs have only been reported at locations near the northwestern property boundary (B-01TR, B-45, MW-01, MW-04, and MW-22A). These additional petroleum-related VOCs at these locations appear to be unrelated to the Hookston Station site; note the proximity of these sample locations to the adjacent (and hydraulically upgradient) Haber Oil site. Benzene has also been reported on-site at MW-08B and downgradient at MW-26B (Table 8-1).

8.1.7

Off-Site Sources/Contributors

Elevated concentrations of PCE, TCE, cis-1,2-DCE, 1,1-DCE, and petroleum-related VOCs have been detected in the A-Zone and/or B-Zone aquifers at locations hydraulically upgradient and cross-gradient of the site.

The greatest PCE concentration detected to date was reported at MW-20B at a concentration of 10,000 µg/L during the Second Quarter 2004 monitoring event. Elevated PCE detections have also been reported at MW-20A and nearby locations MW-21A, MW-21B, CPT-22, and CPT-23. These locations have also reported elevated concentrations of PCE's breakdown products (TCE, cis-1,2-DCE, and 1,1-DCE) in the A-Zone or B-Zone. These monitoring wells and CPT locations are positioned approximately 200 feet west of the site and are hydraulically upgradient of the site based on historical ground water elevation data. The analytical data and elevation data indicate that an upgradient source is responsible for the PCE, TCE, cis-1,2-DCE, and 1,1-DCE concentrations reported at MW-20A/B, MW-21A/B, CPT-22, and CPT-23. Following a recent request from the RWQCB, the owners of the properties located at 3343-3355 Vincent Road are currently investigating the potential source of the ground water impacts in this area.

Significant chlorinated VOC impacts have also been identified during the RI activities at locations west and northwest of the site, at CPT-24, CPT-06, CPT-25, and CPT-26. For example, PCE was reported at a concentration of 460 µg/L in the B-Zone at CPT-25; TCE was also reported at 150 µg/L in the B-Zone at CPT-06. An elevated detection of cis-1,2-DCE (850 µg/L) was also noted during the 1993 T&R investigation at boring B-01, located

on Estand Way. Based on historical ground water elevation data, these locations are hydraulically cross-gradient to the site and it is unlikely that these concentrations are the result of impacts related to the site. It is presently unknown if the source(s) contributing to the impacts near 3343-3355 Vincent Road are associated with the impacts at CPT-24, CPT-06, CPT-25, or CPT-26, or if there are additional unknown sources closer to these sample locations.

Petroleum-related VOCs (primarily benzene, toluene, and MTBE) were identified in on-site ground water during the RI field investigation and previous investigations along the western property boundary at MW-01, MW-04, MW-22A, and additional boring locations. The property bordering this portion of the site has been operated as a bulk fueling facility since the 1950s; this property (220 Hookston Road) has been identified as the former Haber Oil Products site and is currently known as Pitcock Petroleum. Investigation activities conducted on behalf of the property owner at this site since approximately 1998 revealed significant soil and ground water impacts related to gasoline and diesel fuel. Additional investigation activities were conducted at the site in 2003 by GRIBI Associates on behalf of Pitcock Petroleum. The investigation was conducted in response to a 16 November 2001 RWQCB request for further investigation and revealed that ground water impacts, specifically MTBE, extend northeast from the former Haber Oil Products site (GRIBI, 2003b). Ground water sampling activities conducted at this site also reported elevated concentrations of PCE as great as 160 µg/L (GRIBI, 2003a); these PCE impacts are likely associated with the impacts along Vincent Road. The full characterization of ground water impacts associated with the Haber Oil Products site is currently incomplete.

The greatest TCE concentration detected to date within the A-Zone occurred at MW-14A. This well is immediately downgradient from the site along Bancroft Road near the northeast property boundary. Elevated concentrations of TCE at this location may be associated with the Hookston TCE plume that appears to originate at 199 Mayhew Way, or may be associated with other neighboring industrial properties that have not been fully investigated within the context of this RI.

8.2

SEMIVOLATILE ORGANIC COMPOUNDS

Ground water samples collected from MW-1, MW-2, MW-3, MW-4, and MW-10B (formerly MW-02D) were analyzed for SVOCs using USEPA Method 8270 during May 1990. No SVOCs were detected in any of these

wells. Selected SVOCs can also be detected during certain VOC analyses (e.g., USEPA Method 8260); these include naphthalene, hexachlorobutadiene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene. Therefore, these SVOCs were analyzed during selected ground water VOC analyses during the RI and previous investigations.

Naphthalene was the only SVOC detected in site ground water samples; it was detected in monitoring well MW-4, CPT-18 (59 feet bgs), and CPT-16 (88 and 100 feet bgs) at concentrations ranging from 0.5 µg/L to 11 µg/L. A California MCL has not been established for naphthalene; therefore, the results were compared to the RWQCB ESL for drinking water (21 µg/L naphthalene). Table 8-2 summarizes the SVOC ground water results; note that this table only lists the SVOCs detected in at least one ground water sample. A table is provided in Appendix G that lists the results for all the SVOCs that were analyzed.

8.3

PETROLEUM HYDROCARBONS

Selected ground water samples collected during the RI and previous investigations were analyzed for the following ranges of petroleum hydrocarbons: diesel fuel, gasoline, gasoline C₇-C₁₂, kerosene, motor oil, oil and grease, Stoddard solvent, and TPH (some previous investigations did not specify a specific hydrocarbon range).

Petroleum hydrocarbons were detected at B-01TR, MW-1, MW-1D (since renamed MW-8B), MW-2, MW-3, MW-3D (since renamed MW-10B), MW-4, and MW-7. Detected concentrations ranged from 52 µg/L TPH-d at MW-1D to 5,900 µg/L TPH-g at MW-04. California MCLs have not been established for petroleum hydrocarbons; therefore, the results were compared to the RWQCB ESLs for drinking water (100 µg/L for gasoline, middle distillates, and residual fuels). The petroleum hydrocarbon ground water analytical results are summarized on Table 8-3. An additional elevated concentration of TPH-G was also reported in a 1993 T&R sample (B-01-TR), but this sample was located off site and downgradient of the Haber Oil site, and is unlikely associated with the Hookston Station ground water VOC plume.

8.4

DISSOLVED METALS

Ground water samples were collected for dissolved metals analyses during the Second Quarter 2004 monitoring event and from wells MW-01, MW-01D (currently MW-08B), MW-02, MW-03, MW-05, and MW-06 during April 1993. The samples were analyzed for Title 22 metals (dissolved) by USEPA Method Series 6010/7000.

Each of the Title 22 metals was detected in at least one ground water sample. Metals are naturally present in soil and ground water, and low concentrations of dissolved metals in ground water at the site are expected. Samples from every well, except MW-12B, MW-13B, and MW-26B, contained at least one metal at a concentration above the California MCL. The results are summarized on Table 8-4.

It is important to note that the concentrations that exceed the MCLs typically do so by only a small margin. It is also important to note that many of the samples that exceed the MCLs were collected from areas outside of the Hookston Station VOC plume. For example, wells MW-19A/B, MW-18A/B, MW-6, MW-20A/B, and MW-21A/B may be considered background samples for reference to other samples collected within the Hookston Station VOC plume. Because the metals concentrations that are within the Hookston VOC plume are similar to those detected at background locations, the concentrations throughout this area can be attributed to naturally occurring levels of the metals in ground water rather than anthropogenic sources.

8.5

GENERAL MINERALS, WATER QUALITY, AND NATURAL ATTENUATION PARAMETERS

Ground water samples were analyzed for select general minerals (e.g., total dissolved solids, hardness, and alkalinity), natural attenuation parameters (e.g., chloride, iron, sulfate, and ethane), and other selected inorganic water quality parameters during the First, Second, and Third Quarter 2001 monitoring events and during the Second Quarter 2004 monitoring event. The data, which are presented on Table 8-5, were collected for remedial technology and natural attenuation evaluations to be completed during the forthcoming Feasibility Study. A more detailed discussion of the data will be presented at that time.

9.0

CHEMICALS IN SURFACE WATER AND SEDIMENT

Surface water and sediment samples were collected along the unlined portion of the Walnut Creek canal between June 2001 and June 2002. The results are presented in the following sections. Copies of the laboratory analytical reports are provided in Appendix G.

9.1

SURFACE WATER

A total of 28 surface water samples were collected from 18 locations along the Walnut Creek canal and submitted for laboratory analysis for VOCs. VOC results are summarized on Table 9-1. Note that the VOCs included on the table are those most commonly detected in ground water and; not all the reported VOCs were detected in surface water samples. The data were compared to the RWQCB ESLs for freshwater surface water, RWQCB Chronic Freshwater Aquatic Habitat Goals, RWQCB Maximum (acute) Freshwater Aquatic Habitat Goals, and the RWQCB Surface Water Quality Standards for Bioaccumulation and Human Consumption of Aquatic Organisms. Figure 9-1 posts the surface water VOC results. Note that the VOCs included on the figure include only those that were detected in each individual sample.

Each surface water sample has been analyzed for VOCs by USEPA Method 8260. As shown on Table 9-1, low concentrations of PCE, TCE, cis-1,2-DCE, have been detected in the surface water samples. Concentrations of these constituents are below the criteria referenced in the previous paragraph. Toluene and MTBE were also detected in select surface water samples. Toluene and MTBE are both fuel-related hydrocarbons and are not associated with the Hookston Station ground water plume. MTBE was detected in one surface water sample at a concentration of 8.3 µg/L, which exceeds the RWQCB ESL of 5 µg/L MTBE.

9.2

SEDIMENT

Seven sediment samples were collected from seven locations along the unlined portion of the Walnut Creek canal. Each sample was analyzed for VOCs. As shown on Table 9-2, VOCs were not detected in any of the sediment samples.

10.0

CHEMICALS IN AIR

Indoor air and ambient air samples for VOC analysis have been collected on-site and in nearby private residences. The results are summarized in the following sections and on Table 10-1. The results were compared to the RWQCB ESLs for commercial/industrial land use and residential land use. The laboratory analytical reports are included in Appendix G.

10.1

INDOOR AIR

Indoor air samples were collected at 5 locations within the structure at 199 Mayhew and from the living spaces at 17 private residences near the site. Indoor air samples were also collected from the crawl spaces in 15 of these homes; crawl spaces were not present in the two remaining residences. In accordance with the RWQCB-approved *Indoor Air Sampling Workplan Addendum* (ERM, 2003j), the crawl space indoor air samples were submitted to the laboratory under hold status and were analyzed only if elevated levels of VOCs were detected in the samples collected from the living spaces. The purpose of collecting crawl space samples was for use to potentially rule out false positive results if unusually elevated VOC concentrations were detected in indoor air.

TCE, cis-1,2-DCE, and 1,1-DCE were detected in the indoor air samples (Table 10-1 and Figure 10-1). The ESLs for cis-1,2-DCE and 1,1-DCE were not exceeded in any of the samples. Two of the samples collected on-site exceeded the commercial/industrial ESL for TCE. Seven of the samples collected from private residences contained concentrations of TCE in indoor air that exceed the residential land use ESL. The detected concentrations of TCE in the indoor air samples ranged from 1.2 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to $5 \mu\text{g}/\text{m}^3$, as shown on Table 10-1. The results indicated no significant differences between crawl space samples and samples collected within the living spaces; four of the homes showed slightly greater concentrations within the indoor living spaces, while three of the homes showed slightly greater concentrations within the crawl spaces.

10.2

AMBIENT AIR

Ambient air samples were collected from one on-site location and two off-site locations in the nearby residential neighborhood. TCE was detected at a concentration of $0.21 \mu\text{g}/\text{m}^3$ in one of the residential ambient air samples; this sample was collected outside one of the residences that had elevated levels of TCE in both the living space and crawl space indoor air samples. VOCs were not detected in the two remaining samples.

11.0

RWQCB COMMENTS TO RISK ASSESSMENT

On 2 June 2004, the RWQCB provided comments to CTEH and conditionally approved the *Risk Assessment* (CTEH, 2004a). CTEH indicated in their letter dated 1 July 2004 to the RWQCB that responses to two of the RWQCB's comments would be provided in the RI Report. The following subsections provide the requested information.

11.1

RWQCB COMMENT B - SOIL GAS AND INDOOR AIR SAMPLING SURVEYS

As part of the RWQCB's Comment B, the following information was requested:

- Map showing an overlay of soil gas data and ground water data (including isoconcentration contours of primary chemicals of concern);
- Targeted homes and buildings;
- Brief description of each home building design containing information that would be useful in understanding vapor flow into the structures; and
- Recommendations for expanding the soil gas and indoor air studies.

Figures 11-1 to 11-4 present the concentrations of PCE, TCE, cis-1,2-DCE, and 1,1-DCE (respectively) reported in soil vapor samples and in A-Zone ground water samples. The soil vapor sampling results presented on these figures were collected during ERM's October 2003 active soil vapor investigation (Section 5.2.3); the results of this investigation were previously discussed in Section 7.1.1 and presented on Table 7-2. The ground water analytical results presented on Figures 11-1 to 11-4 were collected during the Second Quarter 2004 ground water monitoring event. These data are included on Table 8-1; the ground water isoconcentration contour lines were also presented on Figures 8-5 to 8-8.

The requested information regarding targeted homes and buildings as well as home building design relate to the indoor air sampling survey. The activities conducted during the indoor air sampling investigation are discussed in Section 5.2.5 and the results were presented in Section 10.1. Figure 5-5 illustrates the locations where indoor air samples were collected, as well as the locations where permission to collect samples was

requested but not granted. Table 5-2 also presented the information relating to residence design that was collected at each indoor air sampling location; the information included on this table was provided by occupants of each residence sampled via responses to questionnaires. The questionnaire form was included as Attachment 2 of the *Indoor Air Sampling Workplan* (ERM, 2003i).

Additional soil vapor and indoor air sampling will be scoped in the FS as a function of the need for indoor air mitigation.

11.2

RWQCB COMMENT C - GROUND WATER RESULTS AND SURFACE WATER/DRINKING WATER STANDARDS

The following information was requested in the RWQCB's Comment C:

Provide maps that denote the extent of groundwater impacts which exceed drinking water goals, chronic surface water standards, and acute surface water standards; discuss the potential for chemicals of concern in ground water to exceed acute and/or chronic surface water goals at the point that the groundwater discharges into Walnut Creek. Based on water table elevation data, it is reasonable to assume that shallow groundwater is discharging into the creek...concentrations of chemicals of concern in groundwater should meet chronic surface water goals at the point that the groundwater discharges into a surface water body (i.e., dilution not considered). This is intended to protect benthic habitats that are not likely to receive the benefit of dilution as groundwater mixes with surface water. Upon mixing with surface water, concentrations of chemicals of concern should also meet aquatic habitat standards for bioaccumulation concerns if lower than chronic standards.

The ground water isoconcentration maps presented as Figures 8-5 to 8-8 and Figures 8-13 to 8-16 denote the extent of PCE, TCE, cis-1,2-DCE, and 1,1-DCE concentrations reported during the Second Quarter 2004 ground water monitoring event in A-Zone and B-Zone ground water that exceed the established ESLs for current/potential drinking water sources. Note that the minimum isoconcentration contour used on each of these figures corresponds to the respective ESLs. Isoconcentration contour maps have not been prepared for C-Zone ground water because only a single TCE detection exceeding the drinking water ESL in the C-Zone (MW-15C, 6.6 µg/L) was reported during the Second Quarter 2004 ground water monitoring event.

The ground water analytical results were compared to chronic and acute freshwater surface water body habitat goals published in Tables F-4a and F-4b in Appendix 1 of the San Francisco Bay RWQCB's *Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater, Interim Final July 2003* (updated 4 February 2004). Acute (maximum concentration) freshwater aquatic habitat goals have not been established for PCE, TCE, cis-1,2-DCE, 1,1-DCE, and other COCs associated with the site. MTBE is the only compound detected in ground water for which the RWQCB has established an acute aquatic habitat goal. However, MTBE is not a COC associated with the site and detections of MTBE in site and downgradient ground water are likely due to off-site sources.

Chronic freshwater habitat goals have been established for many of the COCs associated with the site and detected in ground water. Detections of PCE, TCE, cis-1,2-DCE, and 1,1-DCE were reported at selected locations during Second Quarter 2004 at levels exceeding the chronic freshwater surface water body habitat goals. Figures 11-5 to 11-11 illustrate the extent to which the chronic goals were exceeded; the minimum isoconcentration contours used on these figures correspond to the respective chronic freshwater habitat goals. Note that the PCE, TCE, and 1,1-DCE goals were exceeded in both the A-Zone and B-Zone, while the cis-1,2-DCE goal was only exceeded in the A-Zone ground water. Therefore, only an A-Zone map has been prepared for cis-1,2-DCE (Figure 11-9).

Based on the Second Quarter 2004 ground water monitoring data, the chronic surface water standards for PCE, TCE, cis-1,2-DCE, and 1,1-DCE are not apparently exceeded at the point where ground water potentially discharges into the Walnut Creek canal (Figures 11-5 to 11-11).

The RWQCB Surface Water Standards for bioaccumulation for PCE, TCE, and 1,1-DCE are less than the RWQCB chronic surface water standards for these constituents; a bioaccumulation standard for cis-1,2-DCE has not yet been established by the RWQCB. During the Second Quarter 2004 ground water monitoring event, the bioaccumulation standard for TCE (81 µg/L) and 1,1-DCE (3.2 µg/L) were exceeded at the following monitoring wells located within 300 feet of the Walnut Creek canal:

- MW-17A - 170 µg/L TCE and 5.0 µg/L 1,1-DCE;
- MW-17B - 280 µg/L TCE and 9.6 µg/L 1,1-DCE; and
- MW-24B - 240 µg/L TCE and 12 µg/L 1,1-DCE.

Note that the RWQCB Final Surface Water Screening Levels, chronic habitat goals, and bioaccumulation/human consumption standards for these compounds were not exceeded in the surface water samples (Table 9-1).

12.0

CONCEPTUAL SITE MODEL

The previous subsections described the existing environmental data available for the site. This subsection presents an overall Conceptual Site Model (CSM) based on this existing data and the current understanding of site characteristics. The CSM describes the primary and secondary sources of contamination, potentially contaminated media and migration pathways, and potential exposure pathways. A summary of the environmental fate and transport mechanics for chlorinated VOCs that will be evaluated in the FS is also provided.

12.1

CONTAMINATED MEDIA AND TRANSPORT MECHANISMS

Sections 7 through 10 presented an overview of the chemicals detected in the various environmental media at the site. This overview is based on historical and current data for soil, soil vapor, surface water, sediment, ground water, and indoor and outdoor air. A summary of the contaminated media and type of chemical transport that may occur at the site is presented below.

12.1.1

Soil

Organic chemicals such as VOCs, SVOCs, PCBs, and petroleum hydrocarbons have been detected in soils at the site. The highest concentrations of VOCs were detected beneath the 199 Mayhew Way structure near the southwestern corner of the site, but are present in low concentrations throughout the site. SVOCs, PCBs, and petroleum hydrocarbons have been detected in soils at the site, but generally at low concentrations and very localized.

Heavy metals have been detected in soil at the site at concentrations that are generally consistent with expected background concentrations. Metals detected at elevated concentrations (above the ESLs) include arsenic, chromium, copper and vanadium.

Metals and SVOCs (including PCBs) tend to sorb to soil particles and primarily can be transported from surface soils at the site via dust generation or in surface water runoff. More volatile organic chemicals detected at the site (e.g., chlorinated solvents or gasoline-range petroleum hydrocarbons) would not be expected to be present in surface soils, but

can migrate downward from shallow soils to deeper soils under the force of gravity. These volatile chemicals could also migrate upward through soil gas into the atmosphere. In addition, these types of chemicals, along with the more soluble metals, can migrate to underlying groundwater through leaching.

12.1.2 *Soil Vapor*

VOCs detected in soil or ground water can migrate through the subsurface via soil vapor into ambient outdoor or indoor air.

12.1.3 *Surface Water*

Storm water runoff at the site is drained into the regional storm water sewer system and is therefore not available for exposure. Perennial surface water is present in the nearby Walnut Creek canal, which is part of the Contra Costa County Flood Control District's storm water management system. Organic chemicals have been detected in surface water in this channel.

VOCs in surface water may be available for direct contact as well as may volatilize into ambient air.

12.1.4 *Sediment*

Chemicals present in surface water or in the underlying ground water can sorb to fine-grained sediments within the creek bed. Sediment samples collected throughout this study area contained non-detectable concentrations of VOCs. If contaminants were present in creek sediments, they could be transported via natural downstream sediment migration (typically during flood stages when high volumes of water could perturb the underlying sediments). Chemicals in sediments could be available for direct contact to waders or swimmers in the creek; however, this portion of the creek is not open to the public as it is part of the regional storm water control system.

12.1.5 *NAPL*

Residual nonaqueous-phase liquids (NAPLs) are pure, non-dissolved remnants of former hydrocarbon or solvent sources (e.g., spills or leaks of pure-phase gasoline or solvent products) associated with waste discharge at the site. Residual NAPLs above the water table can migrate downward under the force of gravity, or could be held in place by capillary forces

exceeding those gravitational forces. NAPL properties such as density and interfacial tension with water will also affect flow and distribution of NAPL in the subsurface. Light nonaqueous-phase liquids (LNAPLs), such as gasoline or diesel fuel, are expected to migrate to the water table and spread laterally, because their specific gravities are less than the specific gravity of ground water. Dense nonaqueous-phase liquids (DNAPLs), such as TCE and other chlorinated solvents, have not been observed at the site. If sufficient amounts of DNAPL were present, DNAPL would migrate below the water table under the force of gravity until it reached an aquitard layer or until the combination of physical properties of the DNAPL was sufficient to overcome gravitational forces pulling it downward.

Measurable LNAPL has been observed at MW-04; however, in recent monitoring events, only a thin sheen has been noted. MW-04 is immediately adjacent to a former gasoline underground storage tank, and is also immediately adjacent to the Haber Oil site, which has previously reported the presence of LNAPL. All other known underground storage tanks at the site have been removed.

12.1.6

Ground Water

Sections 8.1 through 8.5 present in detail the ground water data that have been collected for the site. As discussed in these sections a variety of organic chemicals and metals have been detected in ground water.

Organic and inorganic chemicals detected in ground water have the potential of migrating off-site to downgradient locations through natural ground water flow processes. Chemicals that migrate as far as the Walnut Creek canal may discharge into the creek through the underlying ground water, or could "daylight" in the form of surface seeps along the creek bank during times of increased rainfall. Organic chemicals detected in ground water also have the potential of volatilizing through the subsurface into the atmosphere or into indoor air. Ground water could also be extracted from the impacted aquifers through the use of privately owned irrigation wells.

12.2

POTENTIAL HUMAN EXPOSURES

Using the assumed baseline conditions and potential transport mechanisms, a site-specific Risk Assessment has been developed to evaluate potential complete exposure pathways, including:

- Direct contact with chemicals in soil via incidental ingestion or dermal contact;
- Inhalation of volatile chemicals emanating from subsurface soils or ground water via soil vapor;
- Direct contact with surface water in the Walnut Creek canal;
- Inhalation of volatile chemicals in the Walnut Creek canal;
- Inhalation of volatile chemicals emanating from ground water used for irrigation and/or recreational purposes;
- Direct exposure and incidental ingestion of ground water via cleaning use;
- Ingestion of fish from Walnut Creek; and
- Ingestion of vegetables that have been watered with impacted ground water.

These exposure pathways have been evaluated in the Risk Assessment, which was submitted by CTEH in April 2004.

12.3

CHLORINATED VOC CONTAMINANT FATE AND TRANSPORT

This section summarizes fate and transport concepts that will be considered in the FS. The four concepts that are addressed include volatilization, adsorption, dispersion, and degradation. Table 12-1 presents applicable fate and transport parameters for VOCs detected at concentrations greater than ESLs at the site.

12.3.1

Volatilization

Volatilization is the process by which a chemical is transferred from soil or water into the vapor phase. The process of volatilization is an important mechanism for describing the partitioning of VOCs between soil vapor, soil, and ground water.

The equilibrium relationship between the concentration of a VOC in ground water and air can be described by the following equation (Olsen and Davis, 1990):

$$K = \frac{1}{H} = \frac{\text{Concentration in Water (mg/L)}}{\text{Concentration in air (mg/L)}}$$

Where H = Henry's constant

Henry's constants for the VOCs detected at concentrations greater than MCLs at the site are listed in Table 12-1. These data will be used in the FS to predict the effectiveness of remedial technologies.

12.3.2

Adsorption

Adsorption is the process by which chemicals from an aqueous solution or vapor phase adhere to the surfaces of vadose zone soil or aquifer materials (Fetter, 1994). The adsorptive properties of organic chemicals greatly affect their transport behavior. Chemicals with strong adsorptive properties with soil are relatively immobile and will not be transported large distances from the source. In contrast, chemicals that adhere weakly to soil can be transported large distances from the source. The degree of adsorption also affects other fate and transport reactions, including volatilization (Olsen and Davis, 1990).

Equilibrium relationships exist between VOC concentrations in ground water and soil. This ratio is referred to as the distribution or partition coefficient (K_d), and can be quantified using the following equation (Olsen and Davis, 1990):

$$K_d = \frac{C_s}{C_w} = \frac{\text{Mass of solute on the solid phase per unit mass of solid phase}}{\text{Concentration of solute in solution}}$$

and

$$K_d = K_{oc} \times f_{oc} = \text{Soil Sorption Coefficient} \times \text{Fraction Organic Carbon}$$

Where C_s is expressed in mg/kg,
 C_w is expressed in mg/L
 f_{oc} is expressed in mg of organic carbon/mg of soil

These data will be used to predict the effectiveness of different remedial technologies in the FS.

12.3.3

Dispersion

Dispersion is the phenomenon that results as ground water flows along different flow paths at different rates (Fetter, 1994). This process is dependent upon ground water velocity and the porosity of the soil matrix. Although the calculation of dispersion involves two types of mixing (mechanical dispersion and molecular diffusion), mechanical dispersion is the dominant process involved.

Mechanical dispersion describes the mixing that occurs because the solute-containing water does not all travel at the same velocity, thus causing mixing along the flow path. This mixing results in dilution. The mixing that occurs along the path of the plume is referred to as longitudinal dispersion and the mixing that occurs as the plume spreads laterally is called transverse dispersion. Mathematically, mechanical dispersion can be described by the following two equations (Fetter, 1993):

Coefficient of longitudinal mechanical dispersion = $\alpha_i v_i$

Where v_i = the average linear velocity in the i direction (L/T)

α_i = the dynamic dispersivity in the i direction (L)

and

Coefficient of transverse mechanical dispersion = $\alpha_j v_i$

Where v_i = the average linear velocity in the j direction (L/T)

α_j = the dynamic dispersivity in the i direction (L)

Dispersion will be considered as an attenuation factor within the FS.

12.3.4

Degradation

VOC transformation and degradation occur at many sites due to natural biotic and abiotic processes in the subsurface. These processes transform original VOC compounds to byproducts. Understanding degradation can be important to assessing plume migration and attenuation at sites where degradation rates are significantly high. In some cases, more harmful substances are created, such as the transformation of cis-1,2-DCE to VC. In other cases, complete destruction occurs and toxic chemicals are reduced to innocuous substances, such as the mineralization of VC to carbon dioxide and water.

The most common degradation process that influences chlorinated ethene plumes is reductive dechlorination. This process results in the sequential degradation of more chlorinated compounds to less chlorinated compounds, such as PCE to TCE (USEPA, 1998). Other processes, such as cometabolism and direct mineralization, can influence chlorinated ethene plumes as well (USEPA, 1998). If complete reductive dechlorination occurs, the following sequence of products occurs: PCE, TCE, 1,2-DCE, VC, ethene, carbon dioxide, and water. Each step leading to VC liberates chloride ions. Chlorinated ethene plumes with active degradation display characteristic patterns of compounds. In the case of complete reductive dechlorination, various configurations of the general pattern in Figure 12-1 may be observed. In many cases, the complete degradation sequence does not occur.

The Hookston Station VOC plume is predominantly TCE, with relatively low ratios of breakdown products. Based on the distribution of cis-1,2-DCE, it is evident that natural processes at the site are transforming TCE to cis-1,2-DCE. VC has only been detected at MW-04 (where petroleum hydrocarbons are also present), indicating that very limited reductive dechlorination of cis-1,2-DCE is occurring. Several samples were analyzed for ethene, which reflects VC degradation (Table 8-5). No ethene was detected, consistent with the lack of VC at the site.

This pattern of compounds within the Hookston Station VOC plume indicates that the natural system has played a limited role to transform, but not to completely destroy chlorinated VOCs. Other natural attenuation processes, such as adsorption and dispersion, have likely played a stronger role in limiting the extent of the plume.

CONCLUSIONS

Fourteen years ago, TCE was identified in ground water at the site. For approximately 6 years after this initial discovery, six different phases of preliminary investigations were completed to identify the probable sources and the impacted area of this ground water problem. A financial responsibility settlement was reached approximately 4 years later. None of the primary parties involved in the work on the property completed to date (Mr. Helix, UPRR, and the CCCRA) caused the chemical release. In advance of any regulatory orders to further investigate the environmental impacts at the site, in December 2000, a *Remedial Investigation Workplan* was prepared on behalf of Mr. Helix and UPRR. Mr. Helix and UPRR voluntarily requested oversight of the investigation from the RWQCB, and have been working cooperatively with the RWQCB to move the investigation and remediation program forward. Over the past 3.5 years, an extensive multi-phase, multi-media investigation has been carried out both on and off the site.

What we know about the site is detailed within the body of this report, but in summary, the key findings of the RI that will be used as the basis for the forthcoming FS are provided below:

- This is primarily a TCE in ground water issue. Daughter products produced by the natural breakdown of TCE are observed at the site, but the complete breakdown of these chemicals (to ethene) has not been observed. Other COPCs in both soil and ground water (e.g., metals, SVOCs, PCBs, and TPH) are limited in concentration and extent, do not add significantly to human health risk at the site, and will therefore not be considered in the FS.
- TCE in soils on the site are widespread, but the observed concentrations are generally low. During the Source Area Investigation phase of the Phase II RI, no obvious high-concentration source areas were identified that warranted immediate remedial action. The highest concentrations of TCE in soil (2,580 µg/kg) were found beneath the commercial building at 199 Mayhew Way.
- The TCE in ground water is primarily found within two monitoring zones at depths above approximately 70 feet bgs. The A-Zone represents thin, discontinuous sand units where ground water is first encountered. To date, the highest concentration of TCE reported in an A-Zone monitoring well was 8,480 µg/L at MW-14A, located near the northeastern property boundary along Bancroft Road, approximately

200 feet north of the machine shop that was formerly operated on Bancroft Road. These sandy layers are sandwiched between fine-grained silts and clays. The B-Zone represents the first laterally continuous sand and gravel deposit, and is generally found between 40 and 70 feet bgs. To date, the highest concentration of TCE reported in a B-Zone monitoring well was 11,000 µg/L at MW-11B, located near the southwestern property boundary. Ground water in both of these zones flows north to northeast beneath the site. The deeper C-Zone aquifer unit has not been significantly impacted by TCE.

- The high concentration core of the TCE plume in ground water is relatively narrow on site (e.g., the width of the central portion of the A-Zone plume with concentrations greater than 500 µg/L is only approximately 120 feet).
- The Hookston Station site is not the only contributor to chemicals in ground water within the study area. Based on ground water flow directions and chemical distribution data, VOCs found in ground water along Vincent Road, Estand Way, and within the Fair Oaks neighborhood northwest of the site are not associated with the Hookston Station VOC plume. These chemicals are attributable to one or more off-site (i.e., non-Hookston) sources. Some of these off-site chemical impacts, such as the PCE and TCE found along Vincent Road, have migrated onto the Hookston Station site, thereby creating a commingled VOC plume. The downgradient commingled VOC plume is wider than the on-site TCE plume.
- Vapors associated with ground water VOC impacts have been detected in indoor air samples within the commercial building at 199 Mayhew Way, as well as within homes in the downgradient residential neighborhood.
- Several privately owned irrigation wells have been identified within the footprint of the Hookston Station VOC plume. Mr. Helix and UPRR have offered (and in many cases, have already implemented) removal of these impacted wells to eliminate the potential for exposure to impacted ground water. This work is being performed in cooperation with the RWQCB and the Contra Costa County Environmental Health Department.
- Low concentrations of VOCs present in the Hookston Station VOC plume are also present within surface water of the Walnut Creek canal. However, other VOCs that are not associated with the Hookston Station VOC plume are also detected in the creek. The detected concentrations are below surface water quality goals.

Given the complexities of characterizing chemical impacts to all media that have been studied during the site investigations (soil, soil vapor, ground water, surface water, and air), and given the natural variations in the subsurface environment, small data gaps may remain. The site characterization that was completed for this RI is sufficient for the purposes of preparing the FS.

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Table 5-1
Private Well Survey Data within Hobbsville Plume Area
Hookston Station Remedial Investigation
Pleasant Hill, California

| ADDRESS | APN | WELLS ON PROPERTY YES/NO | NUMBER OF WELLS | WELL DIAMETER | WELL DEPTH | WELL MATERIAL | DATE OF INSTALLATION | FREQUENCY OF USE | USE OF WATER FROM WELL | COMMENTS/STATUS |
|---|---------------|--|-----------------|---------------|------------|---------------|----------------------|-----------------------|------------------------|--|
| Properties with Active Wells within Hookston Plume Area: | | | | | | | | | | |
| 1270 WATERLOO CT | 148-325-083-1 | Yes | Unknown | Unknown | Unknown | Unknown | Unknown | Once a week | Landscaping | Sampled from spigot on 3/24/04 |
| 1001 STIMBEL DR | 148-325-013-1 | Yes | 1 | 6" | 75' | PVC Plastic | Unknown | 3 times a week | Landscaping | Owner collected sample, 0.25 mg/L TC. Sample collected by ERM from spigot 3/29/04. |
| 1001 STIMBEL DR | 148-325-027-0 | Yes | 1 | 6" | 60' | PVC Plastic | Unknown | 2x per week in summer | Landscaping | Well casing replaced 6 years earlier. Sampled from spigot 4/13/04. |
| 1025 STIMBEL DR | 148-325-012-2 | Yes | 1 | Unknown | Unknown | Unknown | Unknown | | Landscaping/Pool | Sampled from spigot on 3/23/04. |
| Properties with Inactive Wells within Hookston Plume Area: | | | | | | | | | | |
| 1038 BERMUDA DR | 148-331-016-3 | Yes | 1 | Unknown | Unknown | Unknown | Unknown | Never Used | Unknown | Installed POB 3/22/04. Sampled POB 4/7/04 |
| 1340 EDINBURGH CT | 148-331-024-7 | Yes | 1 | 4" | 30' | PVC Plastic | Unknown | Never | Unknown | Well abandoned 6/24/04 |
| 1313 GRAGG LN | 148-331-069-2 | Yes | 1 | Unknown | Unknown | Unknown | Unknown | None | N/A | Well abandoned 6/25/04 |
| 1013 BERMUDA DR | 148-323-021-3 | Yes | 1 | 6" | 55' | Unknown | 1977 | None | Landscaping | Well abandoned 6/25/04 |
| 1024 BERMUDA DR | 148-331-029-6 | Yes | 1 | 4" | 29' | Open Borehole | 1977 | None | N/A | Well abandoned 6/24/04 |
| 1201 THAMES DR | 148-322-005-7 | Yes | 1 | 4" | 30' | PVC Plastic | 1976 | None | Landscaping | Inspected 3/29/03. Sampled from spigot 4/2/04. |
| 1321 HAMPSHIRE CT | 148-331-031-2 | Yes | 1 | 6" | Unknown | Steel | Unknown | None | N/A | Well abandoned 6/25/04 |
| 1065 STIMBEL DR | 148-325-006-4 | Yes | 1 | Unknown | Unknown | Unknown | Unknown | None | N/A | Wellhead buried beneath landscaping; unable to locate. |
| Properties that Did Not Respond to Mailings and Home Visits: | | | | | | | | | | |
| 1020 HAMPTON DR | 148-325-013-8 | No response to three mailings and home visits on 20 August, 29 August, and 31 August 2003. | | | | | | | | |
| 1025 STIMBEL DR | 148-333-004-7 | Met with survey staff. Refused to state. | | | | | | | | |

Table 5-2
 Private Residence Building Design for Indoor Air Sampling Locations
 Hookaton Station Remedial Investigation
 Pleasant Hill, California

| Sample Location/Street Address | Number of Floors | Foundation Design | Heating System | Ventilation System | Sample Start Time | Sample End Time | Inside Temp. | Inside Relative Humidity | Outside Temp. | Outside Relative Humidity |
|--------------------------------|------------------|-------------------|---------------------------------|--|-------------------|-----------------|--------------|--------------------------|---------------|---------------------------|
| 1208 Hookaton | 2 | Concrete Slab | Hot Air Circulation | Swamp Cooler in Summer | 1/19/04 20:15 | 1/20/04 8:00 | -- | -- | -- | -- |
| 1009 Stimmel | 1 | Crawl Space | Hot Air Circulation | Central AC, Kitchen range hood fan, bathroom ventilation fans | 1/19/04 20:40 | 1/20/04 8:10 | -- | -- | -- | -- |
| 1000 Hampton | 1 | Crawl Space | Hot Air Circulation | Central AC | 1/21/04 20:02 | 1/22/04 8:00 | -- | -- | -- | -- |
| 1006 Stimmel | 1 | Crawl Space | Hot Air Circulation | Central AC, Kitchen range hood fan, bathroom ventilation fans | 2/17/04 19:55 | 2/18/04 7:55 | 70 | 59 | 70 | 52 |
| 1005 Stimmel | 2 | Crawl Space | Central Air | Central AC, Kitchen range hood fan, bathroom ventilation fans, mechanical fans | 2/17/04 20:10 | 2/18/04 8:04 | 74 | 63 | 73 | 55 |
| 1204 Hookaton | 2 | Concrete Slab | Radiator | Mechanical fans, Kitchen range hood fan, bathroom ventilation fans | 2/19/04 19:40 | 2/20/04 7:40 | 64 | 46 | 63 | 37 |
| 1002 Hampton | 2 | Crawl Space | Hot Air Circulation- Forced Air | Kitchen range hood fan, bathroom ventilation fans | 2/19/04 19:55 | 2/20/04 7:54 | 70 | 52 | 57 | 44 |
| 1006 Hampton | 1 | Crawl Space | No Information | Central AC, Kitchen range hood fan, bathroom ventilation fans, mechanical fans | 2/19/04 20:10 | 2/20/04 8:00 | 70 | 50 | 57 | 44 |
| 1008 Hampton | 1 | Crawl Space | Hot Air Circulation | Central AC, Kitchen range hood fan, bathroom ventilation fans, mechanical fans | 2/25/04 19:35 | 2/26/04 7:32 | -- | -- | -- | -- |
| 1220 Thames | 2 | Crawl Space | Hot Air Circulation | Central AC, bathroom ventilation fans | 2/19/04 20:25 | 2/20/04 8:21 | 65 | 51 | 55 | 44 |
| 1007 Stimmel | 2 | Crawl Space | Hot Air Circulation | Central AC, Kitchen range hood fan, bathroom ventilation fans | 2/26/04 19:45 | 2/27/04 7:41 | 69 | 56 | 53 | 44 |
| 1260 Waterloo | 2 | Crawl Space | Central Heat, Gas | Central AC, Kitchen range hood fan, bathroom ventilation fans | 2/26/04 20:05 | 2/27/04 8:00 | 68 | 49 | 53 | 64 |
| 1271 Hookaton | 2 | Crawl Space | Hot Air Circulation | Kitchen range hood fan | 3/3/04 19:30 | 3/4/04 7:50 | 68 | 46 | 58 | 43 |
| 1270 Waterloo | 2 | Crawl Space | F.A.F Natural Gas | One individual air conditioning unit | 3/16/04 7:20 | 3/17/04 7:25 | 75 | 33 | 74 | 26 |
| 1011 Bermuda | 1 | Crawl Space | Hot Air Circulation | Central AC, kitchen range hood fan, bathroom ventilation fans | 3/16/04 19:40 | 3/17/04 7:40 | 68 | 35 | 76 | 31 |
| 1019 Bermuda | 2 | Crawl Space | Hot Air Circulation | Mechanical fans, Kitchen range hood fan, bathroom ventilation fans | 3/16/04 19:55 | 3/17/04 7:50 | 74 | 33 | 72 | 32 |
| 1000 Stimmel | 1 | Crawl Space | Hot Air Circulation | Central AC, bathroom ventilation fans | 4/12/04 19:54 | 4/13/04 7:45 | 65 | 44 | 64 | 39 |

Table 6-1
Grain Size Distribution Analyses Results
Hookston Station Remedial Investigation
Pleasant Hill, California

| Sample Location | Sample Depth (ft) | Aquifer Zone | Grain Size Distribution | | | | | Organic Content (%) | Specific Gravity | In-Place Density (g/cm ³) | Porosity (%) |
|-----------------|-------------------|--------------|-------------------------|--------|--------|--------|-----|---------------------|------------------|---------------------------------------|--------------|
| | | | % gravel | % sand | % silt | % clay | | | | | |
| B-73 | 7.5-9 | A-zone | 0.0 | 11.2 | 41.3 | 47.5 | 4.6 | 2.60 | 1.51 | 41.9 | |
| B-88 | 9.5 | A-zone | 0.0 | 4.2 | 39.8 | 56.0 | 4.7 | 2.60 | 1.66 | 36.2 | |
| MW-13A | 7 | A-zone | 0.0 | 19.2 | 38.9 | 41.9 | 3.7 | 2.62 | 1.23 | 53.1 | |
| MW-15A | 15.5 | A-zone | 15.6 | 60.2 | 14.9 | 9.3 | 1.1 | na | na | na | |
| MW-15B | 50 | B-zone | 0.7 | 25.5 | 46.9 | 26.9 | 1.7 | na | na | na | |
| MW-16A | 16.5 | A-zone | 0.0 | 38.1 | 43.1 | 18.8 | 1.5 | na | na | na | |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|---------------------------------|------------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| <i>Shallow Monitoring Wells</i> | | | | | | |
| MW-01 | 4/25/1990 | 10-20 | 64.52 | 15.07 | - | 49.45 |
| | 5/8/1990 | 10-20 | 64.52 | 15.22 | - | 49.30 |
| | 5/17/1990 | 10-20 | 64.52 | 15.33 | - | 49.19 |
| | 3/19/1991 | 10-20 | 64.52 | 14.69 | - | 49.83 |
| | 1/21/1992 | 10-20 | 64.52 | 16.04 | - | 48.48 |
| | 4/2/1993 | 10-20 | 64.52 | 13.46 | - | 51.06 |
| | 9/9/1993 | 10-20 | 64.52 | 16.26 | - | 48.26 |
| | 9/16/1993 | 10-20 | 64.52 | 15.42 | - | 49.10 |
| | 11/17/1995 | 10-20 | 64.52 | 15.29 | - | 49.23 |
| | 6/29/2000 | 10-20 | 64.52 | 14.79 | - | 49.73 |
| | 3/12/2001 | 10-20 | 64.52 | 14.24 | - | 50.28 |
| | 6/27/2001 | 10-20 | 64.52 | 15.37 | - | 49.15 |
| | 9/18/2001 | 10-20 | 64.52 | 15.90 | - | 48.62 |
| | 12/20/2001 | 10-20 | 64.52 | 14.38 | - | 50.14 |
| | 3/20/2002 | 10-20 | 64.52 | 14.47 | - | 50.05 |
| | 6/2/2002 | 10-20 | 64.52 | 15.04 | - | 49.48 |
| | 9/24/2002 | 10-20 | 64.52 | 15.65 | - | 48.87 |
| | 11/14/2002 | 10-20 | 64.52 | 15.43 | - | 49.09 |
| | 2/19/2003 | 10-20 | 64.52 | 14.1 | - | 50.42 |
| | 5/6/2003 | 10-20 | 64.52 | 13.91 | - | 50.61 |
| | 7/22/2003 | 10-20 | 64.52 | 15.01 | - | 49.51 |
| | 10/24/2003 | 10-20 | 65.06 | 15.62 | - | 49.44 |
| | 3/10/2004 | 10-20 | 65.06 | 13.95 | - | 51.11 |
| 4/19/2004 | 10-20 | 65.06 | 14.49 | - | 50.57 | |
| 7/30/2004 | 10-20 | 65.06 | 15.28 | - | 49.78 | |
| MW-02 | 4/25/1990 | 11-21 | 68.48 | 17.43 | - | 51.05 |
| | 5/8/1990 | 11-21 | 68.48 | 17.69 | - | 50.79 |
| | 5/17/1990 | 11-21 | 68.48 | 17.82 | - | 50.66 |
| | 3/19/1991 | 11-21 | 68.48 | 17.02 | - | 51.46 |
| | 1/21/1992 | 11-21 | 68.48 | 18.39 | - | 50.09 |
| | 4/1/1993 | 11-21 | 68.48 | 15.19 | - | 53.29 |
| | 11/17/1995 | 11-21 | 68.48 | 17.76 | - | 50.72 |
| | 6/27/2001 | 11-21 | 68.48 | NM | - | - |
| | 9/18/2001 | 11-21 | 68.48 | NM | - | - |
| | 12/20/2001 | 11-21 | 68.48 | NM | - | - |
| | 3/20/2002 | 11-21 | 68.48 | NM | - | - |
| | 6/2/2002 | 11-21 | 68.48 | NM | - | - |
| | 9/24/2002 | 11-21 | 68.48 | NM | - | - |
| | 11/14/2002 | 11-21 | 68.48 | NM | - | - |
| | 2/19/2003 | 11-21 | 68.48 | NM | - | - |
| | 5/6/2003 | 11-21 | 68.48 | NM | - | - |
| | 7/22/2003 | 11-21 | 68.48 | NM | - | - |
| 10/24/2003 | 11-21 | 68.48 | NM | - | - | |
| 3/10/2004 | 11-21 | 68.48 | NM | - | - | |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|-----------|------------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| MW-03 | 4/25/1990 | 10-20 | 65.20 | 16.40 | -- | 48.80 |
| | 5/8/1990 | 10-20 | 65.20 | 16.54 | -- | 48.66 |
| | 5/17/1990 | 10-20 | 65.20 | 16.64 | -- | 48.56 |
| | 3/19/1991 | 10-20 | 65.20 | 16.02 | -- | 49.19 |
| | 1/21/1992 | 10-20 | 65.20 | 17.33 | -- | 47.87 |
| | 4/2/1993 | 10-20 | 65.20 | 15.02 | -- | 50.18 |
| | 9/9/1993 | 10-20 | 65.20 | 16.69 | -- | 48.51 |
| | 9/16/1993 | 10-20 | 65.20 | 16.71 | -- | 48.49 |
| | 11/17/1995 | 10-20 | 65.20 | 16.42 | -- | 48.78 |
| | 6/29/2000 | 10-20 | 65.20 | 15.64 | -- | 49.56 |
| | 3/12/2001 | 10-20 | 65.20 | 15.08 | -- | 50.12 |
| | 6/27/2001 | 10-20 | 65.20 | 16.11 | -- | 49.09 |
| | 9/18/2001 | 10-20 | 65.20 | 16.58 | -- | 48.62 |
| | 12/20/2001 | 10-20 | 65.20 | 15.46 | -- | 49.74 |
| | 3/20/2002 | 10-20 | 65.20 | 15.38 | -- | 49.82 |
| | 6/2/2002 | 10-20 | 65.20 | 15.87 | -- | 49.33 |
| | 9/24/2002 | 10-20 | 65.20 | 16.35 | -- | 48.85 |
| | 11/14/2002 | 10-20 | 65.20 | 16.19 | -- | 49.01 |
| | 2/19/2003 | 10-20 | 65.20 | 15.12 | -- | 50.08 |
| | 5/6/2003 | 10-20 | 65.20 | NM | -- | -- |
| | 7/22/2003 | 10-20 | 65.20 | NM | -- | -- |
| | 10/24/2003 | 10-20 | 65.20 | NM | -- | -- |
| | 3/10/2004 | 10-20 | 65.56 | 14.94 | -- | 50.62 |
| 4/19/2004 | 10-20 | 65.56 | 15.75 | -- | 49.81 | |
| 7/30/2004 | 10-20 | 65.56 | 16.49 | -- | 49.07 | |
| MW-04 | 4/25/1990 | 11-21 | 64.67 | 15.93 | -- | 48.74 |
| | 5/8/1990 | 11-21 | 64.67 | 16.04 | -- | 48.63 |
| | 5/17/1990 | 11-21 | 64.67 | 16.13 | -- | 48.54 |
| | 3/19/1991 | 11-21 | 64.67 | 15.65 | -- | 49.02 |
| | 1/21/1992 | 11-21 | 64.67 | 16.90 | 0.03 | 47.77 |
| | 4/2/1993 | 11-21 | 64.67 | 15.01 | 0.34 | 49.93 |
| | 9/9/1993 | 11-21 | 64.67 | 16.87 | 0.34 | 47.80 |
| | 9/16/1993 | 11-21 | 64.67 | 16.34 | 0.39 | 48.33 |
| | 11/17/1995 | 11-21 | 64.67 | 16.23 | 0.33 | 48.44 |
| | 6/29/2000 | 11-21 | 64.67 | 15.57 | -- | 49.10 |
| | 3/12/2001 | 11-21 | 64.67 | 15.15 | -- | 49.52 |
| | 6/27/2001 | 11-21 | 64.67 | 13.83 | -- | 50.84 |
| | 9/18/2001 | 11-21 | 64.67 | 16.23 | -- | 48.44 |
| | 12/20/2001 | 11-21 | 64.67 | 15.42 | 0.01 | 49.25 |
| | 3/20/2002 | 11-21 | 64.67 | 15.29 | -- | 49.38 |
| | 6/2/2002 | 11-21 | 64.67 | 15.70 | 0.01 | 48.97 |
| | 9/24/2002 | 11-21 | 64.67 | 15.99 | 0.01 | 48.68 |
| | 11/14/2002 | 11-21 | 64.67 | 15.91 | 0.01 | 48.76 |
| | 2/19/2003 | 11-21 | 64.67 | 15.09 | 0.01 | 49.58 |
| | 5/6/2003 | 11-21 | 64.67 | 14.94 | 0.01 | 49.73 |
| | 7/22/2003 | 11-21 | 64.67 | 15.61 | 0.01 | 49.06 |
| | 10/24/2003 | 11-21 | 64.95 | 16.05 | 0.01 | 48.90 |
| | 3/10/2004 | 11-21 | 64.95 | 14.95 | -- | 50.00 |
| 4/19/2004 | 11-21 | 64.95 | 15.33 | -- | 49.62 | |
| 7/30/2004 | 11-21 | 64.95 | 15.79 | -- | 49.16 | |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|-----------|------------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| MW-05 | 3/19/1991 | 10-30 | 68.60 | 17.52 | Γ | 51.08 |
| | 1/21/1992 | 10-30 | 68.60 | 18.89 | — | 49.71 |
| | 4/1/1993 | 10-30 | 68.60 | 15.72 | — | 52.88 |
| | 9/16/1993 | 10-30 | 68.60 | 18.36 | — | 50.24 |
| | 11/17/1995 | 10-30 | 68.60 | 18.24 | — | 50.36 |
| | 6/28/2000 | 10-30 | 68.60 | 16.65 | — | 51.95 |
| | 3/12/2001 | 10-30 | 68.60 | 15.90 | — | 52.70 |
| | 6/27/2001 | 10-30 | 68.60 | 17.48 | — | 51.12 |
| | 9/18/2001 | 10-30 | 68.60 | 18.15 | — | 50.45 |
| | 12/20/2001 | 10-30 | 68.60 | 17.78 | — | 50.82 |
| | 3/20/2002 | 10-30 | 68.60 | 16.26 | — | 52.34 |
| | 6/2/2002 | 10-30 | 68.60 | 17.10 | — | 51.50 |
| | 9/24/2002 | 10-30 | 68.60 | 18.05 | — | 50.55 |
| | 11/14/2002 | 10-30 | 68.60 | 17.75 | — | 50.85 |
| | 2/19/2003 | 10-30 | 68.60 | 15.91 | — | 52.69 |
| | 5/6/2003 | 10-30 | 68.60 | 15.47 | — | 53.13 |
| | 7/22/2003 | 10-30 | 68.60 | 16.99 | — | 51.61 |
| | 10/24/2003 | 10-30 | 68.58 | 17.89 | — | 50.69 |
| | 3/10/2004 | 10-30 | 68.58 | 15.57 | — | 53.01 |
| | 4/19/2004 | 10-30 | 68.58 | 16.30 | — | 52.28 |
| 7/30/2004 | 10-30 | 68.58 | 17.58 | — | 51.00 | |
| MW-06 | 3/19/1991 | 15-35 | 72.82 | 19.69 | — | 53.13 |
| | 1/21/1992 | 15-35 | 72.82 | 20.84 | — | 51.98 |
| | 4/1/1993 | 15-35 | 72.82 | 17.25 | — | 55.57 |
| | 9/16/1993 | 15-35 | 72.82 | 20.64 | — | 52.18 |
| | 11/17/1995 | 15-35 | 72.82 | 20.02 | — | 52.80 |
| | 6/28/2000 | 15-35 | 72.82 | 18.50 | — | 54.32 |
| | 3/12/2001 | 15-35 | 72.82 | 17.30 | — | 55.52 |
| | 6/27/2001 | 15-35 | 72.82 | 19.29 | — | 53.53 |
| | 9/18/2001 | 15-35 | 72.82 | 21.50 | — | 51.32 |
| | 12/20/2001 | 15-35 | 72.82 | 18.27 | — | 54.55 |
| | 3/20/2002 | 15-35 | 72.82 | 17.71 | — | 55.11 |
| | 6/2/2002 | 15-35 | 72.82 | 18.67 | — | 54.15 |
| | 9/24/2002 | 15-35 | 72.82 | 19.81 | — | 53.01 |
| | 11/14/2002 | 15-35 | 72.82 | 19.60 | — | 53.22 |
| | 2/19/2003 | 15-35 | 72.82 | 17.22 | — | 55.60 |
| | 5/6/2003 | 15-35 | 72.82 | 16.95 | — | 55.87 |
| | 7/22/2003 | 15-35 | 72.82 | 18.60 | — | 54.22 |
| | 10/24/2003 | 15-35 | 72.80 | 19.65 | — | 53.15 |
| | 3/10/2004 | 15-35 | 72.80 | 16.89 | — | 55.91 |
| | 4/19/2004 | 15-35 | 72.80 | 17.65 | — | 55.15 |
| 7/30/2004 | 15-35 | 72.80 | 19.38 | — | 53.42 | |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|-----------|------------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| MW-07 | 8/25/1993 | 15-35 | 65.09 | 17.54 | -- | 47.55 |
| | 9/9/1993 | 15-35 | 65.09 | 17.05 | -- | 48.04 |
| | 9/16/1993 | 15-35 | 65.09 | 16.56 | -- | 48.53 |
| | 11/17/1995 | 15-35 | 65.09 | 16.46 | -- | 48.63 |
| | 6/29/2000 | 15-35 | 65.09 | 15.68 | -- | 49.41 |
| | 3/12/2001 | 15-35 | 65.09 | 15.29 | -- | 49.80 |
| | 6/27/2001 | 15-35 | 65.09 | 16.11 | -- | 48.98 |
| | 9/18/2001 | 15-35 | 65.09 | 16.45 | -- | 48.64 |
| | 12/20/2001 | 15-35 | 65.09 | 15.58 | -- | 49.51 |
| | 3/20/2002 | 15-35 | 65.09 | 15.46 | -- | 49.63 |
| | 6/2/2002 | 15-35 | 65.09 | 15.88 | -- | 49.21 |
| | 9/24/2002 | 15-35 | 65.09 | 16.31 | -- | 48.78 |
| | 11/14/2002 | 15-35 | 65.09 | 16.15 | -- | 48.94 |
| | 2/19/2003 | 15-35 | 65.09 | 15.26 | -- | 49.83 |
| | 5/6/2003 | 15-35 | 65.09 | 15.08 | -- | 50.01 |
| | 7/22/2003 | 15-35 | 65.09 | 15.75 | -- | 49.34 |
| | 10/24/2003 | 15-35 | 65.18 | 16.25 | -- | 48.93 |
| 3/10/2004 | 15-35 | 65.18 | 15.03 | -- | 50.15 | |
| 4/19/2004 | 15-35 | 65.18 | 15.44 | -- | 49.74 | |
| 7/30/2004 | 15-35 | 65.18 | 16.04 | -- | 49.14 | |
| MW-08A | 10/9/2003 | 10-25 | 66.80 | 16.98 | -- | 49.82 |
| | 3/10/2004 | 10-25 | 66.80 | 15 | -- | 51.80 |
| | 4/19/2004 | 10-25 | 66.80 | 15.69 | -- | 51.11 |
| | 7/30/2004 | 10-25 | 66.80 | 16.75 | -- | 50.05 |
| MW-11A | 10/9/2003 | 10-25 | 70.05 | 18.80 | -- | 51.25 |
| | 3/10/2004 | 10-25 | 70.05 | 15.35 | -- | 54.70 |
| | 4/19/2004 | 10-25 | 70.05 | 16.12 | -- | 53.93 |
| | 7/30/2004 | 10-25 | 70.05 | 17.72 | -- | 52.33 |
| MW-12A | 10/9/2003 | 10-25 | 70.13 | -- | -- | -- |
| | 3/10/2004 | 10-25 | 70.13 | 15.45 | -- | 54.68 |
| | 4/19/2004 | 10-25 | 70.13 | 16.22 | -- | 53.91 |
| | 7/30/2004 | 10-25 | 70.13 | 18.45 | -- | 51.68 |
| MW-13A | 10/9/2003 | 18-33 | 67.67 | 17.06 | -- | 50.61 |
| | 3/10/2004 | 18-33 | 67.67 | 14.62 | -- | 53.05 |
| | 4/19/2004 | 18-33 | 67.67 | 15.50 | -- | 52.17 |
| | 7/30/2004 | 18-33 | 67.67 | 16.80 | -- | 50.87 |
| MW-14A | 3/10/2004 | 29-34 | 64.71 | 14.62 | -- | 50.09 |
| | 4/19/2004 | 29-34 | 64.71 | 15.58 | -- | 49.13 |
| | 7/30/2004 | 29-34 | 64.71 | 16.63 | -- | 48.08 |
| MW-15A | 3/10/2004 | 14.5-24.5 | 63.68 | 14.72 | -- | 48.96 |
| | 4/19/2004 | 14.5-24.5 | 63.68 | 15.67 | -- | 48.01 |
| | 7/30/2004 | 14.5-24.5 | 63.68 | 16.41 | -- | 47.27 |
| MW-16A | 3/10/2004 | 15-25 | 61.15 | 14.11 | -- | 47.04 |
| | 4/19/2004 | 15-25 | 61.15 | 15.52 | -- | 45.63 |
| | 7/30/2004 | 15-25 | 61.15 | 16.35 | -- | 44.80 |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|--------------------------------------|------------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| MW-17A | 3/10/2004 | 20.7-30.7 | 64.61 | 21.90 | — | 42.71 |
| | 4/19/2004 | 20.7-30.7 | 64.61 | 22.91 | — | 41.70 |
| | 7/30/2004 | 20.7-30.7 | 64.61 | 23.41 | — | 41.20 |
| MW-18A | 3/10/2004 | 14.7-24.7 | 69.10 | 17.35 | — | 51.75 |
| | 4/19/2004 | 14.7-24.7 | 69.10 | 18.48 | — | 50.62 |
| | 7/30/2004 | 14.7-24.7 | 69.10 | 19.81 | — | 49.29 |
| MW-19A | 3/10/2004 | 14-24 | 67.32 | 20.30 | — | 47.02 |
| | 4/19/2004 | 14-24 | 67.32 | 21.25 | — | 46.07 |
| | 7/30/2004 | 14-24 | 67.32 | 22.13 | — | 45.19 |
| MW-20A | 3/10/2004 | 10-20 | 66.47 | 11.89 | — | 54.58 |
| | 4/19/2004 | 10-20 | 66.47 | 12.73 | — | 53.74 |
| | 7/30/2004 | 10-20 | 66.47 | 14.19 | — | 52.28 |
| MW-21A | 3/10/2004 | 10-20 | 65.81 | 12.23 | — | 53.58 |
| | 4/19/2004 | 10-20 | 65.81 | 13.00 | — | 52.81 |
| | 7/30/2004 | 10-20 | 65.81 | 14.33 | — | 51.48 |
| MW-22A | 3/10/2004 | 15-25 | 64.11 | 14.51 | — | 49.60 |
| | 4/19/2004 | 15-25 | 64.11 | 14.90 | — | 49.21 |
| | 7/30/2004 | 15-25 | 64.11 | 15.31 | — | 48.80 |
| MW-23A | 7/30/2004 | 17-27 | 63.74 | 18.64 | — | 45.10 |
| MW-24A | 3/15/2004 | 19.5-29.5 | 61.04 | 16.55 | — | 44.49 |
| | 4/19/2004 | 19.5-29.5 | 61.04 | 17.38 | — | 43.66 |
| | 7/30/2004 | 19.5-29.5 | 61.04 | 18.05 | — | 42.99 |
| MW-25A | 7/30/2004 | 18-28 | 65.37 | 23.17 | — | 42.20 |
| <i>Intermediate Monitoring Wells</i> | | | | | | |
| MW-01D | 4/27/1993 | 45-60 | 66.56 | 16.37 | — | 50.19 |
| | 9/16/1993 | 45-60 | 66.56 | 18.43 | — | 48.13 |
| | 11/17/1995 | 45-60 | 66.56 | 18.04 | — | 48.52 |
| | 6/29/2000 | 45-60 | 66.56 | 17.02 | — | 49.54 |
| | 3/12/2001 | 45-60 | 66.56 | 16.00 | — | 50.56 |
| | 6/27/2001 | 45-60 | 66.56 | 17.76 | — | 48.80 |
| | 9/18/2001 | 45-60 | 66.56 | 18.20 | — | 48.36 |
| | 12/20/2001 | 45-60 | 66.56 | 16.85 | — | 49.71 |
| | 3/20/2002 | 45-60 | 66.56 | 16.47 | — | 50.09 |
| | 6/2/2002 | 45-60 | 66.56 | 17.29 | — | 49.27 |
| | 9/24/2002 | 45-60 | 66.56 | 18.13 | — | 48.43 |
| | 11/14/2002 | 45-60 | 66.56 | 17.68 | — | 48.88 |
| | 2/19/2003 | 45-60 | 66.56 | 16.19 | — | 50.37 |
| | 5/6/2003 | 45-60 | 66.56 | 15.71 | — | 50.85 |
| | 7/22/2003 | 45-60 | 66.56 | 17.04 | — | 49.52 |
| MW-08B* | 10/24/2003 | 45-60 | 66.65 | 17.92 | — | 48.73 |
| | 3/10/2004 | 45-60 | 66.65 | 15.58 | — | 51.07 |
| | 4/19/2004 | 45-60 | 66.65 | 16.54 | — | 50.11 |
| | 7/30/2004 | 45-60 | 66.65 | 17.74 | — | 48.91 |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|----------|------------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| MW-02D | 8/25/1993 | 50.5-60.5 | 61.71 | 13.45 | -- | 48.26 |
| | 9/16/1993 | 50.5-60.5 | 61.71 | 15.42 | -- | 46.29 |
| | 11/17/1995 | 50.5-60.5 | 61.71 | 14.78 | -- | 46.93 |
| | 6/28/2000 | 50.5-60.5 | 61.71 | 15.01 | -- | 46.70 |
| | 3/12/2001 | 50.5-60.5 | 61.71 | 12.94 | -- | 48.77 |
| | 6/27/2001 | 50.5-60.5 | 61.71 | 14.43 | -- | 47.28 |
| | 9/18/2001 | 50.5-60.5 | 61.71 | 16.10 | -- | 45.61 |
| | 12/20/2001 | 50.5-60.5 | 61.71 | 15.00 | -- | 46.71 |
| | 3/20/2002 | 50.5-60.5 | 61.71 | 14.02 | -- | 47.69 |
| | 6/2/2002 | 50.5-60.5 | 61.71 | 14.93 | -- | 46.78 |
| | 9/24/2002 | 50.5-60.5 | 61.71 | 15.74 | -- | 45.97 |
| | 11/14/2002 | 50.5-60.5 | 61.71 | 14.93 | -- | 46.78 |
| | 2/19/2003 | 50.5-60.5 | 61.71 | 13.6 | -- | 48.11 |
| | 5/6/2003 | 50.5-60.5 | 61.71 | 13.54 | -- | 48.17 |
| | 7/22/2003 | 50.5-60.5 | 61.71 | 14.93 | -- | 46.78 |
| MW-09B* | 10/24/2003 | 50.5-60.5 | 61.74 | 16.16 | -- | 45.58 |
| | 3/10/2004 | 50.5-60.5 | 61.74 | 13.14 | -- | 48.60 |
| | 4/19/2004 | 50.5-60.5 | 61.74 | 13.97 | -- | 47.77 |
| | 7/30/2004 | 50.5-60.5 | 61.74 | 15.58 | -- | 46.16 |
| MW-03D | 8/25/1993 | 40-50 | 64.10 | 9.47 | -- | 54.63 |
| | 9/16/1993 | 40-50 | 64.10 | 19.49 | -- | 44.61 |
| | 11/17/1995 | 40-50 | 64.10 | 19.18 | -- | 44.92 |
| | 6/28/2000 | 40-50 | 64.10 | 18.17 | -- | 45.93 |
| | 3/12/2001 | 40-50 | 64.10 | 17.09 | -- | 47.01 |
| | 6/27/2001 | 40-50 | 64.10 | 18.72 | -- | 45.38 |
| | 9/18/2001 | 40-50 | 64.10 | 19.20 | -- | 44.90 |
| | 12/20/2001 | 40-50 | 64.10 | 17.87 | -- | 46.23 |
| | 3/20/2002 | 40-50 | 64.10 | 17.68 | -- | 46.42 |
| | 6/2/2002 | 40-50 | 64.10 | 18.34 | -- | 45.76 |
| | 9/24/2002 | 40-50 | 64.10 | 19.08 | -- | 45.02 |
| | 11/14/2002 | 40-50 | 64.10 | 18.65 | -- | 45.45 |
| | 2/19/2003 | 40-50 | 64.10 | 17.51 | -- | 46.59 |
| | 5/6/2003 | 40-50 | 64.10 | 16.95 | -- | 47.15 |
| | 7/22/2003 | 40-50 | 64.10 | 18.08 | -- | 46.02 |
| MW10B* | 10/24/2003 | 40-50 | 64.21 | 18.87 | -- | 45.34 |
| | 3/10/2004 | 40-50 | 64.21 | 16.63 | -- | 47.58 |
| | 4/19/2004 | 40-50 | 64.21 | 17.80 | -- | 46.41 |
| | 7/30/2004 | 40-50 | 64.21 | 18.61 | -- | 45.60 |
| MW-11B | 10/9/2003 | 40-50 | 70.22 | 17.80 | -- | 52.42 |
| | 3/10/2004 | 40-50 | 70.22 | 15.35 | -- | 54.87 |
| | 4/19/2004 | 40-50 | 70.22 | 16.19 | -- | 54.03 |
| | 7/30/2004 | 40-50 | 70.22 | 17.70 | -- | 52.52 |
| MW-12B | 10/9/2003 | 50-60 | 70.15 | 19.87 | -- | 50.28 |
| | 3/10/2004 | 50-60 | 70.15 | 17.33 | -- | 52.82 |
| | 4/19/2004 | 50-60 | 70.15 | 19.09 | -- | 51.06 |
| | 7/30/2004 | 50-60 | 70.15 | 19.70 | -- | 50.45 |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|----------|-----------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| MW-13B | 10/9/2003 | 45-55 | 67.61 | 19.26 | -- | 48.35 |
| | 3/10/2004 | 45-55 | 67.61 | 15.82 | -- | 51.79 |
| | 4/19/2004 | 45-55 | 67.61 | 16.81 | -- | 50.80 |
| | 7/30/2004 | 45-55 | 67.61 | 18.02 | -- | 49.59 |
| MW-14B | 3/10/2004 | 40-50 | 64.69 | 14.58 | -- | 50.11 |
| | 4/19/2004 | 40-50 | 64.69 | 15.58 | -- | 49.11 |
| | 7/30/2004 | 40-50 | 64.69 | 16.68 | -- | 48.01 |
| MW-15B | 3/10/2004 | 49-59 | 64.23 | 15.22 | -- | 49.01 |
| | 4/19/2004 | 49-59 | 64.23 | 16.23 | -- | 48.00 |
| | 7/30/2004 | 49-59 | 64.23 | 17.24 | -- | 46.99 |
| MW-16B | 3/10/2004 | 35-45 | 61.06 | 14.35 | -- | 46.71 |
| | 4/19/2004 | 35-45 | 61.06 | 15.66 | -- | 45.40 |
| | 7/30/2004 | 35-45 | 61.06 | 16.46 | -- | 44.60 |
| MW-17B | 3/10/2004 | 44-54 | 64.53 | 21.82 | -- | 42.71 |
| | 4/19/2004 | 44-54 | 64.53 | 22.82 | -- | 41.71 |
| | 7/30/2004 | 44-54 | 64.53 | 23.31 | -- | 41.22 |
| MW-18B | 3/10/2004 | 32-42 | 69.27 | 17.61 | -- | 51.66 |
| | 4/19/2004 | 32-42 | 69.27 | 18.71 | -- | 50.56 |
| | 7/30/2004 | 32-42 | 69.27 | 20.02 | -- | 49.25 |
| MW-19B | 3/10/2004 | 29-39 | 66.67 | 20.16 | -- | 46.51 |
| | 4/19/2004 | 29-39 | 66.67 | 21.35 | -- | 45.32 |
| | 7/30/2004 | 29-39 | 66.67 | 22.21 | -- | 44.46 |
| MW-20B | 3/10/2004 | 30.5-40.5 | 66.46 | 11.87 | -- | 54.59 |
| | 4/19/2004 | 30.5-40.5 | 66.46 | 12.70 | -- | 53.76 |
| | 7/30/2004 | 30.5-40.5 | 66.46 | 14.12 | -- | 52.34 |
| MW-21B | 3/10/2004 | 29-39 | 65.88 | 12.25 | -- | 53.63 |
| | 4/19/2004 | 29-39 | 65.88 | 13.02 | -- | 52.86 |
| | 7/30/2004 | 29-39 | 65.88 | 14.36 | -- | 51.52 |
| MW-22B | 3/10/2004 | 40-50 | 64.44 | 15.56 | -- | 48.88 |
| | 4/19/2004 | 40-50 | 64.44 | 16.45 | -- | 47.99 |
| | 7/30/2004 | 40-50 | 64.44 | 17.55 | -- | 46.89 |
| MW-23B | 7/30/2004 | 48-58 | 63.94 | 19.10 | -- | 44.84 |
| MW-24B | 3/15/2004 | 39.5-49.5 | 61.09 | 16.82 | -- | 44.27 |
| | 4/19/2004 | 39.5-49.5 | 61.09 | 17.62 | -- | 43.47 |
| | 7/30/2004 | 39.5-49.5 | 61.09 | 18.30 | -- | 42.79 |
| MW-25B | 7/30/2004 | 48-58 | 66.04 | 24.55 | -- | 41.49 |
| MW-26B | 3/10/2004 | 40-50 | 63.13 | 14.95 | -- | 48.18 |
| | 4/19/2004 | 40-50 | 63.13 | 16.58 | -- | 46.55 |
| | 7/30/2004 | 40-50 | 63.13 | 17.57 | -- | 45.56 |

Table 6-2
Ground Water Elevations
Hookston Station Remedial Investigation
Pleasant Hill, California

| Location | Date | Screen Interval (ft bgs) | Top of Casing Elevation (feet) | Depth to Water (feet) | Product Thickness (feet) | Ground Water Elevation (feet) |
|------------------------------|-----------|--------------------------|--------------------------------|-----------------------|--------------------------|-------------------------------|
| <i>Deep Monitoring Wells</i> | | | | | | |
| MW-15C | 3/10/2004 | 90-95 | 64.39 | 15.5 | — | 48.89 |
| | 4/19/2004 | 90-95 | 64.39 | 16.29 | — | 48.10 |
| | 6/14/2004 | 90-95 | 64.39 | 16.95 | — | 47.44 |
| | 7/30/2004 | 90-95 | 64.39 | 17.45 | — | 46.94 |
| MW-19C | 3/10/2004 | 70-80 | 66.86 | 18.29 | — | 48.57 |
| | 4/19/2004 | 70-80 | 66.86 | 19.40 | — | 47.46 |
| | 6/14/2004 | 70-80 | 66.86 | 20.16 | — | 46.70 |
| | 7/30/2004 | 70-80 | 66.86 | 20.57 | — | 46.29 |
| MW-23C | 6/14/2004 | 93-103 | 64.00 | 17.84 | — | 46.16 |
| | 7/30/2004 | 93-103 | 64.00 | 18.44 | — | 45.56 |

Notes

ft bgs = feet below ground surface

NM = not measured

* = MW-01D, MW-02D and MW-03D were renamed MW-08B, MW-09B and MW-10B, respectively, as of October 2003.

The top of casing elevations for wells MW-01, MW-04, MW-05, MW-06, MW-07, MW-08A, MW-08B, MW-09B and MW-10B were resurveyed in October 2003 and new top of casing elevations are now being used.

Table 6-3
 Vertical Ground Water Gradients
 2004 Ground Water Monitoring Events
 Hookston Station Remedial Investigation
 Pleasant Hill, California

| Well Designation | Date | Screened Interval | Screen Midpoint | Screen Midpoint Separation | Depth to Water | TOC Elevation | Ground Water Elevation | Head Difference | Vertical Gradient |
|-------------------------------|-----------|-------------------|-----------------|----------------------------|----------------|---------------|------------------------|-----------------|-------------------|
| A-B Zone Well Clusters | | | | | | | | | |
| MW-08A | 3/10/2004 | 10-25 | 20.0 | | 15.00 | 66.80 | 51.80 | | |
| MW-08B | 3/10/2004 | 45-60 | 52.5 | 32.5 | 15.58 | 66.65 | 51.07 | -0.73 | -0.022 |
| MW-08A | 4/19/2004 | 10-25 | 20.4 | | 15.69 | 66.80 | 51.11 | | |
| MW-08B | 4/19/2004 | 45-60 | 52.5 | 32.2 | 16.54 | 66.65 | 50.11 | -1.00 | -0.031 |
| MW-08A | 7/30/2004 | 10-25 | 20.9 | | 16.75 | 66.80 | 50.05 | | |
| MW-08B | 7/30/2004 | 45-60 | 52.5 | 31.6 | 17.74 | 66.65 | 48.91 | -1.14 | -0.036 |
| Avg Vertical Gradient: | | | | | | | | | -0.030 |
| MW-11A | 3/10/2004 | 10-25 | 20.2 | | 15.35 | 70.05 | 54.70 | | |
| MW-11B | 3/10/2004 | 40-50 | 45 | 24.8 | 15.35 | 70.22 | 54.87 | 0.17 | 0.007 |
| MW-11A | 4/19/2004 | 10-25 | 20.56 | | 16.12 | 70.05 | 53.93 | | |
| MW-11B | 4/19/2004 | 40-50 | 45 | 24.4 | 16.19 | 70.22 | 54.03 | 0.10 | 0.004 |
| MW-11A | 7/30/2004 | 10-25 | 21.4 | | 17.72 | 70.05 | 52.33 | | |
| MW-11B | 7/30/2004 | 40-50 | 45 | 23.6 | 17.70 | 70.22 | 52.52 | 0.19 | 0.008 |
| Avg Vertical Gradient: | | | | | | | | | 0.006 |
| MW-12A | 3/10/2004 | 10-25 | 20.23 | | 15.45 | 70.13 | 54.68 | | |
| MW-12B | 3/10/2004 | 50-60 | 55 | 34.8 | 17.33 | 70.15 | 52.82 | -1.86 | -0.053 |
| MW-12A | 4/19/2004 | 10-25 | 20.61 | | 16.22 | 70.13 | 53.91 | | |
| MW-12B | 4/19/2004 | 50-60 | 55 | 34.4 | 19.09 | 70.15 | 51.06 | -2.85 | -0.083 |
| MW-12A | 7/30/2004 | 10-25 | 21.70 | | 18.45 | 70.13 | 51.68 | | |
| MW-12B | 7/30/2004 | 50-60 | 55 | 33.3 | 19.70 | 70.15 | 50.45 | -1.23 | -0.037 |
| Avg Vertical Gradient: | | | | | | | | | -0.058 |
| MW-13A | 3/10/2004 | 18-33 | 25.5 | | 14.62 | 67.67 | 53.05 | | |
| MW-13B | 3/10/2004 | 45-55 | 50 | 24.5 | 15.82 | 67.61 | 51.79 | -1.26 | -0.051 |
| MW-13A | 4/19/2004 | 18-33 | 25.5 | | 15.50 | 67.67 | 52.17 | | |
| MW-13B | 4/19/2004 | 45-55 | 50 | 24.5 | 16.81 | 67.61 | 50.80 | -1.37 | -0.056 |
| MW-13A | 7/30/2004 | 18-33 | 25.5 | | 16.80 | 67.67 | 50.87 | | |
| MW-13B | 7/30/2004 | 45-55 | 50 | 24.5 | 18.02 | 67.61 | 49.59 | -1.28 | -0.052 |
| Avg Vertical Gradient: | | | | | | | | | -0.053 |
| MW-14A | 3/10/2004 | 29-34 | 31.5 | | 14.62 | 64.71 | 50.09 | | |
| MW-14B | 3/10/2004 | 40-50 | 45 | 13.5 | 14.58 | 64.69 | 50.11 | 0.02 | 0.001 |
| MW-14A | 4/19/2004 | 29-34 | 31.5 | | 15.58 | 64.71 | 49.13 | | |
| MW-14B | 4/19/2004 | 40-50 | 45 | 13.5 | 15.58 | 64.69 | 49.11 | -0.02 | -0.001 |
| MW-14A | 7/30/2004 | 29-34 | 31.5 | | 16.63 | 64.71 | 48.08 | | |
| MW-14B | 7/30/2004 | 40-50 | 45 | 13.5 | 16.68 | 64.69 | 48.01 | -0.07 | -0.005 |
| Avg Vertical Gradient: | | | | | | | | | -0.002 |

Table 6-3
Vertical Ground Water Gradients
2004 Ground Water Monitoring Events
Hookston Station Remedial Investigation
Pleasant Hill, California

| Well Designation | Date | Screened Interval | Screen Midpoint | Screen Midpoint Separation | Depth to Water | TOC Elevation | Ground Water Elevation | Head Difference | Vertical Gradient |
|------------------------|-----------|-------------------|-----------------|----------------------------|----------------|---------------|------------------------|-----------------|-------------------|
| MW-15A | 3/10/2004 | 14.5-24.5 | 19.6 | | 14.72 | 63.68 | 48.96 | | |
| MW-15B | 3/10/2004 | 49-59 | 54 | 34.4 | 15.22 | 64.23 | 49.01 | 0.05 | 0.001 |
| MW-15A | 4/19/2004 | 14.5-24.5 | 20.1 | | 15.67 | 63.68 | 48.01 | | |
| MW-15B | 4/19/2004 | 49-59 | 54 | 33.9 | 16.23 | 64.23 | 48.00 | -0.01 | 0.000 |
| MW-15A | 7/30/2004 | 14.5-24.5 | 20.5 | | 16.41 | 63.68 | 47.27 | | |
| MW-15B | 7/30/2004 | 49-59 | 54 | 33.5 | 17.24 | 64.23 | 46.99 | -0.28 | -0.008 |
| Avg Vertical Gradient: | | | | | | | | | -0.002 |
| MW-16A | 3/10/2004 | 15-25 | 20 | | 14.11 | 61.15 | 47.04 | | |
| MW-16B | 3/10/2004 | 35-45 | 40 | 20.0 | 14.35 | 61.06 | 46.71 | -0.33 | -0.016 |
| MW-16A | 4/19/2004 | 15-25 | 20.3 | | 15.52 | 61.15 | 45.63 | | |
| MW-16B | 4/19/2004 | 35-45 | 40 | 19.7 | 16.23 | 61.06 | 44.83 | -0.80 | -0.041 |
| MW-16A | 7/30/2004 | 15-25 | 20.7 | | 16.35 | 61.15 | 44.80 | | |
| MW-16B | 7/30/2004 | 35-45 | 40 | 19.3 | 16.46 | 61.06 | 44.60 | -0.20 | -0.010 |
| Avg Vertical Gradient: | | | | | | | | | -0.022 |
| MW-17A | 3/10/2004 | 20.7-30.7 | 26.3 | | 21.90 | 64.61 | 42.71 | | |
| MW-17B | 3/10/2004 | 44-54 | 49 | 22.7 | 21.82 | 64.53 | 42.71 | 0.00 | 0.000 |
| MW-17A | 4/19/2004 | 20.7-30.7 | 26.8 | | 22.91 | 64.61 | 41.70 | | |
| MW-17B | 4/19/2004 | 44-54 | 49 | 22.2 | 22.82 | 64.53 | 41.71 | 0.01 | 0.000 |
| MW-17A | 7/30/2004 | 20.7-30.7 | 27.1 | | 23.41 | 64.61 | 41.20 | | |
| MW-17B | 7/30/2004 | 44-54 | 49 | 21.9 | 23.31 | 64.53 | 41.22 | 0.02 | 0.001 |
| Avg Vertical Gradient: | | | | | | | | | 0.000 |
| MW-18A | 3/10/2004 | 14.7-24.7 | 21.0 | | 17.35 | 69.10 | 51.75 | | |
| MW-18B | 3/10/2004 | 32-42 | 37 | 16 | 17.61 | 69.27 | 51.66 | -0.09 | -0.006 |
| MW-18A | 4/19/2004 | 14.7-24.7 | 21.6 | | 18.48 | 69.10 | 50.62 | | |
| MW-18B | 4/19/2004 | 32-42 | 37 | 15.4 | 18.71 | 69.27 | 50.56 | -0.06 | -0.004 |
| MW-18A | 7/30/2004 | 14.7-24.7 | 22.3 | | 19.81 | 69.10 | 49.29 | | |
| MW-18B | 7/30/2004 | 32-42 | 37 | 14.7 | 20.02 | 69.27 | 49.25 | -0.04 | -0.003 |
| Avg Vertical Gradient: | | | | | | | | | -0.004 |
| MW-19A | 3/10/2004 | 14-24 | 22.2 | | 20.30 | 67.32 | 47.02 | | |
| MW-19B | 3/10/2004 | 29-39 | 34 | 11.9 | 20.16 | 66.67 | 46.51 | -0.51 | -0.043 |
| MW-19A | 4/19/2004 | 14-24 | 22.6 | | 21.25 | 67.32 | 46.07 | | |
| MW-19B | 4/19/2004 | 29-39 | 34 | 11.4 | 21.35 | 66.67 | 45.32 | -0.75 | -0.066 |
| MW-19A | 7/30/2004 | 14-24 | 23.1 | | 22.13 | 67.32 | 45.19 | | |
| MW-19B | 7/30/2004 | 29-39 | 34 | 10.9 | 22.21 | 66.67 | 44.46 | -0.73 | -0.067 |
| Avg Vertical Gradient: | | | | | | | | | -0.059 |
| MW-20A | 3/10/2004 | 10-20 | 15.9 | | 11.89 | 66.47 | 54.58 | | |
| MW-20B | 3/10/2004 | 30.5-40.5 | 35.5 | 19.6 | 11.87 | 66.46 | 54.59 | 0.01 | 0.001 |
| MW-20A | 4/19/2004 | 10-20 | 16.4 | | 12.73 | 66.47 | 53.74 | | |
| MW-20B | 4/19/2004 | 30.5-40.5 | 35.5 | 19.1 | 12.70 | 66.46 | 53.76 | 0.02 | 0.001 |
| MW-20A | 7/30/2004 | 10-20 | 17.1 | | 14.19 | 66.47 | 52.28 | | |
| MW-20B | 7/30/2004 | 30.5-40.5 | 35.5 | 18.4 | 14.12 | 66.46 | 52.34 | 0.06 | 0.003 |
| Avg Vertical Gradient: | | | | | | | | | 0.002 |

Table 6-3
Vertical Ground Water Gradients
2004 Ground Water Monitoring Events
Hookston Station Remedial Investigation
Pleasant Hill, California

| Well Designation | Date | Screened Interval | Screen Midpoint | Screen Midpoint Separation | Depth to Water | TOC Elevation | Ground Water Elevation | Head Difference | Vertical Gradient |
|-------------------------------|-----------|-------------------|-----------------|----------------------------|----------------|---------------|------------------------|-----------------|-------------------|
| MW-21A | 3/10/2004 | 10-20 | 16.1 | | 12.23 | 65.81 | 53.58 | | |
| MW-21B | 3/10/2004 | 29-39 | 34 | 17.9 | 12.25 | 65.88 | 53.63 | 0.05 | 0.003 |
| MW-21A | 4/19/2004 | 10-20 | 16.5 | | 13.00 | 65.81 | 52.81 | | |
| MW-21B | 4/19/2004 | 29-39 | 34 | 17.5 | 13.02 | 65.88 | 52.86 | 0.05 | 0.003 |
| MW-21A | 7/30/2004 | 10-20 | 17.2 | | 14.33 | 65.81 | 51.48 | | |
| MW-21B | 7/30/2004 | 29-39 | 34 | 16.8 | 14.36 | 65.88 | 51.52 | 0.04 | 0.002 |
| Avg Vertical Gradient: | | | | | | | | | 0.003 |
| MW-22A | 3/10/2004 | 15-25 | 20.0 | | 14.51 | 64.11 | 49.60 | | |
| MW-22B | 3/10/2004 | 40-50 | 45 | 25.0 | 15.56 | 64.44 | 48.88 | -0.72 | -0.029 |
| MW-22A | 4/19/2004 | 15-25 | 20.0 | | 14.90 | 64.11 | 49.21 | | |
| MW-22B | 4/19/2004 | 40-50 | 45 | 25.0 | 16.45 | 64.44 | 47.99 | -1.22 | -0.049 |
| MW-22A | 7/30/2004 | 15-25 | 20.2 | | 15.31 | 64.11 | 48.80 | | |
| MW-22B | 7/30/2004 | 40-50 | 45 | 24.8 | 17.55 | 64.44 | 46.89 | -1.91 | -0.077 |
| Avg Vertical Gradient: | | | | | | | | | -0.052 |
| MW-24A | 3/10/2004 | 19.5-29.5 | 24.5 | | 16.55 | 61.04 | 44.49 | | |
| MW-24B | 3/10/2004 | 39.5-49.5 | 44.5 | 20.0 | 16.82 | 61.09 | 44.27 | -0.22 | -0.011 |
| MW-24A | 4/19/2004 | 19.5-29.5 | 24.5 | | 17.38 | 61.04 | 43.66 | | |
| MW-24B | 4/19/2004 | 39.5-49.5 | 44.5 | 20.0 | 17.62 | 61.09 | 43.47 | -0.19 | -0.009 |
| MW-24A | 7/30/2004 | 19.5-29.5 | 24.5 | | 18.05 | 61.04 | 42.99 | | |
| MW-24B | 7/30/2004 | 39.5-49.5 | 44.5 | 20.0 | 18.30 | 61.09 | 42.79 | -0.20 | -0.010 |
| Avg Vertical Gradient: | | | | | | | | | -0.010 |
| B-C Zone Well Clusters | | | | | | | | | |
| MW-15B | 3/10/2004 | 49-59 | 54 | | 15.22 | 64.23 | 49.01 | | |
| MW-15C | 3/10/2004 | 90-95 | 92.5 | 38.5 | 15.50 | 64.39 | 48.89 | -0.12 | -0.003 |
| MW-15B | 4/19/2004 | 49-59 | 54 | | 16.23 | 64.23 | 48.00 | | |
| MW-15C | 4/19/2004 | 90-95 | 92.5 | 38.5 | 16.29 | 64.39 | 48.10 | 0.10 | 0.003 |
| MW-15B | 7/30/2004 | 49-59 | 54 | | 17.24 | 64.23 | 46.99 | | |
| MW-15C | 7/30/2004 | 90-95 | 92.5 | 38.5 | 17.45 | 64.39 | 46.94 | -0.05 | -0.001 |
| Avg Vertical Gradient: | | | | | | | | | -0.001 |
| MW-19B | 3/10/2004 | 29-39 | 34.0 | | 20.16 | 66.67 | 46.51 | | |
| MW-19C | 3/10/2004 | 70-80 | 75 | 41.0 | 18.29 | 66.86 | 48.57 | 2.06 | 0.050 |
| MW-19B | 4/19/2004 | 29-39 | 34.0 | | 21.35 | 66.67 | 45.32 | | |
| MW-19C | 4/19/2004 | 70-80 | 75 | 41.0 | 19.40 | 66.86 | 47.46 | 2.14 | 0.052 |
| MW-19B | 7/30/2004 | 29-39 | 34.0 | | 22.21 | 66.67 | 44.46 | | |
| MW-19C | 7/30/2004 | 70-80 | 75 | 41.0 | 20.57 | 66.86 | 46.29 | 1.83 | 0.045 |
| Avg Vertical Gradient: | | | | | | | | | 0.049 |

Notes:

All measurements in feet.

Elevations relative to mean sea level.

Negative gradients indicate downward flow potential, positive gradients indicate upward flow potential.

Screen Midpoint = middle of the screen for wells with water levels above the top of the screen or is the midpoint between the water level and bottom of the screen for wells with water levels below the top of the well screen.

Table 7-6
 Polychlorinated Biphenyls in Soil Samples
 Hookston Station Remedial Investigation
 Pleasant Hill, California

| Sample Location | Date | Sample Depth | Analytical Laboratory | Analytical Method | PCB-1016 (mg/kg) | PCB-1221 (mg/kg) | PCB-1232 (mg/kg) | PCB-1242 (mg/kg) | PCB-1254 (mg/kg) | PCB-1260 (mg/kg) |
|-----------------|-----------|--------------|---|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | | RWQCB Commercial/Industrial (≤9.8 ft) ESL | | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 | 0.74 |
| B-69 | 9/17/2003 | 0.5 Ft. | STLSEA | | < 0.0985 | < 0.197 | < 0.0985 | < 0.0985 | < 0.0985 | < 0.0985 |
| B-70 | 9/17/2003 | 0.5 Ft. | STLSEA | | < 0.0973 | < 0.195 | < 0.0973 | 0.288 | < 0.0973 | 0.0857 |
| B-73 | 9/29/2003 | 0.5 Ft. | STLSEA | | < 0.0941 | < 0.188 | < 0.0941 | < 0.0941 | < 0.0941 | < 0.0941 |
| B-94 | 9/29/2003 | 0.5 Ft. | STLSEA | | < 0.1 | < 0.201 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| MW-13A | 9/30/2003 | 0.5 Ft. | STLSEA | | < 0.0962 | < 0.192 | < 0.0962 | < 0.0962 | < 0.0962 | < 0.0962 |

Notes:

- j = Estimated Value
- u = Compound was analyzed for but not detected. Analyte result was below the Reporting Type Limit.
- < = Not Detected
- NA = Not Applicable

(mg/kg) = Results are reported in milligrams per kilogram (mg/kg).

Laboratories:

STLSEA = Severn Trent Laboratory, Seattle

Table 6-1
 Volatile Organic Compounds Detected in Ground Water
 -Hickman Station Remedial Investigation
 Pleasant Hill, California

| Sample Location | Date | Sample Depth (ft) | Location | Analytical Laboratory | CA MCL (ug/L) | PCB (ug/L) | TCE (ug/L) | CA DCE (ug/L) | 1,1-DCE (ug/L) | 1,1-DCE (ug/L) | VINYL CHLORIDE (ug/L) | ACETONE (ug/L) | BENZENE (ug/L) | BROMOMETHANE (ug/L) | 3-METHYLBUTANE (ug/L) | 2-METHYLBUTANE (ug/L) | CARBON DIOXIDE (ug/L) | CYCLOHEXANE (ug/L) |
|-----------------|------------|-------------------|----------|-----------------------|---------------|------------|------------|---------------|----------------|----------------|-----------------------|----------------|----------------|---------------------|-----------------------|-----------------------|-----------------------|--------------------|
| MW-01 | 4/25/1990 | 10-30 | on-site | MFA | 5 | 5 | 10 | 6 | 6 | 6 | 0.5 | 700 | 1 | 100 | 4200 | NS | NS | <0.5 |
| MW-01 | 4/25/1990 | 10-30 | on-site | MFA | NS | NS | NS | NS | NS | NS | <0.5 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 5/17/1990 | 10-30 | on-site | MFA | NS | NS | NS | NS | NS | NS | <0.5 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 3/13/1991 | 10-30 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 1/21/1992 | 10-30 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 4/2/1993 | 10-30 | on-site | CTL | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 4/2/1993 | 10-30 | on-site | CTL | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 11/17/1995 | 10-30 | on-site | MCA | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 6/29/2000 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 6/29/2000 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 3/12/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 3/12/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 6/27/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 9/20/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 9/20/2001 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 12/19/2001 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 3/20/2002 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 6/21/2002 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 9/14/2002 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 11/14/2002 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 2/19/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 5/6/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 7/22/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 10/24/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 3/10/2004 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-01 | 4/20/2004 | 10-30 | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-02 | 4/25/1990 | 11-31 | on-site | MFA | NS | NS | NS | NS | NS | NS | <0.5 | NS | NS | NS | NS | NS | NS | NS |
| MW-02 | 5/17/1990 | 11-31 | on-site | MFA | NS | NS | NS | NS | NS | NS | <0.5 | NS | NS | NS | NS | NS | NS | NS |
| MW-02 | 1/21/1992 | 11-31 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-02 | 4/1/1993 | 11-31 | on-site | CTL | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-02 | 4/1/1993 | 11-31 | on-site | CTL | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-02 | 11/17/1995 | 11-31 | on-site | MCA | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 4/25/1990 | 10-30 | on-site | MFA | NS | NS | NS | NS | NS | NS | <5 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 5/17/1990 | 10-30 | on-site | MFA | NS | NS | NS | NS | NS | NS | <5 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 3/14/1991 | 10-30 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 1/21/1992 | 10-30 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 4/2/1993 | 10-30 | on-site | CTL | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 4/2/1993 | 10-30 | on-site | CTL | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 11/17/1995 | 10-30 | on-site | MCA | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 6/29/2000 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 6/29/2000 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 3/12/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 3/12/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 9/20/2001 | 10-30 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 9/20/2001 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 12/19/2001 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 3/20/2002 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 6/21/2002 | 17ft | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 9/14/2002 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 11/14/2002 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 2/19/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 5/6/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 7/22/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 10/24/2003 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-03 | 3/10/2004 | 17ft | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 4/20/2004 | 10-30 | on-site | STL Sec | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 4/25/1990 | 11-31 | on-site | MFA | NS | NS | NS | NS | NS | NS | <0.5 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 5/17/1990 | 11-31 | on-site | MFA | NS | NS | NS | NS | NS | NS | <0.5 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 1/21/1992 | 11-31 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 1/21/1992 | 11-31 | on-site | CHR | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 11/17/1995 | 11-31 | on-site | MCA | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 6/29/2000 | 11-31 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 6/29/2000 | 11-31 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 3/12/2001 | 11-31 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |
| MW-04 | 3/12/2001 | 11-31 | on-site | CTBERK | NS | NS | NS | NS | NS | NS | <1 | NS | NS | NS | NS | NS | NS | NS |

