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Alameda County  
 Environmental Health  
 APR 07 2005

TRANSMITTAL MEMORANDUM	
TO: ALAMEDA COUNTY HEALTH CARE SERVICES AGENCY DEPT. OF ENVIRONMENTAL HEALTH HAZARDOUS MATERIALS DIVISION 1131 HARBOR BAY PKWY, SUITE 250 ALAMEDA, CA 94502	DATE: APRIL 5, 2005
ATTENTION: MS. DONNA DROGOS	FILE: SES-2005-02
SUBJECT: REDWOOD REGIONAL PARK FUEL LEAK SITE	
WE ARE SENDING: <input checked="" type="checkbox"/> HEREWITH	<input type="checkbox"/> UNDER SEPARATE COVER
<input checked="" type="checkbox"/> VIA MAIL	<input type="checkbox"/> VIA
THE FOLLOWING: FIRST QUARTER 2005 GROUNDWATER MONITORING REPORT FOR REDWOOD REGIONAL PARK SERVICE YARD SITE – OAKLAND, CALIFORNIA (DATED MARCH 31, 2005)	
<input type="checkbox"/> AS REQUESTED	<input type="checkbox"/> FOR YOUR APPROVAL
<input type="checkbox"/> FOR REVIEW	<input checked="" type="checkbox"/> FOR YOUR USE
<input type="checkbox"/> FOR SIGNATURE	<input checked="" type="checkbox"/> FOR YOUR FILES
COPIES TO: N. FUJITA (EBRPD) C. WILCOX (CA FISH & GAME) R. BREWER (REGIONAL BOARD)	By: <u>Bruce Rucker</u>

March 31, 2005

Ms. Donna Drogos – Supervisor  
Local Oversight Program  
Alameda County Department of Environmental Health  
1131 Harbor Bay Parkway, Suite 250  
Alameda, California 94502

Alameda County  
APR 07 2005  
Environmental Health

Subject: First Quarter 2005 Site Monitoring Report  
Redwood Regional Park Service Yard Site – Oakland, California

Dear Ms. Drogos:

Attached is the referenced Stellar Environmental Solutions, Inc. (SES) report for the underground fuel storage tank (UFST) site at the Redwood Regional Park Service Yard, located at 7867 Redwood Road, Oakland, California. This project is being conducted for the East Bay Regional Park District (EBRPD) and follows previous site investigation and remediation activities (conducted since 1993) associated with former leaking UFSTs. The key regulatory agencies for this investigation are the Alameda County Department of Environmental Health, the Regional Water Quality Control Board, and the California Department of Fish and Game.

This report summarizes groundwater and surface monitoring and sampling activities conducted between January 1 and March 31, 2005 (First Quarter 2005). The EBRPD has previously proposed to the regulatory agencies to implement bioventing as a site corrective action, and is awaiting a response to that proposal. When implemented, those activities will be reported in technical submittals separate from the ongoing groundwater and surface water monitoring quarterly reports; salient summary discussions will be included in the quarterly groundwater monitoring reports.

If you have any questions regarding this report, please contact Mr. Neal Fujita of the EBRPD, or contact us directly at (510) 644-3123.

Sincerely,



Bruce M. Rucker, R.G., R.E.A.  
Project Manager



Richard S. Makdisi, R.G., R.E.A.  
Principal

cc: Carl Wilcox, California Department of Fish and Game  
John Wolfenden, California Regional Water Quality Control Board  
Neal Fujita, East Bay Regional Park District

**FIRST QUARTER 2005  
SITE MONITORING REPORT**

**REDWOOD REGIONAL PARK  
SERVICE YARD  
OAKLAND, CALIFORNIA**

*Prepared for:*

**EAST BAY REGIONAL PARK DISTRICT  
P.O. BOX 5381  
OAKLAND, CALIFORNIA 94605**

*Prepared by:*

**STELLAR ENVIRONMENTAL SOLUTIONS, INC.  
2198 SIXTH STREET  
BERKELEY, CALIFORNIA 94710**

**March 31, 2005**

Project No. 2005-02

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## **1.0 INTRODUCTION**

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### **PROJECT BACKGROUND**

The subject property is the East Bay Regional Park District (EBRPD) Redwood Regional Park Service Yard located at 7867 Redwood Road in Oakland, Alameda County, California. The site has undergone site investigations and remediation since 1993 to address subsurface contamination caused by leakage from one or both of two former underground fuel storage tanks (UFSTs) that contained gasoline and diesel fuel. The Alameda County Department of Environmental Health (Alameda County Health) has provided regulatory oversight of the investigation since its inception. Other regulatory agencies with historical involvement in site review include the Regional Water Quality Control Board (Water Board) and the California Department of Fish and Game (CDFG).

### **OBJECTIVES AND SCOPE OF WORK**

This report discusses the following activities conducted/coordinated by Stellar Environmental Solutions, Inc. (SES) between January 1 and March 31, 2005:

- Collecting water levels in site wells to determine shallow groundwater flow direction;
- Sampling site wells for contaminant analysis and natural attenuation indicators;
- Collecting surface water samples for contaminant analysis; and
- Discharging accumulated purge water.

No bioventing-related activities were conducted in the current quarter.

### **HISTORICAL CORRECTIVE ACTIONS AND INVESTIGATIONS**

Previous SES reports have provided a full discussion of previous site remediation and investigations; site geology and hydrogeology; residual site contamination; conceptual model for contaminant fate and transport; and evaluation of hydrochemical trends and plume stability. Section 7.0 (References and Bibliography) of this report provides a listing of all technical reports for the site. The following is a summary of the general phases of site work:

- An October 2000 Feasibility Study report for the site, submitted to Alameda County Health, provided detailed analyses of the regulatory implications of the site contamination and an assessment of viable corrective actions (SES, 2000d).
- Two instream bioassessment events were conducted in April 1999 and January 2000 to evaluate potential impacts to stream biota associated with the site contamination (no impacts were documented).
- Additional monitoring well installations and corrective action by ORC™ injection proposed by SES were approved by the Alameda County Health, in its January 8, 2001 letter to the EBRPD. Two phases of ORC™ injection were conducted—in September 2001 and July 2002.
- A total of 33 groundwater monitoring events have been conducted on a quarterly basis since project inception (November 1994), and a total of 11 groundwater monitoring wells are currently available for monitoring.
- A bioventing pilot test was conducted in September and October 2004 to evaluate the feasibility of this corrective action strategy, and a full-scale bioventing system design was submitted to Alameda County Health. Alameda County Health has not responded to the submittal and the work has not begun. Bioventing activities conducted to date have been discussed in bioventing-specific technical reports, and updates will be provided in groundwater monitoring progress reports as they relate to this ongoing program.

Including the current event, a total of 33 quarterly groundwater monitoring events have been conducted on a quarterly basis since inception (November 1994), and a total of 11 groundwater monitoring wells are currently available for monitoring. Seven site wells are included in the current groundwater monitoring program (the remaining four wells are outside the contaminant plume and are currently utilized only for water level monitoring).

## **RELATED SITE ACTIVITIES**

The EBRPD has proposed to implement bioventing as a corrective action to mitigate residual site contamination, the primary source of ongoing groundwater contamination. In May 2004, Alameda County Health approved conducting a bioventing pilot test to evaluate the feasibility of this strategy. In June 2004, four bioventing pilot test wells (one vent well and three vapor monitoring points) were installed; soil sampling during well installations was conducted; and water levels were measured at the installed wells (SES, 2004f). The pilot tests results report recommended, and EBRPD has proposed, to implement full-scale bioventing as a site corrective action; the pilot tests results report included a design for the full-scale system. The regulatory agencies have not yet responded to that submittal, and no bioventing activities were conducted in the current quarter.



## **SITE DESCRIPTION**

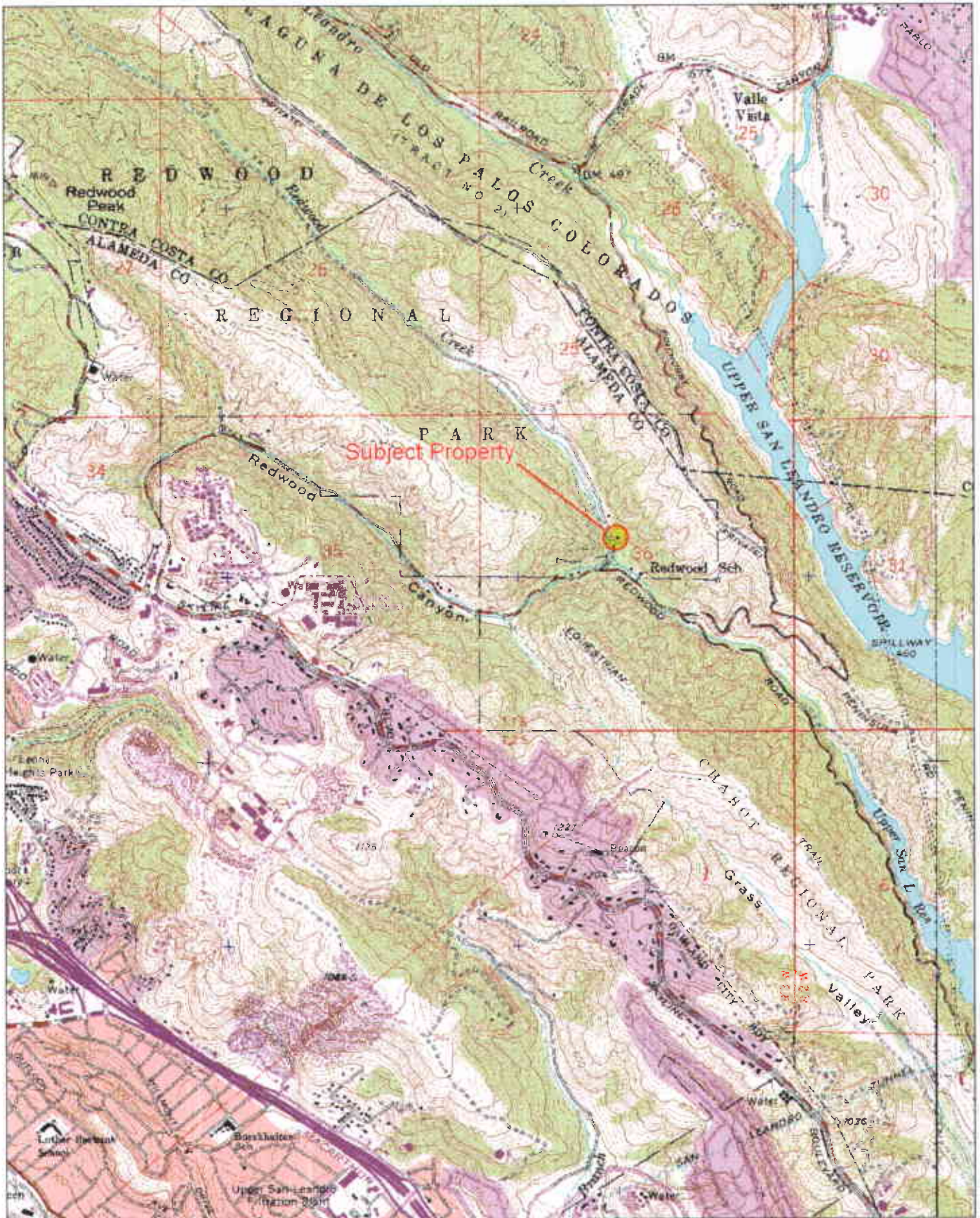
Figure 1 shows the location of the project site. The site slopes to the west, from an elevation of approximately 564 feet above mean sea level (amsl) at the eastern edge of the service yard to approximately 545 feet amsl at Redwood Creek, which defines the approximate western edge of the project site with regard to this investigation. Figure 2 shows the site plan.

## **REGULATORY OVERSIGHT**

The lead regulatory agency for the site investigation and remediation is Alameda County Health, with oversight provided by the Water Board. The CDFG is also involved with regard to water quality impacts to Redwood Creek. All workplans and reports are submitted to these agencies.

Historical Alameda County Health-approved revisions to the groundwater sampling program have included: 1) discontinuing hydrochemical sampling and analysis in wells MW-1, MW-3, MW-5, and MW-6; 2) discontinuing creek surface water sampling at upstream location SW-1; and 3) reducing the frequency of creek surface water sampling from quarterly to semi-annually (Alameda County Health, 1996). EBRPD has pro-actively elected not to implement the latter-approved revision due to continued concern over potential impacts to Redwood Creek.

Since 2001, Electronic Data Format (EDF) groundwater analytical results, well construction and water level data, and site maps have been successfully uploaded to the State Water Resources Control Board's GeoTracker database, in accordance with that agency's requirements for EDF submittals.



5-D TopoQuads Copyright © 1999 Delorme Yamashita, ME 04066 Source Data: USGS 750 B Scale: 1 : 25,000 Detail: 13-0 Datum: WGS84



### SITE LOCATION ON U.S.G.S. TOPOGRAPHIC MAP

Redwood Reg. Park Service Yard  
Oakland, CA

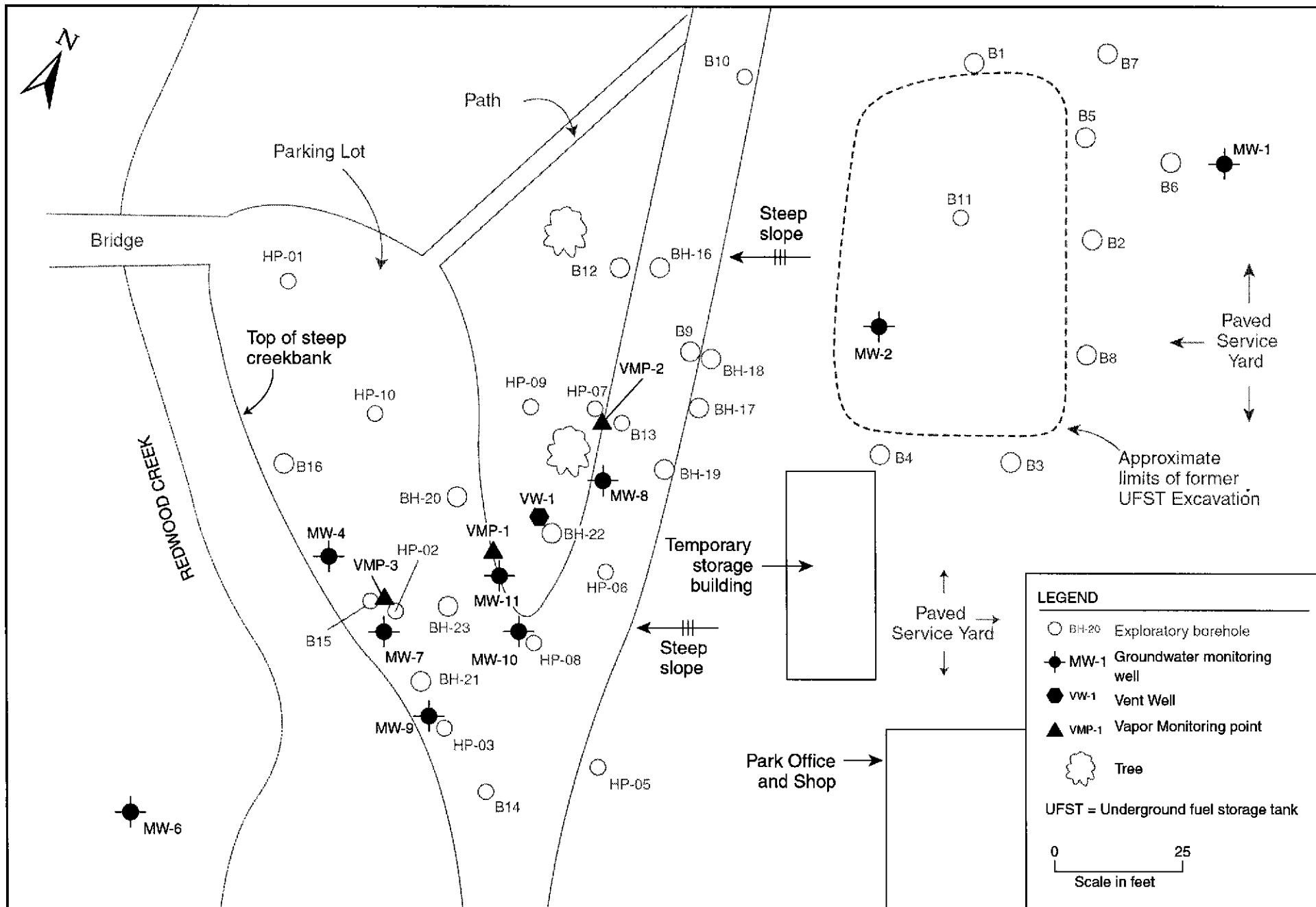
By: MJC

APRIL 2004

Figure 1

★ Stellar Environmental Solutions, Inc.  
Geoscience & Engineering Consulting

2004-02-01



**SITE PLAN AND WELL LOCATIONS**  
**Redwood Regional Park Service Yard, Oakland, CA**

**Figure 2**

by: MJC

APRIL 2005

## 2.0 PHYSICAL SETTING

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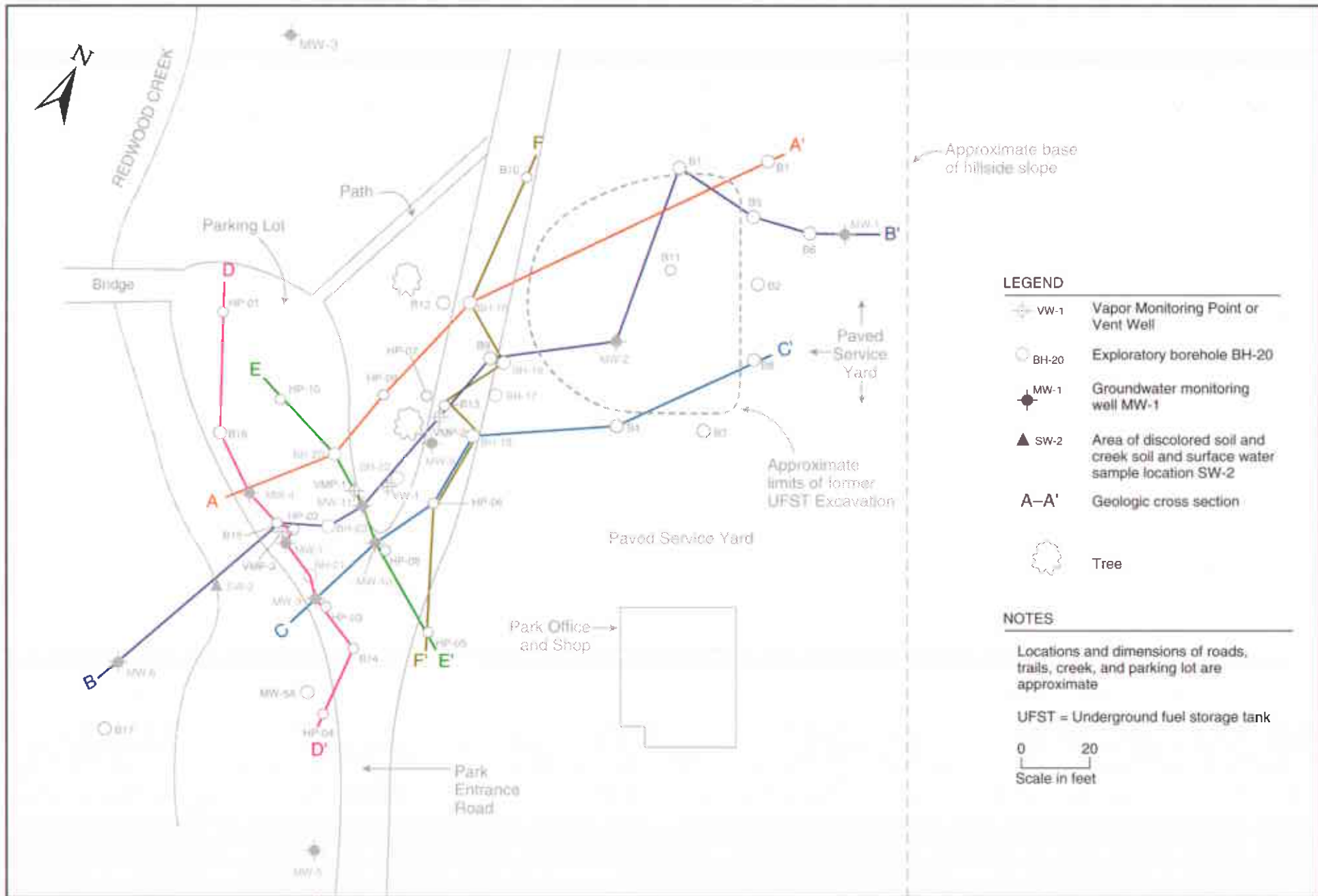
This section discusses the site hydrogeologic conditions based on geologic logging and water level measurements collected at the site since September 1993. Previous SES reports have included detailed discussions of site lithologic and hydrogeologic conditions. In May 2004, Alameda County Health requested, via email, additional evaluation of site lithology—specifically, the preparation of multiple geologic cross-sections parallel to and perpendicular to the contaminant plume's long axis.

### SITE LITHOLOGY

Figure 3 shows the location of geologic cross-sections. Figure 4 shows three sub-parallel geologic cross-sections (A-A' through C-C') along the long axis of the groundwater contaminant plume (i.e., along local groundwater flow direction). Figure 5 shows three sub-parallel geologic cross-sections (D-D' through F-F') roughly perpendicular to groundwater direction. In each figure, the three sub-parallel sections are presented together for ease of comparison. Due to the small scale, these sections show only lithologic conditions (i.e., soil type and bedrock depth). Additional information on water level depths, historical range of water levels, and inferred thickness of soil contamination) were presented in a previous report (SES, 2004c) for cross-section B-B'.

Shallow soil stratigraphy consists of a surficial 3- to 10-foot-thick clayey silt unit underlain by a 5- to 15-foot-thick silty clay unit. In the majority of boreholes, a 5- to 10-foot-thick clayey coarse-grained sand and clayey gravel unit that laterally grades to a clay or silty clay was encountered. This unit overlies a weathered siltstone at the base of the observed soil profile. Soils in the vicinity of MW-1 are inferred to be landslide debris.

A previous SES report (SES, 2004c) presented a bedrock surface isopleth map (elevation contours for the top of the bedrock surface) in the contaminant plume area. That isopleth map and Figures 4 and 5 indicate the following. The bedrock surface slopes steeply, approximately 0.3 feet/foot from east to west (toward Redwood Creek) in the upgradient portion of the site (from the service yard to under the entrance road), then shows a gentle east-to-west slope in the downgradient portion of the site (under the gravel parking area) toward Redwood Creek. This general gradient corresponds to the local groundwater flow direction. On the southern side of the plume area, bedrock slopes gently



- LEGEND**
- VW-1 Vapor Monitoring Point or Vent Well
  - BH-20 Exploratory borehole BH-20
  - MW-1 Groundwater monitoring well MW-1
  - SW-2 Area of discolored soil and creek soil and surface water sample location SW-2
  - A-A'** Geologic cross section
  - Tree

- NOTES**
- Locations and dimensions of roads, trails, creek, and parking lot are approximate
  - UFST = Underground fuel storage tank
- 0 20  
Scale in feet

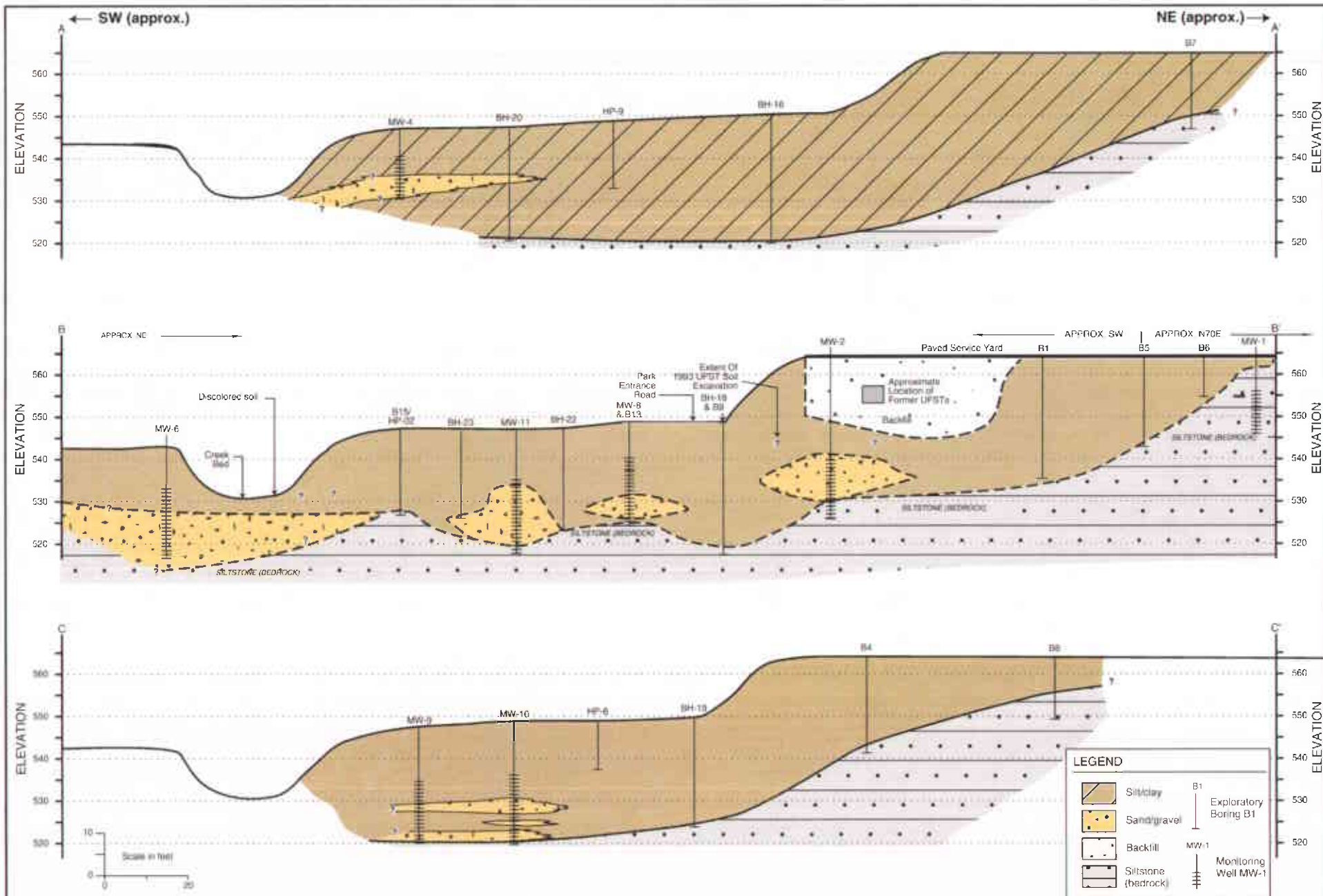
2004-02-14

**★ Stellar Environmental Solutions, Inc.**  
Geoscience & Engineering Consulting

**GEOLOGIC CROSS-SECTION LOCATIONS**  
**Redwood Regional Park Service Yard, Oakland, CA**

**Figure 3**

by: MJC	JULY 2004
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from south to north (the opposite of the general topographic gradient). Bedrock topography on the northern side of the plume cannot be determined from the available data.

In the central and downgradient portions of the groundwater contaminant plume (under the entrance road and the parking area), the bedrock surface has local, fairly steep elevation highs and lows, expressing a hummocky surface. Bedrock elevations vary by up to 10 feet over distances of less than 20 feet in this area. Local bedrock elevation highs are observed at upgradient location BH-13 (see Cross Section F-F') and at downgradient location B15/HP-02 (see Cross-Section B-B'). Intervening elevation lows create troughs which trend north-south in the central portion of the plume, and east-west in the downgradient portion of the plume.

The bedrock surface (and overlying unconsolidated sediment lithology) suggest that the bedrock surface may have at one time undergone channel erosion from a paleostream(s) flowing sub-parallel to present-day Redwood Creek. Because groundwater flows in the unconsolidated sediments that directly overlie the bedrock surface, it is likely that the hummocky bedrock surface affects local groundwater depth and flow direction. This is an important hydrogeologic control that should be considered if groundwater-specific corrective action is contemplated.

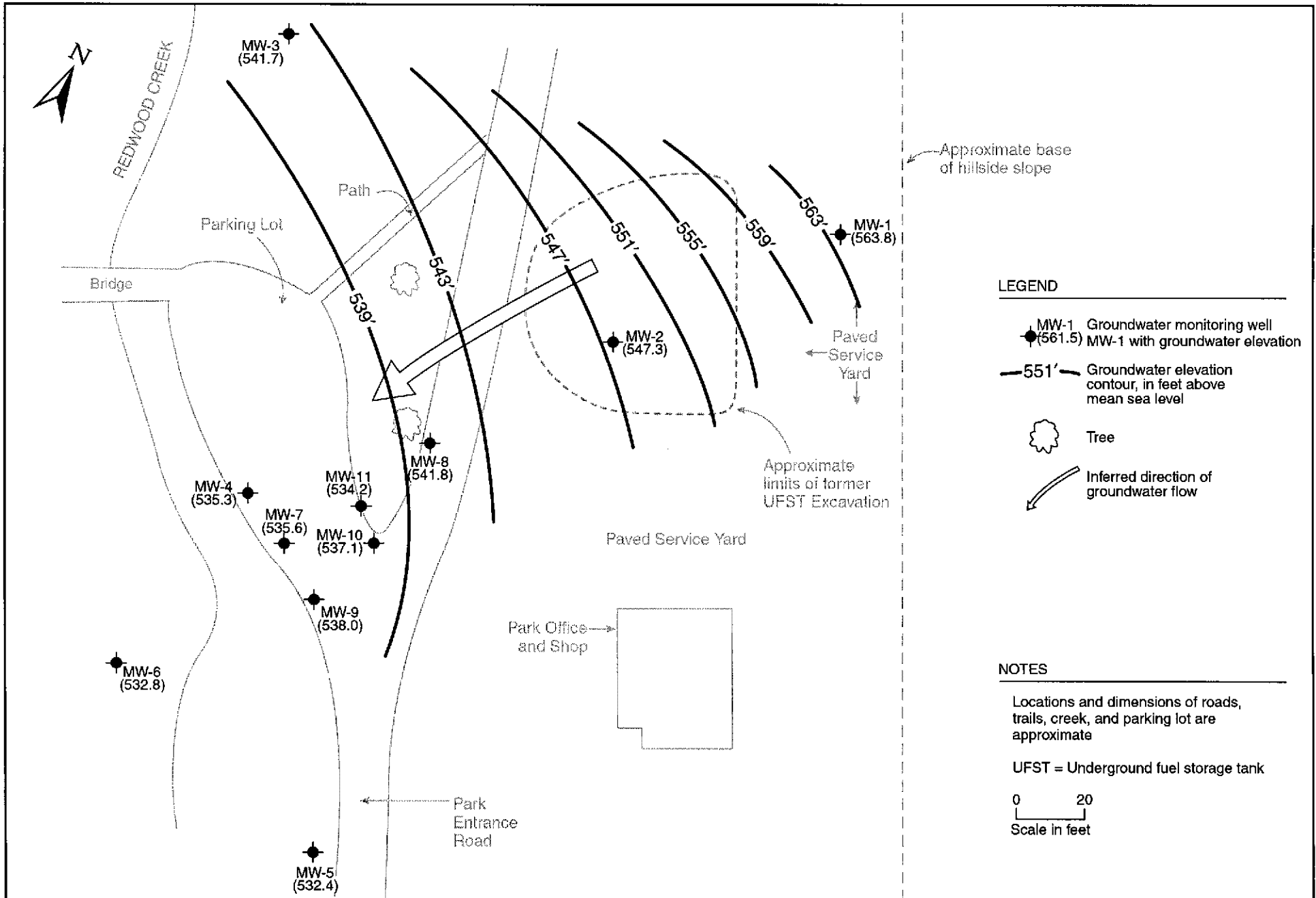
## **HYDROGEOLOGY**

Groundwater at the site occurs under unconfined and semi-confined conditions, generally within the clayey, silty, sand-gravel zone. The top of this zone varies between approximately 12 and 19 feet below ground surface (bgs), and the bottom of the water-bearing zone (approximately 25 to 28 feet bgs) corresponds to the top of the siltstone bedrock unit. Seasonal fluctuations in groundwater depth create a capillary fringe of several feet that is saturated in the rainy period (late fall through early spring) and unsaturated during the remainder of the year. The thickness of the saturated zone plus the capillary fringe varies between approximately 10 and 15 feet in the area of contamination. Local perched water zones have been observed well above the top of the capillary fringe.

Figure 6 is a groundwater elevation map constructed from the current event monitoring well static water levels. Table 1 (in Section 3.0) summarizes current event groundwater elevation data. Appendix A contains historical groundwater elevation data. Consistent with the bedrock isopleth map showing an elevation depression in the vicinity of MW-11, historical groundwater elevations in MW-11 are generally lower than in the surrounding area. As discussed in the previous sub-section, local groundwater flow direction is likely more variable than expressed by groundwater monitoring well data, due to localized bedrock surface topography.

In the upgradient portion of the site (between well MW-1 and the former UFST source area, in landslide debris), the groundwater gradient is approximately 0.2 feet per foot. Downgradient from





2005-02-02

(west of) the UFST source area (between MW-2 and Redwood Creek), the groundwater gradient is approximately 0.1 feet per foot. The direction of shallow groundwater flow during the current event was to the west-southwest (toward Redwood Creek), which is consistent with historical site groundwater flow direction.

We assume a site groundwater velocity at 7 to 10 feet per year using general look-up tables for permeability characteristics for the site-specific lithologic data obtained from site investigations. This velocity estimate is likely conservatively low, but does meet minimum-distance-traveled criteria from the date when contamination was first observed in Redwood Creek (1993) relative to when the USTs were installed in the late 1970s. However, locally, the groundwater velocity could vary significantly. To calculate the specific hydraulic conductivity critical to an accurate site-specific groundwater velocity estimate would require direct testing of the water-bearing zone through a slug or pumping test.

Redwood Creek, which borders the site to the west, is a seasonal creek known for the occurrence of rainbow trout. Creek flow in the vicinity of the site shows significant seasonal variation, with little to no flow during the summer and fall dry season, and vigorous flow with depths exceeding 1 foot during the winter and spring wet season. The creek is a gaining stream (i.e., it is recharged by groundwater seeps and springs) in the vicinity of the site, and discharges into Upper San Leandro Reservoir located approximately 1 mile southeast of the site. During low-flow conditions, the groundwater table is below the creek bed in most locations (including the area of historical contaminated groundwater discharge); consequently, there is little to no observable creek flow at these times.

### **3.0 Q1-2005 GROUNDWATER AND SURFACE WATER MONITORING EVENT ACTIVITIES**

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This section presents the creek surface water and groundwater sampling and analytical methods for the most recent groundwater monitoring event (Q1 2005), conducted in March 2005. Groundwater and surface water analytical results are summarized in Section 5.0. Monitoring and sampling protocols were in accordance with the Alameda County Health-approved SES technical workplan (SES, 1998a). Current event activities included:

- Measuring static water levels and field analyzing pre-purge groundwater samples for indicators of natural attenuation (dissolved oxygen, ferrous iron, and redox potential) in all 11 site wells.
- Collecting post-purge groundwater samples for laboratory analysis of site contaminants from wells located within (or potentially within) the groundwater plume (MW-2, MW-4, MW-7, MW-8, MW-9, MW-10, and MW-11).
- Collecting Redwood Creek surface water samples for laboratory analysis from locations SW-2 and SW-3.
- Discharging accumulated purge water.

Creek sampling and groundwater monitoring/sampling was conducted on March 16, 2005. Creek sampling was conducted by the SES project manager. The locations of all site monitoring wells and creek water sampling locations are shown on Figure 2 (in Section 1.0). Well construction information and water level data are summarized in Table 1. Appendix B contains the groundwater monitoring field records for the current event.

Because it appears that the previously-injected ORC™ has been depleted, continued monitoring of the natural attenuation parameters—dissolved oxygen (DO), oxidation-reduction potential (ORP), nitrate, ferrous iron, and sulfate—is of marginal value until such time as additional corrective actions that would increase oxygen concentrations (e.g., bioventing) are implemented. Therefore, monitoring for natural attenuation parameters was discontinued beginning with the December 2004 event.

**Table 1**  
**Groundwater Monitoring Well Construction and**  
**Groundwater Elevation Data – March 16, 2005 Monitoring Event**  
**Redwood Regional Park Corporation Yard, Oakland, California**

Well	Well Depth	Screened Interval	TOC Elevation	Groundwater Depth <sup>(a)</sup>	Groundwater Elevation <sup>(b)</sup>
MW-1	18	7 to 17	565.9	2.08	563.8
MW-2	36	20 to 35	566.5	19.21	547.3
MW-3	42	7 to 41	560.9	19.16	541.7
MW-4	26	10 to 25	548.1	12.76	535.3
MW-5	26	10 to 25	547.5	15.15	532.4
MW-6	26	10 to 25	545.6	12.80	532.8
MW-7	24	9 to 24	547.7	12.09	535.6
MW-8	23	8 to 23	549.2	7.41	541.8
MW-9	27	12 to 27	549.4	11.45	538.0
MW-10	28	13 to 28	547.3	10.22	537.1
MW-11	26	11 to 26	547.9	13.69	534.2

**Notes:**

<sup>(a)</sup> Depths are in feet relative to top of well casing.

<sup>(b)</sup> All elevations are relative to top of well casing, and are expressed as feet above USGS mean sea level. Elevations of wells MW-1 through MW-6 were surveyed by EBRPD relative to USGS Benchmark No. JHF-49. Wells MW-7 through MW-11 were surveyed by a licensed land surveyor using existing site wells as datum.

TOC = Top of casing.

Wells MW-1 through MW-6 are 4-inch-diameter; all other wells are 2-inch-diameter.

**DISCHARGE OF ACCUMULATED PURGE WATER**

Purge water from previous groundwater monitoring events had been stored onsite in an approximately 1,000-gallon plastic tank. To evaluate disposal options, a “grab” composite water sample was collected from the tank on January 27, 2005, when the tank had approximately 900 gallons of water. The sample was analyzed for site constituents of concern—total petroleum hydrocarbons as gasoline (TPHg); total extractable hydrocarbons as diesel (TEHd); benzene, toluene, ethylbenzene, and xylenes (BTEX); and methyl *tertiary*-butyl ether (MTBE). The analytical laboratory report and chain-of-custody record for that sample are included in Appendix C. No contaminants were detected in the water sample. It is likely that site contaminants in the water volatilized to non-detectable concentrations during residence in the tank. On February 8, 2005, because no contamination was detected, the water was discharged to ground surface (the paved service yard adjacent to the tank). Future purge water will continue to be accumulated in the onsite tank, and sampled to evaluate disposal options.

## **GROUNDWATER LEVEL MONITORING AND SAMPLING**

Groundwater monitoring well water level measurements, purging, sampling, and field analyses were conducted by Blaine Tech Services under the supervision of SES personnel. Groundwater sampling was conducted in accordance with State of California guidelines for sampling dissolved analytes in groundwater associated with leaking UFSTs (State of California Water Resources Control Board, 1989), and followed the methods and protocols approved by Alameda County Health in the SES 1998 workplan (SES, 1998a).

As the first task of the monitoring event, static water levels were measured using an electric water level indicator. Pre-purge groundwater samples were then collected for field and laboratory analysis of natural attenuation indicators. The wells to be sampled for contaminant analyses were then purged (by bailing and/or pumping) of three wetted casing volumes. Aquifer stability parameters (temperature, pH, and electrical conductivity) were measured after each purged casing volume to ensure that representative formation water would be sampled. To minimize the potential for cross-contamination, wells were purged and sampled in order of increasing contamination (based on the analytical results of the previous quarter).

The sampling-derived purge water and decontamination rinseate (approximately 70 gallons) from the current event was containerized in the onsite plastic tank. Purge water from future events will continue to be accumulated in the onsite tank until it is full, at which time the water will be transported offsite for proper disposal.

## **CREEK SURFACE WATER SAMPLING**

Surface water sampling was conducted by SES on March 16, 2005. Surface water samples were collected from Redwood Creek location SW-2 (immediately downgradient of the former UFST source area and within the area of documented creek bank soil contamination), and SW-3 (approximately 500 feet downstream of the SW-2 location). In accordance with a previous SES recommendation approved by the Alameda County Health Care Services Agency, upstream sample location SW-1 is no longer part of the surface water sampling program.

At the time of sampling, the creek was flowing briskly between the two sampling locations; water depth was approximately 1 foot. At this location, where contaminated groundwater discharge to the creek has historically been observed, an orange algae was observed growing on the saturated portion of the creek bank. This algae likely is utilizing the petroleum as a carbon source, and therefore is a good indicator of the presence of petroleum contamination. However, neither petroleum sheen nor odor were evident on the water surface.

## **4.0 REGULATORY CONSIDERATIONS**

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The following is a summary of regulatory considerations regarding surface water and groundwater contamination. There are no Alameda County Health or Water Board cleanup orders for the site, although all site work has been conducted under oversight of these agencies.

### **GROUNDWATER CONTAMINATION**

As specified in the Water Board's San Francisco Bay Region Water Quality Control Plan (Regional Water Quality Control Board, 1986) all groundwaters are considered potential sources of drinking water unless otherwise approved by the Water Board, and are also assumed to ultimately discharge to a surface water body and potentially impact aquatic organisms. While it is likely that site groundwater would satisfy geology-related criteria for exclusion as a drinking water source (excessive total dissolved solids and/or insufficient sustained yield), Water Board approval for this exclusion has not been obtained for the site. As summarized in Table 4 (in Section 5.0), site groundwater contaminant levels are compared to two sets of criteria: 1) Water Board Tier 1 Environmental Screening Levels (ESLs) for sites where groundwater is a current or potential drinking water source; and 2) ESLs for sites where groundwater is not a current or potential drinking water source.

As stipulated in the ESL document (Water Board, 2004), the ESLs are not cleanup criteria; rather, they are conservative screening-level criteria designed to be protective of both drinking water resources and aquatic environments in general. The groundwater ESLs are composed of multiple components, including ceiling value, human toxicity, indoor air impacts, and aquatic life protection. Exceedance of ESLs suggests that additional investigation and/or remediation is warranted. While drinking water standards [e.g., Maximum Contaminant Levels (MCLs)] are published for the site contaminants of concern, Alameda County Health has indicated that impacts to nearby Redwood Creek are of primary importance, and that site target cleanup standards should be evaluated primarily in the context of surface water quality criteria.

### **SURFACE WATER CONTAMINATION**

As summarized in Table 4 (in Section 5.0), site surface water contaminant levels are compared to the most stringent screening level criteria published by the State of California, U.S. EPA, and U.S. Department of Energy. These screening criteria address chronic and acute exposures to aquatic life.

As discussed in the ESL document (Water Board, 2004), benthic communities at the groundwater/surface water interface (e.g., at site groundwater discharge location SW-2) are assumed to be exposed to the full concentration of groundwater contamination prior to dilution/mixing with the surface water). This was also a fundamental assumption in the instream benthic macroinvertebrate bioassessment events, which documented no measurable impacts.

Historical surface water sampling in the immediate vicinity of contaminated groundwater discharge (SW-2) has sporadically documented petroleum contamination, usually in periods of low stream flow, and generally at concentrations several orders of magnitude less than adjacent (within 20 feet) groundwater monitoring well concentrations. It is likely that mixing/dilution between groundwater and surface water precludes obtaining an "instantaneous discharge" surface water sample that is wholly representative of groundwater contamination at the discharge location. Therefore, the most conservative assumption is that surface water contamination at the groundwater/surface water interface is equivalent to the upgradient groundwater contamination (e.g., site downgradient wells MW-4, MW-7, and MW-9).

While site target cleanup standards for groundwater have not been determined, it is likely that no further action will be required by regulatory agencies when groundwater (and surface water) contaminant concentrations are all below their respective screening level criteria. Residual contaminant concentrations in excess of screening level criteria might be acceptable to regulatory agencies if a more detailed risk assessment (e.g., Tier 2 and/or Tier 3) demonstrates that no significant impacts are likely.

## **5.0 MONITORING EVENT ANALYTICAL RESULTS**

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This section presents the field and laboratory analytical results of the most recent monitoring event. Table 2 summarizes the contaminant analytical results of the current monitoring event. Figure 7 shows the current event contaminant analytical results and the inferred limits of the gasoline groundwater plume. Appendix C contains the certified analytical laboratory report and chain-of-custody record for the current event. Appendix D contains a summary of historical groundwater and surface analytical results.

### **CURRENT EVENT GROUNDWATER AND SURFACE WATER RESULTS**

Current quarter site groundwater maximum contaminant concentrations for all analytes exceed their respective groundwater ESLs (drinking water resource is threatened), and for all contaminants except toluene and MTBE (drinking water resource is not threatened). Maximum site groundwater contaminant concentrations also exceed all surface water screening levels, with the exception of toluene and MTBE.

Maximum groundwater contaminant concentrations, except MTBE, were detected in well MW-8 (located approximately half the distance between the former source area and the creek). Maximum MTBE concentrations were detected in upgradient well MW-2. Elevated contaminant concentrations were also detected in mid-plume well MW-11 and downgradient wells MW-7 and MW-9. The northern and southern edges of the plume in the downgradient area of the plume appear to be well defined by wells MW-4 and MW-10. The current event contaminant plume geometry is consistent with recent historical contaminant distribution, showing the center of contaminant mass in groundwater to be located downgradient of the former source area. The increase in the soluble fraction of the hydrocarbons is a result of desorption from the residual hydrocarbons in the soil that is released when recharge and high groundwater occurs, as previously presented in the site conceptual model.

Neither surface water samples collected (SW-3 and SW-3) had detectable concentrations for any of the site contaminants analyzed.



**Table 2**  
**Groundwater and Surface Water Sample**  
**Analytical Results – March 16, 2005**  
**Redwood Regional Park Corporation Yard, Oakland, California**

Compound	Concentrations in $\mu\text{g/L}$						
	TVHg	TEHd	Benzene	Toluene	Ethyl-benzene	Total Xylenes	MTBE
<b>GROUNDWATER SAMPLES</b>							
MW-2	190	68	27	<0.5	14	11	26
MW-4	<50	<50	<0.5	<0.5	<0.5	<1.0	<2.0
MW-7	10,000	4,300	150	<0.5	370	71	<2.0
MW-8	24,000	7,100	840	51	1,800	2,410	<10
MW-9	4,200	1,600	97	<2.5	310	42	<10
MW-10	95	98	8.3	<0.5	7.7	0.77	13
MW-11	4,600	1,900	69	<2.5	300	206	<10
<b>Groundwater ESLs<sup>(a)</sup></b>	100 / 500	100 / 640	1.0 / 46	40 / 130	30 / 290	13 / 13	5 / 1,800
<b>REDWOOD CREEK SURFACE WATER SAMPLES</b>							
SW-2	<50	<50	<0.5	<0.5	<0.5	<1.0	<2.0
SW-3	<50	<50	<0.5	<0.5	<0.5	<1.0	<2.0
<b>Surface Water Screening Levels<sup>(a, b)</sup></b>	500	100	46	130	290	13	8,000

Notes:

<sup>(a)</sup> Water Board Environmental Screening Levels (drinking water resource threatened/not threatened) (Water Board, 2004).

<sup>(b)</sup> Lowest of chronic and acute surface water criteria published by the State of California, U.S. Environmental Protection Agency, or U.S. Department of Energy.

MTBE = Methyl *tertiary*-butyl ether.

TVHg = Total volatile hydrocarbons - gasoline range.

TEHd = Total extractable hydrocarbons - diesel range.

$\mu\text{g/L}$  = Micrograms per liter, equivalent to parts per billion (ppb).

Samples in **bold-face type** exceed the ESL and/or surface water screening levels.

### QUALITY CONTROL SAMPLE ANALYTICAL RESULTS

Laboratory QC samples (e.g., method blanks, matrix spikes, surrogate spikes, etc.) were analyzed by the laboratory in accordance with requirements of each analytical method. All laboratory QC sample results and sample holding times were within the acceptance limits of the methods (see Appendix C).



## **6.0 SUMMARY, CONCLUSIONS AND PROPOSED ACTIONS**

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The following conclusions and proposed actions are based on the findings of the current event activities, as well as on salient historical findings.

### **SUMMARY AND CONCLUSIONS**

- Groundwater sampling has been conducted on an approximately quarterly basis since November 1994 (33 events in the initial site wells). A total of 11 site wells are available for monitoring; 7 of the available wells are currently monitored for contamination.
- Site contaminants of concern include gasoline, diesel, BTEX, and MTBE. Current groundwater concentrations exceed regulatory screening levels for groundwater and surface water.
- The primary environmental risk is discharge of contaminated groundwater to the adjacent Redwood Creek. A stream bioassessment concluded that there were no direct impacts to the surface water benthic community; however, groundwater contamination is sporadically detected in surface water samples, and there is historical visual evidence of plume discharge at the creek/groundwater interface. Surface water samples have sporadically exceeded surface water ESL criteria for gasoline, diesel, and benzene, and generally only in low creek flow conditions. An in-stream bioassessment evaluation in 1999-2000 determined no impacts to the benthic macroinvertebrate community.
- The existing well layout adequately constrains the lateral extent of groundwater contamination, and the vertical limit is very likely the top of the near-surface (25 to 28 feet) siltstone bedrock. The saturated interval extends approximately 12 to 15 feet from top of bedrock through the capillary fringe. Groundwater elevations fluctuate seasonally, creating a capillary fringe that varies seasonally in thickness.
- The groundwater contaminant plume has become disconnected from its original source, but continues to be fed from the residual hydrocarbon concentrations in the soil. The groundwater plume has migrated well beyond the former source area (represented by well MW-2) toward Redwood Creek. The plume of groundwater contamination above screening levels appears to be approximately 120 feet long and approximately 50 feet wide. The zone of greatest contamination (greater than 10,000  $\mu\text{g/L}$  TPH) is an approximately 20- to 30-foot-wide by 50-foot-long area extending from mid-plume well MW-8 to the most downgradient wells MW-7 and MW-9.

- The contaminant plume is neither stable nor reducing, as groundwater contaminant concentrations fluctuate seasonally, and the center of mass of the contaminant plume (represented by maximum concentrations) has alternated between mid-plume and downgradient wells in recent history. While recent groundwater contaminant concentrations are at or near site-wide historical maxima, there is no indication that maximum site groundwater concentrations are increasing, suggesting that “worst-case” contaminant concentrations may have been reached.
- A two-phase ORC™ injection corrective action program was implemented at the site. In September 2001, approximately 3,000 pounds of ORC™ was injected into 44 boreholes over a 4,400-square foot area of the maximum groundwater contamination. In June 2002, approximately 1,000 pounds of ORC™ was injected in 30 boreholes over a smaller area that showed residual high contaminant concentrations following the initial injection phase. The ORC™ was injected over the full saturated interval (including the capillary fringe). The findings indicate that the corrective action was partially effective in reducing the lateral extent of the groundwater contaminant plume; however, initial contaminant reductions were followed by rebounding to pre-injection concentrations. The data suggest that site conditions support aerobic biodegradation when not limited by oxygen concentrations, notably on the plume margins and upgradient former source area, but not along the centerline of the contaminant plume.
- A September 2003 exploratory borehole program confirmed that sorbed-phase contamination in the seasonally-unsaturated zone is a primary source of long-term contaminant contribution to the groundwater plume. Reduction/removal of this contamination will be necessary to eliminate continued discharge of contaminated groundwater to Redwood Creek and ultimately obtain site closure.
- Soil bioventing is a proven technology for contaminant mass removal in the unsaturated zone, under conditions similar to the site, and appears to be the most appropriate corrective action strategy giving consideration to technical, cost, safety, and aesthetic issues. A 2- to 3-year program of bioventing will likely reduce unsaturated zone contamination such that it will no longer be a long-term source of contamination to groundwater. A full-scale bioventing system design was presented to Alameda County Health in October 2004. Alameda County Health has not yet responded to that submittal.

## PROPOSED ACTIONS

The EBRPD proposes to implement the following actions to address regulatory concerns:

- Continue the quarterly program of creek and groundwater sampling and reporting.
- Continue to inform regulators of site progress and seek their concurrence with proposed actions.

- Install the proposed bioventing system as a corrective action to move the site toward closure.
- Continue to evaluate analytical results (and bioventing contaminant removal data) in the context of hydrochemical trends, impacts of groundwater contamination on Redwood Creek, and effectiveness of the corrective action.

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## 8.0 LIMITATIONS

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This report has been prepared for the exclusive use of the East Bay Regional Park District, its authorized representatives, and the regulatory agencies. No reliance on this report shall be made by anyone other than those for whom it was prepared.

The findings and conclusions presented in this report are based on the review of previous investigators' findings at the site, as well as onsite activities conducted by SES since September 1998. This report provides neither a certification nor guarantee that the property is free of hazardous substance contamination. This report has been prepared in accordance with generally accepted methodologies and standards of practice. The SES personnel who performed this limited remedial investigation are qualified to perform such investigations and have accurately reported the information available, but cannot attest to the validity of that information. No warranty, expressed or implied, is made as to the findings, conclusions, and recommendations included in the report.

The findings of this report are valid as of the present. Site conditions may change with the passage of time, natural processes, or human intervention, which can invalidate the findings and conclusions presented in this report. As such, this report should be considered a reflection of the current site conditions as based on the investigation and remediation completed.

**HISTORICAL GROUNDWATER ELEVATIONS IN MONITORING WELLS  
REDWOOD REGIONAL PARK SERVICE YARD  
7867 REDWOOD ROAD, OAKLAND, CALIFORNIA**

Well I.D.	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11
<b>TOC Elevation</b>	565.90	566.50	560.90	548.10	547.50	545.60	547.70	549.20	549.40	547.30	547.90
<b>Date Monitored</b>	<b>Groundwater Elevations (feet above mean sea level)</b>										
September 18, 1998	563.7	544.2	540.8	534.5	531.1	545.6					
April 6, 1999	565.2	546.9	542.3	535.6	532.3	532.9					
December 20, 1999	562.9	544.7	541.5	534.9	531.2	532.2					
September 28, 2000	562.8	542.7	538.3	532.2	530.9	532.0					
January 11, 2001	562.9	545.1	541.7	535.0	531.2	532.3	534.9	538.1			
April 13, 2001	562.1	545.7	541.7	535.1	531.5	532.4	535.3	539.8			
September 1, 2001	560.9	542.0	537.7	533.9	530.7	531.8	534.0	535.6			
December 17, 2001	562.2	545.2	542.2	534.8	531.4	532.4	534.8	538.4	534.6	535.7	535.2
March 14, 2002	563.0	547.1	542.2	535.5	532.4	533.3	535.7	541.8	535.0	537.6	536.6
June 18, 2002	562.1	544.7	541.1	534.6	531.2	532.2	534.8	537.9	534.7	535.6	535.3
September 24, 2002	561.4	542.2	537.3	533.5	530.6	531.8	533.5	535.5	535.3	533.8	531.7
December 18, 2002	562.4	545.0	542.0	534.8	531.5	532.5	534.6	537.1	536.5	535.2	532.8
March 27, 2003	562.6	545.7	541.7	534.8	531.6	532.4	535.1	539.9	537.2	536.2	533.6
June 19, 2003	562.3	544.9	541.5	534.8	531.3	532.3	534.9	538.2	536.9	535.7	533.2
September 10, 2003	561.6	542.1	537.9	533.8	530.8	531.9	533.7	535.6	535.6	534.1	531.9
December 10, 2003	562.4	542.7	537.6	533.7	530.9	531.9	533.7	535.2	535.5	533.8	531.7
March 18, 2004	563.1	546.6	541.9	535.0	531.7	532.4	535.2	540.9	537.4	536.6	533.8
June 17, 2004	562.1	544.3	540.7	534.3	531.0	532.1	534.6	537.4	536.5	535.1	532.7
September 21, 2004	561.5	541.1	536.5	533.1	530.5	531.6	533.1	534.7	532.7	533.2	533.2
December 14, 2004	562.2	545.3	541.7	534.7	531.4	532.2	534.6	540.4	536.7	535.5	532.9
March 16, 2005	563.8	547.3	541.7	535.3	532.4	532.8	535.6	541.8	538.0	537.1	534.2

TOC = Top of well Casing



## WELL GAUGING DATA

Project # 050316-0W-1 Date 3-16-05 Client Stellar

Site Redwood Regional Park Oakland

Well ID	Well Size (in.)	Sheen / Odor	Depth to Immiscible Liquid (ft.)	Thickness of Immiscible Liquid (ft.)	Volume of Immiscibles Removed (ml)	Depth to water (ft.)	Depth to well bottom (ft.)	Survey Point: TOB or <u>TOB</u>	
MW-1	4					2.08	19.05		60
MW-2	4					19.21	39.00		-
MW-3	4					19.16	45.05		60
MW-4	4					12.76	26.40		-
MW-5	4					15.15	27.07		60
MW-6	4					12.80	27.50		60
MW-7	2					12.09	25.35		-
MW-8	2					7.41	22.25		-
MW-9	2					11.45	27.55		-
MW-10	2					10.22	28.35		-
MW-11	2					13.69	30.28	↓	-





**WELL MONITORING DATA SHEET**

Project #: <u>050316-DW-1</u>	Client: <u>Stellar</u>
Sampler: <u>DW</u>	Date: <u>3-16-05</u>
Well I.D.: <u>MW-7</u>	Well Diameter: <u>3</u> 3 4 6 8
Total Well Depth (TD): <u>25.35</u>	Depth to Water (DTW): <u>12.09</u>
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: <u>PVC</u> Grade	D.O. Meter (if req'd): YSI HACH
DTW with 80% Recharge [(Height of Water Column x 0.20) + DTW]:	

Purge Method: Bailer Disposable Bailer <input checked="" type="checkbox"/> Positive Air Displacement Electric Submersible	Waterra Peristaltic Extraction Pump Other _____	Sampling Method: Bailer <input checked="" type="checkbox"/> Disposable Bailer Extraction Port Dedicated Tubing Other: _____
--	--	---

$\frac{2.1 \text{ (Gals.)} \times 3}{\text{Specified Volumes}} = \frac{6.3}{\text{Calculated Volume}} \text{ Gals.}$	<table border="1" style="width:100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th>Well Diameter</th> <th>Multiplier</th> <th>Well Diameter</th> <th>Multiplier</th> </tr> </thead> <tbody> <tr> <td>1"</td> <td>0.04</td> <td>4"</td> <td>0.65</td> </tr> <tr> <td>2"</td> <td>0.16</td> <td>6"</td> <td>1.47</td> </tr> <tr> <td>3"</td> <td>0.37</td> <td>Other</td> <td>radius<sup>2</sup> * 0.163</td> </tr> </tbody> </table>	Well Diameter	Multiplier	Well Diameter	Multiplier	1"	0.04	4"	0.65	2"	0.16	6"	1.47	3"	0.37	Other	radius <sup>2</sup> * 0.163
Well Diameter	Multiplier	Well Diameter	Multiplier														
1"	0.04	4"	0.65														
2"	0.16	6"	1.47														
3"	0.37	Other	radius <sup>2</sup> * 0.163														

Time	Temp (°F or °C)	pH	Cond. (mS or $\mu$ S)	Turbidity (NTUs)	Gals. Removed	Observations
<u>12:15</u>	<u>59.6</u>	<u>6.8</u>	<u>786</u>	<u>91</u>	<u>2.1</u>	
<u>12:18</u>	<u>58.5</u>	<u>6.8</u>	<u>789</u>	<u>108</u>	<u>4.2</u>	
<u>12:21</u>	<u>57.3</u>	<u>6.7</u>	<u>787</u>	<u>35</u>	<u>6.3</u>	

Did well dewater? Yes  No  Gallons actually evacuated: 6.3

Sampling Date: 3-16-05 Sampling Time: 12:26 Depth to Water:

Sample I.D.: MW-7 Laboratory: Kiff CalScience Other CYT

Analyzed for: TPH-G BTEX MTBE TPH-D Oxygenates (5) Other:

EB I.D. (if applicable): @ Time Duplicate I.D. (if applicable):

Analyzed for: TPH-G BTEX MTBE TPH-D Oxygenates (5) Other:

D.O. (if req'd):	Pre-purge:	mg/L	Post-purge:	mg/L
O.R.P. (if req'd):	Pre-purge:	mV	Post-purge:	mV





**WELL MONITORING DATA SHEET**

Project #: <u>050316-DW-1</u>	Client: <u>Stellar</u>
Sampler: <u>DW</u>	Date: <u>3-16-05</u>
Well I.D.: <u>MW-9</u>	Well Diameter: <u>3</u> 3 4 6 8
Total Well Depth (TD): <u>27.55</u>	Depth to Water (DTW): <u>11.45</u>
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: PVC Grade	D.O. Meter (if req'd): YSI HACH
DTW with 80% Recharge [(Height of Water Column x 0.20) + DTW]:	

Purge Method: Bailer Disposable Bailer <input checked="" type="checkbox"/> Positive Air Displacement Electric Submersible	Waterra Peristaltic Extraction Pump Other _____	Sampling Method: Bailer <input checked="" type="checkbox"/> Disposable Bailer Extraction Port Dedicated Tubing Other: _____
--	--	---

<u>2.6</u>	(Gals.) X	<u>3</u>	=	<u>7.8</u>	Gals.
1 Case Volume		Specified Volumes		Calculated Volume	

Well Diameter	Multiplier	Well Diameter	Multiplier
1"	0.04	4"	0.65
2"	0.16	6"	1.47
3"	0.37	Other	radius <sup>2</sup> * 0.163

Time	Temp (°F or °C)	pH	Cond. (mS or $\mu$ S)	Turbidity (NTUs)	Gals: Removed	Observations
11:17	58.0	6.8	645	69	2.6	
11:20	56.9	6.7	648	24	5.2	
11:23	56.7	6.6	658	17	7.8	

Did well dewater? Yes  No  Gallons actually evacuated: 7.8

Sampling Date: 3-16-05 Sampling Time: 11:28 Depth to Water:

Sample I.D.: MW-9 Laboratory: Kiff CalScience Other CAT

Analyzed for: TPH-G BTEX MTBE TPH-D Oxygenates (5) Other:

EB I.D. (if applicable): @ Time Duplicate I.D. (if applicable):

Analyzed for: TPH-G BTEX MTBE TPH-D Oxygenates (5) Other:

D.O. (if req'd):	Pre-purge:	mg/L	Post-purge:	mg/L
O.R.P. (if req'd):	Pre-purge:	mV	Post-purge:	mV







Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878

2323 Fifth Street, Berkeley, CA 94710, Phone (510) 486-0900

A N A L Y T I C A L   R E P O R T

Prepared for:

Stellar Environmental Solutions  
2198 6th Street  
Suite 201  
Berkeley, CA 94710

Date: 24-MAR-05  
Lab Job Number: 178282  
Project ID: STANDARD  
Location: Redwood Regional Park

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures. The results contained in this report meet all requirements of NELAC and pertain only to those samples which were submitted for analysis.

Reviewed by:

  
Project Manager

Reviewed by:

  
Operations Manager

This package may be reproduced only in its entirety.



CASE NARRATIVE

Laboratory number: 178282  
Client: Stellar Environmental Solutions  
Location: Redwood Regional Park  
Request Date: 03/16/05  
Samples Received: 03/16/05

This hardcopy data package contains sample and QC results for ten water samples, requested for the above referenced project on 03/16/05. The samples were received cold and intact.

TPH-Purgeables and/or BTXE by GC (EPA 8015B and EPA 8021B):

No analytical problems were encountered.

TPH-Extractables by GC (EPA 8015B):

No analytical problems were encountered.



### Total Volatile Hydrocarbons

Lab #: 178282	Location: Redwood Regional Park
Client: Stellar Environmental Solutions	Prep: EPA 5030B
Project#: STANDARD	
Matrix: Water	Sampled: 03/16/05
Units: ug/L	Received: 03/16/05
Batch#: 100130	

Field ID: MW-2	Diln Fac: 1.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-001	

Analyte	Result	RL	Analysis
Gasoline C7-C12	190	50	EPA 8015B
MTBE	26	2.0	EPA 8021B
Benzene	27	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	14	0.50	EPA 8021B
m,p-Xylenes	8.7	0.50	EPA 8021B
o-Xylene	2.3	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	84	63-141	EPA 8015B
Bromofluorobenzene (FID)	97	79-139	EPA 8015B
Trifluorotoluene (PID)	78	63-133	EPA 8021B
Bromofluorobenzene (PID)	92	79-128	EPA 8021B

Field ID: MW-4	Diln Fac: 1.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-002	

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	94	63-141	EPA 8015B
Bromofluorobenzene (FID)	96	79-139	EPA 8015B
Trifluorotoluene (PID)	81	63-133	EPA 8021B
Bromofluorobenzene (PID)	89	79-128	EPA 8021B



### Total Volatile Hydrocarbons

Lab #: 178282	Location: Redwood Regional Park
Client: Stellar Environmental Solutions	Prep: EPA 5030B
Project#: STANDARD	
Matrix: Water	Sampled: 03/16/05
Units: ug/L	Received: 03/16/05
Batch#: 100130	

Field ID: MW-7  
Type: SAMPLE

Lab ID: 178282-003

Analyte	Result	RL	Diln Fac	Analyzed	Analysis
Gasoline C7-C12	10,000	100	2.000	03/17/05	EPA 8015B
MTBE	ND	2.0	1.000	03/16/05	EPA 8021B
Benzene	150	0.50	1.000	03/16/05	EPA 8021B
Toluene	ND	0.50	1.000	03/16/05	EPA 8021B
Ethylbenzene	370	0.50	1.000	03/16/05	EPA 8021B
m,p-Xylenes	65	0.50	1.000	03/16/05	EPA 8021B
o-Xylene	6.2	0.50	1.000	03/16/05	EPA 8021B

Surrogate	%REC	Limits	Diln Fac	Analyzed	Analysis
Trifluorotoluene (FID)	94	63-141	2.000	03/17/05	EPA 8015B
Bromofluorobenzene (FID)	118	79-139	2.000	03/17/05	EPA 8015B
Trifluorotoluene (PID)	78	63-133	1.000	03/16/05	EPA 8021B
Bromofluorobenzene (PID)	105	79-128	1.000	03/16/05	EPA 8021B

Field ID: MW-8  
Type: SAMPLE

Lab ID: 178282-004

Analyte	Result	RL	Diln Fac	Analyzed	Analysis
Gasoline C7-C12	24,000	250	5.000	03/16/05	EPA 8015B
MTBE	ND	10	5.000	03/16/05	EPA 8021B
Benzene	840	2.5	5.000	03/16/05	EPA 8021B
Toluene	51	2.5	5.000	03/16/05	EPA 8021B
Ethylbenzene	1,800	2.5	5.000	03/16/05	EPA 8021B
m,p-Xylenes	2,200	5.0	10.00	03/17/05	EPA 8021B
o-Xylene	210	2.5	5.000	03/16/05	EPA 8021B

Surrogate	%REC	Limits	Diln Fac	Analyzed	Analysis
Trifluorotoluene (FID)	130	63-141	5.000	03/16/05	EPA 8015B
Bromofluorobenzene (FID)	111	79-139	5.000	03/16/05	EPA 8015B
Trifluorotoluene (PID)	102	63-133	5.000	03/16/05	EPA 8021B
Bromofluorobenzene (PID)	93	79-128	5.000	03/16/05	EPA 8021B

**Total Volatile Hydrocarbons**

Lab #: 178282	Location: Redwood Regional Park
Client: Stellar Environmental Solutions	Prep: EPA 5030B
Project#: STANDARD	
Matrix: Water	Sampled: 03/16/05
Units: ug/L	Received: 03/16/05
Batch#: 100130	

Field ID: MW-9	Diln Fac: 5.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-005	

Analyte	Result	RL	Analysis
Gasoline C7-C12	4,200	250	EPA 8015B
MTBE	ND	10	EPA 8021B
Benzene	97	2.5	EPA 8021B
Toluene	ND	2.5	EPA 8021B
Ethylbenzene	310	2.5	EPA 8021B
m,p-Xylenes	42	2.5	EPA 8021B
o-Xylene	ND	2.5	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	128	63-141	EPA 8015B
Bromofluorobenzene (FID)	101	79-139	EPA 8015B
Trifluorotoluene (PID)	110	63-133	EPA 8021B
Bromofluorobenzene (PID)	91	79-128	EPA 8021B

Field ID: MW-10	Diln Fac: 1.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-006	

Analyte	Result	RL	Analysis
Gasoline C7-C12	95	50	EPA 8015B
MTBE	13	2.0	EPA 8021B
Benzene	8.3	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	7.7	0.50	EPA 8021B
m,p-Xylenes	0.77	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	106	63-141	EPA 8015B
Bromofluorobenzene (FID)	102	79-139	EPA 8015B
Trifluorotoluene (PID)	95	63-133	EPA 8021B
Bromofluorobenzene (PID)	96	79-128	EPA 8021B

### Total Volatile Hydrocarbons

Lab #: 178282	Location: Redwood Regional Park
Client: Stellar Environmental Solutions	Prep: EPA 5030B
Project#: STANDARD	
Matrix: Water	Sampled: 03/16/05
Units: ug/L	Received: 03/16/05
Batch#: 100130	

Field ID: MW-11	Diln Fac: 5.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-007	

Analyte	Result	RL	Analysis
Gasoline C7-C12	4,600	250	EPA 8015B
MTBE	ND	10	EPA 8021B
Benzene	69	2.5	EPA 8021B
Toluene	ND	2.5	EPA 8021B
Ethylbenzene	300	2.5	EPA 8021B
m,p-Xylenes	200	2.5	EPA 8021B
o-Xylene	5.7	2.5	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	119	63-141	EPA 8015B
Bromofluorobenzene (FID)	103	79-139	EPA 8015B
Trifluorotoluene (PID)	109	63-133	EPA 8021B
Bromofluorobenzene (PID)	93	79-128	EPA 8021B

Field ID: SW-2	Diln Fac: 1.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-008	

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	88	63-141	EPA 8015B
Bromofluorobenzene (FID)	99	79-139	EPA 8015B
Trifluorotoluene (PID)	81	63-133	EPA 8021B
Bromofluorobenzene (PID)	93	79-128	EPA 8021B

### Total Volatile Hydrocarbons

Lab #: 178282	Location: Redwood Regional Park
Client: Stellar Environmental Solutions	Prep: EPA 5030B
Project#: STANDARD	
Matrix: Water	Sampled: 03/16/05
Units: ug/L	Received: 03/16/05
Batch#: 100130	

Field ID: SW-3	Diln Fac: 1.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-009	

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	96	63-141	EPA 8015B
Bromofluorobenzene (FID)	95	79-139	EPA 8015B
Trifluorotoluene (PID)	80	63-133	EPA 8021B
Bromofluorobenzene (PID)	84	79-128	EPA 8021B

Field ID: TB-031605	Diln Fac: 1.000
Type: SAMPLE	Analyzed: 03/16/05
Lab ID: 178282-010	

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	95	63-141	EPA 8015B
Bromofluorobenzene (FID)	98	79-139	EPA 8015B
Trifluorotoluene (PID)	82	63-133	EPA 8021B
Bromofluorobenzene (PID)	90	79-128	EPA 8021B

**Total Volatile Hydrocarbons**

Lab #:	178282	Location:	Redwood Regional Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD		
Matrix:	Water	Sampled:	03/16/05
Units:	ug/L	Received:	03/16/05
Batch#:	100130		

Type: BLANK Diln Fac: 1.000  
 Lab ID: QC286267 Analyzed: 03/16/05

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	90	63-141	EPA 8015B
Bromofluorobenzene (FID)	100	79-139	EPA 8015B
Trifluorotoluene (PID)	80	63-133	EPA 8021B
Bromofluorobenzene (PID)	92	79-128	EPA 8021B

Batch QC Report

**Total Volatile Hydrocarbons**

Lab #:	178282	Location:	Redwood Regional Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8021B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC286268	Batch#:	100130
Matrix:	Water	Analyzed:	03/16/05
Units:	ug/L		

Analyte	Spiked	Result	AREC	Limits
MTBE	20.00	19.71	99	67-125
Benzene	20.00	20.05	100	80-120
Toluene	20.00	20.84	104	80-120
Ethylbenzene	20.00	21.27	106	80-120
m,p-Xylenes	20.00	18.12	91	80-120
o-Xylene	20.00	20.90	105	80-120

Surrogate	AREC	Limits
Trifluorotoluene (PID)	83	63-133
Bromofluorobenzene (PID)	94	79-128

Batch QC Report

**Total Volatile Hydrocarbons**

Lab #:	178282	Location:	Redwood Regional Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8015B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC286269	Batch#:	100130
Matrix:	Water	Analyzed:	03/16/05
Units:	ug/L		

Analyte	Spiked	Result	%REC	Limits
Gasoline C7-C12	2,000	1,894	95	80-120

Surrogate	%REC	Limits
Trifluorotoluene (FID)	124	63-141
Bromofluorobenzene (FID)	111	79-139

Batch QC Report

**Total Volatile Hydrocarbons**

Lab #:	178282	Location:	Redwood Regional Park
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8015B
Field ID:	MW-4	Diln Fac:	1.000
MSS Lab ID:	178282-002	Batch#:	100130
Matrix:	Water	Sampled:	03/16/05
Units:	ug/L	Received:	03/16/05

Type: MS Analyzed: 03/16/05  
 Lab ID: QC286347

Analyte	MSS Result	Spiked	Result	%REC	Limits
Gasoline C7-C12	12.82	2,000	1,898	94	80-120

Surrogate	%REC	Limits
Trifluorotoluene (FID)	135	63-141
Bromofluorobenzene (FID)	111	79-139

Type: MSD Analyzed: 03/17/05  
 Lab ID: QC286348

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Gasoline C7-C12	2,000	1,898	94	80-120	0	20

Surrogate	%REC	Limits
Trifluorotoluene (FID)	137	63-141
Bromofluorobenzene (FID)	112	79-139





**Total Extractable Hydrocarbons**

Lab #:	178282	Location:	Redwood Regional Park
Client:	Stellar Environmental Solutions	Prep:	EPA 3520C
Project#:	STANDARD	Analysis:	EPA 8015B
Matrix:	Water	Sampled:	03/16/05
Units:	ug/L	Received:	03/16/05
Diln Fac:	1.000	Prepared:	03/21/05
Batch#:	100314		

Field ID:	MW-10	Lab ID:	178282-006
Type:	SAMPLE	Analyzed:	03/23/05

Analyte	Result	RL
Diesel C10-C24	98 L Y	50

Surrogate	%REC	Limits
Hexacosane	89	55-143

Field ID:	MW-11	Lab ID:	178282-007
Type:	SAMPLE	Analyzed:	03/23/05

Analyte	Result	RL
Diesel C10-C24	1,900 L Y	50

Surrogate	%REC	Limits
Hexacosane	92	55-143

Field ID:	SW-2	Lab ID:	178282-008
Type:	SAMPLE	Analyzed:	03/23/05

Analyte	Result	RL
Diesel C10-C24	ND	50

Surrogate	%REC	Limits
Hexacosane	94	55-143

Field ID:	SW-3	Lab ID:	178282-009
Type:	SAMPLE	Analyzed:	03/23/05

Analyte	Result	RL
Diesel C10-C24	ND	50

Surrogate	%REC	Limits
Hexacosane	96	55-143

Type:	BLANK	Analyzed:	03/22/05
Lab ID:	QC287012	Cleanup Method:	EPA 3630C

Analyte	Result	RL
Diesel C10-C24	ND	50

Surrogate	%REC	Limits
Hexacosane	98	55-143

L= Lighter hydrocarbons contributed to the quantitation  
 Y= Sample exhibits chromatographic pattern which does not resemble standard  
 ND= Not Detected  
 RL= Reporting Limit  
 Page 2 of 2

Batch QC Report

**Total Extractable Hydrocarbons**

Lab #:	178282	Location:	Redwood Regional Park
Client:	Stellar Environmental Solutions	Prep:	EPA 3520C
Project#:	STANDARD	Analysis:	EPA 8015B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC287013	Batch#:	100314
Matrix:	Water	Prepared:	03/21/05
Units:	ug/L	Analyzed:	03/22/05

Cleanup Method: EPA 3630C

Analyte	Spiked	Result	#REC	Limits
Diesel C10-C24	2,500	2,934	117	50-133

Surrogate	#REC	Limits
Hexacosane	89	55-143

Batch QC Report

**Total Extractable Hydrocarbons**

Lab #: 178282	Location: Redwood Regional Park
Client: Stellar Environmental Solutions	Prep: EPA 3520C
Project#: STANDARD	Analysis: EPA 8015B
Field ID: ZZZZZZZZZZ	Batch#: 100314
MSS Lab ID: 178202-005	Sampled: 03/11/05
Matrix: Water	Received: 03/11/05
Units: ug/L	Prepared: 03/21/05
Diln Fac: 1.000	Analyzed: 03/23/05

Type: MS Cleanup Method: EPA 3630C  
 Lab ID: QC287014

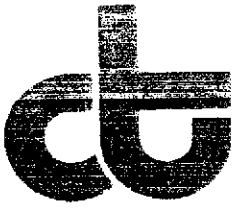
Analyte	MSS Result	Spiked	Result	%REC	Limits
Diesel C10-C24	14.18	2,500	2,318	92	42-127

Surrogate	%REC	Limits
Hexacosane	85	55-143

Type: MSD Cleanup Method: EPA 3630C  
 Lab ID: QC287015

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Diesel C10-C24	2,500	1,992	79	42-127	15	45

Surrogate	%REC	Limits
Hexacosane	74	55-143



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A N A L Y T I C A L   R E P O R T

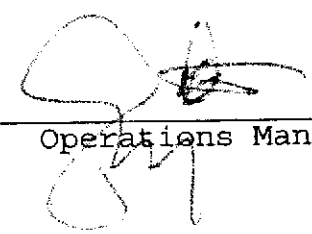
Prepared for:

Stellar Environmental Solutions  
2198 6th Street  
Suite 201  
Berkeley, CA 94710

Date: 03-FEB-05  
Lab Job Number: 177382  
Project ID: STANDARD  
Location: Redwood Service Yard

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signatures. The results contained in this report meet all requirements of NELAC and pertain only to those samples which were submitted for analysis.

Reviewed by:   
Project Manager

Reviewed by:   
Operations Manager

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**CASE NARRATIVE**

Laboratory number: 177382  
Client: Stellar Environmental Solutions  
Location: Redwood Service Yard  
Request Date: 01/27/05  
Samples Received: 01/27/05

This hardcopy data package contains sample and QC results for one water sample, requested for the above referenced project on 01/27/05. The sample was received cold and intact.

**TPH-Purgeables and/or BTXE by GC (EPA 8015B and EPA 8021B):**

No analytical problems were encountered.

**TPH-Extractables by GC (EPA 8015B):**

No analytical problems were encountered.





## Total Volatile Hydrocarbons

Lab #:	177382	Location:	Redwood Service Yard
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD		
Field ID:	PURGE WATER TANK	Batch#:	98688
Matrix:	Water	Sampled:	01/27/05
Units:	ug/L	Received:	01/27/05
Diln Fac:	1.000	Analyzed:	01/27/05

Type: SAMPLE Lab ID: 177382-001

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	92	70-141	EPA 8015B
Bromofluorobenzene (FID)	93	80-143	EPA 8015B
Trifluorotoluene (PID)	87	59-133	EPA 8021B
Bromofluorobenzene (PID)	92	76-128	EPA 8021B

Type: BLANK Lab ID: QC280853

Analyte	Result	RL	Analysis
Gasoline C7-C12	ND	50	EPA 8015B
MTBE	ND	2.0	EPA 8021B
Benzene	ND	0.50	EPA 8021B
Toluene	ND	0.50	EPA 8021B
Ethylbenzene	ND	0.50	EPA 8021B
m,p-Xylenes	ND	0.50	EPA 8021B
o-Xylene	ND	0.50	EPA 8021B

Surrogate	%REC	Limits	Analysis
Trifluorotoluene (FID)	98	70-141	EPA 8015B
Bromofluorobenzene (FID)	94	80-143	EPA 8015B
Trifluorotoluene (PID)	89	59-133	EPA 8021B
Bromofluorobenzene (PID)	93	76-128	EPA 8021B

ND= Not Detected  
 RL= Reporting Limit  
 Page 1 of 1





Batch QC Report

Total Volatile Hydrocarbons

Lab #:	177382	Location:	Redwood Service Yard
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8015B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC280854	Batch#:	98688
Matrix:	Water	Analyzed:	01/27/05
Units:	ug/L		

Analyte	Spiked	Result	%REC	Limits
Gasoline C7-C12	2,000	2,273	114	80-120

Surrogate	%REC	Limits
Trifluorotoluene (FID)	118	70-141
Bromofluorobenzene (FID)	98	80-143



## Batch QC Report

## Total Volatile Hydrocarbons

Lab #:	177382	Location:	Redwood Service Yard
Client:	Stellar Environmental Solutions	Prep:	EPA 5030B
Project#:	STANDARD	Analysis:	EPA 8021B
Type:	LCS	Diln Fac:	1.000
Lab ID:	QC280855	Batch#:	98688
Matrix:	Water	Analyzed:	01/27/05
Units:	ug/L		

Analyte	Spiked	Result	%REC	Limits
MTBE	20.00	22.03	110	67-124
Benzene	20.00	19.65	98	80-120
Toluene	20.00	20.05	100	80-120
Ethylbenzene	20.00	20.12	101	80-120
m,p-Xylenes	20.00	20.08	100	80-120
o-Xylene	20.00	20.17	101	80-120

Surrogate	%REC	Limits
Trifluorotoluene (PID)	90	59-133
Bromofluorobenzene (PID)	95	76-128



Batch QC Report

Total Volatile Hydrocarbons		
Lab #:	177382	Location: Redwood Service Yard
Client:	Stellar Environmental Solutions	Prep: EPA 5030B
Project#:	STANDARD	Analysis: EPA 8015B
Field ID:	ZZZZZZZZZZ	Batch#: 98688
MSS Lab ID:	177352-001	Sampled: 01/26/05
Matrix:	Water	Received: 01/26/05
Units:	ug/L	Analyzed: 01/27/05
Diln Fac:	1.000	

Type: MS Lab ID: QC280856

Analyte	MSS Result	Spiked	Result	%REC	Limits
Gasoline C7-C12	90.22	2,000	2,141	103	80-120
Surrogate	%REC	Limits			
Trifluorotoluene (FID)	116	70-141			
Bromofluorobenzene (FID)	96	80-143			

Type: MSD Lab ID: QC280857

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Gasoline C7-C12	2,000	2,176	104	80-120	2	20
Surrogate	%REC	Limits				
Trifluorotoluene (FID)	113	70-141				
Bromofluorobenzene (FID)	96	80-143				





Batch QC Report

Total Extractable Hydrocarbons

Lab #:	177382	Location:	Redwood Service Yard
Client:	Stellar Environmental Solutions	Prep:	EPA 3520
Project#:	STANDARD	Analysis:	EPA 8015B
Matrix:	Water	Batch#:	98796
Units:	ug/L	Prepared:	02/01/05
Diln Fac:	1.000	Analyzed:	02/02/05

Type: BS Lab ID: QC281251

Analyte	Spiked	Result	%REC	Limits
Diesel C10-C24	2,500	2,643	106	51-131
Surrogate	%REC	Limits		
Hexacosane	91	53-143		

Type: BSD Lab ID: QC281252

Analyte	Spiked	Result	%REC	Limits	RPD	Lim
Diesel C10-C24	2,500	2,689	108	51-131	2	42
Surrogate	%REC	Limits				
Hexacosane	92	53-143				

**HISTORICAL GROUNDWATER MONITORING WELLS ANALYTICAL RESULTS**  
**REDWOOD REGIONAL PARK SERVICE YARD, OAKLAND, CALIFORNIA**  
(all concentrations in ug/L, equivalent to parts per billion [ppb])

Well MW-2									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Nov-94	66	< 50	3.4	< 0.5	< 0.5	0.9	4.3	NA
2	Feb-95	89	< 50	18	2.4	1.7	7.5	30	NA
3	May-95	< 50	< 50	3.9	< 0.5	1.6	2.5	8	NA
4	Aug-95	< 50	< 50	5.7	< 0.5	< 0.5	< 0.5	5.7	NA
5	May-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
6	Aug-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
7	Dec-96	< 50	< 50	6.3	< 0.5	1.6	< 0.5	7.9	NA
8	Feb-97	< 50	< 50	0.69	< 0.5	0.55	< 0.5	1.2	NA
9	May-97	67	< 50	8.9	< 0.5	5.1	< 1.0	14	NA
10	Aug-97	< 50	< 50	4.5	< 0.5	1.1	< 0.5	5.6	NA
11	Dec-97	61	< 50	21	< 0.5	6.5	3.9	31	NA
12	Feb-98	2,000	200	270	92	150	600	1,112	NA
13	Sep-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	7.0
14	Apr-99	82	710	4.2	< 0.5	3.4	4	12	7.5
15	Dec-99	57	< 50	20	0.6	5.9	< 0.5	27	4.5
16	Sep-00	< 50	< 50	0.72	< 0.5	< 0.5	< 0.5	0.7	7.9
17	Jan-01	51	< 50	8.3	< 0.5	1.5	< 0.5	9.8	8.0
18	Apr-01	110	< 50	10	< 0.5	11	6.4	27	10
19	Aug-01	260	120	30	6.7	1.6	6.4	45	27
20	Dec-01	74	69	14	0.8	3.7	3.5	22	6.6

Well MW-2 (continued)									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
21	Mar-02	< 50	< 50	2.3	0.51	1.9	1.3	8.3	8.2
22	Jun-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	7.7
23	Sep-02	98	< 50	5.0	< 0.5	< 0.5	< 0.5	—	13
24	Dec-02	< 50	< 50	4.3	< 0.5	< 0.5	< 0.5	—	< 2.0
25	Mar-03	130	82	39	< 0.5	20	4.1	63	16
26	Jun-03	< 50	< 50	1.9	< 0.5	< 0.5	< 0.5	1.9	8.7
27	Sep-03	120	< 50	8.6	0.51	0.53	< 0.5	9.6	23
28	Dec-03	282	<100	4.3	1.6	1.3	1.2	8.4	9.4
29	Mar-04	374	<100	81.0	1.2	36	7.3	126	18
30	Jun-04	< 50	< 50	0.75	< 0.5	< 0.5	< 0.5	< 0.5	15
31	Sep-04	200	< 50	23	< 0.5	< 0.5	0.70	24	16
32	Dec-04	80	< 50	14	< 0.5	2.9	0.72	18	20
33	Mar-05	190	68	27	<0.5	14	11	52	26
Well MW-4									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Nov-94	2,600	230	120	4.8	150	88	363	NA
2	Feb-95	11,000	330	420	17	440	460	1,337	NA
3	May-95	7,200	440	300	13	390	330	1,033	NA
4	Aug-95	1,800	240	65	6.8	89	67	227	NA
5	May-96	1,100	140	51	< 0.5	< 0.5	47	98	NA
6	Aug-96	3,700	120	63	2.0	200	144	409	NA
7	Dec-96	2,700	240	19	< 0.5	130	93	242	NA
8	Feb-97	3,300	< 50	120	1.0	150	103	374	NA
9	May-97	490	< 50	2.6	6.7	6.4	6.7	22	NA
10	Aug-97	1,900	150	8.6	3.5	78	53	143	NA
11	Dec-97	1,000	84	4.6	2.7	61	54	123	NA
12	Feb-98	5,300	340	110	24	320	402	856	NA
13	Sep-98	1,800	< 50	8.9	< 0.5	68	27	104	23
14	Apr-99	2,900	710	61	1.2	120	80	263	32
15	Dec-99	1,000	430	4.0	2.0	26	14	46	< 2.0

Well MW-4 (continued)									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
16	Sep-00	570	380	< 0.5	< 0.5	16	4.1	20	2.4
17	Jan-01	1,600	650	4.2	0.89	46	13.8	65	8.4
18	Apr-01	1,700	1,100	4.5	2.8	48	10.7	66	5.0
19	Aug-01	1,300	810	3.2	4.0	29	9.7	46	< 2.0
20	Dec-01	< 50	110	< 0.5	< 0.5	< 0.5	1.2	1.2	< 2.0
21	Mar-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
22	Jun-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
23	Sep-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
24	Dec-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
25	Mar-03	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
26	Jun-03	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
27	Sep-03	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
28	Dec-03	< 50	< 100	< 0.3	< 0.3	< 0.3	< 0.6	—	< 5.0
29	Mar-04	< 50	< 100	< 0.3	< 0.3	< 0.3	< 0.6	—	< 5.0
30	Jun-04	< 50	2,500	< 0.3	< 0.3	< 0.3	< 0.6	—	< 5.0
31	Sep-04	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	—	< 2.0
32	Dec-04	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	—	< 2.0
33	Mar-05	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	—	< 2.0



Well MW-5									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Nov-94	50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
2	Feb-95	70	< 50	0.6	< 0.5	< 0.5	< 0.5	0.6	NA
3	May-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
4	Aug-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
5	May-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
6	Aug-96	80	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
7	Dec-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
8	Feb-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
9	May-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
10	Aug-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
11	Dec-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
12	Feb-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
13	Sep-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2
Groundwater monitoring in this well discontinued in 1998 with Alameda County Health Care Services Agency approval.									
Subsequent groundwater monitoring conducted to confirm plume's southern limit									
14	Jun-04	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	5.9
15	Sep-04	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	—	< 2.0

Well MW-7									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Jan-01	13,000	3,100	95	4	500	289	888	95
2	Apr-01	13,000	3,900	140	< 0.5	530	278	948	52
3	Aug-01	12,000	5,000	55	25	440	198	718	19
4	Dec-01	9,100	4,600	89	< 2.5	460	228	777	< 10
5	Mar-02	8,700	3,900	220	6.2	450	191	867	200
6	Jun-02	9,300	3,500	210	6.3	380	155	751	18
7	Sep-02	9,600	3,900	180	< 0.5	380	160	720	< 2.0
8	Dec-02	9,600	3,700	110	< 0.5	400	188.9	699	< 2.0
9	Mar-03	10,000	3,600	210	12	360	143	725	45
10	Jun-03	9,300	4,200	190	< 10	250	130	570	200
11	Sep-03	10,000	3,300	150	11	300	136	597	< 2.0
12	Dec-03	9,140	1,100	62	45	295	184	586	89
13	Mar-04	8,170	600	104	41	306	129	580	84
14	Jun-04	9,200	2,700	150	< 0.5	290	91	531	< 2.0
15	Sep-04	9,700	3,400	98	< 0.5	300	125	523	< 2.0
16	Dec-04	8200	4,000	95	< 0.5	290	124	509	< 2.0
17	Mar-05	10,000	4,300	150	<0.5	370	71.2	591.2	<2.0

Well MW-8									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Jan-01	14,000	1,800	430	17	360	1230	2,037	96
2	Apr-01	11,000	3,200	320	13	560	1,163	2,056	42
3	Aug-01	9,600	3,200	130	14	470	463	1,077	14
4	Dec-01	3,500	950	69	2.4	310	431	812	< 4.0
5	Mar-02	14,000	3,800	650	17	1,200	1,510	3,377	240
6	Jun-02	2,900	1,100	70	2.0	170	148	390	19
7	Sep-02	1,000	420	22	< 0.5	64	50	136	< 2.0
8	Dec-02	3,300	290	67	< 0.5	190	203	460	< 2.0
9	Mar-03	13,000	3,500	610	12	1,100	958	2,680	< 10
10	Jun-03	7,900	2,200	370	7.4	620	562	1,559	< 4.0
11	Sep-03	3,600	400	120	3.3	300	221	644	< 2.0
12	Dec-03	485	100	19	1.5	26	36	83	< 5.0

Well MW-8 (continued)									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
13	Mar-04	16,000	900	592	24	1,060	1,870	3,546	90
14	Jun-04	5,900	990	260	9.9	460	390	1,120	< 10
15	Sep-04	2,000	360	100	< 2.5	180	102	382	< 10
16	Dec-04	15,000	4,000	840	21	1,200	1,520	3,581	< 10
17	Mar-05	24,000	7,100	840	51	1,800	2,410	5,101	<10

Well MW-9									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Aug-01	11,000	170	340	13	720	616	1,689	48
2	Dec-01	9,400	2,700	250	5.1	520	317	1,092	< 10
3	Mar-02	1,700	300	53	4.2	120	67	244	20
4	Jun-02	11,000	2,500	200	16	600	509	1,325	85
5	Sep-02	3,600	2,800	440	11	260	39	750	< 4.0
6	Dec-02	7,000	3,500	380	9.5	730	147	1,266	< 10
7	Mar-03	4,400	1,400	320	6.9	400	93	820	< 2.0
8	Jun-03	7,600	1,600	490	10	620	167	1,287	< 4.0
9	Sep-03	8,300	2,900	420	14	870	200	1,504	< 10
10	Dec-03	7,080	700	287	31	901	255	1,474	< 10
11	Mar-04	3,550	600	122	15	313	84	534	35
12	Jun-04	6,800	1,700	350	< 2.5	620	99	1,069	< 10
13	Sep-04	7,100	1,900	160	8.1	600	406	1,174	< 10
14	Dec-04	4,700	2,800	160	< 2.5	470	< 0.5	630	< 10
15	Mar-05	4,200	1,600	97	<2.5	310	42	449	< 10

Well MW-10									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Aug-01	550	2,100	17	< 0.5	31	44	92	40
2	Dec-01	< 50	81	< 0.5	< 0.5	< 0.5	< 0.5	—	25
3	Mar-02	< 50	< 50	0.61	< 0.5	< 0.5	< 0.5	0.61	6.0
4	Jun-02	< 50	< 50	0.59	< 0.5	0.58	< 0.5	1.2	9.0
5	Sep-02	160	120	10	< 0.5	6.7	3.6	20	26
6	Dec-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	16
7	Mar-03	110	< 50	11	< 0.5	12	1.3	24	15
8	Jun-03	110	< 50	9.6	< 0.5	6.8	< 0.5	16	9.0
9	Sep-03	< 50	< 50	1.1	< 0.5	1.5	< 0.5	2.6	7.0
10	Dec-03	162	<100	6.9	<0.3	8	<0.6	15	9.9
11	Mar-04	94	<100	2.8	<0.3	5.7	7.0	16	<5.0
12	Jun-04	150	56	11	< 0.5	12	< 0.5	23	15
13	Sep-04	< 50	< 50	1.6	< 0.5	1.9	< 1.0	3.5	5.8
14	Dec-04	64	< 50	3.7	< 0.5	3.7	0.7	8.1	10
15	Mar-05	95	98	8.3	<0.5	7.7	0.77	16.8	13

Well MW-11									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Aug-01	17,000	7,800	390	17	820	344	1,571	< 10
2	Dec-01	5,800	2,800	280	7.8	500	213	1,001	< 10
3	Mar-02	100	94	< 0.5	< 0.5	0.64	< 0.5	0.64	2.4
4	Jun-02	8,200	2,600	570	13	560	170	1,313	< 4
5	Sep-02	12,000	4,400	330	13	880	654	1,877	< 10
6	Dec-02	18,000	4,500	420	< 2.5	1,100	912	2,432	< 10
7	Mar-03	7,800	2,600	170	4.7	530	337	1,042	53
8	Jun-03	14,000	3,800	250	< 2.5	870	693	1,813	< 10
9	Sep-03	10,000	3,000	250	9.9	700	527	1,487	< 4
10	Dec-03	15,000	1,100	314	60	1,070	802	2,246	173
11	Mar-04	4,900	400	72	17	342	233	664	61
12	Jun-04	10,000	2,300	210	2.8	690	514	1,417	< 10
13	Sep-04	7,200	2,300	340	< 2.5	840	75	1,255	< 10
14	Dec-04	11,000	3,900	180	5.1	780	695	1,660	< 10
15	Mar-05	4,600	1,900	69	<2.5	300	205.7	575	< 10

**HISTORICAL SURFACE WATER ANALYTICAL RESULTS  
REDWOOD REGIONAL PARK SERVICE YARD, OAKLAND, CALIFORNIA**

(all concentrations in ug/L, equivalent to parts per billion [ppb])

Sampling Location SW-1 (Upstream of Contaminated Groundwater Discharge Location SW-2)									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Feb-94	50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
2	May-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
3	May-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
4	Aug-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
5	Dec-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
6	Feb-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
7	Aug-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
8	Dec-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
9	Feb-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
10	Sep-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
11	Apr-99	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0

Sampling at this location discontinued after April 1999 with Alameda County Health Services Agency approval.

Sampling Location SW-2 (Area of Historical Contaminated Groundwater Discharge)									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	Feb-94	130	< 50	1.9	< 0.5	4.4	3.2	9.5	NA
2	May-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
3	Aug-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
4	May-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
5	Aug-96	200	< 50	7.5	< 0.5	5.4	< 0.5	13	NA
6	Dec-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
7	Feb-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
8	Aug-97	350	130	13	0.89	19	11	44	NA
9	Dec-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
10	Feb-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
11	Sep-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
12	Apr-99	81	< 50	2.0	< 0.5	2.5	1.3	5.8	2.3
13	Dec-99	1,300	250	10	1.0	47	27	85	2.2
14	Sep-00	160	100	2.1	< 0.5	5.2	1.9	9.2	3.4
15	Jan-01	< 50	< 50	< 0.5	< 0.5	0.53	< 0.5	0.5	< 2.0
16	Apr-01	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
17	Sep-01	440	200	2.1	< 0.5	17	1.3	20	10
18	Dec-01	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
19	Mar-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
20	Jun-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
21	Sep-02	220	590	10	< 0.5	13	< 0.5	23	< 2.0
22	Dec-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
23	Mar-03	< 50	< 50	< 0.5	< 0.5	0.56	< 0.5	0.56	2.8
24	Jun-03	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
25	Sep-03	190	92	2.1	< 0.5	4.2	< 0.5	6.3	< 2.0
26	Dec-03	86	< 100	< 0.3	< 0.3	< 0.3	< 0.6	-	< 5.0
27	Mar-04	< 50	< 100	< 0.3	< 0.3	1.1	< 0.6	1.1	< 5.0
28	Jun-04	< 50	< 50	< 0.5	< 0.5	0.83	< 0.5	0.83	< 2.0
29	Sep-04	260	370	4.4	< 0.5	6.3	< 1.0	11	< 2.0
30	Dec-04	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	-	< 2.0
31	Mar-05	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	-	< 2.0

Sampling Location SW-3 (Downstream of Contaminated Groundwater Discharge Location SW-2)									
Event	Date	TVHg	TEHd	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX	MTBE
1	May-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
2	Aug-95	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
3	May-96	< 50	74	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
4	Aug-96	69	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
5	Dec-96	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
6	Feb-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
7	Aug-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
8	Dec-97	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
9	Feb-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	NA
10	Sep-98	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
11	Apr-99	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
12	Dec-99	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
13	Sep-00	NS	NS	NS	NS	NS	NS	—	NS
14	Jan-01	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
15	Apr-01	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
16	Sep-01	NS	NS	NS	NS	NS	NS	—	NS
17	Dec-01	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
18	Mar-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	< 2.0
19	Jun-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	—	2.4
20	Sep-02	NS	NS	NS	NS	NS	NS	—	NS
21	Dec-02	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
22	Mar-03	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
23	Jun-03	< 50	< 50	< 0.5	< 0.5	< 0.5	< 0.5	-	< 2.0
24	Sep-03	NS	NS	NS	NS	NS	NS	—	NS
25	Dec-03	60	< 100	< 0.3	< 0.3	< 0.3	< 0.6	-	< 5.0
26	Mar-04	< 50	< 100	< 0.3	< 0.3	< 0.6	< 0.6	-	< 5.0
27	Jun-04	NS	NS	NS	NS	NS	NS	—	NS
28	Sep-04	NS	NS	NS	NS	NS	NS	—	NS
29	Dec-04	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	-	< 2.0
30	Mar-05	< 50	< 50	< 0.5	< 0.5	< 0.5	< 1.0	-	< 2.0

NS = Not Sampled (no surface water present during sampling event)