E.O. Lawrence Berkeley National Laboratory
University of California
Environmental Restoration Program

United States Department of Energy

RCRA Corrective Measures Implementation (CMI) Report

for the

Lawrence Berkeley National Laboratory
CA-EPA ID No: CA4890008986
ENVIRONMENTAL RESTORATION PROGRAM

April 2007

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A Joint Effort of
Environment, Health and Safety Division and
Earth Sciences Division
Lawrence Berkeley National Laboratory
University of California
Berkeley, CA 94720

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LIST OF ABBREVIATIONS

AOC	Area of Concern
Berkeley Lab	Lawrence Berkeley National Laboratory
Cal-EPA	California Environmental Protection Agency
CAP	Corrective Action Program
CDF	Certified Density Fill
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	Chemical of Concern
CVOCs	Chlorinated Volatile Organic Compounds
DCA	Dichloroethane
DCE	Dichloroethene
DHS	California Department of Health Services
DNAPL	Dense Non-Aqueous Phase Liquid
DPE	Dual Phase Extraction
DTSC	Cal-EPA Department of Toxic Substances Control
EBMUD	East Bay Municipal Utility District
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
GAC	Granular Activated Carbon
gpd	gallons per day
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HRC	Hydrogen Release Compounds
HWHF	Hazardous Waste Handling Facility
ICMs	Interim Corrective Measures
ILCR	Incremental Lifetime Cancer Risk
ISCO	In Situ Chemical Oxidation
MCL	Maximum Contaminant Level
MCS	Media Cleanup Standard
mg/L	milligram per liter
mg/kg	milligram per kilogram
µg/L	microgram per liter
MNA	Monitored Natural Attenuation
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SVE	Soil Vapor Extraction
SWMU	Solid Waste Management Unit
SWRCB	State Water Resources Control Board
TCA	Trichloroethane
TCE	Trichloroethene

TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
USEPA	U. S. Environmental Protection Agency
VOCs	Volatile Organic Compounds
Water Board	Regional Water Quality Control Board

EXECUTIVE SUMMARY

The Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) Hazardous Waste Handling Facility (HWHF) operates under a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit. The Permit requires that Berkeley Lab investigate and address historic releases of hazardous waste and hazardous constituents that may have occurred at the HWHF and at Solid Waste Management Units (SWMUs) throughout Berkeley Lab as part of the RCRA Corrective Action Program (CAP). Berkeley Lab is currently in the final phase of the CAP, Corrective Measures Implementation (CMI).

The RCRA Corrective Measures Study (CMS) Report (Berkeley Lab, 2005a) provided recommendations for the specific corrective measures that are required to eliminate or reduce potential risks to human health from contaminants in the soil and groundwater at Berkeley Lab, and protect the potential beneficial uses of the groundwater. The purpose of CMI phase is to design, construct, operate, maintain, and monitor the corrective measures (cleanup activities) recommended in the CMS report. The initial step of the CMI phase was preparation of the RCRA Corrective Measures Implementation (CMI) Workplan (Berkeley Lab, 2005b). The CMI workplan provided detailed descriptions of the design and the status of the approved corrective measures. This CMI Report has been completed to document the status of the corrective measures proposed in the CMS Report and approved by the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC).

Construction activities completed during the CMI phase include soil excavation, installation and operation of soil flushing and groundwater capture systems, injection of Hydrogen Release Compound® (HRC), and collection of initial samples for Monitored Natural Attenuation (MNA). All of the required systems have been constructed and are operational. A summary of the status of the corrective measures is provided in the following table.

Summary of DTSC Approved Corrective Measures

Unit	Approved Corrective Measure and Status as of December 31, 2006
Soil Units	
Building 51L Groundwater Plume Source Area	Excavate contaminated soil and dispose of off site. **Corrective measure for soil has been completed.**
Former Building 7 Sump (Source area of the Building 7 lobe of the Old Town Plume) Area of Concern (AOC) 2-5:	Excavate contaminated soil and dispose of off site. **Corrective measure has been completed.**
Groundwater Units	
Building 51/64 Groundwater Solvent Plume (AOC 9-13)	Continue operation of the Building 64 in situ soil-flushing system. **Operation is continuing.**
	Implement MNA for contaminants in the groundwater in the downgradient plume area. **Initial round of MNA monitoring completed**. Continue operation of in situ soil flushing/groundwater capture in the source area to help maintain COC concentrations at levels conducive for MNA in the downgradient plume area. **Operation is continuing.**
	Continue collecting and treating water from the Building 51 subdrain system. **Collecting and treating water is continuing.**
Building 51L Groundwater Solvent Plume	Reconstruct Building 51L storm drain to prevent inflow of contaminated groundwater into storm drain system. **Corrective measure has been completed.**
	Excavate contaminated soil from both the saturated and unsaturated zones and dispose of off site. **Excavation and disposal has been completed.**

Summary of DTSC Approved Corrective Measures (Continued)

Unit	Approved Corrective Measure and Status as of December 31, 2006
Groundwater Units	
Building 71 Groundwater Solvent Plume Building 71B Lobe (AOC 1-9)	Continue operation of in situ soil-flushing system with addition of HRC. **Operation is continuing.**
	Continue collecting and treating water from the hydraugers (hillside drains) in the hillside beneath Building 46A. **Collecting and treating water from the hydraugers is continuing.**
Building 7 Lobe of the Old Town Groundwater Solvent Plume (AOC 2-4)	Continue operation of in situ soil-flushing system in plume source area downgradient of the former Building 7 Sump. Continue operation of in situ soil-flushing system in the plume core downgradient of the Building 7 Groundwater Collection Trench. **Operations are continuing.**
	Continue operation of the groundwater collection trenches near the southeast corner and on the west side of Building 58. Continue operation of the dual phase extraction wells on the Building 53/58 slope. **Operations are continuing.**
	Implement MNA for contaminants in the groundwater. **Initial round of MNA monitoring completed**.

Building 52 Lobe of the Old Town Groundwater Solvent Plume (AOC 10-5)	Continue operation of in situ soil-flushing system (injection and extraction wells) near Building 53 and 52. **Operation is continuing.** Continue to collect and treat contaminated groundwater intercepted by the subdrain east of Building 46. **Collecting and treating contaminated groundwater is continuing.**

Summary of DTSC Approved Corrective Measures (Continued)

Unit	Approved Corrective Measure and Status as of December 31, 2006
Groundwater Units	
Building 25A Lobe of the Old Town Groundwater Solvent Plume (AOC 10-5)	Continue operation of in situ soil-flushing system (groundwater infiltration bed and extraction trench) near Buildings 25A and 44A. **Operation is continuing.**
	Continue to collect and treat contaminated groundwater from an electrical utility manhole near Building 6. **Collecting and treating contaminated groundwater is continuing.**
Support Services Area (Building 69A Area)	Implement MNA for contaminants in the groundwater. **Initial round of MNA monitoring completed**. HRC is being injected to enhance natural degradation.

Soil sampling confirms that MCSs have been achieved at the two soil units that required corrective measures. Groundwater monitoring results indicate that the soil flushing systems at the five groundwater units where flushing systems have been installed are effectively reducing the concentrations of chemicals of concern (COCs) in the groundwater; however, continued operation of the systems will be required to reach the required Media Cleanup standards (MCSs). Application of HRC is reducing COC concentrations at the two units where it is being applied. The groundwater monitoring data indicate that the groundwater plumes at Berkeley Lab are stable or attenuating and that contaminants are not migrating offsite in the groundwater. The groundwater remediation systems will continue to operate until MCSs are achieved or they are demonstrated to be technically impracticable.

SECTION 1

INTRODUCTION

1.1 BACKGROUND

The Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) Hazardous Waste Handling Facility (HWHF) operates under a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit. The Permit requires that Berkeley Lab investigate and address historic releases of hazardous waste and hazardous constituents that may have occurred at the HWHF and at Solid Waste Management Units (SWMUs) throughout Berkeley Lab as part of the RCRA Corrective Action Program (CAP). The California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) is the regulatory agency responsible for enforcing the provisions of Berkeley Lab's Hazardous Waste Facility Permit, including the activities required under the CAP. Berkeley Lab's Environmental Restoration Program (ERP) is responsible for carrying out those activities.

The objectives of the CAP are to evaluate the nature and extent of releases of hazardous waste or constituents; to evaluate facility characteristics; and to identify, develop, and implement appropriate corrective measures to protect human health and the environment. The four primary components of the CAP are:

1) *RCRA Facility Investigation (RFI)* - to thoroughly evaluate the nature and extent of the releases of hazardous waste and hazardous constituents and to gather other data to support the Corrective Measures Study (CMS) and/or the need to implement Interim Corrective Measures (ICMs).
2) *Interim Corrective Measures (ICMs)* - to control or abate threats to human health and/or the environment from releases or to prevent or control the further spread of contamination while long-term remedies are pursued.
3) *Corrective Measures Study (CMS)* - to develop and evaluate corrective measure alternative(s) and recommend the final corrective measures.
4) *Corrective Measures Implementation (CMI)* - to design, construct, operate, and maintain, the corrective measures selected and monitor their performance.

On August 31, 2005, following consultation with the Regional Water Quality Control Board (Water Board) and the City of Berkeley Toxics Management Division, DTSC issued its decision for approval of Berkeley Lab's Corrective Measures Study Report and Remedy Selection (DTSC, 2005). The approval decision became effective on October 20, 2005. The Corrective Measures Study Report (Berkeley Lab, 2005a) provided recommendations for the specific corrective measures that should be implemented to eliminate or reduce potential risks to human health from contaminants in the soil and groundwater at Berkeley Lab and protect the potential beneficial uses of the groundwater. It also provided the media-specific concentrations (Media Cleanup Standards [MCSs]) that the measures should achieve in order to be considered complete.

Berkeley Lab is currently in the final phase of the CAP, Corrective Measures Implementation (CMI). The initial step of the CMI was submittal of the RCRA Corrective Measures Implementation (CMI) Workplan to the DTSC on November 10, 2005 (Berkeley Lab, 2005b). The CMI workplan provided detailed descriptions of the design and the status of the corrective measures recommended in the Corrective Measures Study (CMS) Report (Berkeley Lab, 2005a) and approved by the DTSC (DTSC, 2005). On March 28, 2006, DTSC approved the CMI Workplan (DTSC, 2006a). On March 15, 2006, Berkeley Lab submitted a Soil Management Plan and a Groundwater Monitoring and Management Plan to the DTSC as part of the CMI process (Berkeley Lab, 2006a and 2006b). These documents provide the long-term monitoring and management procedures for the approved corrective measures. On September 1, 2006, DTSC approved both Plans (DTSC, 2006b)

1.2 PURPOSE

All of the corrective measures described in the RCRA Corrective Measures Implementation Workplan have been implemented in accordance with the requirements specified in that document. The measures are designed to reduce residual concentrations of chemicals of concern (COCs) to levels at or below the MCSs and include excavation of contaminated soil, installation and operation of soil-flushing systems, and injection into the subsurface of Hydrogen Release Compound® (HRC), and Monitored Natural Attenuation (MNA). The purpose of this report is to provide a consolidated record of the construction and implementation of these measures. It also provides the data to support a determination that corrective measures have been completed at the two soil units included in the CMI, and documents that the implemented measures have generally been effective in reducing COC concentrations in the groundwater.

1.3 STATUS OF UNITS

In 1991 and 1992, the DTSC (DTSC, 1991) and Berkeley Lab (Berkeley Lab, 1992) conducted independent RCRA Facility Assessments (RFAs) to identify and evaluate the potential for releases to the environment from SWMUs and Areas of Concern (AOCs) at Berkeley Lab. SWMUs identified at Berkeley Lab included above-ground and underground waste storage tanks, sumps, scrap yards, plating shops, the former hazardous waste handling facility, waste accumulation areas, hazardous waste storage areas, and waste treatment units. AOCs identified at Berkeley Lab included chemical product storage tanks (e.g. fuel tanks), transformers, and hazardous materials storage areas. In addition, for the purpose of identification and assessment, Berkeley Lab designated areas of groundwater contamination and sanitary sewer lines as AOCs. SWMUs, AOCs, and other areas of known or potential release are collectively referred to as “units” in this report.

A total of 174 units were identified during the RFA and subsequent investigations. Seven of the SWMUs and one of the AOCs were designated as radiological units. These eight units were evaluated under the oversight of the United States Department of Energy (DOE), which has the sole jurisdiction for radiological units. The remaining 166 units were addressed as part of the RCRA CAP, under the lead regulatory authority of the DTSC.

The RFAs established that hazardous waste or hazardous constituents had been released, or were suspected to have been released, to soil and groundwater from some of the units. Based on these findings, DTSC required that Berkeley Lab conduct a RCRA Facility Investigation (RFI) to identify the source and nature of any releases, and to characterize their magnitude and extent.

During the RFI phase, Berkeley Lab implemented “interim measures” in consultation with state and federal regulatory agencies to reduce or eliminate imminent threats to human health or the environment. These measures at Berkeley Lab included removing sources of contamination, stopping discharge of contaminated groundwater to surface waters, eliminating potential pathways that could contaminate groundwater, and preventing further migration of contaminated groundwater.

Based on results of the RFI, the DTSC determined that at 121 of the 166 units, there were either no chemical releases or the concentration levels were low enough that no further action was needed to protect human health or the environment. The remaining 45 units were determined to require further action during the Corrective Measures Study (CMS) phase of the RCRA CAP. As the initial step in the CMS, Berkeley Lab completed both an Ecological Risk Assessment (ERA) and a Human Health Risk Assessment (HHRA) (Berkeley Lab 2002b, 2003a).

The HHRA concluded that four areas of soil contamination and eleven areas of groundwater contamination posed a potential risk to human health and/or beneficial uses of groundwater, and therefore should be retained for further evaluation in the CMS Report (Berkeley Lab, 2005a). The purpose of the CMS Report was to recommend appropriate remedies to eliminate or reduce potential risks to human health from anthropogenic chemicals in soil and groundwater, and protect groundwater and surface water quality under provisions of the Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code).

Table 1.3-1 summarizes the evaluation history of the units included in the RFI and their current status. The table provides references to the reports addressing historical investigations, risk evaluations, and completed and proposed remediation activities.

Table 1.3-1. Summary of Units Included in RFI

Soil Unit	Berkeley Lab Unit Number	DTSC Unit Number	Units included in RFA (Berkeley Lab, 1992)	Reference Page in RFI Report [i]	Units Approved for No Further Action During RFI [a]	Reference Page in HHRA (Berkeley Lab, 2003)	Reference Page in CMS Report (Berkeley Lab, 2005a)	Unit Acceptable for Residential Land Use	Units Acceptable for Institutional Land Use (Berkeley Lab, 2003a)
B7 Former Plating Shop	SWMU 2-1		●	Final B-13		4-95			●
B52B Abandoned Liquid Waste AST and Sump	SWMU 2-2	SWMU-4	●	Final B-18		4-103			●
B17 Former Scrap Yard and Drum Storage Area	SWMU 2-3	SWMU-11	●	Final B-23		4-111			●
Building 69A Former Haz Mat Stor and Delivery Area	SWMU 3-1	SWMU-15	●	not included		4-187		● [b]	
B69 Former (Present) Waste Oil UST	SWMU 3-3	SWMU-8	●	Phase 1: 5-61	●			● [a]	
B69/75A Former Scrap Yard and Drum Storage Area	SWMU 3-4	SWMU-14	●	Phase 2: 5-35	●			● [a]	
B69A Storage Area Sump	SWMU 3-5		●	Phase 1: 5-61		4-193			●
B75 Former Haz Waste Handling and Storage Facility	SWMU 3-6		●	Final C-10		4-201	200	● [c]	
B76 Oil/Water Separator, Basin, and Sumps	SWMU 4-2	SWMU-24	●	Phase 1: 5-62	●			● [a]	
B76 Motor Pool and Collection Trenches (and sump)	SWMU 4-3	SWMU-29	●	Final C-15		4-213			●
B76 Present and Former Waste Accumulation Area #3	SWMU 4-6	SWMU-35	●	Phase 1: 5-63		4-221			●
B42 Scrap Yard	SWMU 5-1	SWMU-12	●	Phase 1: 5-63	●			● [a]	
B77 Plating Shop Floor and Sump	SWMU 5-4	SWMU-30	●	Final C-18	●	4-227			●
B77 Waste Accumulation Area	SWMU 5-6		●	Phase 2: 5-37	●			● [a]	
B77G Waste Accumulation Area	SWMU 5-7	SWMU-34	●	(design evaluation only)	●			● [a]	
B77 Sand Blasting Room	SWMU 5-9	SWMU-37	●	Phase 1: 5-65	●			● [a]	
B77 Present and Former Yard Decontamination Areas	SWMU 5-10	SWMU-32	●	Phase 2: 5-37	●	4-234			●
B88 Waste Accumulation Area	SWMU 6-2	SWMU-36	●	Phase 2: 5-38	●			● [a]	
B58 Inactive Underground Rinseate Tank	SWMU 7-1	SWMU-6	●	Phase 1: 5-69	●			● [a]	
B58 Sumps	SWMU 7-5			Final B-26	●			● [a]	
B70A Former Waste Water Holding Tanks	SWMU 8-1	SWMU-2	●	Phase 2: 5-41	●			● [a]	
B51 Vacuum Pump Room Waste Oil Tank	SWMU 9-1	SWMU-1	●	Final A-10	●			● [a]	
B51 Vacuum Pump Room Sump and Collection Basins	SWMU 9-4	SWMU-1	●	Final A-11		4-49			●
B51 Motor Generator Room Sump	SWMU 9-6		●	Final A-13		4-55			●
B16 Former Waste Accumulation Area	SWMU 10-4	SWMU-9	●	Final B-28		4-119			●
B16 Present Waste Accumulation Area	SWMU 10-5		●	Phase 2: 5-44	●			● [a]	
B25 Plating Shop Floor Drains	SWMU 10-10			Final B-31		4-127		● [b]	
B50 Former Residual Photographic Solution UST	SWMU 12-1	SWMU-5	●	Phase 2: 5-50	●	4-242		● [b]	
B62 Waste Accumulation Area	SWMU 13-2		●	Final D-16	●			● [a]	
B46A Former Motor Pool Gasoline UST	AOC 1-1		●	Final A-17	●			● [a]	
B71 Linear Accelerator Cooling Unit	AOC 1-3		●	Final A-18	●			● [a]	
B71 Former Hazardous Materials Storage Area	AOC 1-5		●	Phase 1: 6-2	●			● [a]	

Table 1.3-1. Summary of Units Included in RFI (Continued)

Soil Unit	Berkeley Lab Unit Number	DTSC Unit Number	Units included in RFA (Berkeley Lab, 1992)	Reference Page in RFI Report [i]	Units Approved for No Further Action During RFI [a]	Reference Page in HHRA (Berkeley Lab, 2003)	Reference Page in CMS Report (Berkeley Lab, 2005a)	Unit Acceptable for Residential Land Use	Units Acceptable for Institutional Land Use (Berkeley Lab, 2003a)
B71 Transformers	AOC 1-6		●	Final A-20	●			● [a]	
B71 Mercury Contamination	AOC 1-10			Final A-22	●			● [a]	
B7E Former UST	AOC 2-1	AOC-4	●	Final B-33		4-133			●
B7 Former Hazardous Materials Storage Area	AOC 2-2		●	Phase 2: 5-33		4-140		● [b]	
B7 Sump	AOC 2-5			Final B-39		4-146	116		● [e]
B69/B75 Fire Drill Area	AOC 3-2		●	Phase 2: 5-36	●			● [a]	
B76 Former Gasoline UST	AOC 4-1		●	Final C-20	●			● [a]	
B76 Former Diesel UST	AOC 4-2		●	Final C-20	●			● [a]	
B79 Hazardous Materials Storage Area #2	AOC 5-3		●	Phase 2: 5-37	●			● [a]	
B77 Sanitary Sewer System	AOC 5-4	AOC-7		Final C-23	●			● [a]	
B77 Generator Pad	AOC 5-5			Phase 2: 5-38	●			● [a]	
B88 Abandoned Diesel UST	AOC 6-1		●	Phase 2: 5-38	●			● [a]	
B88 Transformers	AOC 6-2		●	Phase 2: 5-38	●			● [a]	
B88 Hydraulic Gate Unit	AOC 6-3	AOC-2	●	Phase 2: 5-39		4-247	198	● [c]	
B88 Hazardous Materials Storage Area	AOC 6-4		●	Phase 2: 5-40	●			● [a]	
B46 Former Scrap Yard	AOC 7-1	SWMU-13	●	Final B-44	●			● [a]	
B46 Hazardous Materials Storage Area	AOC 7-3		●	Phase 2: 5-40		4-154		● [b]	
B58 Former Hazardous Mat Storage Area	AOC 7-6		●	Final B-46		4-160		● [b]	
B70A Diesel UST	AOC 8-1		●	Final D-19	●			● [a]	
B70 Diesel UST	AOC 8-2		●	Final D-21	●			● [a]	
B70A Transformer	AOC 8-3		●	Phase 1: 5-71	●			● [a]	
B70 Transformer	AOC 8-4		●	Phase 1: 5-72	●			● [a]	
B70 Hazardous Materials Storage Area	AOC 8-5		●	Phase 2: 5-42	●			● [a]	
B58/B70 Sanitary Sewer	AOC 8-6			Phase 2: 5-42		4-253			●
B70A Sanitary Sewer	AOC 8-7	AOC-6		Final D-23	●			● [a]	
B51 Diesel UST	AOC 9-2		●	Final A-23	●			● [a]	
B51 Former Hazardous Materials Storage Area	AOC 9-7			Final A-26	●			● [a]	
Sanitary Sewer Lines West of Buildings 51 and 51B	AOC 9-8			Final A-27	●			● [a]	
B51 Sanitary Sewer and Drainage System	AOC 9-9			Final A-29		4-62			●
B64 Catch Basin	AOC 9-10			Phase 2: 5-43					

Table 1.3-1. Summary of Units Included in RFI (Continued)

Soil Unit	Berkeley Lab Unit Number	DTSC Unit Number	Units included in RFA (Berkeley Lab, 1992)	Reference Page in RFI Report [i]	Units Approved for No Further Action During RFI [a]	Reference Page in HHRA (Berkeley Lab, 2003)	Reference Page in CMS Report (Berkeley Lab, 2005a)	Unit Acceptable for Residential Land Use	Units Acceptable for Institutional Land Use (Berkeley Lab, 2003a)
Former Cooling Towers SE of Building 51	AOC 9-11			Final A-39	●			●[a]	
B51/64 Former Temp Equipment Stor Area	AOC 9-12			Final A-42		4-75			●
B52 Former Haz Mat Storage Area	AOC 10-2		●	Final B-49		4-167			●
B25A Sanitary Sewer	AOC 10-3			Final B-52	●			●[a]	
B25 Sanitary Sewer	AOC 10-4	AOC-5		Phase 2: 5-47	●			●[a]	
B74 (Former) Diesel UST	AOC 11-1		●	Final D-25	●			●[a]	
B83 Diesel AST	AOC 11-2		●	Phase 2: 5-48	●			●[a]	
B83/83A Sanitary Sewers	AOC 11-3			Final D-29	●			●[a]	
B50 Sanitary Sewer Dislocations	AOC 12-4			Final D-32	●			●[a]	
B62 Hazardous Materials Storage Area	AOC 13-1		●	Final D-34		4-259		●[d]	
B62 Former Diesel UST	AOC 13-2	AOC-3	●	Final D-35	●			●[a]	
Building 62 Transformer	AOC 13-3		●	Phase 2: 5-50	●			●[a]	
B62 Possible Solvent Spills East of B62	AOC 13-4		●	Final D-38	●			●[a]	
B62 Acid Sewer Lines West of B62	AOC 13-8			Phase 2: 5-50	●			●[a]	
B62 Sanitary Sewers South of B62	AOC 13-9			Phase 2: 5-50	●			●[a]	
B10 and B80 Sanitary Sewers	AOC 14-6			Final B-56	●			●[a]	
B37 Proposed Electrical Substation	AOC 14-7			Phase 1: 5-79		4-173		●[b]	
Slope West of Building 53				Final B-59		4-177		●[b]	
Building 51L Groundwater Plume Source Area				not included		4-83	94		●[e]
Building 52A Lobe Source Area				Final B-57			153	●[a]	
Building 71 Plume Source Area				Final A-44			106		●[f]

Table 1.3-1. Summary of Units Included in RFI (Continued)

Groundwater and Surface Water Units	Berkeley Lab Unit Number	DTSC Unit Number	Units included in RFA (Berkeley Lab, 1992)	Reference Page in RFI Report [i]	Units Approved for No Further Action During RFI [a]	Reference Page in HHRA (Berkeley Lab, 2003a)	Reference Page in CMS Report (Berkeley Lab, 2005a)	Unit Acceptable for Residential Land Use	Units Acceptable for Institutional Land Use (Berkeley Lab, 2003a)
B71B Groundwater Solvent Plume	AOC 1-9			A-51		4-15	102		●
Old Town Groundwater Plume (Building 7 lobe)	AOC 2-4			B-65		4-28	116		[g]
Solvents in Groundwater South of Building 76	AOC 4-5			C-34		4-34	181		●
Building 51/64 Groundwater Plume	AOC 9-13			A-56		4-17	78		●[h]
Old Town Groundwater Plume (Building 25A lobe)	AOC 10-5			B-76		4-31	161		●
Old Town Groundwater Plume (Building 52 lobe)	AOC 14-5			B-72		4-30	150		●
Well MWP-7 Groundwater Contamination	AOC 14-5			B-80		4-32		●[b]	
Building 51L Groundwater Plume				A-62		4-18	91		●
Building 69A Area of Groundwater Contamination				C-39		4-42	172		●
Building 75/75A Area of Groundwater Contamination				C-37		4-42	189		●
Building 75B Area of Groundwater Contamination				C-44		4-43		●[b]	
Building 77 Area of Groundwater Contamination				C-42		4-43	185	●[b]	
Benzene East of Building 75A				C-48		4-43	193	●[b]	
Site Wide Contaminated Hydrauger Discharges	AOC-SW1	AOC-8		A-70		5-23		●	
Building 71 Spring				A-69		5-23		●[b]	
Site Creeks				A, B, C, & D		5-23		●[b]	

● indicates yes

(a) Maximum detected concentrations less than Preliminary Remediation Goals (PRGs) for residential soil and/or background levels.

(b) Human Health Risk Assessment (HHRA) result for residential land use: Cancer Risk $<10^{-6}$ and Hazard Index (HI) < 1.

(c) Soil was cleaned up under Interim Corrective Measures (ICMs) to the Toxic Substances Control Act (TSCA) self-implementing cleanup level of 1 mg/kg for soil in high occupancy areas.

(d) Additional samples were collected in 2003 to show that the risk driver, 1,2,3-trichloropropane, detected in a single sample in 1992 was no longer present.

(e) Soil remediated to institutional land use Media Cleanup Standard (MCS) levels during Corrective Measures Implementation (CMI).

(f) Maximum concentration of PCE detected in soil exceeds target risk-based MCS for institutional land use. ILCR for current indoor workers is $<10^{-6}$ and HI < 1 based on indoor air sampling.

(g) Cancer risk $>10^{-4}$ based on HHRA.

(h) Cancer risk originally $>10^{-4}$ based on HHRA, but $<10^{-4}$ based on updated sampling results in Groundwater Monitoring and Management Plan (Berkeley Lab, 2006).

(i) Phase 1 (Berkeley Lab, 1994)
Phase 2 (Berkeley Lab, 1995)
Final (Berkeley Lab, 2000) showing Module number (A, B, C, or D)

SECTION 2

CORRECTIVE MEASURES REQUIREMENTS

2.1 CORRECTIVE ACTION OBJECTIVES

Corrective Action Objectives were developed in the CMS Report to address both potential risk to human health and compliance with regulatory policy. Potential risks to human health were estimated based on an industrial/institutional land use scenario, which is consistent with the current and potential future land use at Berkeley Lab. The potential receptors associated with this land-use scenario are Berkeley Lab employees (laboratory workers, office workers, and outdoor workers such as landscape maintenance workers) and construction workers. The regulatory policy addressed was the protection of beneficial uses of groundwater.

Potential Risk to Human Health

The risk-based MCSs for Berkeley Lab were based on two criteria: 1) the USEPA-recommended target cancer-risk range for risk managers (i.e., a theoretical Incremental Lifetime Cancer Risk [ILCR] between 10^{-6} and 10^{-4}) also referred to as the "risk management range" and 2) a non-cancer hazard quotient (HQ) value (for individual chemicals) of 1.0. An ILCR in the range of 10^{-4} to 10^{-6} is considered by the USEPA to be safe and protective of public health (Federal Register 56 [20]: 3535, Wednesday, January 30, 1991). A Hazard Index (HI) (sum of HQs) below 1.0 will likely not result in adverse non-cancer health effects over a lifetime of exposure.

Regulatory Policy

Groundwater is not used for drinking or other domestic water supply at Berkeley Lab (or in the City of Berkeley) and water for domestic use will be supplied to Berkeley Lab and Berkeley residents by the East Bay Municipal Utility District (EBMUD) for the foreseeable future. However, unless otherwise designated by the Water Board, all groundwaters are considered suitable, or potentially suitable, for municipal or domestic water supply. Exceptions to this policy are specified in State Water Resources Control Board (SWRCB) Resolution 88-63 "Sources of Drinking Water Policy". Resolution 88-63 defines all groundwater as a potential source of drinking water, with limited exceptions for areas with total dissolved solids (TDS) exceeding 3,000 milligrams per liter (mg/L), low yield (<200 gallons per day [gpd]), or naturally high levels of toxic chemicals that cannot reasonably be treated for domestic use.

Under the Water Board's Water Quality Control Plan (Basin Plan), groundwaters with a beneficial use of municipal and domestic supply have cleanup levels set no higher than Maximum Contaminant Levels (MCLs) or secondary MCLs for drinking water. To address this regulatory policy, the following secondary Corrective Action Objectives were developed:

- Groundwater quality should be protected and/or restored to levels that are protective of beneficial uses.
- Migration of contaminated groundwater should be controlled so that COCs do not migrate to adjacent uncontaminated groundwater or to surface water.
- Migration of contaminated groundwater should be controlled so that COCs exceeding risk-based levels do not migrate to groundwater in adjacent areas where concentrations are below risk-based levels.

A compliance level of non-detect was set for surface water and for areas of groundwater that are not currently contaminated but could potentially be impacted by migration of COCs. This addresses the SWRCB non-degradation policy (Resolution 68-16 "Statement of Policy with Respect to Maintaining High Quality of Waters in California") under the Porter-Cologne Water Quality Control Act.

2.2 CHEMICALS OF CONCERN

The Human Health Risk Assessment (HHRA) (Berkeley Lab, 2003) identified chlorinated volatile organic compounds (VOCs) in soil and groundwater and polychlorinated biphenyls (PCBs) in soil as the COCs at Berkeley Lab. Prior to submission of the CMS Report, Berkeley Lab completed ICMs that reduced residual PCB concentrations at the two units where PCB levels were a concern to less than the required MCS. Therefore, no further corrective measures were required for PCBs. However, after submittal of the CMI Workplan, elevated concentrations of PCBs were detected in shallow groundwater samples collected near the Building 51 Motor Generator Room Filter Sump (SWMU 9-6), indicating PCBs were a potential

COC in the soil at this location. A workplan was therefore submitted to the DTSC in February 2006 for the removal of PCB-contaminated soil near the filter sump (Berkeley Lab, 2006c), and all soil exceeding the MCS for PCBs was subsequently excavated.

2.3 MEDIA CLEANUP STANDARDS

Media Cleanup Standards (MCSs) are media- and chemical-specific concentrations that a corrective measure must achieve in order to meet the corrective action objectives and be considered complete. MCSs were developed in the CMS Report (Berkeley Lab, 2005a) to address both risk-based and regulatory-based Corrective Action Objectives. Risk-based MCSs were based on potential threats to human health associated with ongoing institutional land-use at Berkeley Lab. Regulatory-based MCSs were based on protection of beneficial uses of groundwater.

Two sets of risk-based MCSs were developed for VOCs: 1) target risk-based MCSs and 2) upper-limit risk-based MCSs. The target risk-based MCSs were based on theoretical ILCRs of 10^{-6} (the lower bound of the risk management range) and a non-cancer HQ of 1.0. Since the target risk-based MCSs may not be achievable at some groundwater units due to technical impracticability, upper-limit risk-based MCSs were also developed that represent the upper bound of the USEPA risk management range (i.e. a theoretical ILCR of 10^{-4}) and non-cancer HQ of 1.0. The upper-limit risk-based MCSs were established to assess compliance with corrective measure objectives at locations where target risk-based MCSs cannot reasonably be achieved.

Regulatory-based MCSs for VOCs in groundwater were set at California MCLs for drinking water. California MCLs are at least as stringent as the federal MCLs, and for several of the COCs they are significantly more stringent. **Figure 2.2-1** in the CMS Report (Berkeley Lab, 2005a) shows the areas of groundwater contamination exceeding MCLs for drinking water. As shown on the figure, for those areas where the groundwater is considered to be a potential drinking water source, the more stringent of either the risk-based MCSs or the regulatory-based MCSs (MCLs) are the required cleanup levels. For those areas where groundwater is not considered to be a potential drinking water source (well yields are less than 200 gpd based on short-term yield testing results), risk-based MCSs are the required cleanup levels.

The Water Board designates all groundwater potentially suitable for municipal or domestic supply unless it has been formally de-designated. Therefore, in addition to the primary objective of attaining compliance with the required MCSs through the implementation of corrective measures, the long-term goal for all areas of Berkeley Lab is to restore groundwater quality to the maximum beneficial use (MCLs), if practicable. The approach to achieving this long-term-term goal is to monitor the natural degradation of the contaminants and document that migration of contaminated groundwater does not occur. The risk-based and regulatory-based MCSs for COCs in groundwater are listed in **Table 2.3-1**.

Table 2.3-1
Media Cleanup Standards (MCSs) for Groundwater

COC	Regulatory-Based MCS (MCL[a]) (µg/L)	Risk-Based MCS	
		Target MCS Based on Theoretical ILCR=10^{-6} or HQ = 1 (µg/L)	Upper-Limit MCS Based on Theoretical ILCR = 10^{-4} or HQ = 1 (µg/L)
benzene	1.0	175	17,514
carbon tetrachloride	0.5	27	1,004[d]
chloroform	80	1,206	120,582[b] 38,838[c] [d]
1,1-dichloroethane (1-1-DCA)	5	3,663	366,345
1,2-dichloroethane (1,2-DCA)	0.5	1,030	102,956
1,1-dichloroethene (1,1-DCE)	6	28,873[d]	28,873[d]
cis-1,2-dichloroethene (cis-1,2-DCE)	6	98,405[d]	98,405[d]
trans-1,2-dichloroethene (trans-1,2-DCE)	10	94,405[d]	94,405[d]
1,2-dichloropropane	5	1,071	15,302[d]
methylene chloride	5	10,381	1,038,071
1,1,1-trichloroethane (1,1,1-TCA)	200	1,570,783 [d]	1,570,783 [d]
1,1,2-trichloroethane (1,1,2-TCA)	5	1,905	190,489[b] 61,026[c] [d]
tetrachloroethene (PCE)	5	343	25,265[d]
trichloroethene (TCE)	5	1,594	1,159,365[b] 3,065[c] [d]
vinyl chloride	0.5	12	1,213

(a) California Department of Health Services (DHS) Maximum Contaminant Level for drinking water
(b) MCS is applicable where the depth to groundwater is >20 feet.
(c) MCS is applicable where the depth to groundwater is ≤ 20 feet (based on potential risk to intrusive construction worker).
(d) MCS is based on HQ = 1. All other MCSs are based on theoretical ILCR.
µg/L=micrograms per liter

Regulatory-based MCSs for VOCs in soil are applicable to those areas of Berkeley Lab overlying groundwater that is considered a potential drinking water source, and were therefore set at a level that would not potentially result in groundwater concentrations exceeding MCLs (regulatory-based MCSs for groundwater). Where the target risk-based MCS for soil was less than the calculated regulatory-based MCS, the target risk-based MCS was set as the default value. The MCS for PCBs in soil was set at the Toxic Substances Control Act (TSCA) self-implementing cleanup level for PCBs in soil in high occupancy areas of 1 milligram per kilogram (mg/kg). The risk-based and regulatory-based MCSs for COCs in soil are listed in **Table 2.3-2.**

Table 2.3-2
Media Cleanup Standards (MCSs) for Soil

COC	Regulatory-Based MCS (mg/kg)	Risk-Based MCS	
		Target MCS Based on Theoretical ILCR=10^{-6} or HQ = 1 (mg/kg)	Upper Limit MCS Based on Theoretical ILCR = 10^{-4} or HQ = 1 (mg/kg)
benzene	0.044	0.1	6(a)
carbon tetrachloride	0.05(b) (0.11)	0.05	1.8(a)
chloroform	0.28(b) (2.9)	0.28(a)	0.28(a)
1,1-DCA	0.2	1.3	127
1,2-DCA	0.0045	0.23	9(a)
1,1-DCE	1.0	8(a)	8(a)
cis-1,2-DCE	0.19	38(a)	38(a)
trans-1,2-DCE	0.67	50(a)	50(a)
methylene chloride	0.077	1.8	184
1,1,1-TCA	7.8	690(a)	690(a)
PCE	0.45(b) (0.7)	0.45	45
TCE	0.46	2.3	225
vinyl chloride	0.0035(b) (0.085)	0.0035	0.35
polychlorinated biphenyls (PCBs)	1	(c)	(c)

(a) MCS is based on HQ=1. All other MCSs are based on theoretical ILCR.
(b) Target risk-based MCS is less than, and therefore used in lieu of regulatory-based MCS. (Regulatory-based MCS, which is based on protection of beneficial uses of groundwater, is shown in parentheses for reference.)
(c) TSCA self-implementing cleanup level for PCBs in soil in high occupancy areas of 1 mg/kg was used as MCS.
mg/kg=milligrams per kilogram

2.4 COMPLIANCE WITH MEDIA CLEANUP STANDARDS

Soil

Completion of corrective measures at soil units is documented by comparing residual concentrations of COCs in soil to the required MCSs (Berkeley Lab, 2005b). Residual COC concentration values used for these comparisons may be either the maximum detected concentrations or the representative chemical concentrations to which human receptors may be exposed (exposure point concentrations [EPCs]) If either the maximum concentrations or the EPCs are less than the MCSs, then the corrective measure is considered complete. In accordance with USEPA guidance (USEPA, 1989), EPCs for soil may be set at the 95-percent upper confidence limit (UCL) on the arithmetic mean of the sample concentrations, unless the sample size is less than eight ($N < 8$) or the percentage of non-detect values is greater than 80%.

Groundwater

Completion of corrective measures at groundwater units is documented by comparing residual concentrations of COCs in groundwater to the required MCSs (Berkeley Lab, 2005b). Compliance with groundwater MCSs must be demonstrated throughout the area of groundwater contamination. Locations for demonstrating compliance consist of groundwater monitoring wells located in the area where MCSs are exceeded, and also downgradient from those areas to monitor for downgradient plume migration. When the concentrations of COCs in all compliance wells at a groundwater unit averaged over four consecutive quarters of monitoring are less than MCSs, the corrective measure will be considered complete for that unit. Groundwater monitoring at Berkeley Lab is currently based on a schedule (Berkeley Lab, 2005c) that was approved by the Water Board in 2005 (Water Board, 2005). The methods and locations of monitoring groundwater for compliance with MCSs are specified in the Groundwater Monitoring and Management Plan (Berkeley Lab, 2006a).

2.5 TECHNOLOGY DESCRIPTION

Soil Units

The technology approved for cleanup of soil units is excavation and offsite disposal of contaminated soil at an authorized facility.

Groundwater Units

The primary technologies approved for cleanup of groundwater units are in situ soil flushing and monitored natural attenuation (MNA). MNA is the approved measure in those areas where hydrochemical data indicate that natural processes (e.g., biodegradation) could be effective in reducing contaminant concentrations to the required cleanup levels. MNA is typically used in conjunction with active remediation measures or as a follow up to active remedial measures. In addition, HRC is being injected into the subsurface in selected areas to enhance the natural degradation processes (enhanced bioremediation).

Technology Summary

In Situ Soil Flushing

In situ soil flushing consists of the concurrent injection of clean water into, and extraction of contaminated water from, the subsurface. A schematic diagram of the in situ soil-flushing process is shown on **Figure 2.5-1**. The purpose of soil flushing is to promote the flow of contaminated groundwater towards extraction point(s) and to increase the rate that residual soil contaminants desorb into the flowing groundwater. Trenches and wells are used to inject treated water into the subsurface. The injected water is captured by drains, trenches, and wells; extracted; and treated on-site using granular activated carbon (GAC) canisters to reduce volatile organic compound (VOC) concentrations to non-detectable level. The treated water is then either reinjected to flush contaminants from the subsurface or, if the water is not needed for flushing, discharged to the sanitary sewer under a permit issued by EBMUD. All treatment systems have an in-line secondary GAC treatment unit in the event of breakthrough of contaminants from the primary GAC unit.

Monitored Natural Attenuation (MNA)

Monitored Natural Attenuation (MNA) refers to "the reliance on natural attenuation processes within the context of a carefully controlled and monitored site cleanup approach to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods" (USEPA, 1999). The "natural attenuation processes" include a variety of physical, chemical, or biological processes that, under favorable conditions, reduce the mass, toxicity, mobility, volume, or concentration of contaminants. These processes include biodegradation; dispersion; dilution; sorption; volatilization; and chemical or biological stabilization, transformation, or destruction of contaminants. Available hydrochemical data indicate that natural attenuation processes are degrading contaminants in the groundwater in several areas of the site (Berkeley Lab, 2005a).

Natural attenuation processes can reduce the potential risk posed by site contaminants in three ways:

1) Transformation of contaminants to less toxic forms through destructive processes such as biodegradation or abiotic transformation.
2) Reduction of contaminant concentrations so that potential exposure levels are reduced.
3) Reduction of contaminant mobility and bioavailability through sorption onto the soil or rock matrix.

MNA implementation relies on a groundwater monitoring program designed to monitor the long-term behavior of the plumes, ensure that COCs are not migrating downgradient from the plume area, and document attainment of MCSs. The procedures for implementing MNA at Berkeley Lab, including the specific analytes that are being monitored and the monitoring frequency, are provided in Attachment 3 (Monitoring Protocols for Monitored Natural Attenuation and Enhanced Bioremediation) of the RCRA Corrective Measures (CMI) Workplan (Berkeley Lab, 2005b). Analytes being monitored include VOCs and hydrochemical parameters (i.e., oxidation-reduction (redox) parameters, dissolved organic carbon, and pH) in the groundwater. These data are used to identify spatial and temporal changes in the areas of groundwater contamination for which MNA is the approved remedy, and to assess whether MNA continues to be an appropriate remedy to meet the corrective measures objectives.

Enhanced Biodegradation Using Hydrogen Release Compound® (HRC®)

Hydrogen Release Compound® (HRC) is a proprietary, environmentally safe, food quality, polylactate ester formulate manufactured by Regenesis Bioremediation Products, Inc. HRC injection consists of the controlled release of HRC into the groundwater to enhance natural biodegradation of VOCs. Upon hydration of the HRC, lactic acid is slowly released into the groundwater, where it is biotransformed into pyruvic and acetic acid, releasing hydrogen in both steps. If anaerobic conditions exist, then HRC can provide a source of hydrogen, which is used as an electron donor in the reductive dechlorination process. Anaerobic microbes substitute hydrogen atoms for chlorine atoms in chlorinated hydrocarbon molecules, thereby transforming highly chlorinated VOCs to compounds with fewer chlorine atoms, and eventually to non-chlorinated, relatively nontoxic compounds. Prior to injection into the groundwater, the HRC mixture is heated in order to accelerate the consumption of dissolved oxygen by aerobic bacteria so that the mixture becomes anaerobic (i.e., dissolved oxygen drops below 0.5 mg/L). The anaerobic condition of the mixture promotes the growth of indigenous anaerobic bacteria that can degrade chlorinated solvents.

Field implementation of HRC consists of the following elements:

- Installation of injection wells to the target treatment zone or construction of a system such as a drainfield.
- Preparation of batches of HRC solution by mixing 2-3 lbs of HRC and 40 gallons of treated groundwater, and heating the solution to approximately 100°F for one to two days using an electric drum heater.
- Injection of HRC under controlled injection pressures and flow rates.
- Assessment of hydrochemical indicators that may be indicative of changes in biotic processes affecting the rate and extent of biodegradation.

The general monitoring procedures for implementing enhanced bioremediation, including the specific analytes that are being monitored and the monitoring frequency, are described in Attachment 3 (Monitoring Protocols for Monitored Natural Attenuation and Enhanced Bioremediation) of the RCRA Corrective Measures (CMI) Workplan (Berkeley Lab, 2005b).

SECTION 3

CORRECTIVE MEASURES

3.1 SUMMARY OF CORRECTIVE MEASURES

A summary of the status of the corrective measures recommended for implementation in the Corrective Measures Study Report (Berkeley Lab, 2005a) and approved for implementation by DTSC (DTSC, 2005) is provided in **Table 3.1-1**. The table lists the corrective measure objectives, the specific corrective measures approved for implementation, and the current construction and compliance status for the two areas of soil contamination and seven areas of groundwater contamination where corrective action was required. The locations of the nine units are shown on **Figure 3.1-1**. The details of the corrective measures approved for implementation at the nine units were provided in the CMI Workplan (Berkeley Lab, 2005b).

Table 3.1-1 Summary of DTSC Approved Corrective Measures

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Soil Units				
Building 51L Groundwater Plume Source Area	Reduce soil VOC concentrations to target risk-based soil MCSs.	Excavate contaminated soil and dispose of off site.	**Construction Complete** Contaminated soils were excavated and disposed of at an approved offsite disposal facility.	**Corrective Measure for Soil Complete** Samples taken of residual soils confirm cleanup to target risk-based MCSs.
Former Building 7 Sump (Source area of the Building 7 lobe of the Old Town Plume) Area of Concern (AOC) 2-5:	Reduce soil VOC concentrations to target risk-based soil MCSs.	Excavate contaminated soil and dispose of off site.	**Construction Complete** Contaminated soils were excavated and disposed of at an approved offsite disposal facility.	**Corrective Measure Complete** Samples taken of residual soils confirm cleanup to target risk-based MCSs.

Table 3.1-1 Summary of DTSC Approved Corrective Measures (Continued)

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Groundwater Units				
Building 51/64 Groundwater Solvent Plume (AOC 9-13)	Reduce concentrations of groundwater COCs to target risk-based MCSs in upgradient plume area.	Continue operation of the Building 64 in situ soil-flushing system.	**Construction Complete** Soil flushing/groundwater capture system construction completed and currently operating.	Significant reductions in VOC concentrations have been observed in the source area. Groundwater concentrations have not yet been reduced to target risk-based MCSs.
	Reduce concentrations of groundwater COCs (vinyl chloride) in the downgradient core area to the target risk-based MCS. Reduce concentrations of groundwater COCs in the downgradient area where well yields exceed 200 gpd to regulatory-based MCSs (MCLs). Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs.	Implement MNA for contaminants in the groundwater in the downgradient plume area. Continue in situ soil flushing/groundwater capture in the source area to help maintain COC concentrations at levels conducive for MNA in the downgradient plume area.	**Construction Complete** Soil flushing/groundwater capture system construction completed and currently operating. Initial round of MNA monitoring completed.	Vinyl chloride concentrations have not yet been reduced to target risk-based MCSs in the downgradient core area. Groundwater concentrations have not yet been reduced to regulatory-based MCSs (MCLs) in the downgradient area where well yields exceed 200 gpd. An ongoing monitoring program is in place to verify that the COCs do not migrate downgradient from the current plume boundary.
	Ensure that groundwater COCs do not migrate to surface water through the storm drain system.	Continue collecting and treating water from the Building 51 subdrain system.	**Construction Complete** Subdrain water capture and treatment system construction completed.	An ongoing treatment and monitoring program is in place to verify that COCs do not migrate to surface water.

Table 3.1-1 Summary of DTSC Approved Corrective Measures (Continued)

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Groundwater Units				
Building 51L Groundwater Solvent Plume	Ensure that groundwater COCs do not migrate to surface water through the storm drain system	Reconstruct Building 51L storm drain to prevent inflow of contaminated groundwater into storm drain system.	**Construction Complete** Reconstruction of storm drain has been completed so that the pathway from the groundwater plume to North Fork Strawberry Creek has been eliminated.	**Corrective Measure Complete**
	Reduce concentrations of groundwater COCs to target risk-based MCSs. Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs. Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.	Excavate contaminated soil from both the saturated and unsaturated zones and dispose of off site.	**Construction Complete** Contaminated soils were excavated and disposed of at an approved offsite disposal facility. Samples taken of residual soils confirm cleanup to target risk-based MCSs. A groundwater extraction well was installed in the backfilled source area excavation.	Groundwater monitoring has not yet established the effectiveness of the remedial measure in reducing groundwater concentrations to target risk-based MCSs. Extraction of contaminated groundwater should further reduce concentrations of COCs in the groundwater. An ongoing monitoring program is in place to verify that the COCs do not migrate downgradient from the current plume boundary or from areas where concentrations exceed MCLs to areas where concentrations are less than MCLs.

Table 3.1-1 Summary of DTSC Approved Corrective Measures (Continued)

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Groundwater Units				
Building 71 Groundwater Solvent Plume Building 71B Lobe (AOC 1-9)	Reduce concentrations of groundwater COCs in the source area to regulatory-based MCSs (MCLs). Reduce concentrations of soil COCs to regulatory-based MCSs. Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs. Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.	Continue operation of in situ soil-flushing system with addition of HRC. Treat VOCs in soil adjacent to the Building 71 foundation with an in situ chemical oxidation process, if source area remediation using HRC injection is determined to be no longer effective (DTSC, 2006c).	**Construction Complete** In situ soil flushing with HRC injection system construction completed.	Significant decreases in VOC concentrations have been observed in the groundwater in the source area, however, concentrations still remain above regulatory-based MCSs (MCLs). Confirmation soil samples will be collected to assess whether soil COCs have been reduced to target risk-based MCSs after groundwater MCSs have been achieved. An ongoing monitoring program is in place to verify that the COCs do not migrate downgradient from the current plume boundary or from areas where concentrations exceed MCLs to areas where concentrations are less than MCLs.
	Ensure that groundwater COCs above detectable concentrations do not migrate to surface water	Continue collecting and treating water from the hydraugers (hillside drains) in the hillside beneath Building 46A.	**Construction Complete** Hydrauger effluent capture and treatment system construction completed.	An ongoing treatment and monitoring program is in place to verify that COCs do not migrate to surface water.

Table 3.1-1 Summary of DTSC Approved Corrective Measures (Continued)

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Groundwater Units				
Building 7 Lobe of the Old Town Groundwater Solvent Plume (AOC 2-4)	Reduce concentrations of groundwater COCs within the source and the core areas to target risk-based MCSs.	Continue operation of in situ soil-flushing system in plume source area downgradient of the former Building 7 Sump. Continue operation of in situ soil-flushing system in the plume core downgradient of the Building 7 Groundwater Collection Trench.	**Construction Complete** Soil flushing/groundwater capture systems construction completed and currently operating.	Significant decreases in VOC concentrations have been observed, however, groundwater monitoring has not yet established the effectiveness of the remedial measure in reducing groundwater concentrations to target risk-based MCSs in the source area. .
	Ensure that groundwater COCs at concentrations exceeding target risk-based MCSs do not migrate into areas that are below target risk-based MCSs. Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.	Continue operation of the groundwater collection trenches near the southeast corner and on the west side of Building 58. Continue operation of the dual phase extraction wells on the Building 53/58 slope.	**Construction Complete** Groundwater capture system construction completed and currently operating.	An ongoing monitoring program is in place to verify that the COCs do not migrate downgradient from the current plume boundary or from areas where concentrations exceed MCLs to areas where concentrations are less than MCLs.
	Reduce concentrations of groundwater COCs to regulatory-based MCSs (MCLs) in peripheral areas of the plume where well yields exceed 200 gallons per day.	Implement MNA for contaminants in the groundwater.	**Construction Complete** Initial round of MNA monitoring for downgradient periphery area completed. The decision to implement MNA for the Building 53 crossgradient lobe area will not be made until the effectiveness of soil flushing and source area excavation have been determined.	Groundwater concentrations have not yet been reduced to regulatory-based MCSs (MCLs).

Table 3.1-1 Summary of DTSC Approved Corrective Measures (Continued)

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Groundwater Units				
Building 52 Lobe of the Old Town Groundwater Solvent Plume (AOC 10-5)	Reduce concentrations of groundwater COCs to regulatory-based MCSs (MCLs).	Continue operation of in situ soil-flushing system (injection and extraction wells) near Building 53 and 52. Implement MNA and/or enhanced bioremediation if soil flushing cannot achieve MCSs.	**Construction Complete** In situ soil-flushing system construction completed and currently operating. The decision to implement MNA or enhanced bioremediation will not be made until the effectiveness of soil flushing has been determined.	Significant decreases in VOC concentrations have been observed, with concentrations decreasing to regulatory-based MCSs (MCL) in the source area. Concentrations still exceed regulatory-based MCSs (MCLs) in some downgradient wells.
	Ensure that groundwater COCs at detectable concentrations do not migrate to surface water. Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCSs (MCLs). Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.	Continue to collect and treat groundwater intercepted by the subdrain east of Building 46.	**Construction Complete** Groundwater capture and treatment system construction completed.	An ongoing treatment and monitoring program is in place to verify that COCs do not migrate to surface water, or to uncontaminated areas.

Table 3.1-1 Summary of DTSC Approved Corrective Measures (Continued)

Unit	Corrective Measure Objectives	Approved Corrective Measure	Corrective Measures Construction and Operational Status as of December 31, 2006	Compliance Status for Corrective Measures as of December 31, 2006
Groundwater Units				
Building 25A Lobe of the Old Town Groundwater Solvent Plume (AOC 10-5)	Reduce concentrations of groundwater COCs to regulatory-based MCSs (MCLs). Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCSs (MCLs).	Continue operation of in situ soil-flushing system (groundwater infiltration bed and extraction trench) near Buildings 25A and 44A. Implement MNA and/or enhanced bioremediation if soil flushing cannot achieve MCSs.	**Construction Complete** In situ soil-flushing system construction completed and currently operating. The decision to implement MNA or enhanced bioremediation will not be made until the effectiveness of soil flushing has been determined.	Significant decreases in VOC concentrations have been observed. Concentrations have been reduced to regulatory-based MCSs (MCLs) south of Building 25. Concentrations still exceed regulatory-based MCSs (MCLs) in the source and downgradient areas west of Building 25A.
	Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas	Continue to collect and treat contaminated groundwater from an electrical utility manhole near Building 6.	**Construction Complete** Groundwater capture system construction completed and currently operating.	An ongoing monitoring program is in place to verify that the COCs do not migrate downgradient from the current plume boundary or from areas where concentrations exceed MCLs to areas where concentrations are less than MCLs.
Support Services Area (Building 69A Area)	Reduce concentrations of groundwater COCs (vinyl chloride) to target risk-based MCSs. Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.	Implement MNA for contaminants in the groundwater.	**Construction Complete** Initial round of MNA monitoring completed. Due to decreases in natural attenuation rates for COCs, HRC is being injected to enhance natural degradation.	Groundwater concentrations are currently less than target risk-based MCSs. An ongoing monitoring program is in place to verify that the COCs do not migrate downgradient from the current plume boundary.

3.2 CORRECTIVE MEASURES AT SOIL UNITS

This section provides the details of the corrective measures completed at the two soil units (Building 51L Groundwater Solvent Plume Source Area and Building 7 Lobe of the Old Town Groundwater Solvent Plume Source Area) for which cleanup was required in the CMI Workplan (Berkeley Lab, 2005b). It also provides details of the corrective measure at the Building 51 Motor Generator Room Filter Sump, which was completed in accordance with the workplan submitted to DTSC in February 2006 (Berkeley Lab, 2006c)

3.2.1 Building 51L Groundwater Solvent Plume Source Area

Background

A machine/maintenance shop was located in the Building 51L area prior to the 1970's, before Building 51L was constructed. Solvent drum racks were reportedly located at various times where Building 51L was later built, along the adjacent wall of Building 51A, and along a retaining wall located west of Building 51L. Building 51L was constructed in the early 1980's as a computer support facility for Bevatron operations and was demolished in March 2004. The former location of Building 51L is shown on **Figure 3.2-1**.

Contaminated soil and groundwater (Building 51L Groundwater Solvent Plume) were present beneath the area where Building 51L was located. The principal contaminants were VOCs that were used as cleaning solvents, or were derived from degradation of cleaning solvents. Solvent spills in the area where Building 51L was later constructed appear to have been the primary source for the contamination.

In addition, a small area of VOC-contaminated soil was present beneath the abandoned Building 51A stormdrain catch basin next to the Building 51A B-door. The location of the abandoned catch basin is shown on **Figure 3.2-2**. Contaminated soil in the bottom of the catch basin was removed in 2002. However, groundwater samples from temporary groundwater sampling point SB51A-01-8B installed through the catch basin has contained elevated VOC concentrations, suggesting the presence of additional contaminated soil beneath the catch basin.

Corrective Measures Objective

Prior to completion of corrective measures at the unit, VOCs were present in the soil in the Building 51L Groundwater Plume Source Area at concentrations that exceeded target risk-based MCSs, and therefore posed potential risks to human health (Berkeley Lab, 2005a). In addition, the presence of contaminated soil in contact with groundwater constituted an ongoing threat to groundwater quality. Excavation and offsite disposal of contaminated soil was the corrective measure approved to reduce or eliminate these potential risks (Berkeley Lab, 2005b).

The primary objective of the corrective measure at the Building 51L Groundwater Plume Source Area was to reduce VOC concentrations to the target risk-based MCSs. The target risk-based MCSs for the COCs in the soil in the Building 51L plume source area are listed in **Table 3.2-1**.

Table 3.2-1
Target Risk-Based Media Cleanup Standards for Chemicals of Concern in the Soil in the Building 51L Plume Source Area

Chemical	Target Risk-Based MCS (mg/kg)
PCE	0.45
TCE	2.3
1,1,1-TCA	690
1,1-DCA	1.3
1,1-DCE	7.9
benzene	0.1
cis-1,2-DCE	38
trans-1,2-DCE	50
vinyl chloride	0.0035

Corrective Measures Implementation

The planned details for implementing the corrective measure for the Building 51L Groundwater Plume Source Area were provided in Attachment 1 of the RCRA Corrective Measures Implementation (CMI) Workplan (Berkeley Lab, 2005b).

On July 31, 2006, Berkeley Lab issued a Notice to Proceed to the subcontractor, A & B Construction, Inc. of San Francisco, for shoring and excavating the Building 51L Groundwater

Solvent Plume source area. Prior to the start of excavation a P*ermit to Penetrate or Excavate Surface of LBNL Property* was obtained from the Berkeley Lab Facilities Department. As part of the permitting process, a utility clearance was completed in the excavation area. On August 9, 2006, saw cutting and removal of the concrete overlying the excavation area was started.

The proposed extent of the excavation was based on the concentrations of VOCs detected in 348 soil samples collected from 81 locations in the Building 51L plume source area. The completed lateral and vertical extent of excavation were considerably greater than what were specified in the workplan. The increased volume of excavation was the result of the intention to remediate the site to a residential land use level, if practicable, rather than the less stringent industrial/institutional land use level that was required. The areal extent of excavation proposed in the workplan (Attachment 1 of the RCRA Corrective Measures Implementation (CMI) Workplan [Berkeley Lab, 2005b]) and the actual areal extent of soil excavated are shown on **Figure 3.2-2**.

After removing the surface concrete, 24 steel soldier beams were installed around the perimeter of the excavation, as the initial phase in constructing the excavation shoring system. The beams were installed in 2- to 3-foot diameter shafts that were drilled on 6.5- to 8-foot centers using a solid-stem auger. The depths of the shafts ranged from 25 to 48 feet. After placing each beam in a shaft, the section below the planned depth of excavation was backfilled with 2,500 pounds per square foot (psi) concrete and the upper portion with a sand/cement slurry. The locations of the excavation and soldier beams are shown on **Figure 3.2-2**.

Soil was then removed over the entire excavation area to a depth of 5 feet, and 1-foot wide wood lagging (wood planks) was placed between adjacent soldier beams in the exposed 5-foot interval. Excavation was then continued in 5-foot increments, with wood lagging placed between the soldier beams as each 5-foot increment was completed. At a depth of approximately 6 feet, steel struts were placed over the lagging between the soldier beams, primarily along the north and west walls of the excavation. At a depth of approximately 7 feet, steel pipes (whalers) were installed as additional support at three locations between beams on the northwest corner of the excavation. Steel cable tiebacks were also installed at a depth of approximately 7 feet to support two beams on the north side and one beam on the south side of the excavation. The tiebacks were grouted into borings drilled at a downward angle into the excavation walls. After letting the grout set, pull tests were conducted on the tie backs to assure their proper performance. The locations of the whalers and tiebacks are also shown on **Figure 3.2-2**.

Confirmatory soil samples were collected from the wall of the excavation when the sampling locations became accessible. Confirmatory samples were collected in accordance with the requirements specified in Berkeley Lab's Responses to Comments on the Corrective Measures Implementation Workplan (Berkeley Lab, 2006d).

> "Ten post-excavation confirmation soil samples will be collected. Three of the samples will be collected from the floor and seven from the walls of the excavation. The wall samples will be located approximately 1/3 of the way down from the ground surface to the excavation floor, spaced at intervals of approximately 15 to 20 feet. Each sample will be collected at a depth of approximately 6 to 12 inches beneath the floor or into the walls of the excavation."

On August 29, 2006 and September 1, 2006, a total of ten confirmatory soil samples were collected from the excavation walls, which was more than the seven wall samples required. The samples were collected approximately 1/3 of the way down from the surface to the excavation floor. Except for tetrachloroethene (PCE) in one sample collected on the east wall and one sample collected on the north wall of the excavation, the concentrations of all target compounds were less than the target risk-based MCS.

On September 15, 2006, seven confirmatory soil samples were collected from the floor of the excavation, after the design depth had been reached. Vinyl chloride was detected at concentrations above the target risk-based MCS in three of the samples. Subsequently additional soil was removed from the floor of the excavation, and additional confirmatory floor samples were collected until VOCs were not detected in the floor samples at concentrations above MCSs. More than 60 cubic yards of soil were removed from the floor of the excavation to achieve the final goal.

Additional wall samples were then collected to determine the extent of contamination above MCSs at the two locations in the excavation walls where the MCS had been exceeded. Then after backfilling the main excavation area, approximately 42 additional cubic yards of soil were excavated at these two locations. Excavation and the collection of confirmatory soil samples continued until October 27, 2006, with a total of 27 wall samples and 20 floor samples being collected. The concentrations of all target compounds in the confirmatory samples were less than the target risk-based MCSs. The final extent of excavation is depicted on **Figure 3.2-3**.

Approximately 6 inches of gravel were placed in the bottom of the main excavation, except for the 13-foot bench along the east side, which is above the historical high water table. A groundwater extraction well (EW51L-06-1) was installed near the deepest (northwest) corner of the excavation. The extraction well was constructed with 5-inch diameter PVC casing that was slotted over the bottom 5 feet. The location of the well is shown on **Figure 3.2-4**. The main excavation area was backfilled with clean soil, which was compacted in approximately 12-inch lifts to the density specified by the Berkeley Lab Facilities Department. The additional areas excavated on the north and east sides were backfilled with controlled density fill (CDF) (lean concrete) to about 4 inches from the surface. All wood lagging was removed and the upper 5 feet of the steel beams were cut and removed. The excavation process is documented in the photographs included in **Attachment 1**.

In November 2006, the abandoned catch basin next to the Building 51A B-door and a length of about 12 feet of the 24-inch concrete pipe downstream of the catch basin were removed to a depth of about 16 feet. The contaminated soil beneath the concrete backfill was then removed to a depth of 37 feet using a 24-inch solid stem auger and a 4-foot diameter belling tool. SB51-01-8B was replaced with a 5-inch diameter temporary groundwater sampling point screened from 14 to 34 feet below ground surface (bgs).

<u>Waste Disposal</u>

Approximately 2,600 tons (1,350 cubic yards) of (non-hazardous) contaminated soil were excavated from the Building 51L plume source area and shipped offsite for disposal at a Class 2 landfill. Approximately 70 cubic yards of (non-hazardous) contaminated soil were excavated from the abandoned Building 51A catch basin area and shipped offsite for disposal at a Class 2 landfill.

<u>Compliance with Corrective Measures Objectives</u>

Concentrations of VOCs detected in soil in the Building 51L plume area prior to implementation of corrective measures are listed in **Appendix A (Table A-1)**. Concentrations of

VOCs detected in post-excavation confirmatory soil samples collected from the walls and floor of the excavation are listed in **Appendix A (Table A-2)**. The locations where the confirmatory soil samples were collected are shown on **Figure 3.2-4.** Samples collected from locations that have been excavated are noted in the tables. These samples are not representative of post corrective measures completion conditions.

The locations of three cross sections (BB', CC', and DD') that show concentrations of PCE, TCE, cis-1,2-DCE, and vinyl chloride detected in the soil in the excavation area are included on **Figure 3.2-5**. The cross sections (**Figure 3.2-6**, **Figure 3.2-7,** and **Figure 3.2-8**) show concentrations of VOCs detected both in the pre-corrective measure (pre-excavation) soil samples and in the post corrective measure (post-excavation) confirmatory samples. Also provided on the cross sections are the extent of excavation proposed in the workplan (Attachment 1 of the RCRA Corrective Measures Implementation (CMI) Workplan [Berkeley Lab, 2005b]) and the actual extent of soil excavated. As can be seen on the cross sections, a significantly greater volume of contaminated soil was excavated than proposed.

Concentrations of PCE, TCE, and cis-1,2- DCE detected in the wall samples collected from the main (shored) excavation area are shown on **Figure 3.2-9**. Also indicated on the figure, are the two locations on the walls where MCSs were exceeded and the areas where the excavation was extended.

Table 3.2-2 provides comparisons of the maximum concentrations of VOCs detected in the soil prior to implementation of the corrective measure, concentrations of VOCs detected in confirmatory soil samples, and residual concentrations of VOCs in the soil to the target risk-based MCSs. The residual concentrations shown include both the confirmatory soil sample results and results from samples collected in the Building 51L plume source area prior to completion of the corrective measure, from locations that were not subsequently excavated. PCE, TCE, and vinyl chloride were detected at concentrations above target risk based MCSs in the soil prior to implementation of the corrective measure. However, after completion of the corrective measure, maximum residual concentrations of VOCs were all less than target risk-based MCSs.

Since the maximum residual concentrations of all VOCs detected in the soil are all less than the target risk-based MCS, the corrective measure for the Building 51L Groundwater Plume Source Area is considered complete.

Table 3.2-2
Maximum Concentrations of Chemicals of Concern Detected in Soil in the Building 51L Groundwater Solvent Plume Source Area Compared to Risk-Based MCSs

COC	Maximum Concentration Detected Before CMI (mg/kg)	Maximum Concentration Detected in Confirmatory Excavation Wall and Floor Samples (mg/kg)	Maximum Residual Concentrations Detected in Building 51L Area (mg/kg)	Target Risk-Based MCSs (mg/kg)
PCE	**21**[a]	0.33	0.33	0.45
TCE	**24**	1.1	1.1	2.3
1,1,1-TCA	0.019	0.014	0.017	690
1,1-DCA	0.8	0.46	0.46	1.3
1,1-DCE	0.074	0.14	0.14	7.9
benzene	0.0053	ND	ND	0.1
cis-1,2-DCE	3.1	0.14	0.68	38
trans-1,2-DCE	0.45	0.04	0.12	50
vinyl chloride	**0.012**	<0.005[b]	<0.005	0.0035

(a) Boldface numbers indicate that the concentration exceeded the target risk-based MCS.
(a) < indicates that analyte was not detected above method reporting limit noted (<0.005 mg/kg).

3.2.2 Former Building 7 Sump –Area of Concern 2-5 (Source Area of the Building 7 Lobe of the Old Town Groundwater Solvent Plume)

Background

The Old Town Groundwater Solvent Plume is a broad, multi-lobed plume of VOC-contaminated groundwater, which underlies much of the Old Town area. The distribution of chemicals in the plume indicates that it consists of three coalescing lobes that were originally discrete plumes derived from distinct sources (**Figure 3.2-10**). The Building 7 lobe, which contains the highest VOC concentrations of the three lobes, extends northwestward from the northwest corner of Building 7 to the parking area downslope from Building 58.

Leaks and/or overflows of VOCs (primarily PCE) from the Former Building 7 Sump (AOC 2-5), an abandoned sump that was located north of Building 7, were the primary source of the Building 7 lobe. These chemicals were initially released as free product to the soil around the sump and then migrated as dense non-aqueous-phase liquid (DNAPL) into the saturated zone, forming a source zone for further migration of contaminants. Continuing dissolution of contaminants from the soil and westward to northwestward flow of the groundwater from the sump area has resulted in the development of the Building 7 lobe of the Old Town Groundwater Solvent Plume.

<u>Interim Corrective Measures and Pilot Tests</u>

Interim Corrective Measures (ICMs) were implemented during the RCRA Facility investigation (RFI) to remove a substantial portion of the source of the Building 7 lobe groundwater contamination and to control further migration of contaminated groundwater (Berkeley Lab 2000). The initial source-zone ICM, which was conducted when the sump was discovered in 1992, consisted of removal and proper disposal of: 1) the concrete slab that covered the sump; 2) the sediment and liquid in the sump; and 3) contaminated soil filling an adjacent concrete ditch. In August 1995, the sump and approximately 70 cubic yards of adjacent highly contaminated soil were removed.

In 1996, a groundwater collection trench (Building 7 Groundwater Collection Trench) was installed immediately downgradient from the former sump location as a source control measure (**Figure 3.2-11)**. From May 1997 through June 2001, contaminated groundwater extracted from the collection trench was treated and re-injected into a gravel-filled sump excavation to flush subsurface contaminants to the collection trench for removal and treatment at the surface. Almost two million gallons of treated water were recirculated into the remedial excavation and approximately 50 kg of VOCs were removed from the groundwater during this period. The average removal rate was approximately 1 kg/month, but asymptotically declined to very low levels. This process was discontinued in 2001 to help improve the effectiveness of a thermally enhanced soil vapor extraction (SVE) pilot test in the source area.

In July 2001, a thermally enhanced SVE pilot test was started in the area of maximum soil contaminant concentrations immediately west of the sump excavation (**Figure 3.2-11)**. The system operated primarily during the summer and fall seasons until December 2004, when it was shut down permanently. The test system initially consisted of three heater wells; two instrument wells to monitor the test; and a central dual phase (groundwater and soil vapor) extraction (DPE) well. Three additional DPE wells were added to increase the efficiency of the system, and extraction from the original DPE well was stopped. Starting in October 2003, the system was enhanced by injection of hot air under pressure into the original DPE well. More than 700 kg of VOCs were removed from the source area before the pilot test was terminated in 2004.

Although the thermally enhanced SVE pilot test removed a large mass of VOCs from the Building 7 lobe source area, soil samples collected in 2003 to evaluate the performance of the test indicated a significant mass of contaminants still remained, with residual concentrations well above MCSs. In addition, VOC concentrations exceeded MCSs at some adjacent locations outside the area affected by the test. Based on these factors and other considerations including cost, excavation was recommended as the corrective measure for the source area soil rather than thermally enhanced SVE (Berkeley Lab, 2005a).

Figure 3.2-11 shows the distribution of total VOC concentrations in soil in the Building 7 source area at the conclusion of the thermally enhanced SVE pilot test. To provide a better representation of the residual soil contamination, the figure excludes samples that were collected from locations that had previously been excavated and samples that were collected within the thermally enhanced SVE pilot test area prior to test implementation.

<u>Corrective Measures Objective</u>

Prior to implementation of corrective measures at the unit, CVOCs were present in the soil and groundwater in the Building 7 lobe source area at concentrations that exceeded target and upper-limit risk-based MCSs, and therefore posed potential risks to human health (Berkeley Lab, 2005a). Very high concentrations in some samples indicated the probable presence of residual DNAPL in the subsurface. In addition, contaminated soil was in direct contact with site groundwater, resulting in groundwater contaminant concentrations that also exceeded risk-based MCSs. Excavation and offsite disposal of contaminated soil was the corrective measure approved to reduce or eliminate these risks (Berkeley Lab, 2005b).

The primary objective of the corrective measure at the Building 7 lobe source area was to reduce VOC concentrations to levels less than the target risk-based MCSs. The target risk-based MCSs for the COCs in the soil in the Building 7 lobe source area are listed in **Table 3.2-3**.

Table 3.2-3
Target Risk-Based Media Cleanup Standards (MCSs) for Chemicals of Concern Detected in Soil at the Former Building 7 Sump (AOC 2-5)

Chemicals of Concern	Target Risk-Based Soil MCSs (mg/kg)
PCE	0.45
TCE	2.3
cis-1,2-DCE	38
1,1-DCE	8
1,1,1-TCA	690
1,1-DCA	1.3
benzene	0.1
carbon tetrachloride	0.05
chloroform	0.28
vinyl chloride	0.0035

<u>Corrective Measures Implementation</u>

The planned details for implementing the corrective measure for the Former Building 7 Sump were provided in Attachment 2 in the RCRA Corrective Measures Implementation (CMI) Workplan submitted to DTSC in November 2005 (Berkeley Lab, 2005b).

<u>Excavation Delineation Sampling</u>

With the approval of the DTSC and Water Board (DTSC, 2006a), the collection of post-excavation confirmation samples was not required at this unit. As described in Berkeley Lab's responses to comments on the CMI Workplan (Berkeley Lab, 2006d): "The excavation will be completed to a depth of approximately 45 feet using large-diameter solid-stem augers, and therefore the walls of the excavation will not be accessible for collecting post-excavation samples. Samples collected from the bottom of the borings would be of questionable validity since there would likely be loose material (slough) at the bottom of the boring and it would not be feasible to collect a sample of in-place soil." Therefore, the first phase of the corrective measure consisted of collection of 84 pre-excavation soil samples from 11 borings to delineate the extent of the area where excavation was required.

The excavation delineation samples were collected in January and March 2006 during two sampling events by drilling the borings within and around the periphery of the source zone. During the first sampling event, borings were drilled at locations where it was estimated that maximum VOC concentrations would be slightly below the target risk-based MCSs, based on historical sampling data. "Sidewall" borings were placed so as to provide data approximately every 10 feet or less along the planned excavation perimeter. "Floor" borings were placed so as to provide data immediately beneath zones known to exceed the MCS. For the second sampling event, the analytical results from the first sampling event were reviewed, and new borings were located to refine the planned excavation boundaries. The locations, sampling depths, and summary of analytical results for soil borings used for excavation delineation sampling, along with other previously collected sampling data considered to be representative of soil concentrations existing prior to soil excavation, are shown on **Figure 3.2-11**. The analytical results for these samples are provided in **Appendix A (Table A-3)**

Soil Excavation

The second phase of the corrective measure consisted of excavation of contaminated soil to a maximum depth of approximately 52.5 feet using truck-mounted large-diameter augers, as shown in the photographs in **Attachment 2**. Prior to the start of excavation a P*ermit to Penetrate or Excavate Surface of LBNL Property* was obtained from the Berkeley Lab Facilities Department. As part of the permitting process, a utility clearance was completed in the excavation area. Surface concrete and asphalt were removed from the site and the subsurface utilities were then temporarily rerouted. Excavation drilling was started on April 15, 2006 and proceeded on an intermittent schedule to minimize disruptions to operations of the Advanced Light Source (ALS), with drilling generally being conducted on weekends. The final boring was completed on September 6, 2006. To ensure removal of all the contaminated soil, smaller diameter shafts were drilled in the spaces between the larger diameter borings, after the larger diameter borings were backfilled with CDF concrete. These smaller diameter borings partially overlapped with the large diameter boring locations. Sixteen of the shafts were drilled with 48-inch solid stem augers, two with 36-inch solid stem augers, and five with 24-inch solid stem augers.

The deepest shaft was drilled to 52.5 ft bgs at the west edge of the excavation. The depths of the remaining shafts gradually decreased to 47 feet at the east edge of the excavation. The total volume of the excavation was approximately 460 cubic yards and covered an area of approximately 250 square feet**.** **Figure 3.2-12** is a cross section showing the final excavation boundaries and results from both the excavation delineation sampling and sampling conducted within the excavation during 2002 and 2003. The location of the cross section is shown on **Figure 3.2-13**.

A 5-inch-diameter PVC extraction well (EW7-06-1) with a 4-foot long screened interval was installed in the deepest shaft on the west edge of the excavation to allow the extraction of VOC-contaminated groundwater from the source area (**Figure 3.2-13)**. The shaft was then backfilled with 4.5 feet of crushed rock, overlain by 1.5 feet of bentonite and then filled to the surface with CDF concrete, using 3.5 sacks of concrete per cubic yard. Approximately a 1-foot thickness of crushed rock overlain by 1.5 feet of bentonite was placed at the base of each of the remaining shafts, which were then backfilled to the surface with CDF. At the end of the drilling operation, the storm drain and sanitary sewer line that had been rerouted during the operation were restored, and the surface was finished with concrete and asphalt on October 6, 2006. Photographs showing the restored surface are included in **Attachment 2**.

Waste Disposal

Approximately 550 cubic yards of contaminated soil were temporarily stored in covered bins, and then transported under a Non-Hazardous Waste Manifest for disposal at a Class 2 landfill.

Compliance with Corrective Measures Objectives

Concentrations of VOCs detected in soil in the Building 7 lobe source area prior to implementation of corrective measures are listed in **Appendix A, Table A-3**. Concentrations of

VOCs detected in pre-cleanup excavation-delineation soil samples collected from borings advanced adjacent to the walls (i.e. "wall" samples) and through the floor of the excavation (i.e. "floor" samples) are designated as "W" in the table. Samples collected from locations that have been excavated and that are therefore not representative of post-corrective-measures completion conditions are designated as "C" in **Table A-3**. Residual concentrations of VOCs in soil following completion of the corrective measures are shown on **Figure 3.2-13**. The figure shows historical analytical results from soil borings drilled in the areas surrounding the remedial excavation, and results from the excavation delineation "wall" borings drilled adjacent to the boundaries of the excavation. In addition, the deepest sample results from excavation delineation "floor" samples are shown. These samples are considered to represent residual concentrations at the base of the remedial excavation. However, as a conservative measure, the area was over-excavated so that all of the "floor" sample locations were removed.

Based on the excavation delineation sampling conducted prior to excavation, the corrective action removed all soil exceeding the target risk-based MCSs (**Figure 3.2-13)**. The maximum concentrations of residual contaminants detected in the excavation area are listed in **Table 3.2-4**.

Since the maximum concentrations of all VOCs detected in the excavation delineation sampling are less than the target risk-based MCS, the corrective measure for the Building 7 lobe Source Area is considered to be complete.

Table 3.2-4
Maximum Concentrations of Chemicals of Concern Detected in Soil in the Building 7 Lobe Source Area Compared to Target Risk-Based MCSs

COC	Maximum Concentration Detected Before CMI (mg/kg)	Maximum Residual Concentrations Detected in Building 7 Lobe Source Area (mg/kg)	Maximum Concentration Detected in Excavation Delineation Samples (mg/kg)	Target Risk-Based MCSs (mg/kg)
PCE	**720**[(a)]	0.35	0.28	0.45
TCE	**2.7**	0.16	0.051	2.3
cis-1,2-DCE	0.73	0.73	<0.005	38
1,1-DCE	<0.005	<0.005	<0.005	7.9
1,1,1-TCA	<0.005	<0.005	<0.005	690
1,1-DCA	<0.005	<0.005	<0.005	1.3
benzene	0.097	0.045	0.005	0.1
carbon tetrachloride	**0.078**	0.018	0.0064	0.05
chloroform	0.0086	<0.005	<0.005	0.28
vinyl chloride	<0.005	<0.005	<0.005	0.0035

(a) Boldface numbers indicate that the maximum concentration detected exceeded the target risk-based MCS.
(b) < indicates that analyte was not detected above method reporting limit noted (<0.005 mg/kg).

3.2.3 Building 51 Motor Generator Room Filter Sump (SWMU 9-6)

Background

A network of subdrains and relief wells located around the perimeter of Building 51 collects subsurface water from the adjacent hillside. Water collected by this network discharges to the Motor Generator Room Filter Sump, which is part of the Building 51 internal floor-drain system. After submittal of the CMI Workplan, elevated concentrations of PCBs were detected in shallow groundwater samples collected near the sump, indicating that PCBs were a potential COC in the soil at this location. No corrective measures had been proposed in the CMS Report or CMI Workplan because the new findings postdated those documents. A workplan was therefore submitted to the DTSC in February 2006 for the removal of PCB-contaminated soil near the filter sump (Berkeley Lab, 2006c).

Corrective Measures Objective

Prior to completion of corrective measures at the unit, PCBs were present in the soil near the Building 51 Motor Generator Room Filter Sump at concentrations that exceeded the 1 mg/kg MCS for PCBs in soil, and therefore posed a potential risk to human health. In addition, the contaminated soil was in direct contact with site groundwater and constituted an ongoing threat to groundwater quality. Excavation and offsite disposal of contaminated soil was the corrective measure proposed in the workplan (Berkeley Lab, 2006c) to reduce or eliminate these potential risks and approved by DTSC.

Corrective Measures Implementation

PCB-contaminated concrete and soil in the area near the Motor Generator Room Filter Sump were sampled and removed in several stages from March through September 2006. Concentrations of PCBs detected in the soil samples are listed in **Appendix A (Table A-4)**. The soil sampling locations and concentrations of PCBs detected are shown on **Figure 3.2-14.** Concentrations of PCBs detected in concrete samples are listed in **Appendix A (Table A-5)**. The concrete sampling locations and concentrations of PCBs detected are shown on **Figure 3.2-15.**

In early 2006, an approximately 30 square-foot section of the concrete floor in the Building 51 Motor Generator Room Basement adjacent to the filter sump was removed to allow the excavation of PCB-contaminated soil. In April 2006, three samples (SS-B51 Concrete Top Half, Bottom Half, and Full Depth) collected from different depths in the removed concrete were found to contain PCBs at a maximum concentration of 34,000 mg/kg. Following saw-cutting and removal of contaminated concrete, the soil was excavated to a depth of 5 feet from beneath the area of removed concrete and on May 30, 2006, five soil samples (SS-B51 Filter Sump Exc-F1 through –F5) were collected from the floor of the excavation. PCBs (Aroclor 1254 and/or Aroclor 1242) were detected in two of the samples, with the concentration in one of the samples (1.23 mg/kg in SS-B51 Filter Sump Exc-F5-5) above the MCS of 1 mg/kg for PCBs.

On May 18 and May 30, 2006, a total of 25 concrete samples (CS-51-06-1 through CS-51-06-25) were collected on a 2-foot by 2-foot grid to delineate the extent of PCB contamination in the concrete around the excavation area. The samples were collected by drilling to a depth of approximately 8 inches with a ½-inch rotary hammer and collecting the concrete dust. PCBs were detected in all of the samples (4,700 mg/kg Aroclor 1242 and 690 mg/kg Aroclor 1254 maximum).

In July 2006, the concrete floor slab was removed from the area where the contaminated concrete was detected and the underlying soil excavated to a depth of approximately 4 feet. In addition, the excavation depth was increased to 6.5 feet in the area where PCBs had been detected at a concentration above the MCS of 1 mg/kg in the May samples. On July 10, 2006, eight additional confirmatory soil samples (SS-B51 Filter Sump Exc-F6 through –F13) were collected from the floor of this additional excavation area, including the location where PCBs had exceeded the MCS. PCBs were detected in four of the samples (0.1 mg/kg maximum), with all concentrations less than the MCS.

The concrete platform at the southern end of the basement was removed and on July 26, 2006 an additional 21 concrete samples (CS-51-06-26 through CS-51-06-46) were collected on a 2-foot by 2-foot grid at a depth of 6 inches in the underlying floor slab. PCBs were detected in all of the samples except one (1,400 mg/kg Aroclor 1242 and 1,800 mg/kg Aroclor 1254 maximum). The concrete floor slab was therefore also removed from this area, along with the underlying base rock and soil to a depth of approximately 2 to 2.5 feet. On September 6, 2006, six confirmatory soil samples were collected, three from the walls (SS-B51 Filter Sump Exc-W1-06 through W3-06) and three from the floor (SS-B51 Filter Sump Exc-F14 through –F16) of the excavation. The floor samples were collected from this additional excavation area. Two of the wall samples were collected from the west wall and one from the north wall of the excavation. No PCBs were detected in the wall samples and PCBs were only detected in one of the floor samples (0.1 mg/kg). The excavation was backfilled with CDF concrete.

Waste Disposal

The PCB-contaminated concrete and approximately 8 cubic yards of PCB-contaminated soil were shipped offsite for disposal at a Class 1 (for the concrete that contained PCBs at hazardous waste concentrations) or Class 2 (for the concrete and soil that contained PCBs at concentrations less than hazardous waste levels) landfill.

Compliance with Corrective Measures Objectives

After the excavation was completed, maximum residual concentrations of PCBs were all less than the 1 mg/kg MCS for PCBs. Therefore, the corrective measure for the Building 51 Motor Generator Room Filter Sump has been completed.

3.3 CORRECTIVE MEASURES AT GROUNDWATER UNITS

This section provides the details of the corrective measures implemented at the seven groundwater units for which cleanup was required in the CMI Workplan (Berkeley Lab, 2005b).

3.3.1 Building 51/64 Groundwater Solvent Plume

The Building 51/64 Groundwater Solvent Plume extends south and west from the southeast corner of Building 64 beneath the former location of Building 51B (**Figure 3.3-1)**. The corrective measures required for the Building 51/64 Groundwater Solvent Plume consist of operation of an in situ soil-flushing system in the upgradient portion of the plume, implementation of MNA in the downgradient portion of the plume, and collection and treatment of water from the Building 51 subdrain system (**Table 3.1-1**). These corrective measures have been installed and are described below. In addition, HRC injection is being used in conjunction with MNA in order to enhance the natural degradation process for groundwater contaminants in the downgradient portion of the plume.

Corrective Measures Construction Status

Continue Operation of the Building 51/64 Plume In Situ Soil-Flushing System

The location and layout of the Building 51/64 plume in situ soil-flushing system are shown on **Figure 3.3-2**. A schematic diagram of the system is provided on **Figure 3.3-3**. The system consists of an injection trench inside Building 64 (Building 64 Injection Trench) and extraction trenches and extraction wells located inside and outside of the building. The system is designed to flush contaminants from the groundwater in the source area and capture the injected water.

The injected water is extracted from two groundwater collection trenches (Building 64 and Building 64 Southeast), from the gravel-filled source-area excavation completed as an ICM to remove contaminated soil, and from extraction well SB64-05-4, all located around the southern end of Building 64. Groundwater is also extracted from wells inside the building, including SB64-98-8, SB64-99-5, and SB64-00-1. The extracted groundwater is treated to non-detectable levels of VOCs at two systems, with most of the water routed to the Building 64 Treatment System and recirculated to the injection trench. Additional water for flushing is imported when needed for injection from the Firetrail Treatment System, which is used for treatment of contaminated hydrauger effluent from the Building 71 plume (described in detail in **Section 3.3.3**). The Building 64 Treatment System consists of a primary 1,000-pound GAC canister and a secondary 55-gallon GAC drum in series.

The remaining water, which is extracted from EW64-00-1 in the backfilled ICM excavation, is treated at the Building 51 Motor Generator Room Treatment System. The treatment system consists of two 1,000-pound GAC canisters in series. The treated effluent is discharged to the sanitary sewer in accordance with Berkeley Lab's EBMUD Wastewater Discharge Permit. The location of the system is shown on **Figure 3.3-2**. A schematic diagram of the treatment system is provided on **Figure 3.3-4**.

The Building 64 Injection Trench is approximately 17 feet long, 3.5 feet wide, and 11 to 12 feet deep. The bottom of the trench excavation was covered with a high-density polyethylene (HDPE) liner. Approximately 2 feet of gravel (drain rock) was placed on top of the HDPE liner and a 4-inch diameter perforated pipe (IW64-03-1) was embedded in the gravel to inject the water. The trench was backfilled with low-strength concrete to within approximately 0.5 feet of the surface and overlain with a layer of reinforced concrete.

In August 2000, the area of highly contaminated soil that constituted the major source of the Building 51/64 plume was excavated as an ICM. The gravel-filled source area excavation is approximately 15 feet long and 10 feet wide, and ranges from 8 to 18 feet deep. Groundwater extraction well EW64-00-1 was installed in the deepest (northeast) end of the excavation, and the trench was backfilled with gravel and resurfaced with concrete.

The groundwater collection trench on the northeast side of Building 64 is approximately 34 feet long, 2 feet wide, and 25 (southeast end) to 36 feet (northwest end) deep. Groundwater extraction well EW64-03-1 was installed in the deepest (northwest) end of the trench, and the trench was backfilled with gravel to approximately 5 feet below the surface. The trench was backfilled to approximately 6 inches below the surface with low-strength concrete, which was overlain by a layer of reinforced concrete.

The groundwater collection trench on the southeast side of Building 64 is approximately 48 feet long, 2 feet wide, and 28 feet deep. A 31-foot deep groundwater extraction well (EW64-05-1) was installed at the east end of the trench and the trench was backfilled with gravel to a depth of 3 feet. The top of the trench was backfilled with low-strength concrete, which was overlain by a concrete slab.

Implement Monitored Natural Attenuation (MNA) for Contaminants in the Groundwater

Monitored Natural Attenuation (MNA) is the corrective measure approved for the downgradient plume area (DTSC, 2005). MNA requires the evaluation of hydrochemical indicator parameters and VOC concentrations in the groundwater. The specific analytes that are being monitored and the monitoring frequency are listed in **Table 3.3-1**.

Table 3.3-1
Requirements for Monitored Natural Attenuation
Building 51/64 Groundwater Solvent Plume

Well Number	Location	Sampling Frequency: Hydrochemical Indicator Parameters	Sampling Frequency: VOCs (EPA Method 8260)
MW71-95-9	Upgradient	Semiannually for one year and then annually	Not required
MW51-96-16	Plume Core		Semiannually
MW51-96-17	Plume Core		Annually
MW51-97-13	Downgradient Plume Core		Annually
MW51-97-12	Crossgradient		Semiannually
MW51-97-15	Downgradient	not required	Semiannually
MWP-1	Downgradient	not required	Quarterly

In December 2006, the first round of samples was collected to evaluate the effectiveness of MNA in helping to achieve the required MCSs in the downgradient area of the Building 51/64 plume. The hydrochemical indicator parameters that are required and the sampling results are listed in **Table 3.3-2**. Concentrations of VOCs detected above MCLs are listed in **Table 3.3-3**.

Table 3.3-2
Hydrochemical Indicator Parameters Sampling Results
Building 51/64 Groundwater Solvent Plume (December 2006)

Parameter	Units	MW71-95-9	MW51-96-16	MW51-96-17	MW51-97-13	MW51-97-12
Ethane (C_2H_6)	µg/L	<0.025[a]	0.46	0.052	0.22	0.096
Ethene (C_2H_4)		<0.025	18	6.9	2.0	0.041
Methane (CH_4)		2.7	4000	2600	9100	1100
Volatile Fatty Acids (VFAs)	µg/L	0.12[a]	36.5	1162	0.57	0.15
Nitrate (NO_3^-)	mg/L	2.9	<0.5	<0.5	<0.5	<0.5
Nitrite (NO_2^-)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Sulfate (SO_4^{2-})	mg/L	30	2.7	<1	5	15
Sulfide (H_2S)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Ferrous Iron (Fe^{2+})	mg/L	ND[b]	2.9	ND	3.5	3.8
Carbon Dioxide (CO_2)	ppm	25	200	15	120	200
Conductivity	µmhos	480	1440	1120	892	1229
Dissolved Oxygen (DO)	mg/L	1.4	0.63	0.79	0.62	0.94
pH	pH units	7.8	7.4	8.4	7.8	7.3
Temperature	°C	16.1	17.7	17.4	16.3	16.9

(a) < indicates that analyte was not detected above method reporting limit noted.
(b) ND indicates analyte was not detected by instrument.

Table 3.3-3
Concentrations of VOCs (µg/L) Detected Above MCLs
Building 51/64 Groundwater Solvent Plume MNA Monitoring Wells (December 2006)

Well Number	cis-1,2-DCE	1,1-DCA	1,1-DCE	TCE	vinyl chloride	trans-1,2-DCE
Drinking Water MCL	6	5	6	5	0.5	10
MW51-96-16	**44**	<(a)	<	**11**	**9.3**	**24**
MW51-96-17	<	<	<	<	**7.8**	<
MW51-97-13	<	**9.3**	**6.1**	<	**2.7**	<
MW51-97-12	**54**	**8.8**	**9.3**	<	**1.5**	<
MW51-97-15(b)	<	<	<	<	<	<
MWP-1(b)	<	<	<	<	<	<

(a) < indicates that the analyte was either not detected or detected at a concentration below the MCL.
(b) Sample collected July 2006.

To enhance the biodegradation of groundwater contaminants and expedite the cleanup process, about 300 pounds of HRC were injected in the downgradient core area of the plume in February 2005. The HRC was initially injected into four HRC borings constructed on the east side of former Building 51B immediately upgradient from groundwater monitoring wells MW51-96-16 and MW51-96-17. About 150 gallons of warm water per week were pumped into the borings to help flush the HRC into the formation.

In May 2006, three new wells (IW64-06-1, IW64-06-2, and IW64-06-3) were installed to replace the four initial HRC injection wells. The locations of the wells are shown on **Figure 3.3-2**. Two of the wells (IW64-06-2 and IW64-06-3) are currently being used for HRC injection. The HRC system consists of two 55-gallon drums, the first filled with HRC solution and the second with water that is used to flush the HRC solution after it has been injected into the wells. HRC injection has been continuing on an almost daily basis since the wells were installed.

Continue Collecting and Treating Water from the Building 51 Subdrain System

The Building 51 Motor Generator Room Basement discharge sump collects effluent water from the Building 51 subdrain system. The effluent from the subdrain is captured and treated to non-detectable levels of VOCs at the Building 51 Motor Generator Room Treatment System, which is described above. The effluent water will continue to be treated as long as it has detectable concentrations of COCs to prevent the migration of the contaminated subdrain water to surface water.

Compliance with Corrective Measures Objectives

The corrective measures objectives for the Building 51/64 Groundwater Solvent Plume are to:

- Reduce concentrations of COCs in the groundwater in the source and upgradient core areas to target risk-based MCSs.
- Reduce concentrations of COCs in the groundwater in the downgradient area where well yields exceed 200 gpd to regulatory-based MCSs (MCLs).
- Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs.
- Ensure that groundwater COCs do not migrate to surface water through the storm drain system.

Concentration trends for total VOCs detected in groundwater samples collected in the Building 51/64 Groundwater Solvent Plume source area are shown on **Figure 3.3-5.** As can be seen on the figure, the source removal ICM together with the ongoing in situ soil flushing has significantly reduced VOC concentrations in the Building 51/64 plume source area. This reduction in VOC concentrations is illustrated on **Figure 3.3-6,** which provides a comparison between the isoconcentration contour map for total VOCs in source area groundwater in May 2006 and the isoconcentration contour map (transparency) for November 2000, prior to the source removal ICM.

Except for the shallowest level (SB64-02-1A at 11 feet) of six-port well SB64-02-1 inside Building 64, total VOC concentrations detected in the Building 51/64 plume source area decreased from more than 700,000 µg/L prior to the source area ICM excavation to less than 1,000 µg/L in August 2006. **Table 3.3-4** provides a comparison of the maximum concentrations of VOCs detected in groundwater monitoring wells and the two multi-port wells in the source area in August 2006 to the target risk-based MCSs required for the source area. The concentrations of all VOCs have been reduced to levels below target risk-based MCSs in all groundwater monitoring wells in the source area. However, concentrations of vinyl chloride and/or 1,1-dichloroethane (DCA) exceed the target risk-based MCS in the two multi-port wells. These wells were constructed with very short (approximately 1 foot) screened intervals in order to target specific permeable zones within the bedrock, and are therefore not representative of the water-bearing unit as a whole.

Table 3.3-4
Maximum Concentrations of Chemicals of Concern Detected in Groundwater in the Building 51/64 Groundwater Solvent Plume Source Area in August 2006 Compared to Target Risk-Based MCSs

COC	Maximum Concentrations Detected in Groundwater Monitoring Wells in August 2006 (µg/L)	Maximum Concentrations Detected in Multi-Port Wells SB64-02-1 & SB64-02-2 in August 2006 (µg/L)	Target Risk-Based Groundwater MCSs (µg/L)
PCE	208	128	343
TCE	124	534	1,594
1,1,1-TCA	3.2	32	200
1,1,2-TCA	0.57	<10[(a)]	1,905
1,1-DCA	491	**5,490**[(b)]	3,663
1,2-DCA	3.8	49	1,030
1,1-DCE	229	811	28,873
cis-1,2-DCE	12	197	98,405
vinyl chloride	8.1	**160**	12

(a) < indicates that analyte was not detected above method reporting limit noted (<10 µg/L).
(b) Boldface numbers indicate that the maximum concentration detected exceeded the target risk-based MCS.

Concentration trends for total VOCs detected in groundwater samples collected in the Building 51/64 plume core and downgradient area are shown on **Figure 3.3-7.** Concentrations of total VOCs in the two core area monitoring wells (MW51-96-16 and MW51-96-17) immediately downgradient from the HRC injection wells have been decreasing, after initially increasing following the start of HRC injection. The concentration of vinyl chloride, however, still remains above the target risk-based MCS in both of these wells and several VOCs remain at concentrations above MCLs, the required MCS in the downgradient plume area.

Concentrations of VOCs in the downgradient plume area have remained relatively constant, indicating that equilibrium has been reached between advection (migration) of VOCs and degradation in the downgradient area. Several VOCs (1,1-DCA, 1,1-DCE, cis-1,2-DCE, and vinyl chloride) remain at concentrations above MCLs, the required MCS in the downgradient plume area; however, all concentrations are below target risk-based MCSs. Since concentrations of VOCs in the groundwater in the source area have been significantly reduced, as described above, the advection of VOCs downgradient from the source area should decline over time, with a resultant decline in concentrations in both the core and downgradient areas. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary.

Effluent from the Building 51 subdrain will continue to be captured and treated as long as detectable levels of VOCs are present in the water.

3.3.2 Building 51L Groundwater Solvent Plume

Building 51L Groundwater Solvent Plume is centered near the former location of Building 51L (**Figure 3.1-1 and Figure 3.2-1)**. The corrective measures required at the Building 51L Groundwater Solvent Plume consist of excavation and offsite disposal of contaminated soil, and reconstruction of the Building 51L stormdrain **(Table 3.1-1)**. Implementation of these corrective measures has been completed and is described below. In addition as described in **Section 3.2.1,** extraction and treatment of contaminated groundwater from the well (EW51L-06-1) installed in the corrective measure excavation for the Building 51L Groundwater Solvent Plume Source Area, should expedite the reduction of VOC concentrations in the groundwater. MNA will be used if the required measures prove ineffective in reducing VOC concentrations in groundwater to target risk-based MCSs.

<u>Corrective Measures Construction Status</u>

Excavation and Offsite Disposal of Contaminated Soil

Excavation and offsite disposal of contaminated soil in the Building 51L Plume source area has been completed. The corrective measure is described in **Section 3.2.1**, Corrective Measures for Soil Units.

Reconstruct Building 51L Stormdrain to Prevent Inflow of Contaminated Groundwater into Stormdrain System.

The storm drain line and the storm-drain catch basin in the contaminated soil area were permanently removed while excavating the contaminated soil from the source area in August and September 2006 (See **Section 3.2.1**). A replacement 24-inch storm drain line and catch basins were installed along the same alignment, at a level above the historical water table. The purpose of relocating the line was to remove a potential pathway for the migration of contaminated groundwater to surface water through the storm drain system. Prior to completion of this measure, infiltration of contaminated groundwater into the stormdrain was prevented by using two groundwater extraction wells (EW51L-99-1 and EW51L-00-1) to lower the water table below the former stormdrain line. The extraction wells were located in the source area excavation **(Figure 3.2-1**), and were therefore destroyed. Since relocating the stormdrain has eliminated the potential migration pathway to the creek, the extraction wells were not replaced.

Implement MNA for Remaining Groundwater Contaminants

The CMI Workplan states: "It is anticipated that post-excavation residual COC concentrations in groundwater will be less than the required MCSs (target risk-based levels). However, if groundwater COC concentrations still exceed MCSs, then MNA will be implemented to achieve the required cleanup levels." The long-term effects on VOC concentrations in the groundwater of the recent source area excavation and groundwater extraction from the new well installed in the backfilled source area excavation have not yet been determined. Therefore, it has not yet known whether implementation of MNA is needed at the unit.

Groundwater Extraction and Treatment

As described above, a well was installed in the backfilled source area excavation to extract contaminated groundwater. The groundwater extracted from EW51L-06-1 is treated to non-detectable levels of VOCs at the Building 51L Treatment System. A schematic diagram of the treatment system is provided on **Figure 3.3-8**. The treatment system consists of a primary 1,000-pound GAC canister and a secondary 55-gallon GAC drum in series. The treated effluent is discharged to the sanitary sewer in accordance with Berkeley Lab's EBMUD Wastewater Discharge Permit.

Compliance with Corrective Measures Objectives

The corrective measure objectives for the Building 51L Groundwater Solvent Plume are to:

- Reduce concentrations of COCs in the groundwater to target risk-based MCSs.
- Ensure that groundwater COCs do not migrate to surface water through the storm drain system.
- Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs.
- Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.

The long-term effectiveness of the corrective measure (excavation of contaminated source area soil) for achieving the required target risk-based MCSs has not yet been determined since the corrective measure has only recently been completed.

Relocating the storm drain line has eliminated the potential migration pathway of groundwater COCs to surface water.

Concentrations of VOCs in the groundwater throughout the plume have likely been significantly reduced by the removal of the source and should continue to decline as a result of extraction of contaminated groundwater from the well (EW51L-06-1) installed in the excavation backfill. Insufficient time has elapsed, however, to monitor for such reductions.

Concentrations of VOCs in downgradient wells have remained at non-detectable levels, indicating that equilibrium has been reached between advection of VOCs and degradation in the downgradient area. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary.

3.3.3 Building 71B Lobe of the Building 71 Groundwater Solvent Plume

The Building 71B Lobe of the Building 71 Groundwater Solvent Plume extends from beneath the southern edge of Building 71B, southwest towards the Building 51/64 complex (**Figure 3.1-1**). The corrective measures required for the Building 71B lobe consist of operation of an in situ soil-flushing system and HRC injection in the upgradient portion of the plume, and continued collection and treatment of effluent from the hydraugers that drain groundwater from the slope west of Building 46A (**Table 3.1-1**). Implementation of all of these corrective measures has been completed and is described below. In addition, in situ chemical oxidation will be used if HRC based source area remediation activities are determined to be no longer effective.

Corrective Measures Construction Status

Continue Operation of In Situ Soil-Flushing System with Addition of HRC

The location and layout of the Building 71B plume in situ soil-flushing system are shown on **Figure 3.3-9.** A schematic diagram of the system is provided on **Figure 3.3-10**. To install the system, the east side of the source area excavation (previously completed as an ICM) was backfilled with gravel to create a drainfield. Temporary groundwater sampling point SB71B-04-1 located downgradient from the source area was then converted to a groundwater extraction well, and a GAC treatment system (Building 71B Treatment System) was constructed to treat extracted groundwater. The system consists of a primary 1,000-pound GAC canister and a secondary 55-gallon GAC drum in series. Extracted groundwater is treated to non-detectable levels of VOCs, and then discharged to the drainfield via injection well SB71B-04-3 to flush residual contamination from the source area.

Since December 2004, HRC has been periodically added to the injected water to enhance the remediation process through stimulation of in-situ biodegradation. The HRC system consists of two polyethylene drums that are used to mix and dispense HRC solution. HRC injection is continuing on almost a daily basis.

The procedure for groundwater monitoring in support of enhanced biodegradation requires the evaluation of the same hydrochemical indicator parameters and VOC concentrations in the groundwater as specified for MNA. The specific analytes that are being monitored and the monitoring frequency are listed in **Table 3.3-5**.

Table 3.3-5
Monitoring Requirements for Enhanced Biodegradation
Building 71B Lobe

Well Number	Location	Sampling Frequency	
		Hydrochemical Indicator Parameters	VOCs (EPA Method 8260)
MW71-95-9	Upgradient	Semiannually for one year and then annually	Not required
MW71B-99-3R	Plume Core	Semiannually for one year and then annually	Quarterly
SB71B-04-1	Downgradient Core	not required	Quarterly
MW90-5	Downgradient	not required	Semi-annually

In December 2006, the first round of samples was collected to evaluate the effectiveness of enhanced biodegradation in helping to achieve the required MCSs. The hydrochemical indicator parameters that are required and the sampling results are listed in **Table 3.3-6**. Concentrations of VOCs detected above MCLs in the Building 71B lobe MNA monitoring wells are listed in **Table 3.3-7**.

Table 3.3-6
Hydrochemical Indicator Parameters Sampling Results
Building 71B Lobe
(December 2006)

Parameter	Units	MW71-95-9	MW71B-99-3
Ethane (C_2H_6)	µg/L	<0.025[a]	0.5
Ethene (C_2H_4)		<0.025	2.1
Methane (CH_4)		2.700	5800
Volatile Fatty Acids (VFAs)	mg/L	0.12	0.10
Nitrate (NO_3^-)	mg/L	2.9	<0.5
Nitrite (NO_2^-)	mg/L	<0.5	<0.5
Sulfate (SO_4^{2-})	mg/L	30	4.7
Sulfide (H_2S)	mg/L	<0.1	<0.1
Ferrous Iron (Fe^{2+})	mg/L	ND[b]	0.8
Carbon Dioxide (CO_2)	ppm	25	120
Conductivity	µmhos	480	921
Dissolved Oxygen (DO)	mg/L	1.4	2.2
pH	pH units	7.8	7.7
Temperature	°C	16.1	16.1

(a) < indicates that analyte was not detected above method reporting limit noted.
(b) ND indicates analyte was not detected by instrument.

Table 3.3-7
Concentrations of VOCs (µg/L) Detected Above MCLs
Building 71B Lobe MNA Monitoring Wells
(December 2006)

Well Number	cis-1,2-DCE	PCE	TCE	vinyl chloride
Drinking Water MCL	6	5	5	0.5
MW71B-99-3R	**6.5**	<[a]	<	**2.5**
SB71B-04-1	**8.8**	**13**	**13**	<
MW90-5[b]	<	<	<	<

(a) < indicates that the analyte was either not detected or detected at a concentration below the MCL.
(b) Sample collected July 2006.

Treat VOCs in Soil Adjacent to the Building 71B Foundation with an In Situ Chemical Oxidation Process, if HRC is not Effective

Injection of treated groundwater has resulted in an increase in the groundwater level to within a few feet of the surface at Building 71B, thereby allowing the flushing of the contaminated former vadose zone soils in the source area. The addition of HRC to the injected water will accelerate the cleanup of the residual shallow soil contamination that exceeds MCSs adjacent to the foundation piers of the building. At the May 11, 2006 Remedial Project Managers (RPM) meeting, Berkeley Lab submitted a letter with backup documentation to DTSC proposing that the previously proposed in situ chemical oxidation (ISCO) be eliminated as a component of the approved corrective measure for the Building 71B lobe due to the effectiveness of HRC injection. On July 14, 2006, DTSC approved the request with the stipulation that "The implementation of ISCO remedial measures should be postponed until the HRC based source area remediation activities have been determined to be no longer effective." (DTSC, 2006d)

Continue Collecting and Treating Water from the Hydraugers in the Hillside Beneath Building 46A

Effluent from hydraugers (hillside drains) 51-01-01, 51-01-02, 51-01-03, 51-01-03A, and 51-01-09 that drain VOC-contaminated groundwater from the slope near Building 46A is collected and treated to non-detectable levels of VOCs at the Building 51 Firetrail Treatment System. The system consists of two 1,000-pound GAC canisters in series. The location of the system is shown on **Figure 3.3-1**. A schematic diagram of the treatment system is included on **Figure 3.3-3**. The treated water is primarily used for soil flushing purposes but can also be disposed of in the sanitary sewer in accordance with Berkeley Lab's EBMUD Wastewater Discharge Permit, if not needed for flushing. The water can be routed for injection either at the Building 51/64 plume soil-flushing system, which is described in **Section 3.2.1,** or at the Building 52 lobe soil-flushing system, which is described in **Section 3.2.5**.

<u>Compliance with Corrective Measures Objectives</u>

The corrective measure objectives for the Building 71B plume are to:

- Reduce concentrations of COCs in groundwater in the source area to regulatory-based MCSs (MCLs).

- Reduce concentrations of COCs in the soil to regulatory-based MCSs.
- Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs.
- Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.
- Ensure that groundwater COCs above detectable concentrations do not migrate to surface water

Concentration trends for total VOCs detected in groundwater samples collected from wells in the source and core areas of the Building 71B plume are shown on **Figure 3.3-11**. As can be seen on the figures, the ongoing in situ soil flushing and HRC injection has significantly reduced VOC concentrations in the Building 71B lobe source and core areas. In addition, there has been a long-term decreasing trend in the concentration of VOCs in MW90-3, which is located at the downgradient core margin, with the concentration of total VOCs declining from 95 µg/L to 25 µg/L. These reductions in VOC concentrations is illustrated on **Figure 3.3-12,** which provides a comparison between the isoconcentration contour map for total VOCs in source area groundwater in May 2006 and the isoconcentration contour map (transparency) for November 2004. Soil flushing and HRC injection have reduced the concentration of total VOCs from over 6,000 µg/L to approximately 60 µg/L in the groundwater in the source area.

Trends in the concentrations of individual VOCs detected in three source area wells (MW71B-99-3R, SB71B-03-1, and SB71B-03-2) are shown on **Figure 3.3-13**. Shortly after HRC was first introduced into the drainfield, dissolved oxygen (DO) concentrations in the groundwater dropped from approximately 2 to 3 mg/L (aerobic) to less than 0.1 mg/L (anaerobic), creating conditions favorable for reductive dechlorination of the groundwater contaminants. At the same time, significant decreases in the concentration of total VOCs (primarily PCE) were observed in all three wells, suggesting that the VOCs were being biodegraded. As shown on **Figure 3.3-13**, although concentrations of individual VOCs in source area wells are generally declining, concentrations of PCE, cis-1,2-DCE, and vinyl chloride still remain at levels above the MCSs (MCLs). Concentrations of cis-1,2-DCE, PCE, and TCE are also above the MCS (MCL) in the core area.

As discussed above, the addition of HRC to the injected water should also accelerate the cleanup of the residual shallow soil contamination that adjacent to the foundation piers of the building. Soil samples will be collected from this area to document that the soil concentrations are have been reduced to the MCSs after groundwater MCSs have been achieved.

Concentrations of VOCs throughout the downgradient plume have remained relatively constant or decreased, indicating that degradation of VOCs in the downgradient area exceeds advection. Concentrations in the downgradient plume area are well below target risk-based MCSs, the applicable cleanup level. Since concentrations of COCs in the groundwater in the source area have been significantly reduced as described above, the advection of COCs into the core and downgradient areas should decline over time and concentrations in those areas should decline further. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary and from areas where concentrations exceed MCLs to areas where concentrations are less than MCLs.

Concentrations of VOCs have been decreasing in the hydrauger effluent, with all concentrations below MCLs since May 2006. Capture and treatment of effluent from these hydraugers (51-01-01, 51-01-02, 51-01-03, 51-01-03A, and 51-01-04) will continue until VOC concentrations are below levels of detection.

3.3.4 Building 7 Lobe of the Old Town Groundwater Solvent Plume

The Old Town Groundwater Solvent Plume is a broad, multi-lobed groundwater plume, composed primarily of VOCs, which underlies much of the central portion of Berkeley Lab known as Old Town. The geometry and distribution of chemicals in the plume indicate that it consists of three coalescing lobes that were originally discrete plumes derived from distinct sources. The locations of the plume and lobes are shown on **Figure 3.1-1**. The Building 7 lobe contains significantly higher VOC concentrations than the other two plume lobes and extends northwest from the northwest corner of Building 7 to the parking area downslope from Building 58.

The corrective measures required for the Building 7 Lobe consist of excavation and offsite disposal of contaminated soil from the source area, operation of an in situ soil-flushing system in the source and core areas, and MNA in the downgradient plume periphery areas (**Table 3.1-1**). All of these corrective measures have been implemented and are described below. MNA is a contingency in the crossgradient plume periphery area near Building 53 if the implemented corrective measures cannot reduce concentrations of VOCs in groundwater in that area to regulatory-based MCSs (MCLs).

Corrective Measures Construction Status

Excavation and Offsite Disposal of Contaminated Soil

Excavation and offsite disposal of contaminated soil in the Building 7 Lobe source area has been completed. The corrective measure is described in **Section 3.2.2**, Corrective Measures for Soil Units.

Continue Operation of the Building 7 Lobe In Situ Soil-Flushing Systems

The location and layout of the Building 7 lobe in situ soil flushing and groundwater capture system is shown on **Figure 3.3-14** and **Figure 3.3-15**. A schematic diagram of the system is provided on **Figure 3.3-16**. The system is designed to flush contaminants from the subsurface in the source and upgradient core areas and primarily to control migration of contaminated groundwater in downgradient areas. Extracted groundwater from the system is primarily treated at the Building 7 Treatment System, which consists of two primary and one secondary 1,000-pound GAC canisters. The principal components of the soil-flushing system, which was completed in several stages from 1996 to 2004, are described below.

Building 7 Sump Excavation Extraction Well: As described in **Section 3.2.2**, the base of the Building 7 sump excavation was backfilled with an approximately 1-foot-thick layer of gravel ranging in depth from approximately 46 to 51 feet. A groundwater extraction well (EW-7-06-1) with a 4-foot screened interval was constructed at the low point of the gravel layer, in order to be able to capture contaminated groundwater flowing through the source area. The need for groundwater extraction and/or the resumption of in situ soil flushing in the source area will be determined after the effectiveness of the source area excavation on achieving groundwater MCSs has been established. Extracted groundwater from the system would be treated at the Building 7 Treatment System

Building 7 Groundwater Collection Trench in Plume Source Area Downgradient of the Former Building 7 Sump: The Building 7 Groundwater Collection Trench was installed in 1996 to control and capture contaminated groundwater migrating downgradient from the source area. The trench also captures reinjected groundwater flowing eastward from the Building 7 Soil Flushing Injection Trench, described below. The gravel-filled Building 7 collection trench is 40-feet long by 2-feet wide and increases from a depth of approximately 55 feet at the southern end to 60 feet at the northern end. The extracted groundwater is treated at the Building 7 Treatment System.

Building 7 Soil Flushing Injection Trench and Extraction Well System: The Building 7 Soil Flushing Injection Trench consists of six 24-inch diameter borings (IW7-02-1, through IW7-02-6) that were drilled in line to a maximum depth of approximately 56 feet, downgradient from the Building 7 Groundwater Collection Trench. The Building 7 Extraction Well System consists of three groundwater extraction wells (EW7-03-1, EW7-03-2, and EW7-03-3) drilled into the top of the Orinda Formation approximately 30 to 40 feet downgradient (west) of the injection trench. The treated water that is injected into the injection trench either flows westward where it is captured by the three extraction wells or eastward where it is captured by the Building 7 Groundwater Collection Trench. The extracted groundwater is treated at the Building 7 Treatment System.

Dual Phase Extraction Wells on the Building 53/58 Slope: An array of eight dual-phase (groundwater and soil vapor) extraction (DPE) wells (EW58-98-1 through EW58-98-8) is located at the downgradient edge of the Building 7 lobe core area to control migration of the plume core. The wells are 35 to 40 feet deep with 20-foot long gravel-packed screened intervals. The extracted groundwater is collected and pumped to the Building 7 Treatment System, where it is treated. A soil vapor extraction (SVE) treatment system, which is located adjacent to the wells, is used to extract and treat contaminated soil vapor from the vadose zone.

Groundwater Collection Trenches near the Southeast Corner and on the West Side of Building 58: The Building 58 Southeast Groundwater Collection Trench was installed at the southeast corner of Building 58 as an additional control on the downgradient migration of the core of the Building 7 lobe. The trench is approximately 13-feet long and ranges from 29 to 31 feet in depth. Extraction well EW58-02-1 was installed into the gravel backfill in the deepest part of the trench. The extracted groundwater is treated at the Building 7 Treatment System.

A groundwater collection trench was installed west of Building 58 at the downgradient edge of the Building 7 lobe to control the downgradient migration of the plume. The trench is approximately 40 feet long and 20 feet deep. Two 6-inch pipes in the trench (EW58-98-1 and EW58-98-2) extract groundwater, which is pumped to the Building 51 Firetrail Treatment System.

Building 58 West Subdrain: Water is pumped from a concrete sump (SB58-98-4) that was installed adjacent to an abandoned corrugated metal pipe subdrain west of Building 58 to prevent migration of contaminated water to surface water via the drain system. The contaminated effluent from the subdrain flows into the sump from which it is pumped to the Building 51 Fire Trial Treatment System.

Implement Monitored Natural Attenuation (MNA) for Contaminants in the Groundwater

Monitored Natural Attenuation (MNA) requires the evaluation of hydrochemical indicator parameters and VOC concentrations in the groundwater. The specific analytes that are being monitored in the downgradient plume periphery area and the monitoring frequency are listed in **Table 3.3-8**. Any MNA requirements for the crossgradient periphery area near Building 53 will not be specified until after the effectiveness of the other corrective measures on reducing VOC concentrations in the crossgradient periphery area to regulatory-based MCSs (MCLs) has been determined.

Table 3.3-8
Requirements for Monitored Natural Attenuation
Building 7 Lobe Downgradient Periphery Area

Well Number	Location	Sampling Frequency	
		Hydrochemical Indicator Parameters	VOCs (EPA Method 8260)
MW 58A-94-14	Downgradient Periphery	Semiannually for one year and then annually	Semiannually
MW58-93-3			
MW51-94-15	Downgradient	not required	Annually
MW51-96-3			
SB58-98-6			

In December 2006, the first round of samples was collected to evaluate the effectiveness of MNA in helping to achieve the required MCSs in the downgradient periphery area of the Building 7 lobe. The hydrochemical indicator parameters that are required and the sampling results are listed in **Table 3.3-9**. Concentrations of VOCs detected above MCLs are listed in **Table 3.3-10**.

Table 3.3-9
Hydrochemical Indicator Parameters Sampling Results
Building 7 Lobe Downgradient Periphery Area
(December 2006)

Parameter	Units	MW58A-94-14	MW58-93-3
Ethane (C_2H_6)	µg/L	0.072	0.046
Ethene (C_2H_4)		0.13	0.046
Methane (CH_4)		240	16
Volatile Fatty Acids (VFAs)	µg/L	5803	not analyzed
Nitrate (NO_3^-)	mg/L	0.96	4.3
Nitrite (NO_2^-)	mg/L	<0.5[(a)]	<0.5
Sulfate (SO_4^{2-})	mg/L	59	77
Sulfide (H_2S)	mg/L	<0.1	<0.1
Ferrous Iron (Fe^{2+})	mg/L	ND[(b)]	ND
Carbon Dioxide (CO_2)	ppm	20	35
Conductivity	µmhos	757	808
Dissolved Oxygen (DO)	mg/L	1.14	1.23
pH	pH units	8.0	8.5
Temperature	°C	16.2	16.8

(a) < indicates that analyte was not detected above method reporting limit noted.
(b) ND indicates analyte was not detected.

Table 3.3-10
Concentrations of VOCs (µg/L) Detected Above MCLs
Building 7 Lobe MNA Monitoring Wells
(December 2006)

Well Number	cis-1,2-DCE	1,1-DCA	1,1-DCE	PCE	TCE	vinyl chloride	trans-1,2-DCE
Drinking Water MCL	6	5	6	5	5	0.5	10
MW58A-94-14	35	6.2	15	<(a)	<	<	<
MW58-93-3	7	6	14	31	22	1.2	<
MW51-94-15(b)	<	<	<	<	<	<	<
MW51-96-3(b)	<	<	<	<	<	<	<
SB58-98-6(b)	<	<	<	<	<	<	<

(a) < indicates that the analyte was either not detected or detected at a concentration below the MCL.
(b) Sample collected July 2006.

Compliance with Corrective Measures Objectives

The corrective measures objectives for the Building 7 lobe are to:

- Reduce concentrations of COCs in the groundwater in the source and the core areas to target risk-based MCSs.
- Ensure that groundwater COCs at concentrations exceeding target risk-based MCSs do not migrate into areas that are below target risk-based MCSs.
- Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.
- Reduce concentrations of COCs in the groundwater to regulatory-based MCSs (MCLs) in downgradient and crossgradient periphery areas of the plume where well yields exceed 200 gallons per day.

Concentration trends for total VOCs detected in groundwater samples collected for monitoring the Building 7 lobe are shown on **Figure 3.3-17a** for the source area**, Figure 3.3-17b** for the core area, and **Figure 3.3-17c** for the downgradient area and transgradient areas**.** The source removal ICM together with the ongoing in situ soil flushing has significantly reduced VOC concentrations in the source and core areas. This reduction in VOC concentrations is illustrated on **Figure 3.3-18,** which provides a comparison between the isoconcentration contour map for total VOCs in source and core area groundwater in May 2006 and the isoconcentration contour map (transparency) for November 2000. As shown on the graphs, total VOC concentrations in the Building 7 lobe source and core areas have significantly declined since 2000, primarily as a result of the in situ soil flushing conducted during this period.

Concentration trends for individual Building 7 lobe COCs (PCE, TCE, carbon tetrachloride, and vinyl chloride) are shown on **Figure 3.3-19a1** and **Figure 3.3-19a2** for source area wells, **Figure 3.3-19b1** and **Figure 3.3-19b2** for upgradient core area wells, and Figure **3.3-19c1** and **Figure 3.3-19c2** for downgradient core area wells. As can be seen on the figures, soil flushing has reduced VOC concentrations in the source and upgradient core area monitoring wells below target risk-based MCSs. Although concentrations of COCs have also shown significant declines in the downgradient core area, PCE, TCE, carbon tetrachloride, and vinyl chloride still exceed target risk-based MCSs at some groundwater monitoring well locations. The concentrations, however, are at levels well below the upper-limit risk based MCSs.

Concentrations of VOCs in the downgradient plume area (**Figure 3.3-17c**) have remained relatively constant, indicating that equilibrium has been reached between advection of COCs and degradation in the downgradient area. Since concentrations of COCs in the groundwater in the source and core areas have been significantly reduced as described above, the advection of COCs into the core and downgradient areas should decline over time, with a resultant decline in concentrations. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary.

3.3.5 Building 52 Lobe of the Old Town Groundwater Solvent Plume

As described in the preceding section, the Old Town Groundwater Solvent Plume consists of three coalescing lobes (Building 7 lobe, Building 25A lobe, and Building 52 lobe) of VOC-contaminated groundwater derived from distinct sources **(Figure 3.2-10)**. The Building 52 lobe extends northwest from the area east of Building 52 to Building 46, where the contaminated groundwater is captured by a subdrain that was installed in the 1950s as a landslide mitigation measure (Building 46 subdrain). The corrective measures required for the Building 52 Lobe consist of in situ soil flushing, and continued groundwater capture at the Building 46 Subdrain. These corrective measures have been implemented and are described below. In addition, as described below, MNA and/or enhanced bioremediation may be used in the event that the required measures do not reduce groundwater COCs below regulatory-based MCSs (MCLs).

Corrective Measures Construction Status

In Situ Soil Flushing

The location and layout of the Building 52 lobe in situ soil-flushing system are shown on **Figure 3.3-14**. A schematic diagram of the system is provided on **Figure 3.3-20**. The in situ soil-flushing system includes seven injection wells (IW5-04-1, IW5-04-2, MW52A-98-1, MW91-9, IW27-04-1, MW91-8, and IW7C-04-1). The injected water is captured by four extraction wells (MW52A-98-8B, MW52-95-2B, EW53-04-2, and EW7C-04-2) or further downgradient at the lobe margin by the Building 46 Subdrain. Groundwater extracted from the first three wells is treated to non-detectable levels of VOCs at the Building 53 Treatment System. Groundwater extracted from the fourth well (EW7C-04-2) is treated at the Building 7 system. The Building 53 Treatment System consists of a 1,000-pound GAC canister with an in-line 55-gallon GAC drum as backup. The groundwater treated by the Building 53 and Building 46 systems is recirculated to the injection wells for continued flushing.

Monitored Natural Attenuation and Enhanced Bioremediation

Operation of the soil-flushing system will continue until groundwater VOC concentrations are either 1) reduced to regulatory-based MCSs (MCLs) and can be maintained at that level without flushing or 2) reduced to levels above MCLs and no further significant declines in concentration are observed. If condition 2 is the case, implementation of MNA and/or enhanced bioremediation will be considered. The decision to implement MNA will not be made until the long-term effect of in situ soil flushing on VOC concentrations in the groundwater has been determined.

Migration Control at the Building 46 Subdrain

The downgradient migration of the Building 52 lobe is controlled by the Building 46 subdrain. The depth of the subdrain increases from 4 feet at the southern end to approximately 11 feet deep at the northern end. The contaminated groundwater that is extracted from the subdrain is treated to non-detectable levels of VOCs at the Building 46 Treatment System and is then recirculated to injection wells in the source area of the Building 52 lobe. The treatment system consists of two in-line 1,000-pound GAC canisters. Capturing and treating the water in the subdrain prevents the migration of groundwater COCs to surface water. If the treated water is not needed for flushing, it will be discharged to the sanitary sewer under a permit issued by EBMUD.

<u>Compliance with Corrective Measures Objectives</u>

The corrective measures objectives for the Building 52 lobe are to:

1) Ensure that groundwater COCs at detectable concentrations do not migrate to surface water.
2) Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLS) do not migrate into areas where concentrations are less than MCSs.
3) Reduce concentrations of COCs in the groundwater to regulatory-based MCSs (MCLs).
4) Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.

Trends in concentrations of total VOCs detected in groundwater in the Building 52 lobe area are shown on **Figure 3.3-21**. As shown on the figure, in situ soil flushing has resulted in significant reductions in the concentrations of VOCs detected in most wells monitoring the Building 52 lobe. This reduction in concentrations is illustrated on **Figure 3.3-22,** which provides a comparison between the isoconcentration contour map for total VOCs in the Building 52 lobe groundwater in May 2006 and the isoconcentration contour map (transparency) for November 1999, prior to the start of soil flushing in the source area.

Concentration trends for individual Building 52 lobe COCs (PCE, TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride, and chloroform) are shown on **Figure 3.3-23a1**, **Figure 3.3-23a**2, and **Figure 3.3-23a3** for source area wells and **Figure 3.3-23b1**, **Figure 3.3-23b2**, and **Figure 3.3-23b3** for downgradient area wells. As can be seen on the figures, soil flushing in the source area has reduced VOC concentrations in the source area monitoring wells below regulatory-based MCSs (MCLs). Although there have also been significant declines in the downgradient area wells since the start of soil flushing, concentrations of PCE, TCE, and/or carbon tetrachloride still exceed the required MCSs (MCLs) in some of the wells. Concentrations of all VOCs are substantially less than target risk-based values.

Concentrations of VOCs in the downgradient plume area remained relatively constant, or declined slightly prior to the start of soil flushing (**Figure 3.3-21**), indicating that equilibrium had been reached between advection of COCs and degradation in the downgradient area. Since concentrations of COCs in the groundwater in the source area have been significantly reduced as described above, the advection of COCs into the core and downgradient areas should continue to decline over time, with resultant further declines in concentrations. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary.

Effluent from the Building 46 subdrain will continue to be captured and treated as long as detectable levels of VOCs are present in the water, effectively capturing the plume and ensuring that COCs at detectable levels do not migrate further downgradient.

3.3.6 Building 25A Lobe of the Old Town Groundwater Solvent Plume

As described in the preceding sections, the Old Town Groundwater Solvent Plume consists of three coalescing lobes (Building 7 lobe, Building 25A lobe, and Building 52 lobe) of VOC-contaminated groundwater derived from distinct sources (**Figure 3.1-1**). The Building 25A lobe itself encompasses two subplumes of groundwater contamination, containing different suites of COCs, which are likely derived from different sources. The Building 25A subplume extends from the western portion of Building 25A westward to the eastern edge of Building 6 (**Figure 3.2-10**). The Building 25 subplume extends from east of Building 25A to south of Building 25 (**Figure 3.2-10**).

The corrective measures required for the Building 25A lobe consist of in situ soil flushing and continued extraction and treatment of groundwater from the electric utility manhole east of Building 6. These corrective measures have been implemented and are described below. In addition, as described below, MNA and/or enhanced bioremediation may be used in the event that the required measures do not reduce groundwater COCs below regulatory-based MCSs (MCLs).

Corrective Measures Construction Status

In Situ Soil Flushing

The location and layout of the Building 25A lobe in situ soil-flushing system is shown on **Figure 3.3-14**. The in situ soil-flushing system consists of two separate systems that address the separate subplumes described above. Schematic diagrams of the systems are provided on **Figure 3.3-24.**

The system used for flushing the Building 25A subplume consists of a groundwater extraction trench west of Building 25A and south of Building 44, an infiltration bed immediately west of Building 25A, and groundwater extraction well MW25A-98-3 located north of Building 25A (**Figure 3.3-14**). The groundwater collection trench controls the migration of contaminated groundwater from the Building 25A lobe source area. The trench is approximately 40-foot long by 40-foot deep and is backfilled with gravel. Extraction well EW25A-02-1 was installed into the trench backfill. Contaminated groundwater is extracted both from the trench and from well MW25A-98-3. The extracted groundwater is treated to non-detectable levels of VOCs at the Building 25A Treatment System and then injected into the shallow gravel-filled infiltration bed located upgradient of the trench. The treatment system consists of a 1,000-pound GAC canister with an in-line 55-gallon GAC drum as backup.

The system used for flushing the Building 25 subplume consists of two groundwater monitoring wells that have been converted to a groundwater extraction well (MW25-95-5) and a groundwater injection well (MW25-98-10). Groundwater is extracted from MW25-95-5, treated to nondetectable levels of VOCs at the Building 25 Treatment System, and then injected into MW25-98-10. The treatment system consists of two in-line 55-gallon GAC drums.

Monitored Natural Attenuation and Enhanced Bioremediation

Operation of the soil-flushing systems will continue until groundwater VOC concentrations are either 1) reduced to regulatory-based MCSs (MCLs) and can be maintained at that level without flushing or 2) reduced to levels above MCLs and no further significant declines in concentration are observed. If condition 2 is the case, implementation of MNA and/or enhanced bioremediation will be considered. The decision to implement MNA will not be made until the long-term effect of in situ soil flushing on VOC concentrations in the groundwater has been determined.

Extraction of Groundwater from Utility Manhole East of Building 6

Contaminated groundwater that is present in an electrical utility manhole east of Building 6 is pumped from the manhole to the Building 6 Treatment System. This measure prevents the migration of contaminated groundwater through electrical conduits to the Building 37 area. The system consists of two 1,000-pound GAC canisters in series.

<u>Compliance with Corrective Measures Objectives</u>

The corrective measures objectives for the Building 25A Lobe are to:

- Ensure that groundwater COCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCSs.
- Reduce concentrations of groundwater COCs below regulatory-based MCSs (MCLs).
- Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.

Trends in concentrations of total VOCs detected in groundwater in the Building 25A subplume source and downgradient areas are shown on **Figure 3.3-25.** As shown on the figure, in situ soil flushing west of Building 25A has resulted in reductions in the concentrations of VOCs detected in wells monitoring the Building 25A subplume, although concentrations in MW25A-98-1 have fluctuated significantly, possibly due to its proximity to the groundwater collection trench. **Figure 3.3-26** shows concentration trends of total VOCs in the three wells monitoring the Building 25 subplume. As shown on the figure, in situ soil flushing south of Building 25 has resulted in significant reductions in the concentrations of VOCs detected in wells monitoring the Building 25 subplume. The reduction in concentrations in both subplumes of the Building 25A lobe is illustrated on **Figure 3.3-27,** which provides a comparison between the isoconcentration contour map for total VOCs in groundwater in August 2006 and the isoconcentration contour map (transparency) for November 2000, prior to the start of soil flushing at Building 25A.

Concentration trends for individual Building 25A lobe (Building 25A Subplume) COCs (TCE, cis-1,2-DCE, and 1,1-DCE) are shown on **Figure 3.3-28a** and **Figure 3.3-28b** for source area and downgradient area wells, respectively. These are the VOCs that have historically exceeded MCLs in the Building 25A subplume. Concentrations of these constituents have generally declined since the initiation of soil flushing, with the exception of SB25A-96-3, which is located at the southern edge of the source area (**Figure 3.3-27**). TCE exceeds the required regulatory-based MCS (MCL) in most source area and some downgradient area wells and 1,1-DCE exceeds the MCL in SB25A-96-3. However, concentrations of all VOCs are substantially less than target risk-based MCSs throughout the plume area.

Both TCE and 1,1-DCE concentrations have shown long-term increases in SB25A-96-3 that started in 1998 prior to the initiation of soil flushing, and have continued. If concentrations continue to increase in this well, the soil-flushing system may need to be modified to capture contaminants in this area.

Concentrations of VOCs in the downgradient plume area remained relatively constant or declined prior to soil flushing, indicating that equilibrium has been reached between advection of COCs and degradation in the downgradient area. Since concentrations of COCs in the groundwater in the source area have been significantly reduced as described above, the advection of COCs into the core and downgradient areas should decline over time, with further resultant declines in concentrations. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary.

Concentration trends for individual Building 25A lobe (Building 25 Subplume) COCs (PCE, TCE, and carbon tetrachloride) are shown on **Figure 3.3-29**. These are the VOCs that have historically exceeded MCLs in the Building 25A subplume. TCE and PCE concentrations have shown long-term declines that started prior to soil flushing, indicating that natural degradation processes are sufficient to meet corrective measures objectives for these constituents. However, carbon tetrachloride concentrations were relatively constant prior to soil flushing south of Building 25. Significant declines in the concentrations of carbon tetrachloride and TCE were observed after the initiation of soil flushing south of Building 25. Operation of the soil-flushing system was therefore halted on September 2, 2006 to monitor for possible rebound in contaminant levels. Concentrations of TCE in groundwater samples subsequently collected have all been below MCLs, and carbon tetrachloride has been only slightly above the MCL (0.68 µg/L MCL=0.5 µg/L). If concentrations remain below MCLs for four quarters of monitoring, a letter will be submitted to the regulators requesting that the treatment system be closed.

3.3.7 Building 69A Area of Groundwater Contamination

The location of the Building 69A Area of Groundwater Contamination is shown on **Figure 3.3-30**. The most likely source of the contamination was leakage from a pipeline in the Building 69A Hazardous Materials Storage and Delivery Area (AOC 3-1) that drains to the Building 69A Storage Area Sump (SWMU 3-5). A dislocation was observed in one of the sump drainpipes and repaired in 1987. The corrective measure required for the Building 69A Area of Groundwater Contamination is implementation of MNA. In addition, HRC injection has been implemented in conjunction with MNA in order to enhance the natural degradation process for groundwater contaminants.

Corrective Measures Construction Status

Implement Monitored Natural Attenuation (MNA) for Contaminants in the Groundwater Plume

Monitored Natural Attenuation (MNA) requires the evaluation of hydrochemical indicator parameters and VOC concentrations in the groundwater. The specific analytes that are being monitored and the monitoring frequency are listed in **Table 3.3-11**.

Table 3.3-11.
Requirements for Monitored Natural Attenuation
Building 69A Area of Groundwater Contamination

Well Number	Location	Sampling Frequency	
		Hydrochemical Indicator Parameters(1)	VOCs (EPA Method 8260)
SB69A-00-1	Upgradient Plume Core	Annually (rainy season)	Annually (rainy season)
SB69A-99-1	Plume Core	Semiannually for one year and then annually	Semi-annually
MW69-97-8	Downgradient Plume Core	Semiannually for one year and then annually	Semi-annually
MW69A-92-22	Crossgradient	not required	Semi-annually
SB77-02-1	Downgradient	not required	Semi-annually

In December 2006, the first round of samples was collected to evaluate the effectiveness of MNA in helping to achieve the required MCSs in the downgradient area of the Building 69A Area of Groundwater Contamination. The hydrochemical indicator parameters that are required and the sampling results are listed in **Table 3.3-12**. Concentrations of VOCs detected above MCLs are listed in **Table 3.3-13**.

Table 3.3-12.
Hydrochemical Indicator Parameters Sampling Results
Building 69A Area of Groundwater Contamination
(December 2006)

Parameter	Units	SB69A-00-1	SB69A-99-1	MW69-97-8
Ethane (C_2H_6)	µg/L	0.3	<0.025[(a)]	<0.025
Ethene (C_2H_4)		6.8	11	0.026
Methane (CH_4)		2,800	10,000	9.8
Volatile Fatty Acids (VFAs)	µg/L	0.22	0.28	0.32
Nitrate (NO_3^-)	mg/L	<0.5	<0.5	<0.5
Nitrite (NO_2^-)	mg/L	<0.5	<0.5	<0.5
Sulfate (SO_4^{2-})	mg/L	12	<1	8.3
Sulfide (H_2S)	mg/L	<0.1	<0.1	<0.1
Ferrous Iron (Fe^{2+})	mg/L	3.9	3.8	ND[(b)]
Carbon Dioxide (CO_2)	ppm	ND	350	160
Conductivity	µmhos	1355	1358	1220
Dissolved Oxygen (DO)	mg/L	2.72	0.5	1.03
pH	pH units	7.3	7.8	7.5
Temperature	°C	16.5	17.7	17.2

(a) < indicates that analyte was not detected above method reporting limit noted.
(b) ND indicates analyte was not detected by instrument.

Table 3.3-13.
Concentrations of VOCs (µg/L) Detected Above MCLs
Building 69A Area of Groundwater Contamination MNA Monitoring Wells
(December 2006)

Well Number	cis-1,2-DCE	vinyl chloride
Drinking Water MCL	6	0.5
SB69A-00-1	8.8	4.9
SB69A-99-1	<[(a)]	12.5
MW69-97-8	<	<
MW69A-92-22[(b)]	<	<
SB77-02-1[(c)]	<	<

(a) < indicates that the analyte was either not detected or detected at a concentration below the MCL.
(b) Sample collected July 2006.
(c) Sample collected May 2003.

In 2005, a four-inch-diameter well (SB69A-05-1) was installed into the gravel-backfilled former underground storage tank (UST) excavation in the source area of the plume. The purpose of this well was to allow the injection of HRC. In August 2005, HRC injection was started as an enhanced bioremediation measure. Approximately 90 gallons of HRC mixture has been injected each week. The HRC mixture used for injection is generated by mixing approximately 45-gallon batches of GAC-treated EBMUD drinking water with 2 to 4 pounds of HRC, heating the mixture, and allowing it to sit for two to four days prior to injection. Two new HRC injection wells (IW69A-06-1 and IW69A-06-2) were constructed in May 2006 to enhance the delivery of HRC to the subsurface. The locations of the wells are shown on **Figure 3.3-30.**

Compliance with Corrective Measures Objectives

The corrective measures objectives for the Building 69A Area of Groundwater Contamination are as follows. MNA is the approved corrective measure for meeting these objectives.

1) Reduce concentrations of groundwater COCs to target risk-based MCSs.
2) Ensure that groundwater COCs do not migrate into adjacent uncontaminated areas.

The only VOC in the Building 69A area that has exceeded the required (target risk-based) MCS is vinyl chloride, and both vinyl chloride and cis-1,2-DCE have been present at concentrations exceeding MCLs. Concentration trends for both vinyl chloride and cis-1,2-DCE detected in wells monitoring the Building 69A Area of Groundwater Contamination are shown on **Figure 3.3-31**. Vinyl chloride concentrations were relatively static for several years or increased, while cis-1,2-DCE concentrations generally declined. However, subsequent to initiation of HRC injection, both vinyl chloride and cis-1,2-DCE concentrations have recently declined to below the target risk-based MCS. Future monitoring will ascertain whether vinyl chloride concentrations will remain below target risk-based MCS.

No VOCs have been detected in the monitoring well immediately downgradient of the plume area, indicating that equilibrium has been reached between advection of VOCs and attenuation in the downgradient area. Concentrations of all VOCs are below target risk-based MCSs. Berkeley Lab has an ongoing monitoring program in place to verify that COCs do not migrate downgradient from the current plume boundary.

SECTION 4

REFERENCES

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SECTION 5

GLOSSARY

Area of Concern (AOC): Any suspected release of a hazardous waste or hazardous constituent that is not associated with a Solid Waste Management Unit.

Attenuation: The process by which a compound is reduced in concentration over time, through absorption, adsorption, degradation, dilution, and/or transformation.

Bioremediation: The use of living organisms, primarily microorganisms, to degrade environmental contaminants into less toxic forms. It uses naturally occurring bacteria and fungi or plants to degrade or detoxify substances hazardous to human health and/or the environment.

Breakthrough: The failure of the carbon to continue removing contaminants from the treated water.

Chlorinated Hydrocarbons: A hydrocarbon in which chlorine atoms substitute for one or more hydrogen atoms in the compounds structure. Chlorinated solvents commonly are used for grease removal in manufacturing, dry cleaning, and other operations.

Cleanup: Actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and/or the environment. The term "cleanup" is sometimes used interchangeably with the terms remedial action, removal action, response action, corrective action, or corrective measure.

Concentration: The relative amount of a substance mixed with another substance. An example is 1 microgram per liter of trichloroethylene(TCE) in water.

Contaminant: A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful effects to humans or the environment.

Contamination: (Groundwater and Surface Water): An impairment of quality by biological, chemical, or radiological materials that lowers the water quality to a degree that creates a potential hazard to the environment or public health, or interferes with a beneficial use.

Core Area: Area of high contaminant concentrations in the groundwater extending downgradient from the source area.

Corrective Measure: An action taken under RCRA authority to permanently resolve a hazardous waste release or to significantly reduce the potential for a future release (See also cleanup).

Corrective Measures Implementation (CMI): The step in the RCRA process in which corrective measures are designed and implemented.

Corrective Measures Study (CMS): The step in the RCRA process in which corrective measure alternatives are investigated and evaluated.

Degradation: To reduce the complexity of a chemical compound. Destruction of a compound through biological or abiotic reactions.

Dense Non-Aqueous Phase Liquid (DNAPL): Non-aqueous phase liquids such as chlorinated hydrocarbon solvents or petroleum fractions with a specific gravity greater than 1.0 that sink through the water column until they reach a confining layer.

Dissolved Oxygen (DO): The amount of oxygen that is dissolved in a liquid.

Downgradient: The direction that groundwater flows; similar to "downstream" for surface water.

Extraction Well: A discharge well used to remove groundwater or soil vapor.

Granular Activated Carbon (GAC): A highly porous adsorbent material, produced by heating organic matter, such as coal, wood, or coconut shell, in the absence of air, which is then crushed into granules. Activated carbon is positively charged and therefore able to remove negative ions from the water such as chlorine, fluorides, and dissolved organic solutes by absorption onto the activated carbon.

Hazard Quotient: The ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level, at which no adverse health effects are likely to occur.

Human Health Risk: The likelihood that a given exposure or series of exposures may have damaged or will damage the health of individuals.

Hydrogen Release Compound® (HRC): HRC is a proprietary, environmentally safe, polylactate ester specially formulated for the slow release of hydrogen into groundwater.

In Situ: In its original place; unmoved or unexcavated; remaining at the site or in the subsurface.

In-Situ Flushing: Introduction of large volumes of water, at times supplemented with cleaning compounds, into soil, waste, or ground water to flush hazardous contaminants from a site.

In-Situ Oxidation: Technology that oxidizes contaminants dissolved in ground water.

Interim Corrective Measures: Short-term actions to control ongoing risks while site characterization is underway or before a final remedy is selected.

Injection Well: A well into which fluids are injected.

Maximum Contaminant Level: The maximum permissible level of a contaminant in water delivered to any user of a public system. MCLs are enforceable standards.

Media Cleanup Standard: Media- and chemical-specific concentrations that a corrective measure must achieve in order to meet the corrective action objectives and be considered complete.

Monitored Natural Attenuation: The reliance on natural attenuation processes within the context of a carefully controlled and monitored site cleanup approach to achieve site-specific remediation objectives.

Monitoring Well: A well used to obtain water quality samples or measure groundwater levels.

Natural Attenuation: Naturally occurring processes in soil and groundwater environments that act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants.

Non-Degradation: An environmental policy that disallows any lowering of naturally occurring quality regardless of pre-established health standards.

pH: pH is a measure of the concentration of protons (H+) in a solution and, therefore, its acidity or alkalinity. The "pH" value i indicates whether a solution is acidic (pH < 7), basic (pH > 7) or neither (pH = 7) [neutral].

Plume: A zone or distribution of contaminants, usually originating from a source area, and extending in the direction of gravity, preferential pathways, and/or groundwater flow.

Polychlorinated Biphenyls (PCBs): A group of toxic, persistent chemicals that were used in electrical transformers and capacitors for insulating purposes, and in gas pipeline systems as lubricant. The sale and new use of these chemicals, also known as PCBs, were banned by law in 1979.

Resource Conservation and Recovery Act (RCRA): The federal law that regulates management and disposal of solid and hazardous waste.

RCRA Facility Investigation (RFI): A study that examines the nature and extent of contamination at a facility regulated under RCRA.

Release: Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substance.

Remediation: Cleanup or other methods used to remove or contain a toxic spill or hazardous materials.

Residual: Amount of a pollutant remaining in the environment after a natural or technological process has taken place.

Risk Assessment: Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

Soil vapor: Gaseous elements and compounds in the small spaces between particles of the earth and soil.

Solid Waste Management Unit (SWMU): A unit at a hazardous waste facility from which hazardous constituents might migrate. “Hazardous constituent” means a constituent identified in California Code of Regulations (CCR), Title 22, Division 4.5, Chapter 11 (Identification and Listing of Hazardous Waste); or any component of a hazardous waste or leachate which has a chemical or physical property that causes the waste or leachate to be identified as a hazardous waste (CCR, Title 22, Section 66260.10).

Source Area: The location of liquid hydrocarbons or the zone of highest soil or groundwater concentrations, or both, of the chemical of concern.

Vadose Zone: The zone between land surface and the water table within which the moisture content is less than saturation (except in the capillary fringe) and pressure is less than atmospheric. Soil pore space also typically contains air or other gases. The capillary fringe is included in the vadose zone.

Volatile Organic Compound (VOC): Any organic (carbon-containing) compound that evaporates readily to the atmosphere at room temperature.

LIST OF FIGURES

MW25-95-5	Groundwater monitoring well
MW90-6	Properly destroyed monitoring well
T **SB76-97-3**	Temporary groundwater sampling point
T SB64-98-16	Properly destroyed sampling point
	Groundwater extraction well
	Groundwater injection well
	Slope stability well
	Slope indicator well
	Soil boring
64-01-06	Hydrauger
	Spring
700	Topographic contour line (elevation in feet above mean sea level)
	LBNL site boundary
17	Building showing building number
51L	Former building location
GAC	Granular activated carbon treatment system
	Groundwater collection trench

NOTES:
All other symbols used are explained on the figures.

Symbols.ai
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Key to Symbols Used on Figures.

WATER FLOW COMPONENTS

- V — Flow Control / Flood Valve
- SP — Sampling Port
- PG — Pressure Gauge
- TS System — System Totalizer
- T — Individual Totalizer
- CV — One-way Check Valve (Back Flow Control Valve)
- P R — Pressure Relief Valve
- Particulate Filter 0.5µm, 5µm, 25µm
- H1 — Holding Barrel
- D1 — Aqua Scrub Granular Activated Carbon (GAC) Drum (55-gallon)
- C1 — Aqua Scrub Granular Activated Carbon (GAC) Canister (1000-lb)
- SD1, SD2 — Sediment Strainer
- Water Flow Line (showing direction of flow)
- MW53-93-16 GF2 — Groundwater Extraction Location (MW=Monitoring Well, EW=Extraction Well)
- IW5-04-1 — Groundwater Injection Location (MW=Monitoring Well, IW=Injection Well)

ELECTRICAL COMPONENTS

Electric Power Source

- AC Outlet
- Power Cable

Electric Power Controls

- ON / OFF — On/Off Switch
- OFF / HAND / AUTO — Three-Way (Auto/Off/Hand) Electric Control Switch Panel

Pump Controls

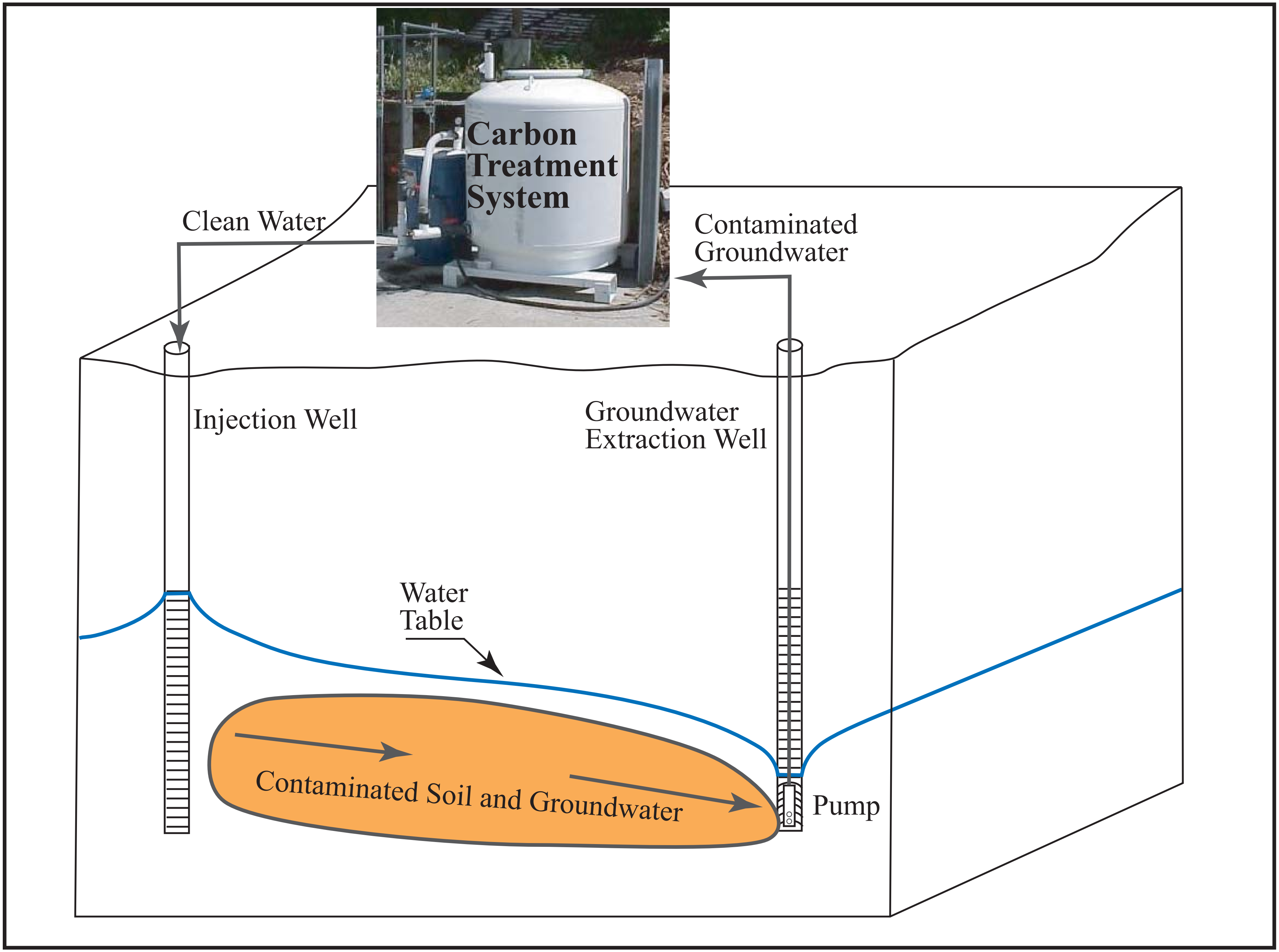
- Float Switch

Pump Types

- GF1 — Submersible (Grundfos) Pump
- SMP1 — Sump Pump

key to symbols schematic.ai

Key to Symbols Used in Schematic Diagrams of Soil Flushing System



2.5-1-flushing diagram.ai
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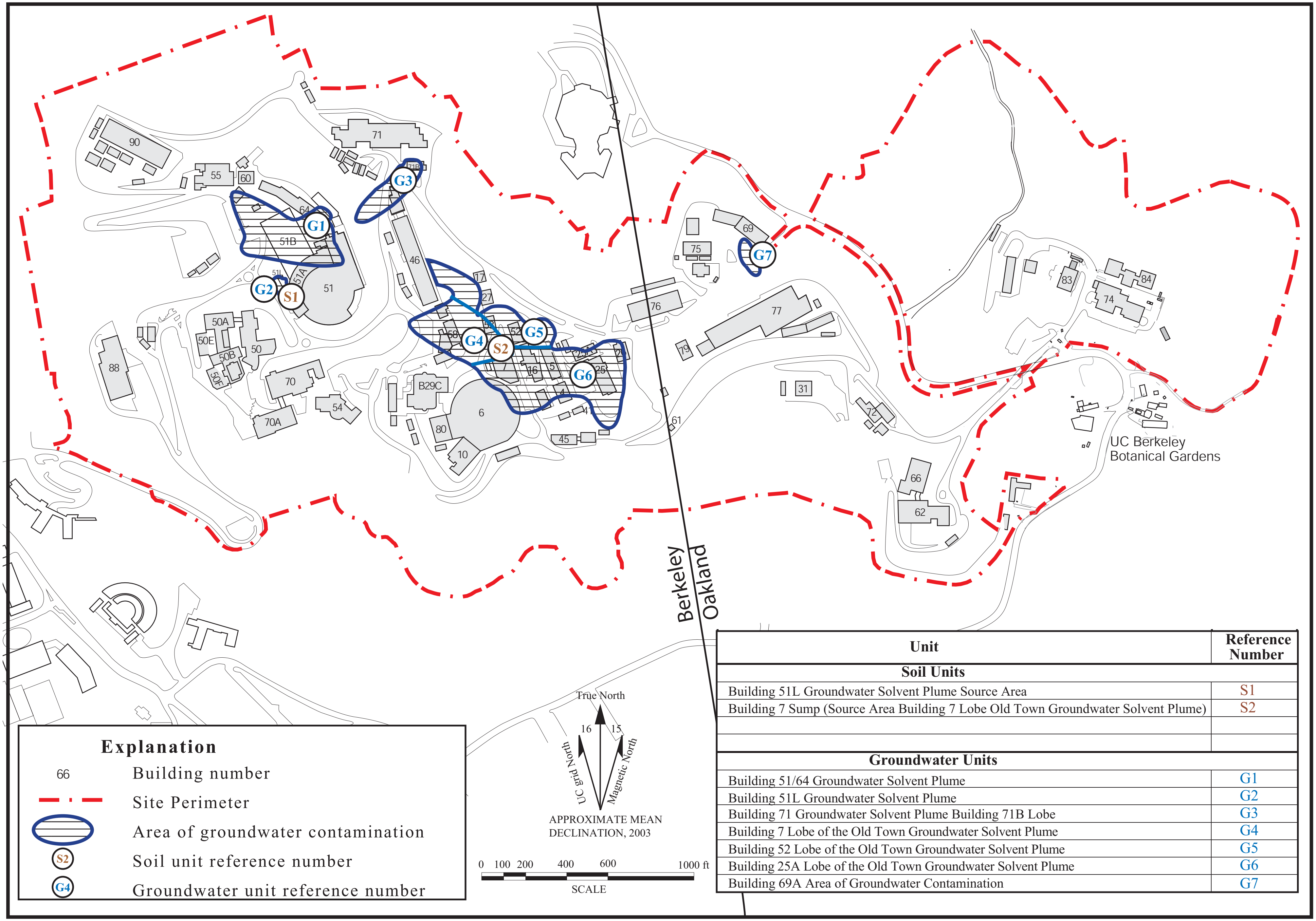
Figure 2.5-1. Schematic Diagram of Soil Flushing System.



Unit	Reference Number
Soil Units	
Building 51L Groundwater Solvent Plume Source Area	S1
Building 7 Sump (Source Area Building 7 Lobe Old Town Groundwater Solvent Plume)	S2
Groundwater Units	
Building 51/64 Groundwater Solvent Plume	G1
Building 51L Groundwater Solvent Plume	G2
Building 71 Groundwater Solvent Plume Building 71B Lobe	G3
Building 7 Lobe of the Old Town Groundwater Solvent Plume	G4
Building 52 Lobe of the Old Town Groundwater Solvent Plume	G5
Building 25A Lobe of the Old Town Groundwater Solvent Plume	G6
Building 69A Area of Groundwater Contamination	G7

3.1-1-units.ai
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Figure 3.1-1. Locations of Soil and Groundwater Units Requiring Corrective Measures.

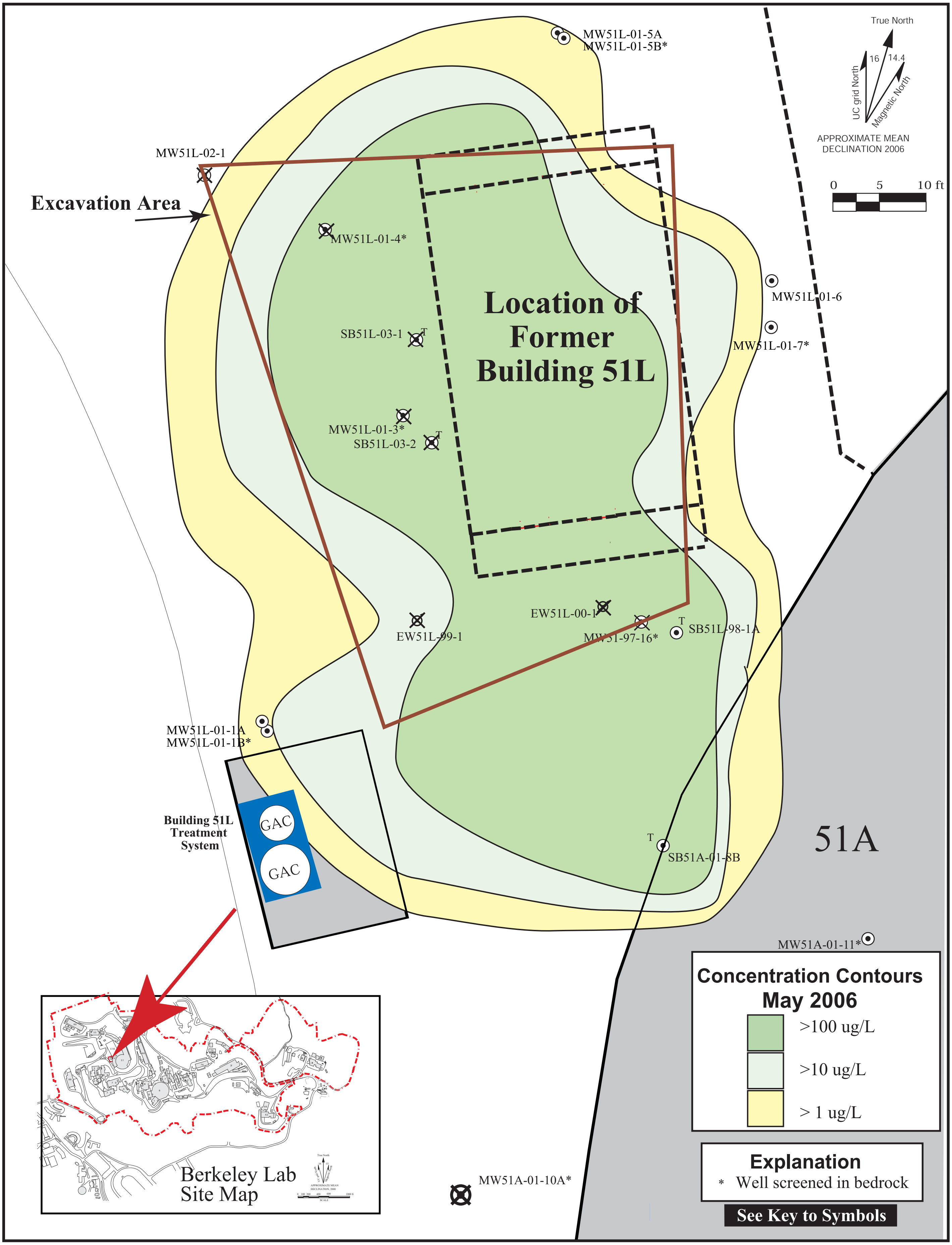

Figure 3.2-1. Location of Former Building 51L Showing Isoconcentration Contour Map, Total CVOCs in Groundwater, May 2006.

3.2-1-location.ai
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Building 51L Groundwater Plume Source Area Excavation September 2006

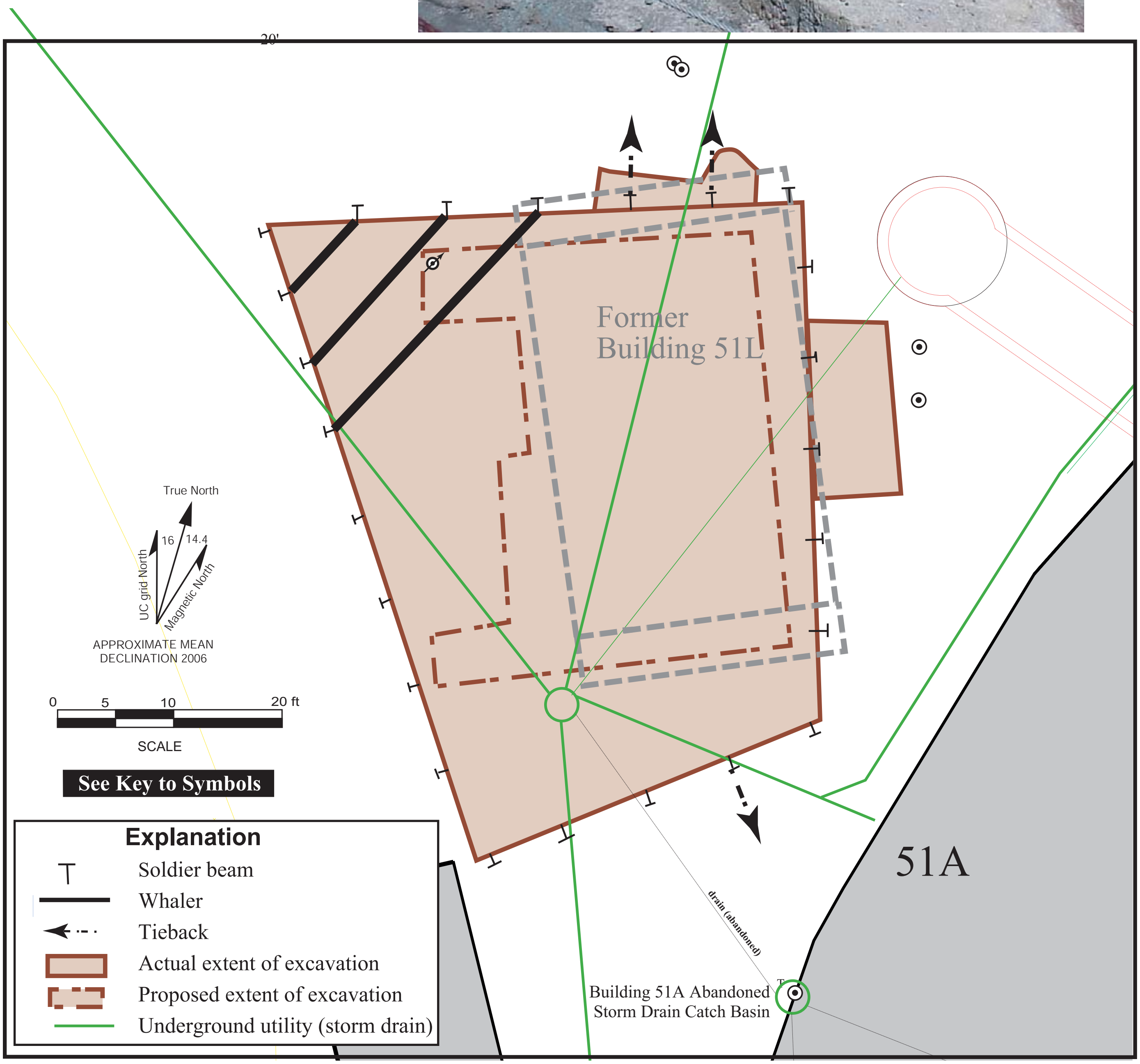

Figure 3.2-2. Excavation Area Showing Excavation Shoring Details.

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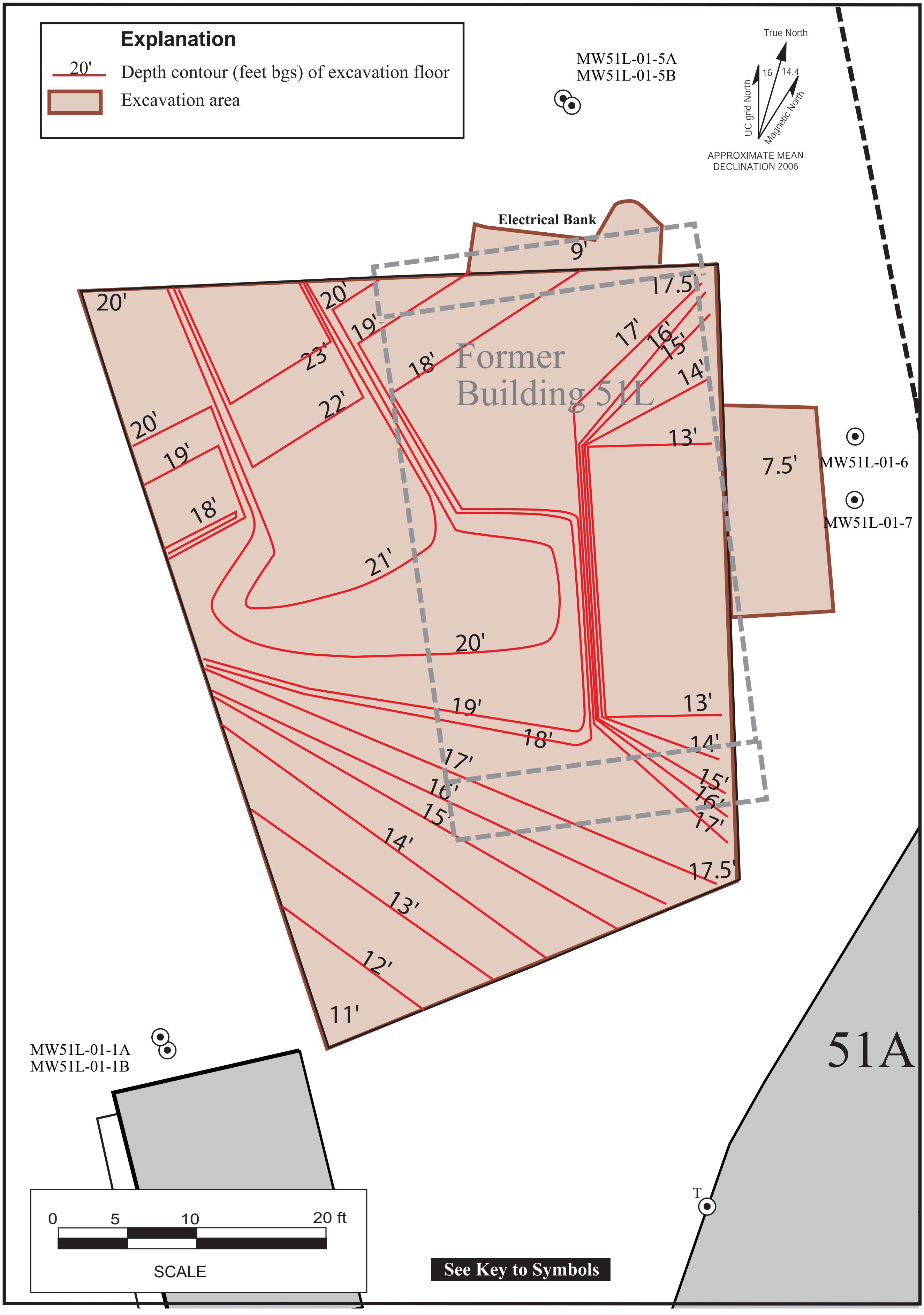

Figure 3.2-3. Final Extent of Excavation.

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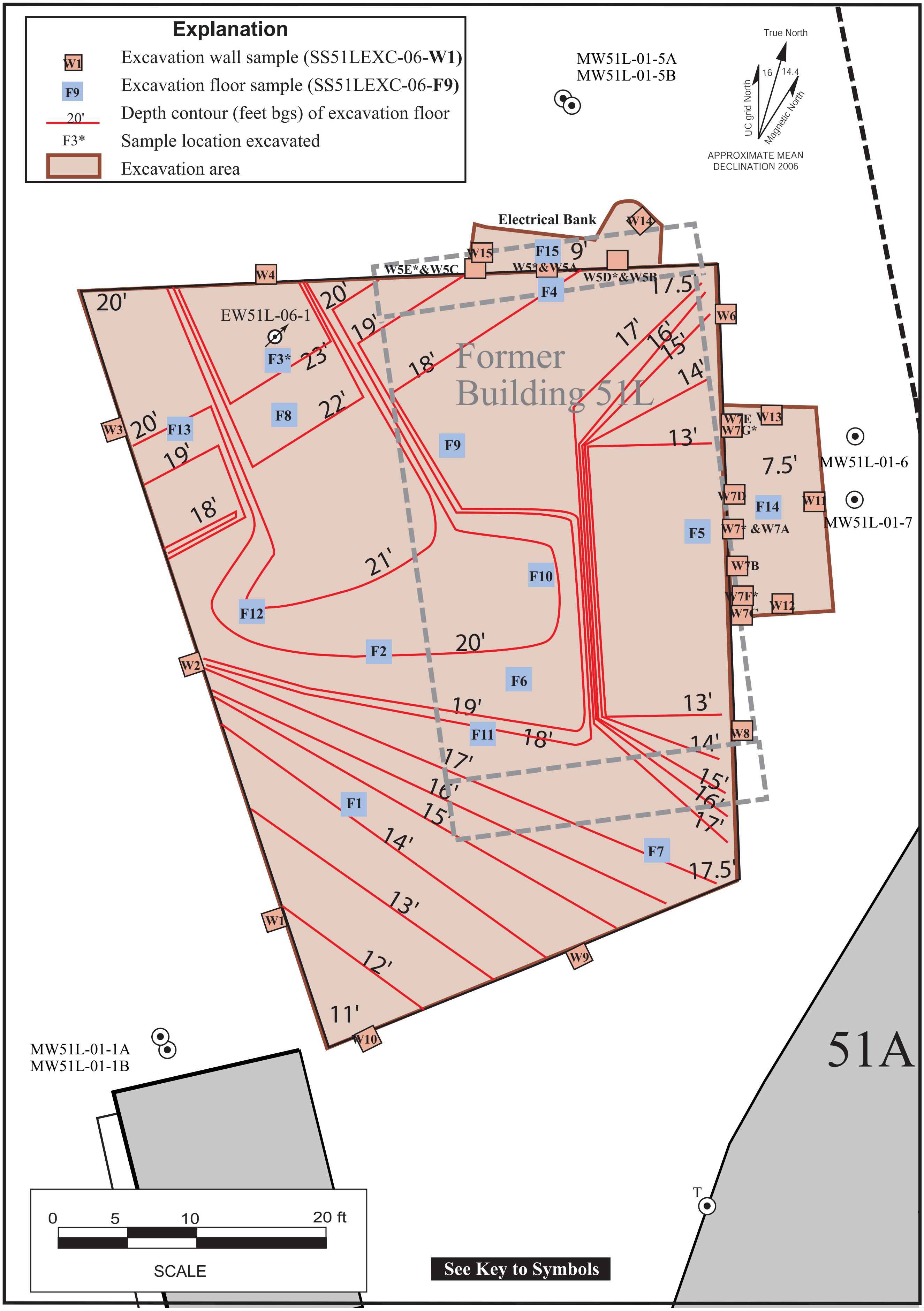

Figure 3.2-4. Locations of Confirmatory Soil Samples .

3.2-3-4-5-B51Lexc.ai
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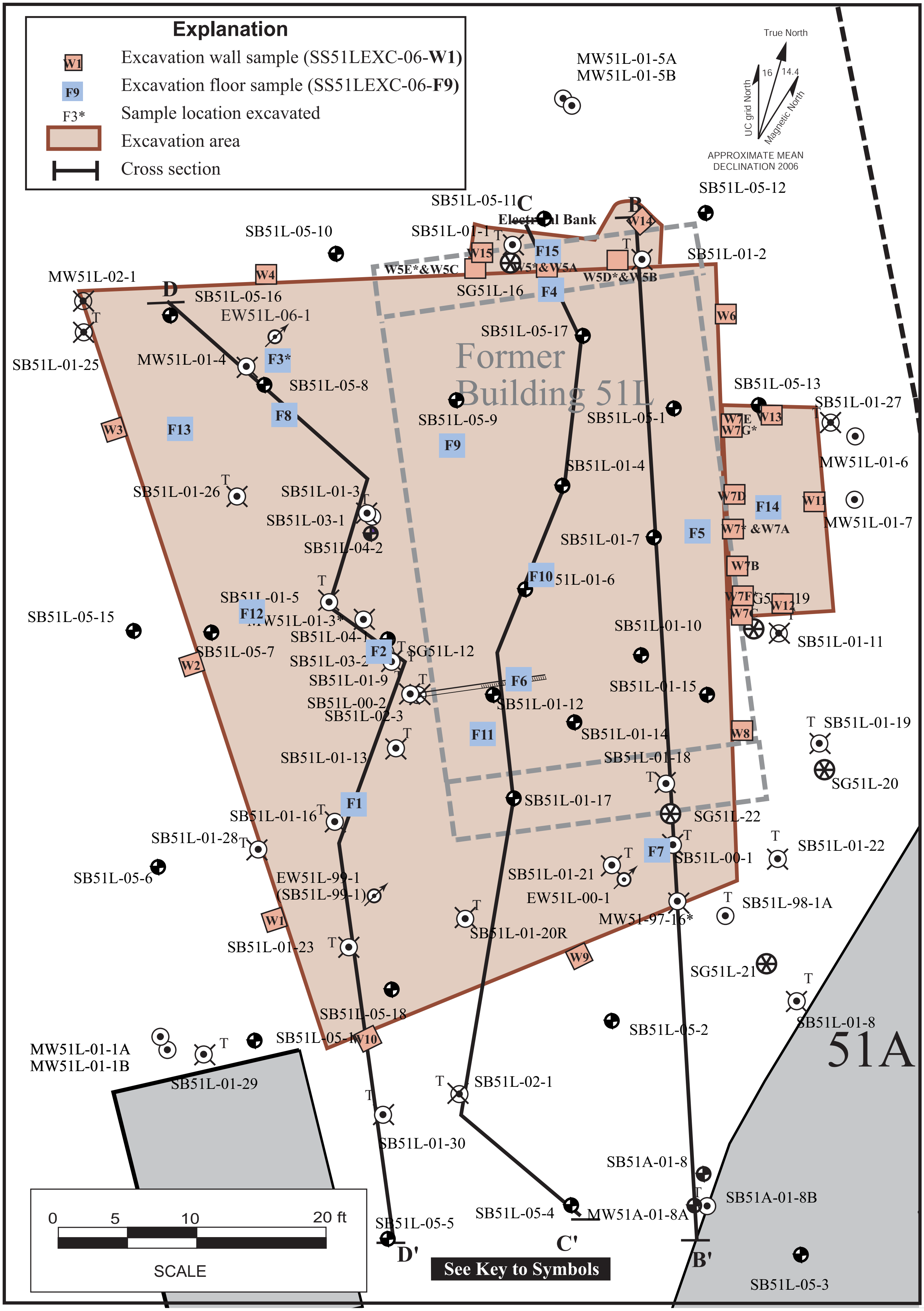

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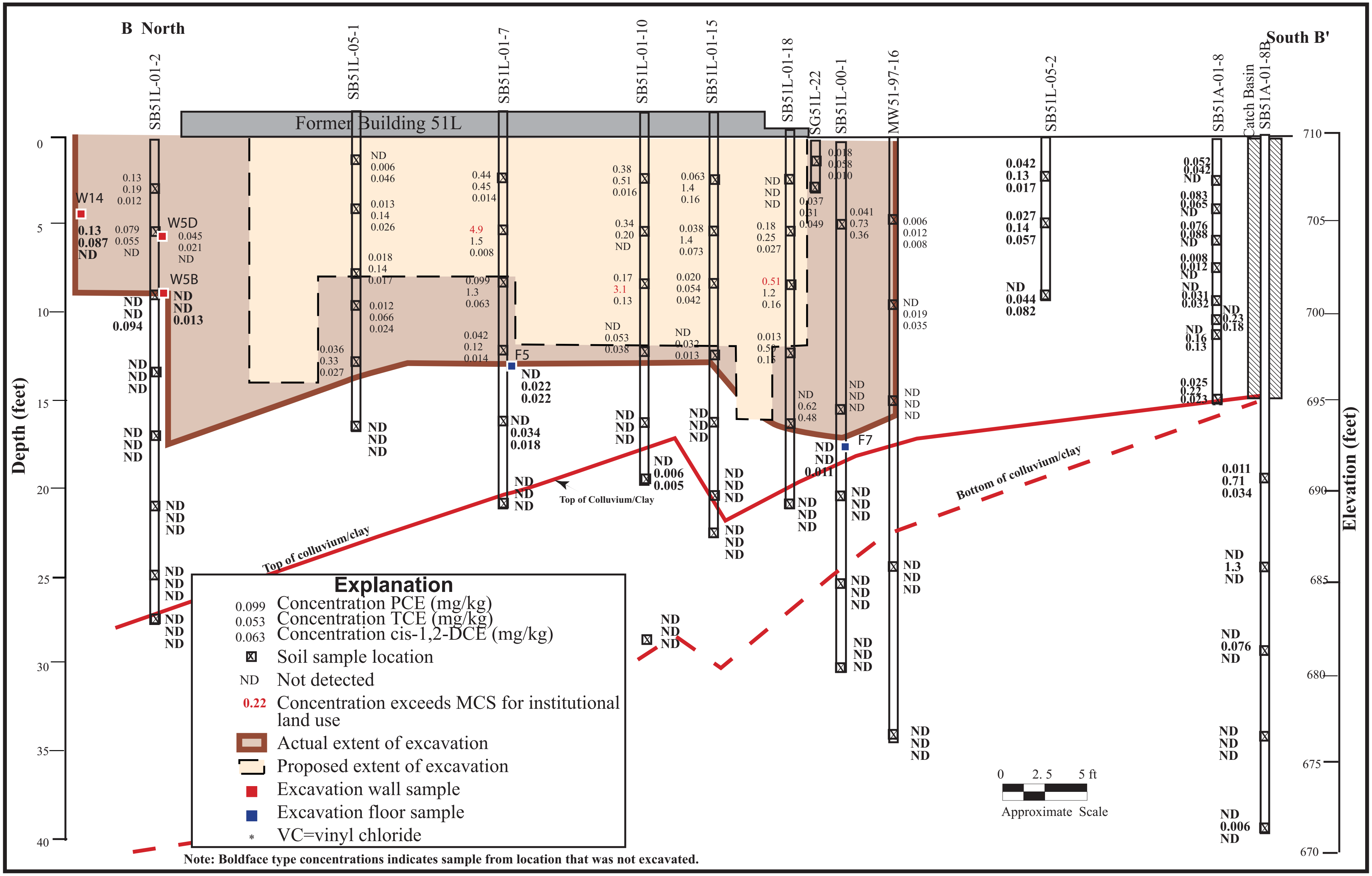
Figure 3.2-5. Locations of Cross Sections.

SB51A-01-10



3.2-6-crosssecAA-8x11
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Figure 3.2-6. Cross section B-B' Showing Extent of Excavation and Concentrations of PCE, TCE and cis-1,2-DCE Detected in Soil (mg/kg) .

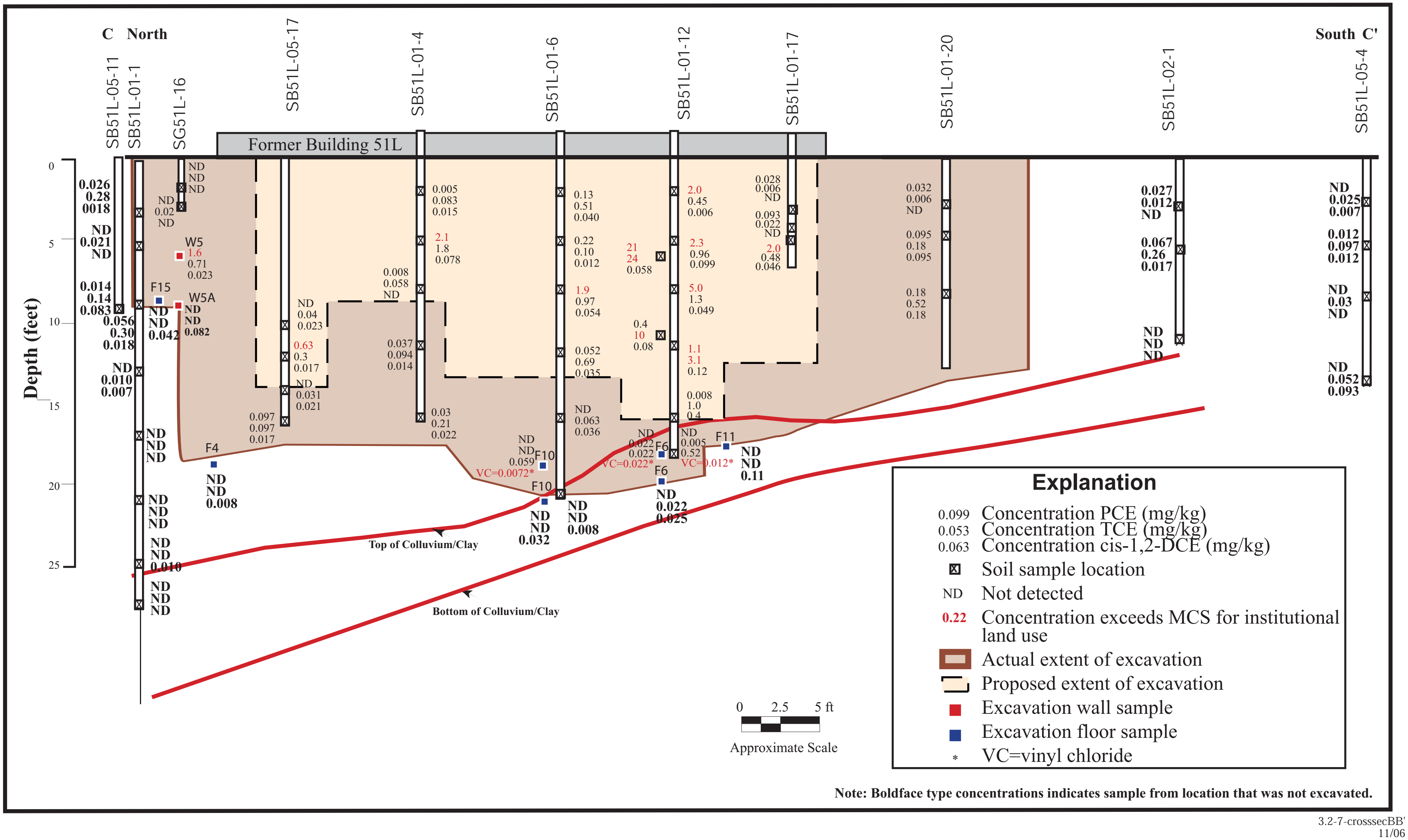

Figure 3.2-7. Cross section C-C' Showing Extent of Excavation and Concentrations of PCE, TCE and cis-1,2-DCE Detected in Soil (mg/kg) .

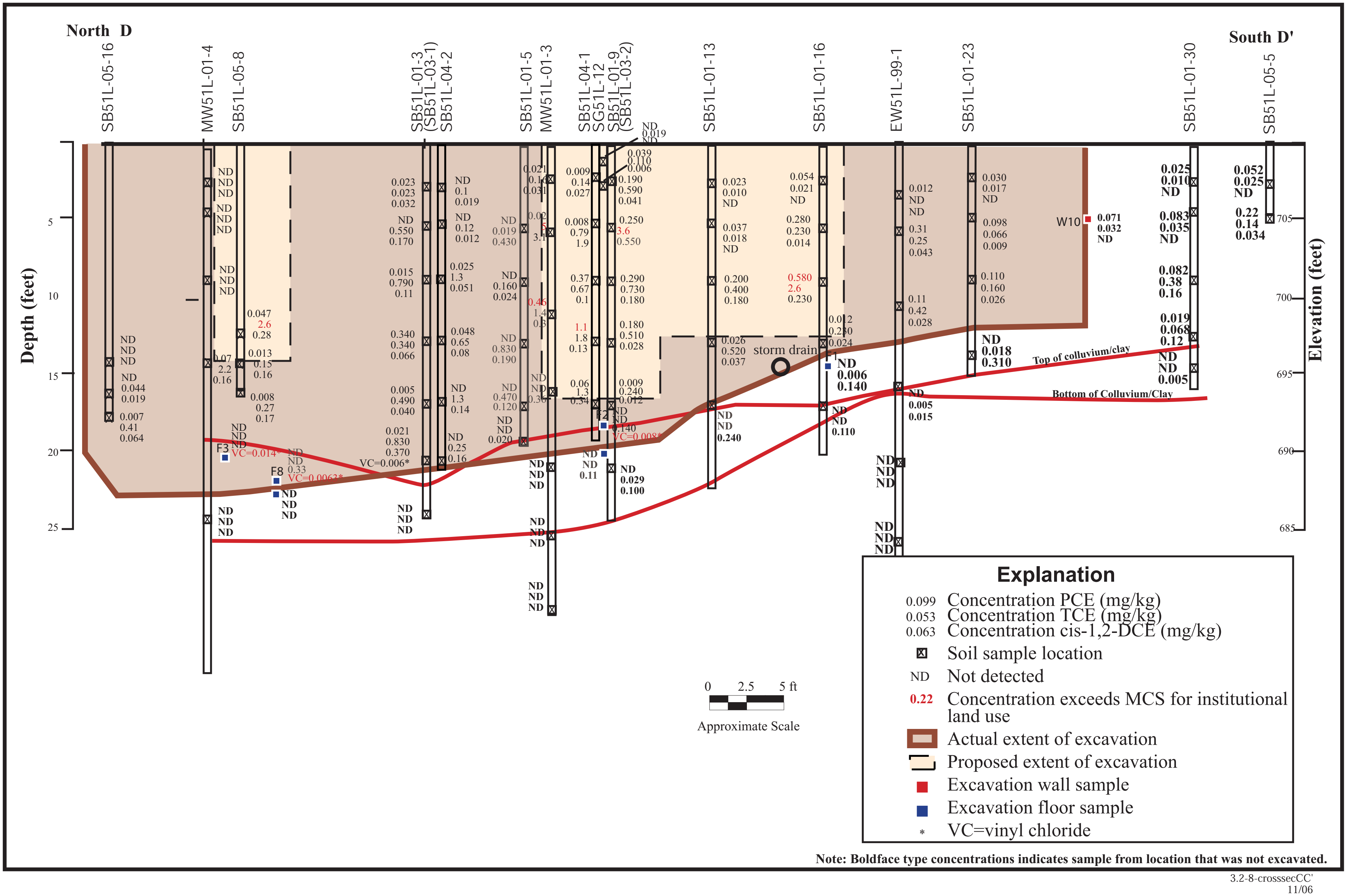

Figure 3.2-8. Cross section D-D' Showing Extent of Excavation and Concentrations of PCE, TCE and cis-1,2-DCE Detected in Soil (mg/kg) .

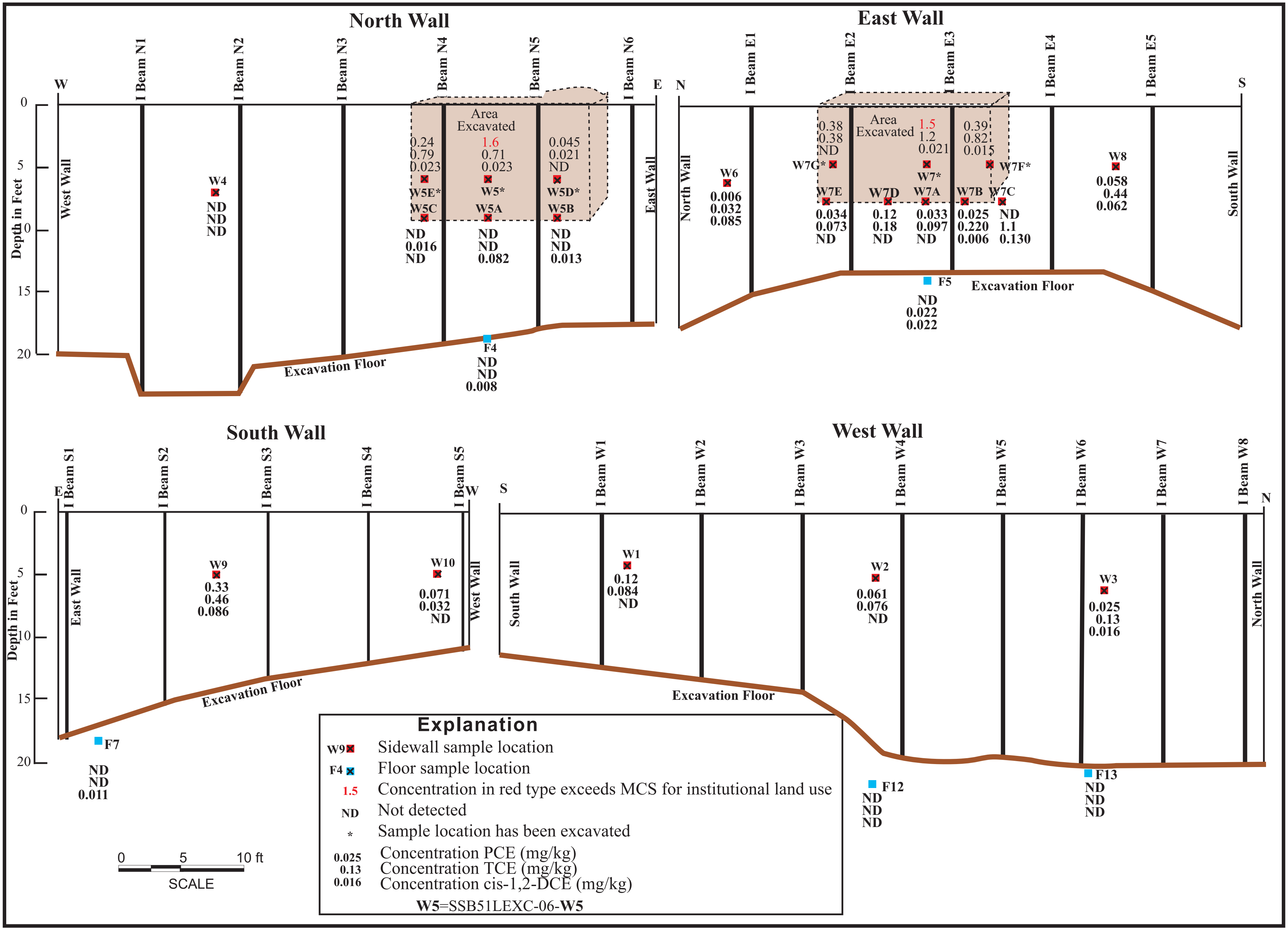

Figure 3.2-9. Building 51L Corrective Measures Excavation Sidewall Sample Locations.

3.2-9-Sidewall samples all.ai
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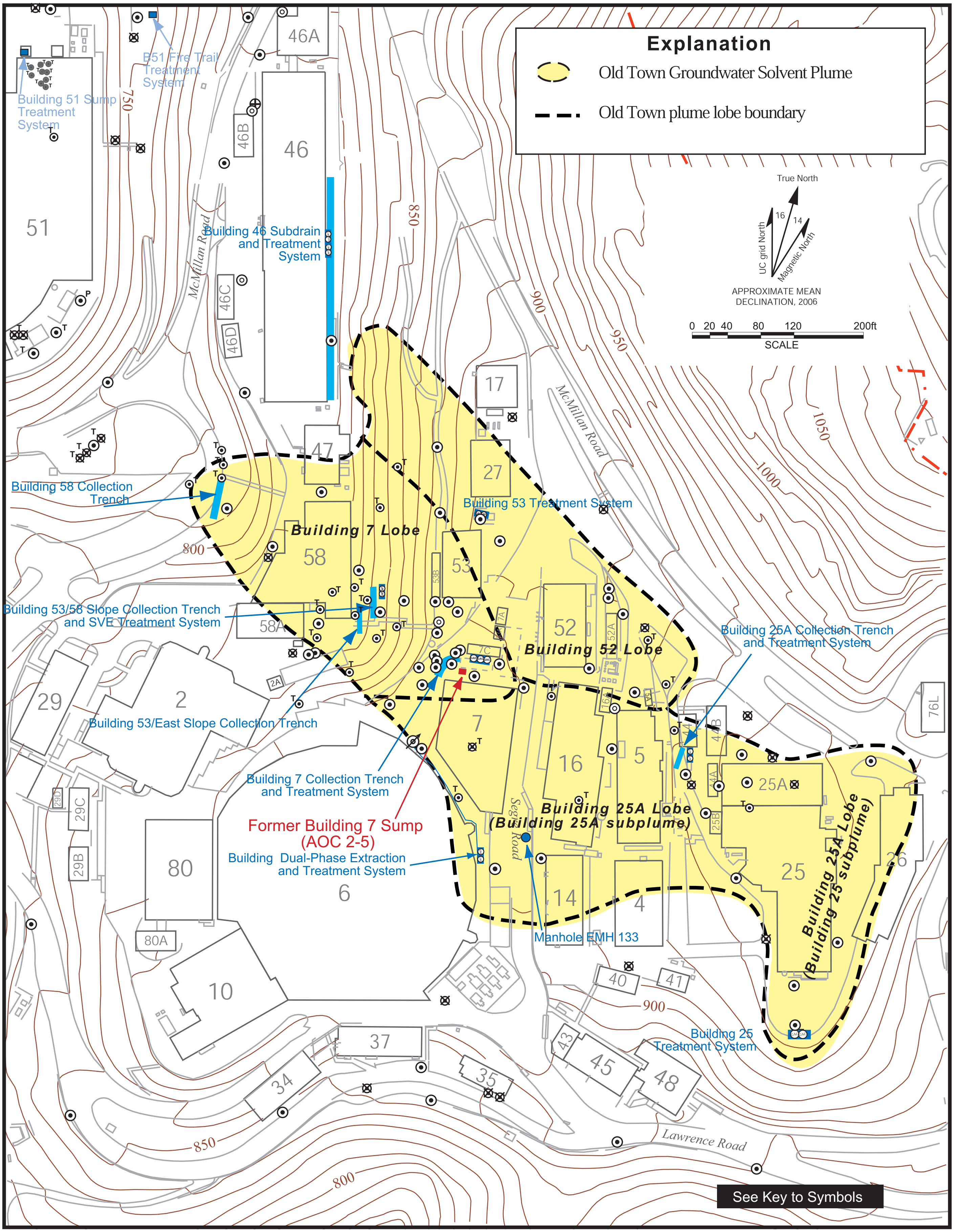

3.2-10 OldTown.ai
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Figure 3.2-10. Location of Building 7 Sump and Lobes of the Old Town Groundwater Solvent Plume.

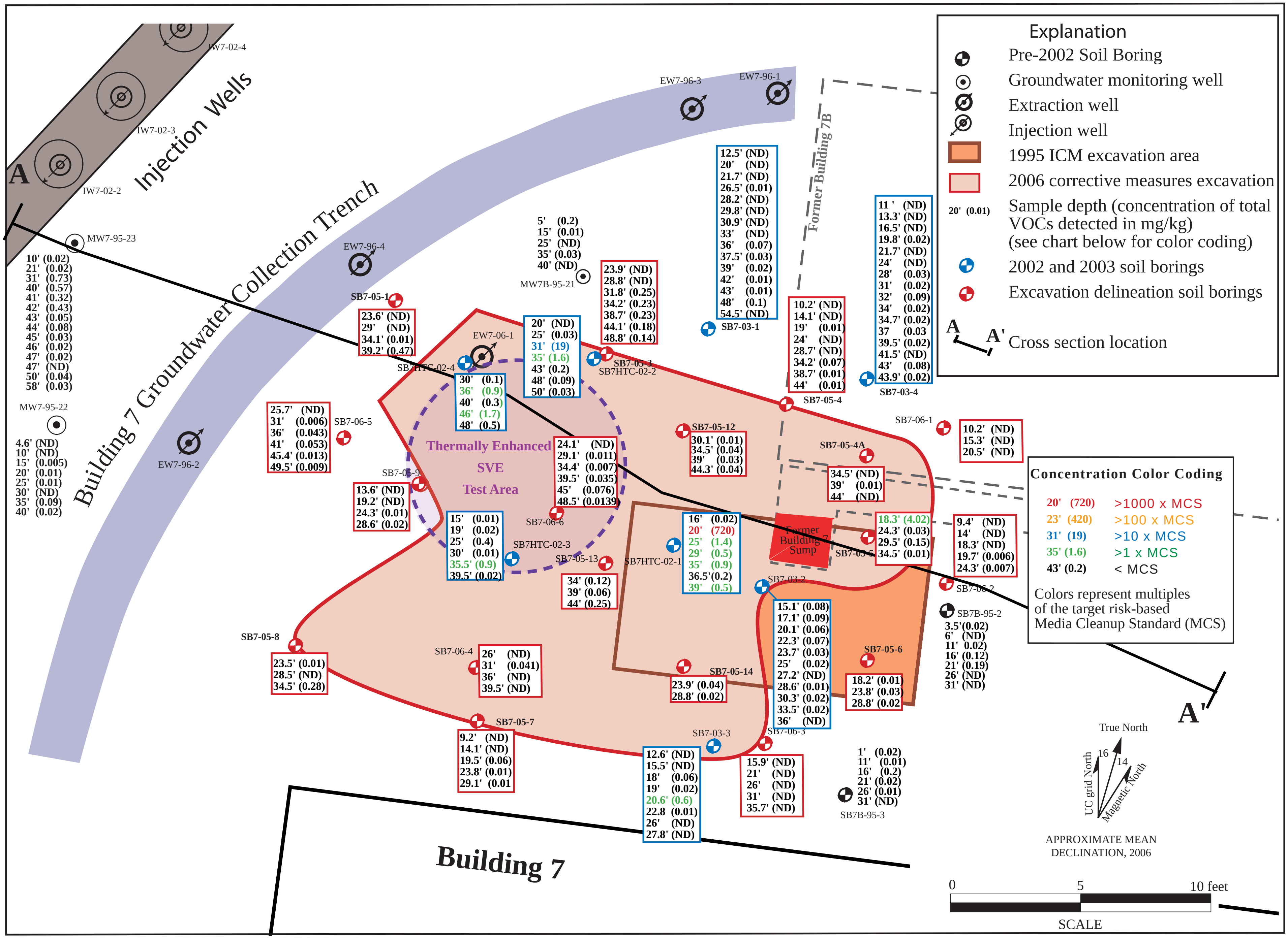

Figure 3.2-11. VOC Concentrations Prior to Corrective Measures Excavation, Building 7 Lobe Source Zone

3.2-11,-13 B7 sump excavation area.ai
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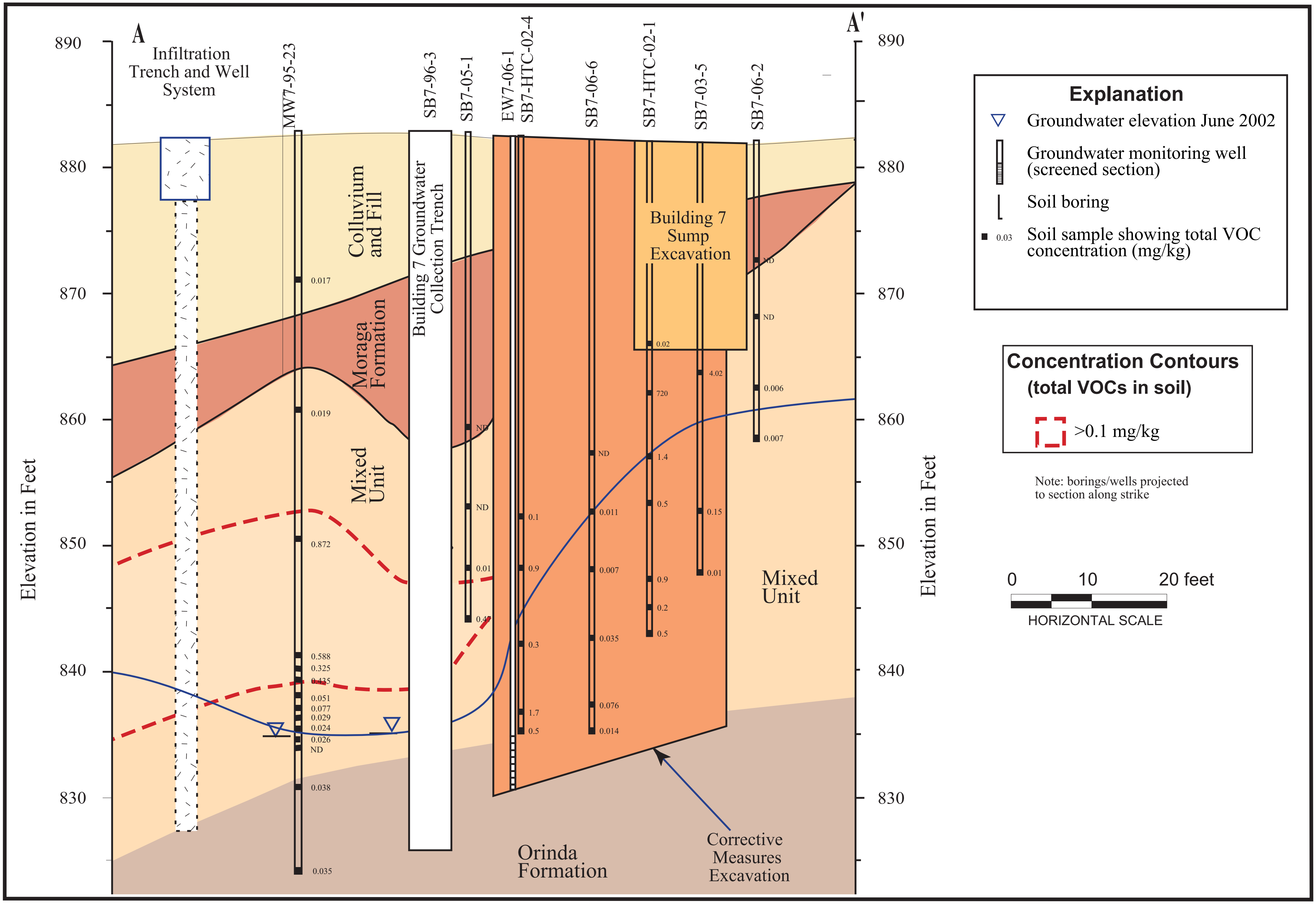

Figure 3.2-12. Geologic Cross Section A-A' Showing Soil Sample Results, Building 7 Area.

3.2-12- OT sump crosssec A-A'.ai
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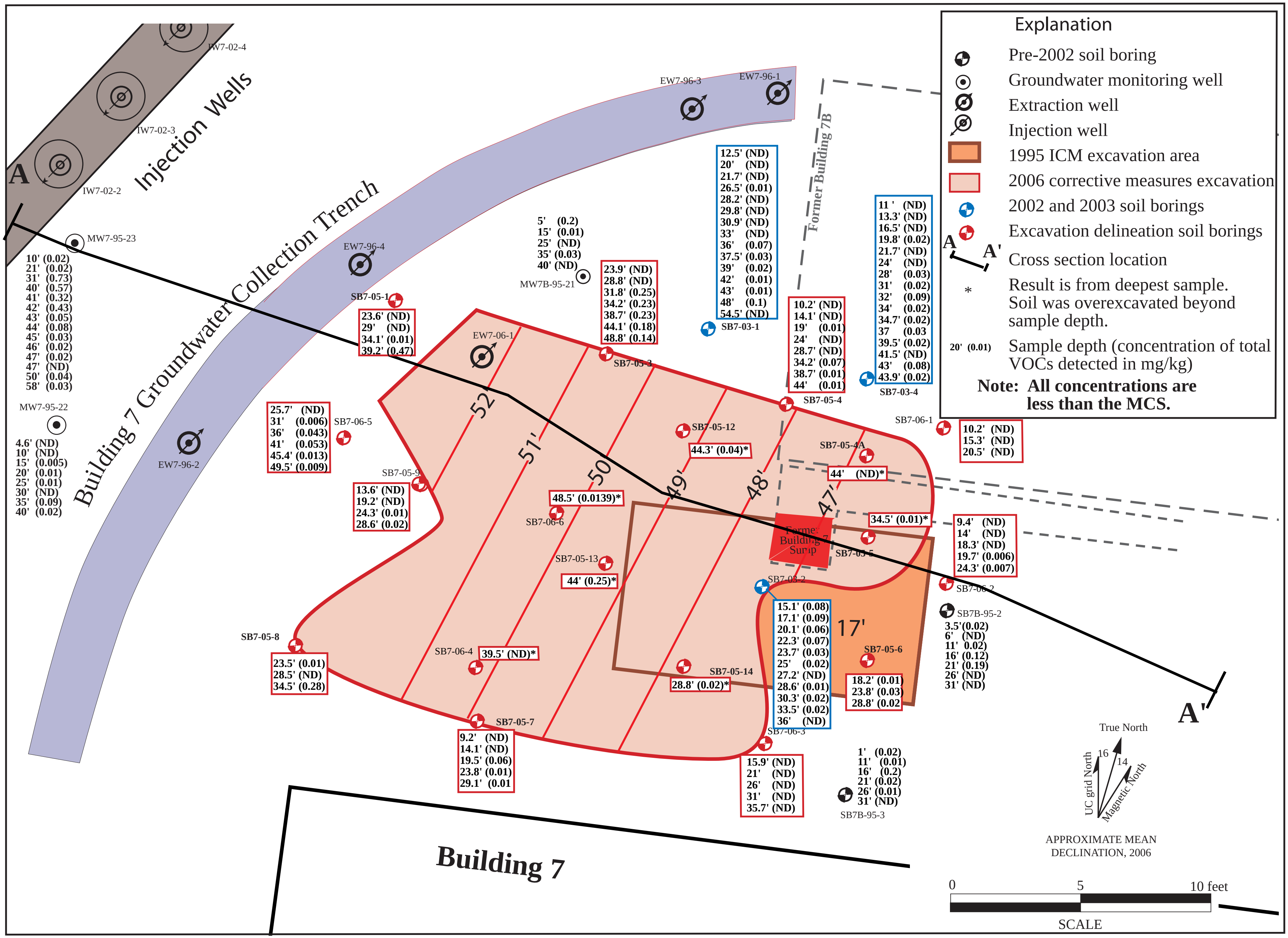

3.2-11,-13 B7 sump excavation area.ai
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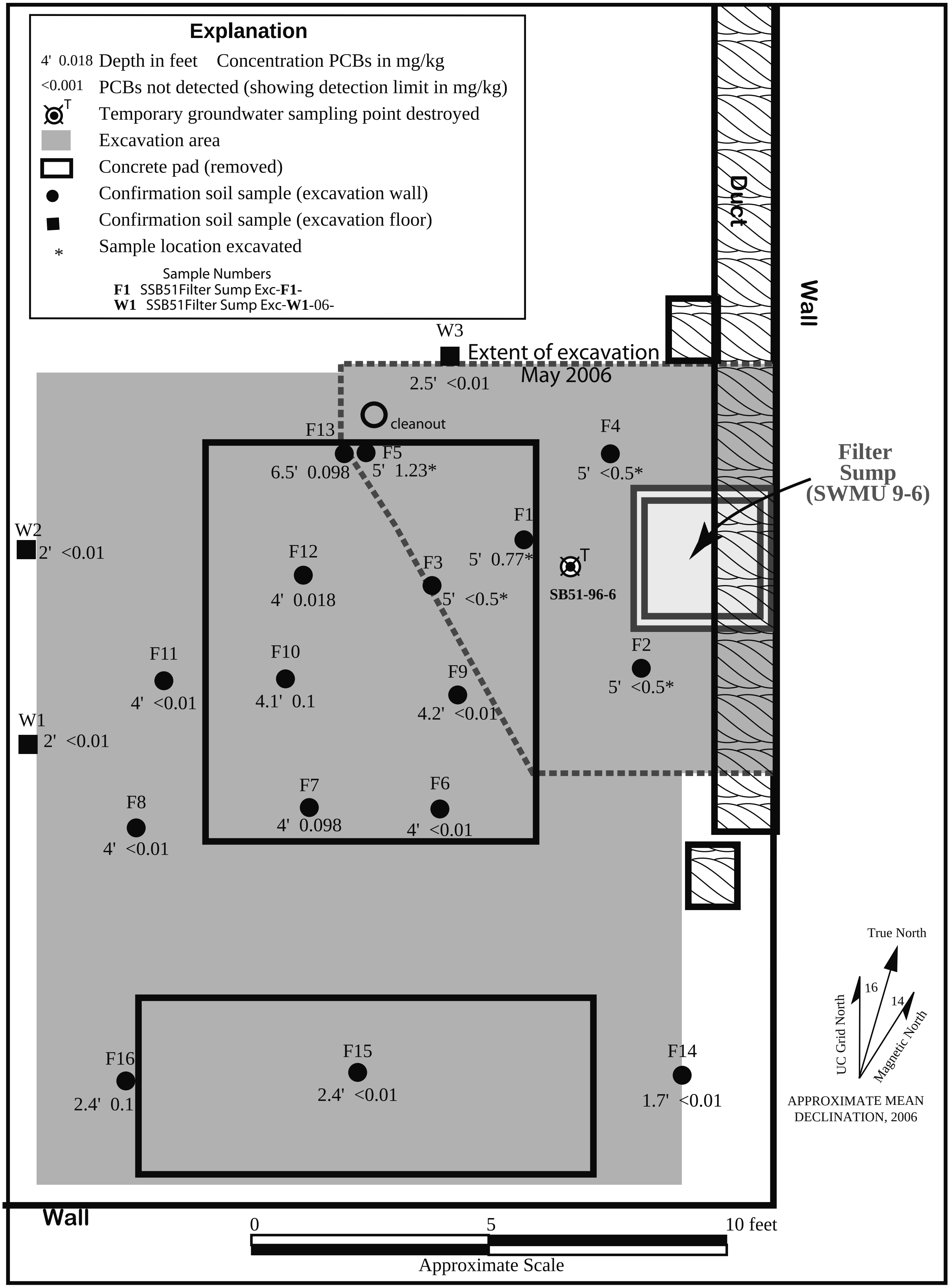
Figure 3.2-13. Residual VOC Concentrations Following Completion of Corrective Measures Excavation, Building 7 Lobe Source Zone.



3.2-14 -15-51mgr.ai
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Figure 3.2-14. Concentrations of PCBs Detected in Soil Samples (mg/kg), Building 51 Motor Generator Room Basement Filter Sump.

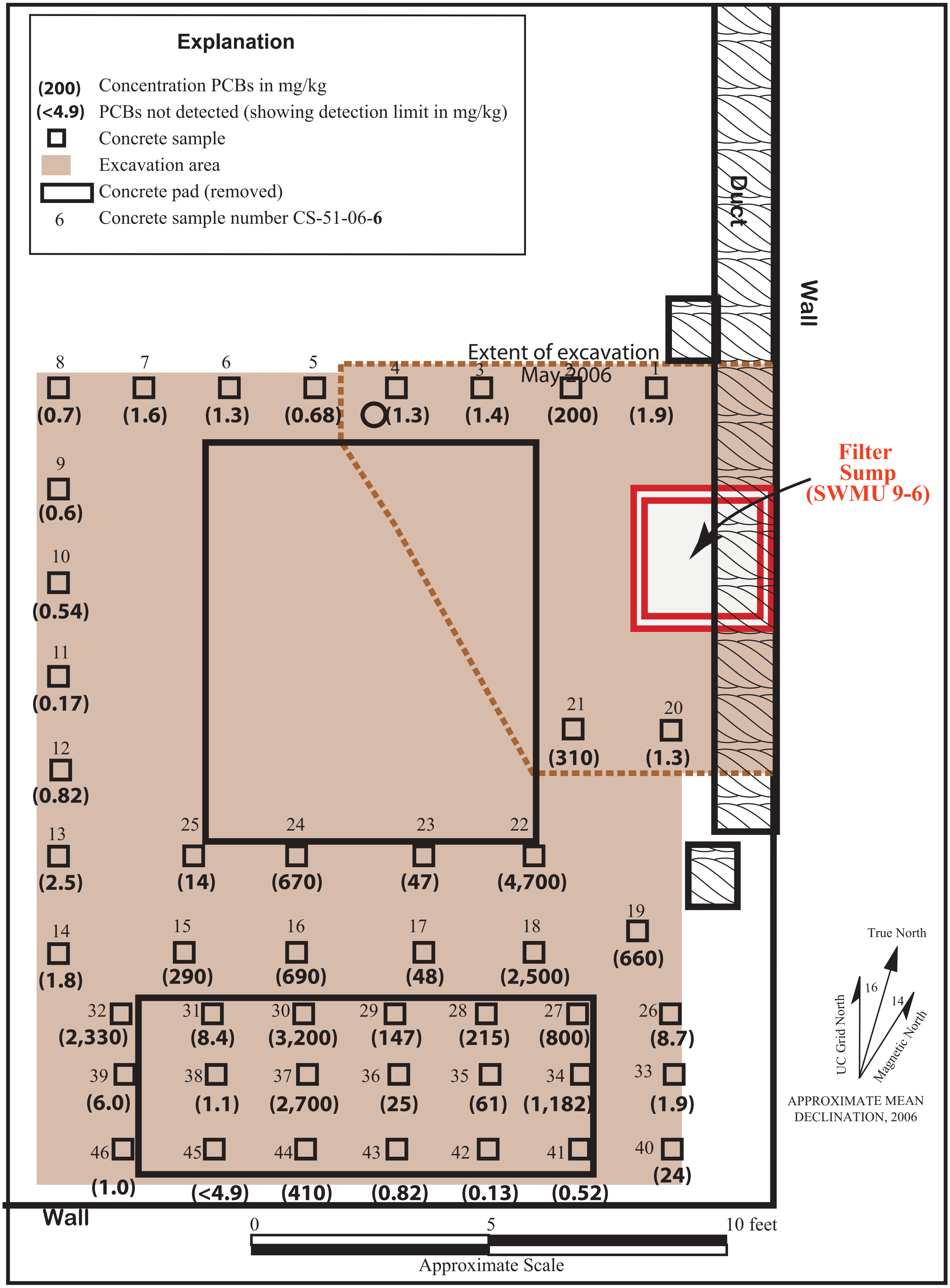

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Figure 3.2-15. Concentrations of PCBs Detected in Concrete (mg/kg), Building 51 Motor Generator Room Basement Filter Sump.

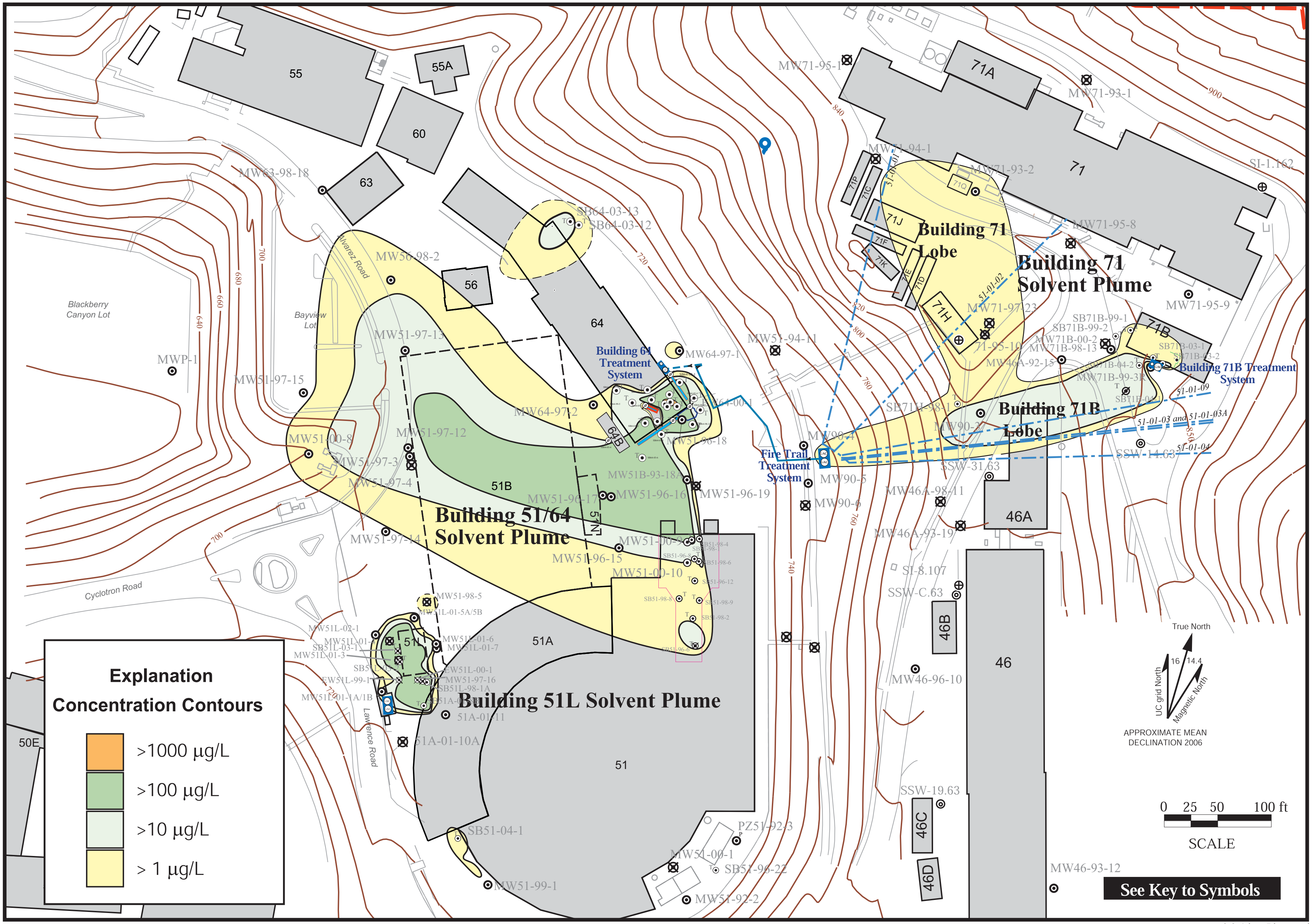

Figure 3.3-1. Isoconcentration Contour Map, Total VOCs in Groundwater (ug/L) in the Bevalac Area, Third Quarter FY06.

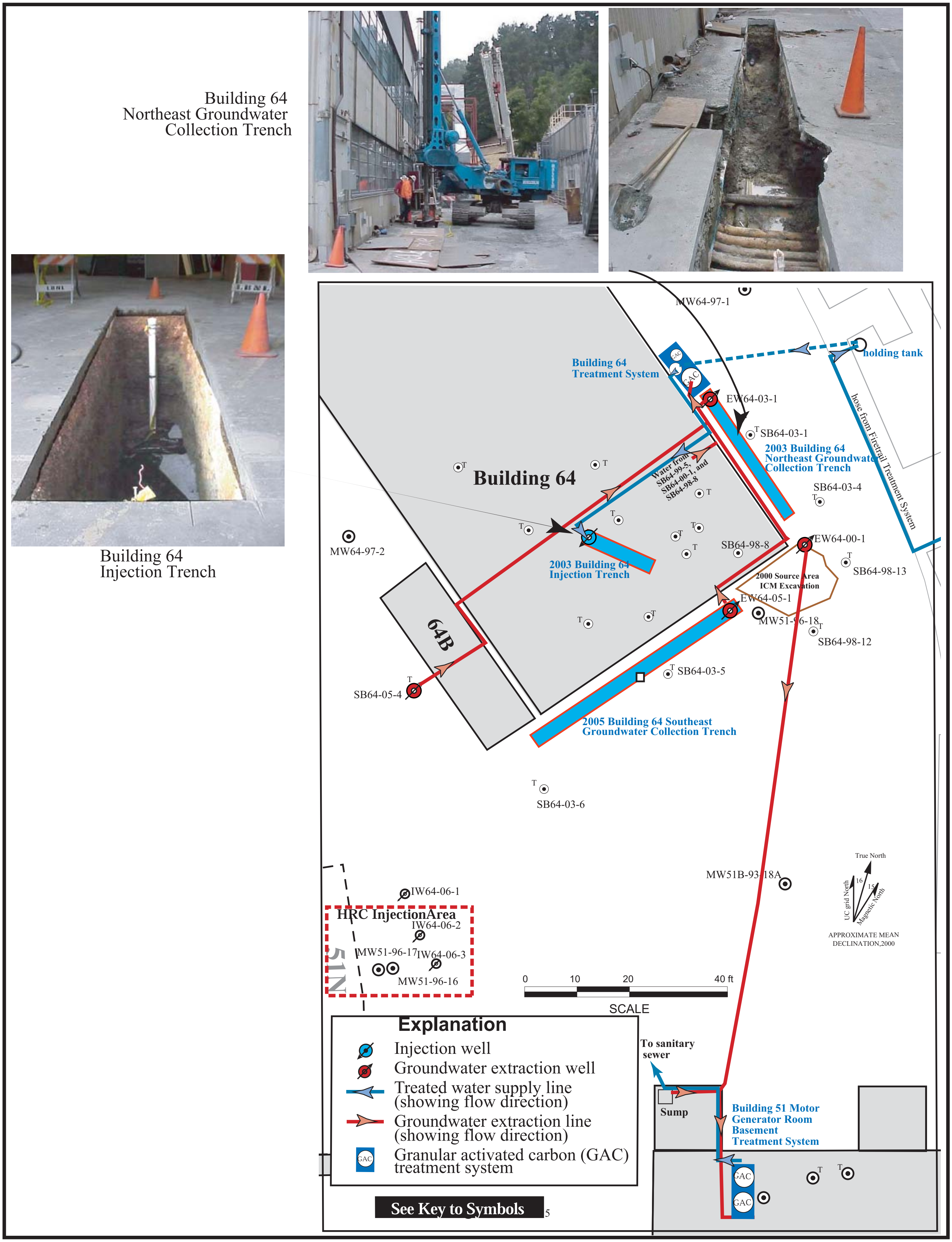

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Figure 3.3-2. Soil Flushing System, Building 51/64 Groundwater Solvent Plume Source Area.

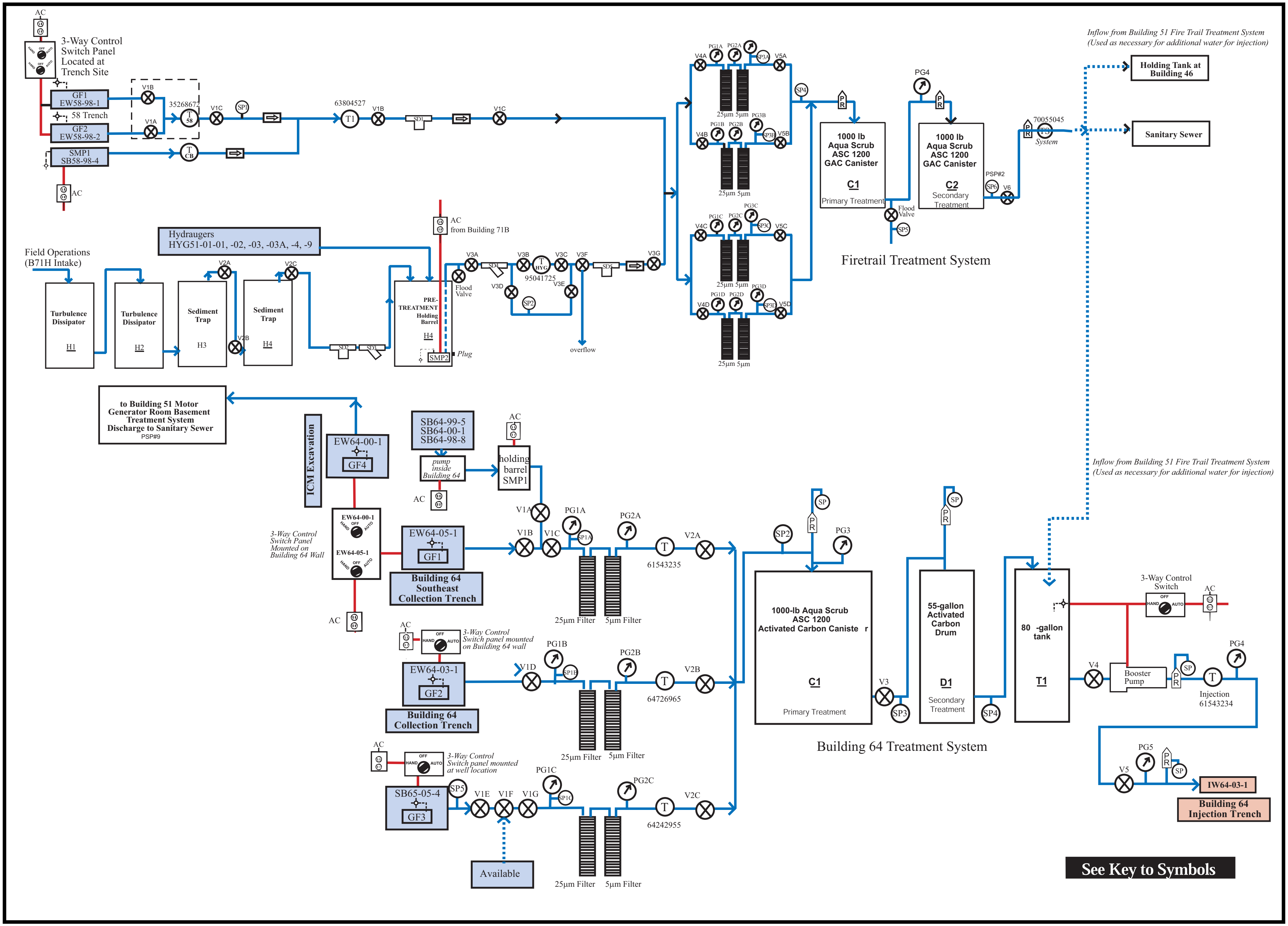

Figure 3.3-3. Building 51/64 Groundwater Solvent Plume Source Area In Situ Soil Flushing System Schematic Diagram.

3.3-3-schematicB64.ai
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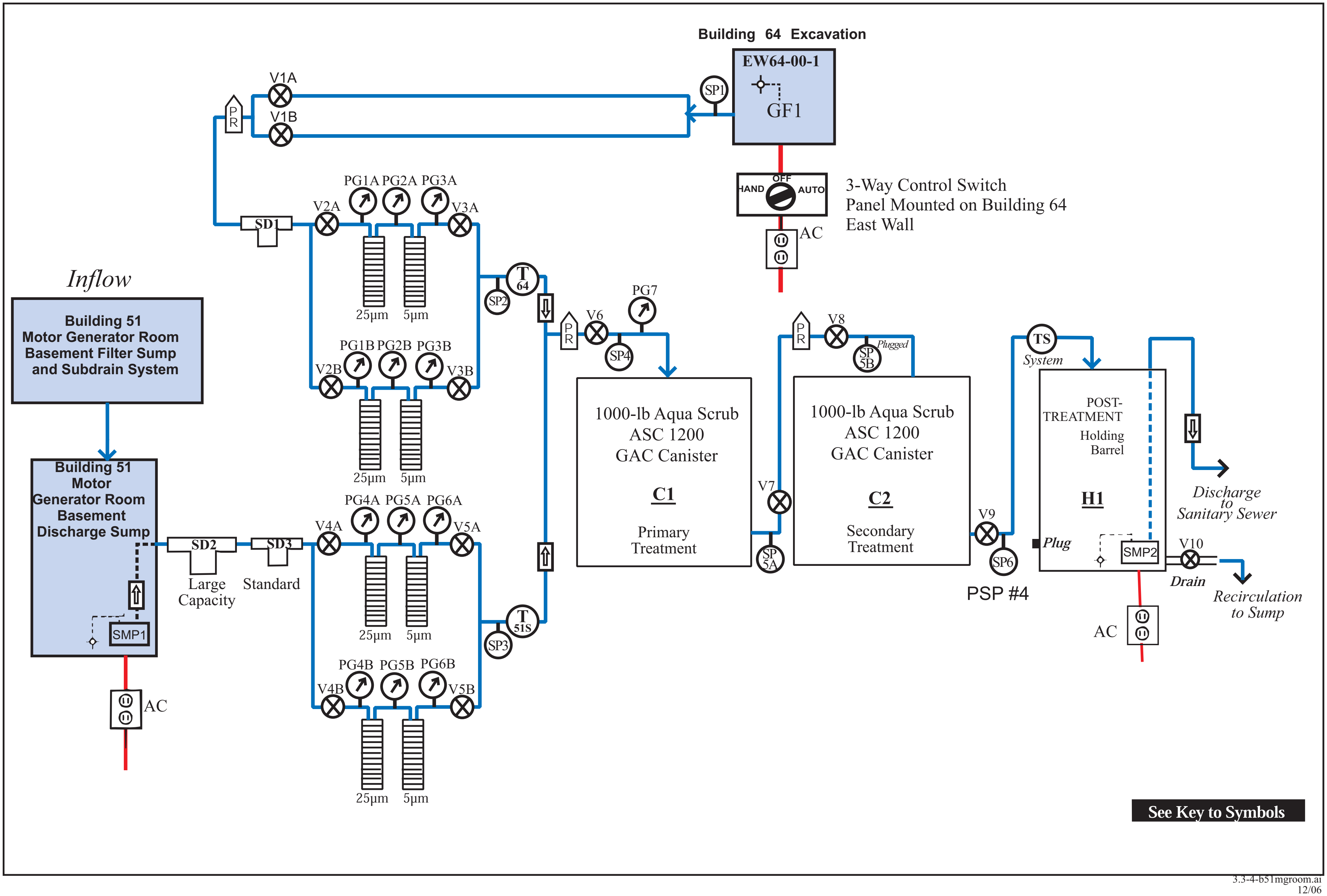


Figure 3.3-4. Schematic Diagram of Building 51 Motor Generator Room Basement GAC Treatment System.

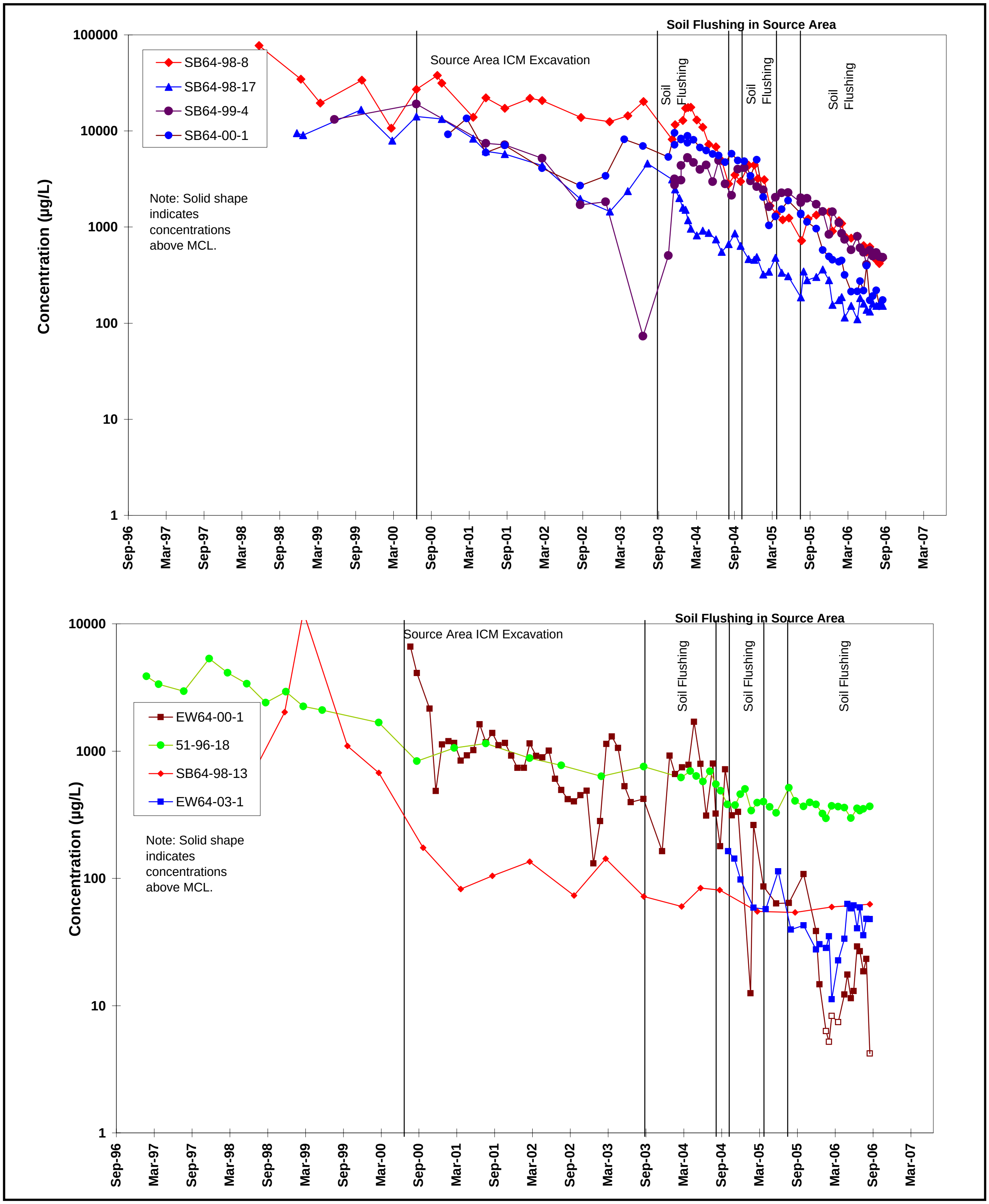
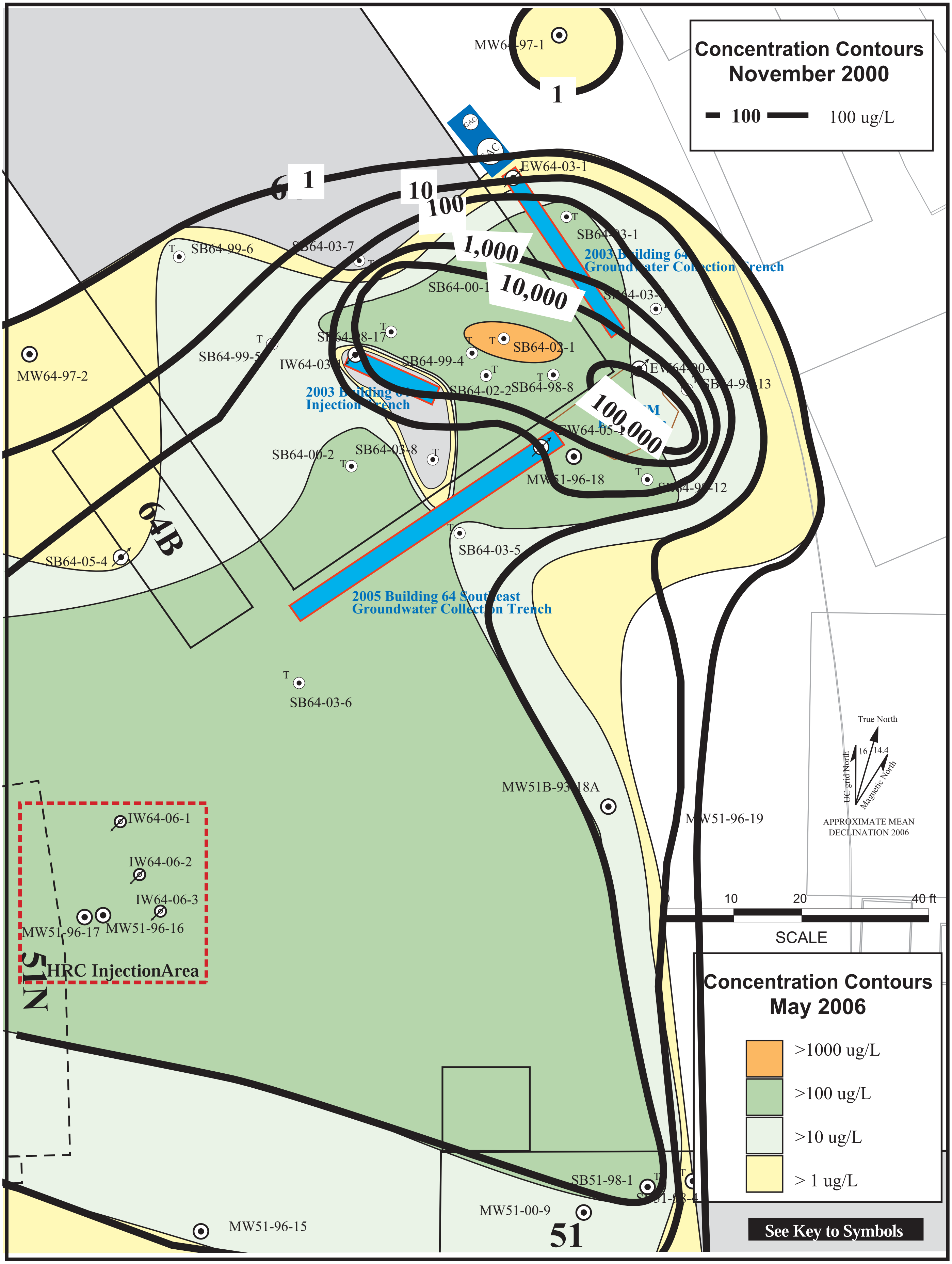


Figure 3.3-5. Concentration Trends for Total VOCs, Building 51/64 Groundwater Solvent Plume Source Area.



3.3-6b64-b64plumcomparison
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Figure 3.3-6. Total VOCs in Groundwater, Source Area Building 51/64 Groundwater Solvent Plume.

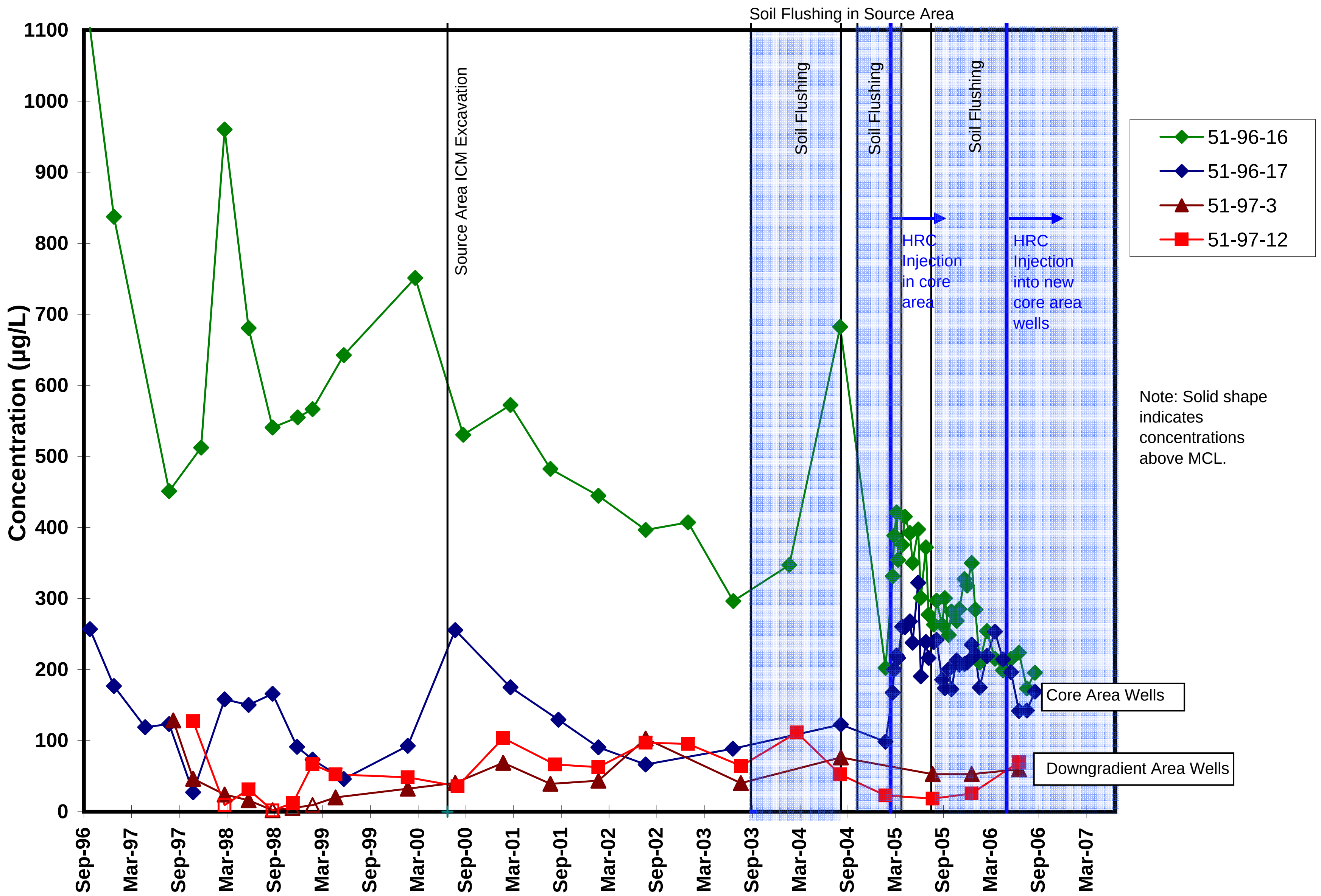

Figure 3.3-7. Concentration Trends for Total VOCs, Building 51/64 Plume Core and Downgradient Areas.

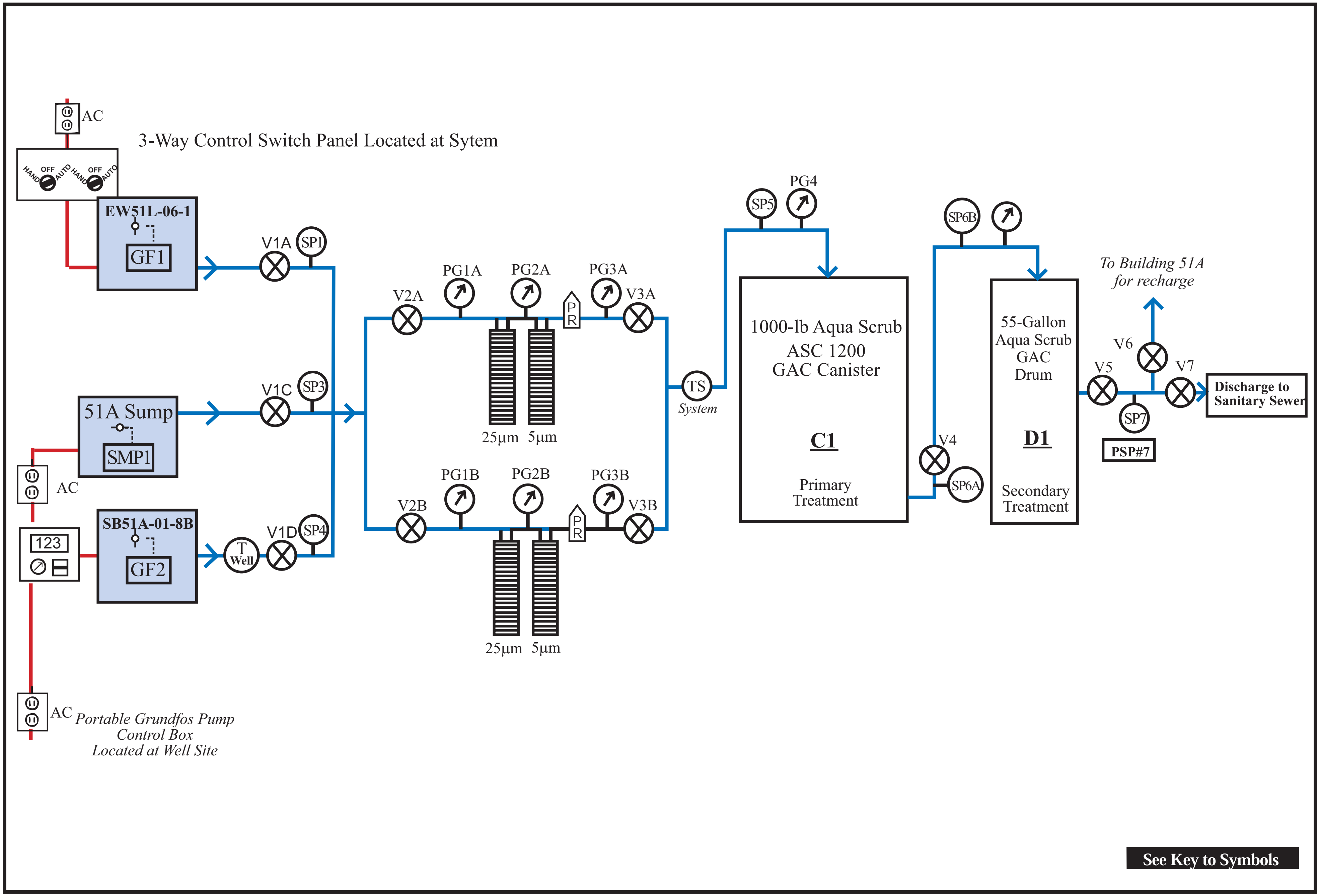

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Figure 3.3-8. Schematic Diagram of Building 51L GAC Treatment System.

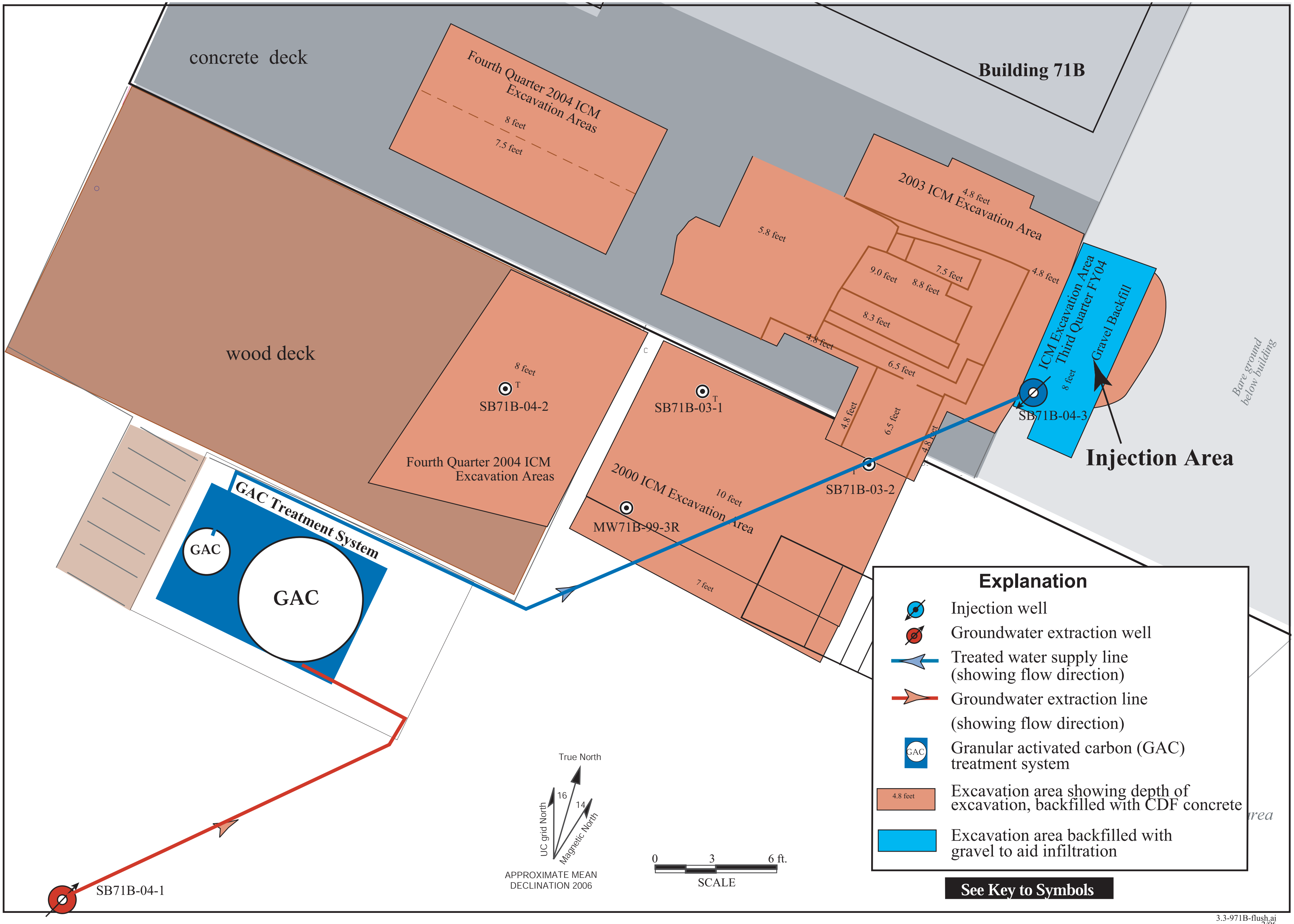

Figure 3.3-9. Soil Flushing System, Building 71B Lobe of the Building 71 Groundwater Solvent Plume Source Area.

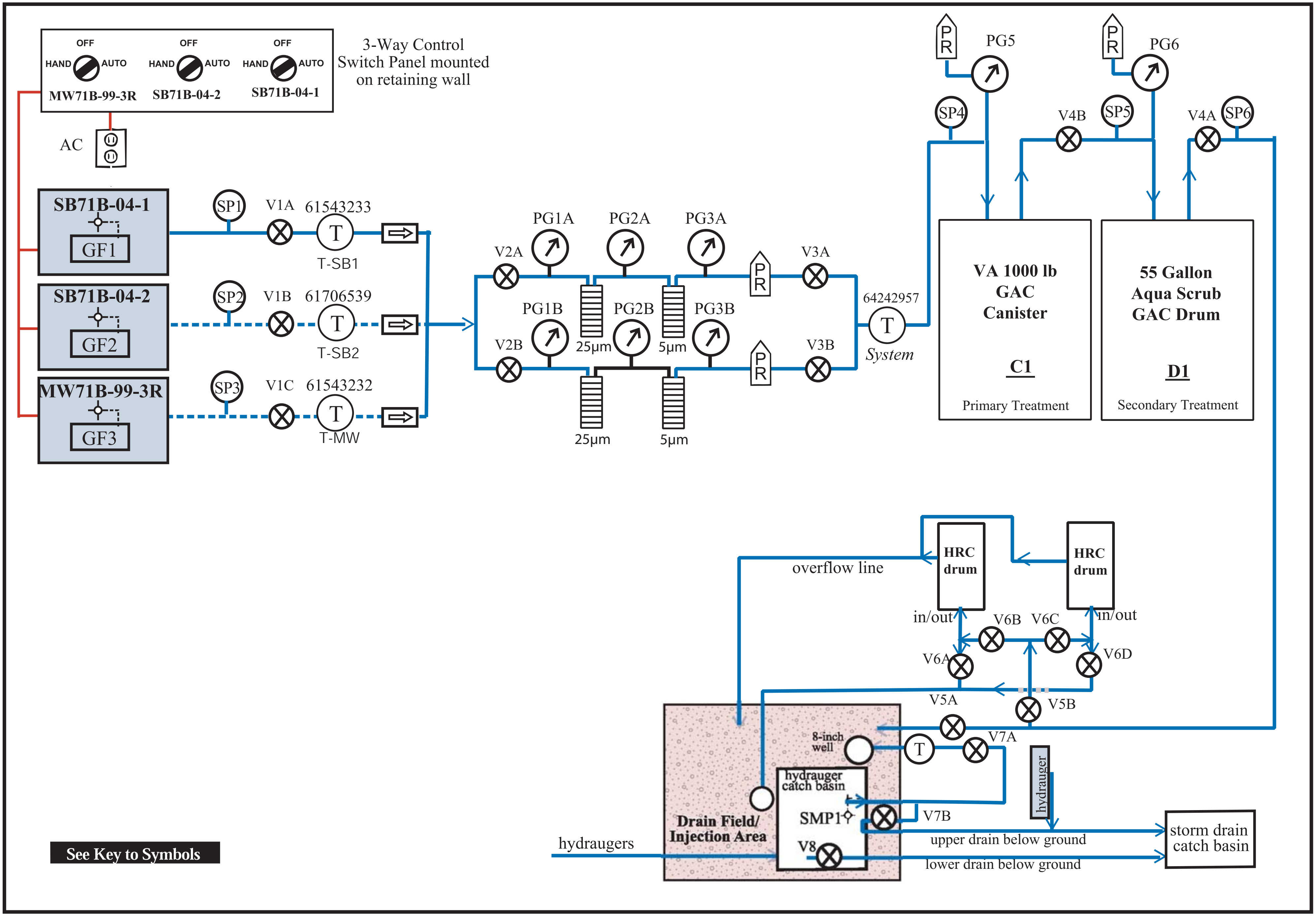

Figure 3.3-10. Building 71B In Situ Soil Flushing System Schematic Diagram

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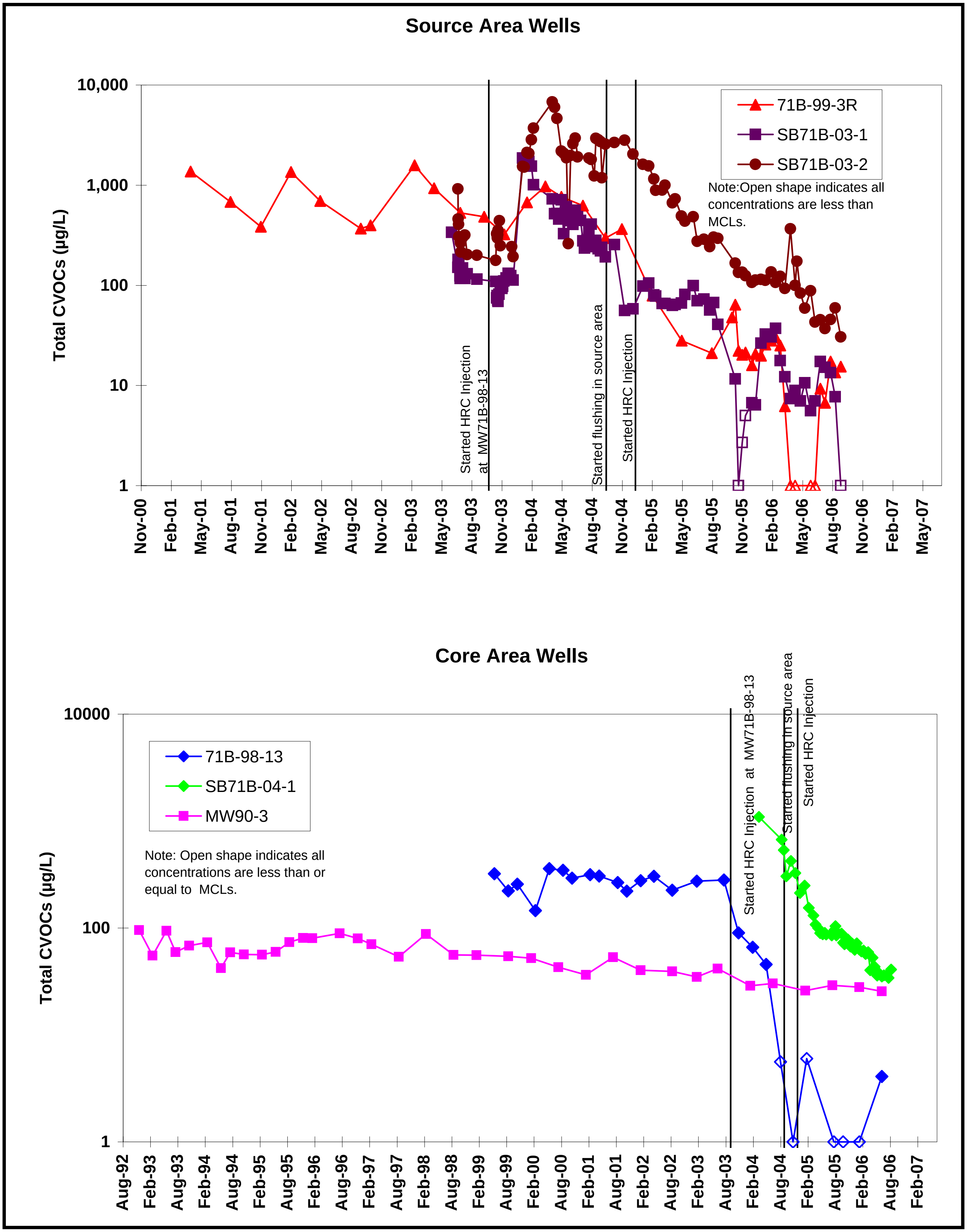

Figure 3.3-11. **Concentration Trends for Total VOCs, Building 71B Plume Source and Core Areas.**

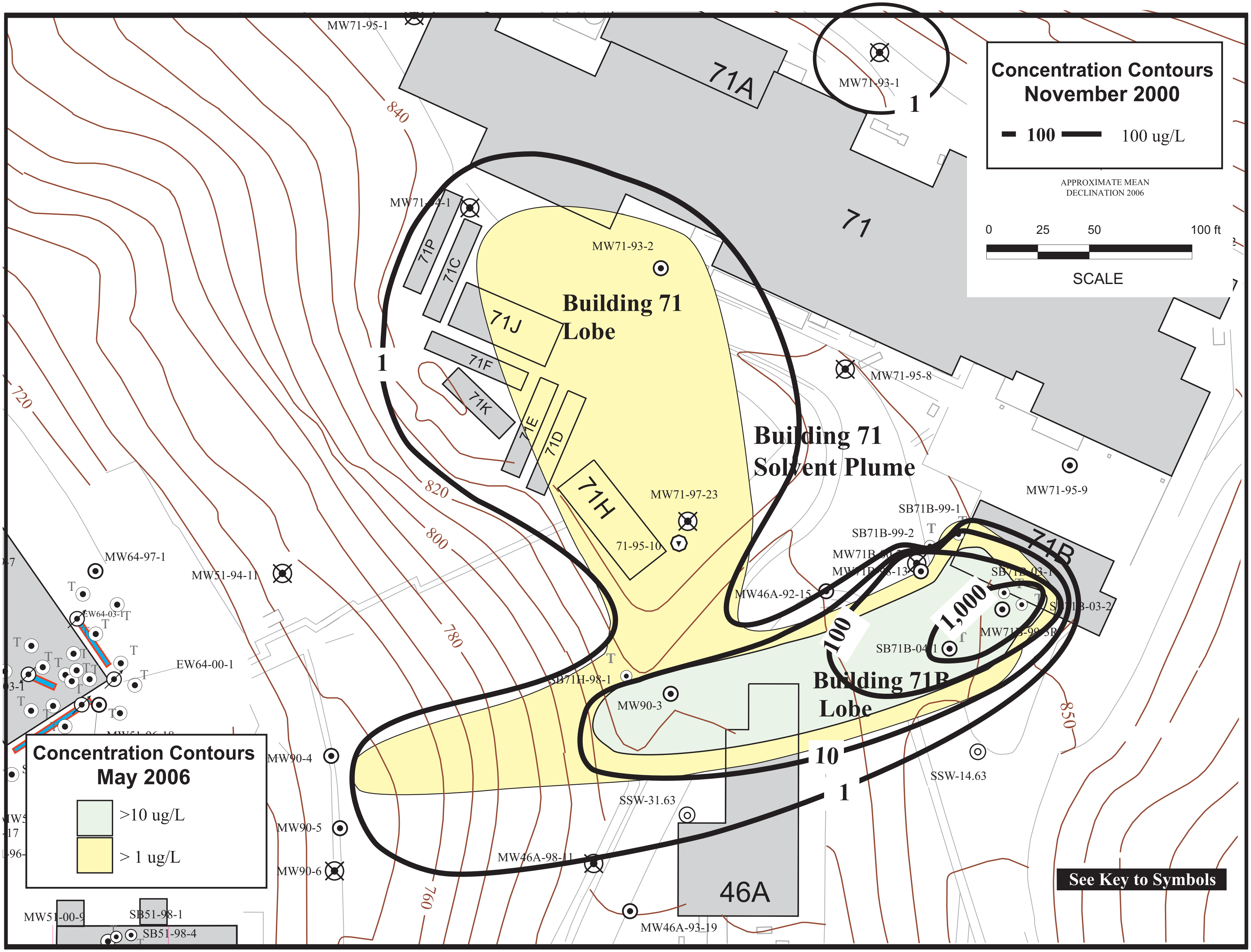

Figure 3.3-12. Total VOCs in Groundwater, Building 71B Lobe.

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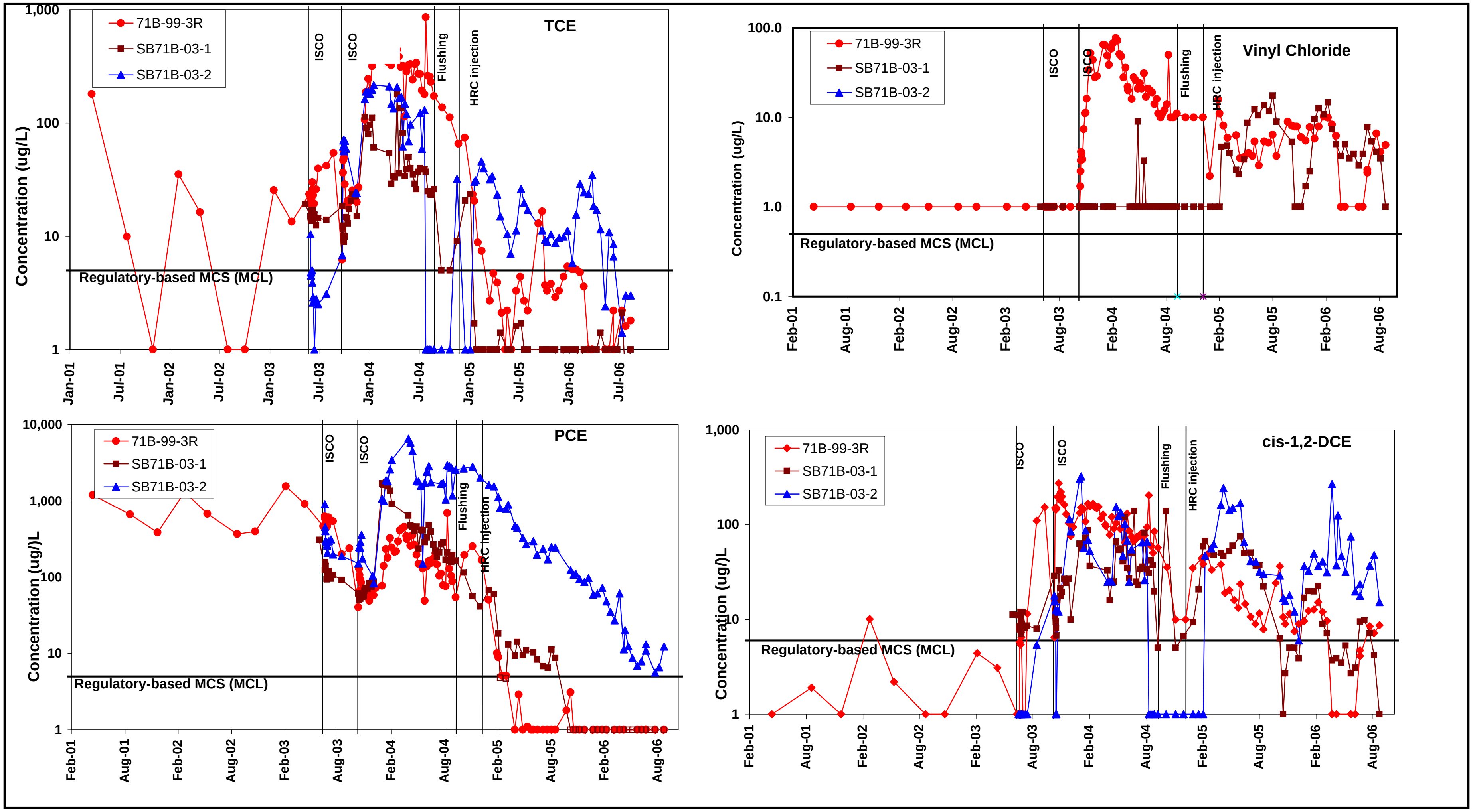


Figure 3.3-13. Concentration Trends for Individual VOCs, Building 71B Plume Source Area.

3.3-13-71B source

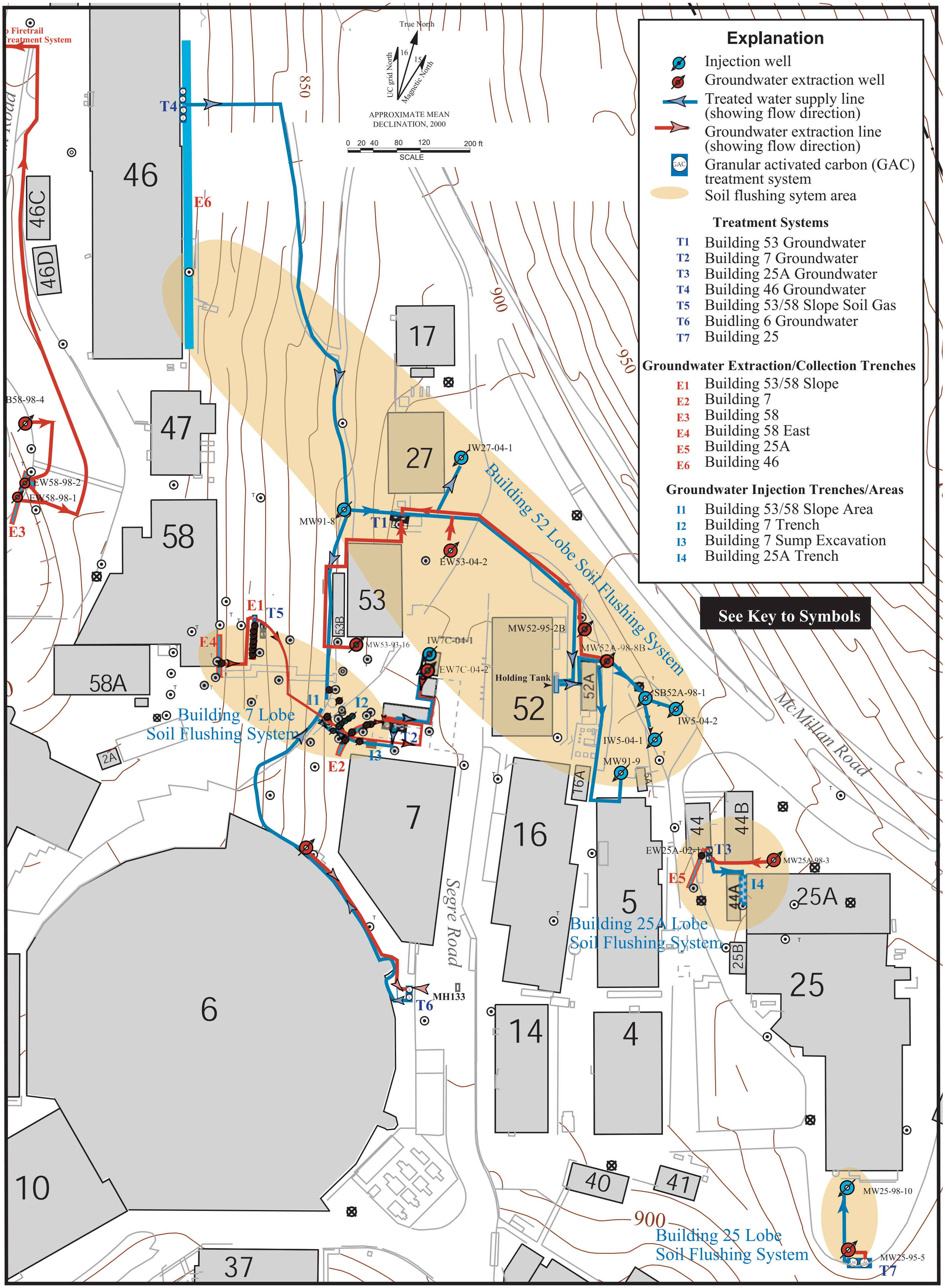


Figure 3.3-14. Soil Flushing and Groundwater Migration Control Systems, Old Town Groundwater Solvent Plume.

3.3-14-OTplume flush.ai
12/06

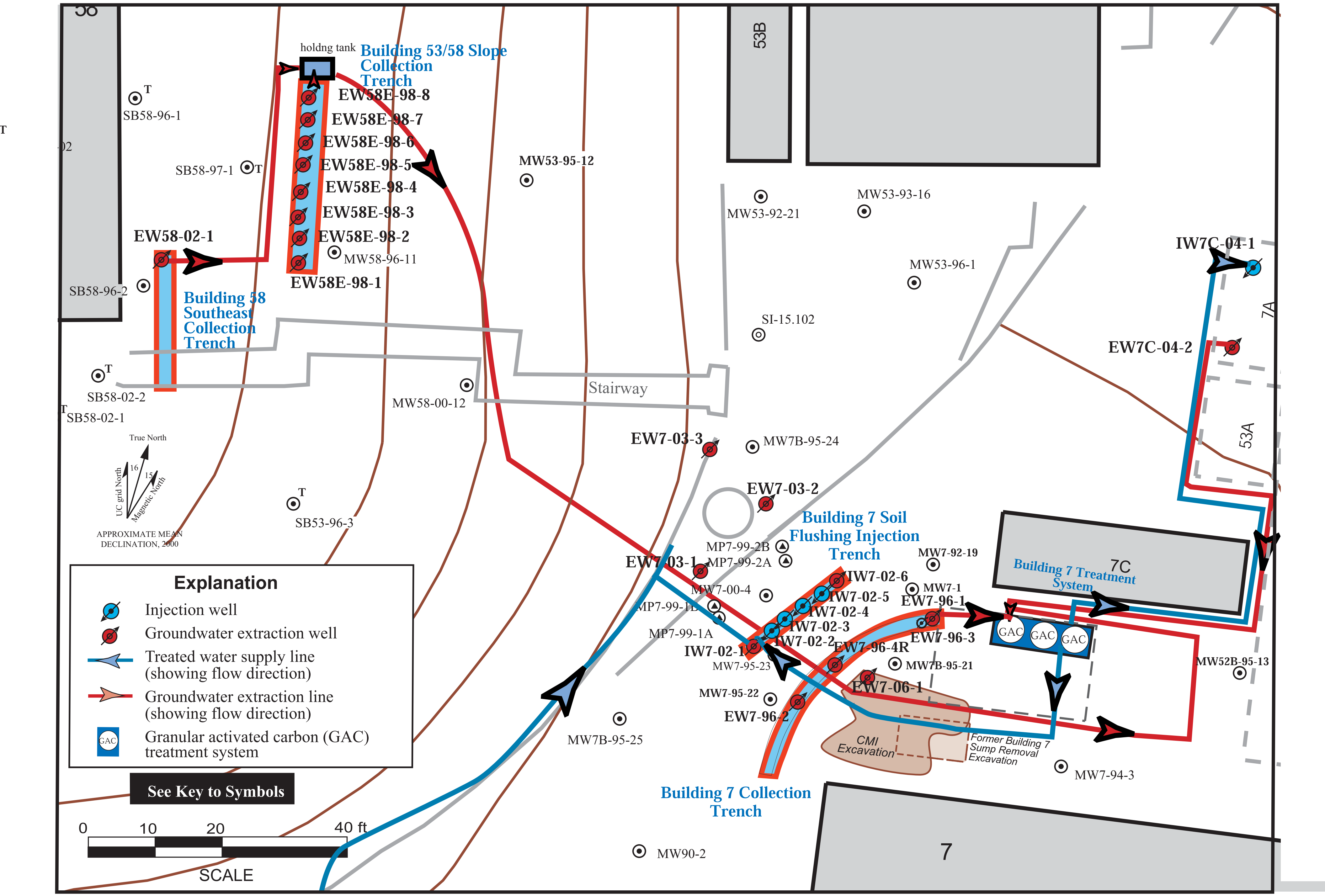
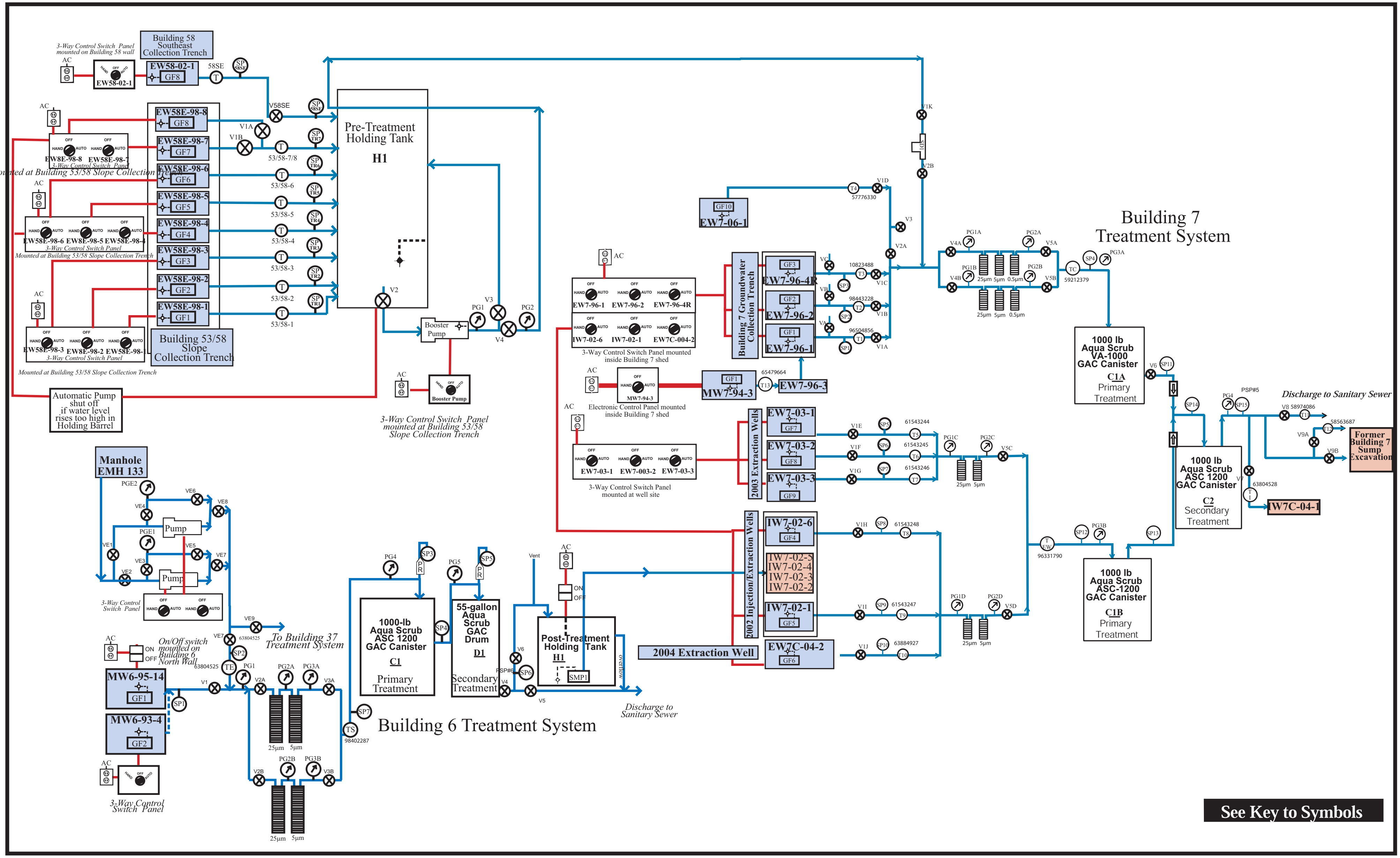
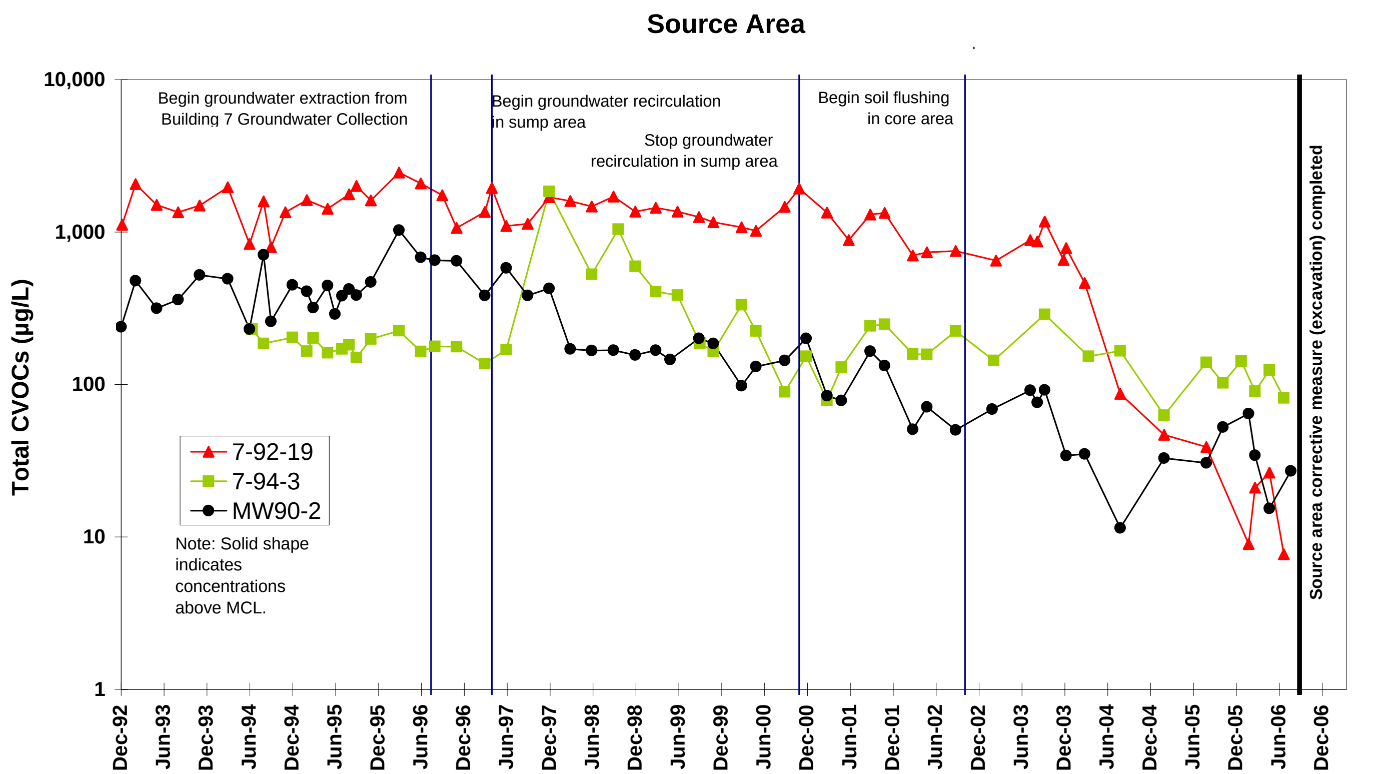


Figure 3.3-15. Soil Flushing and Groundwater Migration Control Systems, Building 7 Lobe.



3.3-16schematic B6.ai
1/06

Figure 3.3-16. Building 7 Lobe of the Old Town Groundwater Solvent Plume In Situ Soil Flushing System Schematic Diagram.



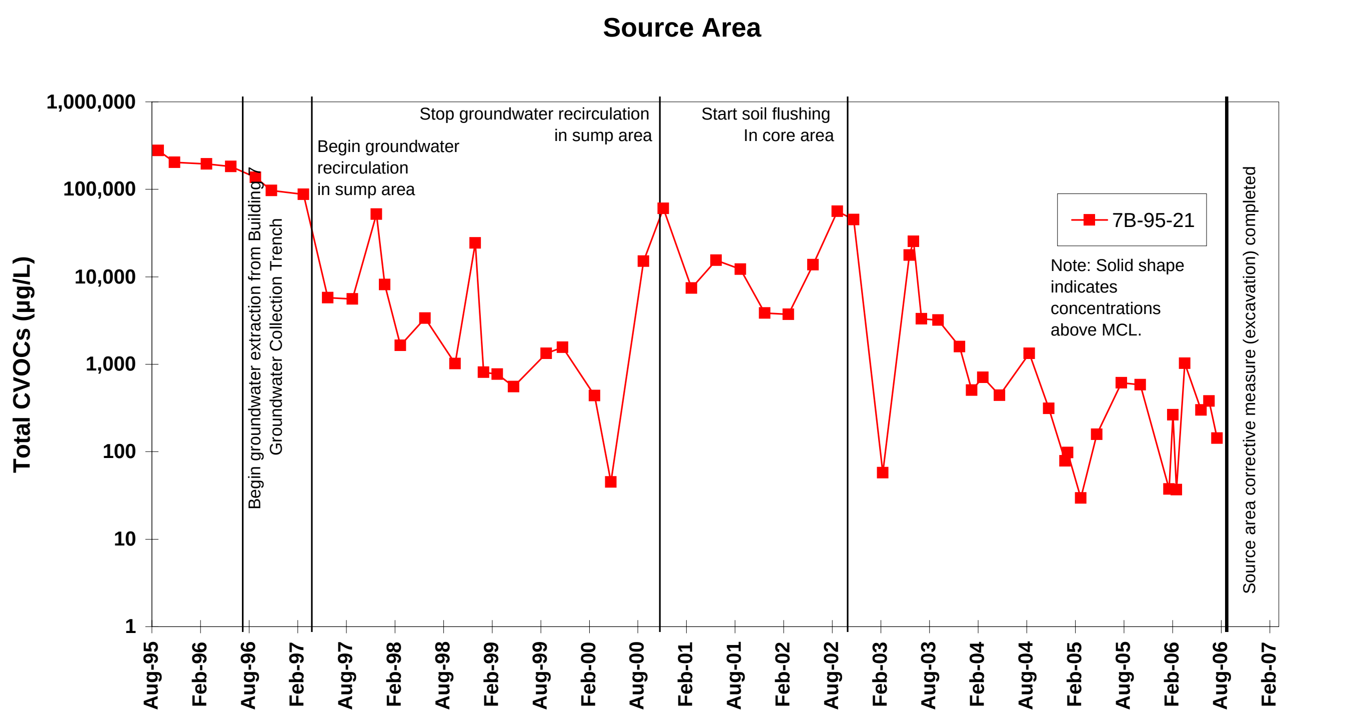


Figure 3.3-17a. Concentration Trends for Total VOCs, Building 7 Lobe Source Area.

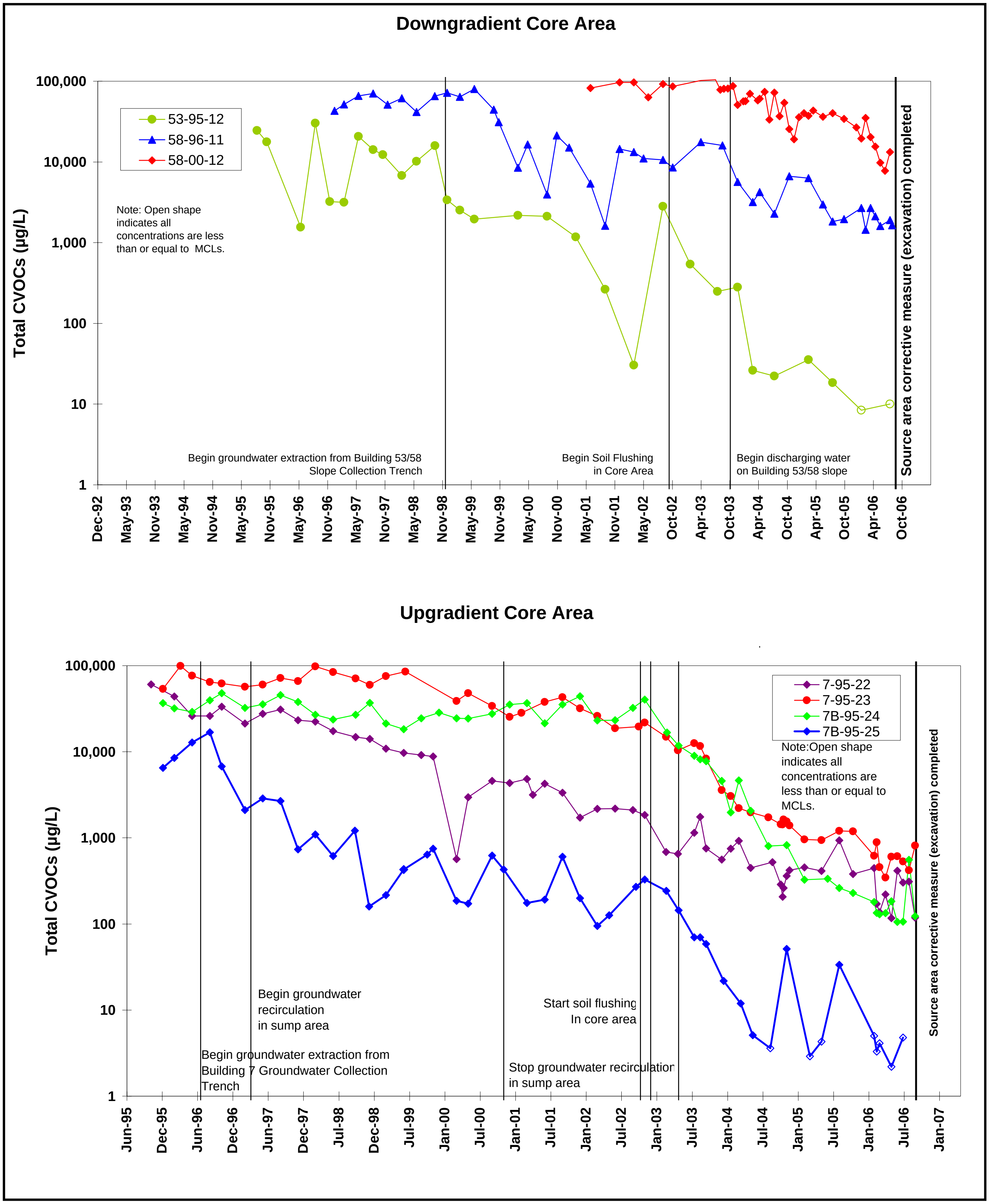


Figure 3.3-17b. **Concentration Trends for Total VOCs, Building 7 Lobe Core Areas.**

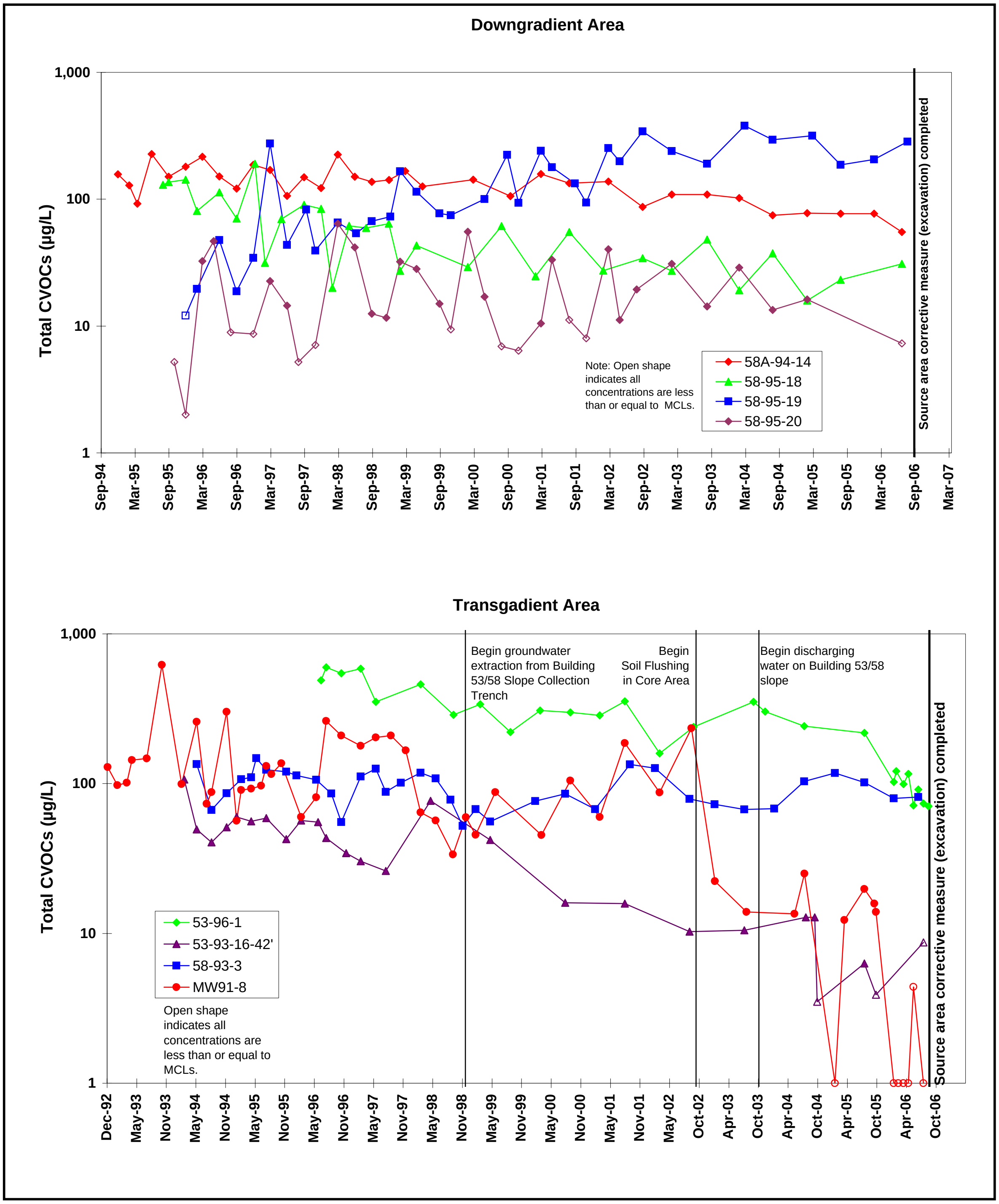


Figure 3.3-17c. **Concentration Trends for Total VOCs, Building 7 Lobe Downgradient and Transgradient Areas.**

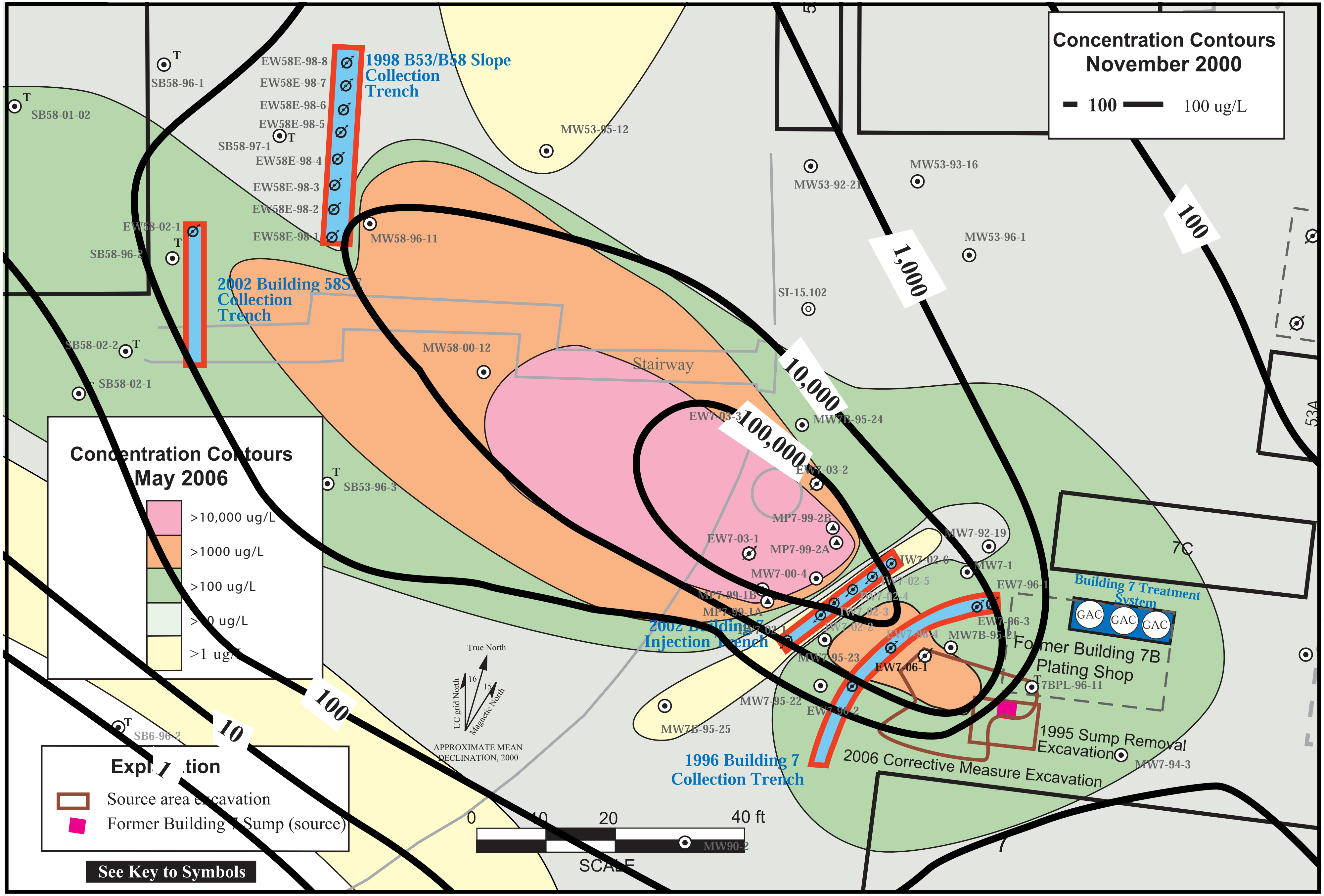


Figure 3.3-18. Total VOCs in Groundwater, Source Area Old Town Groundwater Solvent Plume Building 7 Lobe.

3.3-18 OTsumpareaVOCs.ai
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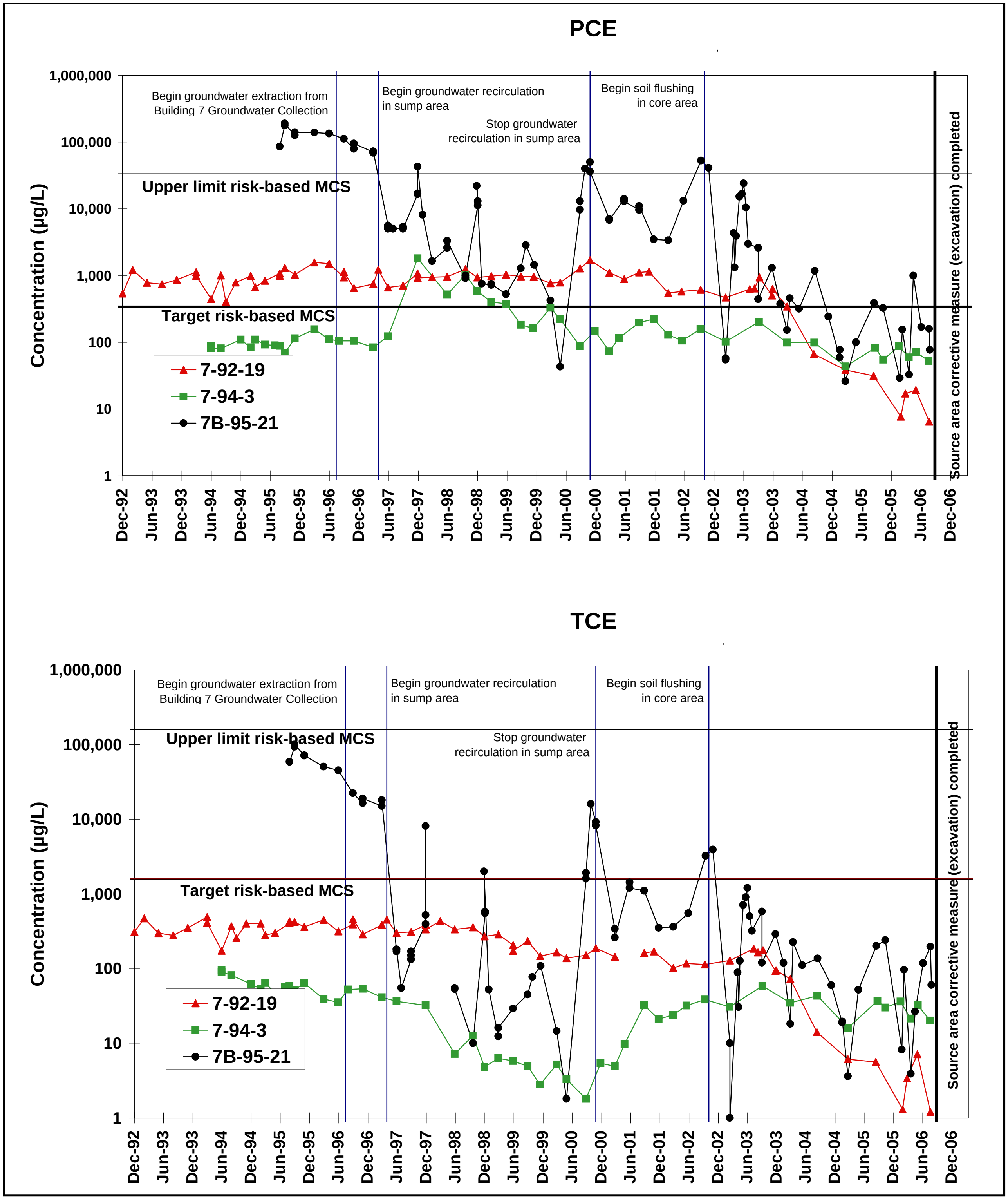


Figure 3.3-19a1. Concentration Trends for VOCs, Building 7 Lobe Source Area.

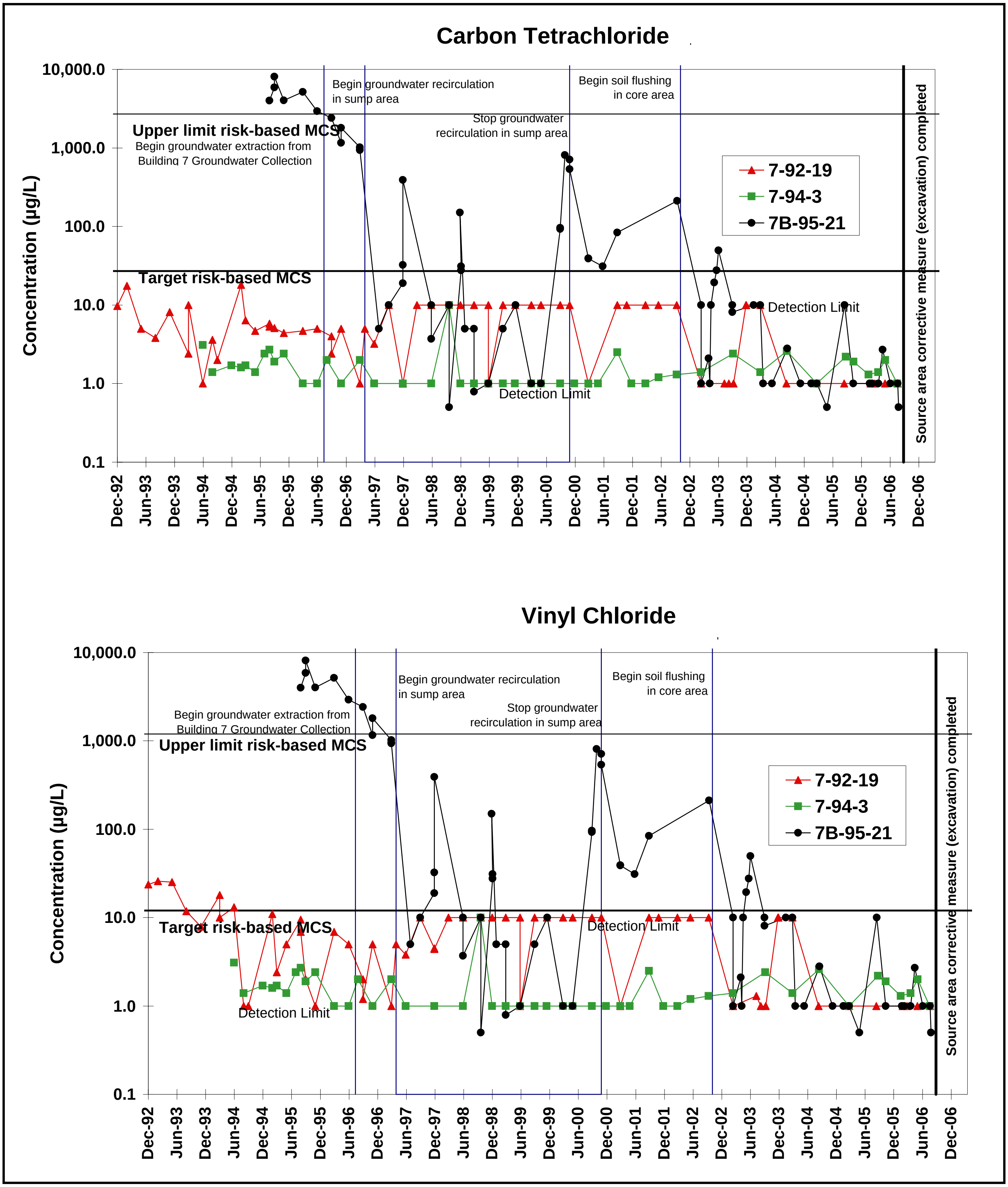


Figure 3.3-19a2. Concentration Trends for VOCs, Building 7 Lobe Source Area.

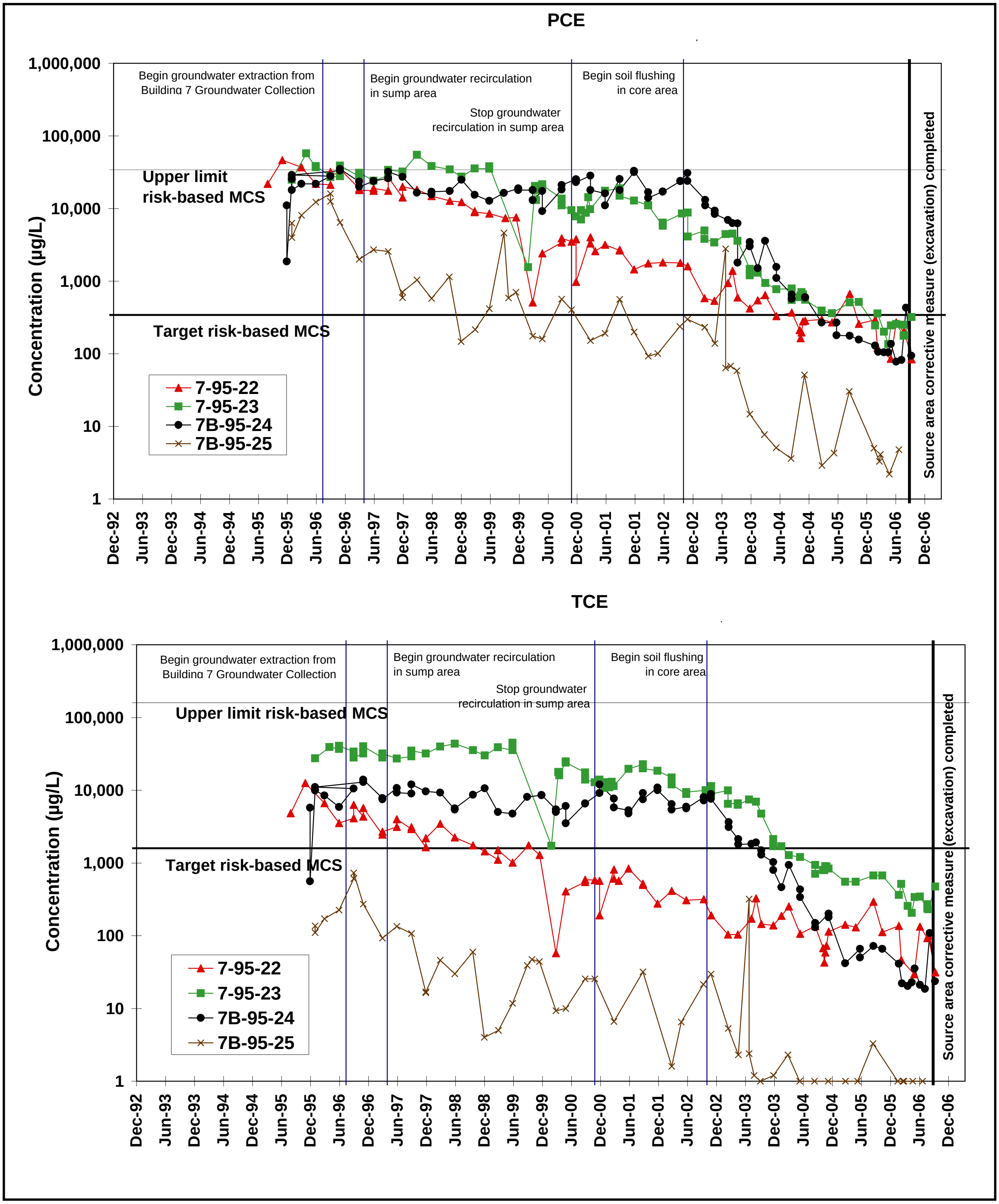
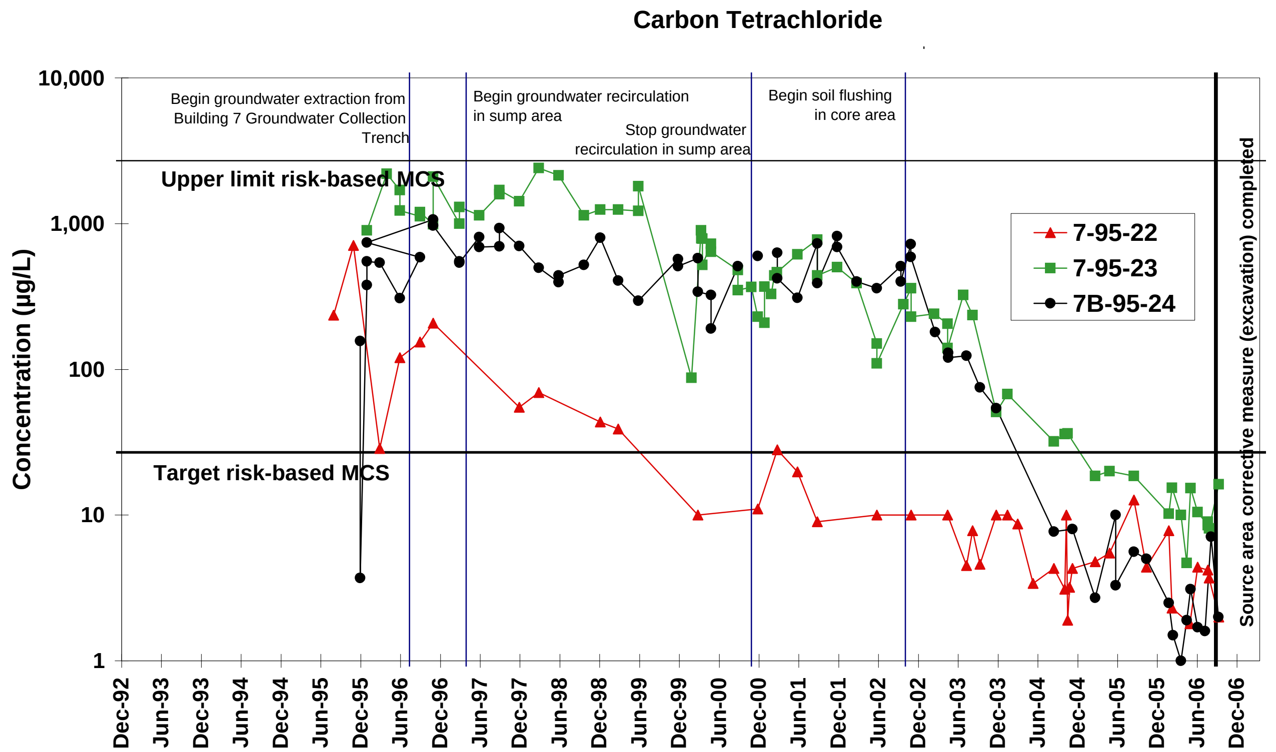


Figure 3.3-19b1. **Concentration Trends for VOCs, Building 7 Lobe Upgradient Core Area.**



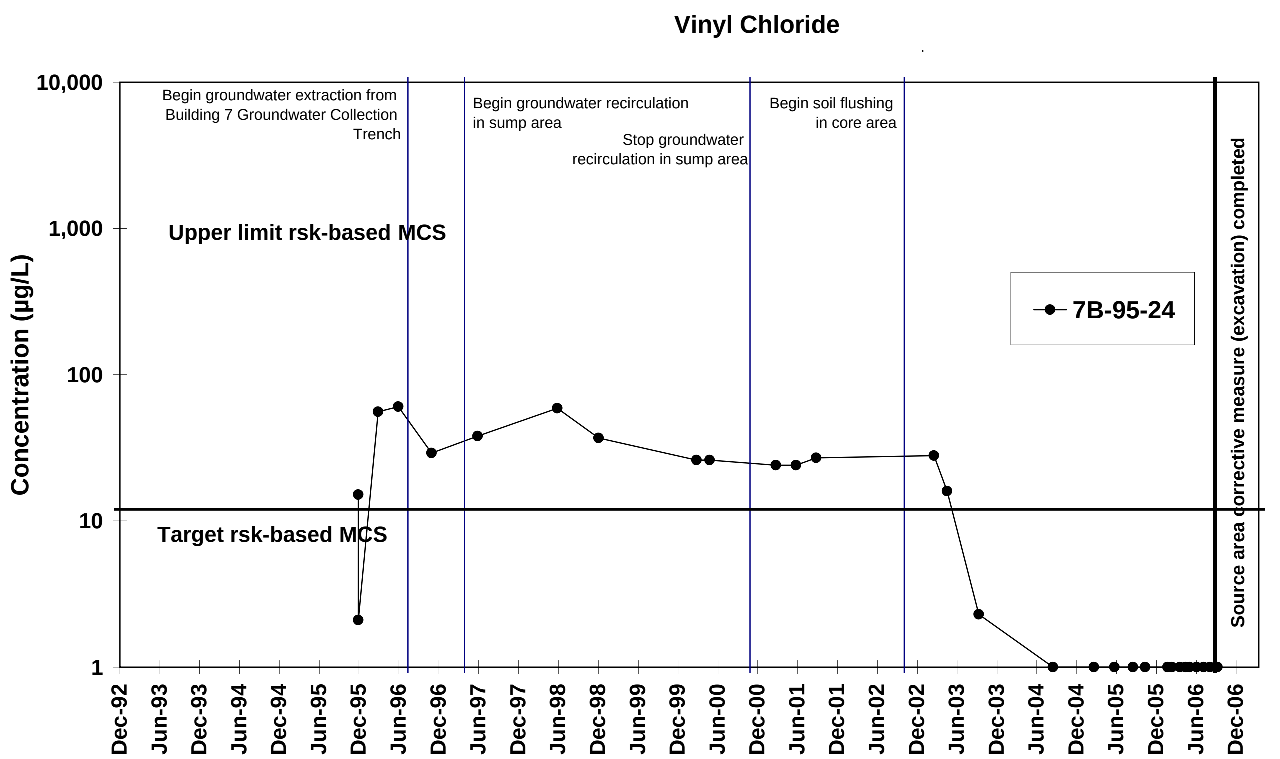


Figure 3.3-19b2. Concentration Trends for VOCs, Building 7 Lobe Upgradient Core Area.

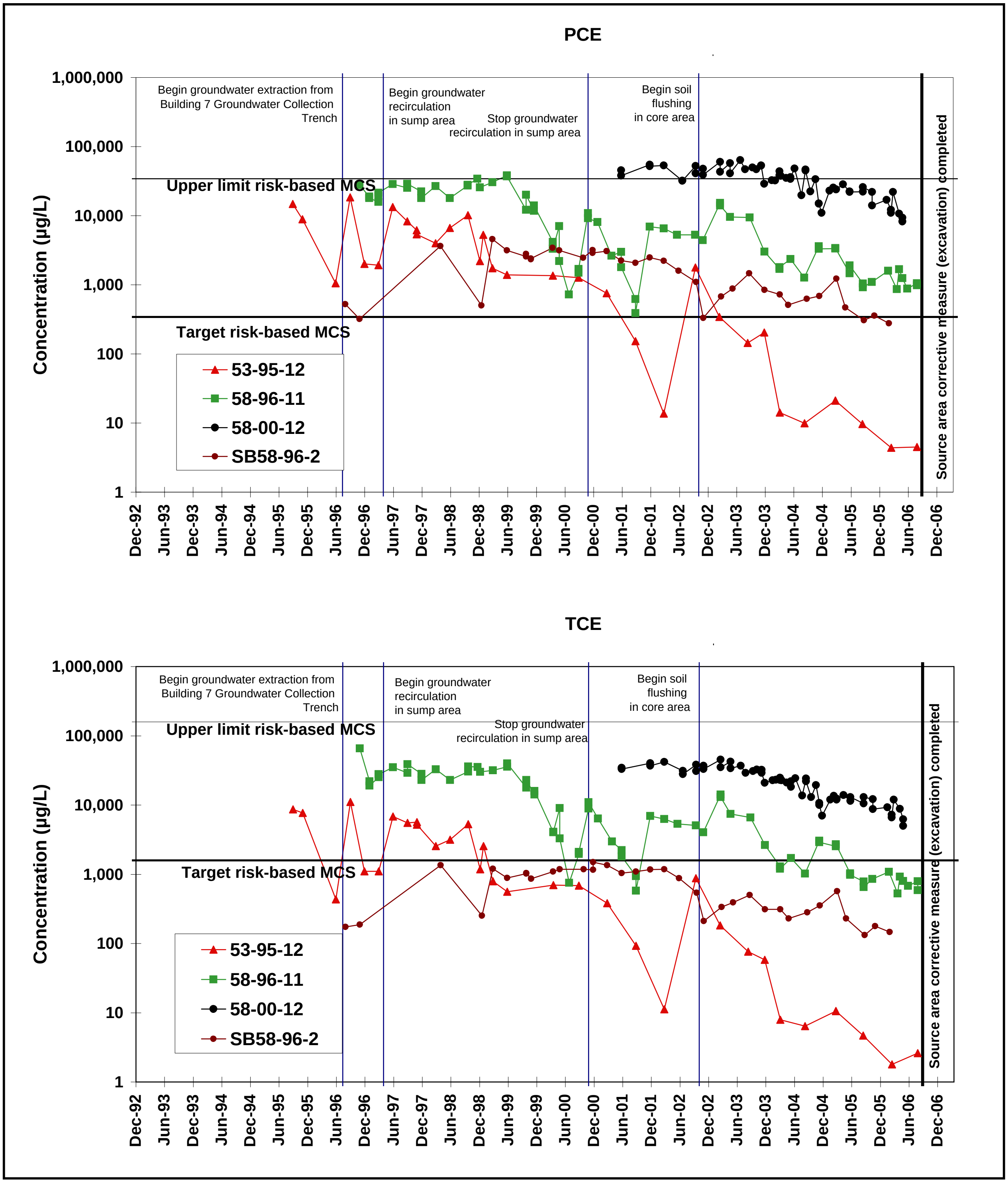


Figure 3.3-19c1. **Concentration Trends for VOCs, Building 7 Lobe Downgradient Core Area.**

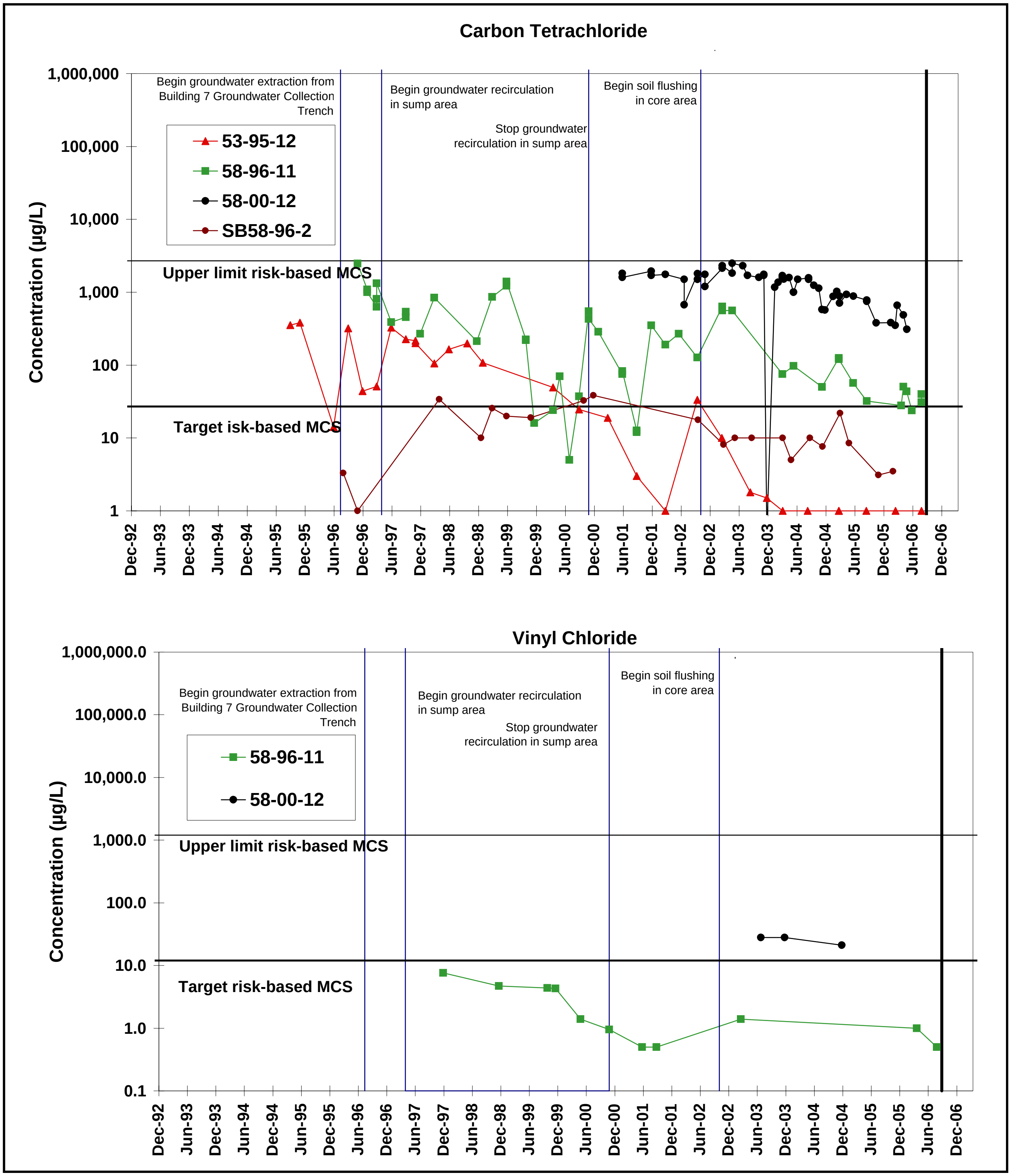


Figure 3.3-19c2. **Concentration Trends for VOCs, Building 7 Lobe Downgradient Core Area.**

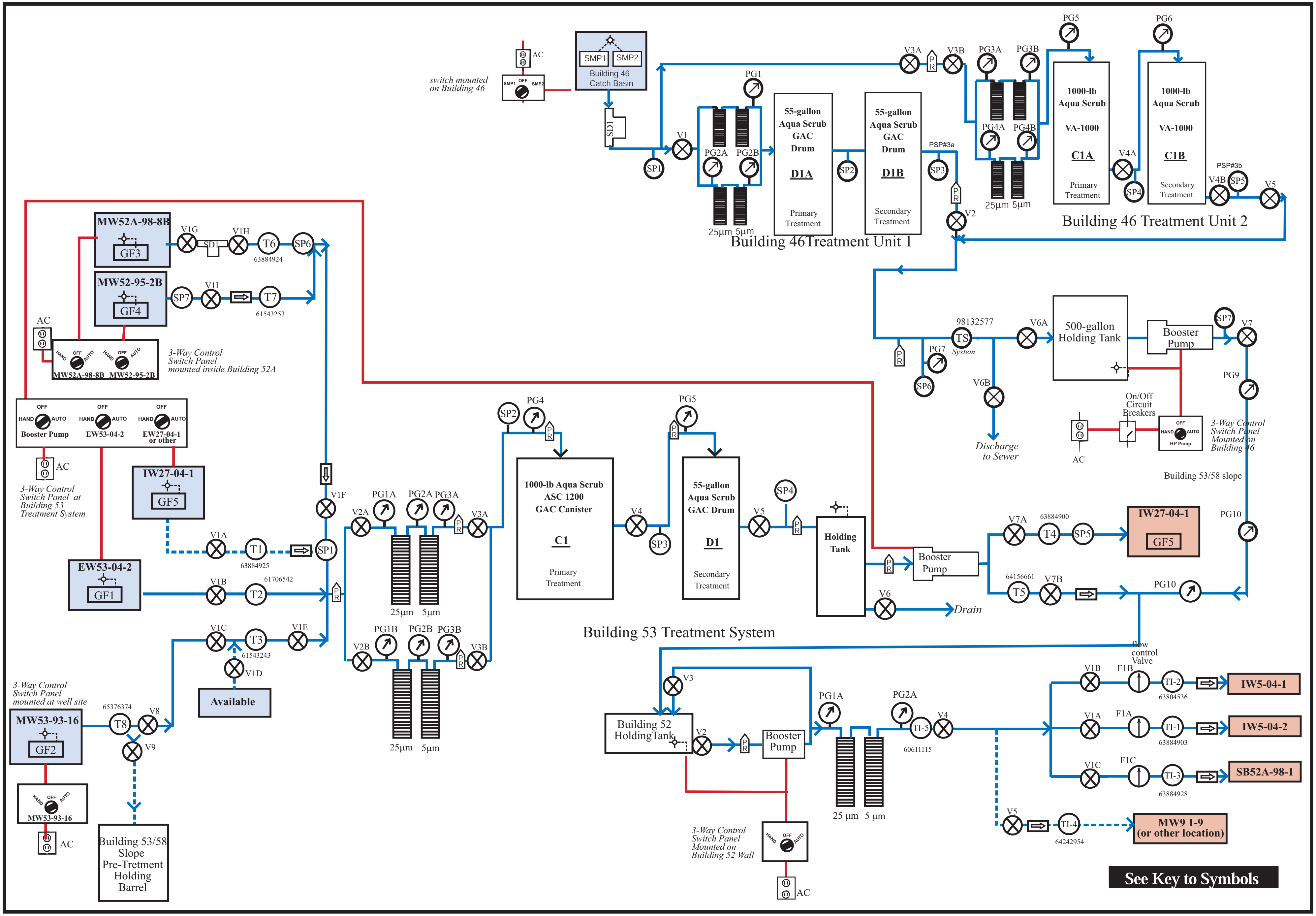


Figure 3.3-20. Building 52 Lobe of the Old Town Groundwater Solvent Plume In Situ Soil Flushing System Schematic Diagram.

3.3-20-1schematic B52lobe.ai
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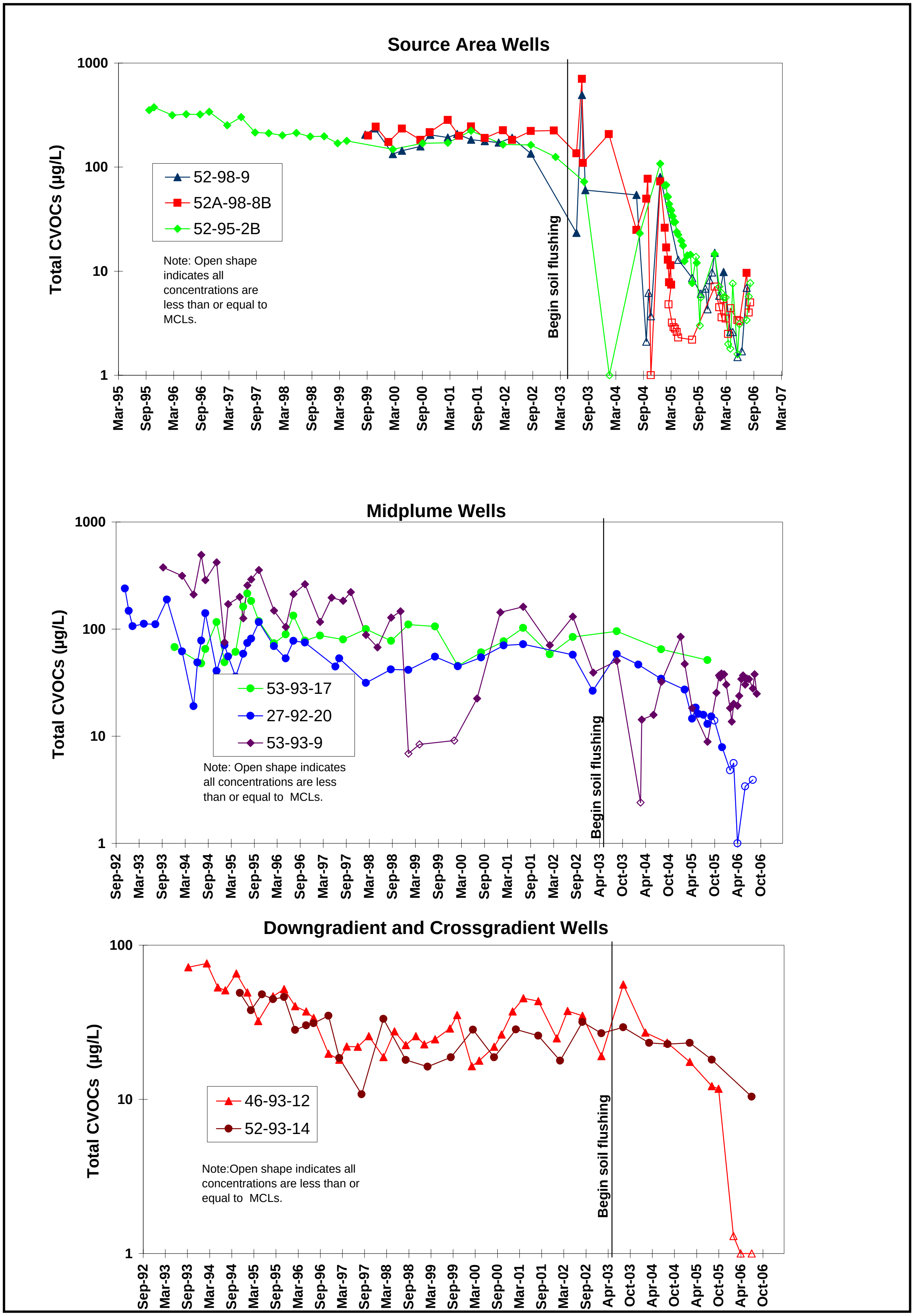
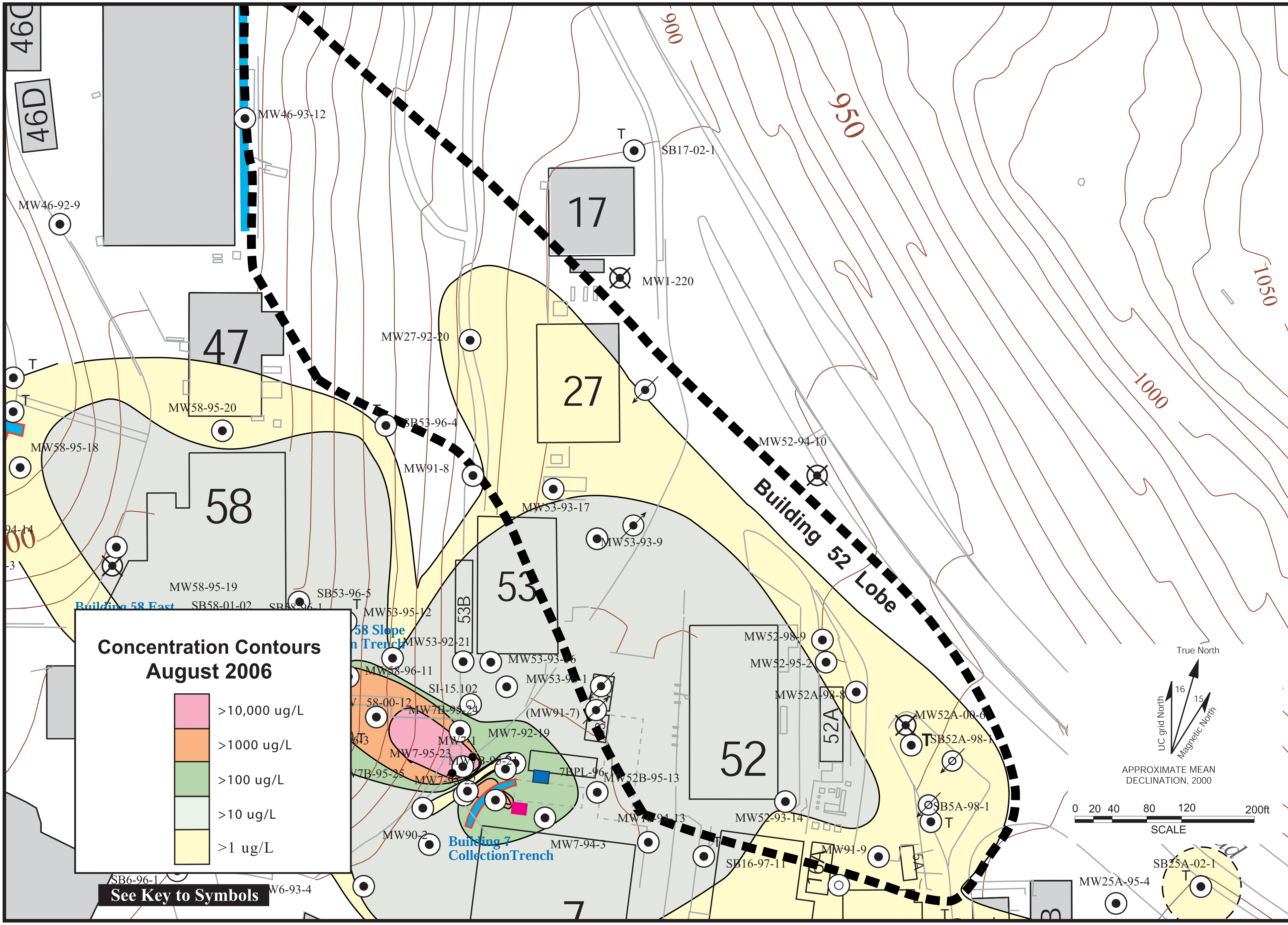


Figure 3.3-21. Concentration Trends for Total VOCs, Old Town Groundwater Plume Building 52 Lobe.



Figur 3.3-22. Total VOCs in Groundwater, Old Town Groundwater Solvent Plume Building 52 Lobe.

-3.3-22b52lobecomparison.ai
12/06

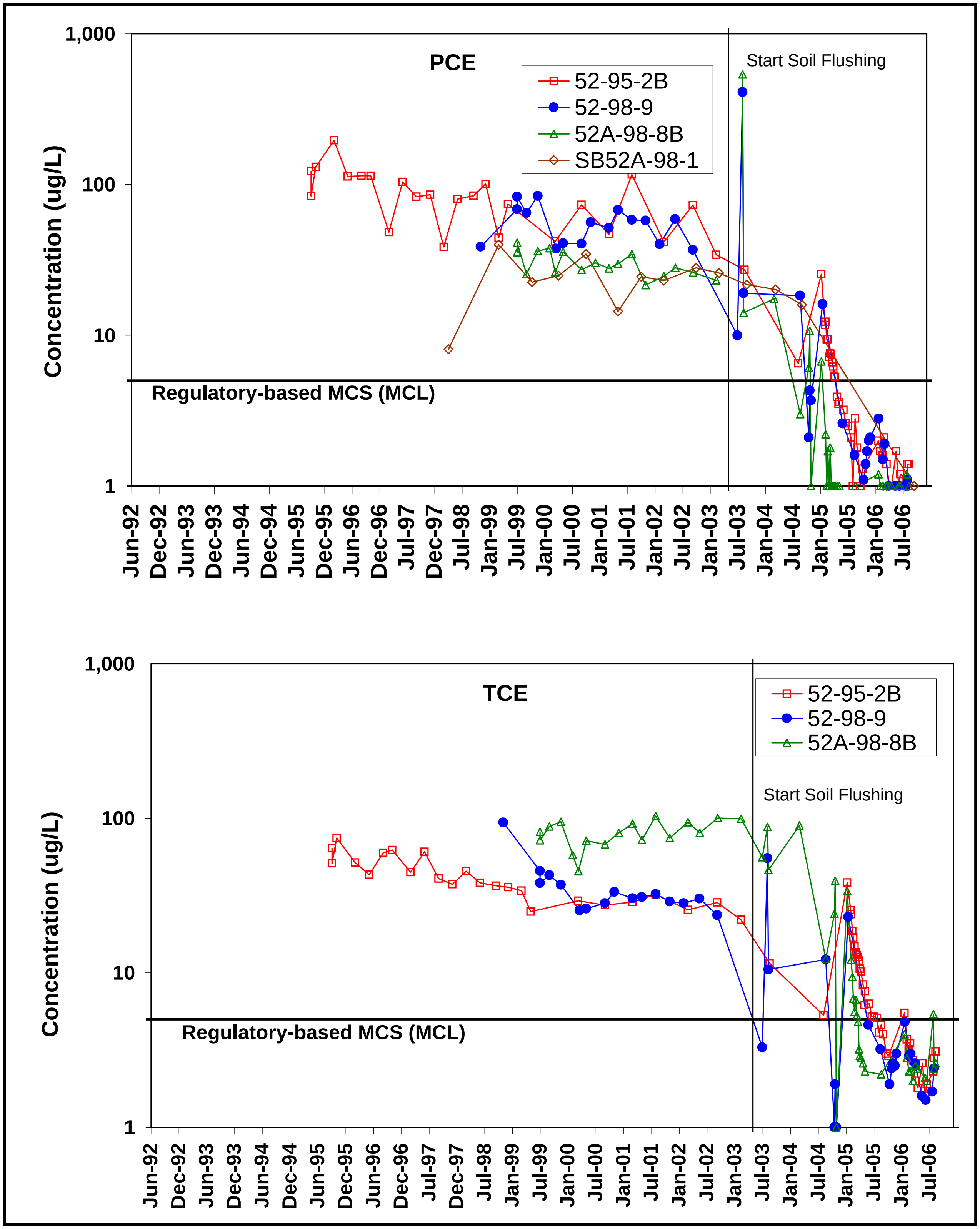


Figure 3.3-23a1. Concentration Trends for VOCs, Building 52 Lobe Source Area.

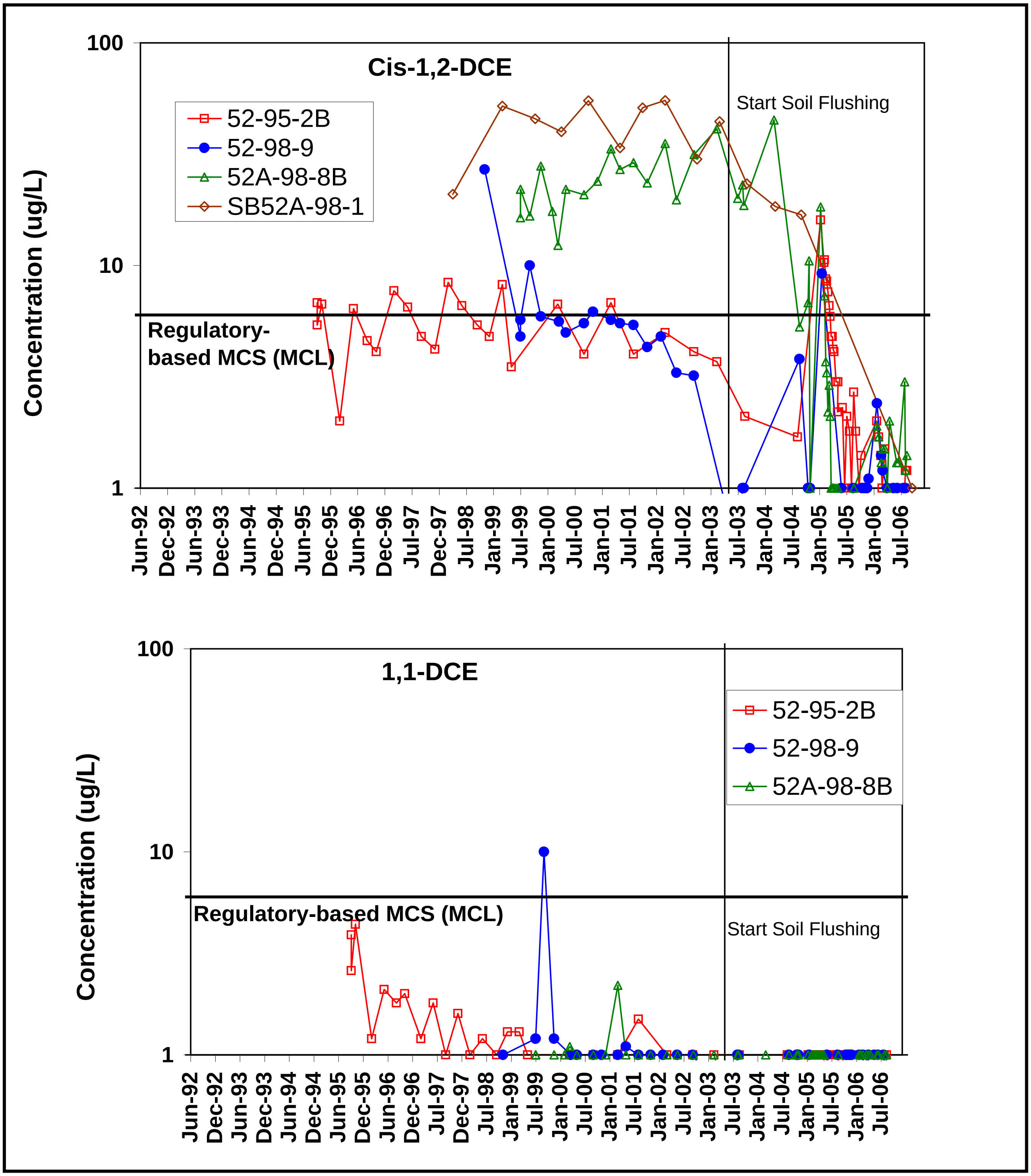
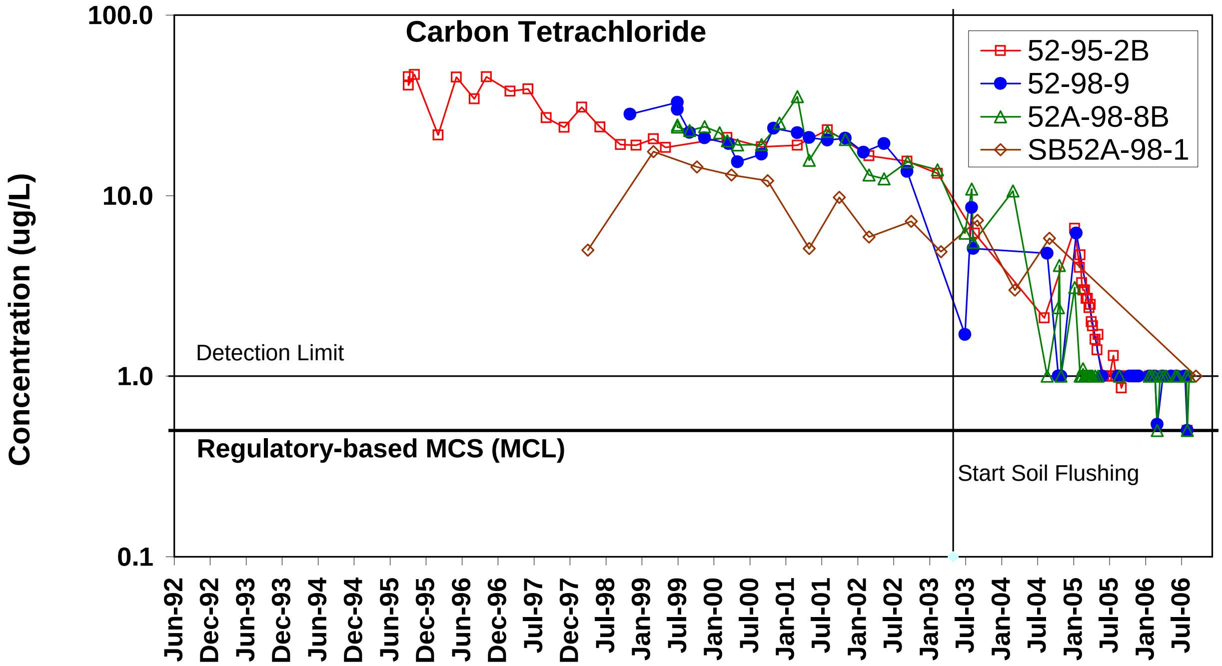


Figure 3.3-23a2. **Concentration Trends for VOCs, Building 52 Lobe Source Area.**



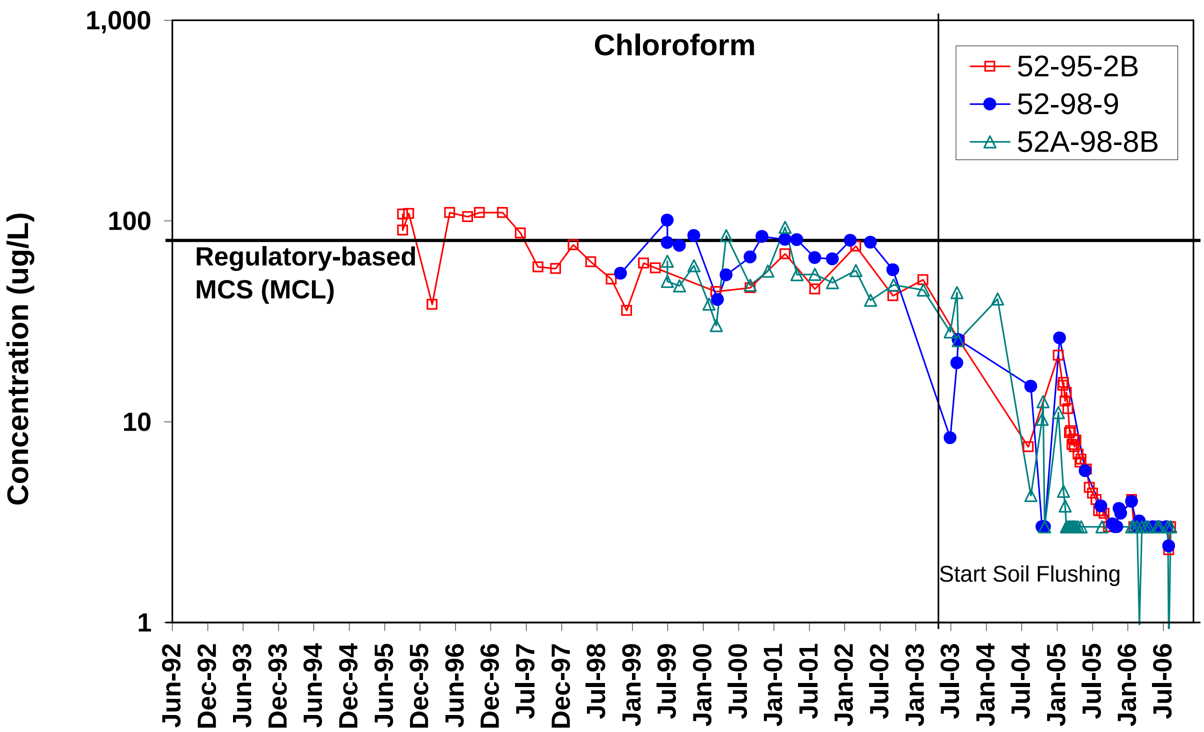


Figure 3.3-23a3. **Concentration Trends for VOCs, Building 52 Lobe Source Area.**

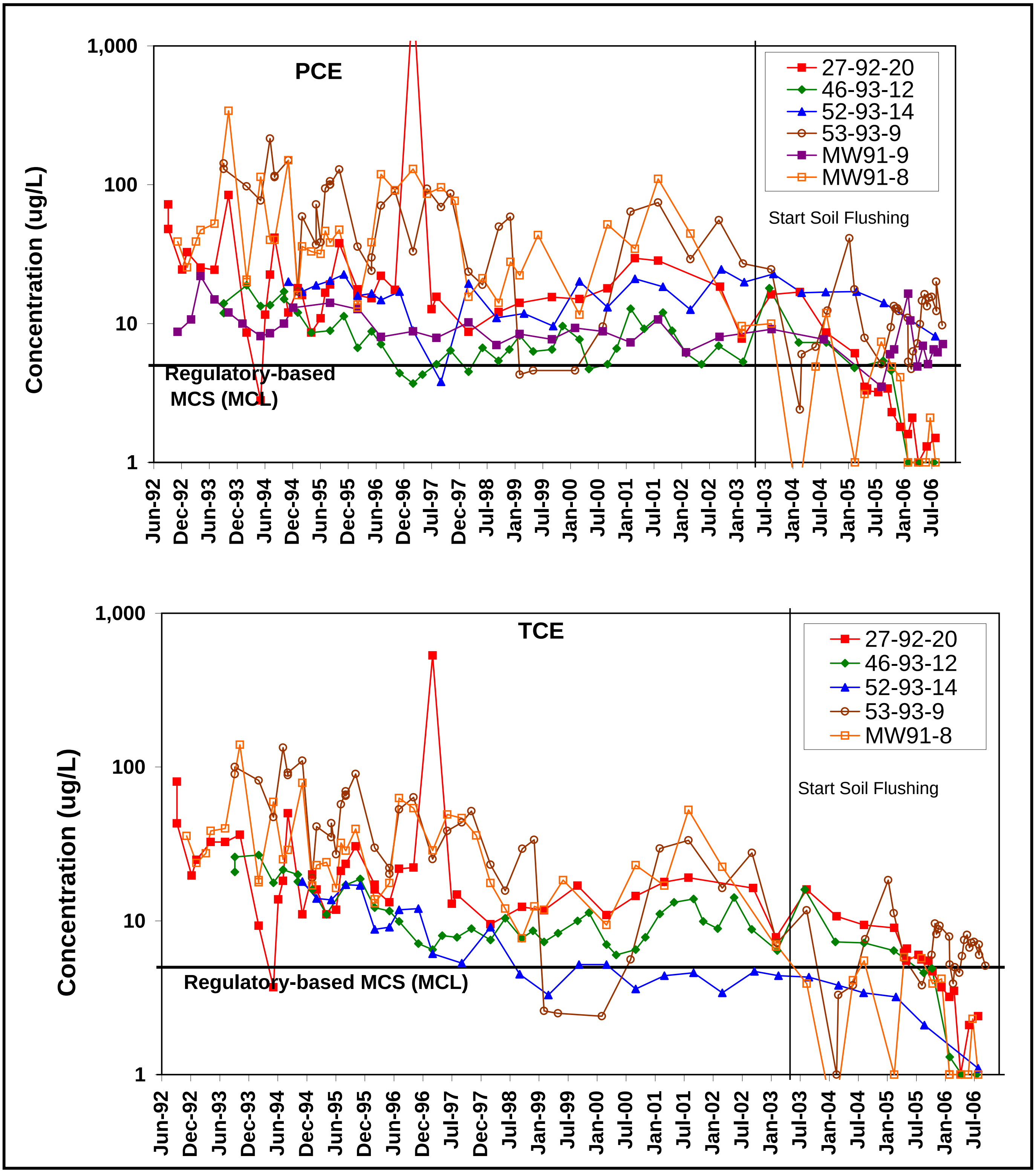


Figure 3.3-23b1. **Concentration Trends for VOCs, Building 52 Lobe Downgradient Area.**

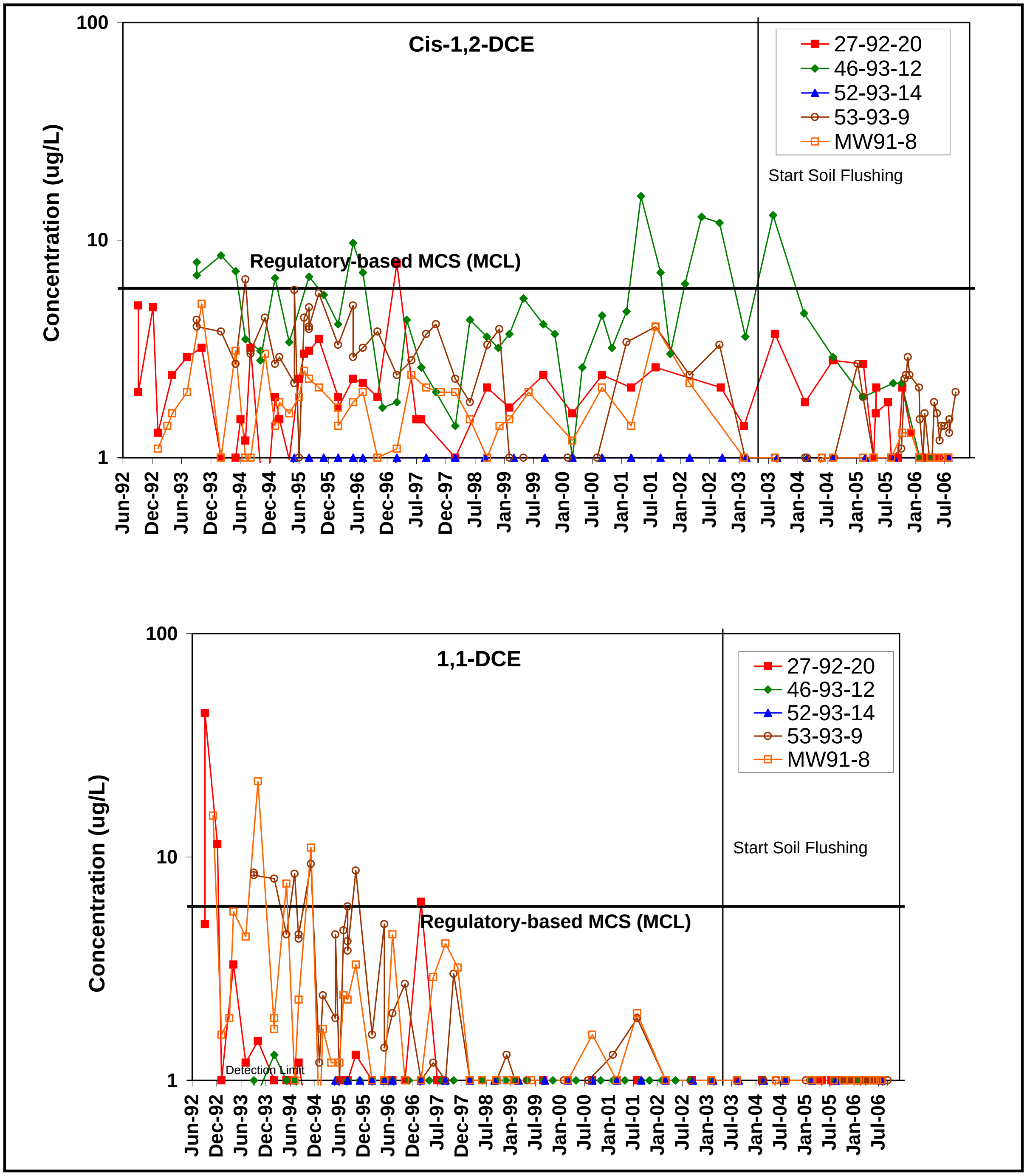


Figure 3.3-23b2. Concentration Trends for VOCs, Building 52 Lobe Downgradient Area.

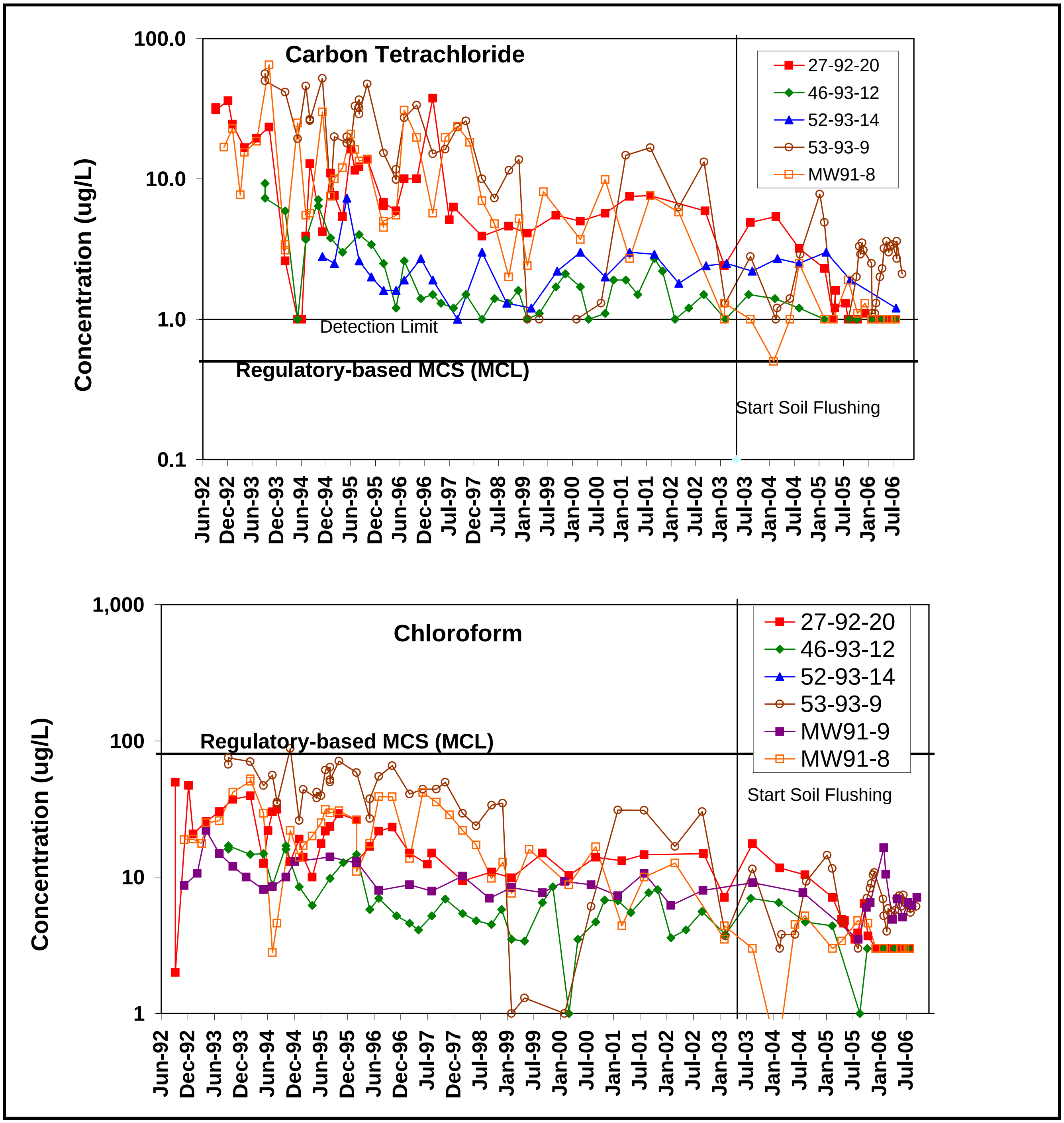


Figure 3.3-23b3. **Concentration Trends for CVOCs, Building 52 Lobe Downgradient Area.**

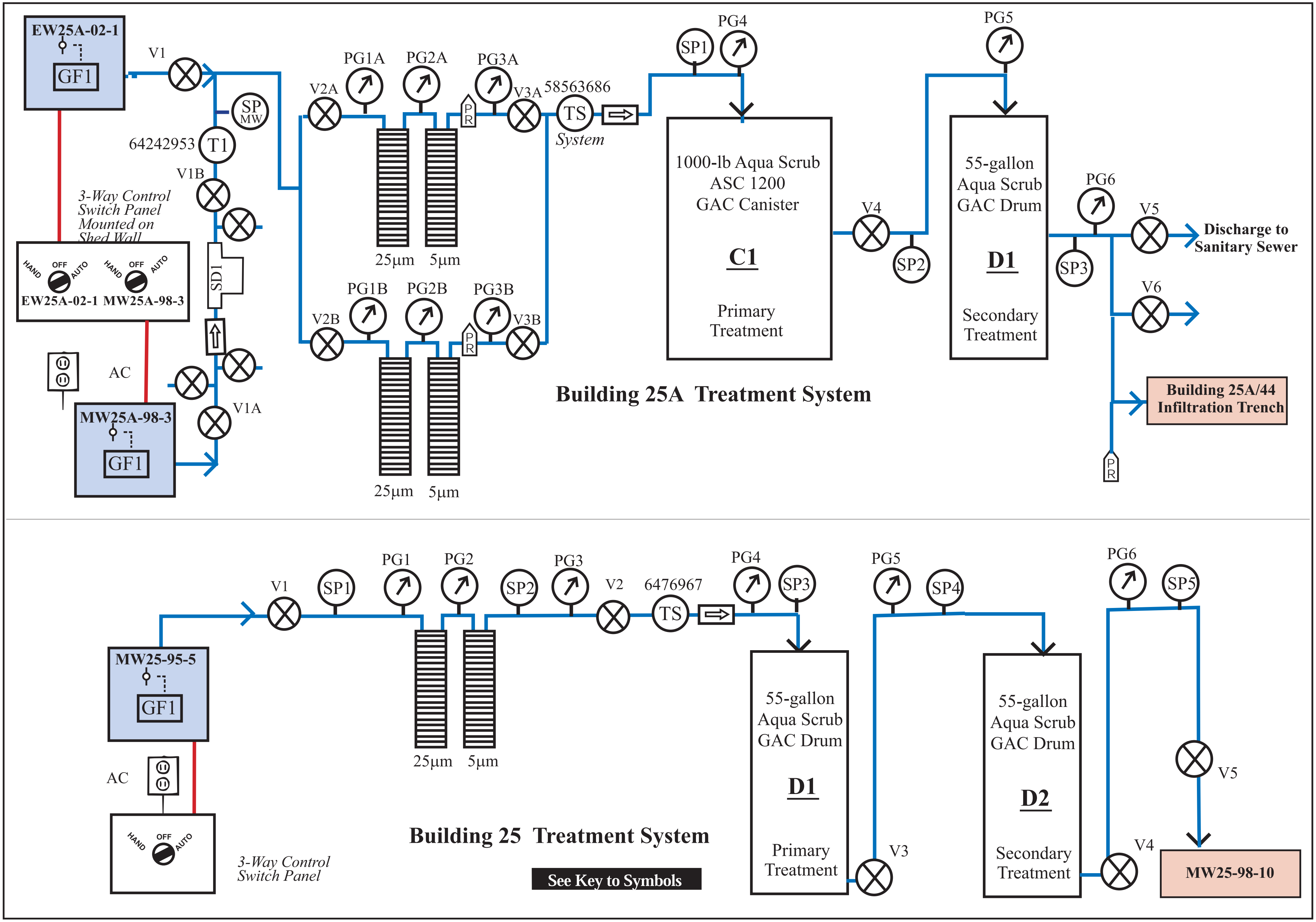


Figure 3.3-24. Building 25A and Building 25 In Situ Soil Flushing System Schematic Diagram

3.3-24-schematicB25Aai
12/06

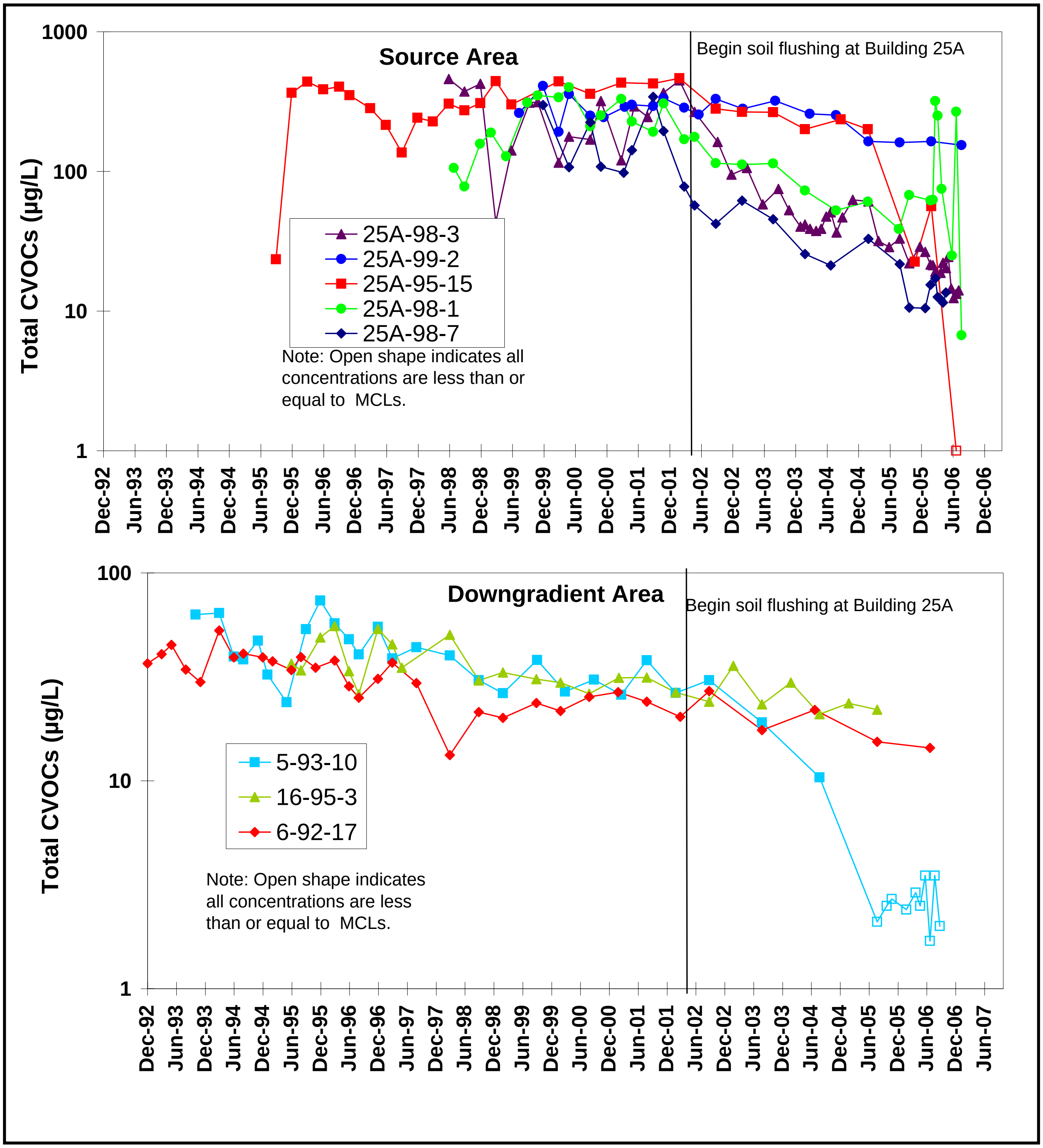


Figure 3.3-25. Concentration Trends for Total VOCs, Old Town Groundwater Plume Building 25A Lobe.

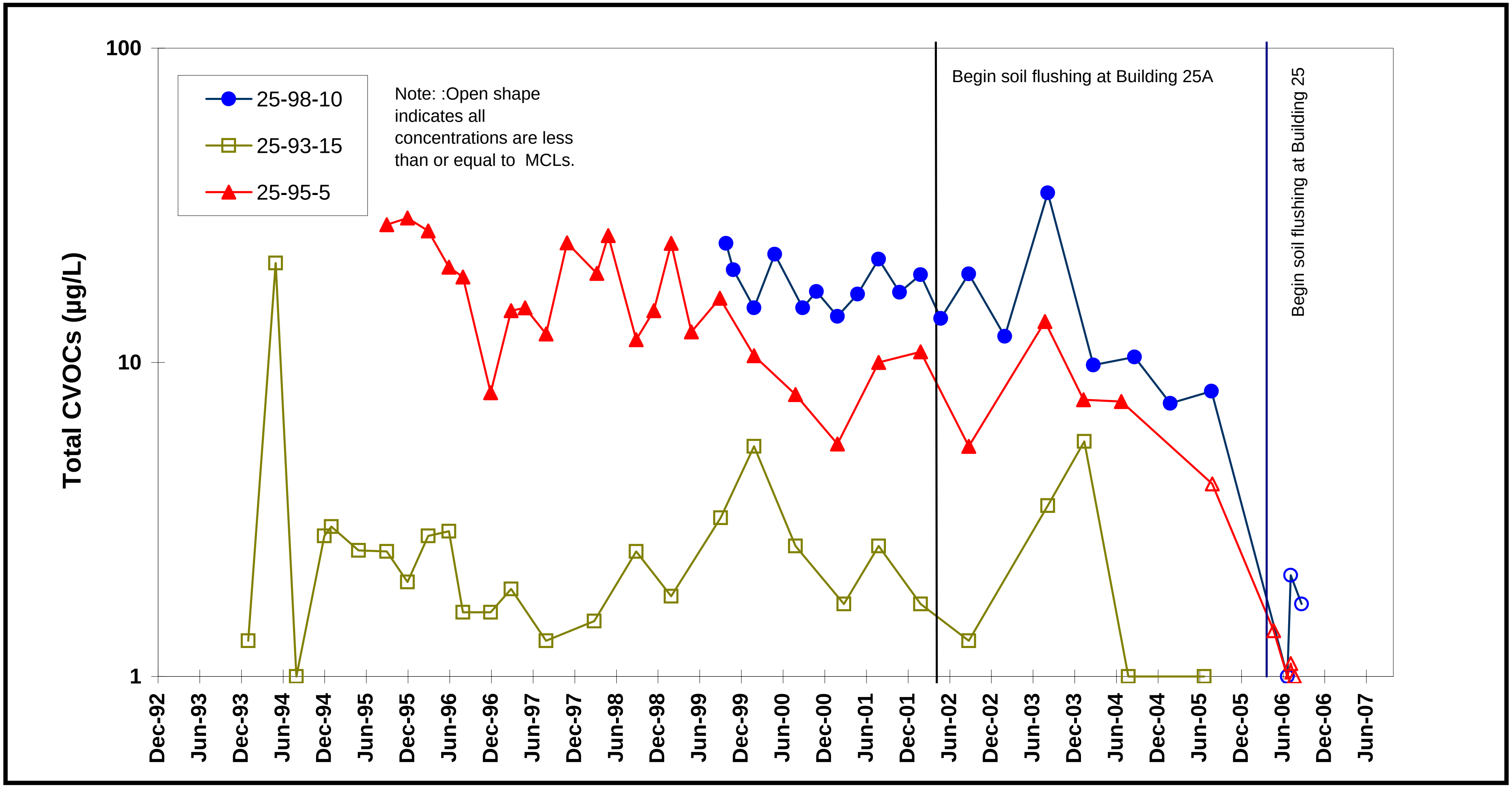


Figure 3.3-26. Concentration Trends for Total VOCs, Old Town Groundwater Plume Building 25 Lobe.

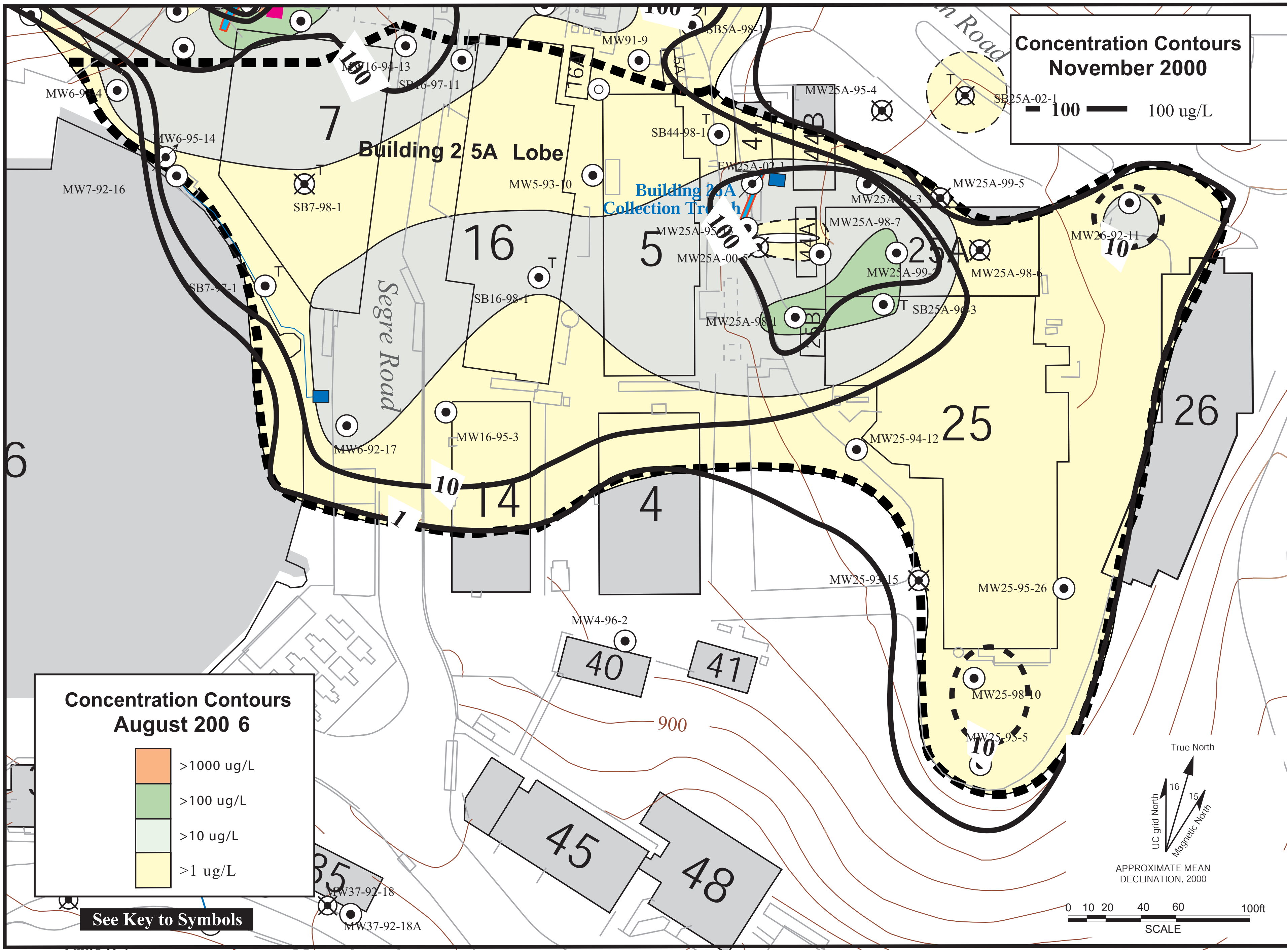


Figure 3.3-27. Total VOCs in Groundwater, Old Town Groundwater Solvent Plume Building 25A Lobe.

3.3-27-b525Alobecomparison.ai
12/06

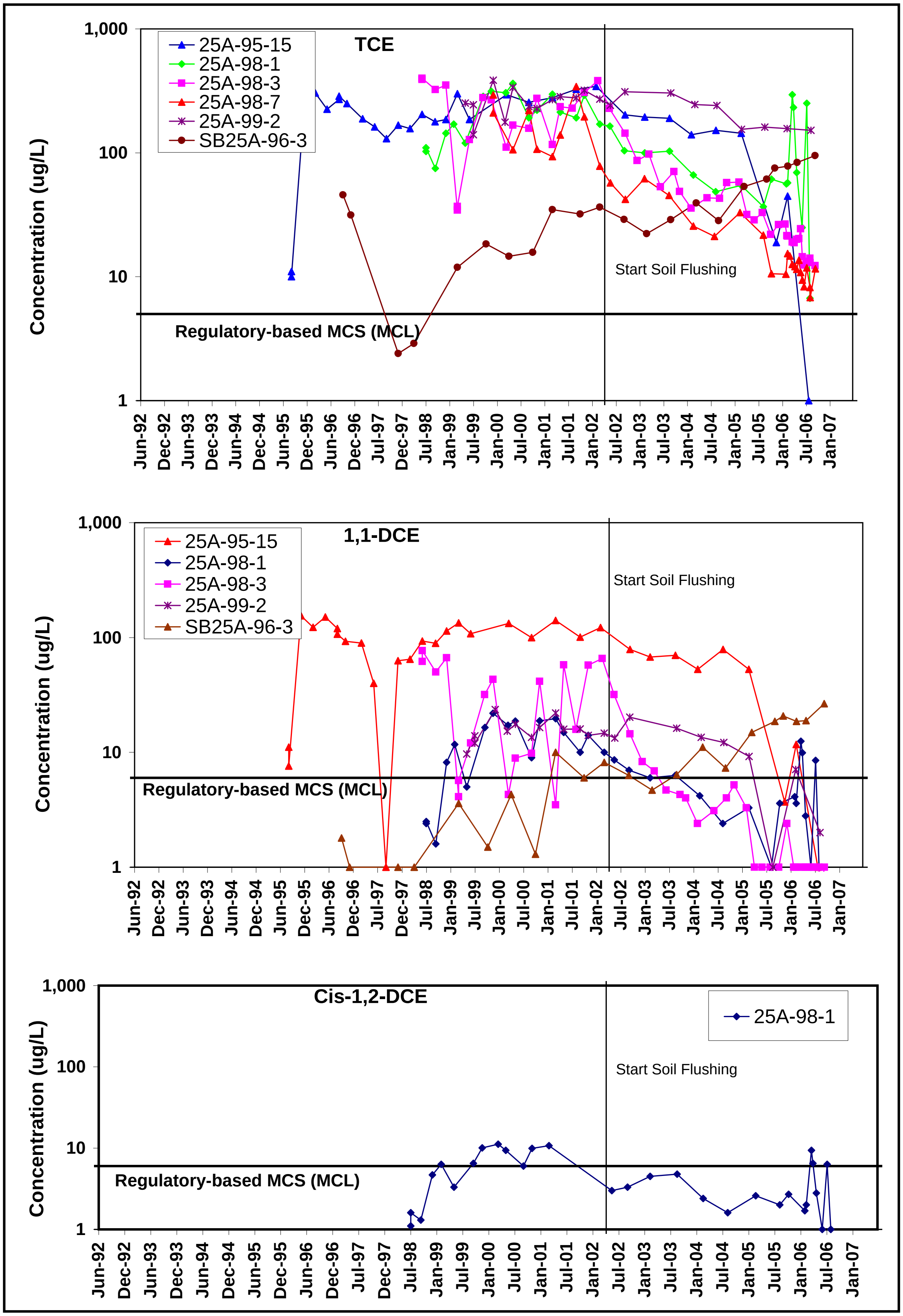


Figure 3.3-28a. **Concentration Trends for VOCs, Building 25A Lobe Building 25a Subplume Source Area (West of Building 25A).**

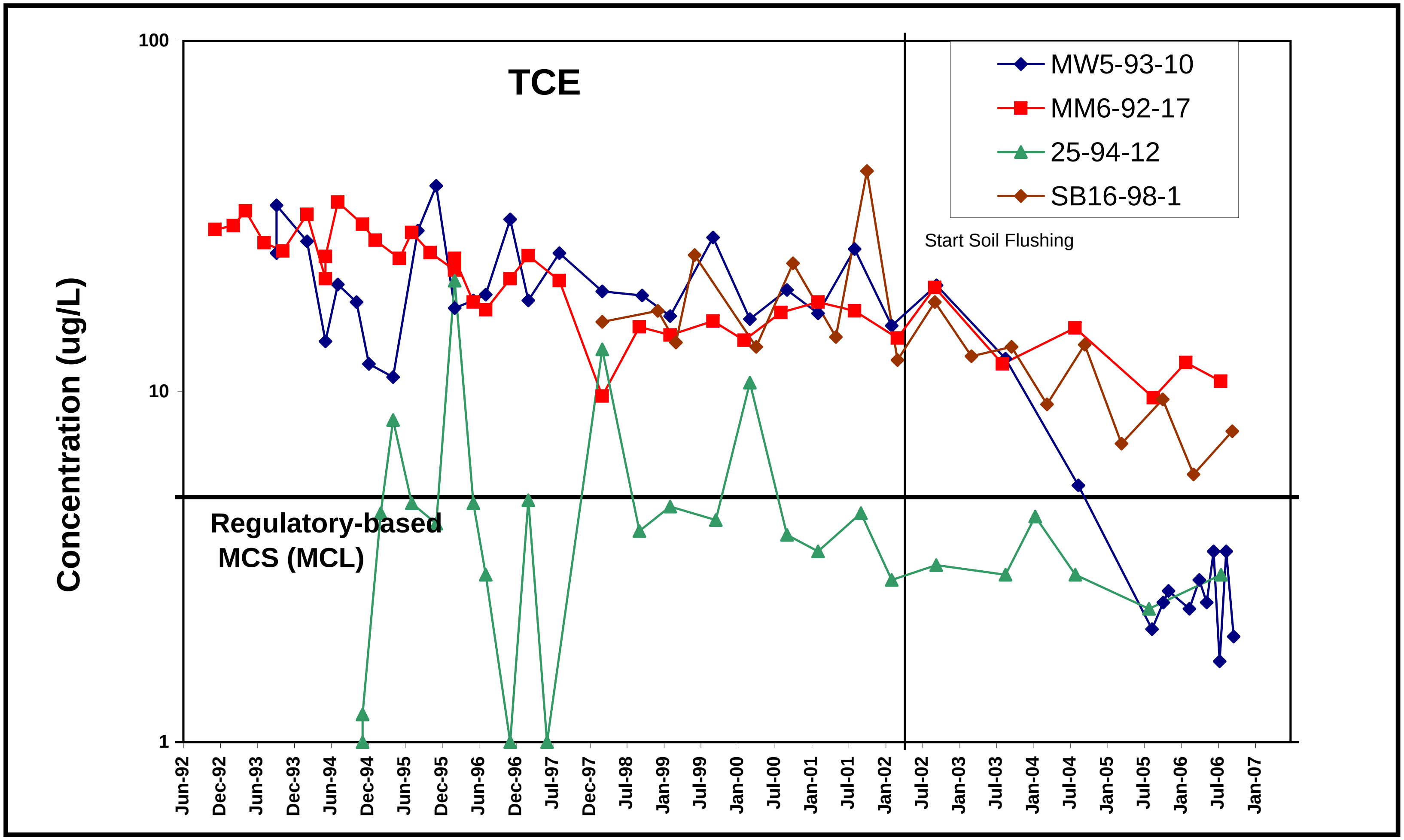


Figure 3.3-28b. **Concentration Trends for VOCs, Building 25A Lobe Building 25a Subplume Downgradient Area (West of Building 25A).**

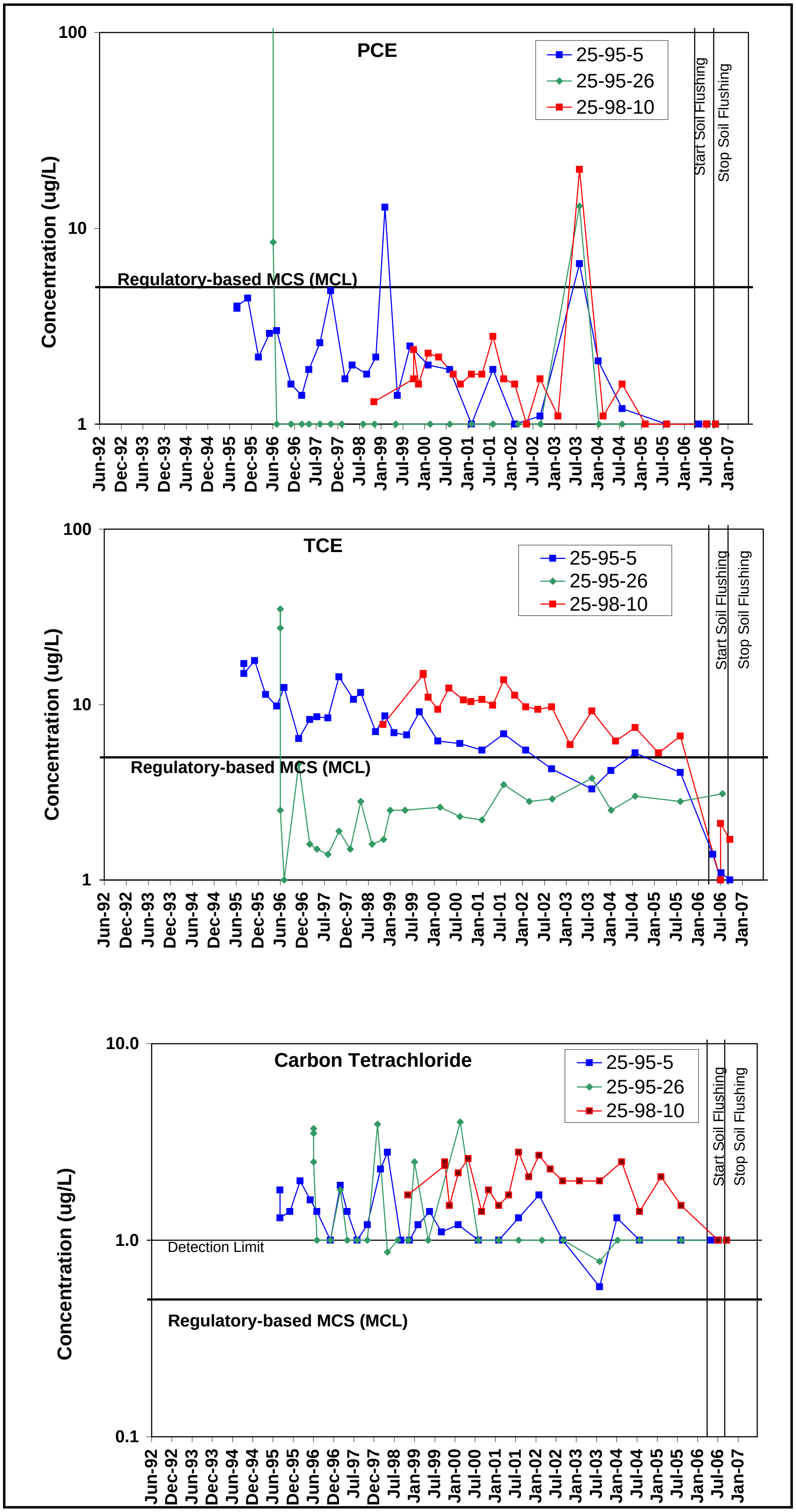


Figure 3.3-29. Concentration Trends for VOCs, Building 25A Lobe Building 25 Subplume (South of Building 25).

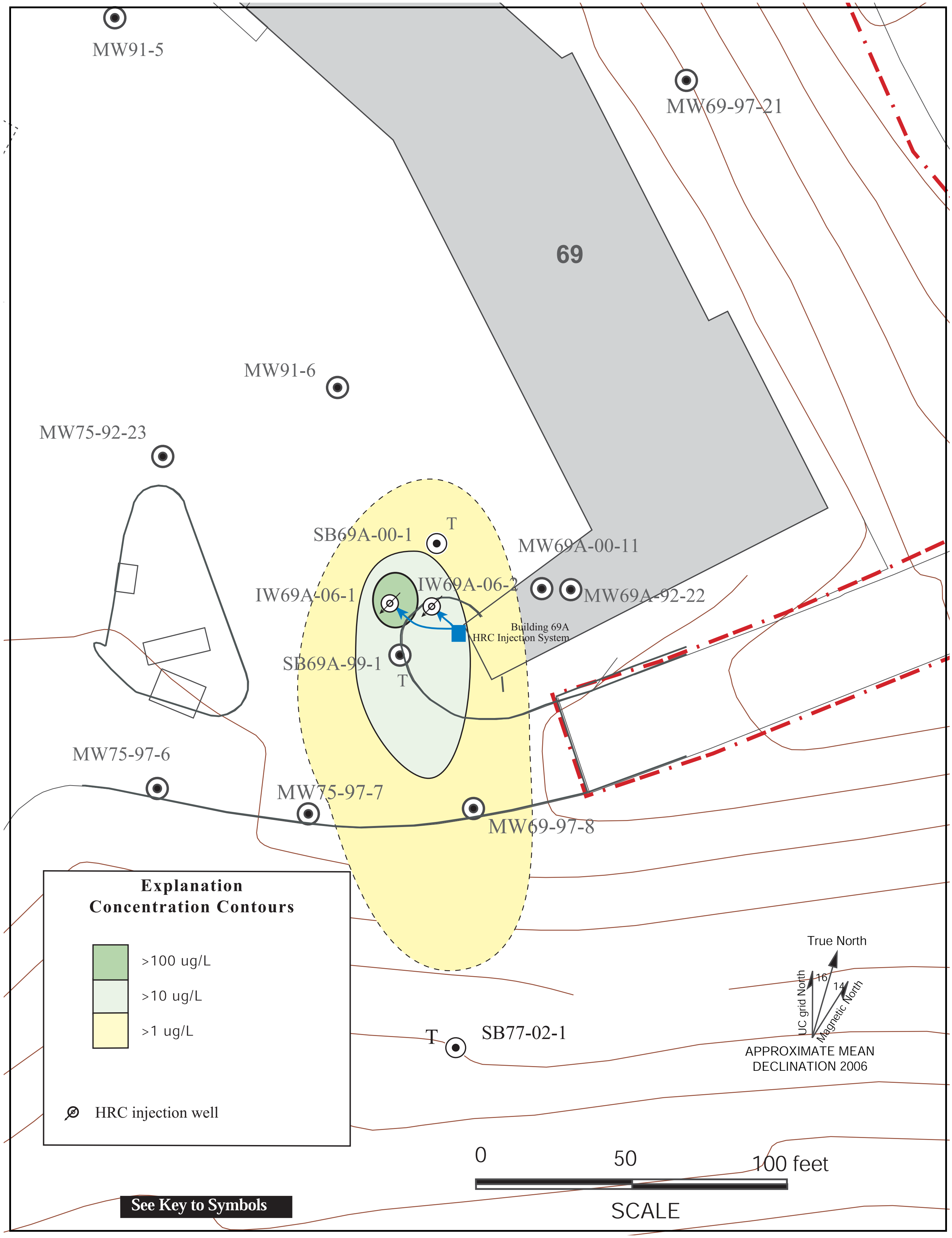


Figure 3.3-30. Isoconcentration Contour Map Total VOCs in Groundwater, Building 69A Area of Groundwater Contamination.

f3.3-30-b69A.ai
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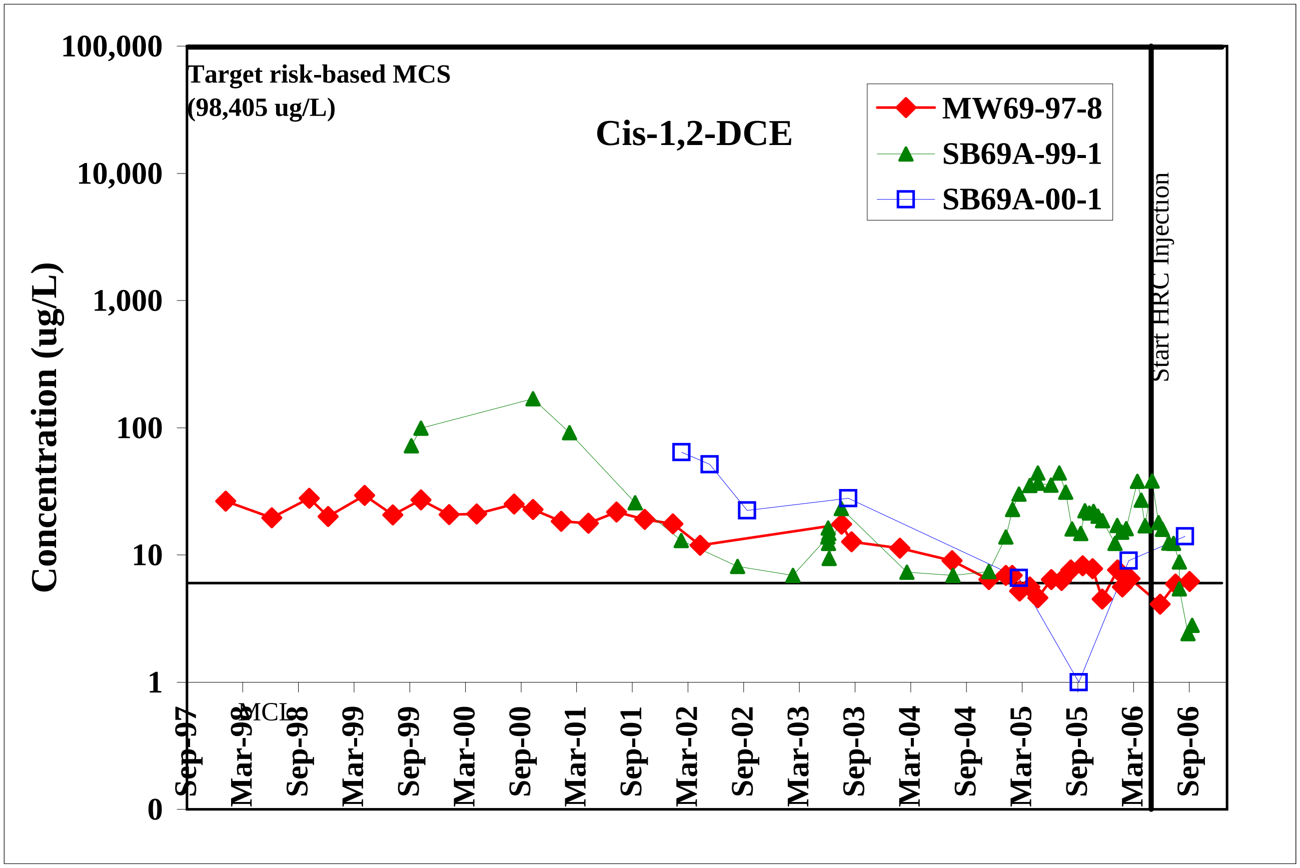


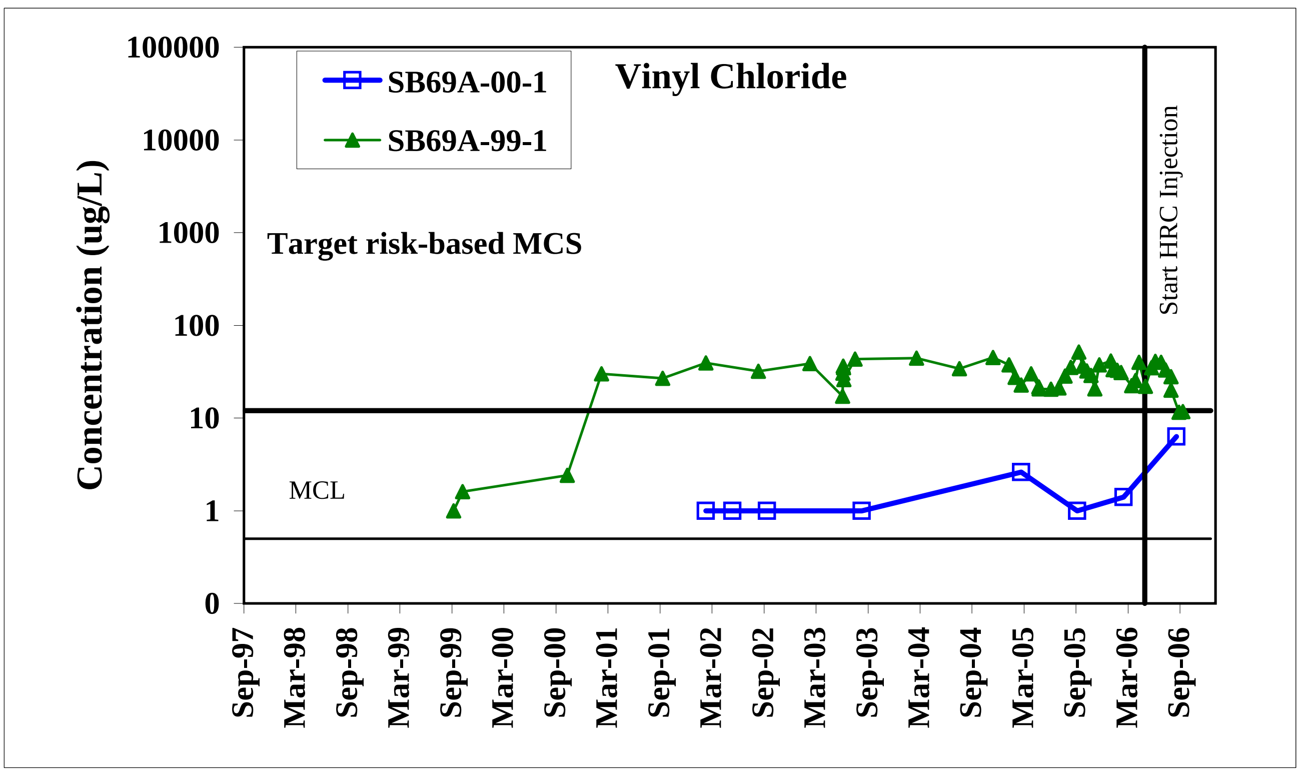


Figure 3.3-31. **Concentration Trends for VOCs, Building 69A Area of Groundwater Contamination.**

Appendix A

Soil Sampling Results

Table A-1
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
Target Risk-Based MCS for Institutional Land Use						1.3	7.9	38	50	0.45	2.3	0.0035	
MW51-97-16	BS-MW51-97-16-4.2	4.2	X	9/1/97	BC	<0.005	<0.005	0.0083	<0.005	0.0058	0.012	<0.005	
	BS-MW51-97-16-8.8	8.8	X			<0.005	<0.005	0.035	<0.005	<0.005	0.019	<0.005	
	BS-MW51-97-16-14	14.0	X			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51-97-16-23.7	**23.7**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51-97-16-34	**34.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
MW51A-01-8A	**BS-MW51A-01-8A-17.5**	**17.5**		9/1/01	BC	<0.005	<0.005	<0.005	<0.005	**0.041**	**0.33**	<0.005	**Hexachlorobutadiene = 0.043**
MW51A-01-10A	**BS-MW51A-01-10A-2.8**	**2.8**		10/3/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51A-01-10A-7.8	**7.8**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51A-01-10A-17.7	**17.7**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51A-01-10A-27.5	**27.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
MW51A-01-11	**BS-MW51A-01-11-2.7**	**2.7**		9/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	**0.050**	<0.005	
	BS-MW51A-01-11-4.2	**4.2**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.018**	<0.005	
	BS-MW51A-01-11-9.7	**9.7**				<0.005	<0.005	**0.012**	<0.005	<0.005	**0.025**	<0.005	
	BS-MW51A-01-11-19.9	**19.9**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0072**	<0.005	
	BS-MW51A-01-11-29.9	**29.9**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0088**	<0.005	
	BS-MW51A-01-11-39.8	**39.8**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0064**	<0.005	
MW51L-01-1	**BS-MW51L-01-1-2.7**	**2.7**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	**0.021**	<0.005	
	BS-MW51L-01-1-4.1	**4.1**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0086**	<0.005	
	BS-MW51L-01-1-9	**9.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-1-14.2	**14.2**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-1-23.5	**23.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
MW51L-01-3	BS-MW51L-01-3-2.5	2.5	X	12/1/01	BC	0.0064	<0.005	0.031	<0.005	0.021	0.16	<0.005	
	BS-MW51L-01-3-5.7	5.7	X			0.18	0.07	3.1	0.18	0.02	5*	<0.005	
	BS-MW51L-01-3-11	11.0	X			0.011	0.0057	0.3	0.06	0.46*	1.4	<0.005	
	BS-MW51L-01-3-16	16.0	X			0.04	0.0079	0.36	0.16	<0.005	<0.005	<0.005	
	BS-MW51L-01-3-20.8	**20.8**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-3-25.4	**25.4**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-3-30.2	**30.2**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-3-40	**40.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-3-50	**50.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**Benzene = 0.0053**
MW51L-01-4	BS-MW51L-01-4-2.4	2.4	X	7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-4-4.1	4.1	X			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-4-8.6	8.6	X			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-4-14	14.0	X			0.016	0.011	0.16	0.14	0.070	2.2	<0.005	
	BS-MW51L-01-4-24.5	**24.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-4-33.8	**33.8**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-4-43.7	**43.7**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	1.3	7.9	38	50	0.45	2.3	0.0035	
MW51L-01-5	**BS-MW51L-01-5-4.5**	**4.5**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-5-10	**10.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-5-20	**20.0**			BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-5-30	**30.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-5-40	**40.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-5-50	**50.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-5-59.5	**59.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
MW51L-01-7	**BS-MW51L-01-7-35.5**	**35.5**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-7-43	**43.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-7-53	**53.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-01-7-62.5	**62.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
MW51L-02-1	**BS-MW51L-02-1-24.8**	**24.8**		1/11/02	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW51L-02-1-29.3	**29.3**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51A-01-8	**BS-MW51A-01-8-2.3**	**2.3**		8/1/01	BC	<0.005	<0.005	<0.005	<0.005	**0.052**	**0.042**	<0.005	
	BS-MW51A-01-8-3.7	**3.7**				<0.005	<0.005	<0.005	<0.005	**0.083**	**0.065**	<0.005	
	BS-MW51A-01-8-5.5	**5.5**				<0.005	<0.005	<0.005	<0.005	**0.076**	**0.088**	<0.005	
	BS-MW51A-01-8-6.8	**6.8**				<0.005	<0.005	<0.005	<0.005	**0.008**	**0.012**	<0.005	
	BS-MW51A-01-8-8.9	**8.9**				<0.005	<0.005	**0.032**	**0.0069**	<0.005	**0.031**	<0.005	
	BS-MW51A-01-8-9.7	**9.7**				<0.005	<0.005	**0.18**	**0.040**	<0.005	**0.23**	<0.005	
	BS-MW51A-01-8-11	**11.0**				<0.005	<0.005	**0.13**	**0.025**	<0.005	**0.16**	<0.005	
	BS-MW51A-01-8-14.6	**14.6**				<0.005	<0.005	**0.023**	<0.005	**0.025**	**0.22**	<0.005	
SB51A-01-8B	**BS-SB51A-01-8B-19.5**	**19.5**	X	6/24/02	BC	<0.005	<0.005	0.034	<0.005	0.011	0.71	<0.005	
	BS-SB51A-01-8B-24.5	**24.5**	X			<0.005	<0.005	<0.005	<0.005	<0.005	1.3	<0.005	
	BS-SB51A-01-8B-29.5	**29.5**	X			<0.005	<0.005	<0.005	<0.005	<0.005	0.076	<0.005	
	BS-SB51A-01-8B-34.5	**34.5**	X			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51A-01-8B-39.5	**39.5**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0058**	<0.005	
SB51A-01-10	**BS-MW51A-01-10-2.9**	**2.9**		8/1/01	BC	<0.005	<0.005	<0.005	<0.005	**0.010**	**0.0097**	<0.005	
	BS-MW51A-01-10-4.5	**4.5**				<0.005	<0.005	<0.005	<0.005	**0.015**	**0.035**	<0.005	
	BS-MW51A-01-10-9	**9.0**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.015**	<0.005	
SB51L-99-1	BS-SB51L-99-1-3.2	3.2	X	10/1/99	BC	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	<0.005	
	BS-SB51L-99-1-6	6.0	X			<0.01	<0.01	0.043	<0.01	0.31	0.25	<0.01	
	BS-SB51L-99-1-10.5	10.5	X			<0.005	<0.005	0.028	<0.005	0.11	0.42	<0.005	
	BS-SB51L-99-1-15.4	**15.4**				<0.005	<0.005	**0.015**	<0.005	<0.005	**0.0051**	<0.005	
	BS-SB51L-99-1-20.5	**20.5**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.011**	<0.005	
	BS-SB51L-99-1-25.5	**25.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-99-1-30.1	**30.1**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-99-1-34.6	**34.6**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	

Table A1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	**1.3**	**7.9**	**38**	**50**	**0.45**	**2.3**	**0.0035**	
SB51L-01-5	BS-SB51L-01-5-5	5.0	X	5/1/01	CLS	0.1	0.05	0.43	0.0066	<0.005	0.019	<0.005	
	BS-SB51L-01-5-8.6	8.6	X			<0.005	<0.005	0.024	0.0072	<0.005	0.16	<0.005	p- & m-xylenes=0.0053
	BS-SB51L-01-5-12.5	12.5	X			0.023	0.0057	0.19	0.036	<0.005	0.83	<0.005	
	BS-SB51L-01-5-16.5	16.5	X			0.018	0.0059	0.12	0.064	<0.005	0.47	<0.005	
	BS-SB51L-01-5-18.8	18.8	X			<0.005	<0.005	0.02	<0.005	<0.005	<0.005	<0.005	
SB51L-01-6	BS-SB51L-01-6-3.5	3.5	X	5/1/01	BC	0.0061	<0.005	0.040	0.028	0.13	0.51	<0.005	
	BS-SB51L-01-6-6.5	6.5	X			<0.005	<0.005	0.012	<0.005	0.22	0.10	<0.005	
	BS-SB51L-01-6-9.5	9.5	X			<0.005	<0.005	0.054	0.0052	1.9*	0.97	<0.005	
	BS-SB51L-01-6-13.5	13.5	X			0.013	<0.005	0.035	0.039	0.052	0.69	<0.005	
	BS-SB51L-01-6-17.5	17.5	X			0.026	<0.005	0.036	0.026	<0.005	0.063	<0.005	
	BS-SB51L-01-6-22.7	**22.7**				**0.011**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-7	BS-SB51L-01-7-3.5	3.5	X	5/1/01	BC	<0.005	<0.005	0.014	<0.005	0.44	0.45	<0.005	
	BS-SB51L-01-7-6.5	6.5	X			<0.005	0.0084	0.0084	<0.005	4.9*	1.5	<0.005	
	BS-SB51L-01-7-9.5	9.5	X			0.012	0.0076	0.063	0.12	0.099	1.3	<0.005	
	BS-SB51L-01-7-13.5	13.5	X			<0.005	<0.005	0.014	0.010	0.042	0.12	<0.005	
	BS-SB51L-01-7-17.5	**17.5**				**0.016**	<0.005	**0.018**	**0.016**	<0.005	**0.034**	<0.005	
	BS-SB51L-01-7-22.1	**22.1**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-8	**BS-SB51L-01-8-2**	**2.0**		5/1/01	CLS	<0.005	<0.005	<0.005	<0.005	**0.008**	**0.005**	<0.005	
	BS-SB51L-01-8-5	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.011**	**0.0089**	<0.005	
	BS-SB51L-01-8-8.5	**8.5**				<0.005	<0.005	**0.006**	<0.005	**0.021**	**0.023**	<0.005	
	BS-SB51L-01-8-12.5	**12.5**				<0.005	<0.005	**0.018**	**0.007**	<0.005	**0.018**	<0.005	
	BS-SB51L-01-8-16.5	**16.5**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0062**	<0.005	
	BS-SB51L-01-8-18.3	18.3				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-9	BS-SB51L-01-9-2	2.0	X	5/1/01	CLS	0.009	<0.005	0.041	<0.005	0.19	0.59	<0.005	
	BS-SB51L-01-9-5	5.0	X			0.044	0.0087	0.55	0.034	0.25	3.6*	<0.005	
	BS-SB51L-01-9-8.5	8.5	X			0.0054	<0.005	0.18	0.0073	0.29	0.73	<0.005	
	BS-SB51L-01-9-12.5	12.5	X			<0.005	<0.005	0.028	<0.005	0.18	0.51	<0.005	p- & m-xylenes=0.0052
	BS-SB51L-01-9-16.5	16.5	X			<0.005	<0.005	0.012	<0.005	0.009	0.24	<0.005	
	BS-SB51L-01-9-20.5	20.5				<0.005	<0.005	**0.1**	**0.044**	<0.005	**0.029**	<0.005	**toluene=0.0059** **1,2,4-Trimethylbenzene=0.0064** **p- & m-xylenes=0.0097**
SB51L-01-10	BS-SB51L-01-10-3.5	3.5	X	5/1/01	BC	0.0066	<0.005	0.016	<0.005	0.38	0.51	<0.005	
	BS-SB51L-01-10-6.5	6.5	X			<0.005	<0.005	<0.005	<0.005	0.34	0.20	<0.005	
	BS-SB51L-01-10-9.5	9.5	X			0.021	0.025	0.13	0.029	0.17	3.1*	<0.005	
	BS-SB51L-01-10-13.5	13.5	X			0.016	<0.005	0.038	0.048	<0.005	0.053	<0.005	
	BS-SB51L-01-10-17.5	**17.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-10-20.6	**20.6**				**0.0054**	<0.005	**0.0052**	<0.005	<0.005	**0.0056**	<0.005	
SB51L-01-11	**BS-SB51L-01-11-2**	**2.0**		5/1/01	BC	**0.048**	**0.035**	<0.005	<0.005	<0.005	<0.005	<0.005	**Naphthalene=0.0077**
	BS-SB51L-01-11-5	**5.0**				**0.024**	**0.013**	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-11-8	**8.0**				**0.088**	**0.074**	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-11-12	**12.0**				**0.014**	**0.0064**	**0.012**	**0.0075**	<0.005	**0.048**	<0.005	
	BS-SB51L-01-11-16	**16.0**				**0.023**	**0.0095**	**0.005**	<0.005	<0.005	**0.039**	<0.005	
	BS-SB51L-01-11-20	**20.0**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.010**	<0.005	
	BS-SB51L-01-11-23.3	**23.3**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

						1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	**1.3**	**7.9**	**38**	**50**	**0.45**	**2.3**	**0.0035**	
Location	Sample ID	Depth	**Excavated**	Date	Lab								
SB51L-01-12	BS-SB51L-01-12-3.5	3.5	X	5/1/01	BC	<0.005	<0.005	0.0059	<0.005	2*	0.45	<0.005	
	BS-SB51L-01-12-6.7	6.7	X			<0.005	<0.005	0.099	<0.005	2.3*	0.96	<0.005	
	BS-SB51L-01-12-9.5	9.5	X			<0.005	<0.005	0.049	<0.005	5*	1.3	<0.005	
	BS-SB51L-01-12-13.5	13.5	X			0.0057	0.0064	0.12	0.019	1.1*	3.1*	<0.005	
	BS-SB51L-01-12-17.5	17.5	X			0.80	0.029	0.40	0.45	0.0076	1.0	<0.005	
	BS-SB51L-01-12-19.2	19.2	X			0.09	0.03	0.52	0.45	<0.005	0.01	0.01	
SB51L-01-13	BS-SB51L-01-13-2	2.0	X	5/1/01	CLS	<0.005	<0.005	<0.005	<0.005	0.023	0.0097	<0.005	
	BS-SB51L-01-13-5	5.0	X			<0.005	<0.005	<0.005	<0.005	0.037	0.018	<0.005	
	BS-SB51L-01-13-8.5	8.5	X			<0.005	<0.005	0.18	0.0081	0.2	0.4	<0.005	
	BS-SB51L-01-13-12.5	12.5	X			<0.005	<0.005	0.037	0.0068	0.026	0.52	<0.005	
	BS-SB51L-01-13-16.6	16.6				<0.005	<0.005	**0.24**	**0.059**	<0.005	<0.005	<0.005	
SB51L-01-14	BS-SB51L-01-14-4	4.0	X	5/1/01	BC	<0.005	<0.005	<0.005	<0.005	0.072	0.021	<0.005	
	BS-SB51L-01-14-6.4	6.4	X			<0.005	<0.005	0.014	<0.005	0.19	0.076	<0.005	
	BS-SB51L-01-14-9.5	9.5	X			<0.005	<0.005	0.12	<0.005	1.6*	0.86	<0.005	
	BS-SB51L-01-14-13.5	13.5	X			<0.005	<0.005	0.066	0.0056	0.66*	0.90	<0.005	
	BS-SB51L-01-14-17.5	17.5	X			0.096	0.027	0.4	0.33	<0.005	<0.005	<0.005	
	BS-SB51L-01-14-23.1	**23.1**				<0.005	<0.005	**0.057**	**0.034**	<0.005	<0.005	<0.005	
SB51L-01-15	BS-SB51L-01-15-3.5	3.5	X	5/1/01	BC	0.085	0.026	0.16	0.028	0.063	1.4	<0.005	
	BS-SB51L-01-15-6.5	6.5	X			0.038	0.0082	0.073	0.020	0.038	1.4	<0.005	
	BS-SB51L-01-15-9.5	9.5	X			0.013	<0.005	0.042	0.025	0.020	0.054	<0.005	
	BS-SB51L-01-15-13.5	13.5	X			0.013	<0.005	0.013	0.0067	<0.005	0.032	<0.005	
	BS-SB51L-01-15-17.5	**17.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-15-21.5	**21.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-15-23.4	**23.4**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-16	BS-SB51L-01-16-2	2.0	X	5/1/01	CLS	<0.005	<0.005	<0.005	<0.005	0.054	0.021	<0.005	
	BS-SB51L-01-16-5	5.0	X			<0.005	<0.005	0.014	<0.005	0.28	0.23	<0.005	
	BS-SB51L-01-16-8.5	2.0	X			0.045	0.0068	0.23	0.0095	0.58*	2.6*	<0.005	
	BS-SB51L-01-16-12.5	12.5	X			<0.005	<0.005	0.024	<0.005	0.012	0.23	<0.005	
	BS-SB51L-01-16-16.5	**16.5**				<0.005	<0.005	**0.11**	**0.011**	<0.005	<0.005	<0.005	
SB51L-01-17	BS-SB51L-01-17-3.5	3.5	X	5/1/01	BC	<0.005	<0.005	<0.005	<0.005	0.028	0.0059	<0.005	
	BS-SB51L-01-17-5	5.0	X			<0.005	<0.005	<0.005	<0.005	0.093	0.022	<0.005	
	BS-SB51L-01-17-5.8	5.8	X			<0.005	<0.005	0.046	<0.005	2*	0.48	<0.005	
SB51L-01-18	BS-SB51L-01-18-2.5	2.5	X	5/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-18-5.5	5.5	X			<0.005	<0.005	0.027	<0.005	0.18	0.25	<0.005	
	BS-SB51L-01-18-8.5	8.5	X			0.011	<0.005	0.16	0.023	0.51*	1.2	<0.005	
	BS-SB51L-01-18-12.5	12.5	X			0.012	<0.005	0.15	0.080	0.013	0.50	<0.005	
	BS-SB51L-01-18-16.5	16.5	X			0.08	0.026	0.48	0.13	<0.005	0.62	<0.005	
	BS-SB51L-01-18-21.5	**21.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	1.3	7.9	38	50	0.45	2.3	0.0035	
SB51L-01-19	**BS-SB51L-01-19-2.5**	**2.5**		5/1/01	BC	**0.024**	<0.005	**0.040**	<0.005	**0.075**	**0.41**	<0.005	**1,1,1-TCA=0.0084**
	BS-SB51L-01-19-5	**5.0**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.027**	<0.005	
	BS-SB51L-01-19-8	**8.0**				**0.0059**	<0.005	**0.0076**	<0.005	**0.01**	**0.061**	<0.005	
	BS-SB51L-01-19-12.5	**12.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-19-16	**16.0**				**0.0066**	<0.005	<0.005	<0.005	<0.005	**0.024**	<0.005	
	BS-SB51L-01-19-20	**20.0**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.029**	<0.005	
	BS-SB51L-01-19-22.1	**22.1**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-20	BS-SB51L-01-20-2	2.0	X	5/1/01	CLS	<0.005	<0.005	<0.005	<0.005	0.032	0.0058	<0.005	
	BS-SB51L-01-20-4.8	4.8	X			<0.005	<0.005	0.095	<0.005	0.095	0.18	<0.005	
	BS-SB51L-01-20-8.5	8.5	X			<0.005	<0.005	0.18	<0.005	0.18	0.52	<0.005	
SB51L-01-21	BS-SB51L-01-21-5.5	5.5	X	5/1/01	BC	<0.005	<0.005	0.012	<0.005	0.012	0.014	<0.005	
	BS-SB51L-01-21-8.5	8.5	X			<0.005	<0.005	0.029	<0.005	0.080	0.065	<0.005	
	BS-SB51L-01-21-12.5	12.5	X			<0.005	<0.005	0.028	<0.005	0.19	0.13	<0.005	
	BS-SB51L-01-21-17	**17.0**				**0.047**	**0.0051**	**0.68**	**0.12**	<0.005	**0.0095**	<0.005	
SB51L-01-22	**BS-SB51L-01-22-2**	**2.0**		5/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	**0.0053**	<0.005	
	BS-SB51L-01-22-3.5	**3.5**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.0074**	<0.005	
	BS-SB51L-01-22-8	**8.0**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.014**	<0.005	
	BS-SB51L-01-22-12	**12.0**				<0.005	<0.005	**0.018**	<0.005	**0.016**	**0.12**	<0.005	
	BS-SB51L-01-22-17	**17.0**				<0.005	<0.005	**0.019**	<0.005	<0.005	**0.094**	<0.005	
	BS-SB51L-01-22-20.5	**20.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-23	BS-SB51L-01-23-1.8	1.8	X	5/1/01	BC	<0.005	<0.005	<0.005	<0.005	0.030	0.017	<0.005	
	BS-SB51L-01-23-4.8	4.8	X			<0.005	<0.005	0.0086	<0.005	0.098	0.066	<0.005	
	BS-SB51L-01-23-8.5	8.5	X			<0.005	<0.005	0.026	<0.005	0.11	0.16	<0.005	
	BS-SB51L-01-23-13.3	**13.3**				<0.005	<0.005	**0.31**	**0.076**	<0.005	**0.018**	<0.005	
SB51L-01-24	**BS-SB51L-01-24-2**	**2.0**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-24-8.5	**8.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-24-12	**12.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-24-16.5	**16.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-24-20.5	**20.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-24-24.5	**24.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-25	**BS-SB51L-01-25-2**	**2.0**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-25-5	**5.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-25-8.5	**8.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**1,1,1-TCA=0.0067**
	BS-SB51L-01-25-12.5	**12.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-25-16.5	**16.5**				**0.028**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-25-18.7	**18.7**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-26	BS-SB51L-01-26-2	2.0	X	7/1/01	BC	0.022	<0.005	0.0068	0.016	<0.005	<0.005	<0.005	
	BS-SB51L-01-26-5	5.0	X			0.021	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

						1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	**1.3**	**7.9**	**38**	**50**	**0.45**	**2.3**	**0.0035**	
Location	Sample ID	Depth	**Excavated**	Date	Lab								
SB51L-01-26	BS-SB51L-01-26-8.5	8.5	X	7/1/01	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-26-12.5	12.5	X			0.021	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-26-16.5	16.5	X			0.028	0.0098	0.020	0.020	<0.005	0.043	<0.005	
	BS-SB51L-01-26-19.2	**19.2**				**0.03**	<0.005	**0.090**	**0.035**	<0.005	<0.005	<0.005	
SB51L-01-27	**BS-SB51L-01-27-2**	**2.0**		7/1/01	BC	**0.022**	<0.005	**0.050**	**0.021**	<0.005	**0.042**	<0.005	
	BS-SB51L-01-27-5	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.006**	**0.007**	<0.005	
	BS-SB51L-01-27-8.5	**8.5**				**0.022**	<0.005	**0.028**	**0.025**	**0.016**	**0.070**	<0.005	
	BS-SB51L-01-27-12.5	**12.5**				**0.021**	<0.005	**0.011**	**0.018**	**0.009**	**0.032**	<0.005	
	BS-SB51L-01-27-16.5	**16.5**				**0.020**	<0.005	<0.005	**0.015**	<0.005	**0.0057**	<0.005	
	BS-SB51L-01-27-20.5	**20.5**				**0.022**	<0.005	<0.005	<0.005	<0.005	**0.0091**	<0.005	
	BS-SB51L-01-27-25	**25.0**				<0.005	<0.005	<0.005	**0.016**	<0.005	<0.005	<0.005	
SB51L-01-28	**BS-SB51L-01-28-2**	**2.0**		7/1/01	BC	**0.021**	<0.005	**0.026**	**0.020**	**0.33**	**1.3**	<0.005	
	BS-SB51L-01-28-8.5	**8.5**				<0.005	<0.005	<0.005	**0.015**	**0.043**	**0.17**	<0.005	
	BS-SB51L-01-28-12.5	**12.5**				<0.005	<0.005	**0.005**	**0.015**	<0.005	<0.005	<0.005	
SB51L-01-29	**BS-SB51L-01-29-2**	**2.0**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	**0.038**	**0.0081**	<0.005	**Toluene=0.0055**
	BS-SB51L-01-29-4.5	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.018**	**0.015**	<0.005	
	BS-SB51L-01-29-8.5	**8.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-30	**BS-SB51L-01-30-2**	**2.0**		7/1/01	BC	<0.005	<0.005	<0.005	<0.005	**0.025**	**0.010**	<0.005	
	BS-SB51L-01-30-5	**4.5**				<0.005	<0.005	<0.005	<0.005	**0.083**	**0.035**	<0.005	
	BS-SB51L-01-30-8.5	**8.5**				<0.005	<0.005	**0.16**	**0.036**	**0.082**	**0.38**	<0.005	
	BS-SB51L-01-30-12.5	**12.5**				<0.005	<0.005	**0.12**	**0.026**	**0.019**	**0.068**	<0.005	
	BS-SB51L-01-30-14	**14.0**				<0.005	<0.005	**0.0054**	<0.005	<0.005	<0.005	<0.005	
SB51L-02-1	**BS-SB51L-02-1-2.6**	**2.6**		1/11/02	BC	<0.005	<0.005	<0.005	<0.005	**0.027**	**0.012**	<0.005	**Toluene=0.015, Xylenes=0.01**
	BS-SB51L-02-1-5.6	**5.6**				<0.005	<0.005	**0.017**	<0.005	**0.067**	**0.26**	<0.005	**Toluene=0.013, Xylenes=0.01**
	BS-SB51L-02-1-11.6	**11.6**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-04-1	BS-SB51L-04-1-2	2.0	X	3/5/04	BC	<0.005	<0.005	0.027	<0.005	0.0086	0.14	<0.005	
	BS-SB51L-04-1-5	5.0	X			0.03	0.014	1.9	0.2	0.0083	0.79	<0.005	Toluene = 0.0094
	BS-SB51L-04-1-8.9	8.9	X			<0.005	<0.005	0.1	0.02	0.37	0.67	<0.005	
	BS-SB51L-04-1-12.2	12.2	X			0.0051	<0.005	0.13	0.018	1.1*	1.8	<0.005	
	BS-SB51L-04-1-16.5	16.5	X			0.038	<0.005	0.34	0.3	0.06	1.3	<0.005	
SB51L-04-2	BS-SB51L-04-2-2.3	2.3	X	3/5/04	BC	<0.005	<0.005	0.019	0.011	<0.005	0.1	<0.005	
	BS-SB51L-04-2-5	5.0	X			<0.005	<0.005	0.012	0.0063	<0.005	0.12	<0.005	
	BS-SB51L-04-2-8.8	8.8	X			0.017	0.0067	0.051	0.0066	0.025	1.3	<0.005	
	BS-SB51L-04-2-12.5	12.5	X			0.012	<0.005	0.08	0.0076	0.048	0.65	<0.005	
	BS-SB51L-04-2-16.5	16.5	X			0.012	0.0069	0.14	0.031	<0.005	1.3	<0.005	
	BS-SB51L-04-2-20.5	20.5	X			0.062	0.015	0.16	0.06	<0.005	0.25	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

						1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
Target Risk-Based MCS for Institutional Land Use						**1.3**	**7.9**	**38**	**50**	**0.45**	**2.3**	**0.0035**	
Location	Sample ID	Depth	**Excavated**	Date	Lab								
SB51L-00-1	BS-SB51L-00-1-9.5	9.5	X	9/1/00	BC	0.019	<0.005	0.36	0.077	0.041	0.73	<0.005	
	BS-SB51L-00-1-15	15.0	X			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-00-1-20.4	**20.4**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-00-1-25	**25.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-00-1-29.5	**29.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-00-2	BS-SB51L-00-2-2.7	2.7	X	9/1/00	BC	<0.005	<0.005	0.012	<0.005	0.018	0.25	<0.005	
	BS-SB51L-00-2-3.6	3.6	X			<0.005	<0.005	0.025	0.0057	1.4*	1.1	<0.005	
	BS-SB51L-00-2-5.6	5.6	X			<0.005	<0.005	0.049	0.0053	1.3*	1.3	<0.005	
	BS-SB51L-00-2-8.5	8.5	X			<0.005	<0.005	0.058	0.0092	21*	24*	<0.005	
SB51L-00-2	BS-SB51L-00-2-14	14.0	X	9/1/00	BC	<0.03	<0.03	0.075	<0.03	0.42	10*	<0.03	
	BS-SB51L-00-2-18.5	18.5	X			0.0099	<0.005	0.051	0.029	<0.005	0.0065	<0.005	
	BS-SB51L-00-2-24.5	**24.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-00-2-29.2	**29.2**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-00-2-34.5	**34.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**Ethylbenzene=0.0076**
SB51L-01-1	BS-SB51L-01-1-3	3.0	X	5/1/01	BC	0.013	<0.005	0.018	<0.005	0.026	0.28	<0.005	1,1,1-TCA=0.019
	BS-SB51L-01-1-5	5.0	X			<0.005	<0.005	<0.005	<0.005	<0.005	0.021	<0.005	
	BS-SB51L-01-1-8.5	8.5	X			<0.005	<0.005	0.018	<0.005	0.056	0.30	<0.005	1,1,1-TCA=0.0069
	BS-SB51L-01-1-12.7	**12.7**				<0.005	<0.005	**0.0073**	<0.005	<0.005	**0.0097**	<0.005	
	BS-SB51L-01-1-16.5	**16.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-1-20.5	**20.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-1-24.5	**24.5**				<0.005	<0.005	**0.0095**	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-1-27.3	**27.3**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-2	BS-SB51L-01-2-2.5	2.5	X	5/1/01	BC	<0.005	<0.005	0.012	<0.005	0.13	0.19	<0.005	
	BS-SB51L-01-2-5	5.0	X			<0.005	<0.005	<0.005	<0.005	0.079	0.055	<0.005	
	BS-SB51L-01-2-8.5	8.5	X			<0.005	<0.005	0.094	0.018	<0.005	<0.005	<0.005	
	BS-SB51L-01-2-13.2	**13.2**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-2-16.5	**16.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-2-20.5	**20.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-2-24.5	**24.5**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-01-2-27.2	**27.2**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-3	BS-SB51L-01-3-2.3	2.3	X	5/1/01	CLS	<0.005	<0.005	<0.005	0.032	0.023	0.023	<0.005	
	BS-SB51L-01-3-5	5.0	X			0.1	0.029	0.17	0.036	<0.005	0.55	<0.005	
	BS-SB51L-01-3-8.5	8.5	X			0.087	0.016	0.11	0.032	0.015	0.79	<0.005	
	BS-SB51L-01-3-12.5	12.5	X			0.012	0.0066	0.066	0.012	0.34	0.34	<0.005	
	BS-SB51L-01-3-16.5	16.5	X			0.016	<0.005	0.040	0.017	0.005	0.49	<0.005	
	BS-SB51L-01-3-20.5	20.5	X			0.12	0.036	0.37	0.087	0.021	0.83	0.0056	
	BS-SB51L-01-3-23.3	**23.3**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB51L-01-4	BS-SB51L-01-4-3.5	3.5	X	5/1/01	BC	<0.005	<0.005	0.015	<0.005	0.0051	0.083	<0.005	
	BS-SB51L-01-4-6.5	6.5	X			<0.005	<0.005	0.078	0.0079	2.1*	1.8	<0.005	
	BS-SB51L-01-4-9.5	9.5	X			<0.005	<0.005	<0.005	<0.005	0.0075	0.058	<0.005	
	BS-SB51L-01-4-13.5	13.5	X			<0.005	<0.005	0.014	<0.005	0.037	0.094	<0.005	
	BS-SB51L-01-4-17.5	17.5	x			0.0098	<0.005	0.022	0.0087	0.030	0.21	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	1.3	7.9	38	50	0.45	2.3	0.0035	
51L-05-1	BS-SB51L-05-1-2	2.0	X	6/1/05	BC	0.074	<0.005	0.046	<0.005	<0.005	0.0055	<0.005	
	BS-SB51L-05-1-5.3	5.3	X			<0.005	<0.005	0.026	0.0084	0.013	0.14	<0.005	
	BS-SB51L-05-1-8.5	8.5	X			<0.005	<0.005	0.017	0.0056	0.018	0.14	<0.005	
	BS-SB51L-05-1-11	11.0	X			0.0056	<0.005	0.024	0.011	0.012	0.066	<0.005	
	BS-SB51L-05-1-13.9	13.9	X			0.018	<0.005	0.027	0.017	0.036	0.33	<0.005	
	BS-SB51L-05-1-17	**17.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
51L-05-2	**BS-SB51L-05-2-2**	**2.0**		6/1/05	BC	<0.005	<0.005	**0.017**	<0.005	**0.042**	**0.13**	<0.005	
	BS-SB51L-05-2-5	**5.0**				<0.005	<0.005	**0.057**	**0.016**	<0.005	**0.14**	<0.005	
	BS-SB51L-05-2-8.5	**8.5**				<0.005	<0.005	**0.082**	**0.029**	<0.027	**0.044**	<0.005	
51L-05-3	**BS-SB51L-05-3-2**	**2.0**		6/1/05	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-3-5	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.013**	**0.042**	<0.005	
	BS-SB51L-05-3-9	**9.0**				<0.005	<0.005	**0.058**	**0.027**	<0.005	**0.15**	<0.005	
	BS-SB51L-05-3-12	**12.0**				<0.005	<0.005	**0.013**	<0.005	<0.005	**0.02**	<0.005	
	BS-SB51L-05-3-17.5	**17.5**				<0.005	<0.005	**0.018**	<0.005	<0.005	**0.0076**	<0.005	
	BS-SB51L-05-3-22.2	**22.2**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-3-26	**26.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
51L-05-4	**BS-SB51L-05-4-2.5**	**2.5**		6/1/05	BC	<0.005	<0.005	**0.0067**	<0.005	<0.005	**0.025**	<0.005	
	BS-SB51L-05-4-5	**5.0**				<0.005	<0.005	**0.012**	<0.005	**0.012**	**0.097**	<0.005	
	BS-SB51L-05-4-8.5	**8.5**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.03**	<0.005	
	BS-SB51L-05-4-13.4	**13.4**				<0.005	<0.005	**0.093**	**0.0098**	<0.005	**0.052**	<0.005	
51L-05-5	**BS-SB51L-05-1-2.5**	**2.5**		6/1/05	BC	<0.005	<0.005	<0.005	<0.005	**0.052**	**0.025**	<0.005	
	BS-SB51L-05-1-4.5	**4.5**				<0.005	<0.005	**0.034**	<0.005	**0.22**	**0.14**	<0.005	
51L-05-6	**BS-SB51L-05-6-2**	**2.0**		6/1/05	BC	<0.005	<0.005	<0.005	<0.005	**0.023**	<0.005	<0.005	
	BS-SB51L-05-6-5	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.017**	<0.005	<0.005	
	BS-SB51L-05-6-8.5	**8.5**				<0.005	<0.005	<0.005	<0.005	**0.02**	**0.0051**	<0.005	
51L-05-7	BS-SB51L-05-7-2	2.0	X	6/1/05	BC	<0.005	<0.005	<0.005	<0.005	0.068	0.1	<0.005	1,1,1-TCA=0.0068
	BS-SB51L-05-7-5	5.0	X			<0.005	<0.005	<0.005	<0.005	0.075	0.2	<0.005	1,1,1-TCA=0.025
	BS-SB51L-05-7-8.2	8.2	X			0.017	0.01	<0.005	<0.005	<0.005	0.021	<0.005	1,1,1-TCA=0.021
	BS-SB51L-05-7-12.5	12.5	X			0.016	0.012	<0.005	<0.005	0.0057	0.058	<0.005	1,1,1-TCA=0.04
	BS-SB51L-05-7-16.2	16.2	X			0.0054	0.0098	0.032	0.0056	<0.005	<0.005	<0.005	
51L-05-8	BS-SB51L-05-8-12.5	12.5	X	6/1/05	BC	0.11	0.049	0.28	0.13	0.047	2.6*	<0.005	
	BS-SB51L-05-8-14.2	14.2	X			0.014	0.011	0.16	0.14	0.013	0.15	<0.005	
	BS-SB51L-05-8-16.3	16.3	X			0.013	0.01	0.17	0.19	0.0077	0.27	<0.005	
51L-05-9	BS-SB51L-05-9-2	2.0	X	6/1/05	BC	0.038	0.015	0.18	0.097	<0.005	0.19	<0.005	
	BS-SB51L-05-9-5	5.0	X			0.027	0.014	0.17	0.051	1.1*	3.1*	<0.005	
	BS-SB51L-05-9-8.5	8.5	X			<0.005	<0.005	0.0062	<0.005	0.18	0.13	<0.005	
	BS-SB51L-05-9-12.2	12.2	X			<0.005	<0.005	0.025	0.0065	0.36	0.55	<0.005	
	BS-SB51L-05-9-18	**18.0**				**0.0093**	<0.005	**0.16**	**0.063**	<0.005	**0.087**	<0.005	
	BS-SB51L-05-9-21	**21.0**				**0.007**	<0.005	**0.069**	**0.027**	<0.005	**0.065**	<0.005	

Table A-1 (Continued)
Pre-Excavation Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
	Target Risk-Based MCS for Institutional Land Use					**1.3**	**7.9**	**38**	**50**	**0.45**	**2.3**	**0.0035**	
51L-05-10	**BS-SB51L-05-10-2**	**2.0**		7/5/05	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-10-5	**5.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-10-8	**8.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-10-11	**11.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-10-14	**14.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-10-17	**17.0**				<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
51L-05-11	**BS-SB51L-05-11-9**	**9.0**		7/5/05	BC	<0.005	<0.005	**0.083**	**0.011**	**0.014**	**0.14**	<0.005	
51l-05-12	**BS-SB51L-05-12-2**	**2.0**		7/5/05	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-12-5	**5.0**				<0.005	<0.005	**<0.005**	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-12-8	**8.0**				<0.005	<0.005	**0.0064**	<0.005	<0.005	<0.005	<0.005	
51L-05-13	**BS-SB51L-05-13-3**	**3.0**		7/5/05	BC	**0.0079**	<0.005	**0.006**	<0.005	**0.027**	**0.33**	<0.005	
	BS-SB51L-05-13-8	**8.0**				<0.005	<0.005	**0.006**	<0.005	**0.099**	**0.13**	<0.005	
	BS-SB51L-05-13-11	**11.0**				<0.005	<0.005	**0.036**	**0.0076**	**0.011**	**0.086**	<0.005	
	BS-SB51L-05-13-14	**14.0**				**0.0088**	<0.005	**0.031**	**0.011**	**0.018**	**0.13**	<0.005	
	BS-SB51L-05-13-17	**17.0**				**0.0057**	<0.005	**0.025**	**0.008**	**0.018**	**0.12**	<0.005	
51L-05-14	**BS-SB51L-05-14-8.5**	**8.5**		7/5/05	BC	<0.005	<0.005	<0.005	<0.005	**0.016**	**0.008**	<0.005	
51L-05-15	**BS-SB51L-05-15-2**	**2.0**		7/5/05	BC	<0.005	<0.005	<0.005	<0.005	**0.009**	<0.005	<0.005	
	BS-SB51L-05-15-5	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.015**	**0.0054**	<0.005	
	BS-SB51L-05-15-7.5	**7.5**				<0.005	<0.005	<0.005	<0.005	**0.016**	**0.0061**	<0.005	
51L-05-16	BS-SB51L-05-16-14	14.0	X	7/5/05	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB51L-05-16-16	16.0	X			<0.005	<0.005	0.019	0.0084	<0.005	0.044	<0.005	
	BS-SB51L-05-16-17.5	17.5	X			<0.005	<0.005	0.064	0.036	0.0071	0.41	<0.005	
51L-05-17	BS-SB51L-05-17-10	10.0	X	7/5/05	BC	<0.005	<0.005	0.023	0.022	<0.005	0.04	<0.005	
	BS-SB51L-05-17-12	12.0	X			0.0056	<0.005	0.017	<0.005	0.63*	0.3	<0.005	xylenes=0.007
	BS-SB51L-05-17-14	14.0	X			<0.005	<0.005	0.021	0.01	<0.005	0.031	<0.005	
	BS-SB51L-05-17-16	16.0	X					0.017	0.0083	0.097	0.097	<0.005	
51L-05-18	BS-SB51L-05-18-10	10.0	X	7/5/05	BC	<0.005	<0.005	0.023	<0.005	0.15	0.073	<0.005	
SG51L-12	BS-SG51L-12-1	1.0	X	12/1/00	BC	<0.005	<0.005	<0.005	<0.005	<0.005	0.019	<0.005	
	BS-SG51L-12-2.5	2.5	X			<0.005	<0.005	0.0062	<0.005	0.039	0.11	<0.005	
SG51L-16	BS-SG51L-16-1	1.0	X	12/1/00	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SG51L-16-2.5	2.5	X			<0.005	<0.005	<0.005	<0.005	<0.005	0.020	<0.005	
SG51L-19	**BS-SG51L-19-1**	**1.0**		12/1/00	BC	<0.005	<0.005	<0.005	<0.005	**0.038**	**0.13**	<0.005	**1,1,1-TCA=0.017**
	BS-SG51L-19-2.5	**2.5**				**0.0068**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SG51L-20	**BS-SG51L-20-1**	**1.0**		12/1/00	BC	<0.005	<0.005	<0.005	<0.005	<0.005	**0.11**	<0.005	
	BS-SG51L-20-2.5	**2.5**				<0.005	<0.005	<0.005	<0.005	<0.005	**0.021**	<0.005	
SG51L-21	**BS-SG51L-21-1**	**1.0**		12/1/00	BC	<0.005	<0.005	<0.005	<0.005	**0.044**	**0.044**	<0.005	
	BS-SG51L-21-2.5	**2.5**				<0.005	<0.005	<0.005	<0.005	**0.022**	**0.023**	<0.005	
SG51L-22	BS-SG51L-22-1	1.0	X	12/1/00	BC	<0.005	<0.005	0.0095	<0.005	0.018	0.058	<0.005	
	BS-SG51L-22-2.5	2.5	X			<0.005	<0.005	0.049	0.0068	0.037	0.31	<0.005	

BC = Analysis by BC Laboratories TA = Analysis by Test America < = Less than reporting limit

x=Sample is from a location that has been excavated.

Boldface type indicates that the sample is from a location that has not been excavated.

* = Concentration exceeded the MCS for institutional land use prior to corrective measure completion.

Table A-2
Confirmatory Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

Location	Sample ID	Depth	Excavated	Date	Lab	1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	1.3	7.9	38	50	0.45	2.3	0.0035	
Excavation Wall Samples													
West Wall	**SS51LEXC-06-W1-4.0**	**4.0**		8/29/06	BC	<0.005	<0.005	<0.005	<0.005	**0.12**	**0.084**	<0.005	
West Wall	**SS51LEXC-06-W2-5.0**	**5.0**				<0.005	<0.005	<0.005	<0.005	**0.061**	**0.076**	<0.005	**1,1,1-TCA=0.0075**
West Wall	**SS51LEXC-06-W3-6.5**	**6.5**				<0.005	<0.005	**0.016**	<0.005	**0.025**	**0.13**	<0.005	**1,1,1-TCA=0.014**
North Wall	**SS51LEXC-06-W4-7**	**7.0**		9/1/06		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
North Wall	SS51LEXC-06-W5-6.0	6.0	X	8/29/06		<0.005	<0.005	0.023	<0.005	1.6*	0.71	<0.005	1,1,1-TCA=0.005 benzene=0.0093
	SS51LEXC-06-W5A-9'	**9.0**		10/6/06	TA	<0.002	<0.002	**0.082**	**0.02**	<0.002	<0.002	<0.002	
	SS51LEXC-06-W5B-9'	**9.0**				<0.002	<0.002	**0.013**	**0.0043**	<0.002	<0.002	<0.002	
	SS51LEXC-06-W5C-9'	**9.0**				<0.002	<0.002	<0.002	<0.002	<0.002	**0.016**	<0.002	
	SS51LEXC-06-W5D-6	6.0	X	10/12/06	BC	<0.005	<0.005	<0.005	<0.005	0.045	0.021	<0.005	
	SS51LEXC-06-W5E-6	6.0	X			0.0085	<0.005	0.023	<0.005	0.24	0.79	<0.005	1,1,1-TC=0.012
East wall	**SS51LEXC-06-W6-6.0**	**6.0**		8/29/06		**0.005**	<0.005	**0.085**	**0.029**	**0.006**	**0.032**	<0.005	
East Wall	SS51LEXC-06-W7-4.5	4.5	X			0.0075	0.02	0.021	<0.005	1.5*	1.2	<0.005	1,1,1-TCA=0.0056
	SS51LEXC-06-W7A-7.5'	**7.5**		10/9/06	TA	**0.002**	<0.002	**0.0038**	<0.002	**0.033**	**0.097**	<0.002	
	SS51LEXC-06-W7B-7.5'	**7.5**				**0.0065**	<0.002	**0.006**	**0.0029**	**0.025**	**0.22**	<0.002	
	SS51LEXC-06-W7C-7.5'	**7.5**				**0.46**	**0.11**	**0.13**	**0.026**	<0.050	**1.1**	<0.050	**naphthalene=0.011**
	SS51LEXC-06-W7D-7.5'	**7.5**				<0.010	<0.010	<0.010	<0.010	**0.12**	**0.18**	<0.010	
	SS51LEXC-06-W7E-7.5'	**7.5**				<0.010	<0.010	<0.010	<0.010	**0.034**	**0.073**	<0.010	
	SS51LEXC-06-W7F-4.5	4.5	X	10/12/06	BC	0.016	<0.005	0.015	<0.005	0.39	0.82	<0.005	
	SS51LEXC-06-W7G-4.5	4.5	X			<0.005	<0.005	<0.005	<0.005	0.38	0.38	<0.005	
East Wall	**SS51LEXC-06-W8-4.5**	**4.5**		8/29/06		**0.031**	<0.005	**0.062**	**0.022**	**0.058**	**0.44**	<0.005	
South Wall	**SS51LEXC-06-W9-5.0**	**5.0**				<0.005	**0.018**	**0.086**	**0.04**	**0.33**	**0.46**	<0.005	
South Wall	**SS51LEXC-06-W10-5**	**5.0**		9/6/06		<0.012	<0.012	<0.012	<0.012	**0.071**	**0.032**	<0.012	
East exc extension	**SS51LEXC-06-W11-4.5**	**4.5**		10/27/06		**0.0094**	<0.005	**0.055**	**0.014**	**0.012**	**0.077**	<0.005	
East exc extension	**SS51LEXC-06-W12-4.5**	**4.5**				**0.29**	**0.14**	**0.027**	**0.0052**	<0.005	**0.29**	<0.005	
East exc extension	**SS51LEXC-06-W13-4.5**	**4.5**				<0.005	<0.005	**0.022**	<0.005	**0.19**	**0.12**	<0.005	
North exc extension	**SS51LEXC-06-W14-5.5**	**5.5**				<0.005	<0.005	<0.005	<0.005	**0.13**	**0.087**	<0.005	
North exc extension	**SS51LEXC-06-W15-5.5**	**5.5**				<0.005	<0.005	**0.0053**	<0.005	**0.012**	**0.15**	<0.005	**1,1,1-TCA=0.0091**

Table A-2 (Continued)
Confirmatory Soil Sampling Results from Building 51L Area
Organic Compounds
(Concentration in mg/kg)

						1,1-DCA	1,1-DCE	cis 1,2-DCE	trans 1,2-DCE	PCE	TCE	vinyl chloride	Other Compounds Detected
					Target Risk-Based MCS for Institutional Land Use	**1.3**	**7.9**	**38**	**50**	**0.45**	**2.3**	**0.0035**	
Location	**Sample ID**	**Depth**	**Excavated**	**Date**	**Lab**								
Excavation Floor Samples													
F1	**SS51LEXC-06-F1-16.5**	**16.5**		9/15/06	TA	<0.005	<0.005	**0.14**	**0.011**	<0.005	**0.0061**	<0.005	
F2	SS51LEXC-06-F2-18.0	18.0	X			<0.005	<0.005	0.14	0.051	<0.005	<0.005	0.0078*	
	SS51LEXC-06-F2-20.0	**20.0**		9/25/06	BC	<0.005	<0.005	**0.11**	**0.025**	<0.005	<0.005	<0.005	**toluene=0.011** **methyl ethyl ketone=0.020**
F3	SS51LEXC-06-F3-20.0	20.0	X	9/15/06	TA	0.049	<0.005	<0.005	<0.005	<0.005	<0.005	0.014*	
F4	**SS51LEXC-06-F4-18.5**	**18.5**				<0.005	<0.005	**0.0075**	<0.005	<0.005	<0.005	<0.005	
F5	**SS51LEXC-06-F5-13.5**	**13.5**				**0.0067**	<0.005	**0.022**	**0.015**	<0.005	**0.022**	<0.005	
F6	SS51LEXC-06-F6-18.0	18.0	X			0.041	0.014	0.31	0.21	<0.005	<0.005	0.019*	
	SS51LEXC-06-F6-19.0	**19.5**		9/25/06	BC	**0.0084**	<0.005	**0.025**	**0.014**	<0.005	<0.005	<0.005	
F7	**SS51LEXC-06-F7-18.0**	**18.0**		9/15/06	TA	<0.005	<0.005	**0.011**	<0.005	<0.005	<0.005	<0.005	
F8	SS51LEXC-06-F8-21.8	21.8	X	9/25/06	BC	0.036	0.023	0.33	0.13	<0.005	<0.005	0.0063*	methyl ethyl ketone=0.0072
	SS51LEXC-06-F8-22.5	**22.5**		10/3/06		**0.036**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
F9	**SS51LEXC-06-F9-17.8**	**17.8**		9/25/06		<0.005	<0.005	**0.046**	**0.024**	<0.005	<0.005	<0.005	
F10	SS51LEXC-06-F10-18.8	17.5	X	9/25/06		0.035	0.022	0.059	0.027	<0.005	<0.005	0.0072*	
	SS51LEXC-06-F10-21.0	**21.0**		10/3/06		<0.005	<0.005	**0.032**	**0.021**	<0.005	<0.005	<0.005	
F11	**SS51LEXC-06-F11-18.0**	**18.0**		9/25/06		<0.005	<0.005	**0.11**	**0.016**	<0.005	<0.005	<0.005	
F12	SS51LEXC-06-F12-17.7	17.7	X	9/25/06		<0.005	<0.005	0.095	0.022	<0.005	<0.005	0.0092*	toluene=0.030 methyl ethyl ketone=0.030
	SS51LEXC-06-F12-21.0	**21.0**		10/3/06		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**toluene=0.019**
F13	**SS51LEXC-06-F13-20**	**20.0**		9/25/06		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
F14	**SS51LEXC-06-F14-7.5**	**7.5**		10/27/06		**0.0085**	<0.005	**0.045**	**0.026**	**0.008**	**0.11**	<0.005	
	SS51LEXC-06-F15-9	**9.0**				<0.005	<0.005	**0.042**	**0.008**	<0.005	<0.005	<0.005	

BC = Analysis by BC Laboratories TA = Analysis by Test America < = Less than reporting limit
x=Sample is from a location that has been excavated.
Boldface type indicates that the sample is from a location that has not been excavated.
* = Concentration exceeded the MCS for institutional land use prior to corrective measure completion.

Table A-3
Pre-Excavation Soil Sampling Results from Building 7 Sump Area
Volatile Organic Compounds
(concentrations in mg/kg)

Sample Location	Sample ID		Depth (ft)	Date	Lab	PCE	TCE	1,1,1-TCA	cis 1,2-DCE	Carbon Tetrachloride	Benzene	Other Compounds Detected
	Target Risk-Based MCS					0.45	2.3	690	38	0.05	0.1	
	Upper Limit Risk-Based MCS					45	225	690	38	1.8	6	
SB7B-95-2	SB7B-95-2-3.5		3.5	Jun-95	BC	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-2-6		6.0			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-2-11		11			0.021	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-2-16		16			0.012	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-2-21		21			0.19	0.012	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-2-26		26			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-2-31		31			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB7B-95-3	SB7B-95-3-1.1		1.1	Jun-95	BC	0.019	<0.005	<0.005	<0.005	<0.005	<0.005	p-isopropyltoluene=0.007
	SB7B-95-3-10.6		10.6			0.014	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-3-16		16			0.20	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-3-20.9		20.9			0.017	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-3-25.7		25.7			0.012	<0.005	<0.005	<0.005	<0.005	<0.005	
	SB7B-95-3-30.9		30.9			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
MW7-95-22	BS-MW7-95-22-4.6		4.6	Aug-95	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW7-95-22-10.3		10.3			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW7-95-22-14.5		14.5			<0.005	<0.005	<0.005	0.0052	<0.005	<0.005	
	BS-MW7-95-22-20.1		20.1			<0.005	<0.005	<0.005	0.013	<0.005	<0.005	
	BS-MW7-95-22-25		25			<0.005	<0.005	<0.005	0.011	<0.005	<0.005	
	BS-MW7-95-22-30.2		30.2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW7-95-22-35.2		35.2			0.033	<0.005	<0.005	0.055	<0.005	<0.005	
	BS-MW7-95-22-40		40			<0.005	<0.005	<0.005	0.022	<0.005	<0.005	
MW7-95-23	BS-MW7-95-23-10		10	Dec-95	BC	<0.005	<0.005	<0.005	0.017	<0.005	<0.005	
	BS-MW7-95-23-20.5		20.5			<0.005	<0.005	<0.005	0.019	<0.005	<0.005	
	BS-MW7-95-23-30.7		30.7			0.13	<0.005	<0.005	0.73	0.0067	<0.005	1,1,1,2-PCA=0.0056
	BS-MW7-95-23-40		40			0.35	<0.005	<0.005	0.22	0.018	<0.005	
	BS-MW7-95-23-41		41			0.15	<0.005	<0.005	0.17	0.005	<0.005	
	BS-MW7-95-23-41.7		41.7			0.12	<0.005	<0.005	0.31	0.0053	<0.005	
	BS-MW7-95-23-43		43			0.024	<0.005	<0.005	0.027	<0.005	<0.005	
	BS-MW7-95-23-44		44	Dec-95	BC	0.028	<0.005	<0.005	0.049	<0.005	<0.005	
	BS-MW7-95-23-44.9		44.9			0.014	<0.005	<0.005	0.015	<0.005	<0.005	
	BS-MW7-95-23-45.6		45.6			0.013	<0.005	<0.005	0.011	<0.005	<0.005	
	BS-MW7-95-23-46.5		46.5			0.018	<0.005	<0.005	0.0075	<0.005	<0.005	
	BS-MW7-95-23-47.2		47.2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-MW7-95-23-50.3		50.3			0.024	<0.005	<0.005	0.014	<0.005	<0.005	
	BS-MW7-95-23-58		58			0.0057	<0.005	<0.005	0.029	<0.005	<0.005	
SB7BHTC-02-1	BS-SB7BHTC-02-1-16	C	16	Dec-02	BC	0.024	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-1-20	C	20			**720**	0.062	<0.005	<0.005	<0.005	<0.005	n-Butylbenzene=0.0055 1,2-Dichlorobenzene=0.016 1,3-Dichlorobenzene=0.046 1,4-Dichlorobenzene=0.046 Ethylbenzene=0.0055 Hexachlorobutadiene=0.0051 p-Isopropyltoluene=0.0072 Naphthalene=0.0080 1,1,1,2-Tetrachloroethane=0.039 Total Xylenes=0.013
	BS-SB7BHTC-02-1-25	C	25.0			**1.4**	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-1-29	C	29.0			**0.52**	0.0057		<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-1-35	C	35.0			**0.92**	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.017
	BS-SB7BHTC-02-1-36.5	C	36.5			0.16	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-1-39	C	39.0			**0.5**	<0.05	<0.05	<0.05	<0.005	<0.005	
SB7BHTC-02-2	BS-SB7BHTC-02-2-20.3	C	20.3	Dec-02	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-2-25	C	25.0			0.028	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.0098
	BS-SB7BHTC-02-2-30.8	C	30.8			**19**	0.041	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.0090
	BS-SB7BHTC-02-2-35.3	C	35.3			**1.4**	0.2	<0.005	<0.005	0.0054	<0.005	
	BS-SB7BHTC-02-2-42.6	C	42.6			0.2	0.011	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-2-47.5	C	47.5			0.09	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.0057
	BS-SB7BHTC-02-2-50	C	50.0			0.032	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.0066
SB7BHTC-02-3	BS-SB7BHTC-02-3-15	C	15.0	Dec-02	BC	0.0084	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.01
	BS-SB7BHTC-02-3-19	C	19.0			0.018	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.016
	BS-SB7BHTC-02-3-24.5	C	24.5			0.4	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.02
	BS-SB7BHTC-02-3-30.5	C	30.5			0.0095	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.016
	BS-SB7BHTC-02-3-35.5	C	35.5			**0.91**	<0.005	<0.005	<0.005	<0.005	<0.005	Methyl t-butyl ether=0.017
	BS-SB7BHTC-02-3-39.5	C	39.5			0.011	0.0064	<0.005	<0.005	<0.005	<0.005	

Table A-3
Pre-Excavation Soil Sampling Results from Building 7 Sump Area
Volatile Organic Compounds
(concentrations in mg/kg)

Sample Location	Sample ID			Depth (ft)	Date	Lab	PCE	TCE	1,1,1-TCA	cis 1,2-DCE	Carbon Tetrachloride	Benzene	Other Compounds Detected
	Target Risk-Based MCS						0.45	2.3	690	38	0.05	0.1	
	Upper Limit Risk-Based MCS						45	225	690	38	1.8	6	
SB7BHTC-02-4	BS-SB7BHTC-02-4-30.3	C		30.3	Dec-02	BC	0.1	0.016	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-4-35.5	C		35.5			**0.54**	0.33	<0.005	<0.005	<0.005	<0.005	Chloroform=0.0076
	BS-SB7BHTC-02-4-40.3	C		40.3			0.11	0.17	<0.005	<0.005	<0.005	<0.005	
	BS-SB7BHTC-02-4-45.6	C		45.6			**1.5**	0.16	<0.005	<0.005	<0.005	<0.005	Chloroform=0.0086
	BS-SB7BHTC-02-4-48	C		48.0			0.45	0.03	<0.005	<0.005	<0.005	<0.005	
SB7-03-1	BS-SB7-03-1-12.5			12.5	Mar-03	BC	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-20			20			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-21.7			21.7			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-26.5			26.5			0.0061	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-28.2			28.2			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-29.8			29.8			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-30.9			30.9			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-33			33			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-36			36			0.066	0.012	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-37.5			37.5			0.032	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-39			39			0.023	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-39R			39			**0.46**	0.021	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-42			42			0.009	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-43			43			0.01	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-43R			43			0.019	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-48			48			0.096	0.0084	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-1-54.5			54.5			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
SB7-03-2	BS-SB7-03-2-15.1	W		15.1	Mar-03	BC	0.0086	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-2-17.1	W		17.1			0.087	<0.005	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-2-17.1R	W		17.1			0.017	<0.005	<0.005	<0.005	<0.005	0.0059	
	BS-SB7-03-2-20.1	W		20.1			0.063	0.01	<0.005	<0.005	<0.005	<0.005	
	BS-SB7-03-2-22.3	W		22.3			0.072	<0.005	<0.005	<0.005			
	BS-SB7-03-2-23.7	W		23.7			0.028	<0.005	<0.005	<0.005			
	BS-SB7-03-2-25	W		25			0.018	<0.005	<0.005	<0.005			
	BS-SB7-03-2-27.2	W		27			<0.005	<0.005	<0.005	<0.005			
	BS-SB7-03-2-28.6	W		28.6			0.0085	<0.005	<0.005	<0.005			
	BS-SB7-03-2-30.3	W		30.3			0.016	<0.005	<0.005	<0.005			
	BS-SB7-03-2-33.5	W		33.5	Mar-03	BC	0.016	<0.005	<0.005	<0.005			
	BS-SB7-03-2-36	W		36			<0.005	<0.005	<0.005	<0.005			
SB7-03-3	BS-SB7-03-3-12.6	C		12.6	Mar-03	BC	<0.005	<0.005	<0.005	<0.005			
	BS-SB7-03-3-18	C		18			0.062	<0.005	<0.005	<0.005			
	BS-SB7-03-3-18R	C		18			0.026	<0.005	<0.005	<0.005	0.0091		
	BS-SB7-03-3-19	C		19			0.02	<0.005	<0.005	<0.005			
	BS-SB7-03-3-19R	C		19			0.15	<0.005	<0.005	<0.005	0.0063		
	BS-SB7-03-3-20.6	C		20.6			**0.6**	<0.005	<0.005	<0.005			
	BS-SB7-03-3-22.8	C		22.8			0.0069	<0.005	<0.005	<0.005			
	BS-SB7-03-3-26	C		26			<0.005	<0.005	<0.005	<0.005			
	BS-SB7-03-3-27.8	C		27.8			<0.005	<0.005	<0.005	<0.005			
SB7-05-1A	BS-SB7-05-1-23.6		D	23.6	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-1-29		D	29	Jan-06	BC	<0.005	<0.005			<0.005	0.045	toluene=0.0091
	BS-SB7-05-1-34.1		D	34.1	Jan-06	BC	0.01	<0.005			<0.005	<0.005	
	BS-SB7-05-1-39.2		D	39.2	Jan-06	BC	0.3	0.16		0.03	0.006	<0.005	
SB7-05-3	BS-SB7-05-3-23.9	W	D	23.9	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-3-28.8	W	D	28.8	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB-7-05-3-28.8(Hom	W	D	28.8	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-3-31.8	W	D	31.8	Jan-06	BC	0.24	0.0056			<0.005	<0.005	
	BS-SB-7-05-3-31.8(Hom	W	D	31.8	Jan-06	BC	0.26	<0.005			<0.005	<0.005	
	BS-SB7-05-3-34.2	W	D	34.2	Jan-06	BC	0.17	0.051			0.0064	<0.005	
	BS-SB-7-05-3-34.2(Hom	W	D	34.2	Jan-06	BC	0.019	<0.005			<0.005	<0.005	
	BS-SB7-05-3-38.7	W	D	38.7	Jan-06	BC	0.21	0.021			<0.005	<0.005	
	BS-SB7-05-3-44.1	W	D	44.1	Jan-06	BC	0.16	0.021			<0.005	<0.005	
	BS-SB7-05-3-48.8	W	D	48.8	Jan-06	BC	0.14	<0.005			<0.005	<0.005	
SB7-05-4	BS-SB7-05-4-10.2	W	D	10.2	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-4-14.1	W	D	14.1	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-4-19	W	D	19	Jan-06	BC	0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-7-24	W	D	24	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-4-28.7	W	D	28.7	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-4-34.2	W	D	34.2	Jan-06	BC	0.072	<0.005			<0.005	<0.005	
	BS-SB7-05-4-38.7	W	D	38.7	Jan-06	BC	0.0073	<0.005			<0.005	<0.005	
	BS-SB7-05-4-44	W	D	44	Jan-06	BC	<0.005	0.0053			<0.005	<0.005	
SB7-05-4A	BS-SB7-05-4A-34.5	C	D	34.5	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-4A-39	C	D	39	Jan-06	BC	0.0084	<0.005			<0.005	<0.005	
	BS-SB7-05-4A-44	C	D	44	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	

Table A-3
Pre-Excavation Soil Sampling Results from Building 7 Sump Area
Volatile Organic Compounds
(concentrations in mg/kg)

Sample Location	Sample ID			Depth (ft)	Date	Lab	PCE	TCE	1,1,1-TCA	cis 1,2-DCE	Carbon Tetrachloride	Benzene	Other Compounds Detected
		Target Risk-Based MCS					0.45	2.3	690	38	0.05	0.1	
		Upper Limit Risk-Based MCS					45	225	690	38	1.8	6	
SB7-05-5	BS-SB7-05-5-18.3	C	D	18.3	Jan-06	BC	**3.9**	0.098			0.0056	<0.005	1,1,1,2-TCA=0.013 Ethylbenzene=0.0052
	BS-SB7-05-5-24.3	C	D	24.3	Jan-06	BC	0.034	<0.005			<0.005	<0.005	
	BS-SB7-05-5-29.5	C	D	29.5	Jan-06	BC	0.15	<0.005			<0.005	<0.005	
	BS-SB7-05-5-34.5	C	D	34.5	Jan-06	BC	0.0076	<0.005			<0.005	<0.005	
SB7-05-6	BS-SB7-05-6-18.2		D	18.2	Jan-06	BC	0.012	<0.005			<0.005	<0.005	
	BS-SB7-05-6-23.8		D	23.8	Jan-06	BC	0.028	<0.005			<0.005	<0.005	
	BS-SB7-05-6-28.8		D	28.8	Jan-06	BC	0.021	<0.005			<0.005	<0.005	
SB7-05-7	BS-SB7-05-7-9.2	W	D	9.2	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-7-14.1	W	D	14.1	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-7-19.5	W	D	19.5	Jan-06	BC	0.055	<0.005			<0.005	<0.005	
	BS-SB7-05-7-23.8	W	D	23.8	Jan-06	BC	0.0055	<0.005			<0.005	<0.005	
	BS-SB7-05-7-29.1	W	D	29.1	Jan-06	BC	0.0095	<0.005			<0.005	<0.005	
SB7-05-8	BS-SB7-05-8-23.5	W	D	23.9	Jan-06	BC	0.0076	<0.005			<0.005	<0.005	
	BS-SB7-05-8-28.5	W	D	28.5	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-8-34.5	W	D	34.5	Jan-06	BC	0.28	<0.005			<0.005	<0.005	
SB7-05-9	BS-SB7-05-9-13.6	W	D	13.6	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-9-19.2	W	D	19.2	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-924.3	W	D	24.3	Jan-06	BC	0.0065	<0.005			<0.005	<0.005	
	BS-SB7-05-9-28.6	W	D	28.6	Jan-06	BC	0.023	<0.005			<0.005	<0.005	
SB7-05-12	BS-SB7-05-12-30.1	C	D	30.1	Jan-06	BC	0.0068	<0.005			<0.005	<0.005	
	BS-SB-7-05-12-30.1(Hon	C	D	30.1	Jan-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-05-12-34.5	C	D	34.5	Jan-06	BC	0.039	<0.005			<0.005	<0.005	
	BS-SB-7-05-12-34.5(Hon	C	D	34.5	Jan-06	BC	0.066	<0.005			<0.005	<0.005	
	BS-SB7-05-12-39	C	D	39	Jan-06	BC	0.028	<0.005			<0.005	<0.005	
	BS-SB7-05-12-44.3	C	D	44.3	Jan-06	BC	0.035	0.0059			<0.005	<0.005	
SB7-05-13	BS-SB7-05-13-34	C	D	34	Jan-06	BC	0.11	0.0073			<0.005	<0.005	
	BS-SB7-05-13-39	C	D	39	Jan-06	BC	0.031	0.026			<0.005	<0.005	
	BS-SB7-05-13-44	C	D	44	Jan-06	BC	0.25	0.025			<0.005	<0.005	
SB7-05-14	BS-SB7-05-14-23.9	C	D	23.9	Jan-06	BC	0.039	<0.005			<0.005	<0.005	
	BS-SB7-05-14-28.8	C	D	28.8	Jan-06	BC	0.019	<0.005			<0.005	<0.005	
SB7-06-1	BS-SB7-06-1-10.2		D	10.2	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-1-15.3		D	15.3	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-1-20.5		D	20.5	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
SB7-06-2	BS-SB7-06-2-9.4		D	9.4	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-2-14		D	14	Mar-06	BC	<0.005	<0.005			<0.005	0.0086	
	BS-SB7-06-2-18.3		D	18.3	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-2-19.7		D	19.7	Mar-06	BC	0.0062	<0.005			<0.005	<0.005	
	BS-SB7-06-2-24.3		D	24.3	Mar-06	BC	0.0066	<0.005			<0.005	<0.005	
SB7-06-3	BS-SB7-06-3-15.9		D	15.9	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-3-21		D	21	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-3-26		D	26	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-3-31		D	31	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-3-35.7		D	35.7	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
SB7-06-4	BS-SB7-06-4-26	C	D	26	Mar-06	BC	<0.005	<0.005			<0.005	0.0078	
	BS-SB7-06-4-31	C	D	31	Mar-06	BC	0.041	<0.005			<0.005	0.0062	Toluene=0.0078
	BS-SB7-06-4-36	C	D	36	Mar-06	BC	<0.005	0.0072			<0.005	<0.005	
	BS-SB7-06-4-39.5	C	D	39.5	Mar-06	BC	<0.005	<0.005			<0.005	0.005	
SB7-06-5	BS-SB7-06-5-25.7		D	25.7	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-5-31		D	31	Mar-06	BC	0.0056	<0.005			<0.005	<0.005	
	BS-SB7-06-5-36		D	36	Mar-06	BC	0.043	<0.005			<0.005	<0.005	
	BS-SB7-06-5-41		D	41	Mar-06	BC	0.053	0.025			<0.005	<0.005	
	BS-SB7-06-5-45.4		D	45.4	Mar-06	BC	0.013	0.0052			<0.005	<0.005	
	BS-SB7-06-5-49.5		D	49.5	Mar-06	BC	0.0087	<0.005			<0.005	<0.005	
SB7-06-6	BS-SB7-06-6-24.1	C	D	24.1	Mar-06	BC	<0.005	<0.005			<0.005	<0.005	
	BS-SB7-06-6-29.1	C	D	29.1	Mar-06	BC	0.011	<0.005			<0.005	<0.005	
	BS-SB7-06-6-34.4	C	D	34.4	Mar-06	BC	0.0073	<0.005			<0.005	0.097	Toluene=0.033 Total Xylenes=0.013
	BS-SB7-06-6-39.5	C	D	39.5	Mar-06	BC	0.035	0.026			<0.005	<0.005	
	BS-SB7-06-6-45	C	D	45	Mar-06	BC	0.076	<0.005			<0.005	<0.005	
	BS-SB7-06-6-48.5	C	D	48.5	Mar-06	BC	0.013	<0.005			<0.005	<0.005	

< (shaded)	= Not detected above reporting limit (reporting limit shown)
(blank)	= Not analyzed

BC = Analysis by BC Laboratories

D = Excavation delineation samples
C = Sample location was excavated during CMI
W = Excavation delineation "wall" samples

Concentrations shown in **bold** are above Target MCSs

Table A-4
Post-Excavation Soil Sampling Results from Building 51 Filter Sump Area
Polychlorinated Biphenyls
(concentrations in mg/kg)

					PCBs	
Sample ID		**Depth (ft)**	**Date**	**Lab**	**Aroclor 1242**	**Aroclor 1254**
SS-B51 Filter Sump Exc-F1-5	x	5	May-02	BC	0.77	<0.5
SS-B51 Filter Sump Exc-F2-5	x	5	May-02	BC	<0.5	<0.5
SS-B51 Filter Sump Exc-F3-5	x	5	May-02	BC	<0.5	<0.5
SS-B51 Filter Sump Exc-F4-5	x	5	May-02	BC	<0.5	<0.5
SS-B51 Filter Sump Exc-F5-5	x	5	May-02	BC	**0.52**	**0.71**
SS-B51 Filter Sump Exc-F6-4		4	Jul-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-F7-4		4	Jul-02	BC	<0.01	0.098
SS-B51 Filter Sump Exc-F8-4		4	Jul-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-F9-4.2		4.2	Jul-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-F10-4.1		4.1	Jul-02	BC	<0.01	0.1
SS-B51 Filter Sump Exc-F11-4		4	Jul-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-F12-4		4	Jul-02	BC	<0.01	0.018
SS-B51 Filter Sump Exc-F13-4		6.5	Jul-02	BC	0.098	<0.01
SS-B51 Filter Sump Exc-F14-06-1.7		1.7	Sep-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-F15-06-2.4		2.4	Sep-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-F16-06-2.4		2.4	Sep-02	BC	<0.1	0.10
SS-B51 Filter Sump Exc-W1-06-2		2	Sep-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-W2-06-2		2	Sep-02	BC	<0.01	<0.01
SS-B51 Filter Sump Exc-W3-06-2.5		2.5	Sep-02	BC	<0.01	<0.01

Boldface indicates samples exceeding MCS for total PCBs of 1 mg/kg

x = excavated sample location < **= Less than Quantitation Limit**

Table A-5
Removed Concrete Sampling Results from Building 51 Filter Sump Area Polychlorinated Biphenyls (concentrations in mg/kg)

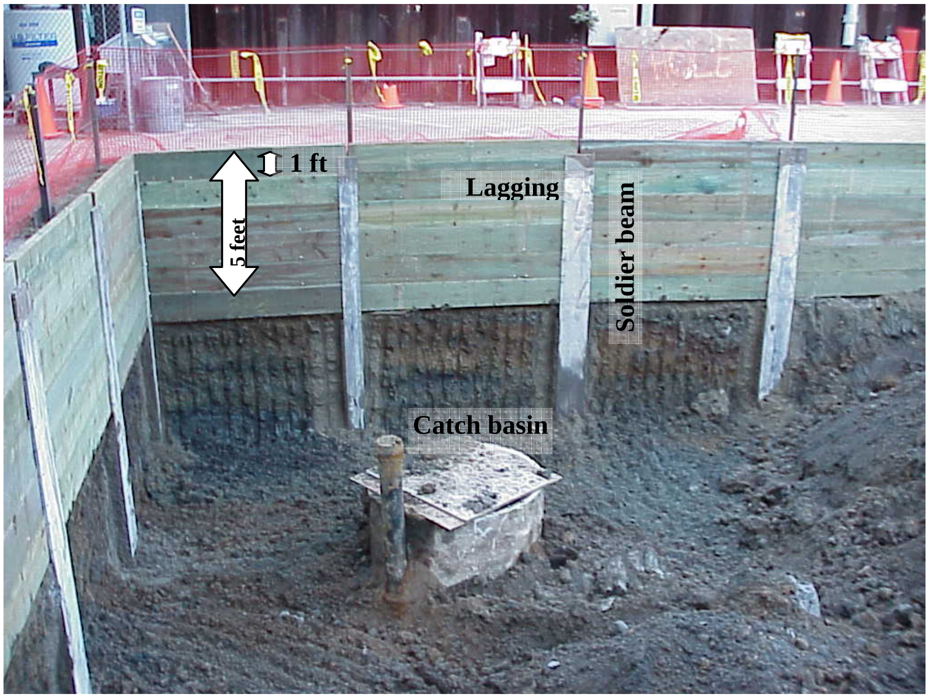
			PCBs	
Sample ID	Date	Lab	Aroclor 1242	Aroclor 1254
SS-B51 Concrete Top Half	Apr-02	BC	5,600	<500
SS-B51 Concrete Bottom Half	Apr-02	BC	110	<50
SS-B51 Concrete Full Depth	Apr-02	BC	34,000	<10000
CS-51-06-1	May-02	BC	1.9	<1
CS-51-06-2	May-02	BC	200	<10
CS-51-06-3	May-02	BC	1.4	<1
CS-51-06-4	May-02	BC	1.3	<1
CS-51-06-5	May-02	BC	0.68	<0.5
CS-51-06-6	May-02	BC	1.3	<1
CS-51-06-7	May-02	BC	1.6	<1
CS-51-06-8	May-02	BC	0.7	<0.5
CS-51-06-9	May-02	BC	0.6	<0.5
CS-51-06-10	May-02	BC	0.54	<0.5
CS-51-06-11	May-02	BC	0.17	<0.01
CS-51-06-12	May-02	BC	0.54	0.28
CS-51-06-13	May-02	BC	<0.5	2.5
CS-51-06-14	May-02	BC	<0.5	1.8
CS-51-06-15	May-02	BC	<20	290
CS-51-06-16	May-02	BC	<40	690
CS-51-06-17	May-02	BC	<10	48
CS-51-06-18	May-02	BC	2,500	<200
CS-51-06-19	May-02	BC	660	<100
CS-51-06-20	May-02	BC	1.8	<0.2
CS-51-06-21	May-02	BC	310	<50
CS-51-06-22	May-02	BC	4,700	<400
CS-51-06-23	May-02	BC	<5	47
CS-51-06-24	May-02	BC	<80	670
CS-51-06-25	May-02	BC	<10	14
CS-51-06-26	Jul-02	BC	6.5	2.2
CS-51-06-27	Jul-02	BC	490	310
CS-51-06-28	Jul-02	BC	190	25
CS-51-06-29	Jul-02	BC	49	98
CS-51-06-30	Jul-02	BC	1,400	1,800
CS-51-06-31	Jul-02	BC	3.1	5.3
CS-51-06-32	Jul-02	BC	830	1,500
CS-51-06-33	Jul-02	BC	1.4	0.48
CS-51-06-34	Jul-02	BC	1,100	82
CS-51-06-35	Jul-02	BC	10	51
CS-51-06-36	Jul-02	BC	14	11
CS-51-06-37	Jul-02	BC	1,000	1,700
CS-51-06-38	Jul-02	BC	0.61	0.46
CS-51-06-39	Jul-02	BC	<0.99	6.0
CS-51-06-40	Jul-02	BC	24	<2
CS-51-06-41	Jul-02	BC	0.33	0.19
CS-51-06-42	Jul-02	BC	0.091	0.04
CS-51-06-43	Jul-02	BC	0.42	0.40
CS-51-06-44	Jul-02	BC	110	300
CS-51-06-45	Jul-02	BC	<4.9	<4.9
CS-51-06-46	Jul-02	BC	0.5	0.54

< = Less than Quantitation Limit

Attachment 1

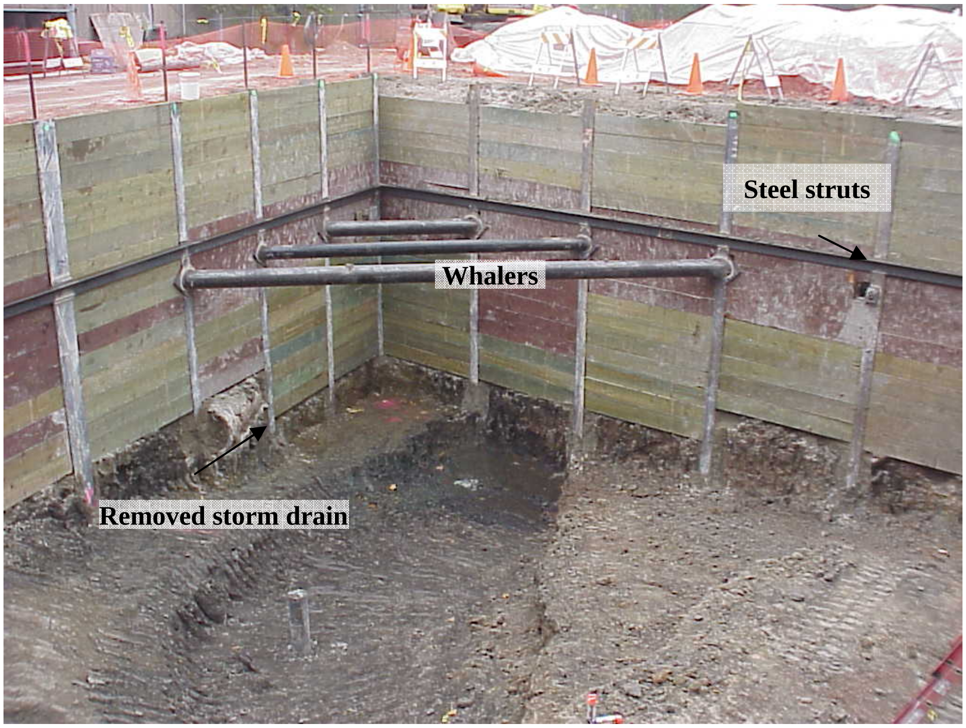
Building 51L Groundwater Solvent Plume Source Area

Photographs of Corrective Measure



Southwest corner of excavation showing storm drain catch basin prior to removal and replacement.

Northeast corner of excavation - September 21, 2006.



Northwest corner of excavation – September 28, 2006.

Southeast corner of the excavation – September 28, 2006.

Additional excavation on east wall to remove contaminated soil detected in confirmatory soil sampling.

Backfilled excavation looking northwest showing the two new storm drain catch basins

Attachment 2

Former Building 7 Sump

Photographs of Corrective Measure

Initial boring using 48" augers at northwest corner of Building 7 – April 15, 2006

Preparing temporary casings - September 21, 2006.

Post-excavation utility and surface restoration- September 28, 2006.

Former Building 7 Sump Excavation