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September 1, 2006

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APPROVAL OF SOIL MANAGEMENT PLAN AND GROUNDWATER MONITORING AND MANAGEMENT PLAN, LAWRENCE BERKELEY NATIONAL LABORATORY, ENVIRONMENTAL RESTORATION PROGRAM, EPA ID No: CA4890008986

Dear Dr. Javandel:

We have received draft Soil Management (SM) and Groundwater Monitoring & Management (GWMM) plans for Lawrence Berkeley National Laboratory, dated March 2006. We have reviewed these plans and considered them to be technically complete. DTSC hereby approves both SM and GWMM plans. Please proceed with the schedule as proposed.

If you have any questions, please call Waqar Ahmad at (510) 540-3932.

Sincerely,

Salvatore Ciriello, PE
Supervising Hazardous Substances Engineer
Standardized Permitting and Corrective Action Branch

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

United States Department of Energy

Groundwater Monitoring and Management Plan

for the

Lawrence Berkeley National Laboratory

ENVIRONMENTAL RESTORATION PROGRAM

September 2006

Groundwater Monitoring and Management Plan

for the

Lawrence Berkeley National Laboratory

ENVIRONMENTAL RESTORATION PROGRAM

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

September 2006

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CONTENTS

Page

LIST OF ABBREVIATIONS v

SECTION 1 INTRODUCTION 1

1.1 PURPOSE AND ORGANIZATION 1

1.2 RCRA CORRECTIVE ACTION PROGRAM 2

1.3 RADIONUCLIDES 5

1.4 REGULATORY OVERSIGHT 5

1.5 PROJECT ORGANIZATION 5

SECTION 2 MONITORING REQUIREMENTS 7

2.1 GROUNDWATER MONITORING 7

2.1.1 Previous Groundwater Characterization 7

2.1.2 Corrective Measures Implementation (CMI) 8

2.1.3 Site-Specific Contaminant Extent, Cleanup, and Monitoring Requirements 9

2.1.3.1 Building 51/64 Groundwater Solvent Plume 11

2.1.3.2 Building 51L Groundwater Solvent Plume 14

2.1.3.3 Building 71 Groundwater Solvent Plume (Building 71B Lobe) 16

2.1.3.4 Building 7 Lobe of the Building 7 Groundwater Solvent Plume (AOC 2-4) 18

2.1.3.5 Building 52 Lobe of the Old Town Groundwater Solvent Plume 22

2.1.3.6 Building 25A Lobe of the Old Town Groundwater Solvent Plume 24

2.1.3.7 Building 69A Area of Groundwater Contamination 26

2.1.3.8 Solvents in Groundwater South of Building 76 (AOC 4-5) 28

2.1.3.9 Building 75/75A Area of Groundwater Contamination 29

2.1.3.10 Building 77 Area of Groundwater Contamination 30

2.1.3.11 Benzene Detected in Wells East of Building 75A 31

2.1.3.12 Building 75 Tritium Plume 32

2.1.3.13 Metals Monitoring Program 34

2.1.3.14 Perimeter and Offsite Monitoring Program 34

2.2 SURFACE WATER MONITORING.....35
2.3 GENERAL PROCEDURES AND REPORTING.....35

SECTION 3 GROUNDWATER MANAGEMENT CONTROLS 37
3.1 RESTRICTIONS ON GROUNDWATER EXTRACTION AND USE ...37
3.2 RESTRICTIONS ON LAND USE.....38
3.2.1 Chemical Contamination 38
3.2.1.1 Land Use and Cleanup Levels 38
3.2.1.2 Residential Land Use Restrictions.....39
3.2.1.3 Institutional Use Restrictions on Construction of New Site Buildings or Improvements.....40
3.2.2 Restrictions at Radiological Units 42
3.3 EXCAVATION AND CONSTRUCTION ACTIVITIES.....42
3.4 MITIGATION CRITERIA FOR DRAIN SYSTEMS.....43

SECTION 4 REFERENCES 44

LIST OF FIGURES

FIGURES

APPENDICES

APPENDIX A. Approved Groundwater Monitoring Schedule — The attached figures and tables listing the groundwater monitoring schedule and showing the locations of wells required for monitoring were revised from the *Proposal for Revised Groundwater Monitoring Schedule* (Berkeley Lab, 2005b) submitted to the Water Board in May 2005. The Water Board approved the schedule proposed in that document in August 2005 (Water Board, 2005).

APPENDIX B. Regional Water Board Order No. R2-2004-0055 NPDES No. CAG912003.

APPENDIX C. Recalculated theoretical Incremental Lifetime Cancer Risks (ILCRs) for 2005 groundwater data within areas of contaminated groundwater at Berkeley Lab.

APPENDIX D. Permit To Penetrate Ground or Existing Surfaces of LBNL Property, Administrative Procedure – Document Control, ADMN-053.

LIST OF ABBREVIATIONS

AOC	Areas of Concern
Berkeley Lab	Lawrence Berkeley National Laboratory
CAP	Corrective Action Program
CVOCs	Chlorinated Volatile Organic Compounds
CMS	Corrective Measures Study
CMI	Corrective Measures Implementation
COC	Chemical of Concern
DCA	Dichloroethane
DCE	Dichloroethene
DO	Dissolved Oxygen
DOE	United States Department of Energy
DTSC	Cal/EPA Department of Toxic Substances Control
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ESG	Environmental Services Group
FY	Fiscal Year
GMMP	Groundwater Monitoring and Management Plan
HHRA	Human Health Risk Assessment
HI	Hazard Index
HRC	Hydrogen Release Compound
IC	Institutional Control
ICM	Interim Corrective Measure
ILCR	Incremental Lifetime Cancer Risk
LLRW	Low Level Radioactive Waste
MCL	Maximum Contaminant Level
MCS	Media Cleanup Standard
MNA	Monitored natural Attenuation
NFA	No Further Action
NFI	No Further Investigation
NTLF	National Tritium Labelling Facility
OEHHA	Office of Environmental Health Hazard Assessment
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyls
PCE	Tetrachloroethene
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility investigation
SMP	Soil Management Plan
SWMU	Solid Waste Management Unit
SVOCs	Semi-volatile Organic Compounds
TCA	Trichloroethane

TCE	Trichloroethene
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
Water Board	Regional Water Quality Control Board

SECTION 1
INTRODUCTION

1.1 PURPOSE AND ORGANIZATION

This Groundwater Monitoring and Management Plan (GMMP) describes the monitoring requirements and management controls required for compliance with the Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) Resource Conservation and Recovery Act (RCRA) Part B Permit. These requirements and controls are based on the corrective measures recommended in Berkeley Lab's RCRA Corrective Measures Study (CMS) Report (Berkeley Lab, 2005a), which was approved by the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) on October 20, 2005. These approved measures will reduce or eliminate the potentially adverse effects to human health or the environment caused by historic releases of chemicals to soil and groundwater at Berkeley Lab. Preparation and implementation of the GMMP is part of the Corrective Measures Implementation (CMI) phase of the RCRA Corrective Action Program (CAP).

In addition, the GMMP addresses groundwater monitoring requirements derived from policies of the California Regional Water Quality Control Board-San Francisco Bay Region (Water Board) and requirements specified by the United States Department of Energy (DOE) for monitoring and managing tritium-contaminated groundwater at Berkeley Lab. The GMMP contains the following elements:

- A description of the lateral and vertical extent of groundwater contamination for each groundwater contamination plume.
- A description of groundwater monitoring requirements including the methods and locations used to 1) monitor compliance with media cleanup standards within areas of groundwater contamination; 2) monitor for downgradient plume migration; and 3) monitor to ensure groundwater contamination does not migrate past the site perimeter.
- A description of specific surface water monitoring requirements
- A description of Berkeley Lab management controls that will be used to reduce potential risks from exposures associated with contaminated groundwater and reduce the potential for any environmental impacts.

Section 1 of this plan provides background information pertaining to cleanup of non-radionuclide chemical contamination under the RCRA CAP and radionuclide contamination under Department of Energy (DOE) oversight. Section 2 provides descriptions of the extent of groundwater contamination, the cleanup measures that have been or will be applied, and groundwater and surface water monitoring requirements. Section 3 describes Berkeley Lab groundwater management controls.

1.2 RCRA CORRECTIVE ACTION PROGRAM

Berkeley Lab's RCRA Hazardous Waste Facility Permit required that Berkeley Lab investigate and address the historical non-radionuclide chemical releases in accordance with the RCRA CAP requirements. The Permit is issued and enforced by the DTSC, including the activities required under the RCRA CAP. The primary components of the RCRA CAP are:

- RCRA Facility Assessment (RFA)
- RCRA Facility Investigation (RFI)
- Corrective Measures Study (CMS)
- Corrective Measures Implementation (CMI).

The RFA, which was completed in 1992, and the RFI, which was completed in 2000, comprised the investigation phase of the CAP. The purpose of the RFA was to identify known and potential past releases of hazardous waste and hazardous constituents to the environment from Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Berkeley Lab. SWMUs, AOCs, and other areas of known or potential release of contaminants are collectively referred to as "units" in this report.

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 primarily included chemical product storage tanks (e.g., fuel tanks), transformers, and hazardous materials storage areas.

Results of the RFA are provided in the *RCRA Facility Assessment at the Lawrence Berkeley Laboratory* (Berkeley Lab, 1992). The RFA found that hazardous waste or hazardous

constituents had been released to soil and groundwater. Based on these findings, DTSC concluded that an RFI was required to characterize areas at the site where releases had occurred.

The RFI, which was conducted between October 1992 and September 2000, included identification of the source and nature of the contaminants that had been released to the environment, and characterization of the magnitude and extent of those releases. The RFI was divided into three phases. The *RCRA Facility Investigation Phase I Progress Report* (Berkeley Lab, 1994a) and the *RCRA Facility Investigation Phase II Progress Report* (Berkeley Lab, 1995) provided results for the first two phases of the RFI. The *RCRA Facility Investigation* (*RFI) Report*, which described the results of the final phase, was submitted to the DTSC on September 29, 2000 (Berkeley Lab, 2000).

As described in the RFI reports, the principal chemical contaminants in the groundwater at Berkeley Lab are chlorinated Volatile Organic Compounds (CVOCs). The CVOCs include primarily tetrachloroethene (PCE), trichloroethene (TCE), carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), 1,1,1-trichloroethane (TCA), and 1,1-dichloroethane (DCA). Most of these CVOCs are solvents (and their degradation products) that were used as degreasers for cleaning equipment at Berkeley Lab. Other contaminants that were detected in groundwater include petroleum hydrocarbons (mainly associated with former underground storage tank [UST] sites) and metals (mainly associated with plating shops); and to a much lesser extent semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and pesticides.

During the RFI, Berkeley Lab implemented a screening process to determine which groundwater units posed a potential risk to human health and/or to beneficial uses of groundwater. The screening process consisted of a comparison between the maximum concentration of each chemical detected in groundwater at each unit to the Maximum Contaminant Levels (MCLs) for drinking water from both the United States Environmental Protection Agency (USEPA) and the California Environmental Protection Agency (Cal/EPA). Concentrations of naturally occurring inorganic elements were also compared to Berkeley Lab background levels for groundwater (Berkeley Lab, 2002a). Based on results of the RFI, the DTSC determined that chemicals detected in the groundwater (and soil) at Berkeley Lab posed a potential

threat to human health and the environment, and required that a CMS be conducted. As the initial step in the CMS, Berkeley Lab completed both an Ecological and a Human Health Risk Assessment (ERA and HHRA) (Berkeley Lab 2002b, 2003a).

The ERA concluded that no hazards exist to plants or animals from exposure to chemicals in soil, groundwater, or surface water at Berkeley Lab. The HHRA generated estimates of risk to humans for each unit based on an industrial-type institutional use scenario for Berkeley Lab. This scenario represents the current use, and the reasonable and likely future use for the facility.

The HHRA concluded that seven groundwater units posed a potential risk to the health of institutional workers. These seven units are:

- Building 51/64 Groundwater Solvent Plume (AOC 9-13)
- Building 51L Groundwater Solvent Plume
- Building 71 Groundwater Solvent Plume, Building 71B lobe (AOC 1-9)
- Building 7 Lobe of the Old Town Groundwater Solvent Plume (AOC 2-4)
- Building 52 Lobe of the Old Town Groundwater Solvent Plume(AOC 10-5)
- Building 25A Lobe of the Old Town Groundwater Solvent Plume (AOC 10-5)
- Support Services Area (Building 69A Area of Groundwater Contamination).

In addition, four groundwater units were identified that did not pose potential risks to the health of institutional workers but did contain Chemicals of Concern (COCs) at concentrations exceeding MCLs, therefore posing a potential threat to beneficial uses of groundwater. These four units are:

- Solvents in Groundwater South of Building 76 (AOC 4-5)
- Support Services Area (Building 75/75A Area of Groundwater Contamination)
- Support Services Area (Building 77 Area of Groundwater Contamination)
- Benzene Detected in Wells East of Building 75A.

All eleven units listed above were included in the CMS Report (Berkeley Lab, 2005a). The CMS Report evaluated methods for cleanup of COCs at each of the seven units that posed potential risks to human health and recommended the measures to be implemented. The primary cleanup methods proposed consisted of combinations of: excavation with offsite disposal of contaminated soil in the source area of the groundwater contamination; soil flushing with

groundwater extraction; monitored natural attenuation (MNA) of groundwater, and enhanced bioremediation of groundwater. The specific corrective measures for each unit were based on site-specific considerations.

1.3 RADIONUCLIDES

Concurrently with the investigation and assessment of chemical releases, Berkeley Lab investigated potential releases of radionuclides from eight units, under the regulatory authority of the DOE. Results of the radiological investigations are provided in the *Summary of Radionuclide Investigations* report (Berkeley Lab, 2003b). As described in that report, the only detected radionuclide contaminant in the groundwater at Berkeley Lab is tritium. The tritium is present in groundwater near Buildings 75 and 71 as a result of past emissions from the former Building 75 National Tritium Labeling Facility (NTLF). Since closure of the NTLF in December 2001, concentrations of tritium in the groundwater have declined to levels below the MCL.

1.4 REGULATORY OVERSIGHT

In July 1993, the DTSC delegated some CAP oversight agency authority and responsibilities at Berkeley Lab to other regulatory agencies. The Water Board was assigned as the lead agency for the technical review of surface water and groundwater impacts.

Radionuclides, including tritium, are not regulated under RCRA and are therefore not included in the CAP. However, radiological contamination at Berkeley Lab has been addressed under the oversight of the DOE.

1.5 PROJECT ORGANIZATION

Berkeley Lab's various divisions manage and operate the laboratory facilities on site. The Environmental Restoration Program (ERP) has been the Berkeley Lab program responsible for investigating and addressing the historical chemical releases under the CAP. The ERP is a joint effort of the Environmental Services Group (ESG) of the Environment, Health and Safety (EH&S) and the Earth Sciences Divisions of LBNL.

The DOE provides funding and oversight of Berkeley Lab operations. The DOE Office of Environmental Management (EM) has been responsible for providing funds for CAP activities at Berkeley Lab. The program is scheduled to be transferred from EM to the DOE Office of Science on October 1, 2006. At that time, the project is scheduled to be in an operation and maintenance (O&M) mode. This will primarily include long-term operation, monitoring, and maintenance of groundwater treatment systems and maintenance and monitoring of the site groundwater well network.

SECTION 2

MONITORING REQUIREMENTS

2.1 GROUNDWATER MONITORING

2.1.1 Previous Groundwater Characterization

Groundwater monitoring wells were installed during the RFA and RFI phases of the CAP with the following four objectives:

1. Determine the source(s) of groundwater contamination and characterize the magnitude and extent of that contamination.
2. Monitor the groundwater quality near the perimeter of the site and downgradient from areas of known contamination.
3. Monitor the groundwater quality at and downgradient from SWMUs and AOCs to determine if releases had occurred.
4. Provide information for evaluating the potential for future migration of contamination in groundwater.

The RFI groundwater monitoring program initially included quarterly sampling of all monitoring wells for volatile organic compound (VOC) analysis, and annual sampling of all monitoring wells for metals. As a result of ongoing characterization work, many new wells were added, and groundwater monitoring requirements changed during the RFI and CMS, leading to submission of five revised monitoring schedule requests, which were approved by the Water Board (Water Board, 1995, 1997, 1999, 2002 and 2005). These requests included monitoring requirements for VOCs, metals, and tritium.

Groundwater characterization results have been documented on a quarterly basis since 1993 in the Berkeley Lab ERP quarterly progress reports. Detailed information on the characterization of the magnitude and extent of groundwater contamination has been provided in the RCRA Facility Investigation Report (Berkeley Lab 2000), the Summary of Radionuclide Investigations (Berkeley Lab 2003b), and the RCRA Corrective Measures Study Report (Berkeley Lab 2005a).

2.1.2 Corrective Measures Implementation (CMI)

Berkeley Lab is currently in the CMI phase of the CAP. The objectives of groundwater monitoring during the CMI are to evaluate the effectiveness of the implemented corrective measures and document the continued stability of groundwater plumes. To accomplish this objective, the following activities are being conducted:

- Monitoring of COC concentrations in groundwater to assess the performance of corrective measures in all areas where Media Cleanup Standards (MCSs) are exceeded.
- Monitoring of COC concentrations in groundwater to assess downgradient plume migration.
- Monitoring COC concentrations to ensure that plumes do not migrate past the site perimeter.
- Monitoring in support of MNA or Enhanced Bioremediation as cleanup methods.

The MCSs applicable at each of the groundwater units were defined in the CMS Report, and are listed in Section 2.1.3 below.

The rationale for, and a detailed description of, CAP compliance monitoring requirements are provided in the *Proposal for Revised Groundwater Monitoring Schedule for the Lawrence Berkeley National Laboratory Environmental Restoration Program* (Berkeley Lab 2005b), which was approved by the Water Board on August 1, 2005 (Water Board, 2005). That document also specifies monitoring requirements to comply with State Water Resources Control Board (SWRCB) policies. To comply with those policies, cleanup to MCLs is the long-term goal for all areas of the site. Therefore in areas where CAP-required MCSs have been achieved but concentrations still exceed MCLs, groundwater monitoring will continue. The proposal also documents monitoring requirements for tritium, which though these are not required under the CAP. To avoid duplication, the *Proposal for Revised Groundwater Monitoring Schedule* is incorporated herein by reference. **Appendix A** contains the figures and tables from the proposal, which list the groundwater monitoring schedule and show the locations of wells required for monitoring.

Monitored Natural Attenuation (MNA) and Enhanced Bioremediation are the approved remedies for several groundwater units. The specific parameters to be monitored, the wells used for monitoring, and the monitoring schedule for these measures are provided in *Monitoring Protocols for Monitored Natural Attenuation and Enhanced Bioremediation for the Lawrence Berkeley National Laboratory Environmental Restoration Program* which is incorporated herein by reference (Berkeley Lab 2005c). The MNA monitoring program will utilize existing monitoring wells to assess whether hydrochemical conditions remain favorable to biodegradation, to determine whether concentration trends for individual CVOCs are consistent with continued natural attenuation, and to evaluate whether corrective action objectives have been met. The hydrochemical parameters to be monitored for this purpose are listed in **Table 1**. These additional monitoring requirements are also summarized where applicable in the following site-specific sections.

2.1.3 Site-Specific Contaminant Extent, Cleanup, and Monitoring Requirements

The following subsections describe each groundwater unit requiring corrective measures under the CAP, and groundwater contamination (tritium) subject to regulation by the DOE. Each plume-specific subsection describes the lateral and vertical extent of groundwater contamination, the corrective measures that have been or will be applied, and monitoring requirements. Maps of the contaminant plumes reflect conditions during the fourth quarter of Fiscal Year 2005 (FY05) (July 1 to September 30, 2005).

Table 1. Analytical Requirements and Significance

Parameter	Trend in Concentration During Natural Biodegradation	Optimum Range in Concentration	Significance
Laboratory Measurements			
CVOCs	Increase in degradation products		Identify parent and degradation (daughter) products. Certain isomers/degradation products provide direct evidence of biodegradation (e.g., cis-1,2-DCE). Used to help assess reductions in contaminant mass.
Methane (CH_4) Ethane (C_2H_6), and Ethene (C_2H_4)	Increases	> 0.5 mg/L	After sulfate has been depleted, carbon dioxide can be used as an electron acceptor for anaerobic biodegradation of organic carbon by methanogenesis, resulting in the production of methane.
Volatile Fatty Acids (VFAs)(1)	Increases	> 0.1 mg/L	Indicates that biodegradation through oxidation has occurred. These acids are added as a primary growth substrate, particularly to induce methanogenic conditions such as in Hydrogen Release Compounds (HRC).
Field or Laboratory Measurements			
Nitrate (NO_3^-)	Decreases	< 1.0 mg/L	After dissolved oxygen (DO) has been depleted, nitrate is used as an electron acceptor for anaerobic biodegradation by denitrifying bacteria.
Nitrite (NO_2^-)	Increases		Produced from nitrate under anaerobic conditions.
Sulfate (SO_4^{2-})	Decreases	< 20 mg/L	After ferrous iron has been depleted used as an electron acceptor for anaerobic biodegradation. Indicator of sulfate reducing bacteria.
Sulfide (H_2S)	Increases	> 1 mg/L	May provide evidence of sulphate reduction.
Field Measurements			
Ferrous Iron (Fe^{2+})	Increases	> 1.0 mg/L	An important trace nutrient for bacterial growth. Indicator of iron reducing bacteria.
Carbon Dioxide (CO_2)	Increases	> 2 times background	Ultimate byproduct of every respiration process except methanogenesis.
Conductivity			Used to help assess representativeness of sample.
Dissolved Oxygen (DO)	Decreases	< 0.5 mg/L	Indicator of aerobic environments; suppresses the reductive dechlorination pathway at higher concentrations.
		> 1.0 mg/L	Vinyl chloride may be oxidized aerobically.
pH		5 < pH < 9	Measurement of suitability of environment to support a wide range of microbial species. pH is also used to help assess representativeness of sample.
		5 > pH > 9	Outside optimal range for reductive pathway.
Temperature		> 20ºC	Biochemical process is accelerated. Used to help assess representativeness of sample.

(1) Analysis for VFAs only in areas where HRC is added to the groundwater to enhance bioremediation.

2.1.3.1 Building 51/64 Groundwater Solvent Plume

Plume Characterization

The Building 51/64 Groundwater Solvent Plume extends westward from the southeast corner of Building 64 (**Appendix A: Figure 2.4-1**). The principal plume constituents are CVOCs that were used as cleaning solvents, including 1,1,1-TCA, TCE, PCE, and their associated degradation products (e.g., 1,1-DCE, 1,1-DCA, cis-1,2-DCE, and vinyl chloride). The principal source of the solvent plume was likely the Building 51/64 Former Temporary Equipment Storage Area (AOC 9-12), although other sources in the Building 51/64 area may have contributed to the plume. Contaminated soil was excavated from the source area in August 2000. In addition to solvents, PCBs are sporadically detected in groundwater within a small portion of the plume beneath the Building 51 Motor Generator Room. The principal source of the PCBs (Aroclors 1242 and 1248) was electrical equipment in the basement of the motor generator room, although low levels of Aroclor 1260 appear to be derived from a bituminous construction materials beneath the concrete floor. PCB-contaminated soil was excavated from this area from 1996 to 2000, and further removal of PCB-contaminated soil in the vicinity of temporary groundwater sampling point SB51-96-6 was in progress during preparation of this plan.

Maximum concentrations of groundwater COCs detected above MCLs during the fourth quarter of FY05 in the plume source and core area are shown in **Table 2a** in comparison to target risk-based MCSs (the required cleanup level in this area of the plume). PCE, 1,1- DCA, and vinyl chloride exceeded the required cleanup level in the source and core areas. Maximum concentrations of groundwater COCs detected above MCLs during the fourth quarter of FY05 in the downgradient area are shown in **Table 2b** in comparison to MCLs (the required regulatory-based cleanup level in that area of the plume) and the target risk-based MCSs. Six CVOCs exceeded MCLs in the downgradient area during the fourth quarter of FY05. In addition, vinyl chloride exceeded the target risk-based value.

Table 2a. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 51/64 Groundwater Solvent Plume Source and Core Area

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	201	1,594
PCE	**393**	343
cis-1,2-DCE	267	98,405
trans-1,2-DCE	48	94,405
1,1-DCE	603	28,873
1,1-DCA	1,750	3,663
1,2-DCA	7.6	1,030
vinyl chloride	**22**	12
PCBs	30	NA

Note: Boldface type indicates that the concentration exceeds the required MCS.
NA: Not Applicable - PCBs do not constitute a risk driver in the Building 51/64 plume so no MCSs were developed.

Table 2b. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 51/64 Groundwater Solvent Plume Downgradient Area

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Regulatory-Based Groundwater MCS (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	**57***	5	1,594
cis-1,2-DCE	**267**	6	98,405
trans-1,2-DCE	**48***	10	94,405
1,1-DCE	**21**	6	28,873
1,1-DCA	**13**	5	3,663
vinyl chloride	**22***	0.5	12

Note: Boldface type indicates that the concentration exceeds the required MCS.
*Based on results from a well within the core area immediately upgradient from the downgradient area.

Corrective Measures

<u>In Situ Soil Flushing and Groundwater Capture in the Source Area</u>

The corrective measure being applied in the source area of the plume is in situ soil flushing. The configuration of the Building 51/64 Groundwater Solvent Plume soil flushing system is shown on **Figure 2.1**. The system consists of an injection trench inside Building 64, and two groundwater collection trenches and a gravel-filled excavation outside the building from which contaminated

groundwater is extracted and treated. Groundwater from three wells (SB64-98-8, SB64-99-5, and SB64-00-1) inside the building and one well (SB64-05-4) outside the southwest corner of the building is also extracted and treated.

Monitored Natural Attenuation in the Downgradient Area

Based on natural attenuation evaluations conducted in the plume area in 1997 and 2003, MNA is being used as the remediation method for this part of the plume.

Sump Effluent Treatment in the Building 51 Motor Generator Room Basement

The Building 51 Motor Generator Room Basement discharge sump collects water from the Building 51 subdrain system. The effluent from the subdrain is captured and treated to prevent the migration of potentially contaminated subdrain water to surface water.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 51/64 Groundwater Solvent Plume are shown in **Appendix A: Table 2.4-1** and **Appendix A: Figure 2.4-1**, respectively.

The requirements for monitoring parameters in support of MNA are listed in **Table 3**.

Table 3. Requirements for Monitored Natural Attenuation – Building 51/64 Groundwater Solvent Plume

Well Number	Location	Sampling Frequency	
		Hydrochemical Indicator Parameters(1)	VOCs (EPA Method 8260)
MW71-95-9(2)	Upgradient	Semiannually for one year and then annually	Not required
MW51-96-16	Plume Core	Semiannually for one year and then annually	Semiannually
MW51-96-17	Plume Core	Semiannually for one year and then annually	Annually
MW51-97-13	Downgradient Plume Core	Semiannually for one year and then annually	Annually
MW51-97-12	Crossgradient	Semiannually for one year and then annually	Semiannually
MW51-97-15	Downgradient	not required	Semiannually
MWP-1	Downgradient	not required	Quarterly

(1) The required parameters and analytical methods are provided in Berkeley Lab, 2005c.
(2) Also used as upgradient well for Building 71B lobe

2.1.3.2 Building 51L Groundwater Solvent Plume

The Building 51L Groundwater Solvent Plume is centered near the southwest corner of former Building 51L in the Bevalac Area of Berkeley Lab (**Appendix A: Figure 2.4-2**). A machine/maintenance shop was located in the Building 51L area prior to the 1970's. Solvent drum racks had at various times reportedly been located nearby along the wall of Building 51A, and along the retaining wall located approximately 20 feet west of Building 51L.

Plume Characterization

The principal plume constituents are CVOCs that were used as cleaning solvents, including TCE, PCE, and associated degradation products (e.g., cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride). Based on the results of soil and groundwater sampling, solvent spills that occurred at the location of Building 51L appear to be the primary source for the soil and groundwater contamination.

Maximum concentrations of groundwater COCs detected in the Building 51L Groundwater Solvent Plume above MCLs during the fourth quarter of FY05 are shown in **Table 4** in comparison to target risk-based MCSs (the required cleanup level). Vinyl chloride is the only COC that exceeds the target risk-based MCS.

Table 4. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 51L Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	310	1,594
PCE	9.5	343
cis-1,2-DCE	643	98,405
trans-1,2-DCE	70	94,405
1,1-DCE	21	28,873
1,1-DCA	100	3,663
vinyl chloride	**400**	12

Note: Boldface type indicates that the concentration exceeds the required MCS.

Corrective Measures

Rerouting Stormdrain Line

The existing 24-inch stormdrain and catch basin that is located within the plume will be relocated to prevent contaminated groundwater from entering the stormdrain and discharging to North Fork Strawberry Creek.

Soil Excavation with Offsite Disposal

Contaminated soil in the Building 51L Groundwater Solvent Plume Source Area will be excavated and disposed of offsite, which will reduce the impact of soil contaminants on groundwater quality in the plume area. The planned excavation geometry is expected to result in preservation of a sufficient number of existing groundwater monitoring wells to evaluate residual groundwater concentrations. 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 specific wells to be included in the program would be specified

only after it was determined that MNA was required, so no MNA monitoring requirements are presented herein.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 51L Groundwater Solvent Plume are shown in **Appendix A: Table 2.4-2** and **Appendix A: Figure 2.4-2**, respectively.

2.1.3.3. Building 71 Groundwater Solvent Plume (Building 71B Lobe)

The Building 71 complex housed the former Super Heavy Ion Linear Accelerator (Super HILAC) and associated support facilities. The Super HILAC is no longer in operation. Building 71B houses a machine shop.

Plume Characterization

The Building 71B Lobe of the Building 71 Groundwater Solvent Plume extends southwestward from Building 71B (**Appendix A: Figure 2.4-3**). The principal Building 71B lobe constituents are CVOCs that were used as cleaning solvents, including TCE, PCE, and associated degradation products (e.g., cis-1,2-DCE, and vinyl chloride). Based on the results of soil and groundwater sampling, solvent spills that occurred at the location of Building 71B appear to be the primary source for the soil and groundwater contamination. Accessible soil contamination in the source area has been previously excavated.

Maximum concentrations of groundwater COCs detected above MCLs during the fourth quarter of FY05 are shown in **Table 5** in comparison to MCLs (the required regulatory-based cleanup level) and target risk-based MCSs. TCE, PCE, cis-1,2-DCE, and vinyl chloride exceeded the required MCS during the fourth quarter of FY05. Vinyl chloride also exceeded the target risk-based value.

Table 5. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 71B Lobe of the Building 71 Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Regulatory-Based Groundwater MCS (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	**42**	5	1,594
PCE	**249**	5	343
cis-1,2-DCE	**56**	6	98,405
vinyl chloride	**16**	0.5	12

Note: Boldface type indicates that the concentration exceeds the required MCS.

Corrective Measures

In Situ Soil Flushing with HRC in the Source Area

The corrective measure being applied in the source area of the plume is in situ soil flushing combined with injection of Hydrogen Release Compound (HRC). The configuration of the soil flushing system is shown on **Figure 2.2**.

Hydrauger Effluent Capture and Treatment

Effluent from several hydraugers used to dewater the slopes for slope stability purposes has been collected, treated, and discharged to the sanitary sewer. Capture and treatment of effluent from these hydraugers will continue until CVOC concentrations are below detectable levels.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 71 Groundwater Solvent Plume are shown in **Appendix A: Table 2.4-3** and **Appendix A: Figure 2.4-3**, respectively. The requirements for monitoring parameters in support of MNA are listed in **Table 6**.

Table 6. Monitoring Requirements for Enhanced Biodegradation – Building 71B Lobe

Well Number	Location	Sampling Frequency	
		Hydrochemical Indicator Parameters(1)	VOCs (EPA Method 8260)
MW71-95-9(2)	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 Plume Core	not required	Quarterly
MW90-5	Downgradient	not required	Semiannually

(1) The required parameters and analytical methods are provided in Berkeley Lab, 2005c.
(2) Also used as upgradient well for Building 51/64 lobe

2.1.3.4 Building 7 Lobe of the Building 7 Groundwater Solvent Plume (AOC 2-4)

The Old Town Groundwater Solvent Plume is a broad, multi-lobed groundwater plume, composed primarily of CVOCs, which underlies much of the Old Town area. 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 (**Appendix A: Figure 2.4-4a**).

Plume Characterization

The Building 7 lobe (AOC 2-4) contains significantly higher VOC concentrations than the other two plume lobes, and extends northwestward from the northwest corner of Building 7 to the parking area downslope from Building 58 (**Appendix A: Figure 2.4-4b**).

Leaks and/or overflows of CVOCs (primarily PCE) from an abandoned sump (the Former Building 7 Sump ([AOC 2-5]) that was located north of Building 7 were the source of the contamination. The principal Building 7 lobe constituents are CVOCs that were used as cleaning solvents, including PCE and carbon tetrachloride, and their associated degradation products (e.g., TCE, 1,1-DCE, cis-1,2-DCE, and vinyl chloride). The sump and adjacent highly contaminated soil were excavated in 1995, although residual contaminated soil is still present in the source area.

Maximum concentrations of groundwater COCs detected above MCLs during the fourth quarter of FY05 in the plume source and core areas are shown in **Table 7a** in comparison to the target risk-based MCSs (the required cleanup level). TCE, PCE, and carbon tetrachloride exceeded the required cleanup level in the source and core areas.

Maximum concentrations of groundwater COCs detected above MCLs during the fourth quarter of FY05 in the plume periphery areas are shown in **Table 7b** in comparison to MCLs (the required regulatory-based cleanup level) and target risk-based MCSs. Seven CVOCs exceeded MCLs during the fourth quarter of FY05. No target risk-based values were exceeded.

Table 7a. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Source and Core Areas of the Building 7 Lobe of the Old Town Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	**33,000**	1,594
PCE	**42,000**	343
carbon tetrachloride	**1,900**	27
cis-1,2-DCE	340	98,405
1,1-DCE	340	28,873
1,1-DCA	15	3,663
vinyl chloride	3.6	12

Note: Boldface type indicates that the concentration exceeds the required MCS.

Table 7b. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Periphery Area Downgradient of the Building 7 Lobe of the Old Town Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Regulatory-Based MCS (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	**140**	5	1,594
PCE	**156**	5	343
carbon tetrachloride	**12**	0.5	27
cis-1,2-DCE	**41**	6	98,405
1,1-DCE	**125**	5	28,873
1,1-DCA	**32**	5	3,663
vinyl chloride	**1.4**	0.5	12

Note: Boldface type indicates that the concentration exceeds the required MCS.

Corrective Measures

Soil Excavation with Offsite Disposal

Contaminated soil in the plume source area will be excavated and disposed of offsite. This measure will reduce the impact of soil contaminants on groundwater quality in the plume area, although it is anticipated that post-excavation residual COC concentrations in groundwater in the source and core areas will likely remain above the required MCSs (target risk-based levels) for some chemicals.

In Situ Soil Flushing in the Source and Core Areas

An additional corrective measure being applied in the source and core areas of the plume is in situ soil flushing. The configuration of the Building 7 Lobe soil flushing system is shown on **Figure 2.3**. The principal components of the system (from east to west) are described below.

Former Building 7 Sump Injection Excavation: The Building 7 Sump remedial excavation was backfilled with gravel and two injection wells were installed within the backfill to allow the injection of treated groundwater.

Building 7 Groundwater Collection Trench: The Building 7 Groundwater Collection Trench is approximately 15 feet northwest of (downgradient from) the former Building 7 sump and intercepts contaminated water flowing from the former sump area. In addition to controlling the migration of contaminated groundwater from the source area, the collection trench currently captures reinjected groundwater flowing eastward from the Building 7 Injection Well System.

Building 7 Injection Well System: Six 24-inch diameter borings (IW7-02-1, through IW7-02-6) form a linear injection array downgradient from the Building 7 Groundwater Collection Trench. Treated groundwater that is injected into the system either flows westward where it is captured by three extraction wells and eastward where it is captured by the Building 7 Groundwater Collection Trench.

Building 53/58 Slope Groundwater Collection Trench and Soil Vapor Extraction System: Eight dual phase (groundwater and soil vapor) extraction wells were installed within the core area of the Building 7 lobe. These wells capture contaminated groundwater migrating westwards towards Building 58.

Building 58 East Groundwater Collection Trench: The Building 58-East Groundwater Collection Trench is located at the southeast corner of Building 58 to control the downgradient migration of the core of the Building 7 lobe, and is complementary to the Building 53/58 Slope Groundwater Collection Trench.

Building 58 West Groundwater Collection Trench: A groundwater collection trench was installed west of Building 58 at the edge of the Building 7 lobe to control downgradient migration.

Building 58 West Subdrain: Water is pumped from a concrete sump that was installed adjacent to an abandoned corrugated metal pipe subdrain west of Building 58. The purpose of the system is to prevent migration of contaminated water to surface water via the drain system.

Monitored Natural Attenuation in the Periphery Areas

Based on a natural attenuation evaluation conducted in the plume area in 1997, and on evaluation of chemical concentration trends, MNA is being used as the remediation method for the periphery area of the plume downgradient (west) of Building 58. MNA may be used in the periphery area north of the plume after concentrations in the core area have been reduced by soil flushing.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 7 Lobe are shown **in Appendix A: Table 2.4-4** and **Appendix A: Figures 2.4-4a and 2.4-4b**, respectively. The requirements for monitoring parameters in support of MNA for the downgradient periphery area are listed in **Table 8**. MNA requirements for the Building 53 crossgradient lobe area will not be specified until the effects of soil flushing and the additional source area excavation on the magnitude and extent of groundwater contamination have been determined.

Table 8. Requirements for Monitored Natural Attenuation - Building 7 Lobe of the Old Town Groundwater Solvent Plume, Downgradient Area

Well Number	Location	Sampling Frequency	
		Hydrochemical Indicator Parameters(1)	VOCs (EPA Method 8260)
MW 58A-94-14	Downgradient Periphery	Semiannually for one year and then annually	Semiannually
MW58-93-3	Crossgradient Periphery	Semiannually for one year and then annually	Semiannually
MW51-94-15	Downgradient	not required	Annually
MW51-96-3	Downgradient	not required	Annually
SB58-98-6	Downgradient	not required	Annually

(1) The required parameters and analytical methods are provided in Berkeley Lab, 2005c.

2.1.3.5 Building 52 Lobe of the Old Town Groundwater Solvent Plume

Plume Characterization

The Building 52 lobe lies at the northern edge of "Old Town" and extends northwestward from the area east of Building 52 to Building 46 (**Appendix A: Figure 2.4-5**). The distribution

of elevated VOC concentrations in the Building 52 lobe indicates that the source of groundwater contamination was located east of Building 52A. Groundwater and soil sampling conducted in that area indicated that a source of the lobe was likely spills in the vicinity of the paved area east of Building 52A. Contaminated soil was excavated from that area.

Maximum concentrations of groundwater COCs detected in the Building 52 lobe above MCLs during the fourth quarter of FY05 are shown in **Table 9** in comparison to MCLs (the required regulatory-based cleanup level) and the target risk-based MCSs. TCE, PCE, and carbon tetrachloride exceeded the required MCS during the fourth quarter of FY05. Concentrations of all CVOCs were well below target risk-based values.

Table 9. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 52 Lobe of the Old Town Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Regulatory-Based Groundwater MCS (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	**12**	5	1,594
PCE	**25**	5	343
carbon tetrachloride	**4.2**	0.5	27

Note: Boldface type indicates that the concentration exceeds the required MCS.

Corrective Measures

Migration Control at the Building 46 Subdrain

The downgradient migration of the Building 52 lobe is controlled by the Building 46 subdrain, located east of Building 46A. Contaminated groundwater in the subdrain is extracted and treated.

In Situ Soil Flushing

The corrective measure being applied to the core of the plume is in situ soil flushing. The configuration of the Building 52 lobe soil flushing system, including the location of the Building 46 Subdrain is shown on **Figure 2.3**. The in situ soil flushing system includes five injection wells. The injected water is captured by four extraction wells or further downgradient at the lobe margin by the Building 46 Subdrain.

Monitored Natural Attenuation and Enhanced Bioremediation

Observed ratios of parent compounds to degradation products within the Building 52 lobe indicate that natural degradation occurs during downgradient migration of the contaminated groundwater. Therefore, MNA and/or enhanced bioremediation may be implemented if either 1) soil flushing ceases to result in further significant declines in concentrations and MCSs have not been attained or 2) groundwater CVOC concentrations rebound to levels above MCLs after cessation of flushing.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 52 Lobe are shown in **Appendix A: Table 2.4-5** and **Appendix A: Figure 2.4-5**, respectively.

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

Plume Characterization

The Building 25A Lobe lies near Buildings 25 and 25A (**Appendix A: Figure 2.4-6**), and encompasses two subplumes of groundwater contamination, containing different suites of COCs, which are likely derived from different sources. The primary western subplume contains TCE, 1,1-DCE and minor amounts of cis-1,2-DCE, and extends from the western portion of Building 25A westward to the eastern edge of Building 6. The secondary eastern subplume contains primarily PCE (approximately 20 µg/L maximum concentration), with lower concentrations of TCE and carbon tetrachloride. This subplume extends from east of Building 25A to south of Building 25.

The principal Building 25A lobe constituents are CVOCs that were used as cleaning solvents including TCE, PCE, and carbon tetrachloride and their degradation products (e.g., 1,1-DCE, cis-1,2-DCE, and chloroform). Based on the concentrations of COCs in the groundwater, the source area for the western subplume is located near the western end of Building 25A.

Maximum concentrations of groundwater COCs detected in the Building 25A lobe of the Old Town Groundwater Solvent Plume above MCLs during the fourth quarter of FY05 are shown in **Table 10** in comparison to MCLs (the required regulatory-based cleanup level) and the target risk-based MCSs. TCE, PCE, carbon tetrachloride, and 1-1-DCE exceeded the required MCS during the fourth quarter of FY05. Concentrations of all CVOCs were well below target risk-based values.

Table 10. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 25A Lobe of the Old Town Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Regulatory-Based Groundwater MCS (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	**161**	5	1,594
PCE	**39**	5	343
Carbon tetrachloride	**1.5**	0.5	27
1,1-DCE	**19**	6	28,873

Note: Boldface type indicates that the concentration exceeds the required MCS.

Corrective Measures

In Situ Soil Flushing

The corrective measure being applied to the plume is in situ soil flushing. The configuration of the Building 25A lobe soil flushing system is shown on **Figure 2.3**. A groundwater collection trench located south of Building 44 controls the migration of contaminated groundwater from the Building 25A lobe source area on the west side of Building 25A. Contaminated groundwater is extracted from a well that was installed within the trench and from a groundwater monitoring well north of Building 25A. The extracted groundwater is treated and then injected into a shallow gravel-filled infiltration bed located upgradient of the trench to flush contaminants from the subsurface.

Monitored Natural Attenuation and Enhanced Bioremediation

Observed ratios of parent compounds to degradation products downgradient from the source area at Building 25A indicate that natural degradation occurs during downgradient migration of the contaminated groundwater. Therefore, MNA and/or enhanced bioremediation may be implemented if either 1) soil flushing ceases to result in further significant declines in concentrations and MCSs have not been attained or 2) groundwater CVOC concentrations rebound to levels above MCLs. The specific wells to be included in the program would be specified only after it was determined that MNA was required, so no MNA monitoring requirements are presented herein.

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 and 37 Treatment Systems. This measure prevents the migration of contaminated groundwater through electrical conduits to the Building 37 area.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 25A Lobe are shown in **Appendix A: Table 2.4-6** and **Appendix A: Figure 2.4-6**, respectively.

2.1.3.7 Building 69A Area of Groundwater Contamination

The most likely source of the Building 69A Area of Groundwater 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.

Plume Characterization

The area of groundwater contamination is located to the southwest of Building 69 (**Appendix A: Figure 2.4-8**). The principal COCs in the area of groundwater contamination are

degradation products of CVOCs that were used as cleaning solvents (e.g., cis-1,2-DCE and vinyl chloride). Lower concentrations of trans-1,2-DCE, PCE, 1,1,1-TCA, and other VOCs, including aromatic hydrocarbons, have also been occasionally detected.

Maximum concentrations of groundwater COCs detected in the Building 69A Area of Groundwater Contamination above MCLs during the fourth quarter of FY05 are shown in **Table 11** in comparison to target risk-based MCSs (the required cleanup level). Vinyl chloride exceeded the required MCS during the fourth quarter of FY05.

Table 11. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 69A Area of Groundwater Contamination

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Target Risk-Based Groundwater Media Cleanup Standard (µg/L)
cis-1,2-DCE	44	98,405
vinyl chloride	**52**	12

Note: Boldface type indicates that the concentration exceeds the required MCS.

Corrective Measures

Monitored Natural Attenuation and Enhanced Bioremediation

Available chemical and geochemical data indicate that biodegradation of groundwater contaminants by reductive dechlorination is occurring in the Building 69A Area of Groundwater Contamination. Therefore, MNA is the primary corrective measure. To expedite the cleanup process, MNA is being supplemented with enhanced bioremediation through injection of HRC into the source area.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 69A Area of Groundwater Contamination are shown in **Appendix A: Table 2.4-8c** and **Appendix A: Figure 2.4-8**, respectively.

The requirements for monitoring parameters in support of MNA are listed in **Table 12**.

Table 12. Requirements for Monitored Natural Attenuation – Building 69A Area of Groundwater Contamination

Well Number	Location	Sampling Frequency	
		Geochemical 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	Semiannually
MW69-97-8	Downgradient Plume Core	Semiannually for one year and then annually	Semiannually
MW69A-92-22	Crossgradient	not required	Semiannually
SB77-02-1	Downgradient	not required	Semiannually

(1) The required parameters and analytical methods are provided in Berkeley Lab, 2005c.

2.1.3.8 Solvents in Groundwater South of Building 76 (AOC 4-5)

Building 76 is located in the western part of the Support Services Area of Berkeley Lab. The building is primarily used as a vehicle fueling and maintenance facility for the motor pool. The primary source of the groundwater contamination south of Building 76 is suspected to have been the result of motor pool operations, although the specific source has not been located.

Plume Characterization

The groundwater solvent plume extends approximately 100 feet southwards from the motor pool area on the south side of Building 76 (**Appendix A: Figure 2.4-8**). Groundwater containing CVOCs lies beneath the existing motor pool gasoline and diesel underground storage tanks and also extends northward beneath Building 76. Maximum concentrations of groundwater COCs detected in the Building 76 area above MCLs during the fourth quarter of FY05 are shown in **Table 13** in comparison to target risk-based MCSs (the required cleanup level). No COCs exceed the required target risk-based groundwater MCSs, so no corrective measures are required.

Table 13. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 76 Groundwater Solvent Plume

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Maximum Contaminant Level (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	14.5	5	1,594

Monitoring Requirements

Groundwater monitoring is not required at this unit for compliance with CAP requirements, however, monitoring will be conducted to record the progress toward achieving the long-term site-wide goal of MCLs. The groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 76 Groundwater Solvent Plume are shown in **Appendix A: Table 2.4-8a** and **Appendix A: Figure 2.4-8**, respectively.

2.1.3.9 Building 75/75A Area of Groundwater Contamination

Plume Characterization

A small area where CVOCs have been detected in the groundwater near Buildings 75 and 75A extends southward from the east side of Building 75A toward Building 75 (**Appendix A: Figure 2.4-8**). The contamination may be related to operations of the Building 75 Former Hazardous Waste Handling and Storage Facility; however, the source has not been confirmed since only relatively low concentrations of COCs have been detected in the soil in the area.

The principal Building 75A Area of Groundwater Contamination constituents are CVOCs that were used as cleaning solvents, including TCE and degradation products (e.g., 1,1-DCE, and cis-1,2-DCE). Maximum concentrations of groundwater COCs detected in the Building 75/75A Area of Groundwater Contamination above MCLs during the fourth quarter of FY05 are shown in **Table 14** in comparison to target risk-based MCSs (the required cleanup level). No COCs exceed the required target risk-based groundwater MCSs, so no corrective measures are required.

Table 14. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 75/75A Area of Groundwater Contamination

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Maximum Contaminant Level (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
TCE	7.4	5	1,594
cis-1,2-DCE	43	6	98,405

Monitoring Requirements

Groundwater monitoring is not required at this unit for compliance with CAP requirements; however, monitoring will be conducted to record the progress toward achieving the long-term site-wide goal of MCLs. The groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 75/75A Area of Groundwater Contamination are shown in **Appendix A: Table 2.4-8d** and **Appendix A: Figure 2.4-8**, respectively.

2.1.3.10 Building 77 Area of Groundwater Contamination

The location of the Building 77 Area of Groundwater Contamination is shown on **Appendix A: Figure 2.4-8**. The Building 77 Sanitary Sewer System (AOC 5-4) was considered the most likely source of the groundwater contamination, based on its location relative to the contamination. Soil and soil-gas sampling conducted along the sewer line, however, could not identify a source area.

Plume Characterization

The principal Building 77 Area of Groundwater Contamination constituents are degradation products of CVOCs that were used as cleaning solvents, including cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and 1,1-DCA. No chemicals were detected in the groundwater at a concentration above the MCL in FY05; however, cis-1,2-DCE was detected at a concentration equal to the MCL (**Table 15**). No COCs exceed the required target risk-based groundwater MCSs, so no corrective measures are required.

Table 15. Maximum Concentrations of COCs Exceeding MCLs during the Fourth Quarter of FY05 in the Building 77 Area of Groundwater Contamination

COC	Maximum Concentration Fourth Quarter FY05 (µg/L)	Maximum Contaminant Level (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
none [(a)]			

(a) Cis-1,2-DCE was detected at the MCL (6.0 µg/L) in FY05. Cis-1,2-DCE (6.1 µg/L maximum) was detected at a concentration slightly above the MCL in FY04.

Monitoring Requirements

Groundwater monitoring is not required at this unit for compliance with CAP requirements; however, monitoring will be conducted to record the progress toward achieving the long-term site-wide goal of MCLs. The groundwater monitoring schedule and locations of wells for monitoring of VOCs for the Building 77 Area of Groundwater Contaminations are shown in **Appendix A: Table 2.4-8b** and **Appendix A: Figure 2.4-8**, respectively. If concentrations do not exceed MCLs for four consecutive quarters, groundwater monitoring will no longer be required for this unit.

2.1.3.11 Benzene Detected in Wells East of Building 75A

Benzene has been detected in two relatively deep monitoring wells (MW91-4 and MW75A-00-7) on the east side of Building 75A. The locations of the wells are shown on **Appendix A: Figure 2.4-8**. The wells are screened within the Orinda Formation from approximately 115 to 145 feet below ground surface. The source of the benzene is not known; however, since benzene has also been detected in other deep wells screened in the Orinda Formation at other locations at Berkeley Lab, it is possible that the benzene is naturally occurring.

Plume Characterization

Benzene has been detected in MW91-4 and MW75A-00-7 most quarters the wells have been sampled, and is generally the only VOC detected in either well. Benzene has not been detected in two shallower monitoring wells (MW75-99-7 and MW75-96-20), which are within approximately

14 feet of the deeper wells, but screened above a depth of 50 feet. The maximum concentration of benzene detected in each of the two deep wells in FY05 is listed in **Table 16**. Benzene has not been detected at a concentration above the target risk-based MCS, so no corrective measures are required.

Table 16. Maximum Concentrations of Benzene Detected in Groundwater during the Fourth Quarter of FY05 in the Building 75A Area

Well Number	Maximum Concentration Fourth Quarter FY05 (µg/L)	Maximum Contaminant Level (MCL) (µg/L)	Target Risk-Based Groundwater MCS (µg/L)
MW91-4	17.5	1	175
MW75A-00-7	69.5	1	175

Monitoring Requirements

Groundwater monitoring is not required at this unit for compliance with CAP requirements. Although the benzene may be naturally occurring, monitoring will continue, at least for the near term, as long as the benzene concentration is above the MCL. MW75A-00-7 will be monitored annually for VOC (**Appendix A: Table 2.4-8f).** The location of MW75A-00-7 is shown in **Appendix A: Figure 2.4-8**.

2.1.3.12 Building 75 Tritium Plume

Plume Characterization

The Building 75 Tritium Plume extends from the Corporation Yard (the area between Buildings 69 and 75) southwards towards Chicken Creek (**Appendix A, Figure 4-3**). The source of the plume was the former National Tritium Labeling Facility (NTLF), which operated inside Building 75 for almost 20 years until December 2001. Tritium concentrations in all monitoring wells have been less than the MCL (20,000 pCi/L), except for one well (MW75-97-5) which had a maximum tritium concentration of 21,301 pCi/L in FY05. Tritium concentrations in most wells have been declining since closure of the NTLF, with the concentration of tritium in MW75-97-5 declining to a level below the MCL during the third quarter of FY05.

Tritium has also been detected in a localized area near Building 71B (**Appendix A: Figure 4-1**), with concentrations substantially less than those detected in the Building 75 area. The tritium in the groundwater in this area was likely derived from surface runoff from the Lawrence Hall of Science area to the northeast of Building 71. The concentration of tritium in the groundwater near Building 71 has generally been below or only slightly above (610 pCi/L maximum) the 300 pCi/L reporting limit since closure of the NTLF.

Corrective Measures

Slope stability and observation wells within the Support Services Area were previously upgraded with bentonite and cement surface seals or were properly destroyed by overdrilling and backfilling with concrete to prevent infiltration of potentially contaminated surface water. In addition, a defect identified in the sanitary sewer line southeast of Building 75B was repaired in 1997. In addition, corrugated-metal stormdrains in this area were lined with PVC casings to prevent leakage of water from the stormdrains and eliminate the resultant artificial recharge of the groundwater, thereby reducing potential downgradient migration of tritium-contaminated groundwater.

Monitoring Requirements

The Water Board-approved groundwater monitoring schedule and locations of wells for monitoring of Building 75 Tritium Plume are shown in **Appendix A: Table 5-1** and **Appendix A: Figures 4-1** (Building 71B area) **and 4-6** (Building 75 area), respectively. Groundwater (and surface water) will continue to be monitored for tritium to ensure that current conditions are maintained or improved (i.e. tritium activities remain below levels of concern) by verification of the following:

1. Tritium activities remain below levels of concern (MCLs)
2. Tritium does not migrate offsite in the groundwater
3. The groundwater plume remains stable or the magnitude and/or extent of contamination decreases.

If the above conditions are maintained through 2008, Berkeley Lab will request that DOE approve that monitoring of groundwater be discontinued.

2.1.3.13 Metals Monitoring Program

Inorganic elements (metals) are not COCs at Berkeley Lab based on the findings of the HHRA (Berkeley Lab, 2003a). However, metals are present in a few locations at Berkeley Lab at concentrations that exceed both MCLs and Berkeley Lab background levels (Berkeley Lab, 2002a). Therefore, annual monitoring of metals is required for selected wells. Some of these metals may be present at naturally occurring levels but are detected at concentrations above estimated background levels because of the statistical method used to calculate background. The groundwater monitoring schedule for metals is shown in **Table 17**.

Table 17. Monitoring Wells Requiring Annual Sampling for Inorganic Elements (Metals) of Potential Concern

Monitoring Well	Inorganic Element of Potential Concern
MW7B-95-24	mercury
MW75-99-8	arsenic
MW51B-93-18A	
MW64-97-1	
MW37-92-18A	arsenic
MW64-97-2	selenium
MW77-92-10	molybdenum
MW77-94-5	
MW46-92-9	
MW51-92-2	
MW51-00-9	
MW51-00-10	

2.1.3.14 Perimeter and Offsite Monitoring Program

To ensure that COCs at Berkeley Lab do not migrate beyond the property boundary in the groundwater, a network of perimeter and offset wells has been defined. These wells are sampled for VOCs. The groundwater monitoring schedule and locations of wells for the perimeter and offsite monitoring program are shown in **Appendix A: Table 2.4-9** and **Appendix A: Figure 2.4-9**, respectively.

2.2 SURFACE WATER MONITORING

The Berkeley Lab surface water monitoring program is provided in **Table 18**. Surface water samples will be collected from all site creeks during the rainy season and from all flowing creeks during the dry season and analyzed for VOCs and metals. Surface water samples will also be collected at the same time for tritium analysis from Chicken Creek and North Fork Strawberry Creek. Since tritium concentrations in groundwater in these two watersheds have been declining, and the source of tritium (NTLF) ceased operations in 2001, Berkeley Lab will request that the DOE approve no further creek sampling for tritium associated with this Groundwater Monitoring and Management Plan at the end of 2008 if tritium is not detected above the reporting limit of 300 pCi/L. Any surface water sampling required by the Berkeley Lab Storm Water Monitoring Program will continue as required by that program

Table 18. Requirements for Surface Water Sampling

Sampling Location	VOC and Metals Sampling Schedule	Tritium Sampling Schedule
Chicken Creek Upstream and Downstream Locations	Semiannually – rainy and dry season	Semiannually through 2008 – rainy and dry season
North Fork Strawberry Creek Upstream and Downstream Locations	Semiannually – rainy and dry season	Semiannually through 2008 – rainy and dry season
Botanical Garden Creek	Semiannually – rainy and dry season	
Cafeteria Creek	Annually – rainy season	
No-Name Creek	Semiannually – rainy and dry season	
Ravine Creek	Annually – rainy season	
Ten-Inch Creek	Annually – rainy season	

2.3 GENERAL PROCEDURES AND REPORTING

Groundwater and surface water monitoring will be performed in accordance with requirements of the ERP Quality Assurance Program Plan (QAPP) (Berkeley Lab, 1994b), Berkeley Lab ERP Standard Operating Procedures (SOPs) (Berkeley Lab, 1994c), and the Berkeley Lab ERP Health and Safety Program Plan (HSPP) (Berkeley Lab, 2004a).

The required analytical methods and reporting limits are listed in **Table 19**.

Table 19. Analytical Methods and Reporting Limits

Parameter	EPA Method	Reporting Limit
VOCs	8260	MCL
metals	6000 & 7000 series	MCL
PCBs	8082	MCL (0.5 µg/L)
Tritium	906	300 pCi/L

Groundwater and surface water sampling results will be documented in the Quarterly Progress Reports that are submitted to the DTSC in accordance with Berkeley Lab's RCRA Part B Permit requirements. The report for the fourth quarter of each fiscal year will provide tables and graphs of the historical groundwater data for VOCs and four quarters of groundwater data for metals, PCBs, and tritium; and will also discuss trends in the data and progress towards achieving MCSs.

In their approval of Berkeley Lab's 2005 *Proposal for Revised Groundwater Monitoring Schedule* (Water Board, 2005b), the Water Board made the approval contingent on two conditions. One of the conditions was that "Berkeley Lab shall incorporate all storm water, surface water (including hydraugers) analytical data into annual groundwater monitoring reports for a coordinated effort between the storm water, surface water and groundwater monitoring programs to insure contained groundwater is not migrating into surface water creeks." The Berkeley Lab Storm Water Monitoring Program analyzes surface water samples for selected metals (aluminum, iron, magnesium, and zinc), total petroleum hydrocarbons, ammonia, and nitrate, gross alpha and beta, and tritium. The only parameter required by both programs and associated with any known groundwater plumes is tritium. Storm water tritium results will therefore be included in the Quarterly Progress Report for the fourth quarter of each fiscal year.

SECTION 3

GROUNDWATER MANAGEMENT CONTROLS

Groundwater management controls are needed at Berkeley Lab to reduce or eliminate potential risks to human health from exposures associated with contaminated groundwater and the potential for releases of contaminated groundwater to the environment. To ensure compliance, these management controls will be incorporated into appropriate sections of the Berkeley Lab Health and Safety Manual (Pub-3000), which governs health and safety throughout the facility, and/or the Berkeley Lab Regulations and Procedures Manual (RPM), which summarizes policies and regulations governing operations at the facility.

Management controls for contaminated groundwater at Berkeley Lab include:

1. Restrictions on the permissible uses of contaminated groundwater.
2. Restrictions on future land use stemming from groundwater contamination.
3. Mitigation methods that must be employed during the construction of new site buildings in the vicinity of areas of groundwater contamination to protect the health of construction workers and/or future indoor workers in those buildings.
4. Written procedures for protecting workers and the environment if contaminated groundwater is encountered during excavation and construction.
5. A description of mitigation measures that must be employed for drain systems (i.e., hydraugers, building subdrains, stormdrains) that capture contaminated groundwater.

3.1 RESTRICTIONS ON GROUNDWATER EXTRACTION AND USE

The following restrictions apply to use of groundwater in all areas of Berkeley Lab where groundwater COC concentrations exceed detectable levels. The current locations subject to these restrictions are shown on **Figure 4.1.**

- Groundwater may not be used for drinking or other domestic purposes.
- Groundwater may not be used for industrial, irrigation, or other non-domestic purposes unless treated prior to use. These groundwater uses must follow discharge and reuse requirements (including permissible contaminant concentrations) specified in Water Board Order R2-2004-0055/NPDES NO. CAG912003 (**Appendix B**). These requirements include the filing of a Notice of Intent with the Water Board at least 60 days prior to any planned use of groundwater for these purposes.

3.2 RESTRICTIONS ON LAND USE

3.2.1 Chemical Contamination

3.2.1.1 Land Use and Cleanup Levels

Soil and groundwater cleanup requirements for chemicals at Berkeley Lab are based on an institutional/industrial land use scenario, which is consistent with the current and potential future land use at Berkeley Lab. Both the HHRA (Berkeley Lab, 2003a) and the CMS Report (Berkeley Lab, 2005a) were completed based on the assumption that an institutional land-use scenario consistent with operation of a research laboratory would continue at Berkeley Lab for the foreseeable future. That scenario was used for the primary risk evaluations in the HHRA and the determination of the required cleanup levels in the CMS Report. Areas of contamination that pose a potential risk to institutional workers are therefore being cleaned up to an institutional/industrial land-use level.

The HHRA provided risk estimates for institutional receptors by calculating theoretical incremental lifetime cancer risks (ILCRs) and non-cancer hazard indices (HIs), assuming an industrial/institutional land use scenario. These calculated measures of risk were compared to established threshold values. The theoretical ILCRs were compared to the USEPA target cancer risk range of 10^{-4} to 10^{-6}, which is considered by the agency to be safe and protective of public health [Federal Register 56(20): 3535, Wednesday, January 30, 1991]. Exposure to chemicals with an HI below 1.0 is considered unlikely to result in adverse non-cancer health effects over a lifetime of exposure. Although the USEPA considers an ILCR anywhere within the target range for risk managers (also referred to as the risk management range) of 10^{-4} to 10^{-6} to be safe and protective of public health, the lowest reasonably achievable level within the risk management range (10^{-6}), or an HI of 1.0 was selected for determining target cleanup level. The upper limit of the risk management range (10^{-4}) or an HI of 1.0 is the basis for determining whether institutional land use restrictions should apply.

The HHRA also provided supplemental risk estimates for a hypothetical future restricted residential land use scenario (i.e., assessing risks to residents but assuming that domestic use of site groundwater would not occur). The primary HHRA risk driver for all wells was cancer risk

for the adult resident. Cancer risks for the child resident and HI thresholds for adult and child residents did not drive risks at any wells. Results of this supplemental estimate are used as the basis for restrictions proposed on residential land use in this plan. Residential land use restrictions are proposed where the theoretical ILCR is greater than 10^{-6} or the HI is greater than 1.0 for a hypothetical future adult resident.

3.2.1.2 Residential Land Use Restrictions

To determine the needed extent of residential land use restrictions, the results of the HHRA residential-risk evaluation of site groundwater were updated using the maximum groundwater contaminant concentrations detected at each well during calendar year 2005. In addition, risks for 1,1-dichloroethene (1,1-DCE) were not included because that analyte was reclassified as a non-carcinogen subsequent to completion of the original HHRA calculations. The relationship between theoretical ILCR and chemical concentrations as calculated in the HHRA is linear for each well. Therefore, updated ILCRs were recalculated based on this linear relationship for wells in all areas of groundwater contamination at Berkeley Lab. The results of this analysis are provided in **Appendix C** and are illustrated on **Figure 4.2**. These results indicate that chemical concentrations in groundwater pose potential risks to hypothetical future residential receptors in six areas, based on the risk evaluation method provided in the HHRA, as updated with calendar year 2005 data. At this time, these areas are therefore considered unsuitable for residential land use, so should be restricted to institutional land use unless measures are implemented to mitigate the risk or additional data are collected to show that the risk is within acceptable levels. (Note that 1,1-DCE was reclassified by DTSC as a non-carcinogen as the HHRA was being published. Since a small area southeast of Building 75B was calculated in the HHRA to have unacceptable potential risks solely due to 1,1-DCE concentrations, **Figure 4.2** has been modified to exclude this area.)

Risk mitigation measures might include:

- Remediating contaminated groundwater to levels that are protective of unrestricted land use.

- Collecting soil gas samples at the units to provide the data to estimate risks more directly and accurately than the groundwater sampling data from which the potential risks were previously estimated. Soil gas sampling data should be collected using guidelines outlined in the DTSC *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, 2004). The soil gas data should be compared to values acceptable to DTSC, which may include Office of Environmental Health Hazard Assessment (OEHHA, 2005) soil gas screening numbers or Water Board soil gas screening numbers if OEHHA chemical specific values are not available (Water Board, 2003); alternatively, a more detailed site-specific risk evaluation might be completed using the soil gas data.

3.2.1.3 Institutional Use Restrictions on Construction of New Site Buildings or Improvements

As shown on **Figure 4.3**, only two areas of groundwater contamination are currently considered unsuitable for unrestricted institutional use because groundwater concentrations exceed upper-limit MCSs. Upper-limit MCSs are presented in the CMS Report, and represent the COC concentrations that would result in a Theoretical Incremental Lifetime Cancer Risk (ILCR) of 10^{-4} or a Hazard Index (HI) equal to 1.0 for institutional land use. Although cleanup of these areas to concentrations below target MCSs (ILCR of 10^{-6} or a Hazard Index (HI) equal to 1.0 for institutional land use) is planned for the CMI, new buildings or other improvements intended for human occupancy may not be constructed at these locations until one or more of the following conditions are met and approved by DTSC:

- COC concentrations are lower than upper-limit MCSs,
- mitigation methods are implemented to ensure that risks to future building occupants are within acceptable levels, or
- additional groundwater or soil gas data are collected to document that risks to human health would be within acceptable levels.

Mitigation methods may include engineering controls used to eliminate contaminant migration pathways. Typically, such controls include installation of contaminant-resistant subslab organic-vapor barriers, lateral routing of utilities to avoid vapor barrier penetration, sealing of utility penetrations, and/or subslab ventilation systems (DTSC, 2004). Any mitigation measures implemented would require the approval of the DTSC. In addition, post-construction

soil-gas and/or indoor air monitoring should be considered, or may be required by the DTSC, to document that risks to indoor workers are within acceptable levels.

Since the primary risk driver at the areas shown on **Figure 4.3** results from the potential for infiltration of vapor volatilized from soil migrating into indoor air, soil gas samples could be collected to provide a more accurate estimate of risk than was derived based on the groundwater sampling results. Any soil-gas sampling should be conducted in accordance with guidelines specified in the DTSC Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (DTSC, 2004). The soil gas data should be compared to the most recent SB32 soil gas screening numbers (OEHHA, 2005) (or other applicable and appropriate screening numbers available) to assess whether risks exceed the screening levels. In plume areas that are subject to ongoing remediation at the time that such soil-gas sampling took place, the documentation that risks are sustainably below threshold levels must include an assessment of the potential for rebound in concentration levels upon termination of remediation measures.

Although only two relatively small areas are currently considered unsuitable for unrestricted institutional use, groundwater concentrations exceed target MCSs (ILCRs that exceed 10^{-6}) in five areas (**Figure 4.3**). Although land use restrictions are not proposed for institutional use of those areas, risk management measures should be incorporated into future site development plans for those areas.

Designs for new buildings or other improvements must include accommodations to ensure that groundwater remediation systems can continue operation, or can be replaced with systems that can meet the cleanup objectives. In addition, groundwater monitoring wells used for compliance in these areas must either remain in place and accessible, or must be replaced with wells that meet the objectives listed in Section 2. Construction planning documents must provide for proper destruction procedures for groundwater monitoring wells that are no longer needed, in accordance with California Department of Water Resources (DWR) (DWR, 1991) Guidelines for destroying wells. In addition, a permit application for well destruction must be submitted to the City of Berkeley.

3.2.2 Restrictions at Radiological Units

The United States Department of Energy (DOE) has specified restrictions on the use of the eight identified radiological units at Berkeley Lab. DOE stipulated that release of the units to the general public was not authorized. One of these units, the former National Tritium Labeling Facility, was the source of both the Building 75 groundwater tritium plume, and a relatively small area of tritium-contaminated groundwater in the vicinity of Building 71B. Therefore, the areas overlying these zones of tritium-contaminated groundwater are restricted from residential use until DOE approves the release of these areas for unrestricted use. The locations of these areas are shown on **Figure 4.4**.

3.3 EXCAVATION AND CONSTRUCTION ACTIVITIES

Preconstruction Evaluation of Groundwater

Prior to beginning any penetration action of ground or existing surfaces at Berkeley Lab, including locations where groundwater may be encountered, a Permit to Penetrate Ground or Existing Surfaces of LBNL Property must be obtained in accordance with requirements of Administrative Procedure (ADMN-053). Section 4.0 of the Procedure is a Ground or Existing Surfaces Penetration Job Safety Analysis (JSA) Checklist, which includes an Existing Contamination Evaluation as Item 48. The Administrative Procedure (ADMN-053) is included as **Appendix D** to this Groundwater Monitoring and Management Plan.

After it is determined that soil or groundwater is to be disturbed at a project site, the responsible individual/project manager or sponsoring-group representative will notify the Environmental Services Group (ESG) to initiate a preconstruction site evaluation. The ESG will then evaluate the proposed project location to determine:

- The nature and extent of any contamination known or likely to be present in the soil or groundwater
- Whether any preconstruction soil or groundwater sampling is required

The initial evaluation will consist of a review of **Figures 2.1 to 2.3**, which show the locations of subsurface groundwater remediation systems; **Figures 4.1 through 4.4**, which show

the locations of groundwater contaminant plumes and associated use restrictions; and the figures presented in **Appendix A**, which show the locations of Berkeley Lab monitoring wells used for compliance monitoring. Detailed information on the nature and extent of groundwater contamination can be obtained from additional reference sources, including the various RFI reports (Berkeley Lab, 1994a, 1995, and 2000), the *Human Health Risk Assessment* (Berkeley Lab, 2003a), the CMS Report (Berkeley Lab, 2005a), and the *Proposal for Revised Monitoring Schedule for the Lawrence Berkeley National Laboratory Environmental Restoration Program* (Berkeley Lab, 2005b).

Written procedures will be provided for protection of workers and the environment for excavation and construction projects that may encounter groundwater in the vicinity of groundwater plumes. For all Berkeley Lab plume areas shown in **Figure 4.1**, project-specific construction risk management plans will be prepared to document procedures for site monitoring, spill contingency, and treatment and discharge requirements. If groundwater must be extracted from construction excavations, or could be released to surface water courses or drain systems in the vicinity of the plumes identified in **Figure 4.1**, it should be captured and treated. Capture would generally involve installation of extraction wells, sumps, or trenches, and construction of piping to an appropriate and permitted discharge point. Discharges to the sanitary sewer must comply with the provisions of the EBMUD wastewater discharge permit.

For groundwater plume areas where risk-based MCSs are exceeded, project-specific construction risk management plans will be prepared to document construction worker protection and training requirements to mitigate potential health risks to construction workers due to contact with or ingestion of groundwater (**Figure 4.3**). Generally, such workers would need to maintain OSHA HAZWOPER training certification at a minimum.

3.4 MITIGATION CRITERIA FOR DRAIN SYSTEMS

Groundwater entering existing and planned drain systems (i.e., hydraugers, building subdrains, stormdrains) that capture contaminated groundwater from groundwater plumes (**Figure 4.1**) falls under the same restrictions for reuse of treated groundwater detailed in Section 3.1 above.

SECTION 4
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LIST OF FIGURES

Figure 2.1 Soil Flushing System, Building 51/64 Groundwater Solvent Plume Source Area.

Figure 2.2 Soil Flushing System, Building 71B Lobe of the Building 71 Groundwater Solvent Plume Source Area.

Figure 2.3 Soil Flushing and Groundwater Migration Control Systems, Old Town Groundwater Solvent Plume.

Figure 4.1 Berkeley Lab Groundwater CVOC Plumes.

Figure 4.2 Extent of Land Not Suitable for Residential Use at Non-Radiological Units.

Figure 4.3 Locations of Areas Where Institutional Land Use Restrictions are Imposed due to Groundwater Contamination.

Figure 4.4 Locations of Areas of Underlain by Tritium-Contaminated Groundwater Not Released for Reuse by General Public.

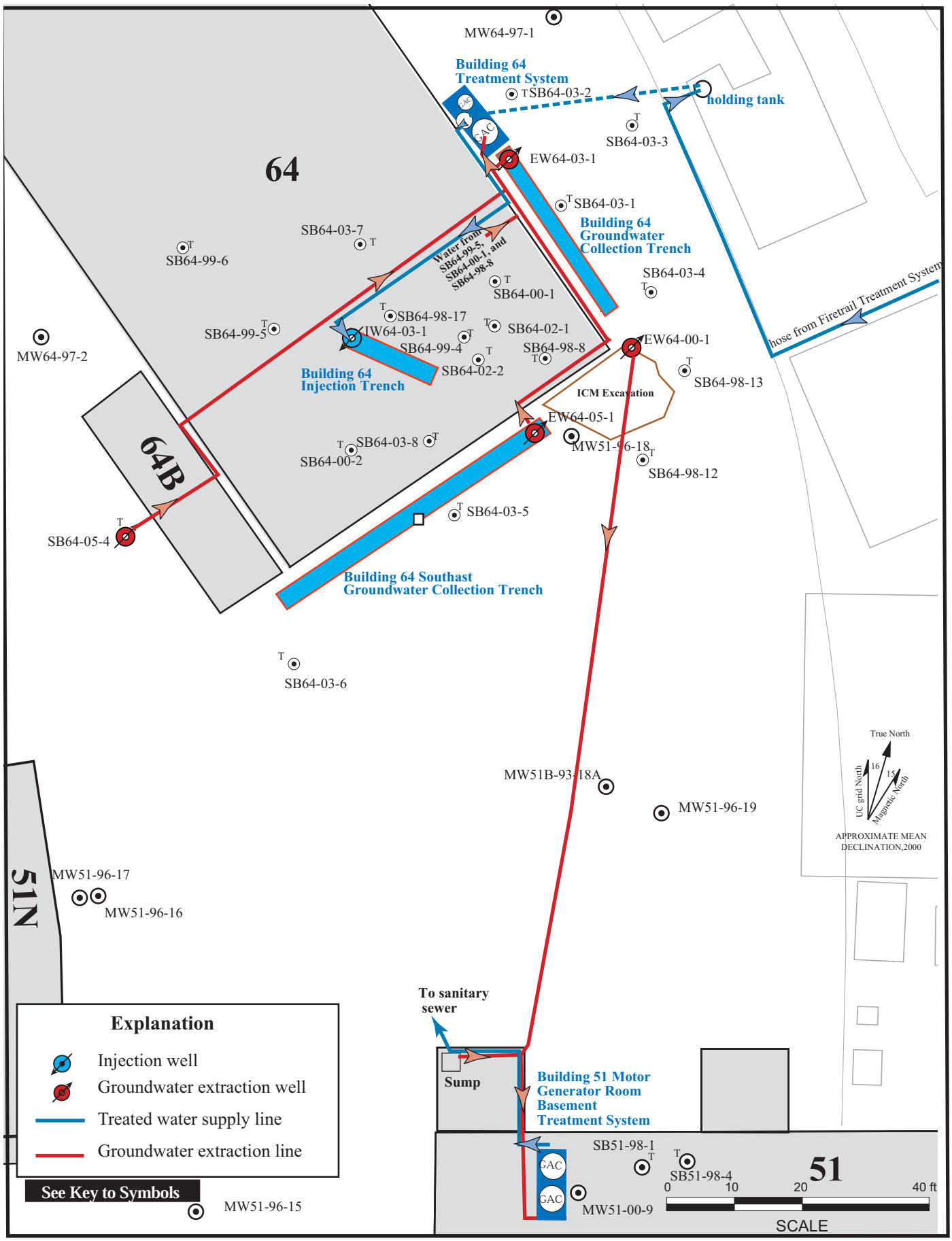

Figure 2.1. Soil Flushing System, Building 51/64 Groundwater Solvent Plume Source Area.

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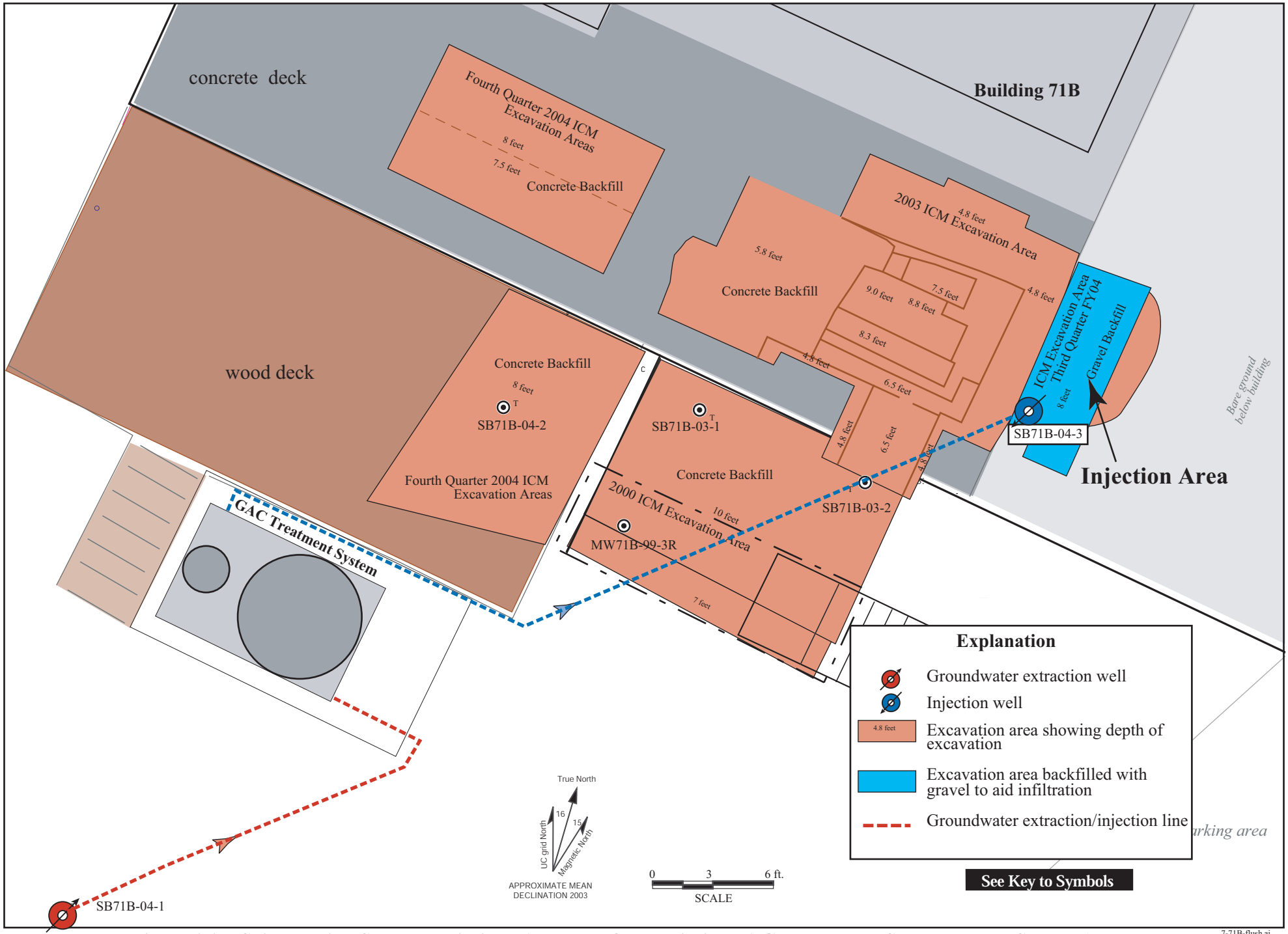

Figure 2.2. Soil Flushing System, Building 71B Lobe of the Building 71 Groundwater Solvent Plume Source Area.

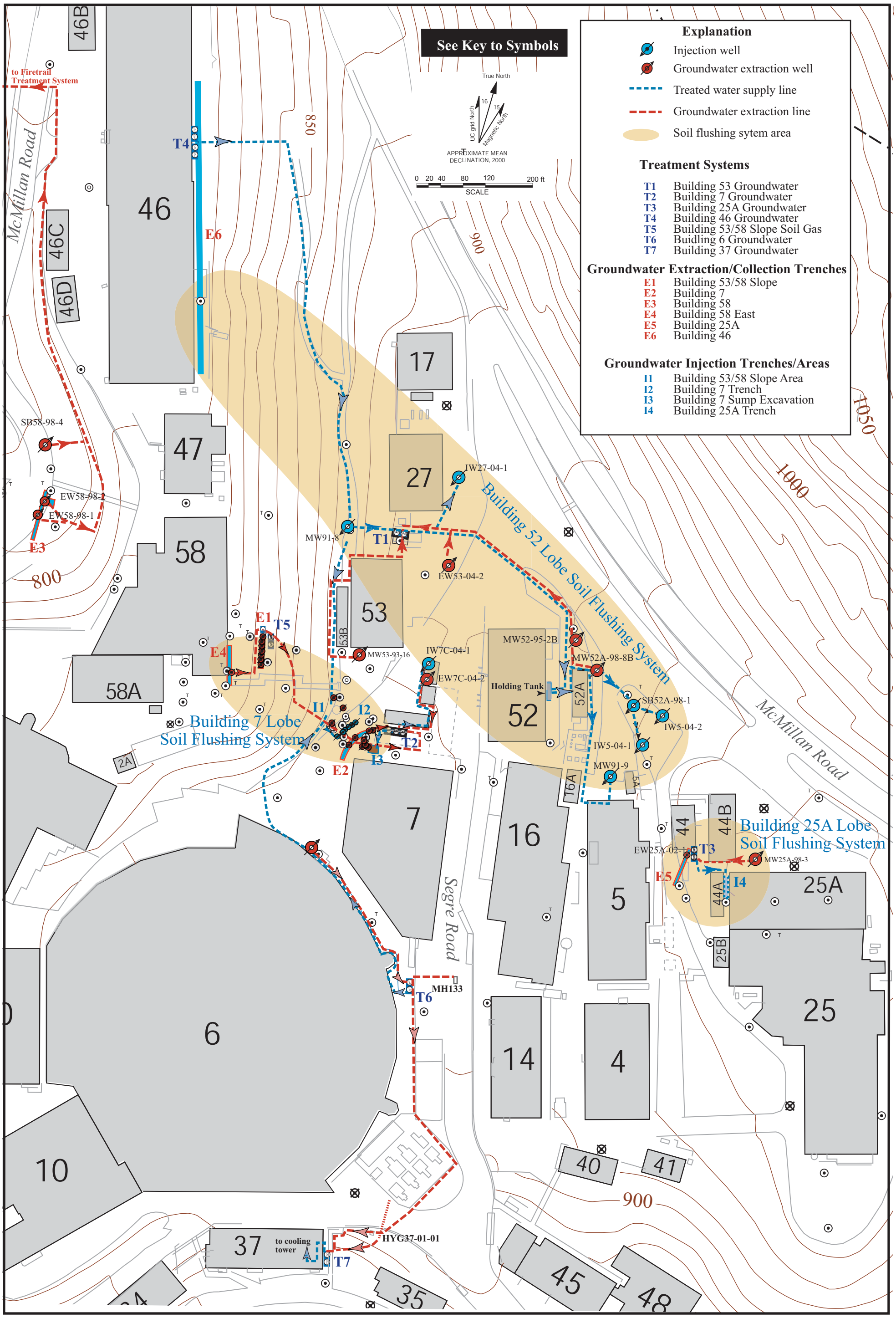

Figure 2.3. Soil Flushing and Groundwater Migration Control Systems, Old Town Groundwater Solvent Plume.

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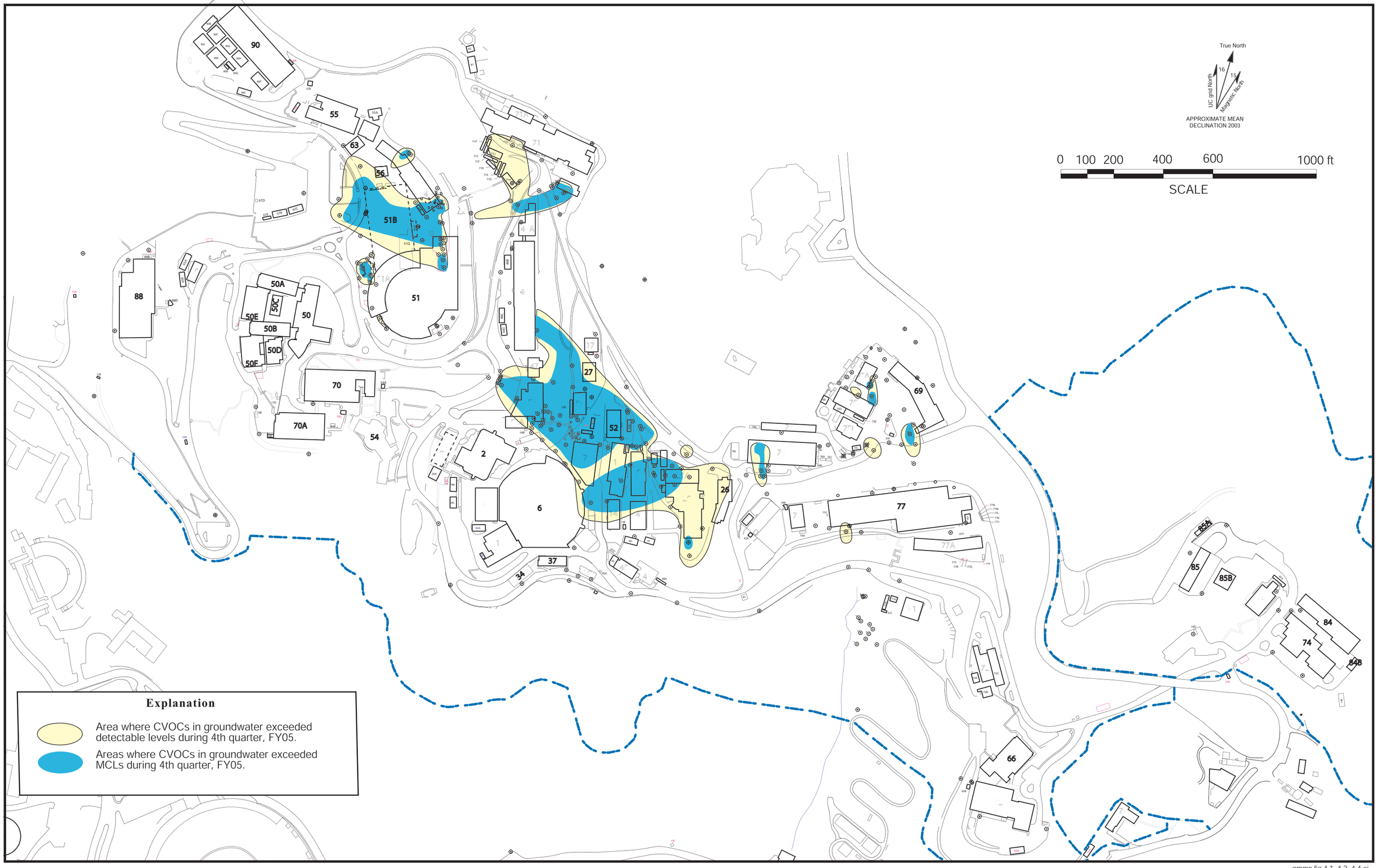

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Figure 4.1. Berkeley Lab Groundwater CVOC Plumes.

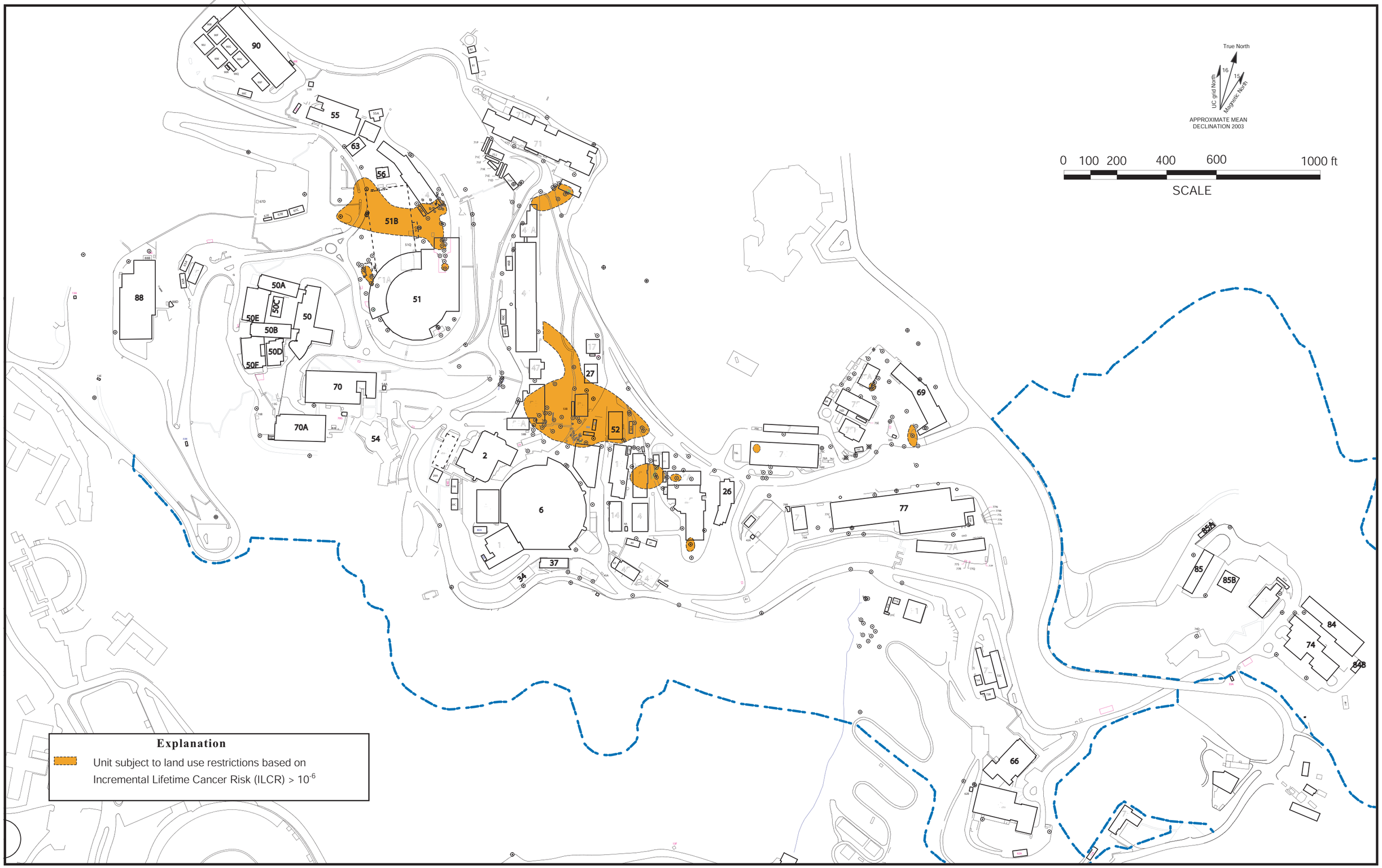

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Figure 4.2. Extent of Land Not Suitable for Residential Use at Non-Radiological Units.

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Figure 4.3. Locations of Areas Where Institutional Land Use Restrictions are Imposed due to Groundwater Contamination.

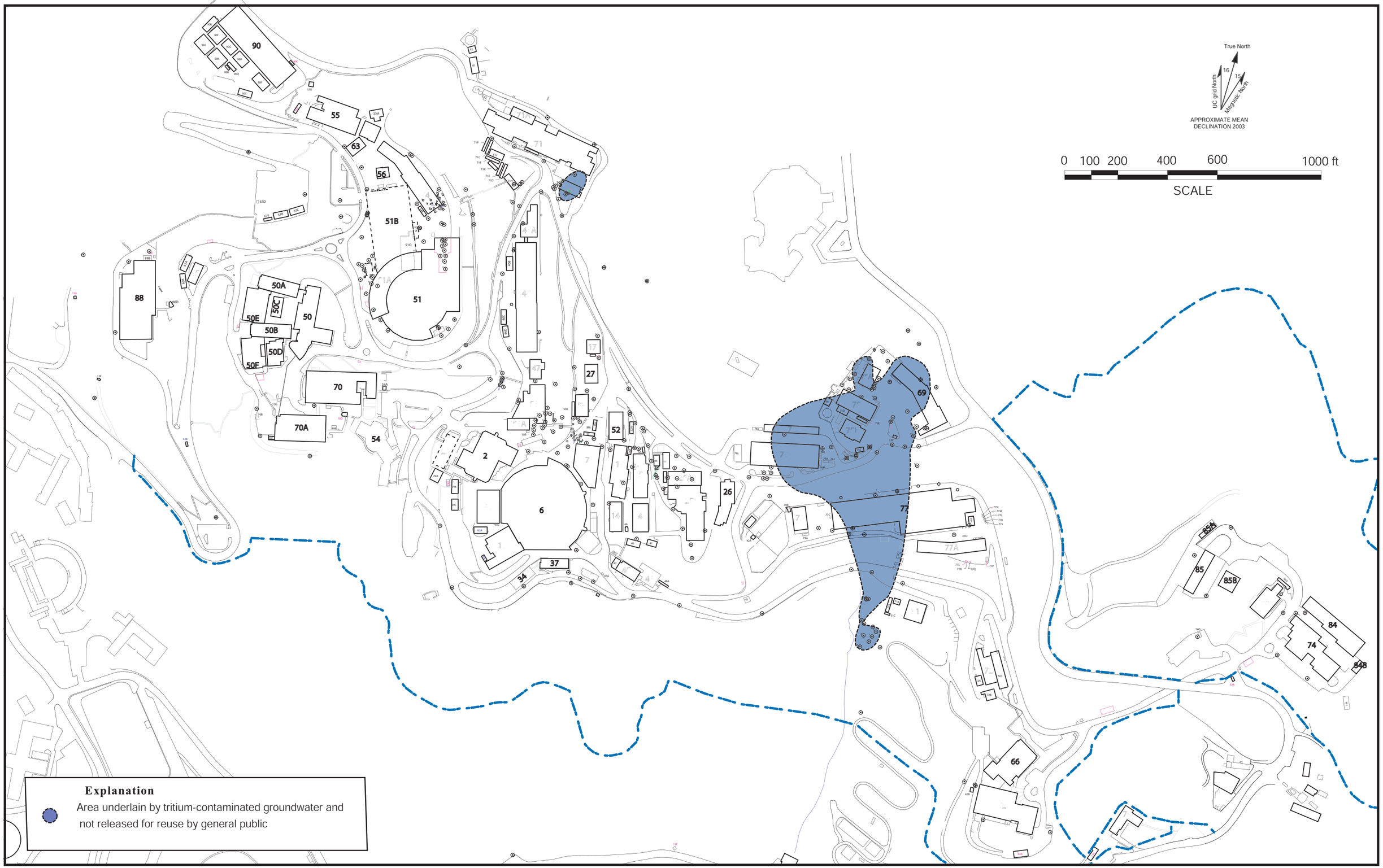

Figure 4.4. Locations of Areas of Underlain by Tritium-Contaminated Groundwater Not Released for Reuse by General Public.

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Appendix A

Approved Groundwater Monitoring Schedule

The attached figures and tables listing the groundwater monitoring schedule and showing the locations of wells required for monitoring were revised from the *Proposal for Revised Groundwater Monitoring Schedule* (Berkeley Lab, 2005b) submitted to the Water Board in May 2005. The Water Board approved the schedule proposed in that document in August 2005 (Water Board, 2005).

MW25-95-5	Groundwater monitoring well
MW90-6	Properly destroyed monitoring well
T SB76-97-3	Temporary groundwater sampling point
EW or EW	Groundwater extraction well
IW	Groundwater injection well
DP	Dual phase extraction well
SSW-31.63	Slope stability well
SI-3.63	Slope indicator well
71-95-10 or VZM-OT-1	Vadose zone monitoring well
	Groundwater monitoring point
	Spring
700	Topographic contour line (elevation in ft above mean sea level)
700	Water level contour line (elevation in ft above mean sea level)
	Surface creek
	Berkeley Lab site boundary
17	Surface structure (e.g. buildings, etc.)

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

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Key to Symbols Used on Figures.

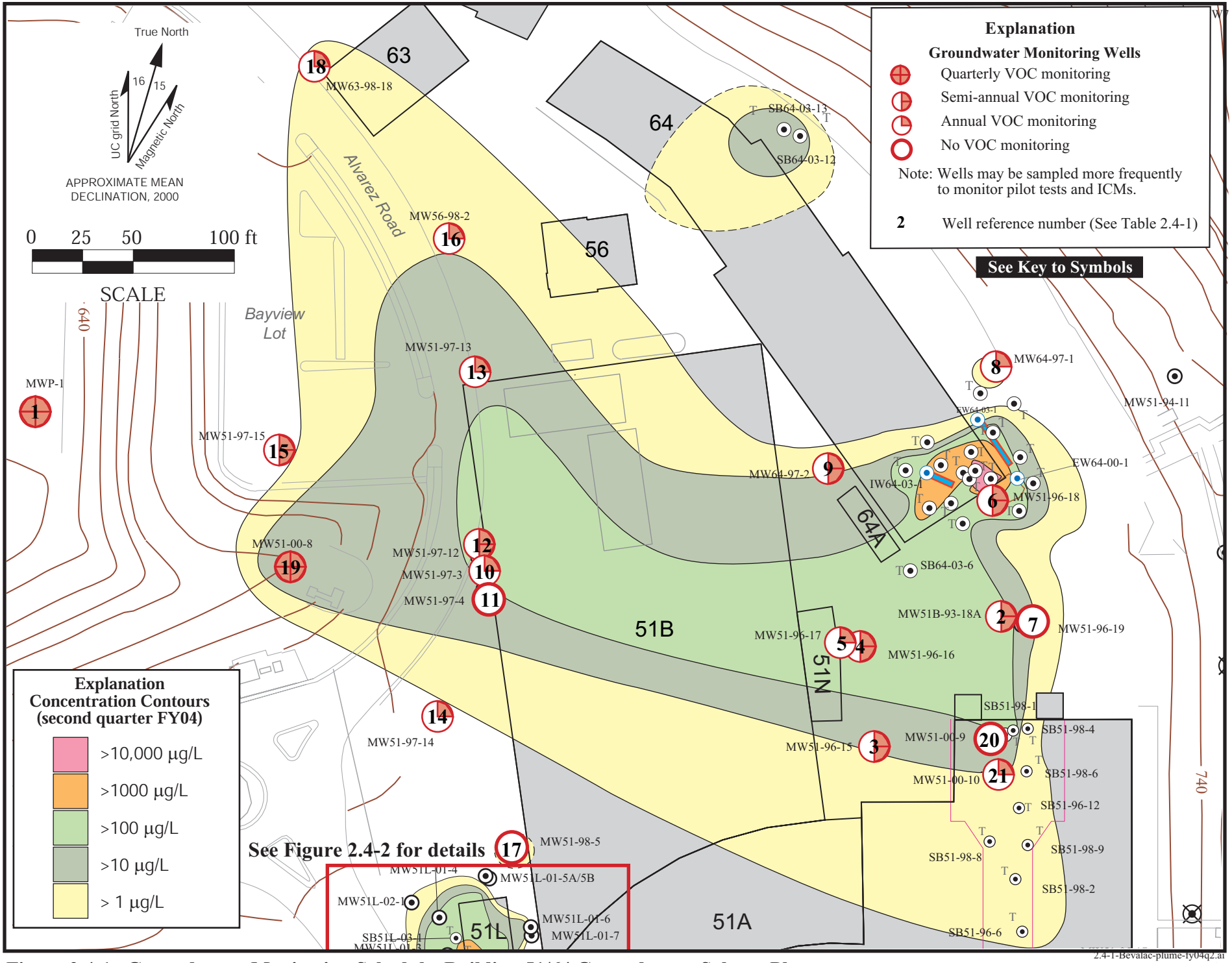

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Figure 2.4-1. Groundwater Monitoring Schedule, Building 51/64 Groundwater Solvent Plume.

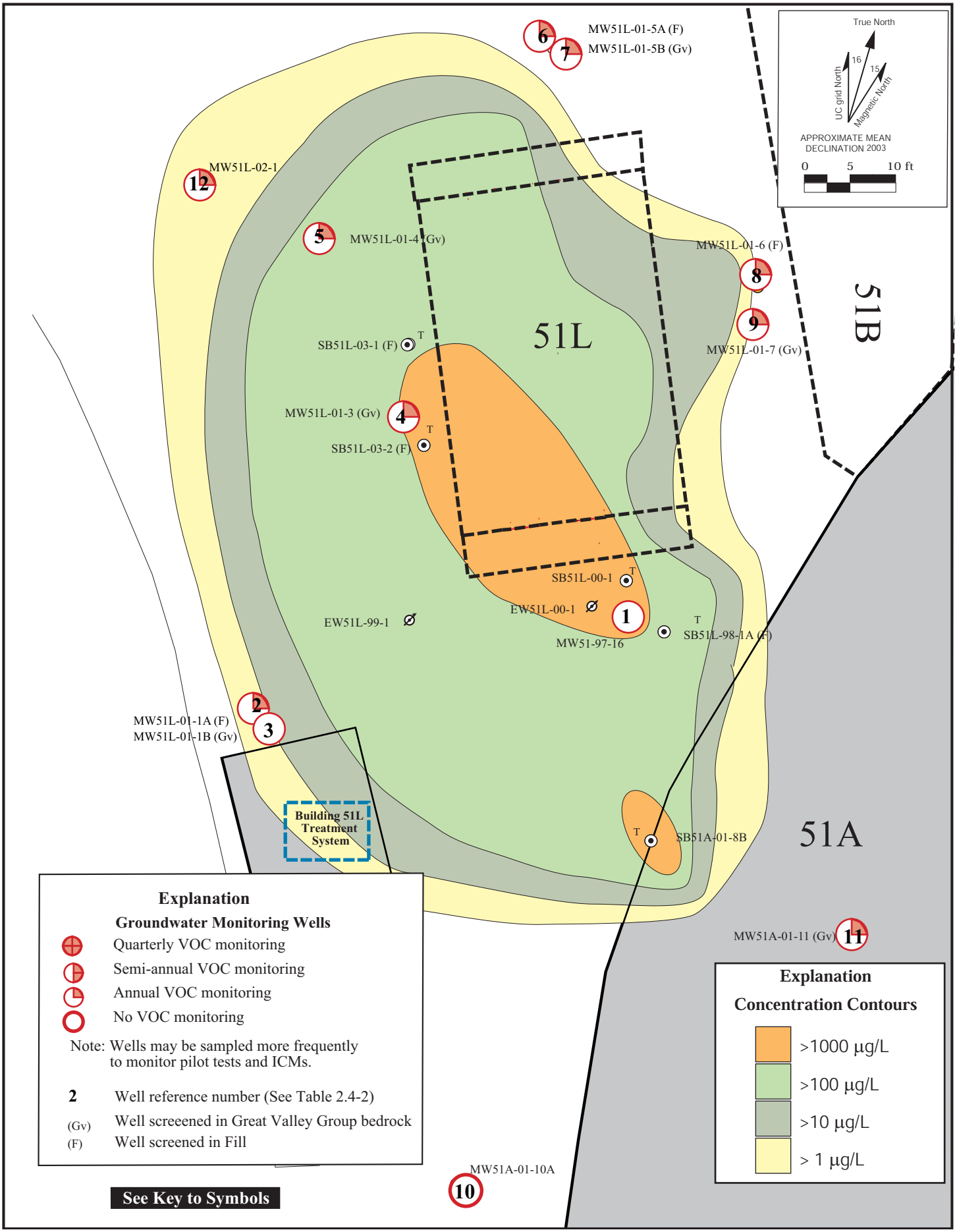

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Figure 2.4-2. Groundwater Monitoring Schedule, Building 51L Groundwater Solvent Plume.

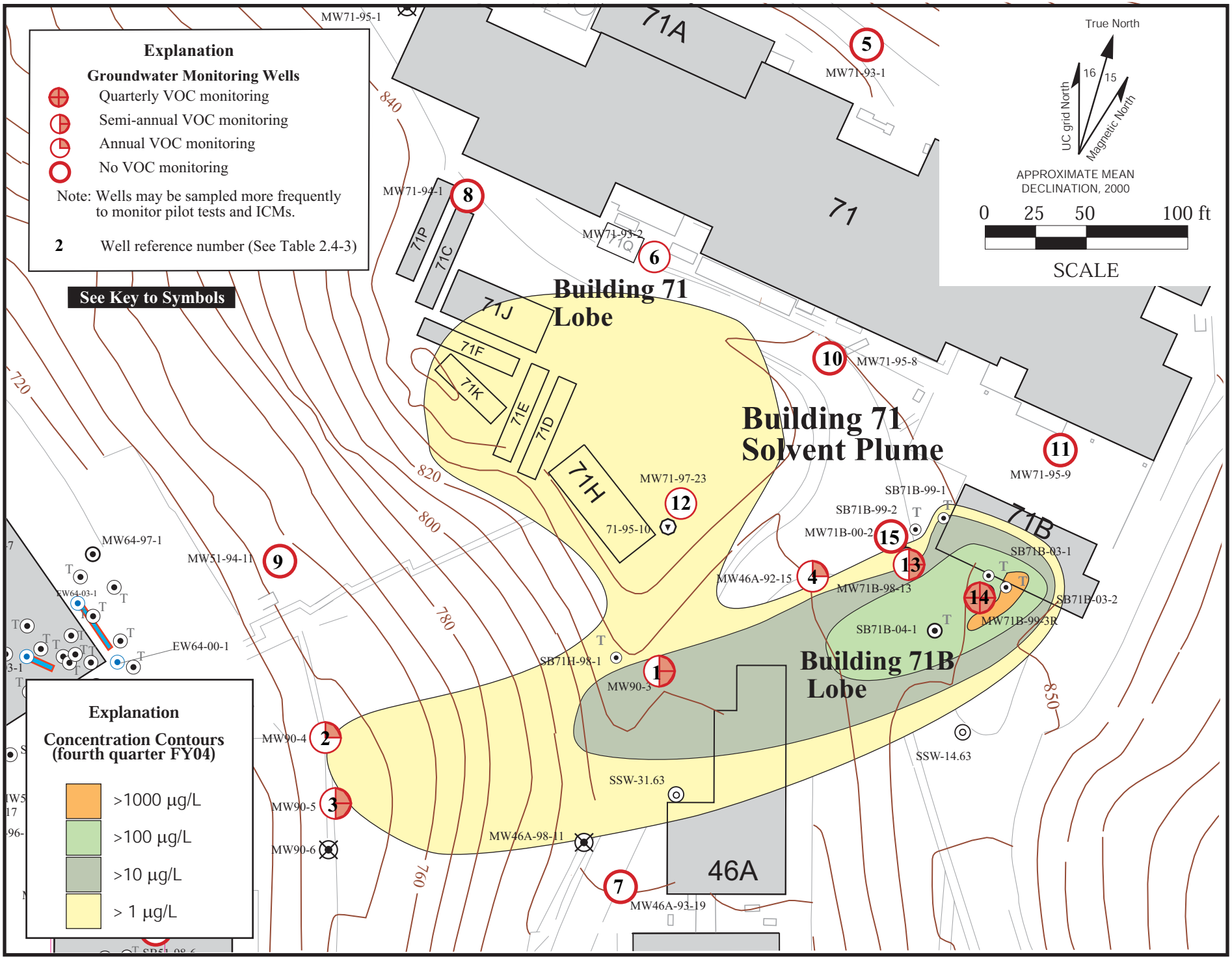

Figure 2.4-3. Groundwater Monitoring Schedule, Building 71 Groundwater Solvent Plume.

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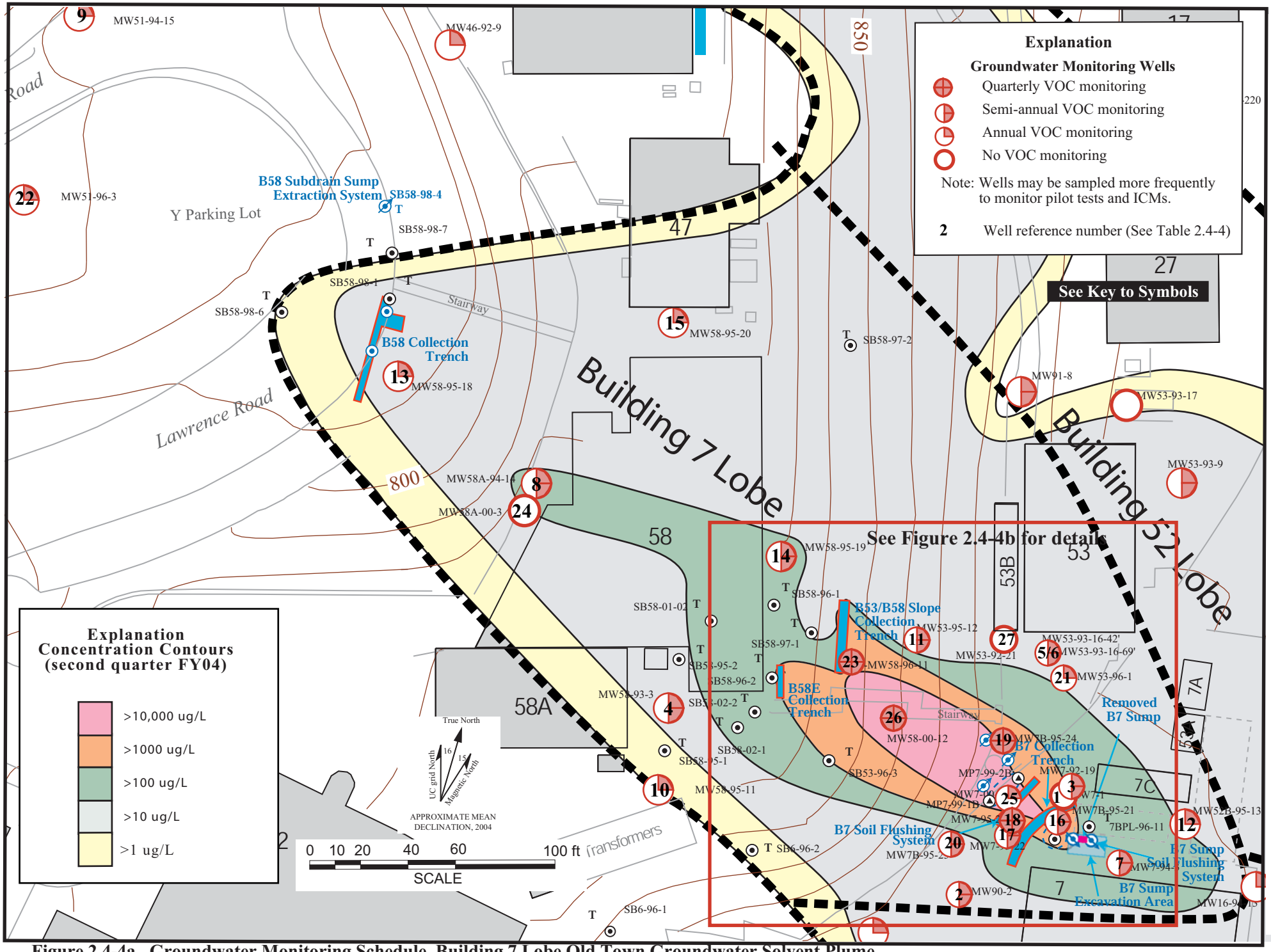

Figure 2.4-4a Groundwater Monitoring Schedule, Building 7 Lobe Old Town Groundwater Solvent Plume.

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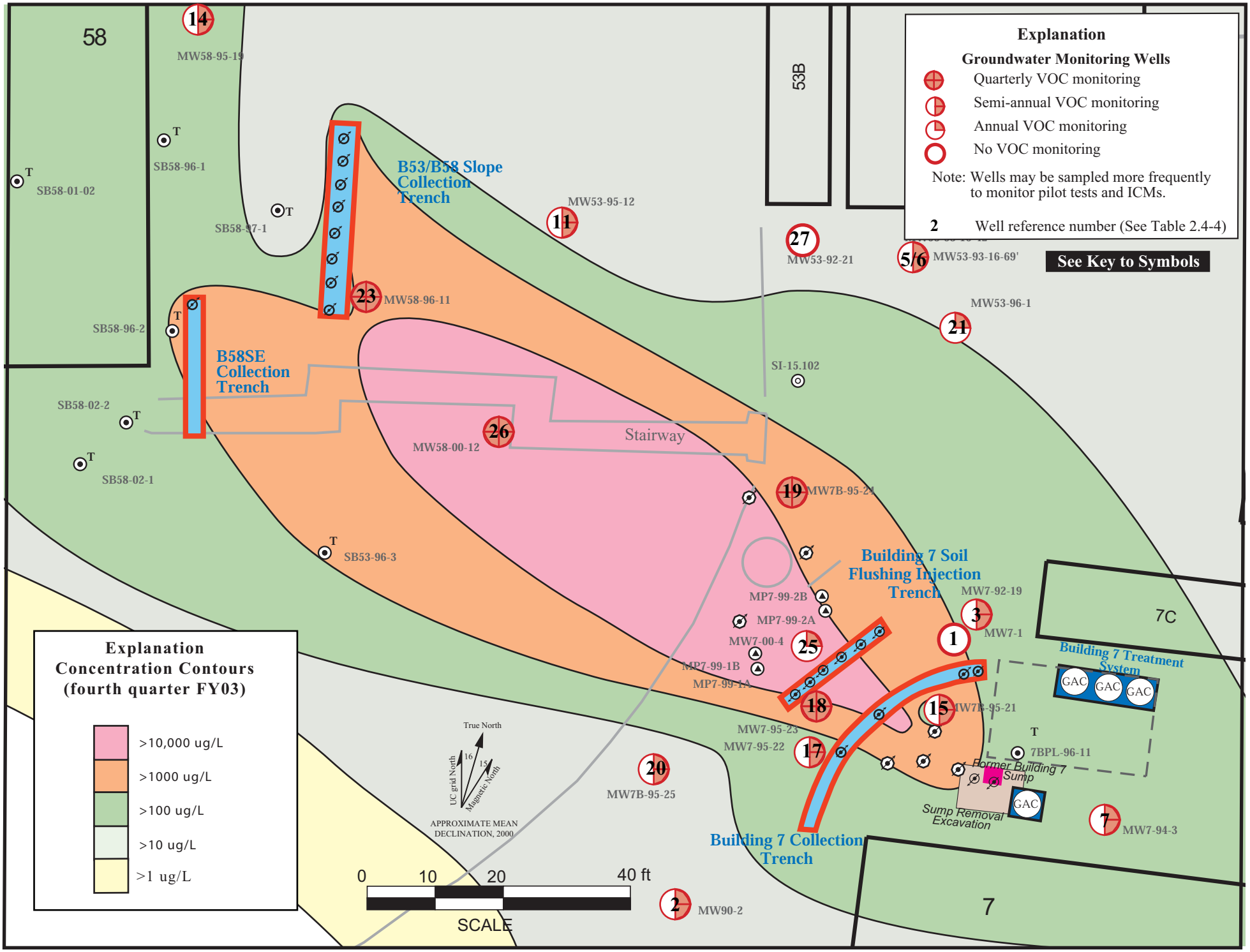

Figure 2.4-4b. Groundwater Monitoring Schedule, Building 7 Lobe Old Town Groundwater Solvent Plume Source Area.

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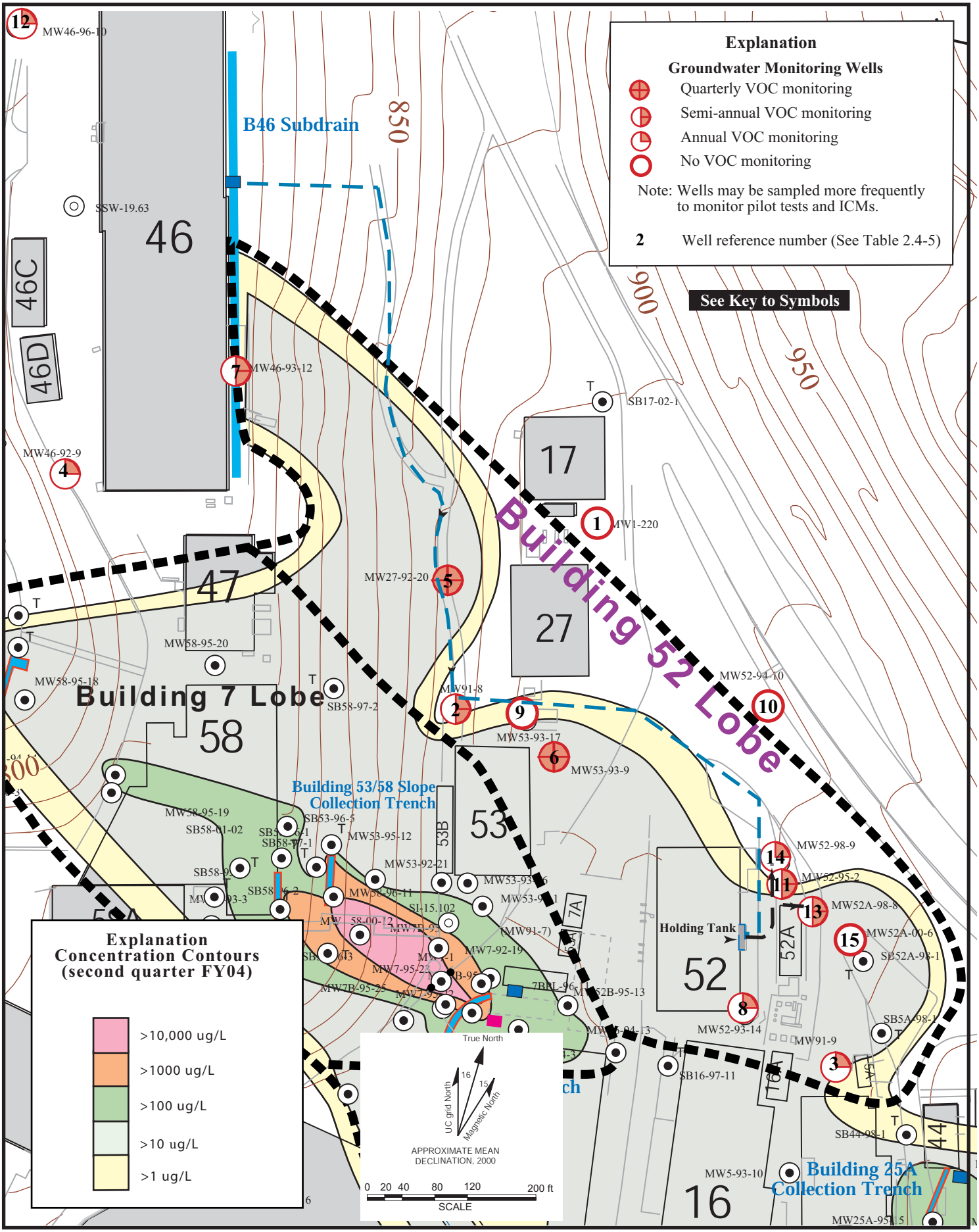


Figure 2.4-5. Groundwater Monitoring Schedule, Building 52 Lobe Old Town Groundwater Solvent Plume.

2.4-5-b52lobe
1/05

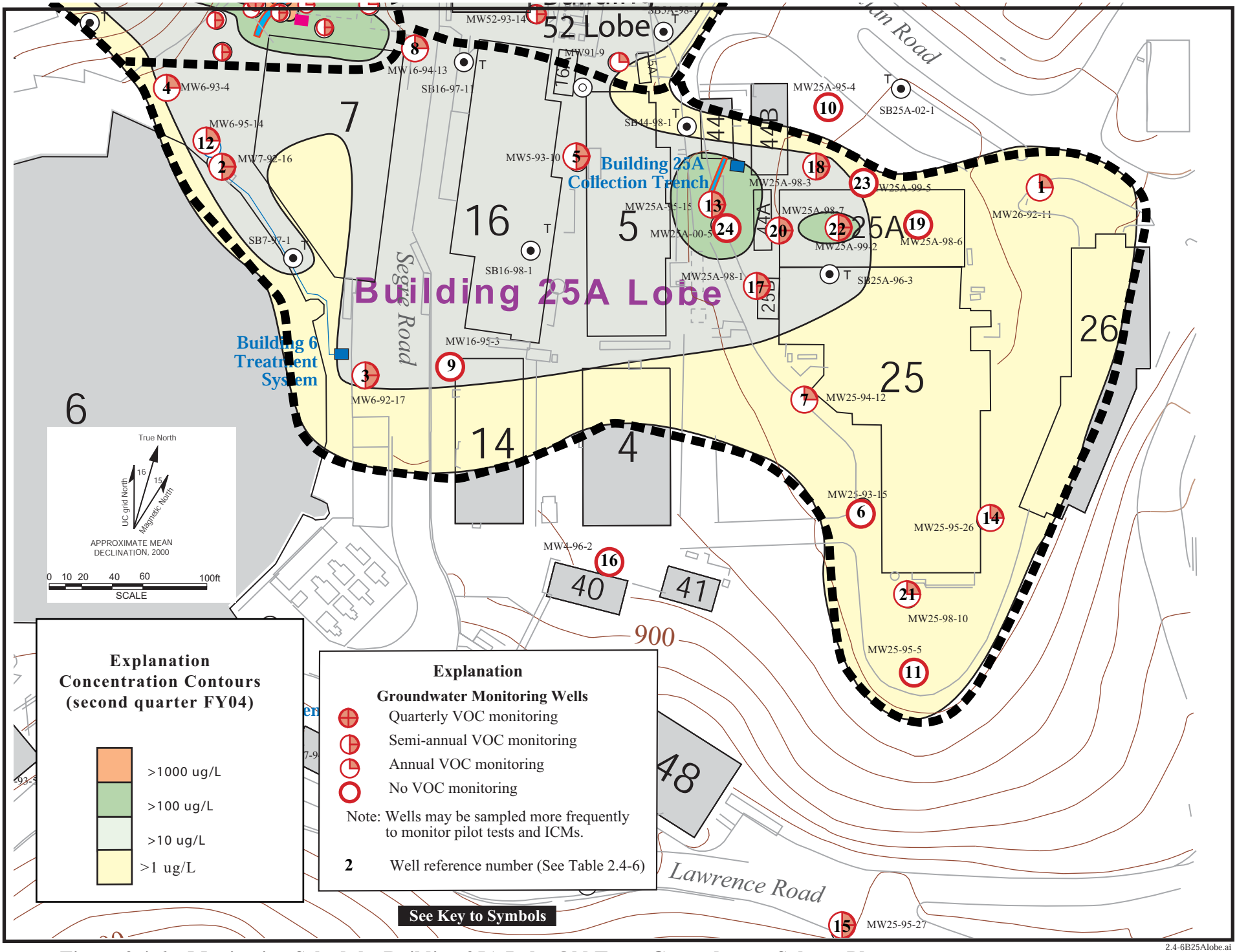


Figure 2.4-6. Monitoring Schedule, Building 25A Lobe Old Town Groundwater Solvent Plume.

2.4-6B25Alobe.ai
1/05

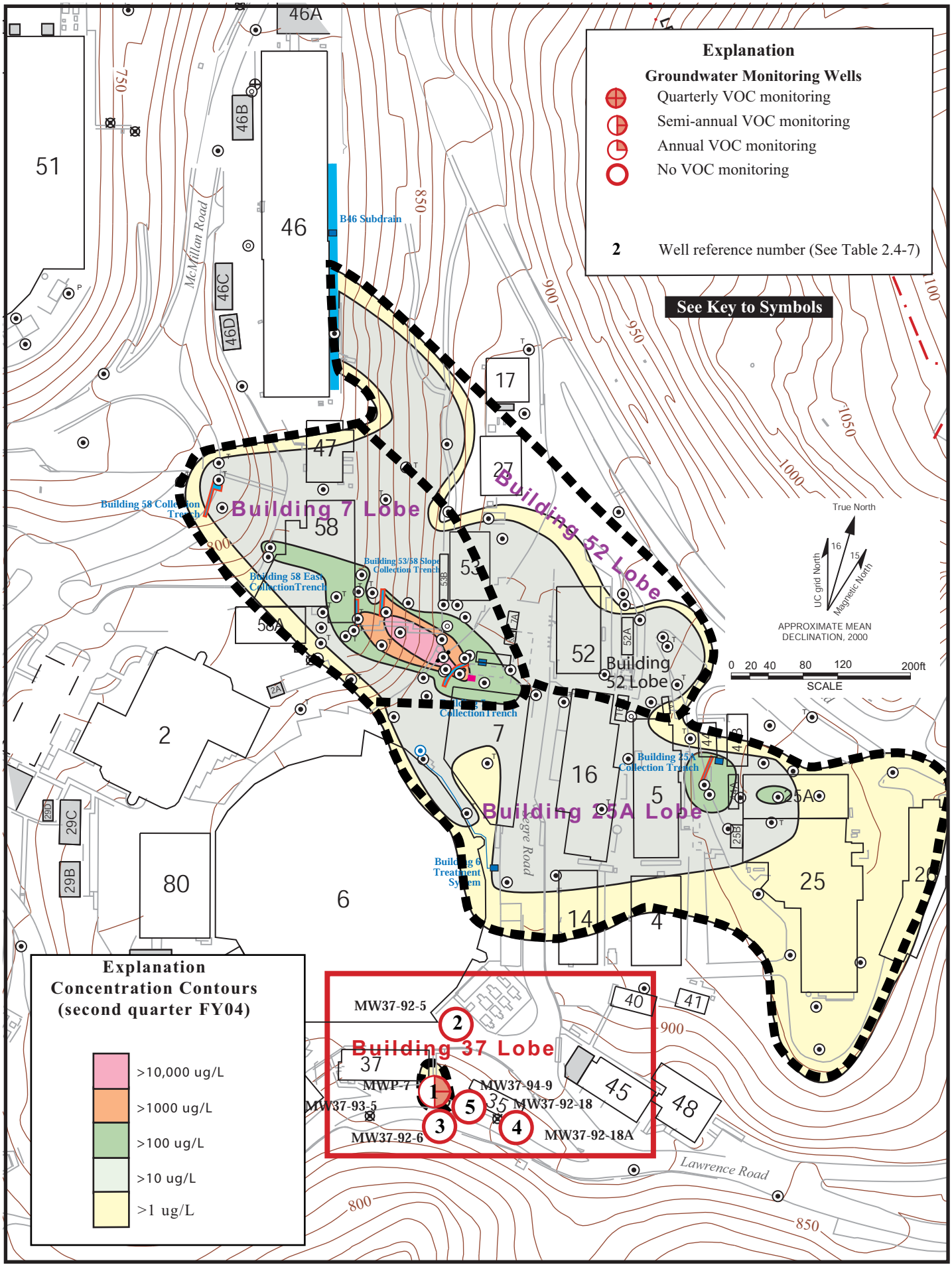


Figure 2.4-7. Groundwater Monitoring Schedule, Building 37 Lobe Old Town Groundwater Solvent Plume.

2.4-7-b37.ai.ai
1/05

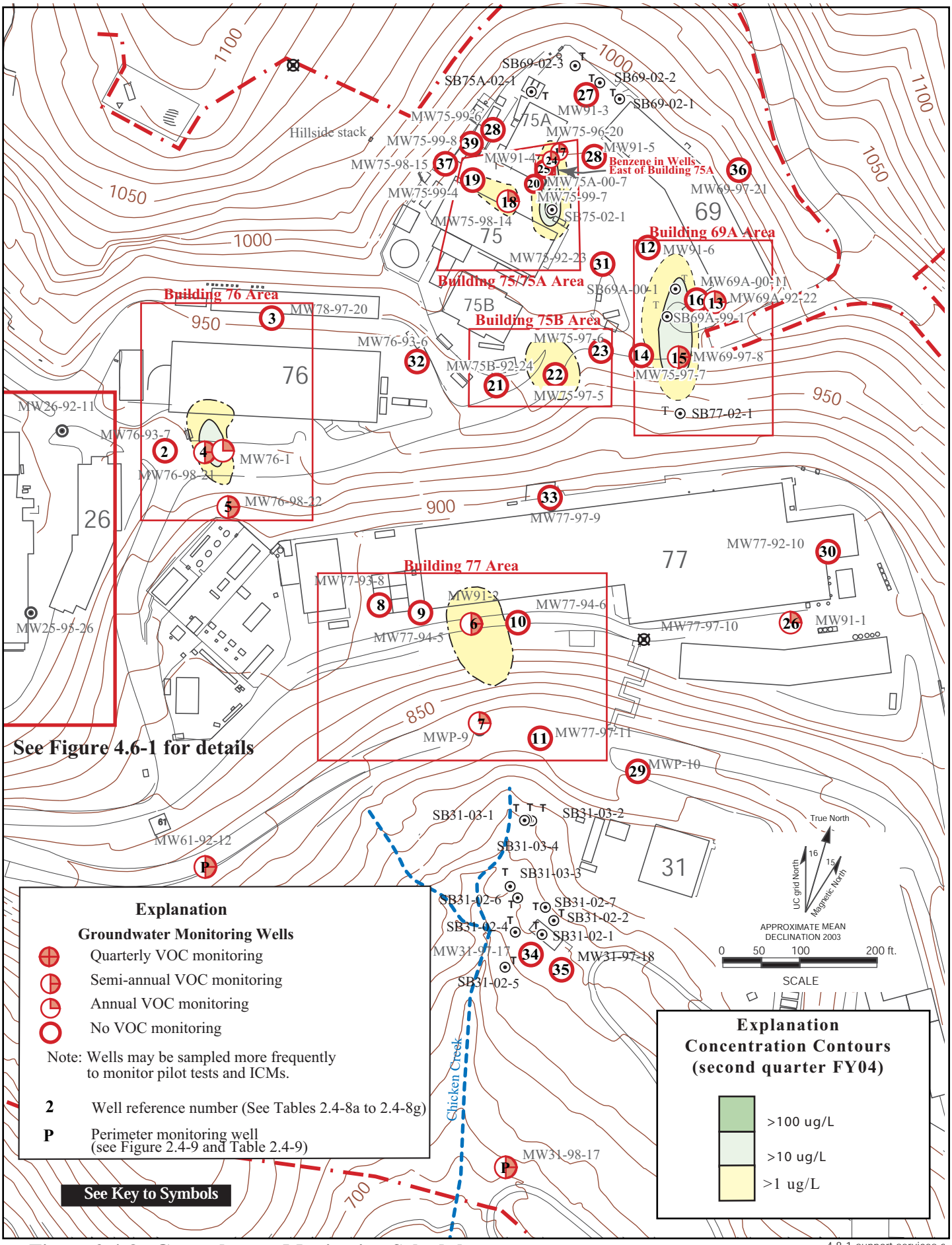


Figure 2.4-8. Groundwater Monitoring Schedule, Support Services Area.

4.8-1-support services.a
8/0

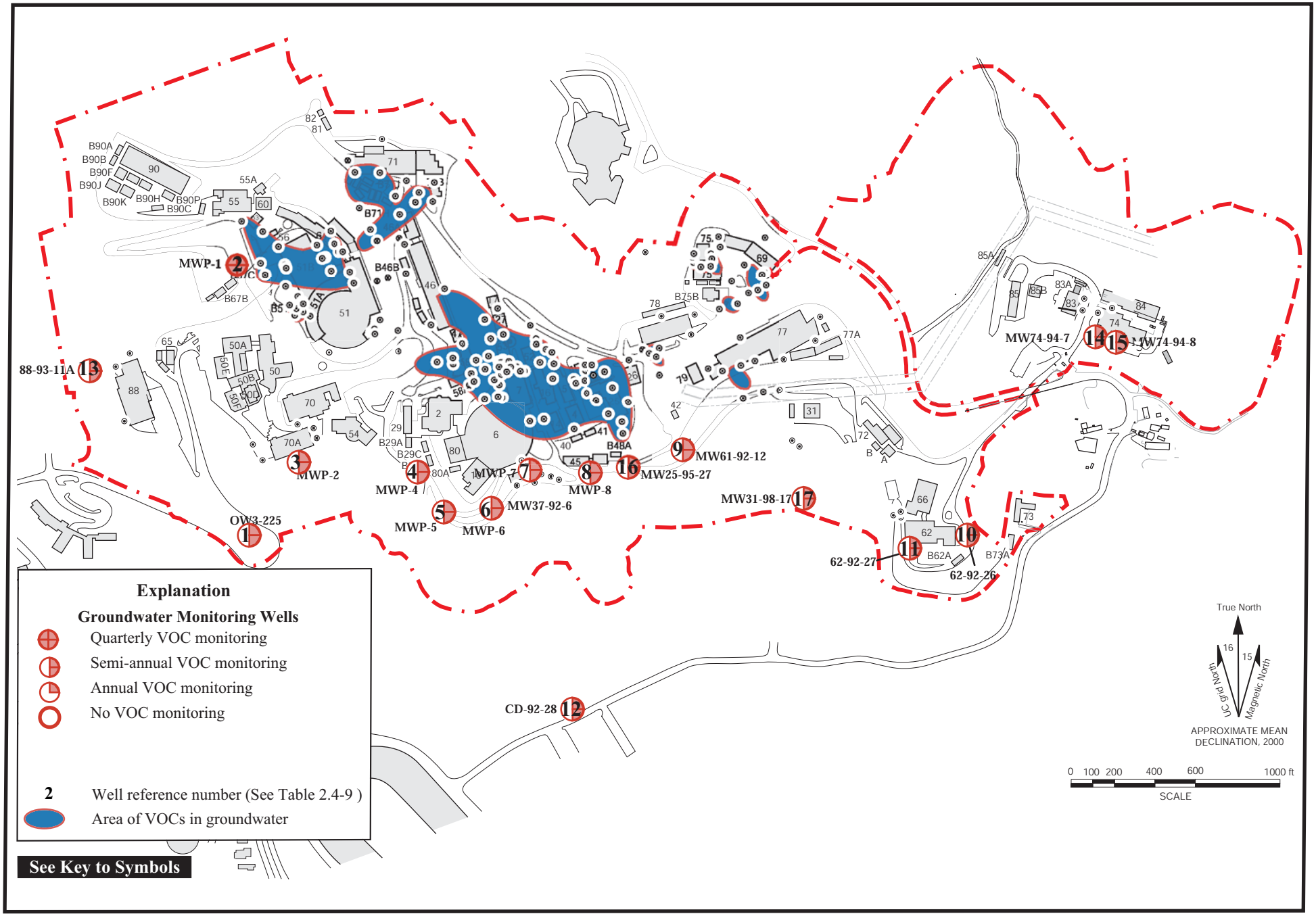


Figure 2.4-9. Groundwater Monitoring Schedule, Perimeter and Offsite Wells.

2.4-9-perimeterwells.ai
1/05

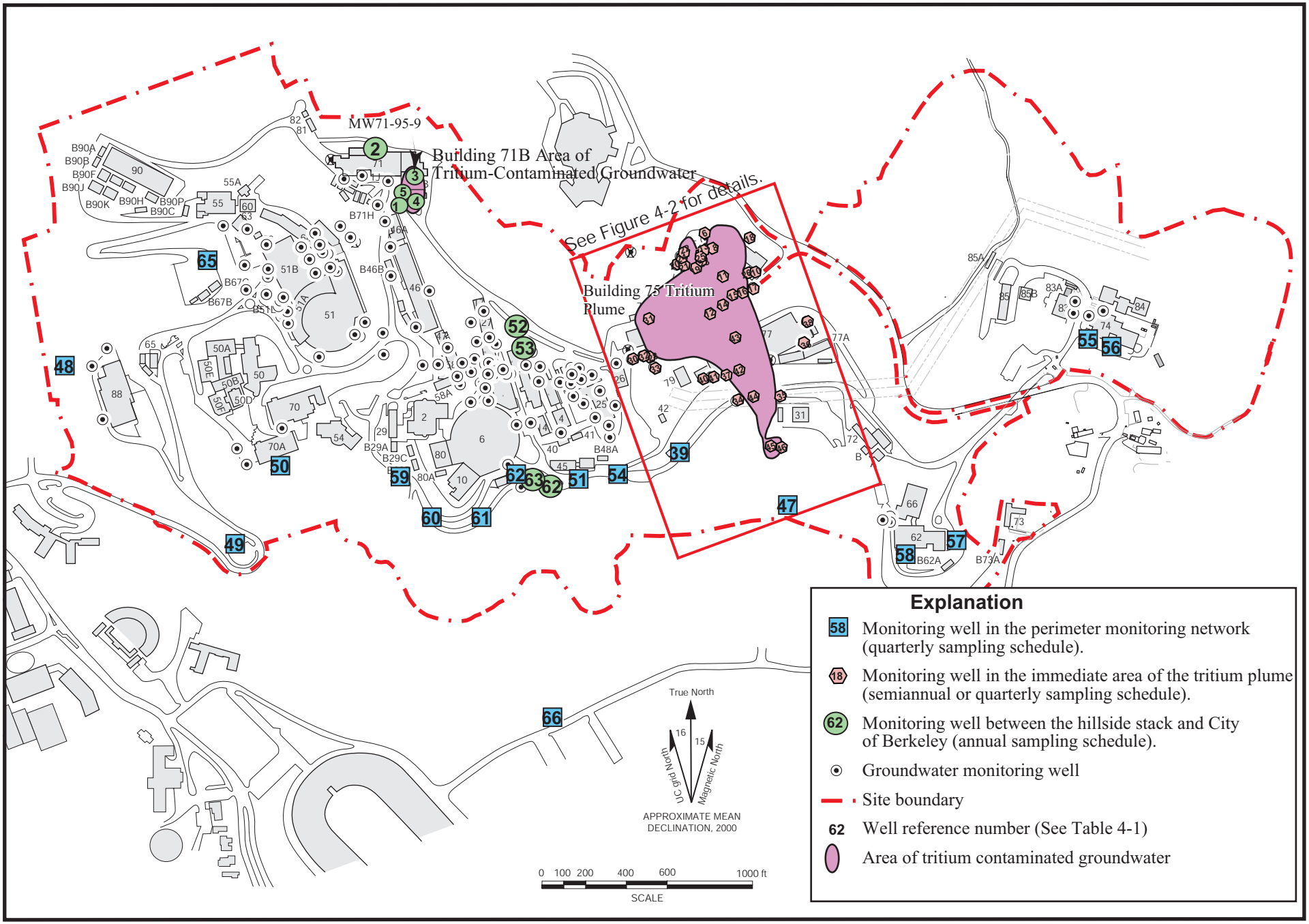
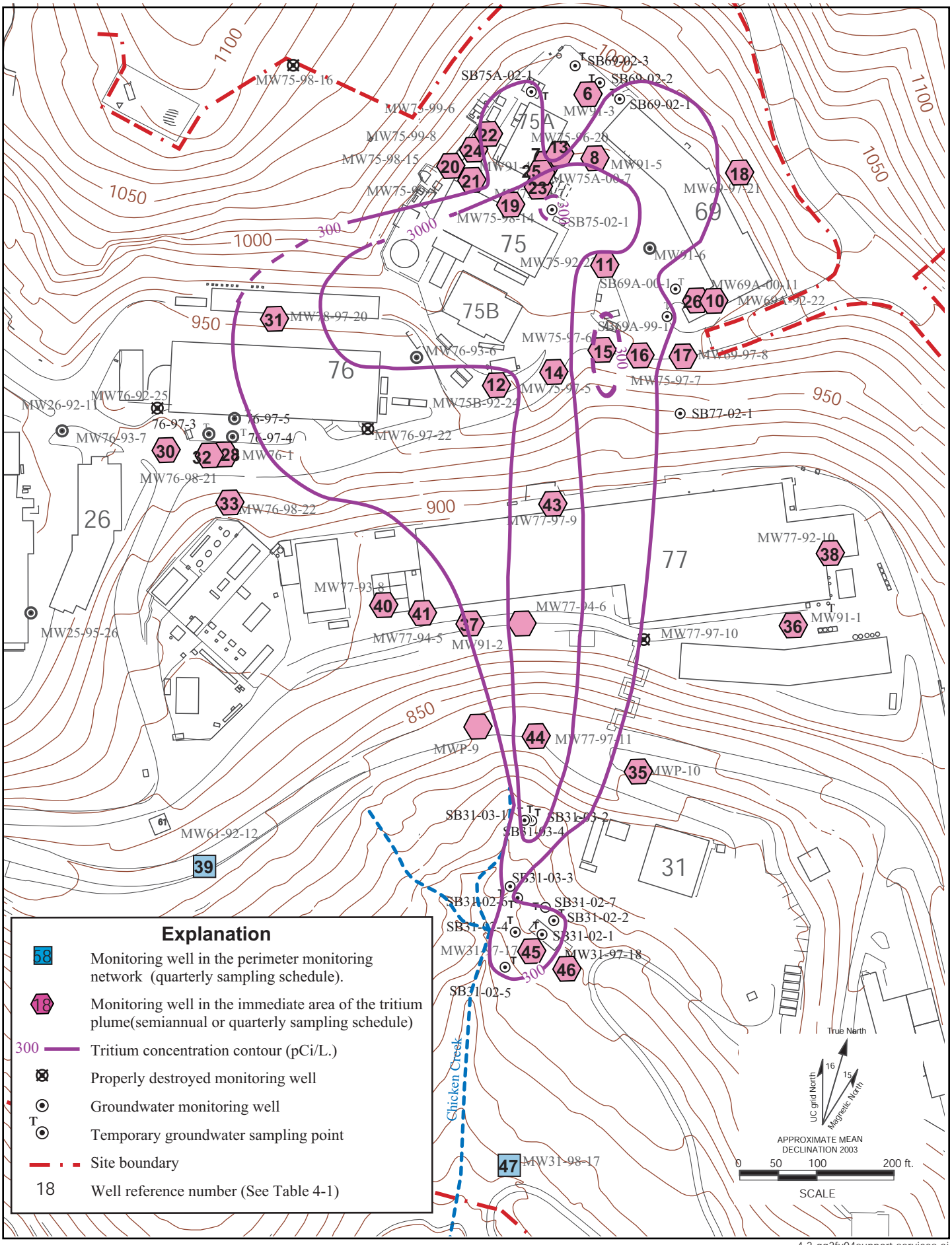


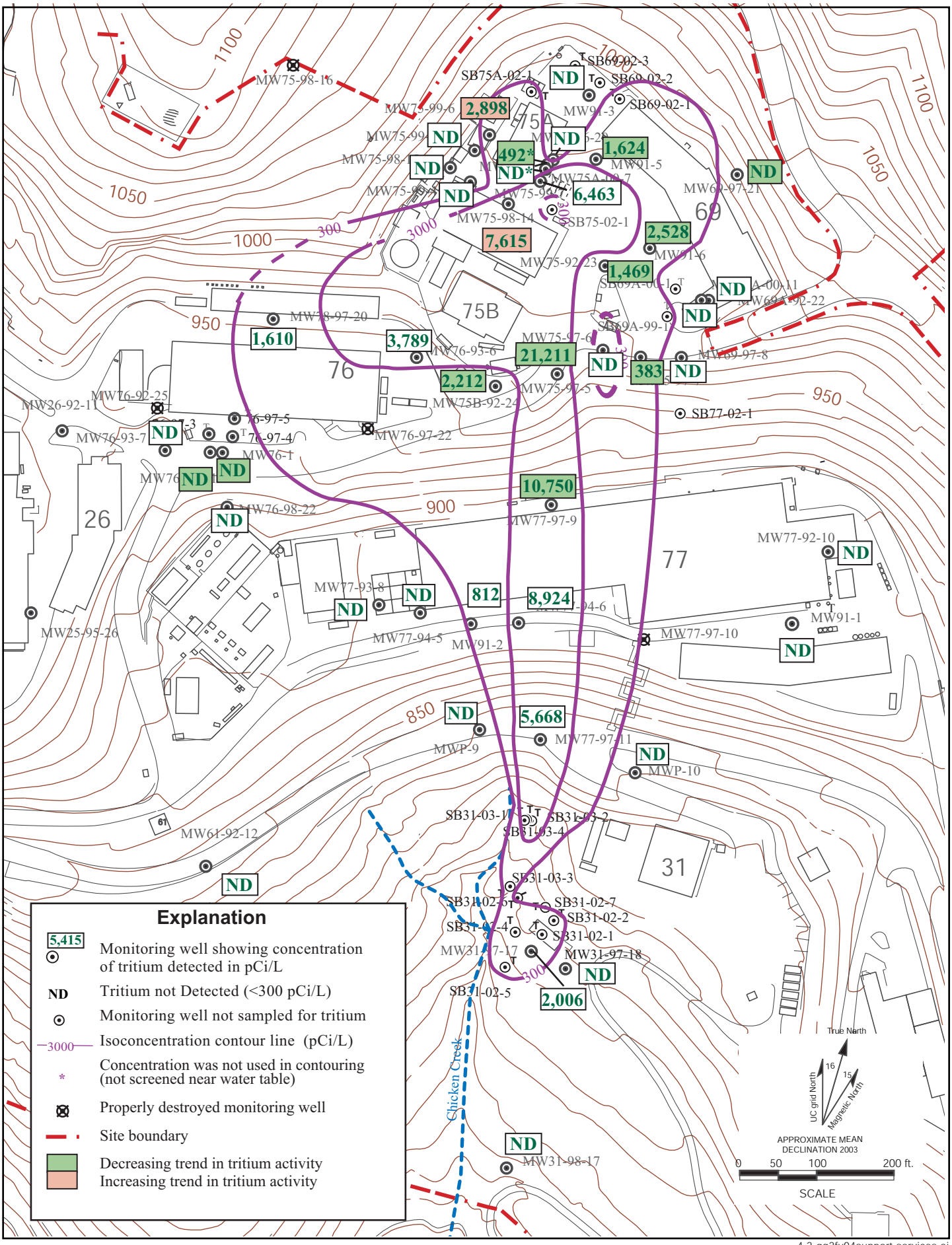
Figure 4-1. Locations of Monitoring Wells Sampled for Tritium.

4-1-tritiumwellssite.ai
1/05



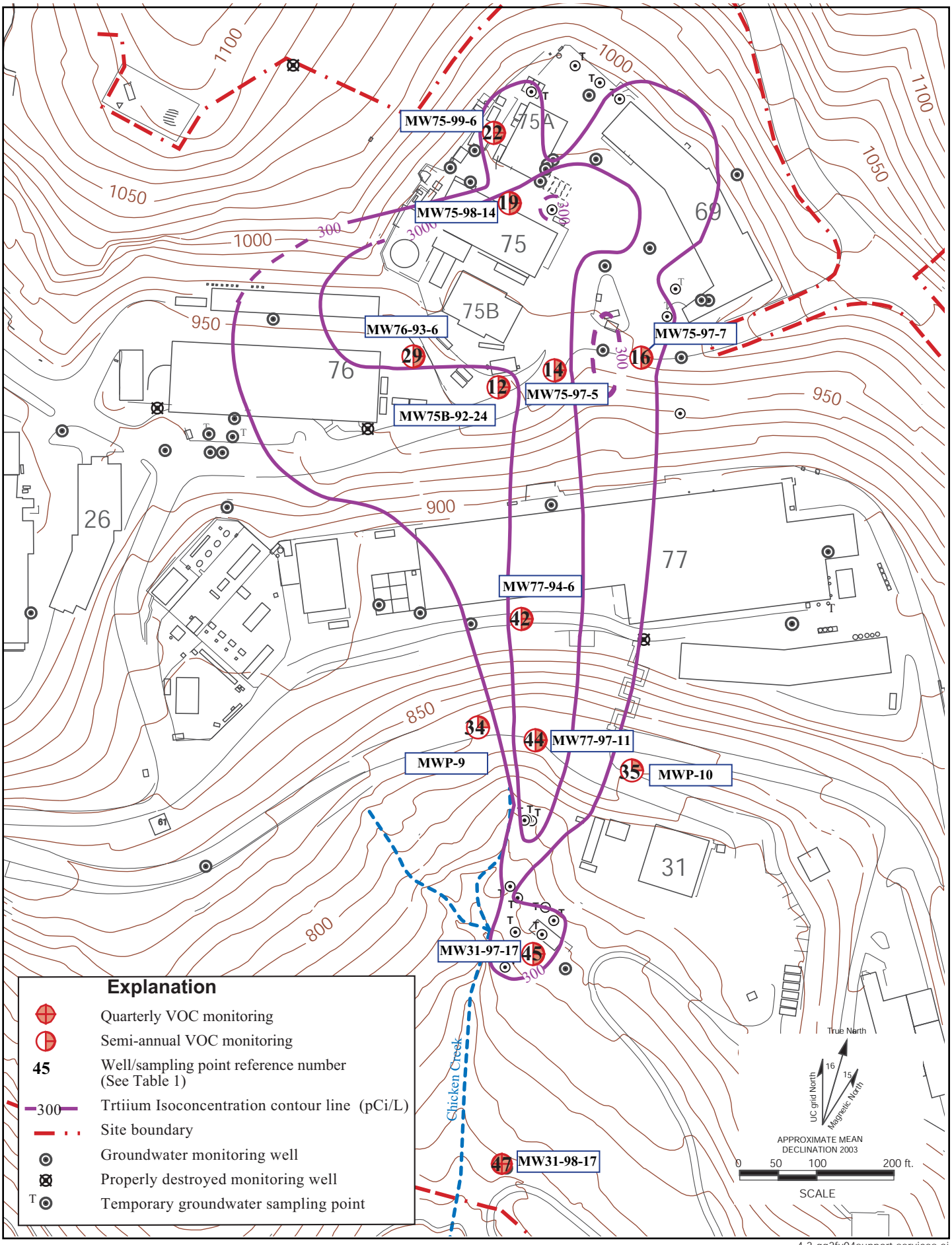
4.2-qq2fy04support services.ai
6/04

Figure 4-2. Locations of Monitoring Wells Sampled for Tritium in the Building 75 Tritium Plume Area.



4.2-qq2fy04support services.ai
6/04

Figure 4-3. Tritium Concentrations in Groundwater (pCi/L) in Corporation Yard Area, Third Quarter FY2004.



4.2-qq2fy04support services.ai
6/04

Figure 4-6. Groundwater Monitoring Schedule.

Table 2.4-1
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 51/64 Groundwater Solvent Plume

		VOC Monitoring Schedule [a]											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MWP-1	◆				12	P	49	LT	LT	no	ND	
2	MW51B-93-18A		◆			11		27	51	142	yes	increasing	Adjacent to MW51-96-19. Screened at greater depth (in Orinda Formation). Higher concentrations detected in this well than MW51-96-19.
3	MW51-96-15		◆			8		20	8.2	11	yes	stable	Concentration of total VOCs approximately 10 ug/L or less.
4	MW51-96-16		◆			8		20	521	751	yes	decreasing	Screened in fill. Same location as MW51-96-17.
5	MW51-96-17			◆		8		18	121	255	yes	variable	Same location as MW51-96-16. Screened at greater depth mainly in Orinda Formation. Lower concentrations detected.
6	MW51-96-18		◆			8		22	1410	1672	yes	decreasing	
7	MW51-96-19				◆	8		18	15	19	yes	stable	Adjacent to MW51B-93-18A Screened at shallower depth (in fill). Lower concentrations detected in this well than MW51B-93-18A. TCE slightly above MCL.
8	MW64-97-1			◆		8		16	3.9	4.4	no	stable	Concentrations of VOCs below MCLs since May 1998. TCE only VOC detected since July 1997.
9	MW64-97-2		◆			8		18	8.7	13	yes	stable	Concentrations of VOCs below MCLs most quarters.
10	MW51-97-3			◆		7		16	40	103	yes	variable	Same location as MW51-97-4 and MW51-97-12. This well is screened in same material (fill) below MW51-97-12. MW51-97-4 is screened at deepest level of the three wells in the Orinda Formation. Concentrations of VOCs are generally lower than in MW51-97-12.
11	MW51-97-4				◆	7		16	LT	LT	no	generally ND	Same location as MW51-97-3 and MW51-97-12 (both screened in fill). Screened deeper in the Orinda Formation. No VOCs detected since March 1998.
12	MW51-97-12		◆			7		17	64	112	yes	variable	Same location as MW51-97-3 and MW51-97-4. This well is screened in fill at shallowest depth of the three wells. Concentrations of VOCs are generally higher than in MW51-97-12 (also screened in fill).
13	MW51-97-13			◆		7		17	33	40	yes	stable	
14	MW51-97-14			◆		7		10	LT	LT	no	ND	No VOCs detected. Outside of plume area.
15	MW51-97-15			◆		7	D	30	LT	3.9	no	generally ND	No VOCs detected except for one quarter. Outside of plume area.
16	MW56-98-2			◆		6		21	11	18	yes	decreasing	Vinyl chloride slightly above MCL. Concentrations of vinyl chloride are decreasing.
17	MW51-98-5				◆	5		16	2.4	8.6	no	stable	Concentrations of VOCs below MCLs
18	MW63-98-18			◆		6		19	1.8	4.8	yes	stable	Consistent detections of only vinyl chloride since November 1999. Concentrations slightly above MCL.
19	MW51-00-8	◆				3		11	15	27	yes	stable	Concentrations slightly above MCLs.
20	MW51-00-9				◆	4		15	15	20	yes	stable	Adjacent to and similar results to MW51-00-10.
21	MW51-00-10			◆		4		15	10	24	yes	stable	Concentrations slightly above MCLs. Adjacent to and similar results to MW51-00-9.

LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume
P=Perimeter monitoring well
(a): Wells monitoring pilot tests or ICMs may be sampled more frequently than indicated on schedule.
ND=not detected

Table 2.4-2
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 51L Groundwater Solvent Plume

		VOC Monitoring Schedule [a]											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MW51-97-16				◆	6		16	18	19	yes	stable	Screened in both fill and bedrock. Adjacent to SB51L-98-1A. TCE slightly above MCL. Destroy since potential migration pathway to bedrock.
2	MW51L-01-1A			◆		2		6	7	13	yes	variable	Screened in fill. Concentrations approximately 10 ug/L or less.
3	MW51L-01-1B				◆	3		14	LT	LT	no	ND	Screened in bedrock.
4	MW51L-01-3			◆		3		12	LT	LT	no	ND	Screened in bedrock.
5	MW51L-01-4			◆		3		12	LT	2	no	generally ND	Screened in bedrock. VOCs sporadically detected approximately 1 ug/L or less.
6	MW51L-01-5A			◆		3		13	LT	LT	no	ND	Screened in fill.
7	MW51L-01-5B			◆		3		14	LT	LT	no	ND	Screened in bedrock.
8	MW51L-01-6			◆		3		13	LT	LT	no	generally ND	Screened in fill. No halogenated VOCs detected
9	MW51L-01-7			◆		3		10	LT	LT	no	ND	Screened in bedrock.
10	MW51A-01-10A				◆	3		13	LT	LT	no	ND	Screened in bedrock.
11	MW51A-01-11			◆		3		13	LT	LT	no	ND	Screened in bedrock. Well used for soil flushing.
12	MW51L-02-1			◆		3		9	1.1	6.7	yes	variable	Screened in fill. All detected concentrations below MCLS, except one detection of PCE..

LT = Less than the quantitation limit.
(a): Wells monitoring pilot tests or ICMs may be sampled more frequently than indicated on schedule.
ND=not detected

Note: The Building 51L Groundwater Solvent Plume source area including the area of MW51L-01-3 and possibly MW51L-01-4 will be excavated as a corrective measure.

Table 2.4-3
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 71 Groundwater Solvent Plume

		VOC Monitoring Schedule [a]											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MW90-3		◆			12		34	56	56	yes	decreasing	
2	MW90-4			◆		12		32	1.8	6.6	no	decreasing	No VOCs above MCLs. No VOCs detected since August 2001. Located adjacent to MW90-5.
3	MW90-5		◆			12	D	35	1	2.2	no	stable	VOCs have been below MCLs since November 1995. Well is at downgradient edge of Building 71B lobe and upgradient from higher concentration Building 51/64 plume.
4	MW46A-92-15			◆		12		37	9.9	1.4	no	decreasing	VOCs have been below MCLs since February 1999.
5	MW71-93-1				◆	12		27	4.9	3	no	decreasing	VOCs have been below MCLs since December 1995.
6	MW71-93-2				◆	12		33	11*	27*	no	decreasing	VOCs have been below MCLs since January 2003.
7	MW46A-93-19				◆	11		21	L T	LT	no	generally ND	No VOCs detected since December 1996. Except for a few anomalous detections, no VOCs have been detected.
8	MW71-94-1				◆	11		29	2.2	4.8	no	stable	VOCs have been below MCLs since August 1994.
9	MW51-94-11				◆	11		23	LT	LT	no	generally ND	No VOCs detected since February 2002. No VOCs above MCLs. Only trace concentrations (<2ug/L) of Freon-123A since Feb. 1996.
10	MW71-95-8				◆	10		23	LT	LT	no	generally ND	No VOCs detected since May 1998. VOCs <1 ug/L since March 1997.
11	MW71-95-9				◆	10		18	LT	LT	no	generally ND	No VOCs detected since May 1998. VOCs <1 ug/L since may 1996.
12	MW71-97-23				◆	7		17	12	20	yes	stable	TCE below or slightly above MCL. All other VOCs below MCLs.
13	MW71B-98-13		◆			6		22	270	358	yes	decreasing	Building 71B lobe source area. Concentrations decreased in 2003 as a result of HRC pilot test.
14	MW71B-99-3R	◆				4		11	581	1,580	yes	variable	Building 71B lobe source area.
15	MW71B-00-2				◆	5		20	LT	40	no	generally ND	Well installed in source area to assess vertical extent of contamination. No VOCs detected since November 2000 except for 1.1 ug/L TCE in February 2004.

* = Excluding Freon and chloroform
LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume
(a): Wells monitoring pilot tests or ICMs may be sampled more frequently than indicated on schedule.
ND=not detected

Table 2.4-4
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 7 Lobe Old Town Groundwater Solvent Plume

		VOC Monitoring Schedule [a]											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	**MW7-1**				◆	11		22	97	58	yes	decreasing	Well is screened across a perched zone.
2	**MW90-2**		◆			12		45	201	201	yes	decreasing	Monitors the effectiveness of the B7 groundwater collection trench.
3	**MW7-92-19**		◆			12		45	1,354	1,933	yes	decreasing	Monitors the effectiveness of the B7 groundwater collection trench.
4	**MW58-93-3**		◆			10		33	87	135	yes	stable	
5	**MW53-93-16-42'**			◆		11		22	42	16	yes	decreasing	Well is screened across a perched zone at the same location as 53-93-16-69'. PCE is only VOC detected since August 2001.
6	**MW53-93-16-69'**		◆			11		34	664	854	yes	decreasing	Same location as well above. Screened across water table.
7	**MW7-94-3**		◆			11		36	186	332	yes	variable	Upgradient from plume source area.
8	**MW58A-94-14**		◆			10		29	142	158	yes	decreasing	
9	**MW51-94-15**			◆		10	D	41	LT	LT	no	ND	
10	**MW58-95-11**			◆		9		19	8	8	no	decreasing	Concentrations below MCLs since February 2000.
11	**MW53-95-12**		◆			9		26	2,988	2,812	yes	decreasing	
12	**MW52B-95-13**			◆		9		23	199	231	yes	decreasing	
13	**MW58-95-18**			◆		9		26	57	62	yes	decreasing	
14	**MW58-95-19**		◆			9		30	97	379	yes	increasing	Downgradient from the B53/B58 slope groundwater collection trench.
15	**MW58-95-20**			◆		9		33	14	56	yes	stable	
16	**MW7B-95-21**		◆			9		40	5,779	60,400	yes	decreasing	Monitors the effectiveness of the B7 groundwater collection trench.
17	**MW7-95-22**		◆			9		40	4,466	4,832	yes	decreasing	Monitors the effectiveness of the B7 soil flushing system.
18	**MW7-95-23**	◆				9		34	38,392	48,017	yes	decreasing	Monitors the effectiveness of the B7 soil flushing system. Adjacent to MW7-95-22 but screened in deeper zone.
19	**MW7B-95-24**	◆				9		36	26,936	44,180	yes	decreasing	Monitors the effectiveness of the B7 soil flushing system.
20	**MW7B-95-25**		◆			9		36	379	3,142	yes	decreasing	Monitors the effectiveness of the B7 groundwater collection trench and the Old Town soil flushing system. Concentrations only slightly above MCL in March 2004. .
21	**MW53-96-1**			◆		9		17	308	355	yes	decreasing	Near MW53-93-16. Lower concentrations of the same VOCs detected. Screened at slightly greater depth.
22	**MW51-96-3**			◆		9	D	34	LT	LT	no	ND	
23	**MW58-96-11**	◆				8		32	15,546	30,622	yes	decreasing	Monitors the effectiveness of the B53/58 slope groundwater collection trench and Old Town soil flushing system.
24	**MW58A-00-3**				◆	5		19	LT	LT	no	generally ND	Deep well installed to monitor vertical migration. No halogenated VOCs detected. Benzene (less than 2 ug/L) detected in 2001.
25	**MW7-00-4**			◆		5		19	LT	7	yes	generally ND	Deep well installed to monitor vertical migration in source area. A single detection of PCE in 2002 is the only halogenated VOC detected. Benzene sporadically detected.
26	**MW58-00-12**	◆				4		14	86,981	108,286	yes	decreasing	
27	**MW53-92-21**				◆	12		15	1.3	1		------	Deep multi-level well. Only benzene above MCL.

LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume
(a): Wells monitoring pilot tests or ICMs may be sampled more frequently than indicated on schedule.
ND=not detected

Table 2.4-5
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 52 Lobe Old Town Groundwater Solvent Plume

		VOC Monitoring Schedule [a]											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MW1-220				◆	12		23	LT	LT	no	generally ND	Sporadic detections of VOCs No VOCs detected since 1997.
2	MW91-8		◆			12		38	97	234	yes	decreasing	No VOCs detected in March 2004 as a result of soil flushing pilot test.
3	MW91-9			◆		12		27	11	14	yes	stable	
4	MW46-92-9			◆		11		22	LT	3.4	no	generally ND	Only halogenated VOC detected was PCE during one quarter .
5	MW27-92-20	◆				12		34	58	72	yes	stable	Monitor soil flushing pilot test.
6	MW53-93-9	◆				11		34	145	161	yes	decreasing	Concentrations below MCLs in February 2004 and slightly above MCLS in March 2004 as a result of soil flushing pilot test
7	MW46-93-12		◆			11		41	31	56	yes	stable	Located adjacent to Building 46 groundwater collection trench.
8	MW52-93-14			◆		10		25	28	32	yes	stable	Decreasing TCE and chloroform.
9	MW53-93-17				◆	10		25	80	102	yes	variable	Near MW53-93-9. Similar concentrations of the same VOCs detected. Similar screened interval.
10	MW52-94-10				◆	10		21	1.1	LT	no	decreasing	No VOCs detected since 1999.
11	MW52-95-2A			◆				2			not sampled	----------	Same location as MW52-95-2B. Screened at shallower depth
11	MW52-95-2B		◆			9		25	198	224	yes	decreasing	Concentrations less than 1 ug/l in February 2004 as a result of soil flushing pilot test.
12	MW46-96-10			◆		8	D	32	LT	LT	no	ND	A single detection of chloroform only VOC detected.
13	MW52A-98-8A			◆				2	-	12	not sampled	----------	Same location as MW52-98-8B. Generally dry. Much lower concentrations.
13	MW52A-98-8B		◆			5		18	219	704	yes	variable	Used for soil flushing.
14	MW52-98-9			◆		5		16	181	494	yes	stable	Same suite of contaminants, generally at similar concentrations as adjacent well MW52-95-2B. Screened intervals overlap. Maintain well for soil flushing pilot test.
15	MW52A-00-6				◆	5		19	LT	LT	no	ND	Well installed to assess vertical extent of contamination.

LT = Less than the quantitation limit.

D=Well monitoring area downgradient from plume

(a): Wells monitoring pilot tests or ICMs may be sampled more frequently than indicated on schedule.

ND=not detected

Table 2.4-6
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 25A Lobe Old Town Groundwater Solvent Plume

		VOC Monitoring Schedule [a]											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MW26-92-11			◆		12		31	11	11	yes	stable	Monitored since 1992. PCE only VOC detected since 1996.
2	MW7-92-16		◆			12		40	21	72	yes	stable	Monitors the effectiveness of the B6 (former UST) dual phase extraction system.
3	MW6-92-17		◆			12		31	30	27	yes	decreasing	Close to MW16-95-3. Similar concentrations of the same VOCs (chloroform and TCE) detected.
4	MW6-93-4			◆		11		28	25	123	yes	decreasing	Extraction well downgradient of Building 6 former UST site. Sec-butylbenzene only detected aromatic since December 1994.
5	MW5-93-10		◆			11		27	38	38	yes	decreasing	
6	MW25-93-15				◆	10		27	2.5	5.6	no		VOCs all below MCLs.
7	MW25-94-12			◆		10		24	6.1	8	no		VOCs generally below MCLs.
8	MW16-94-13			◆		10		31	133	123	yes	decreasing	
9	MW16-95-3				◆	9		23	31	36	yes	decreasing	Close to MW6-92-17. Similar concentrations of the same VOCs (chloroform and TCE) detected.
10	MW25A-95-4				◆	10		16	LT	LT	no	ND	Only one VOC detected in a single sample (trace of PCE one quarter).
11	MW25-95-5				◆	9		28	14	14	yes	decreasing	Same suite of contaminants, generally at lower concentrations than adjacent well MW25-98-10. Both wells located south of Building 25.
12	MW6-95-14			◆		9		34	26	36	yes	stable	Extraction well at Building 6 former UST site.
13	MW25A-95-15		◆			9		26	304	465	yes	variable	
14	MW25-95-26			◆		8		21	5.9	21	yes	stable	
15	MW25-95-27		◆			9	P	35	LT	LT	no	generally ND	ND since February 1999.
16	MW4-96-2				◆	8		27	LT	LT	no	ND	A trace concentration (0.54 ug/L) of cis-1,2-DCE has been the only VOC detected
17	MW25A-98-1		◆			6		21	189	400	yes	decreasing	Decreasing concentrations are the result of the soil flushing pilot test.
18	MW25A-98-3		◆			6		27	162	448	yes	decreasing	Decreasing concentrations may be the result of the soil flushing pilot test.
19	MW25A-98-6				◆	2		4	9.5	13	not sampled	stable	Well inside eastern end of Building 25A.
20	MW25A-98-7		◆			5		15	98	343	yes	decreasing	Decreasing concentrations may be the result of the soil flushing pilot test.
21	MW25-98-10			◆		6		16	17	35	yes	stable	Same suite of contaminants, generally at higher concentrations than adjacent well MW25-95-5. Both wells located south of Building 25.
22	MW25A-99-2		◆			6		17	286	357	yes	stable	Well inside Building 25A.
23	MW25A-99-5				◆	5		15	1.1	7	no	stable	All concentrations below MCLs since 1999.
24	MW25A-00-5				◆	5		19	LT	LT	no	ND	Well installed to assess vertical extent of contamination.

LT = Less than the quantitation limit.

P=Perimeter monitoring well.

(a): Wells monitoring pilot tests or ICMs may be sampled more frequently than indicated on schedule.

ND=not detected

Table 2.4-7
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Building 37 Lobe Old Town Groundwater Solvent Plume

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MWP-7		◆			12	P	48	5.9	7.2	no	decreasing	Concentrations of VOCs below MCLs since February 2000. Area of groundwater contamination approved for no remedial action.
2	MW37-92-5				◆						not sampled	--------	Area of groundwater contamination approved for no remedial action.
3	MW37-92-6				◆	12		49	2.1	1.6	no	decreasing	Concentrations of VOCs below MCLs since September 1994. No VOCs detected since August 2001. Located approximately 40 feet downgradient from and duplicates function of MWP-7. Area of groundwater contamination approved for no remedial action.
4	MW37-92-18A				◆						not sampled	--------	Area of groundwater contamination approved for no remedial action.
5	MW37-94-9				◆						not sampled	--------	Area of groundwater contamination approved for no remedial action.

LT = Less than the quantitation limit.
P=Perimeter monitoring well

Table 2.4-8a
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Building 76 Area of Groundwater Contamination (Solvents in Groundwater South of Building 76)

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Location	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	MW76-1			◆		12		33	13	20	yes	stable	Consistent results for 12 years. Fourteen feet from MW76-98-21.
2	MW76-93-7				◆	11		23	LT	LT	no	generally ND	No VOCs detected since February 1996.
3	MW78-97-20				◆	7		12	1.1	1.4	no	stable	All VOCs below MCLs. TCE about 2 ug/l or less. Other VOCs less than 1 ug/L.
4	MW76-98-21		◆			6		17	18	26	yes	stable	TCE consistently detected above MCL Fourteen feet from MW76-1.
5	MW76-98-22		◆			6	D	24	LT	1.9	no	generally ND	VOCs detected below MCLs.

ND=Not detected.
LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume.

Table 2.4-8b
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Building 77 Area of Groundwater Contamination

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled		Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
6	MW91-2		◆			12		31	17	18	yes	decreasing	VOCs have decreased to levels below or only slightly above MCLs.
7	MWP-9			◆		12	D	47	LT	1.1	no	generally ND	Only a single of detection of TCE (1.1 ug/L) since 1997.
8	MW77-93-8				◆						not sampled	--------	
9	MW77-94-5				◆	11		26	LT	LT	no	generally ND	No VOCs detected since July 1996.
10	MW77-94-6				◆	11		21	LT	LT	no	generally ND	No VOCs detected since February 1995. All concentrations below MCLs.
11	MW77-97-11				◆	8		12	LT	2.2	no	generally ND	Only three anomalous detections. No VOC detected more than one time. All concentrations below MCLs

ND=Not detected.
LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume.

Table 2.4-8c
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Building 69A Area of Groundwater Contamination

		VOC Monitoring Schedule											
Location Reference Number	**Well Number**	**Quarterly**	**Semi- annually**	**Annually**	**No VOC Sampling**	**Years Sampled**		**Quarters Sampled (Through December 2004)**	**Median Concentration of Total Halogenated VOCs Detected (ug/L)**	**Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)**	**Were any Halogenated VOCs Above MCLs from January 2003 through December 2004**	**Trends in Concentration of Total Halogenated VOCs**	**Comments**
12	MW91-6				◆						not sampled	--------	
13	MW69A-92-22			◆		12		24	0.9	LT	no	decreasing to ND	No VOCs detected since August 1998. No VOCs above MCLs.
14	MW75-97-7				◆						not sampled	--------	
15	MW69-97-8		◆			7		24	21	28	yes	decreasing	Consistent detections of cis-1,2-DCE above the MCL.
16	MW69A-00-11				◆	4		17	LT	1.8	no	generally ND	Adjacent to MW69A-92-22. Screened at shallower depth. Only trace concentrations (<1 ug/L) of VOCs detected.

ND=Not detected.
LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume.

Table 2.4-8d
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Building 75/75A Area of Groundwater Contamination

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled		Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
17	MW75-96-20			◆		8		27	8	23	yes	stable	Concentration of TCE below or slightly above MCL.
18	MW75-98-14			◆		5		17	3.7	54	yes	stable	Concentrations of VOCs generally below MCLs. Anomalous detections of PCE in 2003
19	MW75-99-4				◆	5		14	LT	1.4	no	generally ND	All concentrations below MCLs.
20	MW75-99-7				◆	5		16	2.5	5.8	no	stable	All concentrations below MCLs.

ND=Not detected.
LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume.

Table 2.4-8e
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Building 75B Area of Groundwater Contamination

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled		Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
21	MW75B-92-24				◆	12		23	LT	LT	no	ND	No VOCs detected since June 1993. Area of groundwater contamination approved for no remedial action.
22	MW75-97-5				◆	6		21	5.1	7.1	no	stable	All concentrations below MCLs. Consistent results for five years. Area of groundwater contamination approved for no remedial action.
23	MW75-97-6				◆						not sampled	--------	Area of groundwater contamination approved for no remedial action.

LT = Less than the quantitation limit.
ND=Not detected.

Table 2.4-8f
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Benzene Detected in Groundwater East of Building 75A

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled		Quarters Sampled (Through December 2004)	Median Concentration of Benzene Detected (ug/L)	Maximum Concentration of Benzene Detected (ug/L) (past 5 years)	Was benzene Above MCLs from January 2003 through December 2004	Trends in Concentration of Benzene	Comments
24	MW91-4				◆	11		35	24	43	yes	variable	Adjacent to MW75A-00-7 , similar concentrations of benzene.
25	MW75A-00-7			◆		4		7	43	67	yes	variable	Adjacent to MW91-4 , similar concentrations of benzene.

LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume

Table 2.4-8g
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Support Services Area: Other Locations

		VOC Monitoring Schedule											
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled		Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
26	MW91-1			◆		12		19	LT	LT	no	ND	
27	MW91-3				◆						not sampled	--------	
28	MW91-5				◆	12		23	LT	LT	no	decreasing to ND	No VOCs detected since July 1996.
29	MWP-10				◆	12		34	LT	LT	no	ND	
30	MW77-92-10				◆	12		23	LT	LT	no	decreasing to ND	No VOCs detected since July 1996. All concentrations below MCLs since 1992.
31	MW75-92-23				◆	12		21	LT	2.4	no	ND	Only two anomalous detections of VOCs, both well below MCLs.
32	MW76-93-6				◆	11		22	0.4	1.1	no	decreasing to ND	Trace of 1,1-DCA (1.1 ug/L) only VOC detected since June 1996. All concentrations below MCLs.
33	MW77-97-9				◆	7		13	LT	LT	no	ND	Trace 1,1-DCA (<1 ug/L) only VOC detected.
34	MW31-97-17				◆	7		11	LT	LT	no	ND	Trace MTBE (<1 ug/L) only VOC detected.
35	MW31-97-18				◆						not sampled	--------	
36	MW69-97-21				◆						not sampled	--------	
37	MW75-98-15				◆						not sampled	--------	
38	MW75-99-6				◆						not sampled	--------	
39	MW75-99-8				◆						not sampled	--------	

ND=Not detected.
LT = Less than the quantitation limit.
D=Well monitoring area downgradient from plume.

Table 2.4-9
Groundwater Monitoring Schedule For VOCs (EPA Method 8260)
Perimeter and Offsite Groundwater Monitoring Wells

		VOC Monitoring Schedule										
Location Reference Number	Well Number	Quarterly	Semi- annually	Annually	No VOC Sampling	Years Sampled	Quarters Sampled (Through December 2004)	Median Concentration of Total Halogenated VOCs Detected (ug/L)	Maximum Concentration of Total Halogenated VOCs Detected (ug/L) (past 5 years)	Were any Halogenated VOCs Above MCLs from January 2003 through December 2004	Trends in Concentration of Total Halogenated VOCs	Comments
1	OW3-225		◆			12	48	LT	LT	no	ND	No VOCs detected since anomalous detections during three quarters prior to April 1997.
2	MWP-1	◆				12	49	LT	LT	no	ND	Well included under Building 51/64 Groundwater Solvent Plume. Downgradient from plume.
3	MWP-2		◆			12	49	LT	LT	no	ND	Only anomalous detections of PCE during two quarters prior to 1997.
4	MWP-4		◆			12	49	LT	LT	no	ND	
5	MWP-5		◆			12	49	LT	7.3	no	ND	Only anomalous detections of VOCs during three quarters.
6	MWP-6		◆			12	48	LT	LT	no	ND	Only anomalous detections of VOCs during one quarter.
7	MWP-7		◆			12	48	5.9	5.9	no	decreasing	Concentrations of VOCs below MCLs since February 2000. Well included under Building 37 Lobe of the Old Town Groundwater Solvent Plume.
8	MWP-8		◆			12	49	LT	10	no	ND	Only anomalous detections of VOCs during two quarters.
9	MW61-92-12		◆			12	45	LT	LT	no	ND	Anomalous detections of halogenated VOCs during one quarter. Anomalous detections of aromatic VOCs during three quarters.
10	MW62-92-26		◆			12	39	LT	1.5	no	ND	Anomalous detections of VOCs during five quarters.
11	MW62-92-27		◆			12	44	LT	LT	no	ND	Anomalous detections of VOCs during four quarters prior to May 1997.
12	CD-92-28		◆			12	48	LT	1.4	no	ND	Anomalous detections of VOCs during two quarters prior to February 1997 and in May 2004.
13	MW88-93-11A		◆			11	43	LT	LT	no	ND	No VOCs detected since December 1994.
14	MW74-94-7		◆			11	43	LT	LT	no	ND	No VOCs detected since June 1996.
15	MW74-94-8		◆			11	43	LT	LT	no	ND	A single detection of a halogenated Voc in June 1994 and an aromatic VOC in July 2003.
16	MW25-95-27		◆			9	35	LT	LT	no		ND since February 1999. Well included with B25A lobe of Old Town plume.
17	MW31-98-17		◆			6	23	LT	LT	no	ND	

LT = Less than the quantitation limit.
ND=Not detected.

Table 4-1
Groundwater Sampling Schedule For Tritium

Monitoring Well Reference Number	Monitoring Well Number	Quarters Sampled for Tritium (Through December 2004)	Quarters Tritium Detected	Maximum Concentrations of Tritium Detected (pCi/L) since from May 1999 through December 2004	Tritium Sampling Schedule: Quarterly	Semi- annual	Annual	No Sampling Required
1	MW46A-92-15	18	1	530				◆
2	MW71-93-1	10	0	<300				◆
3	MW71-95-9	15	7	770		◆		
4	MW71B-99-3R	15	6	766				◆
5	MW71-98-13	13	3	529				◆
6	MW91-3	22	0	<300				◆
7	MW91-4	32	28	1347				◆
8	MW91-5	31	31	4381				◆
9	MW91-6	30	30	4059				◆
10	MW69A-92-22	19	0	<300				◆
11	MW75-92-23	29	29	3823				◆
12	MW75B-92-24	32	32	5082				◆
13	MW75-96-20	20	1	<300				◆
14	MW75-97-5	26	26	28,800		◆		
15	MW75-97-6	18	0	<300				◆
16	MW75-97-7	18	18	1366		◆		
17	MW69-97-8	27	1	<300				◆
18	MW69-97-21	17	13	949				◆
19	MW75-98-14	24	24	9342		◆		
20	MW75-98-15	25	1	537				◆
21	MW75-99-4	21	0	<300				◆
22	MW75-99-6	20	12	2898		◆		
23	MW75-99-7	21	21	8130				◆
24	MW75-99-8	20	0	<300				◆
25	MW75A-00-7	10	1	388				◆
26	MW69A-00-11	17	0	<300				◆
28	MW76-1	22	13	573				◆
29	MW76-93-6	28	27	4854		◆		
30	MW76-93-7	21	2	882				◆
31	MW78-97-20	17	17	3622				◆
32	MW76-98-21	22	5	553				◆
33	MW76-98-22	24	4	535				◆
34	MWP-9	41	0	<300				◆
35	MWP-10	41	0	<300				◆
36	MW91-1	22	1	<300				◆
37	MW91-2	24	16	952				◆

Table 4-1
Groundwater Sampling Schedule For Tritium

Monitoring Well Reference Number	Monitoring Well Number	Quarters Sampled for Tritium (Through December 2004)	Quarters Tritium Detected	Maximum Concentrations of Tritium Detected (pCi/L) since from May 1999 through December 2004	Tritium Sampling Schedule: Quarterly	Semi- annual	Annual	No Sampling Required
38	MW77-92-10	18	0	<300				◆
39	MW61-92-12	35	0	<300				◆
40	MW77-93-8	19	0	<300				◆
41	MW77-94-5	21	1	<300				◆
42	MW77-94-6	23	23	13,223				◆
43	MW77-97-9	18	18	13,386				◆
44	MW77-97-11	18	18	6998		◆		
45	MW31-97-17	18	18	2228		◆		
46	MW31-97-18	29	0	<300				◆
47	MW31-98-17	23	0	<300	◆			
48	MW88-93-11A	25	0	<300				◆
49	OW3-225	42	0	<300				◆
50	MWP-2	42	0	<300				◆
51	MWP-8	43	1	<300				◆
52	MW52-94-10	8	1	288				◆
53	MW52-95-2B	9	2	402				◆
54	MW25-95-27	13	0	<300				◆
55	MW74-94-7	31	1	<300				◆
56	MW74-94-8	25	0	<300				◆
57	MW62-92-26	31	0	<300				◆
58	MW62-92-27	32	0	<300				◆
59	MWP-4	42	0	<300				◆
60	MWP-5	42	0	<300				◆
61	MWP-6	43	0	<300				◆
62	MWP-7	42	5	<300				◆
63	MW37-92-18A	8	0	<300				◆
64	MW37-94-9	9	0	<300				◆
65	MWP-1	42	1	<300				◆
66	CD-92-28	44	0	<300				◆

Appendix B

Regional Water Board Order No. R2-2004-0055 NPDES No. CAG912003

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. R2-2004-0055
NPDES NO. CAG912003

GENERAL WASTE DISCHARGE REQUIREMENTS FOR:

Discharge or Reuse of Extracted and Treated Groundwater Resulting From the Cleanup of Groundwater Polluted by Volatile Organic Compounds

The California Regional Water Quality Control Board, San Francisco Bay Region, (hereinafter Water Board) finds that:

1. General: This National Pollutant Discharge Elimination System (NPDES) general permit regulates discharge or reuse of extracted and treated groundwater resulting from the cleanup of groundwater polluted by volatile organic compounds (VOC). All dischargers eligible for this general permit must submit a Notice of Intent (NOI) described in the attachment and the appropriate annual fee to obtain coverage. Written authorization to initiate the discharge will be issued by the Executive Officer.

2. Authority: States may request authority to issue general NPDES permits pursuant to Code of Federal Regulations, Title 40, Chapter 1, Subchapter D, part 122.28 (40 CFR 122.28). On June 8, 1989, the State Water Resources Control Board (hereinafter State Board) submitted an application to the United States Environmental Protection Agency (hereinafter USEPA) requesting revisions to its NPDES program in accordance with 40 CFR 122.28, 123.62 and 403.10. The application included a request to add general permit authority to its approved NPDES program. On September 22, 1989, the USEPA, Region IX, approved the State Board's request and granted authorization for the State to issue general NPDES permits.

3. Types of Discharges: 40 CFR 122.28 provides for the issuance of general permits to regulate discharges of waste which result from similar operations, are the same types of waste, require the same effluent limitations, require similar monitoring, and are more appropriately regulated under a general permit rather than individual permits.

4. Eligibility for General Permit: A general permit for existing and proposed discharges of extracted and treated groundwater to surface waters of the San Francisco Bay Region (except for direct discharges to the Pacific Ocean) from groundwater cleanup projects meets the requirements of 40 CFR 122.28. The discharges and proposed discharges:

    a. result from similar operations (all involve extraction, treatment, and discharge of groundwater),
    b. are the same types of waste (all are groundwater containing volatile organic compounds due to leaks and spills from businesses that have used VOC,
    c. require similar effluent limitations for the protection of the beneficial uses of

surface waters in the San Francisco Bay Region (this general permit does not cover direct discharges to the Pacific Ocean),

d. require similar monitoring, and
e. are more appropriately regulated under a general permit rather than individual permits.

Therefore, this Order establishes a general permit regulating extracted and treated groundwater discharges resulting from the cleanup of groundwater polluted by VOC and other related wastes. Entities that fall into this category are hereinafter referred to as discharger(s) and may be regulated by this Order. The following VOC-cleanup discharges are normally not eligible for coverage: discharges from cleanups involving significant contamination by metals, pesticides, or other conservative pollutants; discharges from cleanups involving reinjection of treated groundwater; and discharges from sites with other NPDES discharges (e.g. process waste or stormwater).

5. Former Permit: On July 21, 1999, the Water Board adopted Order No. 99-051 reissuing NPDES No. CAG912003. The expiration date for Order 99-051 was July 21, 2004. During the period July 1999 to July 2004, 98 discharges were authorized under Order No. 99-051.

6. Benefits of General Permit: There are hundreds of VOC-contaminated sites within the San Francisco Bay Region. Within the next five years, approximately 100 of these sites will be conducting groundwater cleanups by extracting contaminated groundwater, treating, and discharging treated groundwater, particularly in Santa Clara County. Because some publicly owned treatment works (POTWs) do not accept new discharges from groundwater cleanups, many of these sites will require waste discharge requirements for discharge to surface water. These cleanups will exceed the capacity of available staff to develop and bring individual waste discharge requirements to the Board for adoption. These circumstances create the need for an expedited system to process the anticipated numerous requests. This general permit expedites the processing of requirements; enables the Board to better utilize limited staff resources; and permits cleanups to begin promptly.

7. Annual Fees: California Regulations, Title 23, Division 3, Chapter 9, Article 1, Section 2200 D, fee schedule dated October 17, 2003, requires the dischargers regulated under this general NPDES permit to pay an annual fee based on one of the three categories listed in subsection (b)(9) plus applicable surcharges: The discharges regulated under this general NPDES permit are categorized as Category 1. The discharges under this category require treatment systems to meet priority toxic pollutant limits and could impair beneficial uses if limits are violated. This fee schedule also requires an ambient water-monitoring surcharge of 18.5% of the calculated fee to be added the Category 1 fee.

8. Basin Plan: Water Board adopted a revised Water Quality Control Plan for the San Francisco Bay Basin (hereinafter called Basin Plan) on June 21,1995. This updated and consolidated plan represents the Water Board's master water quality control planning

document. The State Water Resources Control Board (State Board) and the Office of Administrative Law (OAL) approved the revised Basin Plan on July 20, 1995 and November 13, 1995, respectively. The OAL's action is published in Section 3912 of Title 23 of the California Code of Regulations. The Basin Plan defines beneficial uses and water quality objectives for waters of the State, including surface waters and groundwaters. This Order implements the plans, policies, and provisions of the Water Board's Basin Plan.

9. Beneficial Uses: The Basin Plan defines beneficial uses and water quality objectives for surface waters and groundwaters within the San Francisco Bay Region. Groundwaters have the following potential and existing beneficial uses: Municipal and Domestic Supply, Industrial Service Supply, Industrial Process Supply, Agricultural Supply, and Freshwater Replenishment. Surface waters have the following potential and existing beneficial uses: Municipal and Domestic Supply, Fish Migration and Fish Spawning, Industrial Service Supply, Navigation, Industrial Process Supply, Marine Habitat, Agricultural Supply, Estuarine Habitat, Groundwater Recharge, Shellfish Harvesting, Water Contact and Non-Contact Recreation, Ocean, Commercial, and Sport Fishing, Wildlife Habitat, Areas of Special Biological Significance, Cold Freshwater and Warm Freshwater Habitat, and Preservation of Rare and Endangered Species.

10. State Implementation Policy (SIP) for California Toxics Rule (CTR): The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California was adopted by the State Board on March 2, 2000. The U.S. EPA published the CTR, the *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California* (Federal Register, Volume 65, Number 97, 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations, on May 18, 2000. OAL approved the SIP with some modifications on May 22, 2000.

11. Reuse Policy: The Water Board adopted Resolution No. 88-160 on October 19, 1988. The Resolution urges dischargers of extracted groundwater from site cleanup projects to reclaim their effluent and that when reclamation is not technically and/or economically feasible, to discharge to a publicly owned treatment works (POTW). If neither reclamation nor discharge to a POTW is technically or economically feasible and if beneficial uses of the receiving water are not adversely affected, it is the intent of the Water Board to authorize the discharge of treated extracted groundwater in accordance with the requirements of this Order.

12. Reuse Allowed: This Order permits reuse or reclamation of extracted treated groundwater in conjunction with the discharge to surface water, except for purposes of recharge or reinjection. Reuse of extracted treated groundwater can take many forms, such as irrigation of landscaping or agriculture, dust control or soil compaction on construction sites, and industrial water supply.

13. Basin Plan Prohibition and Exception: The Basin Plan prohibits discharge of "wastewater which has particular characteristics of concern to beneficial uses": (a) "at any point at

which the wastewater does not receive a minimum initial dilution of at least 10:1, or into any nontidal water, dead-end slough, similar confined waters, or any immediate tributaries thereof" and (b) at any point in "San Francisco Bay south of the Dumbarton Bridge." The Basin Plan allows for exceptions to this prohibition if a discharge is approved as part of a groundwater clean-up project in accordance with Resolution No. 88-160, it has been demonstrated that neither reclamation nor discharge to a POTW is technically and economically feasible, and the discharger has provided certification of the adequacy and reliability of treatment facilities and a plan that describes procedures for proper operation and maintenance of all treatment facilities. The Basin Plan also prohibits discharge of "all conservative toxic and deleterious substances, above those levels which can be achieved by a program acceptable to Water Board, to waters of the Basin". Prior to discharge under this permit, dischargers must demonstrate to the satisfaction of the Executive Officer that their groundwater extraction and treatment systems and associated operation, maintenance, and monitoring plans constitute acceptable programs for minimizing the discharge of toxic substances to waters of the State.

14. Anti-degradation Policies: Federal Regulations (40 CFR 131.12) and State Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California" requires that any increase in pollutant loading to a receiving water shall be consistent with the following:

    a. Existing instream water uses and the level of water quality necessary to protect existing beneficial uses shall be maintained and protected; and

    b. Where the quality of the waters exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, the quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located.

15. Anti-degradation Results: This permit complies with State and Federal "antidegradation" policies:

    a. The conditions and effluent limitations established in this Order for discharges of treated groundwater to surface waters in this Region ensure that the existing beneficial uses and quality of surface waters in this Region will be maintained and protected; and

    b. Discharges regulated by this Order should not lower water quality if the terms and conditions of this Order are met.

16. No Preemption: This Order permits the discharge of treated groundwater to waters of the

State subject to the prohibitions, effluent limitations, and provisions of this Order. It does not preempt or supersede the authority of municipalities, flood control agencies, or other local agencies to prohibit, restrict, or control discharges of waste to storm drain systems or other watercourses subject to their jurisdiction. The Discharges regulated by this Order are also responsible to obtain authorization to discharge from the agency having jurisdiction over the use of the storm drain system or watercourse.

17. CEQA: This Order serves as an NPDES Permit, adoption of which is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code (California Environmental Quality Act) pursuant to Section 13389 of the California Water Code.

18. Notice: The Water Board has notified interested agencies and persons of its intent to issue general waste discharge requirements for groundwater dewatering discharges resulting from the cleanup of groundwater polluted by fuel leaks and other related wastes at service stations and similar sites, and has provided them with an opportunity to submit their written views and recommendations.

19. Hearing: The Water Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that dischargers of treated groundwater polluted by VOC, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted there under and the provisions of the Clean Water Act as amended and regulations and guidelines adopted there under, shall comply with the following:

A. Discharge Prohibitions

1. The discharge of extracted and treated groundwater polluted by VOC and related wastes to surface waters is prohibited unless an NOI application for proposed discharge for the discharge has been submitted and the Executive Officer has provided the discharger with written authorization to initiate the discharge.

2. The discharge shall be limited to extracted and treated groundwater and those added treatment chemicals approved by the Executive Officer which do not adversely affect the environment and comply with the requirements of this Order.

3. The discharge of extracted and treated groundwater from a specific site in excess of the flow rate specified in each discharger's authorization letter from the Executive Officer is prohibited, unless an increase in the flow rate is approved by the Executive Officer.

4. The discharge of extracted and treated groundwater discharge shall not cause pollution, contamination, or nuisance.

5. The discharge shall cause no scouring or erosion at the point where the storm drain discharges into the receiving waters.

6. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code.

7. Bypass or overflow of untreated or partially treated polluted groundwater to waters of the State either at the treatment system or from any of the collection or transport systems or pump stations tributary to the treatment system is prohibited.

B. Effluent Limitations (Surface water discharges only)

1. The effluent (at a point after full treatment but before it joins or is diluted by any other waste stream, body of water, or substance) shall not contain constituents in excess of the following:

Table B.1 Effluent Limits

No.	Compound	CAS Number	Discharge to Drinking Water Areas**		Discharge to Other Surface Water Areas	
			Average Monthly Effluent Limitation*** (ug/L)	Maximum Daily Effluent Limitation (ug/L)	Average Monthly Effluent Limitation*** (ug/L)	Maximum Daily Effluent Limitation (ug/L)
1	Benzene	71432		1		5
2	Carbon Tetrachloride	56235	0.25*	0.50	4.4	5
3	Chloroform	67663		5		5
4	1,1-Dichloroethane	75343		5		5
5	1,2-Dichloroethane	107062	0.38*	0.5		5
6	1,1-Dichloroethylene	75354	0.057*	0.11*	3.2	5
7	Ethylbenzene	100414		5		5
8	Methylene Chloride (Dichloromethane)	75092	4.7	5		5
9	Tetrachloroethylene	127184	0.8	1.6		5
10	Toluene	108883		5		5
11	Cis 1,2-Dichloroethylene	156592		5		5
12	Trans 1,2-Dichloroethylene	156605		5		5
13	1,1,1-Trichloroethane	71556		5		5
14	1,1,2-Trichloroethane	79005	0.6	1.2		5
15	Trichloroethylene	79016	2.7	5		5
16	Vinyl Chloride	75014		0.5		5
17	Total Xylenes	1330207		5		5

No.	Compound	CAS Number	Discharge to Drinking Water Areas**		Discharge to Other Surface Water Areas	
18	Methyl Tertiary Butyl Ether (MtBE)	1634044		5		13
19	Total Petroleum Hydrocarbons			50		50
20	Ethylene Dibromide (1,2-Dibromoethane)	106934		0.05*		5
21	Trichloro-trifluoroethane	76131		5		5

* If reported detection level is greater than effluent limit, then a non-detect result using a 0.5 ug/L detection level is deemed to be in compliance.
** Drinking water areas are defined as surface waters with the existing or potential beneficial uses of "municipal and domestic supply" and "groundwater recharge" (the latter includes recharge areas to maintain salt balance or to halt salt water intrusion into fresh water aquifers).
*** Applicable when three or more days of effluent monitoring results are available

2. pH: The pH of the discharge shall not exceed 8.5 nor be less than 6.5.

3. Toxicity: The survival of rainbow trout test fish in 96-hour static renewal bioassays of the discharge shall be a three sample moving median of 90% survival and a minimum value of not less than 70% survival.

C. Receiving Water Limitations

1. Narrative Limits: The discharge shall not cause the following conditions to exist in waters of the State at any place:

    a. Floating, suspended, or deposited macroscopic particulate matter or foam;
    b. Bottom deposits or aquatic growths;
    c. Alteration of temperature, turbidity, taste, odor, or apparent color beyond present natural background levels;
    d. Visible, floating, suspended, or deposited oil or other products of petroleum origin; and
    e. Toxic or other deleterious substances to be present in concentrations or quantities that will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentration.

2. Numerical Limits: The discharge shall not cause the following limits to be exceeded in waters of the State in any place within one foot of the water surface:

a. Dissolved oxygen:

For all tidal waters:

In the Bay downstream of Carquinez Bridge - 5.0 mg/l minimum

Upstream of Carquinez Bridge - 7.0 mg/l minimum

For nontidal waters:

Waters designated as cold water habitat - 7.0 mg/l minimum

Waters designated as warm water habitat - 5.0 mg/l minimum

For all inland surface waters:

The median of any three consecutive months shall not be less than 80% saturation. When natural factors cause lesser concentration(s) than those specified above, then this discharge shall not cause further reduction in the concentration of dissolved oxygen.

b. pH: Variation from natural ambient pH by more than 0.5 pH units.

3. More Stringent Standards May Apply: The discharge shall not cause or contribute to a violation of any applicable water quality standard for receiving waters adopted by the Water Board or the State Board as required by the Clean Water Act and regulations adopted there under. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Clean Water Act, or amendments thereto, the Water Board will revise and modify this Order in accordance with such more stringent standards.

D. Water Reclamation Specifications (water reuse only)

1. Water reclaimed for beneficial reuse as applied shall meet the requirements in Section B-Effluent Limitations.

2. The water reclamation activities shall be described in the discharger's NOI, including method of any additional treatment and location and type of water reuse.

3. No reclaimed water shall be allowed to escape from the authorized use area by airborne spray, nor by surface flow except in minor amounts associated with good irrigation practice, nor from conveyance facilities.

4. Reclamation involving irrigation shall not occur when the ground is saturated.

5. The use of reclaimed water shall not impair the quality of waters of the State, nor shall it create a nuisance as defined by Section 13050(m) of the California Water Code.

6. Adequate measures shall be taken to minimize public contact with reclaimed water and to

prevent the breeding of flies, mosquitoes, and other vectors of public health significance during the process of reuse.

7. Appropriate public warnings must be posted to advise the public that the water is not suitable for drinking. Signs must be posted in the area, and all reclaimed water valves and outlets appropriately labeled.

8. There shall be no cross-connection between the potable water supply and piping containing treated groundwater intended for reuse.

9. Water reclamation consisting of recharge or reinjection is not authorized under this Order.

E. Provisions

1. Notice of Intent (NOI) Application: The NOI application for each point of proposed discharge to a storm drain system shall contain the information required in the “Notice of Intent Contents” as attached to this Order and as may be amended by the Executive Officer.

2. NOI Review: Upon receipt of a complete NOI application package for proposed discharge, the Executive Officer will review the application to determine whether the proposed discharger is eligible to discharge waste under this general permit. The application package should document that:

    a. The proposed discharge results from the cleanup of VOC-polluted groundwater;

    b. The proposed discharger has met the provisions of Resolution No. 88-160; and

    c. The proposed treatment system and associated operation, maintenance, and monitoring plans are capable of ensuring that the discharge will meet the provisions, prohibitions, effluent limitations, and receiving water limitations of this Order.

3. Discharge Authorization: If the Executive Officer determines that the proposed discharger is eligible to discharge waste under this general permit, the Executive Officer will authorize the proposed discharge. If the Executive Officer authorizes the discharge, a "discharge authorization letter" will be transmitted to the discharger authorizing the initiation of the discharge subject to the conditions of this Order and any other conditions necessary to protect the beneficial uses of the receiving waters. The discharge authorization letter from the Executive Officer will specify the maximum allowed discharge flow rate. The discharge authorization letter may be terminated or revised by the Executive Officer at any time.

4. Non-Compliance As A Violation: Upon receipt of the Executive Officer's discharge authorization letter, the discharger(s) shall comply with all applicable conditions and limitations of this Order and the discharge authorization letter. Any permit noncompliance (violations of requirements in this Order or Self Monitoring Program) constitutes a violation of the Clean Water Act and the California Water Code and is grounds for enforcement action, permit or authorization letter termination, revocation and reissuance, modification, the issuance of an individual permit, or denial of a renewal application.

5. Self-Monitoring Program: Dischargers shall comply with (1) the "Self-Monitoring Program" as attached to this Order (or as may be amended by the Executive Officer) or (2) an amended Self-Monitoring Program specified in the discharge authorization letter. The sampling and analysis schedule in the attached Self-Monitoring Program is the program expected to be followed for six months. After six months, the results will be reviewed, if requested by the dischargers, and the Executive Officer may modify the Self-Monitoring Program to cover constituents of concern. If the groundwater extraction and/or treatment system(s) described in the application for proposed discharge and certification report is modified, the schedule of monitoring specified in Table A of the Self-Monitoring Program will be reviewed for possible modification.

6. Triggers: The following triggers are not effluent limitations, and should not be construed as such. Instead, they are levels at which additional investigation is warranted to determine whether a numeric limit for a particular constituent is necessary. If any constituent in the effluent of a discharge exceeds the corresponding trigger as listed in the table E.6 below, then the discharger shall take three additional samples (three influent and three effluent) for each exceeded constituent during the following quarter and conduct activities as explained in the Provisions E.7, E.8, or E.9. If this monitoring activity has already been completed in the past, then summarize the results including the design of any installed treatment unit.

Table E.6 Trigger Compounds

Compound	CAS Number	Trigger (ug/L)
Antimony	7440360	6
Arsenic	7440382	10
Beryllium	7440417	1
Cadmium	7440439	0.07
Chromium (total)	18540299	11*
Chromium (VI)	18540299	11
Copper	7440508	3.1
Lead	7439921	2.0
Mercury	7439976	0.025
Nickel	7440020	8.2
Selenium	7782492	5.0
Silver	7440224	1.9
Thallium	7440280	0.1

Compound	CAS Number	Trigger (ug/L)
Zinc	7440666	35
Cyanide	57125	1.0
Asbestos	1332214	7 MFibers/L
2,3,7,8-TCDD (Dioxin)	1746016	0.000000013
Acrylonitrile	107131	2.0
Bromoform	75252	4.3
Chlorodibromomethane	124481	0.401
Dichlorobromomethane	75274	0.56
1,2-Dichloropropane	78875	0.50
1,3-Dichloropropylene	542756	0.2
1,1,2,2-Tetrachloroethane	79345	0.1
Pentachlorophenol	87865	0.28
2,4,6-Trichlorophenol	88062	2.1
Benzidine	92875	0.00012
Benzo(a)Anthracene	56553	0.0044
Benzo(a)Pyrene	50328	0.004
Benzo(b)Fluoranthene	205992	0.0044
Benzo(k)Fluoranthene	207089	0.0044
Bis(2-Chloroethyl)Ether	111444	0.031
Bis(2-Ethylhexyl)Phthalate	117817	1.8
Chrysene	218019	0.0044
Dibenzo(a,h)Anthracene	53703	0.0044
3,3'-Dichlorobenzidine	91941	0.04
2,4-Dinitrotoluene	121142	0.11
1,2-Diphenylhydrazine	122667	0.04
Hexachlorobenzene	118741	0.00075
Hexachlorobutadiene	87683	0.44
Hexachloroethane	67721	1.9
Indeno(1,2,3-cd)Pyrene	193395	0.0044
N-Nitrosodimethylamine	62759	0.00069
N-Nitrosodi-n-Propylamine	621647	0.005
Aldrin	309002	0.00013
alpha-BHC	319846	0.0039
beta-BHC	319857	0.014
gamma-BHC	58899	0.019
Chlordane	57749	0.00057
4,4'-DDT	50293	0.00059
4,4'-DDE	72559	0.00059
4,4'-DDD	72548	0.00083
Dieldrin	60571	0.00014
alpha-Endosulfan	959988	0.0087
beta-Endosulfan	33213659	0.0087
Endrin	72208	0.0023
Endrin Aldehyde	7421934	0.76

Compound	CAS Number	Trigger (ug/L)
Heptachlor	76448	0.00021
Heptachlor Epoxide	1024573	0.0001
Polychlorinated biphenyls (PCBs) total	1336363	0.00017
Toxaphene	8001352	0.0002
1,4-Dioxane	123911	3.0
Perchlorate	14797730	5.0
Freon 12 (Dichlorodifluoromethane)	75718	0.19
Other VOCs	-	5.0
Other SVOCs	-	5.0

Legend:
CAS = Chemical Abstract System or Service
* If total chromium concentration exceeds 11 then Chromium (VI) analysis shall also be done

7. Triggers Case 1: If the results of the three additional samples for the effluent **do not** exceed the triggers the discharger shall report the results to the Executive Officer in the next Self-Monitoring Report, and shall return to the schedule of sampling and analysis in the Self-Monitoring Program.

8. Triggers Case 2: If the results of **any one of the three** additional samples exceed the triggers, the discharger has two options of submitting a rational for not doing the special studies explained below or performing the following:

    a. Calculate the median and maximum concentration values for the constituent(s) of concern, using the three recent samples **and** all samples collected and analyzed for that constituent in the previous 12-month period.

    b. Estimate the mass load discharged in the previous 12 month period for the constituent(s) of concern. Report the results in grams per day and in pounds per year, using the average flow rate for the previous 12 month period.

    c. Report the results to the Executive Officer in the next Self-Monitoring Report, and return to the schedule of sampling and analysis in the Self-Monitoring Program.

9. Triggers Case 3: If the results of **two or three** of the additional samples exceed the triggers, the discharger shall perform the following:

    a. Calculate median and maximum concentration values and mass load for the constituent(s) of concern, as described in Case 2 above.

    b. Explain or identify source(s) of the compound and any other related chemicals of concern.

c. Define the properties of the compound and any other related chemicals of concern. Attach Material Safety Data Sheets, if available or applicable.

d. Document what standard or customized EPA approved test methods are used to detect this compound.

e. List and evaluate all available technologies for treatment or pre-treatment of this compound and any other related chemicals of concern. This evaluation may include the cost of increased treatment to reduce the constituent(s) of concern, and the amount of reduction in terms of concentration.

f. Discuss any proposed plan for pilot bench scale and field tests for treatment of this compound and any other related chemicals of concern and associated timetable.

g. Determine best available technology economically achievable for treatment of this compound and any other related chemicals of concern or propose the next step after obtaining the results of the pilot tests.

h. If the results of the evaluation indicates that treatment of the discharge does not appear to be a feasible option, then:

1) Perform an evaluation of the potential adverse impacts to the beneficial uses of the receiving water. The evaluation should include, but need not be limited to, description of the beneficial uses specific to the receiving water, physical and chemical characteristics of the water body and sediment, and the physical, chemical, or biological effects from the constituent(s) on the beneficial uses. For metals, include discussions regarding effects related to total or dissolved fraction and hardness with hardness-dependent objectives. If exceedances are only for metals with hardness-dependent objectives, then the discharger may conduct a hardness study prior to completing this task.

2) If the receiving water study finds that the discharge has potential to cause adverse impacts to beneficial uses of the receiving water, then evaluate control measures other than treatment to reduce the constituent(s) of concern in the discharge, such as re-evaluating options for re-use, discharge to POTW, or alternatives to groundwater extraction.

i. Within 180 days of the discharger receiving results of the confirmation sampling, report the results of tasks (a) through (h) above to the Executive Officer, including a proposed method to eliminate or minimize future exceedances, or provide a rationale for why no change to the existing treatment program should take place. The discharger may be required to perform additional evaluations or take additional actions, as deemed necessary by the Executive Officer. The discharger may apply or may be required to apply for an individual NPDES

permit. If the Executive Officer determines that additional numeric limits are necessary for a particular compound (including but not limited to a VOC), these limits will be calculated using the procedures specified in the SIP, Basin Plan, and applicable USEPA regulations.

As an alternative, the discharger may submit a specific technical rational for not conducting the above special studies, subject to the Executive Officer's approval.

10. Exceedance of the same Triggers: If an exceedance of the same trigger in Table E.6 occurs less than 60 months after completion of the required tasks in Provisions E.7, E.8, or E.9, then the Executive Officer may waive the evaluation required above. This waiver will not apply if a different constituent exceeds the triggers set in Tables E.6. In that case, the discharger shall perform an evaluation for that constituent. During and after any additional monitoring, the discharger should continue the required schedule of sampling and analysis in the Self-Monitoring Program.

11. Individual NPDES Permit May Be Required: The U.S. EPA Administrator may request the Water Board Executive Officer to require any discharger authorized to discharge waste by the general permit to subsequently apply for and obtain an individual NPDES permit. The Executive Officer of the Water Board may require any discharger authorized to discharge waste by a general permit to subsequently apply for and obtain an individual NPDES permit. An interested person may petition the Executive Officer or the Regional Administrator to take action under this provision. Cases where an individual NPDES permit may be required include the following:

    a. The discharger is not in compliance with the conditions of this Order or the discharge authorization letter from the Executive Officer;
    b. A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source;
    c. Effluent limitation guidelines are promulgated for point sources covered by the general NPDES permit;
    d. A water quality control plan containing requirements applicable to such point sources is approved; or
    e. The requirements of 40 CFR 122.28(a), as explained in Finding No. 4, are not met.

12. Duty to Comply: The filing of a request by the discharger for modification or termination of permit coverage, or a notification of planned changes or anticipated non-compliance does not stay any permit condition.

13. Duty to Mitigate: The discharger shall take all reasonable steps to minimize or prevent any discharge in violation of this Order which has a reasonable likelihood of adversely affecting public health or the environment, including such accelerated or additional monitoring as requested by Water Board or Executive Officer to determine the nature and

impact of the violation.

14. Inspection and Entry: The Water Board or its authorized representatives shall be allowed:

    a. Entry upon premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of the Order;

    b. Reasonable access to and duplication of any records that must be kept under the conditions of the Order;

    c. To inspect at reasonable times any facility, equipment, practices, or operations regulated or required under the Order; and

    d. To photograph, sample, and monitor at reasonable times for the purpose of assuring compliance with the Order or as otherwise authorized by the Clean Water Act any substances or parameters at any locations.

15. Treatment Reliability: The dischargers shall, at all times, retain a professional engineer certified in State of California to oversee the design, and operation and maintenance of the treatment system to properly operate and maintain all facilities that are used by the dischargers to achieve compliance with this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. All of these procedures shall be described in an Operation and Maintenance manual. The discharger shall keep in a state of readiness all systems necessary to achieve compliance with the conditions of this Order. All systems, both those in service and reserve, shall be inspected and maintained on a regular basis. Records shall be kept of the tests and made available to Water Board for at least five years. Additional requirements for compliance with this provision are explained in item number 6 of the attached "Notice of Intent Contents."

16. Transfers: Coverage by this permit is not transferable to any person except after notice to the Executive Officer. The Executive Officer may require modification of the discharge authorization letter to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

17. Planned Changes: The discharger shall file with the Executive Officer an amended Notice of Intent at least 60 days before making any material change in the character, location, or volume of the discharge. In case of proposing any change of treatment system or operation and maintenance procedures, a professional engineer certified in State of California shall certify the adequacy of the design and/or the procedures.

18. General NPDES Permit and Continuous Coverage: This Order shall serve as a general National Pollutant Discharge Elimination System Permit pursuant to Section 402 of the Clean Water Act or amendments thereto, and shall be effective on the date of its adoption

unless the Regional Administrator, USEPA, has an objection. If the Regional Administrator objects to its issuance, the permit shall not become effective until such objection is withdrawn. The requirements prescribed by this Order supersede the requirements prescribed by Order No. 99-051. Order No. 99-051 is hereby rescinded upon the effective date of this permit. Dischargers who (i) were previously subject to Order No. 99-051, (ii) filed a complete NOI before the effective date of this Order, and (iii) have not yet received an Executive Officer authorization letter pursuant to this Order will be subject to this Order pending receipt of a new authorization letter. This provision will assure no lapse in NPDES permit coverage for authorized discharges.

19. Expiration Date: This Order expires on July 21, 2009. Dischargers who need to discharge treated groundwater after July 21, 2009, must file an application for proposed discharge no later than January 21, 2009, as application for issuance of new waste discharge requirements.

I, Bruce H. Wolfe, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on July 21, 2004.

Bruce H. Wolfe
Executive Officer

Attachments: Notice of Intent Contents
Self-Monitoring Program

Appendix C

Recalculated theoretical Incremental Lifetime Cancer Risks (ILCRs) for 2005 groundwater data within areas of contaminated groundwater at Berkeley Lab.

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
16-94-13	Chloroform	3.4	8.86E-08
16-94-13	Tetrachloroethene	38.8	3.02E-07
16-94-13	Trichloroethene	15.6	2.83E-07
16-94-13 Total			**6.73E-07**
16-95-3	Chloroform	6.5	1.69E-07
16-95-3	Trichloroethene	17.6	3.13E-07
16-95-3 Total			**4.82E-07**
25-98-10	Carbon Tetrachloride	2.1	1.42E-06
25-98-10	Trichloroethene	6.6	7.90E-08
25-98-10 Total			**1.50E-06**
25A-95-15	1,1-Dichloroethene	52.8	0.00E+00
25A-95-15	cis-1,2-Dichloroethene	2.3	0.00E+00
25A-95-15	Tetrachloroethene	1.6	1.14E-08
25A-95-15	Trichloroethene	144	2.38E-06
25A-95-15 Total			**2.39E-06**
25A-98-1	1,1-Dichloroethene	3.6	0.00E+00
25A-98-1	cis-1,2-Dichloroethene	2.7	0.00E+00
25A-98-1	Trichloroethene	61.3	9.91E-07
25A-98-1 Total			**9.91E-07**
25A-98-7	Trichloroethene	32.9	5.63E-07
25A-98-7 Total			5.63E-07
25A-99-2	1,1-Dichloroethene	9.2	0.00E+00
25A-99-2	Trichloroethene	161	2.70E-06
25A-99-2 Total			**2.70E-06**
25A-99-5	1,1-Dichloroethene	3.6	0.00E+00
25A-99-5 Total			**0.00E+00**
27-92-20	1,1-Dichloroethane	1.2	1.05E-08
27-92-20	Carbon Tetrachloride	2.3	1.79E-06
27-92-20	Chloroform	7.1	1.40E-07
27-92-20	cis-1,2-Dichloroethene	2.7	0.00E+00
27-92-20	Tetrachloroethene	6.1	3.72E-08
27-92-20	Trichloroethene	9	1.26E-07
27-92-20 Total			**2.10E-06**
46-93-12	Chloroform	4.4	1.18E-07
46-93-12	cis-1,2-Dichloroethene	2.2	0.00E+00
46-93-12	Tetrachloroethene	5.4	4.23E-08
46-93-12 Total			**1.60E-07**
51-00-10	1,1-Dichloroethane	5.7	5.24E-08
51-00-10	cis-1,2-Dichloroethene	4.2	0.00E+00
51-00-10 Total			**5.24E-08**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
51-00-8	1,1-Dichloroethane	5	3.84E-08
51-00-8	1,1-Dichloroethene	2.3	0.00E+00
51-00-8	cis-1,2-Dichloroethene	6.6	0.00E+00
51-00-8	Vinyl Chloride	1.2	2.43E-06
51-00-8 Total			**2.47E-06**
51-00-9	1,1-Dichloroethane	3.2	2.94E-08
51-00-9	1,1-Dichloroethene	20.5	0.00E+00
51-00-9	cis-1,2-Dichloroethene	19.4	0.00E+00
51-00-9	Vinyl Chloride	2.3	5.34E-06
51-00-9 Total			**5.37E-06**
51-96-15	cis-1,2-Dichloroethene	3.4	0.00E+00
51-96-15	Tetrachloroethene	3.7	2.64E-08
51-96-15	Trichloroethene	11.2	1.85E-07
51-96-15 Total			**2.11E-07**
51-96-16	1,1-Dichloroethane	12.9	1.03E-07
51-96-16	1,1-Dichloroethene	6.3	0.00E+00
51-96-16	Benzene	2.3	3.44E-07
51-96-16	cis-1,2-Dichloroethene	283	0.00E+00
51-96-16	Tetrachloroethene	6	4.38E-08
51-96-16	trans-1,2-Dichloroethene	30.8	0.00E+00
51-96-16	Trichloroethene	78.8	2.87E-07
51-96-16	Vinyl Chloride	25.1	7.30E-05
51-96-16 Total			**7.38E-05**
51-96-17	1,1-Dichloroethane	6.6	5.48E-08
51-96-17	1,1-Dichloroethene	3.9	0.00E+00
51-96-17	cis-1,2-Dichloroethene	224	0.00E+00
51-96-17	Tetrachloroethene	0.64	4.67E-09
51-96-17	trans-1,2-Dichloroethene	59.3	0.00E+00
51-96-17	Trichloroethene	17	2.96E-07
51-96-17	Vinyl Chloride	34.9	7.50E-05
51-96-17 Total			**7.54E-05**
51-97-12	1,1-Dichloroethane	3.2	2.28E-08
51-97-12	1,1-Dichloroethene	4	0.00E+00
51-97-12	cis-1,2-Dichloroethene	15.7	0.00E+00
51-97-12 Total			2.28E-08
51-97-13	1,1-Dichloroethane	8	5.71E-08
51-97-13	1,1-Dichloroethene	5.3	0.00E+00
51-97-13	cis-1,2-Dichloroethene	4	0.00E+00
51-97-13	Trichloroethene	1.9	6.93E-09
51-97-13	Vinyl Chloride	4	7.63E-06
51-97-13 Total			**7.69E-06**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
51-97-3	1,1-Dichloroethane	12.6	8.84E-08
51-97-3	1,1-Dichloroethene	20.6	0.00E+00
51-97-3	cis-1,2-Dichloroethene	15.7	0.00E+00
51-97-3	Trichloroethene	2.5	3.76E-08
51-97-3	Vinyl Chloride	1.4	2.63E-06
51-97-3 Total			**2.76E-06**
51B-93-18A	1,1-Dichloroethane	9.5	8.17E-08
51B-93-18A	1,1-Dichloroethene	6.7	0.00E+00
51B-93-18A	cis-1,2-Dichloroethene	21.9	0.00E+00
51B-93-18A	trans-1,2-Dichloroethene	3.5	0.00E+00
51B-93-18A	Trichloroethene	80.4	1.44E-06
51B-93-18A	Vinyl Chloride	1.6	3.44E-06
51B-93-18A Total			**4.96E-06**
51L-01-4	1,1-Dichloroethane	1.7	1.46E-08
51L-01-4 Total			**1.46E-08**
52-93-14	Carbon Tetrachloride	3	2.49E-06
52-93-14	Tetrachloroethene	17	1.11E-07
52-93-14	Trichloroethene	3.2	4.80E-08
52-93-14 Total			**2.65E-06**
52-95-2B	Carbon Tetrachloride	6.6	4.85E-06
52-95-2B	Chloroform	21.4	3.92E-07
52-95-2B	cis-1,2-Dichloroethene	16	0.00E+00
52-95-2B	Tetrachloroethene	25.4	1.46E-07
52-95-2B	Trichloroethene	38.3	5.03E-07
52-95-2B Total			**5.89E-06**
52-98-9	Carbon Tetrachloride	6.2	4.56E-06
52-98-9	Chloroform	26.1	4.78E-07
52-98-9	cis-1,2-Dichloroethene	9.2	0.00E+00
52-98-9	Tetrachloroethene	16.1	9.27E-08
52-98-9	Trichloroethene	22.9	3.01E-07
52-98-9 Total			**5.43E-06**
52A-98-8B	Carbon Tetrachloride	3.1	2.26E-06
52A-98-8B	Chloroform	11.1	2.01E-07
52A-98-8B	cis-1,2-Dichloroethene	18.3	0.00E+00
52A-98-8B	Tetrachloroethene	6.7	3.82E-08
52A-98-8B	Trichloroethene	33.7	4.38E-07
52A-98-8B Total			**2.94E-06**
53-92-21	Benzene	1.3	1.19E-07
53-92-21 Total			1.19E-07

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
53-93-16-69'	1,1-Dichloroethene	2.1	0.00E+00
53-93-16-69'	Carbon Tetrachloride	6.9	5.27E-06
53-93-16-69'	cis-1,2-Dichloroethene	4.5	0.00E+00
53-93-16-69'	Tetrachloroethene	128	7.67E-07
53-93-16-69'	Trichloroethene	48.5	6.64E-07
53-93-16-69' Total			**6.70E-06**
53-93-17	Carbon Tetrachloride	4.2	2.97E-06
53-93-17	Chloroform	10.7	1.87E-07
53-93-17	Tetrachloroethene	25	1.38E-07
53-93-17	Trichloroethene	11.5	1.45E-07
53-93-17 Total			**3.44E-06**
53-93-9	Carbon Tetrachloride	7.8	5.64E-06
53-93-9	Chloroform	14.5	2.61E-07
53-93-9	cis-1,2-Dichloroethene	2.9	0.00E+00
53-93-9	Tetrachloroethene	41.2	2.33E-07
53-93-9	Trichloroethene	18.4	2.37E-07
53-93-9 Total			**6.38E-06**
53-96-1	1,1-Dichloroethene	6.9	0.00E+00
53-96-1	Carbon Tetrachloride	11.6	8.89E-06
53-96-1	Chloroform	5.5	1.06E-07
53-96-1	cis-1,2-Dichloroethene	14.7	0.00E+00
53-96-1	Tetrachloroethene	126	7.57E-07
53-96-1	trans-1,2-Dichloroethene	2.4	0.00E+00
53-96-1	Trichloroethene	51.4	7.06E-07
53-96-1 Total			**1.05E-05**
56-98-2	1,1-Dichloroethane	2.1	1.67E-08
56-98-2	1,1-Dichloroethene	2.9	0.00E+00
56-98-2 Total			**1.67E-08**
58-93-3	1,1,1-Trichloroethane	3.5	0.00E+00
58-93-3	1,1-Dichloroethane	9.6	8.69E-08
58-93-3	1,1-Dichloroethene	22	0.00E+00
58-93-3	cis-1,2-Dichloroethene	6.9	0.00E+00
58-93-3	Tetrachloroethene	42.6	3.42E-07
58-93-3	Trichloroethene	31.1	5.83E-07
58-93-3	Vinyl Chloride	2	4.59E-06
58-93-3 Total			**5.60E-06**
58-95-18	1,1-Dichloroethane	1.7	1.49E-08
58-95-18	1,1-Dichloroethene	5.1	0.00E+00
58-95-18	cis-1,2-Dichloroethene	3.6	**0.00E+00**
58-95-18	Tetrachloroethene	4.3	3.37E-08
58-95-18	Trichloroethene	8.5	1.55E-07
58-95-18 Total			**2.04E-07**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
58-95-20	cis-1,2-Dichloroethene	2.2	0.00E+00
58-95-20	Tetrachloroethene	8.3	6.19E-08
58-95-20	Trichloroethene	5.7	9.87E-08
58-95-20 Total			**1.61E-07**
58-96-11	1,1-Dichloroethene	9.2	0.00E+00
58-96-11	Carbon Tetrachloride	125	1.05E-04
58-96-11	Chloroform	1.7	3.70E-08
58-96-11	cis-1,2-Dichloroethene	78	0.00E+00
58-96-11	Tetrachloroethene	3400	2.26E-05
58-96-11	Trichloroethene	2700	4.12E-05
58-96-11 Total			**1.69E-04**
58A-94-14	1,1-Dichloroethane	8.5	6.58E-08
58A-94-14	1,1-Dichloroethene	25.3	0.00E+00
58A-94-14	cis-1,2-Dichloroethene	43.3	0.00E+00
58A-94-14	Trichloroethene	1.3	2.13E-08
58A-94-14	Vinyl Chloride	2	5.82E-06
58A-94-14 Total			**5.90E-06**
5-93-10	Trichloroethene	2.7	4.71E-08
5-93-10 Total			**4.71E-08**
64-97-2	1,1-Dichloroethane	6.5	5.51E-08
64-97-2	1,1-Dichloroethene	5	0.00E+00
64-97-2	Trichloroethene	3.7	6.55E-08
64-97-2 Total			**1.21E-07**
6-92-17	Chloroform	5.8	1.51E-07
6-92-17	Trichloroethene	9.6	1.70E-07
6-92-17 Total			**3.21E-07**
6-93-4	cis-1,2-Dichloroethene	3.1	0.00E+00
6-93-4	Tetrachloroethene	5.3	3.62E-08
6-93-4	Trichloroethene	4.1	6.45E-08
6-93-4 Total			**1.01E-07**
71B-98-13	cis-1,2-Dichloroethene	4.1	0.00E+00
71B-98-13	Trichloroethene	1.9	3.34E-08
71B-98-13 Total			**3.34E-08**
71B-99-3R	cis-1,2-Dichloroethene	48.4	0.00E+00
71B-99-3R	Tetrachloroethene	50.5	3.83E-08
71B-99-3R	Trichloroethene	74.4	1.25E-06
71B-99-3R	Vinyl Chloride	15.8	3.40E-05
71B-99-3R Total			**3.52E-05**
75-98-14	1,1-Dichloroethane	1.1	9.14E-09
75-98-14	1,1-Dichloroethene	4.3	0.00E+00
75-98-14 Total			**9.14E-09**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
75A-00-7	Benzene	69.5	6.38E-06
75A-00-7	Tetrachloroethene	1.4	8.90E-09
75A-00-7 Total			**6.39E-06**
7-94-3	1,1-Dichloroethane	1.4	1.23E-08
7-94-3	1,1-Dichloroethene	8.9	0.00E+00
7-94-3	Carbon Tetrachloride	2.2	2.13E-06
7-94-3	Chloroform	7.8	2.03E-07
7-94-3	Tetrachloroethene	82.7	6.34E-07
7-94-3	Trichloroethene	37	6.59E-07
7-94-3 Total			**3.64E-06**
25A-98-3	1,1-Dichloroethene	3.3	0.00E+00
25A-98-3	Trichloroethene	58.1	9.77E-07
25A-98-3 Total			**9.77E-07**
MW90-2	Chloroform	5.8	1.51E-07
MW90-2	Tetrachloroethene	48.5	3.26E-07
MW90-2	Trichloroethene	4	6.19E-08
MW90-2 Total			**5.39E-07**
MW90-3	1,1-Dichloroethane	1.5	1.01E-08
MW90-3	cis-1,2-Dichloroethene	11.8	0.00E+00
MW90-3	Tetrachloroethene	7.7	4.89E-08
MW90-3	Trichloroethene	8.4	1.22E-07
MW90-3 Total			**1.81E-07**
MW91-4	Benzene	17.5	1.90E-06
MW91-4 Total			**1.90E-06**
MW91-8	Carbon Tetrachloride	1.9	1.44E-06
MW91-8	Chloroform	4.8	9.15E-08
MW91-8	cis-1,2-Dichloroethene	1.3	0.00E+00
MW91-8	Tetrachloroethene	7.4	4.40E-08
MW91-8	Trichloroethene	5.8	7.88E-08
MW91-8 Total			**1.66E-06**
MW91-9	Tetrachloroethene	6.5	4.82E-08
MW91-9	Trichloroethene	2.6	4.47E-08
MW91-9 Total			**9.30E-08**
SB16-97-11	cis-1,2-Dichloroethene	20.8	0.00E+00
SB16-97-11	Tetrachloroethene	41	2.87E-07
SB16-97-11	Trichloroethene	8.8	1.42E-07
SB16-97-11 Total			**4.30E-07**
SB16-98-1	Chloroform	6.2	1.62E-07
SB16-98-1	Trichloroethene	9.5	1.54E-07
SB16-98-1 Total			**3.15E-07**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
Sb27-96-1	cis-1,2-Dichloroethene	2.7	0.00E+00
Sb27-96-1	Tetrachloroethene	2.6	1.77E-08
Sb27-96-1	Trichloroethene	3.9	6.11E-08
Sb27-96-1 Total			**7.88E-08**
SB51-04-1	Tetrachloroethene	3.8	3.05E-08
SB51-04-1	Trichloroethene	2.8	5.25E-08
SB51-04-1 Total			**8.30E-08**
SB51-96-6	cis-1,2-Dichloroethene	11.6	0.00E+00
SB51-96-6	trans-1,2-Dichloroethene	2.2	0.00E+00
SB51-96-6	Trichloroethene	7.5	1.41E-07
SB51-96-6	Vinyl Chloride	13.7	3.14E-05
SB51-96-6 Total			**3.15E-05**
SB51-98-1	1,1-Dichloroethane	7.5	7.01E-08
SB51-98-1	cis-1,2-Dichloroethene	120	0.00E+00
SB51-98-1	Trichloroethene	9.6	1.85E-07
SB51-98-1	Vinyl Chloride	2.3	5.40E-06
SB51-98-1 Total			**5.66E-06**
SB51-98-2	Tetrachloroethene	7	5.62E-08
SB51-98-2 Total			**5.62E-08**
SB51-98-6	cis-1,2-Dichloroethene	7.1	0.00E+00
SB51-98-6	Tetrachloroethene	21.9	1.76E-07
SB51-98-6	Trichloroethene	8.7	1.63E-07
SB51-98-6 Total			**3.39E-07**
SB51-98-8	Tetrachloroethene	5	4.02E-08
SB51-98-8 Total			**4.02E-08**
SB51L-03-1	1,1-Dichloroethane	99.8	8.31E-07
SB51L-03-1	1,1-Dichloroethene	21	0.00E+00
SB51L-03-1	cis-1,2-Dichloroethene	643	0.00E+00
SB51L-03-1	trans-1,2-Dichloroethene	61.9	0.00E+00
SB51L-03-1	Trichloroethene	20.6	3.60E-07
SB51L-03-1	Vinyl Chloride	258	5.90E-04
SB51L-03-1 Total			**5.92E-04**
SB51L-03-2	1,1-Dichloroethane	47.7	3.97E-07
SB51L-03-2	1,1-Dichloroethene	7.7	0.00E+00
SB51L-03-2	cis-1,2-Dichloroethene	558	0.00E+00
SB51L-03-2	trans-1,2-Dichloroethene	99.3	0.00E+00
SB51L-03-2	Trichloroethene	42.6	7.44E-07
SB51L-03-2	Vinyl Chloride	624	1.43E-03
SB51L-03-2 Total			**1.43E-03**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
SB51L-98-1A	1,1-Dichloroethane	28.1	2.34E-07
SB51L-98-1A	1,1-Dichloroethene	3.8	0.00E+00
SB51L-98-1A	cis-1,2-Dichloroethene	224	0.00E+00
SB51L-98-1A	Tetrachloroethene	6.4	5.14E-08
SB51L-98-1A	trans-1,2-Dichloroethene	33.6	0.00E+00
SB51L-98-1A	Trichloroethene	164	2.86E-06
SB51L-98-1A Total			**3.15E-06**
SB58-01-02	1,1-Dichloroethane	8	7.24E-08
SB58-01-02	1,1-Dichloroethene	22.4	0.00E+00
SB58-01-02	cis-1,2-Dichloroethene	7.7	0.00E+00
SB58-01-02	Tetrachloroethene	30.3	2.43E-07
SB58-01-02	Trichloroethene	42.1	7.89E-07
SB58-01-02 Total			**1.10E-06**
SB58-02-1	1,1,1-Trichloroethane	2.8	0.00E+00
SB58-02-1	1,1,2-Trichloroethane	1.8	3.58E-08
SB58-02-1	1,1-Dichloroethane	31.9	2.89E-07
SB58-02-1	1,1-Dichloroethene	125	0.00E+00
SB58-02-1	1,2-Dichloroethane	0.56	1.65E-08
SB58-02-1	Chloroform	1.3	3.39E-08
SB58-02-1	cis-1,2-Dichloroethene	18.9	0.00E+00
SB58-02-1	Tetrachloroethene	156	1.25E-06
SB58-02-1	trans-1,2-Dichloroethene	0.57	0.00E+00
SB58-02-1	Trichloroethene	140	2.62E-06
SB58-02-1	Vinyl Chloride	1.4	3.21E-06
SB58-02-1 Total			**7.46E-06**
SB58-02-2	1,1,1-Trichloroethane	2	0.00E+00
SB58-02-2	1,1,2-Trichloroethane	0.91	1.81E-08
SB58-02-2	1,1-Dichloroethane	15	1.36E-07
SB58-02-2	1,1-Dichloroethene	39	0.00E+00
SB58-02-2	Chloroform	0.96	2.50E-08
SB58-02-2	cis-1,2-Dichloroethene	15.9	0.00E+00
SB58-02-2	Tetrachloroethene	91.6	7.36E-07
SB58-02-2	Trichloroethene	84.1	1.58E-06
SB58-02-2	Vinyl Chloride	1.1	2.52E-06
SB58-02-2 Total			**5.02E-06**
SB58-95-1	1,1-Dichloroethane	2.6	2.43E-08
SB58-95-1	Tetrachloroethene	1.7	1.40E-08
SB58-95-1	Trichloroethene	1.4	2.70E-08
SB58-95-1 Total			**6.53E-08**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
SB58-95-2	1,1,1-Trichloroethane	2.7	0.00E+00
SB58-95-2	1,1-Dichloroethane	10.1	8.61E-08
SB58-95-2	1,1-Dichloroethene	26	0.00E+00
SB58-95-2	cis-1,2-Dichloroethene	7.6	0.00E+00
SB58-95-2	Tetrachloroethene	43.7	3.35E-07
SB58-95-2	Trichloroethene	33.8	6.02E-07
SB58-95-2	Vinyl Chloride	2	4.39E-06
SB58-95-2 Total			**5.41E-06**
SB58-96-1	cis-1,2-Dichloroethene	32.4	0.00E+00
SB58-96-1	Tetrachloroethene	106	7.91E-07
SB58-96-1	Trichloroethene	93.3	1.62E-06
SB58-96-1 Total			**2.41E-06**
SB58-96-2	1,1-Dichloroethane	2.7	2.44E-08
SB58-96-2	1,1-Dichloroethene	11	0.00E+00
SB58-96-2	Carbon Tetrachloride	21.9	2.12E-05
SB58-96-2	Chloroform	1.4	3.65E-08
SB58-96-2	cis-1,2-Dichloroethene	42.2	0.00E+00
SB58-96-2	Tetrachloroethene	1230	9.00E-06
SB58-96-2	Trichloroethene	568	9.62E-06
SB58-96-2 Total			**3.99E-05**
SB58-97-1	cis-1,2-Dichloroethene	6.1	0.00E+00
SB58-97-1	Tetrachloroethene	33.2	2.25E-07
SB58-97-1	Trichloroethene	13.4	2.10E-07
SB58-97-1 Total			**4.35E-07**
SB58-97-2	cis-1,2-Dichloroethene	91.1	0.00E+00
SB58-97-2	Trichloroethene	5.3	9.93E-08
SB58-97-2	Vinyl Chloride	5.6	1.28E-05
SB58-97-2	1,1-Dichloroethane	1.2	1.09E-08
SB58-97-2 Total			**1.30E-05**
SB58-98-1	cis-1,2-Dichloroethene	5.5	0.00E+00
SB58-98-1 Total			0.00E+00
SB5A-98-1	Tetrachloroethene	23.6	1.66E-07
SB5A-98-1	Trichloroethene	1.4	2.27E-08
SB5A-98-1 Total			**1.88E-07**
SB64-03-6	1,1-Dichloroethane	3.5	3.01E-08
SB64-03-6	1,1-Dichloroethene	11.2	0.00E+00
SB64-03-6	cis-1,2-Dichloroethene	24.9	0.00E+00
SB64-03-6	Tetrachloroethene	15.7	1.26E-07
SB64-03-6	Trichloroethene	268	4.81E-06
SB64-03-6 Total			**4.97E-06**

Appendix C
Theoretical ILCRs for Monitoring Wells Within Berkeley Lab Groundwater Plumes
2005 Groundwater Data

Well	Analyte	Maximum Detected Concentration (2005)	Theoretical ILCR*
SB69A-99-1	Benzene	0.78	1.17E-07
SB69A-99-1	cis-1,2-Dichloroethene	44.1	0.00E+00
SB69A-99-1	trans-1,2-Dichloroethene	1.7	0.00E+00
SB69A-99-1	Vinyl Chloride	51.6	1.01E-04
SB69A-99-1 Total			**1.01E-04**
SB71B-03-2	cis-1,2-Dichloroethene	243	0.00E+00
SB71B-03-2	Tetrachloroethene	1610	1.22E-06
SB71B-03-2	Trichloroethene	45.9	7.68E-07
SB71B-03-2	Vinyl Chloride	16	3.44E-05
SB71B-03-2 Total			**3.64E-05**
SB71B-04-1	cis-1,2-Dichloroethene	42.2	0.00E+00
SB71B-04-1	Tetrachloroethene	180	1.37E-07
SB71B-04-1	Trichloroethene	44	7.36E-07
SB71B-04-1	Vinyl Chloride	3.8	8.17E-06
SB71B-04-1 Total			**9.04E-06**
SB71B-99-1	cis-1,2-Dichloroethene	5.7	0.00E+00
SB71B-99-1	Trichloroethene	1.7	2.79E-08
SB71B-99-1 Total			**2.79E-08**
SB71H-98-1	1,1-Dichloroethane	2.4	1.62E-08
SB71H-98-1 Total			**1.62E-08**
SB76-04-5	1,1-Dichloroethane	1.3	1.08E-08
SB76-04-5	1,1-Dichloroethene	4.4	0.00E+00
SB76-04-5	cis-1,2-Dichloroethene	3.1	0.00E+00
SB76-04-5	Tetrachloroethene	3.1	2.39E-08
SB76-04-5	Trichloroethene	82.6	1.48E-06
SB76-04-5 Total			**1.52E-06**

*ILCR: Incremental Lifetime Cancer Risk (calculated using maximum concentrations detected during calendar year 2005)

Appendix D

Permit To Penetrate Ground or Existing Surfaces of LBNL Property,

Administrative Procedure – Document Control, ADMN-053.

PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY

ADMINISTRATIVE PROCEDURE – DOCUMENT CONTROL

1.0 OBJECTIVE:

This procedure defines the steps necessary for the safe penetration of ground or existing surfaces of LBNL properties and covers those institutional requirements that must be completed prior to beginning any penetration action in any surfaces in LBNL. Of particular concern is the prevention of contact with live electrical conductors or other significant hazards (i.e., natural gas, water lines, compressed air lines, etc). The intent of this procedure is to minimize the chance of injury or death to personnel and to protect known or unknown buried utility lines. This will minimize disruption of essential services when penetrating or excavating the ground surface of LBNL property. The objectives of this procedure are to assist Laboratory Management with the accomplishment of the following:

A. Maintain employee health/safety.

B. Protect the environment and real property.

C. Ensure operational reliability of concealed utility systems.

D. Ensure that Penetration Permits are tracked, reviewed, approved, distributed, and revised as necessary according to standard Facilities Division document control procedures.

E. Improve communication with personnel involved in the permit process.

1.1 Application:

This procedure applies to all work that requires penetrations of existing surfaces of LBNL and LBNL leased buildings where the surface penetration work is managed, supervised and controlled by LBNL personnel. The LBNL Permit to Penetrate Ground or Existing Surfaces of LBNL Property (here known as Penetration Permit) is required for all penetration of any surfaces of depth greater than 1-1/2 inches at LBNL.

1.2 Scope:

1. The permit is required for all work performed at LBNL that involves penetration of any landscape ground surfaces, walls, columns, floors, and ceiling deeper than 1-1/2 inches.
2. The permit must list special conditions and potential hazards, and clearly identify equipment and underground utilities that will be affected.
3. The permit must be carefully reviewed by Facilities Division personnel, its distribution must be properly controlled, and the fulfillment of these conditions must be documented.

1.3 Special Instructions:

1. Equipment and training required:
   a. Electronic sensing device (Locator).
      Operator must be trained and must be certified as defined by the professional locator competency standards and performance criteria of the National Utility Locating Contractors Association (NULCA) and instrument manufacturer.
   b. Confined Space training and procedures.
   c. Understanding the use of barricades, sand, base rock, concrete, asphalt paving (blacktop), etc.
2. Any core drilling or saw-cut operations including ALS that remove concrete volumes greater than 4″ in diameter shall require the approval of the LBNL Design and Construction Department Structural Engineer.
3. Excavation within 30 inch radius of the marked utility must be excavated by hand using a flat tipped shovel, vacuum, or excavated with appropriate safe technology, such as an air knife until

the utility is located or the excavation has reached the required depth. High pressure water excavator is specifically prohibited due to the possibility of water leaking into high voltage underground electrical duct banks/conduits.

For gypsum board (sheet rock) wall surface penetration; a penetration less than the 1-1/2 inches in depth will be made with an acceptable area removed to expose the interior wall cavity for utility location(s) if necessary. As a result, an electronic survey may be conducted, but a penetration permit will not be required.

If the destructive process is to be used for excavation after underground utilities are located, approval must be obtained from the Project Manager to proceed. The Utilities Coordinator must shut-off and/or secure located utilities by Lockout/Tagout (LOTO) procedures if applicable.

4. Contract Document Requirements.

The LBNL Master Specification includes the requirement that the Subcontractor obtains an approved Penetration Permit prior to any ground penetration, adhere to the conditions during work, and take financial responsibility for any damage to utilities or other resulting losses.

PM shall ensure that the following sections of the specifications are in place, revise if necessary for specific project needs.

a. Master Specification Section M01020, paragraph 1.19.A, Permit to Penetrate Ground or Existing Concrete Surface.

b. Master Specification Section M01210, paragraph 3.01, Safeguards – Existing Equipment, Underground Utilities and Artifacts.

1.4 Addendum:

1. Draft Memorandum of Understanding and Request for Pub. 3000 Variance between the LBNL Advance Light Source Division, the Facilities Division, and the EH&S Division, dated March 28, 2005.

1.5 Responsibilities and controls:

Originators:

Michael C. Dong **Facilities Mechanical Section Chief, Facilities Division, Design & Construction Department**	**Date**
Dennis Nielsen **Technical Services Manager, Facilities Division, Plant Operation Department**	**Date**

Concurred by:

Jerry Ohearn **Department Head, Facilities Division, Design & Construction Department**	**Date**

Approved by:

Steve Black **Department Head, Facilities Division, Plant Operation Department**	**Date**

Glossary of Terms

Utility Coordinator: Person who is trained to use special designed instruments to find utility lines buried underground and responsible for completion of Penetration Permit in accordance with ADMN-053.

Non-destructive Means of Soil Removal: Soil removal by use of vacuum, or excavated with appropriate safe technology, such as an air knife, vacuum or hand digging (flat tipped shovel). Use of high pressure water excavator hand tools is specifically disallowed due to possibility of water leaks into underground high voltage electrical duct banks/conduits.

Destructive Means of Soil Removal: Soil removal by use of powered or heavy equipment.

Soil Excavation: Soil removal by use of non-destructive and /or destructive means.

Area Utility Sheets (U-sheets): Drawings that shows the existing underground utilities in an area of 1,000 feet wide in the East-West directions and 400 feet high in the North-South directions.

Exterior surfaces: 5’ or more from the building exterior wall surfaces.

Interior surfaces: All indoor surfaces including up to 5’ from the building exterior wall surfaces.

LBNL Property: LBNL property is defined to include all properties within the LBNL site and the leased buildings.

Locator: Special designed instruments used to find utility lines buried underground.

2.0 PERMIT PROCESS:

The following process defines the steps for penetration or excavation of any depth greater than 1-1/2 inches at LBNL.

STEP	RESPONSIBLE PERSON	ACTION
1	Project Manager (PM) Subcontractor PM/Requestor Subcontractor/ Requestor PM/ Superintendent/ Requestor	**STEP 1: PENETRATION PERMIT REQUEST WRC** The PM shall ensure that subcontractors are informed about LBNL Penetration Permit requirements so that they will allow for these costs in their bids. The requirement for the LBNL Penetration Permit and underground utilities location prior to excavation must be reviewed at Pre-bid meetings. The subcontractor is instructed to obtain the Penetration Permit from the Project Manager (PM). 1. The Subcontractor requests the PM to initiate the permit request. The request may be made any time after excavation is scheduled, but not so early that conditions may change prior to excavation. For efficiency of scheduling, the request should be made at least 10 working days before digging is scheduled to begin. The Subcontractor shall mark on the ground the extent of the excavation with **"WHITE"** color paint only (per Uniform Paint Color of California Government Code 4216, Underground Service Alert). **Note**: Once the Penetration Permit is issued, the subcontractor is responsible for all new underground utilities installed. As a result, additional Penetration Permit will not be required if the excavation is within the original boundaries of the initial Penetration Permit. If excavation extends beyond the original boundaries of the initial Penetration Permit, a new Penetration Permit with the new white painted boundaries shall be started. 2. The PM or Requestor (for LBNL In-house Labor job) shall obtain a copy of the "Ground or Existing Surface Penetration Job Safety Analysis Checklist" (hereafter known as JSA Checklist) from the Utilities Coordinator Shop Supervisor. The PM shall provide the Job Safety Analysis Reference Checklist to the Subcontractor and/or his subcontractor. 3. The Subcontractor and/or his Subcontractor or Requestor (for LBNL In-house Labor job) shall complete the JSA Checklist and forward the completed checklist to the PM and the PM shall forward the checklist to the Utilities Coordinator Shop Supervisor. The JSA Checklist shall be completed prior to any penetrations. 4. PM/Superintendent/Requestor shall request the Penetration Permit through the Work Request Center by completing the Permit Application form and fax it to the Work Request Center or use the Facilities web-page electronic version and paste into the online Work Request. For efficiency of scheduling, the request should be made at least 10 working days before digging is scheduled to begin. There is typically a 5 working day turnaround for the permit to be issued pending area access and locator sensing survey. For emergencies, there can be a 72 hour (workday) turnaround with Plant Operation Department Head approval. Poor planning does not constitute an emergency. 5. The PM/Superintendent/Requestor shall notify the closest Building Manager(s) of the upcoming construction activities.
2	Utilities Shop Supervisor	**STEP 2: WO TO UTILITIES COORDINATOR SHOP SUPERVISOR** 1. Utilities Coordinator Shop Supervisor gives Work Order and JSA Checklist to Facilities Utilities Coordinator if the exterior surface penetration is in the ground area and within LBNL site. For exterior concrete surface penetration, go to Step 2.2. For exterior surface penetration of LBNL leased building, the PM may proceed to authorize the Subcontractor to contact Underground Service Alert (USA) for underground utilities mark out. The Utilities Coordinator work scope consists of verification of the USA's underground utility mark out and issuance of the

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		Penetration Permit. Go to Steps 3 & 6. 2. For projects that require penetration through existing interior surfaces such as floors, walls and ceiling or exterior concrete surfaces in LBNL site and leased buildings, Utilities Coordinator Shop Supervisor shall initiate a task request to an outside Subcontractor who is qualified to determine the sub-surface utilities and structural components regarding specific location and depth prior to permit issuance. The task request shall include a completed JSA Checklist. The Utilities Coordinator Shop Supervisor will approve Subcontract Locators for work onsite at LBNL only if they have met all training and certification requirements. Under this procedure, Subcontractor firms performing work for LBNL retain responsibility for the health and safety of their personnel while on the job site. For interior surface penetration of the LBNL leased building, the Utilities Coordinator shall provide complete issuance of the Penetration Permit. Go to Steps 3 & 6.
3	**Utilities Coordinator**	**STEP 3: UTILITIES COORDINATOR PERMIT HOUR CLOCK** Utilities Coordinator Shop Supervisor starts the schedule for the permit at this time. Confirmation of receipt of the permit will be made to the requestor 24 hours after the receipt of the Work Order from Work Request Center. For efficiency of scheduling, the request should be made at least 10 working days before digging is scheduled to begin. There is typically a 5 working day turnaround for the permit to be issued pending area access and locator sensing survey. For emergencies, there can be a 72 hour (workday) turnaround with Plant Operation Department Head approval. Poor planning does not constitute an emergency.
4	**Utilities Coordinator**	**Step 4: Site Drawing Review** 1. Review available sub-surface utility maps (Area Utility Sheets (U-sheets)) for exterior underground infrastructure utilities and/or building underground utilities if the permit application is for interior surface penetrations. 2. Review drawings and other historical documentation which are available in B90F, Project Stick Files, and microfiche system. 3. Collect information from knowledgeable employees based on personal recollection of construction in a particular area. 4. Locate, on prints/maps, all underground utilities in work area. 5. Make copies of all relevant drawings. 6. Mark area defined by work requested on drawings to be included with permit. 7. Review any unexpected problems with PM/Superintendent/Requester.
5	**Utilities Coordinator**	**STEP 5: SITE LOCATOR SENSING SURVEY** 1. Thoroughly sweep work area with applicable Locator(s). Look for signs of recent excavations, patched asphalt, etc. particularly around nearby mechanical and electrical equipment pads or substations. Any new unrecorded utilities in these areas may extend into the permit area. Disconnected electrical circuits may need to be turned on to provide a flow signal where they could be crossing the permit area but not be detectable due to lack of current flow. Do not assume anything, if in doubt, get assistance from the appropriate building trades' supervisor and together clear the discrepancies. 2. Compare the location and depth of underground utility lines found using Locator with the location and depth shown on prints/maps. 3. Clear up all discrepancies between Locator findings and locations shown on prints/maps. 4. Mark the center line of buried utilities above ground using Uniform Color Code and marking standard consistent with California Government Code, 4216. Extend marks beyond area to be excavated so they will be visible throughout work. 5. Clearly indicate utility lines and shut-off valves on prints/maps. 6. All electrical wiring is to be considered energized until de-energized and Locked

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		out/Tagged out by a qualified electrical worker. 7. Mark area defined by work requested on surface to indicate extent of excavation. 8. Review any unexpected problems with PM/Superintendent/Requestor.
6	Utilities Coordinator	**STEP 6: PERMIT PREPARATION** Utilities Coordinator completes the permit, including: 1. Fill out the Penetration Permit. 2. Prepare notification list of persons/agencies to be notified before digging begins (if necessary). 3. Review available utility maps. 4. Locate utilities in the field. 5. Mark area defined by permit on maps to be included with permit. 6. Define requirements during initial survey of specific area with details for concrete excavation and any other special conditions to be met on the Penetration Permit. 7. Review any unexpected problems with PM/Representative/Requestor. 8. Complete the Permit Checklist. 9. Notify PM/Representative/Requestor that Permit is ready. 10. Give Penetration Permit, marked-up copy of prints/maps, and, if necessary, special conditions sheet and notification list to PM/Superintendent/Requester.
7	PM/Superintendent/Requestor Utilities Coordinator PM, Utilities Coordinator PM, Subcontractor	**STEP 7: SITE MEETING W/SIGNATURES** 1. Read and become familiar with this procedure. 2. Read and thoroughly understand Penetration Permit, marked-up copy of prints/maps, JSA Checklist, hold points and, if included, special conditions sheet, and notification list from Facilities Utilities Coordinator. Read and thoroughly understand all documents. 3. Discuss job with Facilities Utilities Coordinator, and clarify all uncertainties. 4. The PM/Requestor sets up a Pre-Dig Job Site Meeting at surface penetration site to issue the permit. The Pre-Dig Job Site Meeting shall include the Utilities Coordinator, PM/Requestor, excavation Subcontractor (person responsible for work); the General Contractor's Superintendent, LBNL Construction Safety Engineer and Inspector for the project. 5. The Utilities Coordinator reviews the permit, discussing details and answering any questions. All verbal directions issued during the site meeting, other than those in the permit, must be recorded in the permit. 6. The Utilities Coordinator and PM/Requestor sign the permit, completing LBNL approval. 7. The PM issues the permit to the Subcontractors, and obtains the Subcontractor's and sub-Subcontractor's signature accepting the terms of the permit.
8	Utilities Coordinator	**STEP 8: POSTING OF PERMIT** 1. The Utilities Coordinator notifies the PM/Requestor of the date that the permit will be posted; typically the same as the Job Site Meeting or job start date. 2. The Utilities Coordinator copies the permit, retaining the original in the Utilities Coordination Office, and provides a copy of the approved and official permit to the PM/Requestor and Inspection Section of the Design & Construction Department. 3. The Utilities Coordinator posts or arranges for posting the permit at the job site prior to the start of excavation.
9	Inspector, PM/	**STEP 9: PM/SUPERINTENDENT/INSPECTOR/REQUESTOR COMPLIANCE** 1. Read and thoroughly understand Penetration Permit, marked-up copy of

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
	Superintendent	prints/maps, JSA Checklist, hold points and, if included, special conditions sheet, notification list from Facilities O&M Utilities Coordinator. Read and thoroughly understand all documents. 2. The LBNL Inspector and LBNL PM/Superintendent/Requestor shall confirm permit compliance with signatures, dates, and times. The LBNL Inspector and PM/Superintendent/Requestor will verify that the approved Penetration Permit is posted conspicuously at the excavation site, readily available to the person doing the digging, and will inspect the excavation site as necessary to verify Permit conditions are met and safe practices are followed, stopping work and resolving problems as necessary with Utilities Coordinator, and Subcontractor.
10	**Utilities Coordinator, Inspectors, PM/Superintendent/Requestor** **Subcontractor or In-house Craft Shops**	**STEP 10: HOLD POINT ADMINISTRATION** 1. Hold points identified on the permit will typically be administered as follows, although the LBNL representative who initiates the hold may specify release as appropriate to the circumstances: a. Utilities Lockout/Tagout, authorization to proceed: Utilities Coordinator or M&O Maintenance or LBNL leased building manager/project superintendent. b. Exposed utilities inspected, authorization to proceed: Utilities Coordinator or LBNL leased building manager/project superintendent. c. Inspection of excavation prior to backfill, utility's three-dimension coordinates recorded by LBNL Subcontracted Surveyor, authorization to proceed: Inspector. For LBNL leased building, Inspector shall confirm as-built conditions are marked on the Subcontractor's set of as-built drawings. d. Resolution of unusual conditions encountered, authorization to proceed: PM or as designated by PM. Resolution will be coordinated by the Utilities Coordinator, or PM/Superintendent/ Requestor, Inspectors or LBNL leased building manager/project superintendent. M&O craft supervisors (e.g. electricians or plumbers) and/or D&C Department A&E Chief Engineers (Mechanical, Electrical or Civil/Structural) will be contacted as appropriate. e. Resolution of encountered artifacts is with the LBNL archeologist as necessary. Authorization to proceed: PM. PM shall contact Facilities Planning: Environmental Regulations Specialist to contact LBNL Archeologist. 2. **IF** utility line(s) are found and identified, notify Facilities O&M Utilities Coordinator immediately. Place **HOLD** on job until LBNL Surveyor determines and records the actual alignment and depth of the located utility line(s). For LBNL leased buildings, the LBNL leased building manager/project superintendent shall confirm that the information is recorded on the Subcontractor's set as-built drawings. 3. PM/Superintendent/Requester shall contact LBNL subcontracted Surveyor to record the actual alignment and depth of the located utilities. Not required for LBNL leased buildings. Authorization to release: PM or Inspector. 4. At completion of work, place **HOLD** on job until LBNL subcontracted Surveyor determines and records the actual alignment and depth of the utility line(s). HOLD will be released after the requirements are met. Not required for LBNL leased buildings. Authorization to release: PM or Inspector. The PM or Inspector may release the HOLD if the following alternative work is performed by the Subcontractor. Alternatively, Subcontractor shall install reference points consisting of nail and hub/flagging at all changes in grade or alignment of the new pipeline and for all other utilities exposed by the excavation. The Subcontractor shall keep a separate written record referenced to each point with the following information:

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		(1) Offset and depth to top and centerline of utility, accurate to 0.1 feet (2) Type of utility (i.e. gas, water, etc.) (3) Size of utility (i.e. 2", 4", 16" wide duct, etc.) (4) Type of material of utility (i.e. cast iron, PVC, etc.).
11	**Subcontractor or In-house Labor Shop**	**STEP 11: PENETRATION WORK BEGINS** **HAND DIG ONLY:** 1. Depth of utility is known: Excavation within 30 inches radius of the marked utility must be excavated by hand using flat tipped shovel, vacuum, or excavated with appropriate safe technology, such as an air knife until the utility is located or the excavation has reached the required depth. Picks should be used with caution under these circumstances. High pressure water excavator is specifically prohibited due to the possibility of water leaking into high voltage underground power lines. 2. Depth of utility is unknown: If the depth of the utility is unknown at both ends of the job area which has been defined by the Requestor or Subcontractor, potholing must be performed using non-destructive vacuum, or excavation must be done with appropriate safe technology, such as an air knife, hand digging (flat tipped shovel), or compressed air tool such as bushing hammer with a spade bit (high pressure water excavator shall not be used) until excavation is exposed at the two ends of the utility and at every change of direction of the utility. When depth is verified, the PM may authorize destructive means to within a 30 inch radius around the utility. When 30 inch radius has been reached, non-destructive means must be used to expose the utility. **NOTE**: Where possible, shut-off and / or secure located utilities by Lockout/Tagout (LOTO) procedures before the excavation by destructive process is to start (per the Health & Safety Manual, Pub-3000, Chapter 18). All LOTO procedures shall be performed by LBNL Plant Maintenance Technicians (PMT)/Electrical Shop Electricians and coordinated by the Utilities Coordinator. For LBNL leased buildings, LOTO shall be performed by the LBNL leased building manager/project superintendent. 3. If it is necessary to hand dig 5 feet or deeper, follow the procedures outlined under OSHA and LBNL PUB-3000 Chapter 4, Section 10. 4. Watch for utility lines and indication of utility lines (sand backfill and warning identification tape) while carefully digging.
12	**Subcontractor, PM, Utilities Coordinator** **PM, Utilities Coordinator, Utilities Coordinator Shop Supervisor**	**STEP 12: PERMIT/PROGRESS VALIDATION** 1. All verbal conversations that allow modifications to the Penetration Permit shall be written on the permit. The specific details of the task and area shall then be authorized by signature (with date and time) of responsible parties involved. ANY and all change requests to a Penetration Permit, or extension of an existing permit, to be documented on the Penetration Permit, must receive the same level of review as in the original Penetration Permit process. 2. The Inspector evaluates whether the conditions of the Penetration Permit have changed such that continued work cannot be performed according to the original permit, and requires that a new permit to be issued. A new permit will require a total review of utilities drawings and locator survey if excavation area exceeds the original area approved and as indicated on the original Penetration Permit. The Utilities Coordinator issues a new permit if one is required by the Inspector. Otherwise, the Utilities Coordinator adds the extension dates on the permit original, and obtains the signatures required for the permit extension approval. Only a one-time consecutive 7 day extension is allowed. The Utilities Coordinator updates the permit and posts it at the job site.

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		3. The Subcontractor is responsible to ensure that a valid permit is obtained for the work being performed.
13	**Subcontractor** **Inspector, PM/ Superintendent**	**STEP 13: SUB-SURFACE WORK COMPLETE** 1. Pothole: **HOLD per Step 10.** HOLD shall be for a minimum of two hours. After two hours, the PM or Inspector may release the HOLD if the PM or Inspector verified that it is in compliance with Step 10. After each pothole, backfill with sand and mark results on the ground surface near the pothole with spray paint. Backfill immediately to prevent tripping or falling into hole. 2. Subsurface excavation: Three days before backfilling, the Project Manager shall be notified so that the LBNL subcontracted Surveyor can obtain the three-dimensional coordinates of all buried utilities. Buried utilities including the pipeline and any other utilities exposed during construction shall not be covered with backfill without the prior approval of the LBNL Inspectors. Coordination of this survey requirement is the responsibility of the Subcontractor. LBNL subcontracted Surveyor will be provided by the University when scheduled. The cost for delay or dig-up related to the Subcontractor's failure to schedule the utility survey shall be paid by the Subcontractor. At completion of all subsurface excavation / penetration work, place **HOLD** on job until LBNL subcontracted Surveyor determines and records the three-dimensional coordinates of the utility line(s) per Step 10. Survey is not required for LBNL leased buildings. 3. Inspector will notify PM/Superintendent to contact LBNL subcontracted Surveyor for the utility survey. Not required for LBNL leased buildings.
14	**LBNL subcontracted Surveyor** **PM/ Superintendent**	**STEP 14: RECORD(S) UPDATED W/AS-BUILTS** **HOLD per Step 10.** 1. LBNL subcontracted Surveyor determines and records the three-dimensional coordinates of the utility line(s). Not required for LBNL leased buildings. The LBNL leased building manager/project superintendent shall ensure that the Subcontractor's set of as-builds are updated to include the utility routing. Not required for LBNL leased buildings. 2. PM/Superintendent shall notify the LBNL subcontracted Surveyor to forward the recorded field information in AutoCAD format to the Utilities Engineer for the as-built of the Area Utilities Drawings (U-Sheets). Not required for LBNL leased buildings.
15	**Subcontractor or In-house Craft Shops**	**STEP 15: SUB-SURFACE UTILITY MARKING INSTALLED** **HOLD per Step 10.** Before backfilling for buried utilities over identification tape, the Inspector will verify that identification tape and tracer wire have been installed. Buried non-metallic utilities (electrical, mechanical, and civil) shall receive a tracer wire. 1. The tracer wire shall be installed on top of the buried utility crown. 2. The tracer wire shall be positively attached to the non-metallic buried utilities by plastic wire ties of similar type of attachment every 6 feet for straight run of utility and at all changes of direction. Tape shall be Polyken "930-35," Protecto-Wrap "310", or equal. 3. The ends of the tracer wire shall be exposed above the finished grade. 4. Install pre-cast concrete boxes at all locations where the ends of the tracer wire are exposed above the finished grade. The pre-cast concrete boxes shall not be more than 200 feet apart and shall contain a 24" coil of wire from each end of the tracer wire.

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		5. Tracer wire shall be continuous between boxes and shall be tested for continuity in the presence of Berkeley Lab's inspector. 6. Tracer wire shall be No. 10 AWG, copper wire with TW insulation. 7. Tracer wire shall be exposed above finished grade in the pre-cast concrete boxes at the transition where the non-metallic buried utility connects to the existing metallic utility. 8. Extend wire into valve boxes and terminate with a wire connector. Terminate wire from lines extending from mains to fire risers or building services 12" (300mm) above grade and cap with a wire connector. 9. Identification tape shall be installed 12" above the buried utility crown. The identification tape shall be continuous for the entire length of utility.
16	**Inspector**	**STEP 16: INSPECTION COMPLETE** At completion of work, HOLD will be released after inspection is completed, and the following determination made: 1. No defects found. 2. Minor repair required. 3. Major repair required. 4. Replacement required.
17	**Subcontractor or In-house Labor Shop**	**STEP 17: SUB-SURFACE WORK BURIED** All LBNL subsurface excavation backfill shall be per Contract Documents or LBNL standard drawing # 4BSTP039 for In-house work.
18	**Inspector** **Utilities Coordinator**	**STEP 18: PERMIT REMOVED AND CLOSED** 1. The Inspector will confirm with the Subcontractor that excavation is complete, including backfill, and remove the permit. 2. The Utilities Coordinator will set the electronic permit version to inactive (not current).
19	**Mechanical and Electrical Section Designer and Mechanical Section Chiefs**	**STEP 19: U-SHEETS UPDATE NOTIFICATION** The Mechanical and Electrical Section Designer will incorporate the as-build conditions to the U-sheets with the survey information from the LBNL subcontracted Surveyor. The Mechanical Section Chief will notify the Utility Coordinator Shop Supervisor that the U-sheets had been updated electronically and is ready for use. Not required for LBNL leased buildings.

3.0 PERMIT CHECKLIST:

Items	Checklists	Yes	No	Comment
1.	Has a Job Safety Analysis (JSA) Reference Checklist been completed?			
2.	Is Archaeologists Report (where necessary) required?			
3.	Is Wildlife Biologists Report (where necessary) required?			
4.	Is a Soil Engineering Excavation Evaluation (SEEE) (where applicable) required?			
5.	Have utility location maps, sketches, photos, etc included?			
6.	Has a soil penetration field survey been performed with applicable electronic locator?			
7.	Have As-Built building drawings or Area Utility Sheets (U-sheets) been reviewed?			
8.	Have historical construction project drawings and documents been reviewed?			
9.	Has information from knowledgeable employees based on personal recollection of construction in a particular area been collected?			
10.	Has a site map with enlarged project section showing the extent of the excavation been included?			
11.	Pre-start and Completed Project Notification List (Contact Names & Tel. #s).			
12.	Has a Hazard Assessment been completed?			
13.	Has LBNL Inspection Section of the Facilities Design & Construction Department been notified of permit issuance?			
14.	Has a copy of the approval permit been transmitted to the LBNL Inspection Section of the Facilities Design & Construction Department?			
15.	Utility Outages (where required) for: a. Voltage (High and/or Low) b. Compressed Air c. Water (Domestic, Industrial, Low Conductivity, and Treated) d. Natural Gas (High and/or Low pressure) e. Etc.			
16.	Has the Permit to Penetrate Ground or Existing Surfaces of LBNL Property been approved?			
17.	Has the PM notified the Building Manager, or Building Manager(s) closest to where there will be construction activities?			

4.0 GROUND OR EXISTING SURFACES PENETRATION JOB SAFETY ANALYSIS (JSA) CHECKLIST

This checklist is a reference only. Any additional requirements that the PM or Requestor deems necessary to assure safe-working conditions must take place. Federal OSHA requires that a qualified person perform a safety review of work and that a competent person supervise the work.

Prepared By: _____ **Date Prepared:** _____ **Permit #:** **WO:** _____

Signature: _____

		YES	NO	COMMENTS
1.	Have employees been trained in safe work practices and hazard recognition associated with working in and around excavation?			
2.	Have employees been familiarized with the appropriate excavation emergency procedures?			
3.	Does your excavator/laborer know about and is he/she following the 30″ buffer rule?			
4.	Is an observer present at all times during excavation?			

SURFACE ENCUMBRANCES (TREES, BOULDERS, HEAVY EQUIPMENT)

5.	Have all surface encumbrances, which may potentially pose a threat to employees working in or around the excavation, been removed or supported?			

UNDERGROUND INSTALLATION (SEWER, TELEPHONE, FUEL, ELECTRIC, WATER LINES, ETC.)

6.	Were the estimated location(s) of underground utility installations denoted prior to the opening of the excavation?			
7.	If on program facility, were program representatives contacted to assist in the location of any underground utilities prior to the opening of the excavations?			
8.	Have exposed underground utilities been adequately guarded or supported to protect employees?			
9.	Has an Outage request been submitted?			
10.	If an outage has not been requested, why?			
11.	If work will impact the Drainage Retention Basin or the berm around the Basin, contact PM.			

ACCESS AND EGRESS

12.	At a minimum, are all trench excavations of 4 feet deep or greater equipped with a stairway, ladder, or ramp every 25 feet of lateral travel?			
13.	Has a competent person designed all ramps/runways utilized for access and or egress for both personnel and equipment?			
14.	Have all steep-walled holes or trenches greater than 2 feet in depth been covered for the night or been provided with a ramp for sensitive species egress.			
15.	Have all ramps and/or runways constructed of two or more structural members been joined to prevent displacement?			
16.	Are all structural members utilized in construction of ramps and runways of uniform thickness?			

		YES	NO	COMMENTS
17.	Are all cleats and or other appropriate devices serving to connect runway structural members attached to the bottom of the runway to prevent trips or falls?			
18.	Are all structural ramps and runways constructed in a slip-resistant manner?			

EXPOSURE TO VEHICULAR TRAFFIC

19.	Are all employees associated with excavation activities and who may be exposed to vehicular traffic wearing appropriate high-visibility clothing?			
20.	Vehicle traffic (e.g., buses, trucks, autos) may also cause vibrations and trench/excavation wall loading: are safeguards in place, was traffic re-routed?			
21.	Is LBNL vehicle traffic warned of potential hazard with: road barriers, steel plates and operational flashing warning light?			

EXPOSURE TO FALLING LOADS

22.	Are employees working a safe distance from suspended loads handled by lifting and/or digging equipment?			
23.	Are employees maintaining a safe distance from vehicles, which are loading and unloading?			
24.	If occupied during loading and unloading, are haulage truck cabs equipped with a cap shield or canopy adequate to protect the operator from falling materials?			

WARNING SYSTEM FOR MOBILE EQUIPMENT

25.	Does the mobile equipment operator have a clear view of the edge of the excavation?			
26.	If not, are adequate hand signals, mechanical signals, and/or barricades in place?			

HAZARDOUS ATMOSPHERES, TESTING & CONTROLS

27.	Have all excavations in which potentially oxygen deficient, toxic or explosive atmospheres may exist, had adequate air monitoring performed?			
28.	Have adequate precautions been taken to prevent potential employee exposure to oxygen deficient, toxic or explosive atmospheres (i.e., ventilation/PPE)? Please, describe.			
29.	Is air monitoring conducted with sufficient frequency to ensure that work atmospheres remain safe? Please, describe.			

EMERGENCY RESCUE EQUIPMENT

30.	In excavation where hazardous atmospheres may exist or develop, is emergency rescue equipment including, but not limited to SCBAs, safety harness, and lifeline or basket stretcher available?			
31.	Are employees working in bell-bottom pier holes or similar deep and confined footing excavations wearing a safety harness and lifeline with a dedicated spotter in attendance?			

		YES	NO	COMMENTS
PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION				
32.	Are personnel prohibited from working in excavations where standing water is present?			
33.	Have adequate precautionary measure been implemented in excavations where standing water is present and in which personnel are required to work (e.g., trench, excavation shields, pumps, and/or safety harnesses and lifelines)? Please circle those that apply.			
34.	If water removal equipment is utilized to control the standing water in a trench excavation, does a competent person monitor this equipment to ensure correct operation?			
35.	If an excavation disturbs natural surface drainage, have ditches, dikes and/or sandbags been utilized to divert this drainage from entering the excavation?			
36.	Are excavations which have been subject to runoff from heavy rains or freeze thaw conditions been re-inspected by a competent person?			
STABILITY OF ADJACENT STRUCTURES				
37.	Are excavations which may undermine sidewalks or pavements prohibited?			
38.	Are excavation adequately protected via the installation of shoring or bracing where the stability of adjacent structures is endangered? Engineering Survey is required.			
39.	Are all excavations below the level of foundations or retaining walls prohibited?			
40.	If excavations are dug below the level of foundations or retaining walls, do they meet the following criteria? a. Is the excavation adequately supported (i.e., underpinning)? b. Is the excavation in stable rock? c. Has a registered professional engineer determined that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity. d. Has a registered professional engineer determined that the excavation poses no hazard to employees?			
PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL				
41.	Are all loose material, soil and equipment prevented from falling or rolling into the excavation by removing this material to a minimum of 2 feet from the edge of the excavation?			
INSPECTIONS				
42.	Are pre-work daily inspections of the excavation(s) performed and documented by the subcontractor superintendent and/or LBNL Construction Safety Engineer?			
43.	Are inspections of each excavation performed and documented on as-needed basis to check for evidence of the failure of protective systems, or the accumulation of hazardous atmosphere and other hazardous conditions?			

GROUND OR EXISTING SURFACES PENETRATION JOB SAFETY ANALYSIS CHECKLIST *Continued*

		YES	NO	COMMENTS
44.	Are inspections of each excavation performed and documented after every rainstorm or other occurrence, which may increase hazards?			
45.	Have adequate precautionary measures been implemented to protect workers where there is evidence of a potential hazard posed to employees working in and around an excavation.			

FALL PROTECTION

46.	Are the walkways or bridges equipped with standard guardrails where employees or equipment are required or permitted to cross over excavation?			
47.	Are remotely located excavations adequately barricaded or covered?			

EXISTING CONTAMINATION EVALUATION

48.	Has an EH&S evaluated the project site for possible contamination?			

PERSONAL PROTECTIVE EQUIPMENT

49.	Are the gloves and boots insulated and rated a minimum of Class 2 17kV with moisture absorbing liners and protective leather outers?			
CONCRETE PENETRATION				
50.	Have employees been trained in safe work practices and hazard recognition associated with concrete penetrations?			
51.	Have employees been familiarized with the appropriate emergency procedures?			
52.	Has proper coordination with Facilities personnel and other trades been met?			
53.	Has the location of embedded utilities been found? If yes, have LOTO procedures been followed for de-energization?			
54.	Are personnel performing penetration using proper personal protective equipment? The right safety gloves, safety shoes, safety glasses, ground fault interruption, & respirators?			
55.	Have all other methods the PM or requestor deems necessary to assure safe working conditions been met?			
56.	Has the nearest first aid kit, eyewash and telephone been located?			
57.	Does the working area require barricades? If yes, are they in place?			
58.	Have all special requirements for water dust control been met?			
59.	Is there adequate ventilation in the work area?			
60.	Is there adequate lighting in the work area?			

FACILITIES DIVISION

APPLICATION FOR PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY

THIS IS NOT A PERMIT ***DATE:*** _____

This is an ***application*** for a permit. After the proposed scope of work and the site have been reviewed, and the proposal found acceptable by the Facilities Division, Utility Coordinator, a permit ***may*** be issued.

Instructions

1. This application must be completed by the LBNL Project Manager (PM), LBNL Superintendent, or LBNL Requester.
2. Fax or email to Work Request Center, wrc@lbl.gov.
3. The WRC will send confirmation and job number. You will be contacted by the Utility Coordinator Shop Supervisor within 24 hours.

LBNL contact responsible for job/project: _____ (NAME) _____ (PHONE)

Title: _____ Cell Phone No: _____ Mail Stop: _____

Work to be performed by:

_____ (GROUP OR CONTRACTING AGENCY) _____ (RESPONSIBLE PERSON/CONTACT) _____ (PHONE)

Project Number _____ Account Number _____

Anticipated Start Date: _____ Anticipated Completion Date: _____

Description of Scope of Work: **Closest Building** _____

Penetration or excavation work is to be performed only inside the permit area as marked and defined below by building numbers, room numbers, and attached maps as necessary.

_____

_____

_____

Road/Deck/Surface Work: Type of Surface (Check all that apply)

Asphalt_____ Concrete_____ Landscape Surface_____

Total Length_____ Total Width_____ Depth (Max)_____

Structural Work: (Check all that apply)

Wall_____ Floor_____ Deck_____ Walkway_____

Core Drilling/Saw Cutting:

Area Size: W_____ L_____ Depth:_____ Diameter:_____

Anchoring:

Diameter:_____ Length:_____ Amount/Total number holes:_____

BERKELEY LAB	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	EMERGENCY NUMBERS LBNL On-Site Fire & Medical 7-911 LBNL Off-Site Fire & Medical 9-911 Campus Fire & Medical 9-911 LBNL Security 486-5472 Facilities Utilities 24-hr 486-5481

Instructions

This permit must be completed by the LBNL Utilities Coordinator, approval signatures obtained, and the permit posted at the job site before work is started that will require penetration or excavation of any ground surface, concrete wall, column or slab depth greater than 1-1/2 in. at LBNL, including the use of stakes or poles.

Work

LBNL contact responsible for job/project: _____ _____
NAME PHONE

Work to be performed by:

_____ _____ _____
GROUP OR CONTRACTING AGENCY RESPONSIBLE PERSON/CONTACT PHONE

Project Number _____ Account: _____ Permit: _____

Description of work approved by this permit:
_____
_____

Area Description

Closest Building _____

Penetration or excavation work is to be performed only inside the permit area as marked and defined below by building numbers, room numbers, and attached maps as necessary.
_____
_____
_____

Utilities

The following utilities are mapped as located in the permit area:

Utilities with valves to secure
- ☐ City water
- ☐ Treated water
- ☐ Low conductivity water (LCW)
- ☐ Natural gas
- ☐ Compressed air

Utilities with no valves to secure
- ☐ Sanitary sewers
- ☐ Storm drains
- ☐ Other _____

Utilities with disconnects, switches or breaker to secure
- ☐ Electrical conduits/ductbanks
- ☐ Telephone conduits/ductbanks
- ☐ Fiber Optic conduits
- ☐ Other _____

Prints/maps are attached, indicating approximate location of utility lines and shutoff valves. Valves are to be operated by LBNL personnel only.
CAUTION: Location of existing utility lines shown on maps may not be accurate. Drawings are to be used for reference only. Prior to digging all utility lines shall be located by the LBNL Utilities Coordinator to the best of LBNL's ability, and confirmed in the field by hand digging of test holes by the group or contracting agency prior to start of work (see Cautions and Special Conditions section, Hold Points).
Specifications for the utilities checked above:
_____
_____

BERKELEY LAB	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	_____ - _____ PERMIT NUMBER

Cautions and Special Conditions

HAND DIG ONLY:

1. Depth of utility is known:
   Surface excavation or drilling within 30 inches radius of the marked utility must be excavated by hand using flat tipped shovel, vacuum, or excavated with appropriate safe technology, such as an air knife, or high pressure water excavator until the utility is located or the excavation has reached the required depth. Picks should be used with caution under these circumstances.
2. Depth of utility is unknown:
   If the depth of the utility is unknown at both ends of the job area which has been defined by the Requestor or Subcontractor, pothole must be performed using non-destructive vacuum, or excavated with appropriate safe technology, such as an air knife, hand digging (flat tipped shovel), or high pressure water excavator means of excavation to exposed the two ends of the utility and at every change of directions to ascertain the location and depth of the utility. When depth is verified, the PM may authorize destructive means of soil removal to within a 30 inch radius around the utility. When 30 inch radius has been reached, non-destructive means of soil removal must be used to expose the utility.
   NOTE: Where possible, shut-off and / or secure located utilities by applying Lockout/Tagout (LOTO) procedures before the excavation by destructive means of soil removal. All LOTO procedures shall be performed by LBNL Plant Maintenance Technicians (PMT) and coordinated by the Utilities Coordinator.
3. If it is necessary to hand dig 5 feet or deeper, follow the procedures outlined under OSHA and LBNL PUB-3000 Chapter 4, Section 10.
4. Watch for utility lines and indication of utility lines (sand backfill and tape) while carefully digging.

Special conditions

In addition, the following special conditions must be observed, including environmental and safety concerns.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Hold Points

No work is to proceed from one hold point to the next without authorization from the LBNL representative below.

☐ **Utilities secured as required above in Cautions and Special Conditions**.

LBNL REPRESENTATIVE

☐ **Utilities exposed by hand digging**.

LBNL REPRESENTATIVE

☒ **Prior to backfill**. Hold for inspection and recording of utility coordinates by LBNL subcontracted Surveyor:

LBNL REPRESENTATIVE

☐ **Unusual conditions encountered**. Hold for resolution and authorization to proceed:

LBNL REPRESENTATIVE

☐ **Bones or artifacts encountered**. Hold for PM's authorization to proceed:

LBNL REPRESENTATIVE

PERMIT *Continued*

BERKELEY LAB	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	_____ - _____ PERMIT NUMBER

Permit Approval and Duration

Subject to the above specified conditions, approval is granted for penetration/excavation of the area described above.

Permit is valid from: _____ to: _____

LBNL Facilities/Utilities Coordinator: _____ _____
SIGNATURE DATE

LBNL Facilities/Utilities Coordinator Shop Supervisor: _____ _____
SIGNATURE DATE

Acceptance of Terms of Permit:

I have read and understood the conditions of this Permit to Penetrate or Excavate Surface of LBNL Property per ADMN-053.

LBNL Project Manager/Superintendent/Requestor: _____ _____
SIGNATURE DATE

Subcontractor representative: _____ _____
SIGNATURE DATE

Permit Extension:

At expiration date a one-time consecutive seven day permit extension may be granted by the Utilities Coordinator. Beyond that, a new permit must be processed again.

7 day Extension:	**Signature**	**Date**
Subcontractor Representative:		
Utilities Coordinator:		
PM/Superintendent/Requestor:		
Utilities Coordinator Shop Supervisor:		

Permit Extension is valid from: _____ to: _____

	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	_____ - _____ PERMIT NUMBER

Compliance observation sign-off when site is visited by LBNL personnel

LBNL PM/Superintendent/ Requestor/Supervisor	TIME & DATE OF VISIT	COMPLIANCE YES OR NO	LBNL Inspector	TIME & DATE OF VISIT	COMPLIANCE YES OR NO

Off-shift or night-time phone numbers are 510/486-7941 and 510/486-5481.