Technical Memorandum, Pre-Design Investigation for Shallow Groundwater Unit Remedy, IRP Site 24, Volatile Organic Compound Source Area

Former Marine Corps Air Station, El Toro, California

November 2004

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Base Realignment and Closure
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ACRONYMS AND ABBREVIATIONS

°C	degree Celsius
µg/L	microgram per liter
µmho	micromho
1,1-DCE	1,1-dichloroethene
1,2-DCE	1,2-dichloroethene
BCT	BRAC Cleanup Team
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
CCR	California Code of Regulations
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chain of custody
CTO	contract task order
CTS	central treatment system
DON	Department of the Navy
DTW	depth to water
EPA	Environmental Protection Agency, United States
$feet^2$/day	square feet per day
ft	feet
ft/day	feet per day
GAC	granular activated carbon
GMR	groundwater monitoring report
gpm	gallon per minute
HCl	hydrochloric acid
ID	identification
IDP	Irvine Desalter Project
IDW	investigation-derived waste
IRP	Installation Restoration Program
IRWD	Irvine Ranch Water District
IX	ion exchange
lb/day	pound per day
MCAS	Marine Corps Air Station
mg/L	milligram per liter
mL	milliliter
mL/min	milliliter per minute
mV	millivolt
NAVFAC	Naval Facilities Engineering Command
NAVFAC EFD Pacific	Naval Facilities Engineering Command, Engineering Field Division Pacific
NFECSW SDIEGO	Naval Facilities Engineering Command, Southwest Division
NTU	nephelometric turbidity unit
OCWD	Orange County Water District
PCE	tetrachloroethene
PDB	passive diffusion bag (sampler)
PDI	pre-design investigation
pH	negative log of the hydrogen ion concentration

ppm	part per million
PTFE	Polytetrafluoroethylene/Teflon®
PVC	polyvinyl chloride
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	record of decision
SAP	sampling and analysis plan
scfm	standard cubic feet per minute
SGU	Shallow Groundwater Unit
SOP	standard operating procedure
STLC	Soluble Threshold Limit Concentration
SVE	soil vapor extraction
TBA	tert-butyl alcohol
TCE	trichloroethene
TCLP	Toxicity Characteristic Leachate Procedure
TDS	total dissolved solids
TOC	top of casing
TTLC	Total Threshold Limit Concentration
U.S.	United States
USGS	United States Geological Survey
VOA	volatile organic analysis
VOC	volatile organic compound
WDR	Waste Discharge Requirement
WET	Waste Extraction Test
WP	work plan

1. INTRODUCTION

This technical memorandum presents the results of the pre-design investigation (PDI) for Installation Restoration Program (IRP) Site 24, Shallow Groundwater Unit (SGU), Former Marine Corps Air Station (MCAS), El Toro, California. The results will be used to support the remedial design for IRP Site 24, Volatile Organic Compounds (VOCs) Source Area, Former MCAS El Toro, California. The selected remedy for the SGU is described in the *Record of Decision* [ROD] *for Operable Unit 1, Site 18 – Regional VOC Plume; Operable Unit 2A, Site 24 – VOC Source Area* (DON 2002).

This technical memorandum was prepared for the Department of the Navy (DON), Southwest Division, Naval Facilities Engineering Command (abbreviated as NAVFAC EFD Southwest or NFECSW SDIEGO; formerly abbreviated as SWDIV) as authorized by the U.S. Navy, Naval Facilities Engineering Command, Engineering Field Division Pacific (NAVFAC EFD Pacific) under contract task order (CTO) no. 0068 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048. It complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan in Title 40 of the Code of Federal Regulations, Part 300, and California Health and Safety Code, Section 6.8.

1.1 SITE DESCRIPTION AND BACKGROUND

Former MCAS El Toro is located in a semi-urban/agricultural area of southern California, approximately 8 miles south of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1).

Former MCAS El Toro covers approximately 4,740 acres. Land use surrounding the former station includes commercial, light industrial, agricultural, and residential. Former MCAS El Toro closed on 2 July 1999, in accordance with the Base Realignment and Closure (BRAC) Act.

A Phase I Remedial Investigation (RI), a Phase II RI/Feasibility Study, and various site-specific investigations and studies identified VOC contamination, mainly trichloroethene (TCE) and tetrachloroethene (PCE) in soil and groundwater, at the former station. VOC contamination migrated from the soil to the SGU (IRP Site 24) and to the regional principal aquifer defined as IRP Site 18.

IRP Site 24, VOC Source Area, comprises soil and groundwater. Contaminated soil at IRP Site 24 was addressed in an Interim ROD (DON 1997) that documented selection of soil vapor extraction (SVE), the United States Environmental Protection Agency (EPA) presumptive remedy for VOC-contaminated soil, as the remedy. The remedy for soil has been implemented in accordance with the Interim ROD, and the closure report (Earth Tech 2002) prepared (based on the comprehensive sampling to verify that the remedial action objectives [RAOs] have been met) and submitted to the BRAC Cleanup Team (BCT). This closure report recommended closure of the vadose zone source area for Site 24 based on the conclusions that the RAOs for the vadose zone of Site 24 have been met. The BCT concurred with the conclusions of the closure report. The selected remedies for the contaminated groundwater at IRP Sites 24 and 18, Regional VOC Groundwater Plume, are extraction, treatment, and institutional controls (DON 2002). Groundwater will be extracted from IRP Site 24 using a well field to capture and contain the TCE plume. At the off-station portion (principal aquifer) of IRP Site 18, groundwater will be extracted from areas of the groundwater plume where TCE concentrations are equal to or greater than 5 micrograms per liter (μg/L).

Groundwater extracted at both sites will be treated at the modified Irvine Desalter Project (modified IDP) facility to remove VOCs using air stripping. VOC vapors will then be treated with activated carbon prior to discharge to the atmosphere. The modified IDP is a water supply development project initiated by the Orange County Water District (OCWD) and the Irvine Ranch Water District (IRWD). The goal of this project is to develop a local water supply, extracting from the principal aquifer, by (1) intercepting, containing, and treating groundwater with high concentrations of total dissolved solids (TDS) and nitrates, and (2) accepting and treating groundwater extracted from former MCAS El Toro for VOC removal. The modified IDP is composed of two separate components, a non-potable system and a potable system, designed to treat groundwater from two areas in the principal aquifer and one from the SGU.

Non-potable System – Groundwater from IRP Site 24 and areas inside the principal aquifer VOC plume (which is contaminated above drinking water standards) will be extracted, treated, and conveyed for use as recycled water. Only the VOC-related portion of the modified IDP that treats water from IRP Site 24 and other areas within the principal aquifer VOC plume are considered part of the DON's CERCLA remedy.

Potable System – Groundwater from areas outside the principal aquifer VOC plume will be extracted and treated to remove TDS and nitrates. Treated water will then be supplied for domestic purposes. This system does not fall under the jurisdiction of the DON's CERCLA remedy.

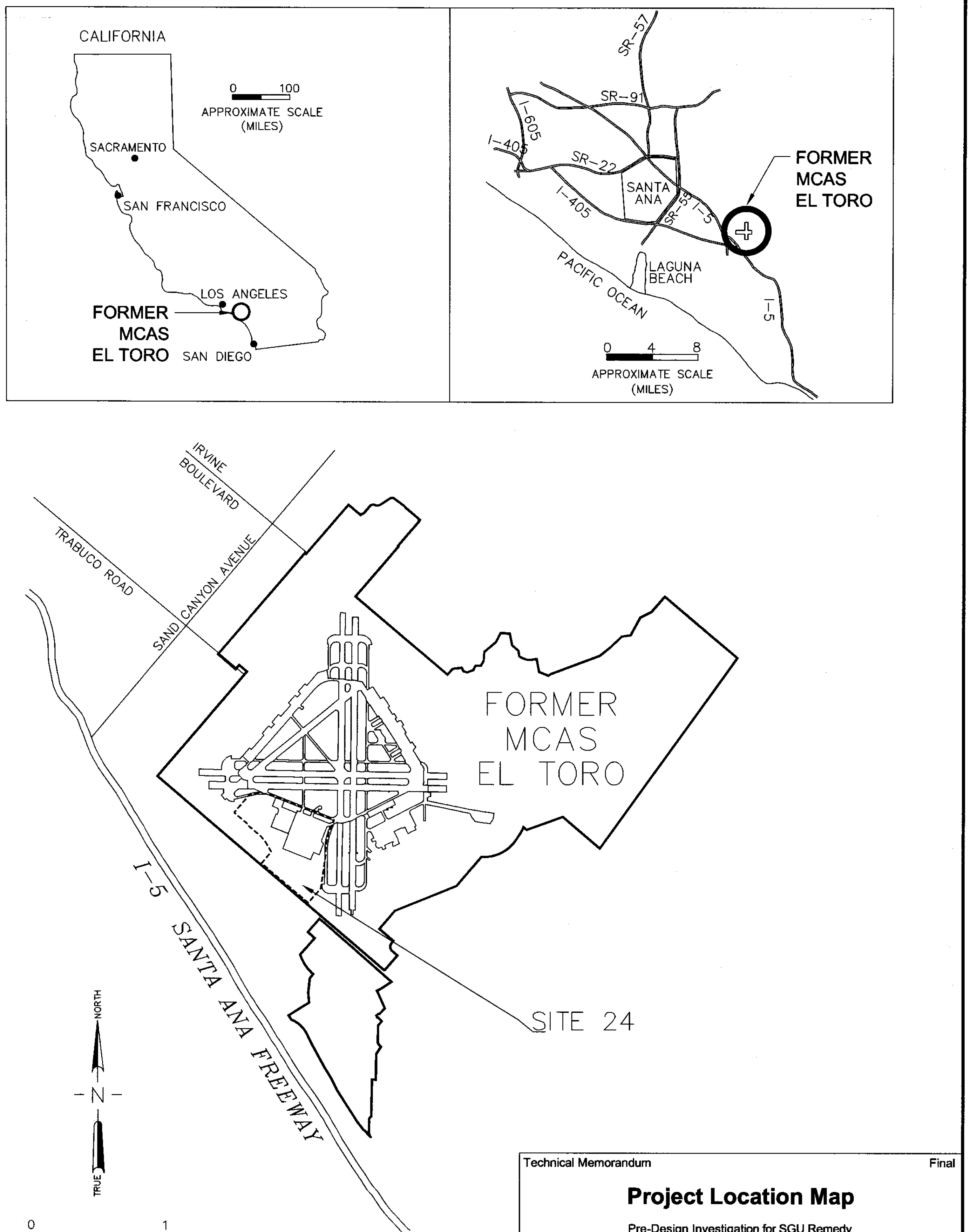
The selected remedy for groundwater includes the following:

- Construction, operation, and maintenance of a groundwater extraction and conveyance system to remove contaminated groundwater from the SGU
- Performance monitoring throughout the remedial action
- Treatment of VOC-contaminated groundwater using air stripping and treatment of VOC vapors using activated carbon prior to discharge to the atmosphere
- Confirmatory groundwater sampling at the end of the remediation to confirm that VOC concentrations meet federal and state cleanup levels
- Institutional controls to prevent use of contaminated groundwater, protect equipment, and allow station property access by the DON, OCWD/IRWD, and regulatory personnel

1.2 PRE-DESIGN INVESTIGATION OBJECTIVES

A PDI was conducted in accordance with the *Work Plan (WP), Pre-design Investigation for Shallow Groundwater Unit Remedy, IRP Site 24, Volatile Organic Compounds Source Area, Former Marine Corps Air Station, El Toro, California* (Earth Tech 2003b) to achieve the following objectives:

- Reduce uncertainties in the groundwater model by evaluating sustainable extraction rates and vertical VOC plume distribution.
- Assess whether SVE would be a technically feasible and cost-effective enhancement to the groundwater remedy.
- Select a layout for the conveyance pipe network.



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Project Location Map

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date 11-04 | Former MCAS El Toro | Figure 1-1

Project No. 29307

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

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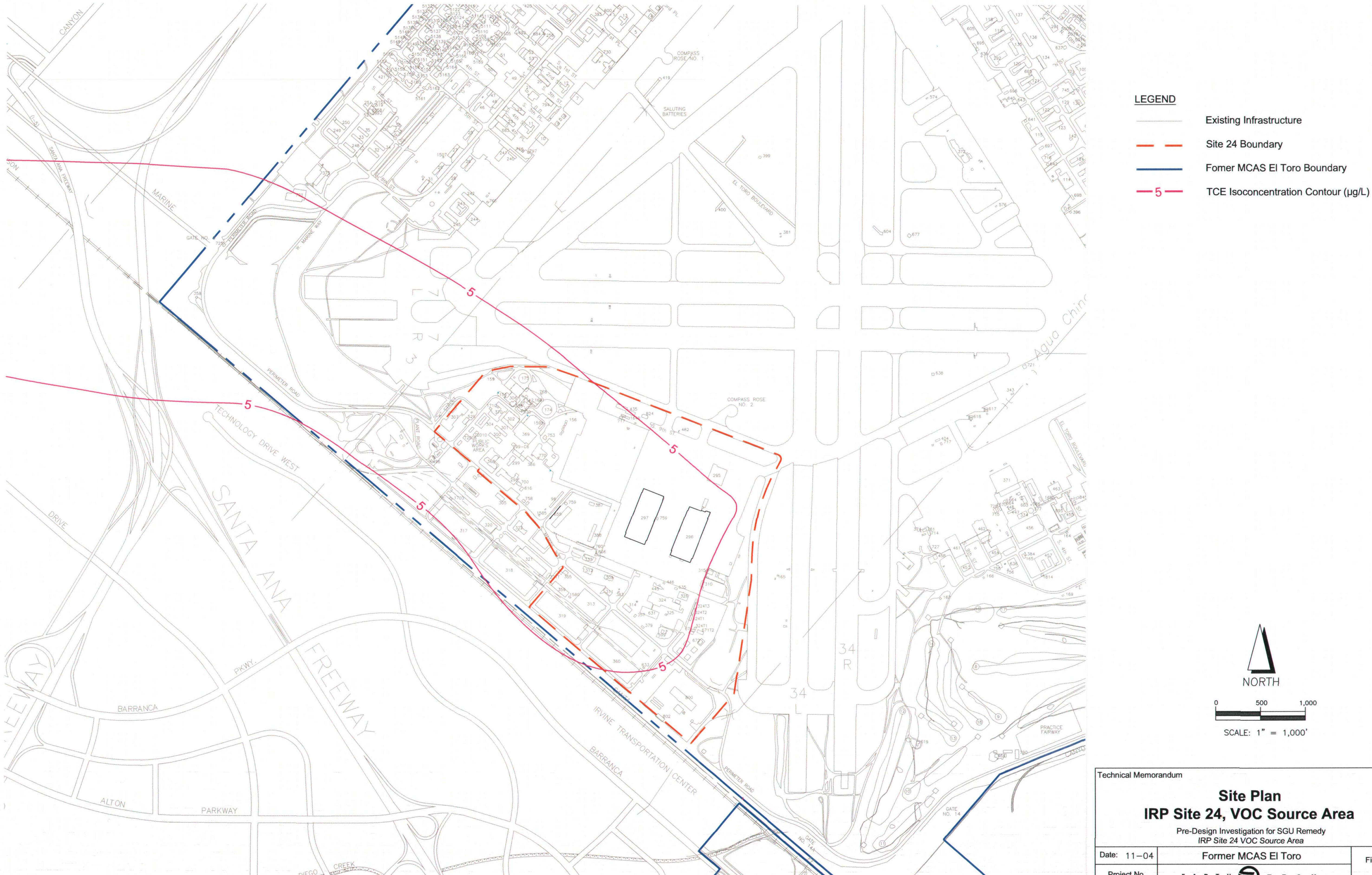

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Site Plan
IRP Site 24, VOC Source Area

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11–04	Former MCAS El Toro	Figure
Project No. 29307	EARTH TECH, A tyco INTERNATIONAL LTD. COMPANY	1–2

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Data collection for this PDI was conducted in three major phases as described below.

Phase I consisted of the following:

- Groundwater elevation monitoring
- Groundwater sampling of existing monitoring wells.

Phase II consisted of the following:

- Evaluation of data collected during Phase I to update plume distribution and revise placement of new monitoring wells, as necessary
- Installation and sampling of new monitoring and extraction wells
- Step-drawdown and 72-hour extraction testing
- Evaluation of groundwater remedial enhancement using SVE
- Geophysical survey and exploratory trenching to locate buried utilities.

Phase III consisted of the following:

- Evaluation of data collected during Phase I and II
- Incorporation of data collected into the extraction and conveyance system design.

2. FIELD ACTIVITIES

2.1 GROUNDWATER SAMPLING

2.1.1 Phase I: Existing Wells

During Phase I of the PDI, groundwater samples were collected at the wells shown on Figure 2-1 using passive diffusion bags (PDBs) and low-flow sampling techniques. Water levels were measured prior to purging and sampling each well.

2.1.1.1 PASSIVE DIFFUSION BAG SAMPLING – EXISTING WELLS

PDB sampling was performed to further evaluate the vertical distribution of VOCs. Standard procedures for PDB sampling are described in United States Geological Survey Water Resources Investigations Report 01-4060 (USGS 2001). Project-specific procedures were followed as presented in Appendix C of the WP (Earth Tech 2003b).

Pre-filled PDBs were deployed at approximately 10-foot intervals across each screen interval, with the exception of the deepest well, 18_TIC55, where an interval of approximately 50 feet was used. In addition, to verify previously reported HydroPunch sampling results, PDB samplers were deployed at specific depths corresponding to the HydroPunch sampling depths in wells 24EX3, 24EX3OB2, 24EX4OB1, and 24EX6. The PDBs were deployed in June 2003, and samples were collected following a residence time of 14 days. PDB leakage prevented sample collection from three depths at well 24EX4. Therefore, PDBs were redeployed and sampled from 24EX4 in July 2003. Table 2-1 lists the depths and dates PDBs were installed and sampled.

Table 2-1: Depths at wich PDB Samplers Were Installed and Collected in Existing Wells

Well ID	Total Depth (ft bgs)	DTW (ft from TOC)	Date Deployed	Date Sampled	Screen Interval (feet bgs)		PDB Deployment Depth (feet bgs) [a]							
							1	2	3	4	5	6	7	8
18_TIC55	746	[b]	07/03/03	07/17/03	300	497	325	375	425	—	—	—	—	—
24EX3	186	103.06	06/09/03	06/24/03	105	180	115	125	135 [c]	145	155	165	175	—
24EX3OB2	156	102.23	06/09/03	06/24/03	105	150	110	120 [c]	130	—	—	—	—	—
24EX4	195	105.10	06/09/03	06/24/03	104	190	110	120	130	140 [d]	150 [d]	160 [d]	170	180
24EX4OB1	156	105.08	06/09/03	06/24/03	105	150	110	120 [c]	130	—	—	—	—	—
24EX5OB2	155	102.29	06/11/03	06/24/03	105	150	110	120	130	140	—	—	—	—
24EX6	178	103.20	06/09/03	06/24/03	103	173	110	119 [c]	130	140	150	160	170	—
24IN2	269	[b]	06/09/03	06/24/03	193	263	200	210	220	230	240	250	—	—
24IN03	169	109.30	06/09/03	06/24/03	95	155	100	110	120	130	140	150	—	—
24NEW4	160	102.65	06/10/03	06/24/03	108	148	115	125	135	145	—	—	—	—

ID identification
ft bgs feet below ground surface
DTW depth to water
TOC top of casing
— No PDB bag sampler deployed.
[a] Depth measured to center of sampler.
[b] Depth to water was not recorded.
[c] Depth corresponding to previous nearby HydroPunch sampling location.
[d] PDB sample was collected at this depth on 07/17/2003.

Groundwater from the PDB samples was transferred into 40-milliliter (mL) volatile organic analysis (VOA) vials with hydrochloric acid (HCl) preservative, immediately placed on ice in a cooler, and submitted under chain-of-custody (COC) for VOC analysis by EPA Method 8260B. Laboratory results are summarized in Section 4.1; validated analytical data are included in Appendix A.

2.1.1.2 LOW-FLOW SAMPLING

Twenty-two monitoring wells were sampled using low-flow sampling techniques in accordance with CLEAN II Standard Operating Procedure (SOP) 8, *Groundwater Sampling* (BNI 1999). A 2-inch, stainless-steel, Grundfos MP1 bladder pump (model number 1A106003) was used for wells without a dedicated pump. The pump was decontaminated between each use, and field and equipment blanks were collected and analyzed. Dedicated Polytetrafluoroethylene/Teflon® (PTFE) bladders and PTFE-lined nylon tubing were used for each well to minimize the possibility of cross-contamination. Water levels were measured prior to purging and were recorded on low-flow sampling logs (included in Appendix B).

Water levels were continuously monitored during purging and purge rates adjusted accordingly to ensure that drawdown within the wells was kept to a minimum. Groundwater was pumped from each well at rates ranging from 0.1 to 0.5 milliliter per minute (mL/min). Water quality properties were monitored during purging and are listed in Table 2-2. All data were recorded on the low-flow sampling logs included in Appendix B. The water quality parameters were measured using a Horiba U-22 water quality monitoring system and flow-through cell. All field measurement equipment was calibrated prior to each workday.

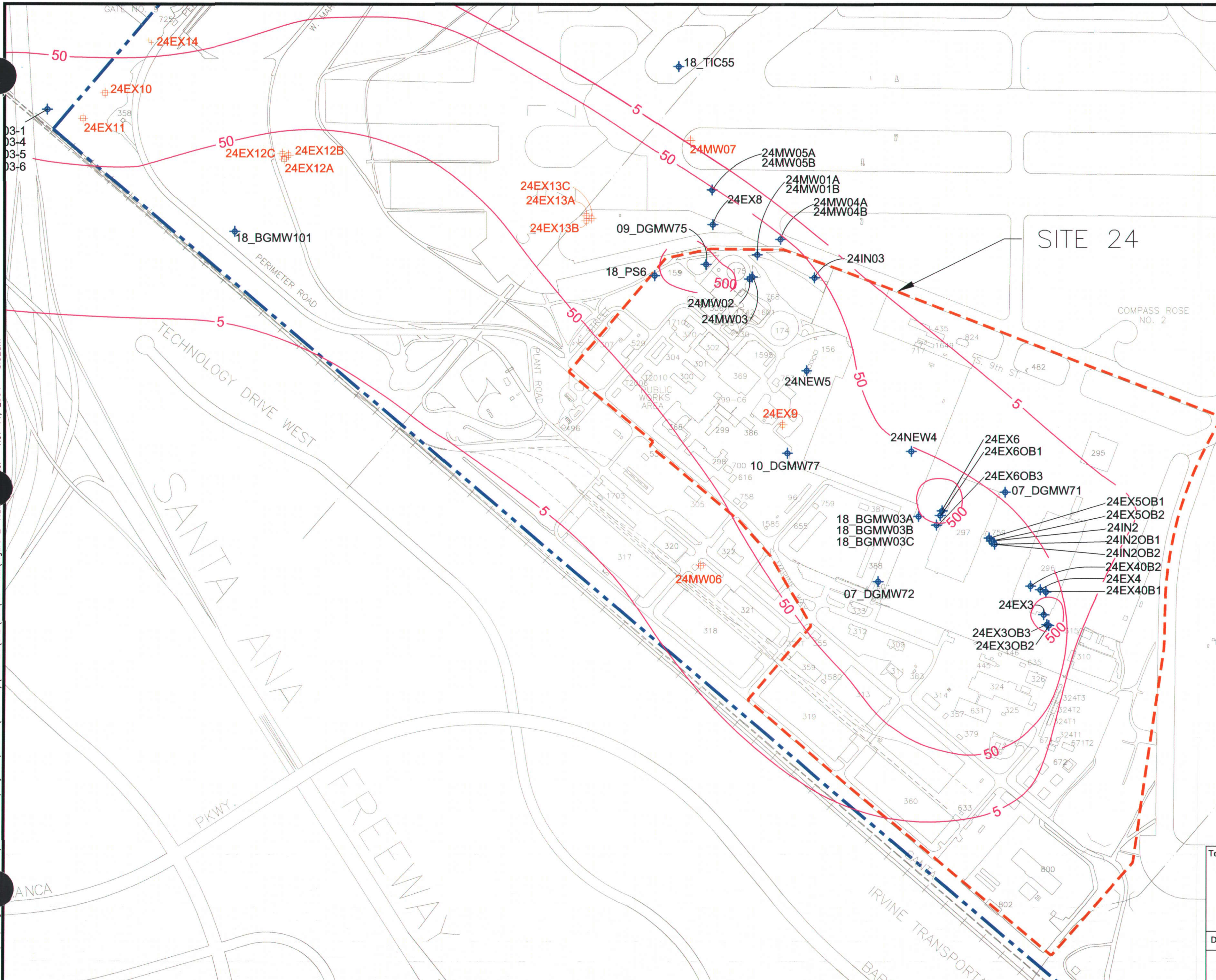
Table 2-2: Monitoring Parameters

Type of Data	Measurement Unit	Resolution
Conductivity	µmho	±5 percent full scale
Dissolved oxygen	ppm	±0.5
Oxidation-reduction potential	mV	±10
pH	standard unit	±0.2
Static groundwater level	feet from TOC	±0.01
Temperature	°C	±1
Turbidity	NTU	±1

µmho	micromho	pH	negative log of the hydrogen ion concentration
ppm	part per million	°C	degree Celsius
mV	millivolt	NTU	nephelometric turbidity unit

The twenty-two wells sampled using low-flow sampling are listed in Table 2-3. Samples were collected in 40-mL VOA vials with HCl as preservative, placed on ice, and submitted under COC to the laboratory for analysis of VOCs. Laboratory results are summarized in Section 4.1; validated analytical data are included in Appendix A.

PRIMARY SOURCE OF MAP INFORMATION:
DRAFT GROUNDWATER REMEDIATION PILOT TEST REPORT (BNI 1998).
FINAL GROUNDWATER MONITORING REPORT, ROUND 16 (CDM 2003).



LEGEND

- Well Installed During the Pre-Design Investigation
- Existing Well
- Site Boundary
- Former MCAS El Toro Boundary
- 5 TCE Isoconcentration Contour (μg/L)

NORTH

0 300 600

SCALE: 1" = 600'

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Wells Used for Extraction Tests and Plume Delineation

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11–04	Former MCAS El Toro	Figure
Project No. 29307	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	2–1

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Table 2-3: List of Existing Wells Sampled Using Low-Flow Sampling Methods

Well ID	Diameter (inches)	Total Depth (ft bgs)	DTW (ft from TOC)	Date Measured	Screen Interval (ft bgs)	Pump Intake (ft bgs)	Evaluation Rationale/Remarks
24EX3OB3	2	182	102.45	06/17/03	170–175	172.5	Used to evaluate the vertical extent of the plume using the existing pump.
24EX4OB2	4	156	105.53	06/17/03	106–151	135	Used to evaluate the vertical extent of the plume using the existing pump.
24EX6OB1	4	156	103.41	06/19/03	106–151	128.5	Used to evaluate the vertical extent of the plume using the existing pump.
24EX6OB3	4	225	100.50	06/20/03	218–223	222.5	Used to evaluate the vertical extent of the plume using existing pump.
24EX8	6	169	108.21	06/18/03	95–155	125	Used to evaluate the vertical extent of the plume.
24IN2OB2	3	275	101.34	06/18/03	195–270	232	Used to evaluate the vertical extent of the plume.
24MW01A	3	170	109.20	06/18/03	99–134	123	Used for TCE plume delineation using existing pump.
24MW01B	3	170	108.7	06/18/03	140–165	160	Used for TCE plume delineation using existing pump.
24MW02	3	171.5	106.35	06/20/03	143–168	160	Used for TCE plume delineation using existing pump.
24MW03	4	140	106.25	06/18/03	100–135	122	Used for TCE plume delineation using existing pump.
24MW04A	3	171.5	110.30	06/16/03	100–135	122	Used for TCE plume delineation using existing pump.
24MW04B	3	171.5	109.95	06/17/03	143–168	160	Used for TCE plume delineation using existing pump.
24MW05A	3	180.5	110.70	06/13/03	100–135	121	Used for TCE plume delineation using existing pump.
24MW05B	3	180.5	110.49	06/17/03	143–168	155	Used for TCE plume delineation using existing pump.
07_DGMW71	4	163	102.41	06/13/03	115–155	125	Used for TCE plume delineation.
07_DGMW72	4	159	96.15	06/16/03	110–150	130	Used for TCE plume delineation.
10_DGMW77	4	175	97.72	06/17/03	150–170	160	Used for TCE plume delineation. Added to the base-wide quarterly groundwater sampling program.
18_BGMW03A	5	471	104.35	06/19/03	370–390	377	Used for TCE plume delineation.
18_BGMW03B	5	310	99.87	06/20/03	280–300	290	Used for TCE plume delineation.
18_BGMW03C	5	250	98.1	06/19/03	222–242	232	Used for TCE plume delineation using existing pump.
18_BGMW101	4	140	74.43	06/16/03	90–130	110	Used for TCE plume delineation using existing pump.
18_PS6	4	155	103.71	06/17/03	130–150	140	Used for TCE plume delineation.

2.1.2 Phase II: New Wells

Groundwater sampling was performed on newly constructed groundwater wells to better define plume distribution and address uncertainties in the groundwater model. Placement of these groundwater wells was based on 1) closing data gaps in the existing monitoring well network for plume delineation, and 2) evaluating sustainable extraction rates in areas previously not evaluated. The locations of these monitoring and extraction wells are shown on Figure 2-1.

Groundwater samples were collected from these newly constructed wells using PDBs, as described in the following section. Groundwater samples were also collected from the new wells at the start and end of the 72-hour extraction tests described in Section 2.1.6.

2.1.2.1 *PASSIVE DIFFUSION BAG SAMPLING – NEW WELLS*

Pre-filled PDB samplers were deployed at approximately 10-foot intervals across each screen interval in the newly installed wells. Following 14 days residence time, the PDBs were recovered and samples were collected. Table 2-4 lists the depths and dates the PDB samplers were deployed and sampled in these wells.

Table 2-4: Depths at which PDB Samplers Were Installed and Collected in New Wells

Well	Total Depth (ft bgs)	DTW (ft from TOC)	Date Deployed	Date Sampled	Screen Interval (ft bgs)		PDB Deployment Depth [a] (ft bgs)							
							1	2	3	4	5	6	7	8
24EX09	210	98.9	09/05/03	09/19/03	120	200	160	—	—	—	—	—	—	—
24EX10	165	68.65	10/10/03	10/24/03	115	160	120	130	140	150	—	—	—	—
24EX11	220	67.48	10/10/03	10/24/03	135	180	140	150	160	170	—	—	—	—
24EX12A	170	78.53	08/13/03	08/27/03	115	160	120	130	140	150	—	—	—	—
24EX12B	220	81.15	08/13/03	08/27/03	165	210	170	180	190	200	—	—	—	—
24EX12C	270	79.08	08/13/03	08/27/03	220	260	225	235	245	255	—	—	—	—
24EX13A	170	99.5	08/13/03	08/27/03	110	160	115	125	135	145	155	—	—	—
24EX13B	220	98.78	08/13/03	08/27/03	170	210	175	185	195	205	—	—	—	—
24EX13C	280	97.78	08/13/03	08/27/03	230	270	235	245	255	265	—	—	—	—
24EX14	195	73.51	10/10/03	10/24/03	115	185	120	130	140	150	160	170	180	—
24MW06	195	82.8	09/05/03	09/19/03	165	185	175	—	—	—	—	—	—	—
24MW07	205	100.80	09/25/03	10/10/03	120	200	125	135	145	155	165	175	185	195

— No PDB sampler deployed.
[a] Depth measured to center of sampler.

Recovered PDB samples were collected in 40-mL VOA vials, placed on ice, and submitted under COC to the laboratory for analysis of VOCs. Analytical results are summarized in Section 4.1; validated analytical data are included in Appendix A.

2.1.3 Vertical Flow Measurements

Vertical groundwater flow within four wells in the vicinity of Buildings 296 and 297 was estimated to assess whether PDB samples are representative of their sampling depths. Two methods were used to evaluate the vertical flow condition:

- Comparison of potentiometric elevations measured at various depths within the aquifer
- Measurement using a heat-pulse flowmeter

Vertical flow based on groundwater elevations was evaluated at wells 18BGMW05, 18_DW135/18_DW250, 18_MCAS03, 24EX3, 24EX6, and 24BGMW03. Heat-pulse flowmeter measurements were performed at 24EX3, 24EX3OB2, and 24EX6, in which previous HydroPunch results were to be verified using PDB samplers. Heat pulse measurements were also conducted in well 24EX4.

K-V Associates, Inc. (KVA), a leader in direct groundwater flow measurements using heat-pulse flow measurements, was selected to perform the heat-pulse measurements using their Model 90

GeoFlo borehole groundwater flowmeter. The heat-pulse flowmeter measures the velocity of interstitial water flow through saturated porous media via thermal transmission. The flowmeter creates a heat pulse that is transmitted through the porous matrix. Movement of the interstitial water mass creates thermal conductance bias that is linearly proportional to the rate of flow.

The field instrument was calibrated for flow velocity responses at the KVA facility prior to use in the field using similar well configurations (slot size and annulus) as the test wells to verify the probe's flow velocity resolution. The probe's peak temperature and time to peak temperature were curve fitted for each flow chamber configuration (see KVA report in Appendix C: Vertical Flow Measurement Report).

2.1.4 Well Installation

Ten extraction wells and two monitoring wells (Figure 2-1) were installed, developed, sampled, and tested to estimate the sustainable extraction rates.

2.1.4.1 Extraction Well Installation

The extraction wells were installed as described below:

- Borehole advancement was initiated by air rotary casing hammer at wells 24EX12C and 24EX13C. However, excessive borehole collapse due to heaving sands necessitated the use of mud rotary technology at the remaining boreholes (with concurrence of the BCT). The diameter of each borehole was 14 inches.
- Soil samples were collected during drilling for field screening and lithologic classification. Samples were collected in accordance with the sampling and analysis plan (SAP) (Earth Tech 2003b) and CLEAN II SOP 4, *Soil Sampling* (BNI 1999). Borehole logs are provided in Appendix D. Table 2-5 summarizes depth intervals of soil samples.

Table 2-5: Summary of Soil Sampling Depths in Extraction Well Boreholes

Well ID	Grab Intervals (feet bgs)	Split-Spoon Intervals (feet bgs)
24EX9	5, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110	120, 130, 140, 150, 160, 170, 180, 190, 200, 210
24EX10	20, 30, 40, 50, 60, 70, 80, 90, 100, 110	120, 125, 130, 135, 140, 145, 150, 155
24EX11	20, 60, 70, 100, 110, 120, 130, 140, 150, 160	170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220
24EX12A	10, 20, 30, 40, 50, 60, 70, 80, 90, 120	100, 140, 160, 180, 200, 220, 230, 250
24EX12B	No grab samples collected	No split-spoon samples collected.
24EX12C	No grab samples collected	260, 270
24EX13A	10, 20, 30, 40, 50, 60, 70, 90, 100, 120, 140, 160, 170	80, 110, 130, 150
24EX13B	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 180, 200	170, 190, 210
24EX13C	10, 20, 30, 40, 50, 60, 70, 80, 90, 110, 130, 150, 170, 190, 210	100, 120, 140, 160, 180, 200, 220, 230, 240, 250, 260, 270, 280
24EX14	20, 30, 40, 50, 60, 70, 80, 90, 100, 110	120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180

- Upon drilling to total depth, each borehole was completed as an extraction well. The extraction wells were constructed of 6-inch, schedule 304S, stainless-steel blank casings, wire-wrapped screens, and sumps. A screen slot size of 0.035 inch was used, except for well 24EX11, where a slot size of 0.06 inch was used. Well seals were constructed using hydrated bentonite chips, and filter packs were constructed with #3 sand (except 24EX11, which was constructed with #6/12 sand). Well construction logs are provided in Appendix D. Table 2-6 summarizes construction details for each well.

Table 2-6: Summary of Extraction Well Construction Details

Well ID	Screen Slot Size (inch)	Depth Interval (feet bgs)					
		Blank Casing	Screen	Sump	Cement Grout	Bentonite Seal	Filter Pack
24EX9	0.035	0–120	120–200	200–210	0–84	84–98	98–214
24EX10	0.035	0–115	115–160	160–165	0–105	105–110	110–165
24EX11	0.06	0–135	135–180	180–185	0–112	112–120	120–190
24EX12A	0.035	0–115	115–160	160–165	0–105	105–110	110–165
24EX12B	0.035	0–165	165–210	210–220	0–155	155–160	160–220
24EX12C	0.035	0–220	220–260	260–265	0–205	205–211	211–272
24EX13A	0.035	0–110	110–160	160–170	0–81	81–86	86–172
24EX13B	0.035	0–165	165–205	205–210	0–147	147–154	154–213
24EX13C	0.035	0–230	230–270	270–280	0–207	207–217	217–280
24EX14	0.035	0–115	115–185	185–195	0–104	104–109	109–195

- Each well was completed in a flush-mounted steel box two feet below ground surface (bgs). Each box was fitted with a traffic-rated cover.
- All generated soil cuttings, groundwater, and drilling fluids were containerized and were disposed of in accordance with CLEAN II SOP 22, *Investigation-derived Waste Management* (BNI 1999). Management of the investigation-derived waste (IDW) is discussed in Section 5 of this report.
- All equipment was decontaminated before each use in accordance with CLEAN II SOP 11, *Decontamination of Equipment* (BNI 1999).

2.1.4.2 Monitoring Well Installation

The monitoring wells were installed as described below:

- Well 24MW06 was advanced by air rotary casing hammer as specified in the WP (Earth Tech 2003b). However, due to heaving sands, well 24MW07 was advanced by mud rotary technology. Borehole logs are included in Appendix D.
- Soil samples were collected during drilling for field screening and lithologic classification. Samples were collected in accordance with the SAP (Earth Tech 2003b) and CLEAN II SOP 4, *Soil Sampling* (BNI 1999). Table 2-7 summarizes depth intervals of soil samples.

Table 2-7: Summary of Soil Sampling Depths in Monitoring Well Boreholes

Well ID	Grab Intervals (feet bgs)	Split-Spoon Intervals (feet bgs)
24MW06	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160	165, 170, 175, 180, 185
24MW07	30, 40, 50, 60, 70, 80, 90, 115, 125, 135, 145, 155, 165,	100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200

- Upon drilling to total depth, each borehole was completed as a monitoring well. The monitoring wells were constructed of 4-inch, schedule 80, polyvinyl chloride (PVC) blank casing, slotted screens, and sump. A screen slot size of 0.02 inch was used. Well seals were constructed using hydrated bentonite chips and filter packs were constructed using #3 sand.

Borehole and well construction logs are presented in Appendix D. Table 2-8 summarizes well construction details for each well.

Table 2-8: Summary of Monitoring Well Construction Details

Well ID	Screen Slot Size (inch)	Depth Interval (feet bgs)					
		Riser	Screen	Sump	Cement Grout	Bentonite Seal	Filter Pack
24MW06	0.020	0–170	170–190	n/a	0–153	153–161	161–195
24MW07	0.020	0–120	120–200	200–205	0–102	102–110	110–208

n/a not applicable

- Each well was completed in a flush-mounted steel box 2 feet bgs. Each box was fitted with a watertight, traffic-rated cover.
- All generated soil cuttings, groundwater, and drilling fluids were containerized and were disposed of in accordance with CLEAN II SOP 22, *Investigation-derived Waste Management* (BNI 1999). Management of the IDW is discussed in Section 5 of this report.
- All equipment was decontaminated before each use in accordance with CLEAN II SOP 11, *Decontamination of Equipment* (BNI 1999).

2.1.5 Well Development

Development of each well was conducted in accordance with CLEAN II SOP 5, *Monitoring Well Installation and Development* (BNI 1999) to remove drilling residuals, develop the filter pack, remove mud smearing, and restore the natural hydraulic conductivity of the formation. Well development activities were performed a minimum of 48 hours after the annular grout seal had been installed. Well development generally consisted of the following activities:

- Bailing to remove materials accumulated in the sump
- Surging to agitate water and dislodge additional fine-grained material
- Bailing to remove the additional fines dislodged during surging
- Pumping to remove suspended sediments (starting at the top of the water column and lowering the pump to the bottom of the screen)
- Bailing to remove any sediment accumulated during pumping activities
- Pumping at a high rate with the pump set at the lowermost section of the well screen for final cleanup

During well development, specific conductivity, temperature, pH, and turbidity were monitored and recorded on well development logs (included in Appendix E). Pumping during the final stage of well development was carried out until a minimum of four well-bore volumes of groundwater were extracted, water quality parameters stabilized, and turbidity reached less than 10 nephelometric turbidity units (NTU).

2.1.6 Extraction Tests

Based on previously reported aquifer test results, the SGU at IRP Site 24 is heterogeneous. Extraction rates from the SGU are highly variable and are anticipated to range from approximately 5 gallons per minute (gpm) to 40 gpm (BNI 1998). Extraction tests were performed to estimate the sustainable flow rates within the proposed SGU extraction well field.

Step-drawdown tests were conducted at newly installed wells 24EX9, 24EX10, 24EX11, 24EX12B, 24EX13A, 24EX14, and existing well 24EX8 to determine the rates most appropriate for 72-hour extraction tests. The 72-hour extraction tests were conducted on wells 24EX9, 24EX10, 24EX11, 24EX12B, 24EX13A, 24EX14, and 24EX8. Figure 2-1 shows test well locations, and Plate 1 shows test well and associated observation well locations. The approximate distances between the test wells and the observation wells are summarized in Table 2-9.

Table 2-9: Summary of Distances between Extraction and Observation Wells

Pumping Well		Pump Intake (feet bgs)	Observation Well		Distance from Pumping Well (feet)
ID	Screen Interval (feet bgs)		ID	Screen Interval (feet bgs)	
24EX9	120–200	195	10_DGMW77	150–170	136
			22_DBMW47	116–156	370
24EX10	115–160	132	24EX11	135–180	200
			18_IDP1	121–681	222
24EX11	135–180	175	18_IDP1	121–681	422
			24EX10	115–160	200
24EX12B	165–210	204	24EX12A	115–160	35
			24EX12C	220–260	37
24EX13A	110–160	153	24EX13C	230–270	33
			24EX13B	165–205	34
24EX14	115–185	174	24EX10	115–160	400
			18_IDP1	121–681	178
24EX8	95–155	155	24MW05B	130–155	208
			24MW05A	95–130	208
			09_DGMW75	114–154	241

Step-drawdown tests were also conducted at existing wells 24EX3, 24EX6, 24EX6OB2, and 24EX3OB1 to determine extraction rates to be used during the groundwater remediation enhancement tests. The enhancement tests are described in Section 2.2.2.

During the extraction tests, groundwater elevation data were collected from all pumping wells and observation wells listed in Table 2-9 using water level transducers (MiniTroll). Water levels were also recorded in pumping wells using manual water level sounders to verify the accuracy of the transducers.

Groundwater samples were collected from the pumping well before and after each 72-hour extraction test.

Each extraction test (step-drawdown test and 72-hour extraction test) included the following procedures:

1. Antecedent monitoring of groundwater elevations was conducted for 48 hours prior to each test in the extraction and corresponding observation wells to identify any temporal trends.
2. A portable weather station was used to record daily precipitation and barometric pressure.
3. Pumping and conveyance equipment was decontaminated in accordance with CLEAN II SOP 11, *Decontamination of Equipment* (BNI 1999), and an equipment blank was collected.

4. The pump was installed at the depth listed in Table 2-9. In general, the pump was installed approximately 5 feet above the bottom of the well to allow maximum drawdown and minimize turbulence at the pump intake.
5. A water level transducer was installed at least 5 feet above the pump to minimize turbulence that might affect the transducer readings.
6. Water level transducers were installed in the observation wells.
7. Extraction was initiated and the flow rate was measured using an in-line flow meter and verified manually using 5 to 50 gallon containers and a stopwatch. Flow rates were all recorded periodically.
8. Groundwater samples were collected.
9. Water levels were measured and recorded by the transducers on a logarithmic cycle to allow for shorter time interval measurements at the beginning of the test and progressively longer intervals as the test progressed.
   - Less than 5 seconds for the first 80 seconds
   - Less than 10 seconds for the next 90 seconds
   - Between 11 and 59 seconds for the next 800 seconds
   - Every minute thereafter
10. Water levels in the pumping wells were also measured manually with a water level sounder. The manual measurements of depth to water were recorded at the following time intervals:
    - Every minute for the first 10 minutes
    - Every 5 minutes for the next 30 minutes
    - Every 10 minutes for the next hour
    - Every 30 minutes thereafter.
11. Water level data were plotted on semi-log graph paper as data were recorded.
12. During step-drawdown testing, flow rate and step duration were adjusted based on water level stabilization observed in the pumping wells.
13. At the end of each 72-hour extraction test, a post-test groundwater sample was collected, and the pump was turned off.
14. Recovery monitoring was initiated using a transducer measurement/recording schedule identical to the drawdown monitoring. Water level recovery was also measured manually in the pumping wells at the same frequencies as the drawdown. The groundwater level was monitored until it reached static conditions or 90 percent recovery (90 percent of pre-test groundwater depth).
15. Extracted groundwater was temporarily stored in 20,000-gallon holding tanks and treated prior to discharge as discussed in Section 5 (Management of IDW) of this report.

2.2 Groundwater Remediation Enhancement Using Soil Vapor Extraction

Groundwater remediation enhancement using soil vapor extraction was performed to evaluate whether SVE would complement and enhance the groundwater remedy by enhancing contaminant mass removal in the capillary fringe. Once the capillary fringe was dewatered, SVE was initiated, vapor samples collected and analyzed as discussed below. Data collected was evaluated and presented in Section 4.4.

2.2.1 Step-Drawdown Tests

Step-drawdown tests were performed at five existing wells to estimate maximum sustainable extraction rates for evaluating groundwater remediation enhancement using SVE. These wells include the two proposed in the WP (Earth Tech 2003b) (24EX6 and24EX3) and two additional wells (24EX6OB2 and 24EX3OB1) that had the highest concentrations of TCE (960 and 520 μg/L, respectively) in the Round 17 groundwater-monitoring event (CDM 2003a). All four wells are located at the TCE hot spots near Buildings 296 and 297, as shown on Plate 1. Table 2-10 summarizes the well details. Step-drawdown procedures are the same as described in Section 2.1.6.

Table 2-10: Extraction Well Details for Groundwater Remediation Enhancement

Well ID	Well Diameter (inches)	Total Depth (feet bgs)	Screen Interval (feet bgs)
24EX3	6	186	105–180
24EX6	6	178	103–173
24EX4	6	195	104–190
24EX6OB2	4	156	105–150
24EX3OB1	4	156	105–150

2.2.2 Groundwater Remediation Enhancement Using Soil Vapor Extraction

Groundwater remediation enhancement using SVE was evaluated at wells 24EX3OB1 and 24EX6OB2 due to the higher TCE concentrations in those wells. The intent of the evaluation was to assess the viability and cost-effectiveness of SVE used concurrently with groundwater extraction as a means of accelerating contaminant mass removal. The primary mechanism of remedial enhancement resulting from SVE is removal of vapor-phase VOCs from dewatered soil.

Based on the step-drawdown tests, flow rates of 22 gpm and 14 gpm were chosen as the initial extraction rates at wells 24EX3OB1 and 24EX6OB2, respectively. Groundwater was extracted for 72 hours to provide sufficient dewatering from nearby soils before vacuum was applied for another 72-hour period. Vacuum was applied for an additional 72-hour period at well 24EX6OB2 to further evaluate VOC mass removal. Pressure transducers were used to record water levels at the pumping well and nearby observation wells 24EX3, 24EX3OB2, 24EX3OB3, 24EX6, 24EX6OB1, and 24EX6OB3. Water levels were also measured manually in the pumping well. A PVC sounding tube was used to avoid any effects of cascading groundwater into the well, which would affect proper reading of the water sounder.

A 25-gpm, 2-horsepower groundwater extraction pump system (consisting of the extraction pump and control panel) and a 225-standard cubic feet per minute (scfm) skid-mounted SVE system (consisting of a moisture knockout vessel with automatic transfer [drain] pump, extraction blower with recirculation line, two 1,000-lb vessels of virgin, granular activated carbon [GAC] for treatment of the extracted vapors, and a control panel) were used for this evaluation. The extraction systems were equipped with start-stop switches and plumbed with control valves at the wellhead for controlling the groundwater and soil vapor extraction rates independently. The SVE system was permitted with a various locations permit by the South Coast Air Quality Management District (permit no. F47126). The permit allowed for a maximum flow rate of 225-scfm through the inlet to the system and a maximum VOC concentration at the inlet of the last stage adsorber of 35 parts per million by volume. These parameters were measured when the system was operational to ensure permit compliance. Both the groundwater extraction system and the moisture knockout transfer pump were plumbed to drain into the inlet tanks of the groundwater central treatment system (CTS) located on the east side of Building 296. In addition, the systems were wired to shut down if the inlet tanks at the CTS reached a preset fill level, indicating that the treatment of the accumulated groundwater was not keeping up with the incoming flows. Treatment of the extracted groundwater at the CTS was performed as discussed in Section 5.2. After application of the vacuum to the wellhead, the groundwater extraction flow rates were adjusted to maintain the same drawdown observed without vacuum application. Vapor extraction flow rates were maintained at approximately 50 scfm. Wellhead vapor samples were collected after 1, 4, 24, and 72 hours of operation, submitted to a laboratory, and analyzed for VOCs. In addition, photoionization detector readings were taken periodically at the wellhead and the inlet, midpoint, and outlet of the vapor treatment system. These data were used to evaluate the effectiveness of SVE as an enhancement to groundwater contaminant mass removal (i.e., remediation) and ensure compliance with local permit conditions for the vapor treatment system.

The vapor samples were collected in 1-liter Tedlar bags using an evacuated chamber device that allows the gas to be collected without passing through the vacuum pump, thereby eliminating the chance of cross-contamination. Samples were also collected from the SVE treatment system at the inlet, midpoint, and the outlet to ensure compliance with air permit requirements. Samples were analyzed for VOCs using EPA Method TO14 (modified).

2.3 GEOPHYSICAL SURVEY AND EXPLORATORY TRENCHING

A geophysical survey and exploratory trenching were performed in September and October 2003, along the entire length of the proposed conveyance pipe alignment. The survey and trenching were conducted to estimate the locations of existing underground utilities for the purposes of providing a conveyance pipe alignment as part of the 60-percent design for the on-station SGU remedy.

The approximate length of proposed conveyance pipe is 10,600 feet, of which approximately 7,600 feet consist of the main header line and 3,000 feet, the branches to the individual wells. In addition, the proposed 39 well locations were cleared for subsurface utilities.

The results of this survey and trenching are presented in construction drawings (as plan and profile drawings) in the draft 90-percent design submittal for the SGU remedy (Weston 2004).

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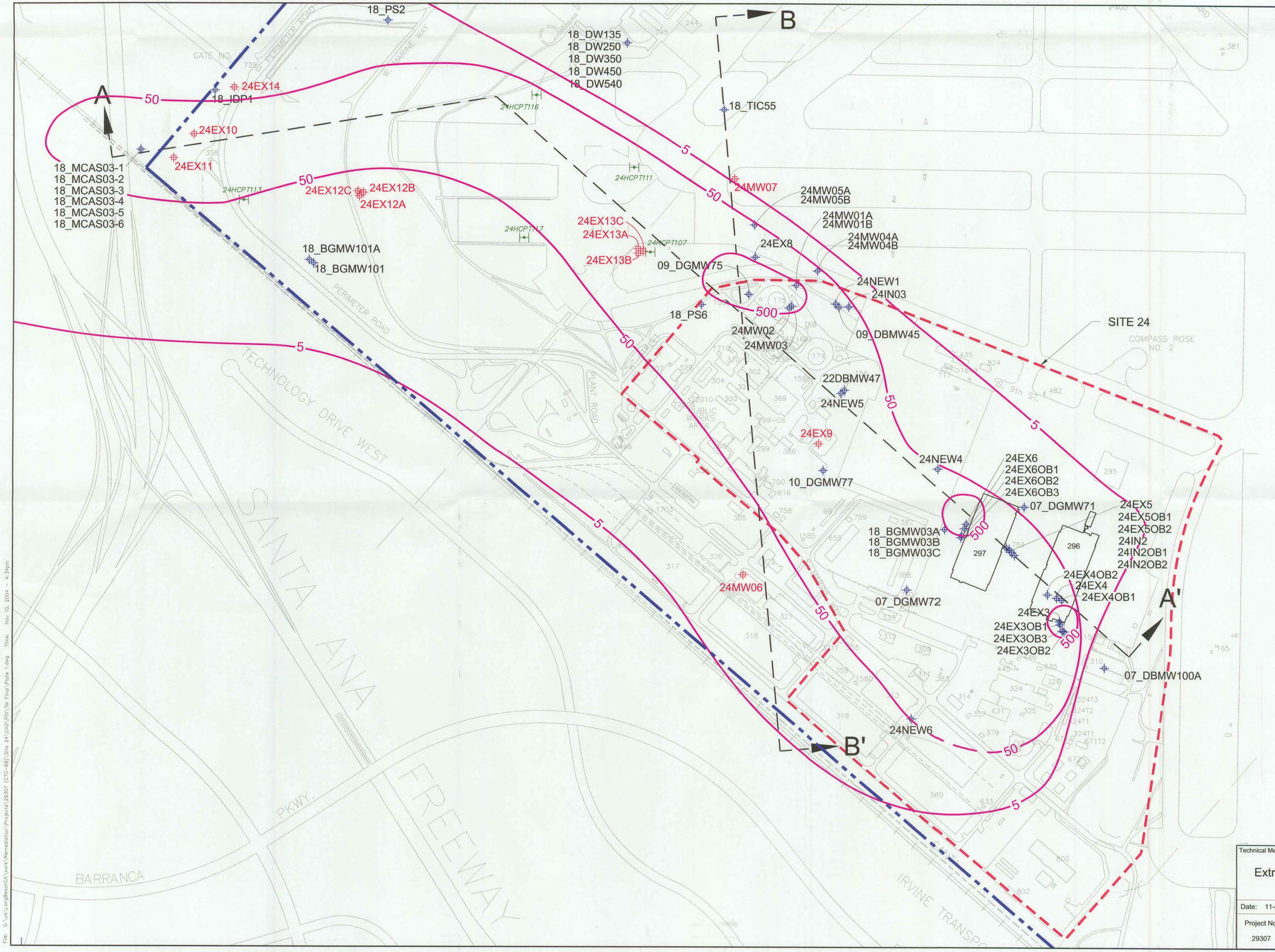

PRIMARY SOURCE OF MAP INFORMATION:
DRAFT GROUNDWATER REMEDIATION PILOT TEST REPORT (BNI, DECEMBER 1998)
FINAL GROUNDWATER MONITORING REPORT, ROUND 17 (CDM, JULY 2003)

LEGEND

- PRE-DESIGN INVESTIGATION WELL
- EXISTING WELL USED IN PRE-DESIGN INVESTIGATION
- PREVIOUS HYDROPUNCH SAMPLE LOCATION USED TO DEVELOP LITHOLOGIC CROSS-SECTIONS (1997-1998)
- SITE BOUNDARY
- FORMER MCAS EL TORO BOUNDARY
- 50 TCE ISOCONCENTRATION CONTOUR (µg/L) [Based on pre-design investigation field sampling results obtained between June and October, 2003 and March 2003 groundwater monitoring data (CDM 2003).]
- A A' CROSS-SECTION LINE

NOTE:

1. SEE PLATE 2 FOR CROSS-SECTION A-A' AND PLATE 3 FOR CROSS-SECTION B-B'
2. PLUME MAPPING BASED ON FINAL GROUNDWATER MONITORING REPORT ROUND 17 (CDM 2003) AND THE SGU PRE-DESIGN INVESTIGATION

NORTH

0 150 300

SCALE: 1" = 300'

Technical Memorandum — Final

Extraction and Monitoring Well Locations

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11-04	Former MCAS El Toro	Plate
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2.4 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

IDW included soil and drilling mud generated during well installation, and extracted groundwater generated from well development, pump tests, and groundwater remediation enhancement tests. Secondary IDW include spent activated carbon and ion-exchange resin as a result of groundwater treatment, and spent activated carbon as a result of vapor treatment. All IDW was classified, labeled, and managed in accordance with EPA guidance and CLEAN II SOP 22, *Investigation-derived Waste Management* (BNI 1999).

2.4.1 Soil and Drilling Mud IDW

Drilling activities for the installation of wells generated approximately 350 cubic yards of soil cuttings and drilling mud as IDW. These were placed into twenty-three 20-cubic yard roll-off bins. The soil and drilling mud were sampled and characterized in preparation for disposal.

2.4.2 Groundwater IDW

Groundwater collected during Phase I and II sampling was stored in 50-gallon drums then transferred to the CTS for treatment. Groundwater extracted from wells during well development and pump tests was temporarily stored in 21,000-gallon storage tanks, then transferred to the CTS for treatment. The CTS was located on the east side of Building 296 and designed with four influent storage tanks (one settling tank and three storage tanks connected in parallel), a treatment train, and two 21,000-gallon effluent storage tanks connected in parallel. The treatment train originally consisted of a 30-horsepower, centrifugal pump, a control panel, two pairs of bag filters arranged in series, a flow meter/totalizer, and two vessels arranged in series containing virgin GAC. The control panel allowed for manual and automatic operation of the transfer pump. Two float switches were used to control the pump under automatic operation. One float switch was installed in the influent tank and was set to shut off the pump if the water level neared the bottom of the tank. The other float switch was installed in the effluent tank and was set to shut off the transfer pump when the water level neared the top of the tank. The treatment train was subsequently modified with the addition of two vessels connected in series containing perchlorate-specific, ion-exchange (IX) resin. The treated groundwater was discharged to a percolation area located approximately 200 feet east of the CTS. Figure 2-2 contains a site plan showing the locations of the CTS and percolation area.

2.4.3 Spent Carbon and Ion-Exchange Resin

Four 1,000-lb vessels of spent liquid-phase GAC and two 1,500-lb vessels of spent perchlorate-specific, IX resin were generated from operation of the CTS, and two 1,000-lb vessels of vapor-phase GAC were generated from operation of the SVE system. Batch samples of the liquid-phase GAC, IX resin, and vapor-phase GAC were collected for analysis prior to transport and disposal off site.

PAGE NO. 2-18

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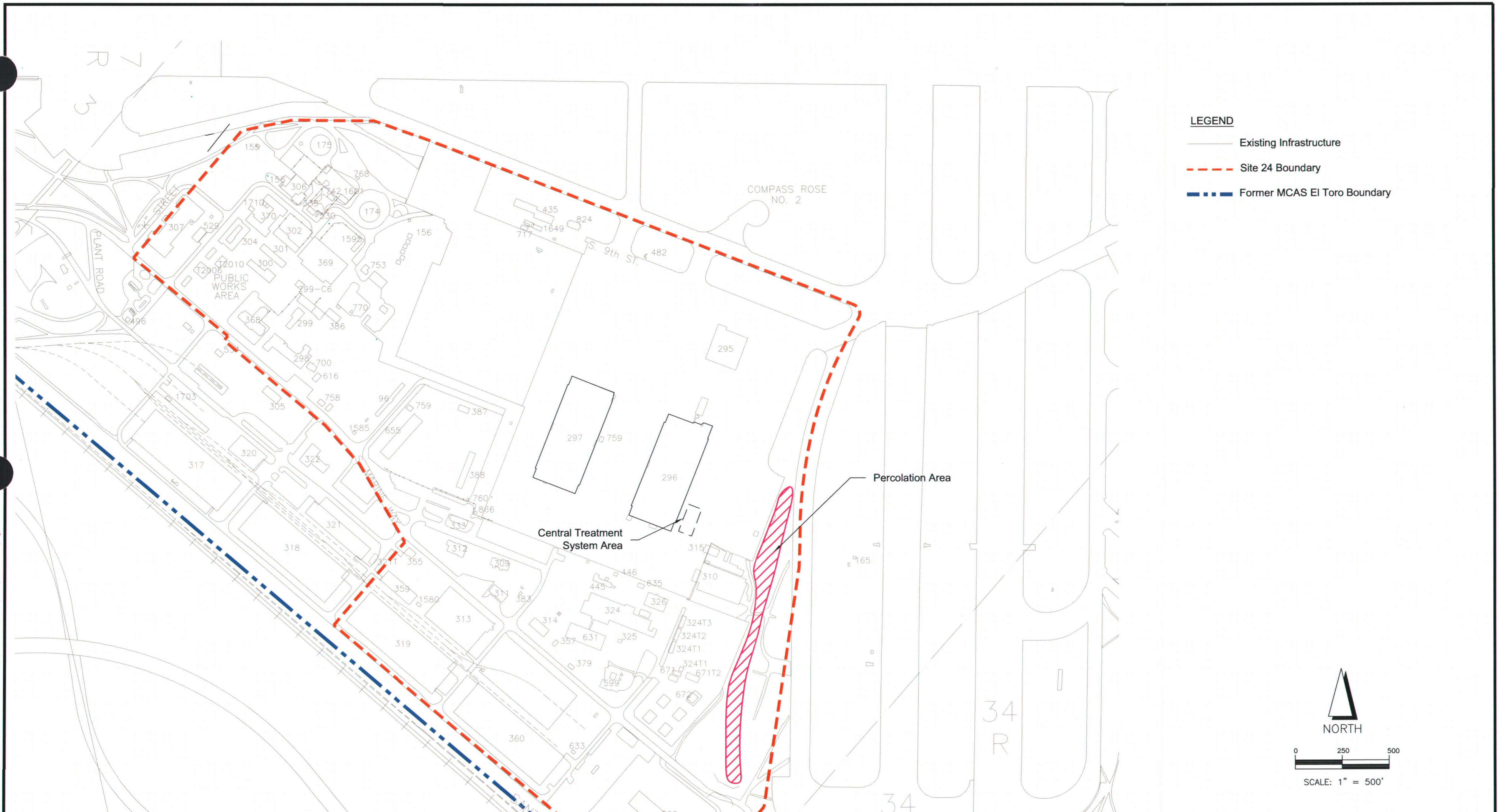

Technical Memorandum — Final

Locations of Central Treatment System and Percolation Area

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11–04	Former MCAS El Toro	Figure
Project No. 29307	EARTH TECH, A tyco INTERNATIONAL LTD. COMPANY	2–2

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3. SAMPLE ANALYSIS AND DATA VALIDATION

3.1 GROUNDWATER SAMPLING

As part of the pre-design investigation at IRP Site 24, groundwater sampling was conducted in accordance with applicable CLEAN II SOPs (BNI 1999). During Phase I, groundwater samples were collected from existing monitoring wells using PDBs and low-flow sampling techniques. All samples were collected in 40-mL VOA vials with HCl preservative and labeled with unique EPA identification (ID) numbers. Each sample was also assigned a unique descriptive sample ID number and recorded in the field logs. Groundwater samples collected during Phase I field activities at IRP Site 24 are listed in Table 3-1. The samples were sent to a state-certified laboratory for VOC analysis. Validated analytical data from the Phase I groundwater sampling are included in Appendix A.

Table 3-1: Phase I Groundwater Sampling Summary

EPA ID	Source	Descriptive Sample ID	Sample Description	Depth (feet bgs)	Sampling Date
LC501	Trip Blank	24-QW-T-050203	Quality Control	—	05/02/03
LC502	Field Blank	24-QW-F-050203	Quality Control	—	05/02/03
LC503	24EX5OB1	24-GW-24EX5OB1-S01-D109	PDB	109	05/02/03
LC504	24EX5OB1	24-GW-24EX5OB1-S01-D126	PDB	126	05/02/03
LC505	24EX5OB1	24-GW-24EX5OB1-S01-D144	Low-Flow	144	05/02/03
LC506	24NEW4	24-GW-24NEW4-S01-D109	PDB	109	05/02/03
LC507	24NEW4	24-GW-24NEW4-S01-D127	PDB	127	05/02/03
LC508	24NEW4	24-GW-24NEW4-S01-D144	PDB	144	05/02/03
LC509	24NEW5	24-GW-24NEW5-S01-D230	PDB	230	05/02/03
LC510	24NEW5	23-GW-24NEW5-S01-D239	PDB	239	05/02/03
LC511	24NEW5	24-GW-24NEW5-S01-D248	PDB	248	05/02/03
LC512	09_DGMW75	24-GW-09DGMW75-S01-D119	PDB	119	05/02/03
LC513	09_DGMW75	24-GW-09DGMW75-D01-D119	Duplicate of LC512	119	05/02/03
LC514	09_DGMW75	24-GW-09DGMW75-S01-D133	PDB	133	05/02/03
LC515	09_DGMW75	24-GW-09DGMW75-S01-D149	PDB	149	05/02/03
LC516	07_DGMW71	24-07DGMW71GW-01S-D125	Low-Flow	125	06/13/03
LC517	24MW05A	24-24MW05AGW-01S-D120	Low-Flow	120	06/13/03
LC518	Trip Blank	24-QW-T-061303	Quality Control	—	06/13/03
LC519	Equipment Rinsate	24-QW-E-061303	Quality Control	—	06/13/03
LC520	Field Blank	24-QW-F-061303	Quality Control	—	06/13/03
LC521	07_DGMW72	24-07DGMW72GW-01S-D130	Low-Flow	130	06/16/03
LC522	18_BGMW101	24-18BGMW101GW-01S-D110	Low-Flow	110	06/16/03
LC523	24MW04 (Shallow)	24-24MW04AGW-01S-D120	Low-Flow	120	06/16/03
LC524	Equipment Rinsate	24-QW-E-061603	Quality Control	—	06/16/03
LC525	Trip Blank	24-QW-T-061603	Quality Control	—	06/16/03
LC526	24EX4OB2	24-24EX4OB2GW-01S-D135	Low-Flow	135	06/17/03
LC527	24EX4OB2	24-24EX4OB2GW-02D-D135	Duplicate of LC526	135	06/17/03
LC528	24MW04 (Deep)	24-24MW04BGW-01S-D150	Low-Flow	150	06/17/03
LC529	24MW05 (Deep)	24-24MW05BGW-01S-D150	Low-Flow	150	06/17/03
LC530	24MW04 (Deep)	24-24MW04BGW-02D-D150	Duplicate of LC528	150	06/17/03
LC531	24EX3OB3	24-24EX3OB3GW-01S-D173	Low-Flow	172.5	06/17/03

EPA ID	Source	Descriptive Sample ID	Sample Description	Depth (feet bgs)	Sampling Date
LC532	10_DGMW77	24-10DGMW77GW-01S-D160	Low-Flow	160	06/17/03
LC533	18PS6	24-18PS6GW-01S-D140	Low-Flow	140	06/17/03
LC534	Equipment Rinsate	24-QW-E-061703	Quality Control	—	06/17/03
LC535	Trip Blank	24-QW-T-061703	Quality Control	—	06/17/03
LC536	24MW01A	24-24MW01AGW-01S-D120	Low-Flow	120	06/18/03
LC537	24MW01B	24-24MW01BGM-01S-D150	Low-Flow	150	06/18/03
LC538	24MW03	24-24MW03GW-01S-D120	Low-Flow	120	06/18/03
LC539	24EX8	24-24EX08GW-01S-D125	Low-Flow	125	06/18/03
LC540	Equipment Rinsate	24-QW-E-061803	Quality Control	—	06/18/03
LC541	24IN2OB2	24-24IN2OB2GW-01S-D232	Low-Flow	232	06/18/02
LC542	Trip Blank	24-QW-T-061803	Quality Control	—	06/18/03
LC543	Trip Blank	24-QW-T-061903	Quality Control	—	06/19/03
LC544	24EX6OB1	24-24EX6OB1GW-01S-D128.5	Low-Flow	128.5	06/19/03
LC545	18_BGMW03A	24-18BGMW03AGW-01S-D377	Low-Flow	377	06/19/03
LC546	Equipment Rinsate	24-QW-E-061903	Quality Control	—	06/19/03
LC547	18_BGMW03C	24-18BGMW03CGW-01S-D232	Low-Flow	232	06/19/03
LC548	Trip Blank	24-QW-T-062003	Quality Control	—	06/20/03
LC549	24EX6OB3	24-24EX6OB3GW-01S-D223	Low-Flow	223	06/20/03
LC550	18_BGMW03B	24-18BGMW03BGW-01S-D290	Low-Flow	290	06/20/03
LC551	24MW02	24-24MW02GW-01S-D150	Low-Flow	150	06/20/03
LC552	24EX3	24-24EX3GW-01S-D115	PDB	115	06/24/03
LC553	24EX3	24-24EX3GW-02S-D125	PDB	125	06/24/03
LC554	24EX3	24-24EX3GW-03S-D135	PDB	135	06/24/03
LC555	24EX3	24-24EX3GW-04S-D145	PDB	145	06/24/03
LC556	24EX3	24-24EX3GW-05S-D155	PDB	155	06/24/03
LC557	24EX3	24-24EX3GW-06S-D165	PDB	165	06/24/03
LC558	24EX3	24-24EX3GW-07S-D175	PDB	175	06/24/03
LC559	24EX3OB2	24-24EX3OB2GW-01S-D110	PDB	110	06/24/03
LC560	24EX3OB2	24-24EX3OB2GW-02S-D120	PDB	120	06/24/03
LC561	24EX3OB2	24-24EX3OB2GE-03S-D130	PDB	130	06/24/03
LC562	24EX3OB2	24-24EX3OB2-04D-D130	Duplicate of LC561	130	06/24/03
LC563	24EX4	24-24EX4GW-01S-D110	PDB	110	06/24/03
LC564	24EX4	24-24EX4GW-02S-D120	PDB	120	06/24/03
LC565	24EX4	24-24EX4GW-03S-D130	PDB	130	06/24/03
LC566	24EX4	24-24EX4GW-06S-D140	PDB	140	07/17/03
LC567	24EX4	24-24EX4GW-04S-D170	PDB	170	06/24/03
LC568	24EX4	24-24EX4GW-05S-D180	PDB	180	06/24/03
LC569	24EX4	24-24EX4GW-07S-D150	PDB	150	07/17/03
LC570	24EX4	24-24EX4GW-08S-D160	PDB	160	07/17/03
LC571	24EX4OB1	24-24EX4OB1GW-01S-D110	PDB	110	06/24/03
LC572	24EX4OB1	24-24EX4OB1GW-02S-D120	PDB	120	06/24/03
LC573	24EX4OB1	24-24EX4OB1GW-03D-D120	Duplicate of LC572	120	06/24/03
LC574	24EX4OB1	24-24EX4OB1GW-04S-D130	PDB	130	06/24/03
LC575	24EX5OB1	24-24EX5OB1GW-01S-D110	PDB	110	06/24/03
LC576	24EX5OB1	24-24EX5OB1GW-02S-D127	PDB	127	06/24/03

EPA ID	Source	Descriptive Sample ID	Sample Description	Depth (feet bgs)	Sampling Date
LC577	24EX5OB1	24-24EX5OB1GW-03S-D145	PDB	145	06/24/03
LC578	24EX5OB2	24-24EX5OB2GW-01S-D110	PDB	110	06/24/03
LC579	24EX5OB2	24-24EX5OB2GW-02S-D120	PDB	120	06/24/03
LC580	24EX5OB2	24-24EX5OB2GW-03S-D130	PDB	130	06/24/03
LC581	24EX5OB2	24-24EX5OB2GW-04S-D140	PDB	140	06/24/03
LC582	24IN2	24-24IN2GW-01S-D200	PDB	200	06/24/03
LC583	24IN2	24-24IN2GW-02S-D210	PDB	210	06/24/03
LC584	24IN2	24-24IN2GW-03S-D220	PDB	220	06/24/03
LC585	24IN2	24-24IN2GW-04S-D230	PDB	230	06/24/03
LC586	24IN2	24-24IN2GW-05S-D240	PDB	240	06/24/03
LC587	24IN2	24-24IN2GW-06S-D250	PDB	250	06/24/03
LC588	24EX6	24-24EX6GW-01S-D110	PDB	110	06/24/03
LC589	24EX6	24-24EX6GW-02S-D120	PDB	120	06/24/03
LC590	24EX6	24-24EX6GW-03S-D130	PDB	130	06/24/03
LC591	24EX6	24-24EX6GW-04S-D140	PDB	140	06/24/03
LC592	24EX6	24-24EX6GW-05D-D140	Duplicate of LC591	140	06/24/03
LC593	24EX6	24-24EX6GW-06S-D150	PDB	150	06/24/03
LC594	24EX6	24-24EX6GW-07S-D160	PDB	160	06/24/03
LC595	24EX6	24-24EX6GW-08S-D170	PDB	170	06/24/03
LC596	24IN03	24-24IN03GW-01S-D100	PDB	100	06/24/03
LC597	24IN03	24-24IN03GW-02D-D100	Duplicate of LC596	100	06/24/03
LC598	24IN03	24-24IN03GW-03S-D110	PDB	110	06/24/03
LC599	24IN03	24-24IN03GW-04S-D120	PDB	120	06/24/03
LC600	24IN03	24-24IN03GW-05S-D130	PDB	130	06/24/03
LC601	24IN03	24-24IN03GW-06S-D140	PDB	140	06/24/03
LC602	24IN03	24-24IN03GW-07S-D150	PDB	150	06/24/03
LC603	24NEW4	24-24NEW4GW-01S-D115	PDB	115	06/24/03
LC604	24NEW4	24-24NEW4GW-02S-D125	PDB	125	06/24/03
LC605	24NEW4	24-24NEW4GW-03S-D135	PDB	135	06/24/03
LC606	24NEW4	24-24NEW4GW-04S-D145	PDB	145	06/24/03
LC607	Field Blank	24-QW-F-062403	Quality Control	—	06/24/03
LC608	Trip Blank	24-QW-T-062403	Quality Control	—	06/24/03
LC609	Trip Blank	24-QW-T-071703	Quality Control	—	07/17/03
LC610	TIC55	24-TIC55GW-01S-D325	PDB	325	07/17/03
LC611	TIC55	24-TIC55GW-02S-D375	PDB	375	07/17/03
LC612	TIC55	24-TIC55GW-03S-D425	PDB	425	07/17/03

The results of the Phase I sampling were, in part, used for the placement of the two new monitoring wells (24MW06 and 24MW07).

Phase II sampling was initiated after all the new extraction and monitoring wells were installed. Groundwater samples collected during Phase II field activities are listed in Table 3-2. All samples were collected in 40-mL VOA vials with HCl preservative and labeled with a unique EPA ID number. A unique descriptive sample ID number was also assigned to each sample and recorded in the field log and database.

Table 3-2: Phase II Groundwater Sampling Summary

EPA ID	Source	Descriptive Sample ID	Sample Description	Depth (feet bgs)	Sampling Date
LC613	Equipment Rinsate	24-QW-E-072203	Quality Control	—	07/22/03
LC614	Trip Blank	24-QW-T-072203	Quality Control	—	07/22/03
LC615	Field Blank	24-QW-F-072203	Quality Control	—	07/22/03
LC616	Equipment Rinsate	24-QW-E-072303	Quality Control	—	07/23/03
LC617	Trip Blank	24-QW-T-072303	Quality Control	—	07/23/03
LC618	Equipment Rinsate	24-QW-E-072503	Quality Control	—	07/25/03
LC619	Trip Blank	24-QW-T-072503	Quality Control	—	07/25/03
LC620	Equipment Rinsate	24-QW-E-072903	Quality Control	—	07/29/03
LC621	Trip Blank	24-QW-T-072903	Quality Control	—	07/29/03
LC622	Equipment Rinsate	24-QW-E-073103	Quality Control	—	07/31/03
LC623	Trip Blank	24-QW-T-073103	Quality Control	—	07/31/03
LC641	Equipment Rinsate	24-QW-E-082103	Quality Control	—	08/21/03
LC642	Field Blank	24-QW-F-082103	Quality Control	—	08/21/03
LC643	Trip Blank	24-QW-T-082103	Quality Control	—	08/21/03
LC644	Trip Blank	24-QW-T-082603	Quality Control	—	08/26/03
LC645	Equipment Rinsate	24-QW-E-082603	Quality Control	—	08/26/03
LC646	Equipment Rinsate	24-QW-E-082603	Quality Control	—	08/26/03
LC647	24EX09	24-24EX09GW-01S-D195	Prelim. – 72-hr test	195	08/26/03
LC648	24EX09	24-24EX09GW-02D-D195	Prelim. – 72-hr test (Duplicate)	195	08/26/03
LC649	Trip Blank	24-QW-T-082703	Quality Control	—	08/27/03
LC650	24EX12A	24-24EX12AGW-01S-D120	PDB	120	08/27/03
LC651	24EX12A	24-24EX12AGW-02S-D130	PDB	130	08/27/03
LC652	24EX12A	24-24EX12AGW-03S-D140	PDB	140	08/27/03
LC653	24EX12A	24-24EX12AGW-04S-D150	PDB	150	08/27/03
LC654	24EX12B	24-24EX12BGW-01S-D170	PDB	170	08/27/03
LC655	24EX12B	24-24EX12BGW-02S-D180	PDB	180	08/27/03
LC656	24EX12B	24-24EX12BGW-03S-D190	PDB	190	08/27/03
LC657	24EX12B	24-24EX12BGW-04S-D200	PDB	200	08/27/03
LC658	24EX12C	24-24EX12CGW-01S-D225	PDB	225	08/27/03
LC659	24EX12C	24-24EX12CGW-02S-D235	PDB	235	08/27/03
LC660	24EX12C	24-24EX12CGW-03D-D235	PDB (Duplicate of LC659)	235	08/27/03
LC661	24EX12C	24-24EX12CGW-04S-D245	PDB	245	08/27/03
LC662	24EX12C	24-24EX12CGW-05S-D255	PDB	255	08/27/03
LC663	24EX13A	24-24EX13AGW-01S-D115	PDB	115	08/27/03
LC664	24EX13A	24-24EX13AGW-02S-D125	PDB	125	08/27/03
LC665	24EX13A	24-24EX13AGW-03S-D135	PDB	135	08/27/03
LC666	24EX13A	24-24EX13AGW-04S-D145	PDB	145	08/27/03
LC667	24EX13A	24-24EX13AGW-05S-D155	PDB	155	08/27/03
LC668	24EX13B	24-24EX13BGW-01S-D175	PDB	175	08/27/03
LC669	24EX13B	24-24EX13BGW-02S-D185	PDB	185	08/27/03
LC670	24EX13B	24-24EX13BGW-03S-D195	PDB	195	08/27/03
LC671	24EX13B	24-24EX13BGW-04D-D195	PDB (Duplicate of LC670)	195	08/27/03
LC672	24EX13B	24-24EX13BGW-05S-D205	PDB	205	08/27/03

EPA ID	Source	Descriptive Sample ID	Sample Description	Depth (feet bgs)	Sampling Date
LC673	24EX13C	24-24EX13CGW-01S-D235	PDB	235	08/27/03
LC674	24EX13C	24-24EX13CGW-02S-D245	PDB	245	08/27/03
LC675	24EX13C	24-24EX13CGW-03S-D255	PDB	255	08/27/03
LC676	24EX13C	24-24EX13CGW-04S-D265	PDB	265	08/27/03
LC677	24MW06	24-24MW06GW-01S-D175	PDB	175	08/27/03
LC678	24EX09	24-24EX09GW-03S-D195	Final — 72-hr test	195	08/29/03
LC679	Equipment Rinsate	24-QW-E-082903	Quality Control	—	08/29/03
LC680	Trip Blank	24-QW-T-082903	Quality Control	—	08/29/03
LC681	Trip Blank	24-QW-T-090203	Quality Control	—	09/02/03
LC682	24EX08	24-24EX08GW-02S-D155	Prelim. – 72-hr test	155	09/02/03
LC683	Trip Blank	24-QW-T-090203	Quality Control	—	09/02/03
LC689	Trip Blank	24-QW-T-090403	Quality Control	—	09/04/03
LC690	Equipment Rinsate	24-QW-E-090403	Quality Control	—	09/04/03
LC691	Trip Blank	24-QW-T-090503	Quality Control	—	09/05/03
LC692	24EX08	24-24EX08GW-03S-D155	Final – 72-hr test	155	09/05/03
LC693	Trip Blank	24-QW-T-090803	Quality Control	—	09/08/03
LC694	24EX14	24-24EX14GW-01S-D174	Prelim. – 72-hr test	174	09/08/03
LC695	Equipment Rinsate	24-QW-E-090803	Quality Control	—	09/08/03
LC696	Trip Blank	24-QW-T-091103	Quality Control	—	09/11/03
LC697	24EX14	24-24EX14GW-02S-D174	Final – 72-hr test	174	09/11/03
LC707	Trip Blank	24-QW-T-091503	Quality Control	—	09/15/03
LC708	24EX12B	24-24EX12BGW-05S-D204	Prelim. – 72-hr test	204	09/15/03
LC709	24EX12B	24-24EX12BGW-06D-D204	Prelim. – 72-hr test (Duplicate)	204	09/15/03
LC714	Trip Blank	24-QW-T-091703	Quality Control	—	09/17/03
LC715	Equipment Rinsate	24-QW-E-091703	Quality Control	—	09/17/03
LC716	Trip Blank	24-QW-T-091803	Quality Control	—	09/18/03
LC717	24EX09	24-24EX09GW-04S-D160	PDB	160	09/18/03
LC718	24EX12B	24-24EX12BGW-07D-D204	Final – 72-hr test	204	09/18/03
LC719	24EX12B	24-24EX12BGW-08D-D204	Final – 72-hr test (Duplicate)	204	09/18/03
LC737	Trip Blank	24-QW-T-092903	Quality Control	—	09/29/03
LC738	24EX13A	24-24EX13AGW-06S-D153	Prelim. – 72-hr test	153	09/29/03
LC743	Trip Blank	24-QW-T-100103	Quality Control	—	10/01/03
LC744	Equipment Rinsate	24-QW-E-100103	Quality Control	—	10/01/03
LC745	Trip Blank	24-QW-T-100203	Quality Control	—	10/02/03
LC746	24EX13A	24-24EX13AGW-07S-D153	Final – 72-hr test	153	10/02/03
LC750	Trip Blank	24-QW-T-100203	Quality Control	—	10/02/03
LC751	Equipment Rinsate	24-QW-E-100203	Quality Control	—	10/02/03
LC758	Trip Blank	24-QW-T-100703	Quality Control	—	10/07/03
LC759	24EX11	24-24EX11GW-01S-D175	Prelim. – 72-hr test	175	10/07/03
LC760	24EX10	24-24EX10GW-01S-D132	Prelim. – 72-hr test	132	10/07/03
LC765	Trip Blank	24-QW-T-101003	Quality Control	—	10/10/03
LC766	24EX11	24-24EX11GW-02S-D175	Final – 72-hr test	175	10/10/03
LC767	24EX11	24-24EX11GW-03D-D175	Final – 72-hr test (Duplicate)	175	10/10/03
LC768	24EX10	24-24EX10GW-02S-D132	Final – 72-hr test	132	10/10/03
LC769	24MW07	24-24MW07GW-01S-D125	PDB	125	10/10/03

EPA ID	Source	Descriptive Sample ID	Sample Description	Depth (feet bgs)	Sampling Date
LC770	24MW07	24-24MW07GW-02S-D135	PDB	135	10/10/03
LC771	24MW07	24-24MW07GW-03S-D145	PDB	145	10/10/03
LC772	24MW07	24-24MW07GW-04S-D155	PDB	155	10/10/03
LC773	24MW07	24-24MW07GW-05D-D155	PDB (Duplicate of LC772)	155	10/10/03
LC774	24MW07	24-24MW07GW-06S-D165	PDB	165	10/10/03
LC775	24MW07	24-24MW07GW-07S-D175	PDB	175	10/10/03
LC776	24MW07	24-24MW07GW-08S-D185	PDB	185	10/10/03
LC777	24MW07	24-24MW07GW-09S-D195	PDB	195	10/10/03
LC778	24EX10	24-24EX10GW-03S-D120	PDB	120	10/24/03
LC779	24EX10	24-24EX10GW-04S-D130	PDB	130	10/24/03
LC780	24EX10	24-24EX10GW-05S-D140	PDB	140	10/24/03
LC781	24EX10	24-24EX10GW-06S-D150	PDB	150	10/24/03
LC782	24EX11	24-24EX11GW-04S-D140	PDB	140	10/24/03
LC783	24EX11	24-24EX11GW-05S-D150	PDB	150	10/24/03
LC784	24EX11	24-24EX11GW-06S-D160	PDB	160	10/24/03
LC785	24EX11	24-24EX11GW-07S-D170	PDB	170	10/24/03
LC786	24EX14	24-24EX14GW-03S-D120	PDB	120	10/24/03
LC787	24EX14	24-24EX14GW-04S-D130	PDB	130	10/24/03
LC788	24EX14	24-24EX14GW-05D-D130	PDB (Duplicate of LC787)	130	10/24/03
LC789	24EX14	24-24EX14GW-06S-D140	PDB	140	10/24/03
LC790	24EX14	24-24EX14GW-07S-D150	PDB	150	10/24/03
LC791	24EX14	24-24EX14GW-08S-D160	PDB	160	10/24/03
LC792	24EX14	24-24EX14GW-09S-D170	PDB	170	10/24/03
LC793	24EX14	24-24EX14GW-10S-D180	PDB	180	10/24/03
LC794	Trip Blank	24-QW-T-102403	Quality Control	—	10/24/03

hr hour
ET Earth Tech

Handling and preservation techniques were performed in accordance with CLEAN II SOP 10, *Sample Custody, Transfer, and Shipment* (BNI 1999). Table 3-3 lists the chemical parameter tested, analytical and preservation requirements, and the type of container used for groundwater sampling and analysis.

Table 3-3: Requirements for Groundwater Sample Analysis, Preservation, Maximum Holding Time, and Containers

Analyte	Analytical Method	Preservation	Maximum Holding Time [a]	Number × Sample Container Type
VOCs	SW5030B/ SW8260B	HCl to pH<2 Cool to 4°C	14 days	4 × 40-mL VOA vial w/ Teflon-lined septa

[a] From sample collection to analysis

3.2 SOIL-VAPOR SAMPLING

An evaluation of groundwater remediation enhancement using SVE was conducted in accordance with applicable CLEAN II SOPs (BNI 1999). Vapor samples were collected from two existing wells (24EX3OB1 and 24EX6OB2) at the VOC source area, 1-, 4-, 24-, and 72-hours after applying the vacuum to the wellheads. All samples were collected in Tedlar bags and labeled with a unique EPA ID number. Each sample was also assigned a unique descriptive sample ID number and recorded in the field logs. The vapor samples were sent to a state-certified laboratory for VOC analysis using EPA Method TO-14 (modified) (see Table 3-4). The SVE system was operated for a second 72-hour period at 24EX6OB2 to further evaluate VOC mass removal. Results of this test are discussed in Section 4.4.

Table 3-4: Soil Vapor Sampling Summary

EPA ID	Source	Descriptive ET Sample ID	Sample Description	Date
LC698	24EX3OB1	24-24EX3OB1SG-01VS-D091103	Well Head, 1-hr	09/11/03
LC699	Treatment System	24-24EX3OB1(SP02) SG-01VS-D091103	Mid-point	09/11/03
LC700	Treatment System	24-24EX3OB1(SP03) SG-01VS-D091103	Outlet	09/11/03
LC702	24EX3OB1	24-24EX3OB1SG-02VS-D091103	Well Head, 4-hr	09/11/03
LC703	24EX3OB1	24-24EX3OB1SG-03VS-D091203	Well Head, 24-hr	09/12/03
LC706	24EX3OB1	24-24EX3OB1SG-04VS-D091403	Well Head, 72-hr	09/14/03
LC730	24EX6OB2	24-24EX6OB2SG-01VS-D092503	Well Head, 1-hr	09/25/03
LC731	24EX6OB2	24-24EX6OB2SG-02VS-D092503	Well Head, 4-hr	09/25/03
LC732	Treatment System	24-24EX6OB2(SP02) SG-01VS-D092503	Mid-point	09/25/03
LC733	Treatment System	24-24EX6OB2(SP03) SG-01VS-D092503	Outlet	09/25/03
LC734	24EX6OB2	24-24EX6OB2SG-03VS-D092603	Well Head, 24-hr	09/26/03
LC735	24EX6OB2	24-24EX6OB2SG-04VS-D092803	Well Head, 72-hr	09/28/03
LC736	24EX6OB2	24-24EX6OB2SG-05VSD-D092803	Well Head, 72-hr (Duplicate)	09/28/03
LC752	24EX6OB2	24-24EX6OB2SG-06VS-D100303	Well Head, 72-hr after second startup	10/03/03
LC753	24EX6OB2	24-24EX6OB2SG-07VSD-D100303	Well Head, 72-hr after second startup (Duplicate)	10/03/03

3.3 SOIL AND DRILLING MUD IDW

Drilling activities for the installation of wells generated approximately 350 cubic yards of soil cuttings and drilling mud as IDW. These were placed into twenty-three 20-cubic yard roll-off bins. The soil and drilling mud were sampled and characterized in preparation for disposal.

3.3.1 Waste Characterization

Two sets of five composite soil samples and one drilling mud composite sample (for a total of six samples per set) were sent to an analytical laboratory for analysis. All samples were collected in two 8-ounce glass jars, labeled with unique EPA ID numbers, and immediately placed on ice in a cooler. Each sample was also assigned a unique descriptive sample ID number and recorded in the field logs. Each sample was a composite of samples from bins containing soil or drilling mud from the same boreholes. Analytical laboratory testing for pH, and VOC and metals analyses by the federal Toxicity Characteristic Leachate Procedure (TCLP) and California Waste Extraction Test (WET) were performed on one set of samples (LC635–LC640). The second set of samples (LC720-LC725) was submitted for total VOCs, petroleum hydrocarbons, and metals concentration analyses. Soil and drilling mud samples collected for characterization are listed in Table 3-5.

Table 3-5: List of Soil and Drilling Mud IDW Samples Collected

EPA ID	Source	Descriptive ET Sample ID	Sample Date
LC635	24EX10, 24EX11, 24EX14	24-IDWSOIL-01S	08/21/03
LC636	24EX12A, 24EX12B, 24EX12C	24-IDWSOIL-02S	08/21/03
LC637	24EX13A, 24EX13B, 24EX13C, 24MW07	24-IDWSOIL-03S	08/21/03

EPA ID	Source	Descriptive ET Sample ID	Sample Date
LC638	24MW06	24-IDWSOIL-04S	08/21/03
LC639	24EX09	24-IDWSOIL-05S	08/21/03
LC640	Drilling mud	24-IDWSOIL-06S	08/21/03
LC720	24EX10, 24EX11, 24EX14	24-IDWSOIL-07S	09/19/03
LC721	24EX12A, 24EX12B, 24EX12C	24-IDWSOIL-08S	09/19/03
LC722	24EX13A, 24EX13B, 24EX13C, 24MW07	24-IDWSOIL-09S	09/19/03
LC723	24MW06	24-IDWSOIL-10S	09/19/03
LC724	24EX09	24-IDWSOIL-11S	09/19/03
LC725	Drilling mud	24-IDWSOIL-12S	09/19/03

3.4 GROUNDWATER IDW

The CTS was operated primarily under California Regional Water Quality Control Board, Santa Ana Region, Waste Discharge Requirement (WDR), Order No. R8-2002-0033 adopted on 30 May 2002. However, amendments to this order (WDR Order No. R8-2003-0085) (as far as CTS operation is concerned) were adopted on 3 October 2003 that 1) revised the maximum daily limit for tert-butyl alcohol (TBA), 2) included a provision for determining compliance with the average monthly limit for TBA, and 3) included effluent limits for cis- and trans- 1,2-dichloroethylene (cis- and trans- 1,2-dichloroethene), 1,4-dioxane, and perchlorate. The discharge requirements for the CTS-treated groundwater are summarized in Appendix F.

3.4.1 Waste Characterization

Influent, midpoint, and effluent water samples were collected in accordance with the SAP presented in Table B-2 of the WP for the pre-design investigation (Earth Tech 2003b). Each sample was assigned a unique EPA ID, as well as a descriptive sample ID number and recorded in the field logs. Water samples collected at the CTS are listed in Table 3-6.

Table 3-6: List of CTS Water Samples Collected

EPA ID	Source	Descriptive Sample ID	Sample Date
LC624	CTS – Influent	24-CTSINFGW-01S	07/31/03
LC625	CTS – Effluent	24-CTSEFFGW-01S	07/31/03
LC626	Field QC Trip Blank	24-QW-T-073103	07/31/03
LC631	CTS – Influent	24-CTSINFGW-02S	08/07/03
LC632	CTS – Effluent	24-CTSEFFGW-02S	08/07/03
LC684	CTS – Influent	24-CTSINFGW-03S	09/02/03
LC685	Field QC Trip Blank	24-QW-T-090203	09/02/03
LC686	CTS – Midpoint	24-CTSMIDGW-01S	09/02/03
LC687	Field QC Trip Blank	24-QW-T-090203	09/02/03
LC688	CTS – Effluent	24-CTSEFFGW-03S	09/02/03
LC696	Field QC Trip Blank	24-QW-T-091103	09/11/03
LC701	CTS – Effluent	24-CTSEFFGW-04S	09/11/03
LC704	Field QC Trip Blank	24-QW-T-091203	09/12/03
LC705	CTS – Midpoint	24-CTSMIDGW-02S	09/12/03
LC707	Field QC Trip Blank	24-QW-T-091503	09/15/03
LC710	Field QC Trip Blank	24-QW-T-091603	09/16/03

EPA ID	Source	Descriptive Sample ID	Sample Date
LC711	CTS – Midpoint	24-CTSMIDGW-03S	09/16/03
LC712	CTS – Effluent	24-CTSEFFGW-05S	09/16/03
LC713	CTS – Influent	24-CTSINFGW-04S	09/16/03
LC726	Field QC Trip Blank	24-QW-T-092303	09/23/03
LC727	CTS – Influent	24-CTSINFGW-05S	09/23/03
LC728	CTS – Midpoint	24-CTSMIDGW-04S	09/23/03
LC729	CTS – Effluent	24-CTSEFFGW-06S	09/23/03
LC737	Field QC Trip Blank	24-QW-T-092903	09/29/03
LC739	CTS – Midpoint	24-CTSMIDGW-05S	09/29/03
LC740	CTS – Midpoint	24-CTSMIDGW-06S	09/29/03
LC741	CTS – Effluent	24-CTSEFFGW-07S	09/29/03
LC742	CTS – Effluent	24-CTSEFFGW-08S	09/29/03
LC745	Field QC Trip Blank	24-QW-T-100203	10/02/03
LC747	CTS – Influent	24-CTSINFGW-06S	10/02/03
LC748	CTS – Midpoint	24-CTSMIDGW-07S	10/02/03
LC749	CTS – Effluent	24-CTSEFFGW-09S	10/02/03
LC754	Field QC Trip Blank	24-QW-T-100603	10/06/03
LC755	CTS – Influent	24-CTSINFGW-07S	10/06/03
LC756	CTS – Midpoint	24-CTSMIDGW-08S	10/06/03
LC757	CTS – Effluent	24-CTSEFFGW-10S	10/06/03
LC761	Field QC Trip Blank	24-QW-T-100803	10/08/03
LC762	CTS – Midpoint	24-CTSMIDGW-09S	10/08/03
LC763	CTS – Effluent	24-CTSEFFGW-11S	10/08/03
LC764	CTS – Effluent	24-CTSEFFGW-12S	10/09/03
LC795	CTS – Midpoint	24-CTSMIDGW-10S	11/04/03
LC796	CTS – Effluent	24-CTSEFFGW-13S	11/04/03
LC797	CTS – Influent	24-CTSINFGW-08S	11/04/03
LC798	Field QC Trip Blank	24-QW-T-110403	11/04/03
LC799	CTS – Effluent	24-CTSEFFGW-14S	11/21/03
LC800	CTS – Midpoint	24-CTSMIDGW-15S	11/21/03
LC801	Field QC Trip Blank	24-QW-T-112103	11/21/03

QC quality control
CTS central treatment system

3.5 Laboratory Data Quality Assessment

Laboratory data were validated by Laboratory Data Consultants of Carlsbad, California, in accordance with the cited method and the following:

- *USEPA Contract Laboratory National Functional Guidelines for Organic Data Review* (EPA 1999a)
- *USEPA Contract Laboratory National Functional Guidelines for Inorganic Data Review* (EPA 2002b)
- *SW-846 On-Line, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA 2004)
- EPA Method TO-14A (EPA 1999b)

Laboratory data were validated as specified in the Environmental Work Instruction EW#1 (DON 1999). Level IV validation was performed on 20 percent or more of the samples, with the balance validated at Level III.

The data validation findings are summarized, indicating the findings of the review process. Data are reported flagged with appropriate qualifiers to indicate their usability.

Data may be assigned the following qualifiers:

U	not detected
J	estimated concentration or reporting limit
N	presumptive evidence of the identification of an analyte
R	rejected data (unusable)

Combinations of qualifiers such as UJ and NJ are possible. Values may be flagged as estimated (J) for any one of the following reasons (or a combination). The validator followed Navy and USEPA guidance wherever possible but may have used professional judgment when necessary.

- Calibration percent relative standard deviation or percent difference were not compliant with Navy or method specifications.
- Laboratory blank spike/blank spike duplicate were not within the control limits.
- Matrix spike or matrix spike duplicate recoveries were poor or the relative standard deviations were in excess of the specifications.
- A compound was also reported in the associated field blank or blanks.
- Calibration response factors were outside of acceptance limits.
- A compound was also reported in the associated laboratory blank.
- Laboratory duplicates showed poor agreement.
- A compound was detected in the associated trip blank.

These concerns were considered technical deviations from the requirements and do not significantly impact the conclusions. Typically these are found for a limited number of compounds or samples in a given batch and are within the limitations of the method and the validation criteria and so do not warrant rejection of the data.

4. DATA EVALUATION

The pre-design investigation at former MCAS El Toro, Site 24 included the following activities:

- Groundwater sampling using PDBs and low-flow sampling methods
- Estimation of vertical flow using groundwater elevations and heat-pulse technology
- Groundwater step-drawdown and 72-hour extraction testing
- Evaluation of groundwater remediation enhancement using SVE

4.1 VOC PLUME DELINEATION

4.1.1 PDBs Sampling Method Verification

A trial to assess the applicability of using PDB samplers for collecting samples for vertical plume delineation was conducted before the WP was issued. Wells having long screen intervals, with varied but stable TCE concentrations during past quarterly sampling events using a regular pump or low-flow sampling pump, were selected for this trial. Historical VOC concentrations in these wells range from below detection limits to greater than 1,000 µg/L, representing low, medium, and high concentrations. Three PDBs were installed in each well: one at the low-flow pump intake depth, and one each above and below the pump depth. Table 4-1 presents the wells used for the trial, the depths at which PDB samplers were installed, and the analytical results from the trial and historical data from the three most recent sampling events. These wells are also shown on Figure 2-1.

Table 4-1: Trial PDB Sampling Results

Well ID	Depth [a] (feet)	Screen Interval (feet)	TCE concentration (µg/L)			
			PDB	Round 15 [b]	Round 16 [c]	Round 17 [d]
24EX5OB1	109	105–150	217 [e]	—	—	—
24EX5OB1	126	105–150	324 [e]	100	96	95
24EX5OB1	144	105–150	438 [e]	—	—	—
24NEW4	109	108–148	15	—	—	—
24NEW4	127	108–148	15	17	15	13
24NEW4	144	108–148	15	—	—	—
24NEW5	230	230–250	1U	—	—	—
24NEW5	239	230–250	1U	1U	1U	32 [f]
24NEW5	248	230–250	1U	—	—	—
09_DGMW75	119	114–154	805	760	1,000	1100
09_DGMW75	119 (duplicate)	114–154	874	760	1,000	1100
09_DGMW75	133	114–154	1,020	—	—	—
09_DGMW75	149	114–154	1,010	—	—	—

U The analyte was not detected above the detection limit shown.
— no applicable data
[a] Depth measures feet below top of casing to top of PDB
[b] Final Groundwater Monitoring Report, March 2002 Monitoring, Round 15 (CDM 2002)
[c] Final Groundwater Monitoring Report, September 2002 Monitoring, Round 16 (CDM 2003b)
[d] Final Groundwater Monitoring Report, March 2003 Monitoring, Round 17 (CDM 2003a)
[e] Samples were recollected during the pre-design investigation in July 2003.
[f] See discussion in Section 4.1.2; this result was considered to be an anomaly.

Based on these results, PDB sampling generally replicated previous sampling results. The exception was one location (24EX5OB1) where the PDB sampler results were consistently higher. These results indicated that PDB samplers could be used for vertical plume delineation.

4.1.2 Sampling Results and Plume Delineation

Groundwater samples were collected in June and July 2003 using PDBs and low-flow sampling pumps at 37 previously existing wells and 12 newly installed wells (see Plate 1). The VOC plume was evaluated using sampling results from this investigation and the base-wide Round 17 sampling conducted in March 2003 (CDM 2003a).

The primary VOCs detected in groundwater are TCE, PCE, 1,2-dichloroethene (1,2-DCE), 1,1-dichloroethene (1,1-DCE), and chloroform. The most frequently detected and widely distributed VOC is TCE. Table 4-2 lists the TCE concentrations detected between June and October 2003. Plate 1 depicts the TCE plume within the SGU. Plates 2 and 3 depict the vertical TCE profile along and transecting the axis of the plume, respectively. Plates 2 and 3 include sampling results from the pre-design investigation and the Round 17 sampling event.

Table 4-2: Summary of Pre-design Investigation TCE Detections

Well ID	Diameter (inches)	Total Depth (feet bgs)	Screen Interval (feet bgs)	Sampling Method	Sampling Date	Pump Intake or PDB Depth (feet bgs)	TCE Concentration (µg/L)
24EX3OB3	2	182	170–175	Low-Flow	06/17/03	172.5	1U
24EX4OB2	4	156	106–151	Low-Flow	06/17/03	135	138/139 [a]
24EX6OB1	4	156	106–151	Low-Flow	06/19/03	128.5	298
24EX6OB3	4	225	218–223	Low-Flow	06/20/03	222.5	1U
24EX8	6	169	95–155	Low-Flow	06/18/03	125	460
24IN2OB2	3	275	195–270	Low-Flow	06/18/03	232	1U
24MW01A	3	170	99–134	Low-Flow	06/18/03	123	741
24MW01B	3	170	140–165	Low-Flow	06/18/03	160	300
24MW02	3	171.5	143–168	Low-Flow	06/20/03	160	676
24MW03	4	140	100–135	Low-Flow	06/18/03	122	1,270
24MW04A	3	171.5	100–135	Low-Flow	06/16/03	122	59
24MW04B	3	171.5	143–168	Low-Flow	06/17/03	160	17/16 [a]
24MW05A	3	180.5	100–135	Low-Flow	06/13/03	121	169
24MW05B	3	180.5	143–168	Low-Flow	06/17/03	155	39
07_DGMW71	4	163	115–155	Low-Flow	06/13/03	125	2
07_DGMW72	4	159	110–150	Low-Flow	06/16/03	130	5.3
10_DGMW77	4	145	150–170	Low-Flow	06/17/03	160	57
18_BGMW03A	5	471	370–390	Low-Flow	06/19/03	377	1U
18_BGMW03B	5	310	280–300	Low-Flow	06/20/03	290	1U
18_BGMW03C	5	250	222–242	Low-Flow	06/19/03	232	0.5J
18_BGMW101	4	140	90–130	Low-Flow	06/16/03	110	30
18_PS6	4	155	130–150	Low-Flow	06/17/03	140	159
TIC-55	12	746	300–497	PDB	07/17/03	325	0.7J
					07/17/03	375	0.9J
					07/17/03	425	0.8J

Well ID	Diameter (inches)	Total Depth (feet bgs)	Screen Interval (feet bgs)	Sampling Method	Sampling Date	Pump Intake or PDB Depth (feet bgs)	TCE Concentration (µg/L)
24EX3	6	186	105–180	PDB	06/24/03	115	2
					06/24/03	125	2
					06/24/03	135	2
					06/24/03	145	2
					06/24/03	155	2
					06/24/03	165	2
					06/24/03	175	2
24EX3OB2	4	156	105–150	PDB	06/24/03	110	95
					06/24/03	120	98
					06/24/03	130	81/101 [a]
24EX4	6	195	104–190	PDB	06/24/03	110	34
					06/24/03	120	33
					06/24/03	130	37
					07/17/03	140	30
					07/17/03	150	34
					07/17/03	160	38
					06/24/03	170	42
					06/24/03	180	32
24EX4OB1	4	156	105–150	PDB	06/24/03	110	204
					06/24/03	120	198/209 [a]
					06/24/03	130	201
24EX5OB2	4	155	105–150	PDB	06/24/03	110	112
					06/24/03	120	109
					06/24/03	130	108
					06/24/03	140	111
24EX6	6	178	103–173	PDB	06/24/03	110	256
					06/24/03	120	256
					06/24/03	130	251
					06/24/03	140	251
					06/24/03	150	235
					06/24/03	160	238
					06/24/03	170	239
24IN2	6	269	193–263	PDB	06/24/03	200	1U
					06/24/03	210	1U
					06/24/03	220	1U
					06/24/03	230	1U
					06/24/03	240	1U
					06/24/03	250	1U
24IN3	6	169	95–155	PDB	06/24/03	100	0.7J/0.6J [a]
					06/24/03	110	180
					06/24/03	120	175
					06/24/03	130	173
					06/24/03	140	174
					06/24/03	150	181

Well ID	Diameter (inches)	Total Depth (feet bgs)	Screen Interval (feet bgs)	Sampling Method	Sampling Date	Pump Intake or PDB Depth (feet bgs)	TCE Concentration (µg/L)
24NEW4	4	160	108–148	PDB	06/24/03	115	8.7
					06/24/03	125	8.6
					06/24/03	135	9.1
					06/24/03	145	11
24EX09	6	210	120–200	PDB	08/26/03	160	33
24EX10	6	165	115–160	PDB	10/24/03	120	84
					10/24/03	130	89
					10/24/03	140	93
					10/24/03	150	93
24EX11	6	220	135–180	PDB	10/24/03	140	239
					10/24/03	150	259
					10/24/03	160	259
					10/24/03	170	275
24EX12A	6	170	115–160	PDB	08/27/03	120	17
					08/27/03	130	17
					08/27/03	140	19
					08/27/03	150	18
24EX12B	6	220	165–210	PDB	08/27/03	170	16
					08/27/03	180	15
					08/27/03	190	15
					08/27/03	200	16
24EX12C	6	270	220–260	PDB	08/27/03	225	1
					08/27/03	235	1
					08/27/03	245	1
					08/27/03	255	1
24EX13A	6	170	110–160	PDB	08/27/03	115	123
					08/27/03	125	118
					08/27/03	135	122
					08/27/03	145	123
					08/27/03	155	124
24EX13B	6	220	165–205	PDB	08/27/03	175	2
					08/27/03	185	1
					08/27/03	195	1
					08/27/03	205	30
24EX13C	6	280	230–270	PDB	08/27/03	235	0.5J
					08/27/03	245	0.4J
					08/27/03	255	0.4J
					08/27/03	265	0.4J
24EX14	6	195	115–185	PDB	10/24/03	120	41
					10/24/03	130	45/44 [a]
					10/24/03	140	43
					10/24/03	150	45
					10/24/03	160	36
					10/24/03	170	36
					10/24/03	180	35

Well ID	Diameter (inches)	Total Depth (feet bgs)	Screen Interval (feet bgs)	Sampling Method	Sampling Date	Pump Intake or PDB Depth (feet bgs)	TCE Concentration (µg/L)
24MW06	4	195	170–190	PDB	08/27/03	175	2.3
24MW07	4	205	120–200	PDB	10/10/03	125	2.8
					10/10/03	135	2.7
					10/10/03	145	2.7
					10/10/03	155	2.8/2.7 [a]
					10/10/03	165	2.7
					10/10/03	175	2.7
					10/10/03	185	2.3
					10/10/03	195	1J

J estimated
U not detected
[a] Normal/duplicate sampling results

Three hot spots (i.e., TCE in excess of 500 µg/L) have been identified at IRP Site 24 based on groundwater sampling during the pre-design investigation and the Round 17 Groundwater Monitoring Report (GMR) (CDM 2003a):

- Near Building 297, where the highest TCE concentration of 960 µg/L was detected in well 24EX6OB2.
- At the northwest boundary of Site 24, near the runways. The wells surrounding this hot spot, 24MW03, 09_DGMW75, 24MW01A, and 24MW02, were sampled using low-flow pumps and had TCE concentrations of 1,270 µg/L, 1,100 µg/L, 741 µg/L, and 676 µg/L, respectively.
- Near well 24EX3OB1, where TCE was detected at 380 µg/L in September 2002 and 520 µg/L in March 2003 (CDM 2003a).

Notable TCE concentration changes were reported in the Round 17 GMR (CDM 2003a) at several wells:

- In well 24NEW5, TCE concentrations increased from below the reporting limit of 1 µg/L in September 2002 to 32 µg/L in March 2003. TCE had been detected above the reporting limit (7 µg/L) only one other time, in the Round 9 (March 1997) sampling event. Well 24NEW5 was also sampled using PDBs during the pre-design investigation. Three bags were installed at 10-foot intervals across the well screen. All samples were below reporting limits for TCE (1 µg/L). These data suggest that the March 2003 result was an anomaly.
- In well 24NEW1, the TCE concentrations decreased from 23 µg/L (September 2002) to below the detection limit of 1 µg/L. TCE concentrations at 24NEW1 have decreased by more than 200 µg/L over the past 5 years.
- In well 10_DGMW77, the TCE concentrations decreased from 150 µg/L in March 2003 (CDM 2003a) to 57 µg/L in June 2003 during this pre-design investigation.

A primary objective of this pre-design investigation is to address data gaps in the vertical delineation of the SGU VOC plume. PDB sampling was proposed to provide information on vertical distribution of contaminants within the aquifer. Since results of PDB sampling may not be representative at locations with significant vertical gradients, vertical flow conditions were evaluated using a heat-pulse flowmeter and groundwater levels in cluster wells. Resolution limitations of the heat pulse method resulted in significant variances in measured vertical flow in the same well. For example, in well 24EX6, the resulting flow rates range from 3.7 ft per day (ft/day) to 175 ft/day. In addition, the measured flow rates are far too excessive for the conditions encountered at Site 24. Gradient calculations using head differentials indicate that no predominant vertical flow direction is evident in the SGU. PDB sampling results are thus appropriate for vertical and horizontal VOC plume delineation. A detailed discussion of vertical flow measurement inside wells at Site 24 is presented in Section 4.2.

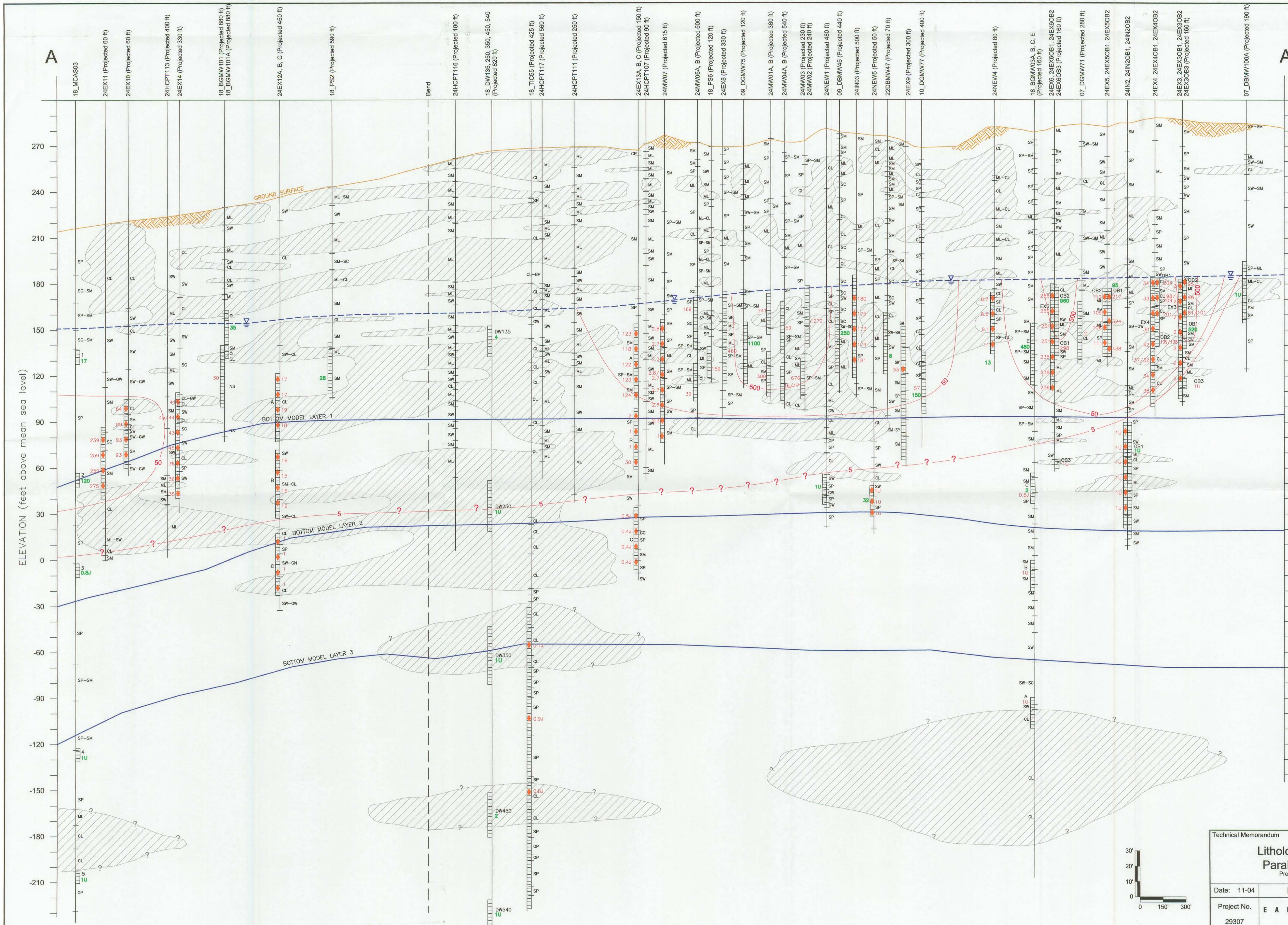
High TCE concentrations (above 50 µg/L) are distributed mainly in the upper 80 feet of the SGU, consistent with the upper layer of the groundwater model (Earth Tech 2003a). The lower extent of the TCE plume (defined as concentrations above the EPA [2002b] maximum contaminant level [MCL] of 5 µg/L) at the source area is well established to a depth of approximately 180 feet bgs. Based on the TCE concentrations from well 24NEW1 and the newly installed cluster wells 24EX13A, B, and C shown on Plate 2, the lower extent of the TCE plume at the hot spot near 09_DGMW75 and 24MW03 is approximately 210 feet bgs. At the station boundary, TCE in excess of 50 µg/L is present primarily within the upper portion of the SGU to a depth of approximately 180 feet bgs, and TCE in excess of the MCL is present within the lower portion of the SGU to a depth of approximately 210 feet bgs.

PDB sampling was also proposed to verify previous HydroPunch sampling results in the vicinity of Buildings 296 and 297. PDB samplers were placed inside wells that had large discrepancies in TCE concentrations between groundwater samples and nearby HydroPunch samples collected at the same depths. Three PDB samplers were placed in each of the wells associated with the HydroPunch samples (24EX3, 24EX3OB2, 24EX4, and 24EX6). The PDBs were installed 10 feet above, 10 feet below, and at the same depth as the previous HydroPunch samples. The sampling results are presented in Table 4-3.

Table 4-3: TCE Concentration Comparison between Corresponding HydroPunch Sampling Results, PDB Sampling Results, and Historical Sampling Results

	HydroPunch Samples				PDB Samples			Latest Historical Basewide Sampling Results [a]		
Well ID	ID	Depth (feet bgs)	TCE Conc. (µg/L)	Date	Depth (feet bgs)	TCE Conc. (µg/L)	Date	TCE Conc. (µg/L)	Sampling Depth (feet bgs)	Date
24EX6	24HCPT102	119	2,870	11/97	110	256	06/03	400	160	08/99
	24HCPT104	121	1,680	11/97	120	256	06/03			
	—	—	—	—	130	251	06/03			
24EX3	24HCPT86	135	1,350	07/97	125	2	06/03	9.9	175	08/99
					135	2	06/03			
					145	2	06/03			
24EX3OB2	24HCPT88	120	4,850	07/97	110	95	06/03	130	130	08/99
					120	98	06/03			
					130	81	06/03			
24EX4	24HCPT84	120	2,490	06/97	110	34	06/03	n/a	n/a	n/a
	24HCPT96	125	1,330	07/97	120	33	06/03			
	—	—	—	—	130	n/r	—			

Conc. concentration
— not available
n/r not recovered
[a] Source: Draft Groundwater Remediation Pilot Test Report (BNI 1998)



PRIMARY SOURCE OF MAP INFORMATION:
DRAFT GROUNDWATER REMEDIATION PILOT TEST REPORT (BNI, DECEMBER 1998)
FINAL GROUNDWATER MONITORING REPORT, ROUND 17 (CDM, JULY 2003)

LEGEND

- CL = INORGANIC CLAY
- GP = POORLY GRADED GRAVEL
- GW = WELL-GRADED GRAVEL
- GM = SILTY GRAVEL WITH SAND
- ML = INORGANIC SILT
- SC = SANDY CLAY
- SP = POORLY GRADED SAND
- SM = SILTY SAND
- SW = WELL GRADED SAND
- NS = NOT SAMPLED

- 18 SAMPLED BY CDM (CDM 2003)
- 18 SAMPLED BY EARTH TECH (EARTH TECH 2004)
- 81/101 SAMPLE DUPLICATES
- 5 TCE ISOCONCENTRATION CONTOUR(µg/L) [Based on pre-design investigation field sampling results obtained between June and October, 2003 and March 2003 groundwater monitoring data (CDM 2003).]
- GROUNDWATER TABLE (CDM 2003, Earth Tech 2004)
- MODEL LAYER
- ? INFERRED TCE ISCONCENTRATION CONTOUR
- ? INFERRED LOW-PERMEABILITY ZONE
- GROUND SURFACE
- LOW-PERMEABILITY ZONE
- SCREEN INTERVAL
- DW540 WELL NAME
- PASSIVE DIFFUSION BAG (PDB) SAMPLER POINTS

NOTES

1. SEE PLATE 1 FOR CROSS SECTION LOCATION
2. SEPARATION BETWEEN WELLS IN CLOSE PROXIMITY HAVE BEEN ALTERED FOR CLARITY
3. HYDROPUNCH DATA OBTAINED FROM GROUNDWATER REMEDIATION PILOT TEST REPORT (BNI 1998)

Technical Memorandum | Final

Lithologic Cross-Section A-A' Parallel to TCE Plume Axis

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11-04
Former MCAS El Toro
Project No. 29307
EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
Plate 2

PAGE NO. 4-8

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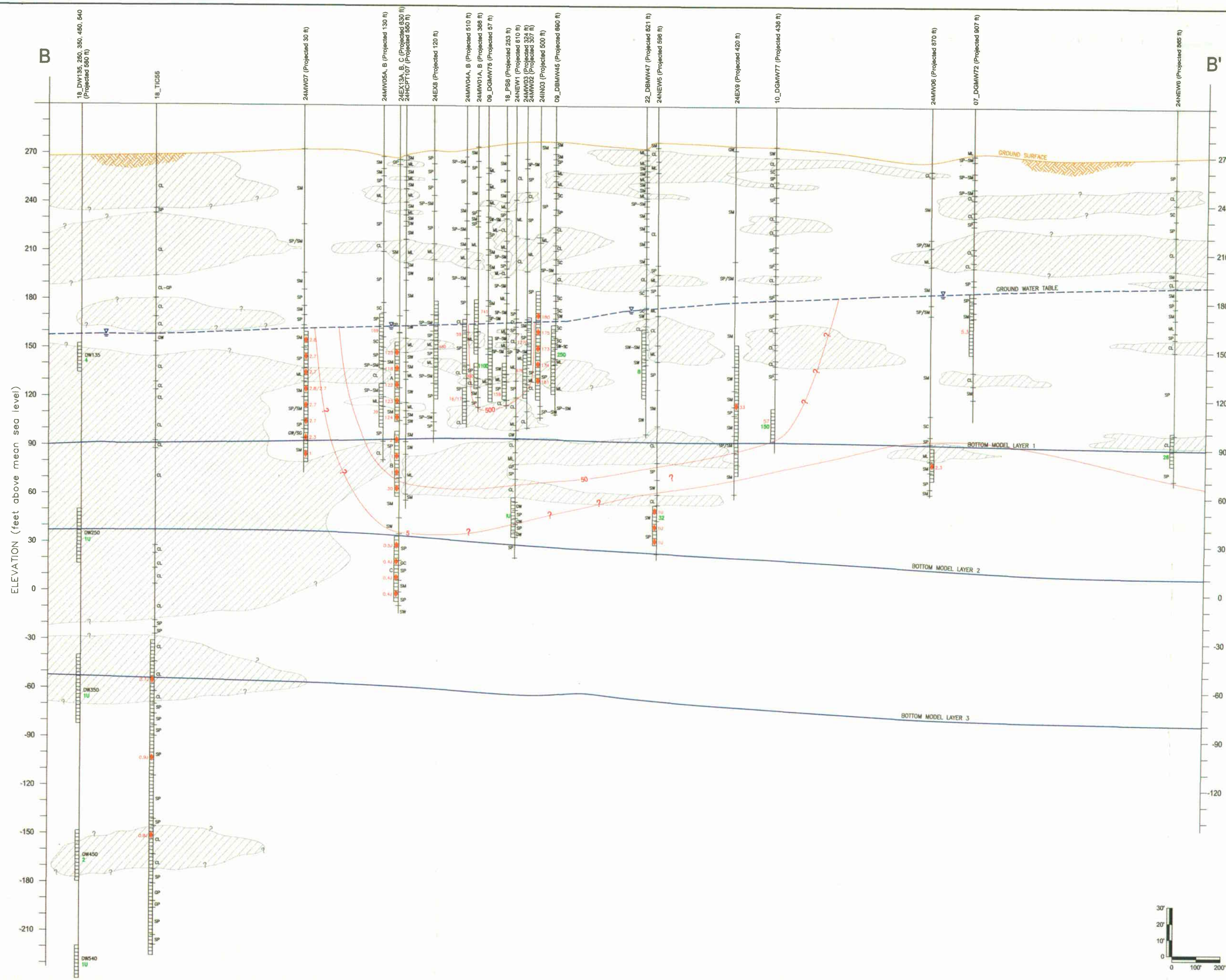

PRIMARY SOURCE OF MAP INFORMATION:
DRAFT GROUNDWATER REMEDIATION PILOT TEST REPORT (BNI, DECEMBER 1998)
FINAL GROUNDWATER MONITORING REPORT, ROUND 17 (CDM, JULY 2003)

LEGEND

- CL = INORGANIC CLAY
- GP = POORLY GRADED GRAVEL
- GW = WELL-GRADED GRAVEL
- GM = SILTY GRAVEL WITH SAND
- ML = INORGANIC SILT
- SC = SANDY CLAY
- SP = POORLY GRADED SAND
- SM = SILTY SAND
- SW = WELL GRADED SAND
- NS = NOT SAMPLED

- 18 — SAMPLED BY CDM (CDM 2003)
- 18 — SAMPLED BY EARTH TECH (EARTH TECH 2004)
- 81/101 — SAMPLE DUPLICATES
- — 5 — TCE ISOCONCENTRATION CONTOUR (µg/L) [Based on pre-design investigation field sampling results obtained between June and October, 2003 (Earth Tech 2004) and March 2003 groundwater monitoring data (CDM 2003).]
- GROUNDWATER TABLE (CDM 2003, Earth Tech 2004)
- MODEL LAYER
- ? — INFERRED TCE ISCONCENTRATION CONTOUR
- ? — INFERRED LOW-PERMEABILITY ZONE
- GROUND SURFACE
- LOW-PERMEABILITY ZONE
- SCREEN INTERVAL
- DW540 — WELL NAME
- PASSIVE DIFFUSION BAG (PDB) SAMPLER POINTS

NOTES

1. SEE PLATE 1 FOR CROSS SECTION LOCATION
2. SEPARATION BETWEEN WELLS IN CLOSE PROXIMITY HAVE BEEN ALTERED FOR CLARITY
3. PLUME MAPPING BASED ON FINAL GROUNDWATER MONITORING REPORT ROUND 17 AND THE SGU PRE-DESIGN INVESTIGATION

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Lithologic Cross-Section B-B' Transecting TCE Plume Axis

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11-04	Former MCAS El Toro	Plate
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TCE concentrations from PDB sampling in June 2003 are of the same order of magnitude as the historical groundwater data, and at least one order of magnitude lower than the corresponding HydroPunch sampling results. These data suggest that the previous HydroPunch sampling results are not representative of the concentrations in groundwater.

In order to evaluate the effect of pumping from well 18_TIC55 on plume migration, both laterally and vertically, PDB samples were collected at three depths across the well screen interval. TCE was not detected above the reporting limit of 1 μg/L. However, TCE was detected in well 18_DW450 (2 μg/L) during the Round 17 basewide sampling, and 24MW07 (ranging from 1 to 2.8 μg/L) during PDB sampling. This suggests that agricultural pumping, including from well 18_TIC55, has not resulted in downward and northward migration of TCE in excess of the MCL. The analytical results are presented in Appendix A. In addition, the updated plume distribution was incorporated into the groundwater model and additional simulations were run to evaluate whether proposed extraction locations were still optimally placed, as further described in Section 4.3.3.

4.2 Vertical Flow Evaluation

Vertical flow at Site 24 was evaluated by computing gradient based on differential groundwater elevations, and by attempting direct measurement with a heat-pulse flow meter.

Vertical flow measurement using a heat-pulse flow meter was performed at 24EX3, 24EX3OB2, 24EX4, and 24EX6. Detailed procedures, calibration results, field data, and estimated flow rates are presented in Appendix C. Vertical groundwater flow rates estimated using the heat-pulse method ranged from 2.9 to 541 ft/day, with an upward flow direction. Table 4-4 summarizes the flow rates estimated in each well.

Table 4-4: Heat Pulse Flowmeter Measurements

Well ID	Well Casing Diameter (inches)	Reading Depth (feet bgs)	Reading No.	Flow Rate (mL/min)	Flow Rate (feet/day)	Flow Direction
24EX3	6	145	1	760	199	Upward
		145	2	810	212	Upward
		135	1	1,970	515	Upward
		135	2	1,430	374	Upward
		125	1	810	212	Upward
		125	2	760	199	Upward
24EX3OB2 [a]	4	120	1	740	436	Upward
		120	2	740	436	Upward
		120	3	740	436	Upward
		120 [b]	4	920	541	Upward
		120 [b]	5	920	541	Upward
		120 [b]	6	480	283	Upward
		110	1	650	383	Upward
		110 [b]	2	840	494	Upward
24EX6	6	130 [b]	1	630	165	Upward
		130 [b]	2	670	175	Upward
		119 [b]	1	190	50	Upward
		119 [b]	2	460	120	Upward
		110 [b]	1	70	18	Upward
		110 [b]	2	14	3.7	Upward

Well ID	Well Casing Diameter (inches)	Reading Depth (feet bgs)	Reading No.	Flow Rate (mL/min)	Flow Rate (feet/day)	Flow Direction
24EX4	6	130 [b]	1	170	44	Upward
		130 [b]	2	170	44	Upward
		120 [b]	1	12	3.1	Upward
		110 [b]	1	11	2.9	Upward

[a] Well obstruction at approximately 125 feet below grade; unable to deploy probe to 130-foot depth
[b] 2-mm glass beads used; otherwise, 5-mm beads used.

Data from the Round 17 GMR (CDM 2003a) were used to calculate vertical gradients for three wells screened in the SGU. Additionally, vertical gradients were calculated for three Site 24 monitoring wells using groundwater elevations measured during the PDI in September 2003. The SGU wells and the calculated vertical gradients are listed in Table 4-5.

Table 4-5: Vertical Gradients Based on Groundwater Elevations

Well ID	Screen Depths (feet bgs)	Date	Gradient [a]	Computed Flow Rate (feet/day)	Direction
Round 17 GMR					
18BGMW05	225 – 245, 83 – 133	03/03	0.0026	0.00052 – 0.011	Upward
18DW135/250	15 – 135, 215 – 250	03/03	-0.0069	0.0014 – 0.029	Downward
18MCAS03	160 – 170, 220 – 230	03/03	-0.029	0.0058 – 0.12	Downward
PDI					
24EX3OB1/OB3	105 – 150, 170 – 175	09/03	0.044	0.0088 – 0.18	Upward
24EX6OB1/OB3	106 – 151, 218 – 223	09/03	0.026	0.0052 – 0.11	Upward
18BGMW03	124 – 164, 222 – 242	09/03	0.019	0.0038 – 0.080	Upward

[a] Gradient = change in head / vertical distance between measurements

Based on the gradient calculations using head differentials, no predominant vertical flow direction is evident in the SGU. The gradients were used to calculate vertical flow velocities in the SGU. Based on a vertical hydraulic conductivity range of 0.20 ft/day to 4.2 ft/day (BNI 1998), with an average of 2.2 ft/day, computed vertical velocities range in magnitude from 0.00052 ft/day to 0.18 ft/day within the SGU wells, with an average of 0.047 ft/day. Data from the Round 17 GMR (CDM 2003a) was also used to calculate vertical gradients for five wells screened in both the SGU and principal aquifer, and four wells screened in the principal aquifer. The predominant vertical flow direction was upward (eight of nine were upward, one of nine was downward), and gradient magnitudes ranged from 0.00125 to 0.212.

The flow rates estimated by the heat-pulse flow meter exceeded all flow rates estimated using groundwater head values. The majority of the vertical gradients measured by the heat pulse method would apply only in the near vicinity of a pumping well or in extreme artesian conditions, neither of which apply to Site 24. The nearest pumping well is TIC111, located approximately 7,000 feet from Site 24. The majority of pumping in the vicinity of former MCAS El Toro is from the principal aquifer, which results in net flow downward from the SGU. All vertical flow directions indicated by the heat-pulse method were upward, in contrast to measured heads, which indicate both upward and downward gradients.

The heat pulse method has resolution (accuracy) limitations resulting from errors in differential temperature detection. Minor variances in differential temperature detected between the source and the sensor and the time to peak temperature (which are the y-axis in the two graphical methods used to compute the vertical flow [on the x-axis]) may result in significant variances in computed vertical flow because the calibration curves used are generated using a log-log plot. In addition, potential error may also result from the short-circuiting of flow around the packer (manifested as a decreased sensitivity/flow rate in machine response). The results of the heat-pulse method yielded a large range of estimated flow rates, including apparently excessive and inappropriate values inconsistent with corresponding gradients estimated using groundwater head elevations. The heat-pulse method thus does not appear to be a suitable means of quantifying vertical flow at Site 24.

Therefore, based on the vertical velocities estimated using water level measurements, the average velocity is 0.047 ft/day, indicating that vertical flows would not have significantly influenced the PDB sampling results.

4.3 SUSTAINABLE GROUNDWATER EXTRACTION RATES

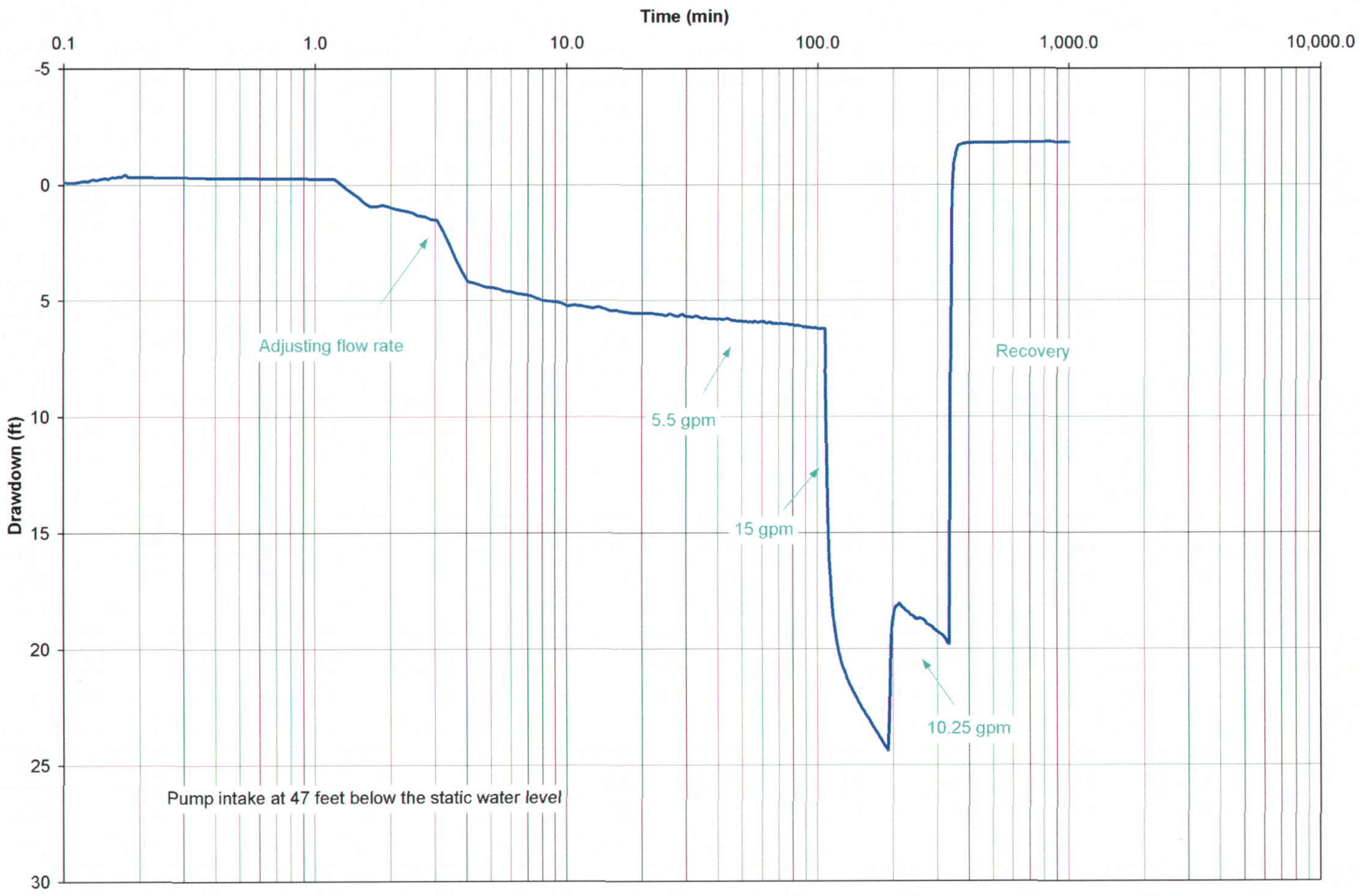
4.3.1 Step-Drawdown Test Results

Step-drawdown tests were conducted at wells 24EX8, 24EX9, 24EX10, 24EX11, 24EX12B, 24EX13A, and 24EX14. In each well, a 1.5-horsepower pump was placed approximately 5 feet above the bottom of the screen to allow maximum drawdown. Pumping rates, number of steps, and the duration of each step were varied based on the response observed in each well. Recovery data were also recorded after the step tests were completed.

Table 4-6 summarizes the pumping steps, duration, pumping rates, resulting maximum drawdown, and the estimated sustainable pumping rates. Figure 4-1 through Figure 4-7 present drawdown versus time on semi-log graphs. Changes in water levels at all observation wells were insignificant during step-drawdown testing, and therefore are not presented.

Table 4-6: Summary of Step-Drawdown Test Results

Well ID	Pump Intake Depth (feet bgs)	Water Above the Pump (feet)	Step	Flow Rate (gpm)	Duration (minutes)	Maximum Drawdown (feet)	Selected Flow Rate for 72-hour Test (gpm)
24EX8	155	46	1	5.5	106	6.226	10
			2	15	84	24.397	
			3	10.25	144	19.82	
24EX9	195	101	1	5	50	1.22	27
			2	11	71	4.74	
			3	27	272	16.93	
			4	38	130	28.20	
24EX12B	204	123	1	9	74	8.28	30
			2	21	196	28.52	
			3	27	219	51.50	
			4	31.5	28	57.73	
			5	33	58	59.76	
24EX14	174	99	1	6	54	4.89	36
			2	12	85	8.94	
			3	20	111	12.48	
			4	36	118	33.28	
			5	43–50	8	40.56	
24EX13A	153	54	1	10	78	8.48	40
			2	21	150	26.30	
			3	40	198	46.20	
24EX10	132	64	1	9.5	75	3.91	25
			2	20	196	15.97	
			3	30	197	28.39	
24EX11	175	108	1	11	174	22.46	15
			2	22	115	53.68	



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Step-Drawdown Test at Well 24EX8

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

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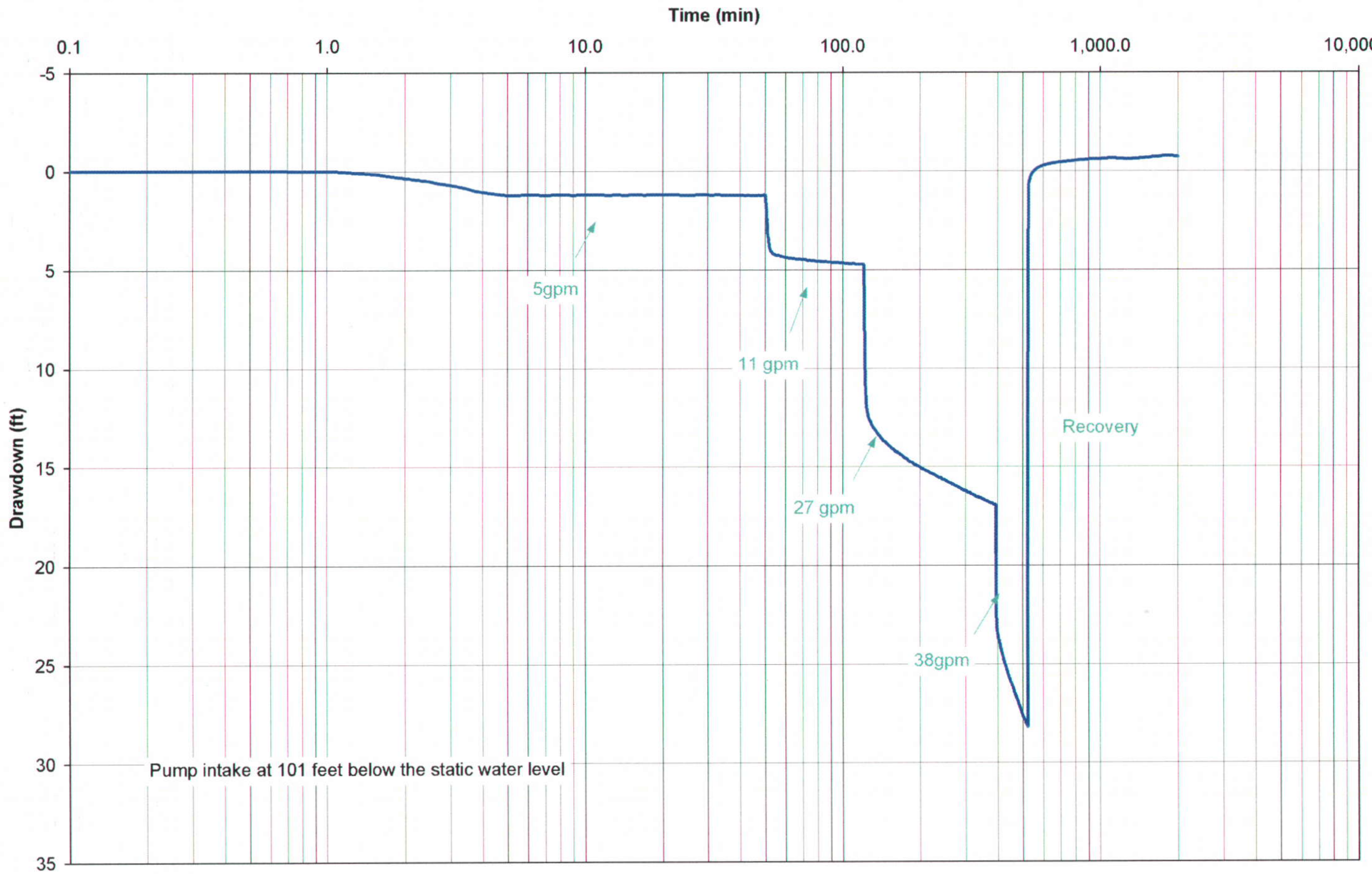

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Step-Drawdown Test at Well 24EX9 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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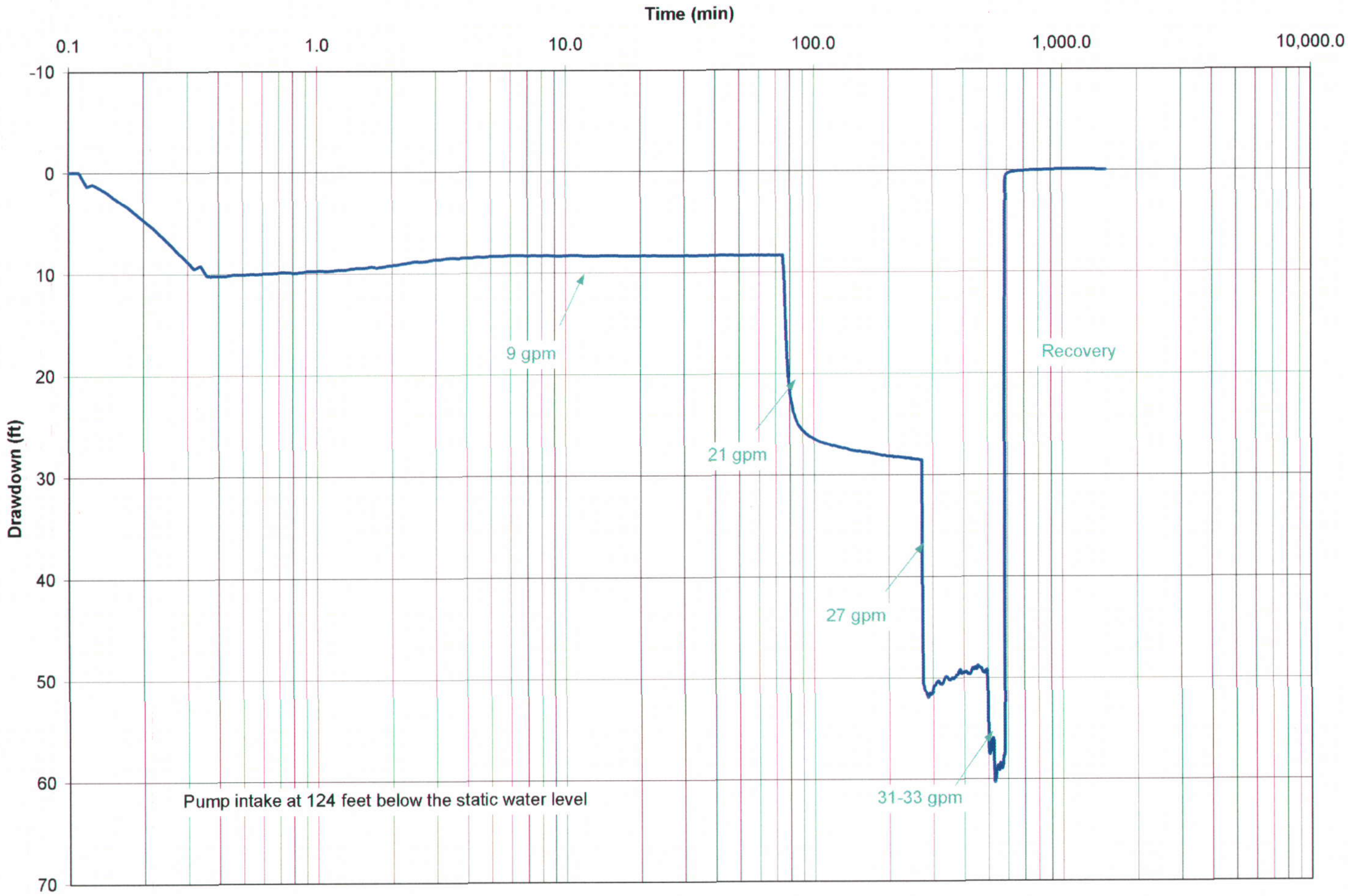

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Step-Drawdown Test at Well 24EX12B

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Project No. 29307	EARTH TECH A Tyco Infrastructure Services Company	4-3

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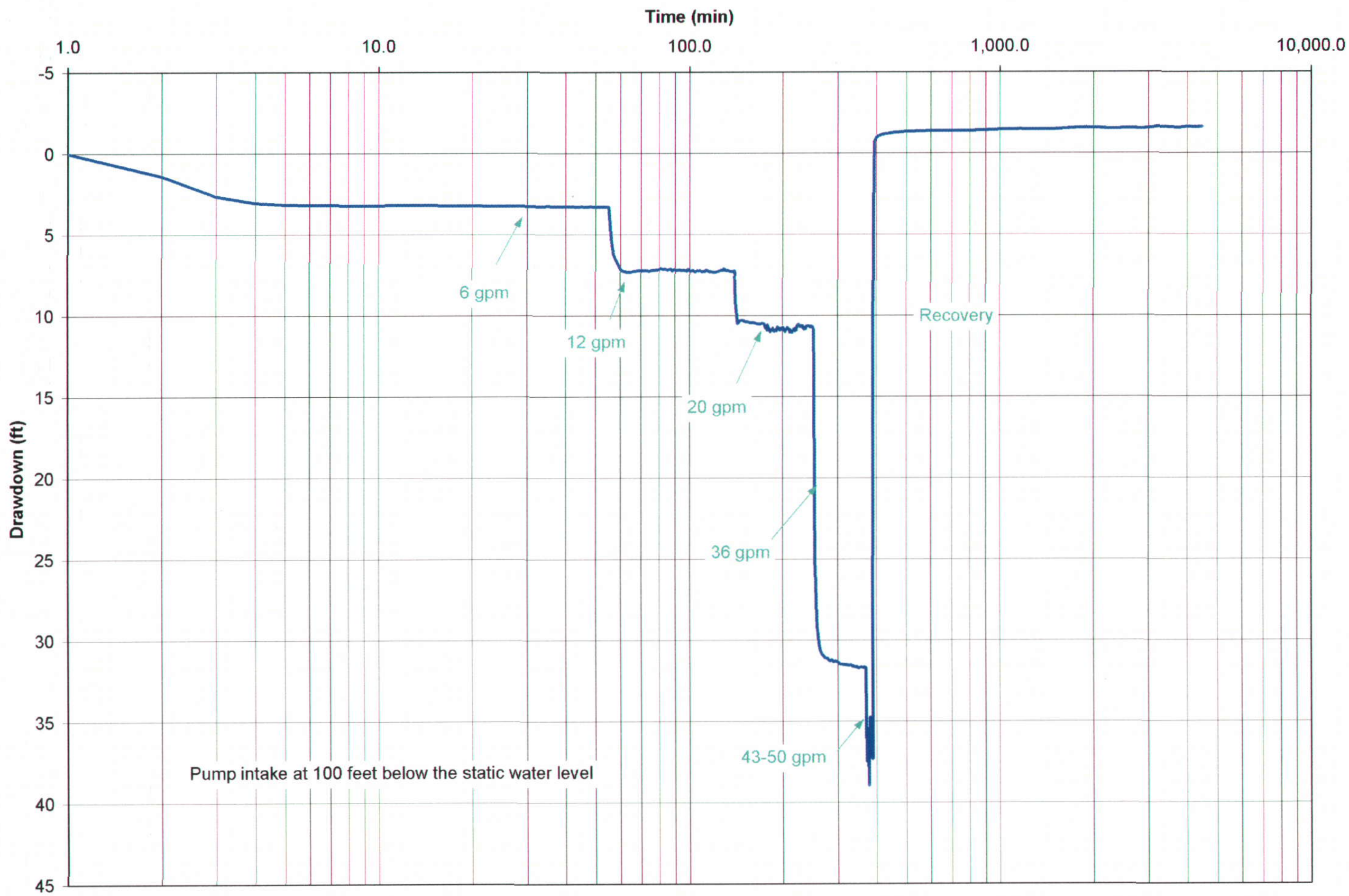

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Step-Drawdown Test at Well 24EX14 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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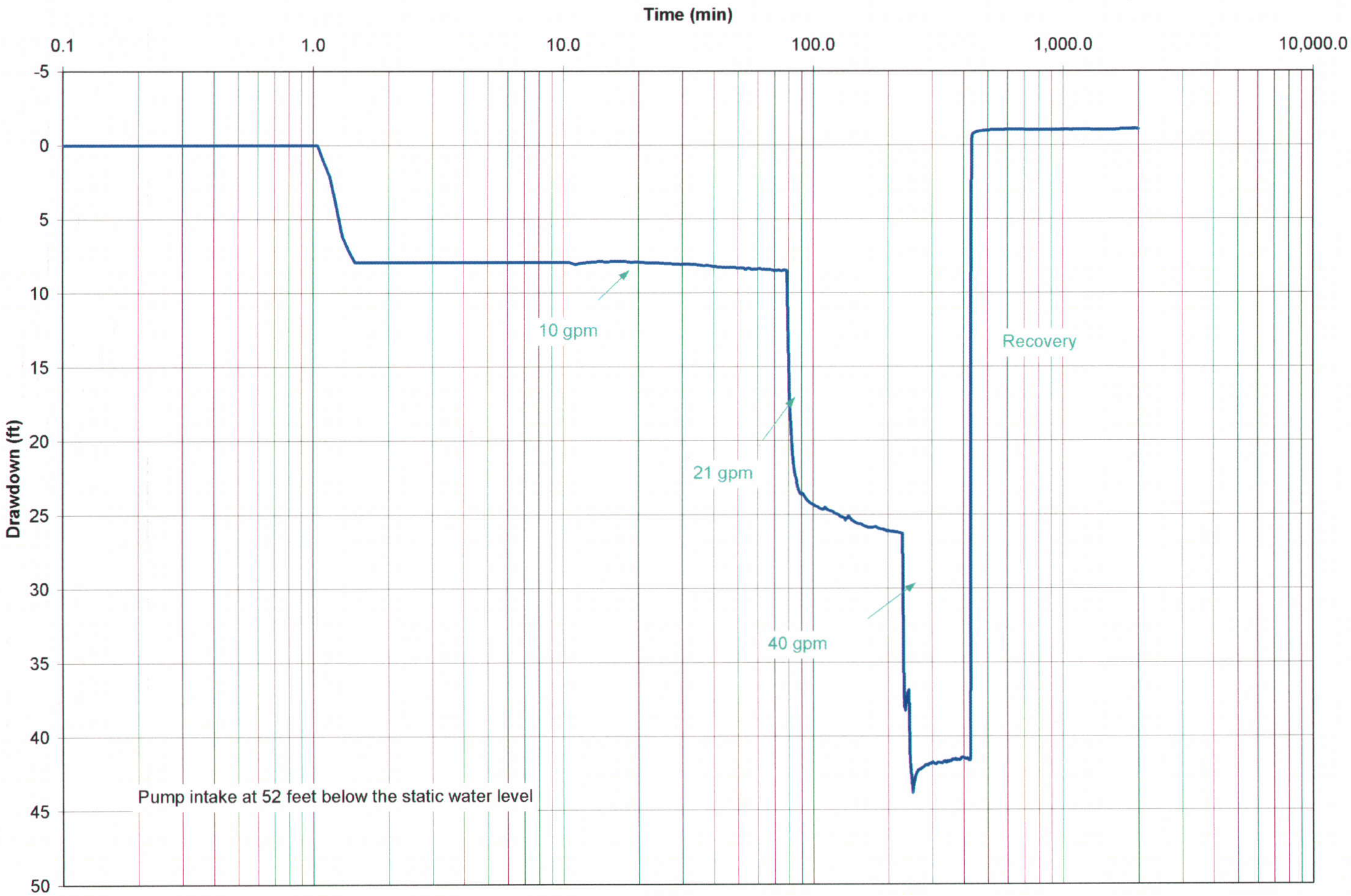

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Step-Drawdown Test at Well 24EX13A

Pre-Design Investigation for SGU Remedy
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Figure 4-5

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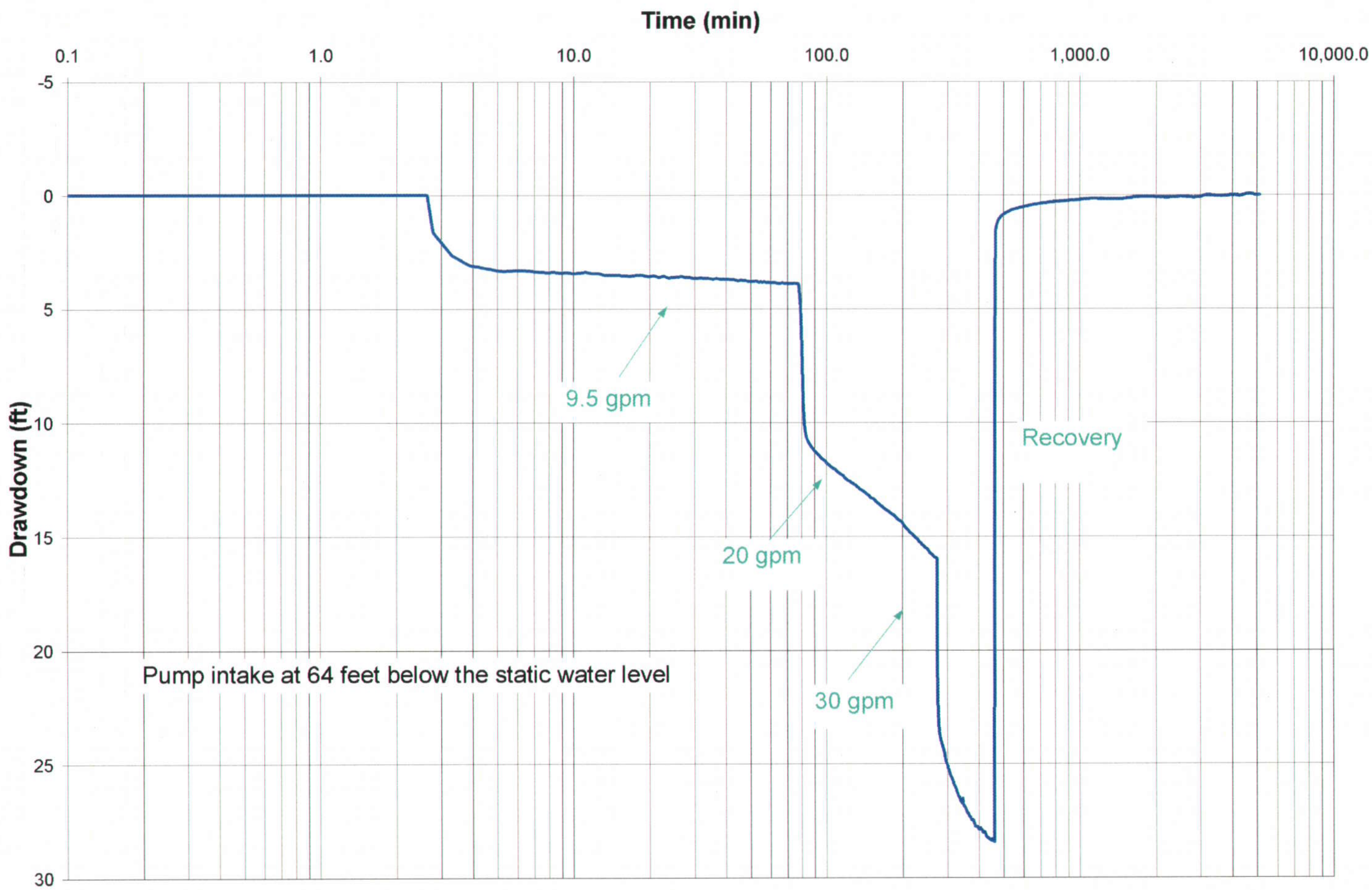

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Step-Drawdown Test at Well 24EX10

Pre-Design Investigation for SGU Remedy
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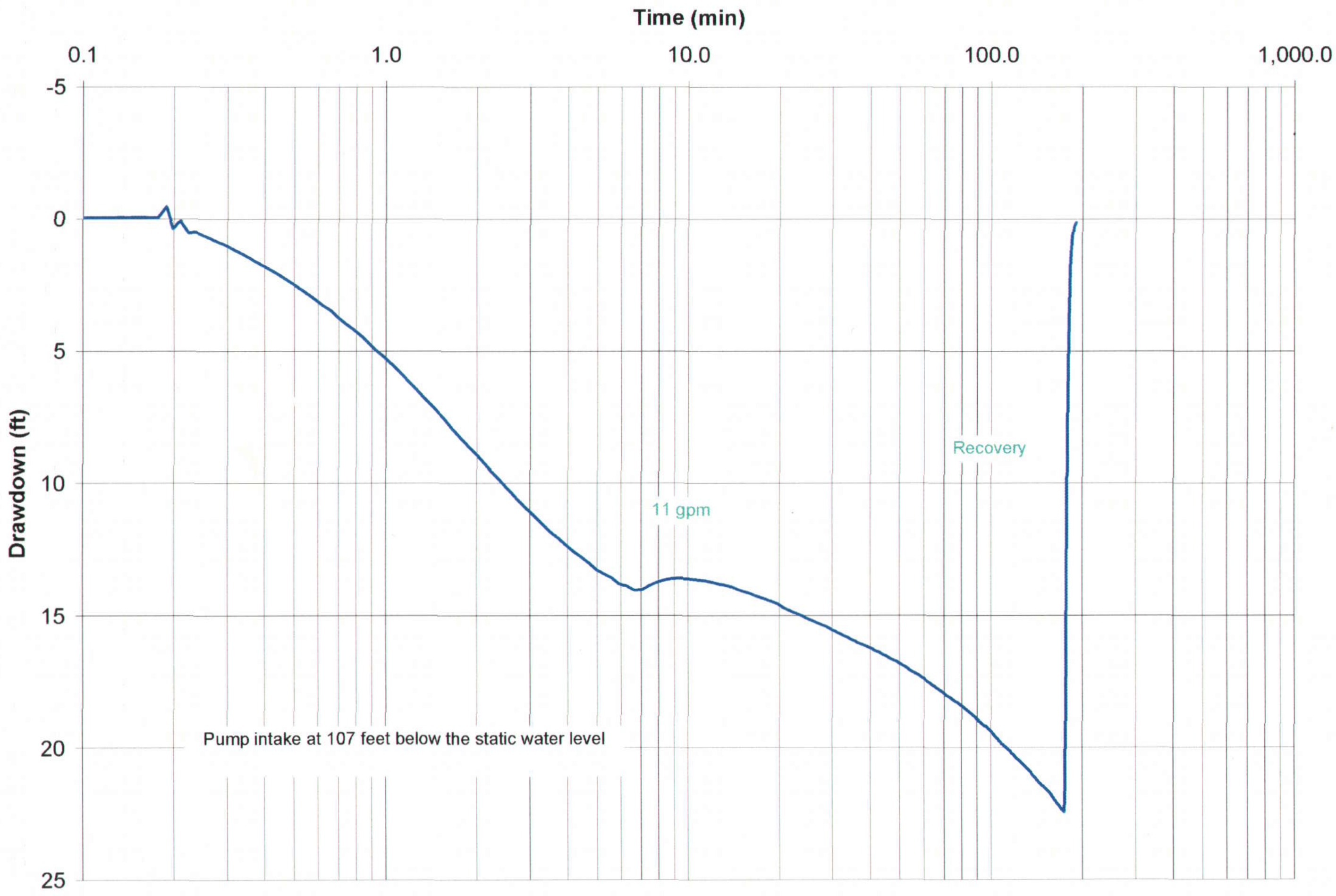

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Step-Drawdown Test at Well 24EX11 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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4.3.2 Extraction Test Results

Seven 72-hour extraction tests were performed, as summarized below:

- At well 24EX8, the 72-hour extraction test was initially run at a pumping rate of 13 gpm. Figure 4-8 is a semi-log graph of drawdown versus time for the duration of the test. The pumping rate was adjusted to prevent complete dewatering of the well. The maximum drawdown in the extraction well was approximately 37 feet. As depicted in Figure 4-8, the rate of dewatering increased, indicating the potential presence of flow barrier or dewatering of the aquifer.

- At well 24EX9, an initial pumping rate of 27 gpm was selected for the 72-hour extraction test. Figure 4-9 is a semi-log graph of drawdown versus time (duration of test). The pumping rate was adjusted at the beginning (during the first three minutes) of the test to achieve the target flow rate, and remained at 27 gpm for the remainder of the test. The maximum drawdown in the extraction well was approximately 27 feet.

- At well 24EX12B, the pumping rate for the 72-hour extraction rate test was initially set at 30 gpm, based on the step-drawdown test results (Figure 4-3). However, the resulting drawdown recorded at the beginning of the 72-hour extraction test was less than the drawdown observed during the step test at the same extraction rate. Therefore, the extraction rate was increased to a maximum of 41 gpm after approximately one day and maintained throughout the remainder of the 72-hour extraction test (approximately 2 days). The maximum drawdown in the extraction well was approximately 23.5 feet. The discrepancy in sustainable flow rates between the step-drawdown test and the 72-hour extraction test most likely indicates insufficient well development prior to the step test. The step-drawdown test effectively developed the well and restored the natural hydraulic conductivity of the formation. Figure 4-10 is a semi-log graph of drawdown versus time.

- At well 24EX14, the 72-hour extraction test was conducted at a pumping rate of 36 gpm. Figure 4-11 is a semi-log graph of drawdown versus time for the extraction test at 24EX14. Approximately 10 minutes were required to stabilize the flow rate. An extraction rate of 36 gpm was maintained for the remainder of the test. The maximum drawdown in the extraction well at the end of the test was approximately 37 feet.

- At well 24EX13A, the 72-hour extraction test was conducted for 72 hours at a constant pumping rate 40 gpm. The maximum drawdown in the extraction well was approximately 39 feet. Figure 4-12 shows drawdown versus time.

- At site boundary wells 24EX10 and 24EX11, 72-hour extraction tests were performed concurrently. At well 24EX10, a constant flow rate of 25 gpm was maintained throughout the test. At well 24EX11, the extraction rate was adjusted between 15 gpm and 25 gpm, and 15 gpm was used for the majority of the test. Figure 4-13 and Figure 4-14 show semi-log graphs of drawdown versus time (duration of test) at 24EX10 and 24EX11, respectively. The maximum drawdown in wells 24EX10 and 24EX11 was 30.6 and 62.7 feet, respectively. Wells 24EX10 and 24EX11 are 201 feet apart and are screened in different zones. This provided the opportunity to evaluate the sustainable extraction rates at these two depths, and evaluate the effect of the slot size on flow rate, assuming the soil conditions are similar. Well 24EX11 was constructed with a slot size of 0.06 inch, and 24EX10 with a slot size of 0.035 inch. However, based on the boring logs, soils within the screen interval for well 24EX10 consist of well-graded sand and silty sand with a very small portion of clay, while soils at well 24EX11 consist of mostly silty sand, sandy clay, and clay. Therefore, the higher flow rate in well 24EX10 is in part due to higher soil permeability, and the effect of slot size cannot be directly compared. However, based on the seven extraction test results, the formation appears to be more of a limiting factor than slot size because the rate of change of drawdown increased with time in each test, indicating that lower permeability zones were encountered, which reduce well yield.

Although the evaluation of aquifer parameters was not a primary objective of the pre-design investigation, the data generated during the extraction tests were used to estimate aquifer transmissivity for comparison with values used in the OU-1 and OU-2A groundwater model (Earth Tech 2003a). During all seven extraction tests, water level data were collected from nearby observation wells, as listed in Table 2-9. However, drawdown in the observation wells was insufficient to allow for aquifer analysis. Therefore, drawdown versus time data in the extraction wells were analyzed using the time-drawdown method (Cooper and Jacob 1946) in pumping wells (Appendix G) and the recovery data were analyzed using the Theis & Jacob Recovery Test method (Theis 1935). When a pump is turned off in an extraction well, groundwater rushes into the well to compensate for head losses due to turbulent flow and well losses. The slope of the residual drawdown curve during this period is relatively steep. Once the slope flattens, the residual drawdown data represent the head losses that reflect the aquifer conductivity. Drawdown versus time curves were fitted for late recovery data, and transmissivity values were estimated. Storativity values cannot be estimated using data from extraction wells.

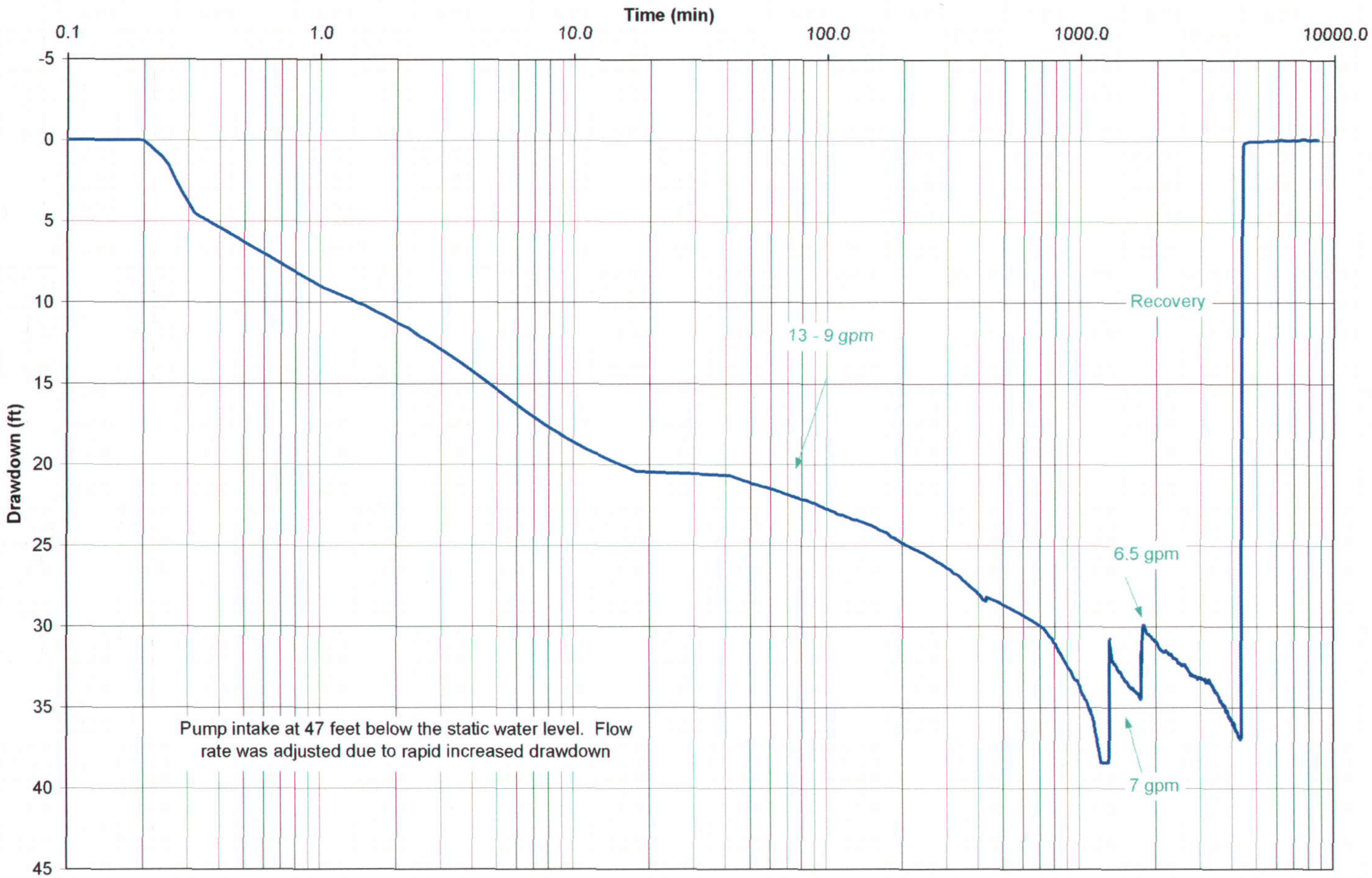
The transmissivity values are presented in Table 4-7; the aquifer test analyses and data are presented in Appendix G. The curve fitting was performed using the computer program Aquifer Test (Waterloo Hydrogeologic, Inc.). The estimated transmissivity values range from 180 to 5,100 square feet per day (feet^2/day), comparable to a range of 300 to 1,800 feet^2/day used in the OU-1 and OU-2A groundwater model (Earth Tech 2003a).

Table 4-7: Estimates of Transmissivity Values

Well ID	Well Type	Extraction Rate (gpm)	Transmissivity (feet^2/day)	
			Time Drawdown Method	Recovery Test
24EX8	Extraction	6.5	—	1,100
24EX9	Extraction	27	—	1,600
24EX10	Extraction	25	200	1,200
24EX11	Extraction	15	—	570
24EX12B	Extraction	41	—	2,700
24EX13A	Extraction	40	180	5,100
24EX14	Extraction	36	460	2,900

Early period after pump was shut down
Late later time period in the recovery test
— not available

Groundwater samples were collected before and after the 72-hour extraction tests. TCE mass removal was estimated using TCE analytical data and pumping rate data from each 72-hour extraction test. The mass of TCE removed with the groundwater was estimated by multiplying the volume of groundwater (gallons) pumped over a specified time period and the average concentrations of TCE for that time period. Gallons pumped were calculated from pumping rate and test duration. Average TCE concentrations were calculated using the two groundwater-sample results obtained at the extraction well before and after each test. Table 4-8 summarizes the analytical results and the calculated mass removal rates.



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72-hour Extraction Test at Well 24EX8 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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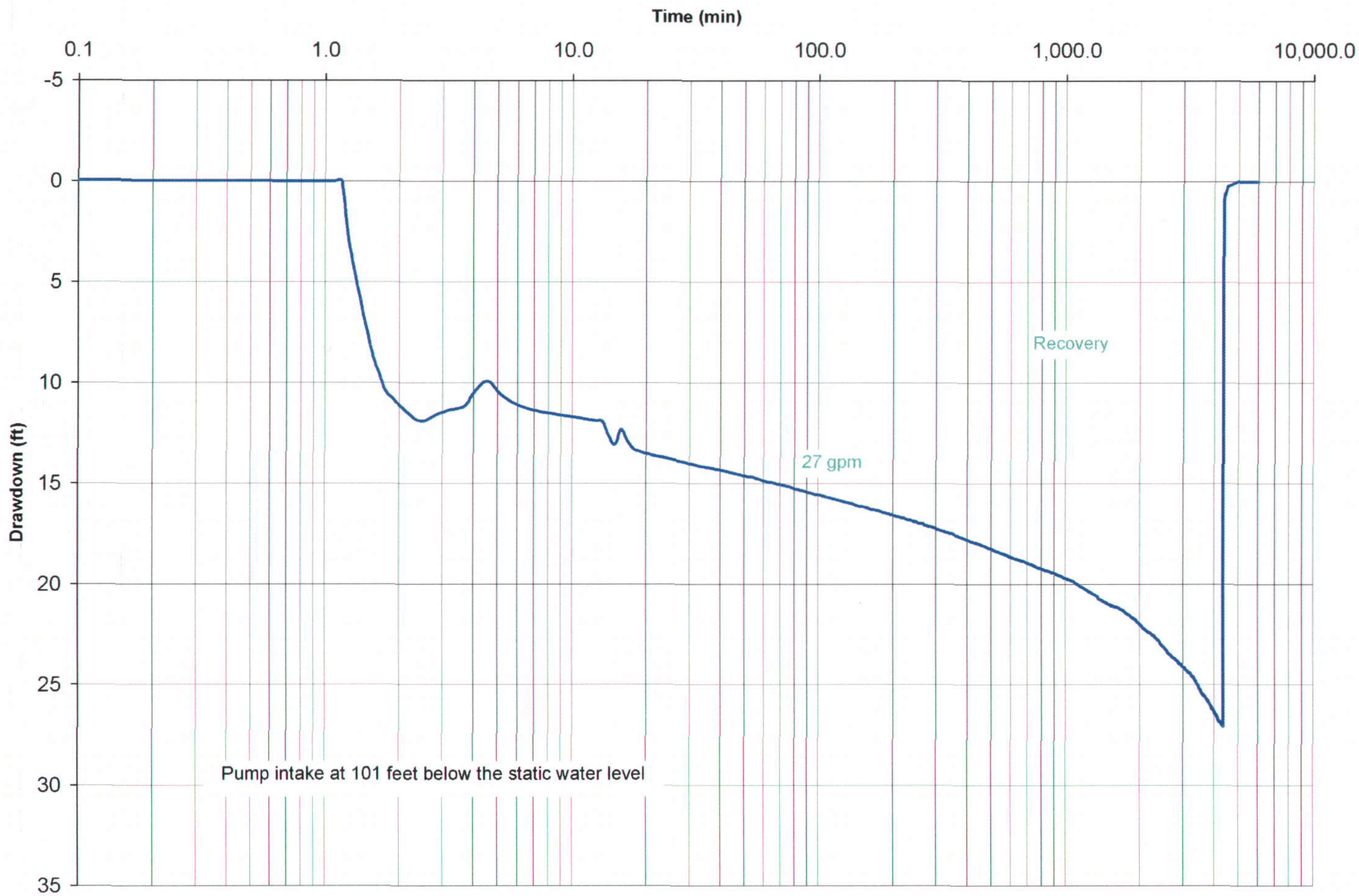

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72-hour Extraction Test at Well 24EX9

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

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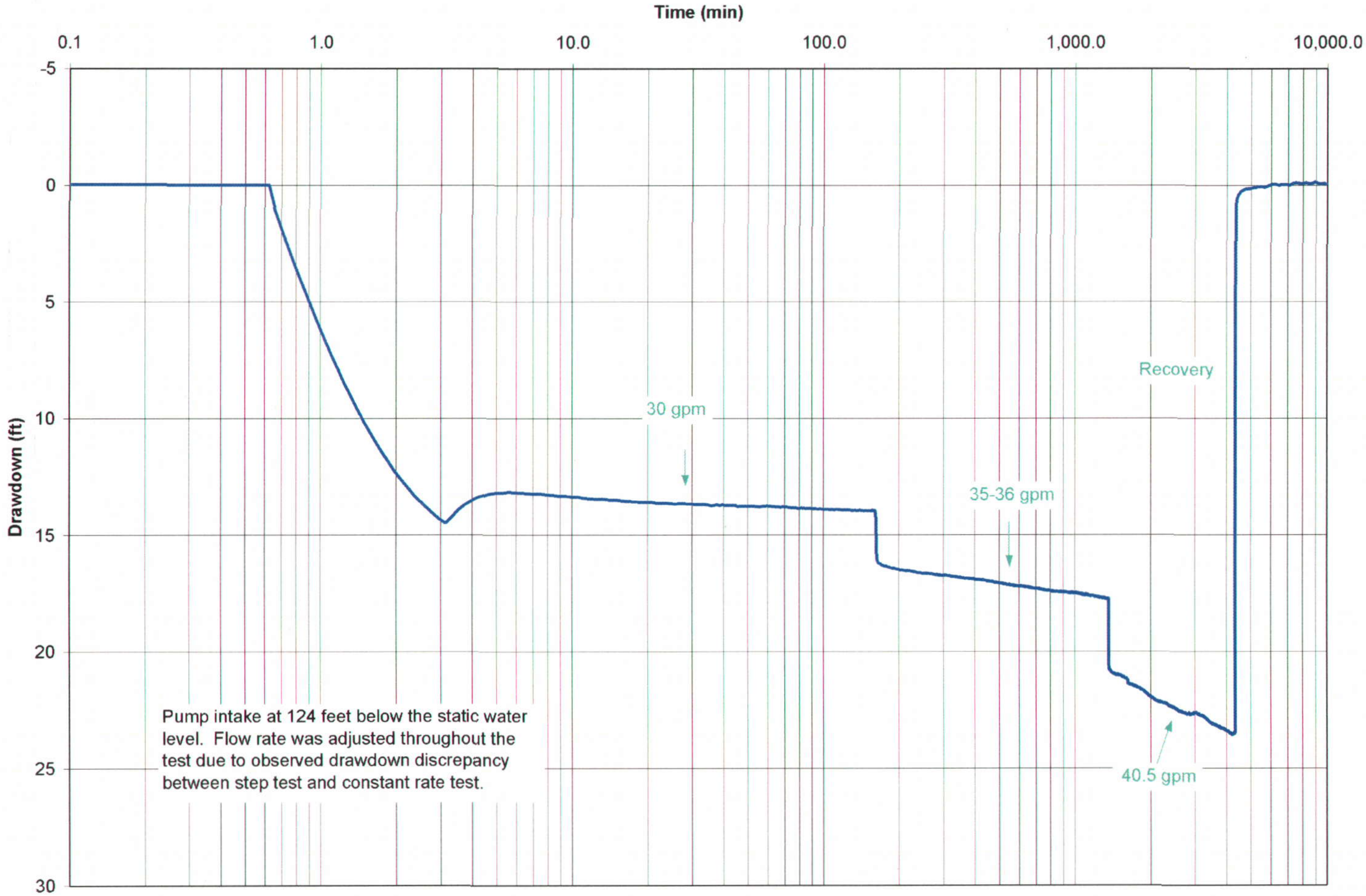

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72-hour Extraction Test at Well 24EX12B Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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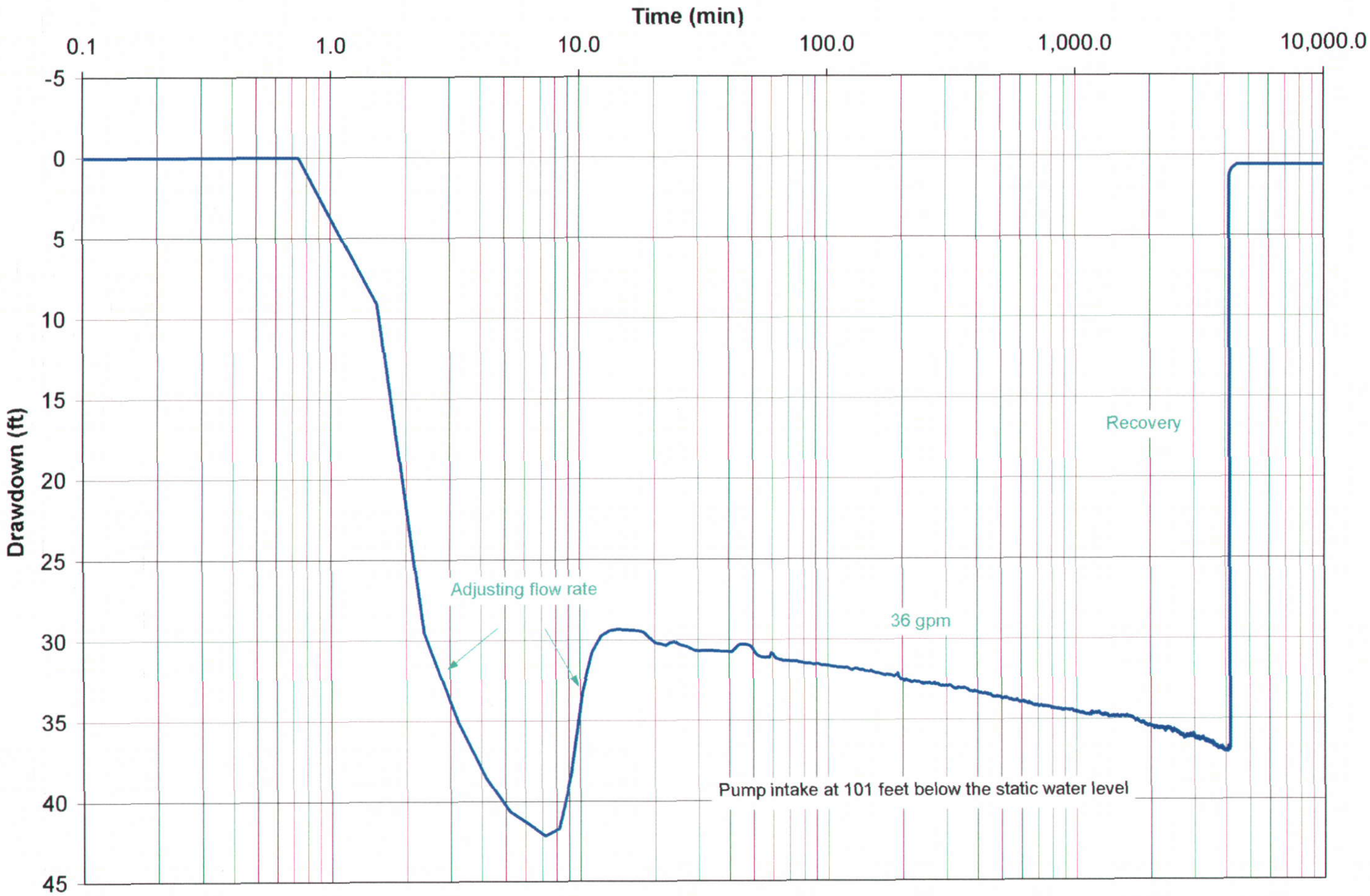

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72-hour Extraction Test at Well 24EX14 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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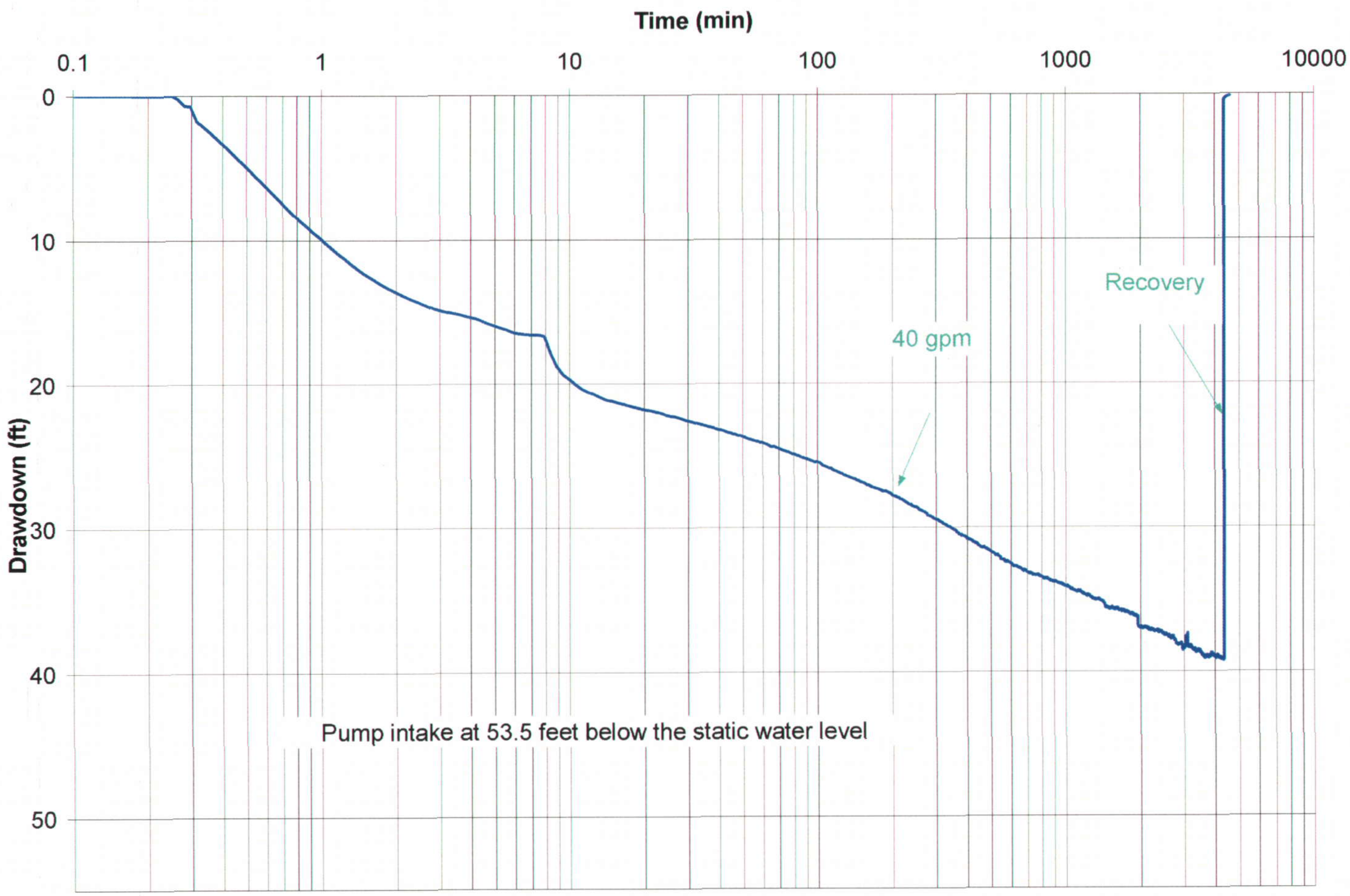

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72-hour Extraction Test at Well 24EX13A

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

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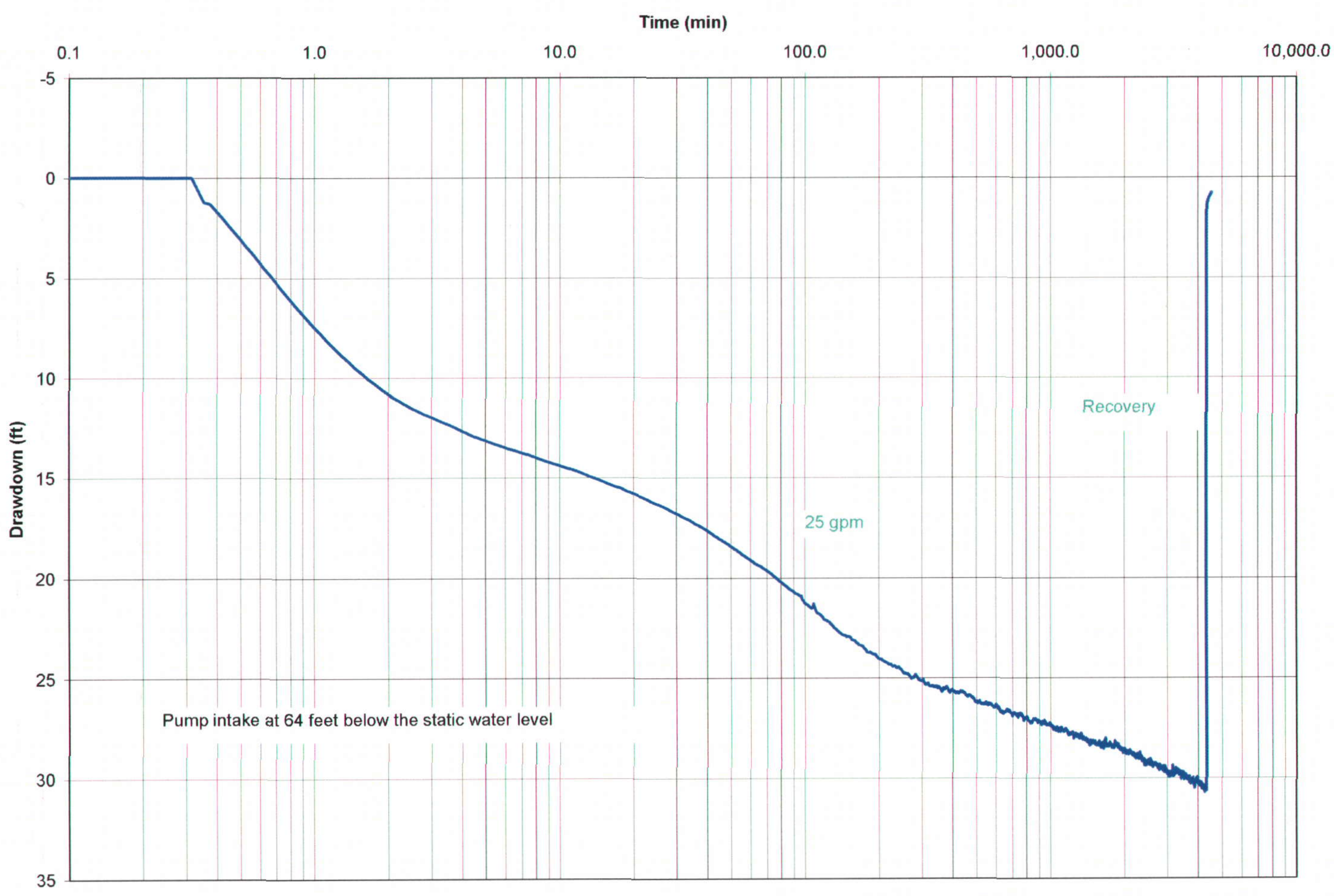

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72-hour Extraction Test at Well 24EX10 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
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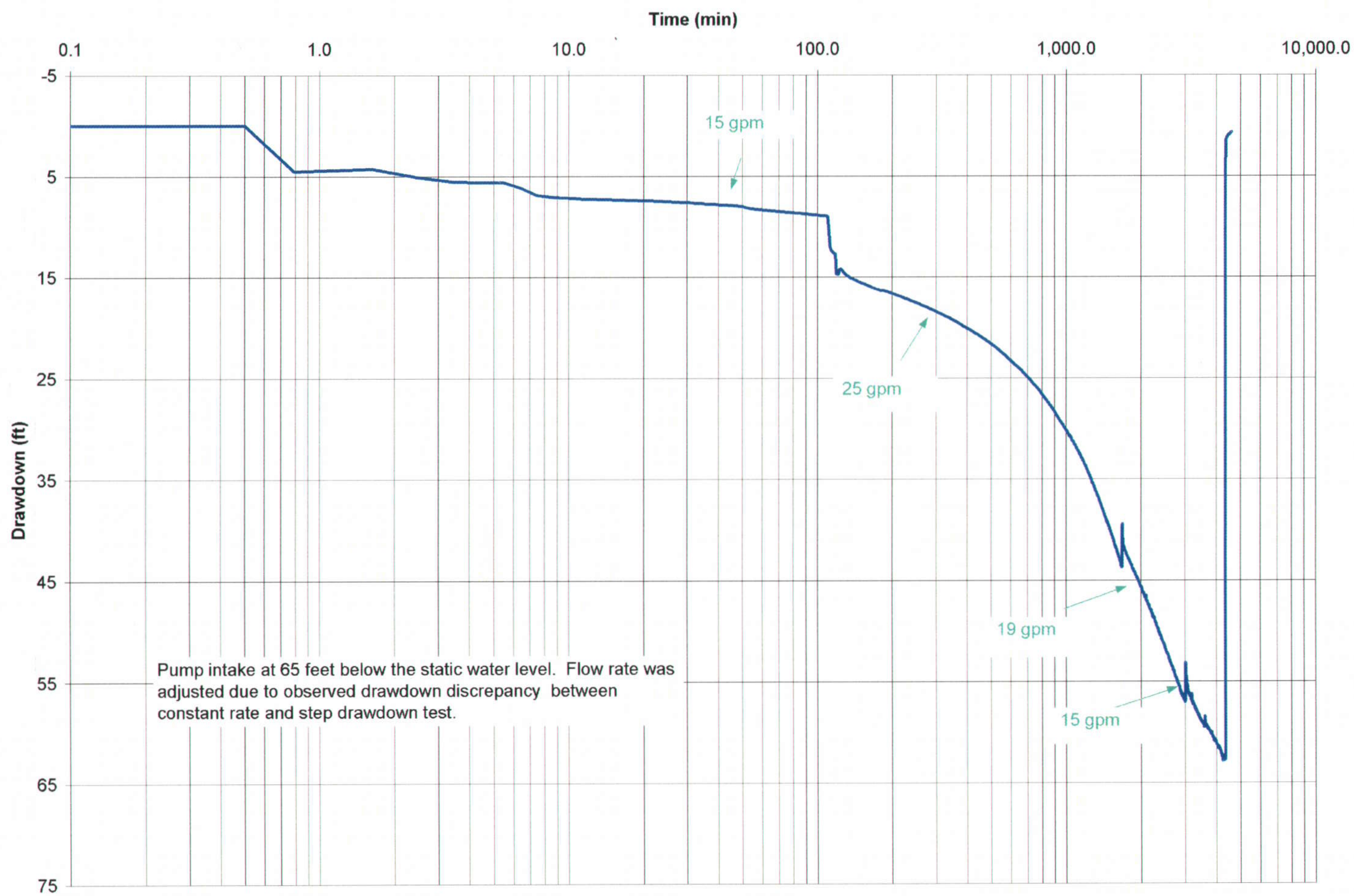

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72-hour Extraction Test at Well 24EX11

Pre-Design Investigation for SGU Remedy
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Table 4-8: Groundwater Sampling Results during 72-hour Extraction Test

Well ID	Pumping Duration (days)	TCE Concentration (µg/L)		Gallons Pumped	Total TCE Mass Removed (lb)	Average Mass Removal Rate for Test (lb/day)
		Before Test	After Test			
24EX8	3.01	385	793	28,738	0.14	0.047
24EX9	3.02	234/219 [a]	176	117,504	0.21	0.068
24EX10	3.00	75	53	108,000	0.06	0.02
24EX11	3.03	192	160/156 [a]	87,045	0.12	0.04
24EX12B	3.01	36	26/25 [a]	167,883	0.04	0.013
24EX13A	3.01	408	495	173,376	0.65	0.217
24EX14	2.89	51	44	152,023	0.06	0.021

lb pound
lb/day pound per day
[a] Normal/duplicate sample results

TCE concentrations at wells 24EX8 and 24EX13A, located down-gradient from the second hot spot near well 09_DGMW75, increased significantly at the conclusion of the 72-hour tests, compared with the initial results or PDB sampling results (Appendix A). This indicates hydraulic capture of the groundwater with higher TCE concentrations.

4.3.3 Groundwater Model Simulation

Extraction rates obtained from 72-hour, constant-rate aquifer tests, ranged from 6.5 gpm to 41 gpm within IRP Site 24 and 15 gpm to 36 gpm at the former station boundary. Long-term extraction rates are expected to vary depending on the exact well locations due to the lithologic heterogeneity of the SGU and dewatering of the aquifer. An average flow rate of 10 gpm for wells within IRP Site 24 and 20 gpm along the former station boundary was used in the initial model simulation. Based on the range of values obtained during the aquifer test, the initial flow rates were retained since they are representative of actual conditions and would conservatively estimate plume capture.

The plume distribution was updated based on the results from the PDI and quarterly groundwater sampling, Round 17 (CDM 2003a). Groundwater sampling results indicated that the plume is homogeneous with little stratification; consistent with historical sampling results and plume delineation. However, the lateral boundary of the TCE plume in the SGU was shifted so that the southern boundary of the 50-microgram per liter (µg/L) contour lies north of well 24EX12A and the 5-µg/L extent at the northern boundary lies south of wells 18_TIC55 and 24MW07 (Plate 1). Accordingly, the TCE plume geometry was updated in the transport model; however, the proposed screened intervals were not changed.

The results of the additional simulations using the updated model parameters are summarized in Appendix H. The updated simulation results are consistent with initial results and indicate complete hydraulic containment of the SGU plume, for concentrations above the clean-up goal, with the proposed well locations and extraction rates. In addition, the predicted TCE plume reduction rates are also consistent with previous simulation results.

4.4 Groundwater Remediation Enhancement Using SVE

4.4.1 Step-Drawdown Test Results

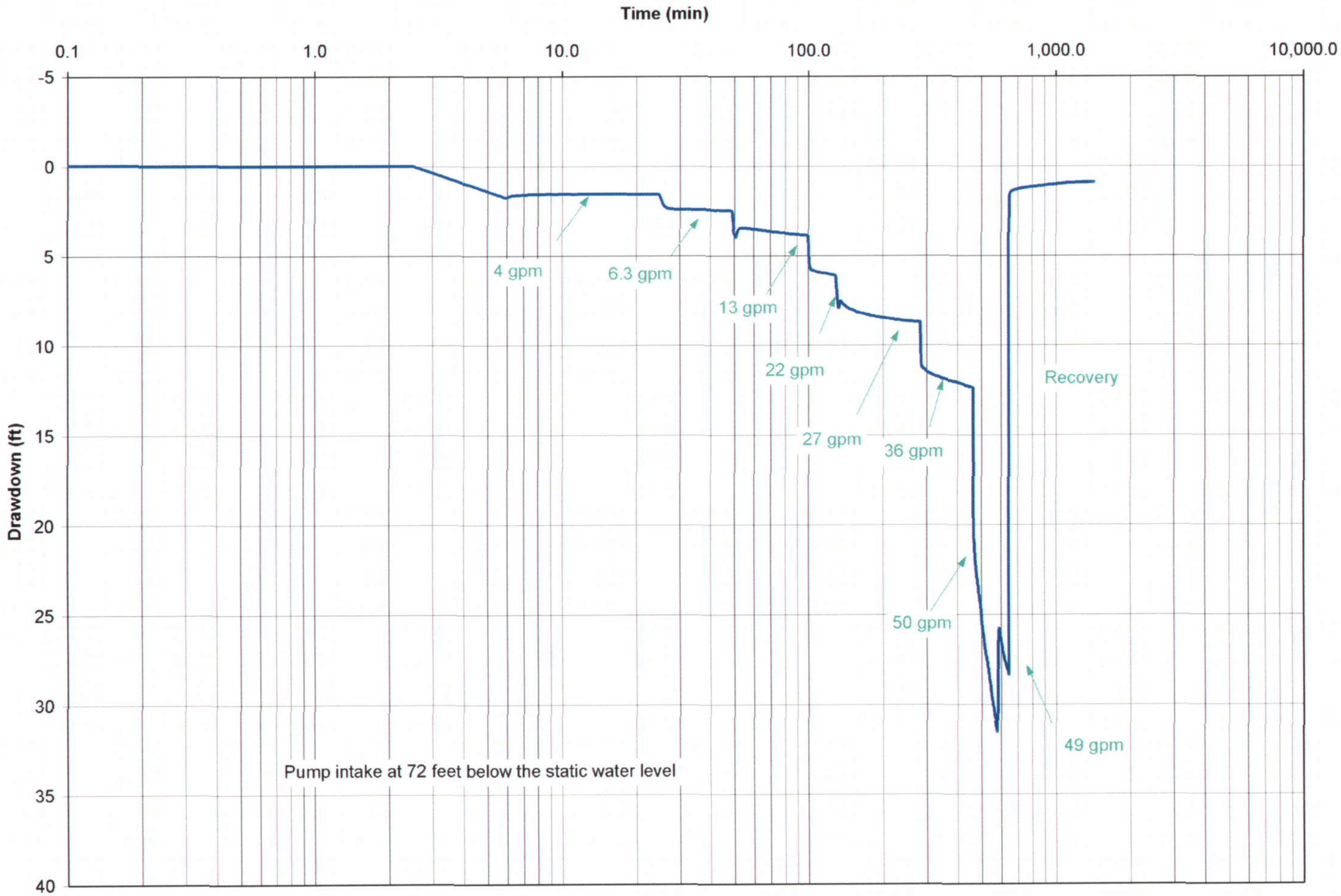
At wells 24EX3, 24EX6, and 24EX4, step-drawdown tests were conducted to determine extraction rates to be used for the mass removal enhancement tests. A 1.5-horsepower pump was placed at approximately 5–10 feet above the bottom of the screen to allow maximum drawdown. Pumping rates, number of steps, and the duration of each step were varied based on responses observed in each well. Figure 4-15 through Figure 4-17 present drawdown versus pumping time on semi-log scale. Table 4-9 summarizes the pumping steps, duration, pumping rates, and resulting maximum drawdown in each well. Changes in water levels at observation wells are also listed.

Table 4-9: Summary of Step-Drawdown Test Results

Well ID	Pump Intake Depth (feet bgs)	Step No.	Flow Rate (gpm)	Duration (minutes)	Maximum Drawdown (feet)	Drawdown in Observation Wells (feet)		
24EX3	175					**24EX3OB1**	**24EX3OB2**	**24EX3OB3**
						20.5 [a]	**71.7 [a]**	**63.2 [a]**
		1	4	22.2	1.57	0.04	0.02	0.07
		2	6.3	24	2.49	0.08	0.03	0.12
		3	13	51	3.87	0.14	0.04	0.22
		4	22	29	6.11	0.21	0.06	0.32
		5	27	148	8.67	0.31	0.11	0.62
		6	36	178	12.35	0.42	0.16	0.89
		7	50	118	31.50	0.76	0.27	1.69
		8	49	64	28.34	0.66	0.27	1.67
24EX6	170.5					**24EX6OB1**	**24EX6OB2**	**24EX6OB3**
						30 [a]	**76.5 [a]**	**91.6 [a]**
		1	4.75	36	1.4	0.09	0.03	0.0
		2	11	45	4.88	0.17	0.04	0.0
		3	15.3	112	8.85	0.35	0.13	0.0
		4	21	201	34.24	0.56	0.2	0.0
24EX4	183					**24EX4OB1**	**24EX4OB2**	—
						36 [a]	**62 [a]**	—
		1	6	43	1.15	0.11	0.06	—
		2	10–14	59	3.32	0.33	0.21	—
		3	22	105	5.6	0.61	0.43	—
		4	32	90	7.7	0.79	0.57	—
		5	46–53	181	19.7	1.33	1.05	—
		6	59	106	59.17	1.55	1.23	—

— no data
[a] distance from corresponding pumping well in feet

Groundwater samples obtained from the cluster of wells at each location where SVE enhancement tests were planned showed that TCE concentrations were highest in 24EX3OB1 and 24EX6OB2. For this reason, the SVE enhancement tests were carried out in wells 24EX3OB1 and 24EX6OB2, which have TCE concentrations of 520 μg/L and 960 μg/L, respectively.



Technical Memorandum		Final
Step-Drawdown Test at Well 24EX3 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
Date: 11-04	Former MCAS El Toro	Figure 4-15
Project No. 29307	EARTH TECH *A Tyco Infrastructure Services Company*	

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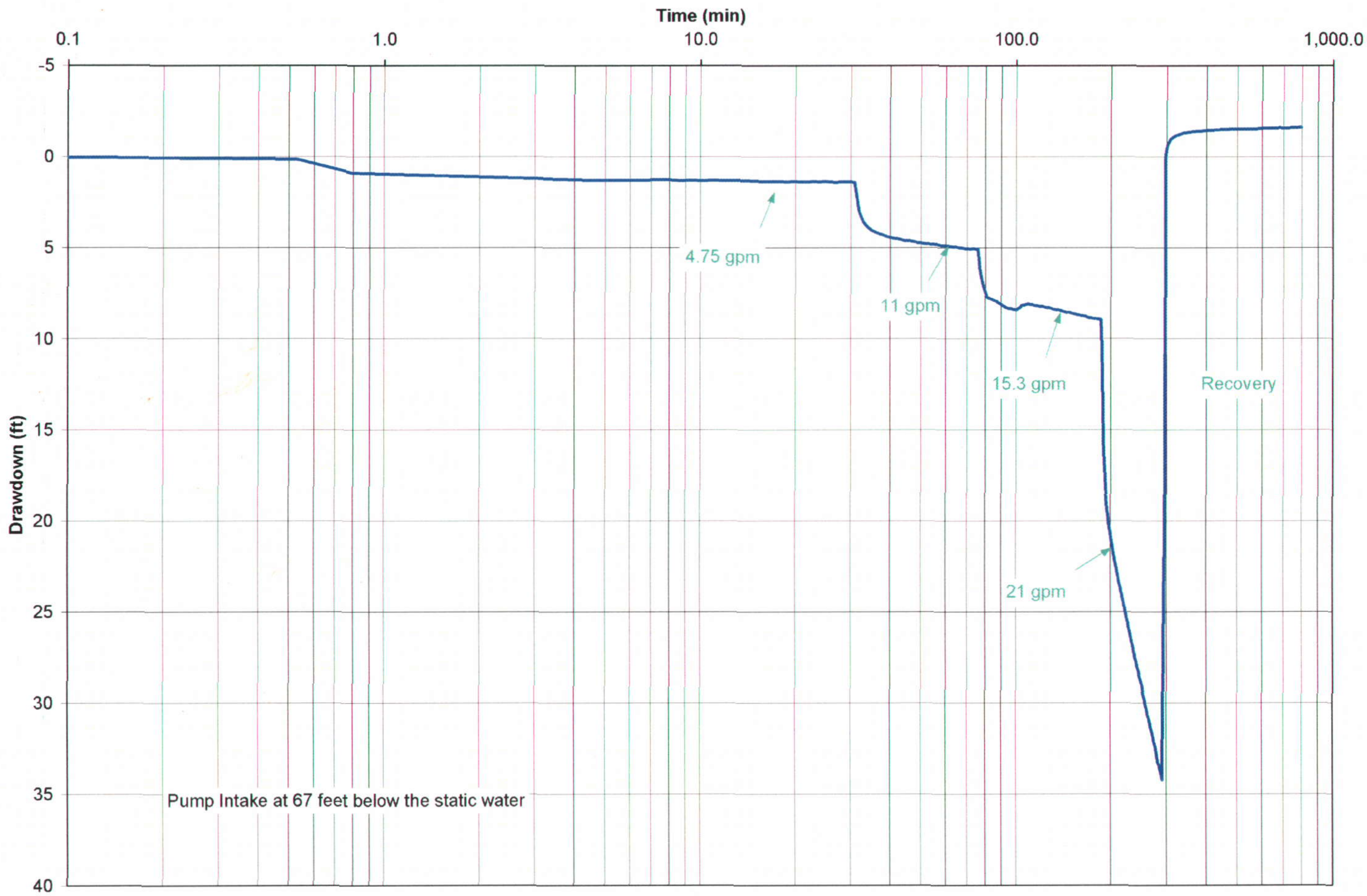

Technical Memorandum		Final
Step-Drawdown Test at Well 24EX6 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
Date: 11-04	Former MCAS El Toro	Figure 4-16
Project No. 29307	EARTH TECH *A Tyco Infrastructure Services Company*	

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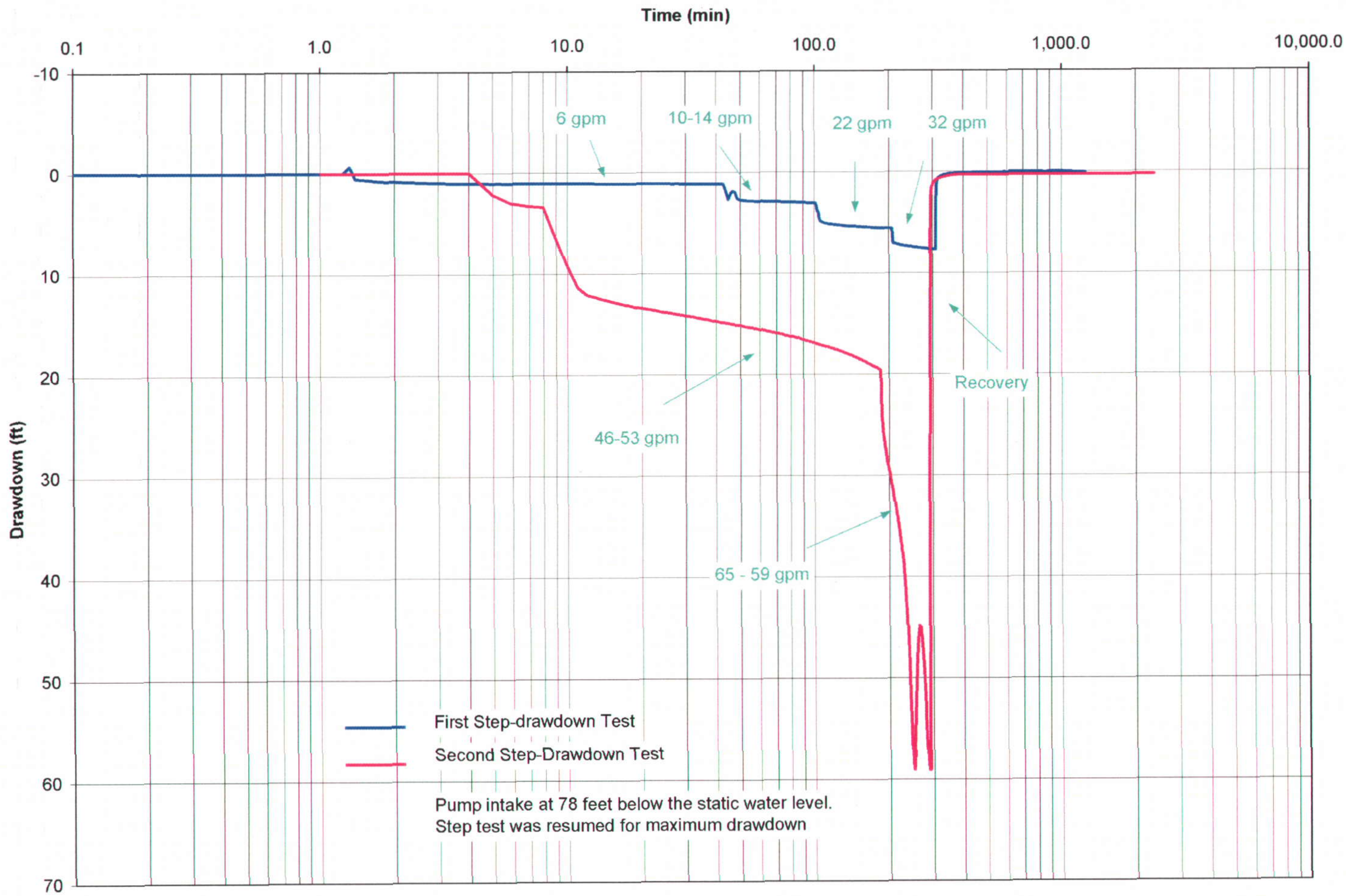

Technical Memorandum		Final
Step-Drawdown Test at Well 24EX4 Pre-Design Investigation for SGU Remedy IRP Site 24 VOC Source Area		
Date: 11-04	Former MCAS El Toro	Figure
Project No. 29307	EARTH TECH *A Tyco Infrastructure Services Company*	4-17

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Using the information obtained from the step-drawdown tests performed on the extraction wells, simplified step-drawdown tests were performed at wells 24EX3OB1 and 24EX6OB2 to estimate the initial startup extraction rates for the remediation enhancement test. A summary of the results is presented in Table 4-10; drawdown graphs are presented in Figure 4-18 and Figure 4-19.

Table 4-10: Summary of Simplified Step-Drawdown Test Results

Well ID	Pump Intake Depth (feet bgs)	Water Above Pump Intake (feet)	Step	Flow Rate (gpm)	Duration (minutes)	Maximum Drawdown (feet)	Drawdown in Observation Well (feet)
24EX3OB1	145	42					**24EX3OB2** **51.6[a]**
			1	5.4	18.7	1.37	0.01
			2	15	50	4.51	0.05
			3	22	45	14.72	0.12
			4	28	80	39.21	0.20
24EX6OB2	138	35					**24EX6OB1** **46.6[a]**
			1	4	35	2.59	0.06
			2	10.5	66	6.02	0.22
			3	14	10	7.39	0.25
			4	21	157	19.45	0.58

[a] distance from corresponding pumping well, in feet

4.4.2 Groundwater Remediation Enhancement Using SVE and SVE Results

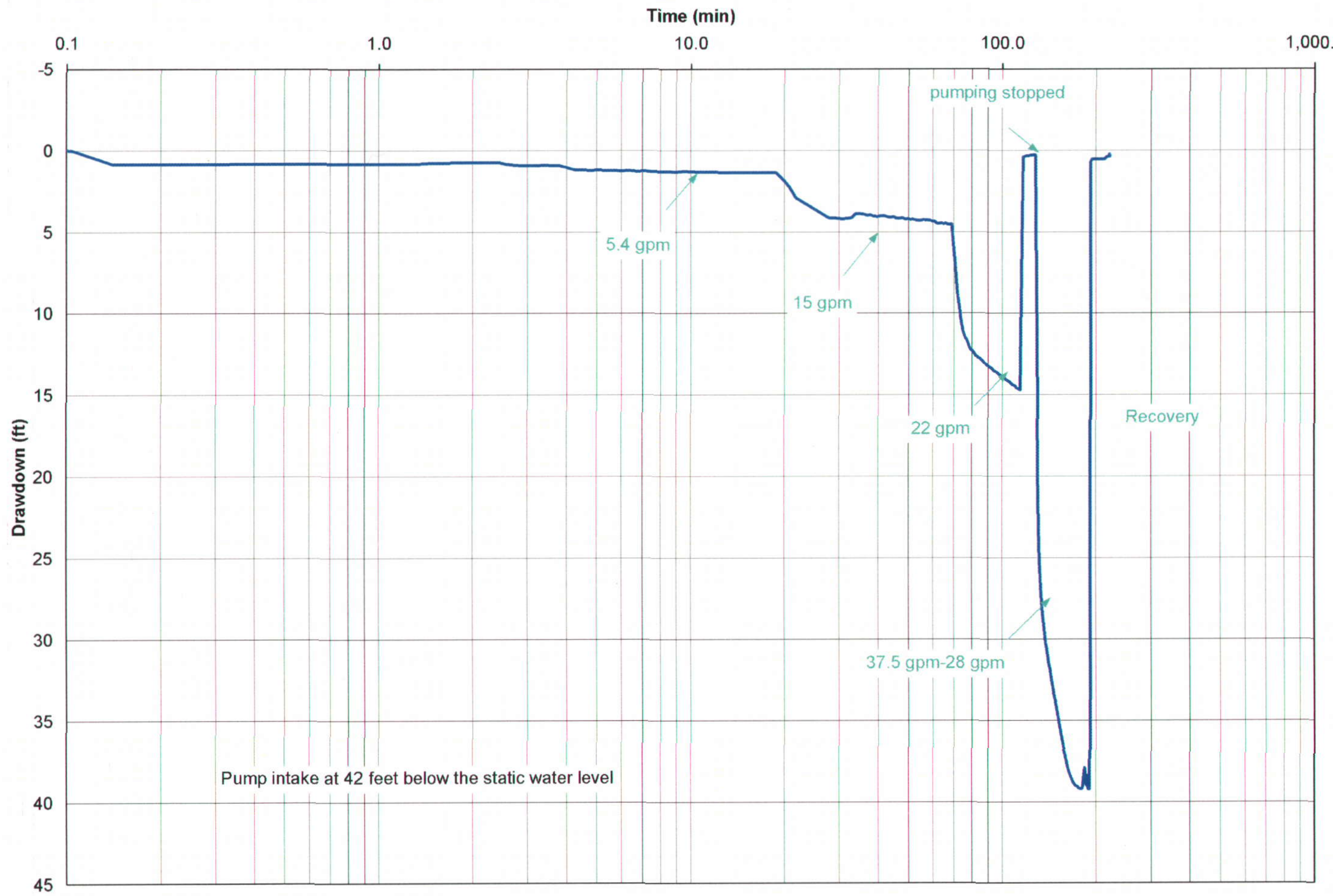
SVE was evaluated as a groundwater remedial enhancement at wells 24EX3OB1 and 24EX6OB2. The evaluation was designed to estimate mass removal of VOCs via SVE from dewatered soils, and in particular from the dewatered capillary fringe. Groundwater was extracted from each well for a period of 72 hours prior to vacuum application to sufficiently dewater the capillary fringe. Drawdown was approximately 30 feet and 27 feet, respectively in wells 24EX3OB1 and 24EX6OB2. Average groundwater extraction rates from 24EX3OB1 and 24EX6OB2 without vacuum were 14 gpm and 12 gpm, respectively. A vacuum of 5.5 inches of mercury was applied at 24EX3OB1 and yielded a vapor flow rate of 50 scfm. A vacuum of 10.5 inches of mercury was applied at 24EX6OB2, and yielded a flow rate of 73 scfm. Groundwater extraction rates increased to approximately 20 gpm and 18 gpm, respectively in 24EX3OB1 and 24EX6OB2 after vacuum application. Drawdown was maintained at pre-vacuum levels. Vapor samples were collected at 1-, 4-, 24-, and 72-hours after the vacuum was applied. Drawdowns within each test well were maintained after applying the vacuum by adjusting the extraction rate. The most frequently detected VOCs in the vapor samples were those established as the contaminants of concern in the vadose zone in the Interim ROD and are summarized in Table 4-11, which lists the associated soil gas threshold cleanup concentrations established in the Interim ROD (DON 1997). Analytical data are included in Appendix A.

Table 4-11: Soil Vapor Sampling Results

VOC	Soil Gas Threshold (µg/L) [a]	24EX3OB1 Concentration (µg/L)				24EX6OB2 Concentration (µg/L)				
		1-hr	4-hr	24-hr	72-hr	1-hr [b]	4-hr	24-hr	72-hr	72-hr After the Second Startup [c]
Trichloroethene (TCE)	27	4.3	3.9	4	2.6	—	30	27	24/23 [d]	26/25 [d]
Tetrachloroethene (PCE)	69	0.22	0.21	0.27	0.19	—	0.54	0.47	0.4/0.41 [d]	0.36/0.34 [d]
1,1-Dichloroethene (1,1-DCE)	563	0.14	0.13	0.15	0.12	—	1.4	1.2	1.1/1.1 [d]	1.1/1.1
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	234,000	4.4	4.4	6.1	3.7	—	4.8	4.0	4.0/3.9 [d]	4.5/4.6 [d]
Carbon tetrachloride	61	ND	ND	0.066	0.033	—	ND	ND	ND	ND

Note: 1-hr, 4-hr, 24-hr, 72-hr = time (hours) after applying vacuum.
— sample lost
ND not detected
[a] Soil gas threshold values established in the Site 24 Interim ROD (DON 1997).
[b] Sample lost in transit to the laboratory. No analytical data available.
[c] A second startup and 72-hour vapor extraction at the final location (well 24EX6OB2) was conducted solely for additional mass removal.
[d] Normal/duplicate sample results

Except for one occurrence (TCE at 24EX6OB2, 4 hours after initiating vapor extraction), VOC concentrations did not exceed the established soil gas thresholds. TCE concentrations in the vapor extracted from 24EX3OB1 reached a maximum of 4.3 µg/L after 1 hour and decreased to 2.6 µg/L after 72 hours. All other detected VOCs were at concentrations at least two orders of magnitude lower than their corresponding soil gas threshold. At well 24EX6OB2, a maximum TCE concentration of 30 µg/L was reached after 4 hours of SVE and dropped slightly to averages of 24 µg/L and 26 µg/L after 72 and 144 hours, respectively. At an average flow rate of 73 scfm and a constant 28 µg/L TCE, the initial mass removal rate of the SVE system at well 24EX6OB2 is approximately 30 kilograms of TCE per year. The vapor flow rate is expected to increase once residual water in the dewatered zone around the SVE well is extracted and the air permeability of the soil increases; however, the vapor concentrations will decrease with time. In comparison, the mass removal rate from groundwater extraction based on 400 gpm and an average TCE concentration of 100 µg/L would be 80 kilograms of TCE per year. To enhance groundwater remediation, SVE will be selectively applied at TCE hot spots within the known dewatered source areas to provide additional mass removal.



Technical Memorandum — Final

Step-Drawdown Test at Well 24EX3OB1

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11-04	Former MCAS El Toro	Figure
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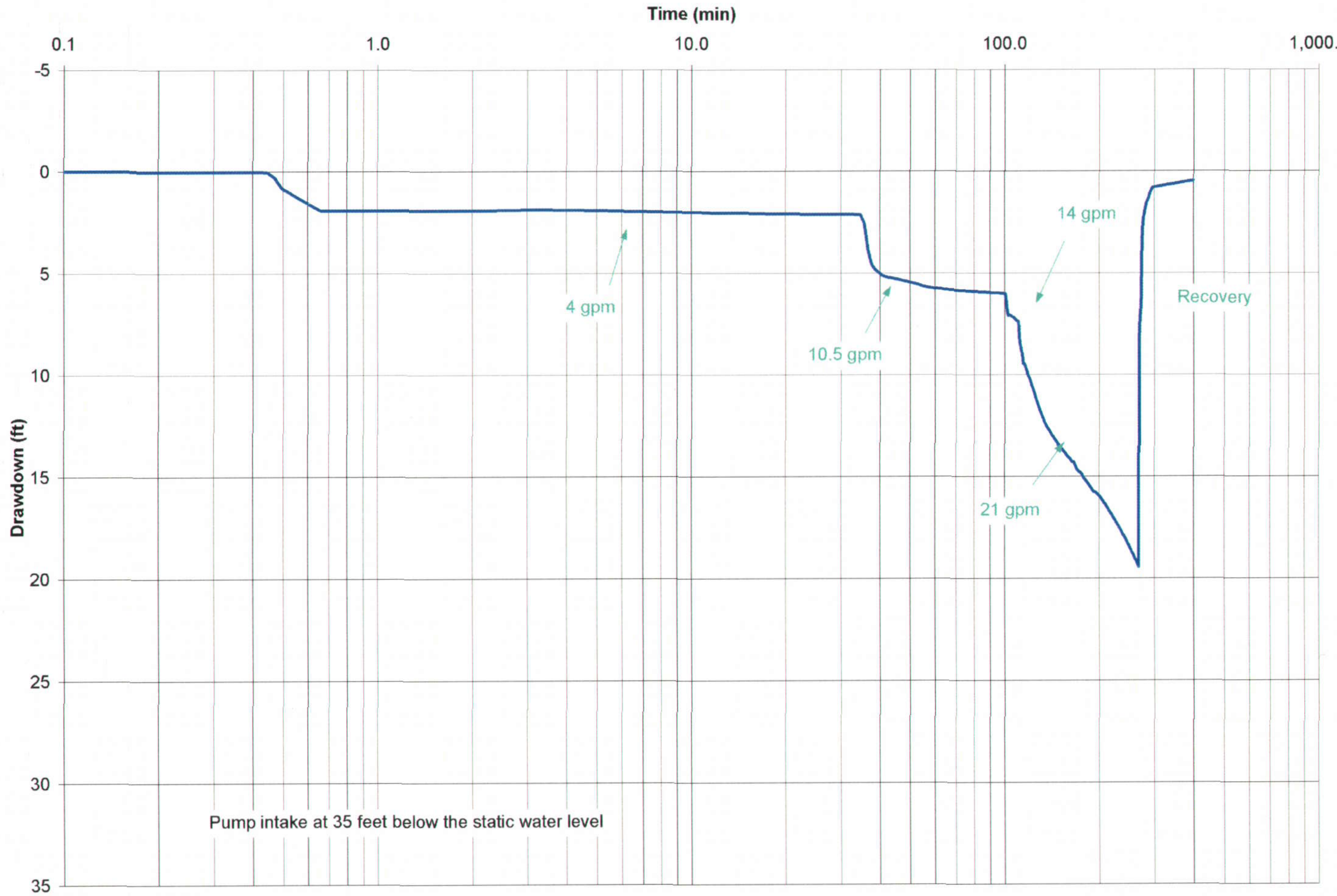

Technical Memorandum

Final

Step-Drawdown Test at Well 24EX6OB2

Pre-Design Investigation for SGU Remedy
IRP Site 24 VOC Source Area

Date: 11-04	Former MCAS El Toro	Figure 4-19
Project No. 29307	EARTH TECH *A Tyco Infrastructure Services Company*	

5. MANAGEMENT OF INVESTIGATION-DERIVED WASTES

5.1 SOIL AND DRILLING MUD IDW

A summary of the analytical results for soil and drilling mud IDW samples versus the corresponding TCLP and WET concentration limits are presented in Table 5-1 and Table 5-2, respectively. Table 5-3 and Table 5-4 present the results of total metals and total petroleum hydrocarbon concentrations, and total VOC concentrations, respectively, along with the corresponding background concentrations for former MCAS El Toro and the EPA-derived residential preliminary remediation goals (PRG concentrations). A copy of the soil IDW plan memorandum to the DON and validated analytical results for these samples are included in Appendix F.

The results show that none of the analytes exceed the corresponding federal regulatory concentrations (Table 5-1) or the state Soluble Threshold Limit Concentrations (STLC) (Table 5-2) used for classification of characteristic hazardous waste. None of the analytes exceed the corresponding background concentrations or the residential PRG concentrations (Tables 5-3 and 5-4), except the following:

- arsenic, which exceeded the corresponding residential PRG concentrations in samples LC720–LC725. Arsenic also slightly exceeded the 95 percent quantile background concentration (6.86 mg/kg) in sample LC725 (drilling mud sample), with a concentration of 7.0 mg/kg. This concentration is within the range of values used to estimate the background concentrations for former MCAS El Toro (BNI 1996);
- cadmium, which exceeded the corresponding residential PRG concentration in sample LC723, but not the corresponding background concentration; and
- aluminum, cobalt, copper, manganese, nickel, and selenium, which exceeded the corresponding background concentrations in sample LC725, but were below the corresponding residential PRG concentrations.

None of the concentrations exceeded the regulatory thresholds (TCLP and WET criteria values) used to classify wastes as federal or state hazardous wastes. In addition, all the soil samples (LC720–LC724) were at or below the station-wide background concentrations for metals and below the EPA residential PRGs for VOCs. In the drilling mud sample (LC725), only arsenic was above its residential PRG and again only slightly above its corresponding, station-wide background concentration, indicating that it is within the range of values used to estimate the station-wide background concentrations.

Based on these results, the soil IDW is classified as non-hazardous. Consistent with the Station-wide IDW Management Plan (CDM 1995), placement of the soil IDW at IRP Site 24 was recommended. It was further recommended that the soil be placed on the ground in the open areas along the west-end of the runways and disked into the ground during the regular station disking/weeding operations. Approval for placement was received on 8 January 2004, from the Navy (after notification to the BCT members) and placement was performed during the week of 12 January 2003. All plastic sheeting and debris or trash was removed and placed in a 3-yard trash bin for disposal as municipal waste.

5.2 GROUNDWATER IDW

5.2.1 Treatment System Evaluation

5.2.1.1 BATCH OPERATION OF CENTRAL TREATMENT SYSTEM

Batch operation of the CTS began 31 July 2003, and continued until the effluent tanks were filled. Water samples were collected on 31 July 2003 and the results conveyed to the Navy on 11 August 2003. Analytical results summarized in Table 5-5 show detections of VOCs in the influent samples were reduced to concentrations meeting the corresponding discharge requirements in the effluent samples, thereby demonstrating the effectiveness of the CTS using liquid-phase GAC.

5.2.1.2 CONTINUOUS OPERATION OF CENTRAL TREATMENT SYSTEM

Continuous treatment and discharge to the ground for percolation (east of Building 296) began on 29 August 2003. The work plan specified discharge to either the storm drain or the sanitary sewer. However, discharge to ground for percolation commenced after the DON notified the BCT that the treatment system was performing as required by the WDR for percolation of treated groundwater. The discharge was performed in accordance with the substantive requirements of WDR Order No. R8-2003-0085 as specified in Section 3.4. Weekly effluent sampling started on 2 September 2003. Midpoint samples were also collected at least once a week.

Sampling results confirmed that the CTS discharge stream met the average monthly concentration limits (summarized in Table 5-5) per WDR Order No. R8-2003-0085.

The CTS system was non-operational between Thursday, 18 September 2003 and Tuesday, 23 September 2003 to assess the need for a carbon change-out and addition of perchlorate treatment resin to the treatment train to enhance removal of perchlorate from the extracted groundwater. Post change-out sampling was conducted on 23 September 2003 to document the effectiveness of the replacement carbon, and then sampled again after addition of the perchlorate resin beds on 8 October 2003 to document the effectiveness of the resin in additional removal of perchlorate. A summary of these sampling results is also included in Table 5-5.

A total of 1,191,160 gallons of extracted groundwater was processed through the CTS over the four months it was in operation. The breakdown of the volume processed by month is as follows:

- August 2003 – 106,060 gallons
- September 2003 – 645,000 gallons
- October 2003 – 281,500 gallons
- November 2003 – 158,600 gallons

5.2.1.3 CARBON CHANGE-OUT AND PERCHLORATE REMOVAL RESIN BED INSTALLATION AT CENTRAL TREATMENT SYSTEM

The TCE results of the 11 September 2003 sampling showed concentrations of 37 µg/L and 2.5 µg/L at the mid-point and effluent of the treatment system, respectively, and 8.5 µg/L and 2.7 µg/L, respectively on 16 September 2003. While the effluent samples had not exceeded the discharge criterion of 5 µg/L, the mid-point samples had; therefore, change-out of the carbon was recommended. Change-out of the spent liquid phase GAC was conducted on 22 September 2003.

Table 5-1: Comparison of IDW Soil Leachate Concentrations to Federal TCLP Concentrations

Parameter	Analytical Method [a]	TCLP Concentration Limit (mg/L)	LC635 24EX10, 24EX11, 24EX14 (mg/L)	LC636 24EX12A, B, C (mg/L)	LC637 24EX13A, B, C and 24MW07 (mg/L)	LC638 24MW06 (mg/L)	LC639 24EX09 (mg/L)	LC640 Drilling Mud (mg/L)
Metals								
Arsenic	6010B	5.0	0.0058J	0.0122	0.0082J	0.0112	0.0126	0.0037J
Barium	6010B	100.0	0.442	0.297	0.375	0.146	0.193	0.533
Cadmium	6010B	1.0	0.0071	0.0071	0.0099	0.0116	0.0038J	0.0042
Chromium	6010B	5.0	0.0249	0.0102	0.0091J	0.0065J	0.0073J	0.0338
Mercury	7470A	0.2	0.000053	0.00011	0.00013	0.00012	0.000087	0.00011
Selenium	6010B	1.0	0.0053J	0.0034J	<0.020	<0.020	<0.020	<0.020
Silver	6010B	5.0	<0.020	<0.020	<0.020	<0.020	0.0017J	0.0052J
Volatile Organic Compounds								
Benzene	8260B	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbon tetrachloride	8260B	0.5	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorobenzene	8260B	100.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	8260B	6.0	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	0.0031
1,2-Dichloroethane	8260B	0.5	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methyl ethyl ketone	8260B	200.0	<0.1J	<0.1J	<0.1J	<0.1J	<0.1J	<0.1J
Tetrachloroethylene	8260B	0.7	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichloroethylene	8260B	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vinyl chloride	8260B	0.2	<0.00052	<0.00052	<0.00052	<0.00052	<0.00052	<0.00052

[a] Extraction by the federal TCLP method SW 1311
J quantitation estimated
mg/L milligram per liter

Table 5-2 Comparison of IDW Soil Leachate Concentrations to State STLC Concentrations

Parameter	Analytical Method [a]	STLC (mg/L)	LC635 24EX10, 24EX11, 24EX14 (mg/L)	LC636 24EX12A, B, C (mg/L)	LC637 24EX13A, B, C and 24MW07 (mg/L)	LC638 24MW06 (mg/L)	LC639 24EX09 (mg/L)	LC640 Drilling Mud (mg/L)
Metals								
Antimony and/or antimony compounds	6010B	15	<0.03	<0.03	<0.03	<0.03	<0.03	0.0175J
Arsenic and/or arsenic compounds	6010B	5.0	0.044	0.0576	0.0503	0.0415	0.0103J	0.343
Barium and/or barium compounds (excluding barite)	6010B	100	2.4	1.71	1.98	1.47	1.63	2.59
Beryllium and/or beryllium compounds	6010B	0.75	0.0015J	0.0014J	0.0019J	0.0019J	0.00061J	0.0011J
Cadmium and/or cadmium compounds	6010B	1.0	0.0436	0.0688	0.0847	0.115	0.0397	0.0396
Chromium and/or chromium (III) compounds	6010B	5	0.083	0.0673	0.103	0.0763	0.0449	0.176
Cobalt and/or cobalt compounds	6010B	80	0.090	0.113	0.138	0.165	0.0714	0.0643
Copper and/or copper compounds	6010B	25	0.169	0.167	0.107	0.102	0.057	0.413
Lead and/or lead compounds	6010B	5.0	0.0571	0.0962	0.0438	0.0425	0.0257	0.1440
Mercury and/or mercury compounds	7470A	0.2	<0.0002	<0.0002	0.00004J	<0.0002	<0.0002	<0.0002
Molybdenum and/or molybdenum compounds	6010B	350	0.0448	0.0487	0.0675	0.0921	0.0312	0.0473
Nickel and/or nickel compounds	6010B	20	0.201	0.240	0.335	0.422	0.183J	0.170J
Selenium and/or selenium compounds	6010B	1.0	0.0262	0.011J	0.0292	0.0302	0.0138J	0.0316
Silver and/or silver compounds	6010B	5	<0.050	<0.050	<0.050	<0.050	<0.050	0.0117J
Thallium and/or thallium compounds	6010B	7.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Vanadium and/or vanadium compounds	6010B	24	0.212J	0.252	0.330	0.325	0.172J	0.300
Zinc and/or zinc compounds	6010B	250	0.191	0.182	0.100	0.0733J	0.109	0.457
Volatile Organic Compound								
Trichloroethylene	8260B	204	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a] Extraction by the California Waste Extraction Test (WET) method (California Code of Regulations Title 22)
J quantitation estimated

Table 5-3: Comparison of IDW Soil Total Concentrations to Background and PRG Concentrations (Metals and Petroleum Hydrocarbons)

Parameter	Analytical Method	Former MCAS El Toro Background concentrations (0.95 Quantile) (mg/kg)	Residential PRGs (mg/kg)	LC720 24EX10, 24EX11, 24EX14 (mg/kg)	LC721 24EX12A, B, C (mg/kg)	LC722 24EX13A, B, C and 24MW07 (mg/kg)	LC723 24MW06 (mg/kg)	LC724 24EX09 (mg/kg)	LC725 Drilling Mud (mg/kg)
Metals									
Aluminum	6010B	14,800	76,000	4,000	7,400	6,470	7,540	8,090	**16,900**
Antimony and/or antimony compounds	6010B	—	31	<3.5	<4.8	<3.6	<4.0	<4.0	<7.2
Arsenic and/or arsenic compounds	6010B	6.86	0.39	<u>1.7</u>	<u>3.6</u>	<u>2.9</u>	<u>2.9</u>	<u>2.8</u>	<u>7.0</u>
Barium and/or barium compounds (excluding barier)	6010B	173	5,400	66.7	76.1	90.5	70.8	94.8	170
Beryllium and/or beryllium compounds	6010B	—	150	<0.23	<0.32	<0.24	<0.27	<0.26	<0.48
Cadmium and/or cadmium compounds "Cal-Modified PRG"[1]	6010B	2	1.70	0.53	1.2	1.0	<u>1.8</u>	0.79	1.5
Calcium	6010B	46,000	—	2,960	6,270	4,130	3,470	4,330	16,800
Chromium compounds (total)	6010B	26.9	210	5.2	10.7	10.5	10.5	10	20.8
Cobalt and/or cobalt compounds	6010B	6.98	900	2.4	4.2	3.7	4.1	4.4	**8.2**
Copper and/or copper compounds	6010B	10.5	3,100	4.0	7.9	5.3	6.6	5.7	**14.4**
Lead and/or lead compounds "Cal-Modified PRG"[1]	6010B	15.1	150	1.8	3.1	5.1	3.0	2.6	6.7
Magnesium	6010B	8,370	—	1,760	3,090	2,550	2,920	3,720	7,180
Manganese	6010B	291	1,800	103	172	164	189	173	**325**
Mercury and/or mercury compounds	7471A	0.22	—	0.035J	0.039J	0.028J	0.038J	0.036J	0.059J
Nickel and/or nickel compounds	6010B	15.3	1,600	4.1	9.9	8.1	11.4	7.7	**16.4**
Potassium	6010B	4,890	—	905	1,800	1,540	1,700	1,910	3,760
Selenium	6010B	0.32	390	0.14J	0.29J	0.32J	0.26J	0.30J	**0.68J**
Silver and/or silver compounds	6010B	0.539	390	0.031J	0.039J	<0.61	<0.66	<0.66	0.047J
Sodium	6010B	1,405	—	83.6J	509	151	269	98.7J	505
Thallium and/or thallium compounds	6010B	0.42	5	<0.47	<0.63	<0.49	<0.53	<0.53	0.18J
Vanadium and/or vanadium compounds	6010B	71.8	550	13.4	26.3	22.3	24.9	26.6	52.5
Zinc and/or zinc compounds	6010B	77.9	23,000	14.2	28.2	26.1	28.7	30.2	59.0
Petroleum Hydrocarbons									
TVPH as Gasoline	SW8015B	—	—	0.02J	0.06J	<11	0.02J	<14	0.1J
TEPH as Diesel	SW8015B	—	—	1J	2J	110	4J	2J	20J
TEPH as Motor Oil	SW8015B	—	—	<12	<16	160	<13	<13	27

[1] California-modified PRG

<u>Underline font</u> indicates exceedance of the EPA Residential PRG concentrations.

Bold font indicates exceedance of former MCAS El Toro background concentrations.

< concentrations were less than the corresponding reporting limit.
J quantitation estimated
mg/kg milligram per kilogram
PRG preliminary remediation goal
TVPH total volatile petroleum hydrocarbons
TEPH total extractable petroleum hydrocarbons

Table 5-4: Comparison of IDW Soil Total Concentrations to Background and PRG Concentrations (VOCs)

Parameter	Analytical Method	Former MCAS El Toro Background Concentrations (0.95 Quantile) (µg/kg)	Residential PRGs (µg/kg)	LC720 24EX10, 24EX11, 24EX14 (µg/kg)	LC721 24EX12A, B, C (µg/kg)	LC722 24EX13A, B, C and 24MW07 (µg/kg)	LC723 24MW06 (µg/kg)	LC724 24EX09 (µg/kg)	LC725 Drilling Mud (µg/kg)
Volatile Organic Compounds									
Acetone	8260B	—	1,600,000	<110	<250	<110	<140	<140	<340
Benzene	8260B	—	600	<5.3	<13	<5.4	<7.1	<7.0	<17
Bromodichloromethane	8260B	—	—	<5.3	<13	<5.4	<7.1	<7.0	<17
Bromoform	8260B	—	62,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Bromomethane	8260B	—	3,900	<5.3	<13	<5.4	<7.1	<7.0	<17
Methyl Ethyl Ketone	8260B	—	7,300,000	<110	<250	<110	<140	<140	<340
Carbon Disulfide	8260B	—	360,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Carbon Tetrachloride	8260B	—	250	<5.3	<13	<5.4	<7.1	<7.0	<17
Chlorobenzene	8260B	—	150,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Dibromochloromethane	8260B	—	1,100	<5.3	<13	<5.4	<7.1	<7.0	<17
Chloroethane	8260B	—	3,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Chloroform "Cal-Modified PRG"	8260B	—	940	<5.3	10J	<5.4	<7.1	6J	190
Chloromethane	8260B	—	1,200	<5.3	<13	<5.4	<7.1	<7.0	<17
Dichlorodifluoromethane	8260B	—	9,400	<5.3	<13	<5.4	<7.1	<7.0	<17
1,1-Dichloroethane "Cal-Modified PRG"	8260B	—	2,800	<5.3	<13	<5.4	<7.1	<7.0	<17
1,2-Dichloroethane	8260B	—	280	<5.3	<13	<5.4	<7.1	<7.0	<17
1,1-Dichloroethene	8260B	—	120,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Cis-1,2-Dichloroethene	8260B	—	43,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Trans-1,2-Dichloroethene	8260B	—	69,000	<5.3	<13	<5.4	<7.1	<7.0	<17
1,2-Dichloropropane	8260B	—	340	<5.3	<13	<5.4	<7.1	<7.0	<17
Cis-1,3-Dichloropropene	8260B	—	780	<5.3	<13	<5.4	<7.1	<7.0	<17
Trans -1.3-Dichlopropene	8260B	—	—	<5.3	<13	<5.4	<7.1	<7.0	<17
Ethylbenzene	8260B	—	8,900	<5.3	<13	<5.4	<7.1	<7.0	<17
2-Hexanone	8260B	—	—	<53	<130	<54	<71	<70	<170
Methylene Chloride	8260B	—	9,100	1J	5J	1J	1J	2J	6J
4-Methyl-2-Pentanone (MIBK)	8260B	—	790,000	<53	<130	<54	<71	<70	<170
Methyl-Tert Butyl Ether (MTBE) "Cal-Modified PRG"	8260B	—	17,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Styrene	8260B	—	1,700,000	<5.3	<13	<5.4	<7.1	<7.0	<17
1,1,1,2-Tetrachloroethane	8260B	—	3,200	<5.3	<13	<5.4	<7.1	<7.0	<17
1,1,2,2-Tetrachloroethane	8260B	—	410	<5.3	<13	<5.4	<7.1	<7.0	<17
Tetrachloroethene	8260B	—	1,500	<5.3	<13	<5.4	<7.1	<7.0	<17
Toluene	8260B	—	520,000	<5.3	<13	<5.4	<7.1	<7.0	<17
1,1,1-Trichloroethane	8260B	—	1,200,000	<5.3	<13	<5.4	<7.1	<7.0	<17
1,1,2-Trichloroethane	8260B	—	730	<5.3	<13	<5.4	<7.1	<7.0	<17
Trichloroethene	8260B	—	53	<5.3	<13	<5.4	<7.1	<7.0	<17
Trichlorofluoromethane	8260B	—	390,000	<5.3	<13	<5.4	<7.1	<7.0	<17
Vinyl Chloride	8260B	—	79	<5.3	<13	<5.4	<7.1	<7.0	<17
Xylenes (TOTAL)	8260B	—	270,000	<16	<38	<16	<21	<21	<52
T-Butyl Alcohol (TBA)	8260B	—	—	<21	<51	<22	<28	<28	<69

[1] California-modified PRG

< concentrations were less than the corresponding reporting limit.
J quantitation estimated
µg/kg microgram per kilogram
PRG preliminary remediation goal

Table 5-5: Summarized Analytical Results for Central Groundwater Treatment System

Parameter	Average Monthly Discharge Concentration Limit (µg/L) [a]	7/31/2003		9/2/2003			9/12/2003	9/112003	9/16/2003			9/23/2003			Average Monthly Effluent Concentration for September (µg/L)	9/29/2003[c]			10/2/2003			10/6/2003			10/8/2003		Average Monthly Effluent Concentration for October (µg/L)	11/4/2003			11/21/2003		Average Monthly Effluent Concentration for November (µg/L)
		Totalizer reading (gal.) = 2,120,940		Totalizer reading (gal.) = 2,227,000			Totalizer reading (gal.) = 2,485,200		Totalizer reading (gal.) = 2,637,800			Totalizer reading (gal.) = 2,684,500				Totalizer reading (gal.) = 2,872,000			Totalizer reading (gal.) = 2,970,700			Totalizer reading (gal.) = 3,121,500			Totalizer reading (gal.) = 3,153,500			Totalizer reading (gal.) = 3,311,300			Totalizer reading (gal.) = 3,312,100		
		Incremental Volume Treated [b] = 0 gal.		Incremental Volume Treated = 106,060 gal.			Incremental Volume Treated = 258,200 gal.		Incremental Volume Treated = 152,600 gal.			Incremental Volume Treated = 46,700 gal.				Incremental Volume Treated = 187,500 gal.			Incremental Volume Treated = 98,700 gal.			Incremental Volume Treated = 150,800 gal.			Incremental Volume Treated = 32,000 gal.			Incremental Volume Treated = 157,800 gal.			Incremental Volume Treated = 800 gal.		
		Influent LC624	Effluent LC625	Influent LC684	Midpoint LC686	Effluent LC688	Midpoint LC705	Effluent LC701	Influent LC713	Midpoint LC711	Effluent LC712	Influent LC727	Midpoint LC728	Effluent LC729		Midpoint LC739/ LC740	Effluent LC741/ LC742	Influent LC727	Influent LC747	Midpoint LC748	Effluent LC749	Influent LC755	Midpoint LC756	Effluent LC 757	Midpoint LC762	Effluent LC763		Influent LC797	Midpoint LC795	Effluent LC796	Midpoint LC800	Effluent LC799	
pH	6–9 [d] pH units	7.32	8.64	7.33	7.44	7.57	NS	7.11	7.36	NS	7.17	7.53	7.17	7.33	7.30	7.07 / 7.20 [c]	7.19 / 7.18 [c]	7.53	7.22	7.16	7.18	7.24	6.96	6.86	7.33	7.35	7.15	7.51	7.43	7.42	7.57	7.64	7.53
Total Petroleum Hydrocarbons	100 [d, e]	0.09	0.02 J	0.02 J	0.02 J	0.01 J	0.03 J	0.04 J	NS	0.04 J	0.06	0.03 J	0.15	0.03J	0.04	0.03 J / 0.04 J [c]	0.03 J / 0.03 J [c]	0.03 J	NS	0.06	0.04 J	NS	0.01 J	0.01 J	0.02 J	0.03 J	0.03	0.03 J	0.03 J	0.03 J	0.15	0.06	0.06
Benzene	1.0 [f]	2.2	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	38	<1	<1	1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	0.4J	<1	<1
Toluene	150 [f]	12	0.4 J	<1	<1	<1	<1	<1	NS	<1	<1	<1	14	<1	<1	1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1
Xylene	1750 [f]	14	0.7 J	<1	0.6 J	<1	<1	<1	NS	<1	<1	<1	0.5 J	<1	<1	<1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	36	<1	<1
Ethylbenzene	700 [f]	2	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbon tetrachloride	0.5 [g]	<0.5	<0.5	<0.5	<0.5	<0.5	0.4 J	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	NS	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	80 [f]	1.89	<0.03	3.28	<0.03	<0.03	1	0.79	NS	1.60	0.79	0.97	<0.053	<0.053	1.3	<0.03	<0.03	0.97	NS	<0.03	<0.03	NS	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.33	0.33
Dichlorobromo-methane	80 [f]	<0.024	<0.024	0.32	<0.024	<0.024	<0.059	<0.024	NS	<0.059	<0.024	<0.059	<0.059	<0.059	<0.024	<0.024	<0.024	<0.036	NS	<0.024	<0.024	NS	<0.065	<0.065	<0.065	<0.065	<0.045	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065
Methyl ethyl ketone	120 [f]	<100	<100	<100	<100	<100	<100	<100	NS	<100	<100	<100	<100	<100	<100	<100	<100	<100	NS	<100	<100	NS	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Methyl isobutyl ketone	120 [f]	<50	<50	<50	<50	<50	<50	<50	NS	<50	<50	<50	<50	<50	<50	<50	<50	<50	NS	<50	<50	NS	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
MTBE	5 [d, e]	<3	<3	<3	<3	<3	<3	<3	NS	<3	<3	<3	10	<3	<3	1 J	<3	<3	NS	<3	0.4 J	NS	<3	0.3 J	<3	0.4 J	<3	<3	<3	<3	<3	<3	<3
Naphthalene	10.0 [g]	<5	<5	<1	<1	<1	<1	<1	NS	<1	<1	NS	NS	NS	<1	NS	NS	<1	NS	NS	NS	NS	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1
Tetrachloroethene (PCE)	5 [d, e]	<1	<1	0.6 J	<1	<1	0.7 J	<1	NS	0.4 J	<1	2	<1	<1	<1	<1	<1	2	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethylene (TCE)	5 [d, f, e]	51	<1	61	<1	<1	37	2.5	NS	8.5	2.7	48	<1	<1	<1	<1	<1	48	NS	<1	<1	NS	<1	<1	<1	<1	<1	6.0	<1	<1	<1	<1	<1
1,1-Dichlorethane (1,1-DCA)	5 [d, e]	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-Dichloroethylene (1,1-DCE)	6 [d, e]	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-Dichloroethylene (1,2-DCE)	5 [d]	<1	<1	<1	<1	<1	0.9 J	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1,2-Dichloroethylene (cis-1,2-DCE)	6 [e]	NS	NS	<1	<1	<1	0.9 J	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1		NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-1,2-Dichloroethylene (trans-1,2-DCE)	10 [e]	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1		NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,1-Trichloroethane (1,1,1-TCA)	200 [d, e]	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2,3-Trichloropropane (1,2,3-TCP)	—	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<0.5	<0.5	NS	NS	NS	<0.5	NS	NS	*<0.5*	NS	NS	NS	NS	<0.5	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TBA	12 [d, e]	<20	<20	<20	<20	<20	<20	<20	NS	<20	<20	<20	<20	<20	<20	<20	<20	<20	NS	<20	<20	NS	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Nitrate (mg/L)	—	11	0.59	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nitrite (mg/L)	—	<1	<0.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 5-5: Summarized Analytical Results for Central Groundwater Treatment System

Parameter	Average Monthly Discharge Concentration Limit (µg/L) [a]	7/31/2003		9/2/2003			9/12/2003	9/112003	9/16/2003			9/23/2003			Average Monthly Effluent Concentration for September (µg/L)
		Totalizer reading (gal.) = 2,120,940		Totalizer reading (gal.) = 2,227,000			Totalizer reading (gal.) = 2,485,200		Totalizer reading (gal.) = 2,637,800			Totalizer reading (gal.) = 2,684,500			
		Incremental Volume Treated [b] = 0 gal.		Incremental Volume Treated = 106,060 gal.			Incremental Volume Treated = 258,200 gal.		Incremental Volume Treated = 152,600 gal.			Incremental Volume Treated = 46,700 gal.			
		Influent LC624	Effluent LC625	Influent LC684	Midpoint LC686	Effluent LC688	Midpoint LC705	Effluent LC701	Influent LC713	Midpoint LC711	Effluent LC712	Influent LC727	Midpoint LC728	Effluent LC729	
Sulfides (mg/L)	0.4 [g]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NS	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Dissolved Solids (TDS) (mg/L)	—	811	751	988	1,170	1,080	1,170	1,060	NS	1,010	985	1,120	1,080	1,110	1058.8
Total Suspended Solids (mg/L)	75 [g]	NS	NS	71	3J	<4	15	7	NS	43	30	3.0 J	<4	<4	10.2
Perchlorate	4 [f, e]	4.7	<4	5	2.7 J	<4	9.0	6.5	NS	5.6	5.5	7.9	<4	<4	3.9
1,4-Dioxane	3 [i, e]	<3	<3	0.6 J	0.4 J	<3	<3	0.3 J	NS	0.8 J	<3	<3	2 J	<3	<3
Fish Toxicity	LC_{50} (96 hours) [j]	>750	>750	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Selenium	—	8.8	<2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Lead	50 [d]	3.8	3.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Parameter	9/29/2003[c]			10/2/2003			10/6/2003			10/8/2003		Average Monthly Effluent Concentration for October (µg/L)	11/4/2003			11/21/2003		Average Monthly Effluent Concentration for November (µg/L)
	Totalizer reading (gal.) = 2,872,000			Totalizer reading (gal.) = 2,970,700			Totalizer reading (gal.) = 3,121,500			Totalizer reading (gal.) = 3,153,500			Totalizer reading (gal.) = 3,311,300			Totalizer reading (gal.) = 3,312,100		
	Incremental Volume Treated = 187,500 gal.			Incremental Volume Treated = 98,700 gal.			Incremental Volume Treated = 150,800 gal.			Incremental Volume Treated = 32,000 gal.			Incremental Volume Treated = 157,800 gal.			Incremental Volume Treated = 800 gal.		
	Midpoint LC739/ LC740	Effluent LC741/ LC742	Influent LC727	Influent LC747	Midpoint LC748	Effluent LC749	Influent LC755	Midpoint LC756	Effluent LC 757	Midpoint LC762	Effluent LC763		Influent LC797	Midpoint LC795	Effluent LC796	Midpoint LC800	Effluent LC799	
Sulfides (mg/L)	<0.2 / <0.2 [c]	<0.2 / <0.2 [c]	<0.2	NS	<0.2	<0.2	NS	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Dissolved Solids (TDS) (mg/L)	994 / 979 [h]	1,050 / 1,120 [h]	1,120	NS	1,300	1,300	NS	1,230	1,180	1,250	1,790	1,288	1,030	1,200	1,060	1,100	1,070	1065
Total Suspended Solids (mg/L)	6.0 / 5.0 [h]	5.0 / 4.0 [h]	3.0J	NS	<4	<4	NS	43.0	14.0	9.0	<4	<4	9.0	79.0	<4	27.0	9.0	9
Perchlorate	3.6 J / 3.3 J [h]	2.9 J / 1.9 J [h]	7.9	NS	6.3	5.4	NS	7.2	7.2	11.1	<4	3.8	8.9	10.3	<4	7.4	<4	<4
1,4-Dioxane	0.4 J / 0.4 J [h]	0.5 J / 0.4 J [h]	<3	NS	<3	<3	NS	<3	<3	0.3 J	<3	<3	0.7 J	0.4 J	<3	0.4 J	0.4 J	0.4 J
Fish Toxicity	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Selenium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Lead	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

J quantitation estimated.
— no existing discharge requirement
NS not sampled
[a] The highest allowable average of daily pollutant discharges over a calendar month, calculated as the sum of all measurements over a calendar month divided by the number of measurements. Units are in µg/L except where indicated.
[b] Volume treated since previous sample
[c] Samples included for the month of October to provide the required average of 4 samples per month when operational.
[d] General Waste Discharge Requirements per Order No. R8-2002-0033.
[e] General Waste Discharge Requirements per Order No. R8-2003-0085.
[f] California MCL, Title 22, California Code of Regulations Division 4. Environmental Health Chapter 15. Domestic Water Quality and Monitoring Article 4. Primary Standards-Inorganic Chemicals and Article 5.5. Primary Standards-Organic Chemicals. (1998).
[g] General Waste Discharge Requirements per Order No. 96-18.
[h] Duplicate samples
[i] California Action Level, Article 17. Special Monitoring Requirements for Unregulated Organic Chemicals. (2002).
[j] According to Title 22, an LC50 value of ≤ 500 mg/L is deemed toxic.

In addition, because the 2 October 2003 and 6 October 2003 effluent sampling results indicated rapid breakthrough of perchlorate through the replacement carbon, two 1,500-lb vessels of perchlorate-specific ion-exchange resin were installed on 8 October 2003, downstream of the carbon vessels as perchlorate removal polishing vessels. Since installation of these vessels, effluent (treated) groundwater samples have all been analyzed to be less than the method detection limit for perchlorate of 1.8 µg/L (see Table 5-5). Between 8 October 2003 and early November 2003, the CTS was largely idle.

Groundwater treatment at the CTS resumed on 31 October 2003 and the next sampling round was conducted on 4 November 2003. A copy of the CTS performance report to the DON is presented in Appendix F together with Table F-3, which presents a summary of validated analytical results for all the CTS samples collected during its operation.

5.3 SPENT CARBON AND ION-EXCHANGE RESIN

As part of the PDI, both groundwater and vapor treatment systems were rented from which the spent media IDW was generated. The spent media consists of spent vapor-phase and liquid-phase GAC and spent perchlorate-specific, ion exchange (IX) resin, which are being handled as individual waste streams. Approximately 2,000 pounds of spent vapor-phase GAC, 4,000 pounds of spent liquid-phase GAC, and 3,000 pounds of spent IX resin were generated during the investigation.

Management of the spent media IDW (vapor and liquid-phase GAC and IX resin) was conducted in accordance with the following guidance documents and regulations:

- CLEAN II SOP 22, *IDW Management* (BNI 1999),
- EPA IDW Guidance (EPA 1992),
- EPA Hazardous Waste Regulations, Title 40 Code of Federal Regulations (CFR) 261, and
- California Code of Regulations (CCR), Hazardous Waste Regulations, Title 22 CCR 66261.

Based on the regulatory requirements for determination of a hazardous waste pursuant to the characteristics of toxicity as listed in Title 22 CCR 66261.24, the spent samples were analyzed for total concentration values and where necessary, as indicated by the total concentration values, also analyzed for leachate concentrations using the federal TCLP. In addition, the spent resin sample was analyzed for fish toxicity using the Fish Toxicity Test pursuant to Title 22 CCR 66261.24(a)(6). Analytical methods used are identified below.

Composite samples of each media were collected and submitted for laboratory analysis as follows:

- The spent liquid-phase and vapor-phase GAC samples were analyzed for total VOCs using EPA Method 8260 to compare against the state Total Threshold Limit Concentrations (TTLC) for each regulated analyte.
- A second vapor-phase GAC sample was analyzed for total leachate VOCs using EPA Method 1311/8260, the federal TCLP, to confirm whether the spent carbon was a Resource Conservation and Recovery Act (RCRA) hazardous waste.
- The spent IX resin was analyzed for total metals (including mercury) and CCR Title 22 toxicity testing. No analysis for VOCs was conducted as the influent stream to the IX resin bed was demonstrated to be free of VOCs (below detection limits) after passage through the liquid-phase GAC. Additional testing for facility acceptance was performed for volatile bromides, chlorides, fluorides, and sulfur.

The validated analytical reports have been included in Appendix F and are summarized below. Table 5-6 presents a summary of the detections, along with the corresponding federal and state limits (if regulated).

5.3.1 Spent Liquid-Phase GAC

The only analytes detected were chloroform (0.037 mg/kg, no TTLC) and TCE (0.045 mg/kg, compared to the TTLC of 2,040 mg/kg).

5.3.2 Spent Vapor-Phase GAC

Analytes detected using EPA Method 8260 for VOCs were TCE (19.6 mg/kg, compared to the TTLC of 2,040 mg/kg) and PCE (46.8 mg/kg, no TTLC). These levels indicated the possibility of a leachate sample exceeding the corresponding regulatory limits for RCRA hazardous waste; therefore, a TCLP analysis was performed on a subsequent sample. Analytes detected in the leachate sample using EPA Method 1311/8260 were chloroform (0.0057 milligram per liter [mg/L], compared to the TCLP limit of 6 mg/L) and methyl tert butyl ether (MTBE) (0.017 mg/L, not regulated).

5.3.3 Spent IX Resin

Selenium was detected at 12.1 mg/kg, compared to the TTLC of 100 mg/kg, and the fish toxicity test showed an acute aquatic 96-hour LC50 value of >750 mg/L, greater than the hazardous criterion of 500 mg/L. Additional analytical results for disposal facility acceptance requirements are included with the IDW disposal memoranda in Appendix F.

Table 5-6: Summary of Detections and Corresponding Hazardous Waste Limits

Compound	Result/TCLP [a] Limit (mg/L)	Result/TTLC [b] Limit (mg/kg)	Result/Acute Aquatic Limit (mg/L)
Spent Vapor-Phase GAC			
Chloroform	0.0057 / 6	—	—
MTBE	0.017 / NR	—	—
TCE	<0.001 / 0.5	19.6 / 2,040	
PCE	<0.001 / 0.7	46.8 / NR	
Spent Liquid-Phase GAC			
Chloroform	—	0.037 / NR	—
TCE	—	0.045 / 2,040	—
Spent Perchlorate Removal Resin			
Selenium	—	12.1 / 100	—
Fish Toxicity[c]	—	—	>750 / <500

NR Not Regulated
[a] Federal Limit, 40 CFR 261.4
[b] State Limit, Title 22, CCR 66261.24
[c] A result greater than the regulatory limit (500 mg/L) is a pass.

Based on the analytical results presented above, all three spent media were classified as non-hazardous waste for the purposes of disposal. Facility waste acceptance profiles for disposal of the spent carbon were completed, signed by the generator, and submitted to the owners of the equipment (treatment systems) for review and acceptance by their disposal vendors. Spent carbon profiles were accepted by the disposal facilities as follows:

- The spent liquid-phase GAC profile was accepted by Barnebey Sutcliffe Corporation (Barnebey) for disposal by regeneration and assigned profile number 5083-L.
- The spent vapor-phase GAC profile was accepted by Barnebey for disposal by regeneration and assigned profile number 6033-V.
- The spent IX resin profile was accepted by Clean Harbors Environmental Services, Inc. for disposal by incineration and assigned profile number CH212382.

All spent media were transported off-site under a non-hazardous waste manifest. The disposal companies, upon disposal of the wastes, will provide regeneration/disposal certificates or incineration certificates for each waste, which will then be forwarded to the DON. A copy of the memorandum to the DON summarizing the spent-media and IDW disposal plan, and analytical results is included in Appendix F.

6. CONCLUSIONS AND RECOMMENDATIONS

Groundwater sampling and extraction testing conducted at IRP Site 24 achieved the objectives of the pre-design investigation:

- Reduce uncertainties in the groundwater model by evaluating sustainable extraction rates and vertical VOC plume distribution.
- Assess whether SVE would be a technically feasible and cost-effective enhancement to the groundwater remedy.
- Select a layout for the conveyance pipe network.

6.1 GROUNDWATER MODEL UNCERTAINTIES

6.1.1 Plume Delineation

Groundwater sampling using PDBs and the low-flow sampling method indicated that the plume is homogeneous with little stratification. Results are consistent with historical sampling results and plume delineation.

The configuration of the TCE plume in the shallow groundwater unit has been modified slightly as follows based on the sampling results obtained from this pre-design investigation and the Round 17 GMR (CDM 2003a):

- The southern boundary of the 50-µg/L contour has been shifted north of well 24EX12A.
- The 5-µg/L extent at the northern boundary has been shifted south of 18_TIC55 and 24MW07.

Consistent with historical sampling results, the high TCE concentrations (above 50 µg/L) are found mainly in the upper portion of the SGU, from the potentiometric surface (approximately 80–100 feet bgs) to approximately 180 feet bgs. TCE concentrations in excess of the MCL are present to a maximum depth of approximately 210 feet bgs, within the lower portion of the SGU.

Three hot spots were identified at IRP Site 24:

- One located near well 24EX6OB2 (maximum TCE concentration of 960 µg/L)
- One located near wells 24MW03 and 09_DGMW75 (maximum TCE concentration of 1,270 µg/L, at 24MW03)
- One located at well 24EX3OB1 (maximum TCE concentration of 520 µg/L)

Pumping from the agricultural wells, including 18_TIC55, has not resulted in northward and downward migration of TCE in excess of the MCL.

PDB samplers were used to confirm previous groundwater contamination results obtained from HydroPunch samples. The results obtained using the PDB sampling method support historical groundwater sampling results, and indicate that the corresponding HydroPunch samples may have been anomalous.

Vertical flow measurements at the plume source area using a heat-pulse flow meter ranged from 2.9 to 541 feet per day with an upward direction. However, the flow rates estimated by the heat-pulse method far exceeded the magnitudes computed using head differentials, and appear to be inconsistent with hydrogeologic conditions at Site 24. Additionally, resolution limitations associated with the heat-pulse render the results uncertain.

Based on intra-well gradient calculations using head differential data, vertical flow within the SGU at IRP Site 24 ranges from 0.00052 to 0.18 ft/day, with an average vertical flow rate of 0.047 ft/day. No predominant vertical flow direction is evident in the SGU.

6.1.2 Sustainable Extraction Rates

Sustainable extraction rates at IRP Site 24 were estimated from a series of step-drawdown tests and 72-hour extraction tests. Extraction rates for the 72-hour tests ranged from 14 gpm to 40 gpm at the source area, 6.5 gpm to 41 gpm at the second hot spot near 09_DGMW75 and 24MW03, and approximately 15 gpm to 36 gpm at the station boundary. However, long-term extraction rates are expected to be lower as dewatering progresses.

A screen slot size of 0.035 inch is appropriate for SGU extraction wells. Lithology appears to be the main limiting factor of sustainable flow rate.

Estimated transmissivity values range from 180 feet^2/day at 24EX11 to 5,100 feet^2/day at 24EX13A, consistent with values used in the OU-1 and OU-2A groundwater model.

6.1.3 Groundwater Model Simulations

The PDI sampling results were incorporated into the OU1 and OU2A groundwater model, and the updated simulation results are presented in Appendix H. The updated simulation results are similar to the results presented in the groundwater modeling technical memorandum (Earth Tech 2003a), and did not result in revisions to the proposed extraction well locations, extraction rates, or proposed screened intervals.

6.2 Mass Removal Enhancement Using SVE

Mass removal rates estimated by the SVE test indicate that SVE may be a cost-effective option to enhance the groundwater remedy. SVE will be utilized for mass removal enhancement during implementation of the SGU remedy. SVE will be implemented in the hot spot areas after sufficient dewatering has occurred as a result of groundwater extraction.

6.3 Conveyance Pipe Network Layout

A geophysical survey and exploratory trenching were performed along the entire length of the proposed conveyance pipe alignment to estimate the locations of existing underground utilities. The results of this survey and trenching are presented in construction drawings (as plan and profile drawings) in the draft 90-percent design submittal for the SGU remedy (Weston 2004).

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Appendix A
Analytical Data for
Groundwater and Soil Gas Sampling

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC501	LC502	LC503	LC504	LC505	LC506	LC507	LC508	LC509	LC510	LC511	LC512	LC513	LC514	LC515	LC516	LC517	LC518	LC519	LC520
Location ID:	FIELD QC	FIELD QC	24_EX50_B1	24_EX50_B1	24_EX50_B1	24_NEW4	24_NEW4	24_NEW4	24_NEW5	24_NEW5	24_NEW5	09_DGMW75	09_DGMW75	09_DGMW75	09_DGMW75	07_DGMW71	24_MW05A	FIELD QC	FIELD QC	FIELD QC
Sample Type:	TB	FB	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	FD	REG	REG	REG	REG	TB	EB	FB
Sample Date:	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	5/2/2003	6/13/2003	6/13/2003	6/13/2003	6/13/2003	6/13/2003
Parameter																				
VOCs (EPA Method 8260B) (µg/L)																				
1,1,1,2-Tetrachloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	5 U	5 U	5 U	1 J	1 J	1 J	5 U	5 U	5 U	14	4 J	17	17	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	11	5.8	12	12	1 U	3.7	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	2 J	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.8	1.5	3.2	3.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	4.46	3.59	4.65	4.58	0.03 U	0.49	0.03 U	0.03 U	0.03 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 J	0.4 J	0.5 J	0.5 J	1 U	0.8 J	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	4 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	20 U	20 U	20 U	20 U	20 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3.1	2	3.7	3.8	1 U	0.4 J	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1 U	1 U	1 U	1 U	1 U	15	15	15	1 U	1 U	1 U	805	874	1020	1010	2	170	1 U	1 U	1 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC521	LC522	LC523	LC524	LC525	LC526	LC527	LC528	LC529	LC530	LC531	LC532	LC533	LC534	LC535	LC536	LC537	LC538	LC539	LC540
Location ID:	07_DGMW72	18_BGMW101	24_MW04 (SHALLOW)	FIELD QC	FIELD QC	24_EX40_B2	24_EX40_B2	24_MW04 (DEEP)	24_MW05 (DEEP)	24_MW04 (DEEP)	24_EX30B3	10_DGMW77	18_PS6	FIELD QC	FIELD QC	24_MW01A	24_MW01B	24_MW03	24_EX08	FIELD QC
Sample Type:	REG	REG	REG	EB	TB	REG	FD	REG	REG	FD	REG	REG	REG	EB	TB	REG	REG	REG	REG	EB
Sample Date:	6/16/2003	6/16/2003	6/16/2003	6/16/2003	6/16/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/17/2003	6/18/2003	6/18/2003	6/18/2003	6/18/2003	6/18/2003
Parameter																				
VOCs (EPA Method 8260B) (µg/L)																				
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	30	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	3 J	4 J	15	5 J	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 J	1 U	1 U
1,1-Dichloroethene	1 U	0.4 J	2.9	1 U	1 U	1 U	1 U	1	2.1	1	1 U	1 U	1 J	1 U	1 U	19	11	21	17	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	4 J	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Bromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.7	0.7	0.5	0.5	0.5	0.5 U	0.5 U	0.9	0.5 U	0.5 U	1.5	0.9	2.6	0.9	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	0.03 U	0.03 U	0.93	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	2.3	0.03 U	0.03 U	1.2	0.48	3.74	0.65	0.053 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 J	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	0.9 J	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 U	20 U	20 U	20 U	20 U	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ
Tetrachloroethene	1 U	18	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.1	1 U	1 U	2	0.5 J	4.8	0.5 J	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5.3	30	59	1 U	1 U	138	139	16	39	17	1 U	57	159	1 U	1 U	741	300	1270	460	1 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC541	LC542	LC543	LC544	LC545	LC546	LC547	LC548	LC549	LC550	LC551	LC552	LC553	LC554	LC555	LC556	LC557	LC558	LC559	LC560
Location ID:	24IN2OB2	FIELD QC	FIELD QC	24_EX60_B1	18_BGMW3A	FIELD QC	18_BGMW3C	FIELD QC	24_EX6OB3	18_BGMW3B	24_MW02 (SHALLOW)	24_EX3	24_EX3	24_EX3	24_EX3	24_EX3	24_EX3	24_EX3	24_EX3OB2	24_EX3OB2
Sample Type:	REG	TB	TB	REG	REG	EB	REG	TB	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Sample Date:	6/18/2002	6/18/2003	6/19/2003	6/19/2003	6/19/2003	6/19/2003	6/19/2003	6/20/2003	6/20/2003	6/20/2003	6/20/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003
Parameter																				
VOCs (EPA Method 8260B) (µg/L)																				
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	15	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U	5.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	0.7 J	100 UJ	100 UJ	100 UJ	1 J	100 UJ	100 UJ	0.7 J	100 UJ
2-Hexanone	50 U	50 U	50 U	50 U	50 UJ	50 U	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
Bromoform	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Tetrachloride	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.9	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.5	1.4
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U
Chloroethane	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Chloroform	0.053 U	0.053 U	0.053 U	0.62	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.87	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.3 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	2 J	3 UJ	3 U	3 UJ	3 UJ	0.5 J	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ
Tetrachloroethene	1 U	1 U	1 U	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U	2.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1 U	1 U	1 U	298	1 U	1 U	0.5 J	1 U	1 U	1 U	676	2	2	2	2	2	2	2	95	98
Trichlorofluoromethane	5 U	5 U	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC561	LC562	LC563	LC564	LC565	LC566	LC567	LC568	LC569	LC570
Location ID:	24_EX3OB2	24_EX3OB2	24_EX4	24_EX4	24_EX4	24_EX4	24_EX4	24_EX4	24_EX4	24_EX4
Sample Type:	REG	FD	REG	REG	REG	REG	REG	REG	REG	REG
Sample Date:	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	7/17/2003	6/24/2003	6/24/2003	7/17/2003	7/17/2003
Parameter										
VOCs (EPA Method 8260B) (µg/L)										
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	0.8 J	100 UJ	2 J	1 J	2 J	100 U	100 UJ	100 UJ	100 U	100 U
2-Hexanone	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.024 U	0.059 U	0.059 U	0.024 U	0.024 U
Bromoform	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 U	1 U
Carbon Disulfide	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 U	1 U
Carbon Tetrachloride	1.1	1.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.065 U	0.036 U	0.036 U	0.065 U	0.065 U
Chloroethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 U	1 U
Chloroform	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.03 U	0.053 U	0.053 U	0.03 U	0.03 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 U	20 UJ	20 UJ	20 U	20 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	81	101	34	33	37	30	34	38	42	32
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Sample ID:	LC571	LC572	LC573	LC574	LC575	LC576	LC577	LC578	LC579	LC580
Location ID:	24_EX4OB1	24_EX4OB1	24_EX4OB1	24_EX4OB1	24_EX50_B1	24_EX50_B1	24_EX50_B1	24_EX5OB2	24_EX5OB2	24_EX5OB2
Sample Type:	REG	REG	FD	REG	REG	REG	REG	REG	REG	REG
Sample Date:	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003
Parameter										
VOCs (EPA Method 8260B) (µg/L)										
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	5 U	5 U	7	14	21	4 J	4 J	4 J
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	0.4 J	0.5 J	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	0.5 J	100 UJ	1 J	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Tetrachloride	0.5	0.6	0.6	0.6	0.3 J	0.5	0.7	0.4 J	0.4 J	0.4 J
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U
Chloroethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Chloroform	0.053 U	0.053 U	0.053 U	0.053 U	0.48	0.63	0.77	0.34	0.35	0.34
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	0.4 J	0.5 J	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ
Tetrachloroethene	1 U	1 U	1 U	1 U	0.5 J	0.7 J	1	0.4 J	0.4 J	0.4 J
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	204	200	209	201	217	324	438	112	109	108
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC581	LC582	LC583	LC584	LC585	LC586	LC587	LC588	LC589	LC590	LC591	LC592	LC593	LC594	LC595	LC596	LC597	LC598	LC599	LC600	LC601
Location ID:	24_EX5OB2	24_IN2	24_IN2	24_IN2	24_IN2	24_IN2	24_IN2	24_EX6	24_EX6	24_EX6	24_EX6	24_EX6	24_EX6	24_EX6	24_EX6	24_IN03	24_IN03	24_IN03	24_IN03	24_IN03	24_IN03
Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	FD	REG	REG	REG	REG	FD	REG	REG	FD	REG
Sample Date:	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003
Parameter																					
VOCs (EPA Method 8260B) (µg/L)																					
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	4 J	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	2 J	2 J	2 J
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.3 J	1 U	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	8.9	9.6	9.4	8.6
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	100 U	100 U	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	3 J	100 U	100 U	100 U	100 U	100 U
2-Hexanone	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ
4-Methyl-2-Pentanone	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ
Acetone	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.059 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.5 U	0.5 U	0.5	0.6	0.6	0.6
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.036 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Chloroethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U
Chloroform	0.33	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.42	0.4	0.41	0.41	0.41	0.39	0.4	0.4	1.42	1.14	0.4	0.41	0.38	0.33
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 J	0.9 J	1 J	0.9 J	0.9 J	0.9 J	0.9 J	0.9 J	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	111	1 U	1 U	1 U	1 U	1 U	1 U	256	256	251	251	251	235	238	239	0.7 J	0.6 J	180	180	170	170
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC602	LC603	LC604	LC605	LC606	LC607	LC608	LC609	LC610	LC611	LC612	LC613	LC614	LC615	LC616	LC617	LC618	LC619	LC620	LC621	LC622
Location ID:	24_IN03	24_NEW4	24_NEW4	24_NEW4	24_NEW4	FIELD QC	FIELD QC	FIELD QC	18_TIC55	18_TIC55	18_TIC55	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC
Sample Type:	REG	REG	REG	REG	REG	FB	TB	TB	REG	REG	REG	EB	TB	FB	EB	TB	EB	TB	EB	TB	EB
Sample Date:	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	6/24/2003	7/17/2003	7/17/2003	7/17/2003	7/17/2003	7/22/2003	7/22/2003	7/22/2003	7/23/2003	7/23/2003	7/25/2003	7/25/2003	7/29/2003	7/29/2003	7/31/2003
Parameter																					
VOCs (EPA Method 8260B) (µg/L)																					
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	9.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
2-Hexanone	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	3 J	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	17 J	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.059 U	0.059 U	0.024 U	0.024 U	0.024 U	0.024 U	0.059 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 U
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.9	1 U	0.7 J	1 U	1 U
Carbon Tetrachloride	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.44	0.036 U	0.065 U	0.065 U	0.065 U	0.065 U	0.38
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	0.33	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.65	0.053 U	0.053 U	0.03 U	0.03 U	0.03 U	0.03 U	0.053 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	0.6 J	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	2 J	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ	20 UJ	20 UJ	20 UJ	20 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 J	0.9 J	0.8 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.7 J	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	180	8.7	8.6	9.1	11	1 U	1 U	1 U	0.7 J	0.9 J	0.8 J	1 U	1 U	1 U	1 U	1 U	3.6	1 U	14	1 U	42
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC623	LC641	LC642	LC643	LC644	LC645	LC646	LC647	LC648	LC649	LC650	LC651	LC652	LC653	LC654	LC655	LC656	LC657	LC658	LC659	LC660
Location ID:	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	FIELD QC	24EX09	24EX09	FIELD QC	24EX12A	24EX12A	24EX12A	24EX12A	24EX12B	24EX12B	24EX12B	24EX12B	24EX12C	24EX12C	24EX12C
Sample Type:	TB	EB	FB	TB	TB	EB	EB	REG	FD	TB	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	FD
Sample Date:	7/31/2003	8/21/2003	8/21/2003	8/21/2003	8/26/2003	8/26/2003	8/26/2003	8/26/2003	8/26/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003
Parameter																					
VOCs (EPA Method 8260B) (µg/L)																					
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 J	6	5 U	1 J	1 J	1 J	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	2 J	50 U	50 U	3 J	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	3 J	100 UJ	100 UJ	5 J	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	5 J	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	1.29	1.2	0.059 U	2.22	2.08	2	1.81	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.3 J	1 U	1 U	0.7 J	0.7 J	0.6 J	0.5 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J	0.3 J	0.3 J	0.4 J	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.036 U	0.4	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	1	0.92	0.036 U	1.55	1.49	1.39	1.29	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	6.87	6.23	0.053 U	12.7	12.5	12.2	11.2	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U	0.053 U
Chloromethane	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.7 J	0.6 J	0.6 J	0.6 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	0.3 J	0.9 J	3 U	3 U	3 U	3 U	0.7 J	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.6 J	0.6 J	1 U	3.5	3.5	3	2.4	0.3 J	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1 U	0.3 J	1 U	1 U	1 U	0.6 J	1 U	234	219	1 U	17	17	19	18	16	15	15	16	1	1	1
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC661	LC662	LC663	LC664	LC665	LC666	LC667	LC668	LC669	LC670	LC671	LC672	LC673	LC674	LC675	LC676	LC677	LC678	LC679	LC680	LC681
Location ID:	24EX12C	24EX12C	24EX13A	24EX13A	24EX13A	24EX13A	24EX13A	24EX13B	24EX13B	24EX13B	24EX13B	24EX13B	24EX13C	24EX13C	24EX13C	24EX13C	24MW06	24EX09	FIELD QC	FIELD QC	FIELD QC
Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	FD	REG	REG	REG	REG	REG	REG	REG	EB	TB	TB
Sample Date:	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/24/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/27/2003	8/29/2003	8/29/2003	8/29/2003	9/2/2003
Parameter																					
VOCs (EPA Method 8260B) (µg/L)																					
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	3 J	2 J	3 J	3 J	3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	37	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	0.9 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	100 UJ	100 UJ	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	6 J	100 UJ	100 UJ	6 J	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.059 U	0.059 U	22.1	14.6	14.7	14.7	14.7	0.82	0.67	0.41	0.42	9.89	0.5	0.62	0.57	0.6	1.69	0.059 U	0.91	0.059 U	0.024 U
Bromoform	1 U	1 U	2	1	1	1	1	1 U	1 U	1 U	1 U	0.7 J	1 U	1 U	1 U	1 U	0.6 J	1 U	0.5 J	1 U	1 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 U
Carbon Disulfide	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ
Carbon Tetrachloride	0.5 U	0.5 U	1.4	0.9	0.9	0.9	0.9	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.036 U	0.036 U	8.76	5.53	5.55	5.38	5.59	0.065 U	0.065 U	0.065 U	0.065 U	3.71	0.065 U	0.065 U	0.065 U	0.065 U	1.44	0.036 U	1.42	0.036 U	0.065 U
Chloroethane	1 U	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Chloroform	0.053 U	0.053 U	82.4	78.6	81.4	82.8	81.8	4.11	3.48	2.07	2.13	61.3	2.1	3.01	2.63	2.81	3.31	1.45 UJ	1	0.053 U	0.03 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ
Tetrachloroethene	1 U	1 U	4.6	3.6	3.6	3	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 J	2.7 UJ	0.6 J	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1	1	123	118	122	123	124	2	1	1	1	30	0.5 J	0.4 J	0.4 J	0.4 J	2.3	180 UJ	42	1 U	1 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC682	LC683	LC689	LC690	LC691	LC692	LC693	LC694	LC695	LC696	LC697	LC707	LC708	LC709	LC714	LC715	LC716	LC717	LC718	LC719	LC737
Location ID:	24EX08	FIELD QC	FIELD QC	FIELD QC	FIELD QC	24EX08	FIELD QC	24EX14	FIELD QC	FIELD QC	24EX14	FIELD QC	24EX12B	24EX12B	FIELD QC	FIELD QC	FIELD QC	24EX09	24EX12B	24EX12B	FIELD QC
Sample Type:	REG	TB	TB	EB	TB	REG	TB	REG	EB	TB	REG	TB	REG	FD	TB	EB	TB	REG	REG	DUP	TB
Sample Date:	9/2/2003	9/2/2003	9/4/2003	9/4/2003	9/5/2003	9/5/2003	9/8/2003	9/8/2003	9/8/2003	9/11/2003	9/11/2003	9/15/2003	9/15/2003	9/15/2003	9/17/2003	9/17/2003	9/18/2003	9/18/2003	9/18/2003	9/18/2003	9/29/2003
Parameter																					
VOCs (EPA Method 8260B) (µg/L)																					
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	6	5 U	5 U	5 U	5 U	8	5 U	0.7 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	15	1 U	1 U	1 U	1 U	13	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	--	--	--	--	--	--	--	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 UJ	100 UJ	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	0.7 J	50 U	50 U	0.5 J	2 J	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 U	100 U	100 U	100 U	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.024 U	0.024 U	0.059 U	0.059 U	0.024 U	0.024 U	0.059 U	0.059 U	0.059 U	0.024 U	0.024 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.42	0.059 U	0.059 U	0.024 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1 UJ
Carbon Tetrachloride	0.7	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.5 U	0.7	0.5 U	0.5 U	0.4 J	0.5 U	0.8	0.8	0.5 U	0.5 U	0.5 U	0.5 U	0.5 J	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.065 U	0.065 U	0.036 U	0.38	0.065 U	0.065 U	0.036 U	0.45 J	0.49	0.065 U	0.065 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.57	0.036 U	0.036 U	0.065 U
Chloroethane	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1	1 U
Chloroform	0.6	0.03 U	0.053 U	0.053 U	0.03 U	0.87	0.053 U	2.14	0.053 U	0.03 U	0.98	0.053 U	1.44	1.46	0.053 U	0.053 U	0.053 U	2.2	1.29	1.24	0.03 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	0.4 J	1 UJ
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2	1 U	1 U	2.1	1 U	0.5 J	0.5 J	1 U	1 U	1 U	1 U	0.5 J	0.5 J	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	0.4 J	3 U	3 U	3 U	3 U	3 U	3 U	1 J	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--	--	1 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 U	20 U	20 UJ	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 UJ
Tetrachloroethene	0.9 J	1 U	1 U	1 U	1 U	2	1 U	2	1 U	1 U	2	1 U	3	3	1 U	1 U	1 U	1 U	3.3	3.4	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	385	1 U	1 U	1 U	1 U	793	1 U	51	7.9	1 U	44	1 U	36	36	1 U	1 U	1 U	33	26	25	1 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC738	LC743	LC744	LC745	LC746	LC750	LC751	LC758	LC759	LC760
Location ID:	24EX13A	FIELD QC	FIELD QC	FIELD QC	24EX13A	FIELD QC	FIELD QC	FIELD QC	24EX11	24EX10
Sample Type:	REG	TB	EB	TB	REG	TB	EB	TB	REG	REG
Sample Date:	9/29/2003	10/1/2003	10/1/2003	10/2/2003	10/2/2003	10/2/2003	10/2/2003	10/7/2003	10/7/2003	10/7/2003
Parameter										
VOCs (EPA Method 8260B) (µg/L)										
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	10	5 U	5 U	5 U	16	5 UJ	5 UJ	5 UJ	8 J	16 J
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 J	0.3 J
1,1-Dichloroethene	2.1	1 U	1 U	1 U	2.6	1 U	1 U	1 U	0.7 J	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 U
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	5 J	100 UJ	100 UJ	100 UJ	100 UJ	5 J	100 UJ	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U
Carbon Tetrachloride	1.9	0.5 U	0.5 U	0.5 UJ	2 J	0.5 UJ	0.5 UJ	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	4.59	0.03 U	0.03 U	0.03 U	2.08	0.03 U	0.03 U	0.03 U	2.63	0.78
Chloromethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	8	3.1
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ
Tetrachloroethene	6.1	1 U	1 U	1 U	5.9	1 U	1 U	1 U	2	1
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	408	1 U	4.4	1 U	495	1 U	7.4	1 U	190	75
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Sample ID:	LC765	LC766	LC767	LC768	LC769	LC770	LC771	LC772	LC773	LC774	LC775
Location ID:	FIELD QC	24EX11	24EX11	24EX10	24MW07	24MW07	24MW07	24MW07	24MW07	24MW07	24MW07
Sample Type:	TB	REG	DUP	REG	REG	REG	REG	REG	DUP	REG	REG
Sample Date:	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003	10/10/2003
Parameter											
VOCs (EPA Method 8260B) (µg/L)											
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 J	5 J	17	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	0.4 J	0.4 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 U	100 U	100 U	100 U	1 J	100 U	100 U	100 U	100 U	100 U	2 J
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	100 UJ	100 UJ	100 UJ	100 UJ	21 J	10 J	11 J	9 J	32 J	9 J	45 J
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.024 U	0.024 U	0.024 U	0.024 U	0.59	0.53	0.51	0.41	0.41	0.35	0.34
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	0.4 J	0.4 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	0.03 U	1.7	1.61	0.88	3.05	2.81	2.61	2.29	2.21	2.12	2.05
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	8.6	8.5	2.9	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ
Tetrachloroethene	1 U	1	2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1 U	160	156	53	2.8	2.7	2.7	2.8	2.7	2.7	2.7
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated limit
mg/L = microgram per liter

Table A-1: Validated Analytical Results for Groundwater Samples

Sample ID:	LC776	LC777	LC778	LC779	LC780	LC781	LC782	LC783	LC784	LC785	LC786	LC787	LC788	LC789	LC790	LC791	LC792	LC793	LC794
Location ID:	24MW07	24MW07	24EX10	24EX10	24EX10	24EX10	24EX11	24EX11	24EX11	24EX11	24EX14	24EX14	24EX14	24EX14	24EX14	24EX14	24EX14	24EX14	FIELD QC
Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	DUP	REG	REG	REG	REG	REG	TB
Sample Date:	10/10/2003	10/10/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003	10/24/2003
Parameter																			
VOCs (EPA Method 8260B) (µg/L)																			
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 U	5 U	14	16	16	15	3 J	3 J	2 J	0.9 J	0.9 J	1 J	1 J	0.9 J	0.9 J	2 J	3 J	3 J	5 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	0.6 J	0.6 J	0.6 J	0.6 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	100 U	3 J	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	0.4 J
Acetone	20 J	70 J	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	48 J	100 UJ	100 UJ
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.31	1.03	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J	0.4 J	0.4 J	0.5 J	0.6	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorodibromomethane	0.065 U	0.39	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1.91	11.9	0.73	0.73	0.74	0.71	1.21	1.04	0.97	0.9	1.05	1.14	1.1	1.07	1.13	1.06	1.12	1.22	0.03 U
Chloromethane	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Cis-1,2-Dichloroethene	1 U	1 U	2.9	3	3.1	3.1	5.2	5.4	5.5	5.8	0.4 J	0.5 J	0.4 J	0.4 J	0.4 J	0.5 J	0.5 J	0.5 J	1 U
Cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (F12)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl-tert-butyl ether (ETBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Naphthalene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tert-Butyl Alcohol	20 UJ	20 UJ	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Tetrachloroethene	1 U	1 U	1	1	1	1	0.7 J	0.7 J	0.7 J	0.6 J	2.3	2.2	2.1	2	2	2	2	2	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	2.3	1 J	84	89	93	93	239	259	259	275	41	45	44	43	45	36	36	35	1 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

EB = equipment blank
EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
TB = trip blank
U = indicates the analyte was not detected at or above the stated *limit*
mg/L = microgram per liter

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Table A-2: Validated Analytical Results for Vapor Treatment System Samples

Sample ID:	LC698	LC699	LC700	LC702	LC703	LC706	LC731	LC732	LC733	LC734	LC735	LC736	LC752	LC753
Location ID:	24_EX3OB1	VTS-MIDPOINT	VTS-EFFLUENT	24_EX3OB1	VTS-INFLUENT	VTS-INFLUENT	VTS-INFLUENT	VTS-MIDPOINT	VTS-EFFLUENT	VTS-INFLUENT	24EX6OB2	24EX6OB2	24EX6OB2	24EX6OB2
Sample Type:	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG
Sample Date:	9/11/2003	9/11/2003	9/11/2003	9/11/2003	9/12/2003	9/14/2003	9/25/2003	9/25/2003	9/25/2003	9/26/2003	9/28/2003	9/28/2003	10/3/2003	10/3/2003
Sample Description:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	FD	REG	FD
Parameter														
VOCs (EPA Method TO-14A) (µg/L)														
1,1,1,2-Tetrachloroethane	0.058 U	0.047 U	0.014 U	0.056 U	0.014 UJ	0.035 U	0.35 U	0.014 U	0.014 U	0.35 U	0.35 U	0.35 U	0.28 U	0.28 U
1,1,1-Trichloroethane	0.046 U	0.037 U	0.011 U	0.044 U	0.011 U	0.028 U	0.28 U	0.011 U	0.011 U	0.28 U	0.28 U	0.28 U	0.22 U	0.22 U
1,1,2,2-Tetrachloroethane	0.058 U	0.047 U	0.014 U	0.056 U	0.014 U	0.035 U	0.35 U	0.014 U	0.014 U	0.35 U	0.35 U	0.35 U	0.28 U	0.28 U
1,1,2-Trichloro-1,2,2-trifluoroethane	4.4	0.05 U	0.015 U	4.4	6.1	3.7	4.8	0.015 U	0.015 U	4	4	3.9	4.5	4.6
1,1,2-Trichloroethane	0.046 U	0.037 U	0.011 U	0.044 U	0.011 U	0.028 U	0.28 U	0.011 U	0.011 U	0.28 U	0.28 U	0.28 U	0.22 U	0.22 U
1,1-Dichloroethane	0.034 U	0.027 U	0.0081 U	0.032 U	0.0081 U	0.02 U	0.2 U	0.0081 U	0.0081 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
1,1-Dichloroethene	0.14	0.026 U	0.0079 U	0.13	0.15	0.12	1.4	0.0079 U	0.0079 U	1.2	1.1	1.1	1.1	1.1
1,2,4-Trichlorobenzene	0.15 U	0.12 U	0.037 U	0.15 U	0.037 U	0.092 U	0.92 U	0.037 U	0.037 U	0.92 U	0.92 U	0.92 U	0.74 U	0.74 U
1,2-Dibromoethane (EDB)	--	--	--	--	0.015 U	0.038 U	0.38 U	0.015 U	0.015 U	0.38 U	0.38 U	0.38 U	0.3 U	0.3 U
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.058 U	0.047 U	0.014 U	0.056 U	0.014 U	0.035 U	0.35 U	0.014 U	0.014 U	0.35 U	0.35 U	0.35 U	0.28 U	0.28 U
1,2-Dichloroethane	0.034 U	0.027 U	0.0081 U	0.032 U	0.0094	0.02 U	0.2 U	0.0081 U	0.0081 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
1,2-Dichloropropane	0.038 U	0.031 U	0.0092 U	0.037 U	0.0092 U	0.023 U	0.23 U	0.0092 U	0.0092 U	0.23 U	0.23 U	0.23 U	0.18 U	0.18 U
1,4-Dichlorobenzene	--	--	--	--	0.012 U	0.03 U	0.3 U	0.012 U	0.012 U	0.3 U	0.3 U	0.3 U	0.24 U	0.24 U
2-Butanone	0.12 U	0.097 U	0.029 U	0.12 U	0.029 U	0.072 U	0.72 U	0.029 U	0.029 U	0.72 U	0.72 U	0.72 U	0.58 U	0.58 U
2-Hexanone	0.17 U	0.14 U	0.041 U	0.16 U	0.041 U	0.1 U	1 U	0.041 U	0.041 U	1 U	1 U	1 U	0.82 U	0.82 U
4-Methyl-2-Pentanone	0.17 U	0.14 U	0.041 U	0.16 U	0.041 U	0.1 U	1 U	0.041 U	0.041 U	1 U	1 U	1 U	0.82 U	0.82 U
Acetone	0.1 U	0.08 U	0.024 U	0.096 U	0.024 U	0.06 U	0.6 U	0.024 U	0.024 U	0.6 U	0.6 U	0.6 U	0.48 U	0.48 U
Benzene	0.027 U	0.072	0.0064 U	0.026 U	0.0064 U	0.016 U	0.16 U	0.018	0.0064 U	0.16 U	0.16 U	0.16 U	0.13 U	0.13 U
Bromodichloromethane	0.054 U	0.043 U	0.013 U	0.052 U	0.013 U	0.032 U	0.32 U	0.013 U	0.013 U	0.32 U	0.32 U	0.32 U	0.26 U	0.26 U
Bromoform	0.032 U	0.026 U	0.0078 U	0.031 U	0.0078 U	0.02 U	0.2 U	0.0078 U	0.0078 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
Bromomethane	0.032 U	0.026 U	0.0078 U	0.031 U	0.0078 U	0.02 U	0.2 U	0.0078 U	0.0078 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
Carbon disulfide	0.13 U	0.1 U	0.031 U	0.12 U	0.031 U	0.078 U	0.78 U	0.031 U	0.031 U	0.78 U	0.78 U	0.78 U	0.62 U	0.62 U
Carbon tetrachloride	0.054 U	0.043 U	0.013 U	0.052 U	0.066	0.033	0.32 U	0.013 U	0.013 U	0.32 U	0.32 U	0.32 U	0.26 U	0.26 U
Chlorobenzene	0.038 U	0.031 U	0.0092 U	0.037 U	0.0092 U	0.023 U	0.23 U	0.0092 U	0.0092 U	0.23 U	0.23 U	0.23 U	0.18 U	0.18 U
Chloroethane	0.046 U	0.037 U	0.011 U	0.044 U	0.011 U	0.028 U	0.28 U	0.011 U	0.011 U	0.28 U	0.28 U	0.28 U	0.22 U	0.22 U
Chloroform	0.041	0.032 U	0.0097 U	0.042	0.049	0.035	0.24 U	0.0097 U	0.0097 U	0.24 U	0.24 U	0.24 U	0.19 U	0.19 U
Chloromethane	0.034 U	0.027 U	0.0082 U	0.033 U	0.0082 U	0.02 U	0.2 U	0.0082 U	0.0082 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
cis-1,2-Dichloroethene	0.033 U	0.026 U	0.0079 U	0.032 U	0.0079 U	0.02 U	0.2 U	0.0079 U	0.0079 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
cis-1,3-Dichloropropene	0.038 U	0.03 U	0.0091 U	0.036 U	0.0091 U	0.023 U	0.23 U	0.0091 U	0.0091 U	0.23 U	0.23 U	0.23 U	0.18 U	0.18 U
Dibromochloromethane	0.071 U	0.057 U	0.017 U	0.068 U	0.017 U	0.042 U	0.42 U	0.017 U	0.017 U	0.42 U	0.42 U	0.42 U	0.34 U	0.34 U
Dichlorodifluoromethane	0.041 U	0.033 U	0.0099 U	0.04 U	0.0099 U	0.025 U	0.25 U	0.0099 U	0.0099 U	0.25 U	0.25 U	0.25 U	0.2 U	0.2 U
Ethylbenzene	0.036 U	0.067	0.0087 U	0.035 U	0.0087 U	0.022 U	0.22 U	0.022	0.0087 U	0.22 U	0.22 U	0.22 U	0.17 U	0.17 U
Methyl tert-butyl ether	0.03 U	2.3	0.0072 U	0.029 U	0.0072 U	0.018 U	0.18 U	0.83	0.0072 U	0.18 U	0.18 U	0.18 U	0.14 U	0.14 U
Methylene chloride	0.029 U	0.023 U	0.0069 U	0.028 U	0.0069 U	0.017 U	0.17 U	0.0069 U	0.0069 U	0.17 U	0.17 U	0.17 U	0.14 U	0.14 U
m-Xylene & p-Xylene	0.036 U	0.33	0.0087 U	0.035 U	0.0087 U	0.022 U	0.22 U	0.11	0.0087 U	0.22 U	0.22 U	0.22 U	0.17 U	0.17 U
o-Xylene	0.036 U	0.22	0.0087 U	0.035 U	0.0087 U	0.022 U	0.22 U	0.083	0.0087 U	0.22 U	0.22 U	0.22 U	0.17 U	0.17 U
Styrene	0.035 U	0.028 U	0.0085 U	0.034 U	0.0085 U	0.021 U	0.21 U	0.0085 U	0.0085 U	0.21 U	0.21 U	0.21 U	0.17 U	0.17 U
Tetrachloroethene	0.22	0.047 U	0.014 U	0.21	0.27	0.19	0.54	0.014 U	0.014 U	0.47	0.4	0.41	0.36	0.34
Toluene	0.031 U	0.29	0.015	0.03 U	0.0075 U	0.019 U	0.19 U	0.094	0.016	0.19 U	0.19 U	0.19 U	0.15 U	0.15 U
trans-1,2-Dichloroethene	0.033 U	0.026 U	0.0079 U	0.032 U	0.0079 U	0.02 U	0.2 U	0.0079 U	0.0079 U	0.2 U	0.2 U	0.2 U	0.16 U	0.16 U
trans-1,3-Dichloropropene	0.038 U	0.03 U	0.0091 U	0.036 U	0.0091 U	0.023 U	0.23 U	0.0091 U	0.0091 U	0.23 U	0.23 U	0.23 U	0.18 U	0.18 U
Trichloroethene	4.3	0.037 U	0.018	3.9	4	2.6	30	0.012	0.011 U	27	24	23	26	25
Trichlorofluoromethane	0.046 U	0.037 U	0.011 U	0.044 U	0.011 U	0.028 U	0.28 U	0.011 U	0.011 U	0.28 U	0.28 UJ	0.28 UJ	0.22 U	0.22 U
Vinyl chloride	0.021 U	0.017 U	0.0051 U	0.02 U	0.0051 U	0.013 U	0.13 U	0.0051 U	0.0051 U	0.13 U	0.13 U	0.13 U	0.1 U	0.1 U
Xylenes (total)	0.036 U	0.55	0.0087 U	0.035 U	0.0087 U	0.022 U	0.22 U	0.19	0.0087 U	0.22 U	0.22 U	0.22 U	0.17 U	0.17 U
Others (EPA Method 16) (ppm v/v)														
Hydrogen sulfide	--	--	--	--	--	--	--	--	--	--	0.2 U	0.2 U	--	--

EPA = Environmental Protection Agency
FB = field blank
FD = field duplicate
J = quantitation estimated
REG = regular sample
ppm (v/v) = parts per million by volume
SG = Soil Gas
U = indicates the analyte was not detected at or above the stated limit