FIRST FIVE-YEAR REVIEW REPORT
SAVAGE MUNICIPAL WATER SUPPLY
SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

Prepared by:

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September 2011

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Date: 9/29/11

SDMS DocID 493790

TABLE OF CONTENTS

Title **Page**

EXECUTIVE SUMMARY ES-1

1. INTRODUCTION 1-1

2. SITE CHRONOLOGY 2-1

3. BACKGROUND 3-1

3.1 PHYSICAL CHARACTERISTICS 3-1
3.2 LAND AND RESOURCE USE 3-3
3.2.1 OU1 3-3
3.2.2 OU2 3-3
3.2.3 Surrounding Area 3-3
3.3 HISTORY OF CONTAMINATION 3-4
3.4 INITIAL RESPONSE 3-4
3.5 BASIS FOR TAKING ACTION 3-5

4. REMEDIAL ACTIONS 4-1

4.1 REMEDY SELECTION 4-1
4.2 REMEDY IMPLEMENTATION 4-2
4.2.1 OU1 4-3
4.2.2 OU2 4-9
4.3 SYSTEM OPERATIONS/OPERATIONS AND MAINTENANCE (O&M) 4-15
4.3.1 OU1 4-15
4.3.2 OU2 4-29
4.4 REMEDY PERFORMANCE MONITORING 4-31
4.4.1 Performance Standards 4-31
4.4.2 OU1 4-31
4.4.3 OU2 4-32
4.5 OPERATION AND MAINTENANCE COSTS 4-33
4.5.1 OU1 4-34
4.5.2 OU2 4-35

5. PROGRESS SINCE THE LAST REVIEW 5-1

6. FIVE-YEAR REVIEW PROCESS 6-1

6.1 NOTIFICATION OF POTENTIALLY-INTERESTED PARTIES OF THE START OF THE REVIEW 6-1

6.2 IDENTIFICATION OF THE FIVE-YEAR REVIEW TEAM MEMBERS 6-1
6.3 DOCUMENT REVIEW 6-1
6.3.1 Source of RAOs, ARARs and Cleanup Levels 6-1
6.4 DATA REVIEW AND EVALUATION 6-5
6.4.1 Groundwater Elevations and Capture Zone 6-5
6.4.2 Hydrogeologic Setting 6-7
6.4.3 Response of Aquifer to System Changes (OU1) 6-9
6.4.4 Groundwater Monitoring 6-10
6.4.5 Metals Sampling 6-22
6.4.6 Vertical Profiling at OU1 6-23
6.5 RISK EVALUATION 6-25
6.5.1 Summary of the Ecological Risk Evaluation 6-25
6.5.2 Summary of Baseline Human Health Risk Assessment 6-27
6.5.3 Changes in Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBCs) 6-28
6.5.4 Changes in Exposure Pathways 6-31
6.5.5 Changes in Toxicity Values 6-34
6.5.6 Conclusions and Recommendations 6-35
6.6 ADDITIONAL REMEDY PERFORMANCE TO DATE 6-37
6.6.1 OU1 6-37
6.6.2 OU2 6-39
6.7 COMMUNITY NOTIFICATION 6-40
6.8 SITE INSPECTION 6-40
6.8.1 OU1 Inspection 6-40
6.8.2 OU2 Inspection 6-42
6.9 INTERVIEWS 6-43
7. TECHNICAL ASSESSMENT 7-1
7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS? 7-1
7.1.1 OU1 - Yes 7-1
7.1.2 OU2 - Yes 7-7
7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOS) USED AT THE TIME OF REMEDY SELECTION STILL VALID? - YES 7-10
7.2.1 Changes in Exposure Pathways 7-10
7.2.2 Changes in Land Use 7-13
7.2.3 New Contaminants and/or Contaminant Sources 7-13
7.2.4 Changes in ARARs and TBCs 7-13
7.2.5 Changes in Toxicity and Other Contaminant Characteristics 7-15
7.2.6 Expected Progress toward Meeting RAOs 7-15
7.2.7 Risk Recalculation/Assessment 7-15

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY? - YES 7-16
7.3.1 Potential Vapor Intrusion 7-16
7.3.2 Ecological Risks 7-16
7.3.3 Natural Disaster Impacts 7-16
7.3.4 Other Information 7-16
7.4 TECHNICAL ASSESSMENT SUMMARY 7-16
8. ISSUES 8-1
9. RECOMMENDATIONS AND FOLLOW-UP ACTIONS 9-1
10. PROTECTIVENESS STATEMENT(S) 10-1
11. NEXT REVIEW 11-1
12. REFERENCES 12-1

LIST OF FIGURES

Title

Figure 1 Area Plan

Figure 2 Site Plan (Northwest Tile)

Figure 3 Site Plan (Northeast Tile)

Figure 4 Site Plan (Southwest Tile)

Figure 5 Site Plan (Southeast Tile)

Figure 6 Site Plan (Slurry Wall Tile)

LIST OF TABLES

Title

Table 1 Chronology of Events

Table 2 Baseline Risk Assessment Contaminants of Concern

Table 3 Summary of PCE Concentrations PW-12, PW-13, and PW-14 Well Clusters (OU1)

Table 4 Remedy Performance Standards

Table 5 Maximum Volatile Organic Compound Detections in 2010

Table 6 Operable Unit 2 Groundwater Quality Monitoring Summary

Table 7 Operable Unit 2 PCE Mass Reduction Summary

Table 8 Annual System Operations/Operation and Maintenance Costs for OU1

Table 9 Summary of Interim Groundwater Cleanup Levels

Table 10 Tetrachloroethylene Summary for OU1

Table 11 Pre and Post In situ Chemical Oxidation Groundwater Analytical Results for Site Contaminants of Concern

LIST OF TABLES
(Concluded)

Title

Table 12 Comparison of Maximum Soil Concentrations with NHDES Soil Standards

Table 13a Recalculation of Risks Associated with Exposure to Soil - Young Child Trespasser

Table 13b Recalculation of Risks Associated with Exposure to Soil - Older Child Trespasser

Table 13c Recalculation of Risks Associated with Exposure to Soil - Treatment Plant Worker

Table 14 Comparison of Current and Previous Toxicity Values for Constituents of Concern

Table 15 Summary of OU-1 Groundwater Treatment Plant Volatile Organic Compound Mass Removal

LIST OF ATTACHMENTS

ATTACHMENT 1	2010 ANNUAL REPORT OU1
ATTACHMENT 2	DRAFT ANNUAL GROUNDWATER MONITORING REPORT – 2010
ATTACHMENT 3	OU1 PHOTOS
ATTACHMENT 4	OU2 PHOTOS
ATTACHMENT 5	FIGURES FROM RI REPORT
ATTACHMENT 6	MILFORD TAX MAPS
ATTACHMENT 7	PRESS RELEASE
ATTACHMENT 8	GROUNDWATER CONTOUR MAPS
ATTACHMENT 9	USGS MODEL EVALUATION
ATTACHMENT 10	INTERVIEW RECORD FORMS AND OU2 INSPECTION CHECKLIST
ATTACHMENT 11	RISK EVALUATION TABLES

LIST OF ACRONYMS

amsl	above mean sea level
AGQS	Ambient Groundwater Quality Standard
ARAR	Applicable or Relevant and Appropriate Requirement
ARD	Air Resources Division
AS	air sparging
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
BHRA	Baseline Health Risk Assessment
BHWM	NHDES, Bureau of Hazardous Waste Management
CD	Consent Decree
CDI	Chronic Daily Intake
CDM	Camp Dresser & McKee, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
cm^2	cubic centimeters
COC	contaminants of concern
cy	cubic yards
DCA	1,1-dichloroethane
DNAPL	dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
ESE	Environmental Science & Engineering
FS	Feasibility Study
ft	feet/foot
GMZ	Groundwater Management Zone
gpm	gallons per minute
Gradient	Gradient Corporation
GWTP	groundwater treatment plant
HDPE	high-density polyethylene
Hendrix	Hendrix Wire and Cable Company, Inc.
HI	hazard index
Hitchiner	Hitchiner Manufacturing Company, Inc.
HMM	HMM Associates, Inc.
ICL	Interim Cleanup Level
IEUBK	Integrated Exposure Uptake Biokinetic

LIST OF ACRONYMS
(Continued)

INEEL	Idaho National Engineering and Environmental Laboratory
ISCO	in situ chemical oxidation
lbs	pounds
kg	kilograms
$KMnO_4$	potassium permanganate
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MEK	methyl ethyl ketone
mg/L	milligrams per Liter
MIBK	methyl isobutyl ketone
µg/L	micrograms per Liter
µg/dl	micrograms per deciliter
$NaMnO_4$	sodium permanganate
NCP	National Contingency Plan
NESF	New England Steel Fabricators, Inc.
NH	New Hampshire
NHDES	New Hampshire Department of Environmental Services
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	operation and maintenance
OU	Operable Units
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PCOR	*Preliminary Close Out Report*
%	percent
ppb	parts per billion
ppm	parts per million
PRG	preliminary remediation goals
PRP	potentially-responsible party
psi	per square inch
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RDI	*Remedial Design Investigation Report*

LIST OF ACRONYMS
(Concluded)

RFD	Reference Dose
RI	Remedial Investigation
RI Report	*Remedial Investigation Report*
ROD	Record of Decision
RSE	Remedial Systems Evaluation
RSL	regional screening levels
SARA	Superfund Amendments and Reauthorization Act
Savage Well	Savage Municipal Water Supply well
SCADA	supervisory control and data acquisition system
SDWA	Safe Drinking Water Act
SMWS Site	Savage Municipal Water Supply Superfund Site
SRS	Soil Remediation Standards
SVE	soil vapor extraction
TBC	To-Be-Considered
TCA	1,1,1-trichloroethane
TCE	trichloroethylene
trans-1,2-DCE	trans-1,2-dichloroethylene
UCL	Upper Confidence Limits
U.S.	United States
USFOS	US Filter Operating Services
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound
WESTON®	Weston Solutions, Inc.

EXECUTIVE SUMMARY

The Savage Municipal Water Supply Well Superfund Site (the "SMWS Site" or "Site") is located in the Town of Milford, New Hampshire about 2 miles west of the center of town.

The SMWS Site includes a groundwater plume that generally extends from the intersection of Route 101 and Elm Street eastward approximately 6,000 feet. It is roughly bounded on the north and east by the Souhegan River and on the south by Elm Street and Tucker Brook. The SMWS Site lies within the floodplain of the Souhegan River. The floodplain is a relatively flat land surface extending through most of the area of the Site. The Souhegan River flows from west to east for the entire length of the site area. At the eastern edge of the Site, the River takes a pronounced southward bend before resuming it's generally west to east orientation.

Residential, agricultural, heavy and light industrial, and commercial land uses are found within the Site. Residences are located along Elm Street and Old Wilton Road. A trailer park is located to the north of Elm Street. Municipal water is provided to all residential, industrial, and commercial entities along Elm Street. Agricultural uses including a cornfield and a former sod farm dominate the central and western portions of the Site between Elm Street and the Souhegan River. The heavy industrial uses are located between Elm Street and Old Wilton Road east of Route 101. Light industrial and commercial uses are generally found along Elm Street.

The land use north of the Souhegan River (extending to North River Road) is predominantly agricultural (corn and hay fields) or forested. The forested areas are within the boundary of the State's Milford Fish Hatchery. The Milford Fish Hatchery provides trout for stocking New Hampshire ponds, lakes, and rivers, and Atlantic salmon for Atlantic salmon restoration efforts. Salmon raised in Milford are transported to the coast for release. A private fish hatchery is also located at the eastern edge of the Site which primarily raises trout. Residences are scattered along North River Road and are mostly on private drinking water wells.

Four major industrial plants were situated to the west of the previously operational Savage Municipal Water Supply well: Hendrix Wire and Cable Corporation, Hitchiner Manufacturing Company, OK Tool Company, and New England Steel Fabricators, Inc. From the 1940s until the

1980s, process waters and wastes from these four industrial facilities were released untreated to the ground or to the surface waters flowing through the Site.

In February, 1983, as part of the first routine sampling of water supplies for organic compounds, the New Hampshire Water Supply and Pollution Control Commission found several volatile organic compounds (VOC) above drinking water standards in water from the Savage Municipal Water Supply well. The VOCs found were: 1,1,1 trichloroethane, trichloroethylene, trans-1,2 dichloroethylene, tetrachloroethylene, and 1,1 dichloroethane. Similar VOCs (i.e., tetrachloroethylene and trans-1,2 dichloroethylene) were also found at that time in the water drawn from the well supplying the nearby Milford Mobile Home Trailer Park. The State of New Hampshire immediately ordered the Town to cease use of the Savage Municipal Water Supply well.

In March, 1983, at the request of the State, the United States Environmental Protection Agency (EPA) conducted an emergency removal action which involved supplying bottled water to residences of the Milford Mobile Home Trailer Park. This action was completed in May, 1983, when the Trailer Park's water distribution system was connected to the existing municipal water supply system.

The Site was proposed for inclusion on the National Priorities List (NPL) on September 1, 1983, and the Site was included on the final NPL on September 1, 1984.

A Record of Decision (ROD) for the entire Site was signed on September 27, 1991. The selected remedy identified in the ROD included:

- "Installation of a groundwater extraction and treatment system at the concentrated plume area. The system will contain and remove highly contaminated groundwater for treatment using air stripping and ultraviolet oxidation.

- Installation of a groundwater and treatment system within the extended plume area. The system will remove contaminated groundwater from two locations near the middle of the plume and two locations near the end of the plume for treatment using ultraviolet oxidation.

- Reliance on natural attenuation of contaminated groundwater to lower contaminant concentrations through physical, chemical and biological processes until groundwater cleanup levels are met.

- Utilization of institutional controls to reduce the risk to public health from consumption of the groundwater. Institutional controls may include deed restrictions and zoning ordinances to restrict the use of contaminated groundwater. Institutional controls shall be imposed in the area where the risk to public health is outside EPA's acceptable risk range.

- Implementation of an environmental monitoring program initiated during remedial design and continuing for 3 years after attaining groundwater cleanup levels to assess the effectiveness of remediation and to confirm that contaminant concentrations in the groundwater have attained cleanup levels. The program will include monitoring of groundwater, surface water, sediments, and existing households obtaining drinking water from the aquifer."

The SMWS Site was separated into two operable units (OU). The cleanup at OU1, the OK Tool Source Area, is being performed by EPA and the New Hampshire Department of Environmental Services (NHDES), Waste Management Division. Operable Unit 1 is defined in detail in the 1994 Consent Decree and includes all of the OK Tool property and additional properties to the east, north, and west of the OK Tool Property (USDOJ, 1994).

The cleanup at OU2, the Extended Plume, is being performed by responsible parties pursuant to a consent decree entered in federal district court in New Hampshire in June, 1994. This Five-Year Review addresses both OU1 and OU2. The ROD defines OU2 as the Extended Plume, including the "remaining portion of the concentrated plume not included in OU1 and the dissolved plume". Operable Unit 2 is described in the ROD as extending eastward from OU1 and is approximately 1 mile in length and about 2,500 feet in width.

Recent deep bedrock investigation activities (2010) have indicated that site-related contamination extends into the deep bedrock beneath the Site. As a result, EPA has established OU3 to address the bedrock aquifer underlying the overburden contamination. The results of the ongoing OU3 bedrock investigations will be provided in a future OU3 Remedial Investigation/Feasibility Study Report. Accordingly, those results will not be reviewed in this Report.

This First Five-Year Review for the entire Site was performed to document whether the selected remedy is protective of human health and the environment. The trigger for this five-year policy review was the *Preliminary Close-Out Report* signed in September 2006.

The remedy at OU1 currently protects human health and the environment because there is no contact with or consumption of contaminated groundwater, and the remedy is being implemented as intended. The GWTP and extraction system, in conjunction with the barrier wall, are operating so as to maintain an inward gradient in order to prevent the migration of contamination. However, in order for the OU1 remedy to be protective in the long-term, an evaluation of the OU1 GWTP and extraction system performance needs to be conducted, groundwater institutional controls need to be implemented, interim cleanup levels for 1,4-dioxane, vinyl chloride, cis-1,2-dichloroethene (cis-1,2-DCE), arsenic, and manganese need to be established, and an updated ecological risk assessment needs to be conducted to ensure long-term protectiveness.

A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained. Despite the fact that operation of the extraction, treatment and reinjection/discharge systems are functioning as designed, further information is needed at OU2 by completing a shallow groundwater and potential vapor intrusion investigation. It is expected that these actions will take approximately two years to complete, at which time a protectiveness determination will be made. In addition, in order for the OU2 remedy to be protective in the long-term, groundwater institutional controls need to be implemented and interim cleanup levels established for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, arsenic and manganese, at a minimum.

Overall, a site-wide protectiveness determination is deferred for the combined remedies at the SMWS Site until further information is obtained. Upon completion of a shallow groundwater and potential vapor intrusion investigation at OU2, a site-wide protectiveness determination will be made.

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Savage Municipal Water Supply Well		
EPA ID *(from WasteLAN)*: NHD980671002		
Region: 1	**State:** NH	**City/County:** Milford, Hillsborough County

SITE STATUS	
NPL status: X Final Deleted Other (specify)	
Remediation status (choose all that apply): Under Construction **X Operating** Complete	
Multiple OUs? X YES NO	**Construction completion date:** September 12, 2006
Has site been put into reuse? YES **X** NO	

REVIEW STATUS	
Lead agency: X EPA State Tribe Other Federal Agency_____	
Author name: Richard Hull with technical assistance from NHDES/Weston Solutions, Inc.	
Author title: Remedial Project Manager	**Author affiliation:** EPA, Region 1
Review period: 01/06/2011 to 09/30/2011	
Date(s) of site inspection: 7/20/2011	
Type of review: **X Post-SARA** Pre-SARA NPL-Removal only Non-NPL Remedial Action Site NPL State/Tribe-lead Regional Discretion	

Review number: X 1 (first) 2 (second) 3 (third) Other (specify) _____
Triggering action: Actual RA Onsite Construction at OU #____ Actual RA Start at OU#____ Construction Completion X Previous Five-Year Review Report Other (specify)
Triggering action date *(from WasteLAN)*: 9/12/2006
Due date *(five years after triggering action date)*: 09/12/2011

Five-Year Review Summary Form, cont'd.

Issues:

1. Additional groundwater and potential indoor vapor intrusion investigations are required for occupied buildings within OU2.
2. Fouling of OU1 GWTP with residual permanganate and under performance of tray aerators.
3. No institutional controls or deed restrictions are in place to regulate development or prevent installation of water supply wells.
4. No interim cleanup levels established for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, or manganese, and the MCL for arsenic has been lowered to 10 ppb.
5. Ecological risk assessment, consistent with current methods, has not been updated for the SMWS Site.

Recommendations and Follow-up Actions:

1. Perform a shallow groundwater investigation.
2. Conduct evaluation of OU1 GWTP and extraction system performance.
3. Implement Institutional Controls: Establish GMZ, Town Ordinance, Zoning and/or Deed Restriction.
4. Establish Interim Cleanup levels for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, arsenic, and manganese, and prepare decision document.
5. Conduct updated ecological risk assessment, consistent with current methods, for the SMWS Site.

Protectiveness Statement(s):

The remedy at OU1 currently protects human health and the environment because there is no contact with or consumption of contaminated groundwater, and the remedy is being implemented as intended. The GWTP and extraction system, in conjunction with the barrier wall, are operating so as to maintain an inward gradient in order to prevent the migration of contamination. However, in order for the OU1 remedy to be protective in the long-term, an evaluation of the OU1 GWTP and extraction system performance needs to be conducted, groundwater institutional controls need to be implemented, interim cleanup levels for 1,4-dioxane, vinyl chloride, cis-1,2-dichloroethene (cis-1,2-DCE), arsenic, and manganese need to be

established, and an updated ecological risk assessment needs to be conducted to ensure long-term protectiveness.

A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained. Despite the fact that operation of the extraction, treatment and reinjection/discharge systems are functioning as designed, further information is needed at OU2 by completing a shallow groundwater and potential vapor intrusion investigation. It is expected that these actions will take approximately two years to complete, at which time a protectiveness determination will be made. In addition, in order for the OU2 remedy to be protective in the long-term, groundwater institutional controls need to be implemented and interim cleanup levels established for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, arsenic and manganese, at a minimum.

Overall, a site-wide protectiveness determination is deferred for the combined remedies at the SMWS Site until further information is obtained. Upon completion of a shallow groundwater and potential vapor intrusion investigation at OU2, a site-wide protectiveness determination will be made.

Long-Term Protectiveness:

In order for the remedy to be protective in the long-term, the following actions are recommended:

1. Perform a shallow groundwater Investigation.
2. Conduct evaluation of GWTP and extraction system performance.
3. Implement Institutional Controls: Establish GMZ, Town Ordinance, Zoning and/or Deed Restriction.
4. Establish Interim Cleanup Levels for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, arsenic and manganese and prepare decision document.
5. Conduct updated ecological risk assessment, consistent with current methods, for the SMWS Site.

1. INTRODUCTION

The purpose of the Five-Year Review is to determine whether the remedy(ies) being implemented at a site is(are) protective of human health and the environment. The methods, findings, and conclusions of these reviews are documented in Five-Year Review Reports. In addition, Five-Year Review Reports identify issues found during the review, if any, and identify recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this Five-Year Review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121(c), as codified in 42 U.S.C. §9621(2) states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in Section 300.430(f)(4)(ii) of the NCP, as codified in CFR §300.430(f)(4)(ii), which states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the First Five-Year Review for the Savage Municipal Water Supply Well Superfund Site (SMWS Site). The triggering action for this review is the completion of construction activities at

the SMWS Site which was documented in the *Preliminary Close-Out Report (PCOR)* prepared by EPA in September 2006 (EPA, 2006).

Although when completed, the selected remedy at the SMWS Site will not leave hazardous substances, pollutants, or contaminants on the Site that preclude unlimited reuse and unrestricted exposure, the SMWS Site will not be completed for many years. In the interim, as a matter of EPA policy, five-year reviews will be conducted until interim cleanup levels are achieved and the remedy is found to be protective. With the support of the New Hampshire Department of Environmental Services (NHDES) and its contractor, Weston Solutions, Inc. (WESTON®), the United States Environmental Protection Agency (EPA) Region I has conducted this review of the remedial actions implemented at the SMWS Site. This five-year policy review was conducted in accordance with EPA's *Comprehensive Five-Year Review Guidance*, OSWER No. 9355.7-03B-P (EPA, 2001) as well as under the authority of CERCLA Section 121 and the National Contingency Plan (NCP). The review was conducted between January and September 2011.

2. SITE CHRONOLOGY

The SMWS Site chronology is provided as Table 1.

3. BACKGROUND

3.1 PHYSICAL CHARACTERISTICS

The SMWS Site is located in the Town of Milford, New Hampshire (NH), approximately 2 miles west of the center of town. The SMWS Site encompasses a plume of contaminated groundwater that originally extended approximately 6,000 feet (ft) eastward from the intersection of Route 101 and Elm Street. The SMWS Site extends beyond the Souhegan River to the north and east and is roughly bounded to the south by Old Wilton Road and Tucker Brook. The dominant groundwater flow direction is to the east.

The SMWS Site includes two operable units (OU). The cleanup at OU1, the former OK Tool Source Area, is being performed by EPA and NHDES, Waste Management Division. The cleanup at OU2, the Extended Plume, is being performed by potentially responsible parties pursuant to a consent decree entered in federal district court in New Hampshire in June, 1994.

Recent deep bedrock investigation activities (2010) have indicated that site-related contamination extends into the deep bedrock beneath the SMWS Site. As a result, EPA has established OU3 to investigate and potentially address the bedrock aquifer underlying the overburden contamination found at OU1. The results of the ongoing OU3 bedrock investigations will be provided in a future OU3 Remedial Investigation/Feasibility Study (RI/FS) Report. Accordingly, those results will not be reviewed in this Report.

Operable Unit 1 is defined in detail in the 1994 Consent Decree (CD) and includes all of the former OK Tool property and additional properties to the east, north, and west of the OK Tool Property (U.S. Department of Justice, 1994). Figure 1 shows the outline of OU1.

The Record of Decision (ROD) defines OU2 as the Extended Plume, including the "remaining portion of the concentrated plume not included in OU1 and the dissolved plume". Operable Unit 2 is described in the ROD as extending eastward from OU1 and is approximately 1 mile in length and about 2,500 ft in width.

The Souhegan River flows easterly across the SMWS Site, and the majority of OU1 and OU2 are located within the river's 100-year flood zone. The floodplain is a relatively flat land surface

extending through most of the area of the SMWS Site. At the eastern edge of the SMWS Site, the Souhegan River takes a pronounced southward bend before resuming its generally east-west orientation. Photographs of the SMWS Site are included in Attachment 3 for OU1 and Attachment 4 for OU2.

Residential, agricultural, heavy and light industrial, and commercial land uses are found within the SMWS Site. Residences are located along Elm Street and Old Wilton Road. A trailer park is located to the north of Elm Street. Agricultural uses including a cornfield and a former sod farm dominate the central and western portions of the SMWS Site between Elm Street and the Souhegan River. The heavy industrial uses are located between Elm Street and Old Wilton Road east of Route 101, and include facilities operated by the Settling PRPs. Light industrial and commercial uses are generally found along Elm Street.

The groundwater aquifer underlying the SMWS Site is a high yield sand and gravel aquifer. From 1960 to 1983, the Town of Milford obtained about 40 percent (%) of its water supply from the Savage Municipal Water Supply Well (Savage Well). The Savage Well was a 60-ft deep, gravel-packed, overburden production well which yielded approximately 500 gallons per minute (gpm). Since 1983, when the State of NH ordered the Town to cease use of the Savage Well due to the detection of volatile organic compounds (VOC) above drinking water standards, the aquifer has not been used as a drinking water source.

One plume of tetrachloroethene (PCE) extends approximately 6,000 ft east of the former OK Tool facility and reaches beyond the Souhegan River to the north and Elm Street to the south. The plume underflows the Souhegan River and is detectable on the north side of the Souhegan River at the distal end of the plume, downstream of the southward meander of the Souhegan River, near monitoring wells FH-27 and MW113A [Gradient Corporation (Gradient), 2011]. Vertical profiling at the former OK Tool Source Area in 1997 identified the presence of PCE in the form of dense non-aqueous phase liquid (DNAPL) and at dissolved concentrations of VOCs exceeding 100,000 parts per billion (ppb) [Camp Dresser & McKee, Inc. (CDM), Federal Programs Corporation, 1995]. Concentrations in the dilute plume (outside the existing barrier wall that was constructed as part of the OU1 remedy) were as high as 5,000 ppb prior to the initiation of pumping, and remain as high as 410 ppb (Gradient, 2011). At the time the RI was

conducted, a plume of 1,1,1-trichloroethane (TCA) which originated on the Hitchiner Manufacturing Company, Inc. (Hitchiner) property, was found to co-mingle with the PCE plume as it flowed to the east [HMM Associates, Inc. (HMM), 1991].

3.2 LAND AND RESOURCE USE

3.2.1 OU1

The portion of OU1 located south of the Souhegan River is currently zoned for integrated commercial and industrial use, but the northern portion of OU1 is zoned residential. Operations at the former OK Tool Company, located in the center of OU1, began during the early 1940s and ended in 1987. The company manufactured machine parts including cutters, grinders, mills, and reamers.

3.2.2 OU2

Operable Unit 2 is currently zoned for a combination of industrial and integrated commercial and industrial uses. Operations at the Hendrix Wire and Cable Company, Inc. (Hendrix), Hitchiner, and New England Steel Fabricators, Inc. (NESF), located at the western end of OU2, began on the SMWS Site during the early 1940s and, with the exception of NESF facility which is now occupied by Hollis Line Machine Company, continue to the present at each of these properties. From the 1940s until the 1980s, process waters and wastes from these three industrial facilities were released untreated to the ground or to the surface waters flowing through their properties. The locations of these facilities are shown on Figure 1-5 from the *Remedial Investigation Report* (*RI Report*), provided in Attachment 5 (HMM, 1991).

3.2.3 Surrounding Area

The current land use of the surrounding area is residential, agricultural, commercial, industrial, and recreational (the adjacent baseball field within OU1). The Souhegan River is used for swimming and fishing. It is anticipated that a mix of land uses will continue into the future, as the surrounding area is zoned for industrial, integrated industrial and commercial, and residential uses (Town of Milford, 2008). In establishing cleanup requirements for the SMWS Site, EPA considered the potential risks to future uses at the SMWS Site and the restoration of the aquifer.

The groundwater aquifer underlying the SMWS Site is currently not used as a drinking water source. There are no municipal ordinances or a Groundwater Management Zone (GMZ) designation in place to prevent use, although portions of OU2 are subject to an agricultural easement. The Town of Milford has established a Groundwater Protection Area around groundwater supply areas in Town, including the Savage Well, which establishes some land use limitations. Residential growth in the Town of Milford has resulted in new deep bedrock drinking water wells being installed north of the SMWS Site. The potential for these wells to induce groundwater flow from the area of the contaminated groundwater plume is currently being evaluated as part of the OU3 investigation.

3.3 HISTORY OF CONTAMINATION

Four major industrial plants are/were situated to the west of the Savage Well: Hendrix Wire and Cable Corporation, Hitchiner Manufacturing Company, the former OK Tool Company, and the former New England Steel Fabricators, Inc. From the 1940s until the 1980s, process waters and wastes from these four industrial facilities were released untreated to the ground or to the surface waters flowing through the Site.

In February, 1983, as part of the first routine sampling of water supplies for organic compounds, the New Hampshire Water Supply and Pollution Control Commission (NHWS&PCC) found several volatile organic compounds (VOCs) above drinking water standards in water from the Savage Well. The VOCs found were: 1,1,1 trichloroethane (TCA), trichloroethylene (TCE), trans-1,2 dichloroethylene (trans-1,2 DCE), tetrachloroethylene (PCE), and 1,1 dichloroethane (DCA). Volatile organic compounds were also found in the water drawn from the well supplying the nearby Milford Mobile Home Trailer Park. The VOCs found at the mobile home park well were tetrachloroethylene and trans-1,2 dichloroethylene. The State of New Hampshire ordered the Town to cease use of the Savage Well in February, 1983.

3.4 INITIAL RESPONSE

In March, 1983, at the request of the State, EPA conducted an emergency removal action to supply uncontaminated water to residences of the Milford Mobile Home Trailer Park. EPA's actions included supplying bottled water to residents as an interim measure. The action was

completed in May, 1983, when the Trailer Park's water distribution system was connected to the existing municipal water supply system.

The Site was proposed for inclusion on the EPA National Priorities List (NPL) on September 1, 1983. The Site was included on the final NPL on September 1, 1984.

In 1985, EPA identified four potentially responsible parties (PRPs) for the cost of the cleanup of the SMWS Site. In June of 1987, after years of discussions and negotiations, the PRPs agreed to perform the Remedial Investigation/Feasibility Study pursuant to an Administrative Order by Consent.

3.5 BASIS FOR TAKING ACTION

Table 2 lists the hazardous substances released at the SMWS Site that were identified as constituents of concern in environmental media in the Baseline Health Risk Assessment (BHRA) (ESE, 1990).

Based on the findings of the 1990 BHRA, residential exposure to groundwater at the SMWS Site is likely associated with significant human health risks. The health risks are due to the exceedance of EPA's risk management criteria for Reasonable Maximum Exposure scenarios with hazard indices greater than the threshold value of 1.0.

The carcinogenic risks were highest for future household use and consumption of groundwater, due primarily to the high concentration of PCE. Arsenic, beryllium, 1,1-dichloroethylene, 1,2-dichloroethane, methylene chloride, and TCE also contributed to risk greater than one in a million. Carcinogenic risks from exposure to soil were significant due to the presence of arsenic and polychlorinated biphenyls (PCBs). These risks exceeded one in one million, but were less than one in ten thousand (i.e., within EPA's acceptable risk range).

Non-carcinogenic hazards were also highest for future household use and consumption of groundwater due to the concentrations of PCE, lead, and arsenic detected in this medium. The noncarcinogenic hazards for future residential use were below one, indicating a non-significant hazard, with the exception of arsenic, for the toxic endpoint of keratosis (skin discoloration). Risks and hazard levels for current exposure to ambient air were within acceptable ranges.

In a letter dated July 9, 2009 to Hitchiner and Hendrix (Settling PRPs), NHDES requested that the Settling PRPs perform 1,4-dioxane sampling and analysis from the OU2 treatment system and select groundwater monitoring well locations within OU2. 1,4-dioxane is primarily used as a stabilizer for 1,1,1-TCA, and had been detected in certain monitoring wells in OU2 in 2003. 1,4-dioxane was not detected in influent or effluent samples from the OU2 Treatment System. However, 1,4-dioxane was detected in 10 of the 17 monitoring wells sampled, ranging from 0.524 to 8.73 micrograms per liter (µg/L), exceeding the NH Ambient Groundwater Quality Standard (AGQS) of 3 µg/L in five of the ten monitoring wells where it was detected.

Since the ROD was issued in 1991, vapor intrusion impacts to indoor air quality above the groundwater plume have been identified as another potential route of exposure that was not assessed during the 1990 BHRA. There are no residences that would be at risk via this potential route of exposure to SMWS Site contaminants within OU1. However, within OU2, numerous residences exist which may result in potential vapor intrusion exposures .

An August 2000, indoor air study conducted at the former Milford Police Station, located within the boundary of OU1, evaluated the vapor intrusion pathway within this portion of the SMWS Site. The investigation identified elevated concentrations of PCE within the building which were attributed to either off gassing from dry cleaned police uniforms or from soil gas. It was concluded that concentrations of PCE were impacting indoor air quality. The former police station is currently vacant; however, if the building becomes inhabited or the property is redeveloped for future use, further evaluation of the vapor intrusion pathway within this building will need to be performed and the need for institutional controls to address vapor intrusion mitigation may be warranted.

In addition, if the former Milford Police Station property or any other property within OU1 is redeveloped and new buildings are constructed, it is likely that engineering controls may need to be incorporated into the design to prevent vapor intrusion exposures.

4. REMEDIAL ACTIONS

4.1 REMEDY SELECTION

The ROD for the SMWS Site was signed on September 27, 1991. The ROD set forth a selected remedy to meet the Remedial Action Objectives (RAO) for the SMWS Site. Two RAOs were established to guide remedy selection including: 1) prevention of ingestion of contaminated groundwater that would pose an unacceptable risk to human health, and 2) restoration of groundwater quality to meet federal and state Applicable or Relevant and Appropriate Requirement (ARAR).

Human health risks due to exposure to potential contaminant source area media other than groundwater were found to be within EPA's acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic compounds and below the hazard index (HI) goal of one for compounds with non-carcinogenic effects. In addition, the ROD stated that contaminants in soil were not found at sufficiently high concentrations to contribute to overall groundwater contamination (EPA, 1991). Since risk levels did not warrant source control remedial actions in soil, a comprehensive remedy to manage the migration of groundwater contamination was deemed appropriate to meet RAOs at the time the ROD was signed. However, pre-design investigations conducted after the ROD was issued confirmed that chlorinated solvents were present in the source area in the form of DNAPL. EPA issued an Explanation of Significant Differences (ESD) in 1997 which added remedial components to the OU1 remedy to address the presence of DNAPL (EPA, 1997).

The remedy mandated by the ROD issued in 1991 and an ESD issued in 1997 includes the following components:

- Acquisition of property upon which the OU1 treatment plant was to be built.
- Construction of a barrier wall around the source area in OU1 to significantly reduce the mobility of contaminants, reduce the volume of groundwater to be pumped, and improve the long-term effectiveness of the remedial actions.
- Installation of a groundwater extraction and treatment system in OU1, the concentrated plume area. The groundwater extraction system in OU1 was to consist of two interior extraction wells (inside the barrier wall), and two exterior extraction wells (outside the barrier wall). The total groundwater extraction rate for OU1 was estimated to be 70 gpm.

- Construction of a soil vapor extraction (SVE) system with air sparging (AS) in the source area to remove the near surface contamination sources within the area contained by the barrier wall in OU1.

- Treatment of groundwater by air stripping with vapor phase carbon adsorption to treat the air streams from both the air stripper and the SVE system in OU1.

- Discharge of treated OU1 groundwater via two subsurface injection wells and a recharge chamber.

- Installation of a groundwater extraction and treatment system within OU2, the extended plume area. The system was to remove contaminated groundwater at a rate of approximately 700 gpm from two locations near the middle of the plume and two locations near the end of the plume, north of the Souhegan River, for treatment via metals removal and ultraviolet oxidation.

- Discharge of treated OU2 groundwater to three injection wells.

- Reliance on natural attenuation of contaminated groundwater to lower contaminant concentrations through physical, chemical, and biological processes until groundwater cleanup levels are met in portions of the plumes outside of the capture zones.

- Implementation of an environmental monitoring program initiated during remedial design and continuing for 3 years after attaining groundwater cleanup levels to assess the effectiveness of remediation and to confirm that contaminant concentrations in the groundwater have attained cleanup levels in addition to ensuring that adverse impacts from remediation are not generated. This program will include monitoring of air, groundwater, surface water, sediments, and existing households obtaining drinking water from the aquifer.

- Utilization of institutional controls to reduce the risk to public health from consumption of the groundwater and prevent disturbance of the on-going remedy. Institutional controls may include deed restrictions and zoning ordinances to restrict the use of contaminated groundwater. Institutional controls shall be imposed in the area where the risk to public health is outside EPA's acceptable risk range.

4.2 REMEDY IMPLEMENTATION

Negotiations completed subsequent to the issuance of the ROD resulted in two Consent Decrees (CDs). The first CD, entered on June 27, 1994, required the Settling PRPs to perform the work in OU2 (USDOJ, 1994). The second CD entered on December 8, 1994, was a cash-out recovering a small portion of the costs of cleaning up OU1. The CD agreed to by the Settling PRPs governed the performance of remedial work at the SMWS Site and resulted in a division of work between

the government (EPA and NHDES) and the Settling PRPs so that the government performed the work in OU1 and the Settling PRPs performed the work in OU2. The remedial work in OU1 was to be funded by the federal and state governments in accordance with the Hazardous Waste Superfund Program. The remedial work in OU2 was to be funded by the Settling PRPs.

4.2.1 OU1

4.2.1.1 Remedy Design

Initial design of the remedial systems for OU1 was performed between 1995 and 1996 by CDM. The *Conceptual Remediation Design Report* (CDM, 1996) provided the basis for the ESD which modified the remedy by adding a barrier wall, installing an SVE/AS system, and reducing the groundwater extraction rates in OU1. The detailed remedial design for OU1 was completed and bids were solicited for construction of the remedial systems in 1997.

4.2.1.2 Remedy Construction

The remedial action was initiated in June 1997 when the State of NH acquired the OK Tool and adjacent Milonas properties to begin construction of the barrier wall and treatment plant. In December 1997, NHDES contracted with Sverdrup Environmental, Inc., for the construction of the OU1 remedial action. Construction activities began in December 1997 and continued through March 1999.

4.2.1.2.1 Soil-Bentonite Slurry Wall

Construction of the low permeability slurry wall was performed between July 1998 and October 1998. The barrier wall is approximately 1,500 ft in circumference, was constructed with a minimum 3-foot (ft) wide soil-bentonite slurry backfill, and capped by a 9-ft wide protective cap of soil and bentonite. The wall was set 3 ft into the glacial till or terminated at competent bedrock where till was not encountered. The depth of the wall varies between 50 ft and 115 ft below ground surface (bgs) (EPA, 2003).

4.2.1.2.2 Groundwater Extraction and Injection Wells

Construction of the initial groundwater treatment and reinjection system began in March 1998 and continued through startup of the system in 1999. The system consisted of groundwater extraction wells, flow equalization tanks, tray aerator feed pumps, tray aerators, tray aerator

blowers, groundwater reinjection/recharge chamber system, and a building sump. Two deep extraction wells were installed inside of the slurry wall (IW-01 and IW-02) with the intended design of lowering the water table and maintaining an inward/upward hydraulic gradient between the slurry wall and surrounding aquifer. Wells IW-01 and IW-02 were installed to depths of approximately 107 and 90 ft bgs, and constructed with a 30-ft and 20-ft long 6-inch-diameter well screen, respectively. The record drawings indicate that IW-02 is constructed with a 30-ft screened interval positioned above a 3-ft sump at the bottom of the well, but the U.S. Geological Survey (USGS) borehole logging, conducted in November 2002, indicated that IW-02 has only 20 ft of screen (Harte, 2002). Each of these wells was designed to pump at 20 gpm.

Two extraction wells are installed outside of the slurry wall (EW-01 and EW-02) with the intended design of capturing the groundwater plume beyond the barrier, but within OU1. Wells EW-01 and EW-02 were installed to depths of approximately 90 ft and 84 ft bgs, respectively and constructed with 30 ft of 8-inch-diameter well screen. Each of these wells was designed to pump at 50 gpm to obtain a greater area of influence than the interior wells.

A modification to the groundwater extraction system was made in 2008. Two shallow groundwater extraction wells were installed as part of the in situ chemical oxidation (ISCO) program implemented at OU1 and are not included in the record drawings. Wells IW-01A and IW-02A were installed adjacent to the existing interior extraction wells to depths of 23.5 ft and 28 ft bgs, respectively (each with a 15-ft screened interval). These wells were installed to extract shallow groundwater from within the barrier wall while sodium permanganate ($NaMnO_4$) was injected into the deep overburden to reduce the potential of drawing $NaMnO_4$ into the treatment plant which is not equipped to neutralize the oxidant.

The groundwater reinjection system consists of three reinjection wells (RW-01, RW-02, and RW-03) and one recharge chamber shown on Figure 6. The reinjection wells are approximately 30 ft deep and have a 10-ft long screen positioned above a 2-ft sump located at the bottom of the well. The capacities of the reinjection wells are unknown, but historic Monthly Operations Reports indicate that RW-01 was used at rates ranging from 3 to 6 gpm, RW-02 at rates from 5 to 6 gpm, and RW-03 at approximately 8 gpm. Interior reinjection wells have historically been unused because they exacerbated high water table conditions that limited the operation of the

SVE system and reversed the hydraulic gradients between the interior and exterior of the barrier wall from the preferred inward/upward direction to downward/outward, thereby compromising the containment system. Further discussion regarding the performance of the extraction wells is provided in Subsection 4.3.1.3.

The recharge chamber has been the primary reinjection location since the startup of the groundwater treatment system. The chamber is made up of three, 8-ft-diameter precast recharge pits, installed approximately 8 ft deep in a trench of crushed stone. The capacity of the trench has been demonstrated to be approximately 90 gpm. Clogging and fouling of the recharge chamber resulted in its cleaning and complete reconstruction in August 2005.

4.2.1.2.3 Tray Aerators

Groundwater from each of the extraction wells flows to the treatment plant and into two polypropylene equalization tanks before being pumped into the tray aerators installed in 1998. The tray aerator system includes two tray-aerators arranged in parallel, each with four trays, to treat VOC contamination. The *Operations and Maintenance Manual, Rev 3.0* (Veolia, 2005) indicates that the system has a capacity of 90 gpm of groundwater at 2,700 μg/L of VOC contamination. Water is pumped from two equalization tanks and treated with a minimum of 900 standard cubic feet per minute of outside air. The tray aerator effluent water is discharged to the building wet well where it either flows by gravity to the recharge chamber or can be directly pumped to any of the three reinjection wells.

4.2.1.2.4 Soil Vapor Extraction/Air Sparging Treatment System

The SVE system was installed in May 1998, and consisted of six wells completed to approximately 25.5 ft bgs. The wells have 15 ft of 6-inch-diameter, stainless steel screen from approximately 7 to 22 ft bgs. There is a 3-ft sump in the bottom of each SVE well. The locations of the SVE wells are shown on Figure 6. The SVE wellheads were connected to the plant via two main SVE trunk lines. One trunk line consisted of SVE wells 1, 2, and 3 and the other consisted of SVE wells 4, 5, and 6.

The AS system was installed in April 1998 and consisted of two AS wells, SP-1 and SP-2, set at a depth of approximately 63.5 and 64 ft bgs, respectively. The AS wells were constructed using

5-ft of 4-inch-diameter, stainless steel screen and completed to the surface using 4-inch-diameter carbon steel casing. The screened interval extends upward from a 3-ft-long sump. The SVE and AS well heads are located in vaults greater than 4 ft bgs, as a result of being constructed prior to site grading at the completion of the remedy construction.

The SVE and AS systems were run intermittently after the plant began operation in March 1999 as the groundwater levels within the OU1 barrier wall were frequently too high to operate the SVE system. In 2002, the 15-ft screens averaged 63% submerged, and were never less than 49% submerged. In April 2002, the screens were over 70% submerged, leaving approximately 4 ft of available unsaturated zone for operation. Several attempts were made to modify the system and enable it to operate efficiently and extend the duration of its seasonal operation, including extraction of groundwater from nearby wells and from select SVE wells to lower the water table elevation.

The SVE system was dismantled in July 2004 for the first full scale ISCO program. In July 2006, the system was partially reassembled and restarted using SVE-04, SVE-05, and SVE-06. In January 2007 the AS system was restarted and subsequently shut down when groundwater was observed fountaining from nearby monitoring well PW-16M. In February 2008, the SVE system was started at the request of EPA and run for a period of approximately 1 month. Influent VOC concentrations ranged from 2.2 parts per million (ppm) to 0.8 ppm during the trial period. Based on the trial period and the sporadic history of operation, it was decided that both the SVE and AS systems were not removing a significant volume of contaminant mass from within the barrier wall. Under the direction of EPA and NHDES, the systems were shut down and both the SVE and AS systems were permanently taken offline in 2008 when the SVE blower and AS compressor were removed during renovations to the groundwater treatment plant (GWTP) at OU1. A portion of the SVE piping between SVE-05 and SVE-06 was removed and the ends capped off during the leach field vadose zone soil excavation conducted in August 2008.

Vapor Phase Carbon and Carbon Regeneration

Two vapor phase carbon units installed during treatment plant construction were previously used to treat off-gas from the tray aerators and the vapor from the SVE system. The influent to these carbon units was routed through a pre-heater to lower humidity and maximize carbon adsorption

efficiency. The carbon units were regenerated with a steam regeneration unit, which discharged the condensed steam and recovered solvent to an on-site storage tank.

The carbon regeneration system included two boilers, a dual-phase separator, and a solvent recovery tank. The regeneration system was designed based on the expected recovery rate of 25 pounds (lbs) of PCE per day; therefore, the system was originally set to regenerate every day. However, after start up of the treatment plant in 1999, the SVE and groundwater extraction system extracted only 0.6 to 1.2 lbs per day. Consequently, less frequent regeneration was needed, with the system typically operating for more than a month between regenerations.

Elimination of the SVE system in fall of 2008 and reductions in the influent groundwater VOC concentration made carbon treatment of VOC emissions unlikely to be necessary and on-site carbon regeneration no longer cost effective. During renovation activities in the fall of 2008, the steam boiler system (used for building heat and carbon regeneration) was replaced with a more efficient water boiler system eliminating the ability to regenerate carbon on-site. Once confirmation was received from NH Air Resources Division (ARD) in April 2009 indicating that carbon treatment of air emissions was no longer required, the emissions from the air strippers were discharged directly to atmosphere. If future conditions warrant treatment of air emissions through the carbon vessels, spent carbon will need to be regenerated or disposed of off-site.

4.2.1.2.5 In-Situ Treatment of Dense Non-aqueous Phase Liquid

In 2001, a Remediation Systems Evaluation (RSE) conducted by EPA concluded that additional remedial measures would be necessary to reduce DNAPL and PCE concentrations in OU1 source area groundwater (EPA, 2001b). In response to the recommendations of the RSE, an ISCO program was developed to aggressively treat “hot spots” within the barrier wall. Pilot testing of ISCO with potassium permanganate ($KMnO_4$) was performed in 2003. A total of 8,400 lbs of $KMnO_4$ were injected into existing wells. A second larger injection of 24,000 lbs of $KMnO_4$ was performed in 2004.

In 2008, the strategy for remediating OU1 was modified to incorporate ISCO on a larger scale for mass removal; and the focus of groundwater pump and treat at OU1 was revised from maximizing contaminant mass removal and hydraulic containment, to predominantly hydraulic

containment. Groundwater extraction was shifted from the deep to the shallow overburden aquifer inside the barrier wall with the installation of two shallow extraction wells (discussed in Subsection 4.2.1.2.2), and the groundwater extraction rate from inside the barrier wall was decreased from approximately 70 gpm to approximately 25 gpm. This allowed $NaMnO_4$ to be injected into the deep overburden, while continuing to operate the groundwater extraction system inside the barrier wall, without drawing permanganate into the treatment plant. A total of 28 new injection wells were installed inside the barrier wall in 2008 and 2009. Three rounds of ISCO were performed in fall 2008, fall 2009, and spring 2010, involving the injection of approximately 307,000 lbs of 40% $NaMnO_4$ into 36 new and existing source area wells inside the barrier wall.

4.2.1.2.6 Vadose Zone Soil Source Removal Action

Two excavations were performed in 2008 and 2009 to remove shallow vadose zone soil contaminated with VOCs identified during subsurface investigations. EPA and NHDES determined that the shallow soils near the water table were not being effectively remediated under the SVE/AS system and therefore represented an on-going source for groundwater contamination within the barrier wall.

Leach Field Soil Remediation

Previous remedial investigations performed at OU1 identified the presence of a potential shallow contamination source in the northwestern portion of the area contained by the barrier wall. The contamination was believed to be the result of a former leach field system associated with the former OK Tool building. Approximately 2,000 to 3,000 cy of shallow unsaturated soils from the vicinity of the former leach field were excavated and stockpiled in late summer of 2008. Soils were treated on-site during July 2009 using a combination of chemical oxidation (ozone and peroxide) and SVE. Confirmation samples were collected from the treated soils before they were returned to the excavation as backfill material.

PW-22 Source Area Removal

During a subsurface investigation conducted in August 2008, elevated concentrations of VOCs were identified in shallow soils near PW-22, a monitoring well which had exhibited elevated concentrations of VOCs in groundwater (>29,000 µg/L). A test pit excavated in this area during September 2008 located an abandoned transite pipe, and in July 2009, impacted soil surrounding

the pipe was excavated to the groundwater table. Approximately 59 cy of impacted soil were removed from the area, stockpiled, and treated with the leach field soils in late summer and fall of 2009.

To aggressively treat the VOC contamination observed in the shallow overburden groundwater, a permanganate solution was pumped into the bottom of the open excavation prior to backfilling. Four 550-lb drums of 40% $NaMnO_4$ were diluted to a 20% concentration and distributed along the sidewalls and bottom of the excavation, with a particular focus on the areas where confirmation samples indicated the highest VOC concentrations.

Construction of the remedy for OU1, as specified in the ROD and ESD, was completed in 1999, with the exception of the implementation of institutional controls. The ESD projected that interim cleanup levels for groundwater contaminants outside the barrier wall would be reached within approximately 10 years. However, groundwater concentrations continue to exceed the interim cleanup levels in some areas, as discussed in Subsection 6.4.4.

4.2.2 OU2

4.2.2.1 Remedy Design

In November 1997, the Settling PRPs submitted a *Draft Remedial Design Investigation Report* (*RDI*) which presented several pump and treat alternatives and compared them to natural attenuation. The model used by the Settling PRPs was developed by their consultant QST, now known as MACTEC Engineering and Consulting, Inc (MACTEC). Pumping rates evaluated included 450, 600, 650, 800, and 1,400 gpm. The conclusion based on the Settling PRPs' modeling was that "natural attenuation would be the most cost effective alternative comparable to active remediation." (Gradient, 2006).

Performing its own analysis of the Settling PRPs' modeling, EPA found that the locations of the extraction and injection wells determined the aquifer clean-up times. EPA then developed its own model and used it to evaluate the 450 gpm pumping scenario (Gradient, 2006). During its review efforts on the 450 gpm pumping scenario, EPA discovered that the QST 3-D model contained an error which caused the clean-up times to be incorrectly estimated. This error has been acknowledged by the consultant for the Settling PRPs. Analysis with the corrected model

by EPA concluded that the clean-up times for active treatment were significantly less than the times used as the basis for the conclusions in the 1997 *Draft RDI Report* (Gradient, 2006).

EPA and NHDES presented their conclusions to the Settling PRPs in a series of meetings between December 2000 and May 2001. In June 2001, the Settling PRPs added a new consultant and changed their Project Coordinator to Gradient. Gradient became the contractor responsible for undertaking additional modeling efforts. The Settling PRPs agreed to use the EPA model and believed that improvements could be made to the model which would assure the construction of an optimum remedy. EPA and NHDES agreed to examine the EPA model with Gradient to improve the model's predictive capability (Gradient, 2006).

As part of that effort, the Settling PRPs performed additional field work in 2001 which provided information that confirmed earlier EPA conclusions and provided new information used to improve the model's predictive output. The fieldwork included subsurface investigations which refined the bedrock contours used in the model. The work also included obtaining information on the geologic properties of the aquifer and groundwater contamination information where needed (Gradient, 2006).

In May 2002, Gradient submitted a revised *Draft RDI Report* which described the field work and the modifications made to the EPA model. The revised *Draft RDI Report* recommended Configuration 4, which was a 450 gpm extraction and injection/recharge system (three extraction wells, two injection wells, and a recharge gallery) with treatment of contaminated groundwater using air stripping technology (Gradient, 2002).

EPA, after review and comment by NHDES, modified the revised *Draft RDI Report*. The modifications were based on modeling performed by USGS and Tetra Tech NUS, EPA's technical consultant. Based upon its modeling effort, EPA and NHDES modified the Settling PRPs' recommendations to include Configuration 5, which was developed as the basis for the conceptual remedial design to address the groundwater contamination in OU2 of the SMWS Site. The difference between Configurations 4 and 5 is the placement of the extraction and injection wells. EPA and NHDES also decided against the use of a recharge gallery. Instead, injection wells were to be used for the recharge of treated groundwater (Gradient, 2006).

The conceptual remedial design approved by EPA consisted of the following elements:

- Three extraction (EW-1 through EW-3) and three injection (IW-1 through IW-3) wells.
- Extraction wells screened to the top of bedrock and located at the core of the plume to minimize clean-up time.
- A water treatment plant to remove contaminants of concern (COC) and dissolved metals, iron and manganese, from groundwater prior to injection.
- Injection wells located at the southern flank of the plume and screened at intervals determined to best enhance flushing of contaminant zones.
- Monitoring well network to monitor performance of remedy on a quarterly basis.

Extracted groundwater was to be pumped to a dedicated GWTP via underground piping equipped with cable leak detection located within secondary containment piping. The GWTP was designed and built as a pre-engineered building with a sanitary sewer connection to the Town of Milford sanitary sewer system. The GWTP design contained all treatment equipment including pumps, piping, process control equipment, as well as flow monitoring, control, and sampling measures, connected to a programmable logic controller (Gradient, 2006).

Although the conceptual design included a metals removal process (no specific technology identified) from the groundwater prior to injection, the Settling PRPs and consultants provided information in accordance with the approved revised *Draft RDI Report* (Gradient, 2002) to replace the metals removal process with a metals sequestering process. EPA and NHDES accepted this change. The treatment system specified to address potential iron and manganese precipitation issues included the addition of a sequestering agent (glycolic and ethylenediaminetetraacetic acid) and a blending polymer (Belclene 200) into extracted groundwater prior to VOC treatment. To address VOC removal, primary and contingency air stripping units were specified and designed to achieve the groundwater clean-up levels. Modeling of the air stripper off-gases determined that no air treatment was necessary to meet the NH 24-hr ambient air limits for PCE. Treated groundwater was to be discharged from each air stripping unit to a wet well and eventually distributed through discharge pumps to the injection well system. Injection piping consisted of separate lines to each of the three injection wells and a fourth discharge line was also included for a potential future discharge (Gradient, 2006).

The 2003 *Draft 100% Remedial Design Report*; (MACTEC, 2003b) was approved by EPA in December 2003, and the *Remedial Action Work Plan* (RAWP) was submitted in September 2003 and revised in January 2004 to address Agency comments (MACTEC, 2004a). The injection and extraction wells were installed in Spring 2003, prior to the approval of the *Draft 100% Remedial Design Report*, to obtain key data required for design completion. The remainder of the system was constructed between February and October of 2004, after approval of the *Draft 100% Remedial Design Report* (Gradient, 2006).

4.2.2.2 Initial Remedy Construction

Construction activities associated with the initial remedy commenced in Spring 2003 and ended in October 2004 (at remedial system start-up). The following subsections describe the construction activities associated with the key components of the initial remedy (Gradient, 2006).

Extraction and Injection Wells

Extraction wells EW-1 through EW-3 and injection wells IW-1 through IW-3 were installed prior to the installation of the other remediation components, to obtain groundwater samples that would be representative of metals influent quality into the proposed GWTP. The well installation was conducted by Dragin Drilling, Inc. under the supervision and oversight of a MACTEC field geologist. Injection and extraction wells are located as shown on Figures 2 and 4. Prior to well construction, test borings were advanced to obtain site-specific lithologic data for proper well screen sizing and to confirm depth to bedrock. Piezometers were also installed in the vicinity of wells for monitoring purposes. Extraction and injection wells were installed with appropriate filter pack and a 10-inch-diameter, stainless steel well screen placed in a 16-inch-diameter borehole. Some difficulties were encountered during development of these wells; however, implementation of multiple techniques over several development events did eventually achieve the desired flow rates. Complete details regarding construction and development are contained in the Interim *Remedial Action Report* issued for OU2 (Gradient, 2006).

Treatment Facility

R.H. White was the general contractor responsible for constructing the OU2 Treatment Plant and installation of mechanical, electrical, instrumentation, heating, ventilation, and air conditioning, plumbing, and treatment equipment necessary for the operation of the 450-gpm groundwater

remediation system. The treatment facility was constructed with a sub-slab electrical conduit and a reinforced steel and concrete foundation and slab, with rigid foundation insulation. The OU2 Treatment Plant building is a pre-engineered metal building furnished by Parkline, Inc. and installed by Construx, Inc. The building is a 28 ft wide, 44 ft long, 16 ft high, Type AL4 building. R.H. White performed the installation of all major treatment equipment which includes air strippers, a chemical storage (sequestering agent)/metering system, and in-line mixing and distribution pumps (Gradient, 2006).

Piping from the extraction wells to the OU2 Treatment Plant is double walled, 8-inch, high-density polyethylene (HDPE), with a leak detection system, whereas the piping from the treatment plant to the injection wells is single-walled, 4-inch, HDPE pipe. Pipe pressure testing was performed about every 500 linear feet of pipe. Pipe bedding material was used in place of soil for backfill. Groundwater is pumped via individual pipes into the OU2 Treatment Plant without equalization of groundwater influent streams prior to treatment. Sample ports inside the building allow collection of influent water samples from each extraction well. In-line flow meters allow verification of extraction rates from each well. Pipes are manifolded into a single pipe and groundwater flows through an in-line static mixer to assure complete mixing is obtained. Control valves distribute flows into each of four shallow tray strippers, and flow meters in the inlet of each stripper provide verification of flow distribution and input signal for the automated controls. As designed, there is no storage or accumulation of groundwater prior to treatment (Gradient, 2006).

The air strippers are low profile cascade tray air strippers, each sized to handle 165 gpm to allow shut down of one stripper for maintenance without impacting the extraction flow rates. Per the initial remedy design, typical operation included four strippers running at 112.5 gpm. The treatment facility is provided with telemetry and a supervisory control and data acquisition system (SCADA) for remote monitoring. Treated groundwater flows via gravity into an effluent sump. Vertically immersed end suction, self-priming pumps transfer the treated groundwater to the injection wells via underground piping (Gradient, 2006).

4.2.2.2.1 Operational Issues Encountered During Remedy Start-up

The initial 30-day startup period for the OU2 remedy began on October 27, 2004. Although the target extraction rate of 450 gpm was initially confirmed, subsequent operational issues were encountered that resulted in reduced extraction rates due to drastic water level increases in addition to the creation of seeps and soil subsidence zones associated with the injection wells and/or vaults. The initial remedial system was shut-down on December 6, 2004, to undergo investigation and analysis of the observed operational issues through the end of 2004 and into January 2005 (Gradient, 2006).

Data collected during the investigation and analysis phase after startup included short-term pump tests, water elevation measurements, water and well-bottom sediment analysis, and biological analyses. The results of data analysis indicated that two of the injection wells were experiencing a diminished ability to infiltrate water due to screen fouling and the other injection well had not been installed properly in addition to fouling. The root cause of fouling was identified as iron precipitate due to failure of the metal sequestering agent to perform as expected. Additionally, water elevation data collected indicated that the thickness of the vadose zone was not as large as expected, which was limiting infiltration and recharge capacity for the aquifer (Gradient, 2006).

Modifications were made to the initial remedial system based upon this analysis including redevelopment/replacement of injection wells; design and implementation of a metals filtration system; and design and installation of a surface water discharge component to the Souhegan River. These modifications were implemented with successful results that ultimately allowed for full-scale operation of the remedy to begin in August 2006 (Gradient, 2006).

Metals Filtration System

Pilot-testing and design activities in 2005 led to implementation of a metals filtration component of the treatment system that included: a hydrogen peroxide addition to oxidize and facilitate metals precipitation prior to entering filters; a sodium hydroxide addition to raise pH and protect filter media; filtration using PureFlow© P-100 media; and, a hydrochloric acid addition to lower the pH prior to discharge to be protective of receiving waters (Gradient, 2006).

Surface Water Discharge

To alleviate some of the demand for infiltration capacity in the injection well system, a temporary (and subsequently permanent) surface water discharge point to the Souhegan River was designed and constructed for the treatment system in 2005. Both systems were designed to handle a maximum flow of 450 gpm, with effluent limitations set based on 7Q10 flow rates, background surface water quality, and Ambient Water Quality Criteria (AWQC). The goal of surface water discharge has been to provide additional discharge capacity for treated groundwater that cannot be infiltrated on-site as the purpose of recharging the system with clean groundwater is intended to enhance the selected extraction and treatment remedy (Gradient, 2006).

4.3 SYSTEM OPERATIONS/OPERATIONS AND MAINTENANCE (O&M)

4.3.1 OU1

This section describes the operation of each remediation component implemented at OU1 including:

- Institutional controls for soil and groundwater use
- SVE/AS
- Groundwater extraction and treatment
- Barrier wall
- ISCO
- Vadose zone soil treatment

4.3.1.1 Institutional Controls

Institutional controls are important in maintaining the protectiveness of the remedy until the cleanup is completed by limiting exposure to contaminated materials at the SMWS Site. The former OK Tool Source Area portion of OU1 is zoned for industrial use, but the portion of OU1 located north of the Souhegan River is zoned residential. The Town of Milford has indicated that long-range plans for the OU1 area south of the Souhegan River will remain industrial/commercial. The former OK Tool Source Area is fenced and the fence is locked when personnel are not on-site. The fence is maintained, approximately 8 ft tall, with barbed wire at the top, and is shown on Figure 6. All visitors to the OU1 portion of the SMWS Site are required

to report to the GWTP office and sign in the visitors log book. Visitors are also required to sign out upon exit.

As shown on Figure 1, OU1 encompasses all or part of eight lots of record in the Town of Milford. Two lots are in the residential zone north of the Souhegan River (Tax Map Lots 7-1 and 4-41) and six lots south of the Souhegan River in the industrial/commercial zone (Tax Map Lots 13-3-1, 13-3, 13-4, 13-5, 7-3, and 14-1). Town of Milford Tax Maps C2, C3, D2, and D3 showing the lot locations are provided in Attachment 6. Owner and property use information is presented below:

- Tax Map/Lot 7-1 – Cleaves, William W Trustee: Undeveloped conservation land.
- Tax Map/Lot 4-41 – NH Fish and Game Department: Undeveloped land used for farming and recreational purposes.
- Tax Map/Lot 13-3-1 – New Bridge Trust, Inc.: Primarily used for commercial purposes including a hair salon and real estate broker.
- Tax Map/Lot 13-3 – NHDES: Location of the former OK Tool Company, and the source area encompassed by the barrier wall.
- Tax Map/Lot 13-4 – NHDES: Location of the current GWTP for OU1.
- Tax Map/Lot 13-5 – Town of Milford: Primarily used for recreational purposes with large fields and a baseball diamond. This property is also the location of the former police department building.
- Tax Map/Lot 7-3 – Multiple Owners: Location of Milhaven Parks, LLC, mobile home park, although all residential properties are located within OU2.
- Tax Map/Lot 14-1 – Melendy Limited Partnership: Primarily used for residential and commercial purposes.

There is no municipal ordinance or GMZ to prohibit the drilling of water supply wells in OU1. The Town of Milford's current zoning ordinance includes a groundwater protection district that encompasses OU1 and OU2. However, the ordinance does not specifically prohibit well development within the groundwater protection district. The ROD indicated that deed notices should be recorded. To date, no institutional controls have been implemented.

4.3.1.2 Soil Vapor Extraction and Air Sparge

In February 2008, the SVE system was started at the request of EPA and run for a period of approximately 1 month. Influent VOC concentrations ranged from 2.2 ppm to 0.8 ppm during the trial period. Based on the trial period and the sporadic history of operation, it was decided that both the SVE and AS systems were not removing a significant volume of contaminant mass from within the barrier wall. Under the direction of EPA and NHDES, the systems were shut down and both the SVE and AS systems were permanently taken offline in 2008 when the SVE blower and AS compressor were removed during renovations to the GWTP at OU1. A portion of the SVE piping was removed and the ends capped off during the leach field vadose zone soil excavation conducted in August 2008.

4.3.1.3 Groundwater Extraction System

Since 2008, groundwater was primarily extracted from interior extraction wells IW-01A and IW-02A via submersible pumps and directed to two equalization tanks located inside the GWTP. The combined pumping rates have fluctuated between 15 gpm and 30 gpm.

The intent of the interior extraction wells is to maintain an inward and/or upward hydraulic gradient to ensure hydraulic isolation of the contaminant mass within the barrier, preventing release of contaminants from the containment structure. During system design, it was estimated that leakage through the wall could occur at a rate of approximately 1 gpm with the presence of a 1-ft gradient across the wall. Maintaining an inward gradient is an important component of the OU1 remediation effort. Although lateral migration of impacted groundwater is limited by the slurry wall, based on water level measurements conducted by USGS, “the mechanism for flow between the interior and exterior areas is likely through the fractured bedrock, and that the bedrock is hydraulically connected to the overburden” (*SIR 2006-5083 Report,* USGS, 2006). Gradients between the overburden and bedrock within the slurry wall have been observed to switch from upward (preferred) to downward when groundwater pumping within the slurry wall ceases or is insufficient.

Currently, pumping rates from the interior extraction wells are maintained at less than maximum yields to minimize the potential to draw in $NaMnO_4$ from previous ISCO injections. A balance is therefore maintained to maximize gradients without causing the pumps to cycle or to draw

$NaMnO_4$ into the plant. Extraction well IW-01A was shut down twice for a short period of time in August and September 2010, when $NaMnO_4$ was observed in the influent from this well.

Groundwater extraction from the exterior extraction wells was discontinued in April 2007, because VOC concentrations were approaching the interim cleanup levels in most of the exterior monitoring wells. However, at times during 2010, the reduced extraction rates from the interior extraction wells did not provide the minimum volume to sufficiently operate the GWTP in continuous automatic mode. To generate the volume of water needed, additional groundwater was extracted from exterior wells EW-01 or EW-02. Additional details regarding the operation of the extraction wells during 2010 is provided in Attachment 1, the *2010 Annual Report, Savage Municipal Water Supply Superfund Site OU1* (WESTON, 2011).

4.3.1.3.1 Response of Extraction Wells to Pumping

Hydrographs for the operation of the extraction wells in 2010 included in Attachment 1 show that water levels within the slurry wall increased gradually over the course of the year. Seasonal changes in the hydrographs for 2010 reflect frequent adjustments to the extraction rates from well IW-1A, as well as precipitation, recharge, and Souhegan River stages. Extraction rates from within the barrier wall were adjusted frequently throughout the year to meet the objective of maintaining the minimum rate necessary to result in an inward hydraulic gradient across the barrier wall. Historical water level data from the extraction wells were clearly influenced by seasonal changes of river levels and groundwater recharge. These changes were historically characterized by a broadly based rise of water levels in the spring followed by declining levels through the summer. Observations regarding specific wells during 2010 are summarized below:

- IW-01A: Water levels at IW-01A show significant fluctuation following rain events and an overall increasing trend over the course of the year. It is difficult to observe significant seasonal trends in the water level data due to the regularly changing rates of groundwater extraction from the well. However, during the initial 5 months of the year, when extraction rates from IW-1A were relatively consistent, a broadly based rise in water levels can be observed which correlates with seasonal effects of increased recharge. Extraction well IW-1A was shut down on two occasions during 2010 when $NaMnO_4$ was observed in the IW-1A influent in August and September. Increases in water table elevations were observed during periods that groundwater was not being extracted from IW-1A.

- IW-02A: The hydrograph for IW-02A illustrates a similar groundwater elevation pattern to that of IW-01A. Groundwater was continuously extracted from IW-2A with the exception of a short period of time at the end of the year when both well pumps were shut down to monitor the recovery of groundwater elevations to static levels. The hydrograph indicates that water levels in IW-02A were significantly influenced by the changing extraction rates from IW-01A.

- EW-01 and EW-02: Groundwater was extracted alternately from one of the two exterior extraction wells, EW-01 and EW-02, between August 2010 and December 2010 because the volume being extracted from within the barrier wall was not sufficient to operate the treatment plant in continuous automatic mode. However, the pressure transducers in both wells were malfunctioning during this period and water level data are not available.

In conclusion, water levels (piezometric heads) in the aquifer system have historically responded broadly and relatively strongly to seasonal changes of recharge. This has been the case inside and outside of the barrier wall. However, the regular fluctuation of groundwater extraction rates during 2010 makes it difficult to view seasonal effects. The influence of the interior extraction wells (IW-01A and IW-02A) extends to the barrier wall and to a much lesser degree to wells immediately outside the barrier wall. However, this influence did not mask seasonal changes of water levels.

4.3.1.4 Reinjection System

Interior injection wells RW-01 and RW-02 were used only rarely between startup of the system in 1999 and 2001. Use of these interior injection wells was hampered by repeated high water alarms that were likely related to the high groundwater levels prevalent inside the containment area. Exterior injection well RW-03 was used only during brief periods in 2000 and again in 2003. Since 2001, the recharge chamber has been used as the primary discharge mechanism for treated groundwater from the treatment plant, with the exception of the times when treated effluent was used to make up $KMnO_4$ or $NaMnO_4$ solutions for injection into wells during the ISCO program, or when it was used for drilling operations. Clogging and fouling of the recharge chamber in August 2005 resulted in a drop in capacity from 100 gpm or greater to approximately 70 gpm, requiring a reduction in groundwater extraction rates at that time. The recharge chamber was excavated and pressure washed and additional bedding material was placed to expand the infiltration area. When the chamber was returned to service in October 2005, the capacity was estimated to be greater than 150 gpm. The recharge chamber was

drained and inspected in 2010, and found to be in good condition, with thin deposits of silt that did not appear to impact its function.

Testing of exterior recharge well RW-03 in 2003 indicated that its capacity was determined to be as high as 30 gpm, but could be limited by high ambient water levels. Well RW-03 may be a potential backup discharge location if the recharge chamber requires shut down for maintenance in the future. However, other than a brief period in July 2005, this recharge well has not been used since 2003. Testing in 2011 indicated that currently this recharge well has reduced capacity and would need to be redeveloped before it can be used for GWTP discharges.

4.3.1.4.1 Solvent Release to Recharge Chamber

In November 2000, and possibly several other times, solvent that had been recovered by the carbon regeneration system and stored on-site was released to the recharge chamber, as documented in the RSE (EPA, 2001b). The release was the result of the carbon regeneration unit overflowing the 1,000-gallon solvent-storage tank, which held 66 gallons of solvent (CDM, November 2001, p.3-1). The solvent was returned to the treatment system through a floor drain. The tray aerators are not designed to treat water at such high concentrations, and, according to the RSE, "significant masses of PCE (likely including free phase PCE) were discharged to the recharge chamber. The effluent sample collected on December 1, 2000, contained 13,000 ppb PCE. If the tray aerator is estimated to achieve 95% removal, the tray aerator influent is estimated to have been 260 milligrams per liter (mg/L) or 260,000 ppb."

The extent of these releases has not been determined; however, the releases may have caused observed increases of PCE concentrations at the following shallow wells in the vicinity of the recharge chamber: PW-12S, PW-12M, PW-13S, and PW-13M, as summarized on Table 3.

The increases began in November 2000 at PW-12S, the well closest to the recharge chamber. Increases were first observed at wells PW-12M and MW-13S in May 2001, at well PW-13M in November 2001, and in PW-14M in November 2002. The increases were more abrupt and were approximately two orders of magnitude higher in concentration at the PW-12 wells. The PCE concentrations at the PW-12 wells have since declined to below laboratory detection limits. The PCE concentration increases at PW-13S, PW-13M, and PW-14M were more gradual and,

although concentrations have been reduced, continue to exhibit concentrations above the maximum contaminant level (MCL).

After the discovery of the discharge, measures were taken to prevent such overflows from occurring, including sealing the drain valve to the solvent tank, isolating the sight-level gauge to prevent leakage, and carbon was only regenerated when necessary and only when personnel were on-site.

4.3.1.5 Barrier Wall

The slurry wall containment system was designed to provide effective source control in conjunction with operation of the groundwater remediation system. Performance of the containment system requires extraction of a sufficient volume of water to create an inward hydraulic gradient across the slurry wall in the overburden and an upward gradient between the bedrock and overburden within the containment structure. This system, in addition to treating impacted groundwater from inside the wall, contained the source area and limited the potential for migration beyond the boundary of the containment area. In addition, some of the extraction and monitoring wells were installed so the screen extends across the deep overburden and into the shallow bedrock, which could provide a potential contaminant migration pathway into the bedrock should insufficient groundwater extraction occur, resulting in reversed gradients. Increases in contaminant concentrations were observed in bedrock and overburden monitoring wells outside and downgradient from the slurry wall following, and possibly related to, shutdown of the treatment plant for 3 months in 2005 as described in the *2005-2006 Annual Report* (Veolia, 2006). The minimum pumping rate required to maintain inward/upward gradients was estimated by USGS to be 14 gpm, but could possibly be as high as 45 gpm during periods of high rainfall (Harte, 2008).

Hydraulic gradients across the slurry wall and between the overburden and bedrock aquifers are monitored via well couplets along the eastern, or downgradient, edge of the barrier wall. Gradient monitoring at these well couplets is conducted on a weekly basis at OU1 to ensure the pumping rate is adequate to maintain the correct gradient direction. During ISCO injections, the pumping rate from interior extraction wells was adjusted to compensate for the volume of solution injected and gradient monitoring was conducted twice daily. Graphs illustrating the

gradient monitoring data are included in Appendix E of Attachment 1, the *2010 Annual Report, Savage Municipal Water Supply Superfund Site OU1* (WESTON, 2011).

4.3.1.6 Tray Aerators

The tray aerators are currently operated individually on alternating months. When the operating tray aerator is taken out of service for cleaning at the end of one period of operation, the other tray aerator is put into service.

The tray aerator air discharge was previously routed to a preheater, then to a vapor phase carbon unit for treatment before being discharged to the atmosphere. After approval from the NH ARD in April 2009, the system was modified and currently discharges directly to the atmosphere without treatment.

4.3.1.7 In-Situ Treatment of Dense nonaqueous Phase Liquid

Pilot Test

In-situ treatment of DNAPL began in September 2003 with an ISCO pilot test using the oxidant $KMnO_4$. The objectives of the pilot test were to determine the effectiveness of the injection/extraction system, quantify contaminant degradation efficiencies under field conditions including oxidant demand and contaminant rebound, and to identify potential problems for subsequent ISCO phases. Injections were performed in select Idaho National Engineering and Environmental Laboratory (INEEL) field wells and included the injection of approximately 8,400 lbs of $KMnO_4$ (NA Water Systems, 2004).

In Situ Chemical Oxidation Phase II

The second phase of the ISCO program was conducted in October 2004 and included the first full scale injection of $KMnO_4$. The ISCO program targeted the INEEL field area and select SVE wells with an objective of reducing DNAPL and PCE concentrations in groundwater within the barrier wall and measuring its success. Phase II consisted of the injection of approximately 24,000 lbs of $KMnO_4$ into four INEEL field wells and four SVE wells. Groundwater monitoring in the injection wells identified contaminant rebound following both rounds of injections indicating that a significant volume of non-aqueous phase VOC contamination may remain in the subsurface (Veolia, 2006).

In Situ Chemical Oxidation Phase III

An aggressive ISCO program using $NaMnO_4$ was implemented in October and November 2008. The 2008 ISCO program targeted deeper areas of impacted groundwater within the barrier wall, and was designed to layer the deep overburden aquifer with $NaMnO_4$, treat high levels of contamination at the base of the aquifer, and prevent impacted groundwater from entering the shallow bedrock aquifer. New injection points were installed to facilitate the injection of $NaMnO_4$ into the deep overburden and the existing groundwater extraction system was modified to facilitate groundwater extraction from the shallow overburden aquifer within the barrier wall. Groundwater was extracted at reduced rates from the shallow overburden aquifer during and after injections to decrease the potential of drawing $NaMnO_4$ into the treatment plant. Approximately 112,000 lbs of 40% $NaMnO_4$ solution were injected during Phase III of the ISCO program into 14 injection points and 7 existing wells. The 40% solution was diluted to a 3% solution during the injections to ensure effective delivery of the oxidant to the aquifer and not displace a significant volume of contaminated groundwater (WESTON, 2010a).

In Situ Chemical Oxidation Phase IV

The 2009 and 2010 ISCO program targeted areas of contaminant rebound in the deep overburden aquifer in addition to targeting shallow source areas in western areas within the barrier wall. A series of new injection points were installed targeting shallow source areas and zones of lower transmissivity, which may not have received adequate contact time with the oxidant in previous injections and may serve as continual source areas by way of reverse matrix diffusion. Approximately 149,000 lbs of 40% $NaMnO_4$, diluted to a 3% solution, were injected into 28 injection points and 8 existing wells during October and November 2009 (Weston, 2010b).

The March 2010 ISCO program targeted higher concentration source areas which had exhibited significant contaminant rebound following the previous injection rounds. Approximately 46,000 lbs of 40% $NaMnO_4$, diluted to a 20% solution, were injected into six injection points and six existing wells during March 2010. Since the March 2010 injections, monthly $NaMnO_4$ monitoring has been conducted at all of the interior monitoring and injection wells to evaluate the persistence of the oxidant at OU1. The 2010 ISCO injections are discussed in the *2010 Annual Report* for OU1 included as Attachment 1 (Weston, 2011).

4.3.1.8 Vadose Zone Soil Treatment

As described in Subsection 4.2.1.2.6, two ex situ chemical oxidation treatment cells were constructed on-site in 2009 to treat contaminated vadose soils from the former leach field and monitoring well PW-22 area. A combination of chemical treatment with ozone and peroxide and SVE was employed to oxidize the contaminants and collect vapors from the treatment cells. Excavation of the contaminated soil and construction of the treatment cells was performed between July 13 and August 3, 2009. Startup of operation of the chemical oxidation and SVE system within the treatment cells occurred on August 3, 2009. The system was shutdown on September 3, 2009, and confirmation samples were collected. Confirmation sample analytical results indicated that the NHDES Soil Remediation Standards (SRS) were attained in all soil samples. Dismantling of the system, backfilling of treated soil, and demobilization of equipment occurred between September 28 and October 2, 2009.

4.3.1.9 System Operation and Maintenance

NHDES contracted with CDM to operate the system from March 1999 until November 2001, at which time system operations were contracted to US Filter Operating Services (USFOS) (also known as North American Water Systems and Veolia). In January 2008, NHDES contracted WESTON to take responsibility for O&M from USFOS. WESTON's Scope of Services for O&M at OU1 is to operate the groundwater remediation system as necessary throughout the year to limit transport of contaminant mass and/or to maintain an inward/upward gradient inside the barrier wall, including minor plant optimization, as necessary. Ancillary services consist of monitoring and adjustment of facility operations, maintaining the site remediation database, and other work items as follows:

- Monitor collection and pumping of groundwater from the groundwater extraction wells to the treatment plant for proper operation.
- Monitor the influent groundwater quality.
- Monitor air stripping tray operation, contaminant removal, and flow rates.
- Adjust process flow rate and related operational parameters as necessary to improve contaminant removal or optimize preferential gradients.
- Monitor performance of recharge chambers.

- Monitor air stripper off-gas emissions to ensure compliance with all applicable regulated toxic air pollutants emission standards.
- Operate and maintain support systems including standby power generator.
- Provide routine equipment and system checks and maintenance.
- Continue to implement the long-term monitoring plan and provide operational data to supplement groundwater sampling and analysis by the State to track the performance of the remedial process.
- Conduct monthly permanganate monitoring.
- Conduct quarterly groundwater elevation surveys.
- Provide monthly O&M data, analytical test results, and operating reports to the State.
- Provide general housekeeping and maintenance of the building and grounds including snow removal and lawn mowing.
- Review subcontractor and supplier invoices associated with O&M prior to payment.
- Provide property insurance.
- Provide budget monitoring and reporting.
- Coordinate monthly off-site laboratory analysis of influent and effluent water samples.

4.3.1.10 Evaluation of Remedial Systems

Several evaluations of OU1 and its remedial system have been conducted since the plant was initially started in 1999. These evaluations investigated the efficiency of the remedial systems, identified potential data gaps, and provided recommendations for methods to improve system efficiency and reduce the estimated time needed to reach interim cleanup levels. A discussion and summary of these evaluations is included below.

4.3.1.10.1 Remedial System Evaluation

A RSE was conducted in March 2001, as part of a project conducted by EPA Technology Innovation Office, and Office of Emergency and Remedial Response. The objective of the project was to conduct RSEs of pump-and-treat systems at Superfund sites that are “fund-lead” (i.e., financed by EPA). The RSE resulted in the several recommendations to improve system

effectiveness, including: reconfiguring the system such that recovered solvent is disposed of off-site thereby reducing the potential for accidental releases in the future; evaluating the effectiveness of capture provided by extraction wells located outside the barrier wall; relocating the recharge points beyond the influence of the extraction wells;, verifying the effectiveness of the slurry wall; and analyzing monthly operations data. Additional recommendations were made to reduce the life-cycle costs of the system including: discontinuing the steam regeneration of the carbon system and replacing carbon when it is spent; reducing operator labor; and replacing the existing blower for the SVE system with a smaller, more efficient one. These savings would more than offset the extra costs associated with recommendations to improve the system effectiveness.

Finally, the RSE identified the need to clarify an exit strategy for the OU1 system, and the RSE team recommended a more aggressive source removal, possibly through pumping from additional extraction wells.

4.3.1.10.2 Evaluation of the Remedy

An *Evaluation of the Remedy Report* was completed by WESTON in 2007. The evaluation involved reviewing data regarding performance of the remedy at OU1 and assessing the progress that has been made toward attainment of the interim cleanup levels specified in the 1991 ROD and 1997 ESD. The objective of the study was to identify potential strategies to expedite cleanup and thereby minimize long-term O&M costs at OU1.

The evaluation revealed that some components of the remedy were performing well, while others were minimally effective. A description of the findings is discussed below.

4.3.1.10.2.1 PW-14 Area

Low permeability lenses in the vicinity of well PW-14M may have retained high concentrations of contaminants outside of the barrier wall. It appeared that the groundwater flow induced by the groundwater extraction system had largely bypassed the low permeability lenses in the vicinity of PW-14M, thereby causing recalcitrance to remediation in this limited area. However, since the extraction of groundwater from the exterior wells was discontinued in 2007, contaminant concentrations in PW-14M have been on a steady downward trend from 1,400 μg/L in February

2007 to 216 µg/L in November 2010. It is likely that normal groundwater flow patterns have resumed and that groundwater is now flowing through the low permeability lenses, rather than bypassing them.

4.3.1.10.2.2 Bedrock Investigation

The minimal amount of water quality and hydrologic data available regarding the deep bedrock aquifer within OU1, and the contaminant concentrations observed in existing bedrock monitoring wells were identified as significant data gaps in evaluating the ability of the remedy to meet interim cleanup levels in the bedrock aquifer in the long-term. The report recommended conducting a subsurface investigation to further characterize and develop a conceptual site model for the bedrock aquifer.

4.3.1.10.2.3 Treatment System Configuration

The report concluded that it is unlikely pump and treat would be able to achieve interim cleanup levels inside the barrier wall within a reasonable time frame based on the estimated contaminant mass remaining. When operated properly, the extraction/reinjection system is capable of maintaining inward and upward gradients inside the barrier wall and capturing dissolved contaminants in the transmissive zones. However, issues with maintenance and a seasonally high water table could occasionally result in the reversal of vertical.

The evaluation also reaffirmed the fact that use of the SVE system was impractical at OU1 due to the limited area and depth that can be remediated and the high water table problems that limit its operation. In addition, the report concluded that there was insufficient data to confirm or disprove the existence of a continuing source of chlorinated hydrocarbons in the unsaturated and/or shallow saturated zone soils in the northeast area inside the barrier wall. Shallow soil and groundwater sampling to better characterize this potential source was recommended.

4.3.1.10.2.4 In Situ Chemical Oxidation

In situ testing indicated that injection of permanganate could be an effective technology to destroy contaminant mass inside the barrier wall. However, several issues were identified in order to provide effective treatment of the remaining mass of sorbed contaminant that is inferred to be the ongoing source of groundwater contamination at OU1. The presence of soil layers and

lenses with varying hydraulic conductivities create preferential groundwater flow pathways inside the barrier wall. Targeting layers of low permeability for injection wells and minimizing pumping of the interior extraction wells during implementation of ISCO would better allow the oxidant to penetrate the low permeability lenses. However, decreasing extraction rates could result in downward vertical gradients that could force contaminants into bedrock. Therefore, in addition to effectively targeting injections to the contaminated low permeability areas, a delicate hydraulic balance would need to be maintained for ISCO technology to be successful at OU1.

4.3.1.10.3 Treatment Plant Renovations

The 2001 RSE included several recommendations for the treatment facility which could improve the effectiveness of the remedy for OU1. Some of the recommendations related to improvements to certain treatment system components which would improve the efficiency of the plant and in turn reduce long-term O&M costs at OU1. Based on the recommendations and an evaluation of the boiler and ventilation system performed by Rist-Frost-Shumway, a subcontractor to WESTON, renovations to the treatment facility were performed in September and October 2008. Renovations included the removal of the existing steam boilers, installation of high efficiency water boilers, removal of the SVE air/water separator, blower, and all associated piping for the system located in the blower room, removal of the AS compressor and associated piping, and finally a carbon vessel by-pass system was installed to allow air emissions from the tray aerators to be discharged directly to the atmosphere. However, the carbon vessel by-pass system was not utilized until April 2009 when approval for direct discharge was received from NH ARD.

Figures 6-1 and 6-2 of the *2010 Annual Report* included as Attachment 1, illustrate the monthly utility usage for natural gas and electricity at the treatment facility for OU1. Monthly electricity usage data from Public Service of NH is available for 2007 through 2010, and natural gas usage data from National Grid is available for 2004 through 2010. Based on usage data from Public Service of NH for 2007 to 2010 and from National Grid between 2004 and 2010, as a result of the treatment plant modifications the annual electricity usage was reduced by approximately 20% and natural gas usage at the plant was reduced by approximately 80%.

4.3.2 OU2

4.3.2.1 Institutional Controls

Institutional controls are important in maintaining the protectiveness of the remedy by limiting exposure to contaminated materials at the SMWS Site via administrative control mechanisms. Operable Unit 2 is zoned for industrial, integrated commercial and industrial, and residential uses. The Town of Milford has indicated that long-range plans for the area anticipate that land use will remain industrial/commercial. Parts of OU2 are fenced and/or have restricted access, but much of OU2, particularly the portion located north of Elm Street, has no access restrictions.

There is no municipal ordinance or GMZ to prohibit the drilling of water supply wells in OU2, although portions of OU2 are subject to an agricultural easement. The Town of Milford's current zoning ordinance includes a groundwater protection district that encompasses OU1 and OU2. However, the ordinance does not specifically prohibit well development within the groundwater protection district. The ROD indicated that deed notices should be recorded for all affected properties, but this has not been implemented.

4.3.2.2 System Operation and Maintenance

Design, construction, and O&M phases of the OU2 treatment system have been performed by five different contractors hired by the settling PRPs. The initial remedial system design was performed by MACTEC, the initial remedial system was constructed by R.H. White Constriction Co., Inc., modifications to the initial remedy were made by GeoSyntec Consultants, current O&M is being completed by GeoInsight, and the overall project coordinator for the OU2 treatment system has been Gradient.

The remediation system was initially operated from October to December 2004 and was restarted in September 2005. The system has, for the most part, operated continuously since the September 2005 startup. The O&M contractor responds to alarms generated via telemetry and a SCADA system. The O&M contractor also conducts site visits and inspections at least once a week. In addition, system operations are also monitored remotely by logging into the SCADA system (Gradient, 2006).

As part of the routine system operation, influent and effluent samples are collected to ensure compliance with applicable performance standards. These performance standards include: ROD interim groundwater clean-up levels (based on MCLs specified in the Safe Drinking Water Act (SDWA) and equivalent to NH groundwater quality standards), NHDES effluent limits set for the surface water discharge, and Milford publicly owned treatment works discharge criteria required for filter backwash. As part of routine system operation, results of surface water discharge sampling, monitoring, testing, and analysis are summarized bi-weekly on the Discharge Monitoring Report form provided by NHDES in the permit issued for the permanent surface water discharge on December 30, 2005. The form is kept at the treatment facility and is available for EPA and NHDES inspection when required (Gradient, 2006).

The O&M contractor also performs system maintenance consisting of: periodic cleaning of extraction and injection wells, water conveyance lines that convey water to and from the GWTP, and monitoring and maintenance of the key unit processes at the GWTP (e.g., air stripper, metal filtration units) (Gradient, 2006).

Additional system O&M details are included in the *Operation and Maintenance Plan* (GeoInsight, 2010). System components are evaluated periodically to determine if adjustments need to be made to system O&M. A progress report is submitted monthly to NHDES in accordance with the CD to document all activities taken by the settling PRPs to achieve remedial goals for OU2. Remedy performance monitoring has been continuously conducted as described below in Subsection 4.4.3.

In December 2008, at the request of EPA, a comprehensive monitoring well inspection program was implemented to review and document the condition of all monitoring wells at OU2. Monitoring well locations, construction details, including Global Positioning System coordinates and well inspection details, were summarized in the *Annual Groundwater Quality Monitoring Report – 2008* (Gradient, 2009). Of 122 known monitoring locations in OU2, 5 monitoring wells were damaged and not functional, 7 monitoring wells were functional, but required minor repairs, and 16 monitoring wells could not be located.

In June and November 2009, a second comprehensive monitoring well inspection program was performed to review and document the condition of all monitoring wells at OU2. The second

inspection program found that 8 monitoring wells were damaged and not functional, 9 monitoring wells were functional, but required minor repairs, and 11 monitoring wells could not be located (Gradient, 2010b). These wells were either repaired or relocated prior to the next round of groundwater monitoring.

4.4 REMEDY PERFORMANCE MONITORING

4.4.1 Performance Standards

The remedy performance standards are provided in Table 4. System performance standards include the interim groundwater cleanup levels for both OU1 and OU2, and the discharge criteria for the OU2 treatment system. The interim groundwater cleanup levels established in the ROD were based on federal drinking water criteria or risk-based criteria, as appropriate. Routine groundwater quality and treatment system monitoring is performed at both OUs to evaluate progress towards achieving and maintaining these performance standards.

Ongoing remedy monitoring in both OUs tracks contaminants with interim cleanup levels specified in the 1991 ROD, in addition to other potential COCs within OU1 and/or OU2 which include cis-1,2-dichloroethene (cis-1,2-DCE), 1,4-dioxane, and vinyl chloride. A summary of the VOC contaminants detected in monitoring wells in OU1 and OU2, and the maximum detected concentrations compared to ROD interim cleanup levels is provided in Table 5. Some of the contaminants identified in the ROD, including arsenic, antimony, beryllium, and 1,1-DCA have newly promulgated federal and/or state interim cleanup levels which are lower than those originally identified in the ROD. These modifications are discussed in more detail under the technical assessment for changes to site contaminants and ARARs in Subsections 7.2.3 and 7.2.4, respectively.

4.4.2 OU1

The treated effluent from the OU1 treatment plant is discharged to groundwater via the recharge chamber. Therefore, the groundwater interim cleanup levels specified in the ROD serve as the discharge standards for the treatment plant effluent. Groundwater monitoring events conducted within OU1 have recently identified the contaminants cis-1,2-DCE and vinyl chloride at concentrations greater than the NHDES AGQS for these compounds. Although neither of these

compounds was included as an initial site COCs, results are reported and compared to the NHDES standard as all contaminants at the SMWS Site are ultimately required to be restored to drinking water conditions.

4.4.3 OU2

In addition to the interim groundwater cleanup levels, the OU2 remedy must also comply with effluent limits issued by NHDES for the surface water discharge and the Milford publicly owned treatment works for the metals filtration backwash. Through 2010, these limits were being monitored through bi-weekly treatment system sampling. To date, the system has been consistently effective in attaining these water treatment-related performance standards.

The *Project Operations Plan,* for OU2 specifies the scope of the remedy performance monitoring program. When originally established in 2004, the monitoring program included: monitoring of groundwater and surface water elevations, and quarterly groundwater quality sampling at 69 monitoring wells (MACTEC, 2004b and Gradient, 2004). In 2008, following two full years of remedy monitoring, groundwater quality sampling frequency was reduced from quarterly to semi-annually (Gradient, 2008). By fall 2010, the annual monitoring well network had been reduced to 51 wells, 21 of which were sampled semi-annually. However, in response to EPA comments and a meeting held on April 16, 2010 with EPA, NHDES, and USGS representatives to discuss those comments, 13 monitoring wells were added to the "typical" annual monitoring well network to support the data requirements of the upcoming Five-Year Review bringing the total number of monitoring wells monitored in fall 2010 to 64. The fall 2010 annual groundwater quality sampling round also included 1,4-dioxane sampling at 21 selected wells (Gradient, 2011).

Table 6 summarizes past groundwater quality monitoring activities for OU2 with minor adjustments to the planned number of wells based on specific data requirements and/or field conditions, which account for some additional sampling and the fact that some wells have been destroyed, damaged, and/or could not be located.

Annual groundwater monitoring reports for OU2 indicate that from startup of the groundwater remediation system in August 2004 up until December 2010, the OU2 groundwater remediation

system had removed approximately 323 kilograms (kg) of PCE from the subsurface. Total PCE mass in the aquifer was estimated to have decreased from 1,830 to 296 kg during this time (Gradient, 2011). Table 7 summarizes PCE mass reduction reported for OU2.

Based on numerical groundwater and contaminant fate and transport modeling results presented in the *RDI*(Gradient, 2006), Gradient has predicted that it will take 16 years of active system operation to achieve the specified clean-up levels for a majority of OU2, and another 22 years of monitored natural attenuation to achieve clean-up levels for the entire OU2. Groundwater quality data is currently being collected on a semi-annual basis to monitor the progress towards these goals. Through 2010, 15 rounds of data have been collected and assessed to gauge the progress towards cleanup at OU2.

Conclusions drawn from assessing groundwater quality at OU2 indicates that remedial progress is being achieved at approximately the same rate as predicted by the numerical groundwater and contaminant fate and transport model predicted in the *RDI*. However, from January 2001 through December 2010, the model has consistently overestimated contaminant mass remaining as compared to the estimate of mass remaining from actual groundwater data (Gradient, 2011). USGS conducted an evaluation of the model used by Gradient to predict contaminant fate and transport to assess its reliability as a predictive tool. USGS recommended several improvements to the model that, once completed, would allow the model to be used effectively to test whether operational changes are warranted at OU2 to expedite the remedy (see Attachment 9).

4.5 OPERATION AND MAINTENANCE COSTS

In the ROD, the estimation of O&M costs for the selected remedy were combined for OU1 and OU2 and based on:

- Pumping from three locations in the plume, the beginning, middle and the end.
- Two treatment plants located at the beginning and the middle of the plume, using air stripping and ultraviolet oxidation as cleanup technologies.
- Natural attenuation and institutional controls.

The time needed to attain cleanup levels was estimated between 15 and 60 years. In the ROD, the remedy Capital Cost was estimated at $2.4 million, the annual O&M was estimated at

$1.4 million per year, and the 1991 present worth cost (based on a 30-year period) was estimated at $15.5 million. The estimate of O&M costs included operation of the groundwater treatment, monitoring well maintenance, general site maintenance, and off-site laboratory analysis.

Further developments at the SMWS Site, such as confirmation of the presence of DNAPL in OU1, as described in the ESD, resulted in changes to the selected remedy and the assumptions used to estimate O&M costs. The revised estimate of the present worth cost for capital and 30 years of O&M presented in the ESD for the modified remedy was $8.2 million. Actual capital costs and projected O&M costs for each OU based upon remedial design/remedial action implementation is discussed below, while variations in actual annual O&M costs are discussed in Section 7 regarding the technical assessment of the implemented remedy (Question A).

4.5.1 OU1

Actual project costs for OU1 remedial actions and O&M through December 2010 were as follows:

- Remedial System Capital Costs: Including demolition of former OK Tool building and Olympia Torch Restaurant, treatment plant construction, slurry wall construction, treatment system construction (AS, SVE, groundwater injection/extraction) - $5,171,000
- Remedial System Projected Annual O&M Costs: $170,000 (CDM, 1996)
- Remedial Action Costs: Former OK Tool leach field and PW-22 area shallow vadose zone soil removal – $702,000
- Remedial Action Costs: ISCO Program – $1,470,000
- Remedial System/Treatment Plant Efficiency Upgrades - $95,000

A detailed breakdown of the annual plant O&M costs is provided in Table 8. As shown on Table 8, the actual O&M costs for each year of operation prior to 2009 exceed the originally projected annual cost. The efficiency upgrades performed at the GWTP in 2008 resulted in a significant reduction in annual O&M costs in 2009 and 2010. Implementation of ISCO inside the barrier wall resulted in destruction of a significant amount of contaminant mass which will result in expediting attainment of remedial goals at the entire SMWS Site. However, an estimate of the reduction in the number of years of O&M or long-term O&M costs is not possible at this time.

4.5.2 OU2

Estimated project costs are provided as follows:

- Remedial System Capital Costs: $3,130,900
- Remedial System Projected Annual O&M Costs: $507,000

A detailed breakdown of these costs is provided in the Interim *Remedial Action Report* issued for OU2 (Gradient, 2006).

5. PROGRESS SINCE THE LAST REVIEW

This is the First Five-Year Review for the SMWS Site.

6. FIVE-YEAR REVIEW PROCESS

6.1 NOTIFICATION OF POTENTIALLY-INTERESTED PARTIES OF THE START OF THE REVIEW

The EPA issued a press release on February 17, 2011, announcing the start of the Five-Year Review for the SMWS Site. The press release is included in Attachment 7.

6.2 IDENTIFICATION OF THE FIVE-YEAR REVIEW TEAM MEMBERS

EPA Region I, through a cooperative agreement with NHDES, contracted WESTON to support preparation of portions of this Five-Year Review. The WESTON Five-Year Review team included staff with expertise in hydrogeology, risk assessment, and plant operations. The Five-Year Review Team was led by Richard Hull of EPA, other EPA members with expertise in geology and hydrology (Steve Mangion), risk assessment (Margaret McDonough, Rick Suggatt), legal issues (Rona Gregory), and Quality Assurance (Charles Porfert), and Robin Mongeon of NHDES.

6.3 DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant documents. Controlling documents such as the ROD, ESD, and CDs that have been established for the SMWS Site were reviewed in addition to technical documents such as preliminary investigation reports, the RI/FS, remedial design reports, interim remedial action reports, the *PCOR*, and Annual O&M and Remedial Performance Reports for OU1 and OU2. A full list of the documents consulted is provided in the reference list in Section 12 of this document.

6.3.1 Source of RAOs, ARARs and Cleanup Levels

A Baseline Health Risk Assessment was performed in 1991 by Environmental Science & Engineering, Inc. (ESE) to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the SMWS Site. Twenty-two COCs were identified, actual or potential exposure pathways were identified, potentially exposed populations were characterized, and a toxicity assessment considering both carcinogenic and non-carcinogenic risks was performed. The results of the risk assessment indicated that carcinogenic risks due to ingestion and household use of site groundwater

exceeded EPA's acceptable risk range of 10-4 to 10-6, and exceeded EPA's HI goal of 1 for non-carcinogenic effects. Risks from exposure to other media, including soil, surface water, and sediment were within EPA's acceptable limits, so no remedial actions were considered to be warranted for other media.

Based on the results of the risk assessment and a review of ARARs, two RAOs were established for the SMWS Site:

1) Prevention of ingestion of contaminated groundwater that would pose an unacceptable risk to human health.

2) Restoration of groundwater quality to meet federal and state ARARs.

Therefore, the interim groundwater cleanup levels in the ROD were based on either proposed or promulgated MCLs/Maximum Contaminant Level Goals (MCLG), except for 1,1-dichloroethane, which was derived from a risk-based criterion. These standards are provided in Table 9 with the results of an evaluation of modifications/updates made to these standards since the establishment of the ROD.

The following ARARs identified in the ROD were reviewed to ensure that the selected remedy continues to be in compliance with them:

- Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 *et seq.* (RCRA) - Hazardous Waste Identification and Listing (40 C.F.R. Part 261) – adopted under delegated NH hazardous waste regulations.

- RCRA - Hazardous Waste Generator Requirements (40 C.F.R. Part 262) – adopted under delegated NH hazardous waste regulations.

- RCRA - Hazardous Waste Facility Requirements (40 C.F.R. Part 264) - adopted under delegated NH hazardous waste regulations.

- RCRA Air Emissions Standards (40 C.F.R. 264, Subpart AA and BB).

- Clean Air Act, 42 U.S.C. §§ 7401 *et seq.* (CAA) - National Emission Standards for Hazardous Waste Pollutants (NESHAPS) (40 C.F.R. Part 61).

- Clean Water Act, 42 U.S.C. §§ 1251 *et seq.* (CWA) - Ambient Water Quality Criteria (renamed National Recommended Water Quality Criteria) (promulgated under 33 U.S.C. § 304(a); 40 C.F.R. 122.44).

- CWA – Dredge and Filling of Wetlands (40 C.F.R. Part 230 and 33 C.F.R. Parts 320-323).
- Safe Drinking Water Act, 42 U.S.C. §§ 300f *et seq.* (SDWA) - Maximum Contaminant Levels (40 C.F.R. Part 141, Subparts B and G).
- SDWA – Maximum Contaminant Levels Goals (40 C.F.R. Part 141, Subpart F).
- Protection of Floodplains (40 C.F.R. Part 6, Appendix A) (since rescinded).
- Protection of Wetlands (40 C.F.R. Part 6, Appendix A) (since rescinded).
- Fish and Wildlife Coordination Act (16 U.S.C. §§ 661 *et seq.*)(regulations identified at 40 C.F.R. § 603.2(g) have been rescinded).

The following more stringent State ARARs:

- New Hampshire Drinking Water Quality Standards (formerly Env-Ws 316, 317, 319 - now Env-Dw 702-705).
- New Hampshire Criteria and Conditions for Dredge and Fill in Wetlands (Env-Wt 300).
- New Hampshire Hazardous Waste Identification and Listing Rules (formerly Env-Wm 403.6, now Env-Hw 403.6).
- New Hampshire Hazardous Waste Generators Rules (formerly Env-Wm 500, now Env-Hw 500).
- New Hampshire Hazardous Waste Facility Owner and Operator Rules (formerly Env-Wm 700, now Env-Hw 700).
- New Hampshire Hazardous Waste – Miscellaneous Units (formerly Env-Wm 708.03(d)(8), now Env-Hw 708.03(d)(8)).
- New Hampshire Solid Waste Management (formerly Env-Wm 100-300, now Env-Sw 100-200, 800).
- New Hampshire Reporting and Remediation of Oil Discharges Rules (formerly Env-Wm 1600, now Env-Or 605.3-605.4).
- New Hampshire Air Pollution Rules (formerly Env-A 100 – 3800, now Env-A 100 - 4800).
- New Hampshire Ambient Air Quality Standards (Env-A 300).
- New Hampshire Fugitive Dust Control (Env-A 1002).

- New Hampshire Regulated Air Toxic Pollutants Rules (Env-A 1400).
- New Hampshire Well Abandonment Rules (formerly listed as Env-We 604, but actually We 604).
- New Hampshire Groundwater Quality Criteria (formerly located in Groundwater Protection Standards, Env-Wm 1403, now Env-Or 603).
- New Hampshire Groundwater Management (formerly located in Groundwater Protection Standards, Env-Wm 1403, now Env-Or 607).
- New Hampshire Groundwater Release Detection Rules (formerly located in Groundwater Protection Standards Env-Wm 1403, now Env-Or 700).
- New Hampshire Groundwater Monitoring Well Rules (formerly Env-Wm 1403.27, now Env-Or 704.02).
- New Hampshire Surface Water Quality Regulations (formerly Env-Ws 1700, now Env-Wq 1700).
- New Hampshire Alteration of Terrain (formerly Env-Wm 415, now Env-Wq 1500).

The following policies, advisories, criteria, and guidance's were also considered during the implementation of the remedial action:

- EPA Reference Doses (RfDs).
- EPA Carcinogenicity Slope Factors (CSFs).
- EPA Health Advisories – Office of Drinking Water (Manganese).
- EPA Guidance on Use of MNA at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.
- EPA Guidance on Risk-Based Clean Closure.
- EPA Guidance on Presumptive Remedy for CERCLA Municipal Landfill Sites.

Based on this review, three compounds have been identified that do not have interim cleanup levels, but are present in groundwater at concentrations exceeding ARARs. Vinyl chloride concentrations exceed both the federal MCL and the NH AGQS. Cis-1,2-DCE and 1,4-dioxane exceed the NH AGQS. In addition, the arsenic MCL has been lowered from 50 ppb to 10 ppb, effective February 22, 2002.

6.4 DATA REVIEW AND EVALUATION

6.4.1 Groundwater Elevations and Capture Zone

6.4.1.1 OU1

The Souhegan River loses water to the overburden aquifer to the east and north of OU1 (Harte and Mack, 1992). Prior to the installation of the barrier wall, according to a December 1995 groundwater elevation map, included as Figure 2-2 in Attachment 8, groundwater flowed from the west to the east, parallel to the Souhegan River, with a fairly even hydraulic gradient across the SMWS Site (CDM, 1996).

Prior analysis of continuous groundwater level data is provided by Harte and others, 2001b, and is summarized as follows: *The report concluded that the barrier wall was effective in isolating groundwater inside the barrier wall and that change in groundwater levels inside the wall did not correlate with changes outside the wall.*

In addition to the December 1995 pre-remedy construction groundwater potentiometric surface map, groundwater elevation maps of the shallow groundwater zones were reviewed from May 2002, July 2002, April 2006, October 2006, June 2010, and October 2010 (Attachment 8). These periods were selected to be representative of the range of water table configurations observed since the treatment plant was put into operation, including 2002 which was within the initial 3 years of plant operation of the OU1 remedy, 2006 when groundwater was consistently being extracted from both interior and exterior wells in OU1 and OU2 at rates in accordance with those specified in the ROD and/or ESD, and 2010 after the focus of groundwater extraction at OU1 had changed from contaminant mass removal to primarily hydraulic containment with a reduction in extraction rates and after the OU2 remedy had been consistently operating for 4 years. The groundwater potentiometric surface maps are based primarily on shallow overburden groundwater elevations. Although several wells are screened across different elevations of the overburden aquifer, there is a relatively neutral hydraulic gradient within the overburden.

The following summarizes significant observations and conclusions derived from the maps.

- The July 2002 (Figure H-7 in Attachment 8) and October 2006 (Figure 9 in Attachment 8) groundwater potentiometric surface maps each illustrate periods of interior groundwater extraction resulting in a strong inward hydraulic gradient

between the interior and exterior of the slurry wall. These figures also illustrate the cone of depression generated by exterior well EW-2 and the groundwater mound created at the recharge gallery.

- The May 2002 groundwater potentiometric surface map (Figure H-5 in Attachment 8) illustrates an inward hydraulic gradient across the slurry wall boundary; however, the gradients are slightly weaker than those during July 2002 and October 2006. This map also identifies a significant groundwater mound at the recharge gallery; however, the elevation for this location was estimated and is likely exaggerated.

- The April 2006 figure (Figure 12 in Attachment 8) depicts a time of higher water levels in the aquifer as well as within the slurry wall. Although IW-1 was extracting approximately 31 gpm during this time, periods of higher rainfall and a lack of pumping from IW-2, likely resulted in a weaker hydraulic gradient between the interior and exterior of the slurry wall. This figure also shows a significant cone of depression at EW-2 which was extracting groundwater at approximately 20 gpm. Groundwater was also being extracted at approximately 20 gpm from EW-1 at this time.

- The groundwater potentiometric surface maps from June (Figure 5-1 in Attachment 8) and November (Figure 5-2 in Attachment 8) 2010, illustrate water table elevations when limited volumes of groundwater was being extracted from the shallow aquifer within the slurry wall. A weak, inward hydraulic gradient is present in the eastern portions of the slurry wall at OU1 between the PW-2 and PW-5 wells as the groundwater extraction rate from the interior wells was adjusted to the minimum rate needed to maintain the inward gradient and allow permanganate injections. No exterior groundwater extraction was being conducted during June 2010. Groundwater was extracted from EW-1 at approximately 39 gpm during November 2010 to supply additional water to the treatment plant an enable it to run in automatic mode.

6.4.1.2 OU2

Groundwater potentiometric surface maps generated for OU2 were reviewed from 2005 and 2010, to represent conditions prior to the implementation of the remedy and current conditions with the selected remedy in operation. Potentiometric contour maps generated using the data from the monitoring rounds in August 2005 and June and November 2010 are presented in Attachment 8 as Figures 3.2, 3.5a, and 3.5b, respectively. The maps were developed from water level measurements collected at OU2 monitoring wells by site personnel during groundwater monitoring events. The groundwater potentiometric surface maps are based primarily on shallow overburden groundwater elevations. Although several wells are screened across different elevations of the overburden aquifer, similar to observations made at OU1, there is minimal head

difference between the shallow and deep zones indicating a relatively neutral hydraulic gradient within the overburden.

The following summarizes significant observations and conclusions derived from the maps.

- The August 2005 groundwater potentiometric surface map indicated that prior to the implementation of the remedy at OU2, a relatively flat hydraulic gradient was present across the entire SMWS Site and groundwater generally flowed in an east-northeast direction. Similar to conditions observed in OU1, the Souhegan River loses water to the overburden aquifer in western portions of OU2. However, water elevation data from stream gauge and piezometer locations in eastern portions of OU2 indicate that the overburden groundwater begins to discharge to the Souhegan River as you move eastward across the SMWS Site (Gradient, 2005).

- Groundwater elevation monitoring during 2010 indicates that groundwater continues to flow in an east-northeast direction and discharges to the Souhegan River in most areas with the exception of the western most portion of OU2. Data from 2010 illustrate the extent of influence of the extraction wells on groundwater which extract groundwater at a combined rate of approximately 414 gpm. During the November monitoring, EW-1 was not operating (Figure 3.5b in Attachment 8). Groundwater elevation monitoring data in the vicinity of the injection wells do not depict a significant mound; however, the groundwater surface gradient flattens out slightly indicating that injected groundwater is influencing this area, and thus flushing the portions of the plume downgradient. Groundwater elevation data from piezometers P-101 and P-102 and surface water monitoring points S-1 and SG-1 through SG-4 indicate that the extraction, treatment, and reinjection of groundwater at OU2 is not significantly impacting the surrounding wetland and agricultural areas (Gradient, 2011).

6.4.2 Hydrogeologic Setting

The entire SMWS Site is underlain by a sequence of layered (stratified) glacial deposits, consisting of fine to coarse sands and gravels. The stratified sands and gravels comprise the principal aquifer in the area which has been referred to as the Milford-Souhegan glacial drift aquifer in prior studies. The aquifer increases in thickness from west to east, ranging from approximately 50 ft to a maximum thickness of approximately 100 ft in the central portion of the SMWS Site. The primary direction of groundwater flow across the SMWS Site is from west to east. Prior to the construction of the barrier wall at OU1 and the groundwater extraction systems at both OU1 and OU2, the hydraulic gradient associated with this flow was relatively uniform.

Variations of groundwater flow induced by the barrier wall and elements of the groundwater treatment system are described elsewhere in this report.

Discrete bodies of layered cobble-sized gravel and layered fine sand have been identified in and correlated among well borings in OU1. Glacial tills underlie the stratified deposits throughout much of OU1 and OU2. Tills are indurated to partially indurated (compacted) deposits of mixed clay, silt, sand, and rock of variable size. The till deposits are of highly irregular thickness (<1 to 33 ft) and are much denser and less permeable than the stratified sands and gravels they underlie. Underlying the tills and, in some areas, the stratified sands and gravels is a relatively competent bedrock fabric. Bedrock beneath the SMWS Site is comprised of the Gray Biotite Granite and Massabesic Gneiss Complex formations. (HMM, 1991).

The upper surface of the bedrock has significant relief. Its configuration has been measured in numerous borings and excavations. A west to east trending valley in the bedrock surface parallels the Souhegan River. Within OU1, the bedrock surface drops in elevation from the northeastern corner of the former OK Tool building toward the Souhegan River. There is a trough in the bedrock surface with approximately 30 ft of relief that underlies the eastern half of the barrier wall. Much of the western half of the barrier wall is founded in till.

The initial conceptual model for the SMWS Site assumed that the deep bedrock was competent across the entire SMWS Site and that the remaining "source" of chlorinated solvents was present in the overburden. Based on the interpretation of site conditions, VOCs would only migrate into the bedrock aquifer if hydraulic containment was not maintained within the barrier wall and downward hydraulic gradients were allowed to develop inside the slurry wall, or via naturally occurring vertical gradients between the aquifers. Therefore, the hydrogeologic characterization of the bedrock was limited to the shallow bedrock aquifer. These investigations identified significantly lower transmissivity values (approximately 3 ft per day) than those observed in the overburden aquifer, in addition to exhibiting concentrations of site COCs up to several orders of magnitude less than those observed within the overburden. An investigation into the deep bedrock aquifer conducted within OU2 during 2003 supported this bedrock model when two out of three bedrock monitoring wells, each installed 300 ft beneath the bedrock surface, effectively yielded no water and were abandoned shortly after installation had been completed. The third

location yielded a significant volume of water, but concentrations of site COCs were below laboratory detection limits (MACTEC, 2003a).

The hydrogeologic setting of the SMWS Site has been profoundly influenced by the installation of the barrier wall and the groundwater extraction/reinjection system. The construction of the barrier wall within OU1 has had a particularly significant influence on the interaction of the overburden aquifer between the interior and exterior of the wall and the interaction between the overburden and bedrock aquifers in the source area. Horizontal flow through the source area has been significantly curtailed, thereby enhancing the potential for upward and downward flow between the overburden to the bedrock inside the wall.

6.4.3 Response of Aquifer to System Changes (OU1)

The response of the aquifer to system changes, including the startup and modification of the extraction well system, provides information about the aquifer characteristics, the barrier wall effectiveness, and the overall functionality of the remediation system. Several events were analyzed, including:

- Groundwater extraction well startup on February 5, 2002.
- Increased interior pumping from IW-02 in March 2002.
- Shutdown of treatment plant and all extraction wells in August through October 2005 for refurbishing of recharge chamber.
- Installation of shallow interior extraction wells (IW-1A and IW-2A) in 2008 and the switch over from pumping from the deep wells (IW-1 and IW-2) to the shallow wells to allow for ISCO injections in the deep aquifer.

The primary conclusions of the aquifer response analysis are described below.

6.4.3.1 Response to Groundwater Extraction

Data from wells screened at different depths were used to evaluate hydraulic gradients in the vertical direction when groundwater was extracted from the deep interior wells IW-1 and IW-2. At the downgradient (eastern) margin of the wall, piezometric heads indicated groundwater upwelling within the barrier wall when horizontal gradients were directed inward. As the horizontal gradient reversed to outward flow, the vertical gradient also reversed, to downward

flow. This change of direction is consistent with leakage at or below the base of the barrier wall. At the eastern downgradient margin of the barrier wall, the preferential pathway of flow beneath the barrier wall is probably through the underlying bedrock.

A review of the hydrographs generated when the treatment plant was shut down and pumping from all extraction wells was discontinued in August through October 2005, indicated that vertical gradients inside the barrier wall rapidly reversed from a strong upward direction to a strong downward direction within a period of several days. This is an indication that groundwater from the overburden within the containment area flows downward into the bedrock when groundwater is not being extracted from the interior wells.

Water level monitoring after the conversion from deep interior extraction wells (IW-1 and IW-2) to shallow interior extraction wells (IW-1A and IW-2A) in 2008 indicated that pumping from the shallow interior extraction wells was effective in maintaining upward gradients inside the barrier wall and inward gradients across the barrier wall.

6.4.3.2 Maintenance of Groundwater Gradients

The effectiveness of the barrier wall to contain the source area contamination is dependent on pumping sufficient groundwater from the interior extraction wells to maintain inward hydraulic gradients across the wall and upward hydraulic gradients between the overburden inside the wall and the bedrock aquifer. If groundwater is not extracted from inside the wall at a sufficient rate, gradients will revert to outward and downward and contamination from the source area can migrate into the bedrock and potentially under the barrier wall. Selective well pairs (overburden/bedrock and interior/exterior) are monitored weekly and interior well pumping rates are adjusted to maintain inward/upward gradients.

6.4.4 Groundwater Monitoring

6.4.4.1 OU1 Groundwater Monitoring

Groundwater monitoring was conducted twice each year at OU1 from the early 1980s until 2009. In 2010, groundwater monitoring was reduced to an annual sampling event in the fall, concurrent with OU2 sampling. Graphs of groundwater concentrations in selected well clusters and tables of

historic concentration data are provided in Appendices D and E of the *2010 Annual Report* for OU1, included as Attachment 1 to this document.

Data from the November 2010 sampling event in OU1, in which 73 groundwater monitoring wells were sampled (Attachment 1/Table 5-2), were reviewed and compared with previous data. The monitoring well locations are shown on the site maps Attachment 1/Figures 1-3A and 1-3B. Many of the wells were installed in clusters to permit the sampling of several vertically distinct aquifer zones at the same location. These wells are identified as S for shallow overburden, M for middle overburden, D for deep overburden, and R for shallow bedrock.

Table 10 compares the November 2010 data with the maximum detected contaminant concentrations and earliest detected concentrations at selected monitoring well clusters both inside and outside of the barrier wall, and shows the percent concentrations reduction (rounded to the nearest whole percent) since the earliest and maximum concentrations were detected. Significant reductions in contaminant concentrations have occurred across OU1, especially the area beyond the barrier wall.

Table 11 lists the maximum concentrations of the only three constituents detected above MCLs inside the wall during the fall 2008 sampling event prior to the start of the aggressive ISCO program, and the four constituents detected above MCLs during the November 2010 sampling event. Although the compound cis-1,2-DCE and vinyl chloride were not included as COCs in the ROD and therefore do not have an interim cleanup level, recent groundwater monitoring events have identified these compounds at concentrations greater than the NHDES AGQS. Based on these results, a significant reduction in PCE and TCE concentrations have been observed following the three rounds of ISCO injections conducted in 2008, 2009, and 2010 at OU1. The increases in concentrations of cis-1,2-DCE and vinyl chloride may be indicative of natural attenuation occurring at the SMWS Site since they are breakdown products of PCE and TCE.

6.4.4.1.1 OU1 Volatile Organic Compound Concentration Trends

Generally PCE concentrations have been reduced substantially since the initiation of treatment system operation. Reductions of 99% have been observed, primarily outside the barrier wall. However, reductions of greater than 95% have also been observed within the wall, at B95-08,

B95-09, PW-05M, PW-05D, PW-06M, PW-07S, PW-08M, PW-10D, PW-10M, PW-15D, PW-15M, and PW-20D. Despite these reductions, groundwater concentrations inside and outside the barrier wall are still well above the interim cleanup level of 5 µg/L. Historical VOC data for OU1 monitoring wells is provided in Table 5-6 of the OU1 *Annual Report*, included as Attachment 1 to this document.

6.4.4.1.2 OU1 Interior Monitoring Wells

Based on an evaluation of laboratory analytical data and isopleth maps, the majority of the monitoring locations positioned within the confines of the slurry wall containment system continue to exceed the applicable MCL for site COCs. During the winter and fall 2010 sampling event, 80% (35 of 44) of the well locations sampled that are located within the slurry wall exceeded the applicable MCL of 5 µg/L for PCE. The highest concentrations detected during both 2010 sampling events were observed in monitoring well PW-25D at 4,900 µg/L and 2,380 µg/L, respectively. However, the 2008, 2009, and 2010 ISCO events targeted areas within the barrier wall which had historically exhibited the highest concentrations of COCs, and several of these areas have not been sampled since the 2008 ISCO event due to the persistence of $NaMnO_4$ at these locations. It is important to note that the persistence of $NaMnO_4$ indicates that the oxidant is still reacting within the slurry wall containment system and the full effectiveness of the ISCO program cannot be accurately quantified until the majority of the oxidant has been exhausted within the system.

Approximately 45% (20 of 44) of the wells sampled within the slurry wall exceeded the applicable MCL for TCE and 11% (5 of 44) of the interior wells sampled exceeded the applicable MCL for cis-1,2-DCE. The highest concentration of TCE detected in the latest monitoring round was at PW-20S in November 2010, at 252 µg/L. As with PCE, areas which historically exhibited the highest concentrations of TCE were not sampled during the most recent sampling events due to the presence of $NaMnO_4$. Well PW-20S also exhibited the highest concentrations of cis-1,2-DCE during the November 2010 monitoring round at 1,790 µg/L. This is the highest concentration of cis-1,2-DCE detected at OU1 since November 2007, when the compound was detected at 3,050 µg/L in a sample from well PW-6MB. The increase of cis-1,2-DCE in PW-20S, and the recent detection of vinyl chloride in two wells (PW-16D [5.2 µg/L] and

SVE-02 [7.5 µg/L]), may be indicative of natural attenuation occurring since they are daughter products of the anaerobic biodegradation of PCE and TCE.

A three dimensional visualization model was generated for OU1 using the program EarthVision. Concentration of both PCE and $NaMnO_4$ were modeled using the program and figures including isopleths maps and cross sections were generated from the model output. Isopleth maps and cross sections are provided as Figures 5-6 through 5-20 in the *2010 Annual Report* for OU1, included as Attachment 1 to this document.

6.4.4.1.3 OU1 Exterior Monitoring Wells

In general, VOC concentration trends in overburden monitoring wells located outside the barrier wall in OU1 have exhibited clear decreasing trends, with VOC concentrations in the majority of the wells below detection, or at trace levels during the most recent sampling round. Only 11 of the 35 exterior overburden monitoring wells sampled in November 2010 contained VOCs at concentrations exceeding interim cleanup levels. The PCE concentrations in these wells ranged from 5.6 µg/L to 47 µg/L with the exception of PW-14M which contained PCE at a concentration of 196 µg/L. Although PW-14M exhibits the highest PCE concentrations in the overburden outside the wall, it has exhibited a consistent decreasing trend over the past 3 years.

Two exterior deep overburden wells exhibited increases in VOC concentrations during recent sampling rounds. The PCE concentrations in monitoring wells B95-03 and PW-03D increased from below detection to 7.4 and 5.6 µg/L. Both of these wells are located just outside the barrier wall to the north and are located adjacent to a newly installed deep bedrock well. It is possible that localized drilling activities may have impacted the overburden in this area. Overburden monitoring well PW-13S also exhibited increases in PCE concentration, from 4.5 µg/L in 2008 to 47 µg/L in 2009, and 26 µg/L in 2010; however, this well has experienced even greater contaminant concentration fluctuations in the past 10 years.

In general, TCE and cis-1,2-DCE concentrations are showing downward trends in overburden groundwater, decreasing to below the detection limit in all the wells except the PW-13 and PW-14 clusters, which exhibited exceedances of the interim cleanup levels during the November 2010 sampling event, or increasing trends over recent sampling rounds. The persistence of VOCs

in the vicinity of the PW-13 and PW-14 clusters may be attributed to multiple factors which include the release of recovered solvent to the recharge chamber in 2000, the diffusion of COCs from low transmissivity lenses of material in the overburden, or a stagnation zone created when the exterior extraction system was in use, which didn't allow for sufficient movement of groundwater through this area.

6.4.4.1.4 OU1 Shallow Bedrock Monitoring Wells

In contrast to the overburden monitoring wells, VOC concentrations in shallow bedrock monitoring wells, both interior and exterior, have exhibited either consistently high contaminant concentrations or upward trends since installation of the barrier wall. The PCE concentrations in shallow bedrock monitoring well PW-02R, located just outside the barrier wall to the east, have increased significantly since the construction of the barrier wall, from approximately 36 µg/L in May 1998 to 426 µg/L in November 2010. By contrast, concentrations of VOCs in shallow bedrock monitoring well PW-05R, located just inside the eastern portion barrier wall across from PW-02R, have remained fairly stable between 32 µg/L and 54 µg/L in recent years. Since it has not exhibited the increases observed in PW-02R, it is unlikely that there is a strong hydraulic connection between these wells within the bedrock. Other shallow bedrock monitoring wells both inside and outside the barrier wall have exhibited increasing trends (MW-02R and MW-16R) or fluctuating concentrations with no clear trends (PW-12R and PW-06R). Although remedial activities have been effective in reducing contaminant concentrations in the overburden, the same improvements have not been observed in the shallow bedrock monitoring wells.

6.4.4.2 OU2 Groundwater Monitoring

Groundwater monitoring within OU2 has been conducted at least annually every year since the construction and start up of the remedy in 2005. Two rounds of groundwater quality monitoring were undertaken in 2010, a semi-annual round, which included a smaller list of monitoring wells, and a more comprehensive, annual round. The semi-annual groundwater quality program included 20 monitoring wells. The scope of the "typical" annual sampling program was expanded based on EPA's request due to this Five-Year Review. A total of 17 monitoring wells were added to the typical annual monitoring well network, resulting in a total of 67 groundwater sampling locations. These additional wells were included in the annual sampling round to further

understand the northern, eastern, and southern edges of the plume, and to assess concentrations within downgradient portions of the plume which rely upon monitored natural attenuation for the remedy. All monitoring wells sampled during 2010 were analyzed for VOCs, and a select number of wells were sampled for iron, manganese, and 1,4-dioxane. The data is presented in the *Draft Annual Groundwater Quality Monitoring Report – 2010* for OU2, provided as Attachment 2. (Gradient, 2011).

Data from the December 2010 annual sampling event in OU2, in which 67 groundwater monitoring wells were sampled (Attachment 2/Table 3.2b), were reviewed and compared with data from previous sampling events. The monitoring well locations are shown on the site maps Figures 1 through 6. Similar to OU1, many of the wells were installed in clusters. However, in OU2 the wells are identified as A for shallow overburden, B for middle overburden, C for deep overburden, and R for bedrock. Analytical results from the 2010 sampling events and PCE concentration isopleths over time are provided in the *Draft Annual Groundwater Quality Monitoring Report - 2010* for OU2 (Gradient, 2011), included as Attachment 2 of this document. Figures illustrating the percent reduction in measured PCE groundwater concentrations are also included in Attachment 2.

6.4.4.2.1 OU2 Volatile Organic Compound Concentration Trends

Generally, concentrations of site COCs have been reduced substantially since the startup of the OU2 treatment plant. The implementation of the OU1 remedy has also likely significantly contributed to the observed reductions throughout OU2. Based on the most recent data available for review, eight VOCs were detected in the groundwater samples collected during the semi-annual and annual sampling rounds in 2010 (Attachment 2/Tables 3.2a and b). Of the compounds identified, PCE, TCE, 1,1-DCE, and 1,4-dioxane exceeded their MCL in at least one sample. Tetrachloroethylene was the most frequently detected compound and was present at the highest concentrations. During the December 2010 annual sampling event, approximately 46% (31 of 67) of wells sampled exceeded the MCL for PCE and 19% (13 of 67) exceeded the MCL for TCE. The highest concentration of PCE was detected in MW-120C in December, at 410 µg/L, and the highest concentration of TCE was detected in MW-103 in December, at 60 µg/L. Both of these wells are screened across the deep overburden aquifer. The compound 1,1-DCE was only identified above its MCL during the June 2010 semi-annual event in 2 of

23 wells. These detections were from wells MW-116A and MW-20B at concentration of 14 µg/L and 9.8 µg/L, respectively.

The most recent PCE groundwater concentrations measured as a function of depth are presented in Figures 3.7 through 3.10 of Attachment 2. Each figure displays PCE groundwater data associated with the same depth range used in the groundwater flow and solute transport (PCE) model (EPA, 2002). Consistent with previous sampling events, elevated PCE concentrations were detected near Trailer Park Road in deep overburden deposits located within a previously defined bedrock depression. Generally, as is the case in OU1, PCE concentrations increase with depth within the overburden deposits in OU2.

A comparison of measured PCE concentrations in this monitoring event to concentrations since 1989 indicates a continued reduction of PCE concentrations in the overburden aquifer (USGS, 2004; MACTEC, 2005; also see Attachment 2/Appendix D). USGS noted that between 1989 and 1994 the PCE plume shifted northward, in part due to a change in groundwater withdrawals at the SMWS Site (USGS, 2004). When vertical profiling was completed in 1995, the areal extent of the plume was greatest in the lower portion of the aquifer. The baseline monitoring event in August 2004 confirmed that PCE concentrations were greatest in the northern portion of OU2 in the deeper portion of the aquifer, where the extraction wells were later installed (MACTEC, 2005). Since 2004, PCE concentrations have decreased in the overburden aquifer and the areal extent of the plume has also reduced. This is illustrated in Figures 3.11 through 3.14 of Attachment 2, which show significant reduction in PCE concentrations from August 2004 to December 2010. The observed decline in concentrations is consistent with natural attenuation of the PCE plume due to advection and dispersion, enhanced by the operation of the treatment system during this period. The PCE concentrations versus time in monitoring wells, extraction wells, and treatment plant influent are included in Attachment 2 as Figures 3.15, 3.16, and 3.17, respectively. Results generally support this conclusion since an overall reduction in concentrations continues to be observed over time. From system startup to 2010, estimated PCE mass in OU2 has declined by approximately 84%, from 1,830 kg in August 2004 to 296 kg in December 2010 (Figure 3.18 and Appendix E of Attachment 2). However, deep overburden wells and bedrock wells appear to be an exception to the general decline with monitoring wells MI-31, MW-11R, MW-14B, MW-19B, MW-103, MW-105, MW-106, MW-

111C, which indicate either increasing or no distinguishable trend to concentrations of PCE (Gradient, 2011).

The RI also identified a plume of 1,1,1-TCA, believed to be the result of historic Hitchiner/Hendrix operations based on available records of use. The plume originated in the vicinity of a drainage ditch which drained into Tucker Brook and ultimately the Souhegan River. However, there are currently no 1,1,1-TCA exceedences at any monitoring location within the SMWS Site. However, 1,4-dioxane used as a stabilizer for 1,1,1-TCA, has been detected in certain monitoring wells in OU2 as discussed below.

6.4.4.2.2 1,4-Dioxane

A July 9, 2009 letter from NHDES requested that the Settling Parties perform sampling for 1,4-dioxane at OU-2 to determine if groundwater concentrations are below NHDES' current AGQS of 3 µg/L (NHDES, 2009). In accordance with NHDES' request, influent and effluent samples for 1,4-dioxane analyses were collected in October 2009, and groundwater samples were collected from 17 wells in November and December 2009. At the request of EPA and NHDES, the fall 2010 sampling event was expanded to include 1,4-dioxane analysis from four additional wells: FH-27, MW-34, MW-115A, and MW-115B (Gradient, 2010a). Several of these monitoring wells, MW-17C, MW-102, MW-106, MW-107C, MW-111A, MW-111B, MW-111C, and MW-114, were previously sampled for 1,4-dioxane in 2003. The 1,4-dioxane results reported for the 2003, 2009, and 2010 sampling events are summarized in Table 3.5 of Attachment 2. All 2003 and 2010 monitoring well locations and results are also presented on Figure 3.19 of Attachment 2. Overall, the data indicate that low levels of 1,4-dioxane are present in OU-2, concentrations are declining temporally (concentrations in 2009/2010 generally lower than 2003), and 1,4-dioxane has not been detected in the influent or effluent associated with the groundwater treatment system. 1,4-dioxane exceeded the NHDES AGQS at six sampling locations (MW-19B, MW-20B, MW-116A, MW-105, MW-14B, and MW-14R) during the annual sampling event. The four wells added to the 2010 sampling plan had no detectable 1,4-dioxane indicating that the presence of 1,4-dioxane appears to be limited to the areas already been identified. A declining trend of 1,4-dioxane is anticipated to continue over time, with the low levels encountered further attenuating due to plume dilution and dispersion (Gradient, 2011).

6.4.4.2.3 OU2 Contaminant Transport Model

As indicated previously, a model was created to estimate the mass of contamination within the aquifer, evaluate contaminant concentrations and trends, and provide an estimate of time necessary to achieve interim cleanup levels within OU2. A detailed evaluation was conducted by USGS as part of the Five-Year Review process to test the reliability of the model and determine its usability as a predictive tool. The USGS evaluation is included in Attachment 9.

An overall comparison of model-predicted total mass remaining to estimated total mass remaining based on measured concentrations in OU-2 from September 2001 to December 2010 is presented in Figure 3.18 of Attachment 2. Consistent with residual statistics, the model-predicted is consistently higher than mass estimated based on measured concentrations (model is conservative). However, this difference between model-predicted and measured mass is partly attributed to the inherent uncertainty involved in estimating total mass (i.e., a slight discrepancy between model-predicted and measured values at discrete points can significantly impact the total mass calculation). This was apparent even in the final model calibration performed in 2001 (TetraTech NUS, 2002), where model-predicted mass (3,750 kg) was greater than mass estimated from measured values (3,000 kg; Figure 3.18). Nonetheless, the overall trend indicated by residual statistics and total mass calculations is that the remedy is performing effectively and progressing in accordance with model predictions (Gradient, 2011).

6.4.4.3 Overall Volatile Organic Compound Plume – OU1 and OU2

Maximum PCE concentrations across the SMWS Site in 1989 and 1994 are illustrated on Figure D.1 in Appendix D of the *Draft Annual Groundwater Quality Monitoring Report - 2010* for OU2, included as Attachment 2 to this document. These figures both illustrate groundwater conditions prior to the implementation of the remedy at both OUs and identify an elongated plume of contamination originating at the former OK Tool building and extending in an easterly direction. The 1994 figure depicts a slightly wider plume extending to the north of the Souhegan River. The migration of the plume to the north may be the result of Hitchiner no longer extracting groundwater from their production wells for industrial processes.

The implementation of the remedy at each site has significantly altered plume conditions and characteristics compared to the 1989 and 1994 figures. A discussion of current plume

characteristics based on the most recent groundwater analytical data for each OU is included below.

6.4.4.3.1 2010 Isoconcentration Maps OU1

Isoconcentration maps of the current VOC plume for OU1 are provided as Figures 5-6 through 5-13 in the *2010 Annual Report* for OU1, included as Attachment 1 to this document. The isoconcentration maps were developed from sampling results, which were used to create a 3D model of estimated values. Maps were generated for four elevations [195 ft above mean sea level (amsl), 218 ft amsl, 235 ft amsl, and 250 ft amsl]. In addition to the plume maps, three vertical cross sections were generated from the model. The maps reflect the containment of the plume within the barrier wall and a detached plume as concentrations attenuate downgradient from the barrier wall. The maps illustrate the location of the highest concentrations which are present in the center and western portions of the barrier wall. The wells sampled during each event are indicated with their respective concentrations.

An analysis of the plume for each year since before the installation of the barrier wall (1998) attests that each phase of the remedy has affected the plume. Since remedy inception, the plume has been significantly diminished, both in area and in concentration. Prior to the remedy, the 1,000 µg/L PCE core of the plume extended from the former OK Tool building location to beyond the ball field, well outside the barrier wall. The highly contaminated plume core is now entirely within the barrier wall. The portion of the plume that contains PCE at concentrations above 100 µg/L has been severed into two lobes by the combined effects of the barrier wall, recharge chamber, and the exterior extraction wells. Although the distant portion of the exterior lobe of the plume was not fully captured by the exterior extraction wells in OU1, their pumping reduced the portion of the lobe with PCE concentrations above 100 µg/L and has resulted in interim cleanup levels being achieved in overburden groundwater directly adjacent to the outside of the barrier wall, although further downgradient in OU1, contaminant concentrations continue to exceed interim cleanup levels.

6.4.4.3.2 2010 Isoconcentration Maps OU2

Isoconcentration maps for the current OU2 plume are provided as Figures 3.7 through 3.10 in the *Draft Annual Groundwater Quality Monitoring Report - 2010* for OU2, included as Attachment 2 to this document. These figures display groundwater data associated with the same depth range used in the groundwater flow and solute transport model for OU2 which was evaluated by USGS during the Five-Year Review process. The evaluation by USGS is included in Attachment 9.

Generally, PCE concentrations increase with depth within the overburden deposits (Gradient, 2011). Based on the figures, the implementation of the remedy at OU2 has had a significant impact on contaminant concentrations within the shallow overburden aquifer (Model Layers 1 and 2). Concentrations of PCE have been reduced to below interim cleanup levels in all wells sampled in the vicinity of the extraction well network. The shallow overburden monitoring wells which continue to exceed PCE interim cleanup levels are in the natural attenuation portion of the plume to the east of the extraction well network and north of the former Savage Well.

Although the PCE concentrations within the intermediate overburden aquifer (Model Layer 3) are similar to the model of the shallow overburden, the areal extent of the plume expands with depth and the magnitude of PCE concentrations increase. The figure indicates that the remedy has greatly affected the plume and resulted in a detached portion downgradient, and likely beyond the influence, of the groundwater treatment system which will rely on natural attenuation to reach interim cleanup levels. The exception to these observations includes the area near MW-107A and MI-31 which continue to exhibit concentrations of PCE above the interim cleanup levels.

The PCE concentrations within the deeper intermediate overburden (Model Layer 4) is limited due to the increase in elevation of the bedrock surface as you move to the east across the SMWS Site as indicated by the model layer boundary. Based on the figure, elevated concentrations of PCE remain in the area north of the trailer park and beneath and east of the drive in theater.

The PCE concentrations within the deep overburden (Model Layer 5) are also limited by increase in elevation of the bedrock surface. The figure identifies a somewhat elongated plume of PCE within the trough which coincides with historical data for the area. Although the river appears to

be utilized as the model layer boundary in the north with limited analytical data, groundwater data from the southwest and south indicate these areas have reached interim cleanup levels.

6.4.4.3.3 Percent Reduction Figures for OU1

Groundwater analytical data collected during 2010 across the entire SMWS Site were compared to the maximum observed concentrations since approximately 1989. This comparison indicates a continued reduction in PCE concentrations throughout the entire overburden aquifer. Figures were generated for each OU illustrating percent reduction across the SMWS Site for each elevation of the groundwater plume.

OU1 PCE percent reduction figures are included as Figure 5-18 through 5-21 in the *2010 Annual Report* for OU1, included as Attachment 1 to this document. The figures for OU1 illustrate that all overburden groundwater monitoring wells beyond the confines of the slurry wall have exhibited contaminant reduction ranging from approximately 86% to 100% indicating the effectiveness of the selected remedy on the aquifer. Percent reduction figures for interior monitoring locations also show significant reductions within the deep aquifer decreasing to moderate reductions within the shallow overburden aquifer. This trend may be the result of the large volume of oxidant delivered to the deep overburden aquifer since 2008 compared to the relatively small volume delivered to the shallow overburden aquifer. However, an accurate representation of percent reductions for PCE within the slurry wall is still difficult to estimate until all remaining permanganate has reacted within the system.

6.4.4.3.4 Percent Reduction Figures for OU2

OU2 PCE percent reduction figures are included as 3.11 through 3.14 in the *Draft Annual Groundwater Quality Monitoring Report - 2010* for OU2, included as Attachment 2 to this document. The figures for OU2 illustrate significant contaminant reduction in the proximity of the groundwater extraction system. Reductions beyond the influence of the groundwater extraction system have generally exhibited moderate percent reduction with the exception of Model Layers 1 and 2 which illustrate significant PCE percent reduction downgradient of the groundwater extraction system to the east and northeast. These reductions illustrate the effectiveness of the groundwater extraction and injection system and for areas beyond the

influence of the system are consistent with natural attenuation of the PCE plume due to advection and dispersion (Gradient, 2011).

6.4.5 Metals Sampling

6.4.5.1 OU1

Samples were collected from all exterior monitoring wells within OU1 during the November 2010 sampling event and submitted for metals analysis as part of this Five-Year Review process. This additional analysis was performed to evaluate concentrations of metals identified as COCs in the ROD including antimony, arsenic, beryllium, chromium, lead, and nickel. Of these metals, arsenic, lead, and nickel were identified above laboratory reporting limits in at least one sample; however, none of these compounds were identified at concentrations above their applicable MCLs.

6.4.5.2 OU2

In the 2005 interim baseline monitoring round (GeoSyntec and Gradient, 2005), groundwater samples from four monitoring wells (MW-111A/B/C and MW-17C) were analyzed to determine if operation of the injection wells effected groundwater quality in the vicinity of the wells. Laboratory analytical results identified low levels (approximately 0.1 mg/L or lower) of iron at all wells, except MW-111C, which exhibited concentrations of approximately 10 mg/L. Based on these concentrations, it was inferred that the higher iron concentrations recorded at MW-111C were likely associated with natural variability in iron concentrations rather than aquifer fouling caused by groundwater injection. Iron and manganese monitoring has continued at select OU2 monitoring locations since 2005. In 2010, samples for dissolved and total iron and manganese were collected from well MW-11R in June and from well MW-111B in December. Concentrations of total and dissolved iron and manganese were identified above laboratory reporting limits in the sample collected from MW-11R at concentrations of 15 µg/L, 2.9 µg/L, 0.5 µg/L, and 0.4 µg/L, respectively. Concentrations of total and dissolved manganese were identified at 0.036 and 0.035 µg/L, respectively in MW-111B during the December sampling event. Total and dissolved iron were not identified above the laboratory reporting limits in the sample collected from MW-111B during the December sampling event (Gradient, 2011).

6.4.6 Vertical Profiling at OU1

Vertical profiling was conducted by Stone Environmental, Inc. and the Johnson Company, in June 2001 and September 2004, respectively. The June 2001 vertical profiling was conducted outside barrier wall to determine whether non-aqueous phase PCE was discharged to the recharge chamber (CDM, 2001). Three profiles were completed adjacent to the recharge gallery, three other profiles were conducted at locations which had been profiled in 1995, and two profiles were completed upgradient of the recharge chamber between the Souhegan River and the barrier wall. A ninth location was completed in the woods at the northeast edge of OU1.

The September 2004 vertical profiling event targeted two areas, one inside and one outside of the barrier wall. Four profiles were conducted to evaluate the distribution of contamination in the proximity of well cluster PW-06 and 13 vertical profiles were conducted outside of the barrier wall to evaluate a potential source of contamination between the barrier wall and the Souhegan River (NA Water Systems, 2005).

6.4.6.1 Results from OU1 Recharge Chamber Area

Stone Environmental, Inc. reported that the three profiles conducted adjacent to the recharge gallery showed no evidence of a release of non-aqueous phase PCE. The highest concentrations encountered were 1,203 µg/L and 1,033 µg/L, at depths of approximately 50 ft and 90 ft bgs. The suspected DNAPL threshold based on the 1% of aqueous solubility rule of thumb, indicates, if DNAPL were encountered, a concentration of approximately 2,000 µg/L would be expected (EPA, 1992 and 2004).

6.4.6.2 Results Compared to 1995 Profiles

Three profiles were drilled in similar locations to 1995 profiles in order to compare the results. Along the northern plume fringe, 2001 data were consistent with those measured in 1995. In the central portion of the plume, the 2001 data were an order of magnitude lower than those measured in 1995. Concentrations declined the most at elevations below 200 ft (approximately 50 ft bgs). The report concluded that these data indicate that, with the source cut off by the barrier wall, the aquifer is flushing itself out.

6.4.6.3 Results Upgradient of OU1 Recharge Chamber

The PCE concentrations observed at these locations in 2001 were consistent with those observed downgradient of the recharge chamber and had decreased since 1995. The report concluded that this is indicative of a persistent source between the barrier wall and the far bank of the river. The report indicated that based on the depth of PCE upgradient of the recharge chamber and adjacent to the PW-13 well cluster, that they emanate from a common source, either in the riverbank or beneath the riverbed. However, the 13 profiles conducted in 2004 between the barrier wall and the Souhegan River did not identify evidence of an additional source in this area, specifically north of the recharge chamber. The report concluded that when data from the 2001 vertical profiling was compared to the 1995 and 2004 results, the area identified during the 2001 event appeared to have been impacted by a transient source of PCE and was not indicative of a new source between the river and the barrier wall (NA Water Systems, 2005).

6.4.6.4 Results from the PW-06 Well Cluster

The four profiles conducted within the OU1 barrier wall in 2004 provided analytical data west, north, and south of the PW-06 well cluster, an area which had exhibited persistent elevated concentrations of PCE. Results of the profiling indicated that the elevated concentrations of PCE (>10,000 µg/L) appeared to be limited to the proximity of the PW-06 wells, and that an elongated band of PCE impacted water (>1,000 µg/L) trended from SVE-5 to extraction well IW-1 (NA Water Systems, 2005). However, investigations conducted in 2008 identified an area of highly contaminated, deep soil in the vicinity of PW-22 (west of (SVE-5) that was likely the source. It is important to note that the vertical profiles within the barrier wall were conducted prior to the implementation of the ISCO program at the OU1 Site, which targeted areas which are believed to directly result in a significant reduction of concentrations in this well cluster. Vadose zone contamination in the vicinity of PW-22 was addressed by the soil excavation and ex situ chemical oxidation conducted in 2009 (see Section 7.1.1.1.6), and shallow saturated contamination in the PW-22 area was addressed by ISCO in 2009. In addition, 3 rounds of deep overburden ISCO were conducted in the vicinity of the PW-6 well cluster in 2008 through 2010.

6.5 RISK EVALUATION

This section describes the evaluation of potential human health and environmental risk associated with the SMWS Site conducted for the Five-Year Review as outlined in EPA's *Comprehensive Five-Year Review Guidance*, June 2001. A Baseline Human Health Risk Assessment (BHRA) was prepared for the SMWS Site in 1991 by ESE, prior to remedy selection. The objective of this section of the Five-Year Review document is to evaluate whether the conclusions of the BHRA are still valid, or whether changes in exposure assumptions, toxicity data, cleanup levels, and remedial action objectives call into question the protectiveness of the selected remedy.

Human health and ecological risk assessments are conducted as a part of the RI/FS process to evaluate potential threats to human health and the environment from hazardous substances. The RI for the SMWS Site was issued in June 1991. The assessments conducted for the SWMS Site are described below.

Twenty-two COCs, a representative subset of the more than 30 contaminants identified during the RI, were selected for evaluation in the BHRA for the SMWS Site. These COCs included arsenic, beryllium, cadmium, chromium (III), chromium (IV), lead, mercury, nickel, acetone, benzene, carbon tetrachloride, chloroform, trans-1,2-DCE, 1,1-DCA, 1,1-DCE, methylene chloride, PCBs, PCE, toluene, TCE, 1,1,1-TCA, and styrene (ESE, 1991).

Subsection 6.5.1 summarizes the ecological risk evaluation and Subsection 6.5.2 summarizes the human health risk assessment. Subsections 6.5.3, 6.5.4, 6.5.5 summarize changes in ARARs/TBCs, exposure assumptions and toxicity values, respectively. Subsection 6.5.6 provides the conclusions and recommendations of this risk evaluation for this five year review.

6.5.1 Summary of the Ecological Risk Evaluation

The Ecological Risk Assessment of the SMWS Site was conducted by The Cadmus Group, Inc. in August 1990. Two methods of assessing ecological risk were used: an aggregate approach based on toxicity data from a range of freshwater species, as well as an indicator species approach based on toxicity data for species known to be present in the Souhegan River. In both approaches, the chemical concentrations of concern were identified based on a methodology

developed by the EPA Office of Toxic Substances for the study of ecosystems. A hazard index (HI) was calculated using the ratio of Exposure Level to Concern Level. If the HI was greater than 1.0, a potential for risk was assumed to exist.

Both the aggregate and indicator species methods showed no cause for concern due to contamination from VOCs for the VOC data that was available. Aquatic toxicity data were not available for some of the VOCs of concern at the time of the assessment. The aggregate approach resulted in a HI greater than 1.0 for aluminum, chromium (VI), copper, and lead. The HI for nickel was approximately equal to 1.0.

The indicator-species approach showed potential risk to rainbow trout and brook trout from copper. The HIs for aluminum and lead were also greater than 1.0 for the brook trout. Potential risk to Atlantic salmon was assumed to be similar to the rainbow trout because the two fish species are congeners.

The environmental concentration values used for hazard assessments of indicator chemical were lower than the standard AWQC values for protection of aquatic organisms at the time of the assessment. It can be argued that this approach to hazard assessment was more sensitive than an approach based strictly on the AWQCs. By using a very conservative approach, potential risk may have been overestimated. In fact, no fish kills have been observed in the area, and no unusual morbidity has been identified in the avian, terrestrial, or aquatic populations prior to or since implementation of the remedy at the SMWS Site.

Sediment concentrations of nine metals and PCBs were compared with levels predicted to produce adverse biological effects, based on a National Oceanic and Atmospheric Administration review of numerous published studies. Maximum concentrations of most of the metals exceeded the level at which adverse effects could be expected. The PCB concentrations at two stations also exceeded the effects level. However, all of the sediment results were strongly influenced by very high concentrations at one station in the Hitchner-Hendrix discharge area.

The exceedances of HIs, AWQCs, and sediment effects levels pointed particularly to the Hitchner-Hendrix outfall as the area contributing the most to potential ecological risk. The Ecological Risk Assessment concluded that if the Hendrix plant reduced or eliminated its

discharges, much if not all of the risk associated with the surface water contamination could be alleviated, since contaminated sediments would be rapidly covered with soil and plant life, thereby reducing further the likelihood of wildlife exposure.

Since the Hitchner-Hendrix outfall is no longer being used for discharges, it is likely that surface sediment concentrations have decreased since the Ecological Risk Assessment was performed. Federal AWQC values have been revised since 1990, but no updated assessments have been conducted for comparison with revised AWQC values. However, it should be noted that the ROD identified no unacceptable risks from surface water or sediment at the time.

6.5.2 Summary of Baseline Human Health Risk Assessment

As outlined in the Five-Year Review guidance, the BHRA was reviewed to evaluate basic assumptions that underlie this risk assessment and to identify significant changes that may affect the protectiveness of the remedy. Exposure pathways and assumptions for current and future use were reviewed for consistency with current guidance and toxicity values used in the baseline risk assessment were compared to current values.

Current use exposure scenarios evaluated in the BHRA included: contact with water and sediment in the trailer park stream north of Elm Street; contact with surface materials at the former OK Tool facility, and inhalation of volatiles in ambient air. Reasonable Maximum Exposure (RME) risks associated with potential exposure to surface water, sediment, and air were within the acceptable EPA cancer risk range (10-4 to 10-6) and noncancer health effects (less than HI = 1.) Cancer risks associated with soil contact for children trespassing on the former OK Tool Facility was 3×10^{-5} and the HI was 2.9.

Future use exposure scenarios evaluated in the BHRA included residential use of groundwater, use of groundwater for irrigation, and residential development of the former OK Tool property. The RME cancer risk associated with potential use of groundwater as residential drinking water greatly exceeded the EPA acceptable cancer risk range. A total RME cancer risk of 2E-1 was attributable to very high concentrations of arsenic and volatile organic compounds (VOCs) including tetrachloroethylene, and trichloroethylene. The noncancer HI exceeded 1000. Contaminants contributing to the noncancer health hazard included arsenic and several VOCs.

The RME cancer risk associated with the use of groundwater for irrigation was 2E-7 and the noncancer HI was well below 1. The RME cancer risks associated with the future residential use of the OK Tool Property was 2E-4. The RME HI was 21.

Soil contamination at the Hitchiner property was also assessed for future residential use in the BHRA, but was not addressed in the remedy specified in the ROD, ESD, or CD and therefore was not included in this review.

6.5.3 Changes in Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBCs)

Changes in ARARs and TBCs used to specify cleanup levels in the ROD were reviewed. The following changes were identified:

1. Changes to ARAR-based interim cleanup levels in the ROD include the reduction of the MCL for arsenic from 50 to 10 µg/L, and the promulgation of a new Ambient Groundwater Quality Standard (AGWS) by NHDES for 1,4-dioxane.

2. NH Env-Or 600 Contaminated Site Management, effective February 1, 2007, is pertinent to this review and is discussed below.

3. Several changes have been made to toxicity information identified in the ROD. The effects of these changes on the protectiveness of the remedy are discussed below.

4. EPA issued an *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (Subsurface Vapor Intrusion Guidance) in November 2002, and NHDES issued a Vapor Intrusion Guidance in July 2006, with an update released in July 2011. Vapor Intrusion risks have not been evaluated for the OU2 portion of the SMWS Site. The remedy was selected in 1991, prior to the issuance of any guidance relating to the assessment of vapor intrusion to indoor air.

5. Ambient Water Quality Criteria, one criteria used to assess ecological risks, has been revised since the Ecological Risk Assessment was performed in 1990.

6.5.3.1 ARARs

The federal AWQC value for one chemical has been revised several times since 1990, but no updated assessments have been conducted for comparison with AWQC values to confirm prior findings of no ecological risk.

The groundwater interim cleanup levels are based primarily on MCLs. The MCLs for VOCs detected at the SMWS Site and included as ARARs in the ROD have not changed; however, MCLs exist for VOCs which were not selected as COCs in the BHRA, nor identified in the ROD. Samples were not originally analyzed for cis-1,2-DCE, vinyl chloride, and 1,4-dioxane, but since have been detected consistently at the SMWS Site. For reasons explained in further detail below, the omission of those VOCs is not affecting the protectiveness of the remedy for VOCs in groundwater at this point in time.

It is notable that cis-1,2-DCE, a degradation product of PCE that was not historically an analyte, is now frequently detected in groundwater throughout the PCE plume. The MCL for cis-1,2-DCE (70 µg/L) is appropriate to the selected remedy, but is not specified as an interim cleanup level in the ROD. The compound vinyl chloride, another degradation product of PCE, has also recently been identified above the MCL of 2 µg/L in a limited number of OU1 monitoring wells.

The compound 1,4-dioxane has been identified above the NHDES AGQS of 3 µg/L in groundwater samples collected from multiple locations within OU2. Although concentrations are relatively low, sampling events conducted in 2003, 2009, and 2010 showed limited reduction in 1,4-dioxane concentrations across OU2 over the approximately 7-year time span. 1,4-dioxane has historically been used as a stabilizer for 1,1,1-TCA, and has, in general, only been detected where the 1,1,1-TCA plume in OU-2 previously existed. Select sampling within OU1 has not identified 1,4-dioxane above the laboratory reporting limits; however, the need to dilute samples to account for elevated concentrations of PCE and TCE at most monitoring well locations has typically resulted in elevated detection limits in excess of the MCL for 1,4-dioxane. The elevated detection limits may be concealing low level concentrations of 1,4-dioxane in excess of the relatively low AGQS; however, since 1,1,1-TCA contamination at the SMWS Site did not originate from OU1, it is unlikely to be detected even at lower detection limits.

The omission of these interim cleanup levels does not call into question the protectiveness of the remedy at this time, because the reduction of PCE concentrations in groundwater within the SMWS Site will result in reductions of cis-1,2-DCE and vinyl chloride. Furthermore, after the interim cleanup levels specified in the ROD have been met, and prior to the shutdown of the

remediation system, a risk assessment will be performed to determine whether the remedy is protective or needs to continue operation until restoration of the aquifer is achieved.

Toxicity information and the MCL for arsenic have been revised since the date of the ROD. The MCL has been reduced from 50 µg/L to 10 µg/L; that change was published in January 2001. Samples were submitted for arsenic analysis, from all exterior monitoring wells within OU1 during the November 2010 sampling event as part of this Five-Year Review process. Arsenic was not identified above its MCL in laboratory analytical results for any of the samples collected from OU1 during the November 2010 sampling event.

New Hampshire state regulation *Env-Or 600 Contaminated Site Management*, effective February 1, 2007, documents the procedures and requirements for the investigation, management, and remediation of contamination from the discharge of regulated contaminants that adversely affect human health or the environment resulting from human operations or activities in the State of NH. The procedures, criteria, and standards of Env-Or 600, are applicable to all sites in NH with contaminated soil and/or groundwater where a remedial action or site investigation is required by state law, although they cannot supersede federal statutes and regulations, Env-Or 600 includes AGQS which in most cases are equal to contaminant MCLs and ROD interim cleanup levels. However, there is one constituent for which the AGQS is lower than the ROD interim cleanup standard: 1,1-dichloroethane. However, 1,1-dichloroethane has not been detected at any location within OU1 or above the AGQS in OU2. Table 9 notes the NH AGQS for each compound when different from the ROD-specified interim cleanup levels. Because the AGQS incorporate EPA MCLs, the groundwater remedy remains protective for these constituents.

The ROD interim cleanup levels for other inorganic constituents of concern in groundwater are below MCLs or action levels, where promulgated.

Soil analytical data from the RI were compared to the more recent NHDES Soil Remediation Standards (SRS) in Env-Or 600. Table 12 shows that 6 of the 13 soil constituents of interest identified in the BHRA (arsenic, cadmium, chromium, lead, nickel, PCB) have maximum concentrations that exceed the current NHDES SRS. However, as described in Sections 6.5.4 and 6.5.5, potential human health risks associated with soil contact are within the acceptable EPA risk range and, therefore, the lack of interim cleanup levels for human health is appropriate.

6.5.3.2 TBCs

An EPA Drinking Water Health Advisory for manganese (300 ug./L) is now available. At the time of the risk assessment and ROD, manganese in groundwater exceeded 300 µg/L, but based on toxicity information available at the time, it was not considered as a contaminant of concern. Based on current toxicity information, concentrations above 300 µg/L in drinking water exceed the health advisory limit, and therefore an interim cleanup level for the SWMS Site needs to be established.

6.5.4 Changes in Exposure Pathways

A review was conducted to determine whether human health or ecological routes of exposure or receptors have been newly identified or changed in a way that could affect the protectiveness of the remedy.

Land use or future expected land use on or near the SMWS Site has not changed significantly since the performance of the RI with the exception of expanded residential development significantly to the north east of the OU1 barrier wall.

The physical site conditions have changed substantially due to demolition of the former OK Tool facility, installation of a fence around much of the OK Tool property, and regrading of the source area, which added approximately 2 to 6 feet of clean soil cover throughout the area encircled by the barrier wall.

Recreational use of the river and riverbank near the SMWS Site is permitted. The GWTPs at OU1 and OU2 are currently occupied and maintained part time (<8 hours per week).

6.5.4.1 Ecological Exposure Pathways

Regrading of the ground surface after construction of the barrier wall resulted in placement of approximately 2 to 6 ft of clean soil over the source area where maximum concentrations of soil contaminants were detected during the RI. The soil cover limits exposure of ecological receptors to these contaminated soils. The former Hitchiner-Hendrix outfall in the Souhegan River is no longer in use. Therefore, exposure of aquatic species to potentially toxic discharges from this outfall has been eliminated.

6.5.4.1.1 Human Health Exposure Pathways and Assumptions

Soil

Potential risks associated with current trespassing and future potential residential exposure to soils at the OK Tool property were evaluated using maximum chemical concentration. A treatment plant worker spends one day (8 hours) per week at the plant and may have minimal contact with soil. Future residential use is no longer considered a future potential use. The physical site conditions have changed substantially due to the installation of controls consisting of a fence around much of the OK Tool Site (see map in Attachment A and photos in Attachment B) and 2 to 6 feet of clean soil placed over the former source area during implementation of the remedy. These controls virtually eliminate any potential exposure under the present-use scenario.

Chromium speciation data (Goehlert 1991 and Szaro 1991) showing that little or none of the chromium is present in the more toxic hexavalent state was not used in the risk assessment. Current guidance on evaluating dermal exposure to soil (RAGS E, 2002) differs slightly from exposure values used in the baseline risk assessment.

Lead exposure is typically evaluated across multiple pathways using the EPA Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children. Typically, exposure to lead in soils is completed by first comparing the 95% UCL (or maximum) soil lead concentrations to a residential screening values (400 mg/kg) based on EPA's "Revised Interim Soil Lead Guidance" for CERCLA Sites and RCRA Corrective Action facilities (EPA, 1994). If the value is exceeded, the EPA IEUBK is used to evaluate lead exposure to children via multiple exposure pathways (i.e., drinking water, soil/dust exposures). Only one soil sample exceeded the residential screening value for lead and no samples exceeded the industrial soil screening value of 800 mg/kg (Regional Screening Levels Table June 2011). Because the area has been covered, the exceedance of the residential screening value does not call into question the protectiveness of the remedy. This conclusion is supported by the results of an IEUBK model run using average soil (23 mg/kg) and groundwater concentrations (0.031 mg/L); these results show that the geometric mean blood level for children aged 0 to 84 months is 3.8 micrograms per deciliter

(µg/dl), and less than 5% are estimated to exceed the EPA exposure limit of 10 µg/dl (see Attachment 11).

Potential current risks associated with contact with soil at the OK Tool Property based on updated toxicity values and the chromium speciation data are presented in Tables 13a, 14b, and 13c. These potential risks are based on contaminant levels prior to the installation of engineering controls.

Groundwater

The assumption of future potential use of groundwater has not changed. Current guidance calls for additional evaluations of exposure via dermal absorption and inhalation. The groundwater cleanup is based on interim cleanup levels which mirror drinking water standards, and therefore, these pathways will be evaluated at the completion of the remedy.

Many residential properties to the north of the Souhegan River are all provided potable drinking water via private bedrock water supply wells; while all properties along Elm Street are on municipal water. Drinking water sampling is conducted annually at a select number of residential properties north of the Souhegan River. Although no COCs have ever been detected in drinking water samples from these properties, the increased residential development in this area may alter hydraulic conditions within the bedrock aquifer at the SMWS Site. These changes could represent a potential exposure pathway to contaminants in groundwater.

Although groundwater quality samples collected from shallow bedrock monitoring wells on private property immediately north of the Soughegan River, and on the Town of Milford and mobile home park properties east of the former OK Tool Source Area along Elm Street, exceed MCLs for PCE and TCE, no institutional controls have been placed on these properties to prevent future development of water supply wells.

Vapor Intrusion

Vapor intrusion of VOCs was not evaluated as part of the 1991 BHRA because the remedy was selected prior to the issuance of any EPA guidance relating to the assessment of vapor intrusion to indoor air. The vapor intrusion pathway involves VOC vapor movement from contaminated

soil and/or groundwater and residual or mobile non-aqueous phase liquid through the subsurface into nearby buildings where occupants can be exposed. Draft EPA guidance on evaluating this pathway was released in 2002 (EPA, 2002). In 2006 NHDES published its Vapor Intrusion Guidance and in 2011, an Addendum (NHDES, 2006 and 2011). These documents provide guidance for the evaluation and mitigation of vapor intrusion resulting from VOCs at contaminated sites.

Groundwater concentrations at the SWMW Site currently exceed screening values provided by both the EPA and NH guidances that are applicable to commercial properties and multiple residential properties including a mobile home park. Therefore, an additional groundwater and potential vapor intrusion investigation is currently being developed.

6.5.5 Changes in Toxicity Values

Changes in toxicity values are summarized in Table 14.

Toxicity values for COCs were reviewed to determine whether changes could affect the protectiveness of the remedy. The noncarcinogenic hazard would likely increase for the groundwater exposure scenario as a result of the following: 1) a threefold decrease in the oral RFD for arsenic, 2) the listing of oral RFDs for TCE and benzene, and a revised RfD for manganese. Manganese was screened out as a contaminant of concern in the BHRA based on toxicity information available at the time. An RfD is no longer used to describe the health hazard associated with exposure to lead. Lead exposure is evaluated across multiple pathways using the EPA IEUBK Model. This evaluation has been conducted and shows that lead levels are not above unacceptable levels (Attachment 11).

The carcinogenic risk associated with the future groundwater use scenario would also increase as a result of the changes in cancer toxicity values shown in Table 14 for several VOCs. The noncancer hazard would increase also based primarily on additional toxicity values now available. These increases do not call into question the protectiveness of the selected remedy because the hazard and risk are already at unacceptable levels, and it is clear that the groundwater beneath the SMWS Site is not suitable for consumption in its present condition. Furthermore, after the interim groundwater cleanup levels specified in the ROD have been met,

and prior to the shutdown of the remediation system, a risk assessment will be performed to determine whether the remedy is protective or continued operation are needed to restore the aquifer.

In summary, the carcinogenic risk and noncarcinogenic hazard for the groundwater ingestion scenario would increase as a result of changes in toxicity values since the completion of the BHRA.

6.5.6 Conclusions and Recommendations

The risk evaluation performed in conjunction with this Five-Year Review indicates that risk assessment methods, assumptions, ARARs, TBCs, and input parameters have changed or been refined since the original BHRA was completed in 1991. Institutional controls restricting use of groundwater in OU1 and OU2 are necessary as required by the ROD and must be put in place to ensure continued protectiveness. A preliminary evaluation of the vapor intrusion pathway at the SMWS Site indicates that additional investigations may be warranted including shallow groundwater sampling and potentially a vapor intrusion study within occupied commercial buildings and residential properties.

It remains clear that the groundwater under much of the SMWS Site is not suitable for consumption. With few exceptions, the ROD-specified interim groundwater cleanup levels for the principal contaminants are MCLs that have not changed over time. There is one inorganic COC in groundwater at OU1 (arsenic) for which the current ARAR or TBC is lower than the ROD-specified interim cleanup level. The arsenic MCL has been changed from 50 µg/L to 10 µg/L; however, no monitoring well locations at OU1 currently exceed the standard based on 2010 laboratory analytical results.

Additionally, the MCL for cis-1,2-DCE (70 µg/L), vinyl chloride (2 µg/L), and 1,4-dioxane (3 µg/L) are appropriate to the selected remedy, but are not specified as interim cleanup levels in the ROD. The omission of these interim cleanup levels does not call into question the protectiveness of the remedy at this time, because the remediation of PCE concentrations in groundwater within the SMWS Site will result in reductions of cis-1,2-DCE and vinyl chloride. Furthermore, after the interim cleanup levels specified in the

ROD have been met, and prior to the shutdown of the remediation system, a risk assessment will be performed.

The ROD and ESD did not identify any soil cleanup levels to address the potential risks associated with contact with soil at the SMWS Site. Risks associated with soil contact are within the acceptable risk range. Further, during final grading of OU1, after installation of the barrier wall, 2 to 6 ft of clean soil was placed over the source area on the former OK Tool property within the barrier wall. A security fence has also been installed around much of the former site at OU1. Therefore, the remedy is protective of human health exposure to soil.

With respect to ecological risk, the assessment methods used originally are outdated. More recent ecological risk assessment guidance has been developed, and the ecological benchmarks for surface water, sediment, soil and food web bioaccumulation have been updated. There was insufficient data for a terrestrial screening level ecological risk assessment (SLERA), and it is uncertain whether the soil cover prevents direct exposure and food web bioaccumulation to burrowing organisms such as earthworms and their predators (birds and mammals). Due to the lack of more recent sediment and surface water data, current conditions cannot be evaluated. And, areas of emerging groundwater should be identified and sampled for site COCs, SVOCs, PCBs, acid volatile sulfide/simultaneously extracted metals (AVS-SEM), and total organic carbon.

If the updated SLERA identifies potential risks (e.g. exceedance of aquatic benchmarks, bioaccumulation into food chain), then further ecological risk assessment studies, such as toxicity tests, tissue residue analysis, and more realistic food chain modeling, would need to be considered. Although an updated assessment of current conditions is warranted based on revised ecological benchmarks, there is no evidence to suggest that the remedy does not remain protective of ecological receptors.

6.6 ADDITIONAL REMEDY PERFORMANCE TO DATE

6.6.1 OU1

6.6.1.1 Removal and Destruction of Contaminant Mass

Volatile organic contaminants are currently being removed from the subsurface in OU1 via groundwater extraction and treatment, and previously from OU1 through extraction of contaminant vapors by the SVE system. In addition, five rounds of ISCO injections have been performed within the barrier wall at OU1 resulting in destruction of additional contaminant mass in situ. Ex situ oxidation treatment of vadose zone soil with ozone and peroxide in 2009 was also implemented which destroyed an estimated 84 lbs of contaminant mass, based on the average concentration of VOCs in the 2,000 cy of soil treated.

Operation of the OU1 groundwater remediation system has resulted in the removal of approximately 2,758 lbs of total VOCs, predominantly PCE. Table 15 shows mass removed annually. Appendix A of Attachment 1 contains tables and graphs showing the monthly and accumulative removal of VOCs.

The estimates for mass removal from groundwater are based on the flow rate and influent concentration data from the monthly reports or from the November 2001 CDM calculations, where available. Between 1999 and 2008 when the SVE system was in operation, mass removal via vapor extraction were calculated similarly based on daily photo ionization detector readings of influent concentrations and daily measurements of total vapor flow through the vapor phase carbon units.

Quantification of the mass of contaminant destroyed by ISCO inside the barrier wall is not possible. However, significant decreases have been observed in groundwater contaminant concentrations in almost all of the monitoring wells inside the barrier wall, but particularly in the deep overburden zone which was targeted by most of the ISCO injections. Contaminant concentration reductions from their historic maximums in the deep overburden wells inside the wall are typically 90% or more. Reductions in shallow and mid level overburden wells inside the wall range from 18% to 100%. It should be noted, however, that it is possible that there may be a rebound in contaminant concentrations after the oxidant has been depleted. A summary of contaminant reduction percentages in OU1 is provided in Table 10.

6.6.1.2 Influent Concentrations

The concentrations of site COCs in the influent show some variability since the startup of the treatment plant, but overall they have exhibited a gradual decline. One exception is the significant increase in contaminant concentrations observed in IW-02 in 2002. The initial increase, from approximately 1,500 ppb to 2,900 ppb, occurred when the system was restarted after being off for 2 months. Well IW-01 also increased slightly when the system was restarted, but then decreased to historic concentrations. The concentrations in the exterior extraction wells increased slightly when the system was restarted, but decreased thereafter until the wells were taken out of service in 2007.

Since fall 2008 when extraction wells IW-1A and IW-2A were put into service, Total VOC concentrations in these wells have ranged from a maximum of 1,267 µg/L in IW-2A in May 2009 to a low of 143 µg/L in IW-1A in August 2010. Concentrations in IW-1A have exhibited a downward trend, but concentrations in IW-1B have remained fairly consistent in the 700 to 1,000 µg/L range during the last 2 years.

A review of the trends for the three primary contaminants in the influent, PCE, TCE, and cis-1,2-DCE indicates that they are generally downward, consistent with the trends for total VOCs. The three contaminants have behaved similarly to one another and have maintained their relative proportions, although TCE and cis-1,2-DCE relative concentrations have varied historically, with the cis-1,2-DCE occasionally exceeding the TCE concentration.

6.6.1.3 Sodium Permanganate

Currently the system extracts groundwater from within the slurry wall at a sufficient volume needed to maintain an inward hydraulic gradient across the wall and an upward gradient between the bedrock and overburden aquifers. The groundwater treatment system for the OU1 source area is not equipped to neutralize permanganate, a strong oxidizer, historically used for ISCO treatment, that can cause significant fouling and corrosion to the treatment system even at relatively low concentrations. Sodium permanganate was observed in the influent from extraction well IW-1A in August 2010 and resulted in the well being shut down for a period of approximately 2 weeks. Extraction well IW-2A has a relatively low yield and was unable to

increase capacity enough to maintain an inward/upward hydraulic gradient across the wall during this time period.

Although additional rounds of ISCO are not currently planned and concentrations of $NaMnO_4$ will dissipate with time as the oxidant continues to react with contaminants within the OU1 slurry wall, the inability of the treatment plant to neutralize permanganate currently reduces the effectiveness of the remedy at OU1. However, recent rounds of ISCO (2008-2010) were designed to flood the basal unit of the aquifer confined by the slurry wall. Based on the current conceptual model for the shallow bedrock at OU1, it can be inferred that if groundwater extraction ceases and contaminated overburden groundwater moves downward into the shallow bedrock aquifer during periods of reversed hydraulic gradients, some level of treatment may be provided by residual permanganate.

6.6.2 OU2

6.6.2.1 Removal and Destruction of Contaminant Mass

The OU2 GWTP has operated relatively consistently since its restart in January 2006 following the construction of the permanent surface water discharge. The estimated PCE mass removed by the treatment system was calculated using combined influent concentrations measured every 2 weeks since the plant has been in operation. The average influent concentration (µg/L) between two sampling events was used in conjunction with total volume of water extracted during that period to obtain the total PCE mass removed (kg). The total PCE mass removed by the treatment system since the start of the remedy was estimated at 712 lbs, which is expected to be an underestimate since this does not account for the VOCs lost by volatilization during the extraction process and as the water flows from the extraction wells to the treatment plant (where the influent sampling ports are located) (Gradient, 2011).

Calculations of the total PCE mass within the OU2 portion of the SMWS Site were estimated to be approximately 1,830 kg based on the baseline groundwater monitoring events conducted in 2004. Based on laboratory analytical results from the December 2010 groundwater sampling event, the current mass of PCE within OU2 is estimated to be approximately 296 kg, indicating an approximately 84% reduction in contaminant mass. The reduction in PCE mass is inferred to

be the combined result of both groundwater extraction and natural attenuation within the aquifer (Gradient, 2011).

6.6.2.2 Influent Concentrations

Treatment system influent and effluent quality monitoring is currently conducted bi-weekly within OU2. The influent and effluent quality monitoring data collected over the last 4 years demonstrate that there have been only minor temporal changes in influent quality, and the effluent monitoring results have consistently met the remedial objectives prior to re-injection and discharge (Gradient, 2011).

6.7 COMMUNITY NOTIFICATION

Once this document has been finalized, a public notice will be published in the local paper, and the document will be available on the EPA website and at the OSRR Records and Information Center (Boston, Massachusetts) and in the local repository in Milford, New Hampshire.

6.8 SITE INSPECTION

A site inspection of the OU2 remedial system was performed on July 20, 2011. The objective was to inspect the system to evaluate if it is being operated in accordance with ROD requirements and is being properly maintained. The inspection checklist is provided in the Attachment 10. An inspection checklist was not completed for OU1 because NHDES and EPA are on-site on a regular basis to ensure the OU1 system is being properly maintained and operated in accordance with the ROD requirements. A summary of both OU1 and OU2 inspections are provided below.

6.8.1 OU1 Inspection

6.8.1.1 Observations/Conclusions

6.8.1.1.1 Groundwater Treatment Plant

The inspection of the OU1 GWTP indicates that the plant is generally maintained well and in proper working condition. Efficiency upgrades to the plant have significantly reduced utility costs including natural gas and electricity usage and use of the SCADA system has reduced the weekly number of plant operator hours (WESTON, 2011). Standard O&M activities for OU1 are

documented in monthly reports and summarized in annual reports for OU1. One potential deficiency of the GWTP is the inability for the system to neutralize residual permanganate associated with the ISCO program within the OU1 source area as discussed in Subsection 6.6. Any plant deficiencies and improvements since startup have been documented in annual reports.

6.8.1.1.2 Capture Evaluation of Extraction Wells

Plume isoconcentration maps for the fall 2010 sampling event are provided as Figures 5-7 through 5-8 in the *2010 Annual Report* for OU1, included as Attachment 1 to this document. Potentiometric surface maps for selected months in 2002, 2006, and 2010 are provided in Attachment 8.

The isoconcentration maps show that since implementation of the remedy in OU1, the plume has split into two lobes, one inside the wall and one outside. The interior lobe is hydraulically contained by the barrier wall, in combination with groundwater extraction from the interior extraction wells.

The exterior lobe has been cut off from the interior plume by the combined effect of the pumping of the exterior extraction wells and the barrier wall. Since pumping from the exterior extraction wells was discontinued in 2007, the VOC concentrations in the exterior lobe have continued to decline, again indicating the effectiveness of the barrier wall and pumping at containing contamination within the barrier wall.

6.8.1.1.3 Groundwater Recharge

The original design of the recharge system consisted of three recharge wells, two of which are located within the barrier wall (RW-1 and RW-2), one outside the barrier wall (RW-3), and a recharge chamber outside the barrier wall. As originally constructed, the recharge chamber had a design capacity of approximately 90 gpm, but by 2005 the capacity was reduced to approximately 70 gpm. Fouling of the recharge chamber was likely attributable to the potassium permanganate injections as part of the pilot ISCO testing conducted in 2003 and 2004, which resulted in permanganate being drawn into the GWTP and discharged to the recharge chambers. In 2005, the recharge chamber was cleaned and reconstructed. This necessitated the shutdown of the GWTP from August 17 through October 19, 2005. The three pre-cast concrete basins were

pressure washed, and crushed stone was added to expand the footprint of the subsurface leach field to an area 53 ft by 27 ft. Testing of the recharge chamber after reconstruction indicated that the capacity had been increased to 150 gpm.

The exterior recharge well had an initial design capacity of 15 gpm, but recent testing of this recharge well indicates that currently it will not accept flow and would require redevelopment or reconstruction before being used for recharge. The interior recharge wells were designed to aid in recirculation of water inside the barrier wall to enhance recovery of contaminated groundwater. However, these recharge wells were not often used for this purpose because they increased the water level inside the barrier wall and aggravated the high water level problem with operating the SVE system. In addition, in order to maintain inward and upward gradients inside the barrier wall, a net volume of water must be extracted from within the wall to compensate for precipitation and upward flow from the bedrock aquifer. Although the initial recharge capacities of the interior recharge wells may have been as high as 30 gpm, it is currently estimated that they can accept flows of approximately 10 gpm each.

Treated groundwater has been primarily discharged to the recharge chamber since startup of the groundwater remediation system in OU1. Use of the recharge chamber allows for efficient operation of the GWTP and the extraction well system, and contributes to the overall protectiveness of the remedy.

6.8.2 OU2 Inspection

6.8.2.1 Observations/Conclusions

The inspection of the OU2 GWTP indicates that the plant is generally maintained well and in proper working conditions. Plant deficiencies since start-up including the metals sequestering process and sand filters have been identified, corrected, and documented in the annual reports for OU2.

An interview with the Project Manager and plant operator indicates that the treatment plant is currently operated effectively and efficiently, and that they do not feel there are any significant areas of improvement that would improve the operation of treatment plant. Additional non-routine site visits, beyond the standard weekly monitoring, have been reduced from monthly

during the first 1 to 2 years of plant operation to only once every 2 to 3 months currently. These non-routine visits are typically the result of power failure as there is no backup generator for the system and it must be restarted manually.

6.9 INTERVIEWS

Interviews were conducted with Milford town officials, concerned citizens, and the PRPs. The Interview Record forms are provided in Attachment 10.

7. TECHNICAL ASSESSMENT

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

7.1.1 OU1 - Yes

7.1.1.1 Remedial Action Performance and Monitoring Results

7.1.1.1.1 Soil Vapor Extraction/Air Sparging System

The SVE wells were designed and constructed with screens that extended more than 50% of their length below the operational water table anticipated at the time of the design. Due to the elevation of the water table within the barrier wall, the SVE/AS system was operable only 2 to 3 months each year. Several unsuccessful attempts, including the extraction of additional groundwater from within the area of the SVE well heads, were made to lower the water table. The system was permanently decommissioned in 2008 during optimization of the GWTP which included the removal of the SVE blower and AS compressor, and during the leach field soil removal action in 2008 which included the removal of the piping leg between SVE-05 and SVE-06. However, these wells remain within the barrier wall for monitoring and other uses (e.g., ISCO injections).

7.1.1.1.2 Groundwater Treatment System Effectiveness

The groundwater extraction and reinjection well system was constructed and typically operated as designed for the first 11 years of treatment system operation. However, several operational problems and system modifications should be noted:

- An operational mistake resulted in the release of VOCs to the recharge chamber outside the barrier wall in November 2000. This release is documented in the *Draft Remedial Systems Evaluation* (EPA, 2001b) and *Summary of Investigations* (CDM, 2001). In order to prevent such an overflow from occurring again, the drain valve to the solvent tank was sealed, and the sight level gauge was isolated to prevent leakage in the event of breakage. As part of the efficiency upgrades performed in 2008, the steam regeneration unit used to regenerate carbon was removed from the treatment plant and the recharge chamber was completely rebuilt.
- The treatment capacity of the tray aerators is limited to approximately 50% of design capacity. At influent VOC concentrations ranging from 400 µg/L to 1500 µg/L and flow rates ranging from 45 to 70 gpm, breakthrough approaching or exceeding the MCL for PCE was often observed in the effluent stream early in the operation. No

exceedances of discharge standards have been observed under current operating conditions (groundwater extraction from IW-1A and IW-2A at less than 30 gpm), since the influent flow and concentrations are well below the design capacity and each tray aerator has sufficient treatment capacity to meet effluent discharge standards. Troubleshooting of the tray aerators was performed by the manufacturer's representative in 2010. The aerators were disassembled and inspected and blower efficiency was tested, but no cause for the underperformance was discovered.

- Two additional groundwater extraction wells were installed in 2008 within the barrier wall containment system to extract groundwater from the shallow overburden aquifer instead of the deep overburden aquifer, to allow ISCO to be performed in the deep overburden. The ISCO program required that the hydraulic dynamics of the groundwater extraction system be altered to prevent extraction of the injected $NaMnO_4$ from the deep overburden. Two shallow extraction wells (IW-1A and IW-2A) were installed adjacent to the existing deep interior wells (IW-1 and IW-2) in order to reduce the likelihood of drawing $NaMnO_4$ into the treatment plant. However, the altered groundwater extraction is sufficient to maintain an inward hydraulic gradient across the barrier wall and an upward gradient between the bedrock and overburden inside the wall.

- Groundwater is currently not being extracted from the exterior extraction well network in OU1 in order to maintain an inward gradient within the barrier wall.

- The groundwater treatment system is currently unable to neutralize the sodium permanganate used in ISCO treatment. If $NaMnO_4$ enters the area of influence of the groundwater extraction well network and is observed within the treatment plant influent, the extraction well is shut down to prevent corrosion and fouling of the treatment process. Entry of the oxidant into the treatment plant has previously resulted in fouling of the tray aerators and operational problems. When permanganate entered extraction well IW-1A in 2010, the well was taken off-line for approximately 1 month to allow the permanganate to dissipate. As a result, hydraulic gradients reversed to downward and outward. Although concentrations of $NaMnO_4$ are expected to dissipate with time as the oxidant reacts with contaminated groundwater, during especially dry periods, $NaMnO_4$ may be drawn into the extraction wells which may require taking them off-line. However, the three ISCO rounds performed in 2008 through 2010 were designed to provide a protective layer of oxidant overlying the bedrock inside the slurry wall. Based on the conceptual model for the bedrock at OU1, it can be inferred that if contaminated overburden groundwater flows downward into the shallow bedrock aquifer during periods of reversed hydraulic gradients, some level of treatment may be provided by the passive barrier of $NaMnO_4$.

7.1.1.1.3 Remedial Action Effectiveness and Achievement of Interim Cleanup Levels

Since initiation of the remedial action, there is evidence indicating that it has contributed to significant reductions of contaminant concentrations, particularly outside the barrier wall. The

effectiveness of the barrier wall is evidenced by the significant decreases in contaminant concentrations in groundwater in the exterior extraction well network by 2007, as shown in Figures 5-21 through 5-24 in the *2010 Annual Report* for OU1, included as Attachment 1 of this document. In addition, based on the most recent round of groundwater sampling conducted in November 2010, approximately 61% (23 of 38) of the exterior monitoring wells included in the monitoring program have met interim cleanup levels. Of the 15 wells which exceed the MCL for PCE, all have exhibited a clear decreasing trend in contaminant concentrations, with the exception of three overburden monitoring wells with no discernable trends, and two shallow bedrock wells which display increasing trends. These results indicate that the barrier wall has been highly effective for containment of contamination in the overburden aquifer and reduction of contaminant concentrations in the overburden outside the barrier wall.

The groundwater extraction system has consistently removed contaminant mass from inside the containment wall since initial implementation of the remedy. In addition to the contaminant mass removed by the groundwater extraction system, the implementation of the ISCO program has likely resulted in a significant mass of contamination being destroyed in situ. Sodium permanganate continues to persist within several of the areas targeted during the most recent round of injections conducted in March 2010. Therefore, the effectiveness of the ISCO program cannot be accurately quantified until all $NaMnO_4$ has dissipated from the system and concentrations within the barrier wall have been allowed to stabilize.

The SVE and AS systems did not operate effectively and were both decommissioned in 2008. The purpose of the SVE system was to remediate contamination in the vadose zone soil. As a more effective alternative to in situ treatment with SVE, excavation and ex situ oxidation of contaminated soil was performed in 2008 and 2009. Soil exceeding the NHDES SRS was excavated and treated in above ground treatment cells. Once confirmation sampling indicated that the soil was successfully treated, it was backfilled on-site. Therefore, treatment of vadose zone soil in OU1 has been successfully completed.

7.1.1.1.4 Effectiveness of Containment

The barrier wall effectively retards the flow of groundwater and dissolved contaminants. This retardation in combination with interior extraction well pumping contains the contaminants within the barrier wall. This has been demonstrated by the maintenance of inward hydraulic gradients measured at the eastern perimeter of the barrier wall. During temporary system shutdowns, the migration of groundwater and contaminants is retarded, but may not be fully contained. In addition, the implementation of ISCO inside the wall created a protective layer of permanganate that will provide treatment to contaminated groundwater migrating from the overburden into bedrock aquifer during periods of reversed hydraulic gradients.

Additionally, the combination of the barrier wall with the exterior extraction wells has significantly limited VOCs from migrating downgradient through the overburden into OU2. As indicated previously, the majority of the exterior monitoring wells have met interim cleanup levels. In addition, based on the most recent round of data, only one overburden monitoring well exhibits concentrations of PCE greater than ten times the MCL of 5 µg/L for PCE (PW-14M at 196 µg/L). However, all of the shallow bedrock wells beyond the barrier wall exhibit concentrations of PCE greater than the MCL.

7.1.1.1.5 Chemical Oxidation Program Effectiveness

Four phases of ISCO injections have aggressively targeted "hotspots" within the area surrounded by the slurry wall. The decision to treat contaminants in situ, rather than by pump and treat as stated in the ESD, was made by EPA based on the findings of the 2001 RSE (EPA, 2001b). NHDES concurred on the decision. The ISCO program has included the injection of approximately 340,000 lbs of $NaMnO_4$ and $KMnO_4$ since 2004 and is estimated to have destroyed a significant portion of the contaminant mass present in the overburden within the slurry wall. It is difficult to estimate the actual mass of VOCs destroyed by the ISCO program at this time due to the persistence of $NaMnO_4$ in site groundwater, specifically in the targeted areas which have historically exhibited elevated concentrations of PCE. An estimate of contaminant destruction cannot be accurately determined until the majority of $NaMnO_4$ has dissipated from within the barrier wall and groundwater quality is given sufficient time to stabilize.

7.1.1.1.6 Effectiveness of the Vadose Zone Soil Treatment

Under agreement between EPA and NHDES, excavation and treatment of contaminated vadose zone soil was conducted between 2008 and 2009. Approximately 2,000 to 3,000 cy of shallow unsaturated soils from the vicinity of the former leach field system and an underground drain pipe within the barrier wall at OU1 were excavated down to the water table and treated via ex situ chemical oxidation with ozone and peroxide. This remedial action removed a significant source of shallow vadose zone contamination in an area where elevated concentrations of site COCs had been observed in the vadose zone. Soil confirmation samples collected from sidewalls of the excavation areas indicated that the remedial action was effective at removing the lateral extent of vadose zone soils impacted with concentrations of PCE above the NHDES SRS of 2mg/kg. Samples of the treated soil indicated that the chemical oxidation process was effective in reducing contaminant concentrations to the NHDES SRS of 2 mg/kg.

7.1.1.2 System Operations/Operations and Maintenance

Prior to 2002, the OU1 GWTP experienced a number of operational problems related to the SVE/AS system and processing of recovered solvent. In 2002, many operational procedures were revised to address previous deficiencies and ensure that ongoing procedures would maintain the effectiveness of the response actions. In 2008 ineffective systems (SVE/AS and carbon regeneration) were decommissioned, vadose zone soil contamination was effectively remediated with ex situ chemical oxidation, and significant contaminant mass was destroyed in the deep overburden aquifer inside the wall via ISCO.

Since 2008, plant operator labor has been reduced to part time and the treatment process is controlled remotely via the SCADA system. Weekly monitoring of treatment plant processes ensure that the plant is operating effectively. Any deficiencies noted are corrected immediately to ensure continuous operation of the treatment plant.

Currently groundwater is extracted from within the barrier wall to maintain an inward hydraulic gradient across the barrier wall and an upward hydraulic gradient between the bedrock and overburden inside the barrier wall, ensuring effective containment of contamination in the overburden while also providing contaminant mass removal. Shallow interior extraction wells have replaced the deep interior extraction wells to reduce the likelihood of drawing $NaMnO_4$ into

the treatment plant which is not designed to neutralize the oxidant. Observations of $NaMnO_4$ in the treatment plant influent during August and September 2010 resulted in interior extraction well IW-1A being shut down for a period of approximately 1 month. Hydraulic gradients on the eastern perimeter of the barrier wall reversed during this time period due to the reduced extraction rates. Although concentrations of $NaMnO_4$ are anticipated to dissipate as the oxidant breaks down contaminants and no additional rounds of ISCO are currently planned, the potential for drawing $NaMnO_4$ into the treatment plant and having to shut down for periods of time still exists.

7.1.1.3 Costs of System Operations/Operations & Maintenance

The O&M costs at the OU1 treatment plant have been reduced significantly since 2008. The plant is operated remotely via the SCADA system and plant O&M activities are limited to weekly visits by a treatment plant operator, with the exception of emergencies or power failures. In addition to labor reductions, GWTP efficiency upgrades were conducted in 2008 which have resulted in an approximately 80% reduction in natural gas use and an approximately 30% reduction in electricity usage at the treatment plant.

7.1.1.4 Opportunities for Optimization

Recent groundwater sampling events indicate that, although concentrations of PCE appear to be decreasing within the barrier wall, several monitoring wells continue to exhibit concentrations of PCE in excess of 1,000 µg/L. Options to optimize remedial systems at OU1 include targeting high concentration areas for either additional mass removal via groundwater extraction or mass destruction via ISCO. Due to the presence of residual permanganate within the barrier wall, adding extraction wells in areas of high PCE contamination to increase mass removal would likely draw permanganate into the treatment plant. Therefore, the treatment plant would need to be upgraded to handle permanganate and higher influent PCE concentrations.

Additional rounds of ISCO injections could be performed in the deep overburden inside the barrier wall without requiring modifications to the treatment plant. Groundwater could continue to be extracted to maintain hydraulic control. However, if permanganate were to be injected into the shallower overburden aquifer, which has not yet been treated by ISCO, groundwater extraction could not be performed inside the wall without drawing permanganate into the plant.

The pump and treat system would either need to be shutdown or an upgrade to the treatment plant would be necessary to neutralize permanganate in the influent.

7.1.1.5 Potential Issues Related to Equipment Malfunction or Changes

The changes to the remedial action discussed above could potentially become an issue if groundwater extraction cannot be conducted within the source area for hydraulic containment due to the presence of permanganate. If groundwater is not extracted from inside the slurry wall, a groundwater mound could develop inside the wall which may accentuate migration of contamination through bedrock fractures, potentially impacting receptors outside OU1.

7.1.1.6 Implementation of Institutional Controls and Other Measures

7.1.1.6.1 Are access controls in place and preventing exposure? (e.g., fencing and warning signs)

A fence surrounds the treatment system and barrier wall area, precluding exposure to contaminated material on the OK Tool property. In addition, a soil cover of 2 to 6 ft was placed over the source area during final grading after the barrier wall construction. These engineering controls have reduced the potential exposure of human and ecological receptors to the waste materials identified in OU1 and have thereby increased remedy protectiveness.

7.1.1.6.2 Are institutional controls in place and preventing exposure?

A GMZ has not been established, deed restrictions have not been placed on any properties, and no town ordinances or zoning have been put in place to prohibit the drilling of water supply wells in the plume or to prevent development or invasive activities at OU1. It is recommended that either the municipality establish zoning that restricts any groundwater use from this area or a GMZ be established. It is also recommended that institutional controls be put in place to restrict future use of the former OK Tool property for residential purposes.

7.1.2 OU2 - Yes

7.1.2.1 Remedial Action Performance and Monitoring Results

7.1.2.1.1 Groundwater Extraction and Reinjection System

The groundwater treatment system at OU2 has generally operated effectively for 5 years extracting groundwater at approximately 414 gpm and injecting treated water at approximately 377 gpm. The remaining volume of groundwater extracted is discharged to the Souhegan River. In general, groundwater extraction wells are redeveloped annually due to reduced specific capacity and iron fouling. In general, injection wells are redeveloped biannually as they have not exhibited the same rate of reduction in specific capacity as the extraction wells. Hydrographs of extraction and injection wells illustrate an increase of specific capacity following each redevelopment event (Gradient, 2011).

The influent and effluent quality monitoring data collected over the last 4 years demonstrate minor temporal changes in influent quality. The effluent monitoring results have consistently met the remedial objectives prior to re-injection and discharge (Gradient, 2011). The current configuration and performance results indicate that the remedial action for OU2 is protective of human health and the environment.

7.1.2.2 System Operations/Operations and Maintenance

The current operating procedures appear to be maintaining the protectiveness of the remedy. Groundwater is extracted from concentrated areas of the extended plume and treated prior to being discharged to the aquifer and Souhegan River. Treatment plant operator visits have been reduced to 1 day a week and emergency visits have been reduced from approximately 2 to 3 per month to one emergency visit every 2 to 3 months. Any deficiencies noted are corrected immediately to ensure continuous operation of the treatment plant.

7.1.2.3 Costs of System Operations/Operations and Maintenance

Costs for system O&M were not available for review as part of this Five-Year Review process. However, the system is currently able to be operated remotely via the SCADA system and plant O&M activities are limited to weekly visits by a treatment plant operator unless there are emergencies or power failures. All costs for operation of the OU2 system are paid by the PRPs.

7.1.2.4 Opportunities for Optimization

No opportunities for optimization of the GWTP were noted during this Five-Year Review process. Multiple upgrades and improvements have been made during its initial 5 years of operation including a metals filtration process, a water surge suppressor for the treatment plant effluent and influent for when the system is initially turned on, and bag filters to collect process line solids during cleaning.

The PRPs have developed a groundwater solute transport model to be used for predictive modeling of groundwater remediation in OU2. USGS evaluated this model to assess its reliability. The USGS model evaluation report, provided as Attachment 9 of this document, includes several recommendations for modifications to the model. Once the modifications have been incorporated, the model may be used to better assess the effectiveness of remedial operations in OU2 and could also be used to evaluate alternate extraction/reinjection scenarios to optimize the groundwater remediation system.

7.1.2.5 Potential Remedy Problems Related to Equipment Malfunctions or Changes

No frequent equipment breakdowns were noted during this Five-Year Review process. Groundwater extraction is generally continuous with the exception of when lines are cleaned to remove iron buildup and during redevelopment activities.

7.1.2.6 Implementation of Institutional Controls and Other Measures

7.1.2.6.1 Are access controls in place and preventing exposure? (e.g., fencing and warning signs)

The large areal extent of OU2 makes site access controls difficult to implement. Signs are posted at the GWTP identifying the environmental contractor along with 24-hour emergency contact phone numbers. Since OU2 is the “Extended Plume Area”, defined as the area of the SMWS Site outside of the area defined as the OK Tool Source Area (OU1), the potential for exposure is limited to contact with groundwater from the extended plume. Weekly monitoring of GWTP effluent samples for discharge permits compliance ensures that discharges of treated water do not pose human health or ecological risks. Most of the monitoring wells on the south side of Elm Street on the Hitchiner and Hendrix properties are inactive and have not been sampled in recent

years. One well on the Hendirx property is sampled annually and the data is used to help define the current extent of the southern plume boundary.

7.1.2.6.2 Are institutional controls in place and preventing exposure?

A GMZ has not been established, deed restrictions have not been placed on any properties, and no town ordinances or zoning have been put in place to prohibit the drilling of water supply wells in the plume or to prevent development or invasive activities within OU2. Although the Town of Milford has established a Groundwater Protection District which limits development and invasive activities within the SMWS Site. It is recommended that either the municipality establish zoning that restricts any groundwater use from this area or a GMZ be established for the entire SMWS Site. As with OU1, it is also recommended that institutional controls be implemented to set restrictions on the future use of the OU2 portion of the SMWS Site. The vapor intrusion pathway has not been evaluated at OU2, and as a result it is unclear if institutional controls are necessary to address this potential exposure pathway for current buildings or future development.

7.1.2.6.3 Are there other actions (e.g., removals) necessary to ensure that immediate threats have been addressed?

Based on the current concentrations of site COCs within groundwater and the location of several commercial and residential buildings within the footprint of the plume, further investigations of the potential vapor intrusion pathway may be warranted. An initial groundwater screening evaluation conducted as part of this Five-Year Review process identified concentrations of PCE above the GW-2 standard within the 100-ft distance of residential properties at OU2.

7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOS) USED AT THE TIME OF REMEDY SELECTION STILL VALID? - YES

7.2.1 Changes in Exposure Pathways

Land use or future expected land use on or near the SMWS Site has not changed since the performance of the RI. The current land use of the SMWS Site and surrounding area is residential, agricultural, commercial, industrial, and recreational (the baseball field adjacent to OU1). Recreational use of the Souhegan River is permitted, although the observed frequency of

use is very low. The properties located north of the Souhegan River are also utilized for recreational purposes including hunting and hiking.

Since the listing of the SMWS Site and the construction of the remedy at OU1, increased residential development has occurred north of the Souhegan River. All of these residential properties obtain potable drinking water via private water supply wells, most of which are installed within the bedrock aquifer. Drinking water samples collected annually from several of these properties have consistently been below laboratory detection limits for site COCs.

The physical site conditions at OU1 have changed substantially due to the installation of source area controls. A fence around much of the OK Tool property has been erected and a soil cover of 2 to 6 feet over the area within the barrier wall was established during construction of the barrier wall. These engineering controls have reduced the potential exposure of human and ecological receptors to the waste materials identified in OU1 and have thereby increased remedy protectiveness.

OU2 consists of the downgradient extended groundwater plume and did not include areas of aboveground "waste". Therefore, with the exception of a groundwater treatment building and associated system components (e.g., extraction/injection wells and piping), physical site conditions have not changed substantially in this portion of the SMWS Site. As mentioned above, a thorough investigation of any potential vapor intrusion pathway has not been conducted for occupied buildings within OU2. Several commercial and residential properties within OU2, in particular a residential mobile home park, are in the proximity of groundwater contaminated with PCE. These conditions warrant further investigation of the potential vapor intrusion pathway to ensure the remedy is protective.

An ecological risk assessment was conducted for the SMWS Site in 1990 during preparation of the RI. The ecological risk assessment concluded that there were potential impacts to the Souhegan River sediments as a result of industrial discharges to the river. However, with discontinuation of the discharges, ecological impacts were expected to diminish. Ecological risks resulting from soil contamination were not evaluated. In addition, federal surface water quality criteria have been revised several times since the Ecological Risk Assessment was performed.

Therefore, it is recommended that an updated screening level ecological risk assessment, consistent with current methods be conducted for the SMWS Site.

There are no newly identified contaminant sources at the SMWS Site. However, cis-1,2-DCE, vinyl chloride, and 1,4-dioxane, although not included as COCs in the ROD, have been identified at concentrations in excess of current standards.

It is notable that cis-1,2-DCE, a degradation product of PCE which was not historically an analyte, is now frequently detected in groundwater throughout the PCE plume. The MCL for cis-1,2-DCE (70 µg/L) is appropriate and relevant to the selected remedy, but is not specified as an interim cleanup level in the ROD. The compound vinyl chloride has also been recently detected above the NHDES AGQS of 2 µg/L in wells within the barrier wall. Vinyl chloride is also a degradation product of PCE and TCE and was not specified as a COC in the ROD and therefore no interim cleanup level was developed.

Sampling for 1,4-dioxane has been included in recent groundwater monitoring events for OU1 and OU2. In May 2009, samples were collected for 1,4-dioxane analysis from 9 wells in OU1, but there were no detections at the reporting limit of 2 µg/L. Concentrations of the compound have been identified above the NHDES AGQS of 3 µg/L at multiple locations within OU2, and although concentrations are relatively low, they have exhibited minimal decreases between sampling events conducted in 2003, 2009, and 2010. 1,4-dioxane has not been detected in influent samples collected from the OU2 extraction wells.

The omission of interim cleanup levels for these contaminants does not call into question the protectiveness of the remedy at this time, because the remediation of PCE concentrations in groundwater at the SMWS Site will result in reductions of cis-1,2-DCE and vinyl chloride. Furthermore, after the interim cleanup levels specified in the ROD have been met, and prior to the shutdown of the remediation systems, a risk assessment will be performed to determine whether the remedy is protective.

The only physical site conditions that have changed are the construction of the barrier wall, regrading of the OK Tool Source Area, installation of a fence around much of the former OK Tool property, and construction of the groundwater treatment facilities at OU1 and OU2.

However, upward trends of PCE concentrations in shallow bedrock wells in OU1 have raised concerns regarding contaminant migration through bedrock fractures. Data are currently being collected on conditions in the deep bedrock to gain a better understanding of the nature and extent of bedrock contamination and the potential for contaminant migration from the OU1 source area.

7.2.2 Changes in Land Use

Changes in land use at the SMWS Site have been limited to the construction of the OU1 and OU2 GWTP. There have been no significant changes in land use since the implementation of the remedy at the SMWS Site, although additional residential development with bedrock water supply wells has occurred to the far north of the SMWS Site, and potential redevelopment of the former Milford Police Station property, located adjacent to the OK Tool property (part of OU1), is currently under consideration.

7.2.3 New Contaminants and/or Contaminant Sources

The contaminants cis-1,2-DCE, vinyl chloride, and 1,4-dioxane were not identified in the ROD as COCs but have been identified at concentrations above their applicable NHDES AGQS and/or recently promulgated MCLs. The compound cis-1,2-DCE and vinyl chloride are both byproducts of the PCE and TCE degradation process. The identification of these contaminants at concentrations above standards is likely the result of natural attenuation occurring at the SMWS Site. The compound 1,4-dioxane is an emerging COC at several sites throughout the state due to the recently promulgated NH AGQS. As indicated previously, a concomitant reduction in concentrations of these compounds is expected to occur under the current remedy for both OU1 and OU2.

No new contaminant sources have been identified at the SMWS Site.

7.2.4 Changes in ARARs and TBCs

The only significant change to standards listed as ARARs in the ROD, is the reduction of the MCL for arsenic from 50 to 10 µg/L. Arsenic has not been a frequent groundwater analyte and was not observed above its MCL in any of the samples collected from OU1 in preparation for

this Five-Year Review during the December 2010 sampling event. Since preparation of the ROD, NH has established an AGQS for 1,4-dioxane of 3 µg/L.

7.2.4.1 Do any newly promulgated standards call into question the protectiveness of the remedy?

NH *Env-Or 600 Contaminated Site Management* documents the procedures and requirements for the investigation, management, and remediation of contamination from the discharge of regulated contaminants that adversely affect human health or the environment resulting from human operations or activities in the State of NH. Env-Or 600 includes AGQS for groundwater, which in most cases are equal to contaminant MCLs and ROD ICLs, and SRS values for soil cleanup.

Because the AGQSs incorporate EPA MCLs, the groundwater remedy remains protective for the constituents which have MCLs listed as interim cleanup levels. However, the AGQS is lower than the ROD interim cleanup level for 1,1-dichloroethane. This difference does not affect the protectiveness of the groundwater remedy for OU1 because 1,1-dichloroethane has not been detected at any location within the SMWS Site. Although some samples were analyzed for arsenic during the fall 2010 monitoring event at OU1, to assure protectiveness, it is recommended that all ROD constituents, including arsenic, be included as routine groundwater analytes in future sampling events for both OU1 and OU2.

As indicated previously, the compound 1,4-dioxane has been detected at concentrations above the newly promulgated NH AGQS, although there has been minimal reduction in concentrations detected between sampling events conducted in 2003, 2009, and 2010 at OU2. Concentrations of 1,4-dioxane are relatively low and exceedences have not been identified beyond the extent of the PCE plume at the SMWS Site. In addition, contaminant reduction is expected to occur under the current remedy, likely via natural attenuation mechanisms including dilution. There are no newly promulgated standards that call into question the protectiveness of the remedy.

7.2.4.2 Have TBCs used in selecting cleanup levels at the Site changed and/or affected the protectiveness of the remedy?

An EPA Drinking Water Health Advisory (300 µg./L) is now available. At the time of the risk assessment and ROD, manganese in groundwater exceeded 300 µg/L, but based on toxicity

information available at the time, it was not considered as a contaminant of concern. It is recommended that the establishment of an interim cleanup level for manganese be adopted.

7.2.4.3 Tables Illustrating Changes in Chemical-Specific, Action-Specific, and Location-Specific Standards

Table 9 illustrates the changes to chemical specific standards. The changes do not call into question the protectiveness of the remedy. The remedy, as anticipated in the ROD, continues to address the contaminants of concern. Operation of the groundwater extraction and treatment systems provides capture and treatment of contaminated groundwater.

There were no changes in action-specific and location-specific standards identified.

7.2.5 Changes in Toxicity and Other Contaminant Characteristics

The increase in concentrations of cis-1,2-DCE and vinyl chloride is inferred to be the result of the degradation process of PCE at the SMWS Site. Due to the fact that there is still a significant amount of PCE remaining in groundwater at the SMWS Site, there is the potential that concentrations of these contaminants may continue to increase as PCE degrades. However, the increase of cis-1,2-DCE and vinyl chloride would not affect the protectiveness since these contaminants would be treated under the current remedy. There is no other information to suggest that other contaminant characteristics have changed in a way that could affect the protectiveness of the remedy.

7.2.6 Expected Progress toward Meeting RAOs

The remedy is progressing as expected towards meeting RAOs. Contaminant mass has been significantly reduced across the SMWS Site and groundwater concentrations of COCs continue a downward trend. Treatment systems at both OU1 and OU2 continue to operate effectively and as anticipated in the ROD.

7.2.7 Risk Recalculation/Assessment

Risks associated with direct contact with soil were recalculated to reflect updated exposure parameter values for dermal contact and to reflect analytical data that speciated chromium in soil. See Tables 13a, 13b, and 13c for a summary of the risk calculations. The tables present

exposure scenarios that are most likely to occur at the SMWS Site, including exposure rates and durations. The calculations and tables demonstrate that the risk is at acceptable levels. Based on the recalculations, the remedy remains protective with respect to the soil exposure pathway.

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY? - YES

7.3.1 Potential Vapor Intrusion

As mentioned above, a thorough investigation of any potential vapor intrusion pathway has not been conducted for occupied buildings within OU2. Several commercial and residential properties within OU2, in particular a residential mobile home park, are in close proximity of deep groundwater contaminated with PCE. These conditions warrant further investigations of this potential exposure pathway to ensure the remedy is protective.

7.3.2 Ecological Risks

An ecological risk assessment was conducted for the SMWS Site during the 1990 RI, but it was not performed in accordance with current standard practice. Consequently, it is recommended that a screening level ecological risk assessment consistent with current methods be conducted for the SMWS Site. Although an updated assessment of current conditions is warranted based on revised ecological benchmarks, there is no evidence to suggest that the remedy does not remain protective of ecological receptors.

7.3.3 Natural Disaster Impacts

There have been no impacts from natural disasters since the implementation of the remedies in OU1 and OU2 at the SMWS Site.

7.3.4 Other Information

No other information has come to light which could affect the protectiveness of the remedy.

7.4 TECHNICAL ASSESSMENT SUMMARY

According to the data and records reviewed, the site inspections, and EPA's interviews, the remedy is functioning as intended by the ROD, as modified by the ESD. However, some components have proven to be ineffective in accomplishing the design objectives. The barrier

wall, and the groundwater extraction and treatment systems have been effective in reducing contaminant mass and concentrations in the plume. In-situ chemical treatment has been implemented to supplement the remedy anticipated in the ROD by replacing the treatment provided by the SVE/AS system.

The SVE/AS system in OU1 had numerous operational issues which prevented it from effectively remediating the contamination in the vadose zone soil. This system was decommissioned in 2008. Instead, successful excavation and ex situ oxidation of vadose zone soils was completed in 2009. The ex situ oxidation was effective in reducing soil contaminant concentration to below the NHDES SRS levels of 2 mg/kg PCE for soil leaching potential.

Additionally, ISCO using $KMnO_4$ and $NaMnO_4$ was implemented in 2003, 2004, 2008, 2009, and 2010 to aggressively destroy contaminant mass inside the barrier wall. As a result, contaminant concentrations in the overburden aquifer inside the wall have decreased. However, the continued presence of residual permanganate in the overburden inside the barrier wall has resulted in issues with full operation of the groundwater extraction and treatment system inside the barrier wall at OU1. These issues are being addressed continually and do not impact the current protectiveness of the remedy. It is recommended that the overall operation of the remedial system be evaluated.

There have been no changes in the physical conditions of the SMWS Site that would affect the protectiveness of the remedy. Access to the OU1 portion of the SMWS Site is prevented by a locked gate. Although there have been changes in the toxicity factors for the COCs that were used in the 1990 baseline risk assessment, these changes do not affect the protectiveness of the remedy for groundwater because the cleanup levels are based on MCLs. Changes to the toxicity factors and standardized risk assessment methodology affect the calculated risk and hazard for future use scenarios, but these do not affect the protectiveness of the remedy because the ROD requires that a risk assessment be conducted after the interim cleanup levels are met.

A potential exists for vapor intrusion risks in the residential and commercial buildings located at the SMWS Site, or any future residential or commercial developments within the footprint of the plume. Within OU1, the Town of Milford former Police Station property is under consideration for residential redevelopment.

There are currently no institutional controls in place to guide development or prevent installation of water supply wells on any of the properties that are impacted by the groundwater plume.

8. ISSUES

The table below summarizes the issues identified by the Five-Year Review for the SMWS Site and indicates whether each issue affects the current and/or future protectiveness of the remedy.

Summary of Issues Identified During the Five-Year Review

Issues	Affects Current Protectiveness (Y/N)	May Affect Future Protectiveness (Y/N)
Additional groundwater and potential indoor vapor intrusion investigations are required for occupied buildings within OU2.	Y	Y
Fouling of OU1 GWTP with residual permanganate and under performance of tray aerators.	N	Y
No institutional controls or deed restrictions are in place to regulate development or prevent installation of water supply wells.	N	Y
No interim cleanup levels established for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, or manganese, and the MCL for arsenic has been lowered to 10 ppb.	N	Y
Ecological risk assessment, consistent with current methods, has not been updated for the SMWS Site.	N	Y

Notes:

GWTP = groundwater treatment plant
cis-1,2,DCE – cis-1,2- dichloroethene

Other issues identified during the review, but do not impact the protectiveness of the remedy, include continued monitoring for arsenic and other metals with interim cleanup levels in both OU1 and OU2.

9. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The table below specifies suggested improvements to current site operations, activities, remedy, or conditions and notes the parties responsible for actions, milestone dates, and which agencies have oversight authority. These recommendations address all the issues that may affect current and/or future protectiveness, as well as others that will improve the efficiency of the remedy.

Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Schedule for Completion	Affects Protectiveness (Y/N)	
					Current	Future
Additional groundwater and potential indoor vapor intrusion investigations are required for occupied buildings within OU2	Perform a shallow groundwater investigation. EPA has requested that the PRPs conduct this investigation at potentially impacted residential structures within OU2, but the investigation has not been initiated	PRPs	NHDES and EPA	9/30/2013	Y	Y
Fouling of OU1 GWTP with residual permanganate and under-performance of tray aerators	Conduct evaluation of OU1 GWTP and extraction system performance	NHDES	EPA	3/30/13	N	Y
No institutional controls or deed restrictions are in place to regulate development or prevent installation of water supply wells	Implement institutional controls: Establish GMZ, Town Ordinance, Zoning and/or Deed Restriction	NHDES and PRPs	EPA	By 2016 (next 5-Year Review)	N	Y
No interim cleanup levels established for 1,4-dioxane, vinyl chloride, cis-1,2-DCE or manganese, and the MCL for arsenic has been lowered to 10 ppb	Establish interim cleanup levels and prepare decision document	EPA	NHDES and EPA	9/30/2013	N	Y

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Schedule for Completion	Affects Protectiveness (Y/N)	
					Current	Future
Ecological risk assessment, consistent with current methods, has not been updated for the SMWS Site	Conduct updated ecological risk assessment, consistent with current methods, for the SMWS Site	NHDES and EPA	NHDES and EPA	By 2016 (next 5-Year Review)	N	Y

Notes:

NHDES = New Hampshire Department of Environmental Services
EPA = U.S. Environmental Protection Agency
GMZ = Groundwater Management Zone\
cis-1,2,DCE – cis-1,2- dichloroethene
GWTP = groundwater treatment plant
PRP = potentially-responsible party

10. PROTECTIVENESS STATEMENT(S)

The remedy at OU1 currently protects human health and the environment because there is no contact with or consumption of contaminated groundwater, and the remedy is being implemented as intended. The GWTP and extraction system, in conjunction with the barrier wall, are operating so as to maintain an inward gradient in order to prevent the migration of contamination. However, in order for the OU1 remedy to be protective in the long-term, an evaluation of the OU1 GWTP and extraction system performance needs to be conducted, groundwater institutional controls need to be implemented, interim cleanup levels for 1,4-dioxane, vinyl chloride, cis-1,2-dichloroethene (cis-1,2-DCE), arsenic, and manganese need to be established, and an updated ecological risk assessment needs to be conducted to ensure long-term protectiveness.

A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained. Despite the fact that operation of the extraction, treatment and reinjection/discharge systems are functioning as designed, further information is needed at OU2 by completing a shallow groundwater and potential vapor intrusion investigation. It is expected that these actions will take approximately two years to complete, at which time a protectiveness determination will be made. In addition, in order for the OU2 remedy to be protective in the long-term, groundwater institutional controls need to be implemented and interim cleanup levels established for 1,4-dioxane, vinyl chloride, cis-1,2-DCE, arsenic and manganese, at a minimum.

Overall, a site-wide protectiveness determination is deferred for the combined remedies at the SMWS Site until further information is obtained. Upon completion of a shallow groundwater and potential vapor intrusion investigation at OU2, a site-wide protectiveness determination will be made.

11. NEXT REVIEW

The next Five-Year Review for the SMWS Site is required by September 2016, 5 years from the date of this review.

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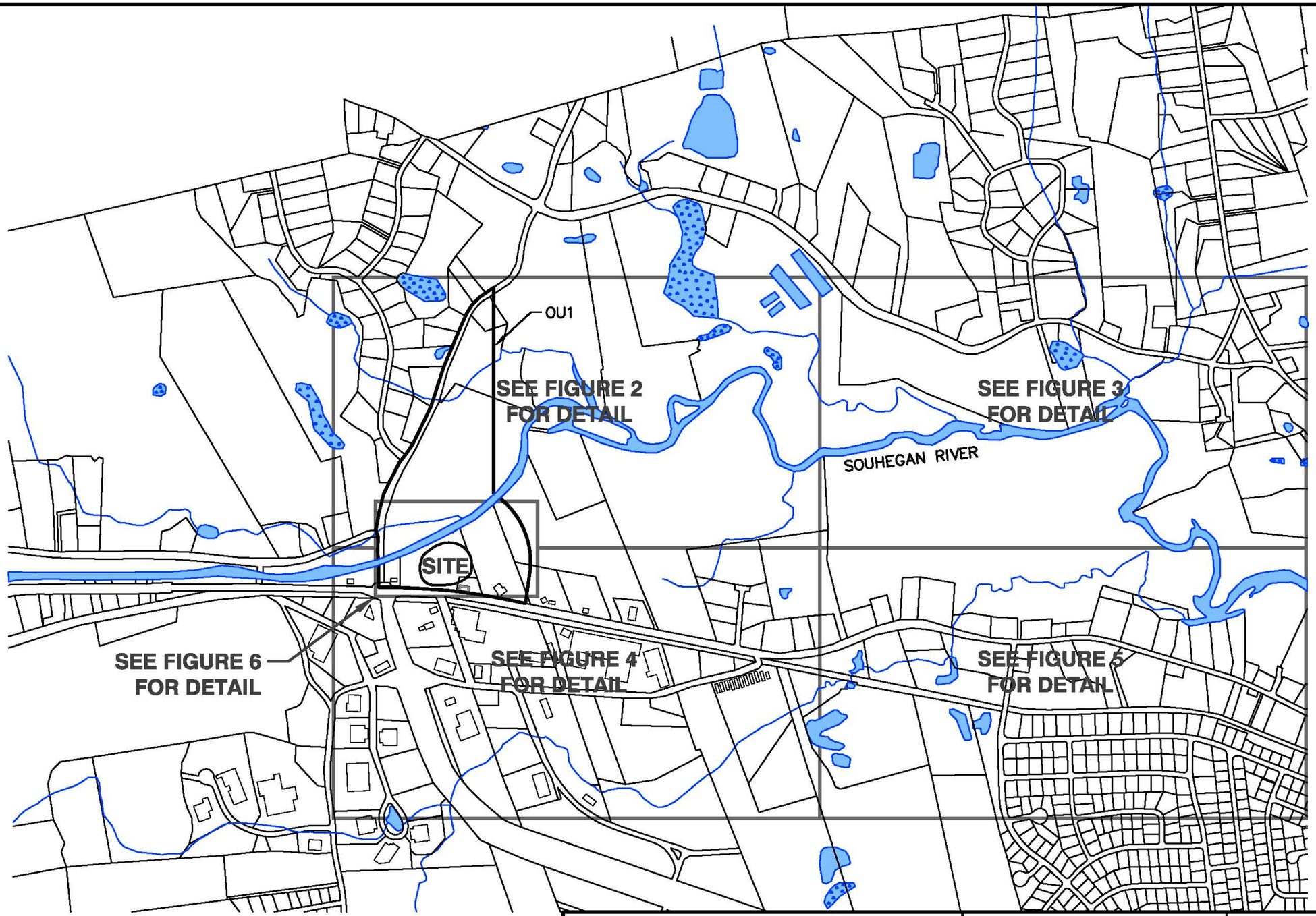

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AREA PLAN

SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
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LEGEND
- WELL
- BEDROCK WELL

GRAPHIC SCALE
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SITE PLAN (NORTHWEST TILE)

SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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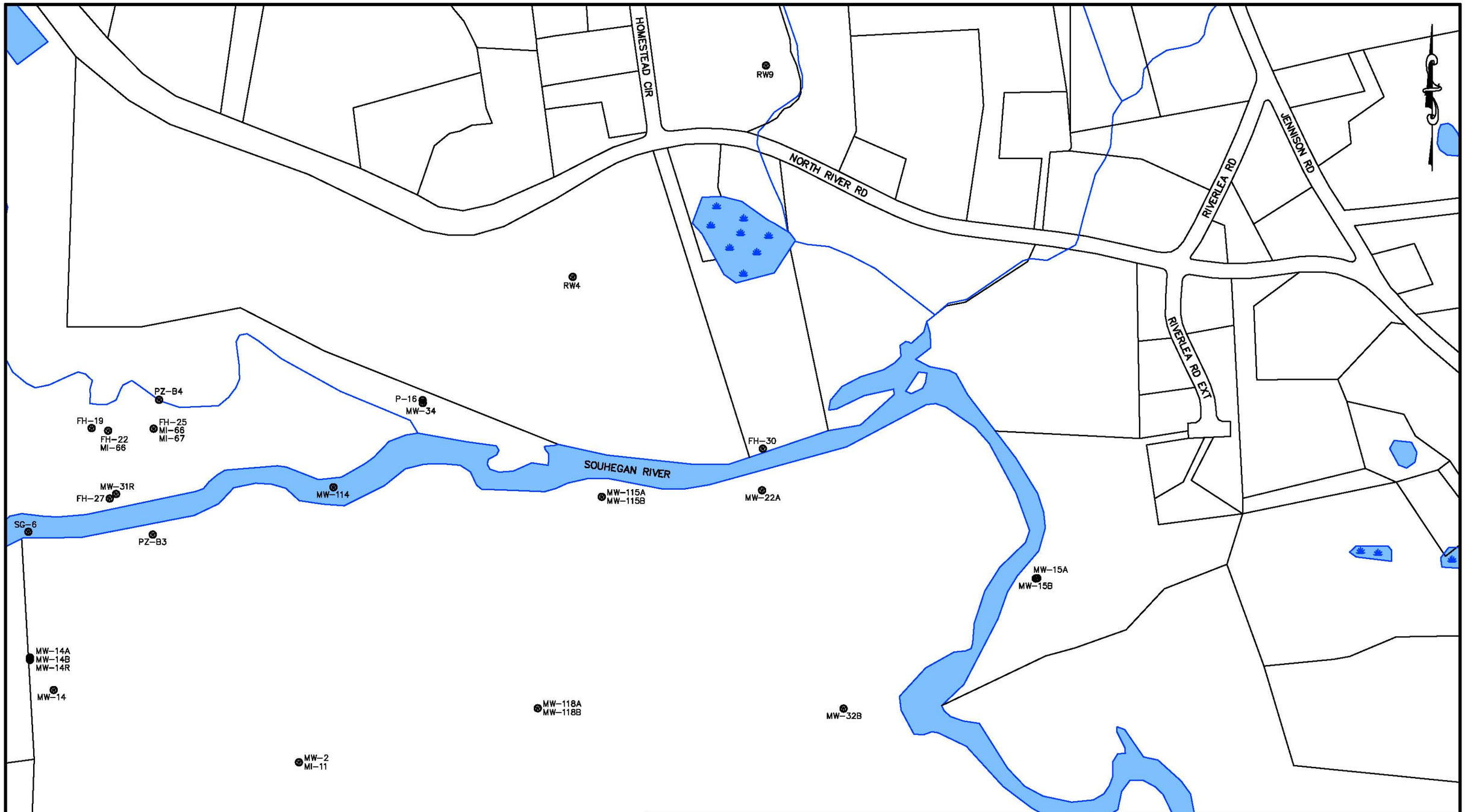

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WELL

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SITE PLAN (NORTHEAST TILE)	WESTON SOLUTIONS CONCORD NEW HAMPSHIRE		NEW HAMPSHIRE DEPARTMENT OF Environmental Services		
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE MILFORD, NEW HAMPSHIRE	DRAWN BEG	DATE MAY 2011	DES. ENG.	DATE	W.O. NO. 20111.023.004
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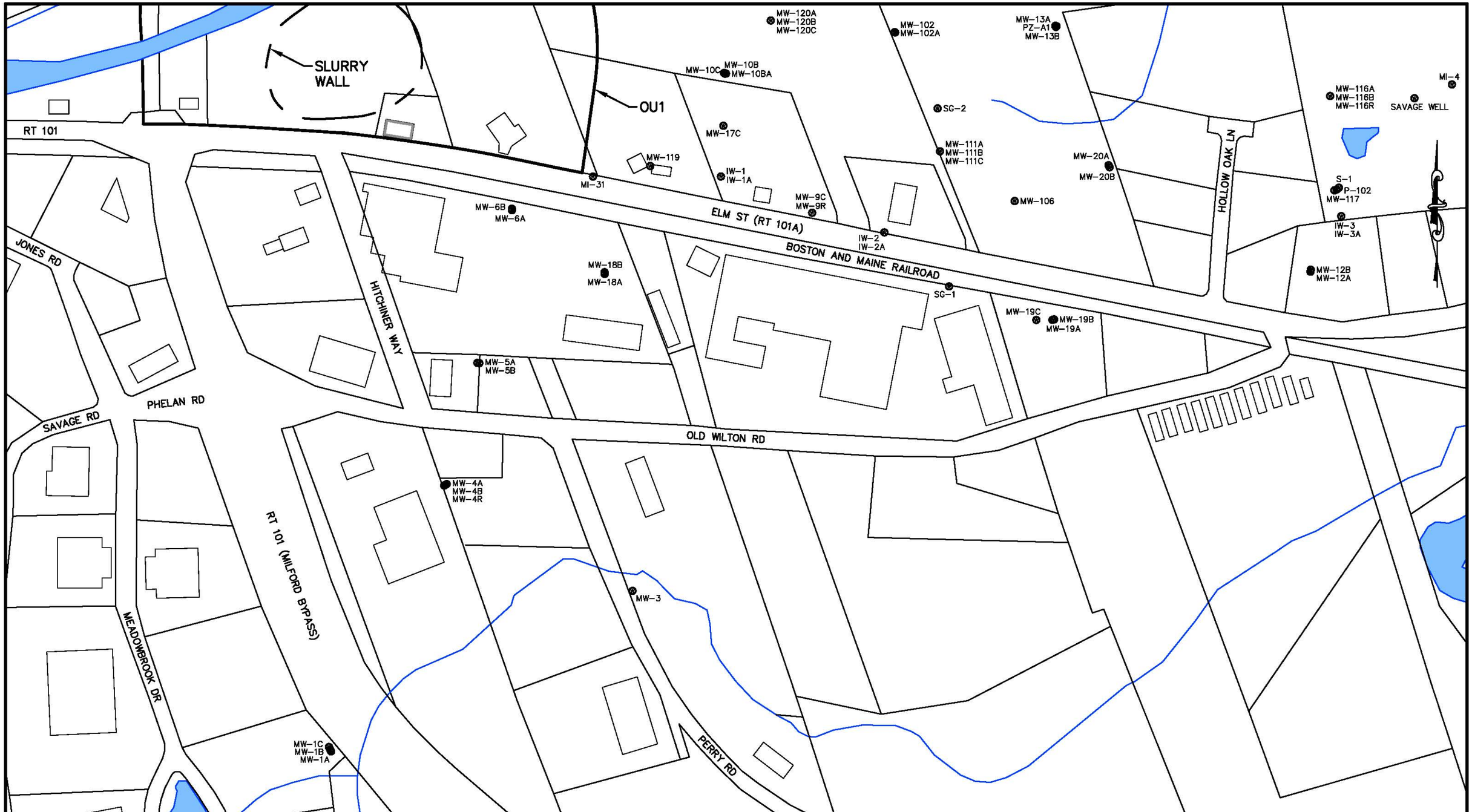

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WELL

GRAPHIC SCALE
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APPROXIMATE SCALE IN FEET

SITE PLAN (SOUTHWEST TILE)

SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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LEGEND
WELL

GRAPHIC SCALE
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APPROXIMATE SCALE IN FEET

SITE PLAN (SOUTHEAST TILE)

SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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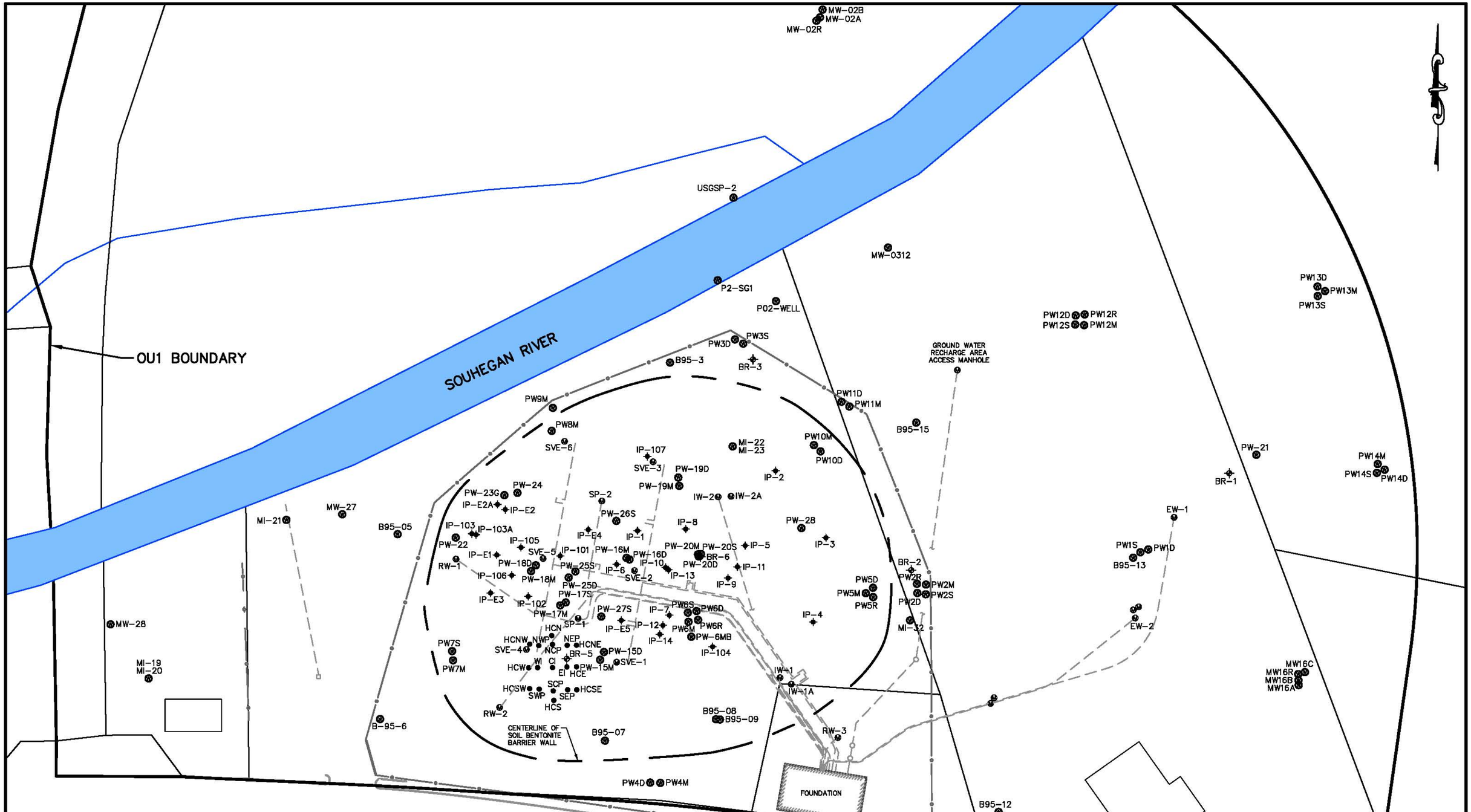

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LEGEND
- WELL
- BEDROCK WELL
- INEEL WELL
- MANHOLE
- ISCO INJECTION POINT

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APPROXIMATE SCALE IN FEET

SITE PLAN (SLURRY WALL TILE)

SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Table 1

Chronology of Events
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Event	Date
Manufacturing operations at OK Tool Company, Inc., to produce metal cutting tools and tool hardware	1940s through 1987
Initial discovery of volatile organic compound contamination in Savage Municipal Water Supply Well	February 1983
Inspection of OK Tool Company reveals potential releases to floor drains, the ground, and the Souhegan River	February 1983
EPA conducted an emergency removal action to supply uncontaminated water to the Milford Mobile Home Park, completed when trailer park was connected to municipal water supply system	March 1983-May 1983
Listing on EPA National Priorities List (NPL)	Proposed September 8, 1983, Final September 21, 1984
Normandeau Associates completes Hydrogeologic Study and Waste Evaluation of OU1	December 1983
Normandeau Associates completes Phase II Site Investigation of OU1	November 1984
New Hampshire Water Supply and Pollution Control Commission completes hydrogeological investigation of the SMWS Site	1984
Soil remediation activities within the OK Tool building	1985
Administrative Order by Consent signed by EPA	June 10, 1987
Remedial Investigation/Feasibility Study (RI/FS) complete	1988 through June 1991
Proposed plan identifying EPA's preferred remedy presented to public; start of public comment period	July 11, 1991
RI/FS presented to public	July 12, 1991
ROD selecting the remedy is signed	September 27, 1991
Consent Decree requiring settling PRPs (Hitchiner Manufacturing Company and Hendrix Wire and Cable Company) to perform the work in the Extended Plume, defined as the area outside OU1. Thereafter OU1 is referred to as OU1 and the Extended Plume, OU2	June 27, 1994
Superfund State Contract, Cooperative Agreement, or Federal Facility Agreement signature, OU1	October 1, 1994
Consent Decree cashing out the parties connected to the OK Tool Company	December 8, 1994
Vertical Contaminant Profiling investigation indicates that dense non-aqueous phase liquid (DNAPL) is present at OKTSA	March through April 1995, report November 1995
OU1 Remedial Design start [Camp, Dresser, & McKee (CDM)]	1995
OU1 Remedial Design complete (100% design submitted)	October 1996
Public Meeting held at Milford Town Hall to present Explanation of Significant Differences (ESD)	November 19, 1996
Explanation of Significant Differences is signed to address the discovery of DNAPL at OU1, changes include: acquisition of the property for the treatment plant, addition of the barrier wall, addition of three extraction wells, reduction of pumping rate, construction of a SVE system with AS, and the treatment of groundwater by air stripping with carbon adsorption. Treated groundwater will be discharged to the ground using two injection wells and a recharge pit	December 19, 1996
OU1 actual remedial action start, NHDES contracts with Sverdrup Environmental, Inc., for construction	November 1997
OU2 Draft *Remedial Design Investigation Report*	November 1997
OU1 Remedy construction dates (start, finish)	December 1997 through March 1999
OU1 barrier wall construction dates (start, finish)	June 1998 through October 1998
OU1 Treatment Plant substantial completion date	March 23, 1999

Table 1

Chronology of Events
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Event	Date
OU1 Treatment Plant full operation initiated	May 1999
CDM, NHDES, and EPA host open house at OU1 Treatment Plant	June 19, 2000
Indoor Air Study completed for the Milford Police Station	August 2000
OU1 Surfactant pilot testing	Fall 2000
OU1 Release of an unknown amount of volatile organic compounds to recharge chamber	November 2000
OU1 Remedial System Evaluation conducted	March 2001
USFilter Operating Services, Inc., contracted to operate OU1 Treatment Plant	January 2002
OU2 *Revised Draft Remedial Design Investigation Report*	May 2002
OU2 *Remedial Design Investigation Report* approved by EPA	September 2002
OU2 Remedy construction start (extraction wells installed)	Spring 2003
OU2 Remedial Design complete (100% design submitted)	September 22, 2003
OU2 Final Design approved by EPA	Jaunary 22. 2004
OU2 Remediation system construction begins	February 2004
OU2 Remedy initial operation	October 27, 2004
OU2 Remedy shut down	December 6, 2004
OU2 Remedy resumes temporary operation	September 6, 2005
OU2 Remedy inspection by EPA, NHDES, et al.	November 19, 2005
OU2 permanent surface water discharge permit granted by NHDES	December 30, 2005
OU2 Remedy resumes full operation	Jaunary 27, 2006
OU2 Remedy inspection by EPA, NHDES, CENAE, et al.	April 20, 2006
OU2 Pre-final Remedy inspection by EPA, NHDES, et al.	June 29, 2006
OU1 and OU2 *Preliminary Close Out Report*	September 2006
OU2 comprehensive monitoring well inspection program	2008
Gradient reports groundwater samples 1,4-dioxane results for OU2	February 19, 2010
Well replacement/repair activities performed at OU2 by Gradient	October 12, 2010
Gradient prepares a Revised Fall 2010 Annual Groundwater Sampling Plan for OU2	December 13, 2010
Final Close-out Report	NA
Deletion from NPL	NA
Previous five-year reviews	none

Notes:

EPA = United States Environmental Protection Agency

SMWS Site = Savage Municipal Water Supply Superfund Site

ROD = Record of Decision

PRP = potentially-responsible party

OKTSKA = OK Tool Source Area

SVE = soil vapor extraction

AS = air sparging

NHDES = New Hampshire Department of Environmental Services

CENAE = United States Army Corps of Engineers, New England District

Gradient = Gradient Corporation

NA = Not applicable

Table 2

Baseline Risk Assessment Contaminants of Concern
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Groundwater	Soil	Surface Water	Sediment	Air
Benzene	Acetone	Acetone	Acetone	Acetone
1,1-Dichloroethane	Carbon Tetrachloride	Benzene	1,1-Dichloroethane	Methylene Chloride
1,1-Dichloroethylene	Methylene Chloride	1,1-Dichloroethane	Methylene Chloride	Tetrachloroethylene
trans-1,2-Dichloroethylene	Tetrachloroethylene	Styrene	Chloroform	1,1,1-Trichloroethane
Tetrachloroethylene	Toluene	Tetrachloroethylene	Tetrachloroethylene	Nickel
1,1,1-Trichloroethane	Trichloroethylene	1,1,1-Trichloroethane	Trichloroethylene	Lead
Trichloroethylene	Arsenic	Arsenic	Toluene	--
Arsenic	Cadmium	Chromium	1,1,1-Trichloroethylene	--
Beryllium	Chromium	Lead	Arsenic	--
Chromium	Lead	Nickel	Beryllium	--
Lead	Mercury	--	Cadmium	--
Nickel	Nickel	--	Chromium	--
--	PCBs	--	--	--

Notes:

-- = Not a contaminant of concern for this media.

PCB = polychlorinated biphenyl

Table 3

Summary of PCE Concentrations
PW-12, PW-13, and PW-14 Well Clusters (OU1)
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

	PW-12S	PW-12M	PW-13S	PW-13M	PW-14M
Before (11/00)	72	18	42	80	1,000
After (date)	200 (5/01)	880 (5/01)	140 (5/01)	120 (11/01)/200 (5/02)	1,300 (11/02)
Current (Nov-10)	< 2	< 2	26	8.1	216

Notes:

All concentrations are in micrograms per liter (µg/L).

Table 4

Remedy Performance Standards
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Compound	Performance Standards (µg/L)		Basis[2,3, 4]
	Interim Cleanup Levels[1]	Surface Water Discharge and Filtration Backwash[2]	
1,1,1-Trichloroethane (TCA)	200		MCL (ROD)
1,1-Dichloroethane	3,500		RfD (ROD)
1,1-Dichloroethene	7		MCL (ROD)
Antimony	3		PMCLG (ROD)
Arsenic, Total	50	150	MCL (ROD) Milford POTW
Benzene	5		MCL (ROD)
Beryllium	1		MCLG (ROD)
Cadmium, Total		987	Milford POTW
Chromium	100		MCL (ROD)
Copper, Total		634	Milford POTW
Cyanide, Total		32,000	Milford POTW
Iron, Total		910	NHDES
Lead, Total	15	5	MCL (ROD) NHDES (SW Discharge)
Manganese,Total		820	NHDES
Mercury, Total		57	Milford POTW
Methylene Chloride	5		MCL (ROD)
Molybdenum, Total		926	Milford POTW
Nickel	100		PMCL (ROD)
Silver, Total		3,132	Milford POTW
t-1,2-Dichloroethene	100		MCL (ROD)
Tetrachloroethene (PCE)	5		MCL (ROD)
Trichloroethene (TCE)	5		MCL (ROD)
Zinc,Total		33	NHDES

Notes:

NHDES = New Hampshire Department of Environmental Services

µg/L = micrograms per liter

ROD = Record of Decision

[1] Interim Cleanup Levels for volatiles are equivalent to New Hampshire Ambient Groundwater Quality Standards, with the exception of 1,1-Dichloroethane, and were established in the ROD (1991).

[2] Performance standards issued by the Milford Publically Owned Treatment Works (POTW) are for metals filtration backwash conveyed to the POTW via sanitary sewer from the OU2 treatment process; added to remedy in January 2006.

[2] Federal Maximum Contaminant Levels (MCL) and/or Maximum Contaminant Level Goals (MCLG) were actual or proposed (PMCL/PMCLG) at the time of the ROD.

[4] "RfD" means the cleanup level was determined based on a human health protection-based reference dose.

Table 5

Maximum Volatile Organic Compound Detections in 2010
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Contaminant	ROD MCL	OU1 Max	Well ID	Date	OU2 Max	Well ID	Date
1,1,1-TCA	200	4	IW-1A	12/17/2010	5.3	MW-20B	12/7/2010
1,1-DCA	3,500	ND	NA	NA	19	MW-116A	6/28/2010
1,1,-DCE	7	ND	NA	NA	**14**	**MW-116A**	**6/28/2010**
MEK	NS (4,000)	ND	NA	NA	6.1	MW-109A	6/28/2010
Acetone	NS (6,000)	102	PW-15M	11/18/2010	47	MW-101A	12/9/2010
cis-1,2-DCE	NS (7)	**1790**	**PW-20S**	**11/16/2010**	**39**	**MW-103**	**6/28/2010**
tans-1,2-DCE	100	4.2	SVE-02	11/16/2010	ND	NA	NA
PCE	5	**4900**	**PW-25D**	**2/16/2010**	**410**	**MW-120C**	**12/9/2010**
TCE	5	**540**	**PW-25D**	**2/16/2010**	**60**	**MW-103**	**12/9/2010**
Vinyl Chloride	NS (2)	**7.5**	**SVE-02**	**11/16/2010**	ND	NA	NA
1,4-Dioxane	NS (3)	NA	NA	NA	**5.85**	**MW-116A**	**12/6/2010**

Notes

ROD = Record of Decision

MCL = Maximum contaminant level

TCA = Trichloroethane

DCA = Dichloroethane

DCE = Dichloroethylene

MEK = Methyl ethyl ketone

PCE = Tetrachloroethylene

TCE = Trichloroethene

NS = No MCL specified in ROD. New Hampshire Ambient Groundwater Quality Standard in parentheses.

ND = Not detected

NA = Not applicable

Bold = Indicates sample result exceeds MCL or AGQS where applicable.

Table 6

Operable Unit 2 Groundwater Quality Monitoring Summary
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Date	Number of Wells	Analytical Parameters	Notes
November/December 2003	42	VOCs, plus 1,4-dioxane at 8 wells	Baseline monitoring round
Summer 2004	69	VOCs	Baseline monitoring round
September 2005	34	VOCs, plus iron and manganese at 4 wells	Interim monitoring round
Winter 2005	70	VOCs	Quarterly monitoring round
April 2006	70	VOCs	Quarterly monitoring round
July 2006	69	VOCs, plus manganese and/or iron at 1 well	Quarterly monitoring round
November 2006	70	VOCs, plus manganese and/or iron at 1 well	Quarterly monitoring round
April 2007	70	VOCs, plus manganese and/or iron at 1 well	Quarterly monitoring round
August 2007	48	VOCs, plus manganese and/or iron at 1 well	Quarterly monitoring round
December 2007	21	VOCs, plus manganese and/or iron at 1 well	Quarterly monitoring round
January/February 2008	69	VOCs, plus manganese and/or iron at 1 well	Quarterly monitoring round
March 2008	21	VOCs, plus manganese and iron at 1 well	Quarterly monitoring round
September 2008	41	VOCs, plus manganese and iron at 1 well	Quarterly monitoring round
December 2008	49	VOCs, plus manganese and iron at 1 well	Quarterly monitoring round
June 2009	22	VOCs, plus manganese and iron at 1 well	Semi-annual monitoring round
November/December 2009	51	VOCs, plus manganese and iron at 1 well and 1,4-dioxane at 17 wells	Annual monitoring round
June 2010	20	VOCs	Semi-annual monitoring round
December 2010	68	VOCs, plus 1,4-dioxane at 21 wells	Annual monitoring round

Notes:

VOC = volatile organic compounds

Table 7

Operable Unit 2 PCE Mass Reduction Summary
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Remedy Operating Period	PCE Mass Reduction via Extraction	Estimated Total PCE Aquifer Mass Reduction	Cumulative PCE Mass Reduction via Extraction	Estimated Cumulative PCE Aquifer Mass Reduction
October to December 2004, September to November 2005	83 kilograms	500 kilograms	83 kilograms	500 kilograms
Winter 2005 - July 2006	72 kilograms	250 kilograms	155- kilograms	750 kilograms
July 2006 - January 2008	95 kilograms	310 kilograms	250 kilograms	1,060 kilograms
January 2008 - November 2008	30 kilograms	195 kilograms	280 kilograms	1,255 kilograms
November 2008 - January 2010	23 kilograms	116 kilograms	303 kilograms	1,371 kilograms
January 2010 - December 2010	20 kilograms	163 kilograms	323 kilograms	1,534 kilograms

Notes:

PCE = tetrachloroethylene

Table 8

Annual System Operations/Operation and Maintenance Costs for OU-1
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Dates		Total Cost rounded to nearest $1,000
From	To	
Apr-99	Dec-99	$180,000
Jan-00	Dec-00	$306,000
Jan-01	Dec-01	$315,000
Jan-02	Dec-02	$348,000
Jan-03	Dec-03	$294,000
Jan-04	Dec-04	$348,000
Jan-05	Dec-05	$287,000
Jan-06	Dec-06	$318,000
Jan-07	Dec-07	$225,000
Jan-08	Dec-08	$198,000
Jan-09	Dec-09	$147,000
Jan-10	Dec-10	$117,000
Average Annual Cost		$257,000

Table 9

Summary of Interim Groundwater Cleanup Levels
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Chemical of Concern	Date of Establishment	Interim GW Cleanup Level	Basis for Cleanup Level	Notes
Benzene	ROD - 9/27/1991	5 µg/L	MCL	Current MCL is still 5 µg/L [MCLG is zero]
1,1-Dichloroethane	ROD - 9/27/1991	3,500 µg/L	Based on RfD of 0.1 mg/kg/day	Current HEAST RfD is still 0.1 mg/kg/day [NH AGQS of 81 µg/L]
1,1-Dichloroethylene	ROD - 9/27/1991	7 µg/L	MCL	Current MCL is still 7 µg/L
trans-1,2-Dichloroethylene	ROD - 9/27/1991	100 µg/L	MCL	Current MCL is still 100 µg/L
Methylene Chloride	ROD - 9/27/1991	5 µg/L	Proposed MCL	Current MCL is still 5 µg/L [MCLG is zero]
Tetrachloroethylene	ROD - 9/27/1991	5 µg/L	MCL	Current MCL is still 5 µg/L [MCLG is zero]
1,1,1-Trichloroethane	ROD - 9/27/1991	200 µg/L	MCL	Current MCL is still 200 µg/L
Trichloroethylene	ROD - 9/27/1991	5 µg/L	MCL	Current MCL is still 5 µg/L [MCLG is zero]
Antimony	ROD - 9/27/1991	3 µg/L	Proposed MCLG	Current MCL is 6 µg/L
Arsenic	ROD - 9/27/1991	50 µg/L	MCL	Current MCL is 10 µg/L [MCLG is zero]
Beryllium	ROD - 9/27/1991	1 µg/L	Proposed MCL	Current MCL is 4 µg/L
Chromium	ROD - 9/27/1991	100 µg/L	MCL	Current MCL is still 100 µg/L
Lead	ROD - 9/27/1991	15 µg/L	Action Level	Action Level is still 15 µg//L [MCLG is zero]
Nickel	ROD - 9/27/1991	100 µg/L	Proposed MCL	Proposed MCL was not finalized [NH AGQS of 100 µg/L]
Vinyl Chloride	Proposed	2 µg/L	MCL	Detected in OU1 wells during 2010 performance monitoring
cis-1,2-Dichloroethene	Proposed	70 µg/L	MCL	Added to sampling program for OU1 and OU2 as a degradation by-product
1,4-Dioxane	Proposed	3 µg/L	NH AGQS	Emerging contaminant added to OU2 sampling program due to known association with 1,1,1-TCA

Notes:

EPA = United States Environmental Protection Agency

ROD = Record of Decision (EPA, 1991)

GW = groundwater

µg/L = micrograms per liter (parts per billion)

MCL = Maximum Contaminant Level in drinking water

MCLG = Maximum Contaminant Level Goal in drinking water

RfD = Reference Dose

HEAST = Health Effects Assessment Summary Tables

NH AGQS = New Hampshire Ambient Groundwater Quality Standard

Table 10

Tetrachloroethylene Summary for OU1
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

	Nov-10 Result	Pre-Remedy*	Max	Percent Reduction Since Earliest Event	Percent Reduction From Max Concentration	Location
B95-03	<2	<2	180	NA	99%	Northern Boundary Outside Barrier Wall
B95-05	<2	<2	<2	NA	NA	Western Boundary Outside Barrier Wall
B95-06	<2	<2	<2	NA	NA	Western Boundary Outside Barrier Wall
B95-08	<2	9.3	240	89%	100%	Plume Interior
B95-09	2.9	52	610	94%	100%	Plume Interior
B95-12	<2	<2	<2	NA	NA	Dissolved Plume Southeast of Barrier Wall
B95-13	5.9	2000	5500	100%	100%	Dissolved Plume East of Barrier Wall
B95-15	<2	920	2000	100%	100%	Dissolved Plume Northeast of Barrier Wall
MW-2R	93	26	130	**-258%**	28%	Dissolved Plume North of Barrier Wall
MW-16A	<2	71	71	98%	98%	Dissolved Plume Southeast of Barrier Wall
MW-16B	<2	510	510	99%	99%	Dissolved Plume Southeast of Barrier Wall
MW-16C	9.2	930	1600	99%	100%	Dissolved Plume Southeast of Barrier Wall
MW-16R	110	510	630	78%	83%	Dissolved Plume Southeast of Barrier Wall
PW-01D	29	2600	2600	99%	99%	Dissolved Plume East of Barrier Wall
PW-01S	2.1	3400	3400	100%	100%	Dissolved Plume East of Barrier Wall
PW-02D	19	170	1700	89%	99%	Eastern Extent Outside Barrier Wall
PW-02M	<2	1100	1600	100%	100%	Eastern Extent Outside Barrier Wall
PW-02R	426	36	1100	**-1083%**	61%	Eastern Extent Outside Barrier Wall
PW-02S	<2	830	1400	100%	100%	Eastern Extent Outside Barrier Wall
PW-03D	5.6	<2	5.6	**-460%**	0%	Northern Boundary Outside Barrier Wall
PW-03S	2	2.1	7.4	5%	73%	Northern Boundary Outside Barrier Wall
PW-04D	<2	38	38	97%	97%	Dissolved Plume South of Barrier Wall
PW-04M	<2	2.1	2.1	52%	52%	Dissolved Plume South of Barrier Wall
PW-05D	63	1500	1700	96%	96%	Eastern Extent Inside Barrier Wall
PW-05M	2.9	1400	1400	100%	100%	Eastern Extent Inside Barrier Wall
PW-05R	34	95	200	64%	83%	Eastern Extent Inside Barrier Wall
PW-06D	2500	4900	19100	49%	87%	Plume Interior
PW-06M	134	3300	7700	96%	98%	Plume Interior
06MB	172	3120	3120	94%	94%	Plume Interior
PW-06R	496	940	2100	47%	76%	Plume Interior
PW-06S	307	1700	19000	82%	98%	Plume Interior
PW-07M	<2	12	12	92%	92%	Western Boundary Inside Barrier Wall
PW-07S	<2	40	40	98%	98%	Western Boundary Inside Barrier Wall
PW-08M	23	540	540	96%	96%	Northern Boundary Inside Barrier Wall
PW-09M	<2	3	4	66%	71%	Northern Boundary Outside Barrier Wall
PW-10D	26	2200	6300	99%	100%	Northeastern Boundary Inside Barrier Wall
PW-10M	5.1	130	390	96%	99%	Northeastern Boundary Inside Barrier Wall
PW-11D	<2	1200	1200	99%	99%	Northeastern Boundary and Exterior Plume
PW-11M	<2	45	45	98%	98%	Northeastern Boundary and Exterior Plume
PW-12D	<2	550	700	100%	100%	Dissolved Plume Northeast of Barrier Wall
PW-12M	<2	610	1100	100%	100%	Dissolved Plume Northeast of Barrier Wall
PW-12R	55	1200	1200	95%	95%	Dissolved Plume Northeast of Barrier Wall
PW-12S	<2	8.7	260	89%	100%	Dissolved Plume Northeast of Barrier Wall
PW-13D	40	1000	1100	96%	96%	Dissolved Plume East of Barrier Wall
PW-13M	8.1	400	630	98%	99%	Dissolved Plume East of Barrier Wall
PW-13S	26	93	250	72%	90%	Dissolved Plume East of Barrier Wall
PW-14D	47	2500	2900	98%	98%	Dissolved Plume East of Barrier Wall
PW-14M	196	1300	1400	85%	86%	Dissolved Plume East of Barrier Wall
PW-14S	13	840	990	98%	99%	Dissolved Plume East of Barrier Wall

Table 10

Tetrachloroethylene Summary for OU1
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

	Nov-10 Result	Pre-Remedy*	Max	Percent Reduction Since Earliest Event	Percent Reduction From Max Concentration	Location
PW-15D	34	16	570	**-113%**	94%	Plume Interior
PW-15M	3	1600	1700	100%	100%	Plume Interior
PW-16D	248	1190	2370	79%	90%	Plume Interior
PW-16M	331	940	1370	65%	75%	Plume Interior
PW-17M	783	263	3600	**-198%**	78%	Plume Interior
PW-17S	666	297	810	**-124%**	18%	Plume Interior
PW-18D	560	2620	8900	79%	94%	Plume Interior
PW-18M	295	840	1100	65%	73%	Plume Interior
PW-19D	187	63	516	**-196%**	64%	Plume Interior
PW-19M	1080	240	1800	**-350%**	40%	Plume Interior
PW-20D	2.8	474	4880	99%	100%	Plume Interior
PW-20M	177	1300	2340	86%	92%	Plume Interior
PW-20S	1240	1400	1700	11%	27%	Plume Interior
PW-21	4.4	160	160	97%	97%	Dissolved Plume East of Barrier Wall

Notes:

* - Represents earliest sample data available since the construction of the remedy began. Data from either 1997 or 1998 depending on when the well was sampled. Some wells were not constructed until after the remedy was in place. Sample results are from the initial groundwater sampling event at these locations. Compete data set available in Attachment I.

- A value of 1/2 the detection limit was utilized for non-detect results.
- Wells installed 2007 or later were not included in this table.
- All results are presented in ug/L.

NA - Not applicable due to non-detect results

Indicates well located outside barrier wall.

Indicates well located inside barrier wall.

Bold type indicates increases in concentration.

Table 11

Pre and Post In situ Chemical Oxidation Groundwater Analytical Results for Site Contaminants of Concern Savage Municipal Water Supply Superfund Site Milford, New Hampshire

Constituent	Maximum Concentration Oct-2008 (µg/L)	Maximum Concentration Nov-2010 (µg/L)
cis-1,2-DCE	150	1,790
PCE	17,000	2,380
TCE	850	252
Vinyl Chloride	ND	7.5

Notes:

µg/L = micrograms per liter

DCE = dichloroethene

PCE = tetrachloroethene

TCE = Trichloroethylene

ND = Non detect

Table 12

Comparison of Maximum Soil Concentrations with NHDES Soil Standards
OK Tool Source Area, OU1, Savage Municipal Water Supply Well
Superfund Site, Milford, New Hampshire

Contaminant	Maximum Soil Concentration (mg/kg)	Reported Average Soil Concentration (mg/kg)	NHDES Soil Remediation Standard (Env-Or 600)
Arsenic	204	19	11
Cadmium	81	5	33
Chromium (III)/(VI)*	15,100	764	1000/130
Lead	610	23	400
Mercury (inorg)	0.21	0.02	6
Nickel	1,380	117	400
Acetone	0.31	0.31	75
Carbon Tetrachloride	0.099	0.099	12
PCB (Aroclor 1254 and 1260)	10	4.7033	1
Tetrachloroethene	0.44	0.44	2
Toluene	0.02	0.02	100
Trichloroethene	0.006	0.006	0.8

Notes:

Shading indicates that maximum concentration detected or reported average concentration exceeds NHDES Soil Remediation Standard.

* Chromium speciation data indicated that little or none of the chromium is present in the more toxic hexavalent state (Goehlert, 1991 and Szaro, 1991).

Table 13a
Recalculation of Risks Associated with Exposure to Soil - Young Child Trespasser
Savage Municipal Water Supply Superfund Site
Milford, New Hamsphire

Trespasser, Young Child, Ingestion												
Chemical	Max Conc (mg/kg)	RfD (mg/kg/day)	CSF (mg/kg/day)-1	Ingestion Rate (mg/day)	Conversion Factor	Exp. Freq. (days/yr)	Exp. Duration (years)	Body Weight (kg)	Avg Time Cancer	Avg Time Noncancer	Cancer Risk	HI
Arsenic	204	4.00E-03	1.5	200	0.000001	30	5	10	25550	1825	3.6E-05	8.4E-02
Cadmium	81	1.00E-03		200	0.000001	30	5	10	25550	1825	0.0E+00	1.3E-01
Chromium	10	3.00E-03	5.00E-01	200	0.000001	30	5	10	25550	1825	5.9E-07	5.5E-03
Mercury	0.21			200	0.000001	30	5	10	25550	1825	0.0E+00	
Nickel	1380	2.00E-02		200	0.000001	30	5	10	25550	1825	0.0E+00	1.1E-01
PCBs	10	2.00E-05	2.00E+00	200	0.000001	30	5	10	25550	1825	2.3E-06	8.2E-01
											3.9E-05	1.2E+00

Trespasser, Young Child, Dermal													
Chemical	Max Conc (mg/kg)	RfD (mg/kg/day)	CSF (mg/kg/day)-1	Surface Area (cm^2/day)	Adherence Factor (mg/cm^2)	Absorption Factor (unitless)	Exp. Freq. (days/yr)	Exp. Duration (years)	Body Weight (kg)	Avg Time Cancer	Avg Time Noncancer	Cancer Risk	HI
Arsenic	204	4.00E-03	1.5	2800	0.2	0.03	30	5	10	25550	1825	3.0E-06	2.8E-03
Cadmium	81	1.00E-03		2800	0.2	0.001	30	5	10	25550	1825	0.0E+00	4.6E-05
Chromium	10	3.00E-03	5.00E-01	2800	0.2	0	30	5	10	25550	1825	0.0E+00	0.0E+00
Mercury	0.21			2800	0.2	0	30	5	10	25550	1825	0.0E+00	
Nickel	1380	2.00E-02		2800	0.2	0	30	5	10	25550	1825	0.0E+00	0.0E+00
PCBs	10	2.00E-05	2.00E+00	2800	0.2	0.14	30	5	10	25550	1825	9.2E-07	0.0E+00
												3.9E-06	2.8E-03
											TOTAL	**4.E-05**	**1.E+00**

Assumptions:

Concentration - Maximum Detected, Chromium revised to 10 mg/kg

Exposure Scenarios:

Trespasser parameters from baseline risk assessment
Young Child, 200 mg/day, 30 days, 5 years, BW = 10

Notes:
Max Conc = maximum concentration
PCB = polychlorinated biphenyls
mg/kg = milligrams per kilogram
HI = hazard index
cm^2 = cubic centimeter
Exp. Freq. = exposure frequency
Avg = average
yr = year
RfD = Reference Dose
CSF = Cancer Slope Factor

Table 13b
Recalculation of Risks Associated with Exposure to Soil - Older Child Trespasser
Savage Municipal Water Supply Superfund Site
Milford, New Hamsphire

Trespasser, Young Child, Ingestion												
Chemical	Max Conc (mg/kg)	RfD (mg/kg/day)	CSF (mg/kg/day)-1	Ingestion Rate (mg/day)	Conversion Factor	Exp. Freq. (days/yr)	Exp. Duration (years)	Body Weight (kg)	Avg Time Cancer	Avg Time Noncancer	Cancer Risk	HI
Arsenic	204	4.00E-03	1.5	100	0.000001	30	10	36	25550	3650	1.0E-05	1.2E-02
Cadmium	81	1.00E-03		100	0.000001	30	10	36	25550	3650	0.0E+00	1.8E-02
Chromium	10	3.00E-03	5.00E-01	100	0.000001	30	10	36	25550	3650	1.6E-07	7.6E-04
Mercury	0.21			100	0.000001	30	10	36	25550	3650	0.0E+00	
Nickel	1380	2.00E-02		100	0.000001	30	10	36	25550	3650	0.0E+00	1.6E-02
PCBs	10	2.00E-05	2.00E+00	100	0.000001	30	10	36	25550	3650	6.5E-07	1.1E-01
											1.1E-05	**1.3E-01**

Trespasser, Young Child, Dermal													
Chemical	Max Conc (mg/kg)	RfD (mg/kg/day)	CSF (mg/kg/day)-1	Surface Area (cm^2/day)	Adherence Factor (mg/cm^2)	Absorption Factor (unitless)	Exp. Freq. (days/yr)	Exp. Duration (years)	Body Weight (kg)	Avg Time Cancer	Avg Time Noncancer	Cancer Risk	HI
Arsenic	204	4.00E-03	1.5	2800	0.2	0.03	30	10	36	25550	3650	8.4E-07	7.8E-04
Cadmium	81	1.00E-03		2800	0.2	0.001	30	10	36	25550	3650	0.0E+00	1.3E-05
Chromium	10	3.00E-03	5.00E-01	2800	0.2	0	30	10	36	25550	3650	0.0E+00	0.0E+00
Mercury	0.21			2800	0.2	0	30	10	36	25550	3650	0.0E+00	
Nickel	1380	2.00E-02		2800	0.2	0	30	10	36	25550	3650	0.0E+00	0.0E+00
PCBs	10	2.00E-05	2.00E+00	2800	0.2	0.14	30	10	36	25550	3650	2.6E-07	0.0E+00
												1.1E-06	**0.0E+00**

TOTAL	**1.E-05**	**1.E-01**

Assumptions:

Concentration - Maximum Detected, Chromium revised to 10 mg/kg

Exposure Scenarios:

Trespasser parameters from baseline risk assessment
Older Child, 100 mg/day, 30 days/year, 10 years, BW = 36 kg,

Notes:
Max Conc = maximum concentration
PCB = polychlorinated biphenyls
mg/kg = milligrams per kilogram
HI = hazard index
cm^2 = cubic centimeter
Exp. Freq. = exposure frequency
Avg = average
yr = year
RfD = Reference Dose
CSF = Cancer Slope Factor

Table 13c
Recalculation of Risks Associated with Exposure to Soil - Treatment Plant Worker
Savage Municipal Water Supply Superfund Site
Milford, New Hamsphire

Chemical	Max Conc (mg/kg)	RfD (mg/kg/day)	CSF (mg/kg/day)-1	Ingestion Rate (mg/day)	Conversion Factor	Exp. Freq. (days/yr)	Exp. Duration (years)	Body Weight (kg)	Avg Time Cancer	Avg Time Noncancer	Cancer Risk	HI
Arsenic	204	4.00E-03	1.5	50	0.000001	1	25	70	25550	1825	2.1E-07	5.0E-04
Cadmium	81	1.00E-03		50	0.000001	1	25	70	25550	1825	0.0E+00	7.9E-04
Chromium	10	3.00E-03	5.00E-01	50	0.000001	1	25	70	25550	1825	3.5E-09	3.3E-05
Mercury	0.21			50	0.000001	1	25	70	25550	1825	0.0E+00	
Nickel	1380	2.00E-02		50	0.000001	1	25	70	25550	1825	0.0E+00	6.8E-04
PCBs	10	2.00E-05	2.00E+00	50	0.000001	1	25	70	25550	1825	1.4E-08	4.9E-03
											2.3E-07	**6.9E-03**

Assumptions:

Concentration - Maximum Detected, Chromium revised to 10 mg/kg
Treatment Plant worker parameters, site-specific
50 mg/day, 250 days/year, 25 years, BW = 70 kg

Reference: Regional Screening Level Tables Equations for Indoor Worker

Notes:
Max Conc = maximum concentration
PCB = polychlorinated biphenyls
mg/kg = milligrams per kilogram
HI = hazard index
cm^2 = cubic centimeter
Exp. Freq. = exposure frequency
Avg = average
yr = year
RfD = Reference Dose
CSF = Cancer Slope Factor

Table 14

Comparison of Current and Previous Toxicity Values for Constituents of Concern
OK Tool Source Area, OU1, Savage Municipal Well
Superfund Site, Milford, New Hampshire

Chemical	RfD mg/kg/d		CSF $(mg/kg/d)^{-1}$		RfC mg/m^3		IUR $(\mu g/m^3)^{-1}$	
	New	Old	New	Old	New	Old	New	Old
Arsenic	3.00E-04 I	1.00E-03	1.50E+00 I	1.75E+00	1.5E-05 C		4.3E-03 I	5.00E+01
Beryllium	2.00E-03 I	5.00E-03	NA	4.30E+00	2.5E-05 I		2.4E-03 I	8.40E+00
Cadmium-Water	5.00E-04 I	5.00E-04			2.0E-05 C		1.8E-03 I	6.10E+00
Cadmium-Food	1.00E-03 I	5.00E-04			2.0E-05 C		1.8E-03 I	
Chromium (III)	1.50E+00 I	1.00E+00			NA	5.70E-07		
Chromium (VI)	3.00E-03 I	5.00E-03	5E-01 J		1.0E-04 I	5.70E-07	8.4E-02 S	4.10E+01
Lead*	NA	1.40E-03			NA	1.40E-03		
Mercury (elemental)	NA	3.00E-04			3.0E-04			
Nickel	2.00E-02 I	2.00E-02					NA	8.40E-01
Acetone	9.0E-01 I	1.00E-01			3.1E+01 A			
Benzene	4.0E-03 I		5.5E-02 I	2.90E-02	3.0E-02		7.8E-06	2.90E-02
Carbon Tetrachloride	4.0E-03 I	7.00E-04	7.0E-02	1.30E-01	1.0E01 I		6.0E-06	5.20E-02
Chloroform	1.00E-02 I	1.00E-02	3.1E-02 C	6.10E-03	9.8E-02		2.3E-05	8.10E-02
1,1-Dichloroethane	2.0E-01 P	1.00E-01	5.7E-03 C		NA	1.00E-01	1.6E-06 C	
1,1-Dichloroethene	5.00E-02 I	9.00E-03	NA	6.00E-01	2.0E-01 I		NA	1.75E-01
t-1,2-dichloroethene	2.00E-02 I	2.00E-02			6.0E-02 P			
Manganese** Diet	1.4E-01 I				5.0E-05 I			
Manganese** Nondiet	2.4E-02 I				5.0E-05 I			
Methylene chloride	6.00E-02 I	6.00E-02	7.50E-03 I	7.50E-03	1.0E+00 A	8.60E-01	4.7E-07 I	
PCB	2.0E-05 I		2.0E+00 I	7.70E+00			2.00E+00 I	
Styrene	2.00E-01 I	2.00E-02	NA	3.00E-02	1.0E+00 I		NA	2.00E-03
Tetrachloroethene	1.00E-02 I	1.00E-02	5.4E-01 C	5.10E-02	2.7E-01 A		5.9E-06 C	1.82E-03
Toluene	8.0E-02 I	2.00E-01			5.0E+00 I	5.70E-01	NA	
1,1,1-Trichloroethane	2.0E+00 I	9.00E-02			5.0E+00 I	3.00E-01		
Trichloroethene			5.9E-03 C	1.10E-02	1.0E-02 Y		2.0E-06 C	5.95E-02

Table 14

Comparison of Current and Previous Toxicity Values for Constituents of Concern
OK Tool Source Area, OU1, Savage Municipal Well
Superfund Site, Milford, New Hampshire

Notes:

RfD = Reference Dose, CSF = Cancer Slope Factor, RfC = Reference Concentration, IUR = Inhalation Risk Units.

I = IRIS, J = New Jersey DEP, Y = New York DoH, H = HEAST, A = HEAST alternate or ATSDR, P = Provisional Peer Reviewed Toxicity Values.

S= See Section 5 of Regional Screening Level Table User Guide, NA = Value no longer available.

* Lead toxicity values are not available. An evaluation for lead using USEPA IEUBK model is presented in Attachment 11.

** Manganese was screened out during original risk assessment.

Table 15

Summary of OU-1 Groundwater Treatment Plant Volatile Organic Compound Mass Removal Savage Municipal Water Supply Superfund Site Milford, New Hampshire

	Volume VOC removed (gal)			Mass VOC removed (lbs)		
Year	Groundwater	SVE	Total (gal)	Groundwater	SVE	Total (lbs)
1999	14	0	14	194	0.4	195
2000	16	35	51	215	470	685
2001*	13	3	16	176	37	213
2002	19	2	21	256	22	278
2003	20	0	20	249	0	249
2004	12	3	15	172	35	207
2005	8	0	8	110	0	110
2006	11	8	19	151	112	263
2007	16	10	26	220	136	356
2008	7	0	7	101	0	101
2009	4	0	4	56	0	56
2010	3	0	3	45	0	45
Totals	143	61	204	1945	812	2758

Notes:

* Data missing for SVE from May 2001 to Oct 2001

VOC - volatile organic compounds

gal - gallons

lbs - pounds

SVE - soil vapor extraction

2010 Annual Report
Savage Municipal Water Supply
Superfund Site OU-1
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Milford, New Hampshire

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May 2011

TABLE OF CONTENTS

Section **Page**

1. INTRODUCTION 1-1
1.1 SITE DESCRIPTION AND HISTORY 1-1
1.2 REMEDIATION SYSTEM DESCRIPTION 1-3
1.2.1 Groundwater Extraction System 1-3
1.2.2 Reinjection System 1-4
1.2.3 Treatment Facility 1-5
1.2.4 Barrier Wall 1-6
1.2.5 Monitoring Wells 1-6
1.3 2010 REMEDIAL ACTIONS 1-6
1.3.1 In Situ Chemical Oxidation Program 1-6
1.4 2010 SITE INVESTIGATIONS 1-7
1.4.1 Bedrock 1-7
2. OPERATION AND MAINTENANCE OF REMEDIATION SYSTEMS 2-1
2.1 EXTRACTION WELLS 2-1
2.2 REINJECTION SYSTEM 2-2
2.3 TREATMENT FACILITY 2-2
2.3.1 Tray Aerators 2-2
2.3.2 Vapor-Phase Carbon 2-3
2.4 MONITORING WELLS 2-3
3. PROCESS SYSTEM DATA ANALYSIS 3-1
3.1 DATA COLLECTION 3-1
3.2 COMPARISON OF PLANT INFLUENT AND EFFLUENT CONCENTRATIONS TO DISCHARGE CRITERIA 3-1
3.3 CONTAMINANT MASS REMOVAL 3-2
4. 2010 REMEDIAL ACTIONS 4-1
4.1 IN SITU CHEMICAL OXIDATION PROGRAM 4-1
4.1.1 In Situ Chemical Oxidation Injections 4-1
4.1.2 Gradient Monitoring 4-2
4.1.3 Permanganate Monitoring 4-3
5. GROUNDWATER AND DRINKING WATER DATA 5-1
5.1 UNITED STATES GEOLOGICAL SURVEY INVESTIGATIONS 5-1
5.2 WATER LEVELS 5-2
5.3 WINTER 2010 BASELINE ISCO SAMPLING ROUND 5-3
5.3.1 Winter 2010 Analytical Results 5-3
5.4 FALL 2010 GROUNDWATER SAMPLING 5-4
5.4.1 Fall 2010 Analytical Results 5-5

TABLE OF CONTENTS
(Continued)

Section **Page**

5.5 TREATMENT SYSTEM METALS SAMPLING 5-5
5.5.1 September 2010 Analytical Results 5-6
5.6 RESIDENTIAL WELL SAMPLING 5-6
5.7 PERMANGANATE MONITORING 5-6
5.8 ISOPLETH MAPS 5-7
5.8.1 Tetrachloroethene Isopleth Maps 5-7
5.8.2 Permanganate Isopleth Maps 5-7
5.9 HISTORICAL GROUNDWATER MONITORING DATA 5-7
5.9.1 Interior Well Data 5-8
5.9.2 Exterior Well Data 5-8
6. STATUS OF REMEDIATION 6-1
6.1 OPERATIONS AND MAINTENANCE 6-1
6.1.1 Results of Routine Inspections 6-1
6.1.2 Monthly List of Major Repairs, Modifications, Non-Routine Maintenance, and Other Activities 6-1
6.1.3 Breakdown of Actual Costs January 2010 through December 2010 6-6
6.1.4 Updates of Operation and Maintenance Manual and As-Built Plans 6-6
6.1.5 Community Complaints and Responses 6-6
6.1.6 Verification of the Integrity of Institutional Controls 6-6
6.2 EVALUATION OF THE TREATMENT SYSTEM WITH RESPECT TO REMEDY OBJECTIVES 6-7
6.2.1 PW-22 Source Area 6-7
6.2.2 INEEL Field Source Area 6-8
6.2.3 Interior Conditions 6-8
6.2.4 Exterior Conditions 6-9
6.3 SUMMARY OF REMEDIAL PROGRESS DURING 2010 6-10
6.4 OPTIMIZATION 6-10
7. SUMMARY AND CONCLUSIONS 7-1
7.1 SUMMARY OF ACTIVITIES - JANUARY THROUGH DECEMBER 2010 7-1
7.2 2010 ANALYTICAL DATA 7-3
7.3 REMEDIAL PROGRESS IN OVERBURDEN 7-3
7.4 REMEDIAL PROGRESS IN BEDROCK AQUIFER 7-4

TABLE OF CONTENTS
(Concluded)

Section **Page**

8. RECOMMENDATIONS 8-1

9. REFERENCES 9-1

LIST OF FIGURES

Title

Figure 1-1	Site Location Map
Figure 1-2	Property Map
Figure 1-3a	Monitoring Well Locations (South)
Figure 1-3b	Monitoring Well Locations (North)
Figure 2-1	2010 Influent and Effluent Flows
Figure 5-1	Groundwater Potentiometric Surface Map June 29, 2010
Figure 5-2	Groundwater Potentiometric Surface Map November 15, 2010
Figure 5-3	2010 Vertical Gradients Between Overburden and Bedrock
Figure 5-4	2010 Horizontal Gradients Across Slurry Wall
Figure 5-5	Residential and Fish Hatchery Sampling Locations
Figure 5-6	Plan View Showing Locations of Cross-Sections
Figure 5-7	Fall 2010 PCE Concentrations at 195 feet amsl
Figure 5-8	Fall 2010 PCE Concentrations at 218 feet amsl
Figure 5-9	Fall 2010 PCE Concentrations at 235 feet amsl
Figure 5-10	Fall 2010 PCE Concentrations at 250 feet amsl
Figure 5-11	Cross-Section A-A' PCE Distribution Fall 2010
Figure 5-12	Cross-Section B-B' PCE Distribution Fall 2010
Figure 5-13	Cross-Section C-C' PCE Distribution Fall 2010
Figure 5-14	March 2010 NaMnO4 Concentrations at 195 feet amsl
Figure 5-15	March 2010 NaMnO4 Concentrations at 218 feet amsl
Figure 5-16	March 2010 NaMnO4 Concentrations at 235 feet amsl
Figure 5-17	March 2010 NaMnO4 Concentrations at 250 feet amsl

LIST OF FIGURES
(Concluded)

Title

Figure 5-18 Cross-Section A-A' NaMnO4 Distribution March 2010

Figure 5-19 Cross-Section B-B' NaMnO4 Distribution March 2010

Figure 5-20 Cross-Section C-C' NaMnO4 Distribution March 2010

Figure 5-21 Fall 2010 Percent Reduction in Measured PCE Concentrations at 195 feet amsl

Figure 5-22 Fall 2010 Percent Reduction in Measured PCE Concentrations at 218 feet amsl

Figure 5-23 Fall 2010 Percent Reduction in Measured PCE Concentrations at 235 feet amsl

Figure 5-24 Fall 2010 Percent Reduction in Measured PCE Concentrations at 250 feet amsl

Figure 6-1 National Grid Gas Usage (Therms)

Figure 6-2 PSNH Electricity Usage (kWh/day)

LIST OF TABLES

Title

Table 1-1	Groundwater Chemicals of Concern and Associated Interim Cleanup Levels and Ambient Groundwater Quality Standards Criteria
Table 2-1	Monitoring Locations
Table 3-1	Reporting Period Influent and Effluent Concentrations
Table 3-2	Flows and Contaminant Mass Removal by Well
Table 3-3	Treatment Plant Flows, Concentrations, and Removal Efficiencies
Table 4-1	Winter 2010 In Situ Chemical Oxidation Injection Summary
Table 4-2	Permanganate Monitoring Data
Table 5-1	Baseline In Situ Chemical Oxidation Groundwater Analytical Results
Table 5-2	Fall 2010 Groundwater Analytical Results for Volatile Organic Compounds
Table 5-3	Fall 2010 Groundwater Analytical Results for Metals
Table 5-4	Fall 2010 Groundwater Treatment Plant Analytical Results for Metals
Table 5-5	2010 Residential Water Supply Well Sampling Locations
Table 5-6	Historical Groundwater Analytical Results for COCs
Table 6-1	Project Costs January through December 2010

LIST OF APPENDICES

APPENDIX A **DETAILED OPERATION AND MAINTENANCE ACTIVITIES**

APPENDIX B **CHEMICAL ANALYSIS OF SODIUM PERMANGANATE**

APPENDIX C **ANALYTICAL DATA PACKAGES**

APPENDIX D **INTERIOR WELL PCE GRAPHS**

APPENDIX E **EXTERIOR WELL PCE GRAPHS**

LIST OF ACRONYMNS

AGQS	Ambient Groundwater Quality Standards
ARD	Air Resources Division
AS	air sparging
bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
COC	contaminants of concern
CSE	confined space entry
EPA	United States Environmental Protection Agency
ft	feet/foot
gpm	gallons per minute
IDW	investigation derived waste
INEEL	Idaho National Environmental and Engineering Laboratory
ISCO	in situ chemical oxidation
MCL	Maximum Contaminant Level
µg/L	micrograms per liter
mg/L	milligrams per liter
mL	milliliter
$NaMnO_4$	sodium permanganate
NH	New Hampshire
NHDES	New Hampshire Department of Environmental Services
O&M	operation and maintenance
OEME	Office of Environmental Measurement and Evaluation
OU	operable units
PCE	tetrachloroethene
%	percent
ppm	parts per million
PRP	potentially responsible party
PVC	polyvinyl chloride
QA	quality assurance
ROD	*Record of Decision*
Site	Savage Municipal Water Supply Superfund Site OU-1 (OK Tool Source Area)
SVE	soil vapor extraction
3-D	three-dimensional
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene

LIST OF ACRONYMNS
(Concluded)

trans-1,2-DCE	trans-1,2-dichloroethene
U.S.	United States
USGS	U.S. Geological Survey
Veolia	Veolia Water North American Water Services
VFD	variable frequency drive
VOC	volatile organic compound
WESTON®	Weston Solutions, Inc.

SECTION 1

INTRODUCTION

1. INTRODUCTION

Weston Solutions, Inc. (WESTON®) is pleased to present the 2010 Annual Report evaluating the progress of remediation at the Savage Municipal Water Supply Superfund Site OU-1 (OK Tool Source Area) (Site) located in Milford, New Hampshire (NH). The intent of this Annual Report is to document the progress of remediation at the Site during the 2010 calendar year.

This report includes a brief overview and history of the Site; a discussion of data collection; a summary of sampling results, routine operation and maintenance (O&M) activities, major repairs or equipment upgrades, remediation activities and investigations performed; an evaluation of current site conditions; and recommendations for any future activities or changes to the current operating procedures. This report was completed under the requirements of WESTON's contract with the New Hampshire Department of Environmental Services (NHDES) for the Site.

NHDES, the United States (U.S.) Environmental Protection Agency (EPA), and the U.S. Geological Survey (USGS) also performed various investigative activities at the Site during the reporting period. Although this work is referenced in this report, not all of the data from these investigations is presented or discussed in detail. USGS work was performed under a cooperative agreement with NHDES and EPA.

1.1 SITE DESCRIPTION AND HISTORY

The Site is located in the western portion of the Town of Milford, NH, approximately 2 miles west of the center of town. The Site encompasses a plume of contaminated groundwater that extends approximately 6,000 feet (ft) eastward from the intersection of Route 101 and Elm Street. It is roughly bounded on the north and east by the Souhegan River and on the south by Elm Street and Tucker Brook. The Site lies within the floodplain of the Souhegan River. The dominant groundwater flow direction is to the east.

The Site has been divided by EPA into two operable units (OU), a fund-lead OU, and a potentially responsible party (PRP)-lead OU. The fund-lead OU (OU-1) is known as the OK Tool Source Area OU, and is being administered by NHDES, Waste Management Division. The PRP-lead OU (OU-2) is known as the Extended Plume OU. This Annual Report is associated with the fund-lead OU-1. The location of the Site is shown on Figure 1-1 Site

Location Map. The boundary of OU-1 and the property boundaries of lots within OU-1 and in the surrounding area (as derived from the Town of Milford Tax Maps) are shown on Figure 1-2 Property Map. The OU-1 encompasses approximately 52 acres. The Souhegan River flows through OU-1.

First developed in 1950, the Savage Municipal Water Supply well provided potable drinking water to approximately 10,000 residents in the Town of Milford, NH. In February 1983, as part of the first routine sampling of water supplies for organic compounds, the NH Water Supply and Pollution Control Commission found volatile organic compounds (VOC) above drinking water standards in water from the Savage Municipal Water Supply well. The VOCs found included 1,1,1-trichloroethane (1,1,1-TCA), trichloroethene (TCE), trans-1,2-dichloroethene (trans-1,2-DCE), tetrachloroethene (PCE), and 1,1-dichloroethane. Tetrachloroethene and trans-1,2-DCE were also found in water sampled from the well supplying the nearby Milford mobile home trailer park. The Site was added to the EPA National Priorities List on 1 September 1984.

A Remedial Investigation was completed in June 1991 and resulted in EPA issuing a *Record of Decision* (*ROD*) identifying two portions of the contaminated plume that needed to be remediated: the concentrated plume near the OK Tool and Hitchiner Facilities and the extended plume. Division of the remedy into two OUs occurred by Consent Decree after issuance of the *ROD*. Table 1-1 contains the Groundwater Chemicals of Concern identified in the *ROD* and the associated Interim Cleanup Levels. The Interim Cleanup Levels were based on EPA's Maximum Contaminant Levels (MCL) for drinking water, which are equivalent to the NHDES Ambient Groundwater Quality Standards (AGQS) Criteria.

The final remedy selected for OU-1 was modified (from the *ROD*) as explained in the *Explanation of Significant Differences* issued by EPA in December 1996. Elements of this remedy included institutional controls, a subsurface barrier (slurry) wall, four groundwater extraction wells (two inside and two outside the barrier), soil vapor extraction (SVE) via six wells screened in the vadose zone, air sparging (AS) via two wells screened beneath the SVE wells, and groundwater monitoring. The remedy, as designed, involved treatment of extracted groundwater by air stripping and discharge of the treated water to the unconsolidated aquifer via a recharge chamber and three reinjection wells (two inside the barrier). Vapors from the air

stripping system were treated by passage through granular activated carbon prior to discharge to the atmosphere. The design of the OU-1 remedy was completed in March 1996 and its construction was completed in August 1998. Operation of the groundwater extraction system began in April 1999. The treatment plant has operated continuously since 1999 with several periods of extended downtime for maintenance or research purposes. The SVE system was last operated in March 2008. In September 2008, the SVE/AS system was decommissioned and the boilers used for regeneration of the carbon were replaced with smaller boilers sized for building heat only. Beginning in May 2009, with approval of the NHDES Air Resources Division, vapor discharge from the tray aerators was vented directly to the atmosphere. Vapor emissions from the aerators can be redirected through the carbon vessels, if necessary, but regeneration of carbon will now need to be performed off-site. A discussion regarding the current configuration of the remediation system is discussed in the following sections.

In addition to the pump and treat method already implemented at the Site, a large scale in situ chemical oxidation (ISCO) treatment was conducted by WESTON in the deep overburden during the fall of 2008. A second treatment was performed during fall 2009 targeting till layers and geological lenses on the western portion of the Site. A third application was administered in winter of 2010 targeting persistent locations in the deep overburden and till layers.

Upward trends of VOC concentrations in bedrock monitoring wells in recent years prompted the initiation of additional bedrock investigations in 2010 and the formation of a new OU (OU-3) to address deep bedrock groundwater contamination at the Site. A description of the ongoing OU-3 investigations and data analysis are not covered in this document, but will be presented in separate documents addressing OU-3.

1.2 REMEDIATION SYSTEM DESCRIPTION

1.2.1 Groundwater Extraction System

During 2010, groundwater was extracted from interior extraction wells IW-01A and IW-02A and exterior extraction wells EW-01 and EW-02 via submersible pumps and directed to two equalization tanks located inside the groundwater treatment plant. The intent of the interior extraction wells is to maintain an inward and/or upward gradient to ensure hydraulic isolation of the contaminant mass within the barrier, preventing release of contaminants from the

containment structure. Maintaining an inward gradient is an important component of the site remediation because based on water level measurements conducted by USGS, "the mechanism for flow between the interior and exterior areas is likely through the fractured bedrock, and that the bedrock is hydraulically connected to the overburden" (*SIR 2006-5083 Report*, USGS, 2006). Gradients between the overburden and bedrock within the slurry wall have been observed to switch from upward (preferred) to downward when groundwater pumping within the slurry wall ceases or is of insufficient yield. As a result of the ISCO programs at the Site, pumping rates from the extraction wells are maintained at less than maximum yields to minimize the potential to draw in sodium permanganate ($NaMnO_4$). A balance is therefore maintained to maximize gradients without causing the pumps to cycle or to draw $NaMnO_4$ into the plant. At times during 2010, the reduced extraction rates from the interior extraction wells did not provide the minimum volume to sufficiently operate the groundwater treatment plant continuously in automatic mode. To increase the volume of water needed to continuously run the treatment plant processes, additional groundwater was extracted from exterior wells EW-01 and EW-02.

The groundwater extraction system at the Site consists of two deep extraction wells inside the limits of the barrier wall (IW-01 and IW-02), two shallow extraction wells inside the limits of the barrier wall (IW-01A and IW-02A), and two deep extraction wells to the east and downgradient of the barrier wall (EW-01 and EW-02). The shallow extraction wells and the exterior extraction wells were the only wells used during the reporting period. Extraction wells IW-01, IW-02, EW-01, EW-02, IW-01A, and IW-02A have depths of 106.75 ft, 89.8 ft, 90 ft, 84 ft, 23.5 ft, and 28 ft, respectively. Well screen lengths for IW-01, EW-01, and EW-02 are 30 ft, IW-02 is 20 ft, and IW-01A and IW-02A are each 15 ft.

1.2.2 Reinjection System

The reinjection system at the Site consists of two injection wells inside the barrier wall on the western edge, one injection well outside the barrier wall to the southeast, and a recharge chamber outside the barrier wall to the northeast. The reinjection wells are 6-inch wells constructed in the shallow overburden ranging from 29 to 40 ft in depth. The recharge chamber consists of three 8-foot (ft)-diameter concrete recharge pits, installed approximately 8 ft deep in a trench of crushed stone. The recharge chamber has been used as the primary discharge mechanism for treated groundwater from the treatment plant. Clogging and fouling of the recharge chamber

resulted in its cleaning and reconstruction in August 2005 and subsequent cleanings. The recharge chamber has been the primary source for discharge of treated groundwater since 2008 with the exception of water diverted to RW-3 for use during the ISCO program and drilling operations. The recharge chamber was emptied and inspected in April 2010 to determine if it was becoming fouled, or would need to be cleaned for efficient operation. With the exception of a thin layer of silt, which would not be expected to hinder performance, the recharge chamber was in good condition and did not require cleaning.

1.2.3 Treatment Facility

1.2.3.1 Tray Aerators

The tray aerator system includes two tray-aerators arranged in parallel, each with four trays, each with a design capacity of 90 gallons per minute (gpm) of groundwater at 2,700 micrograms per liter (µg/L) of VOC contamination per the *Operations and Maintenance Manual* [Veolia Water North American Water Services (Veolia), 2005]. Water is pumped from two equalization tanks and treated with a minimum of 900 standard cubic feet per minute of outside air. The tray aerator effluent water is discharged to the building wet well where it either flows by gravity to the discharge chamber or can be directly pumped to any of the three reinjection wells. For the majority of 2010, the tray aerators were operated individually on alternating months. For a short period in September, the aerators were alternated weekly. When the operating tray aerator was taken out of service for cleaning at the end of one period of operation, the other tray aerator was put into service.

1.2.3.2 Vapor-Phase Carbon

The treatment system design included two vapor-phase carbon vessels for treatment of air emissions from the SVE wells and the tray aerators. Reductions in the influent groundwater VOC concentration made carbon treatment of VOC emissions no longer necessary. With approval from NH Air Resources Division (ARD) air stripper vapor emissions have been discharged directly to the atmosphere without carbon treatment since May 2009. The carbon vessels remain on-site and can be put back on-line if necessary. However, carbon from the vessels will now need to be regenerated or disposed of off-site.

1.2.4 Barrier Wall

A barrier wall was installed at the Site in 1998 as part of remediation activities for source control. Based on the design documents "The barrier wall is constructed of low-permeability materials (bentonite clay) and is designed to contain the highest concentrations of contaminants. The barrier encircles an area of approximately 5 acres and generally fully penetrates the overburden (sand and gravel layers and underlying till); it sits atop the bedrock in most cases. The barrier was designed to penetrate at least 3 ft into the basal till but in many locations this minimum depth was exceeded. In the eastern part of the barrier, till thickness is less than 3 ft and the barrier rests atop bedrock" (*SIR 2006-5083 Report,* USGS, 2006). By encircling the area with the highest levels of contamination, the barrier wall improves the effectiveness of the groundwater extraction system and limits the potential for off-site migration of site contaminants in the overburden.

1.2.5 Monitoring Wells

An extensive network of wells for monitoring groundwater conditions has been installed throughout the Site. Monitoring wells have been installed inside and outside of the barrier wall in all directions at the Site. Many of the wells have been installed in clusters which monitor different depth zones of the groundwater aquifer including the shallow, intermediate, and deep overburden, and the shallow and deep bedrock. Two rounds of groundwater sampling were performed in 2010. A baseline sampling round was conducted in February in the wells being considered for ISCO injections, and a more extensive sampling round was conducted in November. Figures 1-3A and 1-3B illustrate the locations of monitoring wells at the Site.

1.3 2010 REMEDIAL ACTIONS

1.3.1 In Situ Chemical Oxidation Program

WESTON worked in conjunction with representatives of NHDES and EPA to develop an aggressive ISCO program designed to reduce the time required to achieve cleanup goals at the Site. The 2010 ISCO program was designed to target previous injection locations that had experienced contaminant rebound. The 2010 ISCO program was conducted in the winter and included the injection of approximately 46,000 pounds of 40 percent (%) $NaMnO_4$. Further discussion of the winter 2010 ISCO program is included in Section 4.

1.4 2010 SITE INVESTIGATIONS

1.4.1 Bedrock

Prior to 2010, a limited amount of information existed regarding the character of the deep bedrock or the nature and extent of contamination in the deep bedrock aquifer in OU-1. All previously existing bedrock monitoring wells in OU-1 extend less than 40 ft below the bedrock surface and have all exhibited VOC concentrations exceeding the MCLs. The predominant contaminant in the shallow bedrock wells has been PCE, as in overburden wells, but maximum concentrations of PCE in the shallow bedrock wells have typically been one to two orders of magnitude lower than the highest concentrations detected in the overburden. Although recent VOC concentrations in shallow bedrock wells have historically been significantly lower than VOC concentrations in overburden wells, a general trend of increasing contaminant concentrations has been observed in the shallow bedrock wells. As a result, in 2010 additional investigations were initiated in bedrock at the Site and a separate OU (OU-3) was formed to address contamination in the deep bedrock aquifer.

The investigations into the bedrock aquifer at the Site are ongoing and are not summarized in this submittal. After the investigations are completed, information regarding the bedrock aquifer will be documented in a comprehensive Conceptual Site Model report for OU-3.

SECTION 2

OPERATION AND MAINTENANCE OF REMEDIATION SYSTEMS

2. OPERATION AND MAINTENANCE OF REMEDIATION SYSTEMS

This section provides a brief summary and evaluation of O&M activities for each remedial component at the Site. A more detailed description of events performed on a day-to-day and month-to-month basis can be found in Appendix A.

2.1 EXTRACTION WELLS

In 2008, the decision was made to implement an aggressive ISCO program for remediation of the source area inside the barrier wall, rather than relying on groundwater pump and treat. The focus of groundwater extraction was revised from maximizing contaminant removal to controlling the release of contaminant mass to the bedrock or overburden outside the barrier wall. This was achieved by maintaining an inward hydraulic gradient across the barrier wall in the overburden and an upward hydraulic gradient between the overburden and bedrock groundwater inside the barrier wall. Due to the large quantity of oxidant injected in the deep overburden and the presence of the oxidant in the deep extraction wells, groundwater was only extracted from the shallow interior extraction wells in 2010 (IW-01A and IW-02A).

Throughout the year, the combined pumping rate of the extraction wells was adjusted to the minimum volume which would maintain a slight inward/upward gradient. The low pumping rate minimized the possibility of drawing $NaMnO_4$ into the treatment plant, but was sufficient to maintain inward and upward hydraulic gradients inside the containment area. Both extraction wells were operated continuously at less than maximum capacity during ISCO operations.

The influent from the extraction wells was monitored weekly to visually confirm that $NaMnO_4$ was not being drawn into the treatment plant. While performing visual inspections on 12 August, low concentrations of $NaMnO_4$ were observed in groundwater from IW-01A and the well pump was immediately shut down. Extracting groundwater solely from IW-02A did not provide the necessary volume to continuously operate the groundwater treatment plant in automatic mode. On 13 August, exterior extraction well EW-02 was activated to provide enough water to prevent low water-level alarms in the plant. Well IW-01A was re-started at a decreased flow rate after a period of approximately 3 days had passed, after dissipation of the $NaMnO_4$. Although not visible in influent samples collected, the presence of $NaMnO_4$ persisted as a problem in the

treatment plant when biofouling was observed occurring in the tray-aerators shortly after re-starting IW-1A. On 14 September $NaMnO_4$ was again observed in IW-1A and the well was subsequently shut down until 29 September, when the presence of $NaMnO_4$ had dissipated. Groundwater continued to be extracted from EW-02 to provide the required volume of water for the treatment plant until 26 October 2010.

Because exterior extraction well EW-02 has a sump that extends into the bedrock, it was shutdown on 26 October, to minimize any potential disturbance to the bedrock aquifer during a bedrock pumping test conducted at the Site. Exterior extraction well EW-01 was repaired and activated on 2 November, to provide the additional water needed to operate the system in continuous automatic mode. Groundwater continued to be extracted from EW-01 for the remainder of the year.

Figure 2-1 graphically depicts the groundwater extraction flow rates during 2010.

2.2 REINJECTION SYSTEM

The recharge chamber located northeast of the barrier wall was used for discharge of all treated effluent during 2010, except for periods in February, March, August, and September when a portion of the treated effluent was used for water during bedrock drilling.

The pitless adapter in reinjection well RW-3 had previously been modified to allow treatment plant effluent to be used as makeup water for the 2008 and 2009 ISCO injections. Treatment plant effluent water was diverted from RW-3 for use during bedrock drilling, rather than using municipal water. A graphical depiction of effluent flow to the recharge chamber and RW-3 during 2010 can be found in Figure 2-1.

2.3 TREATMENT FACILITY

2.3.1 Tray Aerators

The two tray aerators are arranged in parallel and were each operated during the 2010 year during alternating months. The inactive tray aerator was cleaned during down time when the other tray aerator was in operation, to remove sediment, biological growth, and metal oxide deposits to ensure proper contaminant removal during the next month. Regular preventative

maintenance allowed the tray aerator system to be run continuously throughout the 2010 year with the exception of occasions when the entire treatment plant was not in operation for a groundwater recovery evaluation, plant modifications, or power outages.

The frequency of tray aerator change out increased to weekly following the observation of $NaMnO_4$ in groundwater extracted from IW-01A. The $NaMnO_4$ caused increased fouling in the aerators, which resulted in an opaque film forming on the aerator view ports and inside the aerator itself. The frequency of change outs decreased back to monthly on 16 September when $NaMnO_4$ was no longer observed in the plant influent and fouling of the aerators was no longer a problem.

While performing a regularly scheduled change out in September to Tray Aerator Feed Pump P-102B, the pump would not operate. After investigation, it was determined that both the motor and a fuse and control release switch in the variable frequency drive (VFD) needed to be replaced. Both were replaced in early 2011, and P-102B returned to operation. While P-102B was nonoperational, P-102A was used with increased frequency and Tray Aerator 1 saw increased use. The plant maintained full operations during repairs.

2.3.2 Vapor-Phase Carbon

Vapor-phase carbon vessels A-1 and A-2 are arranged in series, but have been bypassed since May 2009 with NHDES ARD approval of direct discharge of emissions. Both vessels remain in place and are available for use should a changed in effluent vapor concentrations from the tray aerators warrant the need for carbon treatment.

2.4 MONITORING WELLS

A baseline ISCO sampling event was conducted in February of 2010 by WESTON. The annual groundwater sampling event was performed in the fall of 2010, during the month of November. During both events, sampling was conducted by NHDES with WESTON's assistance. Table 2-1 is a list of site monitoring wells included in the winter and fall 2010 sampling events. Results of the chemical analysis of samples collected during the winter and fall 2010 sampling rounds are presented in Section 5. In addition to annual groundwater monitoring, water level measurements

were collected from wells at the Site prior to the ISCO sampling event in the winter, in the month of June, and prior to the annual sampling event in the fall.

SECTION 3

PROCESS SYSTEMS DATA ANALYSIS

3. PROCESS SYSTEM DATA ANALYSIS

This section discusses data collection and analysis associated with the O&M of the groundwater treatment plant.

3.1 DATA COLLECTION

Samples of the combined influent, effluent, and each active extraction well were collected during January, February, and March and analyzed by EPA Office of Environmental Measurement and Evaluation (OEME) Laboratory for 12 VOCs, including the primary contaminants of concern (COC): PCE, TCE, 1,1,1-TCA, and cis-1,2-dichloroethene (cis-1,2,-DCE). Samples were analyzed in accordance with EPA Region I Standard Operating Procedures, EIASOP-FLDVOA2. The remainder of the year, samples were collected each month and submitted to NHDES Laboratory for analysis of VOCs by EPA Method 8260B. Headspace photoionization detector readings were collected weekly from the combined influent to the tray aerator and the effluent from the tray aerator.

Groundwater flow rates from the extraction wells and air flow rates from the blowers were electronically recorded daily via computer program. Site-wide water levels were recorded three times in 2010. Water levels on select well pairs were collected weekly in order to confirm positive inward/upward gradients along the barrier wall. Weekly data was collected from the boilers, vapor-phase carbon vessels, extraction wells, and the instrument air compressor which was tracked for preventative maintenance purposes.

3.2 COMPARISON OF PLANT INFLUENT AND EFFLUENT CONCENTRATIONS TO DISCHARGE CRITERIA

Table 3-1 presents the results of the chemical analyses of the influent and effluent samples taken each month in comparison with the discharge criteria. Five contaminants were found in the influent during 2010: cis-1,2-DCE, TCE, PCE, naphthalene, and 1,1,1-TCA. No compounds were detected in any of the effluent samples collected during 2010.

3.3 CONTAMINANT MASS REMOVAL

The contaminant mass removal was calculated by multiplying the monthly flow rates by the concentration of contaminants in the combined influent samples for each month. Since results were only collected once a month, it was assumed that the sample results were representative of the entire month.

The plant influent flow volumes were based on the Supervisory Control and Data Acquisition system logs of the flow rates throughout the course of the month. Individual extraction well samples, a combined influent and a tray aerator effluent sample, were collected on a monthly basis.

Table 3-2 shows flow rates, contaminant concentrations, and estimated contaminant mass removed from individual extraction wells for each month during the reporting period. Estimated mass removed from each extraction well does not sum to the total estimated mass removed from the influent because of volatilization and mixing the equalization tanks. Table 3-3 provides a summary of total groundwater treated, contaminant concentrations in combined influent, total contaminant mass removed, the contaminant removal efficiency of the groundwater treatment system, and the volumes of treated water discharged each month during the reporting period.

SECTION 4

2010 REMEDIAL ACTIONS

4. 2010 REMEDIAL ACTIONS

This section provides a summary of the remedial activities and associated investigations conducted at the Site during 2010. The remedial activities consisted primarily of ISCO treatment of the deep saturated zone and geologic lenses located at the western portion of the Site within the barrier wall.

4.1 IN SITU CHEMICAL OXIDATION PROGRAM

WESTON implemented a third round of ISCO treatment with $NaMnO_4$ in March of 2010. The first phase of the program, implemented in fall of 2008, was designed to target the deeper zones of the overburden aquifer within the barrier wall. The second phase involved re-injection into the deep zone, but also targeted more shallow geological lenses and potential overburden non-aqueous phase liquid collection areas in the western portion of the Site. The third phase involved targeting the higher concentration source areas and areas which had experienced contaminant rebound following the previous two ISCO rounds. The following sections provide an overview of the ISCO program and associated activities.

4.1.1 In Situ Chemical Oxidation Injections

The ISCO was first implemented in the source area on a pilot scale in 2003 and 2004 using potassium permanganate as an oxidant. In October and November of 2008, WESTON began a larger scale ISCO program in the deep overburden inside the containment structure. During October and November 2009, WESTON conducted a second phase of $NaMnO_4$ injections, which included re-injecting into the deep overburden in addition to targeting more shallow areas of high concentrations at the western portion of the Site. The March 2010 injections targeted the same areas as the fall 2009 injections, focusing on specific locations that saw rebound of contamination. Injections of $NaMnO_4$ were performed in accordance with the procedures described in the *ISCO Work Plan, Version 4* (WESTON, 2008a), but a more concentrated solution of 20% $NaMnO_4$ was used for injections, as opposed to the 2% to 6% concentrations specified in the *ISCO Work Plan*.

A total of 45,856 pounds of 40 % $NaMnO_4$ solution was purchased from Wintersun Chemical for injection into 12 existing wells. A chemical analysis of the $NaMnO_4$ solution is provided in Appendix B.

The ISCO injections were conducted during the week of 1 March 2010. Injections started in the deepest zones of the overburden aquifer located in eastern portion of the treatment zone and progressed toward the west and into shallower zones as the injections proceeded. A total of 9,360 gallons of approximately 20% $NaMnO_4$ solution (by weight) were injected at the Site by gravity flow between 1 and 2 March 2010. Approximately 250-gallons of water were injected into each injection location on 3 and 4 March 2010, to flush the permanganate into the aquifer. The volume was divided between six injection wells, three monitoring wells, one Idaho National Environmental and Engineering Laboratory (INEEL) well, one recovery well and one former AS well. A list of the wells used for the injection of $NaMnO_4$ and the total volume each location received is provided in Table 4-1 of this report.

4.1.2 Gradient Monitoring

The slurry wall containment system was designed to provide effective source control in conjunction with operation of the groundwater remediation system. Groundwater is extracted from within the slurry wall area and discharged to a recharge chamber outside the wall to create an inward hydraulic gradient across the slurry wall in the overburden, and an upward gradient between the bedrock and overburden within the containment structure. During the ISCO injections, hydraulic gradients across the slurry wall and between the overburden and bedrock aquifers were monitored via well couplets. Water levels were collected usually twice daily in monitoring wells PW-2D, PW-2R, PW-5D, PW-5R, PW-10D, and PW-11D. Water level data collected each day during permanganate injections at the Site and the vertical gradients between the well couplets is included in Section 5 of this report.

During the winter 2010 ISCO injections, groundwater was extracted from extraction wells IW-01A and IW-02A inside the wall at a rate of 29 to 30 gpm. Due to the reduced volume of oxidant injected during this phase, this rate was sufficient to induce positive inward gradients across the slurry wall and upward gradients from the shallow bedrock to the deep overburden aquifer throughout the ISCO program.

4.1.3 Permanganate Monitoring

WESTON conducted monthly monitoring for the presence of $NaMnO_4$ in select wells at the Site during 2010. This monitoring was performed to evaluate the distribution and depletion of permanganate in groundwater over time. Monitoring conducted in February also functioned as a baseline monitoring event prior to the 2010 ISCO injection round. Due to the fact that the groundwater treatment plant was not designed to treat water containing $NaMnO_4$, at least once weekly, the interior extraction wells were monitored by opening the sampling ports within the treatment plant and purging approximately 1 liter into a container to ensure that it was not being drawn into the treatment plant.

Permanganate monitoring consisted of a color comparison of the groundwater sample with permanganate standards of 10 parts per million (ppm), 100 ppm, and 1,000 ppm. WESTON observed stratified concentrations of permanganate in the INEEL field with the highest concentrations observed in the deepest zones and little to no permanganate observed in the shallowest zone. Permanganate was observed in IW-01A on 12 August at a concentration of less than 10 ppm. The plant was shut down immediately for a period of 21 hours, and when restarted, flow from IW-01A was reduced from its previous flow rate of 17 gpm to 10 gpm to limit the amount of permanganate being drawn into the plant. The well was then turned off to allow permanganate to dissipate over 3 days. On 16 August, once permanganate was no longer visually present in IW-01A, the flow rate was increased to 11 gpm. Table 4-2 lists the wells included in, and the results of, the permanganate monitoring program. Permanganate monitoring will be continued in 2011.

USGS is assisting in the monitoring of the ISCO treatment by mapping real-time permanganate migration through the use of borehole geophysical logging and surface geophysical surveys. USGS will use this data to help delineate the distribution of permanganate and chloride over time; correlate permanganate and chloride distribution with remedial activities; ISCO treatment, and groundwater flow and transport processes; and assess the effectiveness of ISCO in targeting areas of high VOC contamination (USGS, 2011).

SECTION 5

SOIL, GROUNDWATER, AND DRINKING WATER DATA

5. GROUNDWATER AND DRINKING WATER DATA

NHDES personnel performed the fall drinking water sampling of nearby residential water supply wells and the fall groundwater sampling of on-site monitoring wells. The fall groundwater sampling event was conducted with WESTON's assistance. Groundwater data collected at the Site by WESTON in 2010 included a baseline groundwater monitoring event prior to ISCO activities in the winter, permanganate monitoring, and water level measurements. No soil data was collected in 2010. The groundwater and drinking water data collected is discussed in the following sections. Copies of the laboratory analytical data packages are provided in Appendix C.

5.1 UNITED STATES GEOLOGICAL SURVEY INVESTIGATIONS

USGS performed several investigations at the Site throughout the year under the direction of NHDES and EPA. These investigations are performed by USGS and reporting is typically included in published papers. A brief synopsis of the investigations performed by USGS is included below:

- Short term bedrock water level monitoring was performed during the month of January 2010. Monitoring wells targeted included MW-16R, MW-30, PW-2R, and PW-5R. Overburden wells B95-09 and P-02 were also included to monitor ambient conditions at the Site.
- Borehole electromagnetic logging was conducted at monitoring wells HCNE, PW-18D, PW-25D, PW-15D, PW-16D, PW-20D, and PW-6R for time lapse ISCO monitoring.
- Surface geophysical surveys were conducted in the OU-1 source area. The surveys included two DC resistivity lines for time lapse ISCO monitoring at the Site.
- Surface geophysical surveys were conducted in the area directly north of the Souhegan River, including four DC resistivity survey lines and one square array resistivity survey. The surveys were performed to evaluate characteristics of the bedrock surface in the area between the OU-1 source area and the residential properties located further to the north.
- Chloride samples were collected from monitoring wells PW-15D, PW-16D, and PW-20D.

5.2 WATER LEVELS

WESTON collected three site-wide water level measurement rounds during 2010. Water level data was collected to evaluate groundwater flow directions in the overburden aquifer and to evaluate the hydraulic gradients between the interior and exterior of the slurry wall and between the overburden and the bedrock aquifers. The water level data is provided in the monthly O&M reports. WESTON generated two groundwater potentiometric surface maps for the June 2010 water level round and the fall 2010 groundwater sampling event. The groundwater potentiometric surface maps are included as Figures 5-1 and 5-2. Based on the figure, the direction of groundwater flow during the groundwater monitoring event remained consistent with historic observations at the Site.

Beginning in February 2009, water levels in selected well clusters were measured on a weekly basis to confirm that groundwater gradients were in the preferred direction (inward across the slurry wall and upward between the overburden and bedrock inside the slurry wall). The six wells monitored weekly were PW-2D, PW-2R, PW-5D, PW-5R, PW-10D, and PW-11D. When one or more gradients at the Site became neutral or reversed, the extraction rate from either one or both of IW-01A and IW-02A was increased. Figures 5-3 and 5-4 are graphs of the hydraulic gradients at the monitored well pairs from January through December 2010 in the overburden/bedrock well pairs and the interior/exterior well pairs, respectively. These figures show that the gradients were generally maintained in the preferred direction with the exception of four brief intervals: during installation of bedrock well BR-2 on 9 February, when a large volume of water was utilized during drilling operations causing groundwater mounding in the proximity of the gradient monitoring wells; between 12 and 16 August and between 14 and 29 September, when IW-01A was shut down due to the presence of $NaMnO_4$ in groundwater extracted from this well; and after the treatment facility was shut down on 22 December to observe groundwater recovery to static levels across the Site. Both figures show extraction well pumping rates to provide an understanding of their effect on gradients and show when major events occurred that temporarily reversed one or more gradients on-site.

5.3 WINTER 2010 BASELINE ISCO SAMPLING ROUND

The winter 2010 groundwater sampling event was conducted on 16 February 2010, in conjunction with the monthly $NaMnO_4$ monitoring round. As part of this effort, samples were collected from 20 monitoring locations which included 11 overburden monitoring wells, 5 injection points, 1 INEEL well, 1 reinjection well, and 2 former AS wells, all located inside the slurry wall. Prior to sample collection, the static water level in each well was measured from the top of the well casing or polyvinyl chloride (PVC) using an electronic water level meter. The list of wells included in the winter monitoring program has been provided in Table 2-1.

All groundwater samples were collected using peristaltic pumps following a micro-purge technique which included purging three tubing volumes from the well prior to sampling. After removing at least three tubing volumes, groundwater samples were collected from each of the wells. Field duplicate samples were also collected from two locations for quality assurance (QA) purposes. All samples were collected into pre-preserved 40-milliliter (mL) glass vials, packed in a cooler on ice with a trip blank, and submitted under standard chain-of-custody to be analyzed by EPA OEME Laboratory for 12 VOCs, including the primary COC: PCE, TCE, 1,1,1-TCA, and cis-1,2,-DCE. A copy of the OEME Laboratory analytical report for the February 2010 sampling event is included in Appendix C. Groundwater analytical results from the February 2010 sampling event are included in Table 5-1.

5.3.1 Winter 2010 Analytical Results

Volatile organic compounds detected in samples during the winter 2010 groundwater sampling event included cis-1,2-DCE, PCE, and TCE. Each of these compounds was detected above the applicable MCL in at least one sample. Tetrachloroethene was the most commonly detected compound, with 18 detections out of the 20 locations sampled. All of those 18 locations exhibited concentrations of PCE above the applicable MCL. Trichloroethene was detected above its applicable MCL at 9 locations; however, the laboratory reporting limit was above the MCL for 8 additional samples. The compound cis-1,2-DCE was detected above its applicable MCL at three locations. The highest concentrations of PCE and TCE detected during the winter 2010 groundwater sampling event were detected in monitoring well PW-25D at concentrations of 4,900 µg/L and 540 µg/L, respectively. The highest concentration of cis-1,2-DCE was detected

in IP-103A at 81 µg/L. Concentrations of PCE and TCE have decreased by as much as an order of magnitude from previous sampling events, likely the result of the multiple ISCO injections conducted since 2008. However, samples were not collected from historic hotspots, such as PW-22 and IP-101, due to the presence of $NaMnO_4$ at concentrations greater than 1,000 milligrams per liter (mg/L) in these source area wells.

5.4 FALL 2010 GROUNDWATER SAMPLING

The fall 2010 groundwater sampling event was conducted between 16 and 18 November 2010, in conjunction with the November $NaMnO_4$ monitoring round. As part of this effort, samples were collected from 73 monitoring locations which included 63 overburden monitoring wells, 7 shallow bedrock monitoring wells, 2 former SVE wells, and 1 former AS well. Prior to sample collection, the static water level in each well was measured from the top of the well casing or PVC using an electronic water level meter. The list of wells included in the fall monitoring program has been provided in Table 2-1.

All groundwater samples were collected using peristaltic pumps following a micro-purge technique which included purging three tubing volumes from the well prior to sampling. After removing at least three tubing volumes, groundwater samples were collected from each of the wells. Field duplicate samples were also collected from four locations for QA purposes. All samples were collected into pre-preserved 40-mL glass vials, packed in a cooler on ice with a trip blank, and submitted under standard chain-of-custody procedures to NHDES Laboratory for analysis of VOCs by EPA Method 8260B. Samples from selected monitoring wells (18 wells total) located outside of the slurry wall containment system were also collected into pre-preserved 500-mL poly containers and submitted for analysis of the metals antimony, arsenic, beryllium, chromium, lead, and nickel by EPA Method 200.8 ICP-MS. Copies of the NHDES Laboratory analytical reports for the November 2010 sampling event are included in Appendix C. Groundwater analytical results for VOC COC detections from the November 2010 sampling event are included in Table 5-2. Metals results from the groundwater monitoring event are included in Table 5-3.

5.4.1 Fall 2010 Analytical Results

Volatile organic compounds detected in samples during the fall 2010 groundwater sampling event included acetone, chloroform, cis-1,2-DCE, naphthalene, PCE, tetrahydrofuran, trans-1,2-DCE, TCE, and vinyl chloride. The compounds cis-1,2-DCE, PCE, TCE, and vinyl chloride were each detected above their applicable MCL in at least one sample. Tetrachloroethene was the most commonly detected compound, with 50 detections out of the 73 sample locations. A total of 43 locations sampled exhibited concentrations of PCE above the applicable MCL. Trichloroethene was detected above its applicable MCL at 23 locations, cis-1,2-DCE was detected above it applicable MCL at 4 locations, and vinyl chloride was detected above its applicable MCL at 2 locations. TCE was identified at the MCL in the sample from one monitoring location (PW-18M). The highest concentration of PCE detected during the fall 2010 groundwater sampling event was detected in monitoring well PW-25D at a concentration of 2,380 µg/L. The highest concentrations of TCE and cis-1,2-DCE were detected in PW-20S at 252 µg/L and 1,790 µg/L, respectively. Vinyl chloride was detected monitoring wells PW-16D and SVE-02 at concentrations of 5.2 µg/L and 7.5 µg/L, respectively.

Concentrations of PCE and TCE in monitoring wells inside the wall are generally decreasing, likely the result of the multiple ISCO injections conducted since 2008. However, samples were not collected from historic hotspots, such as PW-22 and IP-101, due to the presence of $NaMnO_4$ in recently targeted source area wells. Concentrations of cis-1,2-DCE and vinyl chloride have also exhibited an increase during 2010. Increases of this nature may be attributed to anaerobic degradation of PCE and TCE at the Site, as they are daughter products of the breakdown process.

The results of the metals analysis conducted in fall 2010 on samples from18 monitoring wells outside the barrier wall indicated that there were no exceedences of the MCL for antimony, arsenic, beryllium, chromium, lead, or nickel.

5.5 TREATMENT SYSTEM METALS SAMPLING

On 26 August, a thin black slimy deposit was observed developing in the tray aerators. Daily visual monitoring indicated that the deposits progressively increased until each of the view ports became too opaque to see through. Samples were collected for analysis of metals by EPA Method 200.7 on 16 September to evaluate concentrations of manganese and iron present in

IW-01A, IW-02A, EW-02, the combined influent, the combined effluent, the effluent weir, and the recharge chamber. Copies of the NHDES Laboratory analytical reports for the September 2010 sampling event are included in Appendix C. Groundwater analytical results from the September metals sampling event are included in Table 5-4.

5.5.1 September 2010 Analytical Results

Laboratory analytical results identified the presence of manganese in all seven of the samples collected ranging from 0.023 mg/L to 0.737 mg/L. The highest concentrations of manganese were identified in the influent from well IW-2A and the recharge gallery at 0.737 mg/L and 0.632 mg/L, respectively. These concentrations were all below the NHDES AGQS of 0.84 mg/L. Iron was detected in three of the samples collected at concentrations ranging from 0.055 mg/L to 0.337 mg/L, with the highest concentrations identified in the sample collected from the recharge gallery. The low metals concentrations detected by the chemical analyses indicated that the deposits were more likely the result of bio-fouling rather than mineral deposits.

5.6 RESIDENTIAL WELL SAMPLING

NHDES collected samples from 19 residences on Cortland Road and North River Road and the Fish Hatchery on 300 North River Road on 11 and 21 October 2010. Table 5-5 lists the wells sampled by NHDES in 2010. The samples were analyzed by the NHDES Laboratory for VOCs by EPA Method 524. All samples were non-detect for the full list of VOCs. Copies of the laboratory analytical data packages are included in Appendix C. Figure 5-5 shows the locations of the residential and Fish Hatchery wells sampled.

5.7 PERMANGANATE MONITORING

Permanganate monitoring was conducted monthly during 2010 to evaluate the distribution and dissipation of $NaMnO_4$ in the subsurface based on ISCO rounds conducted since 2008. The $NaMnO_4$ monitoring activities included purging at least one tubing volume from each well before comparing the purge water color to a set of known $NaMnO_4$ standards. The results of the $NaMnO_4$ monitoring are included in Table 4-2.

5.8 ISOPLETH MAPS

WESTON generated isopleth maps which illustrate the concentrations of PCE in the overburden aquifer at the Site and isopleths maps which illustrate the distribution of permanganate in the subsurface.

5.8.1 Tetrachloroethene Isopleth Maps

One set of PCE isopleth maps were generated based on laboratory analytical results from the fall 2010 sampling events. For the sampling event, the results were compiled into seven figures which consist of four horizontal and three vertical sections through the Site. A three-dimensional (3-D) visualization software, called EarthVision, was used to model the contaminant plume and interpolate contaminant concentrations both vertically and horizontally. Horizontal sections through the EarthVision 3-D plume rendition were placed as overlays on the base map to produce isopleths maps in plain view at elevations 195, 218, 235, and 250 ft above mean sea level. Three vertical isopleths sections were produced from the EarthVision 3-D plume rendition at locations A-A', B-B', and C-C' as shown on Figure 5-6. The horizontal and vertical isopleths figures for the sampling round are provided as Figure 5-7 through Figure 5-13.

5.8.2 Permanganate Isopleth Maps

Isopleth maps illustrating the distribution of permanganate based on the March 2010 permanganate monitoring round were also generated using the EarthVision program. Although this round directly followed the March 2010 ISCO injections, these figures represent all residual permanganate as well which continues to persist at the bedrock/overburden interface in some areas from ISCO injections conducted in 2008 and 2009. Seven figures were generated illustrating the distribution of permanganate in the slurry wall containment including four horizontal sections and three vertical sections. All of the maps were generated along the same elevations as the PCE maps for comparison purposes. The permanganate isopleth maps are provided as Figure 5-14 through Figure 5-20.

5.9 HISTORICAL GROUNDWATER MONITORING DATA

Table 5-6 presents a historical summary of analytical data for the compounds PCE, TCE, and cis-1,2-DCE collected from site monitoring wells from 1998 to the present.

5.9.1 Interior Well Data

Based on an evaluation of laboratory analytical data and the isopleth maps, the majority of the monitoring locations positioned within the confines of the slurry wall containment system continue to exceed the applicable MCL for site COCs. During the winter and fall 2010 sampling event, 80% (35 of 44) of the well locations sampled that are located within the slurry wall exceeded the applicable MCL of 5 µg/L for PCE. Approximately 45% (20 of 44) of the wells sampled within the slurry wall exceeded the applicable MCL for TCE and 11%, (5 of 44) of the interior wells sampled exceeded the applicable MCL for cis-1,2-DCE. Graphs of PCE concentrations versus time indicate a large variation of PCE concentrations within source area wells. Several interior monitoring wells have exhibited a moderate to significant decrease in concentrations following the implementation of the ISCO program at the Site. Appendix D includes the plots of PCE concentrations versus time for interior overburden wells. Some interior monitoring wells which exhibited the highest concentrations of site COCs prior to the implementation of the ISCO program are not included in Appendix D. Concentrations of $NaMnO_4$ have persisted at wells CI, PW-6D, PW-15D, and PW-22 and therefore, samples have not been submitted for laboratory analysis of VOCs. A graphic of PCE concentrations versus time would not provide an accurate representation of current groundwater conditions in these wells.

5.9.2 Exterior Well Data

Laboratory analytical results for groundwater samples collected from outside of the slurry wall containment indicate that concentrations of site COCs in exterior overburden wells have been exhibiting an overall downward trend since installation of the slurry wall. However three exterior monitoring wells experienced slight increases in PCE concentrations in 2009 and/or 2010. Concentrations of PCE in overburden monitoring wells B95-03 and PW-03D increased from non-detectable levels to 7.4 and 5.6 µg/L, respectively and PCE concentrations in PW-13S increased from 4.5 µg/L to 47 and 26 µg/L in the last 2 years. By contrast, most of the shallow bedrock wells outside the wall have exhibited upward or variable trends in contaminant concentrations. Based on the laboratory analytical results, two of the exterior shallow bedrock wells exhibit a clear increasing trend in concentrations of site COCs, specifically PCE. These wells are shallow bedrock wells MW-02R and PW-02R.

Based on the most recent groundwater sampling event performed in the fall of 2010, approximately 39% (15 of 38) of the wells sampled outside of the slurry wall are above the MCL for PCE. In 2010, the highest concentrations of PCE were exhibited in shallow bedrock well PW-02R at a concentration of 426 µg/L. The next highest concentration of PCE was detected in overburden monitoring well PW-14M located along the OU-1/OU-2 boundary. All other exterior wells exhibited concentrations of PCE below 100 µg/L. In addition to PCE, the compound TCE was identified above its MCL in 21% (8 of 38) of the wells sampled and cis-1,2-DCE was identified above in MCL in one of the wells sampled (PW-12R).

Graphs illustrating PCE concentrations over time indicate that significant decreases in concentrations occurred following the construction of the barrier wall and the start up of the groundwater treatment plant. Concentrations of PCE in exterior wells do not appear to have been significantly influenced by the implementation of an ISCO program at the Site. Appendix E includes the plots of PCE concentrations versus time for exterior wells.

5.9.2.1 Boundary Wells

The PW-13, PW-14, and MW-16 monitoring well clusters are located along the boundary between OU-1 and OU-2. Reaching compliance in these well clusters is of particular importance due to the conditions set forth in the ESD which allows the Settling Parties to stop remediation efforts after 30 years if contamination from OU-1 is the reason that the Settling Parties are unable to attain the ROD cleanup goals within OU-2 (EPA, 1997).

PW-13 Well Cluster – Monitoring wells PW-13S, PW-13M, and PW-13D all currently exhibit concentrations of PCE above the cleanup goals for the Site ranging from 8.1 µg/L to 40 µg/L. Concentrations are highest in PW-13D which is screened within the deep overburden aquifer. Each of these three wells have exhibited fluctuations in PCE concentrations since the implementation of the remedy, but in general have exhibited a downward trend in contaminant concentrations based on the graphs included in Appendix E. However, as indicated previously, PW-13S has exhibited an increase in PCE concentrations over the last three sampling events fluctuating from 4.5 µg/L to 47 µg/L to 26 µg/L from 2008 through 2010.

PW-14 Well Cluster – Monitoring wells PW-14S, PW-14M, and PW-14D all currently exhibit concentrations of PCE above the cleanup goals, ranging from 13 µg/L to 216 µg/L in PW-14S and PW-14M, respectively. Historic analytical results from PW-14S indicate a general decline in concentrations. Analytical results from PW-14D have decreased significantly since the implementation of the remedy site; however, concentrations have fluctuated between 64 µg/L and 47 µg/L since approximately 2008. Well PW-14M has historically exhibited higher concentrations of PCE than most exterior monitoring wells within OU-1. However, PCE in groundwater samples collected from PW-14M have consistently declined since approximately 2007.

MW-16 Well Cluster – Monitoring wells MW-16A, MW-16B, and MW-16C all currently exhibit a decline in PCE concentrations. MW-16A and MW-16B have reached cleanup goals, and during the November 2010 sampling event PCE was detected within MW-16C at approximately 9.2 µg/L. Shallow bedrock well MW-16R has shown an increase in PCE and contaminant concentrations and trends are currently being investigated under OU3.

5.9.2.2 Reductions in Groundwater Concentrations

Figures 5-21 through 5-24 show the percent reductions in PCE concentrations from their historical maximum concentrations at elevations 195, 218, 235, and 250 ft above mean sea level. The greatest reductions (75 to 100%) in PCE concentrations have been observed outside the containment wall at all elevations and inside the containment wall at the lower elevations which have been treated by ISCO. Lesser reductions in concentrations (10 to 60%) have been observed in the more shallow zones inside the containment wall where ISCO was not performed.

SECTION 6

STATUS OF REMEDIATION

6. STATUS OF REMEDIATION

6.1 OPERATIONS AND MAINTENANCE

WESTON has been responsible for O&M of the treatment plant and its equipment since 1 January 2008. This section describes O&M performed by WESTON during the calendar year 2010.

6.1.1 Results of Routine Inspections

WESTON personnel performed routine inspections at the Site on a weekly or as needed basis for maintenance issues. While at the Site, personnel monitored the condition and operation of equipment and performed the preventative maintenance specified in equipment O&M manuals and any non-routine maintenance as its need was identified.

Major repairs, modifications, and other non-routine maintenance activities are described in Subsection 6.1.2.

6.1.2 Monthly List of Major Repairs, Modifications, Non-Routine Maintenance, and Other Activities

General operational modes, significant repairs, treatment system modifications, and non-routine activities that occurred during this reporting period are listed by month below. For a complete chronological list of activities performed on-site during the months of January through December 2010, refer to the *Monthly Operations Reports* (WESTON, 2010a).

January 2010

- Backflow prevention devices were tested by the Town of Milford and passed.
- Annual security alarm inspection and testing was completed. All devices responded as designed and communications with the monitoring company were verified.
- Reinjection well RW-3 used to provide make up water for drilling activities during bedrock monitoring well installations.

February 2010

- Reinjection well RW-3 used to provide make up water for bedrock drilling activities.
- A total of 45,855 pounds of 40% $NaMnO_4$ was delivered in 16, 250-gallon totes and stored on-site in a heated container to prevent freezing. The container and outside mixing and injection containment structures were constructed of timber frames with polyethylene sheeting liners.
- Baseline ISCO groundwater monitoring of 20 wells was conducted in conjuncture with monthly permanganate monitoring to assess current distribution of contamination within barrier wall.
- Site fire alarm and sprinkler systems were inspected and tested.
- Annual assessment of condition of on-site equipment was performed to identify any equipment needing repair.
- The treatment facility shut down due to a power failure on 26 February. The emergency generator failed to start due to a battery failure. The battery was replaced, and the emergency generator operated the system until municipal power was restored.

March 2010

- Winter 2010 $NaMnO_4$ injections commenced. For a complete description of the ISCO event, refer to Subsection 4.1.
- Borehole geophysical testing and packer sampling was conducted in selected bedrock monitoring wells as part of the OU-3 investigations.
- A blown fuse in level transmitter LT-107-2 was replaced.
- A test valve was installed in the sprinkler system to meet National Fire Protection Association standards 13 and 25.
- A benchmark was surveyed onto the property and tied into the NH state plane. The bedrock monitoring wells were surveyed from the benchmark.

April 2010

- A shelving system was installed in the air compressor room to better store historical NHDES files.
- Conducted a confined space entry (CSE) into vaults SVE-4 and 5 to remove flanges for better access during groundwater monitoring events.

- The treatment facility was shut down for 8 hours and 20 minutes on 15 April to conduct a CSE into the recharge chamber. The recharge chamber was inspected and found to have ¼" to ½" of black sediment on the walls and floor. Since there was not a sufficient amount of sediment to negatively impact the recharge of groundwater, a full scale cleanout was not performed.

- Recharge well RW-3 (the only exterior recharge well) was tested briefly to determine if it could be used for recharge of treated effluent while the recharge chamber was being inspected. A brief initial test indicated that this well has likely silted in and cannot be used for recharge unless it is rehabilitated.

- Flow meters for the effluent, IW-01A, IW-02A, P-101, P-102, EW-02, and combined influent were calibrated by an independent vendor.

- Level transducers across the Site were inspected by an independent contractor. Level tranducers in RW-1, RW-2, IW-01A, IW-02A, T-1, T-2, and plant effluent were adjusted and confirmed to be calibrated properly. The level sensor in EW-02 has malfunctioned and is no longer operating properly. There are no tranducers in either EW-01 or RW-3.

- The tray aerators were inspected by an independent contractor and found to be in good working order.

May 2010

- New belts were installed on the Blowers 1 and 2 and the filters to the inlet to the blower were replaced as preventative maintenance.

- The IW-01A level transducer was calibrated.

- Observed that RW-1 level transducer was no longer functioning.

- Operators responded to one emergency power failure call.

June 2010

- Operators verified calibration of flow meter on influent to tray aerators.

- Calibration of the Magnatrol STI 341 flow meter on the effluent weir was checked. It was determined that in order to calibrate the flow reading to actual flow rate, the Magnatrol STI 341 must be set for a 45° angle weir instead of a 30° angle weir which is the actual configuration of the weir installed. Calibration subcontractor was unable to explain reason for this discrepancy.

- Operators responded to one emergency power failure call.

July 2010

- While changing out from Tray Aerator 2 to Tray Aerator 1, Tray Aerator Feed Pump P-102B had an electrical fault and discontinued operating. Since the aeration system has four feed pumps, the fault was investigated later in the year and determined to be a malfunctioning motor and a burned out fuse and control switch in the VFD. The unit was repaired in February 2011.

- Backflow prevention devices were tested by the Town of Milford and passed.

August 2010

- Permanganate was observed in IW-01A on 12 August at a concentration of less than 10 ppm. The plant was shut down for 21 hours. When restarted, flow from IW-01A was reduced from its previous flow rate of 17 gpm to 10 gpm to limit the amount of permanganate being drawn into the plant. The well was then turned off to allow permanganate to dissipate over 3 days. While the flow from IW-01A was at a reduced rate, exterior extraction well EW-02 was put on-line to provide sufficient flow into the plant to allow for continuous automatic operation of the treatment system. On 16 August, once permanganate was no longer visually present in IW-01A, the flow rate was increased to 11 gpm.

- The drilling of bedrock wells in OU-3 commenced on 17 August. Reinjection well RW-3 was used to provide treated effluent water for drilling activities.

- Fouling of the view ports of the active tray aerator was observed on 26 August. The fouling was most likely due to permanganate entering the plant and stimulating biological growth.

September 2010

- Reinjection well RW-3 used to provide treated plant effluent water for OU-3 bedrock drilling activities.

- Fouling of the tray aerators with a black slimy deposit was observed in September, most likely due to the presence of permanganate in the water extracted from IW-01A. On 14 September, IW-01A was taken off-line and on 16 September water samples were collected for metals analysis from the plant influent, effluent, IW-01A, IW-02A, EW-02, the effluent weir, and recharge chamber. The results are presented in Section 5. The IW-01A was put back on-line on 30 September.

- Borehole packer testing was conducted in selected bedrock monitoring wells as part of the OU-3 investigations.

- The inoperable tray aerator feed pump, P-102B, was disassembled and cleaned. Upon reassembly, P-102B was still would not operate indicating a faulty electrical or motor issue.

October 2010

- Continued borehole packer testing at selected bedrock monitoring wells as part of the OU-3 investigations.
- Approximately 17,000 gallons of investigation derived waste (IDW) water from drilling operations were pumped into the treatment plant.
- Site boilers were inspected and tested concurrently with winter start up.
- Exterior extraction well EW-02, which has a bedrock sump, was taken off-line in preparation for bedrock aquifer pumping test. Extraction well EW-01, which does not extend into the bedrock, was put on-line to provide sufficient flow to the plant.
- The IDW water from bedrock drilling activities was treated using approximately 3% permanganate left over from USGS calibration barrel created during the fall 2008 injections.
- After a low EQ Tank alarm due to operational issues with the extraction well pump, EW-01 was taken off-line and submersible pumps were installed in the effluent wet well to recirculate treated effluent, providing sufficient flow to allow the plant to operate continuously in automatic mode.

November 2010

- Backflow prevention devices were tested by the Town of Milford and passed.
- Motor and wiring for EW-01 were replaced and EW-01 was put back on-line.
- Annual sampling of 73 monitoring wells was conducted by NHDES with WESTON assistance.
- Conducted step drawdown test at new OU-3 bedrock monitoring well BR-6.
- Operators responded to one emergency power failure call.

December 2010

- Conducted 76-hour pumping test at new OU-3 bedrock monitoring well BR-6.
- Borehole geophysical surveys were conducted in selected bedrock monitoring wells during the pumping test.
- Groundwater treatment plant was shut down on 22 December to monitor groundwater elevations in selected monitoring wells while groundwater levels recovered to static levels.

- Installed circulation pumps in three frac tanks to keep the 50,000 gallons of water generated by pumping test from freezing while being treated with permanganate.

6.1.3 Breakdown of Actual Costs January 2010 through December 2010

A breakdown of actual costs by contract task number for January 2010 through December 2010 is included as Table 6-1.

6.1.4 Updates of Operation and Maintenance Manual and As-Built Plans

There were no changes made to the *O&M Manual* or the as-built drawings during 2010. Copies of the as-built drawings and the *O&M Manual* are maintained at the Site.

6.1.5 Community Complaints and Responses

The Town of Milford requested that drill cuttings from the installation of a bedrock monitoring well on the town property be removed. The drill cuttings were removed and spread out in an area on the OK Tool property.

6.1.6 Verification of the Integrity of Institutional Controls

The Site is fully surrounded by a chain-link fence, which is gated and locked when personnel are not at the Site. Each monitoring well located outside the fence has either a lock on the outer casing or is securely bolted closed. Analytical data collected from monitoring wells MW-2R and MW-30R on undeveloped property within OU-1 north of the Souhegan River (Lot 7-1, Milford Tax Map D2) have indicated that MCLs are exceeded in the bedrock aquifer on this lot. Currently, there are no institutional controls preventing use of groundwater within OU-1.

An indoor air study conducted at the former Milford Police Station located within the boundary of OU-1, evaluated the vapor intrusion pathway at the Site. The investigation identified elevated concentrations of PCE within the building which were attributed to either being the result of off gassing from dry cleaned uniforms or from soil gas. It was concluded that concentrations of PCE were impacting indoor air quality. The former police station is currently vacant, however if the building becomes inhabited or the property is redeveloped for future use, further evaluation of the vapor intrusion pathway will need to be performed and the need for institutional controls to address vapor intrusion mitigation may be warranted.

6.2 EVALUATION OF THE TREATMENT SYSTEM WITH RESPECT TO REMEDY OBJECTIVES

The system has been operational for approximately 11 years, and there is evidence that during this time remedial actions and natural attenuation have contributed to significant reductions of contaminant concentrations, particularly outside the barrier wall. During fall 2008, fall 2009, and winter 2010, three rounds of ISCO injections were performed, as explained in the *2008 Annual Report* (WESTON, 2010b), *Draft 2009 Annual Report* (WESTON 2010c) and Subsection 4.1 of this report. As a result, decreases in contaminant mass inside the barrier wall during 2010 are attributable to both removal of VOCs by the pump and treat system and destruction of VOCs by ISCO.

6.2.1 PW-22 Source Area

Investigations conducted in 2007 and 2008 identified shallow vadose zone contamination in the area of the former septic system for the OK Tool building which represented a potential ongoing source of contamination to shallow overburden groundwater within the confines of the slurry wall. The investigation also identified elevated concentrations of PCE and other VOCs in soil and groundwater at PW-22 located in the proximity of a former drain pipe for the facility. In addition to conducting a large scale removal action targeting soils in these areas during 2008 and 2009, an application of sodium permanganate was administered to the PW-22 excavation prior to backfilling and it has been targeted during ISCO injections. The remedial actions conducted in the former leach field and PW-22 areas have resulted in a significant reduction of contaminant mass within vadose zone soils. Several shallow monitoring wells positioned hydraulically down gradient from these areas including PW-24, SVE-2, SVE-3, and SVE-5 have exhibited significant decreases in concentrations of PCE since the implementation of these remedial actions. However, the persistence of sodium permanganate in some of the source area wells, including PW-22, makes it difficult to determine the exact mass of contamination which has been destroyed by these remedial actions. The continued monitoring of PW-22 and other wells for permanganate and subsequent groundwater monitoring rounds will allow for a more refined estimate.

6.2.2 INEEL Field Source Area

The INEEL field is positioned in an area of former building floor drains and storage tanks which were identified as some of the primary sources of contamination at the Site. The area has been the target of several ISCO events including the 2003 pilot study and 2004 injection of potassium permanganate and three rounds of sodium permanganate injections conducted in 2008, 2009, and 2010. Similar to observations made in the PW-22 area, sodium permanganate continues to persist at concentrations ranging from 10 to 1,000 µg/L in several INEEL field wells including CI, HCNE, HCNW, HCSE, HCSW and NCP. The presence of permanganate has limited the number of groundwater samples which have been collected from the area. However, laboratory analytical results for samples collected from well CI in 2009 indicated a significant decrease in concentrations of PCE, decreasing from approximately 1,900 µg/L in October 2008, to 33 µg/L in June 2009. INEEL well NCP also exhibited a reduction in concentrations of PCE decreasing from approximately 1,500 µg/L in October 2008 to approximately 8.5 µg/L in June of 2009. In addition, shallow overburden well PW-6S, positioned hydraulically down gradient from the INEEL field has exhibited a decrease in PCE concentrations from approximately 5,500 µg/L, in June of 2008 to approximately 307 µg/L in November 2010. Therefore, although the persistence of sodium permanganate has limited the number of groundwater samples collected from the INEEL field area, initial laboratory analytical results point towards a potentially significant reduction in contaminant mass within this area. Future permanganate and groundwater monitoring events will facilitate further evaluations of contaminant mass reduction and the potential for contaminant rebound.

6.2.3 Interior Conditions

Contaminant levels inside the barrier wall continued to decrease as a result of the remediation system, source removal actions, and the aggressive ISCO program implemented at the Site. Concentrations of VOCs decreased in 24 of the 37 wells not used as injection points between October 2008 and November 2010. Contaminant concentrations in four of these wells, B95-08, PW-05M, PW-07M, and PW-07S, have consistently been below the cleanup goals, and wells PW-15M and PW-20D were below cleanup goals during the November 2010 sampling event. However, there continue to be several monitoring wells that contain high levels of PCE contamination. The highest detected concentrations during 2010 were encountered in PW-25D

during the February monitoring event at 4,900 µg/L. These concentrations proceeded to drop to 2,380 µg/L after the well was used as an injection point during the 2010 ISCO. In addition to well PW-25D, five additional wells, including PW-103A, PW-19M, PW-20S, PW-26S, and RW-1, exhibited concentrations of PCE greater than 1,000 µg/L during the 2010 sampling events. These wells are generally located in the center or western areas of the slurry wall containment system.

Prior to the 2009 and 2010 ISCO events, a total of 19 monitoring wells and injection points exhibited concentrations of PCE greater than 1,000 µg/L. Twelve of these locations were utilized as injection points during the fall 2009 and/or winter 2010 ISCO events. Based on the February and November 2010 groundwater sampling events, permanganate continues to persist in eight of the injection points, two locations have exhibited concentrations of PCE below 1,000 µg/L, and two of the locations, PW-25D and RW-1, continued to exhibit concentrations of PCE greater than 1,000 µg/L. Laboratory analytical results from 2010 indicated that concentrations of PCE have dropped below 1,000 µg/L in five of the seven locations not utilized as injection points. The wells which historically exhibit the highest concentrations were generally observed overlying till in the deep overburden including the area of IP-101 which exhibited concentrations of PCE as high as 41,000 µg/L prior to the 2009 and 2010 ISCO injections. The exception to this is the area between PW-22 and PW-24 where high PCE concentrations have consistently been observed in the shallow overburden. Prior to the 2008, 2009, and 2010 ISCO events, monitoring well PW-22 exhibited the highest concentrations at the Site; however, the presence of $NaMnO_4$ has persisted in monitoring well PW-22 since the 2009 ISCO event.

6.2.4 Exterior Conditions

Contamination in the overburden outside the barrier wall continued to approach cleanup goals more rapidly than those inside the barrier wall. The shallow overburden wells outside the barrier wall have lower contaminant levels than those screened in the deep overburden or bedrock. As of November 2010, contaminant concentrations had decreased to below cleanup levels in 30 of the 45 wells, or 66% of wells outside the barrier wall as discussed in Section 5.9.2. Of particular importance are boundary wells between OU-1 and OU-2 which include the PW-13, PW-14, and MW-16 well clusters. Concentrations of site COCs within these wells have decreased

significantly since the implementation of the remedy at the Site with cleanup goals being reached at MW-16A and MW-16B. Although significantly less than before the implementation of the remedy, concentrations of PCE in the remaining wells have fluctuated as indicated in section 5.9.2.

6.3 SUMMARY OF REMEDIAL PROGRESS DURING 2010

When WESTON took over O&M responsibilities in 2008, the strategy for remediating the Site was reevaluated. The focus of groundwater pump and treat at the Site was revised from contaminant mass removal and hydraulic containment, to hydraulic containment only. An aggressive ISCO program was initiated to destroy contaminant mass in situ, rather than remove contaminants by pump and treat. Two shallow extraction wells, IW-01A and IW-02A, screened to depths of 23 and 29 ft below ground surface (bgs), were installed to replace the two deep interior extraction wells (IW-1 and IW-2), and the groundwater extraction rate from inside the barrier wall was decreased from approximately 65 gpm to approximately 23 gpm. The lower flow rates were sufficient for hydraulic containment, but low enough to minimize the risk of drawing $NaMnO_4$ into the treatment plant. However, even at the low extraction rates extraction well IW-01A was temporarily impacted by $NaMnO_4$ for a six week period of unseasonably low rainfall in August and September. During this time, biofouling was observed within the treatment plant tray aerators which required more frequent alternating and cleaning of the aerators. IW-01A was taken off-line until the $NaMnO_4$ in the vicinity of the well had dissipated.

However, because less water was extracted from within the containment structure during 2010, the mass of contaminants removed by pump and treat was less than in previous years. The treatment plant removed an estimated 45 pounds of VOCs from the groundwater during 2010. It is difficult to estimate the amount of contaminant mass that has been destroyed by ISCO since 2008, as many of the wells cannot be sampled because of the persistence of residual permanganate.

6.4 OPTIMIZATION

Several optimization improvements were made to the treatment plant during 2008, including decommissioning of the SVE/AS system, replacement of the steam boilers with high efficiency

water boilers, and installation of a bypass around the vapor phase carbon vessels to allow for direct discharge of tray aerator exhaust. Increased energy efficiency resulting from these improvements was observed in late 2008, 2009, and 2010. Figures 6-1 and 6-2 show the monthly natural gas and electric power use for the last few years. When comparing the total number of natural gas therms used in 2010 (the second full year of data after optimization) with the total number of natural gas therms used in 2007 (the last full year of data before optimization), there is a 81% reduction in fuel use. Likewise, when comparing the average daily kilowatt hours usage for 2010 with that of 2007, a 30% reduction of electric power usage is observed.

Focusing on hydraulic containment rather than mass removal, and setting extraction well pumping rates at the minimum required to maintain neutral or inward/upward hydraulic gradients resulted in low VOC emissions from the tray aerators, thereby allowing discharge without vapor-phase carbon treatment.

SECTION 7

SUMMARY AND CONCLUSIONS

7. SUMMARY AND CONCLUSIONS

This Annual Report covers the activities which occurred at the Site during the 2010 calendar year, including activities performed by NHDES, EPA, and USGS. The subsections below include a summary of the activities performed and conclusions that can be derived from data collected during the investigations and remedial actions performed at the Site.

7.1 SUMMARY OF ACTIVITIES - JANUARY THROUGH DECEMBER 2010

A brief summary of the major activities conducted at the Site between January and December 2010 and the dates that the activities were performed is provided below.

- Interior extraction wells IW-01A and IW-02A operated throughout the year at a total extraction rate ranging from 15 to 32 gpm except as discussed in Section 3.
- EW-01 and EW-02 were each operated for limited periods of time between August and December 2010 when IW-01A was off-line to provide sufficient water to operate the plant in continuous automatic mode as discussed in Section 6.
- January 13: Monthly permanganate monitoring was conducted.
- January 27 to February 26: Boart Longyear installed four new bedrock monitoring wells.
- February 15 to 16: Site-wide groundwater level measurements, baseline ISCO sampling, and permanganate monitoring were performed.
- February 15 to March 2: Northeast Geophysical Services performed borehole geophysical logging of existing and newly installed bedrock monitoring wells.
- March 1 to 4: ISCO injections were performed in 12 existing wells.
- March 8 to 11: Northeast Geophysical Services performed packer testing on newly installed bedrock monitoring wells.
- March 11: Monthly permanganate monitoring was conducted.
- April 20: Environmental Instrument Services calibrated all site flow meters and level indicators.
- April 21: Monthly permanganate monitoring was conducted.
- April 21: Bisco Environmental evaluated air stripper performance.

- May 25: Monthly permanganate monitoring was conducted.
- June 24: Monthly permanganate monitoring was conducted.
- June 25: Site-wide groundwater level monitoring was performed.
- July 21: Monthly permanganate monitoring was conducted.
- August 12: Permanganate drawn into plant from IW-01A. Extraction well IW-01A was taken off-line or set at a reduced rate between 12 to 16 August and 14 to 30 September. Exterior extraction well EW-02 put on-line 13 August to provide water to plant.
- August 16: Monthly permanganate monitoring was conducted.
- August 17 to September 9: Boart Longyear installed two new bedrock monitoring wells and extended the depth of two existing bedrock monitoring wells.
- September 13 to 16: Hager-Richter Geoscience, Inc. performed borehole geophysical logging of extended and newly installed bedrock monitoring wells.
- September 16: Monthly permanganate monitoring was conducted.
- September 27 to October 8: Northeast Geophysical Services performed packer testing on newly installed bedrock monitoring wells.
- October 18: Monthly permanganate monitoring was conducted.
- October 25 to November 2: Exterior extraction well EW-01 pump motor and motor lead were repaired.
- November 15 to 18: Fall groundwater monitoring round, permanganate monitoring, and site-wide water level monitoring were performed.
- November 26: A step drawdown test was performed on BR-6.
- December 6 to 9: Conducted 76 hour pumping test at BR-6.
- December 9: Hager-Richter Geoscience, Inc. performed borehole geophysical logging on selected bedrock monitoring wells during pumping test.
- December 22: Monthly permanganate monitoring was conducted and treatment plant was shut down to monitor changes in water table elevations.

7.2 2010 ANALYTICAL DATA

Laboratory analytical data collected during 2010 included groundwater and drinking water. No VOCs were detected above the laboratory reporting limits in the samples collected from residential drinking water wells.

Groundwater data collected during this reporting period consisted of monthly sampling in the groundwater treatment plant, an ISCO baseline sampling event conducted in February, and the fall groundwater monitoring event, conducted in November 2010. Groundwater analytical data indicated that although concentrations of PCE within the source area inside the slurry wall continue to remain well above the cleanup goals at most locations, concentrations have exhibited significant decreases since the implementation of ISCO. Most recently, the highest detected concentrations of PCE were 4,900 µg/L and 2,380 µg/L at PW-25D during the ISCO baseline event and fall groundwater monitoring event, respectively. However, several monitoring locations with historically higher concentrations (>10,000 µg/L) were not sampled due to the presence of $NaMnO_4$. Groundwater analytical data from all but three monitoring points in the overburden aquifer outside of the containment system continue to show a gradual decline in concentrations of PCE over time indicating that the slurry wall containment system has been effective in reducing the size of the plume and decreasing contaminant concentrations in the overburden aquifer. The three wells that exhibited slight increases were B95-03, PW-03D, and PW-13S, with concentrations of 7.4 µg/L, 5.6 µg/L, and 26 µg/L, respectively during the fall monitoring round.

No metals were detected above their applicable MCL in any of the 18 wells which were sampled for antimony, arsenic, beryllium, chromium, lead and nickel during the fall 2010 monitoring round.

7.3 REMEDIAL PROGRESS IN OVERBURDEN

Considerable contaminant mass has been removed over the last 10 years by groundwater pump and treat, SVE/AS, and five rounds of ISCO injections. The size of the chlorinated VOC plume in the overburden aquifer outside the containment structure has been greatly reduced. Although a significant volume has likely been destroyed with the implementation of ISCO, a large mass of

chlorinated VOC contamination remains inside the slurry wall containment structure, and VOC concentrations in bedrock monitoring wells have been trending upward.

It is difficult to know how much contaminant mass remains in the source area. Sodium permanganate injections conducted in 2008, 2009, and 2010 have resulted in decreases in contaminant concentrations in the deep zone. In addition, several areas of high contaminant concentrations in the shallow overburden were targeted during the most recent round of injections conducted in 2010. Monitoring wells in these zones of contamination were not sampled during 2010 due to residual permanganate from the injections; therefore, more time is needed to determine if contaminant concentrations will rebound and to accurately estimate the remaining mass of contamination.

Groundwater extraction from the exterior extraction wells was discontinued in April 2007, because VOC concentrations were approaching the cleanup goals in most of the exterior monitoring wells. Extraction from the exterior wells was reinitiated in August 2010 to provide a sufficient volume of water to operate the plant, but was discontinued again in early 2011. The OU-2 groundwater remediation system located downgradient of the OU-1 has been in operation continuously since January 2006, and is expected to capture residual contamination flowing downgradient. The highest VOC concentrations detected in exterior monitoring wells in the overburden are in PW-14M with a PCE concentration of 216 µg/L detected during the fall 2010 monitoring round. Although most exterior monitoring wells have attained or are approaching cleanup goals, VOC concentrations in monitoring well PW-14M have been decreasing more slowly than in other areas of the overburden aquifer outside the containment wall.

7.4 REMEDIAL PROGRESS IN BEDROCK AQUIFER

Although there has been significant remedial progress in the overburden groundwater outside the containment wall, contaminant concentrations in the bedrock aquifer have either been stable or have exhibited an increasing trend. The highest VOC concentrations detected in shallow bedrock monitoring wells during the fall 2010 sampling round was detected in PW-02R (426 µg/L PCE), located just outside the slurry wall. Concentrations of PCE in this well have fluctuated between 376 µg/L and 650 µg/L since June 2007 remaining relatively stable. Shallow bedrock monitoring well PW-05R is located adjacent to PW-02R on the inside of the slurry wall and has

exhibited concentrations of PCE approximately one order of magnitude less ranging from 14 µg/L to 36 µg/L during the same time period. The significant difference in concentrations of PCE indicates that there is not a strong hydraulic connection between the two shallow bedrock monitoring wells. Based on the comparable concentrations with PW-05D, fractures intercepted by PW-05R likely have a strong hydraulic connection with the deep overburden aquifer in that area. PW-02R does not have comparable concentrations to PW-02D and therefore fractures intercepted by the shallow rock well are likely connected to a deeper source of contamination beneath the slurry wall. However, an on-going investigation into contaminant distribution and migration in the bedrock aquifer is currently being conducted and will be evaluated in a separate OU-3 Remedial Investigation/Feasibility Study report after the investigation has been completed.

SECTION 8

RECOMMENDATIONS

8. RECOMMENDATIONS

- Groundwater monitoring should continue on an annual basis to evaluate remedial progress. The monitoring event should be conducted during the fall in concurrence with groundwater sampling performed at the OU-2 portion of the Savage Municipal Water Supply Superfund Site. Permanganate monitoring should continue to be performed on a bi-monthly basis to evaluate distribution and depletion of permanganate with time.

- Hydraulic gradients should continue to be monitored to ensure that a neutral or slightly inward/upward gradient is maintained inside the containment structure. Groundwater should continue to be extracted from shallow interior extraction wells IW-01A and IW-02A at the minimum flow rates required to maintain neutral or inward/upward gradients. Higher flow rates are not recommended since they would increase the probability of drawing permanganate into the treatment plant.

- An evaluation of the groundwater treatment plant and system should be conducted to optimize VOC removal, as well as maintaining an upward/inward gradient. The optimization should include an evaluation of the use of alternate extraction wells for extracting higher concentration groundwater and a feasibility study into installing a permanganate neutralization system.

- As funds become available, additional permanganate injections should be performed in the source area at the Site. Permanganate should be injected in the contaminated areas in shallow saturated overburden inside the wall and in all areas previously treated where contaminant rebound has been observed.

- The recharge gallery should be inspected every 2 years and, if appropriate, cleaned out to prevent future problems with siltation, mineral deposits, and/or bio-fouling.

- Recharge Well RW-3 should be inspected and rehabilitated, if necessary, so that it can be used for recharge in the event that the recharge chamber is taken out of service for maintenance.

SECTION 9

REFERENCES

9. REFERENCES

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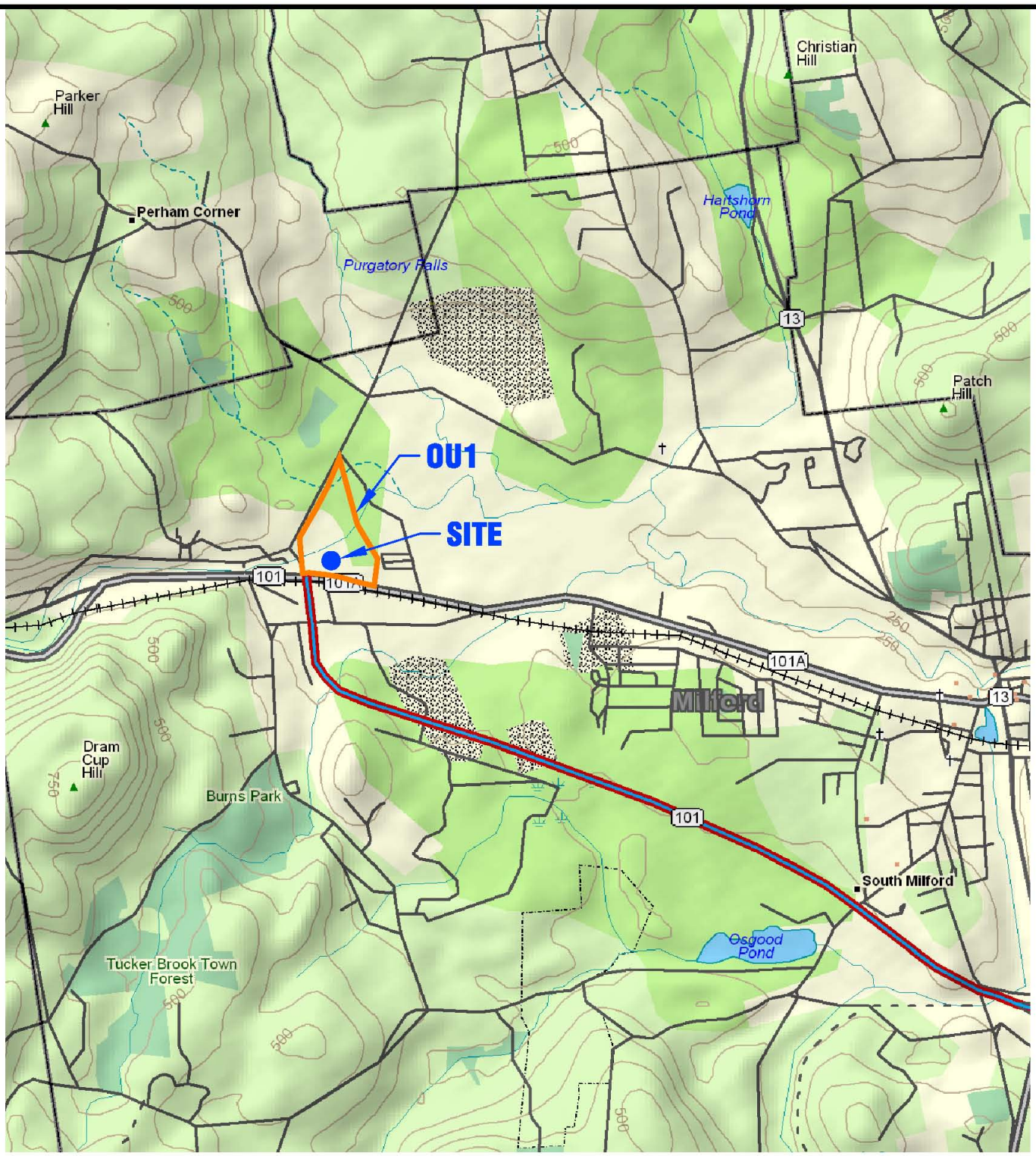
FIGURES



SOURCE:
DELORME 3-D TOPOQUADS
SOFTWARE; NEW HAMPSHIRE &
VERMONT 3-D TOPOQUADS CD

GRAPHIC SCALE
3000 1500 0 1500 3000
APPROXIMATE SCALE IN FEET

SITE LOCATION MAP

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

DRAFT 2010 ANNUAL REPORT
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
BEG	MAY 2011			20111.023.004
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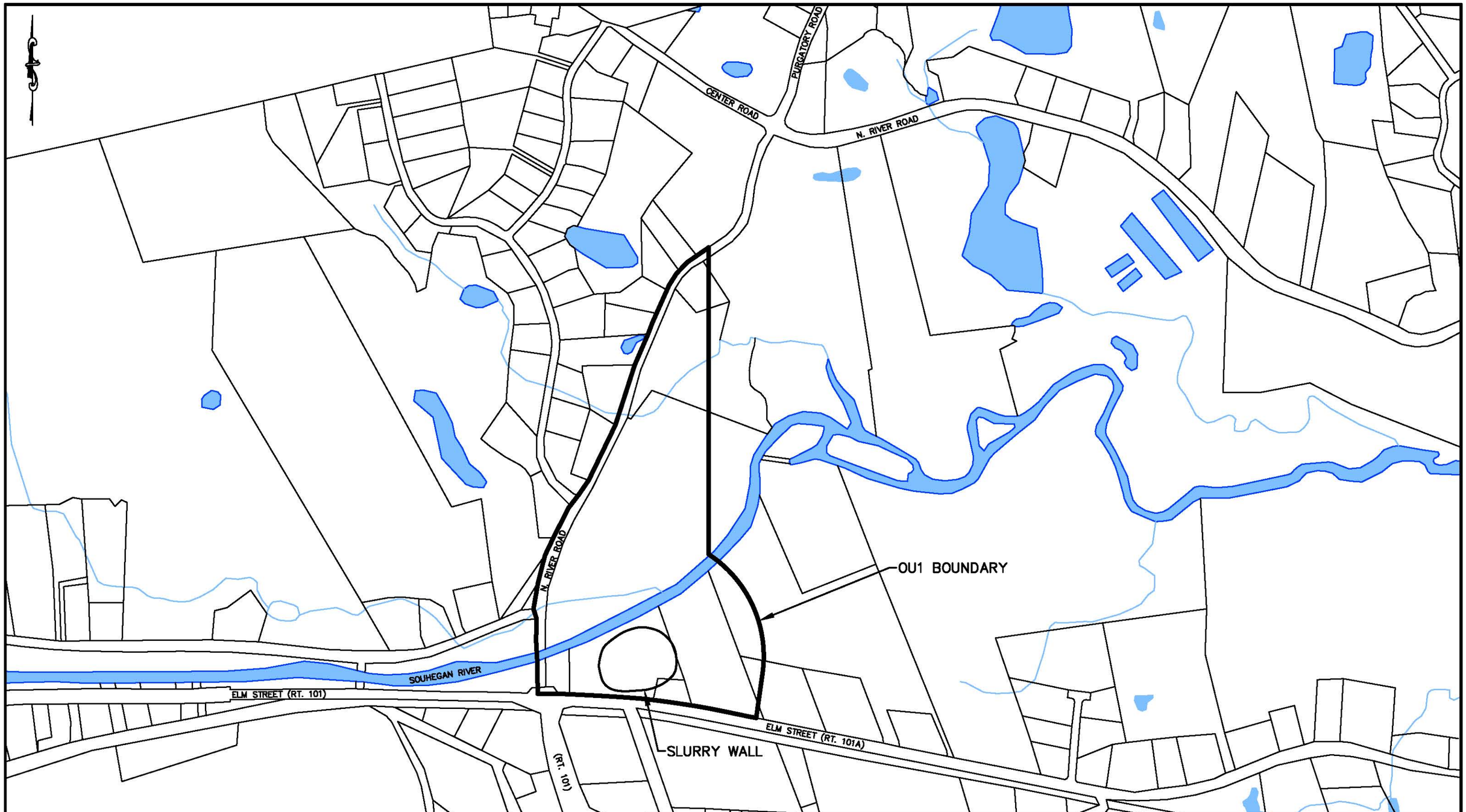
		AS SHOWN		1-1

M:\Design\DWG\NHDES\savage\2011\draft 2010 annual report\FIG 1-1.dwg, Layout1, 5/12/2011 10:03:22 AM, GIRARDEB, 1:1



SOURCE:
PROPERTY MAPS TAKEN FROM TOWN OF MILFORD, NH, TAX MAP DATABASE, MAP NUMBERS B2, B3, C2, C3, D2, & D3, DATED APRIL, 2009.

GRAPHIC SCALE
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APPROXIMATE SCALE IN FEET

PROPERTY MAP	WESTON SOLUTIONS CONCORD NEW HAMPSHIRE		NEW HAMPSHIRE DEPARTMENT OF Environmental Services		
DRAFT 2010 ANNUAL REPORT SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE MILFORD, NEW HAMPSHIRE	DRAWN BEG	DATE MAY 2010	DES. ENG.	DATE	W.O. NO. 20111.023.004
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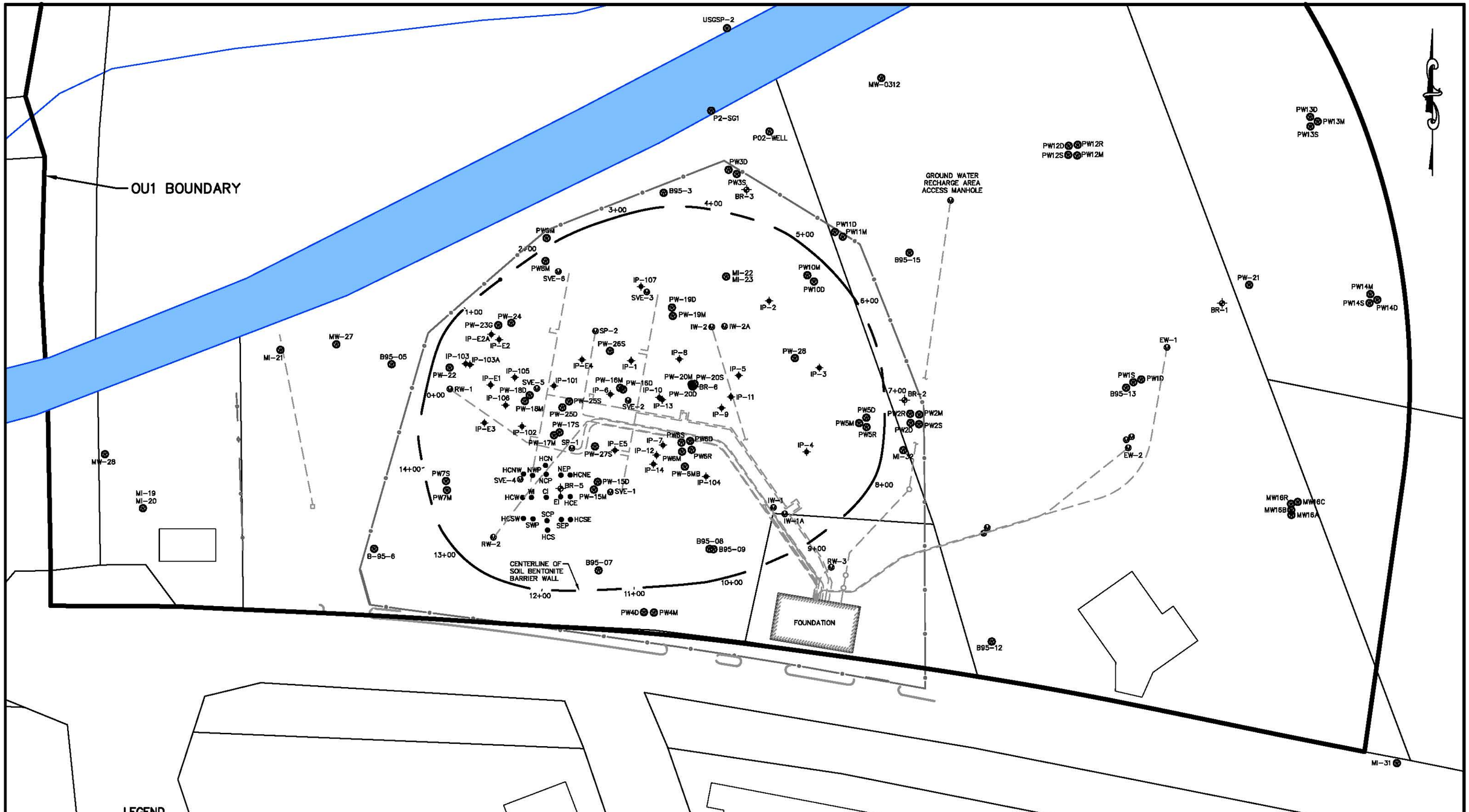

LEGEND

HCSE ●	INEEL WELL LOCATION
PW5R Ⓦ	MONITORING WELL LOCATION
IW-1 Ⓜ	MANHOLE LOCATION
IP-3	ISCO INJECTION POINT LOCATION
BR-1	BEDROCK MONITORING WELL LOCATION (THESE WELLS ARE PART OF OU3)

GRAPHIC SCALE

100 50 0 50 100

APPROXIMATE SCALE IN FEET

MONITORING WELL LOCATIONS (SOUTH)

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CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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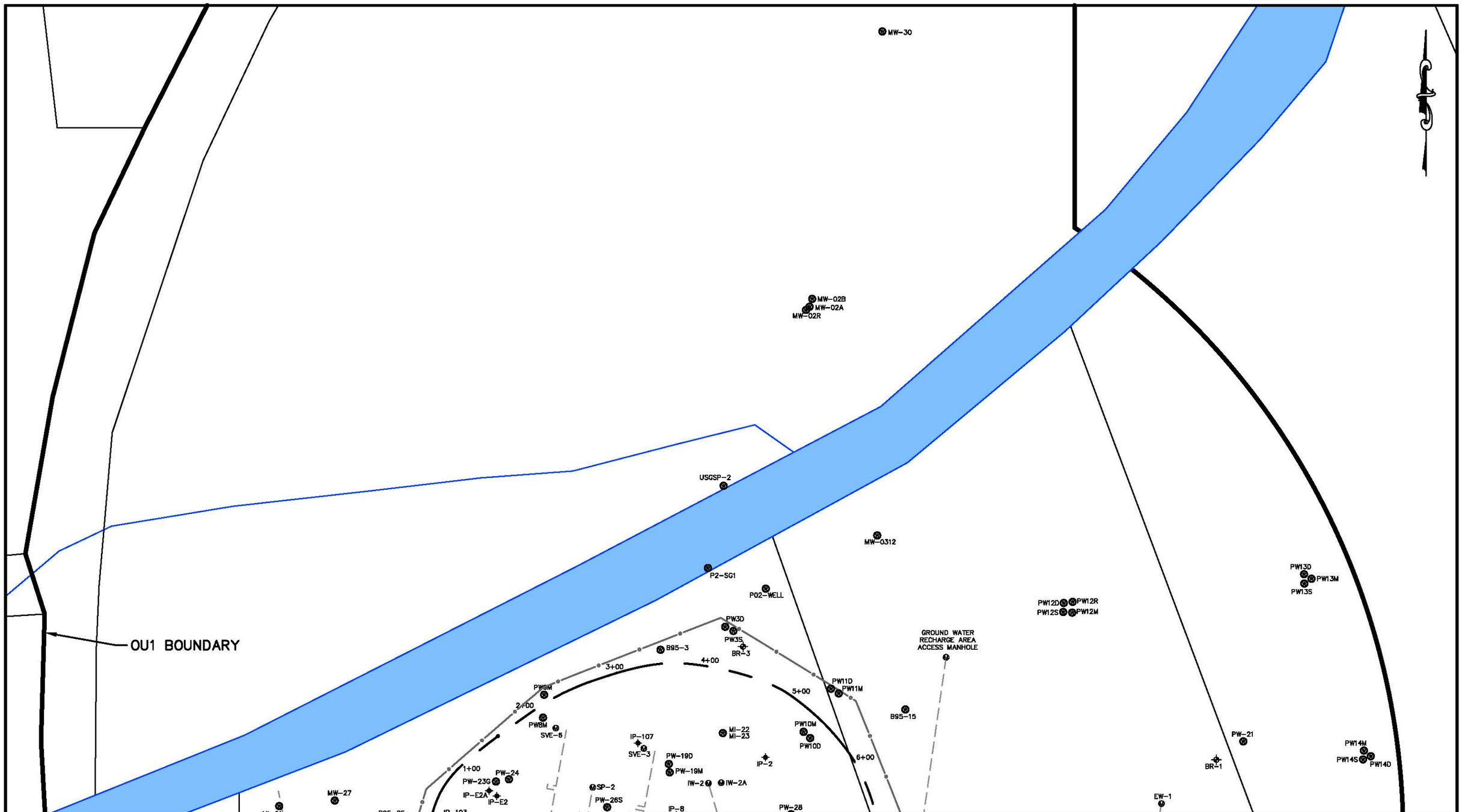
		AS SHOWN		1-3A

M:\Design\DWG\NHDES\savage\2011\draft 2010 annual report\FIG 1-3A.dwg, Layout 1, 5/19/2011 4:46:29 PM, GIRARDEB, 1:1



LEGEND

HCSE ●	INEEL WELL LOCATION
PW5R Ⓦ	MONITORING WELL LOCATION
IW-1 Ⓜ	MANHOLE LOCATION
IP-3	ISCO INJECTION POINT LOCATION
BR-1	BEDROCK MONITORING WELL LOCATION (THESE WELLS ARE PART OF OU3)

GRAPHIC SCALE

100 50 0 50 100

APPROXIMATE SCALE IN FEET

MONITORING WELL LOCATIONS (NORTH)

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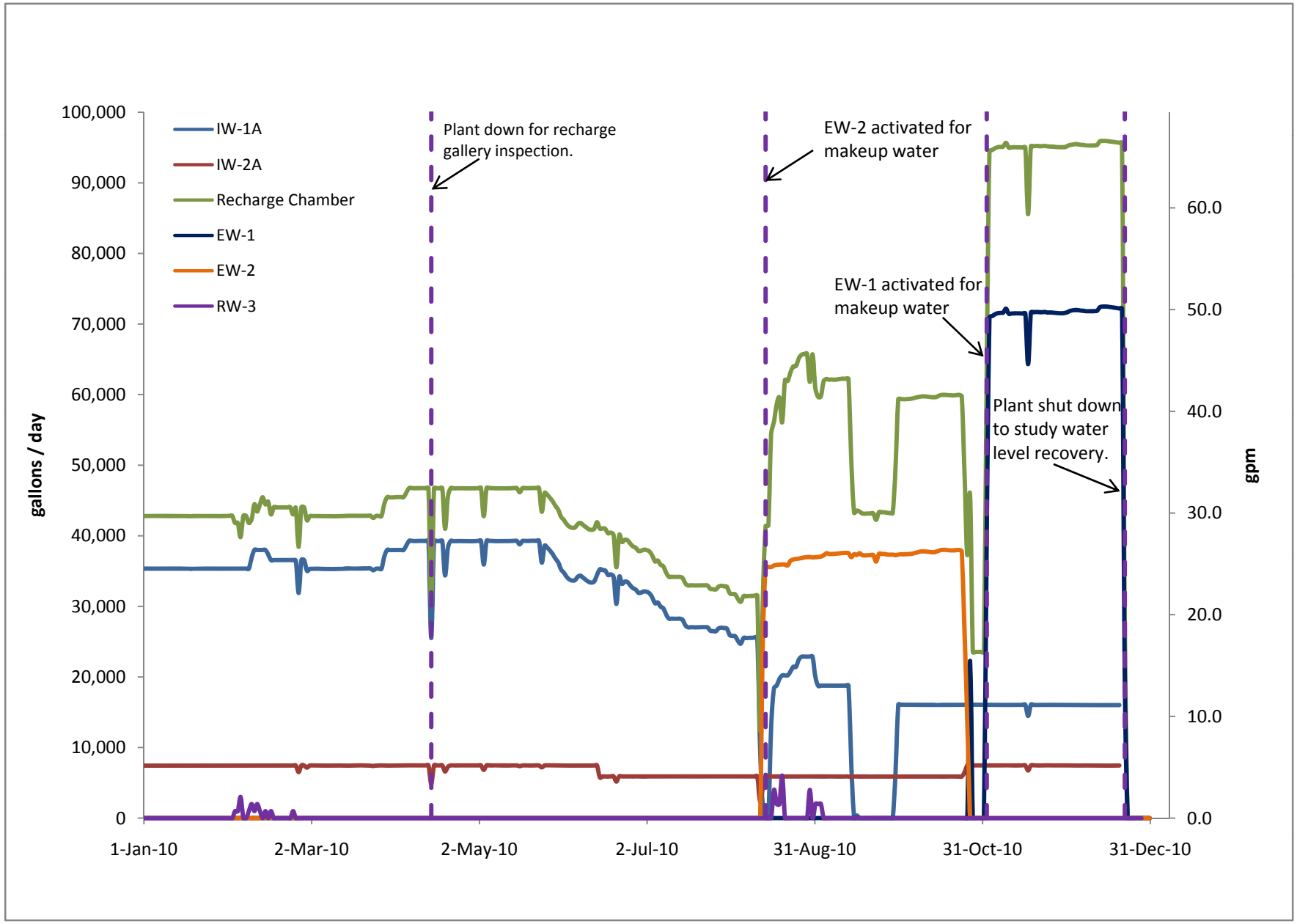
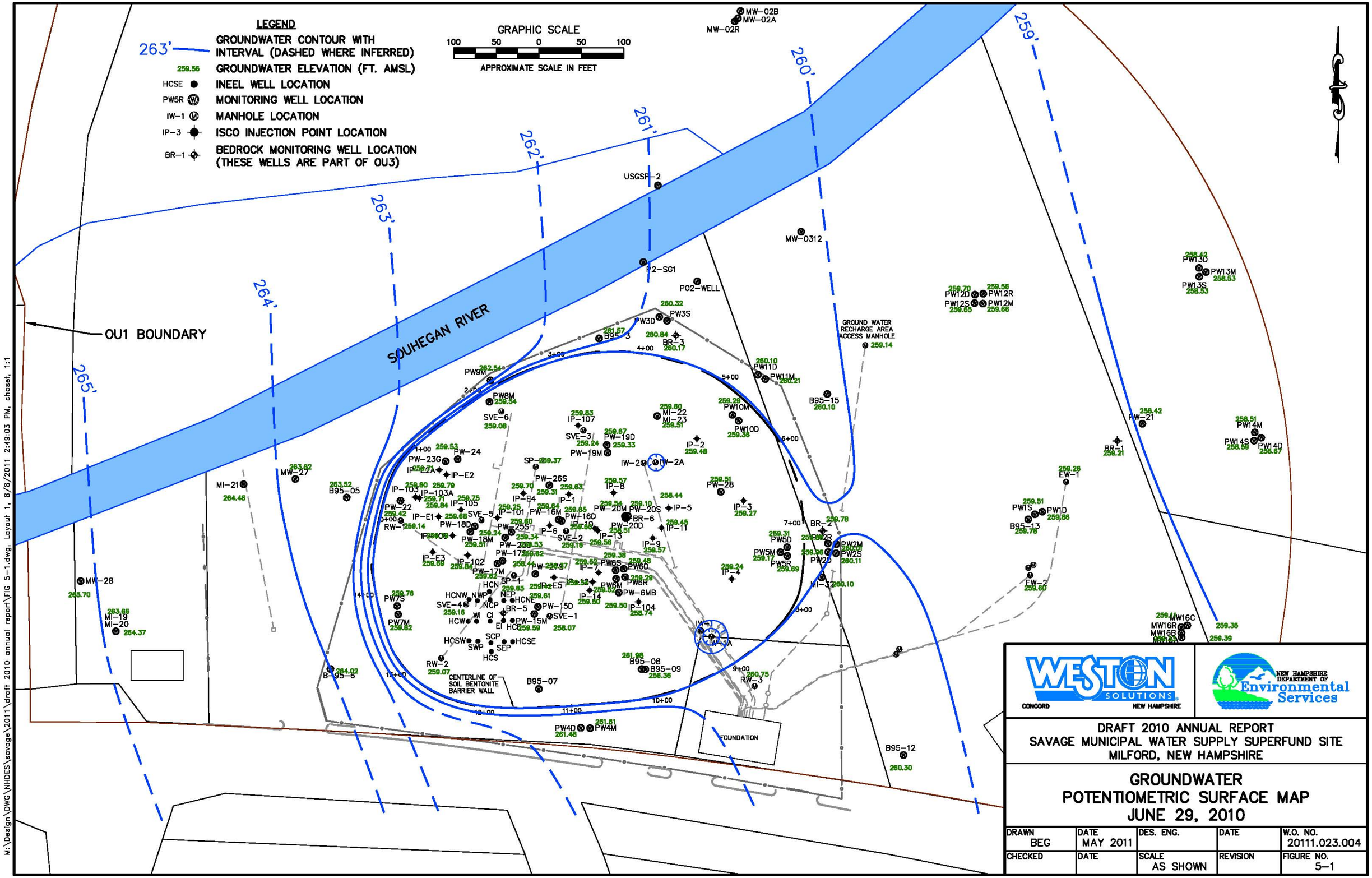
		AS SHOWN		1-3B

M:\Design\DWG\NHDES\savage\2011\draft 2010 annual report\FIG 1-3B.dwg, Layout 1, 5/19/2011 4:51:36 PM, GIRARDEB, 1:1

Figure 2-1
2010 Influent and Effluent Flows
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire




LEGEND
263' GROUNDWATER CONTOUR WITH INTERVAL (DASHED WHERE INFERRED)
259.56 GROUNDWATER ELEVATION (FT. AMSL)
HCSE INEEL WELL LOCATION
PW5R MONITORING WELL LOCATION
IW-1 MANHOLE LOCATION
IP-3 ISCO INJECTION POINT LOCATION
BR-1 BEDROCK MONITORING WELL LOCATION (THESE WELLS ARE PART OF OU3)
GRAPHIC SCALE
100 50 0 50 100
APPROXIMATE SCALE IN FEET
SOUHEGAN RIVER
OU1 BOUNDARY
GROUND WATER RECHARGE AREA ACCESS MANHOLE
CENTERLINE OF SOIL BENTONITE BARRIER WALL
FOUNDATION
WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE
NEW HAMPSHIRE DEPARTMENT OF Environmental Services
DRAFT 2010 ANNUAL REPORT
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE
GROUNDWATER
POTENTIOMETRIC SURFACE MAP
JUNE 29, 2010
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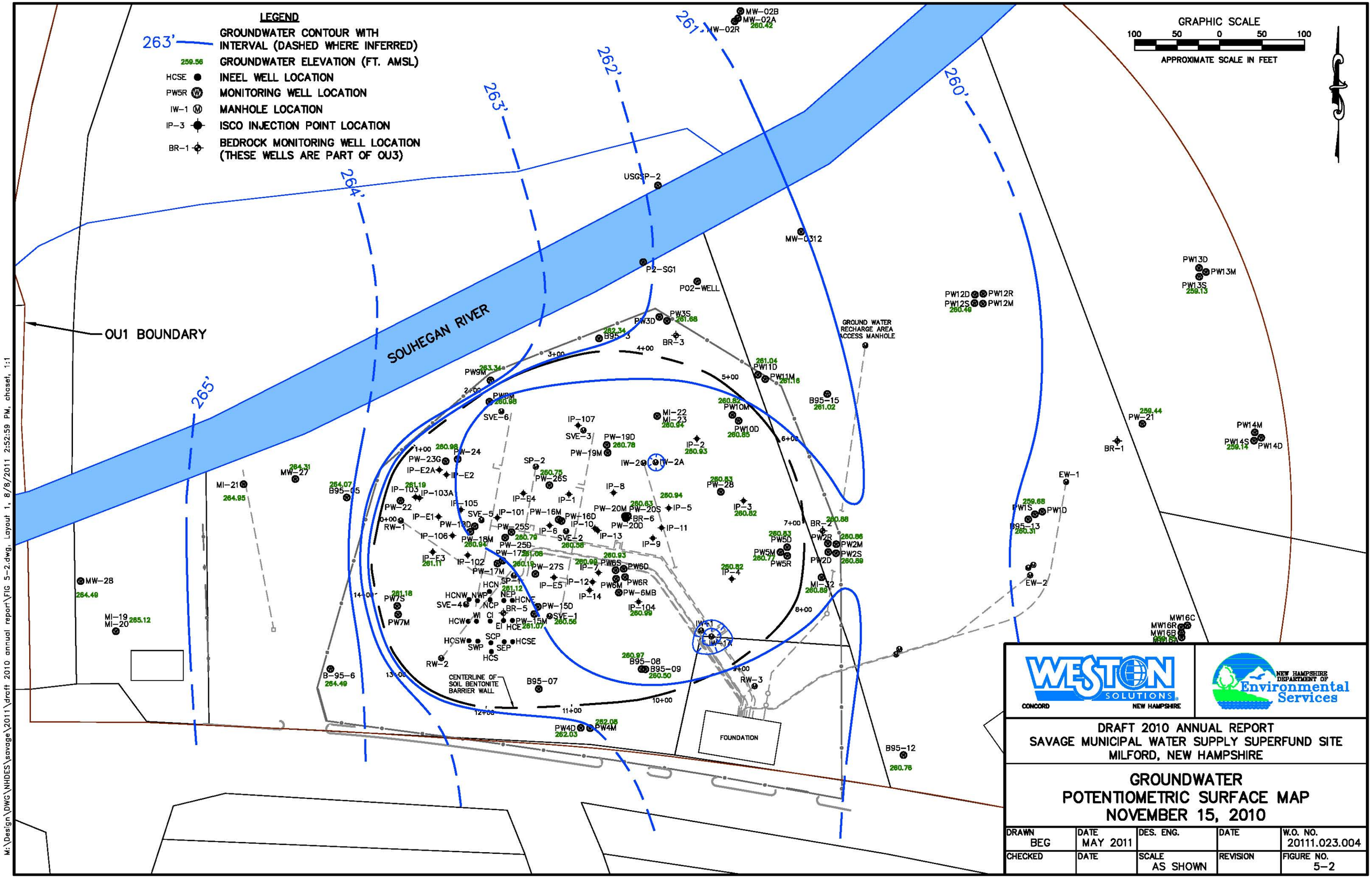
LEGEND
263' GROUNDWATER CONTOUR WITH INTERVAL (DASHED WHERE INFERRED)
259.56 GROUNDWATER ELEVATION (FT. AMSL)
HCSE INEEL WELL LOCATION
PW5R MONITORING WELL LOCATION
IW-1 MANHOLE LOCATION
IP-3 ISCO INJECTION POINT LOCATION
BR-1 BEDROCK MONITORING WELL LOCATION (THESE WELLS ARE PART OF OU3)
GRAPHIC SCALE
100 50 0 50 100
APPROXIMATE SCALE IN FEET
SOUHEGAN RIVER
OU1 BOUNDARY
GROUND WATER RECHARGE AREA ACCESS MANHOLE
CENTERLINE OF SOIL BENTONITE BARRIER WALL
FOUNDATION
WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE
NEW HAMPSHIRE DEPARTMENT OF Environmental Services
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SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE
GROUNDWATER
POTENTIOMETRIC SURFACE MAP
NOVEMBER 15, 2010
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Figure 5-3
2010 Vertical Gradients Between Overburden and Bedrock
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

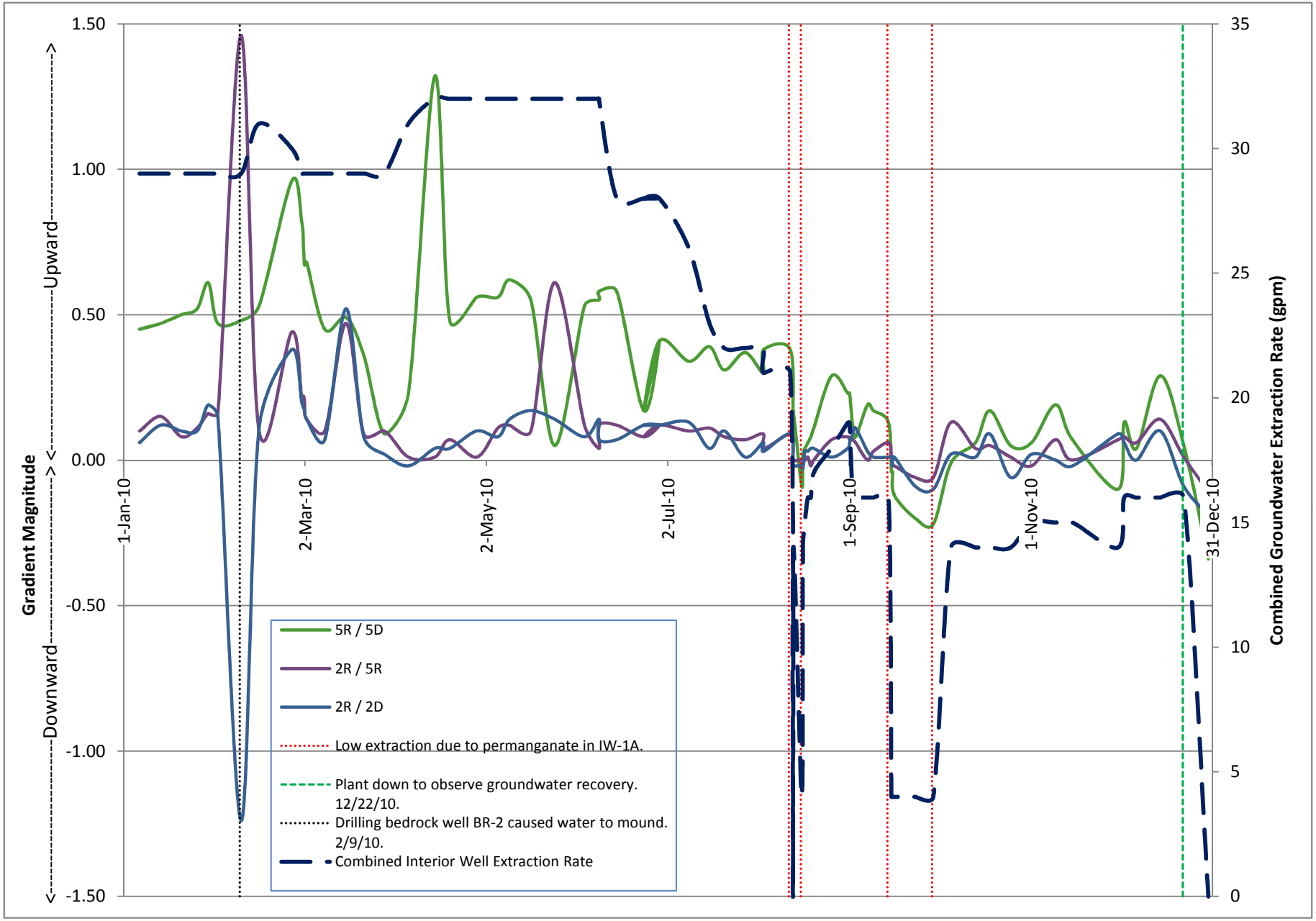
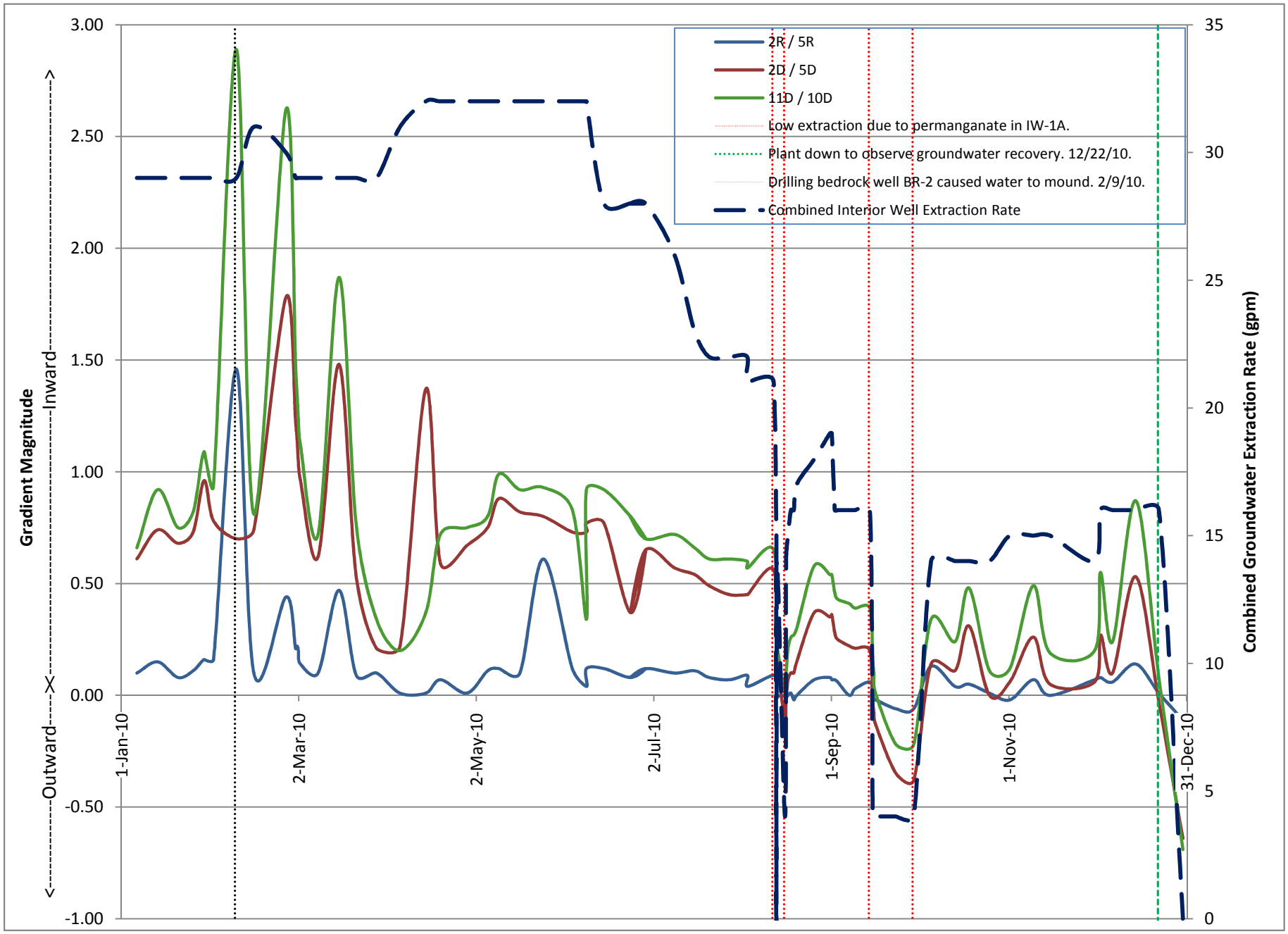
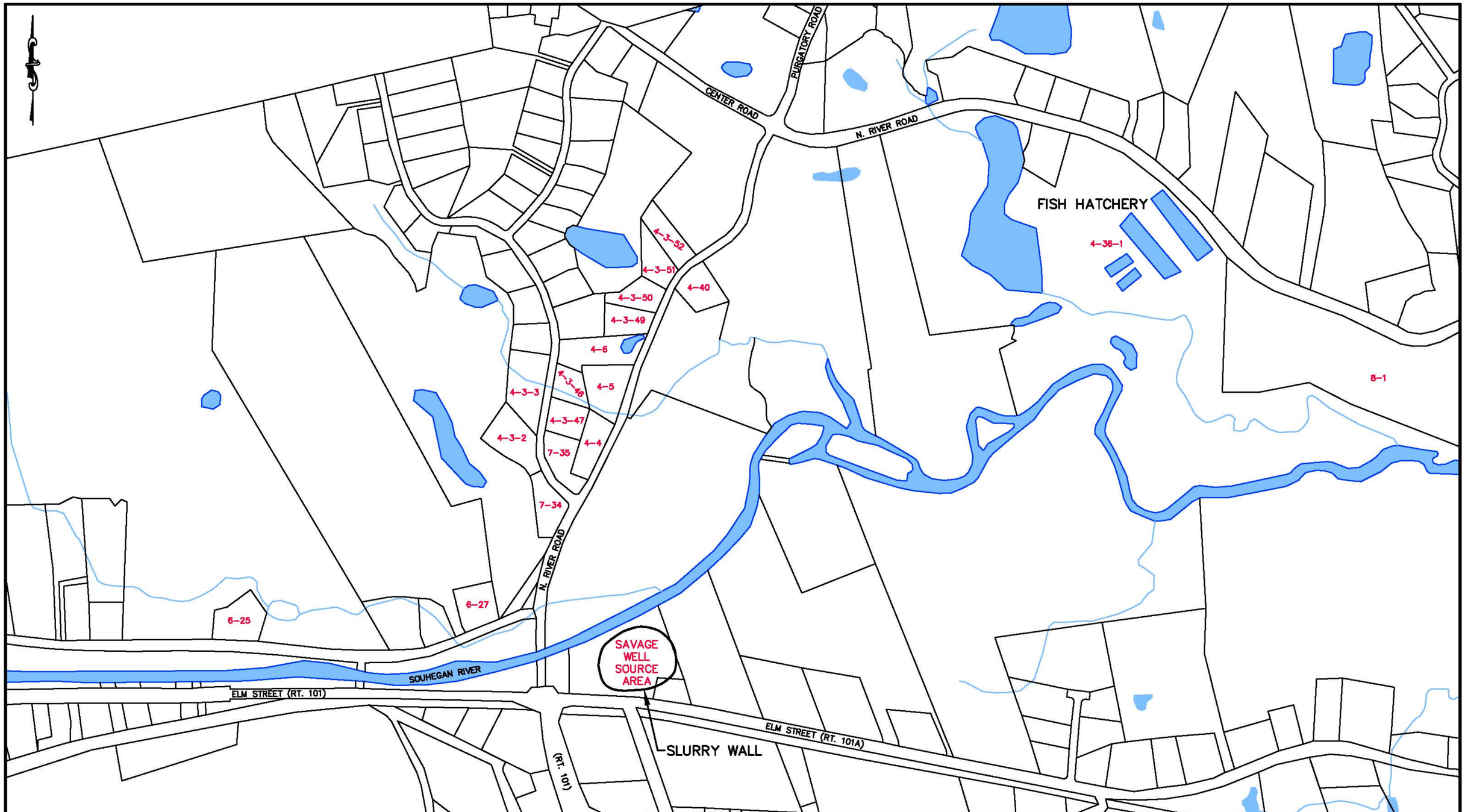


Figure 5-4
2010 Horizontal Gradients Across Slurry Wall
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire





LEGEND

4-3-50 WELLS SAMPLED IN NOVEMBER 2010 (ALL RESULTS NON-DETECT)

SOURCE:
PROPERTY MAPS TAKEN FROM TOWN OF MILFORD, NH, TAX MAP DATABASE, MAP NUMBERS B2, B3, C2, C3, D2, & D3, DATED APRIL, 2009.

GRAPHIC SCALE
600 300 0 300 600
APPROXIMATE SCALE IN FEET

RESIDENTIAL AND FISH HATCHERY SAMPLING LOCATIONS

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MILFORD, NEW HAMPSHIRE

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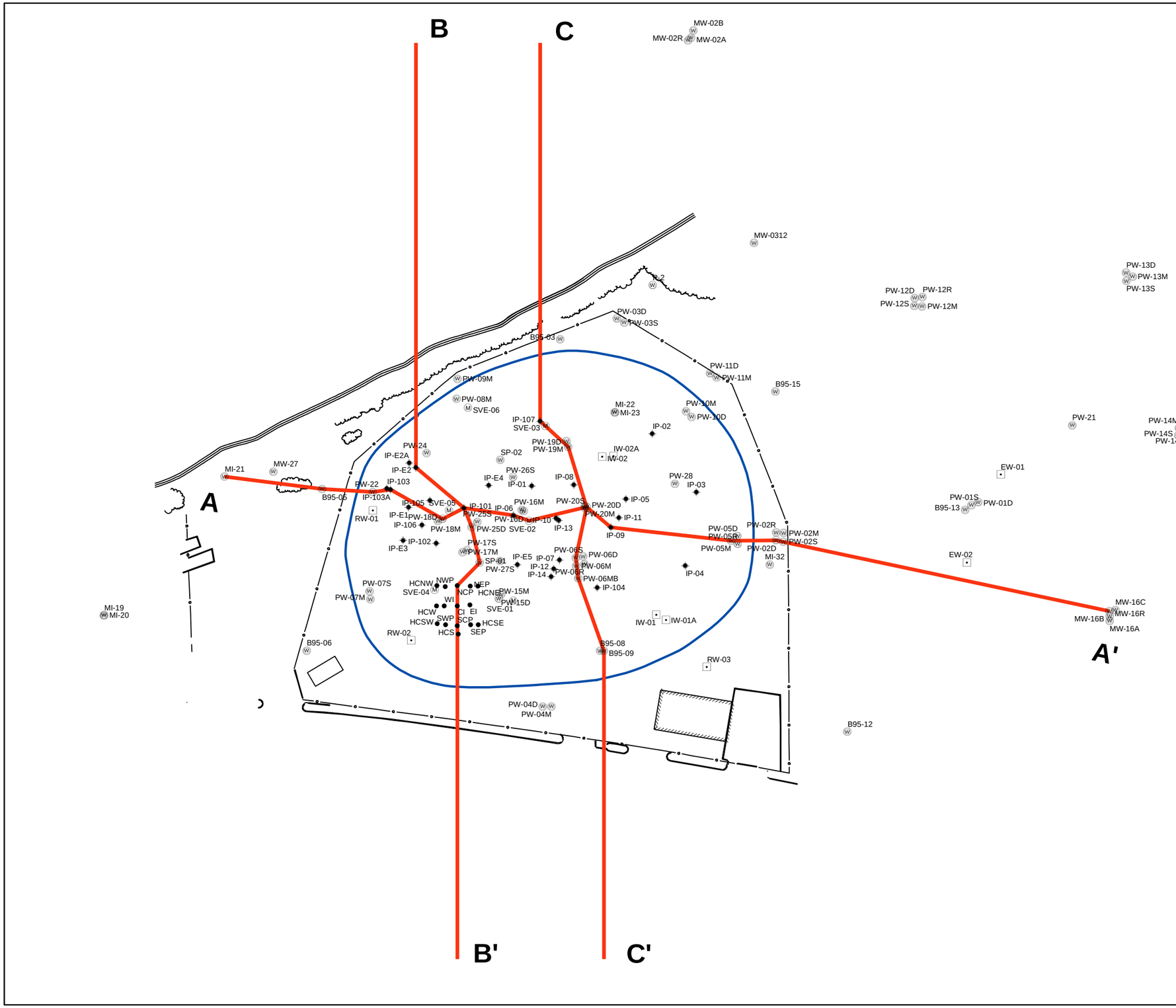
M:\Design\DWG\NHDES\savage\2011\draft 2010 annual report\FIG 5-5.dwg, Layout1, 5/12/2011 11:48:03 AM, GIRARDEB, 1:1



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PLAN VIEW SHOWING LOCATIONS OF CROSS-SECTIONS

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AF	MAY 2011	AS SHOWN		Figure 5-6

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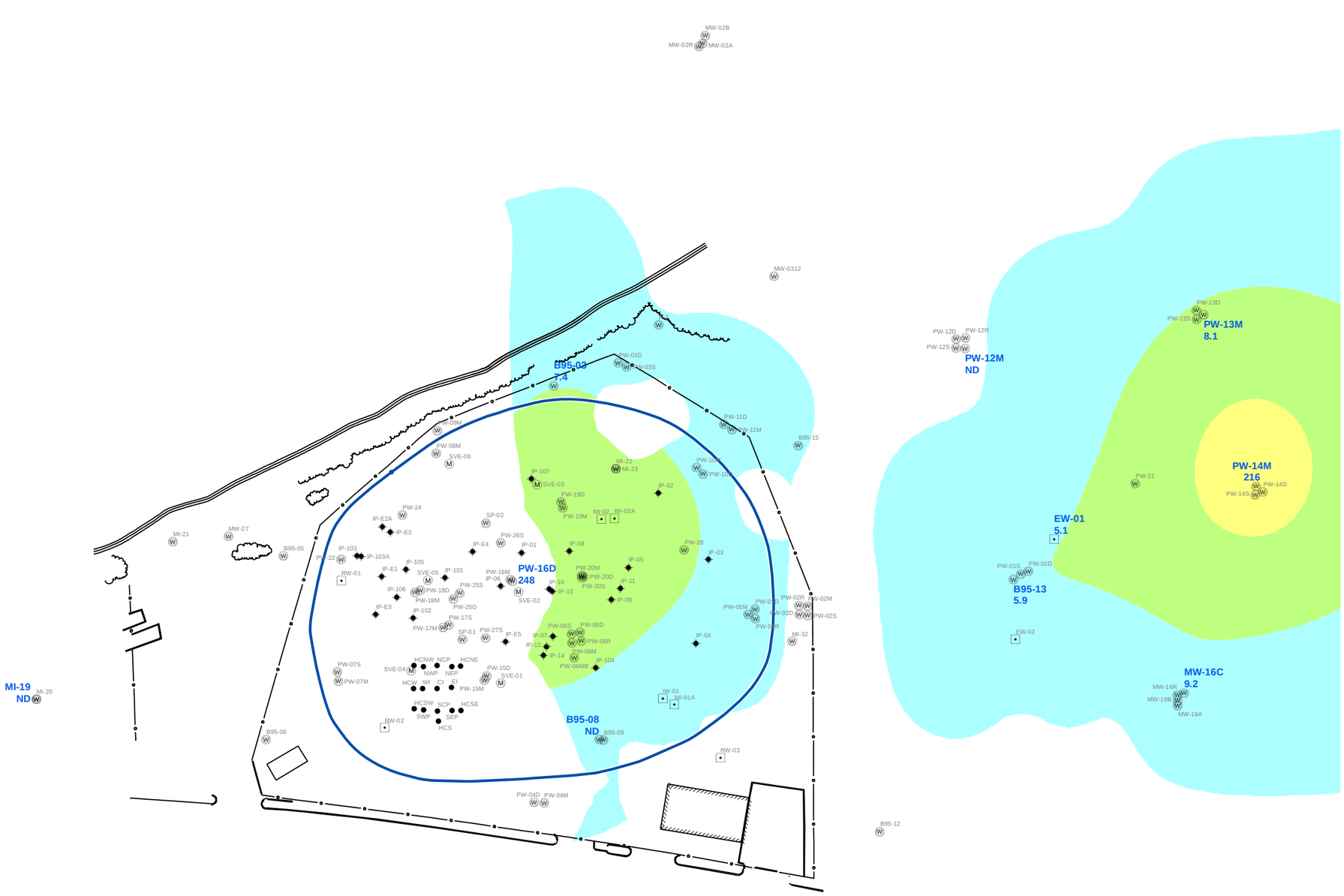

Legend

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Model Concentration

- >5000ppb
- >500ppb
- >50ppb
- >5ppb (MCL)
- Detection

0 50 100 200
Feet

Note:

1. All Concentrations are in units of ug/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.
3. The slicing plane at 195 ft cuts through the aquitard (till & bedrock) in the west portion of the area inside the slurry wall, thus the modeled PCE plume does not extend into that portion of area;

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SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

FALL 2010 PCE CONCENTRATIONS AT 195 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
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AF	MAY 2011	AS SHOWN		Figure 5-7

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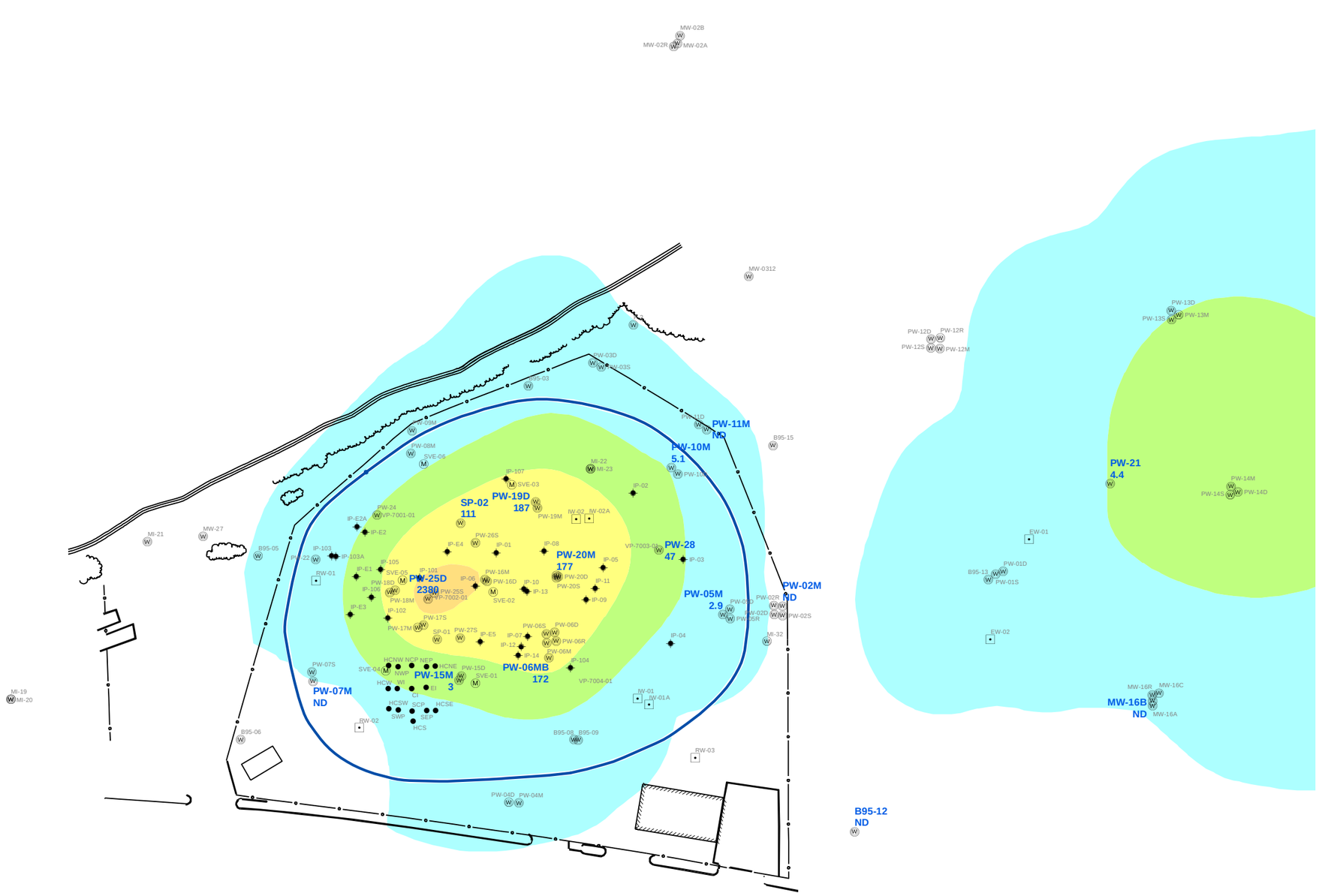

N

Legend

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Model Concentration

- **>5000ppb**
- **>500ppb**
- **>50ppb**
- **>5ppb (MCL)**
- **Detection**

0 50 100 200
Feet

Note:
1. All Concentrations are in units of ug/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.

WESTON SOLUTIONS CONCORD NEW HAMPSHIRE

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SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

FALL 2010 PCE CONCENTRATIONS AT 218 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.004
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AF	MAY 2011	AS SHOWN		Figure 5-8

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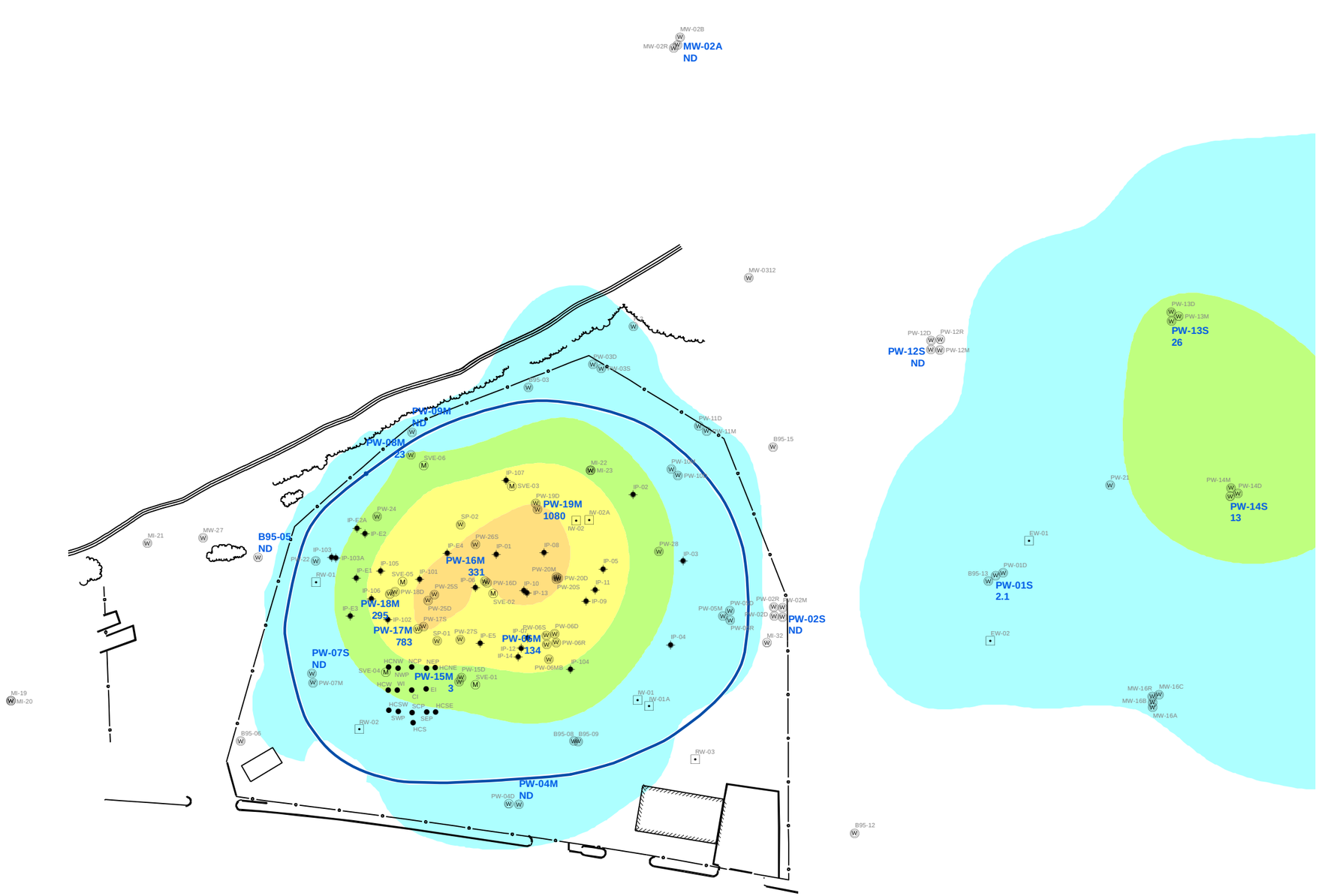

N

Legend

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Model Concentration

- **>5000ppb**
- **>500ppb**
- **>50ppb**
- **>5ppb (MCL)**
- **Detection**

0 50 100 200
Feet

Note:
1. All Concentrations are in units of ug/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.

WESTON SOLUTIONS CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

FALL 2010 PCE CONCENTRATIONS
AT 235 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
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CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	MAY 2011	AS SHOWN		Figure 5-9

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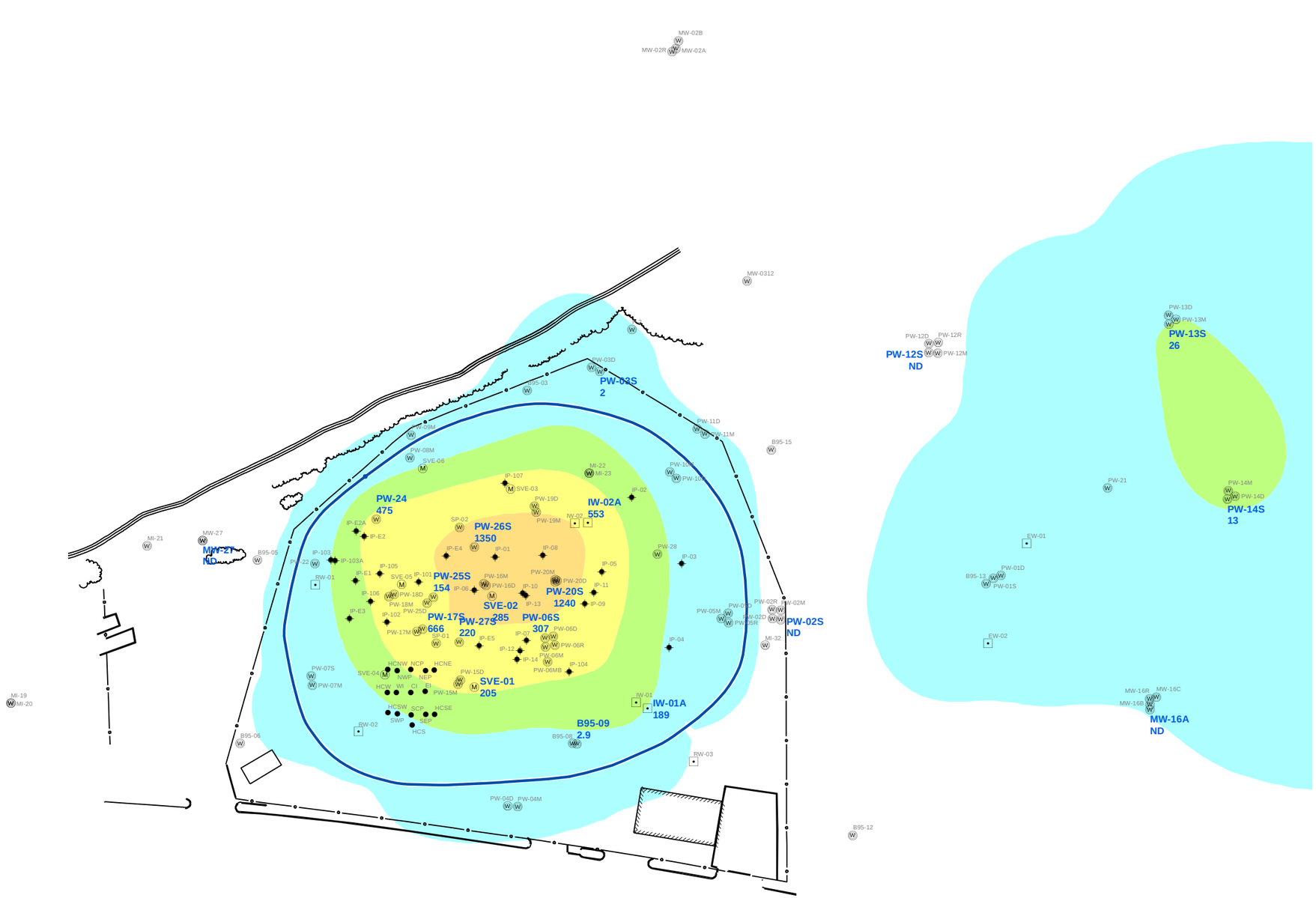

N

Legend

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Model Concentration

- **>5000ppb**
- **>500ppb**
- **>50ppb**
- **>5ppb (MCL)**
- **Detection**

0 50 100 200
Feet

Note:
1. All Concentrations are in units of ug/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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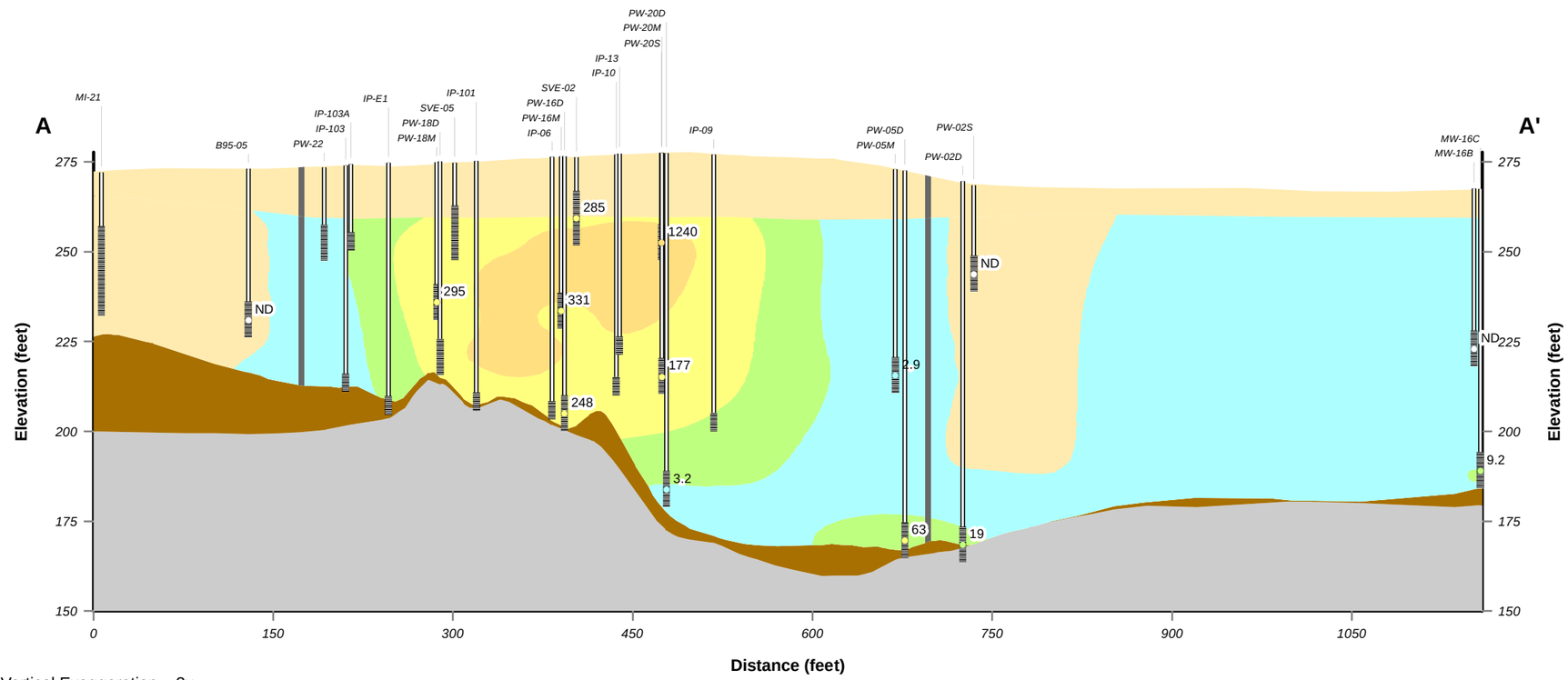
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

FALL 2010 PCE CONCENTRATIONS
AT 250 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	MAY 2011	AS SHOWN		Figure 5-10

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\V5ZPLANE\Zplanes.mxd, 6-May-2010, LIUA



Vertical Exaggeration = 3x

Legend

Modeled Concentration

- >5000ppb
- >500ppb
- >50ppb
- >5ppb (MCL)
- Detection

Geologic Zone

- Overburden
- Till
- Slurry Wall
- Bedrock

Notes:

1) *The cross-section was extracted from a three-dimensional geospatial model developed using EarthVision.*
2) *Well locations and data >10-ft off the transect are not shown.*
3) *Not all wells shown in the figure were sampled during this monitoring round.*
4) *Well locations not directly on the cross-section may appear to be screened across the incorrect geologic units.*

Cross-Section A-A'
PCE Distribution
Fall 2010

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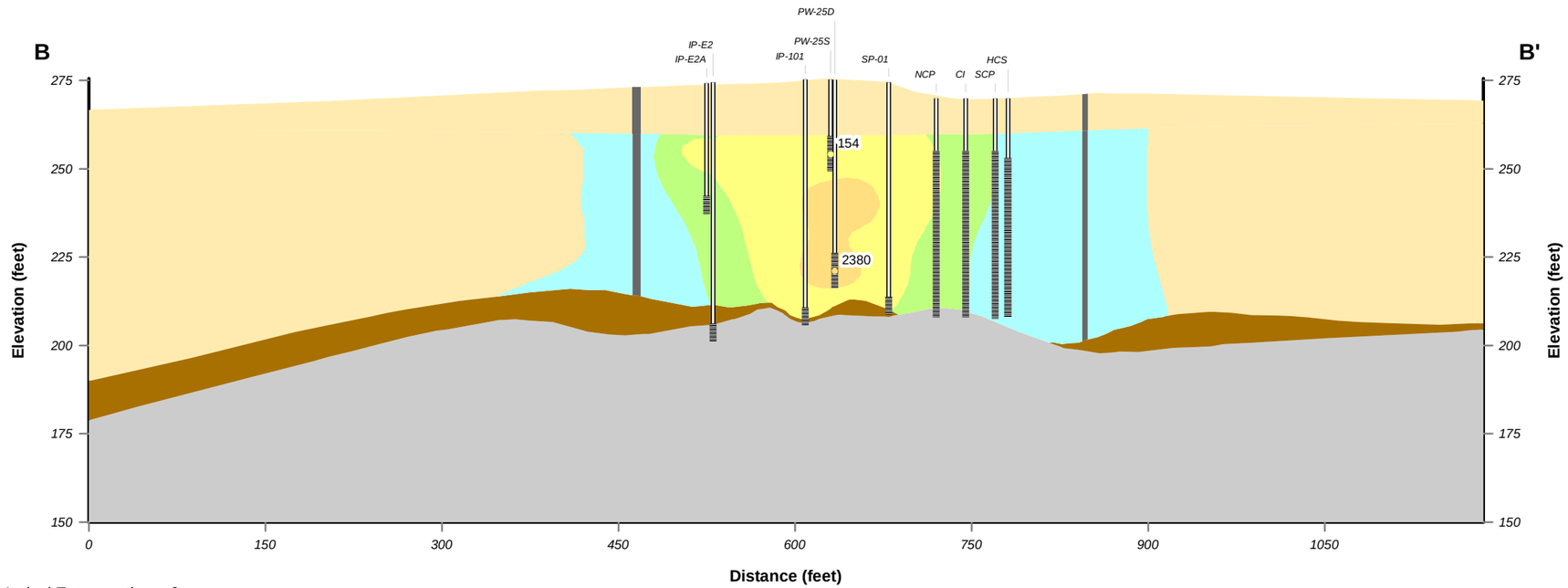
SAVAGE MUNICIPAL WATER SUPPLY
SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	MAY 2011	AS SHOWN		Figure 5-11

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\v2



Vertical Exaggeration = 3x

Legend

Modeled Concentration

- >5000ppb
- >500ppb
- >50ppb
- >5ppb (MCL)
- Detection

Geologic Zone

- Overburden
- Till
- Slurry Wall
- Bedrock

Notes:

1) *The cross-section was extracted from a three-dimensional geospatial model developed using EarthVision.*
2) *Well locations and data >10-ft off the transect are not shown.*
3) *Not all wells shown in the figure were sampled during this monitoring round.*
4) *Well locations not directly on the cross-section may appear to be screened across the incorrect geologic units.*

Cross-Section B-B'
PCE Distribution
Fall 2010

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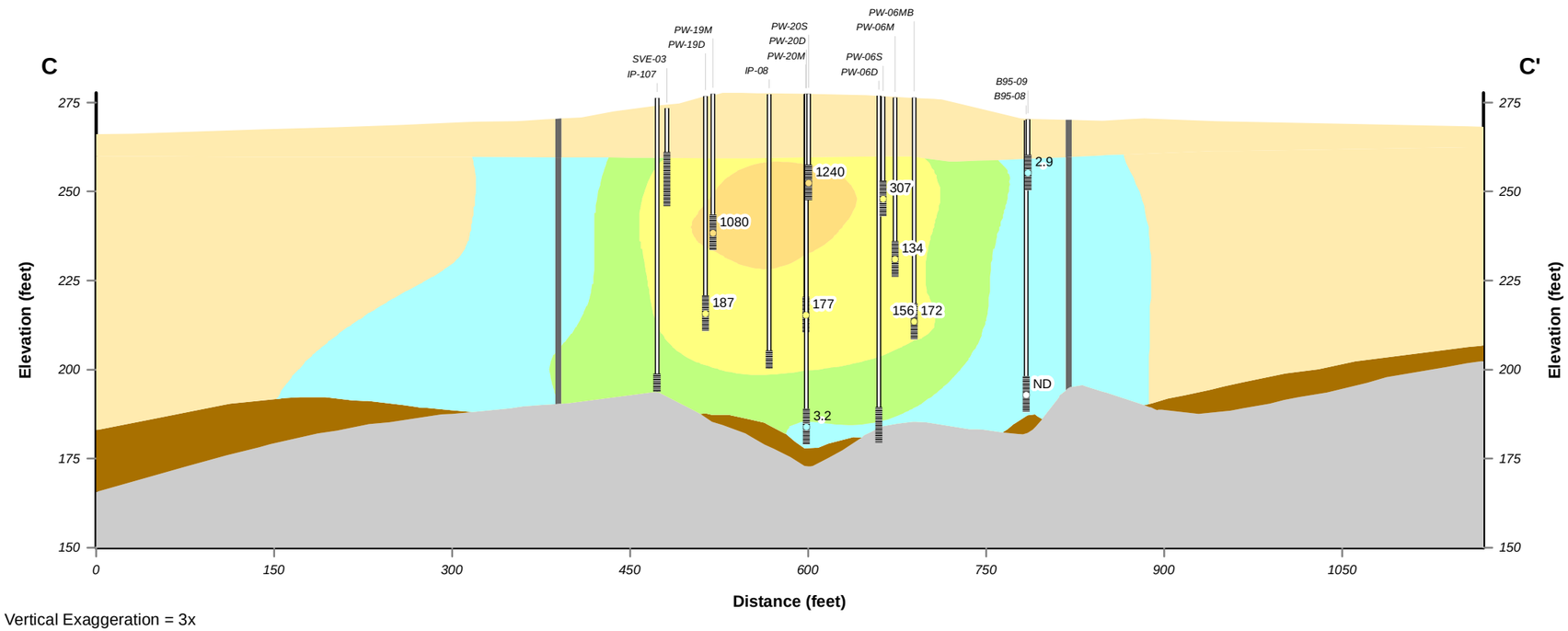
DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	MAY 2011	AS SHOWN		Figure 5-12

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\v2



Vertical Exaggeration = 3x

Legend

Modeled Concentration

- >5000ppb
- >500ppb
- >50ppb
- >5ppb (MCL)
- Detection

Geologic Zone

- Overburden
- Till
- Slurry Wall
- Bedrock

Notes:

1) *The cross-section was extracted from a three-dimensional geospatial model developed using EarthVision.*
2) *Well locations and data >10-ft off the transect are not shown.*
3) *Not all wells shown in the figure were sampled during this monitoring round.*
4) *Well locations not directly on the cross-section may appear to be screened across the incorrect geologic units.*

Cross-Section C-C'
PCE Distribution
Fall 2010

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SUPERFUND SITE
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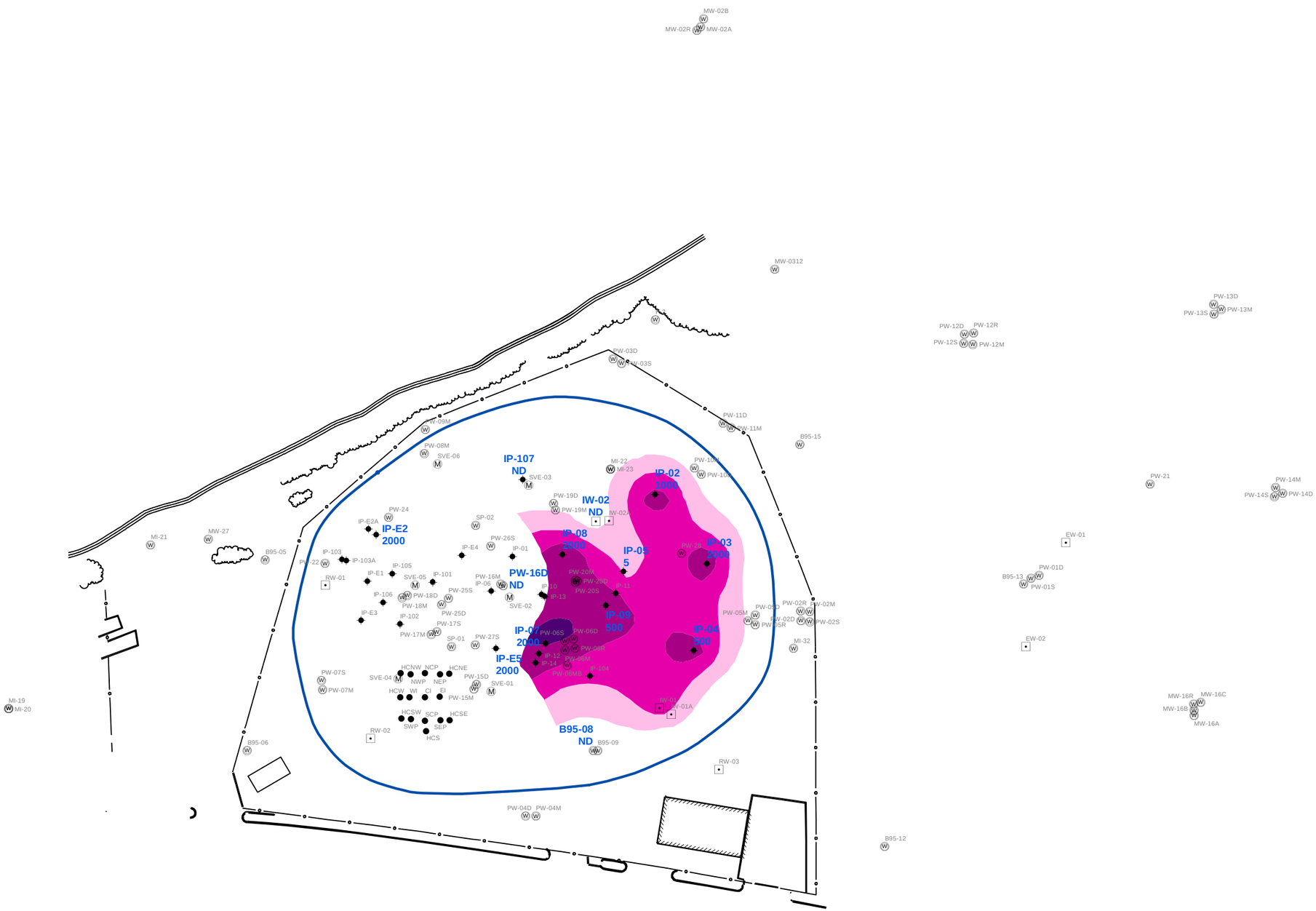
AL	MAY 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	MAY 2011	AS SHOWN		Figure 5-13

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\v2



N

Legend

All_Wells

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Modeled Concentration

- >1000mg/L
- <1000mg/L
- <100mg/L
- <10mg/L
- ND

0 50 100 200
Feet

Note:

1. All Concentrations are in units of mg/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.
3. The slicing plane at 195 ft cuts through the aquitard (till & bedrock) in the west portion of the area, thus inside the slurry wall the modeled MnO4 plume does not extend to that portion of area.

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MARCH 2010 NaMnO4 CONCENTRATIONS AT 195 FEET AMSL

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AL	MAY 2011			20111.023.004
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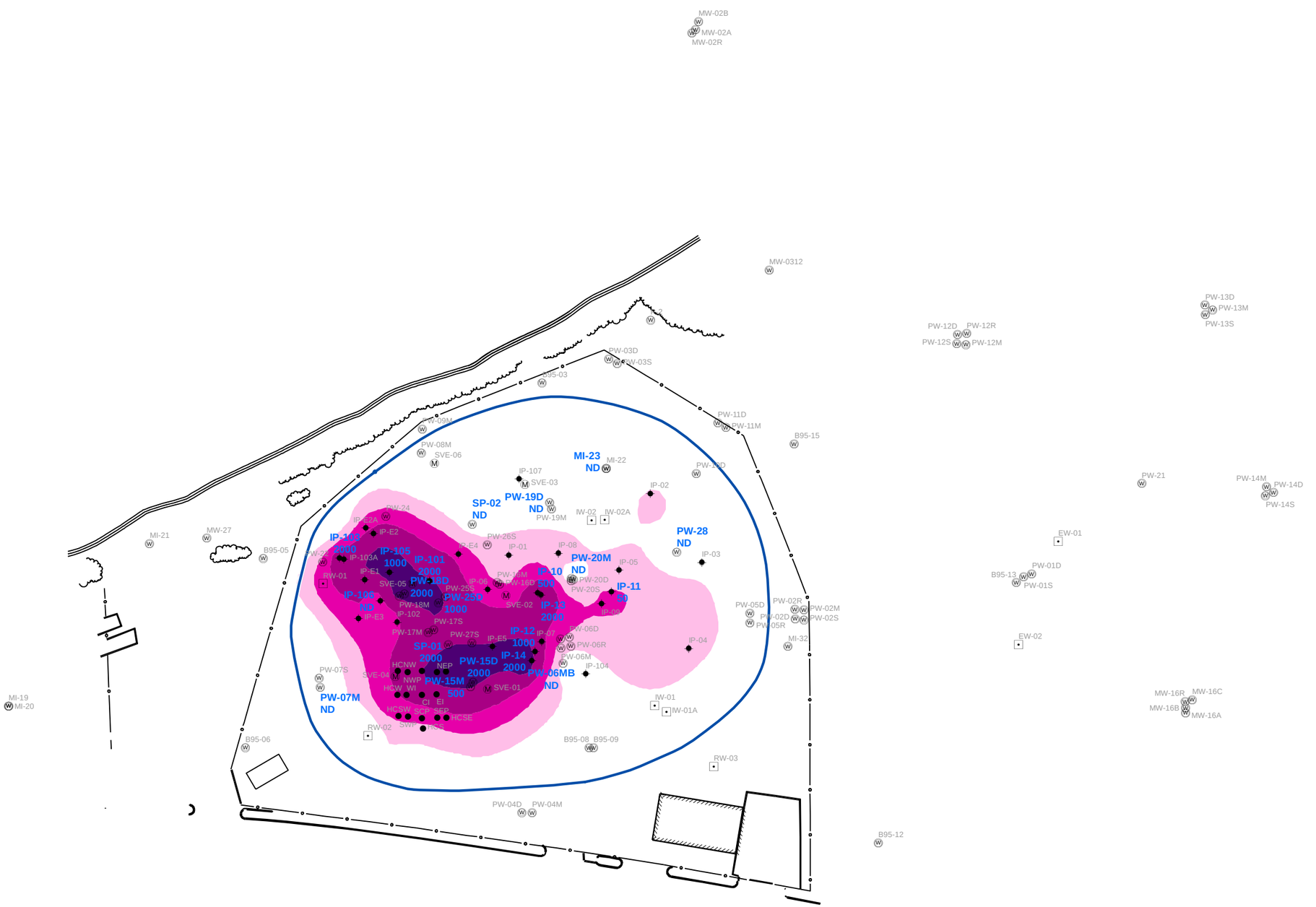
AF	MAY 2011	AS SHOWN		Figure 5-14

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\V5ZPLANE\Zplanes.mxd, 6-May-2010, LIUA



N

Legend

All_Wells

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Modeled Concentration

- >1000mg/L
- <1000mg/L
- <100mg/L
- <10mg/L
- ND

0 50 100 200
Feet

Note:
1. All Concentrations are in units of mg/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.

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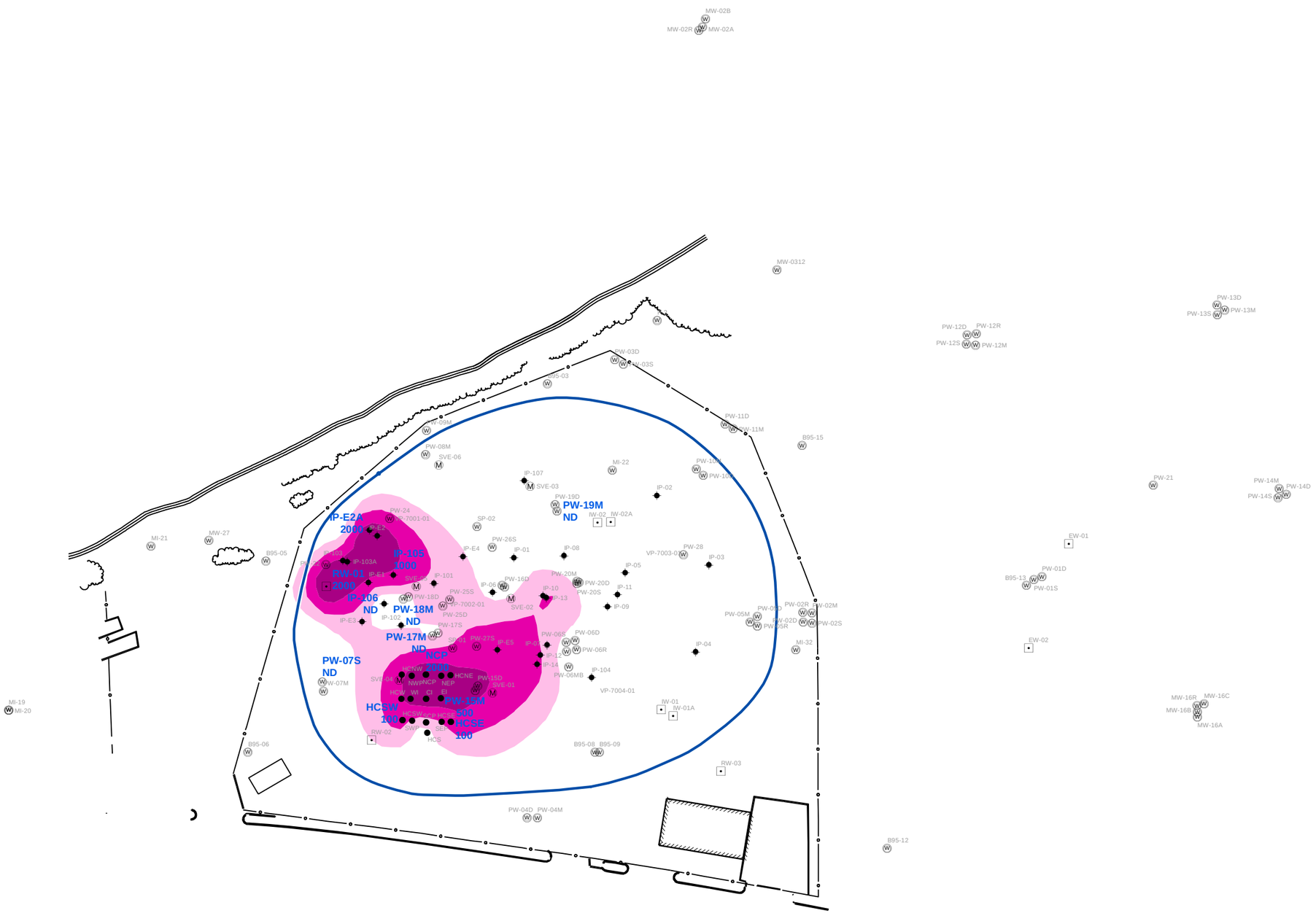
MARCH 2010 NaMnO4 CONCENTRATIONS AT 218 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.003
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
		AS SHOWN		Figure 5-15

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\V5ZPLANE\Zplanes.mxd, 6-May-2010, LIUA



N

Legend

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Modeled Concentration

- >1000mg/L
- <1000mg/L
- <100mg/L
- <10mg/L
- ND

0 50 100 200
Feet

Note:
1. All Concentrations are in units of mg/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.

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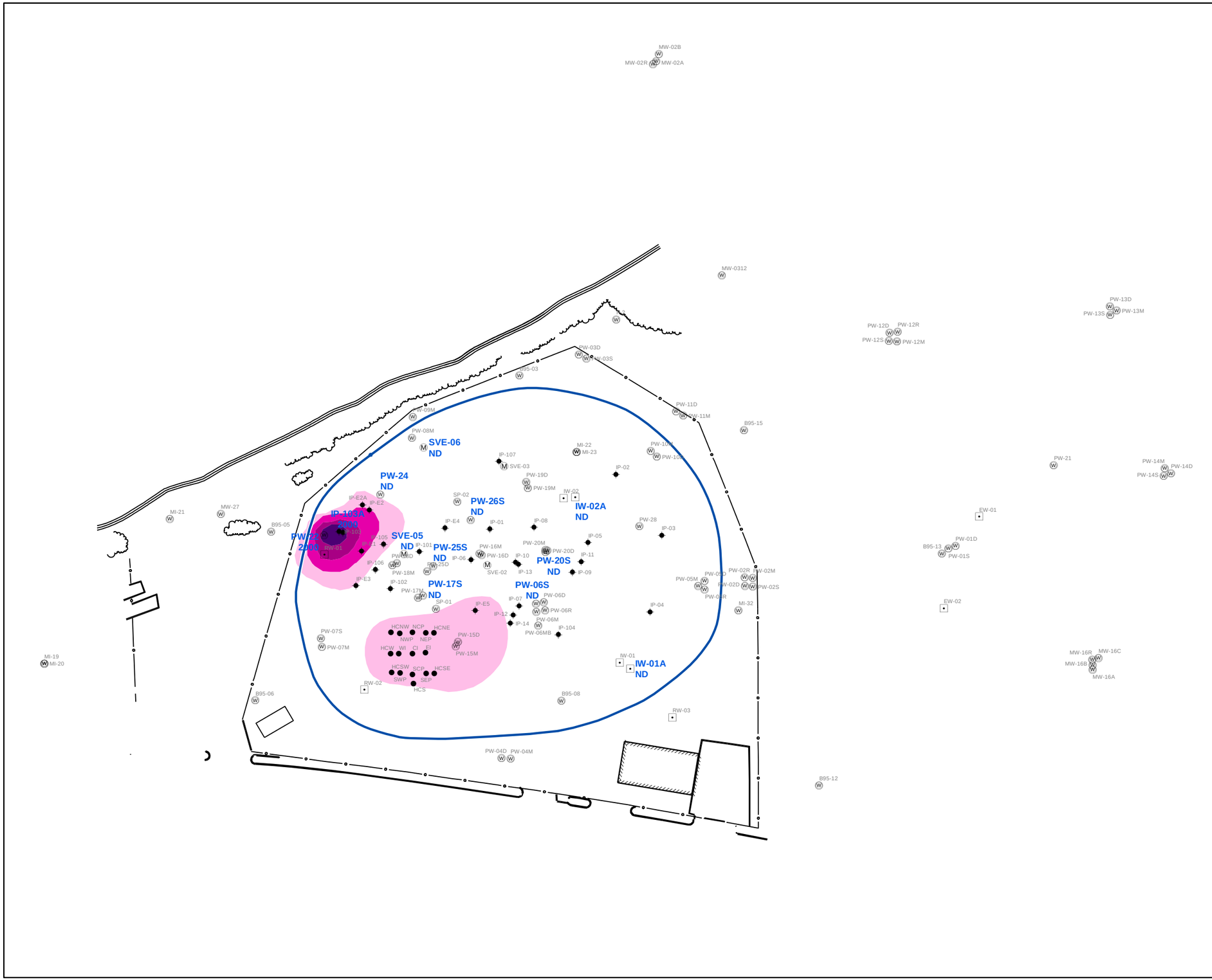
MARCH 2010 NaMnO4 CONCENTRATIONS AT 235 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	MAY 2011	AS SHOWN		Figure 5-16

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\V5ZPLANE\Zplanes.mxd, 6-May-2010, LIUA



Legend

Location Type

- INEL
- ISCO Injection Point
- Monitoring Well
- SVE
- Extraction/Recharge Well

Modeled Concentration

- >1000mg/L
- <1000mg/L
- <100mg/L
- <10mg/L
- ND

0 50 100 200
Feet

Note:
1. All Concentrations are in units of mg/L.
2. Only samples taken at the elevation which is within 10 feet inteval of the slicing plane are shown with concentrations in the figure.

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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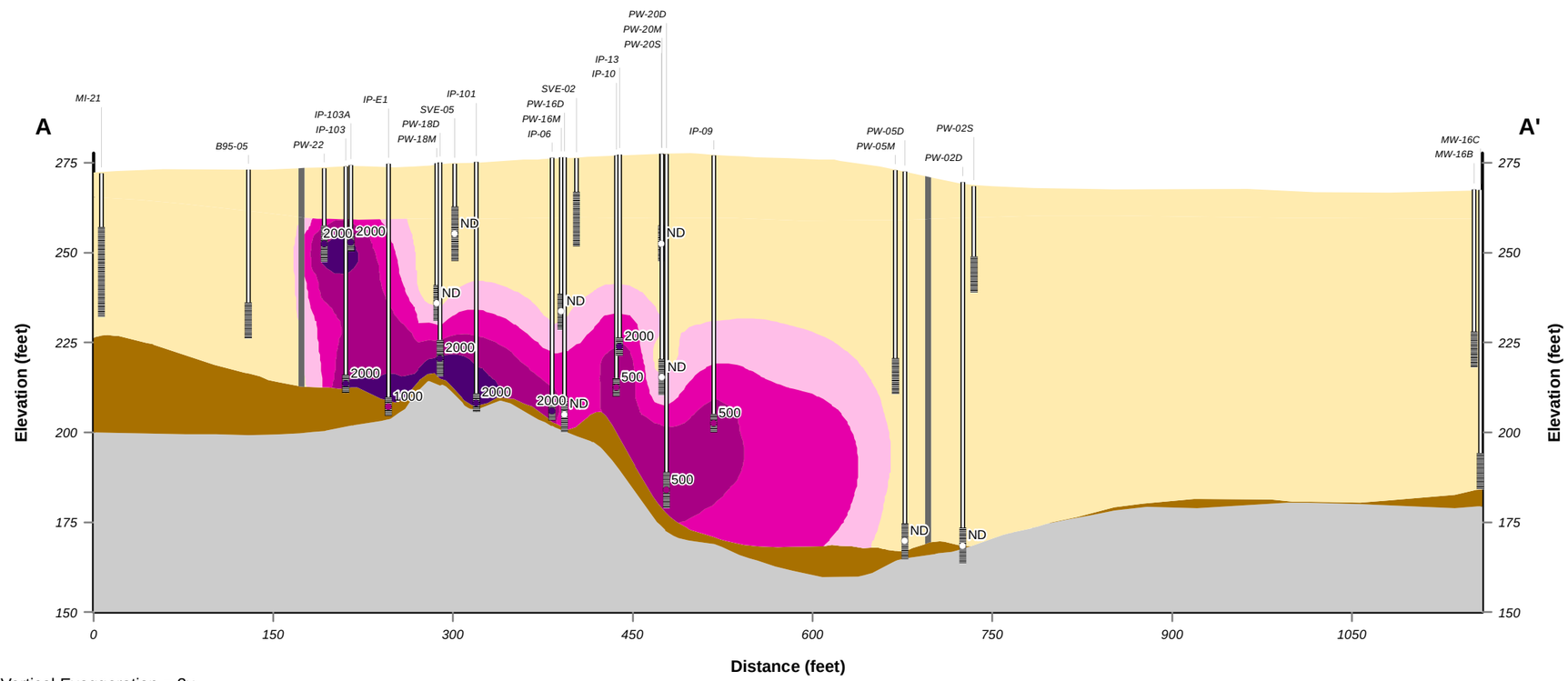
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

MARCH 2010 NaMnO4 CONCENTRATIONS AT 250 FEET AMSL

DRAWN	DATE	DEG. ENG.	DATE	W.O. NO.
AL	MAY 2011			20111.023.004
CHECKED	**DATE**	**SCALE**	**REVISION**	**FIGURE NO.**
AF	MAY 2011	AS SHOWN		Figure 5-17

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\V5ZPLANE\Zplanes.mxd, 6-May-2010, LIUA



Vertical Exaggeration = 3x

Legend

Modeled Concentration	Geologic Zone
>1000mg/L	Overburden
<1000mg/L	Till
<100mg/L	Slurry Wall
<10mg/L	Bedrock

Notes:
1) *The cross-section was extracted from a three-dimensional geospatial model developed using EarthVision.*
2) *Well locations and data >10-ft off the transect are not shown.*
3) *Not all wells shown in the figure were sampled for permanganate during this monitoring round.*
4) *Well Locations not positioned directly on the cross-section may appear to be screened across the incorrect geologic units.*

Cross-Section A-A'
NaMnO4 Distribution
Mar 2010

DRAFT 2010 ANNUAL REPORT
SAVAGE MUNICIPAL WATER SUPPLY
SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

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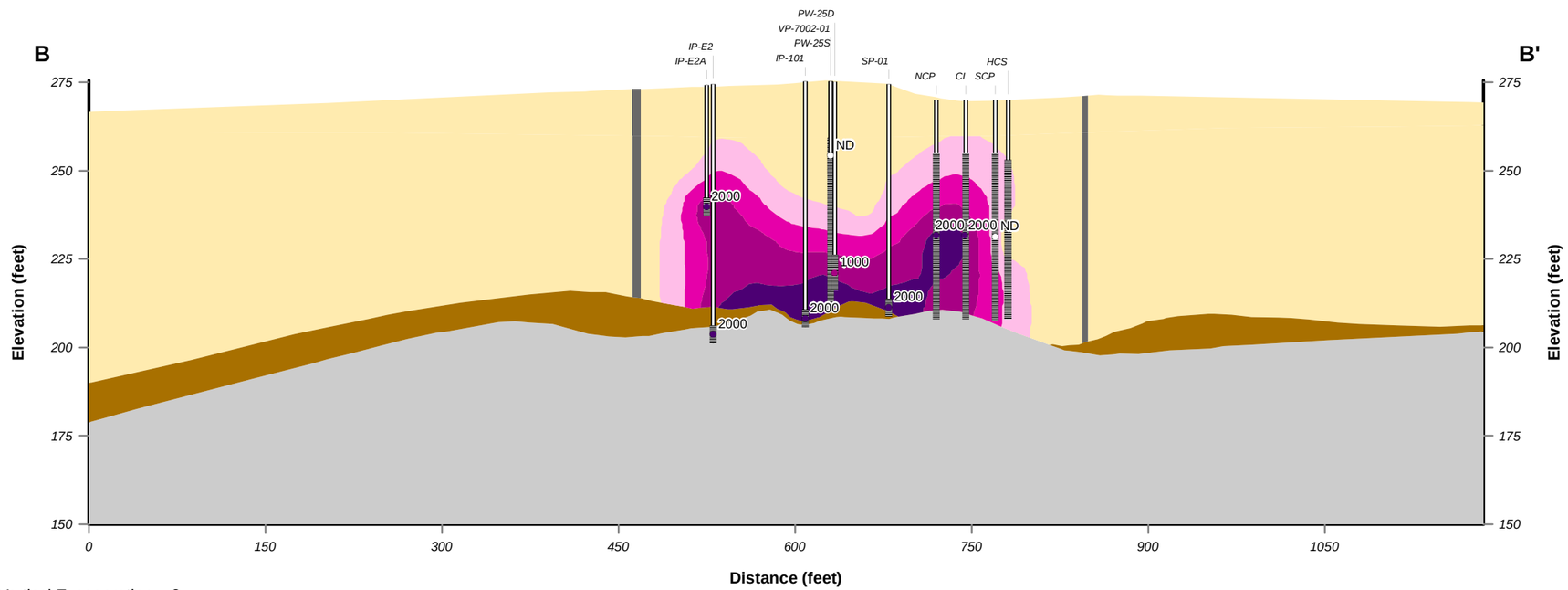
DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
AL	May 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	May 2011	AS SHOWN		Figure 5-18

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\v2



Vertical Exaggeration = 3x

Legend

Modeled Concentration
- >1000mg/L
- <1000mg/L
- <100mg/L
- <10mg/L

Geologic Zone
- Overburden
- Till
- Slurry Wall
- Bedrock

Notes:
1) *The cross-section was extracted from a three-dimensional geospatial model developed using EarthVision.*
2) *Well locations and data >10-ft off the transect are not shown.*
3) *Not all wells shown in the figure were sampled for permanganate during this monitoring round.*
4) *Well Locations not positioned directly on the cross-section may appear to be screened across the incorrect geologic units.*

Cross-Section B-B'
NaMnO4 Distribution
Mar 2010

DRAFT 2010 ANNUAL REPORT
SAVAGE MUNICIPAL WATER SUPPLY
SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

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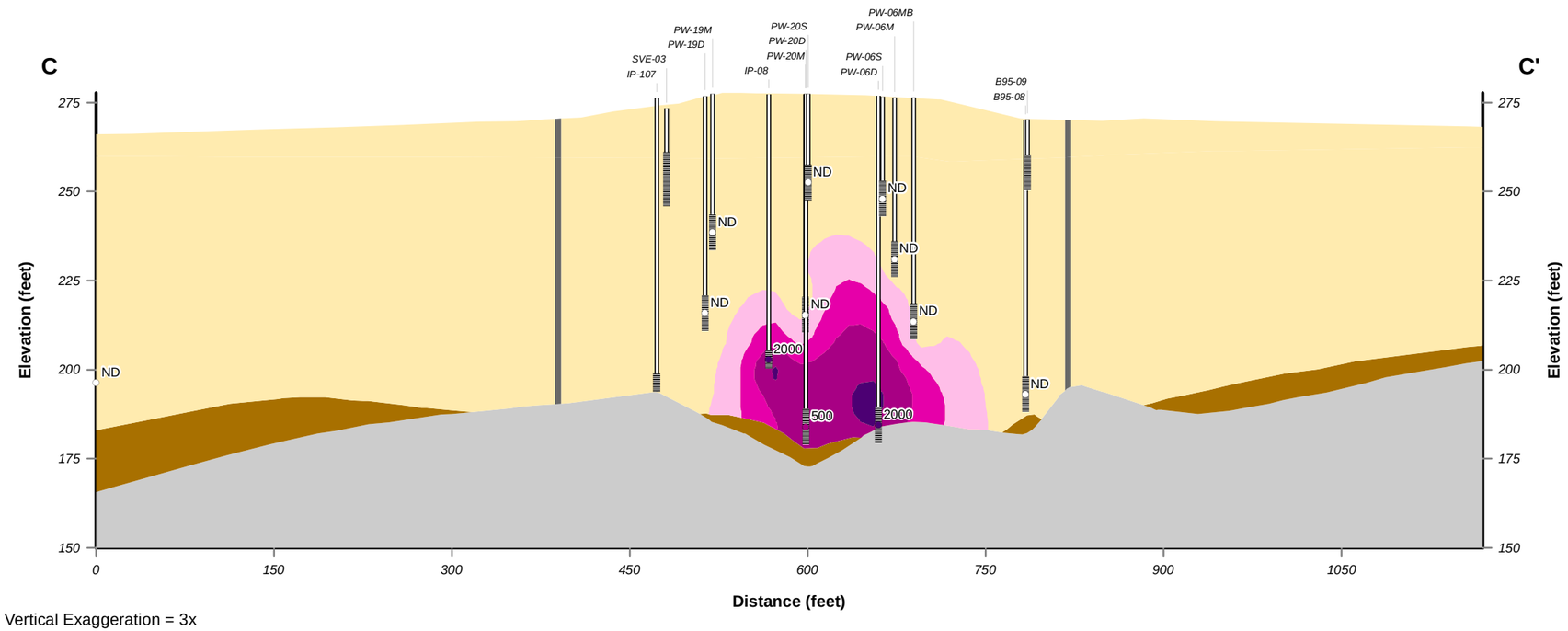
AL	May 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	May 2011	AS SHOWN		Figure 5-19

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\v2



Vertical Exaggeration = 3x

Legend

Modeled Concentration	Geologic Zone
>1000mg/L	Overburden
<1000mg/L	Till
<100mg/L	Slurry Wall
<10mg/L	Bedrock

Notes:
1) *The cross-section was extracted from a three-dimensional geospatial model developed using EarthVision.*
2) *Well locations and data >10-ft off the transect are not shown.*
3) *Not all wells shown in the figure were sampled for permanganate during this monitoring round.*
4) *Well Locations not positioned directly on the cross-section may appear to be screened across the incorrect geologic units.*

Cross-Section C-C'
NaMnO4 Distribution
Mar 2010

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SAVAGE MUNICIPAL WATER SUPPLY
SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

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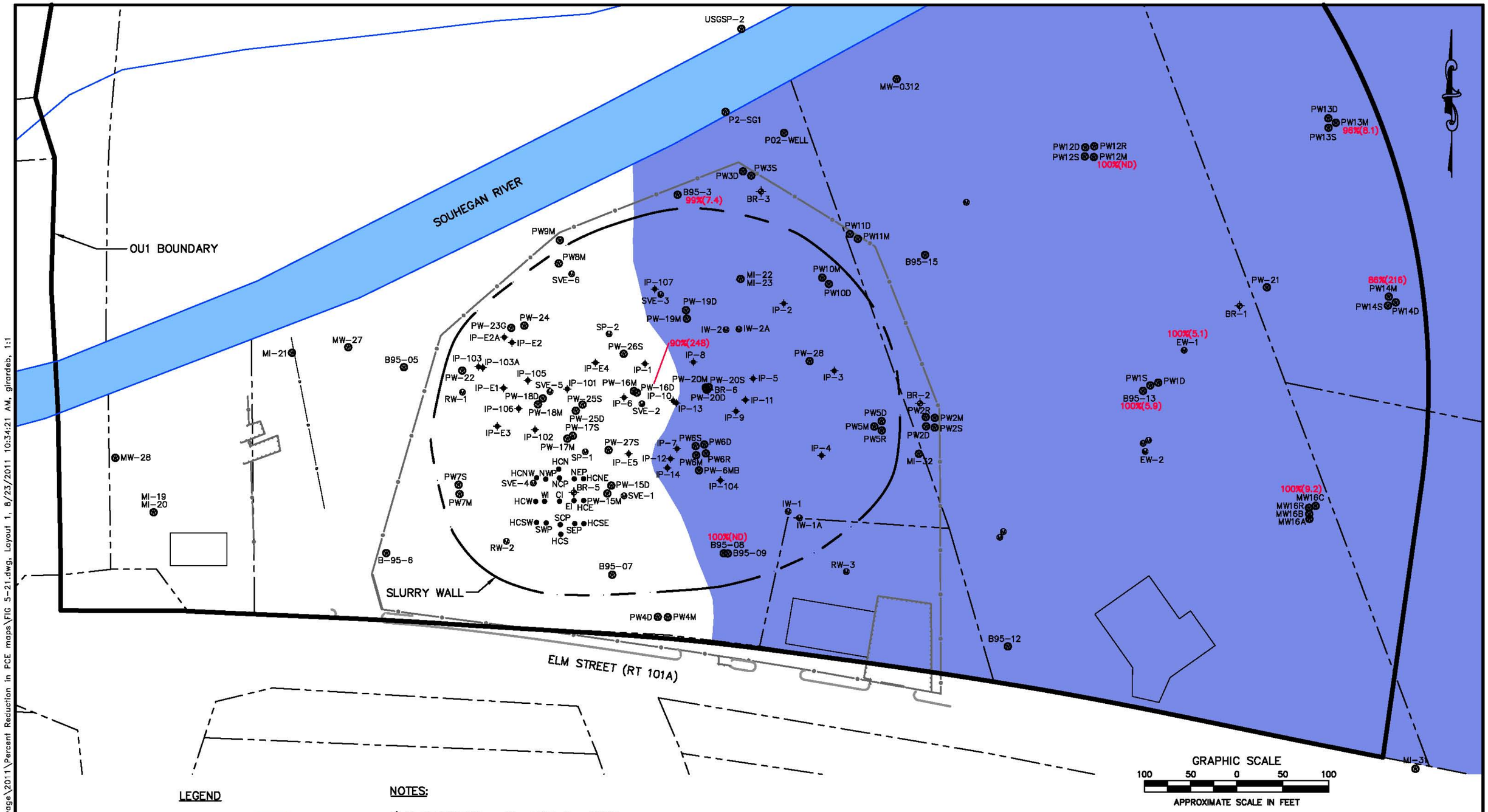
DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
AL	May 2011			20111.023.004
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
AF	May 2011	AS SHOWN		Figure 5-20

File: G:\PROJECTS\20111023\002\EarthVisionModel\GIS\v2



LEGEND

BR-2	BEDROCK WELL		75–100%
HCSE	INEEL WELL		50–75%
PW5R	MONITORING WELL		25–50%
IW-1	MANHOLE		0–25%
IP-3	ISCO INJECTION POINT		
	PROPERTY BOUNDARY		

NOTES:

1) % REDUCTION = $\frac{\text{Max PCE} - \text{Nov 2010}}{\text{Max PCE}}$

2) ONLY SAMPLES TAKEN AT AN ELEVATION WITHIN THE 10 FT INTERVAL OF THE SLICING PLANE ARE SHOWN WITH CONCENTRATIONS IN THIS FIGURE.

3) 90%(26) – PERCENT REDUCTION AND CURRENT PCE CONCENTRATION

FALL 2010 PERCENT REDUCTION IN MEASURED PCE CONCENTRATIONS AT 195 FEET AMSL

BEDROCK CONCEPTUAL SITE MODEL REPORT
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

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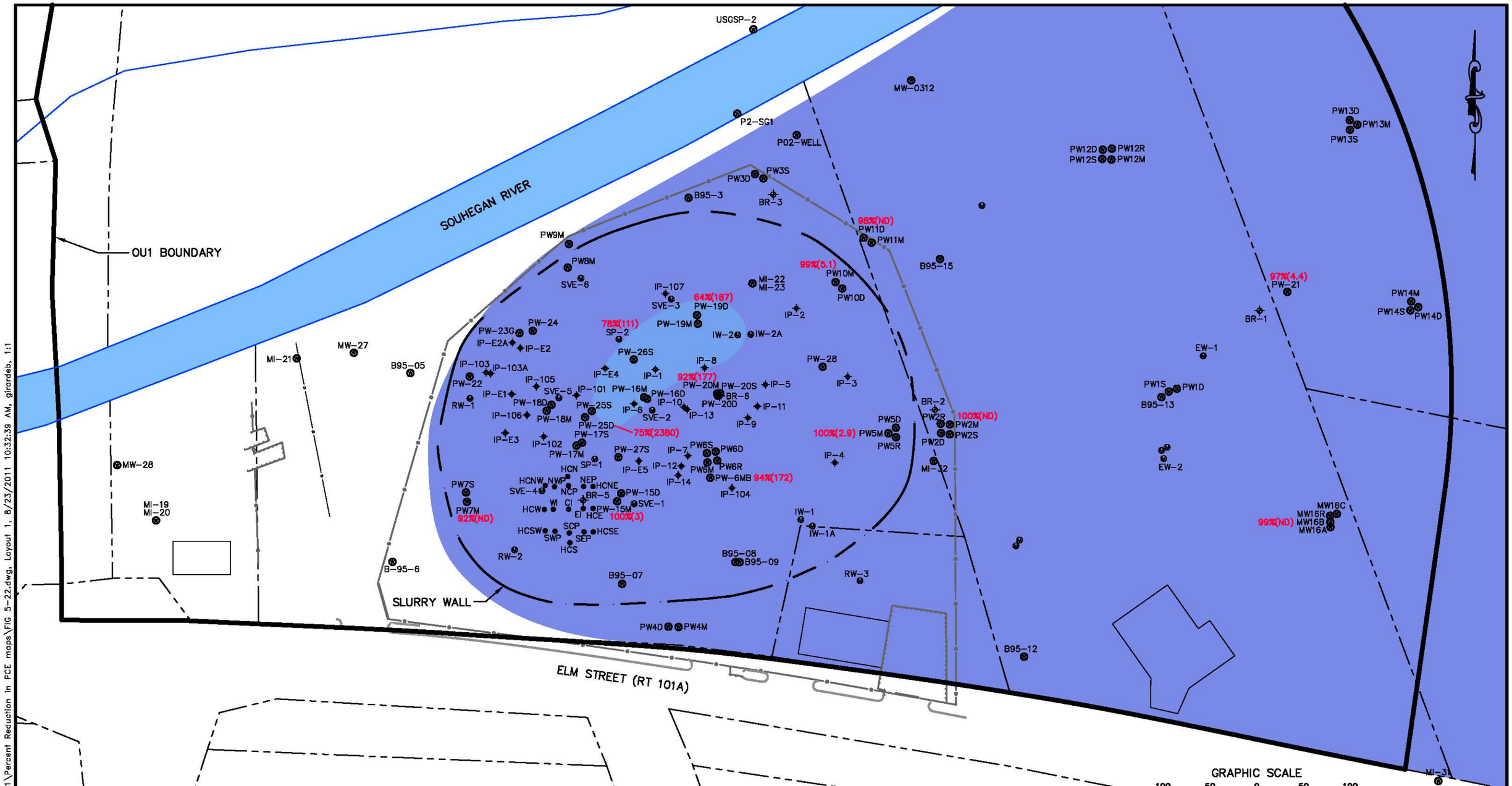
BEG	AUG 2011			20111.023.003
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
		AS SHOWN		5–21

M:\Design\DWG\NHDES\savage\2011\Percent Reduction in PCE maps\FIG 5-21.dwg, Layout 1, 8/23/2011 10:34:21 AM, girardeb, 1:1



LEGEND

BR-2	BEDROCK WELL
HCSE	INEEL WELL
PW5R	MONITORING WELL
IW-1	MANHOLE
IP-3	ISCO INJECTION POINT
	PROPERTY BOUNDARY

	75–100%
	50–75%
	25–50%
	0–25%

NOTES:

1) % REDUCTION = $\frac{\text{Max PCE} - \text{Nov 2010}}{\text{Max PCE}}$

2) ONLY SAMPLES TAKEN AT AN ELEVATION WITHIN THE 10 FT INTERVAL OF THE SLICING PLANE ARE SHOWN WITH CONCENTRATIONS IN THIS FIGURE.

3) 90%(26) – PERCENT REDUCTION AND CURRENT PCE CONCENTRATION

FALL 2010 PERCENT REDUCTION IN MEASURED PCE CONCENTRATIONS AT 218 FEET AMSL

BEDROCK CONCEPTUAL SITE MODEL REPORT
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

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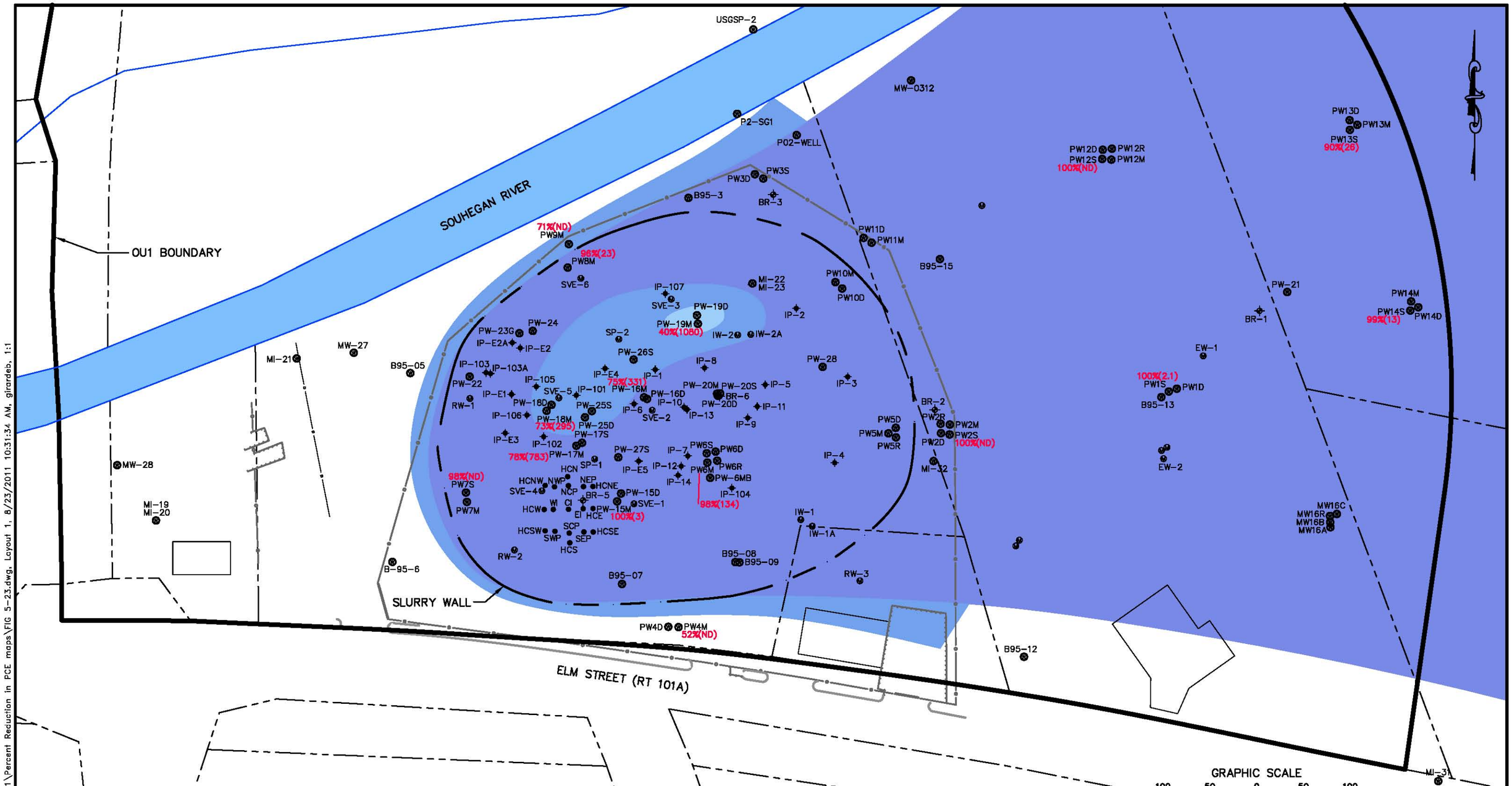
DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
BEG	AUG 2011			20111.023.003
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
		AS SHOWN		5–22

M:\Design\DWG\NHDES\savage\2011\Percent Reduction in PCE maps\FIG 5-22.dwg, Layout 1, 8/23/2011 10:32:39 AM, girardeb, 1:1



LEGEND

BR-2	BEDROCK WELL
HCSE	INEEL WELL
PW5R	MONITORING WELL
IW-1	MANHOLE
IP-3	ISCO INJECTION POINT
— — — —	PROPERTY BOUNDARY

	75–100%
	50–75%
	25–50%
	0–25%

NOTES:

1) % REDUCTION = $\frac{\text{Max PCE} - \text{Nov 2010}}{\text{Max PCE}}$

2) ONLY SAMPLES TAKEN AT AN ELEVATION WITHIN THE 10 FT INTERVAL OF THE SLICING PLANE ARE SHOWN WITH CONCENTRATIONS IN THIS FIGURE.

3) 90%(26) – PERCENT REDUCTION AND CURRENT PCE CONCENTRATION

FALL 2010 PERCENT REDUCTION IN MEASURED PCE CONCENTRATIONS AT 235 FEET AMSL

BEDROCK CONCEPTUAL SITE MODEL REPORT
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
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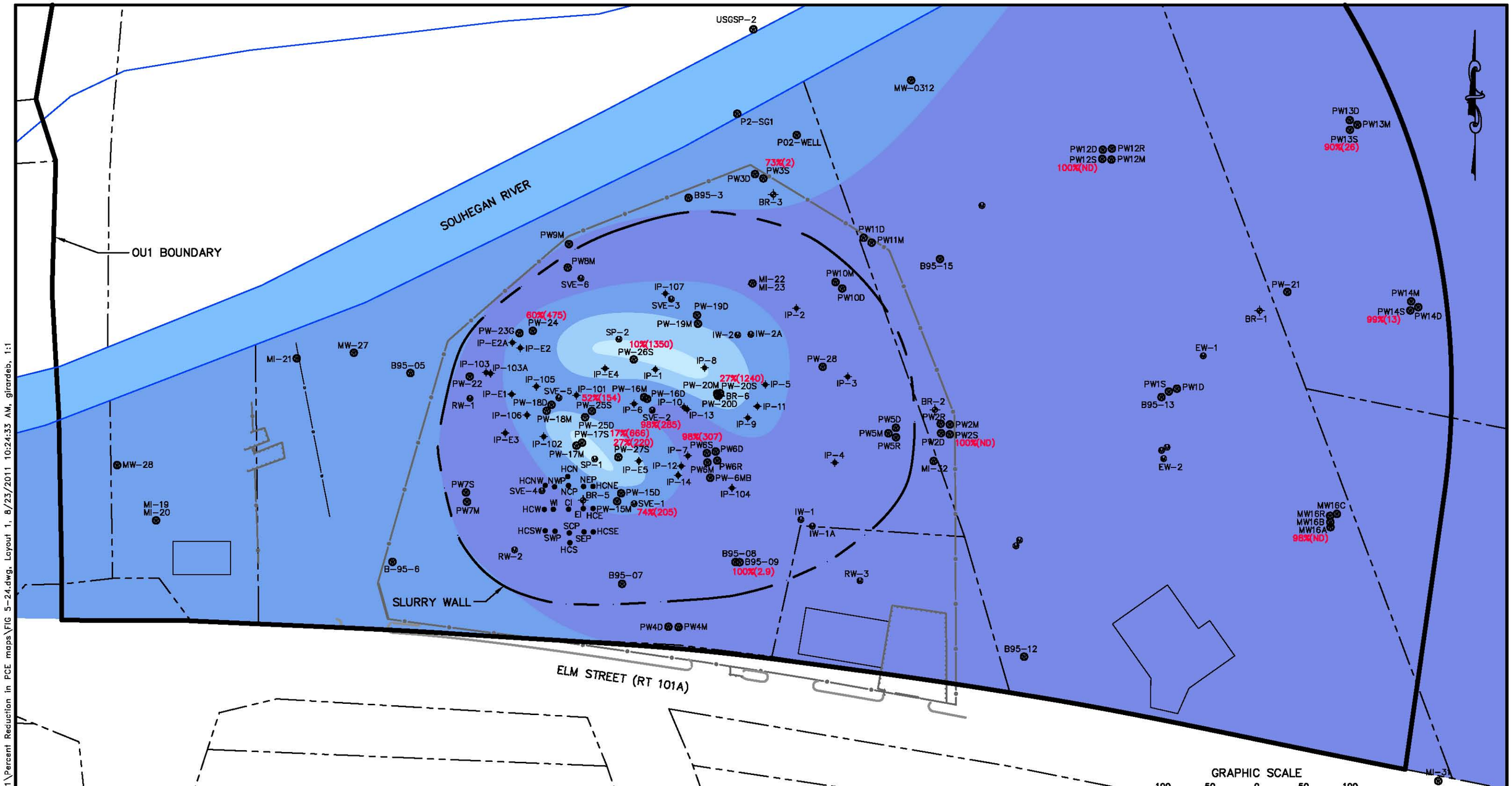
DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
BEG	AUG 2011			20111.023.003
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
		AS SHOWN		5–23

M:\Design\DWG\NHDES\savage\2011\Percent Reduction in PCE maps\FIG 5-23.dwg, Layout 1, 8/23/2011 10:31:34 AM, girardeb, 1:1



LEGEND

BR-2	BEDROCK WELL
HCSE	INEEL WELL
PW5R	MONITORING WELL
IW-1	MANHOLE
IP-3	ISCO INJECTION POINT
	PROPERTY BOUNDARY

	75–100%
	50–75%
	25–50%
	0–25%

NOTES:

1) % REDUCTION = $\frac{\text{Max PCE} - \text{Nov 2010}}{\text{Max PCE}}$

2) ONLY SAMPLES TAKEN AT AN ELEVATION WITHIN THE 10 FT INTERVAL OF THE SLICING PLANE ARE SHOWN WITH CONCENTRATIONS IN THIS FIGURE.

3) 90%(26) – PERCENT REDUCTION AND CURRENT PCE CONCENTRATION

FALL 2010 PERCENT REDUCTION IN MEASURED PCE CONCENTRATIONS AT 250 FEET AMSL

BEDROCK CONCEPTUAL SITE MODEL REPORT
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

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DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
BEG	AUG 2011			20111.023.003
CHECKED	DATE	SCALE	REVISION	FIGURE NO.
		AS SHOWN		5–24

M:\Design\DWG\NHDES\savage\2011\Percent Reduction in PCE maps\FIG 5-24.dwg, Layout 1, 8/23/2011 10:24:33 AM, girardeb, 1:1

Figure 6-1
National Grid Gas Usage (Therms)
Savage Well Superfund Site
Milford, New Hampshire

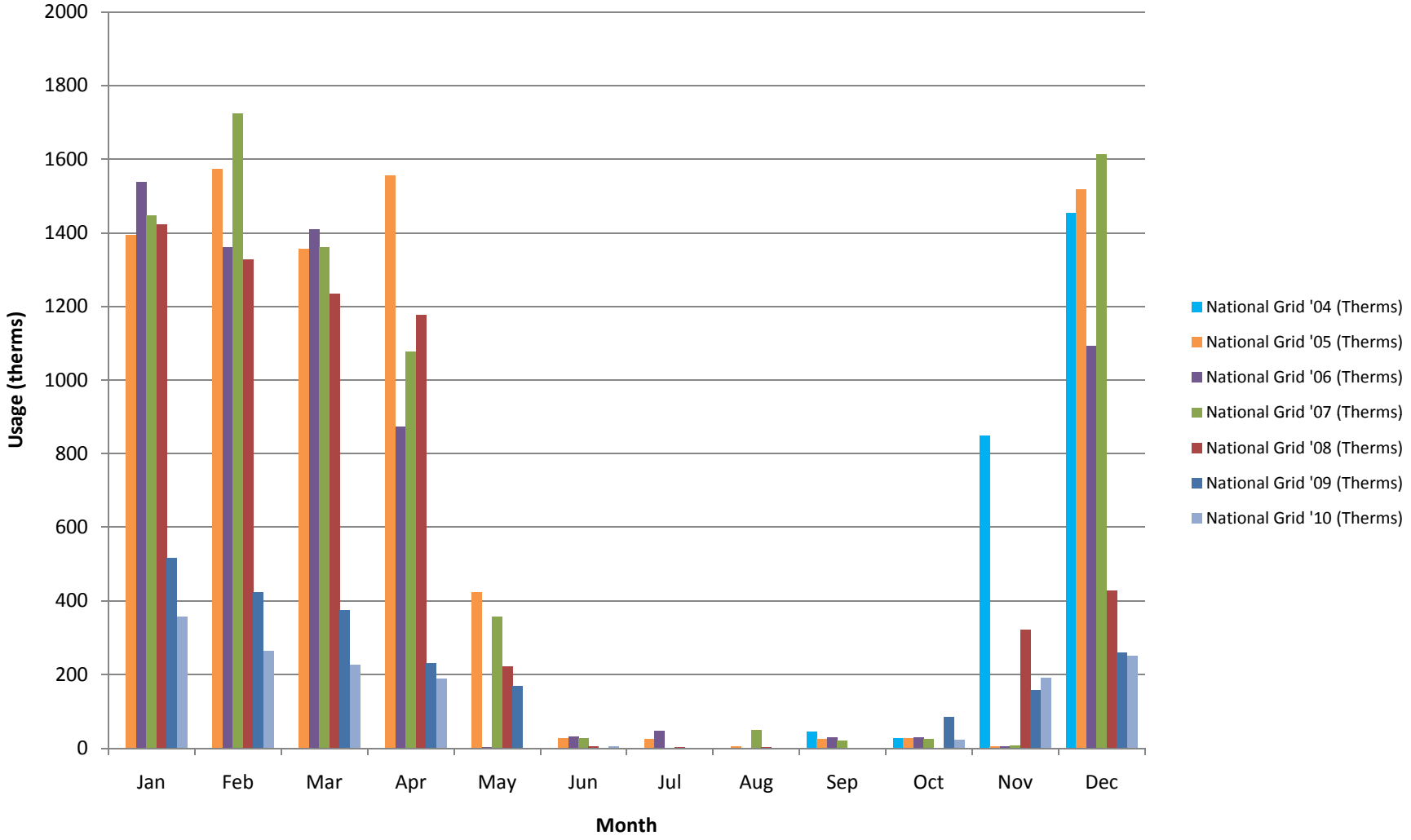
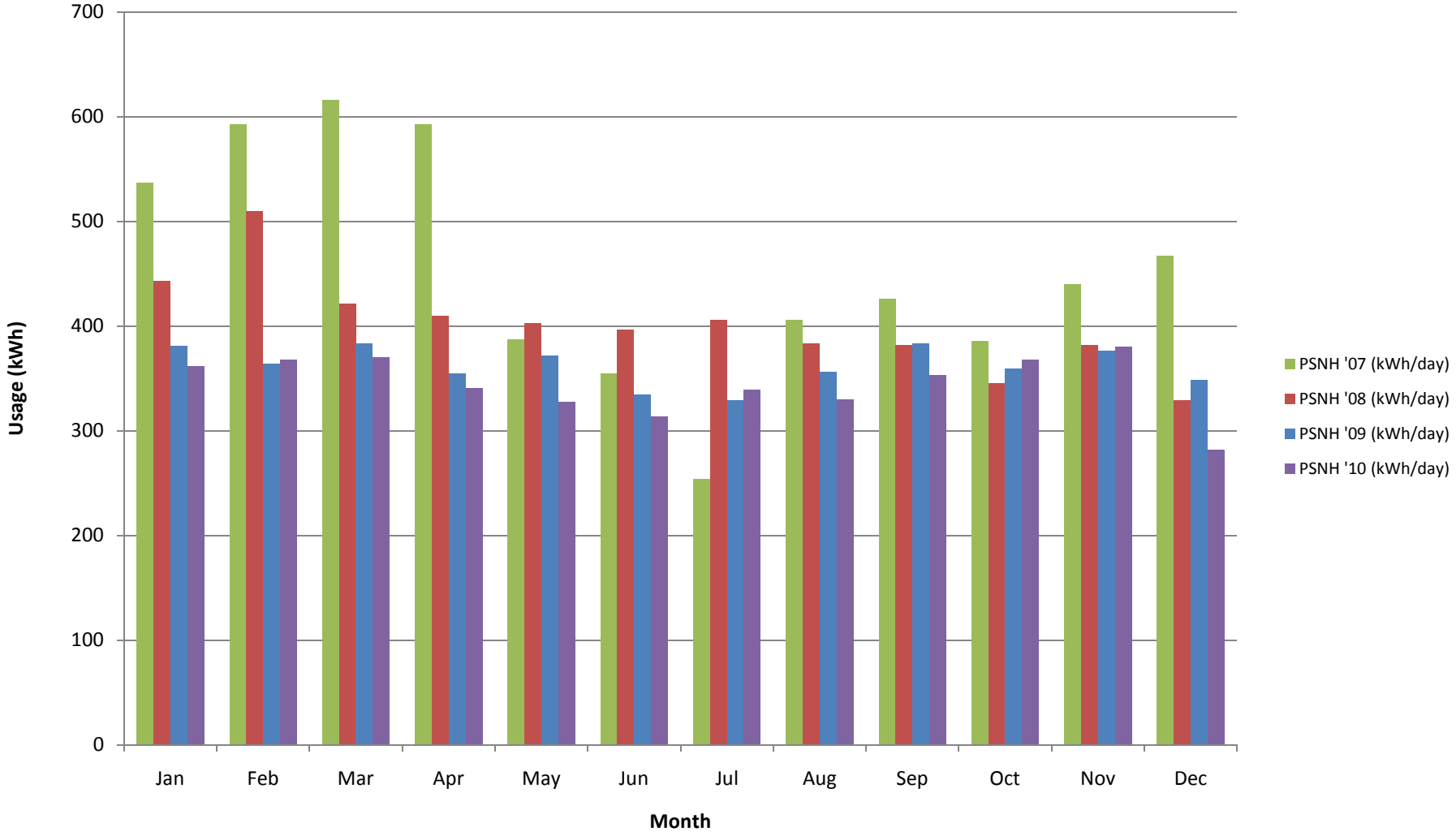


Figure 6-2
PSNH Electricity Usage (kWh/day)
Savage Well Superfund Site
Milford, New Hampshire



TABLES

Table 1-1

Groundwater Chemicals of Concern and Associated Interim Cleanup Levels and Ambient Groundwater Quality Standards Criteria Savage Municipal Water Supply Superfund Site Milford, New Hampshire

Compound	MCL µg/L (ppb)	ROD ICLs µg/L (ppb)
1,1-Dichloroethane	81 (1)	3,500
Trans 1,2-Dichoroethene (2)	100	100
Cis 1,2-Dichloroethene	70	Not Established
1,1-Dichloroethylene	7	7
Benzene	5	5
1,1,1-Trichloroethane	200	200
Methylene Chloride	Not Established	5
Tetrachloroethene	5	5
Trichloroethene	5	5
Antimony	6	3
Arsenic	10(3)	50
Beryllium	4	1
Chromium	100	100
Lead	15	15
Nickel	100	100

Notes:

(1) State health advisory, risk estimate based on cancer potency factor of 9.1×10^{-2} (milligrams per kilograms per day)$^{-1}$ derived by State.

(2) Using the more restrictive Maximum Contaminant Level Goals for cis-1,2-dichloroethene (Cis = 70, Trans = 100).

(3) The arsenic standard was changed from 50 parts per billion (ppb) to 10 ppb by the United States Environmental Protection Agency in 2001. The New Hampshire Department of Environmental Services has also changed the Ambient Groundwater Quality Standards (MCL) to 10 ppb per RSA 485 C:6 (MCL) and Env-Ws 316.01.

ROD = Record of Decision
µg/L = micrograms per liter
MCL = Maximum Contaminant Level
ICL = Interim Cleanup Levels

Table 2-1

Monitoring Locations
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Sample Point	Sample Frequency	Screened Interval (ft bgs)	Lithological Zone
B95-03	Fall		
B95-05	Fall	72 – 82	Deep overburden
B95-08	Fall	72 – 82	Deep overburden
B95-09	Fall	10 – 20	Shallow overburden
B95-12	Fall		
B95-13	Fall		
B95-15	Fall		
INEEL-SCP	Winter	16 - 66	Long Screen, sample till interface
IP-05	Winter	81.5 - 86.5	Deep overburden
IP-11	Winter	61.6 - 66.6	Intermediate overburden
IP-103A	Winter	19 - 24	Shallow overburden
IP-104	Winter	90 - 95	Deep overburden
IP-106	Winter	45 - 50	Intermediate overburden
MI-19	Fall		
MI-22	Winter & Fall	99 - 104	Deep overburden
MW-0312	Fall	92.7 - 97.7	Deep overburden
MW-16A	Fall		
MW-16B	Fall	39.6 – 49.6	Intermediate overburden
MW-16C	Fall	73.2 – 83.2	Deep overburden
MW-2A	Fall	29 - 39	Shallow overburden
MW-2B	Fall		Intermediate overburden
MW-2R*	Fall	134 - 164	Shallow bedrock
MW-27	Fall	5 - 15	Shallow overburden
PW-01D	Fall	85.1 - 95.1	Deep overburden
PW-01S	Fall	26.1 - 36.1	Shallow overburden
PW-02S	Fall	17.8 - 27.8	Shallow overburden
PW-02D	Fall	94 – 104	Deep overburden
PW-02M	Fall	47.72 – 57.72	Intermediate overburden
PW-02R*	Fall	111 – 113	Shallow bedrock
PW-03S	Fall		
PW-03D	Fall		
PW-04M	Fall	31 - 41	Intermediate overburden
PW-04D	Fall	66 - 76	Deep overburden
PW-05D	Fall	96 – 106	Deep overburden
PW-05M	Fall	51 – 61	Intermediate overburden
PW-05R*	Fall	120 – 130	Shallow bedrock
PW-06M	Winter & Fall	40 – 50	Intermediate overburden
PW-06MB	Winter & Fall	57.7 – 67.7	Intermediate overburden
PW-06R*	Fall	95 – 105	Shallow bedrock
PW-06S	Fall	20 – 30	Shallow overburden
PW-07M	Fall	51 – 61	Intermediate overburden
PW-07S	Fall	31 – 41	Shallow overburden
PW-08M	Fall	29 – 39	Intermediate overburden
PW-09M	Fall	29 – 39	Intermediate overburden
PW-10D	Fall	95 – 105	Deep overburden

Table 2-1

Monitoring Locations
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Sample Point	Sample Frequency	Screened Interval (ft bgs)	Lithological Zone
PW-10M	Fall	45 – 55	Intermediate overburden
PW-11D	Fall	95 – 105	Deep overburden
PW-11M	Fall	45 – 55	Intermediate overburden
PW-12D	Fall	87 - 97	Deep overburden
PW-12M	Fall	60 - 70	Intermediate overburden
PW-12R*	Fall	113.9 – 133.9	Shallow bedrock
PW-12S	Fall	20 – 30	Shallow overburden
PW-13D	Fall	95 – 105	Deep overburden
PW-13M	Fall	60 – 70	Intermediate overburden
PW-13S	Fall	20 - 30	Shallow overburden
PW-14D	Fall	90 – 100	Deep overburden
PW-14M	Fall	60 – 70	Intermediate overburden
PW-14S	Fall	20 – 30	Shallow overburden
PW-15M	Fall	42.8 – 52.8	Intermediate overburden
PW-16D	Winter & Fall	66.5 – 76.5	Deep overburden
PW-16M	Winter & Fall	38.4 – 48.4	Intermediate overburden
PW-17M	Fall	32 – 42	Intermediate overburden
PW-17S	Fall	14 – 24	Shallow overburden
PW-18D	Winter	49.5 – 59.5	Deep overburden
PW-18M	Winter & Fall	34.1 – 44.1	Intermediate overburden
PW-19D	Winter & Fall	56 – 66	Deep overburden
PW-19M	Winter & Fall	34.2 – 44.2	Intermediate overburden
PW-20D	Fall	88.5 – 98.5	Deep overburden
PW-20M	Fall	57.1 – 67.1	Intermediate overburden
PW-20S	Fall	20.2 – 30.2	Shallow overburden
PW-21	Fall	51.4 – 61.4	Intermediate overburden
PW-24	Winter & Fall	18.4 - 28.4	Shallow overburden
PW-25D	Winter & Fall	19.4 - 29.4	Intermediate overburden
PW-25S	Fall	50.5 - 60.5	Shallow overburden
PW-26S	Fall	18.1 - 28.1	Shallow overburden
PW-27S	Fall	17.7 - 27.7	Shallow overburden
PW-28	Fall	62 - 72	Intermediate overburden
RW-1	Winter	30 - 40	Intermediate overburden
SP-1	Winter	60.7 - 65.7	Deep overburden
SP-2	Winter & Fall	59.7 - 64.7	Deep overburden
SVE-1	Fall	9.32-24.31	Shallow overburden
SVE-2	Fall	10.36 - 25.36	Shallow overburden

Notes:

Yellow highlighting indicates well sampled during the winter 2010 sampling event.

* = Monitoring well is screened in bedrock.

ft = feet

bgs = below ground surface

Table 3-1

Reporting Period Influent and Effluent Concentrations
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Date	Influent (Total VOCs) (mg/L)	Effluent				
		PCE (mg/L)	Naphthalene (mg/L)	cis-1,2-DCE (mg/L)	1,1,1-TCA (mg/L)	TCE (mg/L)
Discharge Criteria		**5**		**70**	**200**	**5**
January 6, 2010	397	<1.0	NA	<0.5	<1.0	<1.0
February 15, 2010	265	<1.0	NA	<0.5	<1.0	<1.0
March 9, 2010	305	<1.0	NA	<0.5	<1.0	<1.0
April 6, 2010	248	<2.0	<2.0	<2.0	<2.0	<2.0
May 6, 2010	215	<2.0	<2.0	<2.0	<2.0	<2.0
June 4, 2010	273	<2.0	<2.0	<2.0	<2.0	<2.0
July 9, 2010	228	<2.0	<2.0	<2.0	<2.0	<2.0
August 3, 2010	159	<2.0	<2.0	<2.0	<2.0	<2.0
September 7, 2010	109	<2.0	<2.0	<2.0	<2.0	<2.0
October 13, 2010	99	<2.0	<2.0	<2.0	<2.0	<2.0
November 9, 2010	101	<2.0	<2.0	<2.0	<2.0	<2.0
December 15, 2010	111	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

VOC = volatile organic compound

µg/L = micrograms per liter

PCE = tetrachloroethene

cis-1,2-DCE = cis-1,2-dichloroethene

1.1.1-TCA = 1,1,1-trichloroethane

TCE = trichlorethylene

NA = Sample not analyzed for particular contaminant.

Table 3-2

Flows and Contaminant Mass Removal by Well
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

	Total	Effluent	Combined Influent			IW-1A			IW-2A			EW-1			EW-2			RW-3	Recharge Area
Month	Flow (gal)	VOCs (mg/L)	Total VOCs (mg/L)	VOCs Removed lb	Efficiency %	Flow (gal)	Total VOCs (mg/L)	Est. Mass Removed lb	Flow (gal)	Total VOCs (mg/L)	Est. Mass Removed lb	Flow (gal)	Total VOCs (mg/L)	Est. Mass Removed lb	Flow (gal)	Total VOCs (mg/L)	lb	(gal)	(gal)
Jan-10	1,326,671	1.0	397	4.38	99.75	1,095,825	351	3.21	230,846	1,093	2.11	0	0	0.00	0	0	0.00	0	1,326,671
Feb-10	1,225,480	1.0	265	2.70	99.62	1,017,583	264	2.24	207,896	976	1.69	0	0	0.00	0	0	0.00	15,000	1,210,480
Mar-10	1,332,889	1.0	305	3.38	99.67	1,102,029	261	2.40	230,860	889	1.71	0	0	0.00	0	0	0.00	0	1,332,889
Apr-10	1,371,698	2.0	248	2.82	99.19	1,151,177	260	2.50	220,521	712	1.31	0	0	0.00	0	0	0.00	0	1,371,698
May-10	1,430,496	2.0	215	2.54	99.07	1,199,909	232	2.32	230,587	697	1.34	0	0	0.00	0	0	0.00	0	1,430,496
Jun-10	1,209,885	2.0	273	2.74	99.27	1,011,699	206	1.74	198,185	736	1.22	0	0	0.00	0	0	0.00	0	1,209,885
Jul-10	1,060,523	2.0	228	2.00	99.12	877,042	208	1.52	183,482	868	1.33	0	0	0.00	0	0	0.00	0	1,060,523
Aug-10	1,479,557	2.0	159	1.94	98.74	623,074	143	0.74	178,171	780	1.16	0	0	0.00	678,312	5	0.03	18,000	1,461,557
Sep-10	1,556,049	2.0	109	1.39	98.17	260,006	201	0.44	177,091	788	1.16	0	0	0.00	1,118,952	5	0.04	6,000	1,550,049
Oct-10	1,642,190	2.0	99	1.33	97.98	497,837	173	0.72	193,046	711	1.15	6,206	5	0.00	945,101	4	0.03	0	1,642,190
Nov-10	2,274,624	2.0	101	1.88	98.02	479,952	232	0.93	223,488	700	1.31	1,571,184	5	0.07	0	0	0.00	0	2,274,624
Dec-10	1,697,247	2.0	111	1.54	98.20	341,942	221	0.63	159,178	765	1.02	1,196,127	4	0.04	0	0	0.00	0	1,697,247
Total 2010	17,607,310		209	28.64		3,079,853	229	19.39	2,433,352	810	16.50	2,773,517	1	0.11	2,742,365	1	0.10	24,000	9,686,191

Notes:

Extraction wells IW-1 and IW-2 are not included in this table because they were not operated during the reporting period.

Combined influent VOC removal does not correspond with individual wells. VOCs may volatilize in Equalization Tanks prior to influent sampling.

VOC = volatile organic compounds

gal = gallon

µg/L = micrograms per liter

% = percent

lb = pounds

Table 3-3

Treatment Plant Flows, Concentrations, and Removal Efficiencies
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Month	Influent (Total VOCs) mg/L	Effluent (Total VOCs) mg/L	Water Treated (gal)	Total Influent VOCs (lbs)	Total Effluent VOCs (lbs)	Mass Removed (lbs)	Efficiency (%)	Discharge of Treated Effluent	
								RW-3[1] (gal)	Recharge Chamber (gal)
January 2010	397	1.0	1,326,671	4.39	0.011	4.4	99.7	0	1,326,671
February 2010	265	1.0	1,225,480	2.71	0.010	2.7	99.6	15,000	1,210,480
March 2010	305	1.0	1,332,889	3.39	0.011	3.4	99.7	0	1,332,889
April 2010	248	2.0	1,371,698	2.84	0.023	2.8	99.2	0	1,371,698
May 2010	215	2.0	1,430,496	2.57	0.024	2.5	99.1	0	1,430,496
June 2010	273	2.0	1,209,885	2.76	0.023	2.7	99.2	0	1,209,885
July 2010	228	2.0	1,060,523	2.02	0.018	2.0	99.1	0	1,060,523
August 2010	159	2.0	1,479,557	1.96	0.025	1.9	98.7	18,000	1,461,557
September 2010	109	2.0	1,556,049	1.42	0.026	1.4	98.2	6,000	1,550,049
October 2010	99	2.0	1,642,190	1.36	0.027	1.3	98.0	0	1,642,190
November 2010	101	2.0	2,274,624	1.92	0.007	1.9	99.6	0	2,274,624
December 2010	111	2.0	1,697,247	1.57	0.028	1.6	98.2	0	1,697,247
Total for Reporting Period			17,607,310	28.90	0.234	28.7	99.2	39,000	17,568,310

Notes:

[1] Treated water discharge to RW-3 used during drilling.

VOC = volatile organic compounds

gal = gallons

lbs = pounds

% = percent

Table 4-1

Winter 2010 In Situ Chemical Oxidation Injection Summary
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Well No.	Total Volume of Diluted Permanganate Solution Injected (gal)	Volume of 40% Permanganate	Pounds of 40% Permanganate	Dilution Water Volume (gal)	Pounds of Dilution Water	Water added to each well (lb)	Permanganate added to each well (lb)	% Permanganate in Solution Injected	Post Injection Flushing with Water, (gal)
IP-E1	880	370	4,218	510	4,253	6,784	1,687	19.92%	250
IP-E2	855	360	4,104	495	4,128	6,591	1,642	19.94%	250
IP-E2A	855	360	4,104	495	4,128	6,591	1,642	19.94%	250
IP-103A	830	350	3,990	480	4,003	6,397	1,596	19.97%	250
PW-22	930	390	4,446	540	4,504	7,171	1,778	19.87%	250
PW-18D	830	350	3,990	480	4,003	6,397	1,596	19.97%	250
PW-25D	780	330	3,762	450	3,753	6,010	1,505	20.02%	250
RW-1	680	290	3,306	390	3,253	5,236	1,322	20.16%	250
CI	680	290	3,306	390	3,253	5,236	1,322	20.16%	250
IP-101	680	290	3,306	390	3,253	5,236	1,322	20.16%	250
SP-1	680	290	3,306	390	3,253	5,236	1,322	20.16%	250
IP-E4	680	290	3,306	390	3,253	5,236	1,322	20.16%	250
Totals	9,360	3,960	45,144	5,400	45,036	72,122	18,058	20.02%	3,000

Notes:

We have purchased 45,855 pounds of 40% permanganate.
250 gallons / tote * 16 totes = 4,000 gallons of 40%
gal = gallons
% = percent
lb = pounds

Table 4-2

Permanganate Monitoring Data
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Well	Jan-10 NaMnO4 (mg/L)	Feb-10 NaMnO4 (mg/L)	Mar-10 NaMnO4 (mg/L)	Apr-10 NaMnO4 (mg/L)	May-10 NaMnO4 (mg/L)	Jun-10 NaMnO4 (mg/L)	Jul-10 NaMnO4 (mg/L)	Aug-10 NaMnO4 (mg/L)	Sep-10 NaMnO4 (mg/L)	Oct-10 NaMnO4 (mg/L)	Nov-10 NaMnO4 (mg/L)	Dec-10 NaMnO4 (mg/L)
B95-03	NC	NC	NC	NC	0	0	0	NC	0	NM	0	NM
B95-08	0	0	0	0	0	0	0	0	0	0	0	0
B95-09	NC	NC	NC	NC	0	0	0	0	0	0	0	0
INEEL-CI	*100*	*100<X<1,000*	*>1,000*	*10-100*	*10*	*0*	*0*	*10-100*	*0*	*0*	*1000*	*100-1000*
INEEL-HCNE	NC	NC	NC	---	100 - 1000	100-1000	100-1000	100-1000	100-1000	100-1000	1000	1000
INEEL-HCNW	**NC**	**NC**	**NC**	**---**	**0**	**NC**	**NC**	**100-1000**	**100-1000**	**100-1000**	**1000**	**1000**
INEEL-HCSE	***100***	***100***	***100***	***100***	***100***	***0***	***0***	***100***	***10-100***	***10-100***	***10-100***	***10-100***
INEEL-HCSW	***100<X<1,000***	***100***	***100***	***10-100***	***10 - 100***	***10-100***	***10-100***	***<10***	***<10***	***0***	***10-100***	***10-100***
INEEL-SCP	0	0	0	0	0	0	0	0	0	0	0	0
INEEL-NCP	>1,000	1,000	>1,000	100-1000	>1000	100-1000	100-1000	100-1000	1000	1000	1000	>1000
IP-01	***100***	***10<X<100***	***10<X<100***	***<10***	***<10***	***>10***	***<10***	***0***	***0***	***0***	***0***	***0***
IP-02	***1,000***	***>1,000***	***1,000***	***100-1000***	***100 - 1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***100***	***100***	***100***
IP-03	***>1,000***	***>1,000***	***>1,000***	***>1000***	***>1000***	***1000***	***100-1000***	***1000***	***1000***	***1000***	***1000***	***1000***
IP-04	***1,000***	***1,000***	***100<X<1,000***	***100-1000***	***100 - 1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***1000***	***100-1000***
IP-05	***10<X<100***	***10<X<100***	***<10***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
IP-06	***>1,000***	***>1,000***	***>1,000***	***1,000***	***1,000***	***100-1000***	***100-1000***	***1000***	***1000***	***1000***	***1000***	***1000***
IP-07	***1,000***	***1,000***	***>1,000***	***>1000***	***>1000***	***100-1000***	***100-1000***	***1000***	***1000***	***1000***	***1000***	***1000***
IP-08	***>1,000***	***>1,000***	***>1,000***	***100-1000***	***100 - 1000***	***100-1000***	***100-1000***	***1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***
IP-09	***100<X<1,000***	***100<X<1,000***	***100<X<1,000***	***100-1000***	***100***	***10-100***	***10***	***10***	***0***	***10-100***	***<10***	***<10***
IP-10	***100<X<1,000***	***100<X<1,000***	***100<X<1,000***	***<100***	***10 - 100***	***10-100***	***10-100***	***10***	***<10***	***<10***	***0***	***0***
IP-11	***10<X<100***	***10<X<100***	***10<X<100***	***<10***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
IP-12	***>1,000***	***1,000***	***1,000***	***1,000***	***1,000***	***100-1000***	***100-1000***	***100-1000***	***1000***	***1000***	***1000***	***1000***
IP-13	***>1,000***	***>1,000***	***>1,000***	***100-1000***	***100 - 1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***
IP-14	***100<X<1,000***	***>1,000***	***>1,000***	***100-1000***	***100 - 1000***	***100-1000***	***100-1000***	***100-1000***	***100-1000***	***100***	***<10***	***<10***
IP-101	*>1,000*	*1,000*	*>1,000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*
IP-102	*100<X<1,000*	*100<X<1,000*	*100<X<1,000*	*100-1000*	*100 - 1000*	*100-1000*	*100-1000*	*100-1000*	*1000*	*1000*	*1000*	*1000*
IP-103	*>1,000*	*100<X<1,000*	*>1,000*	*>1000*	*>1000*	*1000*	*1000*	*>1000*	*1000*	*1000*	*1000*	*1000*
IP-103A	*100<X<1,000*	*100*	*>1,000*	*>100*	*100*	*100*	*100-1000*	*>1000*	*1000*	*1000*	*1000*	*100-1000*
IP-104	*100*	*10<X<100*	*10<X<100*	*10-100*	*10 - 100*	*10-100*	*10-100*	*100*	*10*	*10*	*10*	*0*
IP-105	*100<X<1,000*	*100*	*1,000*	*---*	*---*	*NC*	*NC*	*100*	*1000*	*<10*	*<10*	*10-100*
IP-106	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
IP-107	0	0	0	0	0	0	0	0	0	0	0	0
IP-E1	*>1,000*	*>1,000*	*1,000*	*100-1000*	*100 - 1000*	*100-1000*	*100-1000*	*100-1000*	*100-1000*	*1000*	*1000*	*>1000*
IP-E2	*100*	*100<X<1,000*	*>1,000*	*1000*	*1000*	*1000*	*1000*	*>1000*	*1000*	*1000*	*1000*	*>1000*
IP-E2A	*100<X<1,000*	*100<X<1,000*	*>1,000*	*>1000*	*>1000*	*1000*	*1000*	*>1000*	*1000*	*1000*	*1000*	*1000*
IP-E3	*>1,000*	*1,000*	*1,000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*1000*	*1000*	*1000*	*>1000*
IP-E4	*100<X<1,000*	*100<X<1,000*	*1,000*	*>1000*	*100 - 1000*	*100-1000*	*100-1000*	*1000*	*1000*	*>1000*	*>1000*	*>1000*
IP-E5	*>1,000*	*>1,000*	*>1,000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*	*>1000*
IW-1A	0	0	0	0	0	0	0	0	0	0	0	0
IW-2A	0	0	0	0	0	0	0	0	0	0	0	0
IW-1	>1,000	>1,000	1,000	100-1000	100 - 1000	100-1000	100-1000	1000	1000	1000	1000	100-1000
IW-2	0	0	0	0	0	0	0	0	0	0	0	0
MI-22	0	0	0	0	0	0	0	0	NM	NM	0	NM
MI-23	0	0	0	0	0	0	0	0	0	0	0	0
PW-02D	0	0	0	0	0	0	0	0	0	0	0	0
PW-02R	0	0	0	0	0	0	0	0	0	0	0	0
PW-05M	NC	NC	NC	---	0	0	0	0	0	0	0	0
PW-05D	0	0	0	0	0	0	0	0	0	0	0	0
PW-05R	0	0	0	0	0	0	0	0	0	0	0	0

Table 4-2

Permanganate Monitoring Data
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Well	Jan-10 NaMnO4 (mg/L)	Feb-10 NaMnO4 (mg/L)	Mar-10 NaMnO4 (mg/L)	Apr-10 NaMnO4 (mg/L)	May-10 NaMnO4 (mg/L)	Jun-10 NaMnO4 (mg/L)	Jul-10 NaMnO4 (mg/L)	Aug-10 NaMnO4 (mg/L)	Sep-10 NaMnO4 (mg/L)	Oct-10 NaMnO4 (mg/L)	Nov-10 NaMnO4 (mg/L)	Dec-10 NaMnO4 (mg/L)
PW-06D	***1,000***	***>1,000***	***>1,000***	***>1000***	***>1000***	***>1000***	***>1000***	***>1000***	***1000***	***1000***	***1000***	***1000***
PW-06M	0	0	0	0	0	0	0	0	0	0	0	0
PW-06MB	0	0	0	0	0	0	0	0	0	0	0	0
PW-06R	<10	0	0	0	0	0	0	0	0	0	0	0
PW-06S	0	0	0	0	0	0	0	0	0	0	0	0
PW-07M	0	0	0	0	0	0	0	0	0	0	0	0
PW-07S	0	0	0	0	0	0	0	0	0	0	0	0
PW-10D	0	0	0	0	0	0	0	0	0	0	0	0
PW-10M	NC	NC	NC	NC	0	0	0	0	0	0	0	0
PW-11D	0	0	0	0	0	0	0	0	0	0	0	0
PW-15D	**>1,000**	**>1,000**	**>1,000**	**>1000**	**>1000**	**>1000**	**>1000**	**>1000**	**1000**	**1000**	**1000**	**1000**
PW-15M	**0**	**0**	**100<X<1,000**	**100-1000**	**100 - 1000**	**100**	**~100**	**100**	**100**	**100**	**100**	**100**
PW-16D	0	0	0	0	0	0	0	0	0	0	0	0
PW-16M	0	0	0	0	0	0	0	0	0	0	0	0
PW-17M	0	0	0	0	0	0	0	0	0	0	0	0
PW-17S	0	0	0	0	0	0	0	0	0	0	0	0
PW-18D	0	0	>1,000	100-1000	100 - 1000	1000	1000	1000	1000	1000	1000	1000
PW-18M	0	0	0	0	0	0	0	0	0	0	0	0
PW-19D	0	0	0	0	0	0	0	0	0	0	0	0
PW-19M	NC	0	0	0	0	0	0	0	0	0	0	0
PW-20D	1,000	100<X<1,000	100<X<1,000	100-1000	100	10-100	10-100	10-100	<10	0	0	0
PW-20M	0	0	0	0	0	0	0	0	0	0	0	0
PW-20S	0	0	0	0	0	0	0	0	0	0	0	0
PW-22	*1,000*	*>1,000*	*>1,000*	*>1000*	*>1000*	*1000*	*1000*	*1000*	*>1000*	*1000*	*1000*	*>1000*
PW-24	*10<X<100*	*<10 (MgO)*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	*0*
PW-25D	0	0	1,000	10	0	0	0	0	0	0	0	0
PW-25S	0	0	0	0	---	NC	NC	NC	NC	0	0	0
PW-26S	0	0	0	0	0	0	0	0	0	0	0	0
PW-27S	NC	NC	NC	NC	0	0	0	0	0	0	0	0
PW-28	0	0	0	0	0	0	0	0	0	0	0	0
RW-1	*0*	*0*	*>1,000*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SP-1	***0***	***0***	***>1,000***	***>1000***	***>1000***	***>1000***	***>1000***	***>1000***	***>1000***	***>1000***	***>1000***	***>1000***
SP-2	0	0	0	0	0	0	0	0	0	0	0	0
SVE-1	NC	NC	NC	NC	0	0	0	0	0	0	0	0
SVE-4	NC	NC	NC	NC	0	0	0	0	0	0	0	0
SVE-5	0	0	0	0	0	0	0	0	0	0	0	0
SVE-6	0	0	0	0	0	0	0	0	0	0	0	0

Notes:
All locations sampled using peristaltic pump and dedicated pump tubing unless otherwise indicated in comments.
NA = Not applicable, chloride concentrations not evaluated.
Bold indicates 2008 NaMnO4 injection location.
Italics indicates 2009 NaMnO4 injection location.
Purple indicates 2010 NaMnO4 injection location.
NC = Not checked for NaMnO4 concentration.

Table 5-1

Baseline In Situ Chemical Oxidation Groundwater Analytical Results
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
INEEL-SCP	2/16/2010	0.50	U	1.0	U	1.0	U
IP-05	2/16/2010	0.50	U	**19**		1.0	U
IP-11	2/16/2010	10	U	**220**		**20**	U
IP-103A	2/16/2010	**81**		**1400**		**130**	
IP-104	2/16/2010	0.50	U	1.0	U	1.0	U
IP-106	2/16/2010	10	U	**300**		**20**	U
MI-22	2/16/2010	10	U	**660**		**77**	
PW-06M	2/16/2010	10	U	**260**		**20**	U
PW-06MB	2/16/2010	10	U	**540**		**20**	U
PW-06MB DUP	2/16/2010	10	U	**510**		**20**	U
PW-16D	2/16/2010	10	U	**360**		**43**	
PW-16M	2/16/2010	10	U	**480**		**23**	
PW-18D	2/16/2010	10	U	**560**		**51**	
PW-18M	2/16/2010	10	U	**570**		**20**	U
PW-19D	2/16/2010	10	U	**210**		**27**	
PW-19M	2/16/2010	**76**		**1200**		**150**	
PW-24	2/16/2010	10	U	**560**		**20**	U
PW-25D	2/16/2010	10	U	**4900**		**540**	
RW-1	2/16/2010	68		**3300**		**74**	
RW-1 DUP	2/16/2010	**70**		**3500**		**76**	
SP-01	2/16/2010	10	U	**37**		**20**	U
SP-02	2/16/2010	10	U	**240**		**20**	U

Notes:

NHDES - New Hampshire Department of Environmental Services
AGQS - Ambient Groundwat Quality Standard
Bold - Value for compound exceeds the applicable AGQS
cis-1,2-DCE - cis-1,2-dichloroethylene
PCE - tetrachloroethylene
TCE - trichloroethylene
µg/L - micrograms per liter.
U - Indicates that compound was not detected above the identified laboratory reporting limit.

Table 5-2

Fall 2010 Groundwater Analytical Results for Volatile Organic Compounds
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)		Vinyl Chloride (µg/L)	
NHDES AGQS		70		5		5		2	
B95-03	11/18/2010	5.0		**7.4**		**6.3**		2.0	U
B95-05	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
B95-08	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
B95-09	11/16/2010	2.0	U	2.9		2.0	U	2.0	U
B95-12	11/18/2010	2.0	U	2.0	U	2.0	U	2.0	U
B95-13	11/16/2010	2.0	U	**5.9**		2.0	U	2.0	U
B95-15	11/18/2010	2.0	U	2.0	U	2.0	U	2.0	U
MI-19	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
MI-22	11/16/2010	21		**512**		**73**		10	U
MW-0312	11/18/2010	2.0	U	2.0	U	2.0	U	2.0	U
MW-02A	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
MW-02B	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
MW-02R	11/16/2010	2.4		**93**		**29**		2.0	U
MW-16A	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
MW-16B	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
MW-16C	11/16/2010	2.0	U	**9.2**		2.0	U	2.0	U
MW-27	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-01D	11/16/2010	2.0	U	**29**		4.7		2.0	U
PW-01S	11/16/2010	2.0	U	2.1		2.0	U	2.0	U
PW-02D	11/16/2010	2.0	U	**16**		2.2		2.0	U
PW-02D DUP	11/16/2010	2.0	U	**19**		2.7		2.0	U
PW-02M	11/16/2010	2.0	U	2.0	U	2.00	U	2.0	U
PW-02R	11/18/2010	13		**426**		**24**		10	U
PW-02S	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-03D	11/18/2010	2.0	U	**5.6**		2.0	U	2.0	U
PW-03S	11/18/2010	2.0	U	2.0		2.0	U	2.0	U
PW-04D	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-04M	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-05D	11/16/2010	2.0	U	**63**		2.4		2.0	U
PW-05M	11/16/2010	2.0	U	2.9		2.0	U	2.0	U
PW-05R	11/16/2010	2.0	U	**34**		2.2		2.0	U
PW-06M	11/16/2010	2.4		**134**		4.0		2.0	U
PW-06MB	11/16/2010	4.0	U	**156**		4.0	U	4.0	U
PW-06MB DUP	11/16/2010	4.0	U	**172**		4.0	U	4.0	U
PW-06R	11/16/2010	10	U	**496**		**10**	U	10	U
PW-06S	11/16/2010	12		**307**		**48**		4.0	U
PW-07M	11/18/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-07S	11/18/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-08M	11/18/2010	2.0	U	**23**		2.0	U	2.0	U
PW-09M	11/18/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-10D	11/16/2010	2.0	U	**26**		2.0	U	2.0	U
PW-10M	11/16/2010	2.0	U	**5.1**		2.0	U	2.0	U
PW-11D	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-11M	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U

Table 5-2

Fall 2010 Groundwater Analytical Results for Volatile Organic Compounds
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)		Vinyl Chloride (µg/L)	
NHDES AGQS		70		5		5		2	
PW-12D	11/16/2010	2.2		2.0	U	2.0	U	2.0	U
PW-12M	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-12R	11/16/2010	**190**		**55**		**16**		10	U
PW-12S	11/16/2010	2.0	U	2.0	U	2.0	U	2.0	U
PW-13D	11/16/2010	2.0	U	**40**		**14**		2.0	U
PW-13M	11/16/2010	2.0	U	**8.1**		2.0	U	2.0	U
PW-13S	11/16/2010	2.0	U	**26**		2.80		2.0	U
PW-14D	11/16/2010	2.0	U	**47**		**9.3**		2.0	U
PW-14M	11/16/2010	28		**216**		**23**		10	U
PW-14M DUP	11/16/2010	27		**196**		**22**		10	U
PW-14S	11/16/2010	2.0	U	**13**		2.0	U	2.0	U
PW-15M	11/18/2010	2.0	U	3.0		2.0	U	2.0	U
PW-16D	11/18/2010	16		**248**		**29**		**5.2**	
PW-16M	11/18/2010	15		**331**		**16**		4.0	U
PW-17M	11/18/2010	20	U	**783**		**77**		20	U
PW-17S	11/18/2010	14		**666**		**42**		10	U
PW-18M	11/18/2010	4.0	U	**295**		**5.0**		4.0	U
PW-19D	11/16/2010	15		**187**		**22**		10	U
PW-19M	11/16/2010	62		**1080**		**125**		40	U
PW-20D	11/16/2010	2.0	U	3.2		2.0	U	2.0	U
PW-20D DUP	11/16/2010	2.0	U	2.8		2.0	U	2.0	U
PW-20M	11/16/2010	7.3		**177**		**10**		4.0	U
PW-20S	11/16/2010	**1790**		**1240**		**252**		100	U
PW-21	11/16/2010	2.0	U	4.4		2.0	U	2.0	U
PW-24	11/18/2010	10	U	**475**		**10**	U	10	U
PW-25D	11/18/2010	40	U	**2380**		**175**		40	U
PW-25S	11/18/2010	4.0	U	**154**		4.0	U	4.0	U
PW-26S	11/18/2010	**121**		**1350**		**65**		20	U
PW-27S	11/18/2010	8.3		**220**		**22**		4.0	U
PW-28	11/16/2010	2.0		**47**		3.30		2.0	U
SP-02	11/18/2010	7.4		**111**		**32**		2.0	U
SVE-01	11/18/2010	8.2		**205**		**14**		4.0	U
SVE-02	11/16/2010	**482**		**285**		**54**		**7.5**	

Notes:

NHDES - New Hampshire Department of Environmental Services
AGQS - Ambient Groundwat Quality Standard
Bold - Value for compound exceeds the applicable AGQS
cis-1,2-DCE - cis-1,2-dichloroethylene
PCE - tetrachloroethylene
TCE - trichloroethylene
µg/L - micrograms per liter
U - Indicates that compound was not detected above the identified laboratory reporting limit.

Table 5-3

Fall 2010 Groundwater Analytical Results For Metals
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	ANTIMONY 6 µg/l		ARSENIC 10 µg/l		BERYLLIUM 4 µg/l		CHROMIUM 100µg/l		LEAD 15 µg/l		NICKEL 100 µg/l	
NHDES AGQS/MCL													
B95-03	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U
B95-05	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
B95-08	11/16/2010	-		-		-		-		-		-	
B95-09	11/16/2010	-		-		-		-		-		-	
B95-12	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U
B95-13	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
B95-15	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U
MI-19	11/16/2010	3	U	9		2	U	5	U	1	U	5	U
MI-22	11/16/2010	-		-		-		-		-		-	
MW-0312	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-02A	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-02B	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-02R	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-16A	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-16B	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-16C	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
MW-27	11/16/2010	3	U	4.5		2	U	5	U	1	U	12.2	
PW-01D	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-01S	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-02D	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-02D DUP	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-02M	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-02R	11/18/2010	3	U	1	U	2	U	5	U	2.1		5	U
PW-02S	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-03D	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U

Table 5-3

Fall 2010 Groundwater Analytical Results For Metals
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	ANTIMONY 6 µg/l		ARSENIC 10 µg/l		BERYLLIUM 4 µg/l		CHROMIUM 100µg/l		LEAD 15 µg/l		NICKEL 100 µg/l	
NHDES AGQS/MCL													
PW-03S	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-04D	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-04M	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-09M	11/18/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-11D	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-11M	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-12D	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-12M	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-12R	11/16/2010	3	U	1.8		2	U	5	U	1	U	5	U
PW-12S	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-13D	11/16/2010	3	U	2.6		2	U	5	U	1	U	5	U
PW-13M	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-13S	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-14D	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-14M	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-14M DUP	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-14S	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U
PW-21	11/16/2010	3	U	1	U	2	U	5	U	1	U	5	U

Notes:

NHDES - New Hampshire Department of Environmental Services

AGQS - Ambient Groundwat Quality Standard

MCL - Maximum Contaminant Level

µg/L - micrograms per liter.

U - Indicates that compound was not detected above the identified laboratory reporting limit.

Table 5-4

Fall 2010 Groundwater Treatment Plant Analytical Results for Metals
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Sample Location	Sample Date	Iron (mg/L)		Manganese (mg/L)	
NHDES AGQS		**NS**		**0.84**	
Aerator Influent	9/16/2010	0.101		0.138	
Aerator Effluent	9/16/2010	0.055		0.094	
IW-1A	9/16/2010	0.05	U	0.092	
IW-2A	9/16/2010	0.05	U	0.737	
EW-2	9/16/2010	0.05	U	0.023	
Effluent Weir	9/16/2010	0.05	U	0.116	
Recharge Gallery	9/16/2010	0.337		0.632	

Notes:

NHDES - New Hampshire Department of Environmental Services

AGQS - Ambient Groundwat Quality Standard

mg/L - milligrams per liter

NS - No standard has been developed

U - Indicates that compound was not detected above the identified laboratory reporting limit.

Table 5-5

2010 Residential Water Supply Well Sampling Locations
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Street Address	Map #	Lot #	Station ID	Station Description	Comments
2 Cortland Rd	C2	7-34	OKT_DW-10	Outside tap just left of front door	No treatment
9 Cortland Rd	C2	7-35	OKT_DW-11	Kitchen sink	Connected to the softener
			OKT_DW-11A	Outside tap to the right of front door	Not connected to the softener
16 Cortland Rd	C2	4-3-2	OKT_DW-12	Outside tap right side of house, next to screened porch	No treatment
25 Cortland Rd	C2	4-3-47	OKT_DW-13	Outside tap near front door	No treatment
32 Cortland Rd	C2	4-3-3	OKT_DW-14	Outside tap right of front door	No treatment
33 Cortland Rd	C2	4-3-46	OKT_DW-15	Outside tap on the right by garage	Not connected to the softener
721 North River Rd	C2	6-25	OKT_DW-17	Outside tap at the well, located on northeast edge of lawn	Raw water directly from well
649 North River Rd	D2	6-27	OKT_DW-1	Spigot on right side of house near bulkhead.	Paper filter, can't shut off
599 North River Rd	C2	4-4	OKT_DW-16	Outside tap on the back of main house, past the deck/addition near pool	No treatment
577 North River Rd	C2	4-5	OKT_DW-2	Spigot to right of blue door in front.	No longer has treatment connected
569 North River Rd	C2	4-6	OKT_DW-9 OKT_DW-9A	Kitchen sink after bypassing softener Tap at tank before softener in basement	Softener
561 North River Rd	C2	4-3-49	OKT_DW-3	Outside tap in front	No softener, built in sand filter. Bedrock 380 ft
			OKT_DW-3A	Outside tap on left	
559 North River Rd	C2	4-3-50	OKT_DW-4	Outside tap in front	No softener, built in sand filter. Bedrock - 315 ft
544 North River Rd	C2	4-40	OKT_DW-5	Kitchen sink	No Treatment
			OKT_DW-5A	Outside tap out front	
543 North River Rd	C2	4-3-51	OKT_DW-6	Outside tap in front	No softener, built in sand filter. Bedrock? Artesian 450-500 ft
541 North River Rd	C2	4-3-52	(OKT_DW-7)	Outside tap on right side of house, BROKEN	No softener, built in sand filter. Bedrock - 380 ft
			(OKT_DW-7A)	Outside tap on left side of house by driveway BROKEN	
			OKT_DW-7B	Kitchen sink	

Table 5-5

2010 Residential Water Supply Well Sampling Locations
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Street Address	Map #	Lot #	Station ID	Station Description	Comments
298 North River Rd	C3&C4	8-1	OKT_DW-8	Outside tap to the right of the front door	Softeners have been disconnected. Sand filter
			OKT_DW-8A	Outside tap by the pool.	
			OKT_DW-8B	Basement tap	
300 North River Rd	C3	4-36-1 *	OKT_DW-MFH-W1	Well #1 Aeration tank on left, dirt road facing N. River Rd.	* Actual well is on Map C3, Lot 4-41 (possibly 4-42)
			OKT_DW-MFH-RW	River Well Aeration tank on right, facing N. River Rd.	* Actual well is on Map C3, Lot 4-38 (possibly 4-36)
			OKT_DW-MFH-POOL	First pool on left, **only sampled on request**	Map C, Lot 4-36-1
			Aeration Tanks are located on dirt road on the right, behind the Hatchery.		
			Samples are collected from the inlet before water falls into the aeration tank.		
			Ask them for a ladder to reach inlet at top of tanks.		

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
B95-03	5/29/1997	-		2.0	U	2.0	U
B95-03	6/17/1997	-		2.0	U	2.0	U
B95-03	12/16/1997	2.0	U	2.0	U	2.0	U
B95-03	5/12/1998	2.0	U	2.0	U	2.0	U
B95-03	12/3/1998	2.0	U	2.1		2.0	U
B95-03	4/20/1999	6.0		**20**		**7.2**	
B95-03	11/1/1999	2.8		**180**		4.9	
B95-03	5/15/2000	20		**81**		**25**	
B95-03	11/16/2000	11		**18**		**10**	
B95-03	6/5/2001	2.0	U	3.4		2.2	
B95-03	11/16/2001	2.0	U	2.0	U	2.0	U
B95-03	6/10/2002	10		**26**		**11**	
B95-03	11/14/2002	6.4		**11**		**7.5**	
B95-03	5/8/2003	2.0	U	2.8		2.0	U
B95-03	4/29/2004	2.0	U	2.0	U	2.0	U
B95-03	4/29/2004	2.0	U	2.0	U	2.0	U
B95-03	8/20/2004	2.0	U	2.0	U	2.0	U
B95-03	10/10/2005	2.0	U	2.0	U	2.0	U
B95-03	10/30/2006	2.0	U	2.0	U	2.0	U
B95-03	11/14/2007	2.0	U	0.20	U	0.50	U
B95-03	11/18/2010	5.0		**7.4**		**6.3**	
B95-05	6/2/1997	-		2.0	U	2.0	U
B95-05	12/17/1997	2.0	U	2.0	U	2.0	U
B95-05	5/12/1998	2.0	U	2.0	U	2.0	U
B95-05	12/2/1998	2.0	U	2.0	U	2.0	U
B95-05	4/21/1999	2.0	U	2.0	U	2.0	U
B95-05	10/29/1999	2.0	U	2.0	U	2.0	U
B95-05	5/16/2000	2.0	U	2.0	U	2.0	U
B95-05	11/20/2000	2.0	U	2.0	U	2.0	U
B95-05	6/6/2001	2.0	U	2.0	U	2.0	U
B95-05	11/16/2001	2.0	U	2.0	U	2.0	U
B95-05	6/10/2002	2.0	U	2.0	U	2.0	U
B95-05	11/12/2002	2.0	U	2.0	U	2.0	U
B95-05	5/7/2003	2.0	U	2.0	U	2.0	U
B95-05	4/29/2004	2.0	U	2.0	U	2.0	U
B95-05	8/19/2004	2.0	U	2.0	U	2.0	U
B95-05	10/11/2005	2.0	U	2.0	U	2.0	U
B95-05	10/30/2006	2.0	U	2.0	U	2.0	U
B95-05	11/17/2008	1.0	U	0.20	U	0.50	U
B95-05	11/16/2010	2.0	U	2.0	U	2.0	U
B95-06	6/16/1997	-		2	U	2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
B95-06	12/17/1997	2	U	2	U	2	U
B95-06	5/12/1998	2.0	U	2	U	2	U
B95-06	12/2/1998	2.0	U	2	U	2.0	U
B95-06	4/21/1999	2.0	U	2	U	2	U
B95-06	10/29/1999	2.0	U	2	U	2.0	U
B95-06	5/12/2000	2.0	U	2	U	2.0	U
B95-06	11/20/2000	2.0	U	2	U	2.0	U
B95-06	6/5/2001	2.0	U	2	U	2.0	U
B95-06	11/16/2001	2.0	U	2	U	2.0	U
B95-06	6/10/2002	2.0	U	2	U	2.0	U
B95-08	6/16/1997	-		**9.3**		2.0	U
B95-08	12/16/1997	6.4		**240**		2.6	
B95-08	5/12/1998	3.0		**34**		2.5	
B95-08	12/7/1998	2.0	U	**65**		2.0	U
B95-08	4/22/1999	2.0	U	**79**		3.6	
B95-08	11/4/1999	2.0	U	**15**		2.0	U
B95-08	5/16/2000	2.0	U	**9.8**		2.0	U
B95-08	5/16/2000	2.0	U	**10**		2.0	U
B95-08	11/16/2000	2.0	U	**6.5**		2.0	U
B95-08	6/1/2001	2.0	U	**7.6**		2.0	U
B95-08	11/15/2001	2.0	U	4.7		2.0	U
B95-08	6/10/2002	2.0	U	3.5		2.0	U
B95-08	11/14/2002	2.0	U	3.2		2.0	U
B95-08	5/7/2003	2.0	U	2.8		2.0	U
B95-08	9/3/2003	1.0	U	3.0		1.0	U
B95-08	4/28/2004	2.0	U	2.0	U	2.0	U
B95-08	8/19/2004	2.0	U	2.0	U	2.0	U
B95-08	4/20/2005	2.0	U	2.0	U	2.0	U
B95-08	10/12/2005	2.0	U	2.0	U	2.0	U
B95-08	4/21/2006	2.0	U	2.0	U	2.0	U
B95-08	10/30/2006	2.0	U	2.0	U	2.0	U
B95-08	6/14/2007	2.0	U	2.0	U	2.0	U
B95-08	6/14/2007	2.0	U	2.0	U	2.0	U
B95-08	11/13/2008	1.0	U	0.32		0.50	U
B95-08	10/5/2009	2.0	U	0.88		0.20	U
B95-08	11/16/2010	2.0	U	2.0	U	2.0	U
B95-09	5/29/1997	-		**52**		2.1	
B95-09	12/16/1997	2.0	U	**140**		3.8	
B95-09	12/16/1997	2.0	U	**140**		3.5	
B95-09	5/12/1998	2.0	U	**120**		2.6	
B95-09	5/12/1998	2.0	U	**120**		2.9	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
B95-09	12/3/1998	6.7	U	**610**		**6.7**	U
B95-09	4/22/1999	10	U	**440**		**10**	U
B95-09	11/4/1999	26		**230**		**34**	
B95-09	5/16/2000	36		**230**		**20**	
B95-09	11/16/2000	67		**290**		**39**	
B95-09	5/31/2001	28		**200**		**21**	
B95-09	11/15/2001	**73**		**190**		**38**	
B95-09	11/15/2001	**79**		**190**		**41**	
B95-09	6/10/2002	18		**170**		**17**	
B95-09	11/14/2002	10		**90**		**9.5**	
B95-09	5/7/2003	15		**298**		**19**	
B95-09	4/28/2004	7.4		**158**		**12**	
B95-09	8/19/2004	12		**200**		**15**	
B95-09	4/20/2005	9.2		**150**		**26**	
B95-09	10/12/2005	4.1		**96**		**11**	
B95-09	4/20/2006	2.0	U	**27**		2.0	U
B95-09	10/30/2006	2.0	U	**36**		2.1	
B95-09	6/14/2007	3.6		**104**		**5.5**	
B95-09	11/13/2008	1.0	U	**12**		0.50	U
B95-09	10/5/2009	2.0	U	**7.3**		0.43	
B95-09	11/16/2010	2.0	U	2.9		2.0	U
B95-12	5/28/1997	-		2.0	U	2.0	U
B95-12	12/15/1997	2.0	U	2.0	U	2.0	U
B95-12	5/18/1998	2.0	U	2.0	U	2.0	U
B95-12	12/2/1998	2.0	U	2.0	U	2.0	U
B95-12	4/13/1999	2.0	U	2.0	U	2.0	U
B95-12	10/22/1999	2.0	U	2.0	U	2.0	U
B95-12	5/10/2000	2.0	U	2.0	U	2.0	U
B95-12	11/9/2000	2.0	U	2.0	U	2.0	U
B95-12	5/30/2001	2.0	U	2.0	U	2.0	U
B95-12	11/6/2001	2.0	U	2.0	U	2.0	U
B95-12	6/4/2002	2.0	U	2.0	U	2.0	U
B95-12	11/12/2002	2.0	U	2.0	U	2.0	U
B95-12	5/7/2003	2.0	U	2.0	U	2.0	U
B95-12	4/21/2004	2.0	U	2.0	U	2.0	U
B95-12	8/19/2004	2.0	U	2.0	U	2.0	U
B95-12	10/10/2005	2.0	U	2.0	U	2.0	U
B95-12	10/31/2006	2.0	U	2.0	U	2.0	U
B95-12	11/14/2007	2.0	U	0.20	U	0.50	U
B95-12	11/18/2010	2.0	U	2.0	U	2.0	U
B95-13	5/28/1997	-		**2000**		**180**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
B95-13	12/18/1997	**170**		**5500**		**350**	
B95-13	12/18/1997	**150**		**1900**		**260**	
B95-13	12/18/1997	**160**		**4900**		**320**	
B95-13	5/21/1998	**160**		**4100**		**270**	
B95-13	5/21/1998	**150**		**3200**		**250**	
B95-13	5/21/1998	**160**		**3300**		**230**	
B95-13	7/23/1998	**150**		**3900**		**230**	
B95-13	7/23/1998	**150**		**3100**		**220**	
B95-13	7/23/1998	**150**		**3400**		**210**	
B95-13	7/23/1998	**140**		**2800**		**190**	
B95-13	7/23/1998	**140**		**3100**		**200**	
B95-13	9/30/1998	**140**		**1900**		**170**	
B95-13	11/23/1998	**140**		**1900**		**170**	
B95-13	11/24/1998	**140**		**2100**		**130**	
B95-13	2/8/1999	**170**		**1400**		**130**	
B95-13	2/8/1999	**180**		**1500**		**97**	
B95-13	2/8/1999	**190**		**1600**		**100**	
B95-13	4/7/1999	**160**		**950**		**200**	
B95-13	4/14/1999	**190**		**1700**		**120**	
B95-13	4/14/1999	**180**		**1400**		**110**	
B95-13	5/13/1999	**190**		**1700**		**97**	
B95-13	6/10/1999	**180**		**1400**		**92**	
B95-13	6/10/1999	**170**		**1200**		**85**	
B95-13	7/16/1999	**110**		**850**		**51**	
B95-13	7/30/1999	**100**		**290**		**40**	
B95-13	7/30/1999	**100**		**590**		**40**	
B95-13	7/30/1999	**110**		**590**		**40**	
B95-13	8/12/1999	**95**		**520**		**35**	
B95-13	9/10/1999	**71**		**690**		**30**	
B95-13	10/22/1999	53		**470**		**22**	
B95-13	5/9/2000	3.0		**100**		2.0	U
B95-13	11/14/2000	2.0	U	**19**		2.0	U
B95-13	5/29/2001	20	U	**1000**		**20**	U
B95-13	11/8/2001	4.0	U	**200**		4.0	U
B95-13	5/31/2002	2.0	U	**27**		2.0	U
B95-13	11/12/2002	2.0	U	**10**		2.0	U
B95-13	5/7/2003	2.0	U	**15**		2.0	U
B95-13	4/21/2004	2.0	U	**12**		2.0	U
B95-13	8/11/2004	2.0	U	**9.5**		2.0	U
B95-13	4/20/2005	2.0	U	**8.3**		2.0	U
B95-13	10/6/2005	2.0	U	**7.1**		2.0	U
B95-13	4/19/2006	2.0	U	**7.0**		2.0	U
B95-13	10/31/2006	2.0	U	**5.7**		2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
B95-13	6/8/2007	2.0	U	**8.2**		2.0	U
B95-13	11/14/2007	2.0	U	**6.7**		0.50	U
B95-13	11/16/2010	2.0	U	**5.9**		2.0	U
B95-15	5/28/1997	-		**920**		**22**	
B95-15	12/16/1997	66		**1400**		**42**	
B95-15	12/16/1997	54		**840**		**30**	
B95-15	12/16/1997	61		**1200**		**36**	
B95-15	5/18/1998	43		**1000**		**28**	
B95-15	5/18/1998	45		**890**		**27**	
B95-15	7/22/1998	63		**1400**		**42**	
B95-15	7/22/1998	68		**1200**		**39**	
B95-15	9/30/1998	48		**2000**		**38**	
B95-15	9/30/1998	46		**1900**		**50**	U
B95-15	11/23/1998	37		**480**		**29**	
B95-15	11/24/1998	36		**350**		**26**	
B95-15	2/8/1999	22		**350**		**26**	
B95-15	2/8/1999	22		**310**		**27**	
B95-15	4/7/1999	22		**210**		**28**	
B95-15	4/8/1999	22		**91**		**14**	
B95-15	5/13/1999	26		**160**		**19**	
B95-15	6/10/1999	21		**110**		**17**	
B95-15	6/10/1999	14		**93**		**13**	
B95-15	7/16/1999	14		**89**		**14**	
B95-15	8/12/1999	8.9		**62**		**9.5**	
B95-15	8/12/1999	8.5		**78**		**9.1**	
B95-15	9/10/1999	9.6		**86**		**12**	
B95-15	9/10/1999	7.9		**82**		**9.3**	
B95-15	10/26/1999	6.4		**47**		**5.8**	
B95-15	5/8/2000	2.0	U	**12**		2.0	U
B95-15	11/9/2000	2.0	U	**15**		2.0	U
B95-15	5/29/2001	4.0	U	**210**		4.0	U
B95-15	11/8/2001	2.0	U	**43**		2.0	U
B95-15	6/3/2002	2.0	U	**6.7**		2.0	U
B95-15	11/4/2002	2.0	U	2.6		2.0	U
B95-15	4/28/2003	2.0	U	2.0	U	2.0	U
B95-15	4/21/2004	2.0	U	2.0	U	2.0	U
B95-15	8/11/2004	2.0	U	2.0	U	2.0	U
B95-15	4/13/2005	2.0	U	2.0	U	2.0	U
B95-15	10/10/2005	2.0	U	**16**		2.0	U
B95-15	4/20/2006	2.0	U	2.0	U	2.0	U
B95-15	10/31/2006	2.0	U	2.0	U	2.0	U
B95-15	6/4/2007	2.0	U	2.1		2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
B95-15	11/14/2007	2.0	U	1.9		0.50	U
B95-15	11/18/2010	2.0	U	2.0	U	2.0	U
INEEL-CI	3/26/2007	50	U	**3000**		**25**	U
INEEL-CI	3/26/2007	50	U	**2900**		**25**	U
INEEL-CI	3/26/2007	66		**4300**		**25**	U
INEEL-CI	3/26/2007	50	U	**4000**		**25**	U
INEEL-CI	3/26/2007	50	U	**2900**		**25**	U
INEEL-CI	3/26/2007	50	U	**960**		**25**	U
INEEL-CI	3/26/2007	50	U	**320**		**25**	U
INEEL-CI	3/26/2007	50	U	**780**		**25**	U
INEEL-CI	3/26/2007	50	U	**480**		**25**	U
INEEL-CI	3/26/2007	50	U	**130**		**25**	U
INEEL-CI	3/26/2007	50	U	**182**		**25**	U
INEEL-CI	3/26/2007	50	U	**230**		**25**	U
INEEL-CI	3/26/2007	50	U	**180**		**25**	U
INEEL-CI	3/26/2007	50	U	**180**		**25**	U
INEEL-CI	3/26/2007	50	U	**130**		**25**	U
INEEL-CI	3/26/2007	50	U	**130**		**25**	U
INEEL-CI	3/26/2007	50	U	**120**		**25**	U
INEEL-CI	3/26/2007	50	U	**260**		**25**	U
INEEL-CI	3/26/2007	50	U	**190**		**25**	U
INEEL-CI	3/26/2007	50	U	**140**		**25**	U
INEEL-CI	3/26/2007	50	U	**210**		**25**	U
INEEL-CI	5/21/2007	50	U	**1100**		**51**	
INEEL-CI	5/21/2007	50	U	**250**		**25**	U
INEEL-CI	5/21/2007	50	U	**340**		**25**	U
INEEL-CI	5/21/2007	50	U	**310**		**25**	U
INEEL-CI	5/21/2007	50	U	**330**		**25**	U
INEEL-CI	5/21/2007	50	U	**340**		**25**	U
INEEL-CI	5/21/2007	50	U	**430**		**25**	U
INEEL-CI	5/21/2007	50	U	**460**		**25**	U
INEEL-CI	5/21/2007	50	U	**180**		**25**	U
INEEL-CI	5/21/2007	50	U	**1800**		**25**	U
INEEL-CI	5/21/2007	50	U	**2000**		**25**	U
INEEL-CI	5/21/2007	50	U	**1200**		**25**	U
INEEL-CI	5/21/2007	50	U	**1200**		**25**	U
INEEL-CI	5/21/2007	50	U	**930**		**25**	U
INEEL-CI	5/21/2007	50	U	**1400**		**25**	U
INEEL-CI	5/21/2007	50	U	**1500**		**25**	U
INEEL-CI	5/21/2007	50	U	**960**		**25**	U
INEEL-CI	5/21/2007	1.0	U	**350**		0.5	U
INEEL-CI	10/16/2008	50	U	**1900**		**25**	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
INEEL-CI	6/1/2009	2.0	U	**33**		0.30	U
INEEL-SCP	2/16/2010	0.50	U	1.0	U	1.0	U
IP-01	10/17/2008	12		**200**		**57**	
IP-01 DUP	10/17/2008	12		**220**		**72**	
IP-01	5/29/2009	20	U	**52**		3.0	U
IP-01	10/5/2009	2.8		**62**		4.3	
IP-02	10/16/2008	10	U	**87**		**5**	U
IP-02	5/29/2009	2.0	U	1.1		0.30	U
IP-02	10/6/2009	2.0	U	3.6		0.79	
IP-03	10/16/2008	1.0	U	2.9		0.50	U
IP-03	10/6/2009	2.0	U	2.6		0.20	U
IP-04	10/16/2008	1.0	U	3.9		0.50	U
IP-04	6/1/2009	2.0	U	**57**		0.30	U
IP-04	10/6/2009	2.0	U	**20**		0.26	
IP-05	10/16/2008	20	U	**20**		**10**	U
IP-05	6/1/2009	7.3		**130**		**12**	
IP-05	10/6/2009	8.1		**90**		**10**	
IP-05	2/16/2010	0.50	U	**19**		1.0	U
IP-06	10/16/2008	**100**	U	**11000**		**850**	
IP-06	5/29/2009	2.0	U	2.1		0.30	U
IP-06	10/5/2009	2.0	U	2.3		0.20	U
IP-07	10/22/2008	10	U	**250**		**5**	U
IP-08	10/22/2008	10	U	**290**		**16**	
IP-08	6/11/2009		JU	3.6	J		JU
IP-08	10/6/2009	2	U	**38**		2.8	
IP-09	10/16/2008	20	U	**900**		**10**	
IP-09	6/1/2009	20	U	**560**		**20**	
IP-09	10/6/2009	**100**	U	**2200**		**78**	
IP-10	10/16/2008	50	U	**2700**		**380**	
IP-10	6/11/2009	58		**420**		**95**	
IP-10	10/5/2009	**100**	U	**620**		**88**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
IP-11	10/16/2008	20	U	**42**		**10**	U
IP-11	6/1/2009	41		**270**		**32**	
IP-11	10/6/2009	68		**530**		**66**	
IP-11	2/16/2010	10	U	**220**		**20**	U
IP-12	10/17/2008	13		**500**		**26**	
IP-13	10/16/2008	50	U	**1200**		**79**	
IP-13	5/28/2009	**100**	U	**170**		**15**	U
IP-13	10/5/2009	**100**	U	**570**		**37**	
IP-14	10/17/2008	10	U	**340**		**14**	
IP-14	5/29/2009	20	U	**84**		3.0	U
IP-14	10/5/2009	20	U	**300**		3.7	
IP-101	10/5/2009	**400**	U	**41000**		**3600**	
IP-102	10/5/2009	20	U	**470**		**30**	
IP-102 DUP	10/5/2009	20	U	**460**		**29**	
IP-103	10/5/2009	2.0	U	**10**		1.8	
IP-103A	10/6/2009	**310**		**25000**		**3400**	
IP-103A	2/16/2010	**81**		**1400**		**130**	
IP-104	10/5/2009	2.0	U	1.3		0.2	U
IP-104	2/16/2010	0.50	U	1.0	U	1.0	U
IP-105	10/5/2009	20	U	**650**		**7.8**	
IP-106	10/5/2009	20	U	**420**		**12**	
IP-106	2/16/2010	10	U	**300**		**20**	U
IP-107	10/6/2009	20	U	**46**		**6.1**	
IP-E1	10/5/2009	20	U	**3100**		**82**	
IP-E2	10/5/2009	20	U	**5900**		**660**	
IP-E2A	10/5/2009	20	U	**2800**		**480**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
IP-E3	10/5/2009	20	U	**520**		**39**	
IP-E4	10/5/2009	20	U	**1200**		**85**	
IP-E5	10/5/2009	20	U	2.8		2	U
IW-2	10/6/2009	20	U	**58**		**5.2**	
MI-19	5/30/1997	-		2.0	U	2.0	U
MI-19	5/8/2003	2.0	U	2.0	U	2.0	U
MI-19	6/29/2007	2.0	U	2.0	U	2.0	U
MI-19	11/16/2010	2.0	U	2.0	U	2.0	U
MI-20	5/30/1997	-		2	U	2	U
MI-20	12/17/1997	2	U	2	U	2	U
MI-20	5/8/2003	2	U	2	U	2	U
MI-21	5/30/1997	-		2	U	2	U
MI-21	5/14/1998	2	U	2	U	2	U
MI-22	12/16/1997	57		**3400**		**160**	
MI-22	5/13/1998	40	U	**2400**		**130**	
MI-22	10/6/2009	**300**	U	**940**		**100**	
MI-22	2/16/2010	10	U	**660**		**77**	
MI-22	11/16/2010	21		**512**		**73**	
MI-32	6/2/1997	-		**1000**		**79**	
MI-32	5/12/1998	44		**1100**		**65**	
MI-32	12/4/1998	10	U	**700**		**38**	
MI-32	4/20/1999	29		**550**		**41**	
MI-32	11/1/1999	18		**380**		**24**	
MI-32	5/10/2000	10	U	**430**		**16**	
MI-32	5/10/2000	10	U	**440**		**16**	
MI-32	11/15/2000	2.6		**170**		**5.1**	
MI-32	5/31/2001	4	U	**260**		4	U
MI-32	11/13/2001	2	U	**150**		2	U
MI-32	6/7/2002	2	U	**120**		2	U
MW-0312	5/11/2004	2	U	2	U	2	U
MW-0312	8/12/2004	2	U	2	U	2	U
MW-0312	4/13/2005	2	U	2	U	2	U
MW-0312	10/6/2005	2	U	2	U	2	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
MW-0312	10/31/2006	2	U	2	U	2	U
MW-0312	10/6/2009	2	U	0.21		0.2	U
MW-0312	11/18/2010	2.0	U	2.0	U	2.0	U
MW-02A	9/30/1998	2.0	U	2.0	U	2.0	U
MW-02A	4/26/2004	2.0	U	2.0	U	2.0	U
MW-02A	11/9/2006	2.0	U	2.0	U	2.0	U
MW-02A	6/18/2008	2.0	U	2.0	U	2.0	U
MW-02A	5/29/2009	2.0	U	0.35		0.30	U
MW-02A	10/6/2009	2.0	U	0.2	U	0.20	U
MW-02A	11/16/2010	2.0	U	2.0	U	2.0	U
MW-02B	9/30/1998	2.0	U	2.0	U	2.0	U
MW-02B	9/30/1998	2.0	U	2.0	U	2.0	U
MW-02B	4/26/2004	2.0	U	2.0	U	2.0	U
MW-02B	11/9/2006	2.0	U	2.0	U	2.0	U
MW-02B	6/18/2008	2.0	U	2.0	U	2.0	U
MW-02B	5/29/2009	2.0	U	0.2		0.30	U
MW-02B	10/6/2009	2.0	U	0.2	U	0.20	U
MW-02B	11/16/2010	2.0	U	2.0	U	2.0	U
MW-02R	9/30/1998	2.0	U	**26**		**5.9**	
MW-02R	4/26/2004	2.0	U	**45**		**11**	
MW-02R	11/9/2006	7.0		**62**		**17**	
MW-02R	6/18/2008	-		**29**		-	
MW-02R	6/19/2008	-		**131**		-	
MW-02R	11/17/2008	7.3		**130**		**31**	
MW-02R	5/29/2009	20	U	**96**		**22**	
MW-02R	10/6/2009	20	U	**130**		**32**	
MW-02R	11/16/2010	2.4		**93**		**29**	
MW-16A	5/27/1997	-		**71**		2.0	U
MW-16A	5/13/1998	2.0	U	**39**		2.0	U
MW-16A	11/30/1998	2.0	U	**59**		2.0	U
MW-16A	4/13/1999	2.0	U	**64**		2.0	U
MW-16A	10/28/1999	4.0	U	**58**		4.0	U
MW-16A	5/9/2000	2.0	U	**38**		2.0	U
MW-16A	11/14/2000	2.0	U	**11**		2.0	U
MW-16A	5/30/2001	2.0	U	**7.6**		2.0	U
MW-16A	11/7/2001	2.0	U	**7.8**		2.0	U
MW-16A	6/4/2002	2.0	U	**5.3**		2.0	U
MW-16A	11/12/2002	2.0	U	3.0		2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
MW-16A	4/28/2003	2.0	U	2.0	U	2.0	U
MW-16A	4/21/2004	2.0	U	2.0	U	2.0	U
MW-16A	8/12/2004	2.0	U	2.0	U	2.0	U
MW-16A	4/19/2005	2.0	U	2.0	U	2.0	U
MW-16A	10/6/2005	2.0	U	2.0	U	2.0	U
MW-16A	4/20/2006	2.0	U	2.0	U	2.0	U
MW-16A	10/24/2006	2.0	U	2.0	U	2.0	U
MW-16A	2/28/2007	1.0	U	1.2		0.50	U
MW-16A	6/5/2007	2.0	U	2.0	U	2.0	U
MW-16A	11/13/2007	2.0	U	0.60		0.50	U
MW-16A	11/16/2010	2.0	U	2.0	U	2.0	U
MW-16B	5/27/1997	-		**320**		**11**	
MW-16B	6/11/1997	-		**510**		**12**	
MW-16B	12/18/1997	10	U	**360**		**11**	
MW-16B	5/11/1998	5.0	U	**310**		**11**	
MW-16B	11/30/1998	10	U	**310**		**12**	
MW-16B	4/13/1999	8.7		**280**		**15**	
MW-16B	4/13/1999	8.6		**260**		**15**	
MW-16B	5/13/1999	11		**400**		**19**	
MW-16B	6/10/1999	8.8		**330**		**16**	
MW-16B	7/16/1999	5.2		**260**		**10**	
MW-16B	7/16/1999	4.2		**210**		**8.5**	
MW-16B	8/12/1999	5.0	U	**100**		**8.4**	
MW-16B	9/10/1999	4.1		**320**		**9.7**	
MW-16B	10/28/1999	4.0	U	**140**		4.0	U
MW-16B	10/28/1999	4.0	U	**140**		4.0	U
MW-16B	5/9/2000	2.0	U	**51**		2.0	U
MW-16B	11/14/2000	2.0	U	**14**		2.0	U
MW-16B	5/30/2001	2.0	U	**8.9**		2.0	U
MW-16B	11/7/2001	2.0	U	4.3		2.0	U
MW-16B	6/4/2002	2.0	U	3.1		2.0	U
MW-16B	11/12/2002	2.0	U	2.5		2.0	U
MW-16B	4/28/2003	2.0	U	2.4		2.0	U
MW-16B	4/21/2004	2.0	U	2.0	U	2.0	U
MW-16B	8/12/2004	2.0	U	2.0	U	2.0	U
MW-16B	4/19/2005	2.0	U	2.0	U	2.0	U
MW-16B	10/6/2005	2.0	U	2.0	U	2.0	U
MW-16B	4/20/2006	2.0	U	2.0	U	2.0	U
MW-16B	10/24/2006	2.0	U	2.0	U	2.0	U
MW-16B	2/28/2007	1.0	U	0.80		0.50	U
MW-16B	6/5/2007	2.0	U	2.0	U	2.0	U
MW-16B	11/13/2007	2.0	U	0.60		0.50	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
MW-16B	11/14/2008	1.0	U	0.40		0.50	U
MW-16B	11/16/2010	2.0	U	2.0	U	2.0	U
MW-16C	5/27/1997	-		**560**		**42**	
MW-16C	6/12/1997	-		**930**		**51**	
MW-16C	12/15/1997	**79**		**1200**		**110**	
MW-16C	5/11/1998	**75**		**1200**		**110**	
MW-16C	11/30/1998	**85**		**1600**		**130**	
MW-16C	4/13/1999	**81**		**1100**		**110**	
MW-16C	5/13/1999	**97**		**1300**		**110**	
MW-16C	6/10/1999	63		**1000**		**78**	
MW-16C	7/16/1999	43		**880**		**60**	
MW-16C	8/12/1999	41		**880**		**56**	
MW-16C	9/10/1999	38		**860**		**45**	
MW-16C	10/28/1999	33		**570**		**36**	
MW-16C	5/9/2000	12		**380**		**16**	
MW-16C	11/14/2000	6.1		**240**		**10**	
MW-16C	5/30/2001	4.1		**150**		**6.9**	
MW-16C	11/7/2001	3.8		**170**		**7.5**	
MW-16C	6/4/2002	4.0	U	**230**		**7.1**	
MW-16C	11/12/2002	2.0	U	**130**		**5.0**	
MW-16C	4/28/2003	4.0	U	**76**		2.7	
MW-16C	4/21/2004	2.0	U	**40**		2.0	U
MW-16C	8/12/2004	2.0	U	**50**		2.0	U
MW-16C	4/19/2005	2.0	U	**24**		2.0	U
MW-16C	10/6/2005	2.0	U	**12**		2.0	U
MW-16C	4/20/2006	2.0	U	**19**		2.0	U
MW-16C	10/24/2006	2.0	U	**20**		2.0	U
MW-16C	2/28/2007	1.0	U	**19**		1.1	
MW-16C	6/5/2007	2.0	U	**12**		2.0	U
MW-16C	11/13/2007	2.0	U	**18**		0.70	
MW-16C	11/14/2008	1.0	U	**12**		0.65	
MW-16C	10/6/2009	2.0	U	**17**		0.71	
MW-16C	11/16/2010	2.0	U	**9.2**		2.0	U
MW-16R	5/27/1997	-		**510**		**53**	
MW-16R	12/18/1997	43		**330**		**41**	
MW-16R	5/13/1998	48		**390**		**48**	
MW-16R	11/30/1998	44		**300**		**34**	
MW-16R	5/13/1999	56		**470**		**61**	
MW-16R	6/10/1999	51		**330**		**55**	
MW-16R	7/16/1999	38		**320**		**44**	
MW-16R	7/30/1999	32		**78**		**25**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
MW-16R	7/30/1999	38		**110**		**29**	
MW-16R	7/30/1999	35		**180**		**32**	
MW-16R	7/30/1999	**110**		**110**		**49**	
MW-16R	8/12/1999	38		**160**		**33**	
MW-16R	9/10/1999	41		**210**		**36**	
MW-16R	10/28/1999	**140**		**260**		**56**	
MW-16R	10/28/1999	43		**270**		**37**	
MW-16R	10/28/1999	**98**		**310**		**66**	
MW-16R	10/28/1999	**110**		**340**		**83**	
MW-16R	10/28/1999	**190**		**630**		**98**	
MW-16R	5/9/2000	**420**		**70**		**54**	
MW-16R	11/14/2000	**140**		**110**		**64**	
MW-16R	5/30/2001	**140**		**140**		**57**	
MW-16R	11/7/2001	**73**		**120**		**42**	
MW-16R	6/4/2002	**140**		**110**		**49**	
MW-16R	11/12/2002	**180**		**220**		**50**	
MW-16R	4/28/2003	**137**		**141**		**40**	
MW-16R	4/21/2004	**114**		**128**		**29**	
MW-16R	8/12/2004	**73**		**109**		**21**	
MW-16R	4/19/2005	**94**		**169**		**33**	
MW-16R	10/6/2005	62		**176**		**25**	
MW-16R	4/20/2006	52		**147**		**22**	
MW-16R	10/24/2006	46		**171**		**21**	
MW-16R	2/28/2007	**83**		**370**		**21**	
MW-16R	6/5/2007	48		**188**		**21**	
MW-16R	11/14/2007	62	U	**277**		**21**	
MW-16R	6/19/2008	49		**166**		**18**	
MW-16R	6/19/2008	33		**459**		**47**	
MW-16R	6/1/2009	35		**620**		**54**	
MW-16R	10/6/2009	27		**490**		**49**	
MW-27	12/2/1998	2.0	U	2.0	U	2.0	U
MW-27	12/2/1998	2.0	U	2.0	U	2.0	U
MW-27	4/21/1999	2.0	U	2.0	U	2.0	U
MW-27	10/28/1999	2.0	U	2.0	U	2.0	U
MW-27	5/16/2000	2.0	U	2.0	U	2.0	U
MW-27	11/20/2000	2.0	U	2.0	U	2.0	U
MW-27	6/6/2001	2.0	U	2.0	U	2.0	U
MW-27	11/8/2001	2.0	U	2.0	U	2.0	U
MW-27	6/10/2002	2.0	U	2.0	U	2.0	U
MW-27	11/12/2002	2.0	U	2.0	U	2.0	U
MW-27	5/7/2003	2.0	U	2.0	U	2.0	U
MW-27	4/29/2004	2.0	U	2.0	U	2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
MW-27	8/19/2004	2.0	U	2.0	U	2.0	U
MW-27	10/11/2005	2.0	U	2.0	U	2.0	U
MW-27	10/31/2006	2.0	U	2.0	U	2.0	U
MW-27	10/6/2009	2.0	U	0.20	U	0.20	U
MW-27	11/16/2010	2.0	U	2.0	U	2.0	U
MW-28	5/8/2003	2.0	U	2.0	U	2.0	U
NCP	8/5/2003	**170**		**4100**		**240**	
NCP	6/7/2007	**-**		**2030**		**192**	
NCP	8/14/2007	63		**2194**		**115**	
NCP	8/16/2007	50	U	**1594**		**56**	
NCP	6/19/2008	10	U	**495**		**10**	U
NCP	10/16/2008	20	U	**1500**		**11**	
NCP	6/1/2009	2.0	U	**8.5**		0.30	U
PW-01D	5/14/1998	**130**		**2600**		**220**	
PW-01D	12/1/1998	**110**		**2400**		**160**	
PW-01D	4/9/1999	65		**940**		**80**	
PW-01D	10/22/1999	64		**470**		**82**	
PW-01D	5/9/2000	11		**320**		**28**	
PW-01D	11/14/2000	4.5		**120**		**18**	
PW-01D	5/29/2001	4.1		**370**		**26**	
PW-01D	11/8/2001	4.0	U	**370**		**28**	
PW-01D	5/31/2002	2.2		**140**		**17**	
PW-01D	11/5/2002	2.0	U	**78**		**15**	
PW-01D	4/30/2003	2.0	U	**74**		**12**	
PW-01D	4/21/2004	2.0	U	**52**		**9.9**	
PW-01D	8/11/2004	2.0	U	**46**		**8.4**	
PW-01D	4/20/2005	2.0	U	**36**		**7.8**	
PW-01D	10/4/2005	2.0	U	**33**		**7.3**	
PW-01D	4/19/2006	2.0	U	**30**		**7.5**	
PW-01D	10/31/2006	2.0	U	**35**		**7.4**	
PW-01D	6/8/2007	2.0	U	**43**		**5.7**	
PW-01D	11/14/2007	2.0	U	**33**		**8.0**	
PW-01D	10/6/2009	20.0	U	**53**		**7.5**	
PW-01D	11/16/2010	2.0	U	**29**		4.7	
PW-01S	5/14/1998	**160**		**3400**		**250**	
PW-01S	12/1/1998	**190**		**3000**		**170**	
PW-01S	4/9/1999	**200**		**1200**		**87**	
PW-01S	10/22/1999	**81**		**930**		**47**	
PW-01S	5/9/2000	17		**540**		**14**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-01S	11/14/2000	13		**390**		**11**	
PW-01S	5/29/2001	5.0	U	**350**		**6.8**	
PW-01S	11/8/2001	4.0	U	**370**		**7.2**	
PW-01S	5/31/2002	4.0	U	**360**		**6.1**	
PW-01S	11/5/2002	2.0	U	**160**		4.0	
PW-01S	4/30/2003	2.0	U	**156**		2.6	
PW-01S	4/21/2004	2.0	U	**67**		2.0	U
PW-01S	8/11/2004	2.0	U	**35**		2.0	U
PW-01S	4/20/2005	2.0	U	**9.6**		2.0	U
PW-01S	10/5/2005	2.0	U	**5.2**		2.0	U
PW-01S	4/19/2006	2.0	U	**6.4**		2.0	U
PW-01S	10/31/2006	2.0	U	**5.0**		2.0	U
PW-01S	6/8/2007	2.0	U	2.4		2.0	U
PW-01S	11/14/2007	2.0	U	1.8		0.50	U
PW-01S	10/6/2009	2.0	U	4.5		0.20	
PW-01S	11/16/2010	2.0	U	2.1		2.0	U
PW-02D	5/18/1998	4.7		**170**		**9.4**	
PW-02D	12/4/1998	**91**		**1700**		**170**	
PW-02D	4/14/1999	**88**		**1000**		**140**	
PW-02D	10/29/1999	**93**		**970**		**79**	
PW-02D	5/10/2000	43		**1000**		**49**	
PW-02D	11/15/2000	13		**420**		**18**	
PW-02D	5/31/2001	6.1		**290**		**11**	
PW-02D	11/13/2001	5.0	U	**320**		**8.1**	
PW-02D	6/7/2002	4.0	U	**240**		**5.5**	
PW-02D	11/7/2002	2.0	U	**150**		**25**	
PW-02D	5/6/2003	2.0	U	**118**		**15**	
PW-02D	4/27/2004	2.0	U	**80**		**11**	
PW-02D	8/13/2004	2.0	U	**60**		**6.2**	
PW-02D	2/8/2005	1.0	U	**72.6**		**8.9**	
PW-02D	4/20/2005	2.0	U	**58**		**6.8**	
PW-02D	10/5/2005	2.0	U	**69**		**8.8**	
PW-02D	4/21/2006	2.0	U	**51**		**8.6**	
PW-02D	10/26/2006	2.0	U	**45**		4.1	
PW-02D	6/14/2007	2.0	U	**53**		**5.3**	
PW-02D	11/13/2007	2.0	U	**59**		**13**	
PW-02D	6/17/2008	2.0	U	**38**		**6.6**	
PW-02D	10/15/2008	10	U	**32**		**7.4**	
PW-02D	5/28/2009	2.0	U	**23**		4.8	
PW-02D DUP	5/28/2009	2.0	U	**26**		**5.4**	
PW-02D	10/6/2009	2.0	U	**29**		**6.2**	
PW-02D DUP	10/6/2009	2.0	U	**29**		**6.5**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-02D	11/16/2010	2.0	U	**16**		2.2	
PW-02D DUP	11/16/2010	2.0	U	**19**		2.7	
PW-02M	5/20/1998	**180**		**1100**		**190**	
PW-02M	12/4/1998	68		**1600**		**130**	
PW-02M	4/14/1999	**89**		**950**		**110**	
PW-02M	10/29/1999	**70**		**550**		**53**	
PW-02M	5/10/2000	3.5		**210**		4.6	
PW-02M	11/15/2000	2.0	U	**71**		2.0	U
PW-02M	5/31/2001	10	U	**560**		**10**	U
PW-02M	11/13/2001	4.0	U	**260**		4.0	U
PW-02M	6/7/2002	2.0	U	**57**		2.0	U
PW-02M	11/7/2002	2.0	U	**18**		2.0	U
PW-02M	5/6/2003	2.0	U	**17**		2.0	U
PW-02M	4/27/2004	2.0	U	4.6		2.0	U
PW-02M	8/13/2004	2.0	U	2.4		2.0	U
PW-02M	2/8/2005	1.0	U	2.8		1.0	U
PW-02M	4/20/2005	2.0	U	2.0	U	2.0	U
PW-02M	10/5/2005	2.0	U	2.0	U	2.0	U
PW-02M	4/21/2006	2.0	U	2.0	U	2.0	U
PW-02M	10/26/2006	2.0	U	2.0	U	2.0	U
PW-02M	6/14/2007	2.0	U	2.3		2.0	U
PW-02M	11/13/2007	2.0	U	2.7		0.50	U
PW-02M	6/17/2008	2.0	U	2.0	U	2.0	U
PW-02M	5/28/2009	2.0	U	1.8		0.30	U
PW-02M	10/6/2009	2.0	U	3.1		0.20	U
PW-02M	11/16/2010	2.0	U	2.0	U	2.00	U
PW-02R	5/20/1998	2.1		**36**		**6.2**	
PW-02R	12/4/1998	2.0	U	**20**		3.6	
PW-02R	5/13/1999	2.0	U	**29**		4.4	
PW-02R	6/10/1999	2.0	U	**28**		**5.1**	
PW-02R	9/10/1999	2.0	U	**38**		4.0	
PW-02R	10/29/1999	2.7		**16**		2.5	
PW-02R	10/29/1999	2.0	U	**44**		4.6	
PW-02R	5/10/2000	2.0	U	**9.0**		2.1	
PW-02R	11/15/2000	2.0	U	**17**		3.9	
PW-02R	5/31/2001	2.0	U	**28**		**6.0**	
PW-02R	11/13/2001	3.6		**52**		**12**	
PW-02R	6/7/2002	2.7		**38**		**10**	
PW-02R	11/7/2002	5.5		**77**		**20**	
PW-02R	5/6/2003	10		**128**		**30**	
PW-02R	4/27/2004	18		**242**		**44**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-02R	8/13/2004	17		**198**		**37**	
PW-02R	4/20/2005	17		**241**		**38**	
PW-02R	10/5/2005	17		**228**		**35**	
PW-02R	4/21/2006	19		**282**		**39**	
PW-02R	10/26/2006	40		**686**		**80**	
PW-02R	2/13/2007	50	U	**1100**		**94**	
PW-02R	6/14/2007	22		**376**		**35**	
PW-02R	11/14/2007	**150**	U	**474**		**17**	
PW-02R	6/17/2008			**282**			
PW-02R	6/19/2008			**461**			
PW-02R	10/15/2008	50	U	**360**		**38**	
PW-02R	6/1/2009	20	U	**590**		**42**	
PW-02R	10/6/2009	21		**650**		**49**	
PW-02R	11/18/2010	13		**426**		**24**	
PW-02S	5/18/1998	**110**		**830**		**120**	
PW-02S	12/4/1998	**110**		**1400**		**140**	
PW-02S	4/14/1999	63		**530**		**73**	
PW-02S	10/29/1999	5.0	U	**280**		**7.7**	
PW-02S	5/10/2000	2.0	U	**27**		2.0	U
PW-02S	11/15/2000	2.0	U	**90**		2.0	U
PW-02S	5/31/2001	4.0	U	**230**		4.0	U
PW-02S	11/13/2001	2.0	U	**19**		2.0	U
PW-02S	6/7/2002	2.0	U	**6.6**		2.0	U
PW-02S	11/7/2002	2.0	U	4.8		2.0	U
PW-02S	5/6/2003	2.0	U	3.3		2.0	U
PW-02S	4/27/2004	2.0	U	2.3		2.0	U
PW-02S	8/13/2004	2.0	U	2.4		2.0	U
PW-02S	4/20/2005	2.0	U	2.0	U	2.0	U
PW-02S	10/5/2005	2.0	U	2.0	U	2.0	U
PW-02S	4/21/2006	2.0	U	2.0	U	2.0	U
PW-02S	10/26/2006	2.0	U	2.0	U	2.0	U
PW-02S	6/14/2007	2.0	U	2.3		2.0	U
PW-02S	11/13/2007	2.0	U	3.2		0.50	U
PW-02S	10/6/2009	2.0	U	3		0.20	U
PW-02S	11/16/2010	2.0	U	2.0	U	2.0	U
PW-03D	12/3/1998	2.0	U	2.0	U	2.0	U
PW-03D	4/14/1999	2.0	U	2.0	U	2.0	U
PW-03D	11/4/1999	2.0	U	2.0	U	2.0	U
PW-03D	5/15/2000	2.0	U	2.0	U	2.0	U
PW-03D	11/16/2000	2.0	U	2.0	U	2.0	U
PW-03D	6/5/2001	2.0	U	2.0	U	2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-03D	11/13/2001	2.0	U	2.0	U	2.0	U
PW-03D	6/4/2002	2.0	U	2.0	U	2.0	U
PW-03D	11/14/2002	2.0	U	2.0	U	2.0	U
PW-03D	5/8/2003	2.0	U	2.0	U	2.0	U
PW-03D	4/27/2004	2.0	U	2.0	U	2.0	U
PW-03D	8/18/2004	2.0	U	2.0	U	2.0	U
PW-03D	10/10/2005	2.0	U	3.4		2.0	U
PW-03D	10/30/2006	2.0	U	2.0	U	2.0	U
PW-03D	11/14/2007	2.0	U	0.20	U	0.50	U
PW-03D	11/18/2010	2.0	U	**5.6**		2.0	U
PW-03S	12/3/1998	2.0	U	2.1		2.0	U
PW-03S	4/14/1999	2.0	U	2.0		2.0	U
PW-03S	11/4/1999	4.8		**7.4**		**6.6**	
PW-03S	5/15/2000	2.0	U	2.0	U	2.0	U
PW-03S	11/16/2000	2.0	U	2.0	U	2.0	U
PW-03S	6/5/2001	2.0	U	2.0	U	2.0	U
PW-03S	11/13/2001	2.0	U	2.0	U	2.0	U
PW-03S	6/4/2002	2.0	U	2.0	U	2.0	U
PW-03S	11/14/2002	2.0	U	2.0	U	2.0	U
PW-03S	5/8/2003	2.0	U	2.0	U	2.0	U
PW-03S	4/27/2004	2.0	U	2.0	U	2.0	U
PW-03S	8/18/2004	2.0	U	2.0	U	2.0	U
PW-03S	10/10/2005	2.0	U	2.0	U	2.0	U
PW-03S	10/30/2006	2.0	U	2.0	U	2.0	U
PW-03S	11/14/2007	2.0	U	0.20	U	0.50	U
PW-03S	11/18/2010	2.0	U	2.0		2.0	U
PW-04D	12/7/1998	2.0	U	**38**		**5.9**	
PW-04D	4/22/1999	2.0	U	2.0	U	2.0	U
PW-04D	11/4/1999	2.0	U	2.1		2.0	U
PW-04D	5/10/2000	2.0	U	2.0	U	2.0	U
PW-04D	11/16/2000	2.0	U	2.0	U	2.0	U
PW-04D	6/6/2001	2.0	U	2.0	U	2.0	U
PW-04D	11/16/2001	2.0	U	2.0	U	2.0	U
PW-04D	6/12/2002	2.0	U	2.0	U	2.0	U
PW-04D	11/14/2002	2.0	U	2.0	U	2.0	U
PW-04D	5/8/2003	2.0	U	2.0	U	2.0	U
PW-04D	4/22/2004	2.0	U	2.0	U	2.0	U
PW-04D	8/20/2004	2.0	U	2.0	U	2.0	U
PW-04D	10/11/2005	2.0	U	2.0	U	2.0	U
PW-04D	10/30/2006	2.0	U	2.0	U	2.0	U
PW-04D	11/14/2007	2.0	U	0.20	U	**30**	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-04D	10/5/2009	2.0	U	0.23		0.2	U
PW-04D	11/16/2010	2.0	U	2.0	U	2.0	U
PW-04M	12/7/1998	2.0	U	2.1		2.0	U
PW-04M	12/7/1998	2.0	U	2.0	U	2.0	U
PW-04M	4/22/1999	2.0	U	2.0	U	2.0	U
PW-04M	11/4/1999	2.0	U	2.0	U	2.0	U
PW-04M	5/10/2000	2.0	U	2.0	U	2.0	U
PW-04M	11/16/2000	2.0	U	2.0	U	2.0	U
PW-04M	11/16/2000	2.0	U	2.0	U	2.0	U
PW-04M	6/6/2001	2.0	U	2.0	U	2.0	U
PW-04M	11/16/2001	2.0	U	2.0	U	2.0	U
PW-04M	6/12/2002	2.0	U	2.0	U	2.0	U
PW-04M	11/14/2002	2.0	U	2.0	U	2.0	U
PW-04M	5/8/2003	2.0	U	2.0	U	2.0	U
PW-04M	4/22/2004	2.0	U	2.0	U	2.0	U
PW-04M	8/20/2004	2.0	U	2.0	U	2.0	U
PW-04M	10/11/2005	2.0	U	2.0	U	2.0	U
PW-04M	10/30/2006	2.0	U	2.0	U	2.0	U
PW-04M	11/14/2007	2.0	U	0.20	U	**30**	U
PW-04M	10/5/2009	2.0	U	0.20	U	0.2	U
PW-04M	11/16/2010	2.0	U	2.0	U	2.0	U
PW-05D	12/8/1998	**100**		**1500**		**190**	
PW-05D	4/19/1999	**97**		**770**		**100**	
PW-05D	11/4/1999	**180**		**1700**		**220**	
PW-05D	5/12/2000	17		**420**		**24**	
PW-05D	11/20/2000	10	U	**580**		**22**	
PW-05D	5/31/2001	4.0	U	**220**		**8.4**	
PW-05D	5/31/2001	4.0	U	**200**		**7.4**	
PW-05D	11/13/2001	2.0	U	**190**		**5.4**	
PW-05D	11/13/2001	2.0	U	**190**		**5.7**	
PW-05D	6/5/2002	2.0	U	**120**		**5.3**	
PW-05D	6/5/2002	2.0	U	**110**		4.9	
PW-05D	11/7/2002	2.0	U	**130**		4.6	
PW-05D	11/7/2002	2.0	U	**120**		4.1	
PW-05D	5/6/2003	2.0	U	**76**		2.3	
PW-05D	4/26/2004	2.0	U	**57**		2.0	U
PW-05D	8/18/2004	2.0	U	**40**		2.0	U
PW-05D	8/18/2004	2.0	U	**42**		2.0	U
PW-05D	4/21/2005	2.0	U	**52**		2.0	U
PW-05D	10/7/2005	2.0	U	**175**		**6.8**	
PW-05D	4/21/2006	2.0	U	**121**		4.7	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-05D	10/26/2006	2.0	U	**36**		2.0	U
PW-05D	10/26/2006	2.0	U	**32**		2.0	U
PW-05D	6/26/2007	2.0	U	**34**		2.0	U
PW-05D	6/26/2007	2.0	U	**33**		2.0	U
PW-05D	11/13/2007	7.6	U	**42**		1.9	U
PW-05D	6/17/2008	2.0	U	**29**		2.0	U
PW-05D	10/15/2008	10	U	**43**		**5.0**	U
PW-05D	5/28/2009	2.0	U	**32**		0.30	U
PW-05D	10/6/2009	2.0	U	**63**		0.34	
PW-05D	11/16/2010	2.0	U	**63**		2.4	
PW-05M	12/8/1998	**120**		**1400**		**160**	
PW-05M	4/19/1999	**150**		**520**		**98**	
PW-05M	11/4/1999	**190**		**544**		**74**	
PW-05M	5/12/2000	**140**		**690**		**16**	
PW-05M	11/20/2000	54		**630**		**46**	
PW-05M	11/20/2000	**70**		**810**		**60**	
PW-05M	5/31/2001	14		**180**		**13**	
PW-05M	11/13/2001	5.0		**140**		**5.9**	
PW-05M	6/5/2002	4.4		**160**		**6.5**	
PW-05M	11/7/2002	2.0	U	**110**		2.2	
PW-05M	5/6/2003	2.0	U	**82**		2.2	
PW-05M	9/4/2003	2.3		**64**		2.3	
PW-05M	9/4/2003	1.7		**64**		2.0	
PW-05M	4/26/2004	2.0	U	**17**		2.0	U
PW-05M	8/18/2004	2.0	U	**8.3**		2.0	U
PW-05M	4/21/2005	2.0	U	4.9		2.0	U
PW-05M	10/7/2005	2.0	U	4.3		2.0	U
PW-05M	4/21/2006	2.0	U	**8.5**		2.0	U
PW-05M	4/21/2006	2.0	U	**8.7**		2.0	U
PW-05M	10/26/2006	2.0	U	4		2.0	U
PW-05M	6/26/2007	2.0	U	2.6		2.0	U
PW-05M	11/13/2007	2.0	U	3.8		0.50	U
PW-05M	11/14/2008	1.0	U	2.4		0.50	U
PW-05M	10/6/2009	2.0	U	**7.5**		0.22	
PW-05M	11/16/2010	2.0	U	2.9		2.0	U
PW-05R	12/8/1998	9.6		**95**		**14**	
PW-05R	5/13/1999	15		**170**		**21**	
PW-05R	6/10/1999	16		**170**		**24**	
PW-05R	9/10/1999	13		**190**		**22**	
PW-05R	11/4/1999	8.9		**34**		**7.8**	
PW-05R	11/4/1999	12		**200**		**20**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-05R	5/12/2000	5.8		**37**		**9.4**	
PW-05R	11/20/2000	5.2		**49**		**10**	
PW-05R	5/31/2001	5.2		**54**		**10**	
PW-05R	11/13/2001	4.8		**44**		**9.0**	
PW-05R	6/5/2002	4.0		**38**		**8.2**	
PW-05R	11/7/2002	3.2		**42**		**7.5**	
PW-05R	5/6/2003	3.8		**46**		**8.6**	
PW-05R	4/26/2004	2.7		**45**		**6.4**	
PW-05R	8/18/2004	2.3		**32**		4.7	
PW-05R	4/21/2005	2.1		**36**		**5.2**	
PW-05R	10/7/2005	2.0	U	**28**		4.0	
PW-05R	10/7/2005	2.0	U	**30**		4.5	
PW-05R	4/21/2006	2.1		**37**		4.8	
PW-05R	10/26/2006	2.0	U	**26**		3.4	
PW-05R	6/26/2007	2.0	U	**22**		2.7	
PW-05R	6/18/2008	2.0	U	**14**		2.0	U
PW-05R	10/15/2008	1.0	U	**32**		0.50	U
PW-05R	5/28/2009	2.0	U	**22**		2.2	
PW-05R	10/6/2009	2.0	U	**36**		3.1	
PW-05R	11/16/2010	2.0	U	**34**		2.2	
PW-06D	5/21/1998	**100**	U	**4900**		**100**	U
PW-06D	5/21/1998	**100**	U	**4800**		**100**	U
PW-06D	12/10/1998	10	U	**610**		**10**	U
PW-06D	4/21/1999	**100**	U	**3600**		**100**	U
PW-06D	11/1/1999	**200**	U	**11000**		**210**	
PW-06D	5/11/2000	10	U	**11000**		**42**	
PW-06D	11/15/2000	**200**	U	**17000**		**210**	
PW-06D	6/1/2001	**400**	U	**17000**		**400**	U
PW-06D	11/14/2001	**200**	U	**16000**		**430**	
PW-06D	6/11/2002	**200**	U	**13000**		**290**	
PW-06D	11/12/2002	50	U	**4200**		**170**	
PW-06D	5/2/2003	**250**	U	**19100**		**476**	
PW-06D	4/23/2004	**200**	U	**18400**		**545**	
PW-06D	8/17/2004	**200**	U	**17500**		**648**	
PW-06D	12/14/2004	**100**	U	**2100**		**100**	U
PW-06D	2/8/2005	**100**	U	**3477.1001**		**142.5**	
PW-06D	4/19/2005	60		**6080**		**623**	
PW-06D	4/19/2005	61		**6410**		**650**	
PW-06D	9/30/2005	21		**1700**		**540**	
PW-06D	10/11/2005	2.0	U	**1040**		**452**	
PW-06D	4/24/2006	41		**643**		**22**	
PW-06D	4/24/2006	50	U	**590**		**25**	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-06D	5/17/2006	50	U	**1300**		**25**	U
PW-06D	6/13/2006	50	U	**2500**		**380**	
PW-06D	6/26/2006	50	U	**2000**		**260**	
PW-06D	8/16/2006	28		**4800**		**350**	
PW-06D	9/6/2006	50	U	**7100**		**450**	
PW-06D	10/11/2006	50	U	**4700**		**380**	
PW-06D	10/31/2006	**100**	U	**5640**		**547**	
PW-06D	6/11/2007	**100**	U	**5450**		**169**	
PW-06D	11/13/2007	**2500**	U	**2000**		**632**	U
PW-06D	6/16/2008	20	U	**1780**		**112**	
PW-06D	10/14/2008	50	U	**2300**		**120**	
PW-06D DUP	10/14/2008	50	U	**2500**		**130**	
PW-06M	5/21/1998	**800**		**3300**		**1300**	
PW-06M	12/10/1998	**650**		**3600**		**1300**	
PW-06M	4/21/1999	**240**		**2300**		**390**	
PW-06M	11/1/1999	**100**	U	**6700**		**140**	
PW-06M	5/11/2000	**100**	U	**3100**		**250**	
PW-06M	11/15/2000	**100**	U	**3900**		**100**	U
PW-06M	6/1/2001	**140**		**4000**		**160**	
PW-06M	11/14/2001	**210**		**5900**		**160**	
PW-06M	6/11/2002	**240**		**1900**		**170**	
PW-06M	11/12/2002	31		**580**		**29**	
PW-06M	5/2/2003	**97**		**3480**		**97**	
PW-06M	5/2/2003	**92**		**3310**		**92**	
PW-06M	9/3/2003	**81**		**3600**		**84**	
PW-06M	4/23/2004	50	U	**4780**		**72**	
PW-06M	4/23/2004	50	U	**4810**		**72**	
PW-06M	8/17/2004	40	U	**3850**		**66**	
PW-06M	12/14/2004	**100**	U	**2100**		**150**	
PW-06M	2/8/2005	51.2		**1565.3001**		**93.2**	
PW-06M	4/19/2005	**93**		**2548**		**187**	
PW-06M	9/30/2005	**360**		**3000**		**870**	
PW-06M	10/11/2005	2.0	U	**3530**		**294**	
PW-06M	10/11/2005	2.0	U	**3750**		**306**	
PW-06M	4/24/2006	**559**		**4070**		**769**	
PW-06M	4/24/2006	**520**		**4200**		**760**	
PW-06M	5/17/2006	**230**		**5200**		**1100**	
PW-06M	6/13/2006	**410**		**6800**		**1000**	
PW-06M	6/26/2006	**320**		**2100**		**370**	
PW-06M	8/16/2006	**160**		**1900**		**210**	
PW-06M	9/6/2006	**370**		**7700**		**1600**	
PW-06M	10/11/2006	**110**		**3200**		**180**	
PW-06M	10/31/2006	**100**	U	**3640**		**100**	
PW-06M	10/31/2006	**150**		**4150**		**174**	
PW-06M	6/11/2007	20	U	**850**		**20**	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-06M	11/13/2007	**302**	U	**246**		**76**	U
PW-06M	6/16/2008	10	U	**913**		**10**	U
PW-06M	10/14/2008	50	U	**1300**		**60**	
PW-06M	5/28/2009	**100**	U	**3600**		**95**	
PW-06M	10/5/2009	**100**	U	**1600**		**48**	
PW-06M	2/16/2010	10	U	**260**		**20**	U
PW-06M	11/16/2010	2.4		**134**		4.0	
PW-06MB	11/13/2007	**3050**	U	**3120**		**760**	U
PW-06MB	11/13/2007	**2940**	U	**2910**		**740**	U
PW-06MB	6/16/2008	50	U	**3110**		**57**	
PW-06MB	6/16/2008	50	U	**2820**		**50**	
PW-06MB	10/14/2008	42		**2300**		**70**	
PW-06MB	5/28/2009	**100**	U	**1400**		**15**	U
PW-06MB DUP	5/28/2009	**100**	U	**1300**		**27**	
PW-06MB	10/5/2009	**100**	U	**550**		**10**	U
PW-06MB DUP	10/5/2009	**100**	U	**590**		**10**	U
PW-06MB	2/16/2010	10	U	**540**		**20**	U
PW-06MB DUP	2/16/2010	10	U	**510**		**20**	U
PW-06MB	11/16/2010	4.0	U	**156**		4.0	U
PW-06MB DUP	11/16/2010	4.0	U	**172**		4.0	U
PW-06R	12/10/1998	20	U	**940**		**43**	
PW-06R	5/13/1999	30		**1200**		**62**	
PW-06R	6/10/1999	20	U	**1600**		**64**	
PW-06R	9/10/1999	40	U	**2000**		**47**	
PW-06R	11/1/1999	20	U	**510**		**26**	
PW-06R	11/1/1999	50	U	**2100**		**64**	
PW-06R	5/11/2000	6.7		**230**		**16**	
PW-06R	11/15/2000	4.5		**250**		**15**	
PW-06R	6/1/2001	6.1		**250**		**19**	
PW-06R	11/14/2001	6.5		**320**		**24**	
PW-06R	6/11/2002	5.3		**260**		**24**	
PW-06R	11/12/2002	10	U	**650**		**43**	
PW-06R	5/2/2003	5.6		**436**		**35**	
PW-06R	9/3/2003	8.1		**920**		**70**	
PW-06R	4/23/2004	10	U	**565**		**42**	
PW-06R	8/17/2004	10	U	**441**		**37**	
PW-06R	4/19/2005	2.0	U	**683**		**53**	
PW-06R	10/11/2005	2.0	U	**223**		**24**	
PW-06R	4/24/2006	4.1		**109**		**23**	
PW-06R	10/31/2006	3.8		**140**		**26**	
PW-06R	6/11/2007	4.1		**201**		**25**	
PW-06R	11/13/2007	57	U	**159**		**24**	
PW-06R	6/17/2008	3.1		**148**		**21**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-06R	10/14/2008	50	U	**170**		**40**	
PW-06R	5/28/2009	20	U	**300**		3.3	
PW-06R	10/6/2009	20	U	**760**		**11**	
PW-06R	11/16/2010	10	U	**496**		**10**	U
PW-06S	5/21/1998	**1100**		**1700**		**1400**	
PW-06S	12/10/1998	**850**		**3100**		**1600**	
PW-06S	4/21/1999	**1400**		**4000**		**2000**	
PW-06S	11/1/1999	**920**		**5000**		**1500**	
PW-06S	11/1/1999	**970**		**4300**		**1600**	
PW-06S	5/11/2000	**550**		**4600**		**750**	
PW-06S	11/15/2000	**700**		**17000**		**2200**	
PW-06S	11/15/2000	**670**		**19000**		**2200**	
PW-06S	6/1/2001	**800**		**9100**		**1400**	
PW-06S	11/14/2001	**950**		**6200**		**1400**	
PW-06S	6/11/2002	**680**		**2700**		**840**	
PW-06S	6/11/2002	**640**		**2500**		**790**	
PW-06S	11/12/2002	**140**		**2800**		**160**	
PW-06S	5/2/2003	**977**		**13300**		**2050**	
PW-06S	9/3/2003	**620**		**9800**		**1400**	
PW-06S	4/23/2004	**263**		**3000**		**405**	
PW-06S	8/17/2004	**688**		**11100**		**1500**	
PW-06S	12/14/2004	**100**		**3000**		**210**	
PW-06S	2/8/2005	**107**		**2287**		**158**	
PW-06S	4/19/2005	**230**		**2770**		**313**	
PW-06S	9/30/2005	**310**		**2600**		**480**	
PW-06S	10/11/2005	2.0	U	**5520**		**481**	
PW-06S	3/7/2006	**1700**		**2700**		**840**	
PW-06S	3/21/2006	**1100**		**4500**		**660**	
PW-06S	4/3/2006	**820**		**4600**		**720**	
PW-06S	4/24/2006	**725**		**3250**		**578**	
PW-06S	4/24/2006	**876**		**4430**		**791**	
PW-06S	5/1/2006	**960**		**5800**		**1000**	
PW-06S	5/17/2006	**220**		**3000**		**520**	
PW-06S	6/13/2006	**1400**		**3700**		**610**	
PW-06S	6/26/2006	**1100**		**4100**		**600**	
PW-06S	8/16/2006	**250**		**4500**		**530**	
PW-06S	9/6/2006	**210**		**4700**		**450**	
PW-06S	10/11/2006	**530**		**8700**		**1100**	
PW-06S	10/31/2006	**518**		**2030**		**400**	
PW-06S	10/31/2006	**527**		**2000**		**412**	
PW-06S	6/11/2007	**146**		**887**		**70**	
PW-06S	11/13/2007	**302**	U	**2265**		**76**	U
PW-06S	6/16/2008	**327**		**5500**		**649**	
PW-06S	10/14/2008	**150**		**2500**		**240**	
PW-06S	5/28/2009	**100**	U	**2500**		**700**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-06S	10/5/2009	**100**	U	**1200**		**440**	
PW-06S	11/16/2010	12		**307**		**48**	
PW-07M	12/9/1998	2.0	U	**12**		2.3	
PW-07M	4/15/1999	2.0	U	**5.8**		2.0	U
PW-07M	10/28/1999	2.0	U	4.2		2.0	U
PW-07M	5/16/2000	2.0	U	2.4		2.0	U
PW-07M	11/16/2000	2.0	U	2.0	U	2.0	U
PW-07M	6/5/2001	2.0	U	2.0	U	2.0	U
PW-07M	6/5/2001	2.0	U	2.0	U	2.0	U
PW-07M	11/14/2001	2.0	U	2.5		2.0	U
PW-07M	6/11/2002	2.0	U	2.0	U	2.0	U
PW-07M	11/14/2002	2.0	U	2.0	U	2.0	U
PW-07M	11/14/2002	2.0	U	2.0	U	2.0	U
PW-07M	5/8/2003	2.0	U	2.0	U	2.0	U
PW-07M	4/29/2004	2.0	U	2.0	U	2.0	U
PW-07M	8/18/2004	2.0	U	2.0	U	2.0	U
PW-07M	4/22/2005	2.0	U	2.0	U	2.0	U
PW-07M	10/10/2005	2.0	U	2.0	U	2.0	U
PW-07M	3/8/2006	1.0	U	1.3		0.50	U
PW-07M	3/21/2006	1.0	U	1.8		0.50	U
PW-07M	4/3/2006	1.0	U	1.3		0.50	U
PW-07M	4/24/2006	2.0	U	2.0	U	2.0	U
PW-07M	10/30/2006	2.0	U	3.3		2.0	U
PW-07M	6/7/2007	2.0	U	2.0	U	2.0	U
PW-07M	11/14/2007	2.0	U	0.50		0.50	U
PW-07M	11/13/2008	1.0	U	0.36		0.50	U
PW-07M	10/5/2009	2.0	U	1.3		0.44	
PW-07M	11/18/2010	2.0	U	2.0	U	2.0	U
PW-07S	12/9/1998	2.0	U	**40**		2.5	
PW-07S	4/15/1999	2.0	U	**8.5**		2.0	U
PW-07S	10/28/1999	2.0	U	4.6		2.0	U
PW-07S	5/16/2000	2.0	U	2.2		2.0	U
PW-07S	11/16/2000	2.0	U	2.0	U	2.0	U
PW-07S	6/5/2001	2.0	U	2.0	U	2.0	U
PW-07S	11/14/2001	2.0	U	2.0		2.0	U
PW-07S	6/11/2002	2.0	U	2.0	U	2.0	U
PW-07S	11/14/2002	2.0	U	2.0	U	2.0	U
PW-07S	5/8/2003	2.0	U	2.0	U	2.0	U
PW-07S	4/29/2004	2.0	U	2.0	U	2.0	U
PW-07S	8/18/2004	2.0	U	2.0	U	2.0	U
PW-07S	4/22/2005	2.0	U	2.0	U	2.0	U
PW-07S	10/10/2005	2.0	U	2.0	U	2.0	U
PW-07S	3/7/2006	63		**250**		**48**	
PW-07S	3/21/2006	1.0	U	0.20	U	0.50	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-07S	4/3/2006	1.0	U	1.9		0.50	U
PW-07S	4/24/2006	2.0	U	2.0	U	2.0	U
PW-07S	10/30/2006	2.0	U	**5.8**		2.0	U
PW-07S	6/7/2007	2.0	U	2.0	U	2.0	U
PW-07S	11/14/2007	2.0	U	0.40		0.50	U
PW-07S	11/13/2008	1.0	U	0.20	U	0.50	U
PW-07S	10/5/2009	2.0	U	0.59		0.68	
PW-07S	11/18/2010	2.0	U	2.0	U	2.0	U
PW-08M	4/20/1999	10	U	**540**		**12**	
PW-08M	11/1/1999	10	U	**460**		**19**	
PW-08M	5/12/2000	4.0	U	**170**		**7.0**	
PW-08M	11/15/2000	2.5		**150**		**11**	
PW-08M	6/6/2001	4.4		**84**		**11**	
PW-08M	11/15/2001	3.0		**88**		**27**	
PW-08M	6/10/2002	4.5		**58**		**44**	
PW-08M	11/14/2002	2.0	U	**42**		**29**	
PW-08M	11/14/2002	2.0	U	**45**		**32**	
PW-08M	5/8/2003	2.5		**42**		**23**	
PW-08M	5/8/2003	2.5		**42**		**22**	
PW-08M	4/27/2004	2.0	U	**31**		**6.2**	
PW-08M	4/27/2004	2.0	U	**31**		**6.2**	
PW-08M	8/19/2004	2.0	U	**23**		**5.5**	
PW-08M	8/19/2004	2.0	U	**23**		**5.2**	
PW-08M	4/20/2005	2.0	U	**23**		2.3	
PW-08M	10/10/2005	2.0	U	**20**		2.0	U
PW-08M	10/10/2005	2.0	U	**19**		2.0	U
PW-08M	4/20/2006	2.0	U	**23**		2.7	
PW-08M	10/30/2006	2.0	U	**24**		2.0	U
PW-08M	6/14/2007	2.0	U	**23**		2.0	U
PW-08M	11/14/2007	2.0	U	**42**		0.80	
PW-08M	11/13/2008	1.0	U	**26**		0.50	U
PW-08M	9/3/2009	40	U	**25**		4.0	U
PW-08M	11/18/2010	2.0	U	**23**		2.0	U
PW-09M	4/20/1999	2.0	U	2.9		2.0	U
PW-09M	4/20/1999	2.0	U	2.6		2.0	U
PW-09M	11/1/1999	2.0		3.5		1.7	
PW-09M	5/12/2000	2.0	U	2.0	U	2.0	U
PW-09M	11/15/2000	2.0	U	2.0	U	2.0	U
PW-09M	6/6/2001	2.0	U	2.0	U	2.0	U
PW-09M	11/15/2001	2.0	U	2.0		2.0	U
PW-09M	6/10/2002	2.0	U	2.0	U	2.0	U
PW-09M	11/14/2002	2.0	U	2.0	U	2.0	U
PW-09M	5/8/2003	2.0	U	2.0	U	2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-09M	4/27/2004	2.0	U	2.0	U	2.0	U
PW-09M	8/19/2004	2.0	U	2.0	U	2.0	U
PW-09M	4/20/2005	2.0	U	2.0	U	2.0	U
PW-09M	10/10/2005	2.0	U	2.0	U	2.0	U
PW-09M	4/20/2006	2.0	U	2.0	U	2.0	U
PW-09M	10/30/2006	2.0	U	2.0	U	2.0	U
PW-09M	6/8/2007	2.0	U	2.0	U	2.0	U
PW-09M	11/14/2007	2.0	U	0.20	U	0.50	U
PW-09M	11/13/2008	1.0	U	0.36		0.50	U
PW-09M	11/18/2010	2.0	U	2.0	U	2.0	U
PW-10D	5/20/1998	40	U	**2200**		**80**	
PW-10D	12/7/1998	**100**	U	**6300**		**100**	U
PW-10D	4/19/1999	45		**1800**		**62**	
PW-10D	11/4/1999	40	U	**2700**		**83**	
PW-10D	5/15/2000	25	U	**1800**		**39**	
PW-10D	11/16/2000	40	U	**2400**		**53**	
PW-10D	6/1/2001	44		**1800**		**56**	
PW-10D	11/14/2001	11		**660**		**21**	
PW-10D	6/5/2002	24		**290**		**16**	
PW-10D	11/12/2002	10	U	**790**		**20**	
PW-10D	5/2/2003	6.4		**416**		**12**	
PW-10D	4/28/2004	10	U	**587**		**16**	
PW-10D	8/20/2004	5.0	U	**399**		**10**	
PW-10D	8/20/2004	5.0	U	**435**		**12**	
PW-10D	4/22/2005	2.0	U	**95**		2.0	U
PW-10D	10/10/2005	2.0	U	**96**		2.0	U
PW-10D	4/24/2006	2.0	U	**59**		2.0	U
PW-10D	10/26/2006	10	U	**858**		**22**	
PW-10D	6/11/2007	4.0	U	**318**		**7.3**	
PW-10D	11/14/2007	7.2		**469**		**18**	
PW-10D	6/17/2008	4.0	U	**298**		**7.7**	
PW-10D	5/28/2009	2.0	U	**53**		0.30	U
PW-10D	10/6/2009	2.0	U	**75**		0.69	
PW-10D	11/16/2010	2.0	U	**26**		2.0	U
PW-10M	5/20/1998	**130**		**130**		**30**	
PW-10M	12/7/1998	**110**		**140**		**32**	
PW-10M	4/19/1999	**82**		**66**		**22**	
PW-10M	11/4/1999	**100**		**120**		**29**	
PW-10M	5/15/2000	**180**		**180**		**50**	
PW-10M	11/16/2000	**310**		**390**		**92**	
PW-10M	6/1/2001	**190**		**250**		**58**	
PW-10M	11/14/2001	**120**		**210**		**44**	
PW-10M	6/5/2002	**150**		**230**		**57**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-10M	11/12/2002	**140**		**230**		**61**	
PW-10M	5/2/2003	**157**		**238**		**61**	
PW-10M	4/28/2004	47		**112**		**19**	
PW-10M	8/20/2004	23		**79**		**10**	
PW-10M	4/22/2005	47		**245**		**40**	
PW-10M	4/22/2005	47		**236**		**38**	
PW-10M	10/10/2005	32		**149**		**23**	
PW-10M	4/24/2006	53		**230**		**36**	
PW-10M	10/26/2006	16		**97**		**13**	
PW-10M	6/11/2007	41		**190**		**24**	
PW-10M	11/14/2007	60	U	**48**		**15**	U
PW-10M	6/17/2008	3.1		**27**		3.0	
PW-10M	11/13/2008	4.9		**26**		3.5	
PW-10M	5/28/2009	2.0	U	3.4		0.62	
PW-10M	10/6/2009	3.1		**12**		3.5	
PW-10M	11/16/2010	2.0	U	**5.1**		2.0	U
PW-11D	12/3/1998	20	U	**1200**		**44**	
PW-11D	4/15/1999	20		**330**		**41**	
PW-11D	10/29/1999	27		**570**		**42**	
PW-11D	5/15/2000	5.7		**81**		**7.8**	
PW-11D	11/16/2000	2.0	U	**37**		2.8	
PW-11D	5/30/2001	2.0	U	**14**		2.0	U
PW-11D	11/14/2001	2.0	U	**9.1**		2.0	U
PW-11D	6/5/2002	2.0	U	**6.7**		2.0	U
PW-11D	11/12/2002	2.0	U	3.3		2.0	U
PW-11D	5/7/2003	2.0	U	2.6		2.0	U
PW-11D	4/27/2004	2.0	U	2.0	U	2.0	U
PW-11D	8/20/2004	2.0	U	2.0	U	2.0	U
PW-11D	10/10/2005	2.0	U	**8.2**		2.0	U
PW-11D	10/30/2006	2.0	U	2.0	U	2.0	U
PW-11D	11/14/2007	2.0	U	0.40		0.50	U
PW-11D	11/13/2008	1.0	U	0.59		0.50	U
PW-11D	5/29/2009	2.0	U	0.51		0.30	U
PW-11D	10/6/2009	2.0	U	0.67		0.20	U
PW-11D	11/16/2010	2.0	U	2.0	U	2.0	U
PW-11M	12/3/1998	26		**45**		**13**	
PW-11M	4/15/1999	3.8		**8.6**		3.2	
PW-11M	10/29/1999	2.0	U	2.0	U	2.0	U
PW-11M	5/15/2000	2.0	U	2.0	U	2.0	U
PW-11M	11/16/2000	2.0	U	**11**		2.0	U
PW-11M	5/30/2001	2.0	U	**14**		2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-11M	11/14/2001	2.0	U	4.7		2.0	U
PW-11M	6/5/2002	2.0	U	2.0	U	2.0	U
PW-11M	11/12/2002	2.0	U	2.0	U	2.0	U
PW-11M	5/6/2003	2.0	U	2.0	U	2.0	U
PW-11M	4/27/2004	2.0	U	2.0	U	2.0	U
PW-11M	8/20/2004	2.0	U	2.0	U	2.0	U
PW-11M	10/10/2005	2.0	U	2.0	U	2.0	U
PW-11M	10/30/2006	2.0	U	2.0	U	2.0	U
PW-11M	11/14/2007	2.0	U	0.20		0.50	U
PW-11M	11/13/2008	1.0	U	0.28		0.50	U
PW-11M	10/6/2009	2.0	U	0.52		0.20	U
PW-11M	11/16/2010	2.0	U	2.0	U	2.0	U
PW-12D	5/15/1998	**87**		**550**		**52**	
PW-12D	11/25/1998	56		**700**		**43**	
PW-12D	4/8/1999	28		**550**		**33**	
PW-12D	5/13/1999	30		**660**		**35**	
PW-12D	6/10/1999	35		**510**		**36**	
PW-12D	7/16/1999	28		**480**		**32**	
PW-12D	8/12/1999	**71**		**430**		**65**	
PW-12D	9/10/1999	53		**380**		**41**	
PW-12D	10/26/1999	24		**240**		**18**	
PW-12D	5/8/2000	12		**190**		**11**	
PW-12D	11/9/2000	6.0		**130**		**5.9**	
PW-12D	5/17/2001	3.4		**140**		4.2	
PW-12D	6/7/2001	4.1		**120**		4.7	
PW-12D	11/7/2001	2.0	U	**110**		2.0	U
PW-12D	6/3/2002	20	U	**180**		**20**	U
PW-12D	11/5/2002	2.0	U	**24**		2.0	U
PW-12D	4/29/2003	2.0	U	**56**		2.0	U
PW-12D	4/21/2004	2.0	U	**16**		2.0	U
PW-12D	8/12/2004	2.0	U	**13**		2.0	U
PW-12D	4/19/2005	2.0	U	**9.1**		2.0	U
PW-12D	10/4/2005	2.0	U	**7.6**		2.0	U
PW-12D	4/20/2006	2.0	U	**8.0**		2.0	U
PW-12D	10/27/2006	2.0	U	**5.6**		2.0	U
PW-12D	2/20/2007	3.9		**7.2**		**7.7**	
PW-12D	6/4/2007	2.0	U	2.9		2.2	
PW-12D	11/13/2007	4.7		2.5		2.6	
PW-12D	10/6/2009	2.8		3.5		0.78	
PW-12D	11/16/2010	2.2		2.0	U	2.0	U
PW-12M	5/15/1998	**85**		**610**		**53**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-12M	11/25/1998	57		**700**		**41**	
PW-12M	4/7/1999	30		**440**		**62**	
PW-12M	4/8/1999	46		**530**		**42**	
PW-12M	5/13/1999	69		**630**		**170**	
PW-12M	6/10/1999	41		**490**		**78**	
PW-12M	7/16/1999	**93**		**190**		**71**	
PW-12M	8/12/1999	58		**63**		**41**	
PW-12M	9/10/1999	**380**		4.0	U	**5.3**	
PW-12M	10/26/1999	5.3		**410**		**10**	
PW-12M	5/8/2000	2.0	U	**41**		2.0	U
PW-12M	11/9/2000	2.0	U	**18**		2.0	U
PW-12M	5/17/2001	50	U	**1100**		**50**	U
PW-12M	6/7/2001	10	U	**880**		**15**	
PW-12M	11/7/2001	2.0	U	**70**		2.0	U
PW-12M	6/3/2002	2.0	U	**10**		2.0	U
PW-12M	11/5/2002	2.0	U	2.7		2.0	U
PW-12M	4/29/2003	2.0	U	3.2		2.0	U
PW-12M	4/21/2004	2.0	U	2.0	U	2.0	U
PW-12M	8/12/2004	2.0	U	2.0	U	2.0	U
PW-12M	4/19/2005	2.0	U	2.2		2.0	U
PW-12M	10/4/2005	2.0	U	2.0	U	2.0	U
PW-12M	4/20/2006	2.0	U	2.0	U	2.0	U
PW-12M	10/27/2006	2.0	U	2.0	U	2.0	U
PW-12M	2/20/2007	1.0	U	1.7		0.50	U
PW-12M	6/4/2007	2.0	U	2.0	U	2.0	U
PW-12M	11/13/2007	2.0	U	1.9		0.5	U
PW-12M	10/6/2009	2.0	U	4.0		0.2	U
PW-12M	11/16/2010	2.0	U	2.0	U	2.0	U
PW-12R	5/15/1998	**110**		**1200**		**89**	
PW-12R	11/25/1998	**120**		**870**		**340**	
PW-12R	4/8/1999	**130**		**530**		**380**	
PW-12R	5/13/1999	**350**		**260**		**480**	
PW-12R	6/10/1999	**210**		**330**		**680**	
PW-12R	7/16/1999	**280**		**280**		**560**	
PW-12R	8/12/1999	**570**		**46**		**490**	
PW-12R	9/10/1999	**490**		**53**		**760**	
PW-12R	10/26/1999	**280**		**620**		**250**	
PW-12R	10/26/1999	**620**		**89**		**650**	
PW-12R	5/8/2000	**280**		**650**		**300**	
PW-12R	11/9/2000	**250**		**510**		**250**	
PW-12R	5/17/2001	**130**		**690**		**120**	
PW-12R	6/7/2001	**110**		**480**		**95**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-12R	11/7/2001	**330**		**190**		**100**	
PW-12R	6/3/2002	**130**		**290**		**110**	
PW-12R	11/5/2002	**160**		**260**		**110**	
PW-12R	4/29/2003	**96**		**340**		**71**	
PW-12R	4/21/2004	**79**		**282**		**60**	
PW-12R	8/12/2004	56		**234**		**42**	
PW-12R	4/19/2005	44		**184**		**33**	
PW-12R	10/4/2005	62		**212**		**44**	
PW-12R	4/20/2006	67		**173**		**39**	
PW-12R	10/27/2006	46		**193**		**30**	
PW-12R	2/20/2007	60	U	**200**		**23**	
PW-12R	6/4/2007	39		**147**		**19**	
PW-12R	11/13/2007	**77**	U	**173**		**7.3**	
PW-12R	6/19/2008	65		**112**		**15**	
PW-12R	5/29/2009	**93**		**240**		**57**	
PW-12R	10/6/2009	**380**		**120**		**39**	
PW-12R	11/16/2010	**190**		**55**		**16**	
PW-12S	5/14/1998	2.0	U	**8.7**		2.0	U
PW-12S	11/25/1998	4.1		**9.7**		2.4	
PW-12S	4/8/1999	2.0	U	2.0	U	2.0	U
PW-12S	5/13/1999	8.7		**36**		3.9	
PW-12S	6/10/1999	2.0	U	3.3		2.0	U
PW-12S	7/16/1999	2.0	U	**170**		2.0	U
PW-12S	8/12/1999	2.0	U	**62**		2.0	U
PW-12S	9/10/1999	2.0	U	**21**		2.0	U
PW-12S	10/26/1999	2.0	U	2.8		2.0	U
PW-12S	5/8/2000	2.0	U	2.1		2.0	U
PW-12S	11/9/2000	2.0	U	**72**		2.0	U
PW-12S	5/17/2001	4.0	U	**260**		4.0	U
PW-12S	6/7/2001	4.0	U	**200**		4.0	U
PW-12S	11/7/2001	2.0	U	**13**		2.0	U
PW-12S	6/3/2002	2.0	U	2.0	U	2.0	U
PW-12S	11/5/2002	2.0	U	2.0	U	2.0	U
PW-12S	4/29/2003	2.0	U	2.0	U	2.0	U
PW-12S	4/21/2004	2.0	U	2.2		2.0	U
PW-12S	8/12/2004	2.0	U	2.0	U	2.0	U
PW-12S	4/19/2005	2.0	U	2.0	U	2.0	U
PW-12S	10/4/2005	2.0	U	2.0	U	2.0	U
PW-12S	4/20/2006	2.0	U	2.0	U	2.0	U
PW-12S	10/27/2006	2.0	U	2.0	U	2.0	U
PW-12S	2/20/2007	1.0	U	1.9		0.50	U
PW-12S	6/4/2007	2.0	U	2.0		2.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-12S	11/13/2007	2.0	U	2.7		0.5	U
PW-12S	10/6/2009	2.0	U	2.7		0.2	U
PW-12S	11/16/2010	2.0	U	2.0	U	2.0	U
PW-13D	7/24/1998	**85**		**1000**		**54**	
PW-13D	11/24/1998	**100**		**1100**		**63**	
PW-13D	4/8/1999	**92**		**760**		**55**	
PW-13D	5/13/1999	**96**		**720**		**54**	
PW-13D	6/10/1999	**110**		**810**		**92**	
PW-13D	7/16/1999	**130**		**650**		**140**	
PW-13D	8/12/1999	**780**		**35**		**110**	
PW-13D	9/10/1999	**1800**		**69**		**160**	
PW-13D	10/19/1999	**110**		**1000**		**131**	
PW-13D	5/8/2000	66		**1100**		**180**	
PW-13D	11/13/2000	69		**1100**		**150**	
PW-13D	5/29/2001	69		**1100**		**100**	
PW-13D	11/6/2001	48		**790**		**62**	
PW-13D	5/31/2002	38		**650**		**51**	
PW-13D	11/4/2002	29		**520**		**58**	
PW-13D	4/30/2003	29		**423**		**47**	
PW-13D	4/22/2004	18		**320**		**43**	
PW-13D	8/11/2004	14		**230**		**49**	
PW-13D	4/13/2005	14		**257**		**49**	
PW-13D	10/6/2005	8.9		**192**		**37**	
PW-13D	4/19/2006	7.7		**130**		**31**	
PW-13D	10/27/2006	5.7		**115**		**27**	
PW-13D	2/13/2007	50	U	**160**		**48**	
PW-13D	6/8/2007	3.9		**105**		**13**	
PW-13D	11/13/2007	52	U	**54**		**22**	
PW-13D	6/19/2008	2.0	U	**59**		**12**	
PW-13D	11/17/2008	1.9	U	**45**		**21**	
PW-13D	5/29/2009	2.0	U	**37**		**14**	
PW-13D	10/6/2009	2.0	U	**44**		**17**	
PW-13D	11/16/2010	2.0	U	**40**		**14**	
PW-13M	7/23/1998	40		**400**		**25**	
PW-13M	11/23/1998	43		**630**		**30**	
PW-13M	11/23/1998	39		**490**		**26**	
PW-13M	2/8/1999	12		**140**		**10**	
PW-13M	2/8/1999	13		**120**		**9.4**	
PW-13M	4/7/1999	25		**270**		**23**	
PW-13M	4/8/1999	25		**240**		**18**	
PW-13M	5/13/1999	40		**320**		**22**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-13M	6/10/1999	20		**170**		**13**	
PW-13M	7/16/1999	15		**110**		**10**	
PW-13M	8/12/1999	12		**90**		**8.5**	
PW-13M	9/10/1999	9.1		**120**		**8.6**	
PW-13M	10/19/1999	11		**87**		**8.0**	
PW-13M	5/8/2000	3.1		**71**		3.8	
PW-13M	11/13/2000	2.0	U	**80**		3.0	
PW-13M	5/29/2001	2.0	U	**53**		2.0	U
PW-13M	11/6/2001	2.0	U	**120**		2.8	
PW-13M	5/31/2002	2.0	U	**100**		3.1	
PW-13M	11/4/2002	2.0	U	**120**		3.8	
PW-13M	4/30/2003	2.0	U	**183**		**5.2**	
PW-13M	4/22/2004	2.0	U	**156**		4.3	
PW-13M	8/11/2004	2.0	U	**106**		3.4	
PW-13M	4/13/2005	2.0	U	**79**		3.2	
PW-13M	10/6/2005	2.0	U	**35**		2.0	U
PW-13M	4/19/2006	2.0	U	**39**		2.2	
PW-13M	10/27/2006	2.0	U	**21**		2.0	U
PW-13M	2/13/2007	50	U	**65**		**25**	U
PW-13M	6/8/2007	2.0	U	**19**		2.0	U
PW-13M	11/13/2007	2.0	U	**12**		0.60	
PW-13M	6/19/2008	2.0	U	**13**		2.0	U
PW-13M	11/17/2008	1.0	U	**9.4**		0.56	
PW-13M	5/29/2009	2.0	U	**8.9**		0.60	
PW-13M	10/6/2009	2.0	U	**8.9**		0.74	
PW-13M	11/16/2010	2.0	U	**8.1**		2.00	U
PW-13S	7/23/1998	29		**93**		**8.4**	
PW-13S	11/24/1998	25		**94**		**9.6**	
PW-13S	4/8/1999	24		**70**		**9.8**	
PW-13S	5/13/1999	31		**120**		**20**	U
PW-13S	5/13/1999	27		**78**		**8.4**	
PW-13S	6/10/1999	28		**88**		**9.9**	
PW-13S	7/16/1999	26		**86**		**10**	
PW-13S	8/12/1999	15		**68**		**6.6**	
PW-13S	9/10/1999	6.1		**41**		3.3	
PW-13S	10/20/1999	12		**55**		**5.0**	
PW-13S	5/8/2000	4.1		**89**		3.1	
PW-13S	11/13/2000	2.0	U	**42**		2.0	U
PW-13S	5/29/2001	2.0	U	**140**		2.0	U
PW-13S	11/6/2001	2.0	U	**180**		2.0	U
PW-13S	5/31/2002	2.0	U	**200**		2.1	
PW-13S	11/4/2002	4.0	U	**250**		4.0	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-13S	4/30/2003	2.0	U	**160**		2.0	U
PW-13S	4/22/2004	2.0	U	**52**		2.0	U
PW-13S	8/11/2004	2.0	U	**44**		2.0	U
PW-13S	4/13/2005	2.0	U	**20**		2.0	U
PW-13S	10/6/2005	2.0	U	**12**		2.0	U
PW-13S	4/19/2006	2.0	U	**7.8**		2.0	U
PW-13S	10/27/2006	2.0	U	**8.7**		2.0	U
PW-13S	2/13/2007	1.0	U	4.7		0.5	U
PW-13S	6/8/2007	2.0	U	4.6		2.0	U
PW-13S	11/13/2007	2.0	U	**5.5**		0.50	U
PW-13S	11/17/2008	1.0	U	4.5		0.50	U
PW-13S	10/6/2009	2.0	U	**47**		**5.10**	
PW-13S	11/16/2010	2.0	U	**26**		2.80	
PW-14D	7/24/1998	**110**		**2500**		**180**	
PW-14D	11/23/1998	**130**		**1900**		**150**	
PW-14D	4/7/1999	**120**		**2300**		**220**	
PW-14D	5/13/1999	**150**		**2800**		**200**	
PW-14D	6/10/1999	**170**		**2900**		**240**	
PW-14D	7/16/1999	**140**		**2700**		**210**	
PW-14D	8/12/1999	**130**		**2500**		**190**	
PW-14D	9/10/1999	**110**		**2700**		**150**	
PW-14D	10/21/1999	**100**		**1900**		**140**	
PW-14D	5/8/2000	**100**		**2700**		**120**	
PW-14D	11/13/2000	57		**1700**		**84**	
PW-14D	5/29/2001	46		**1200**		**62**	
PW-14D	11/6/2001	33		**910**		**56**	
PW-14D	5/29/2002	32		**840**		**53**	
PW-14D	11/4/2002	26		**800**		**48**	
PW-14D	4/30/2003	30		**736**		**48**	
PW-14D	4/22/2004	17		**507**		**27**	
PW-14D	8/11/2004	12		**338**		**19**	
PW-14D	2/8/2005	5.6		**111**		**38**	
PW-14D	4/13/2005	8.3		**233**		**46**	
PW-14D	10/5/2005	6.2		**166**		**13**	
PW-14D	4/19/2006	5.8		**140**		**17**	
PW-14D	10/27/2006	4.6		**122**		**13**	
PW-14D	2/13/2007	50	U	**280**		**38**	
PW-14D	6/7/2007	3.6		**105**		**9.1**	
PW-14D	11/14/2007	60	U	**85**		**15**	U
PW-14D	6/19/2008	2.5		**64**		**7.1**	
PW-14D	11/14/2008	2.4		**40**		**6.9**	
PW-14D	5/29/2009	2.0	U	**49**		**7.3**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-14D DUP	5/29/2009	2.0	U	**49**		**7.8**	
PW-14D	10/6/2009	2.7		**56**		**11**	
PW-14D DUP	10/6/2009	2.5		**59**		**9.8**	
PW-14D	11/16/2010	2.0	U	**47**		**9.3**	
PW-14M	7/23/1998	**210**		**1300**		**110**	
PW-14M	11/23/1998	**190**		**1400**		**92**	
PW-14M	11/23/1998	**200**		**1200**		**93**	
PW-14M	2/8/1999	**190**		**1200**		**96**	
PW-14M	2/8/1999	**180**		**1200**		**91**	
PW-14M	4/7/1999	**160**		**760**		**92**	
PW-14M	4/7/1999	**190**		**1100**		**110**	
PW-14M	5/13/1999	**250**		**1400**		**110**	
PW-14M	6/10/1999	**300**		**1400**		**130**	
PW-14M	7/16/1999	**200**		**940**		**87**	
PW-14M	8/12/1999	**200**		**940**		**85**	
PW-14M	9/10/1999	**200**		**1100**		**87**	
PW-14M	10/21/1999	**210**		**940**		**87**	
PW-14M	5/8/2000	**82**		**730**		**48**	
PW-14M	11/13/2000	**170**		**1000**		**62**	
PW-14M	5/29/2001	**140**		**890**		**59**	
PW-14M	11/6/2001	**130**		**600**		**49**	
PW-14M	5/29/2002	**140**		**760**		**60**	
PW-14M	11/4/2002	**220**		**1300**		**87**	
PW-14M	4/30/2003	**196**		**1060**		**76**	
PW-14M	4/22/2004	**185**		**1260**		**78**	
PW-14M	8/11/2004	**172**		**1130**		**67**	
PW-14M	2/8/2005	**227**		**1098**		**250**	U
PW-14M	4/13/2005	**167**		**1270**		**79**	
PW-14M	10/5/2005	**126**		**776**		**51**	
PW-14M	4/19/2006	**104**		**561**		**45**	
PW-14M	5/9/2006	48		**340**		**20**	
PW-14M	5/9/2006	46		**330**		**25**	U
PW-14M	5/9/2006	51		**340**		**25**	U
PW-14M	5/9/2006	5.0	U	**320**		2.5	U
PW-14M	10/27/2006	**83**		**528**		**35**	
PW-14M	12/18/2006	**100**	U	**460**		**50**	U
PW-14M	2/13/2007	**170**		**1400**		**97**	
PW-14M	3/26/2007	**140**		**650**		**98**	
PW-14M	6/7/2007	**140**		**710**		**53**	
PW-14M	6/7/2007	**120**		**720**		**43**	
PW-14M	6/7/2007	**120**		**580**		**51**	
PW-14M	6/7/2007	**100**		**525**		**35**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-14M	6/7/2007	**130**		**680**		**64**	
PW-14M	6/7/2007	**98**		**541**		**35**	
PW-14M	6/7/2007	**97**		**538**		**33**	
PW-14M	6/7/2007	**94**		**578**		**34**	
PW-14M	6/7/2007	**94**		**588**		**33**	
PW-14M	11/14/2007	**150**	U	**682**		**19**	
PW-14M	6/19/2008	50		**444**		**26**	
PW-14M	11/14/2008	**70**		**450**		**84**	
PW-14M	5/29/2009	40		**360**		**29**	
PW-14M	10/6/2009	41		**340**		**51**	
PW-14M	11/16/2010	28		**216**		**23**	
PW-14M DUP	11/16/2010	27		**196**		**22**	
PW-14S	7/23/1998	**95**		**840**		**76**	
PW-14S	7/23/1998	**91**		**870**		**PW**	
PW-14S	11/23/1998	**120**		**990**		**82**	
PW-14S	4/7/1999	**82**		**620**		**61**	
PW-14S	5/13/1999	**120**		**790**		**69**	
PW-14S	5/13/1999	**130**		**890**		**73**	
PW-14S	6/10/1999	**99**		**610**		**58**	
PW-14S	7/16/1999	61		**520**		**41**	
PW-14S	8/12/1999	47		**560**		**33**	
PW-14S	9/10/1999	41		**640**		**31**	
PW-14S	10/21/1999	32		**330**		**22**	
PW-14S	5/8/2000	13		**230**		**11**	
PW-14S	11/13/2000	17		**300**		**12**	
PW-14S	5/29/2001	7.2		**320**		**7.8**	
PW-14S	11/6/2001	7.3		**220**		**7.2**	
PW-14S	5/29/2002	3.5		**80**		3.3	
PW-14S	11/4/2002	12		**200**		**9.4**	
PW-14S	4/30/2003	4.2		**77**		3.5	
PW-14S	4/22/2004	2.0	U	**39**		2.0	U
PW-14S	8/11/2004	5.9		**80**		3.9	
PW-14S	4/13/2005	2.0	U	**33**		2.0	U
PW-14S	10/5/2005	6.3		**89**		4.4	
PW-14S	4/19/2006	5.1		**64**		3.4	
PW-14S	10/27/2006	3.4		**51**		2.3	
PW-14S	2/13/2007	50	U	**98**		**25**	U
PW-14S	6/7/2007	2.0		**23**		1.2	
PW-14S	6/7/2007	2.1		**24**		1.3	
PW-14S	6/7/2007	3.1		**44**		2.1	
PW-14S	6/7/2007	2.4		**44**		2.0	U
PW-14S	6/7/2007	3.3		**32**		1.9	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-14S	6/7/2007	2.3		**40**		2.0	U
PW-14S	6/7/2007	2.0	U	**33**		2.0	U
PW-14S	6/7/2007	2.0	U	**33**		2.0	U
PW-14S	6/7/2007	2.0	U	**33**		2.0	U
PW-14S	11/14/2007	10	U	**36**		3.0	U
PW-14S	6/19/2008	2.0		**36**		2.0	U
PW-14S	11/14/2008	2.4		**27**		1.4	
PW-14S	5/29/2009	3.3		**39**		2.1	
PW-14S	10/6/2009	7.1		**72**		4.4	
PW-14S	11/16/2010	2.0	U	**13**		2.0	U
PW-15D	10/12/2005	2.0	U	**16**		2.0	U
PW-15D	3/14/2006	50	U	**200**		**25**	U
PW-15D	3/28/2006	50	U	**170**		**25**	U
PW-15D	4/25/2006	2.0	U	**184**		2.0	U
PW-15D	4/25/2006	50	U	**200**		**25**	U
PW-15D	5/9/2006	50	U	**200**		**25**	U
PW-15D	5/17/2006	50	U	**100**		**25**	U
PW-15D	7/19/2006	50	U	**120**		**25**	U
PW-15D	11/1/2006	20	U	**570**		**20**	U
PW-15D	6/29/2007	4.0	U	**314**		4.0	U
PW-15D	11/14/2007	**150**	U	**271**		**30**	U
PW-15D	6/19/2008	2.0	U	**52**		2.0	
PW-15D	10/15/2008	10	U	**34**		**5.0**	U
PW-15M	6/8/2006	50	U	**1600**		**25**	U
PW-15M	7/26/2006	50	U	**1700**		**36**	
PW-15M	11/1/2006	2.0	U	**80**		2.0	U
PW-15M	6/29/2007	10	U	**576**		**12**	
PW-15M	6/29/2007	10	U	**587**		**13**	
PW-15M	11/14/2007	**150**	U	**107**		**30**	U
PW-15M	6/19/2008	4.0	U	**187**		4.0	U
PW-15M	10/15/2008	50	U	**180**		**25**	U
PW-15M	5/29/2009	20	U	**330**		3.0	U
PW-15M	10/5/2009	2	U	**100**		0.2	U
PW-15M	11/18/2010	2.0	U	3.0		2.0	U
PW-16D	10/12/2005	**102**		**1190**		**2870**	
PW-16D	3/14/2006	**70**		**70**		**40**	
PW-16D	3/28/2006	27		**80**		**20**	
PW-16D	4/24/2006	2.2		**43**		2.0	U
PW-16D	4/24/2006	4.6		**56**		1.5	
PW-16D	5/9/2006	1.2		**24**		0.50	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-16D	5/24/2006	50	U	**520**		**130**	
PW-16D	6/27/2006	50	U	**420**		**230**	
PW-16D	7/19/2006	**110**		**810**		**310**	
PW-16D	11/1/2006	38		**571**		**299**	
PW-16D	6/27/2007	40	U	**2160**		**532**	
PW-16D	11/13/2007	**600**	U	**532**		**150**	U
PW-16D	6/17/2008	50	U	**2370**		**714**	
PW-16D	5/29/2009	**100**	U	**390**		**82**	
PW-16D	10/5/2009	33		**350**		**54**	
PW-16D	2/16/2010	10	U	**360**		**43**	
PW-16D	11/18/2010	16		**248**		**29**	
PW-16M	6/27/2006	50	U	**940**		**140**	
PW-16M	7/26/2006	50	U	**920**		**76**	
PW-16M	11/1/2006	35		**376**		**72**	
PW-16M	6/27/2007	63		**1220**		**103**	
PW-16M	11/13/2007	**600**	U	**840**		**150**	U
PW-16M	6/17/2008	20	U	**1370**		**41**	
PW-16M	6/17/2008	20	U	**1370**		**44**	
PW-16M	11/13/2008	47		**860**		**52**	
PW-16M	5/29/2009	**100**	U	**390**		**19**	
PW-16M	10/5/2009	26		**450**		**27**	
PW-16M	2/16/2010	10	U	**480**		**23**	
PW-16M	11/18/2010	15		**331**		**16**	
PW-17M	10/12/2005	31		**263**		**52**	
PW-17M	3/14/2006	**73**		**170**		**35**	
PW-17M	3/28/2006	50	U	**190**		**25**	U
PW-17M	4/25/2006	12		**106**		**29**	
PW-17M	4/25/2006	12		**110**		**30**	
PW-17M	5/24/2006	50	U	**180**		**26**	
PW-17M	7/26/2006	50	U	**170**		**35**	
PW-17M	8/31/2006	29		**250**		**46**	
PW-17M	11/1/2006	10	U	**436**		**39**	
PW-17M	6/27/2007	39		**1270**		**117**	
PW-17M	11/14/2007	**300**	U	**3600**		**37**	
PW-17M	11/14/2007	**300**	U	**3490**		**37**	
PW-17M	6/18/2008	10	U	**584**		**34**	
PW-17M	6/18/2008	10	U	**638**		**35**	
PW-17M	10/15/2008	50	U	**320**		**31**	
PW-17M	5/29/2009	20	U	**62**		4.2	
PW-17M	10/5/2009	31		**120**		**9.5**	
PW-17M	11/18/2010	20	U	**783**		**77**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-17S	10/12/2005	52		**297**		**60**	
PW-17S	3/8/2006	**120**		**570**		**110**	
PW-17S	3/21/2006	**110**		**580**		**63**	
PW-17S	4/3/2006	**130**		**380**		**55**	
PW-17S	4/24/2006	**70**		**267**		**56**	
PW-17S	5/1/2006	**140**		**580**		**130**	
PW-17S	5/24/2006	69		**330**		**39**	
PW-17S	11/1/2006	38		**195**		**41**	
PW-17S	6/27/2007	49		**229**		**46**	
PW-17S	11/13/2008	10	U	**790**		**18**	
PW-17S	10/5/2009	40	U	**810**		**25**	
PW-17S	11/18/2010	14		**666**		**42**	
PW-18D	10/12/2005	2.0	U	**2620**		**225**	
PW-18D	4/24/2006	2.0	U	**494**		**18**	
PW-18D	5/11/2006	50	U	**290**		**25**	U
PW-18D	5/24/2006	50	U	**770**		**58**	
PW-18D	7/19/2006	50	U	**510**		**25**	U
PW-18D	9/13/2006	50	U	**2100**		**160**	
PW-18D	11/1/2006	10	U	**521**		**10**	U
PW-18D	6/27/2007	**100**	U	**4870**		**647**	
PW-18D	11/13/2007	38	U	**146**		**150**	U
PW-18D	6/18/2008	10	U	**512**		**10**	U
PW-18D	10/15/2008	50	U	**1300**		**62**	
PW-18D	10/15/2008	50	U	**1400**		**67**	
PW-18D	5/29/2009	**100**	U	**6700**		**720**	
PW-18D	10/5/2009	**400**	U	**8900**		**920**	
PW-18D	2/16/2010	10	U	**560**		**51**	
PW-18M	7/26/2006	50	U	**840**		**25**	U
PW-18M	8/31/2006	50	U	**1100**		**25**	U
PW-18M	11/1/2006	20	U	**679**		**20**	U
PW-18M	6/27/2007	10	U	**427**		**10**	
PW-18M	11/13/2007	26	U	**159**		**100**	U
PW-18M	11/13/2008	10	U	**91**		**5.0**	U
PW-18M	10/5/2009	20	U	**230**		3.9	
PW-18M	2/16/2010	10	U	**570**		**20**	U
PW-18M	11/18/2010	4.0	U	**295**		**5.0**	
PW-19D	10/12/2005	**128**		**63**		**61**	
PW-19D	3/14/2006	50	U	**300**		**78**	
PW-19D	3/28/2006	50	U	**320**		**110**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-19D	4/24/2006	49		**300**		**121**	
PW-19D	4/24/2006	**77**		**350**		**100**	
PW-19D	6/13/2006	50	U	**230**		**49**	
PW-19D	9/13/2006	32		**380**		**77**	
PW-19D	11/1/2006	34		**448**		**73**	
PW-19D	6/29/2007	68		**516**		**114**	
PW-19D	11/14/2007	**150**	U	**312**		**16**	
PW-19D	6/16/2008	23		**191**		**33**	
PW-19D	10/15/2008	50	U	**390**		**60**	
PW-19D	5/29/2009	**100**	U	**230**		**46**	
PW-19D	10/6/2009	32		**280**		**48**	
PW-19D	2/16/2010	10	U	**210**		**27**	
PW-19D	11/16/2010	15		**187**		**22**	
PW-19M	6/13/2006	**410**		**240**		**420**	
PW-19M	11/1/2006	**296**		**184**		**101**	
PW-19M	6/29/2007	**109**		**432**		**230**	
PW-19M	11/14/2007	**150**	U	**1110**		**104**	
PW-19M	10/15/2008	**120**		**1800**		**170**	
PW-19M	10/15/2008	**100**		**1500**		**150**	
PW-19M	5/29/2009	**110**		**960**		**170**	
PW-19M	10/6/2009	**170**		**1500**		**300**	
PW-19M	2/16/2010	**76**		**1200**		**150**	
PW-19M	11/16/2010	62		**1080**		**125**	
PW-20D	10/13/2005	2.0	U	**474**		**14**	
PW-20D	4/24/2006	**247**		**791**		**462**	
PW-20D	4/24/2006	**200**		**770**		**360**	
PW-20D	11/1/2006	**100**	U	**4880**		**289**	
PW-20D	6/27/2007	4.0	U	**156**		**11**	
PW-20D	11/13/2007	**302**	U	**2530**		**38**	U
PW-20D	6/17/2008	**100**	U	**4840**		**205**	
PW-20D	9/3/2009	2	U	4.8		0.2	U
PW-20D	10/5/2009	50	U	**2500**		**72**	
PW-20D	11/16/2010	2.0	U	3.2		2.0	U
PW-20D DUP	11/16/2010	2.0	U	2.8		2.0	U
PW-20M	6/13/2006	50	U	**1300**		**54**	
PW-20M	11/1/2006	20	U	**763**		**48**	
PW-20M	6/27/2007	**85**		**2340**		**303**	
PW-20M	11/13/2007	**602**	U	**2030**		**115**	
PW-20M	6/16/2008	10	U	**666**		**21**	
PW-20M	10/14/2008	50	U	**1100**		**27**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-20M	5/28/2009	**100**	U	**110**		**15**	U
PW-20M	10/6/2009	20	U	**130**		**6.9**	
PW-20M DUP	10/6/2009	2	U	**140**		**7.8**	
PW-20M	11/16/2010	7.3		**177**		**10**	
PW-20S	6/13/2006	50	U	**1400**		**460**	
PW-20S	11/1/2006	**433**		**677**		**170**	
PW-20S	6/27/2007	**114**		**1510**		**132**	
PW-20S	11/13/2007	**302**	U	**913**		**72**	
PW-20S	6/16/2008	59		**1250**		**61**	
PW-20S	10/14/2008	50	U	**1700**		**82**	
PW-20S	5/28/2009	**400**		**1000**		**100**	
PW-20S	10/6/2009	**370**		**1500**		**99**	
PW-20S	11/16/2010	**1790**		**1240**		**252**	
PW-21	6/9/2006	50	U	**160**		**25**	U
PW-21	9/27/2006	50	U	**38**		**25**	U
PW-21	10/31/2006	2.0	U	**35**		2.0	U
PW-21	10/31/2006	2.0	U	**35**		2.0	U
PW-21	11/13/2006	50	U	**100**		**25**	U
PW-21	11/13/2006	1.4		**39**		2.1	
PW-21	11/14/2006	50	U	**69**		**25**	U
PW-21	11/15/2006	50	U	**53**		**25**	U
PW-21	11/16/2006	50	U	**52**		**25**	U
PW-21	11/17/2006	1.0	U	**75**		2.3	
PW-21	11/20/2006	1.0	U	**37**		1.7	
PW-21	11/21/2006	1.0	U	**31**		1.5	
PW-21	11/22/2006	1.0	U	**46**		2.2	
PW-21	11/27/2006	1.0	U	**52**		2.0	
PW-21	11/27/2006	1.0	U	**61**		2.2	
PW-21	11/28/2006	1.0	U	**69**		2.0	
PW-21	11/29/2006	1.0	U	**62**		2.0	
PW-21	11/30/2006	1.0	U	**26**		1.1	
PW-21	12/1/2006	1.0	U	**28**		0.98	
PW-21	6/7/2007	1.2		**32**		2.6	
PW-21	6/7/2007	2.0	U	**32**		2.0	U
PW-21	11/14/2007	8.0	U	**18**		3.0	U
PW-21	11/17/2008	1.0	U	**5.8**		0.50	U
PW-21	10/6/2009	2.0	U	**9**		0.20	U
PW-21	11/16/2010	2.0	U	4.4		2.0	U
PW-22	11/15/2007	**250**	U	**18000**		**130**	U
PW-22	1/7/2008	**-**		**29900**		**1100**	U

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-22	6/18/2008	**100**	U	**13500**		**100**	U
PW-22 DUP	6/18/2008	**100**	U	**13200**		**100**	U
PW-22	11/13/2008	**200**	U	**17000**		**100**	U
PW-22	5/29/2009	**400**	U	**8100**		**88**	
PW-22	9/3/2009	**400**	U	**15000**		**140**	
PW-24	11/15/2007	**250**	U	**550**		**130**	U
PW-24	6/17/2008	10	U	**699**		**10**	U
PW-24	11/14/2008	50	U	**1200**		**25**	U
PW-24	6/1/2009	**100**	U	**1000**		**23**	
PW-24	10/5/2009	20	U	**910**		**15**	
PW-24	2/16/2010	10	U	**560**		**20**	U
PW-24	11/18/2010	10	U	**475**		**10**	U
PW-25D	11/14/2007	**300**	U	**147**		**75**	U
PW-25D	1/7/2008	**-**		**259**		**12**	U
PW-25D	6/18/2008	2.0	U	**74**		**6.8**	
PW-25D	10/16/2008	20	U	**190**		**33**	
PW-25D	5/29/2009	20	U	**3500**		**470**	
PW-25D	10/5/2009	20	U	**8500**		**1200**	
PW-25D	2/16/2010	10	U	**4900**		**540**	
PW-25D	11/18/2010	40	U	**2380**		**175**	
PW-25S	11/15/2007	**250**	U	**230**		**130**	U
PW-25S	11/15/2007	**250**	U	**220**		**130**	U
PW-25S	6/18/2008	48		**310**		**32**	
PW-25S	11/14/2008	17		**320**		**25**	
PW-25S	5/29/2009	20	U	**220**		**11**	
PW-25S	10/5/2009	20	U	**170**		**6.4**	
PW-25S	11/18/2010	4.0	U	**154**		4.0	U
PW-26S	11/15/2007	**250**	U	**1500**		**130**	U
PW-26S	6/17/2008	10	U	**559**		**11**	
PW-26S	11/13/2008	20	U	**970**		**23**	
PW-26S	11/17/2008	5.0		**740**		**20**	
PW-26S	6/1/2009	**100**	U	**840**		**25**	
PW-26S	10/5/2009	40	U	**680**		**15**	
PW-26S	11/18/2010	**121**		**1350**		**65**	
PW-27S	11/15/2007	**250**	U	**150**		**130**	U
PW-27S	6/18/2008	**88**		**131**		**21**	
PW-27S	11/13/2008	30		**230**		**17**	
PW-27S	11/13/2008	31		**280**		**18**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
PW-27S	5/29/2009	36		**280**		**21**	
PW-27S	10/5/2009	31		**300**		**23**	
PW-27S	11/18/2010	8.3		**220**		**22**	
PW-28	10/16/2008	1	U	**39**		1.6	
PW-28	5/29/2009	2	U	**9.7**		0.50	
PW-28	10/6/2009	2	U	**16**		0.76	
PW-28	11/16/2010	2.0		**47**		3.30	
RW-1	1/18/2007	50	U	**89**		**25**	U
RW-1	10/5/2009	47		**100**		**14**	
RW-1	2/16/2010	68		**3300**		**74**	
RW-1	2/16/2010	**70**		**3500**		**76**	
SP-01	8/20/2004	20	U	**1800**		**20**	U
SP-01	12/14/2004	20	U	**420**		**35**	
SP-01	2/8/2005	**500**	U	**20774.4**		**907.5**	
SP-01	2/8/2005	**500**	U	**21194.199**		**1168.2**	
SP-01	2/16/2005	5	U	**107.5**		**5.3**	
SP-01	4/19/2005	2	U	**1100**		**172**	
SP-01	4/19/2005	2	U	**4300**		**424**	
SP-01	4/25/2005	50	U	**88**		**29**	
SP-01	9/30/2005	7.5		**6600**		**250**	
SP-01	3/14/2006	8.8		**24**		**9.3**	
SP-01	3/28/2006	50	U	**830**		**25**	U
SP-01	4/24/2006	50	U	**320**		**18**	
SP-01	4/24/2006	2	U	**238**		**23**	
SP-01	7/19/2006	50	U	**110**		**74**	
SP-01	9/26/2006	50	U	**1190**		**360**	
SP-01	1/18/2007	50	U	**140**		**25**	U
SP-01	10/22/2008	12		**12000**		**780**	
SP-01	5/29/2009	2	U	**18**		0.32	
SP-01	10/5/2009	**400**	U	**1000**		**40**	U
SP-01	2/16/2010	10	U	**37**		**20**	U
SP-02	4/29/2004	5		**262**		**11**	
SP-02	8/20/2004	8.5		**213**		**10**	
SP-02	12/14/2004	14		**1200**		**27**	
SP-02	12/14/2004	11		**140**		**9.1**	
SP-02	2/8/2005	6.3		**124**		**9.8**	
SP-02	4/19/2005	7.5		**144**		**14**	
SP-02	4/19/2005	6.8		**185**		**13**	
SP-02	4/25/2005	10	U	**49.1**		**10.4**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
SP-02	4/25/2005	20	U	**62.3**		**9.8**	
SP-02	4/25/2005	1	U	4.3		1	
SP-02	9/30/2005	22		**190**		**19**	
SP-02	9/30/2005	17		**300**		**17**	
SP-02	4/24/2006	17		**501**		**45**	
SP-02	7/19/2006	50	U	**410**		**22**	
SP-02	9/26/2006	50	U	**220**		**25**	U
SP-02	1/18/2007	50	U	**360**		**25**	U
SP-02	10/22/2008	11		**180**		**22**	
SP-02	6/1/2009	20	U	**120**		**49**	
SP-02	2/16/2010	10	U	**240**		**20**	U
SP-02	11/18/2010	7.4		**111**		**32**	
SVE-01	4/29/2004	26		**328**		**43**	
SVE-01	8/2/2004	20		**400**		**33**	
SVE-01	12/14/2004	19		**420**		**28**	
SVE-01	2/8/2005	47.9		**793.79999**		**76.3**	
SVE-01	4/26/2005	36.1		**198.39999**		**42.1**	
SVE-01	9/30/2005	10		**200**		**15**	
SVE-01	3/7/2006	1.8		**220**		4.9	
SVE-01	3/21/2006	50	U	**130**		**25**	U
SVE-01	4/3/2006	50	U	**140**		**25**	U
SVE-01	5/1/2006	1.64		**44**		1.6	
SVE-01	5/17/2006	1.0	U	**59**		2.8	
SVE-01	7/12/2006	50	U	**340**		**25**	U
SVE-01	9/13/2006	52		**680**		**25**	U
SVE-01	6/1/2009	20	U	**420**		**7.0**	
SVE-01	6/1/2009	20	U	**420**		**6.4**	
SVE-01	11/18/2010	8.2		**205**		**14**	
SVE-02	4/29/2004	43		**3640**		**135**	
SVE-02	4/29/2004	41		**3770**		**136**	
SVE-02	8/2/2004	33		**3500**		**100**	
SVE-02	12/14/2004	**100**	U	**950**		**100**	U
SVE-02	2/8/2005	50	U	**3144.8001**		**56.6**	
SVE-02	4/26/2005	**200**	U	**904.5**		**200**	U
SVE-02	9/30/2005	14		**1900**		**58**	
SVE-02	3/7/2006	**2900**		**850**		**460**	
SVE-02	3/21/2006	**4000**		**1700**		**970**	
SVE-02	4/3/2006	**2200**		**920**		**580**	
SVE-02	4/3/2006	**2700**		**1100**		**730**	
SVE-02	5/1/2006	**2700**		**2000**		**1200**	
SVE-02	5/17/2006	**2400**		**12000**		**1400**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
SVE-02	5/24/2006	**1700**		**7800**		**840**	
SVE-02	6/9/2006	**1100**		**14000**		**680**	
SVE-02	6/26/2006	**220**		**2700**		**170**	
SVE-02	6/27/2006	**210**		**2000**		**150**	
SVE-02	7/7/2006	**580**		**5000**		**320**	
SVE-02	7/12/2006	**660**		**5300**		**340**	
SVE-02	7/18/2006	**600**		**5200**		**350**	
SVE-02	7/26/2006	**460**		**5400**		**320**	
SVE-02	8/16/2006	**370**		**4700**		**350**	
SVE-02	8/31/2006	**440**		**6900**		**500**	
SVE-02	9/6/2006	**420**		**6400**		**490**	
SVE-02	9/13/2006	**340**		**7200**		**460**	
SVE-02	9/27/2006	**370**		**5900**		**510**	
SVE-02	10/11/2006	**520**		**8700**		**720**	
SVE-02	10/26/2006	**510**		**9100**		**780**	
SVE-02	11/7/2006	**430**		**8400**		**710**	
SVE-02	11/17/2006	**280**		**4800**		**440**	
SVE-02	6/7/2007	**-**		**6360**		**765**	
SVE-02	7/2/2007	**370**		**4100**		**430**	
SVE-02	7/3/2007	**360**		**3600**		**360**	
SVE-02	7/17/2007	**300**		**4400**		**490**	
SVE-02	8/7/2007	**340**		**8100**		**650**	
SVE-02	8/16/2007	**220**		**3403**		**379**	
SVE-02	8/29/2007	**300**		**11000**		**550**	
SVE-02	9/27/2007	**96.4**		**4742.7998**		**235**	
SVE-02	10/10/2007	**130**		**7400**		**290**	
SVE-02	6/17/2008	50	U	**2360**		**90**	
SVE-02	11/13/2008	**130**		**5600**		**170**	
SVE-02	6/1/2009	**200**	U	**2500**		**84**	
SVE-02	10/5/2009	20	U	**2000**		**85**	
SVE-02	11/16/2010	**482**		**285**		**54**	
SVE-03	8/2/2004	35		**1300**		**49**	
SVE-03	12/14/2004	5	U	**88**		**5**	U
SVE-03	2/8/2005	20.3		**803.29999**		**15.2**	
SVE-03	4/26/2005	**200**	U	**289**		**200**	U
SVE-03	9/30/2005	11		**690**		**31**	
SVE-03	5/1/2006	59		**1200**		**71**	
SVE-03	5/17/2006	50	U	**400**		**25**	U
SVE-03	7/12/2006	50	U	**980**		**29**	
SVE-03	8/30/2006	**280**		**2100**		**250**	
SVE-03	8/31/2006	**270**		**1600**		**220**	
SVE-03	9/6/2006	**230**		**1400**		**200**	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
SVE-03	9/13/2006	**120**		**1200**		**140**	
SVE-03	9/27/2006	**160**		**1100**		**130**	
SVE-03	10/11/2006	**160**		**1300**		**130**	
SVE-03	10/26/2006	**140**		**1300**		**100**	
SVE-03	11/7/2006	68		**1100**		**68**	
SVE-03	6/7/2007	**-**		**1384**		**25**	
SVE-03	7/2/2007	**130**		**700**		**94**	
SVE-03	7/3/2007	**83**		**850**		**100**	
SVE-03	7/17/2007	57		**720**		**100**	
SVE-03	8/7/2007	**100**		**1400**		**89**	
SVE-03	8/16/2007	**82**		**933**		**90**	
SVE-03	8/29/2007	**120**		**1600**		**76**	
SVE-03	9/27/2007	**74.4**		**1269.3001**		**84.6**	
SVE-03	10/10/2007	**100**		**1600**		**74**	
SVE-03	10/6/2009	20	U	**170**		**23**	
SVE-04	8/2/2004	2.4		**20**		**10**	
SVE-04	12/14/2004	1	U	**16**		2.2	
SVE-04	2/8/2005	10	U	**20.6**		**8.2**	
SVE-04	4/26/2005	5	U	**13.6**		**9.9**	
SVE-04	9/30/2005	1	U	**8.6**		**9.4**	
SVE-04	4/25/2006	1	U	**6.5**		0.33	
SVE-05	4/29/2004	10	U	**858**		**22**	
SVE-05	8/2/2004	11		**1600**		**34**	
SVE-05	12/14/2004	20	U	**430**		**20**	U
SVE-05	2/8/2005	**173.60001**		**2481.5**		**75.6**	
SVE-05	4/26/2005	**100**	U	**434.20001**		**100**	U
SVE-05	9/30/2005	6.4		**1300**		**26**	
SVE-05	3/7/2006	**70**		**3600**		**120**	
SVE-05	3/21/2006	50	U	**2100**		**58**	
SVE-05	4/3/2006	50	U	**1100**		**25**	U
SVE-05	5/1/2006	50	U	**700**		**25**	U
SVE-05	5/17/2006	50	U	**930**		**25**	U
SVE-05	6/9/2006	50	U	**680**		**25**	U
SVE-05	7/12/2006	50	U	**320**		**25**	U
SVE-05	7/12/2006	50	U	**620**		**25**	U
SVE-05	9/4/2009	40	U	**130**		4	U
SVE-06	8/2/2004	8.8		**55**		**6.6**	
SVE-06	12/14/2004	18		**30**		**6**	
SVE-06	2/8/2005	9.1		**37.2**		**5.4**	
SVE-06	4/26/2005	2.4		2.3		1.2	

Table 5-6

Historical Groundwater Analytical Results for COCs
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Station	Date Sample Collected	Analyte					
		cis-1,2-DCE (µg/L)		PCE (µg/L)		TCE (µg/L)	
NHDES AGQS		70		5		5	
SVE-06	9/30/2005	3.8		**28**		4.6	
SVE-06	5/1/2006	50	U	**90**		**25**	U
SVE-06	5/17/2006	3.1		**51**		**8.6**	
SVE-06	9/26/2006	50	U	**83**		**25**	U
SVE-06	10/6/2009	20	U	**37**		2.5	

Notes:
NHDES = New Hampshire Department of Environmental Services
AGQS = Ambient Groundwat Quality Standard
Bold = Value for compound exceeds the applicable AGQS.
cis-1,2-DCE = cis-1,2-dichloroethylene
PCE = tetrachloroethylene
TCE = trichloroethylene
µg/L = micrograms per liter
U = Indicates that compound was not detected above the identified laboratory reporting limit.
- = Compound not analyzed for.
Purple = Indicates monitoring point is located within slurry wall.
Green = Indicates monitoring point is located outside of slurry wall.

Table 6-1

Project Costs
January through December 2010
Savage Municipal Water Supply Superfund Site
Milford, New Hampshire

Task Number	Task Description	Total Task to DateTask
3000	Routine O&M	$99,839
3100	Non-Routine Maintenance	$17,436
3300	Reporting	$54,845
4000	2010 ISCO Injections	$119,101
4100	Vadose Zone Soil Treatment (Site Restoration & Final Report)	$73,953
6000	Groundwater & Permanganate Monitoring	$13,954
8000	Bedrock Investigations	$499,909
9989	Project Management & Meetings	$35,725
Total		**$914,762**

Notes:
O&M = operation and maintenance
ISCO = in situ chemical oxidation

APPENDIX A

DETAILED OPERATION AND MAINTENANCE ACTIVITIES

OPERATIONS SUMMARY
January 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
1/1/2010	J. Warrington	≈ 0.16 hrs	* Reset SCADA for 2010.	
1/5/2010				USGS
1/6/2010	J. Warrington	≈ 2.25 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise of generator. * Monthly sampling. * Annual inspection of security alarm system (Lamy).	Lamy Electric
1/7/2010				USGS
1/13/2010	J. Warrington	≈8.83 hrs	* Monthly permanganate monitoring. * Water levels on gradient wells. * Biannual testing of backflow preventers (Milford). * Clearing snow from building exits and gates.	Town of Milford Water Department
1/20/2010	J. Warrington	≈ 4.5 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise of generator. * Clearing snow from building exits and gates. * Monthly inspection of fire extinguishers, safety shower and eyewash.	
1/25/2010	A. Fuller	≈ 0.66 hrs	* Water levels on gradient wells. * Delivery of equipment (BLY).	Boart Longyear
1/26/2010	A. Fuller	≈ 2.0 hrs	* Delivery of equipment for drilling (BLY).	Boart Longyear
1/27/2010	A. Fuller	≈ 9.0 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear USGS
1/28/2010	A. Fuller	≈ 9.0 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
1/29/2010	A. Fuller J. Warrington	≈ 7.0 hrs ≈ 3.5 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise of generator. * Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling. * Quarterly maintenance on AHU-1, 2, 3. * Changing out tray aerator #1 for tray aerator #2. * Monthly maintenance on tray aerator #1.	Boart Longyear

OPERATIONS SUMMARY
February 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
2/1/2010	J. Warrington A. Fuller	≈ 2.16 hrs ≈ 9.66 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise of generator. * Checking facility water usage (Milford). * Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear Milford Water Department
2/2/2010	J. Soukup	≈ 9.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling. * Begin use of RW-3 for drilling water.	Boart Longyear
2/3/2010	A. Fuller	≈ 9.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/4/2010	A. Fuller M. Swiech-Laflamme	≈ 10.5 hrs ≈ 9.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/5/2010	A. Fuller M. Swiech-Laflamme	≈ 9.5 hrs ≈ 9.75 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/8/2010	A. Fuller	≈ 9.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/9/2010	J. Warrington A. Fuller	≈ 3.75 hrs ≈ 10.5 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise of generator. * Inspection of suppression systems (REM-C). * Inspection of fire extinguishers and emergency lighting (LRC). * Inspection of fire alarm systems (Norris). * Monthly inspection of emergency showers and fire extinguishers. * Increased purge rate of IW-1A to 26 gpm to compensate for drilling water influx near PW-2R. * Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear LRC Fire Safety REM-C Norris, Inc. Milford Fire Department
2/10/2010	A. Fuller M. Swiech-Laflamme	≈ 10.0 hrs ≈ 9.75 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear NHDES: R. Mongeon
2/11/2010	A. Fuller	≈ 7.66 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/12/2010	A. Fuller	≈ 5.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/15/2010	J. Warrington A. Fuller A. Klappholz	≈ 8.25 hrs ≈ 11.2 hrs ≈ 10.0 hrs	* Daily Readings. * Quarterly groundwater levels. * Exercise of generator. * Monthly treatment plant sampling. * Decreased purging rate of IW-1A from 26 to 25 gpm. * Borehole geophysics (NGS). * Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear Northeast Geophysical Services

OPERATIONS SUMMARY
February 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
2/16/2010	J. Warrington A. Fuller A. Klappholz J. Schmidl	≈ 8.0 hrs ≈ 9.0 hrs ≈ 8.0 hrs ≈ 8.66 hrs	* Baseline ISCO groundwater monitoring. * Permanganate monitoring. * Borehole geophysics (NGS). * Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling. * O&M review with new plant operator.	Boart Longyear Northeast Geophysical Services
2/17/2010	J. Warrington A. Fuller J. Schmidl	≈ 5.75 hrs ≈ 8.25 hrs ≈ 7.25 hrs	* Facility housekeeping. * Inventory of damaged equipment. * Preliminary leak detection plan. * Borehole geophysics (NGS). * Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear Northeast Geophysical Services
2/18/2010	A. Fuller	≈ 9.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear USGS
2/19/2010	A. Fuller	≈ 6.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/22/2010	A. Fuller	≈ 10.3 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/23/2010	A. Fuller A. Klappholz J. Warrington	≈ 9.0 hrs ≈ 9.0 hrs ≈ 9.0 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling. * Bedrock well sampling.	Boart Longyear
2/24/2010	A. Fuller	≈ 5.5 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling.	Boart Longyear
2/25/2010	A. Fuller J. Warrington S. Lizotte	≈ 7.0 hrs ≈ 1.66 hrs ≈ 8.75 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling. * Class VII Fork Truck delivery. * ISCO containment construction.	Boart Longyear
2/26/2010	A. Fuller J. Warrington S. Lizotte	≈ 6.0 hrs ≈ 11.5 hrs ≈ 9.0 hrs	* Drilling of bedrock monitoring wells (BLY). * Oversight of bedrock drilling. * Changing out tray aerator #2 for tray aerator #1. * Partial monthly maintenance on tray aerator #2. * O&M review with new plant operator. * Permanganate delivery of (16) 250 gallon 40% totes. * Decreased purge rate from IW-1A from 25 to 24 gpm. * Storage container delivery. * Response to emergency generator failure alarm. New battery installed. Generator operating normally. * Daily Readings. * Water levels on gradient wells.	Boart Longyear

OPERATIONS SUMMARY
March 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
3/1/2010	J. Warrington A. Fuller E. Hall A. Klappholz S. Lizotte B. Nowack J. Soukup	≈ 10.5 hrs ≈ 11.3 hrs ≈ 4.66 hrs ≈ 10.3 hrs ≈ 10.3 hrs ≈ 5.2 hrs ≈ 3.5 hrs	* Final ISCO planning meeting. * ISCO with 20% solution via siphon method. * Water levels of gradient wells. * Bedrock well geophysics (NGS). * Bedrock well geophysics oversight. * Drilling demobilization (BLY).	EPA: M. Jasinski, S. Mangion NHDES: R. Mongeon USGS Boart Longyear Northeast Geophysical Services
3/2/2010	J. Warrington A. Fuller A. Klappholz S. Lizotte	≈ 10.5 hrs ≈ 8.0 hrs ≈ 10.5 hrs ≈ 10.3 hrs	* ISCO with 20% solution via siphon method. * Water levels of gradient wells. * Bedrock well geophysics (NGS). * Bedrock well geophysics oversight.	Northeast Geophysical Services
3/3/2010	J. Warrington A. Klappholz S. Lizotte	≈ 9.2 hrs ≈ 9.0 hrs ≈ 9.0 hrs	* Injection setup breakdown. * Injection well water flushing (250 gallons per well). * Water levels of gradient wells.	
3/4/2010	J. Warrington A. Klappholz	≈ 6.0 hrs ≈ 5.75 hrs	* Injection setup breakdown. * Injection well water flushing (250 gallons per well). * Daily Readings. * Water levels of gradient wells. * Exercise of generator.	
3/8/2010	A. Fuller	≈6.75 hrs	* Packer testing (NGS). * Packer testing oversight.	Northeast Geophysical Services
3/9/2010	A. Fuller J. Warrington	≈ 10.2 hrs ≈ 4.0 hrs	* Daily Readings * Exercise of generator. * Water levels on gradient wells. * Monthly Sampling. * February / March Monthly Reports. * Packer testing (NGS). * Packer testing oversight. * Monthly inspection of emergency showers and fire extinguishers.	Northeast Geophysical Services
3/10/2010	A. Fuller	≈ 10.0 hrs	* Packer testing (NGS). * Packer testing oversight.	NHDES: R. Mongeon, M. Estabrook, J. Bledsoe USEPA: S. Mangion USGS Northeast Geophysical Services
3/11/2010	J. Warrington A. Fuller A. Klappholz	≈ 9.0 hrs ≈ 10.5 hrs ≈ 8.5 hrs	* Permanganate Monitoring. * Replaced fuse in LIT-107-2, did not resolve alarm concerns. * Reprogrammed autodialer. * Facility housekeeping. * Purged water from IW-1 well vault. * Inspection of fire alarm systems by Norris Inc. * Packer testing (NGS). * Packer testing oversight.	Northeast Geophysical Services Norris, Inc. (subcontractor to LRC Fire Safety)
3/16/2010	S. Lizotte A. Fuller	≈ 2.0 hrs ≈ 9.25 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise of generator.	
3/22/2010	S. Lizotte	≈ 4.0 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise generator. * Oversight on Rem-C for sprinkler test valve * Pressure wash Tray Aerator #2	Rem-C (subcontractor to LRC Fire Safety, LLC)
3/22/2010	E. Hall	≈ 7.0 hrs	* Investigate RW-3 flow transmitter and tranducer issues. * General House keeeping. * Paperwork for monthly report * Oversight on Rem-C for sprinkler test valve	Rem-C (subcontractor to LRC Fire Safety, LLC)
3/29/2010	S. Lizotte	≈4.0 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise generator. * Determing Shelving options for Files * Housekeeping * Increased IW-1A to 26 gpm for its SPT due to gradients	
3/31/2010	E. Hall	≈1.25 hrs	* Show Meridan Land Services (MLS) (the locations of BR1 through BR4). * MSL ran local level loop for BR2,BR3 and set a benchmark with blue chiseled "X" on the north corner or the western overhead door. MLS will tie in local level loop, BR1, and BR4 to NH state plan later this week * Water levels on gradient wells.	Meridan Land Services

OPERATIONS SUMMARY
April 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
4/6/2010	S. Lizotte	≈ 4 hrs	* Daily Readings. * Water levels on gradient wells. * Exercise generator. * Greased Blower * Switched out Tray Aerators * Water Samples on IW-1A, IW-2A, INF, and EFF for EPA * Update March and April Log from daily SCADA printouts * Increased SPT on IW-1A from 26 to 27	
4/13/2010	S. Lizotte	≈ 8 hrs	* Installing shelving in air compressor room	
4/15/2010	E. Hall S. Lizotte	≈ 10.25 hrs ≈ 10 hrs	* Daily Readings. * Water levels of gradient wells. * Exercise of generator. * Shut down plant @ 7:30 to drain Recovery Trench * Finished installing shelving in air compressor room. * Remove flanges in SVE-04 and SVE-05 to facilitate easier access for GW sampling. * Entered and inspected the recharge gallery. Approximately 1/4"-1/2" of black precipitate on the walls and floor of the chambers. * Restart plant @ 15:50. Collected water level readings until 17:00.	R. Mongeon-NHDES
4/20/2010	E. Hall	≈ 8.25 hrs	* Daily Readings. No headspace readings as the PID has been shipped to Pine Environmental for service. * Water levels of gradient wells. * Exercise of generator. * Shut down heater and heat pumps for the non-heating season. * Shut the plant down at 10:59 to check the calibration on the plant effluent flow meter. Restarted system at 14:00. * Checked the calibration settings on flow meters on IW-1A, IW-2A, P-101, P-102, EW-2, and the Combined Influent,. *Adjusted and confirmed the correct operation of the level tranducers in RW-1, RW-2, IW-1A, IW-2A, T-1, T-2, and plant effluent. The level sensor in EW-2 has malfunctioned. There are no tranducers in EW-1 and RW-3. If in the future, operational level controls are necessary in EW-1, EW-2 and EW-3, the feed lines should be tested and confined space will be necessary. * GPS'ed in the new bedrock well BR-1 through BR-4.	Environmental Instrument Services, Inc. (EIS) - Calibration of flow and level controls
4/21/2010	E. Hall A. Liu	≈ 9.25 hrs ≈ 2.1 hrs	* Checked the calibration settings on air flow meters on the blowers. * Shut the plant down temporarily to test flow meters and check performance of air strippers. * Bisco Environmental evaluated the air stripper performance. Bisco could not find an obvious performance issue. They recommend changing the air filter for the blower, tightening the belts on the blower, and collected an effluent sample at 900 scfm and current scfm (approximately 1100 scfm) * Began monthly permanganate monitoring.	EIS - Calibration of flow and level controls Bisco Environmental - evaluatation of air stripper performance
4/29/2010	S. Lizotte	≈ 7.5 hrs	* Daily Readings * Exercise of generator. * Water levels on gradient wells. * Relocation of drill cuttings to gravel area between Prudential office and silt fencing. * IW-1A level transducer reading ranged from 0.8 to 1.2 ft. Need to follow up to adjust transducer as needed. * Permanganate Monitoring * Picked up Replacement Belts from Grainger for Blower Maintenance.	Sam Trombly Landscaping

OPERATIONS SUMMARY
May 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
5/4/2010	S. Lizotte	≈ 1.00 hrs	* Autodialer alarmed at 1735 due to power outage. Responded to alarms and restarted plant at 1920. Restarted IW-1, IW-2, P-102, and Blower 2. Waited for Emergency generator to automatically shut off.	
5/6/2010	S. Lizotte	≈ 5.0 hrs	* Finished Permanganate Monitoring for April. * Collected Monthly Samples at INF, EFF, IW-1A, and IW-2A to deliver to State. * Weekly Readings. * Water Levels on Gradient Wells.	
5/10/2010	S. Lizotte	≈ 7.0 hrs	* Input Daily printouts from SCADA into April log for monthly. * Water Levels on Gradient Wells. * Weekly Readings. * Exercised Emergency Generator. * Installed new belts on Blower 1. * Greased Blower 1 and 2. * Pressure washed Tray Aerator 1 and transferred flow from Tray Aerator 2 to 1. * At 0830, measured depth to water from TOIC of IW-1A at 17.89' and depth to bottom of well to TOIC at 25.08'. This means approximately 7.19' of water in well. Adjusted transducer depth down 3' and level went from 0.82' on transducer display to 3.73'. * Measure water depth at weir in recharge chamber to be about 4.50 inches of water. Then calculated the weir to be at 30 degrees which gave 27 gpm approx. I checked the flow meter for the chamber and it read about 26 gpm and the influent to the tray aerator was at 29.7 gpm. Need to follow up on fluctuations in influent vs recharge flows. * Measured existing influent air filters to procure replacements.	
5/17/2010	S. Lizotte	≈ 3.0 hrs	* Entered daily SCADA printouts into log sheet. * Installed new belts on Blower 2. Re-tightened new belts on Blower 1 (Had to temporarily shut down system to allow for adjustments on Blower 1). * Monthly inspection of emergency showers and fire extinguishers. * Exercised Emergency Generator. * Water Levels on gradient wells. * Determined we will need 3 of the new Influent Air Filters to match existing filter housing and that the existing threaded rod for the cap of the filters may need to be extended to accomodate new filters. * Noticed the transducer reading on RW-1 was 33.99' (usually is between 12' and 14'). Need to follow up to resolve transducer issue. * Weekly Readings.	
5/25/2010	S. Lizotte E. Hall A. Fuller	≈ 9.5 hrs ≈ 3.0 hrs ≈ 9.0 hrs	* Entered daily SCADA printouts into monthly log sheet. * Water Levels on gradient wells. * Weekly Readings. * Historical data for RW-1 has water level between 12 - 13 ft. On 17 May it was observed that the level transducer was reading 33.99 ft. Pulled RW-1 and tried varying depths for the response and found that transducer was not functioning and read 43.93 ft on SCADA. Will need to follow up to troubleshoot transducer issue. * Pulled IW-1A level transducer and reset transducer at 23.00 ft depth from TOIC. * Exercized Emergency Generator. * Confirmed Recharge Gallery Wet Well weir to be at 29-30 degrees. Need to take multiple measurements to check flow meter versus SCADA and ultrasonic depth. * Shut down Treatment Plant at 9:43 to replace influent air filters with (3) new filters from Stoddard Silencers. * Started and Completed May Permanganate Monitoring. Entered observations into monitoring record.	

OPERATIONS SUMMARY
June 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
6/4/2010	S. Lizotte	≈ 6.5 hrs	* Collected Monthly Samples at INF, EFF, IW-1A, and IW-2A to deliver to State * Input Daily printouts from SCADA into May log for monthly * Completed log for May to attach to May monthly report. * Monthly inspection of emergency showers, first aid kit and fire extinguishers. * Weekly Readings * Water Levels on Gradient Wells * Exercised Emergency Generator * Pressure washed Tray Aerator 2 and transferred flow from 1 to 2 * Greased Blower 1 and 2 * Worked on troubleshooting weir flow by checking flow into tray aerator. Validated flow meter into tray aerator as working properly. Tried to troubleshoot settings on Magnatrol STI 341 readout to ultrasonic in weir and could not determine issue. Will need to follow up.	
6/9/2010	E. Hall	≈ 2.0 hrs	* Weekly Readings * Water Levels on Gradient Wells * Exercised Emergency Generator	
6/15/2010	E. Hall	≈ 2.0 hrs	* Weekly Readings * Water Levels on Gradient Wells * Exercised Emergency Generator * Troubleshoot the Calibration of FIT-108-1 (Recharge Gallery Flowmeter). Changed controls in FIT-108-1 to 45 degrees instead of the actual 30 degree weir in vault The readings matched the bucket test (~20 gpm) and the FIT-102 (Tray Aerator Feed Pump). We will monitor the flowrates between FIT 102 and 108 over the next week. Randy Robbins from EIS will contact STI to find out the reason the programming for a 45 degree weir matchs the flow of a 30 degree weir in the field.	Randy Robbins - EIS
6/21/2010	E. Hall	≈ 2.0 hrs	* Respond Autodialer alarm for power outage. Restarted system at 07:10. Power outage @ 04:08.	
6/24/2010	S. Lizotte O. Friend-Gray	≈ 10.0 hrs ≈ 6.0 hrs	* Monthly inspection of emergency showers, first aid kit and fire extinguishers. * Weekly Readings * Water Levels on Gradient Wells * Exercised Emergency Generator * Greased Blower 2 * Instructed Owen Friend-Gray on system operation, maintenance, and permanganate monitoring * Checked belt tension on blower 1 and 2 * June Permanganate monitoring * Pressure-washed Tray Aerator 1 * Input Daily printouts from SCADA into May log for monthly	
6/29/2010	S. Lizotte O. Friend-Gray	≈ 11.0 hrs ≈ 11.0 hrs	* Finished June Permanganate Monitoring * Bi-annual water levels * Weekly Readings * Water Levels on Gradient Wells * Exercised Emergency Generator * Instructed Owen Friend-Gray on system operation, maintenance, and permanganate monitoring * Input Daily printouts from SCADA into May log for monthly * Adjusted IW-1A Setpoint from 24 to 22 due to cycling.	B. Nowack (WESTON) Robin Mongeon (NHDES) Skip Hull (EPA RPM)

OPERATIONS SUMMARY
JULY 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
9-Jul-10	Seth Lizotte Owen Friend-Gray	≈ 6.5 hrs ≈ 6.5 hrs	* Collected Monthly Samples at INF, EFF, IW-1A, and IW-2A to deliver to State * Input Daily printouts from SCADA into June and July log for monthly * Completed log for June to attach to June monthly report. * Monthly inspection of emergency showers, first aid kit and fire extinguishers * Weekly Readings * Water Levels on Gradient Wells * Exercised Emergency Generator * Greased Blower 1 and 2 * Transferred flow from Tray 2 to Tray 1. Pump 102B faulted at 13:00 hrs: need to follow up	
16-Jul-10	Seth Lizotte Owen Friend-Gray	≈ 2.5 hrs ≈ 2.5 hrs	* Reduced Set Point on IW-1 from 19 to 18 * Weekly Readings * Excerised Emergency Generator * Input Daily printouts from SCADA into July log for monthly * Water Levels on Gradient Wells * Greased Blower 1 and 2 * Purchased a case of Citgo Lithoplex RT Bearing Grease for the blowers * Completed draft for June Monthly reporting	Kris Jensen - Milford Water
21-Jul-10	Owen Friend-Gray Lisa Kammer	≈ 5.0 hrs ≈ 5.0 hrs	* Weekly Readings * Monthly Permanganate Monitoring * Excerised Emergency Generator * Input daily printouts from SCADA into July monthly log * Water Levels on Gradient Wells * Setpoints on wells unchanged due to limited cycling and all positive gradients	
28-Jul-10	Erik Hall	≈ 1.0 hr	* Weekly Readings * Excerised Emergency Generator * Input daily printouts from SCADA into July monthly log * Water Levels on Gradient Wells	

OPERATIONS SUMMARY
August 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
8/3/2010	A. Fuller J. Warrington O. Friend-Gray	≈ 3.5 hrs ≈ 5.0 hrs ≈ 5.0 hrs	* Weekly Readings * Water levels on Gradient Wells. * Exercised Emergency Generator. * Input daily prinouts from SCADA into July and August. * Collected monthly samples for DES testing. * Changing out tray aerator #1 for tray aerator #2. * Monthly maintenance on tray aerator #1. * Monthly inspection of emergency showers and fire extinguishers. * Decreased purge rate of IW-1A to 17 gpm. * Installed pressure transducers in select wells. * Cleaned tray aerator blower inlet. * Reprogrammed autodialer.	
8/11/2010	A. Fuller	≈ 0.5 hrs	Marking for Dig Safe.	
8/12/2010	J. Warrington	≈ 3.5 hrs	* Weekly Readings. * Water levels on Gradient Wells. * Exercised Emergency Generator. * Weir calibration check. (EIS) * Shut down plant due to permanganate being drawn in through IW-1A.	EIS Milford Water Department
8/13/2010	J. Warrington	≈ 3.8 hrs	* Water levels on Gradient Wells. * Plant start up. Extraction from EW-2 (34gpm), IW-1A (17gpm), IW-2A (4gpm). * Reducing Flow on IW-1A to 10gpm. * O&M Readings. Color from IW-1A decreases over time. * Review of electrical drawings prior to dig safe. * Review of O&M appendices for July report. * Shut down IW-1A for weekend.	
8/16/2010	J. Warrington A. Fuller	≈ 9.5 hrs ≈ 8.25 hrs	* Weekly Readings. * Water levels on Gradient Wells. * Exercised Emergency Generator. * Starting IW-1A at 10gpm, then increasing purge rate to 11 gpm. * Monthly permanganate monitoring. * Transcription of data from level transducers in select wells. * Driller mobilization to site (BLY).	Boart Longyear
8/17/2010	A. Fuller	≈ 11.2 hrs	Bedrock drilling (BLY). * Water levels on Gradient Wells. * Increasing purge rate of IW-1A to 13 gpm from 12gpm.	Boart Longyear
8/18/2010	A. Fuller	≈ 10.8 hrs	Bedrock drilling (BLY).	Boart Longyear NHDES: R. Mongeon USEPA: S. Mangion (sp?), S. Hull USGS
8/19/2010	A. Fuller B. Nowack	≈ 9.75 hrs ≈ 3.66 hrs	Bedrock drilling (BLY). * Water levels on Gradient Wells. * Increasing purge rate of IW-1A to 13 gpm from 12gpm.	Boart Longyear NHDES: R. Mongeon USEPA: S. Mangion (sp?), S. Hull USGS
8/20/2010	A. Fuller	≈ 12.0 hrs	Bedrock drilling (BLY). * Water levels on Gradient Wells.	Boart Longyear
8/26/2010	J. Warrington	≈ 2.0 hrs	* Weekly Readings. * Water levels on Gradient Wells. * Exercised Emergency Generator. * Increasing purge rate of IW-1A to 15 gpm from 14gpm (increased to 14gpm via PCanywhere on 8/23).	
8/30/2010	A. Fuller	≈ 7.5 hrs	Bedrock drilling (BLY).	Boart Longyear
8/31/2010	A. Fuller	≈ 10.3 hrs	Bedrock drilling (BLY). * Water levels on Gradient Wells.	Boart Longyear NHDES: R. Mongeon

OPERATIONS SUMMARY
SEPTEMBER 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
9/1/2010	A. Fuller J. Warrington D. Kammer	≈ 10.3 hrs ≈ 4.75 hrs ≈ 10.3 hrs	* Weekly Readings * Water levels on Gradient Wells. * Exercised Emergency Generator. * Changing out tray aerator #2 for tray aerator #1. * Monthly maintenance on tray aerator #2. * Monthly inspection of emergency showers and fire extinguishers. * Decreased purge rate of IW-1A to 12 gpm. * Bedrock drilling (BLY).	Boart Longyear EPA: S. Mangion
9/2/2010	A. Fuller	≈ 10.5hrs	* Bedrock drilling (BLY). * Water levels on Gradient Wells.	Boart Longyear
9/3/2010	A. Fuller	≈ 7.33 hrs	* Bedrock drilling (BLY). * Water levels on Gradient Wells.	Boart Longyear
9/7/2010	A. Fuller J. Warrington B. Nowack	≈ 11.0 hrs ≈ 2.0 hrs ≈ 3.5 hrs	* Bedrock drilling (BLY). * Water levels on Gradient Wells. * Collected monthly samples for DES testing. * Weekly Readings * Exercised Emergency Generator.	Boart Longyear
9/8/2010	A. Fuller	≈ 10.3hrs	* Bedrock drilling (BLY).	Boart Longyear
9/9/2010	A. Fuller J. Warrington	≈ 8.25 hrs ≈ 5.83 hrs	* Bedrock drilling (BLY). * Water levels on Gradient Wells. * Changing out tray aerator #1 for tray aerator #2. * Cleaned tray aerator #1 and view ports for tray aerator #1. * Reviewing calibrations of extraction well flow meters.	Boart Longyear
9/10/2010	A. Fuller	≈ 2.25 hrs	* Driller demob (BLY).	Boart Longyear
9/13/2010	A. Fuller	≈ 13.0 hrs	* Borehole geophysics (HR).	Hager-Richter
9/14/2010	A. Fuller	≈ 14.0 hrs	* Borehole geophysics (HR). * Water levels on gradient wells. * Shut down extraction well IW-1A for tray aerator view port investigation. * Plant lost power at 1330 for unknown reasons. Plant was reset within 15 minutes.	Hager-Richter
9/15/2010	A. Fuller J. Warrington	≈ 11.5 hrs ≈ 5.0 hrs	* Borehole geophysics (HR). * Water levels on gradient wells.	Hager-Richter USEPA: S. Hull, S. Mangion, G. Millan
9/16/2010	A. Fuller J. Warrington O. Friend-Gray	≈ 10.5 hrs ≈ 10.5 hrs ≈ 10.5 hrs	* Borehole geophysics (HR). * Water levels on gradient wells. * Changing out tray aerator #2 for tray aerator #1. * Cleaned tray aerator #2and view ports for tray aerator #2. * Metals sampling of combined influent, combined effluent, recharge gallery, weir, IW-1A, IW-2A and EW-2 to determine cause of tray aerator fouling. * Monthly premanganate monitoring. * Reinstalling tubing in IP-105 & HCNW.	Hager-Richter NHDES: R. Mongeon
9/23/2010	O. Friend-Gray J. Warrington	~ 5.0 hrs ~ 5.0 hrs	* Weekly levels on gradient wells. * Weekly readings. * Excercised generator. * Disassembled P-102B todetermine cause of faulting. Impellor and pump appear in working condition. Most likely cause either an electrical issue with the wiring or the pump motor. * Created inventory of parts on site for potential temporary extraction wells. * Confirmed tray aerator filters to ensure proper installation.	
9/27/2010	A. Fuller	~ 10.5 hrs	* Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
9/28/2010	A. Fuller	~ 10.0 hrs	* Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
9/29/2010	A. Fuller	~ 10.0 hrs	* Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
	A. Klappholtz	~ 2.0 hrs	* Weekly levels on gradient wells. * Weekly Readings * Exercised Emergency Generator.	USEPA: S. Hull
9/30/2010	A. Fuller	~ 9.5 hrs	* Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services

OPERATIONS SUMMARY
OCTOBER 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
10/1/2010	A. Fuller	~ 6.75	* Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
10/4/2010	A. Fuller A. Klappholz	~ 3.75 ~ 9.0	* Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
10/5/2010	Andy Fuller Owen Friend-Gray	~ 9.5 ~ 5.0	* Exercised emergency generator. * Noted that there was no color in IW-1A and that the tray aerators were still clear. and the bubbles easily visible after 4 days of running. * Greased Tray Aerator Blower, B-1. * Packer testing of newly installed bedrock wells (NGS). * Weekly O&M readings. * Weekly gradients monitoring.	Northeast Geophysical Services USEPA: Skip Hull
10/6/2010	A. Fuller	~ 10.0	*Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
10/7/2010	A. Fuller	~ 10.0	*Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
10/8/2010	A. Fuller B. Nowack	~ 10.5 ~ 4.33	*Packer testing of newly installed bedrock wells (NGS).	Northeast Geophysical Services
10/13/2010	Andy Fuller Owen Friend-Gray	~ 5.5 ~ 5.5	* Exercised emergency generator. * Treated totes of BR-6 and BR-3 with permanganate, pumped down 1 tote of permanagante water back into BR-5. * Greased tray aerator blowers. * Began frac tank pump down into EQ treatment tanks. * General site cleanup. * Surveyed elevations and locations of BR-3, -5, -6, MW-16R. * Weekly O&M readings. * Weekly gradients monitoring. * Monthly treatment plant sampling. * Monthly inspection of fire extinguishers and safety shower.	
10/172010			* USGS geophysics work	USGS
10/18/2010	J. Warrington O. Friend-Gray	~ 8.66 ~ 8.25	* Exercised emergency generator. * Pumping down drilling water from frac tank to treatment plant for 7.25 hours. * Troubleshooting pumps 102-A and 102-B. Determineed 102B motor the issue, ordering new motor. * Turned on plant boilers. * Weekly O&M readings. * Weekly gradients monitoring. * Monthly permangante monitoring.	USGS

OPERATIONS SUMMARY
OCTOBER 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
10/19/2010	O. Friend-Gray	~2.75	* Checking on wet well recirculation pumping system and installing backup sump	USGS
10/20/2010			USGS geophysics work	USGS
10/25/2010	J. Warrington O. Friend-Gray	~ 10.0 ~ 9.5	* Exercised emergency generator * Frac tank pumped down for 9.0 hrs. * Annual maintenance on blower system (GSPH). * Pull pump from EW-1 to determine reason for start failure. * Weekly O&M readings. * Weekly gradients monitoring.	Granite State Plumbing and Heating
10/26/2010	J. Warrington O. Friend-Gray	~ 11.7 ~ 11.5	* Frac tank pumped down for 10.5 hrs. * Shut down EW-2 and pulled pump to replace motor for EW-1 but did not obtain flow.	
10/27/2010	J. Warrington O. Friend-Gray	~ 4.3 ~ 4.5	* Determined pump in EW-1 fell off pipe, reattached and received flow to plant for several hours. * Received low EQ Tank alarm due to EW-1 pump failure. * Operator responded to the site and installed sump pumps in wet well to to provide adequate flow.	

OPERATIONS SUMMARY
NOVEMBER 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
11/1/2010	J. Warrington	~ 7.5	* Weekly O&M readings.	
	O. Friend-Gray	~ 7.3	* Exercise of generator.	
			* Water levels on gradient wells.	
			* Changed over Tray Aerator #1 to Tray Aerator #2.	
			* Maintenance and cleaning of Tray Aerator #1.	
			* EW-1 had shorted out almost immediately after starting last night. Pulled EW-1 and redid wiring.	
			* EW-1 operational for 15 minutes before shorting out again.	
			* Continuing to use sump pump from Wet Well to EQ tanks to provide enough flow to plant.	
11/2/2010	B. Fletcher	~ 8.0	* Troubleshooting EW-1 electrical.	Milford Water Department
	O. Friend-Gray	~ 9.25	* While examining MCC, observed yellow wire for EW-2 was burned out. LOTO, needs repairs before being operated again.	
			* Noted that there is no dedicated ground wiring running to manual shut off.	
			* Determined that both motor and wiring running to motor in EW-1 are in disrepair. Changing motor to EW-1 and removing lead from EW-2 and splicing onto EW-1 's lead for extended wiring.	
			* EW-1 operational. Continuing to pump directly from wet well to EQ tanks using sump pump.	
			* Milford Water Dept. performed yearly check of backflow preventor and passed system.	
11/3/2010	O. Friend-Gray	~ 0.25	* Checked operation of EW-1. Still operating normally.	
			* Discontinued pumping from wet well into EQ tanks.	
11/9/2010	J. Warrington	~ 7.5	* Weekly O&M readings.	
	O. Friend-Gray	~ 10.5	* Exercise of generator.	
			* Installation of Divers in select wells for bedrock monitoring.	
			* Monthly sampling of plant influent, effluent, IW-1A, IW-2A, EW-1 for VOCs.	
			* Finished pumping out Frac tank. Opening hatches to allow tank to dry.	
			* Maintenance on Air Handling Units.	
			* When connecting portable instrument air compressor to UPS outlet, shorted out UPS. Reset UPS and computers operating normally.	
			* Tubing inventory for next week's biannual samping.	
11/15/2010	J. Warrington	~ 3.5	* Biannual static water levels.	
11/16/2010	J. Warrington	~ 8.5	* Biannual sampling (NHDES).	NHDES: R. Mongeon, S. Perkins

OPERATIONS SUMMARY
NOVEMBER 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
11/17/2010	J. Warrington	~ 0.5	* Responded to alarm calls beginning at 1422. Power outage, most likely result of high winds. * Arrived on site at 1625. Reset system. Plant operational at 1647.	
11/18/2010	J. Warrington	~ 5.5	* Biannual sampling (NHDES). * Weekly O&M readings. * Installing pressure transducers in 5 wells. * Permanganate monitoring.	NHDES: R. Mongeon, S. Perkins
11/22/2010	A. Fuller A. Klappholz	~ 5.5 ~ 5.5	* Preparations for Step Test on BR-6.	
11/29/2010	A. Fuller J. Soukup O. Friend-Gray B. Nowack	~ 9.5 ~ 9.5 ~ 2.8 ~ 1.5	* Transducer installation. * Step test on BR-6. * Preparations for 76-hour pump test on BR-6.	USEPA: S. Hull NHDES: R. Mongeon
11/30/2010	A. Fuller J. Warrington O. Friend-Gray	~ 3.0 ~ 6.0 ~ 8.5	* Weekly O&M readings. * Exercise of generator. * Permanganate monitoring. * Installation of level transducer in EW-2 from PW-14D. * Moved permanganate drums onto containment. * Water levels on pump test wells.	

OPERATIONS SUMMARY
DECEMBER 2010
SAVAGE MUNICIPAL WATER SUPPLY SUPERFUND SITE

Date	Weston personnel on site	Time on site	Tasks accomplished	Visitors
12/2/2010	O. Friend-Gray	10.5 hrs	* Transducer data download and recording period reset for pump test starting 12/6/10. * Tray aerator #2 turned off and cleaned with tray aerator #1 put online. * Gradient levels taken.	
12/6/2010	O. Friend-Gray A. Fuller D. Kammer J. Warrington	~ 12.0 hrs ~ 12.5 hrs ~ 11.7 hrs ~ 12.5 hrs	* Setup for 76-Hour pump test. * 76-Hour pump test.	
12/7/2010	O. Friend-Gray A. Fuller D. Kammer J. Warrington	~ 12.7 hrs ~ 12.5 hrs ~ 12.0 hrs ~ 11.5 hrs	* 76-Hour pump test.	
12/8/2010	O. Friend-Gray A. Fuller D. Kammer J. Warrington	~ 13.0 hrs ~ 12.5 hrs ~ 12.2 hrs ~ 12.3 hrs	* 76-Hour pump test.	
12/9/2010	O. Friend-Gray A. Fuller	~ 12.7 hrs ~ 12.8 hrs	* 76-Hour pump test. * Began breakdown of pump test equipment. * Bedrock geophysics (HR).	USEPA: S. Hull NHDES: R. Mongeon Hager Richter
12/14/2010	A. Fuller J. Warrington	~ 4.5 hrs ~ 5.8 hrs	* Pulled pump from BR-6. * Deconned equipment from BR-6. * Began transducer data collection. * Weekly O&M readings. * Exercise of generator. * Water levels on gradient wells.	
12/17/2010	J. Warrington	~5.8 hrs	* Monthly sampling. * Weekly O&M readings. * Water levels on gradient wells. * Deiced top of frac tanks. * Performed pump maintenance, and purchased new sump pump for contaminated frac tank.	
12/20/2010	A. Fuller J. Warrington	~3.5 hrs ~6.5 hrs	* Downloaded transducer data. * Changed out wells for level transducers for recharge study. Removed transducers from MW-2B, BR-1, BR-4, and MW-11R. Installing transducers in PW-2D, 5D, 10Dand 11D. * Deiced top of frac tanks.	
12/22/2010	J. Warrington	~8.5 hrs	* Weekly O&M readings. * Exercise of generator. * Water levels on gradient wells. * Shut down plant for well recharge study. * Permanganate monitoring. * Deiced top of frac tanks.	
12/30/2010	J. Warrington	~3.5 hrs	* Exercise of generator. * Water levels on gradient wells. * Deiced top of frac tanks. * Moved sump pump from Frac Tank 2 to Frac Tank 1 due to faulty / frozen in sump pump in Tank 1. Weather outlook for weekend indicates pump may unfreeze.	

APPENDIX B

CHEMICAL ANALYSIS OF SODIUM PERMANGANATE

BN

WSC01

Wintersun Chemical

1150 S Mildred Ave. Ontario, CA 91761
Phone # 909-930-1688 Fax # 909-947-1788 E-mail : info@wintersunchem.com Web Site : www.wintersunchem.com

Invoice

Bill To
Weston Solutions Inc. 45 Constitution Ave Suite 100 Concord, NH 03301 ATTN: GENA GOOD

RECEIVED FEB 22 2010

Ship To
Weston Solutions Inc. OK TOOL / SAVAGE WELL SITE MILFORD, NH

Date	2/16/2010
Invoice No.	**0912274-2A**
Terms	Net 10
Customer PO No.	69953
Sales Rep	MS
Incoterms	To Door

Product Name	Description	Quantity	Unit	Unit Price	Amount
Sodium Permanganate T	WCode: 19-041 CAS No.: 10101-50-5 Molecular Formula: NaMnO4 Appearance: Dark, purple solution Assay: 40% Min as NaMnO4 Ph: 6.0 – 7. 0 Insoluble: 100 ppm Max Potassium: 1,000 – 2,200 ppm Chloride Content: 0.04% Max Specific Gravity: 1.36 - 1.39 Packing: In 1300KG plastic tote. Total 16 totes. Shipping Mark Sodium Permanganate Net Weight: 260KG Batch No.: UN No.: 3214 Hazard Class: 5.1 Packing Group: II Wintersun Chemical Ontario, CA 91761	45,855.68	LBS	1.98	90,794.25

PO#: 0069953
W.O.#: 20111.023.002.4020
Line No:
Approval:
Approval Date:

Thank you for your business. **Total** **$90,794.25**

Please reference our invoice number with payment.
If you have questions about this invoice or your account, please call Nancy Hsu - 909-930-1688.

WINTERSUN CHEMICAL

1150 S. Mildred Ave., Ontario, CA 91761
TEL: 909-930-1688 FAX: 909-947-1788 E-mail: sales@wintersunchem.com

February 16, 2010

Weston Solutions Inc.
45 Constitution Ave Suite 100
Concord, NH 03301

Re: Documents for PO# 69953

To Whom It May Concern:

Enclosed is document for your order of 16 totes of Sodium Permanganate, 40% under your PO# 69953 for your reference.

- One Original Invoice
- One Packing List
- Two Original COA

Thank you very much. Should you have any questions about the shipment, please feel free to contact me.

Best Regards,

Erika Bean

Enclosures

WINTERSUN CHEMICAL

1150 S. Mildred Ave., Ontario, CA 91761
Tel: 909-930-1688 Fax: 909-947-1788 E-mail: sales@wintersunchem.com

CERTIFICATE OF ANALYSIS

Product Name:	**Sodium Permanganate, 40% Min**
WCode:	19-041
CAS No.:	10101-50-5
Molecular Formula:	$NaMnO_4$
COA Report Date:	October 25, 2009
Batch No.:	20091020
Quantity:	6 Totes
Weight:	17,195.88 LBS
Our PO No.:	0909198-1A
Customer PO#:	69953
Packing:	In 1300 Kg Tote

THIS IS TO CERTIFY THAT WE, THE UNDERSIGNED, HAVE INSPECTED THE QUALITY OF THE ABOVE MENTIONED GOODS AND FOUND THE RESULT OF THE INSPECTION AS FOLLOWED:

INDEX	STANDARD	RESULT
Appearance	Dark purple Solution	Dark Purple Solution
Purity	40.0% Min	40.22%
Ph	6.0-7.0	6.78
Insoluble	100ppm Max	50ppm
Potassium	1000-22000ppm	1500ppm
Chloride Content	0.04% Max	0.02%
Specific Gravity	1.36-1.39g/cm3	1.37g/cm3

CONCLUSION: THE SUBJECT MATERIAL IS UP TO STANDARD.

WINTERSUN CHEMICAL

Erika Bean

These results are based on the manufacturer's test according to the original manufacturer's specification. Wintersun Chemical makes no guarantee of the results and assumes no liability with the accuracy or completeness of the data herein.

WINTERSUN CHEMICAL

1150 S. Mildred Ave., Ontario, CA 91761
Tel: 909-930-1688 Fax: 909-947-1788 E-mail: sales@wintersunchem.com

CERTIFICATE OF ANALYSIS

Product Name:	**Sodium Permanganate, 40% Min**
WCode:	19-041
CAS No.:	10101-50-5
Molecular Formula:	$NaMnO_4$
COA Report Date:	January 3, 2010
Batch No.:	20100105
Quantity:	10 Totes
Weight:	28,659.8 LBS
Our PO No.:	0912274-2A
Customer PO#:	69953
Packing:	In 1300 Kg Tote

THIS IS TO CERTIFY THAT WE, THE UNDERSIGNED, HAVE INSPECTED THE QUALITY OF THE ABOVE MENTIONED GOODS AND FOUND THE RESULT OF THE INSPECTION AS FOLLOWED:

INDEX	STANDARD	RESULT
Appearance	Dark purple Solution	Dark Purple Solution
Purity	40.0% Min	40.31%
Ph	6.0-7.0	6.78
Insoluble	100ppm Max	100ppm
Potassium	1000-22000ppm	1500ppm
Chloride Content	0.04% Max	0.02%
Specific Gravity	1.36-1.39g/cm3	1.37g/cm3

CONCLUSION: THE SUBJECT MATERIAL IS UP TO STANDARD.

WINTERSUN CHEMICAL

Erika Bean

These results are based on the manufacturer's test according to the original manufacturer's specification. Wintersun Chemical makes no guarantee of the results and assumes no liability with the accuracy or completeness of the data herein.

WINTERSUN CHEMICAL

1150 S. Mildred Ave., Ontario, CA 91761
TEL: 909-930-1688 FAX: 909-947-1788 E-mail: sales@wintersunchem.com

Packing List

Bill to:	Weston Solutions Inc. 45 Constitution Ave Suite 100 Concord, NH 03301	Date: Invoice No.: Term: Customer PO No.: Sales Rep.:	February 16, 2010 **0912274-2A** Payment upon Receipt 69953 Michael Shen

Ship To: Ok Tool / Savage Wells Site
Incoterms: To Door

Marks	Qty	Description	Net Wt
Sodium Permanganate 40% Net Weight: 1300 KG	16 Totes	Sodium Permanganate 40 %	45,855.68 LBS
TOTAL	**16 Totes**		**45,855.68 LBS**

Packing: In 1300KG tote. Total 16 totes

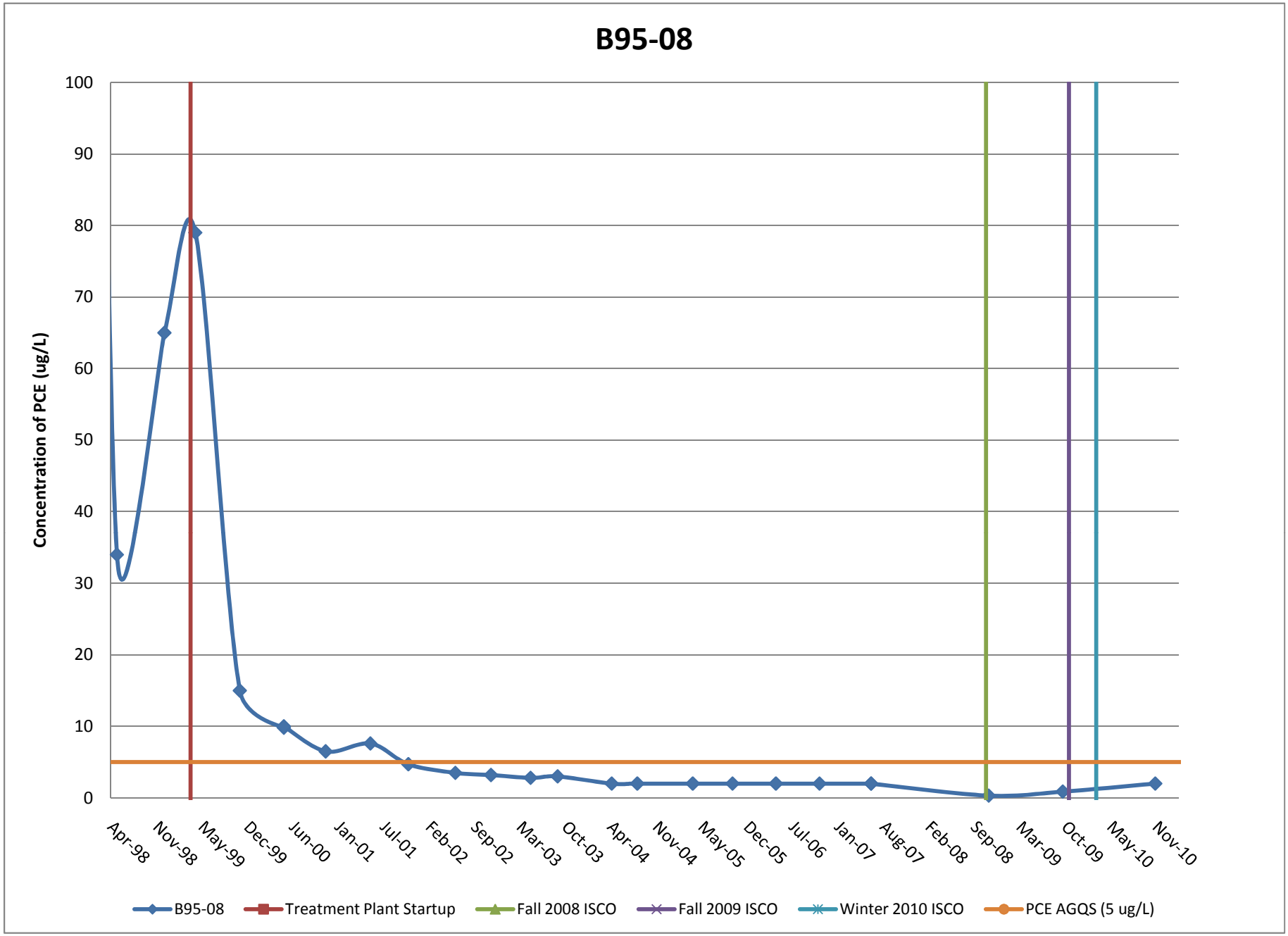
APPENDIX C

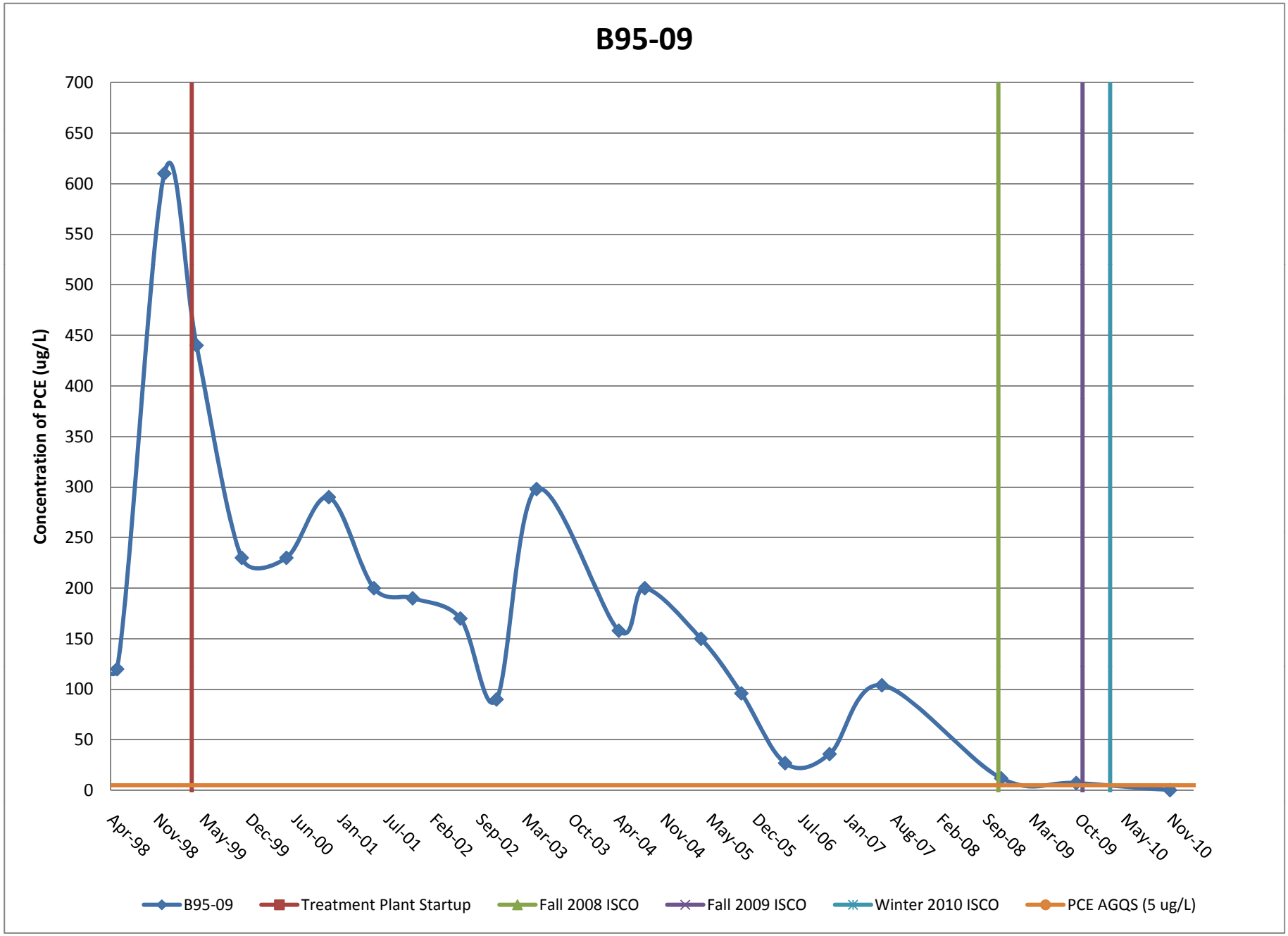
ANALYTICAL DATA PACKAGES

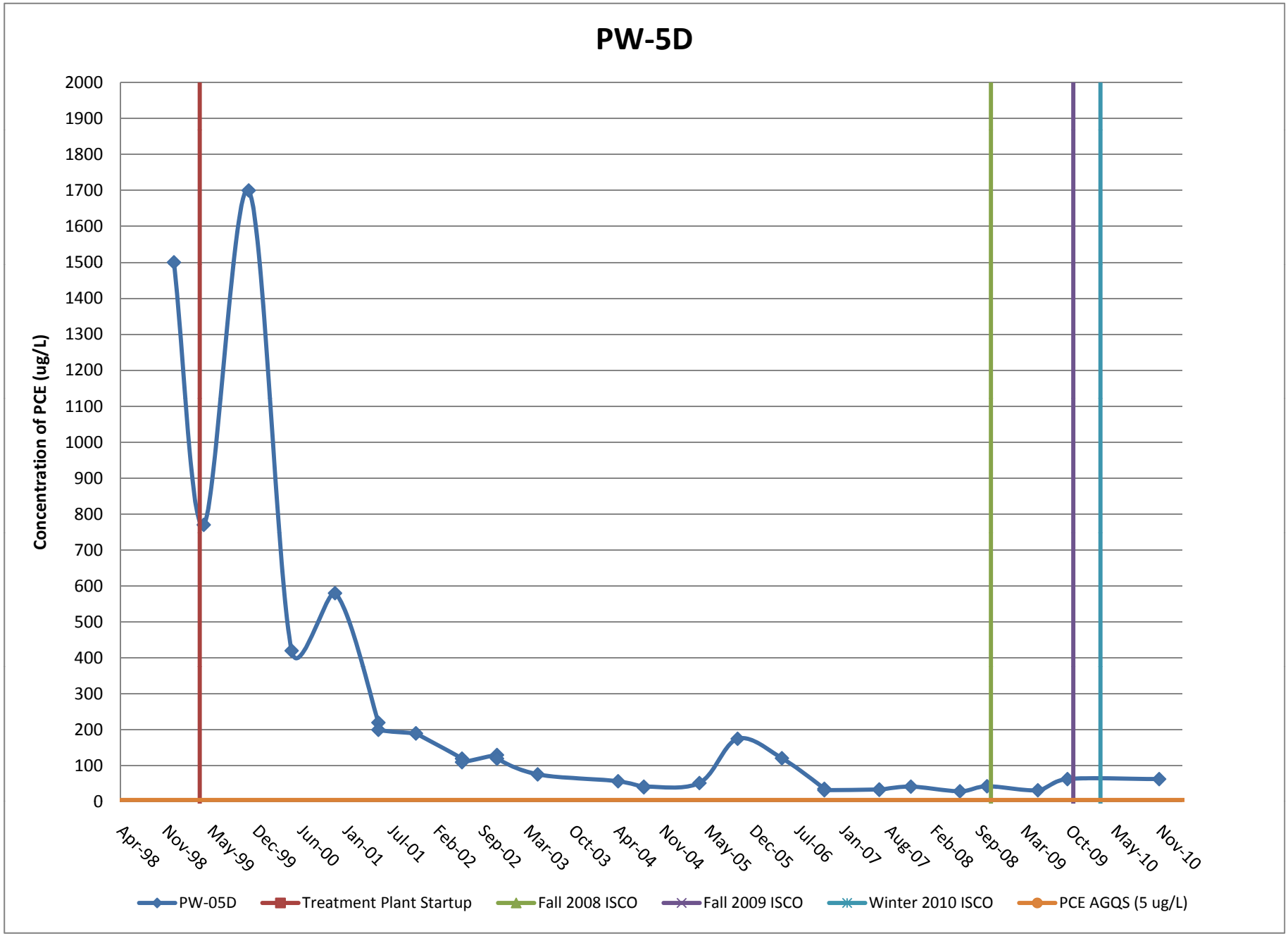
Appendix C not included in this copy of the document.

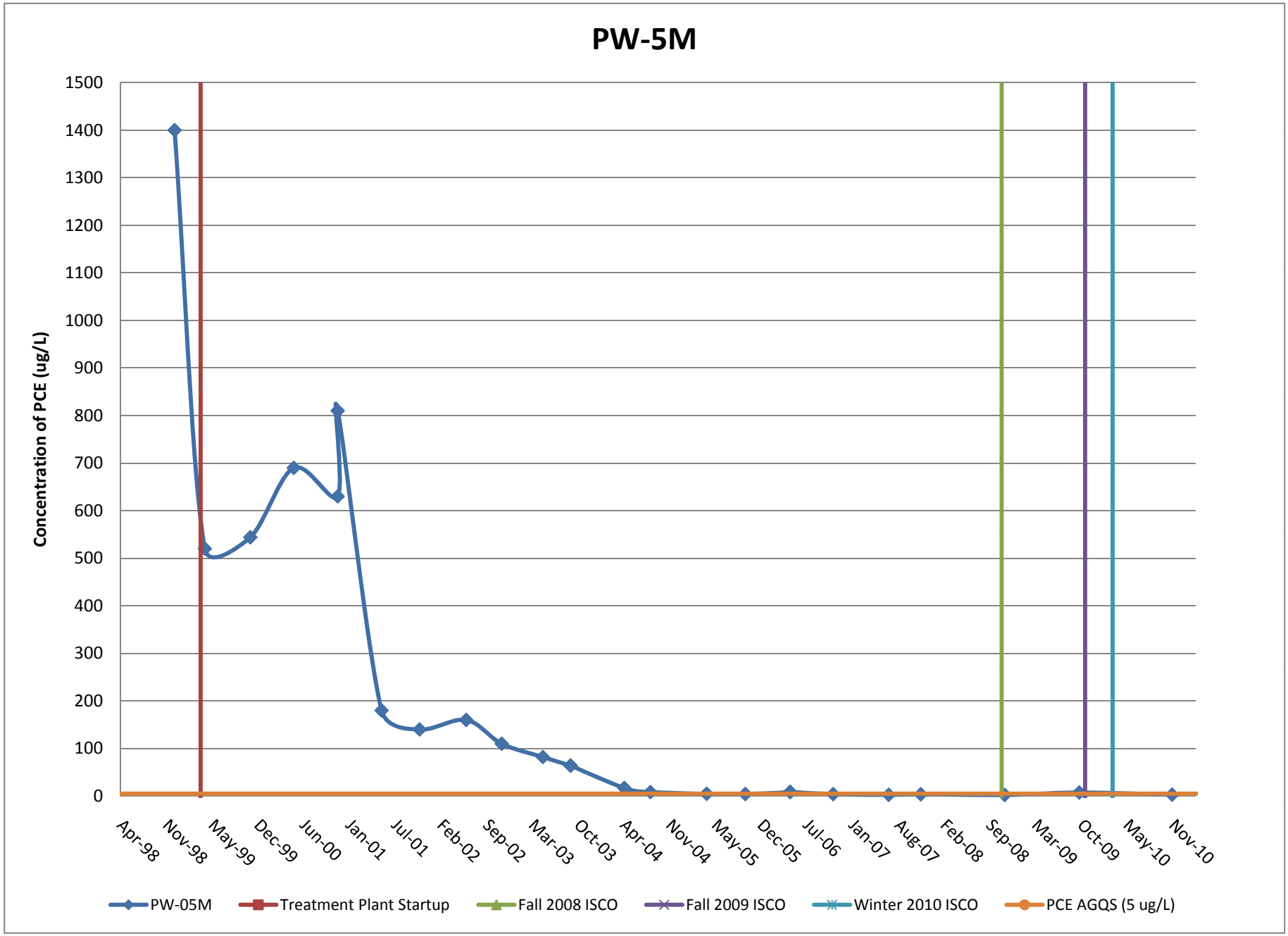
APPENDIX D

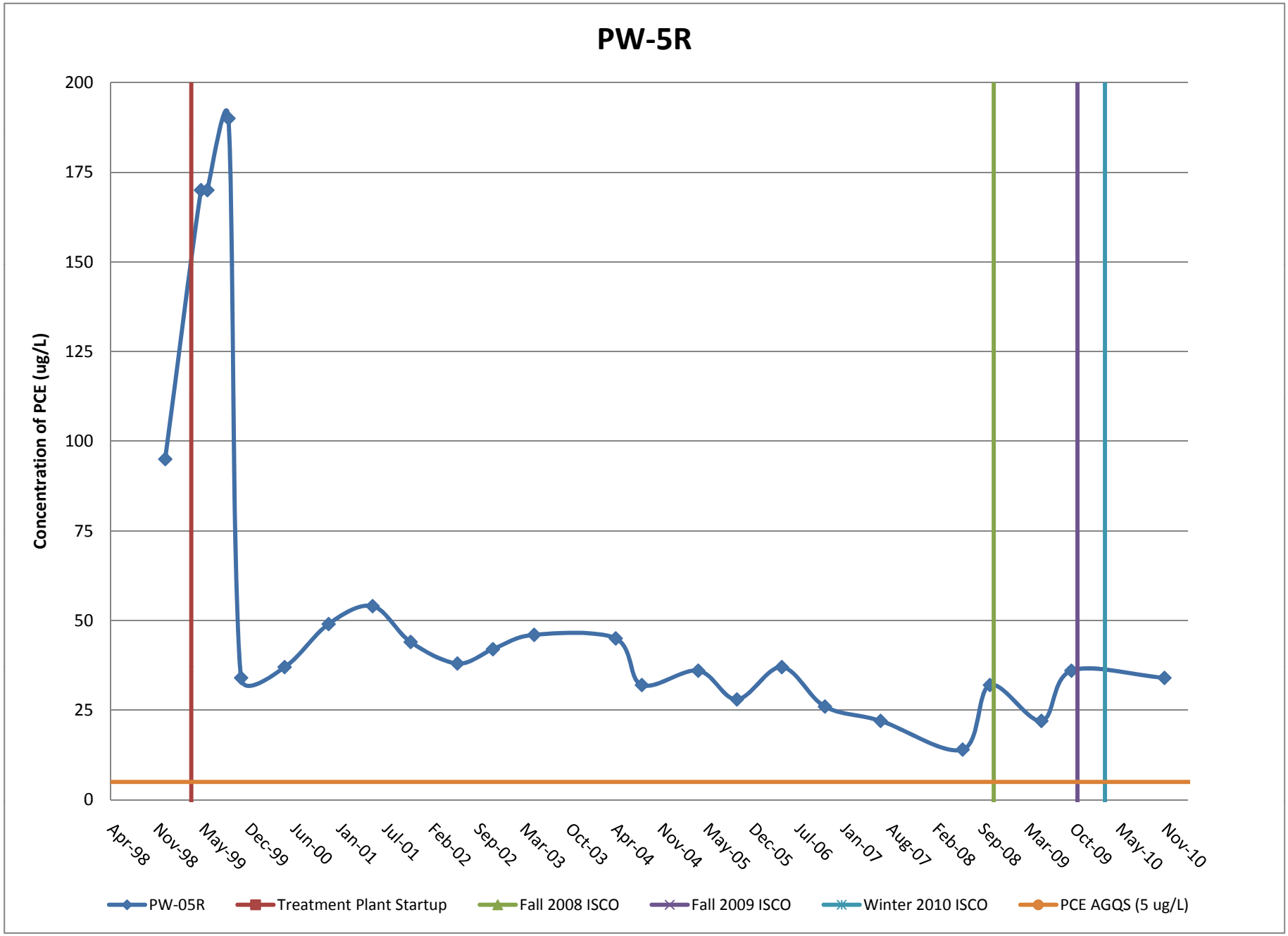
INTERIOR WELL PCE GRAPHS

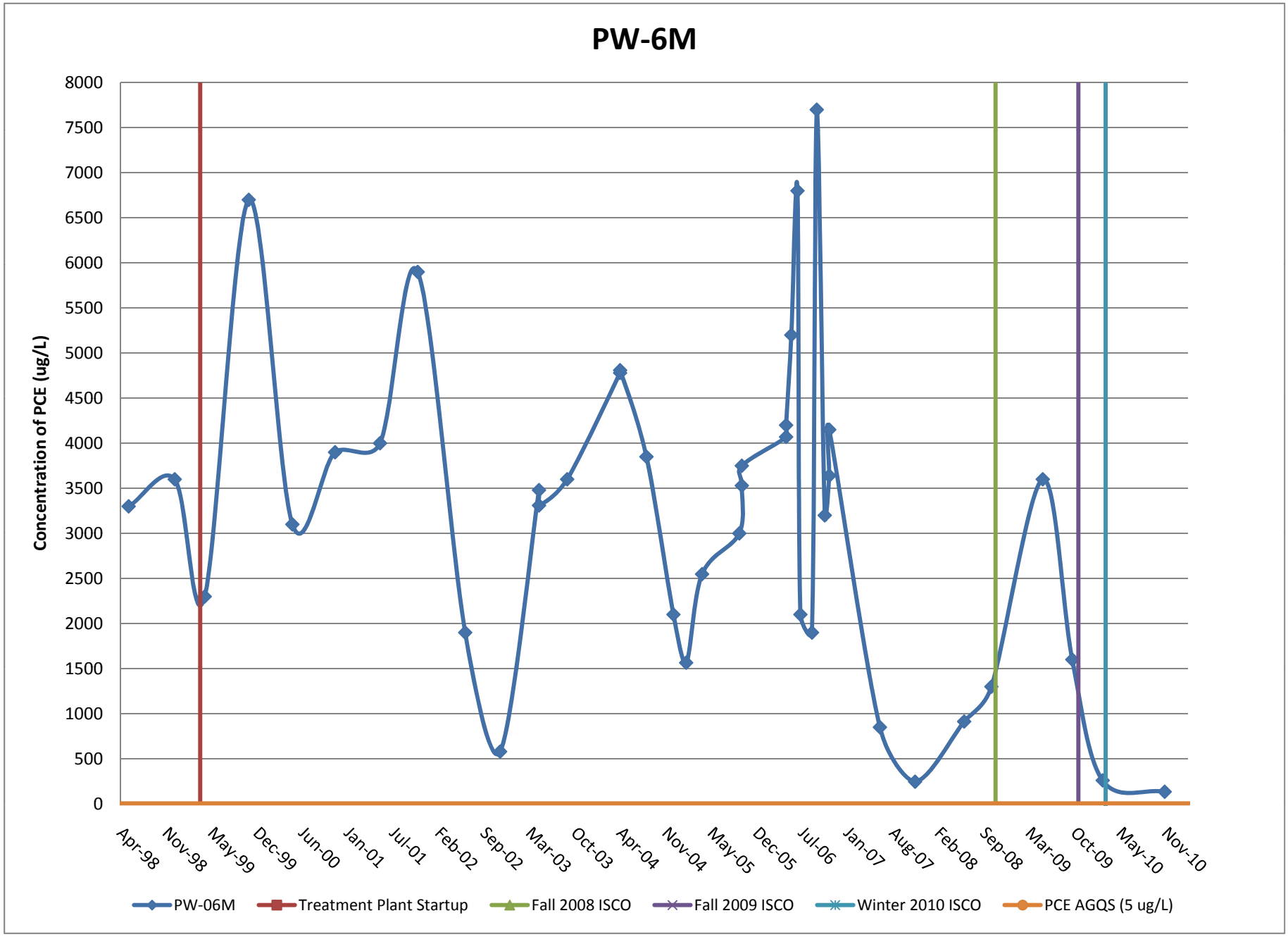

B95-08
Concentration of PCE (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
B95-08
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

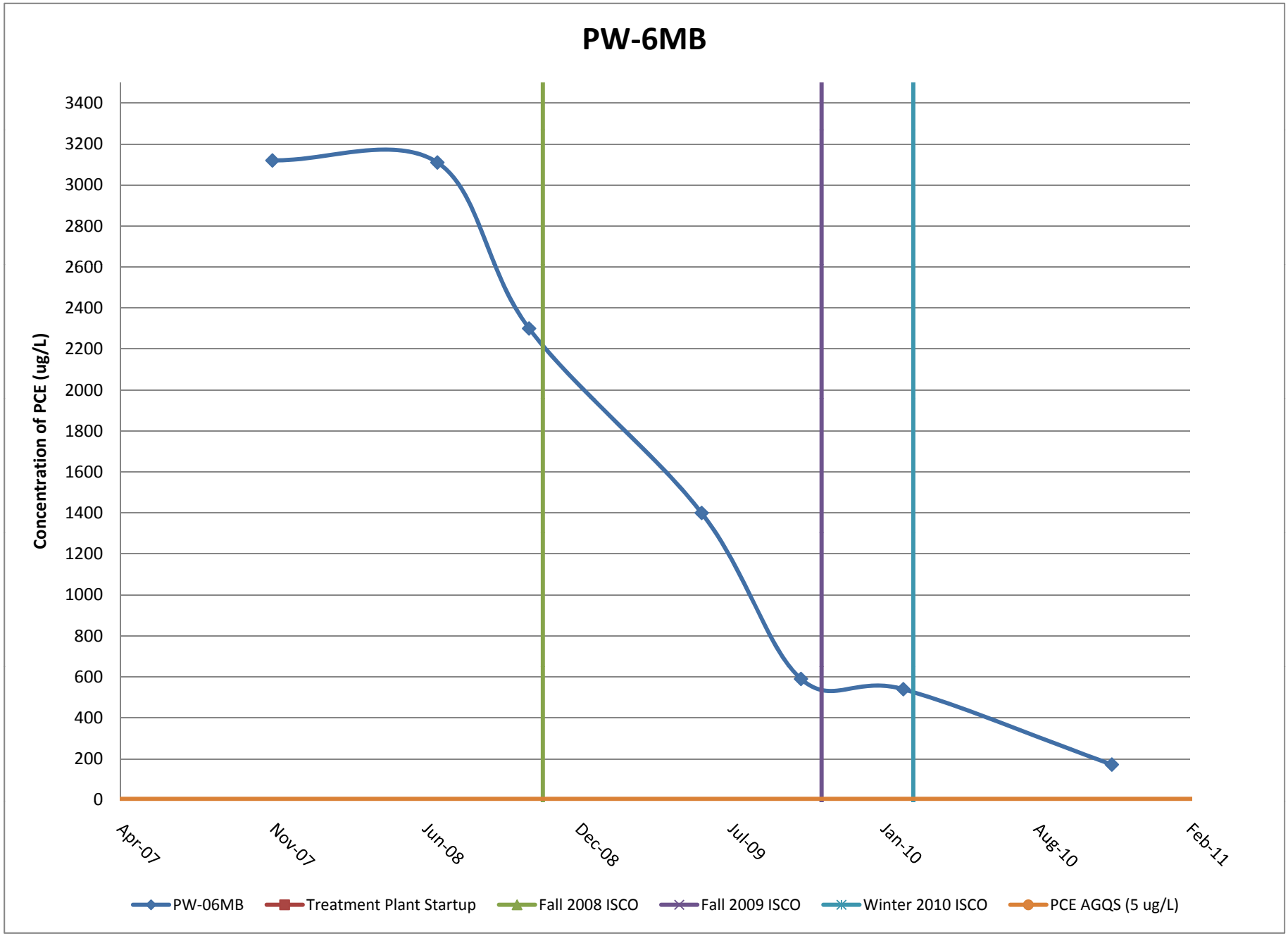

B95-09
Concentration of PCE (ug/L)
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
B95-09
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

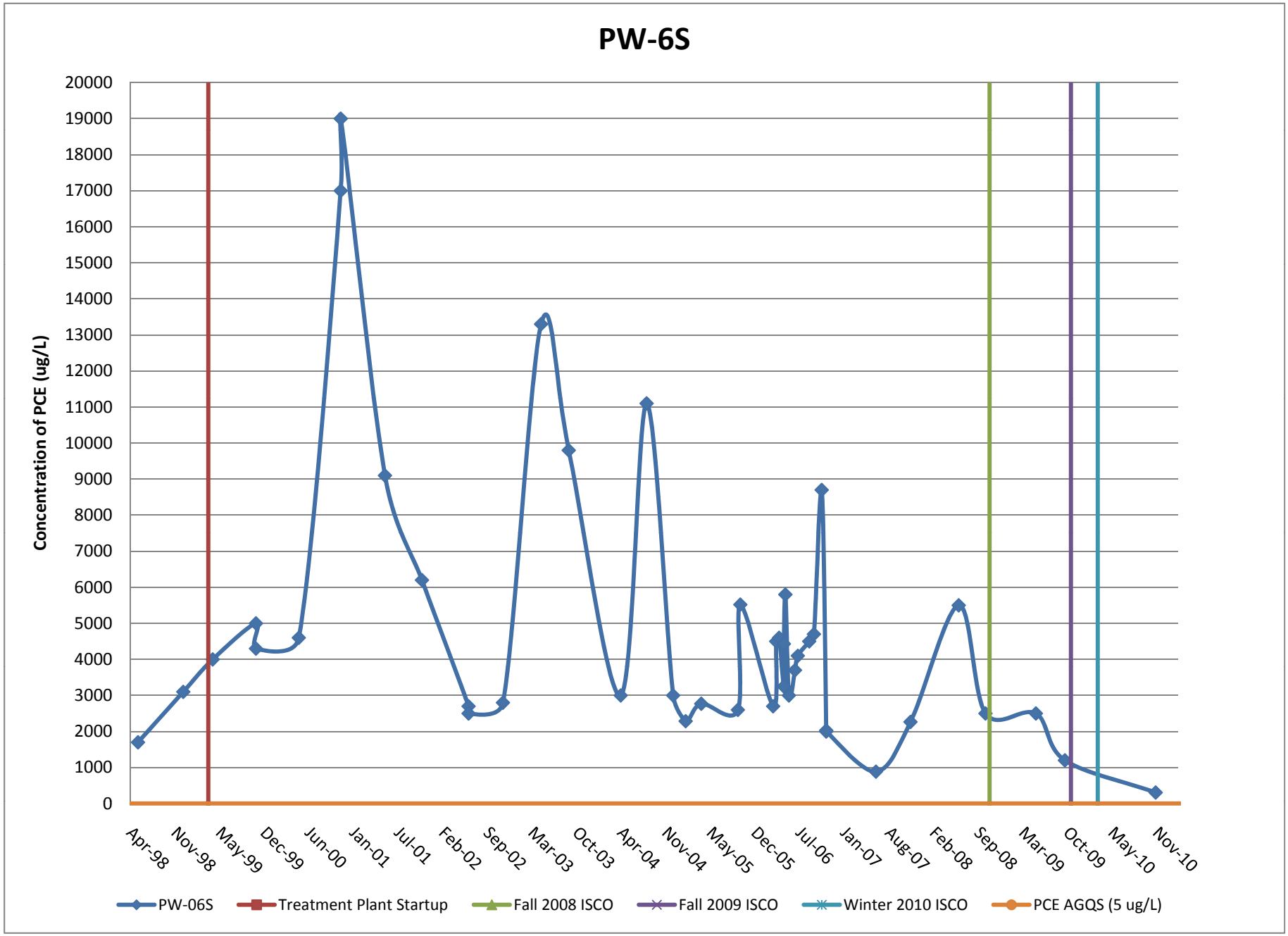

PW-5D
Concentration of PCE (ug/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-05D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

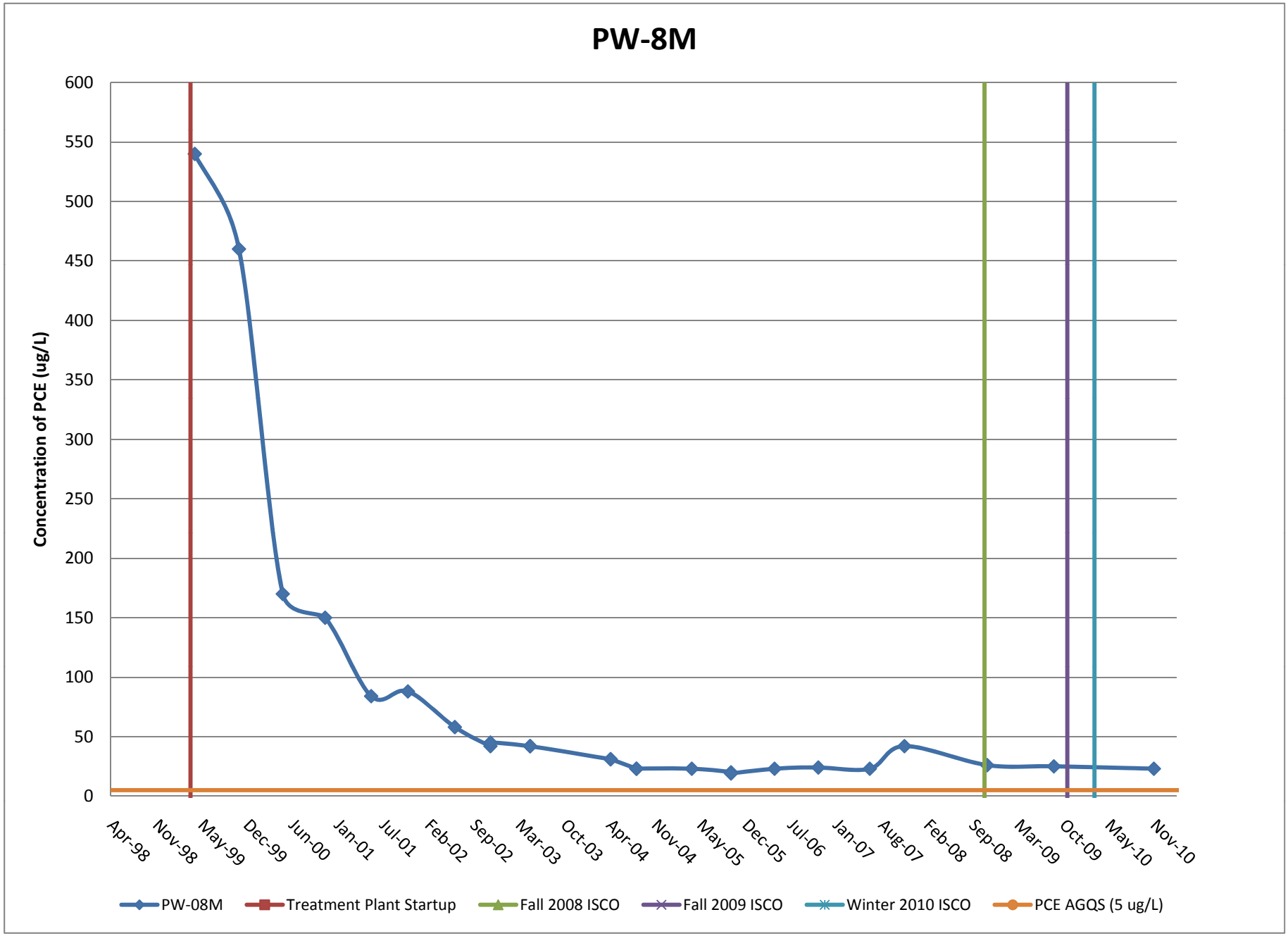

PW-5M
Concentration of PCE (ug/L)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-05M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

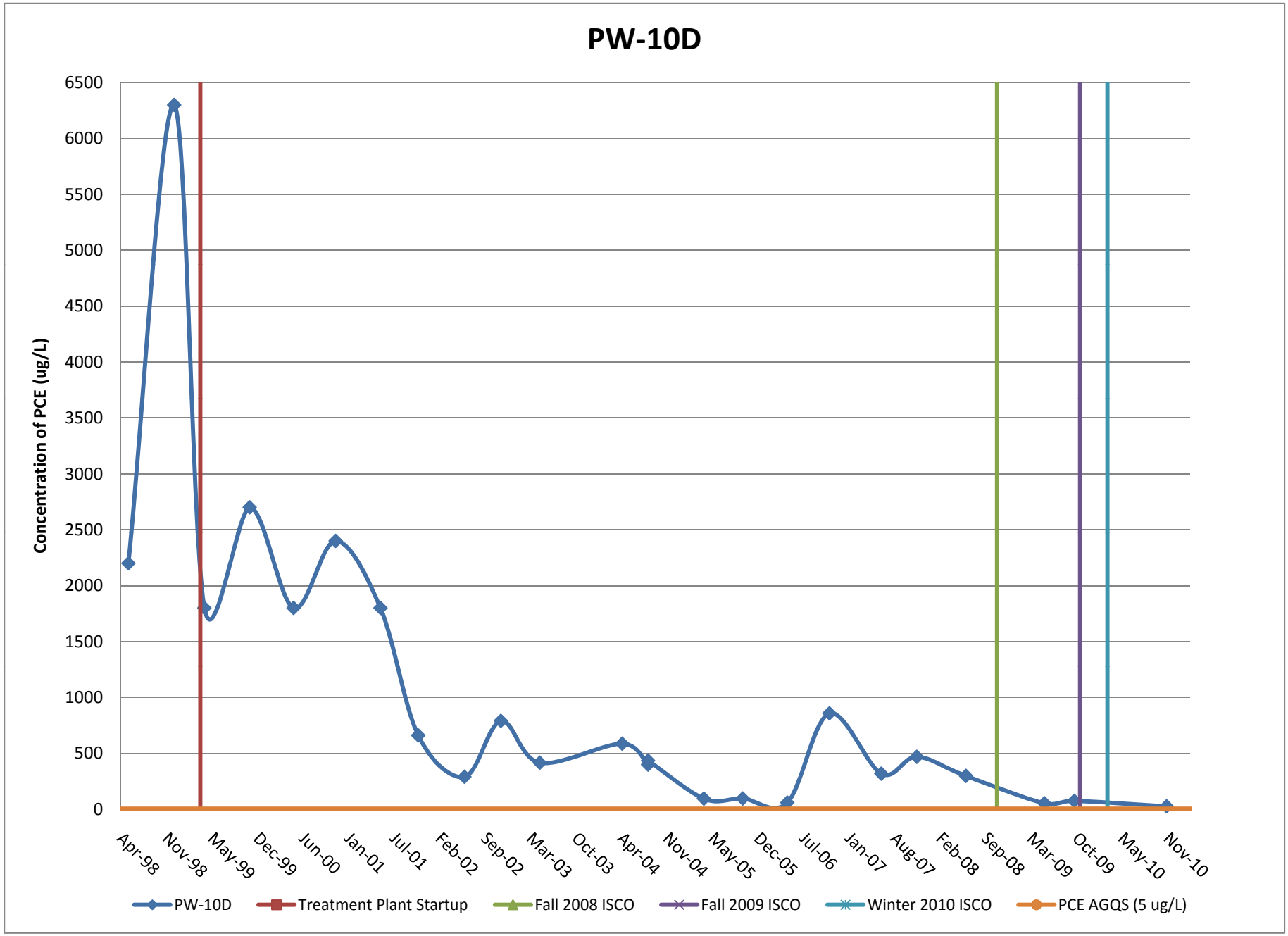

PW-5R
Concentration of PCE (ug/L)
200
175
150
125
100
75
50
25
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-05R
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

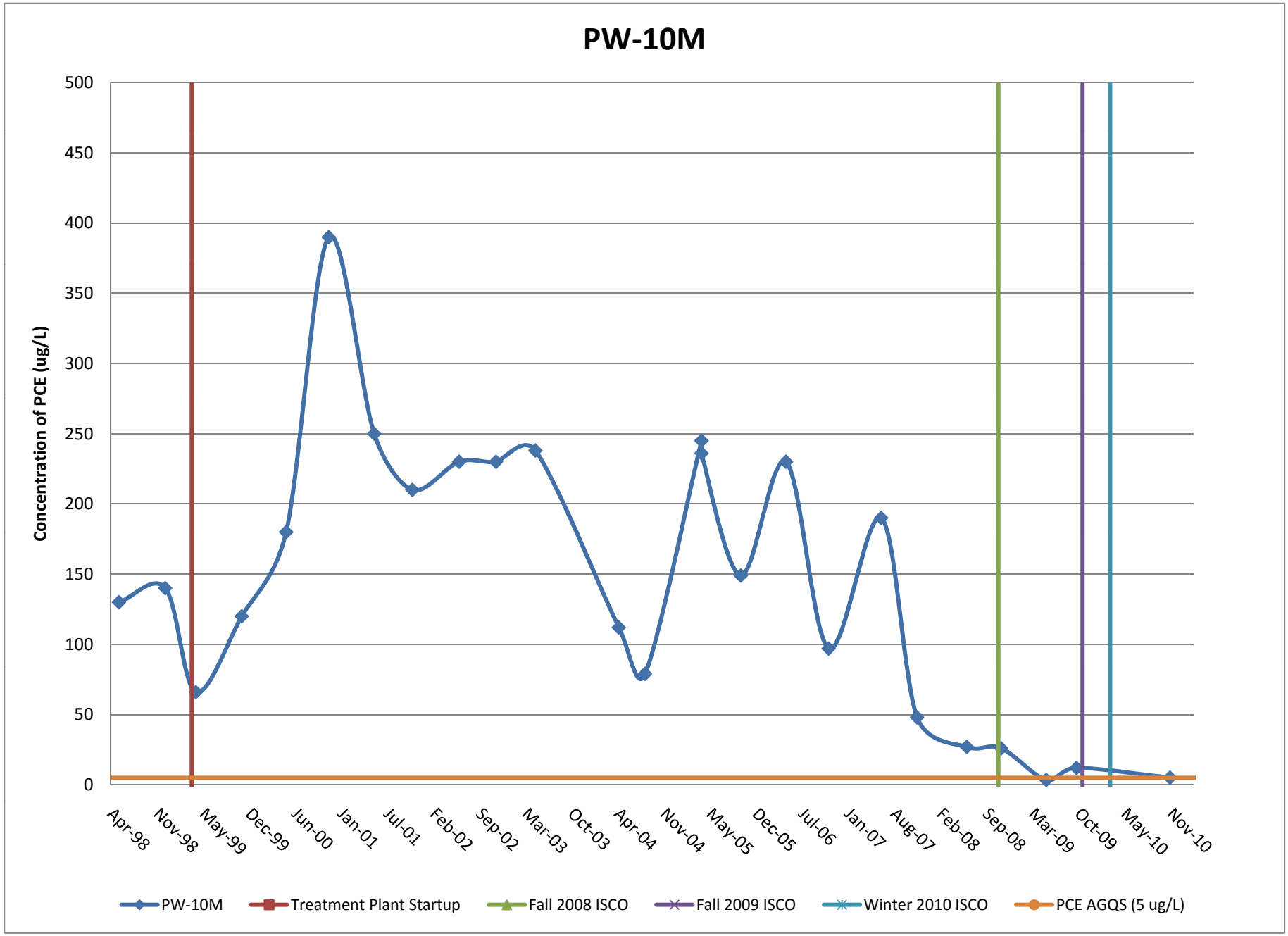

PW-6M
Concentration of PCE (ug/L)
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-06M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

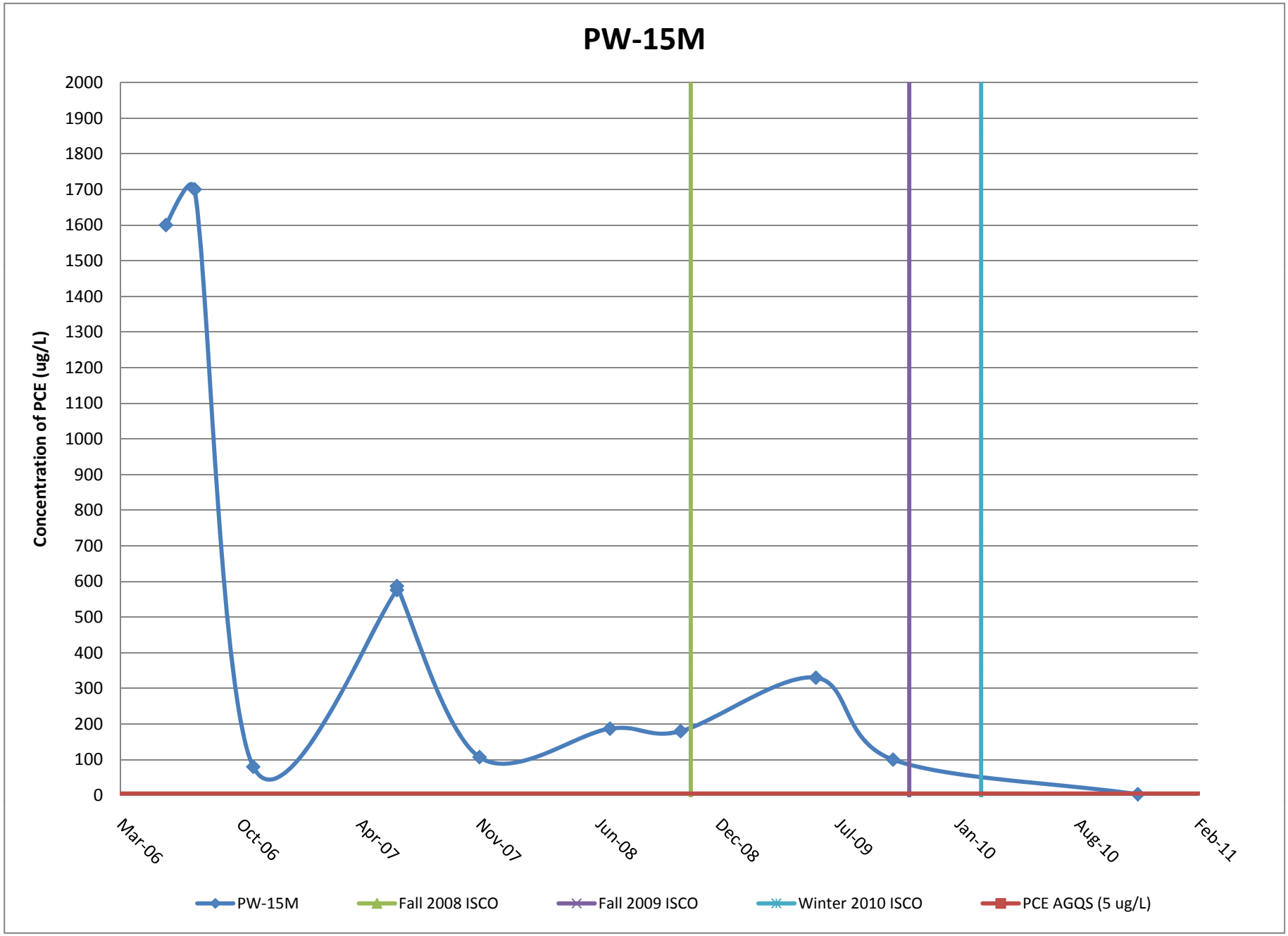

PW-6MB
Concentration of PCE (ug/L)
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-06MB
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

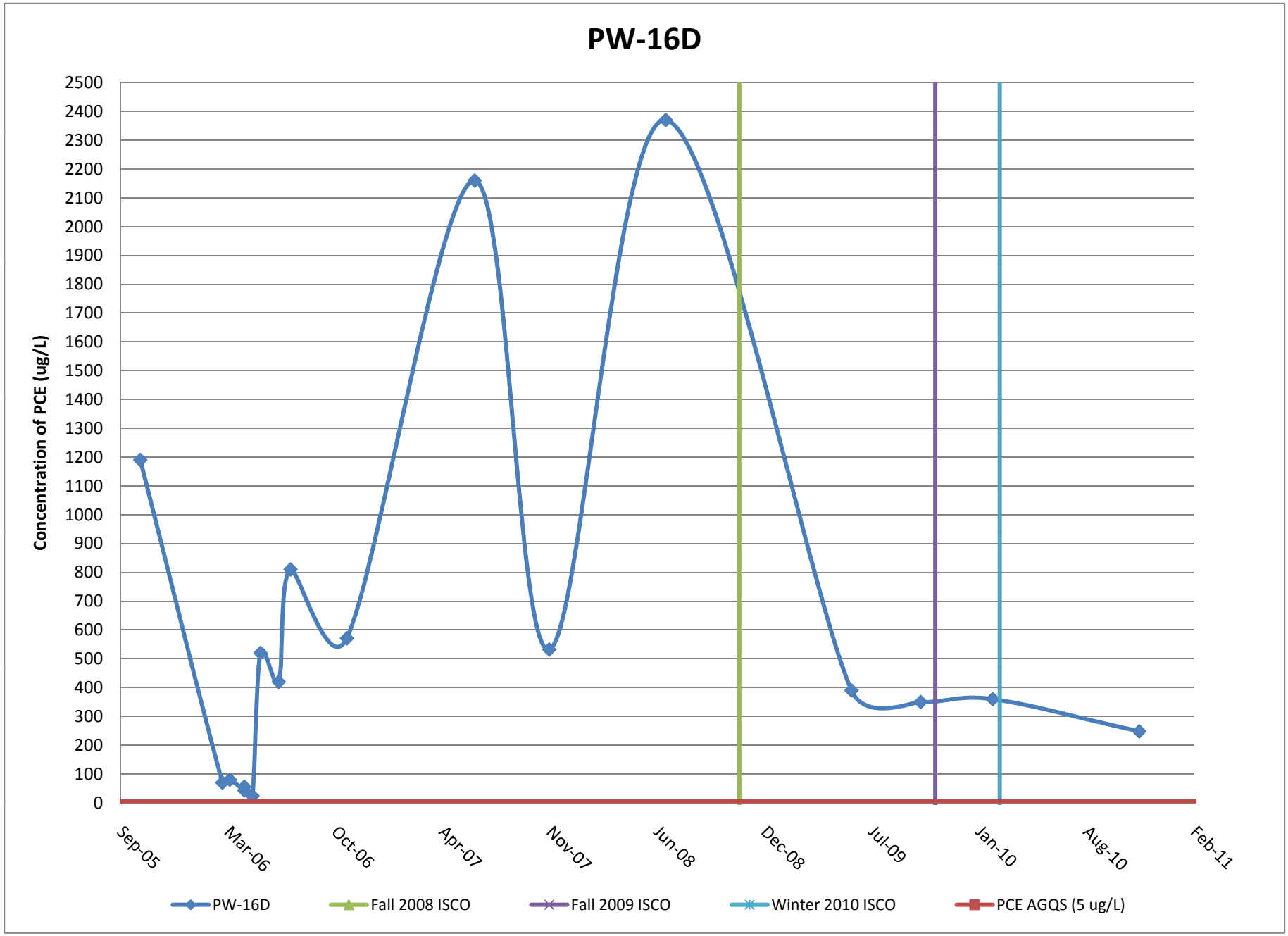

PW-6S
Concentration of PCE (ug/L)
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-06S
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

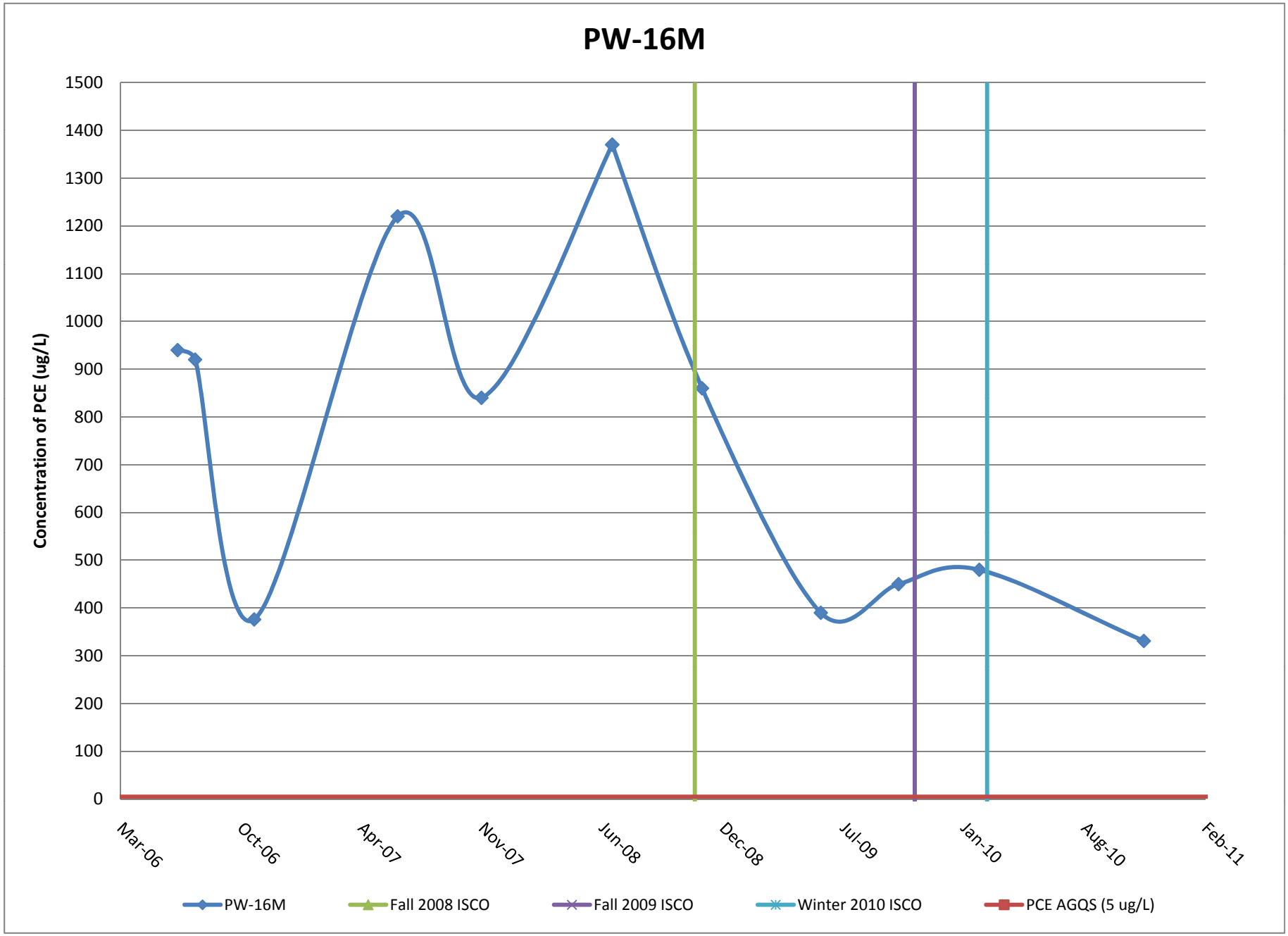

PW-8M
Concentration of PCE (ug/L)
600
550
500
450
400
350
300
250
200
150
100
50
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-08M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

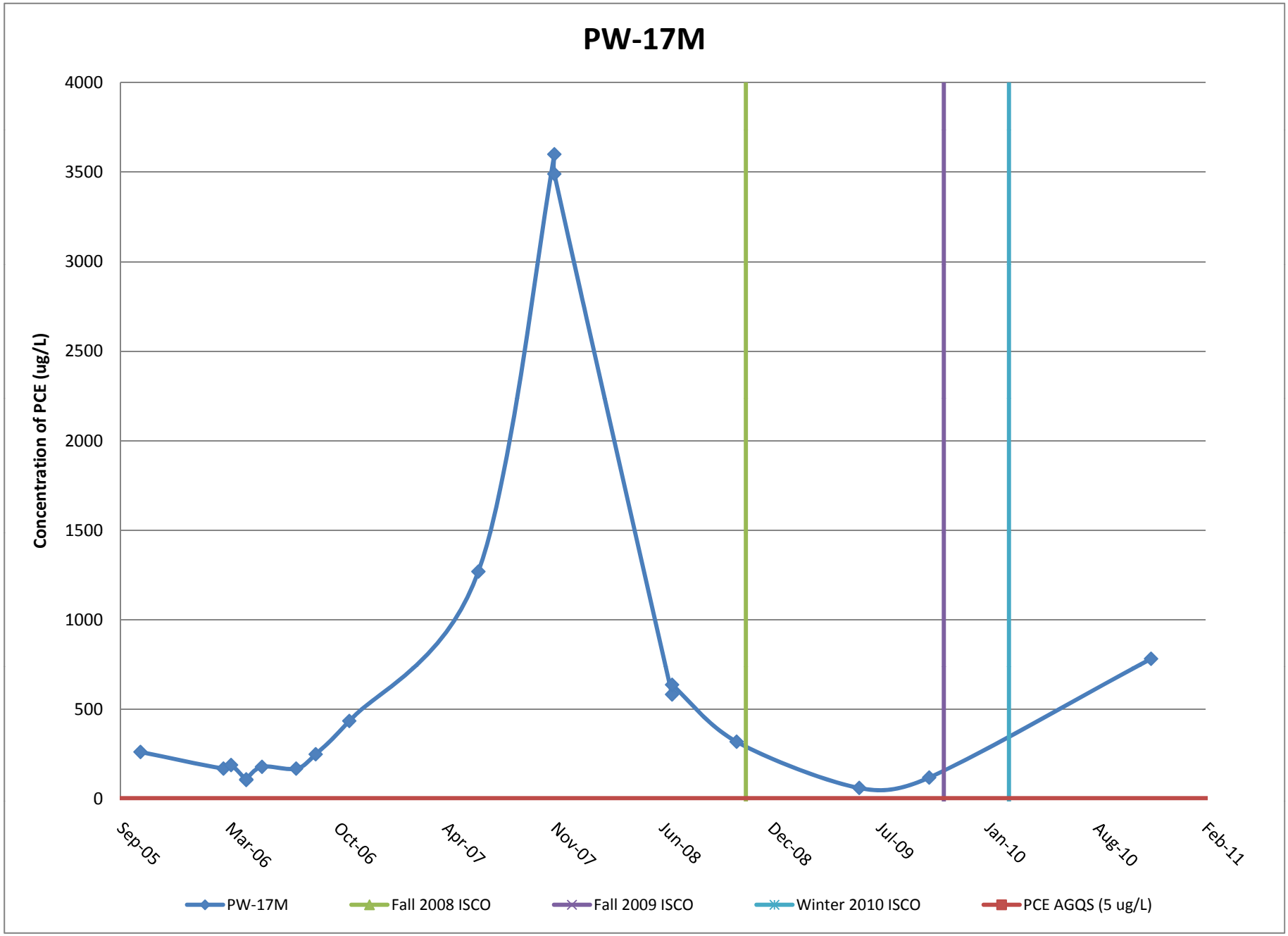

PW-10D
Concentration of PCE (ug/L)
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-10D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

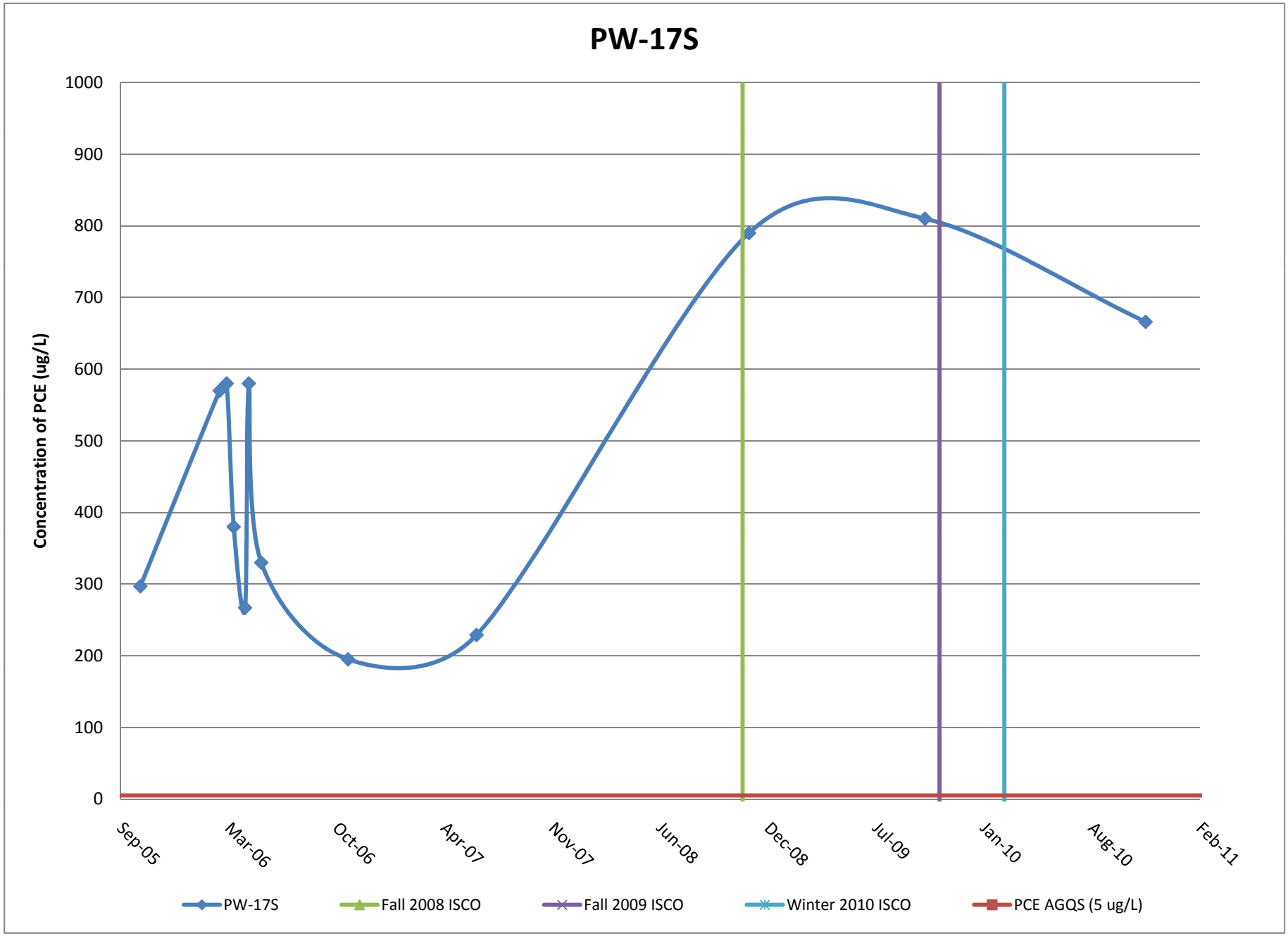

PW-10M
Concentration of PCE (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-10M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

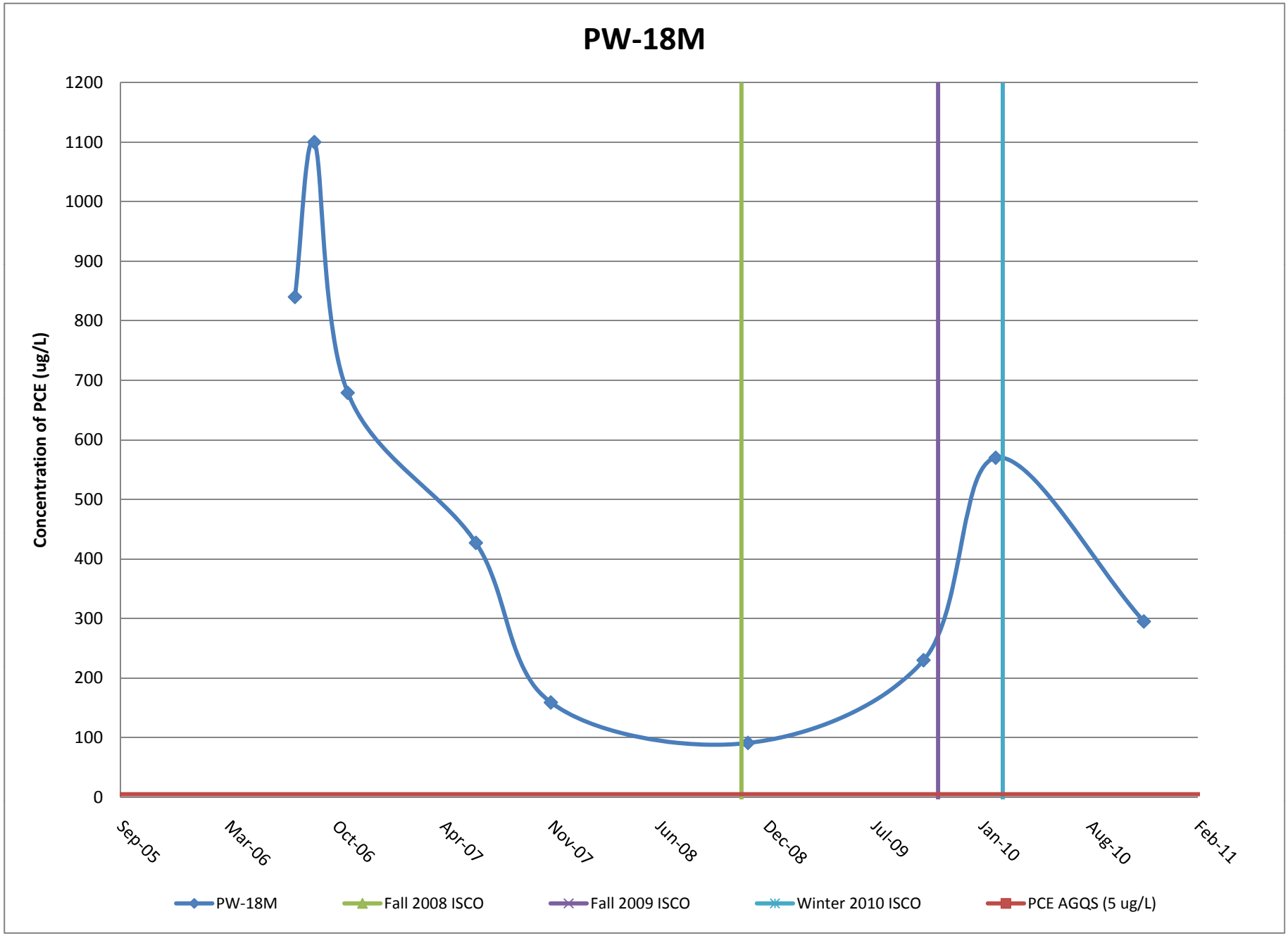

PW-15M
Concentration of PCE (ug/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-15M
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

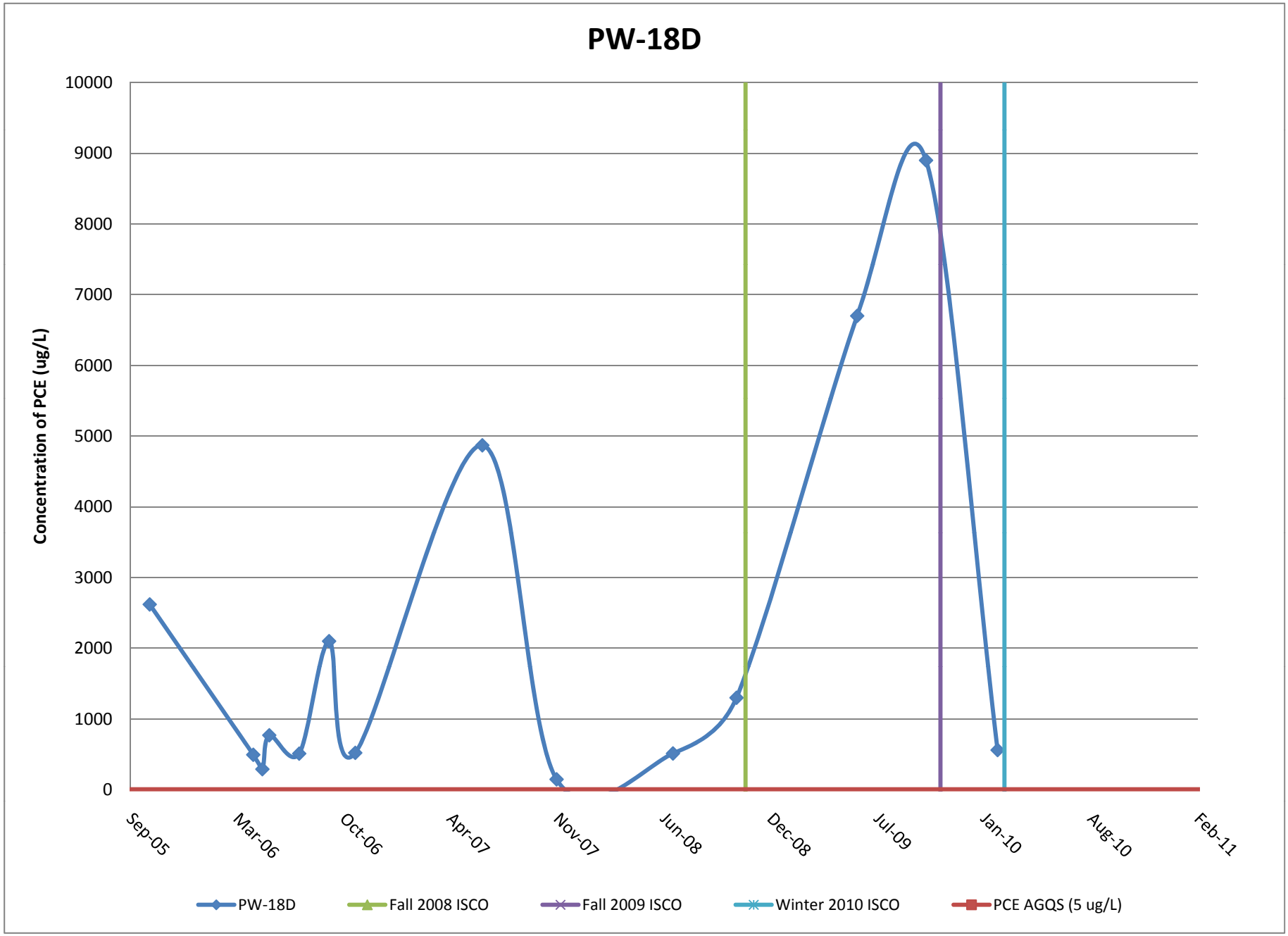

PW-16D
Concentration of PCE (ug/L)
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-16D
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

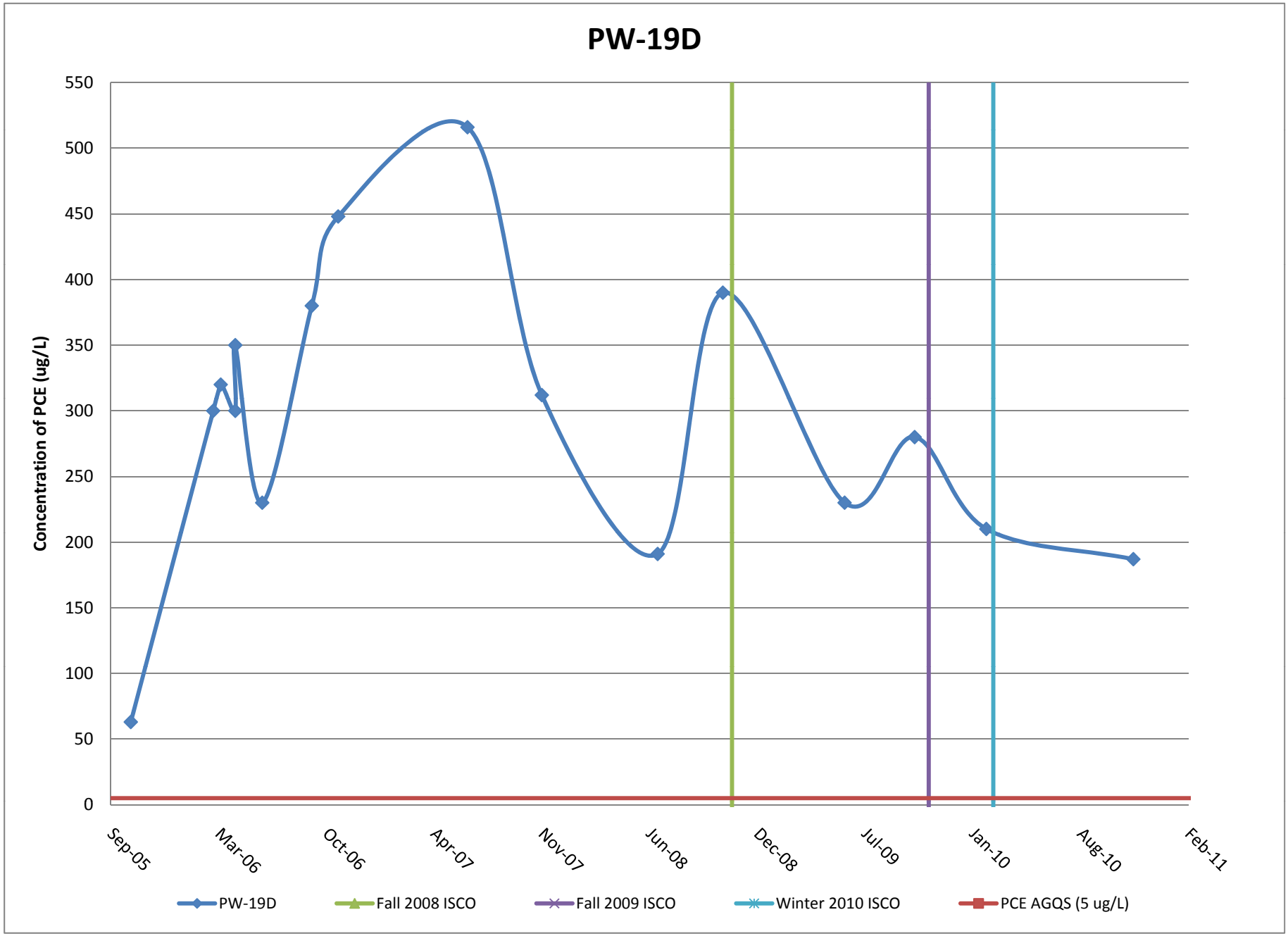

PW-16M
Concentration of PCE (ug/L)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-16M
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

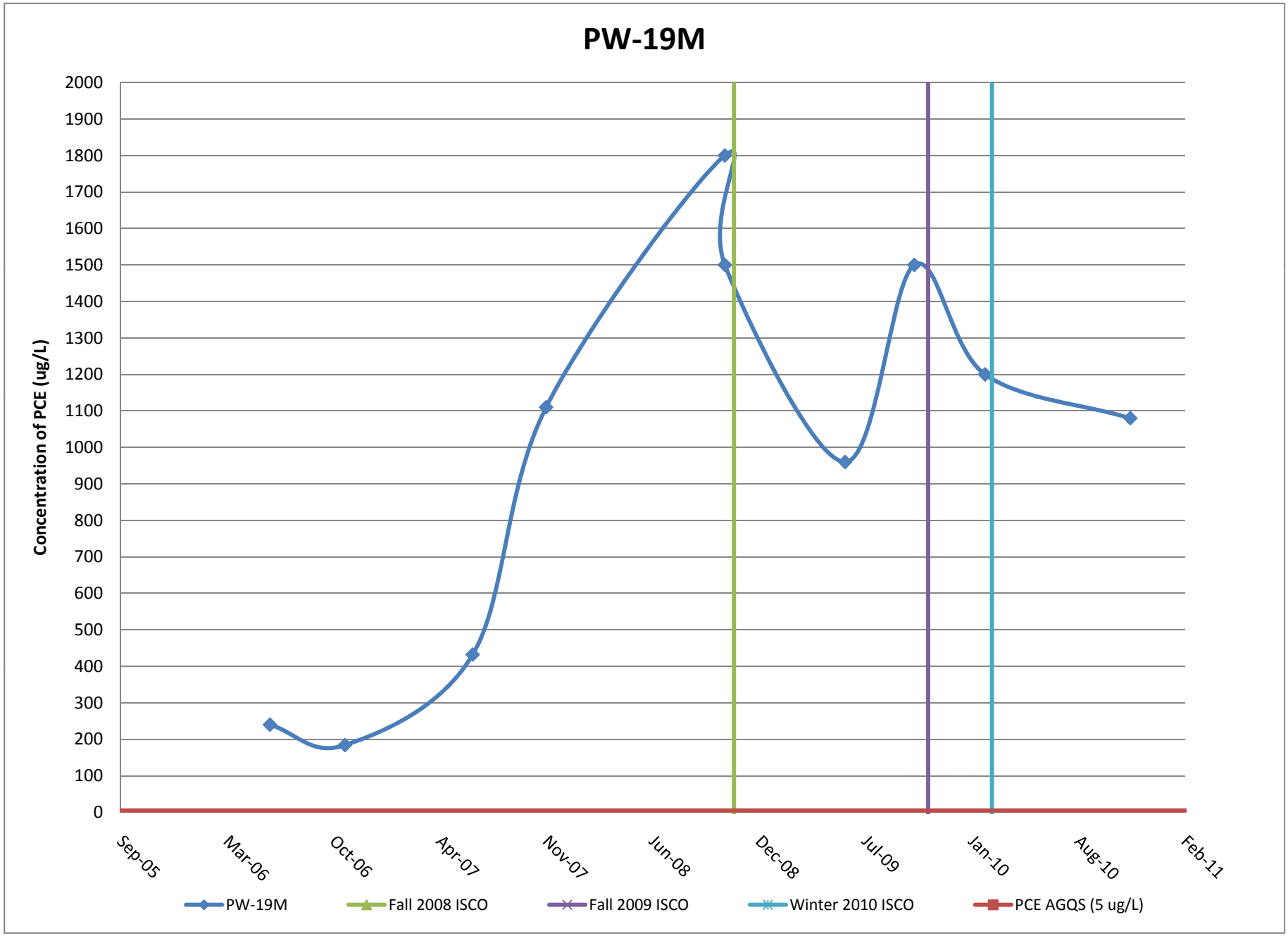

PW-17M
Concentration of PCE (ug/L)
4000
3500
3000
2500
2000
1500
1000
500
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-17M
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

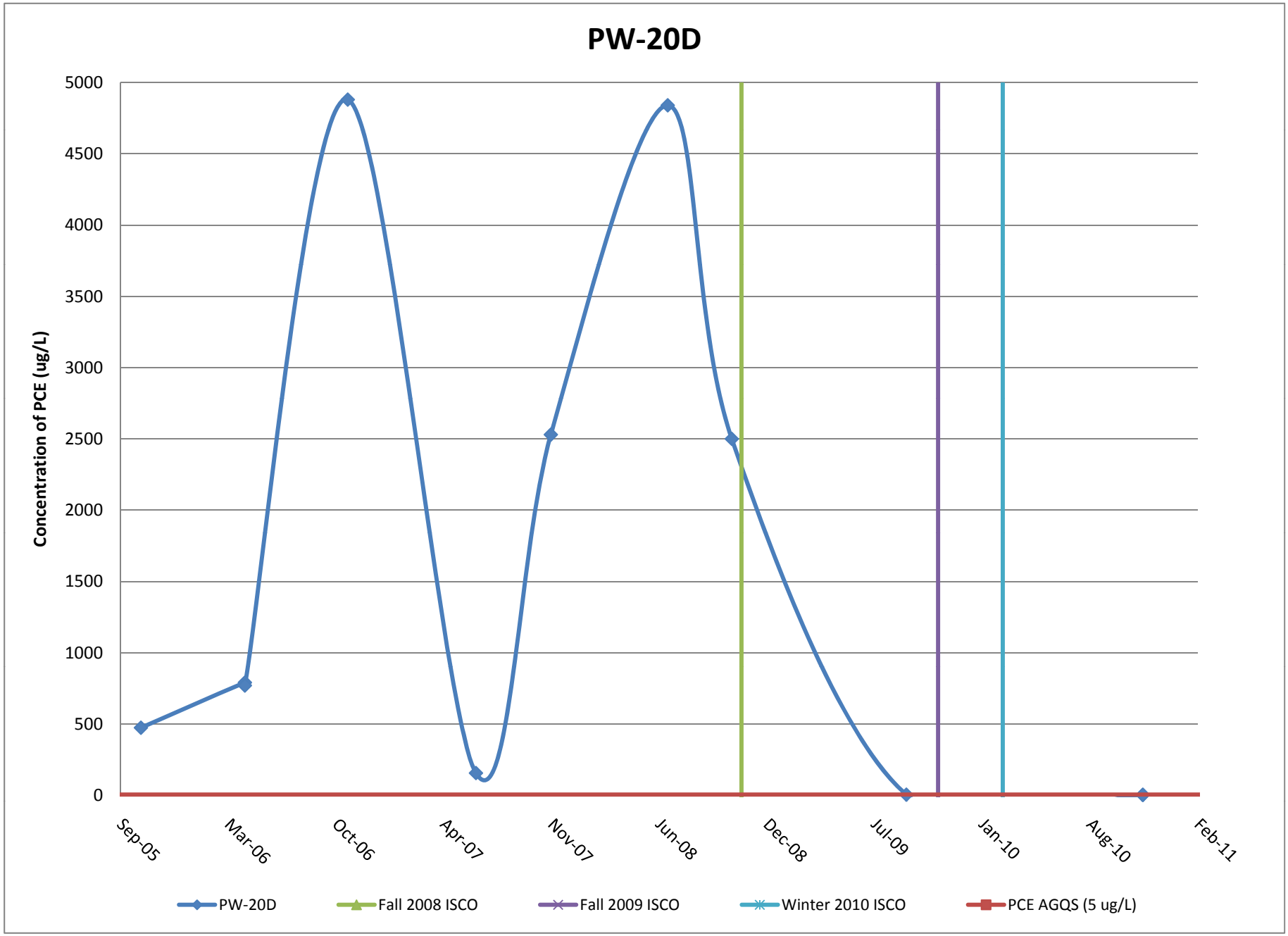

PW-17S
Concentration of PCE (ug/L)
1000
900
800
700
600
500
400
300
200
100
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-17S
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

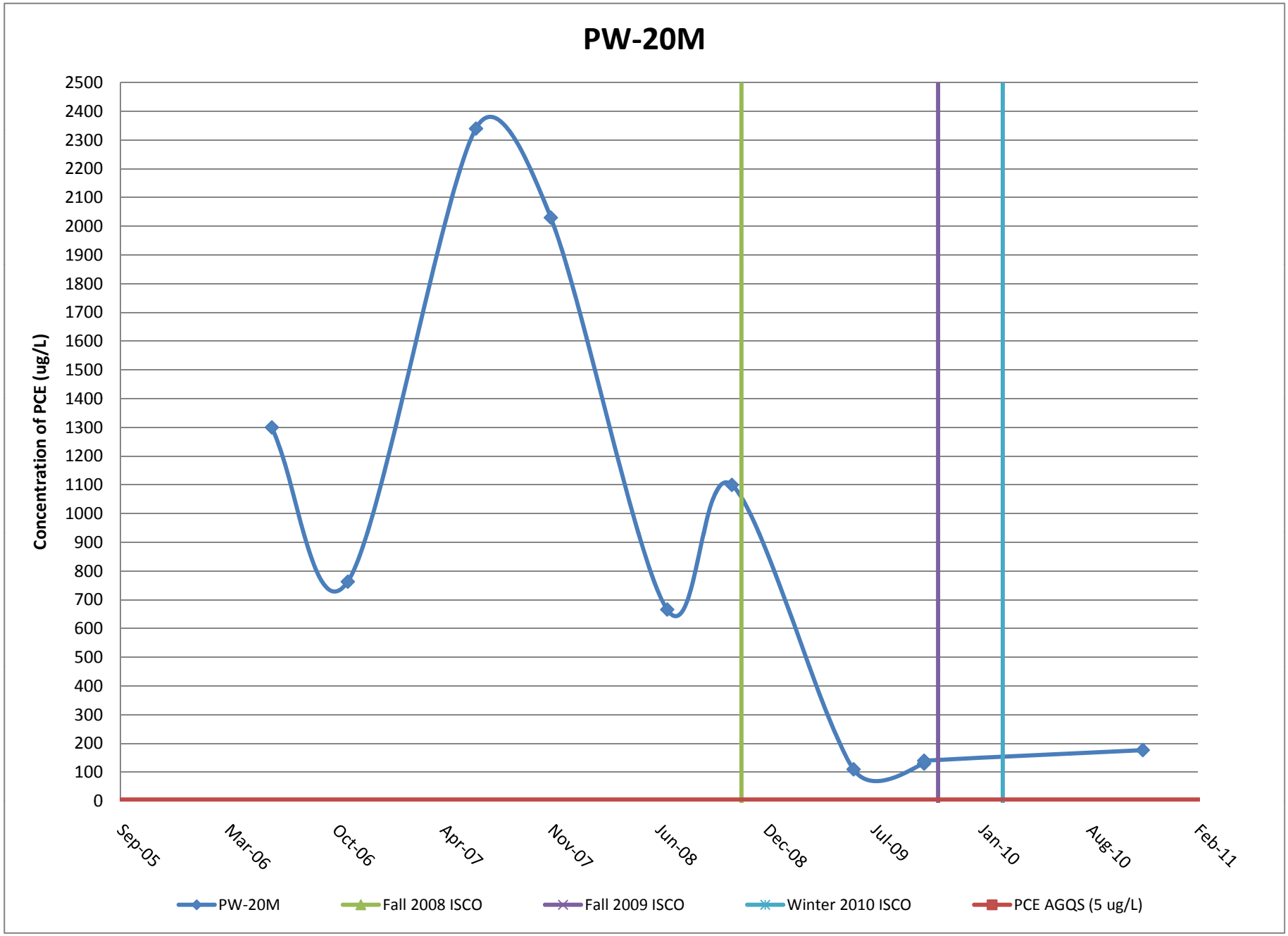

PW-18M
Concentration of PCE (ug/L)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-18M
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

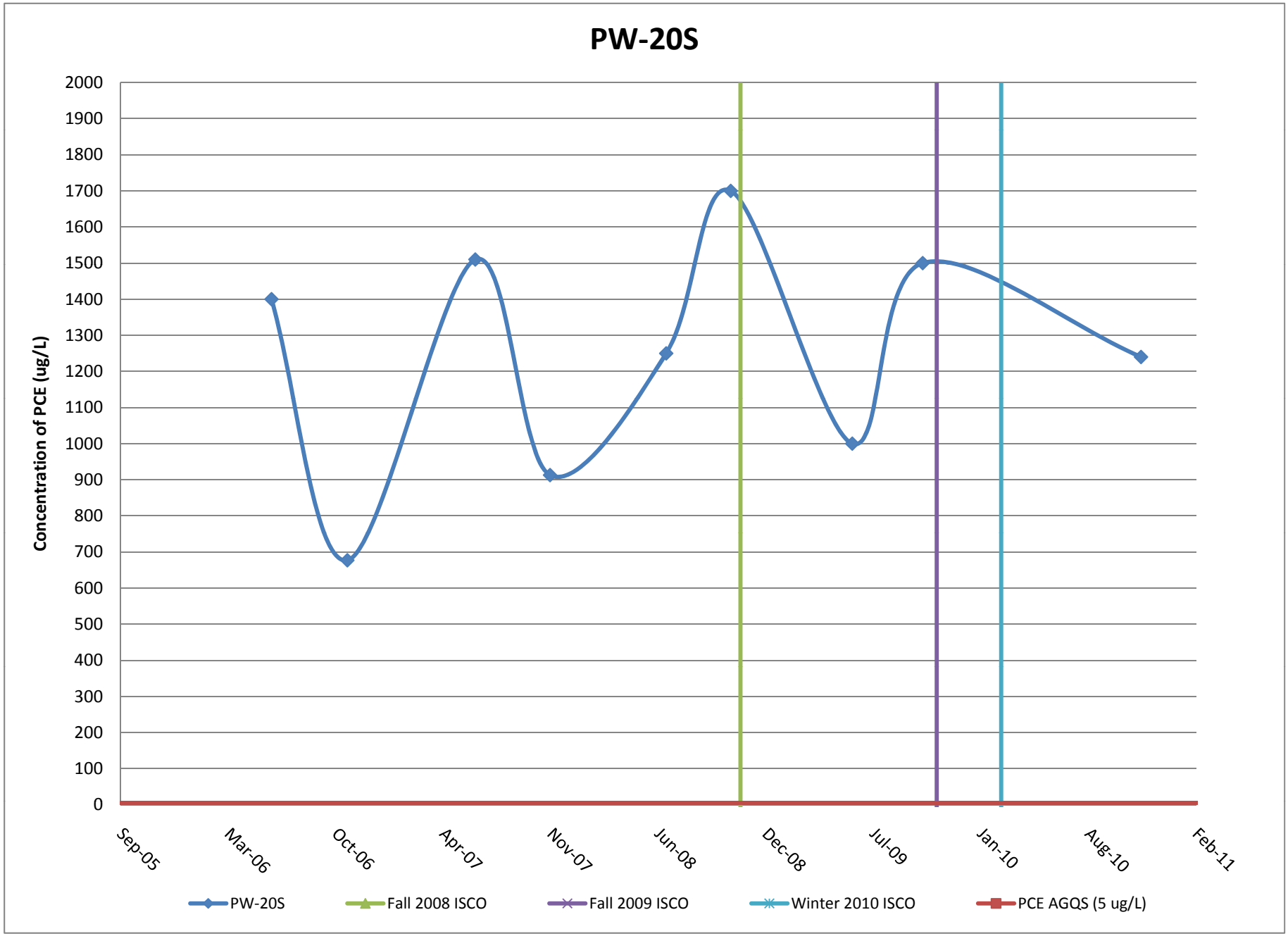

PW-18D
Concentration of PCE (ug/L)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-18D
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

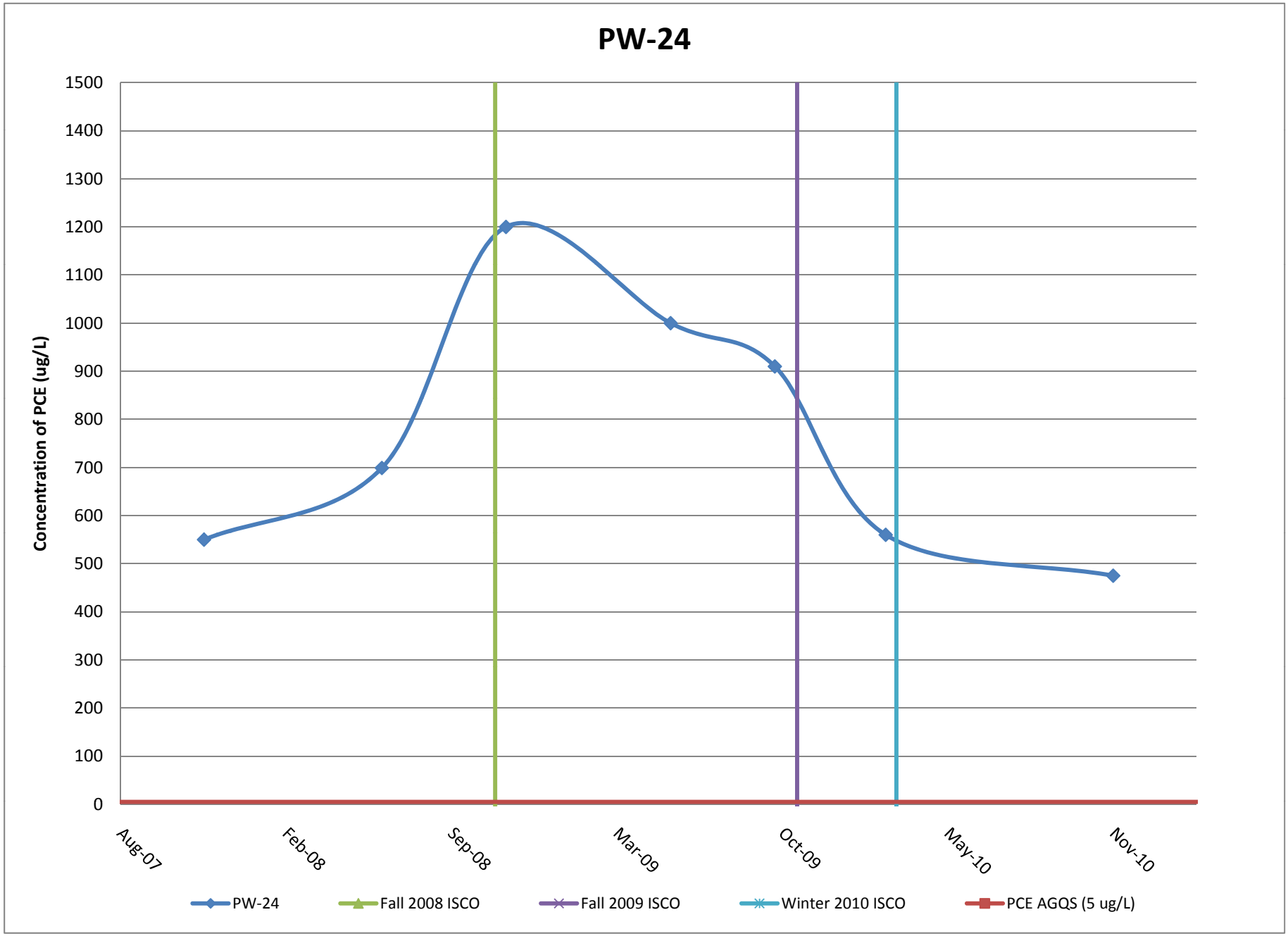

PW-19D
Concentration of PCE (ug/L)
550
500
450
400
350
300
250
200
150
100
50
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-19D
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

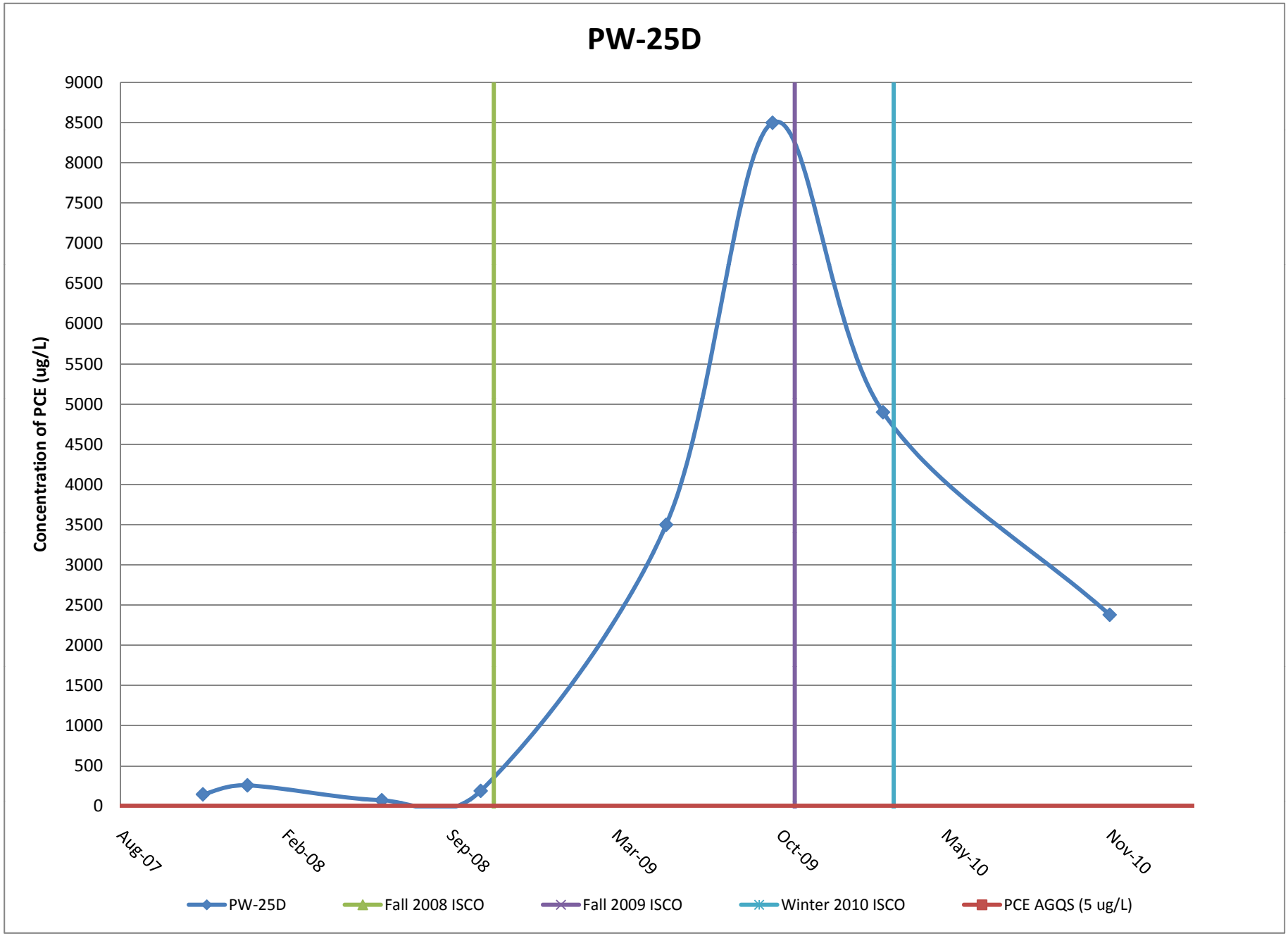

PW-19M
Concentration of PCE (ug/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-19M
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

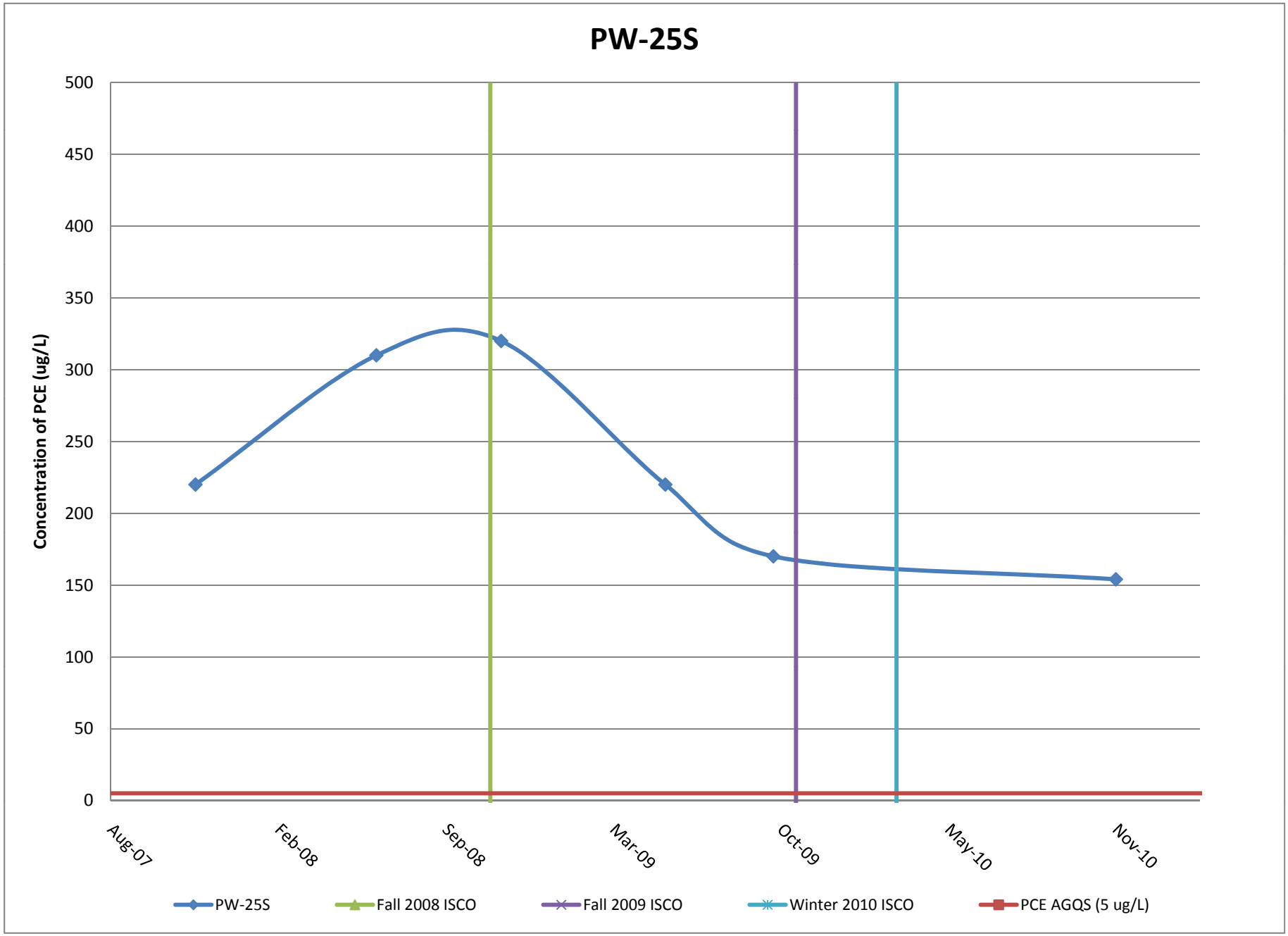

PW-20D
Concentration of PCE (ug/L)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-20D
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

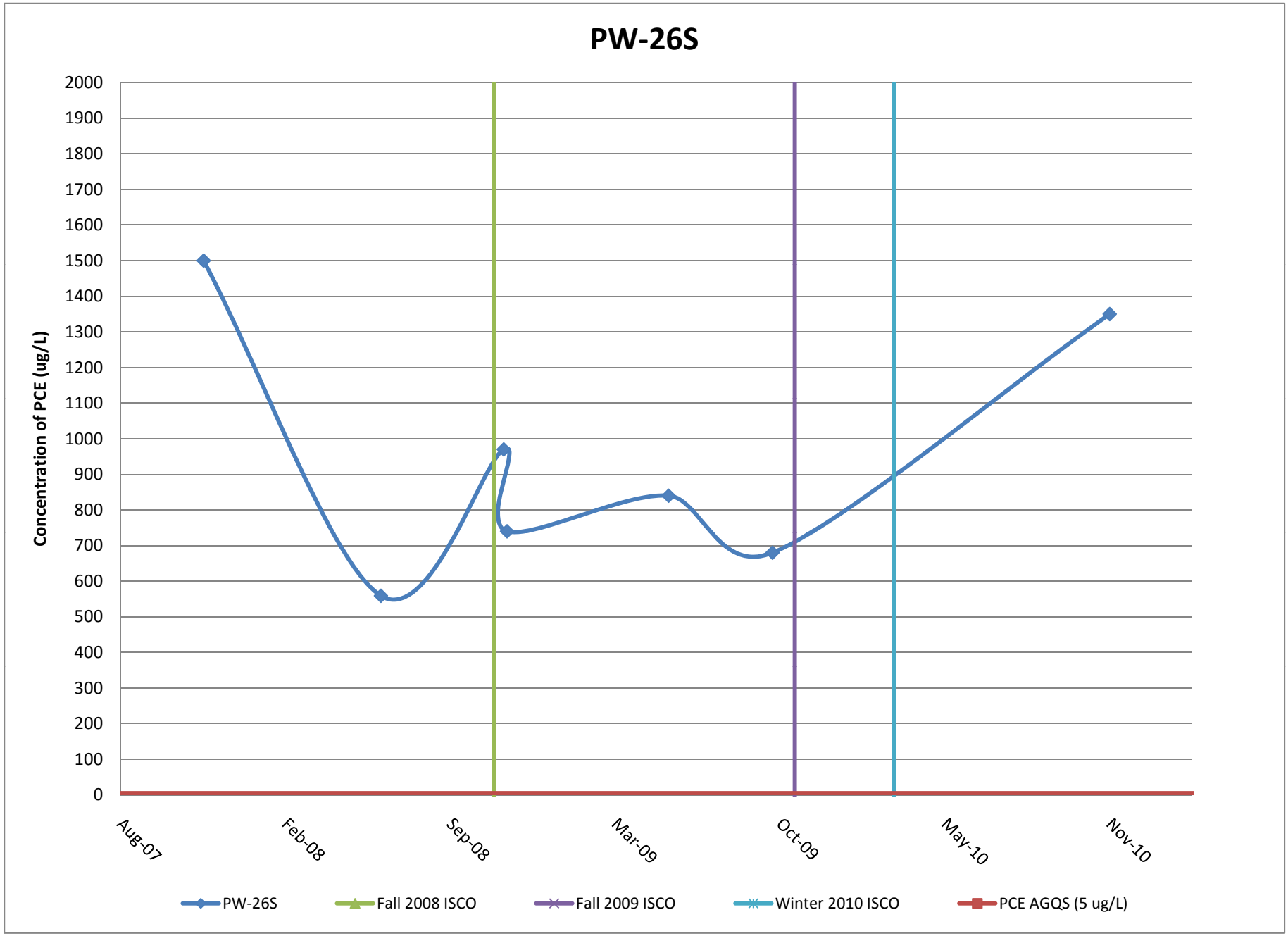

PW-20M
Concentration of PCE (ug/L)
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-20M
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

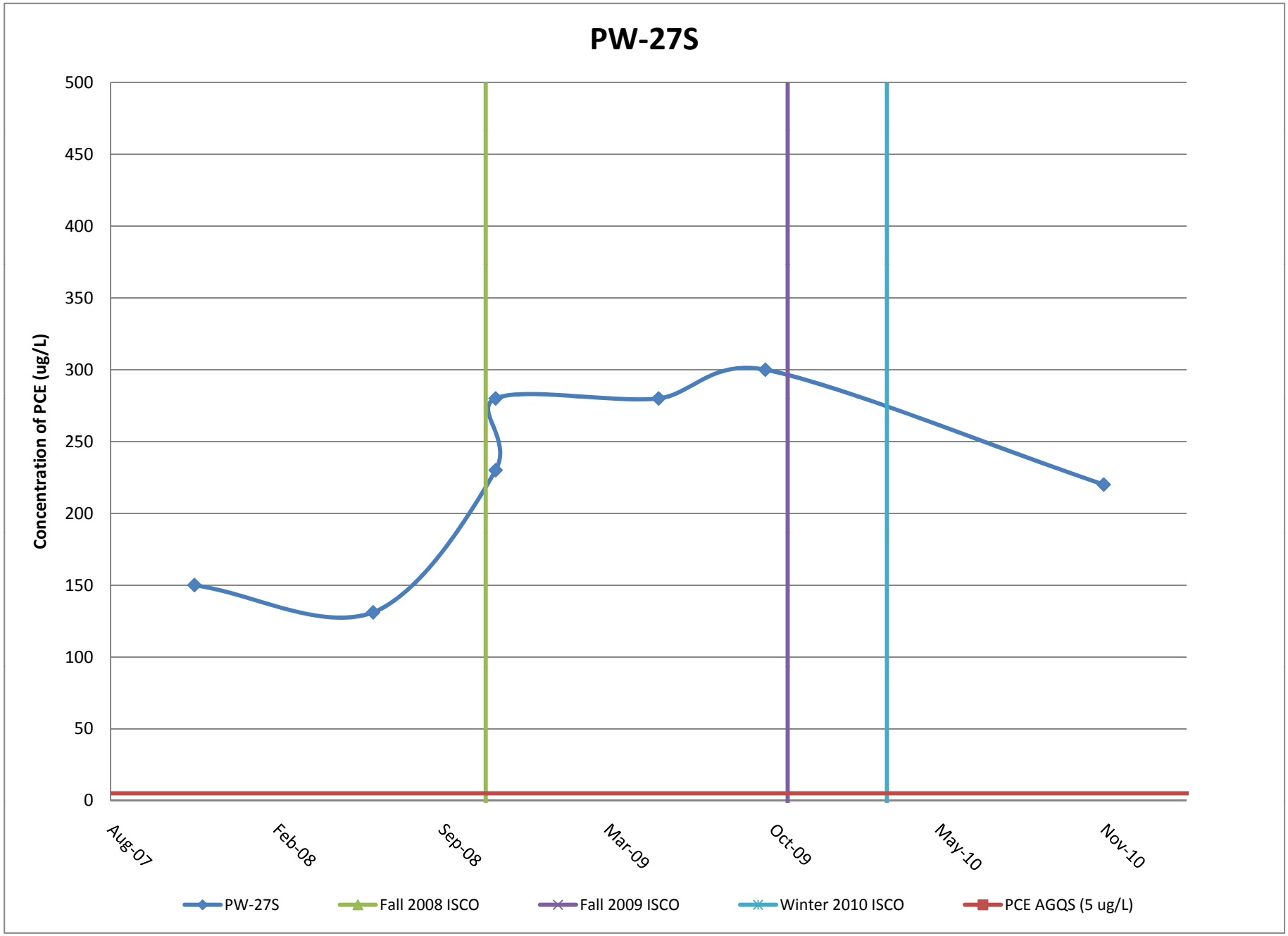

PW-20S
Concentration of PCE (ug/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Sep-05
Mar-06
Oct-06
Apr-07
Nov-07
Jun-08
Dec-08
Jul-09
Jan-10
Aug-10
Feb-11
PW-20S
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

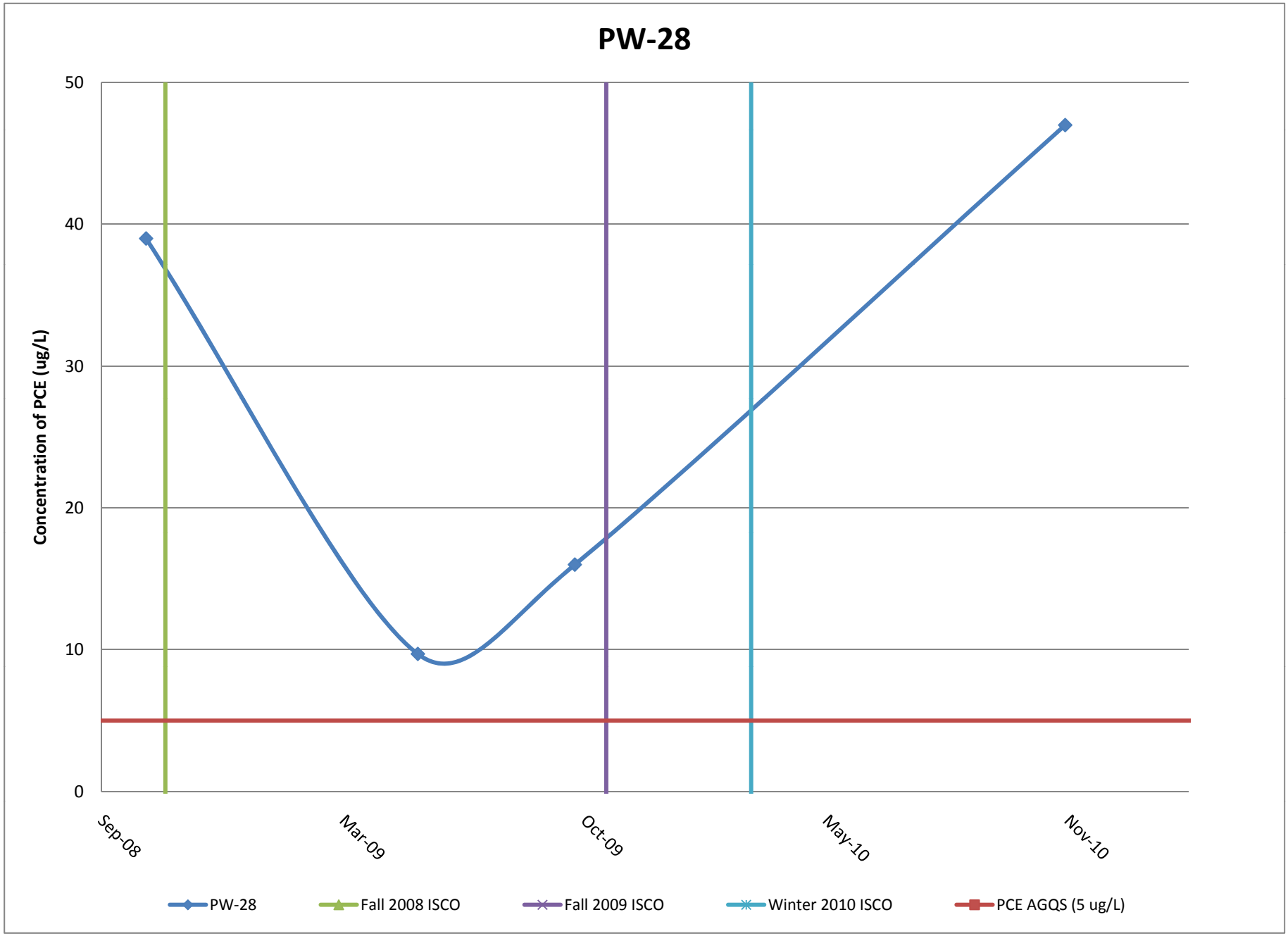

PW-24
Concentration of PCE (ug/L)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-24
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

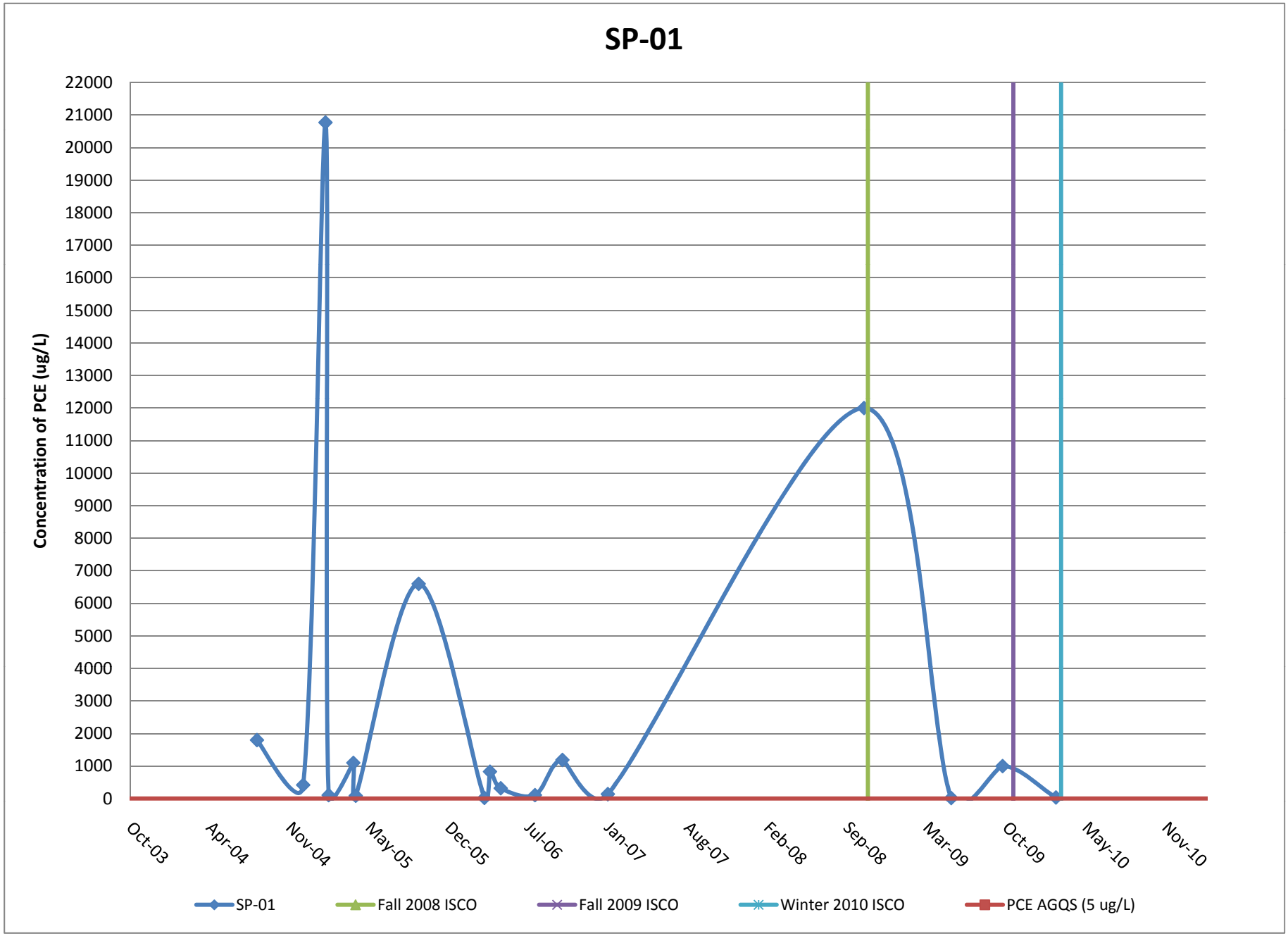

PW-25D
Concentration of PCE (ug/L)
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-25D
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

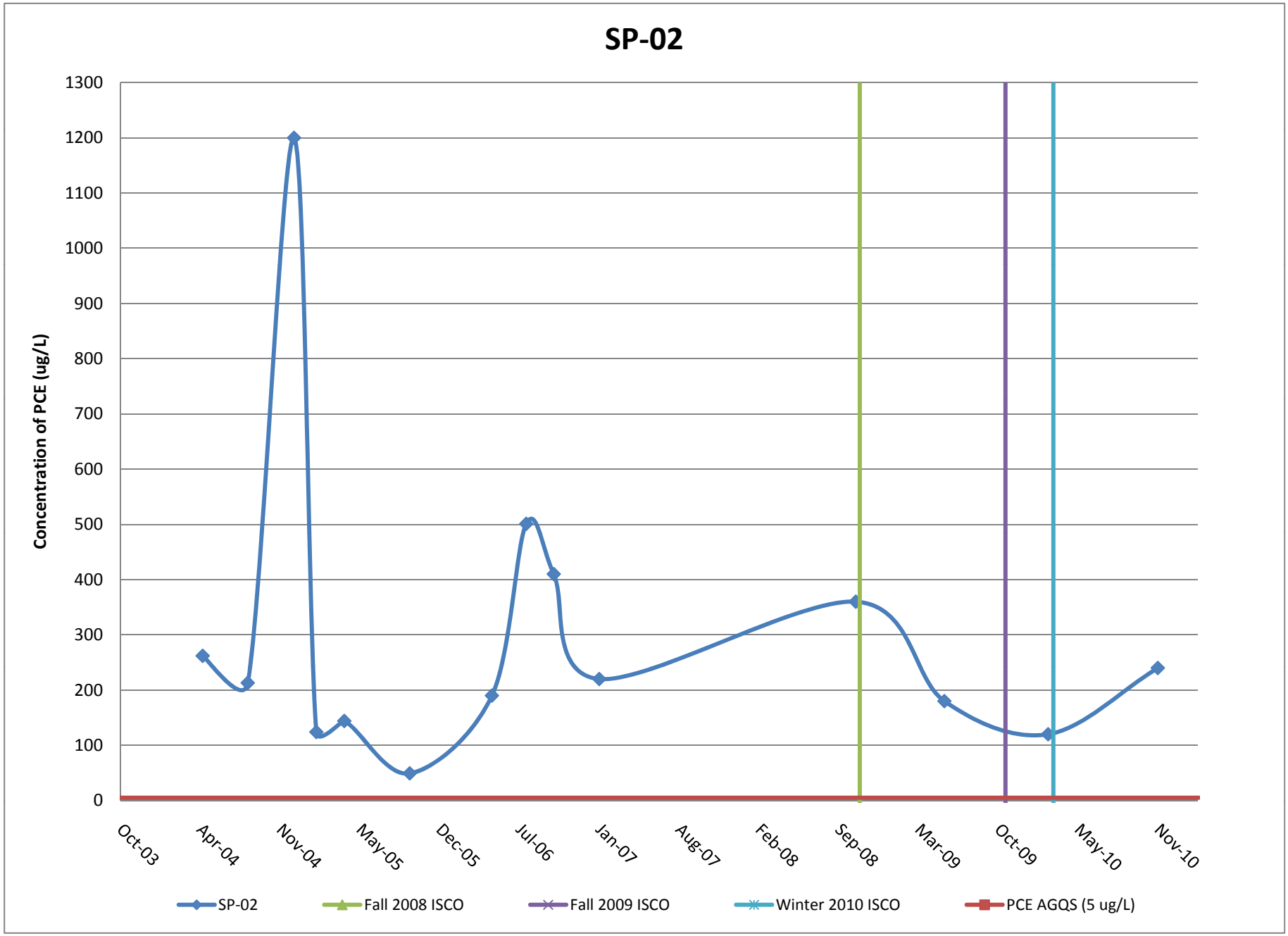

PW-25S
Concentration of PCE (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-25S
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

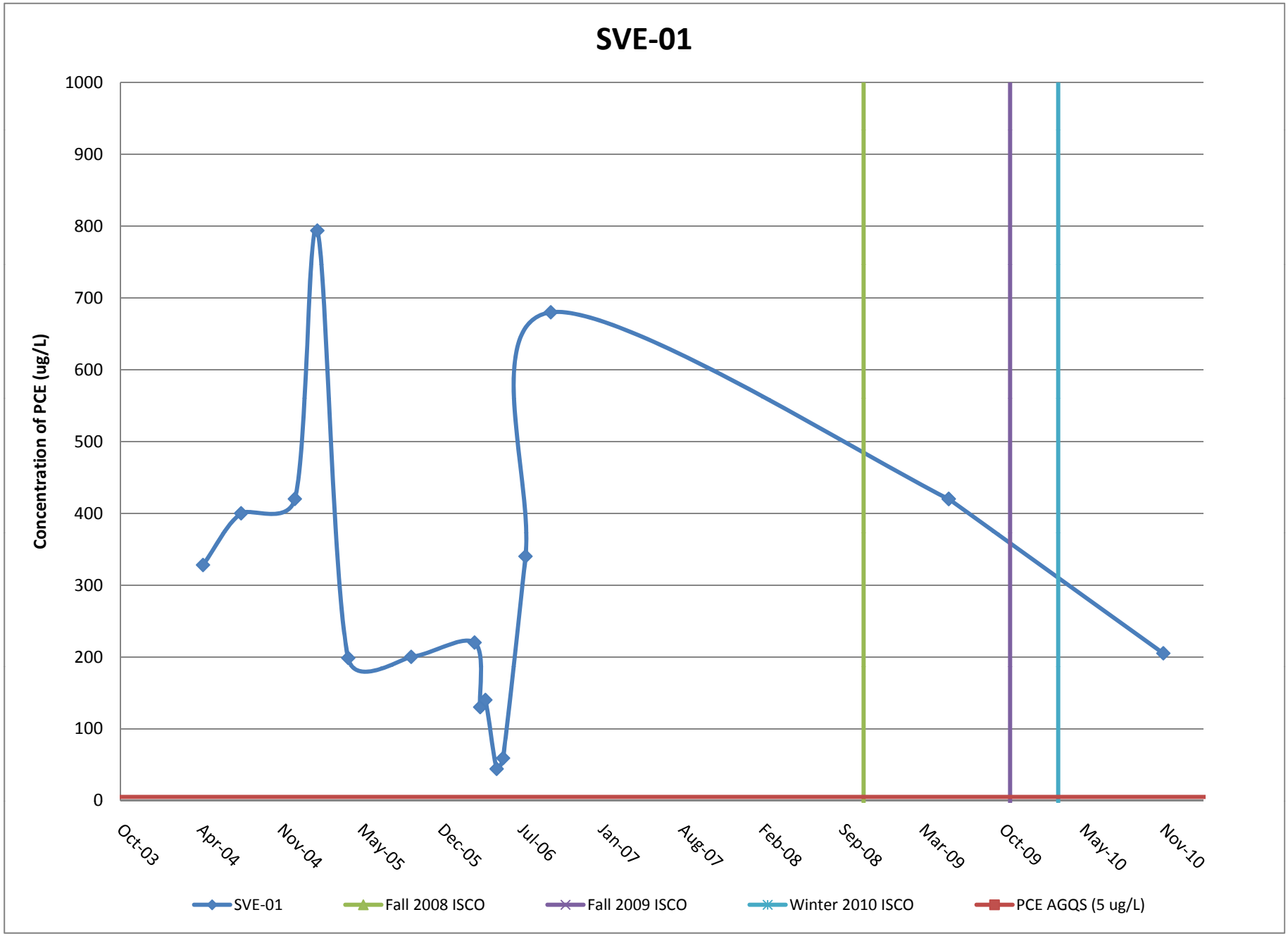

PW-26S
Concentration of PCE (ug/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-26S
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

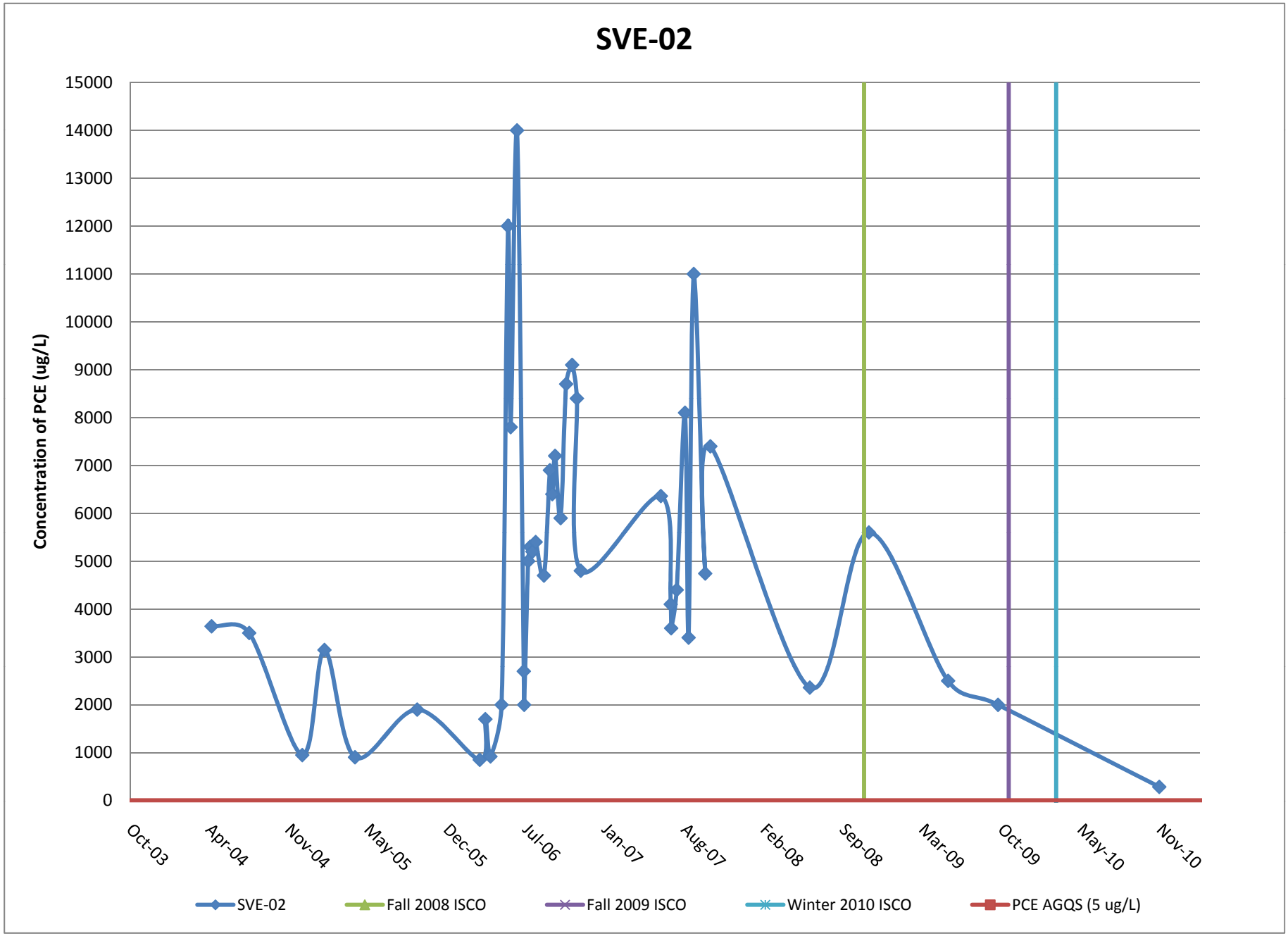

PW-27S
Concentration of PCE (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-27S
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)


PW-28
Concentration of PCE (ug/L)
50
40
30
20
10
0
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-28
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)


SP-01
Concentration of PCE (ug/L)
22000
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
SP-01
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

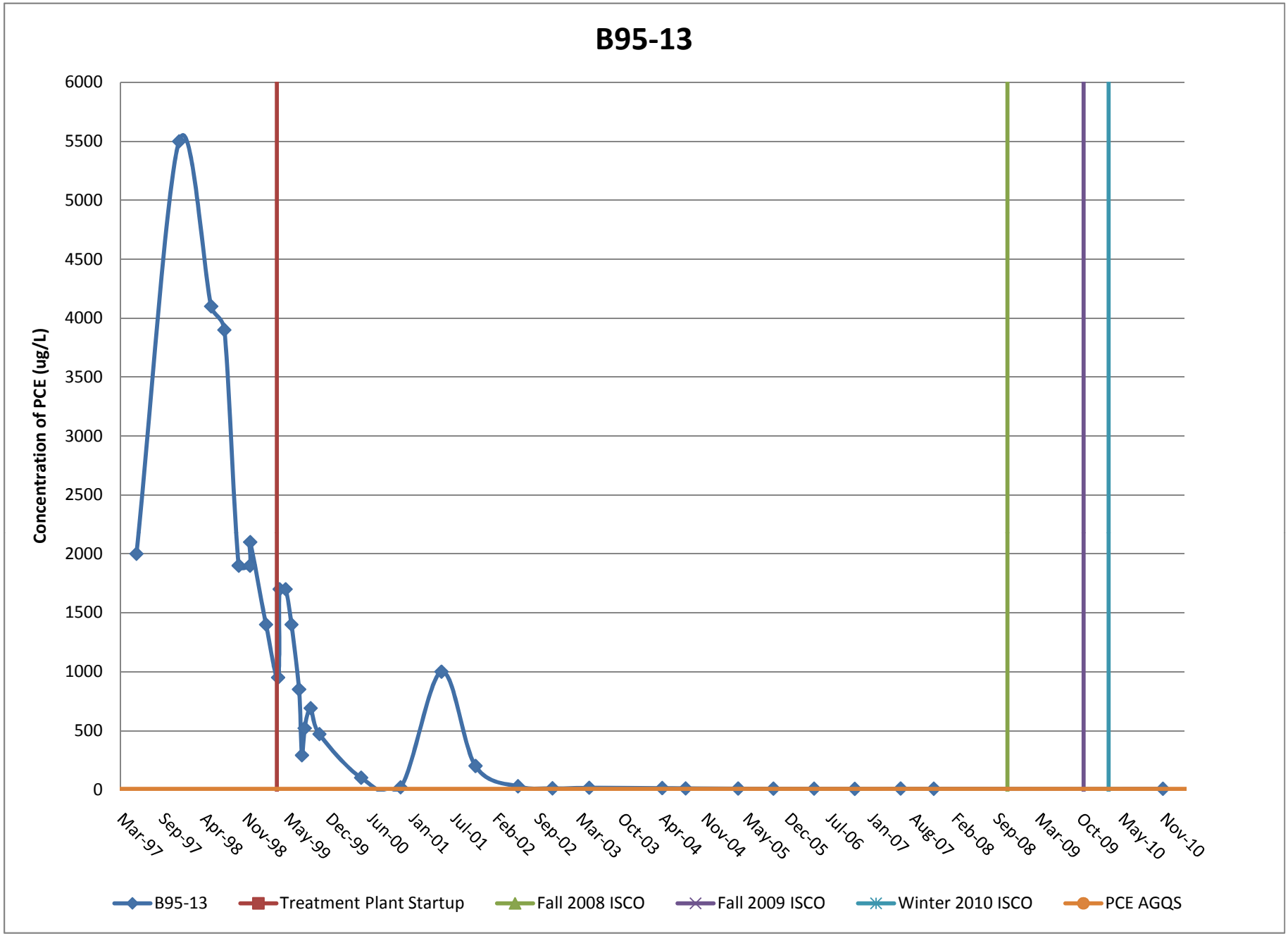

SP-02
Concentration of PCE (ug/L)
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
SP-02
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

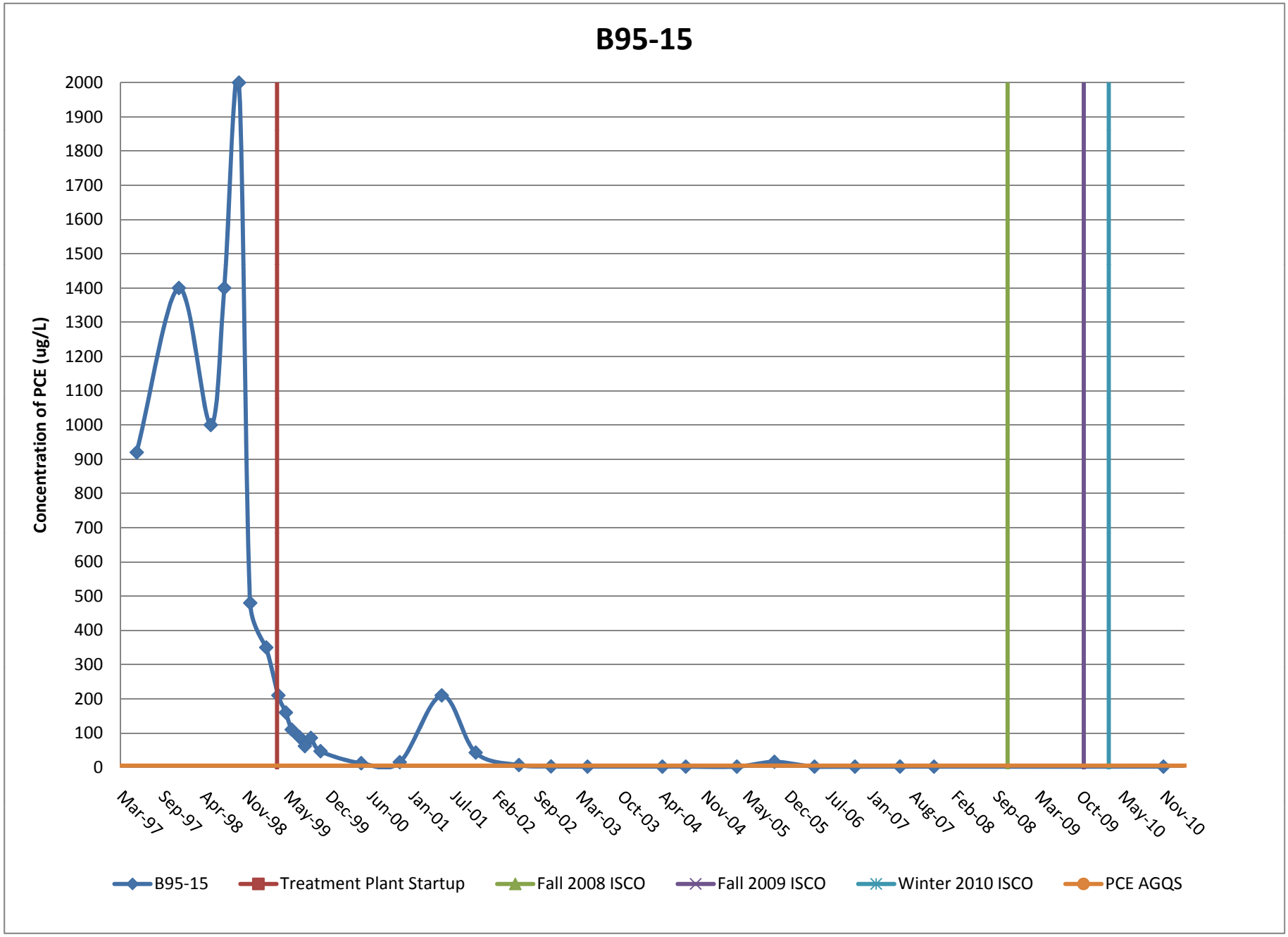

SVE-01
Concentration of PCE (ug/L)
1000
900
800
700
600
500
400
300
200
100
0
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
SVE-01
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

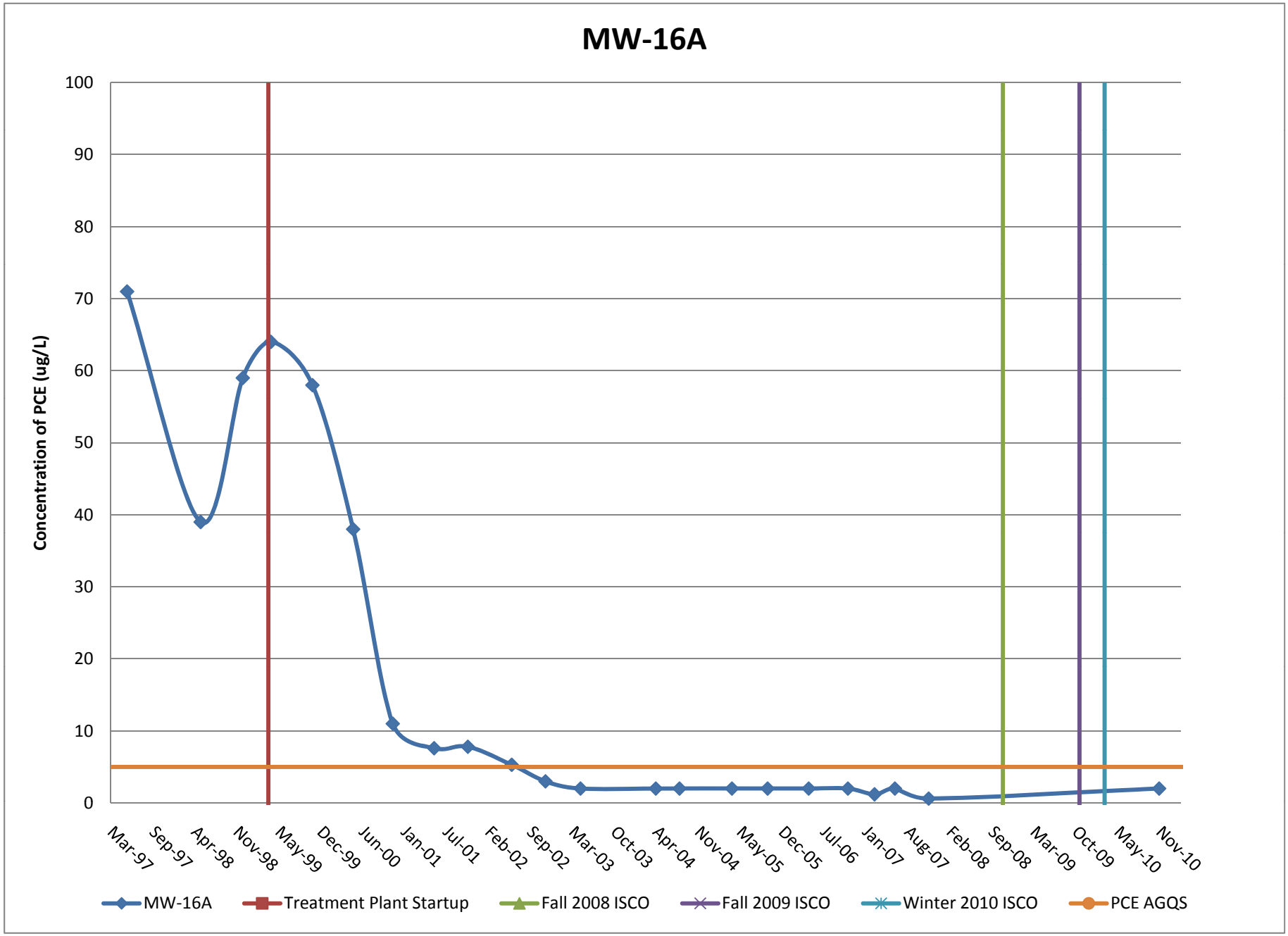

SVE-02
Concentration of PCE (ug/L)
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
SVE-02
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS (5 ug/L)

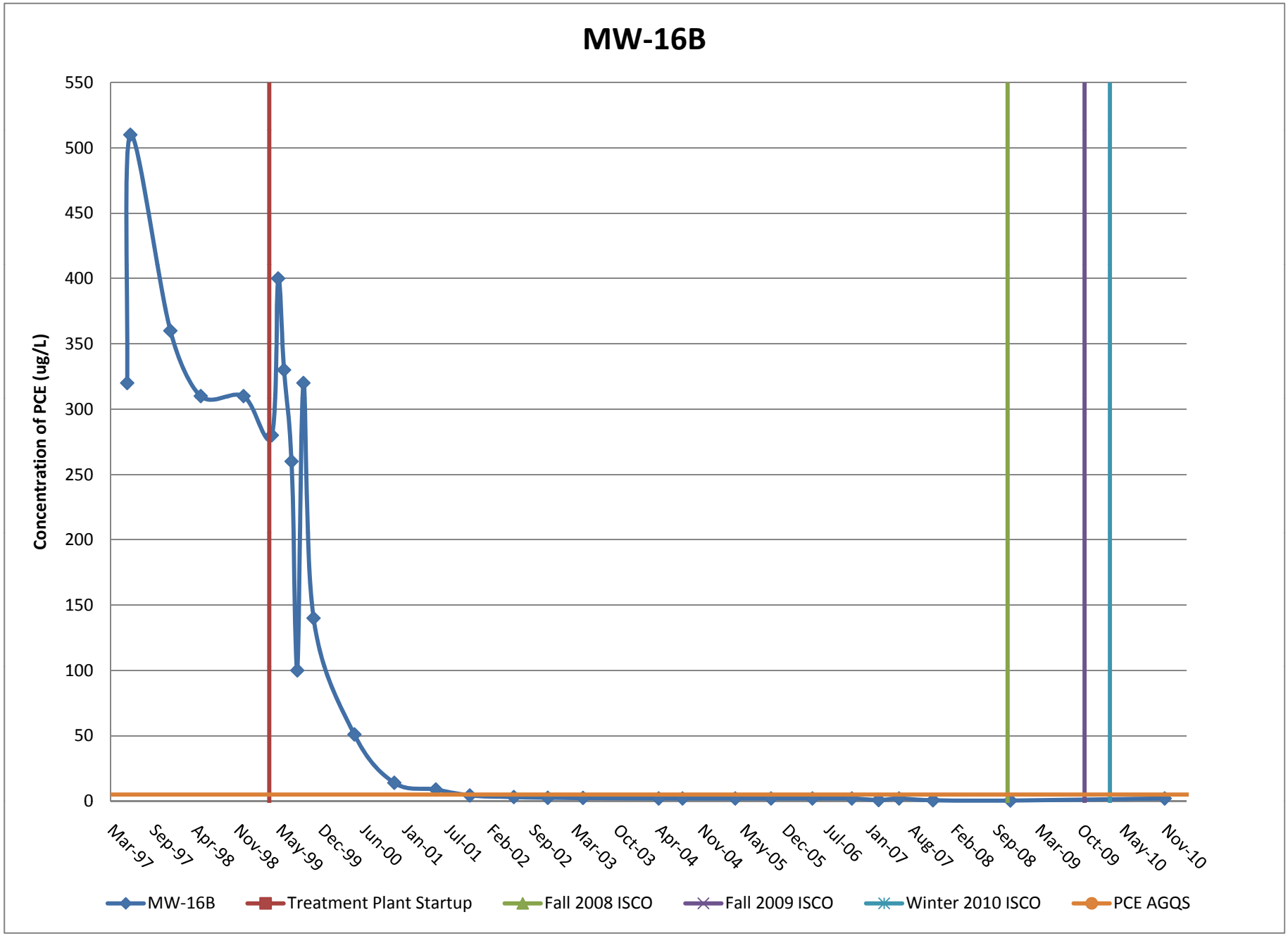
APPENDIX E

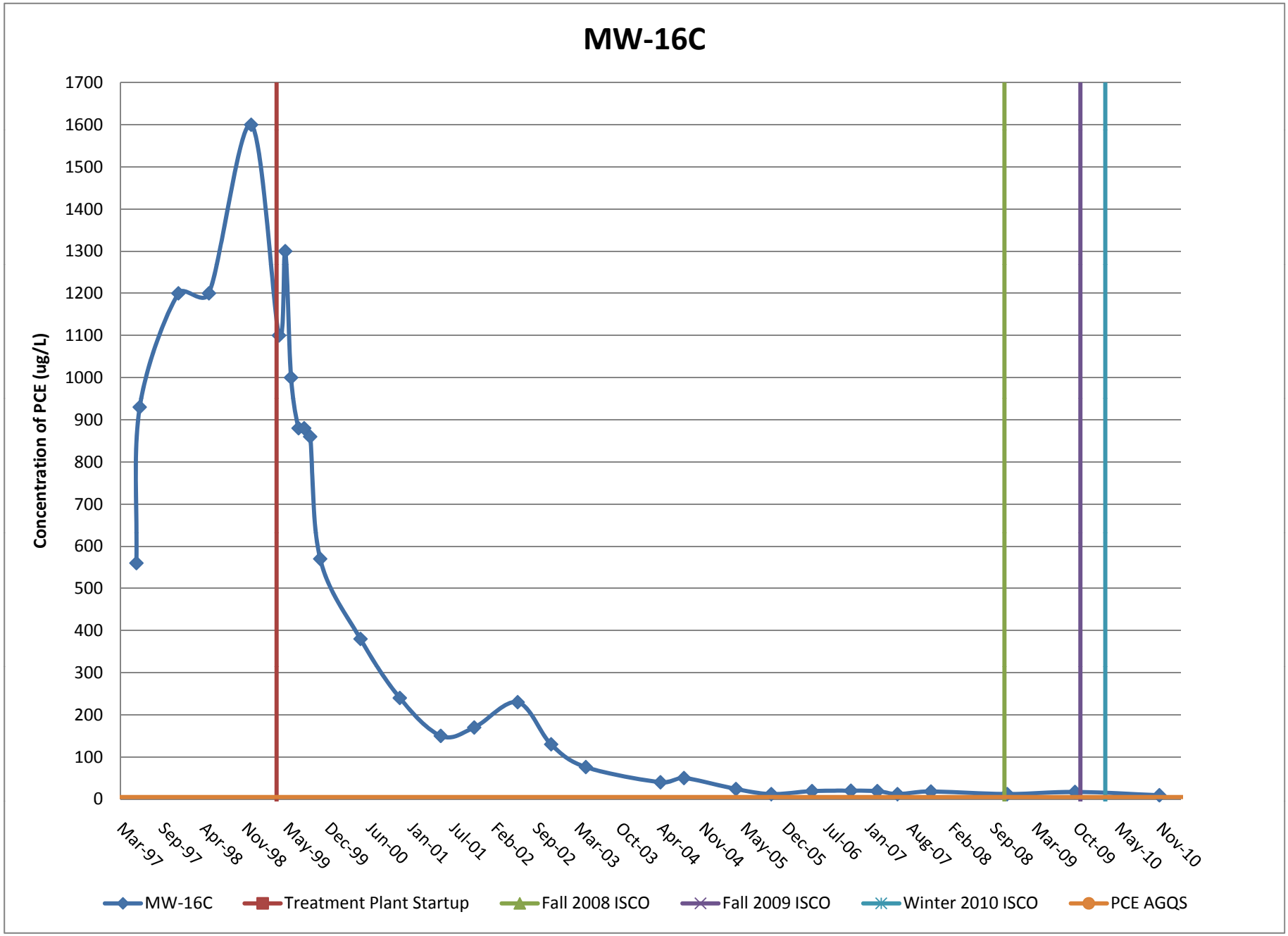
EXTERIOR WELL PCE GRAPHS

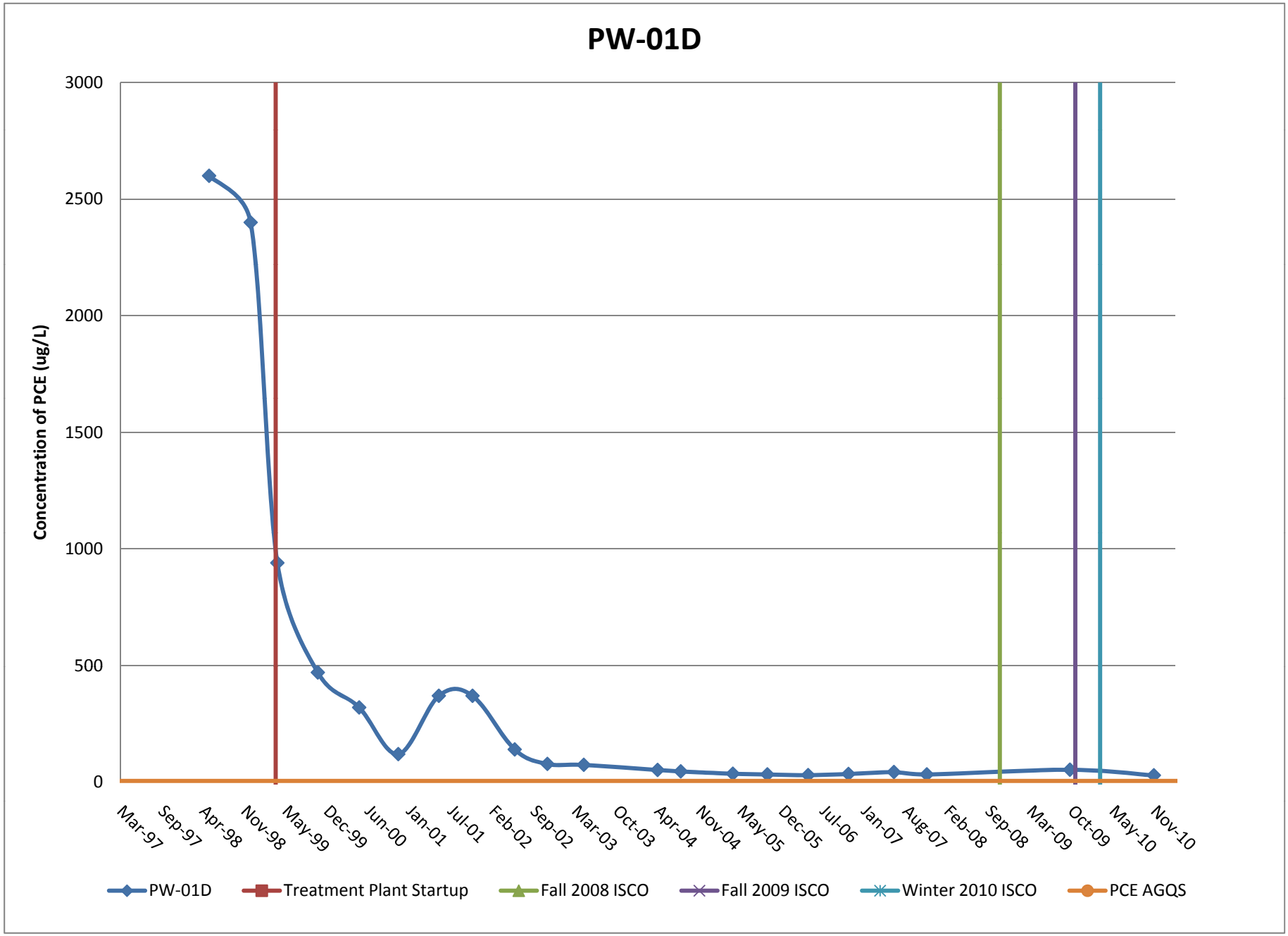

B95-13
Concentration of PCE (ug/L)
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
B95-13
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

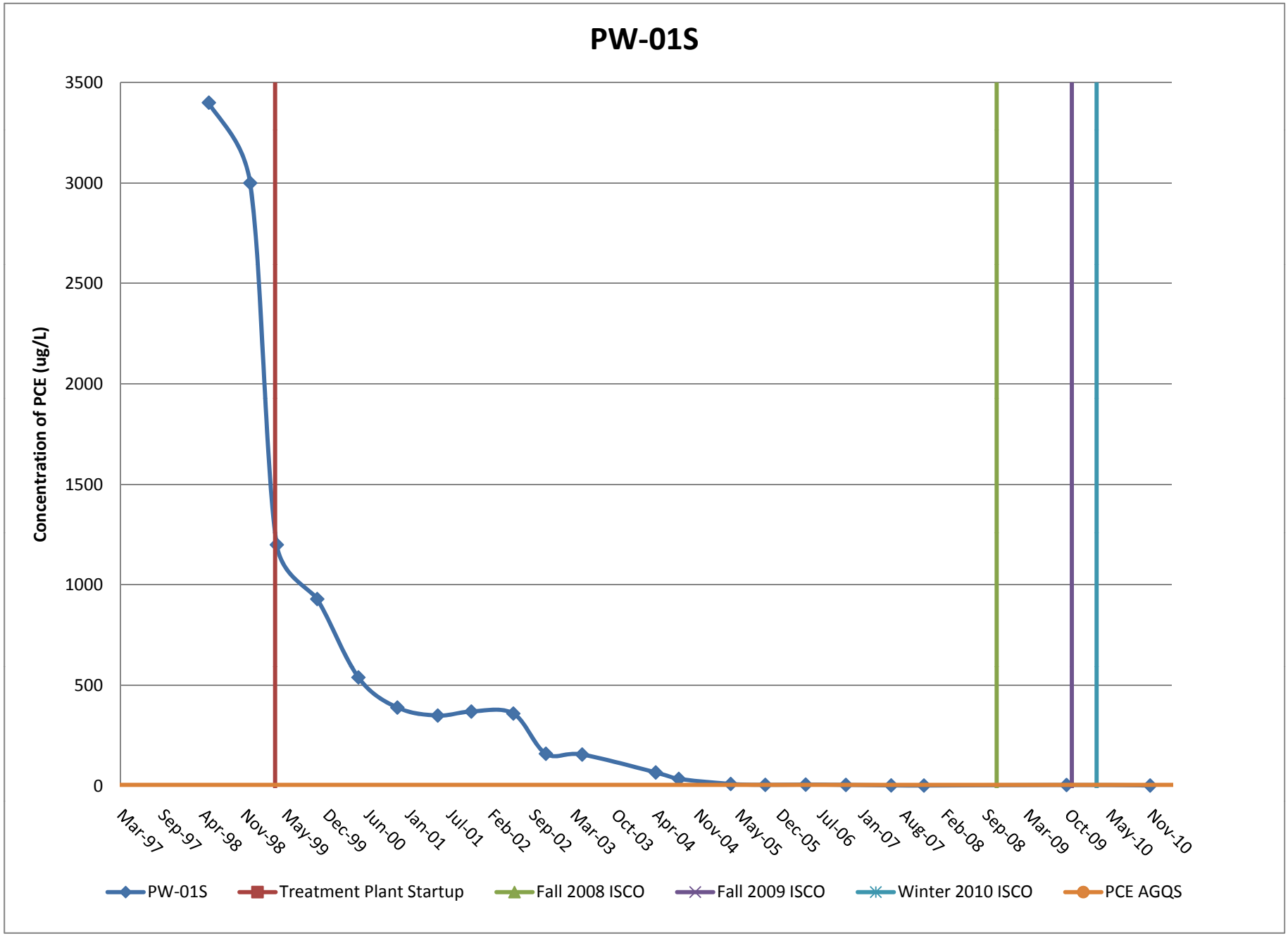

B95-15
Concentration of PCE (ug/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
B95-15
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

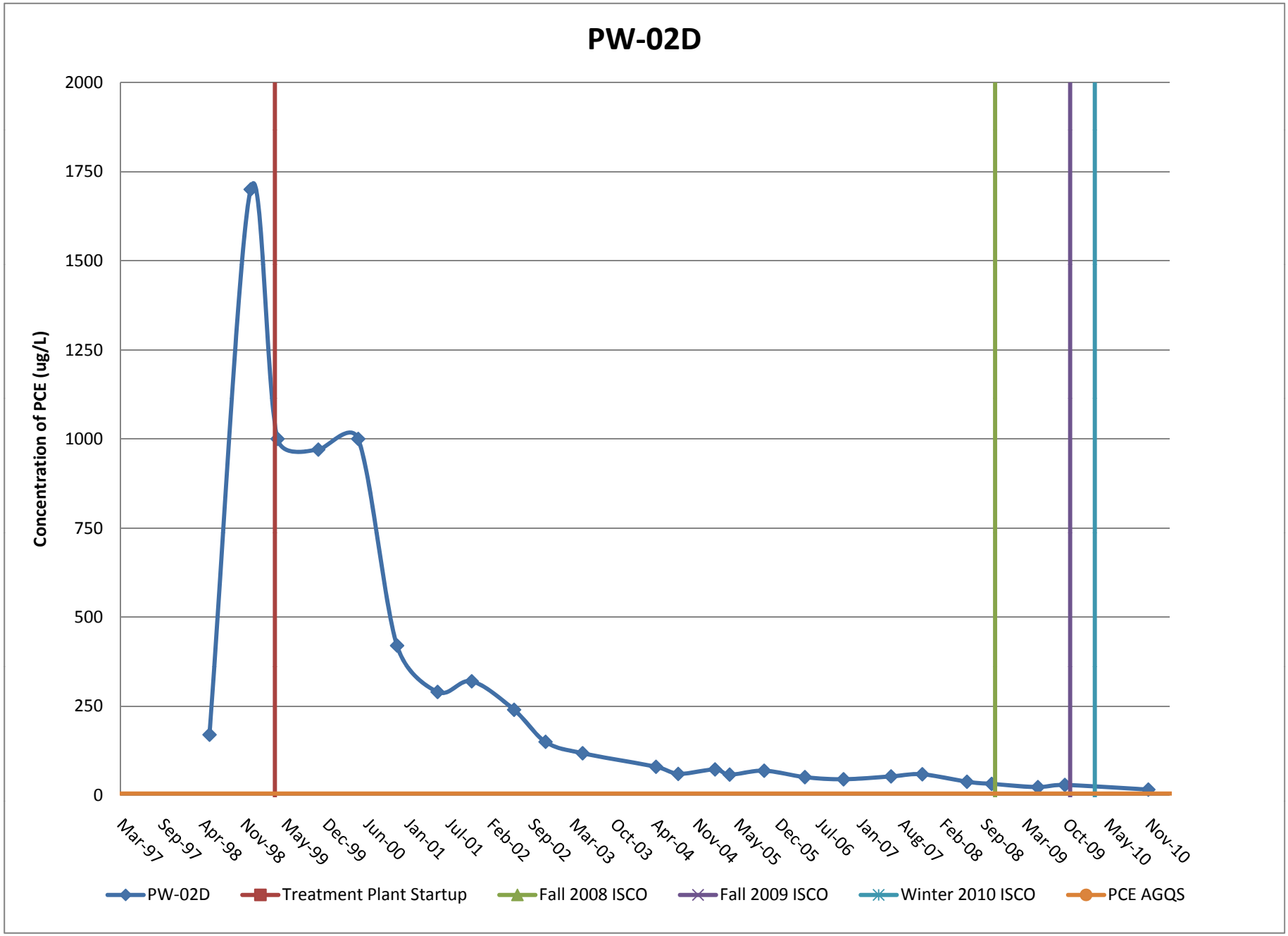

MW-16A
Concentration of PCE (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
MW-16A
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

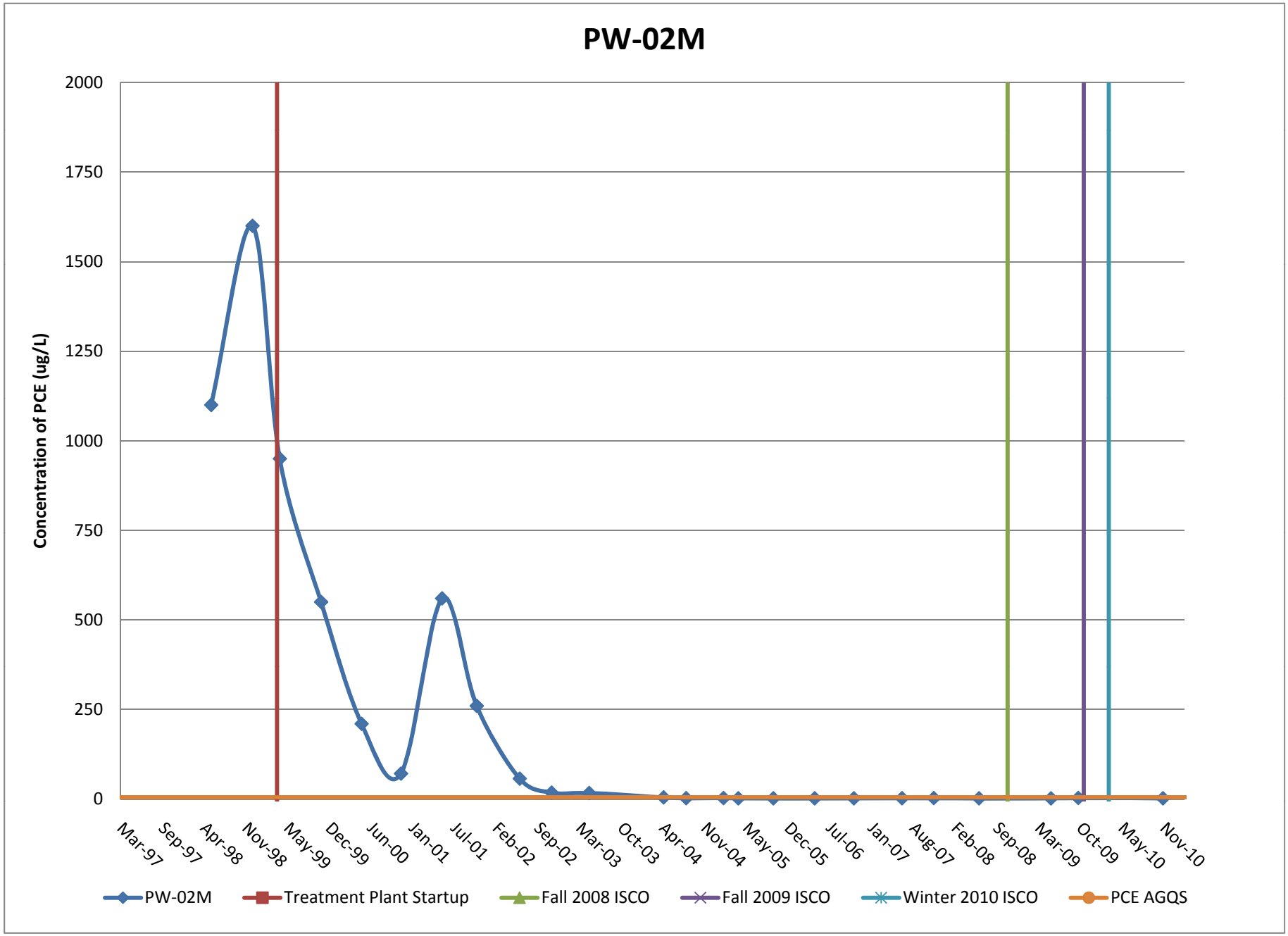

MW-16B
Concentration of PCE (ug/L)
550
500
450
400
350
300
250
200
150
100
50
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
MW-16B
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

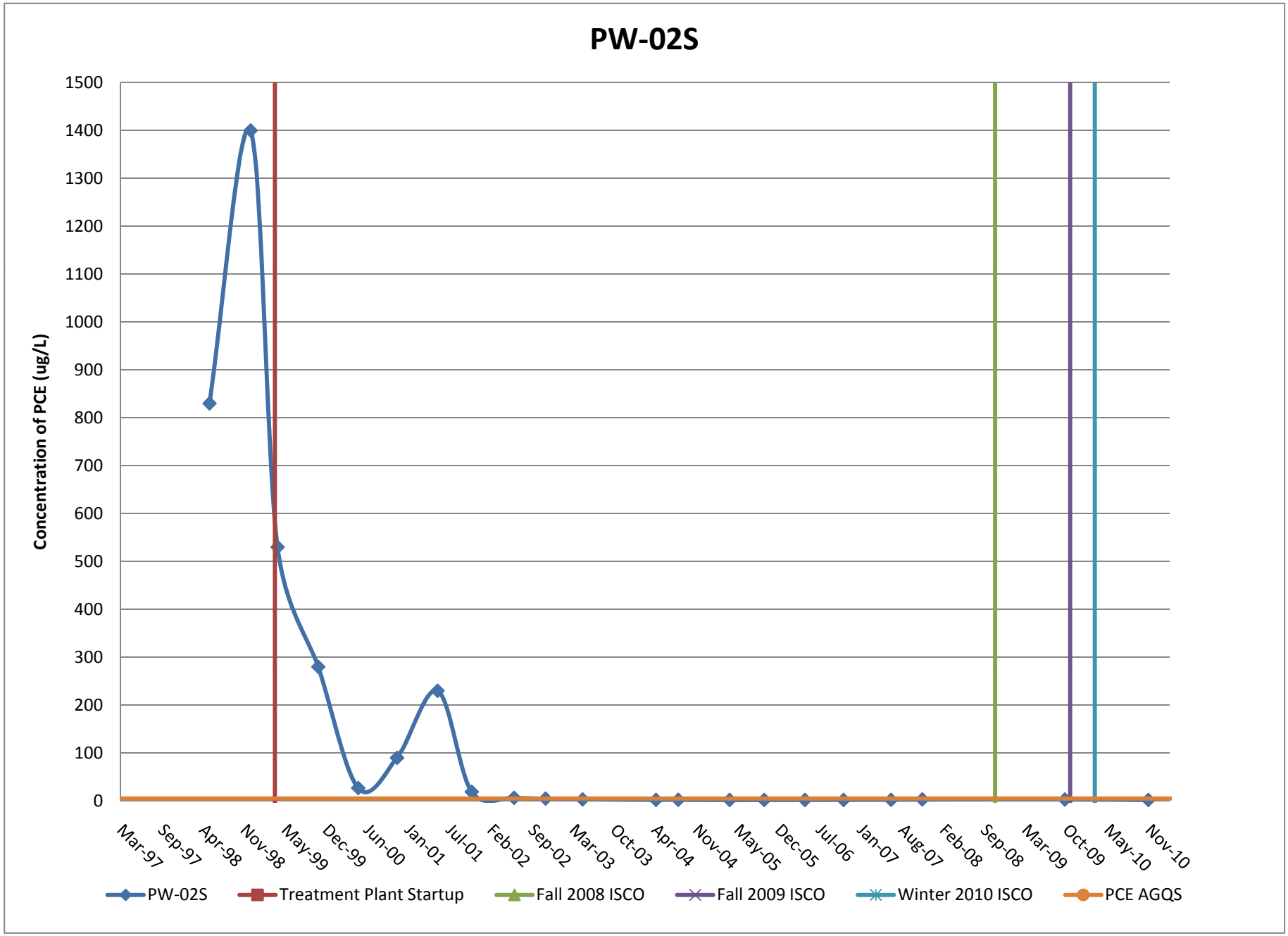

MW-16C
Concentration of PCE (ug/L)
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
MW-16C
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

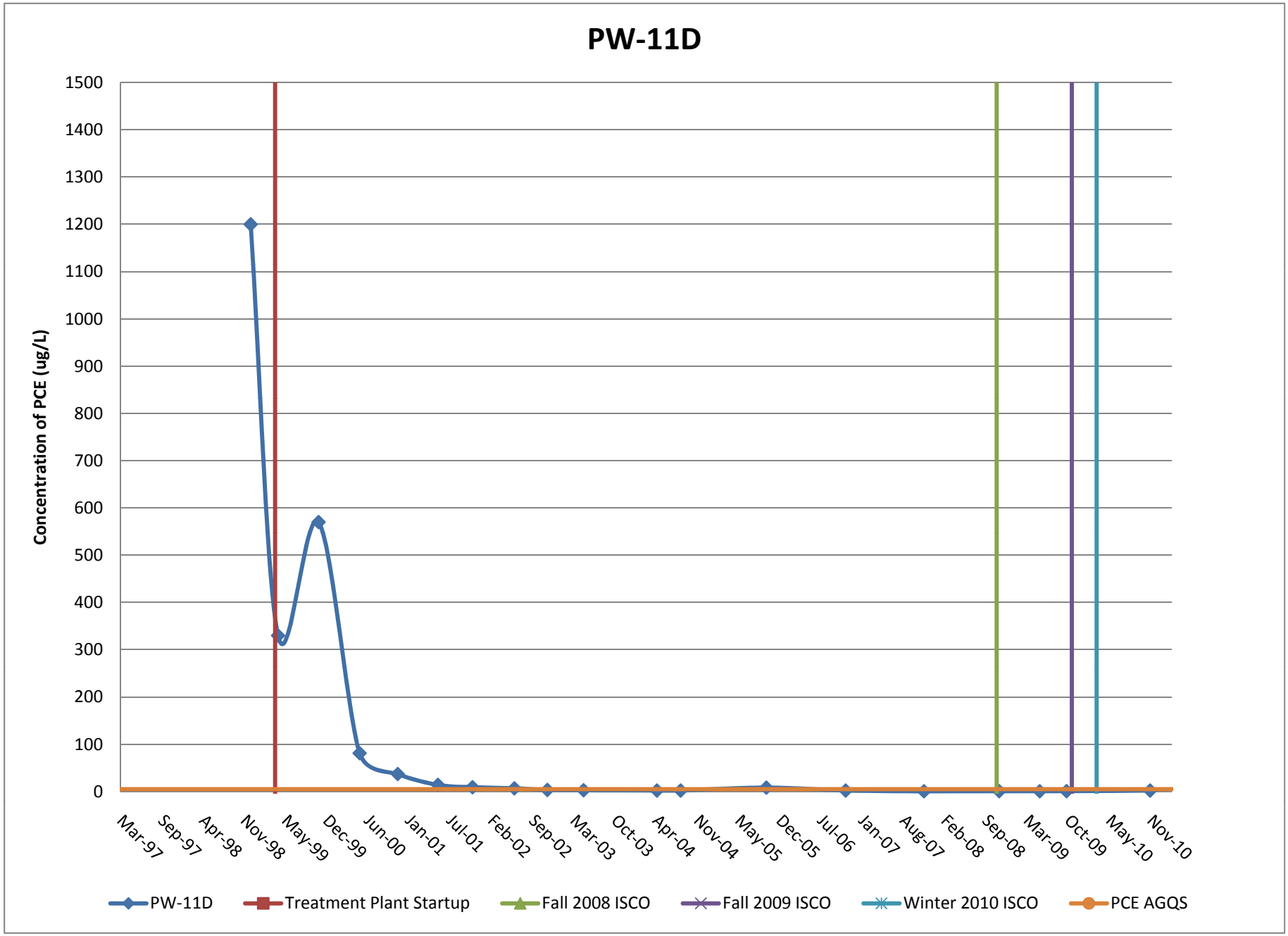

PW-01D
Concentration of PCE (ug/L)
3000
2500
2000
1500
1000
500
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-01D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

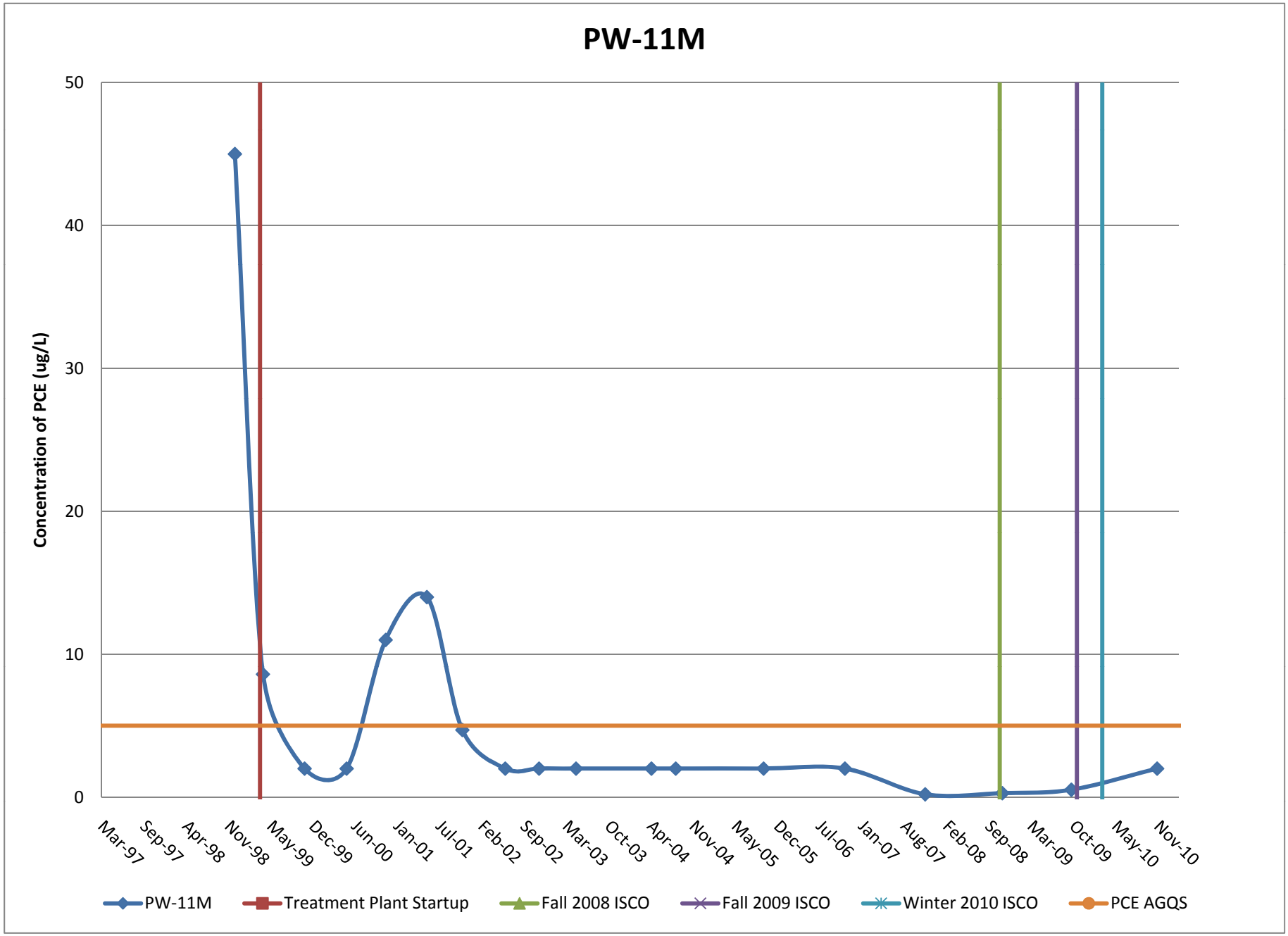

PW-01S
Concentration of PCE (ug/L)
3500
3000
2500
2000
1500
1000
500
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-01S
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

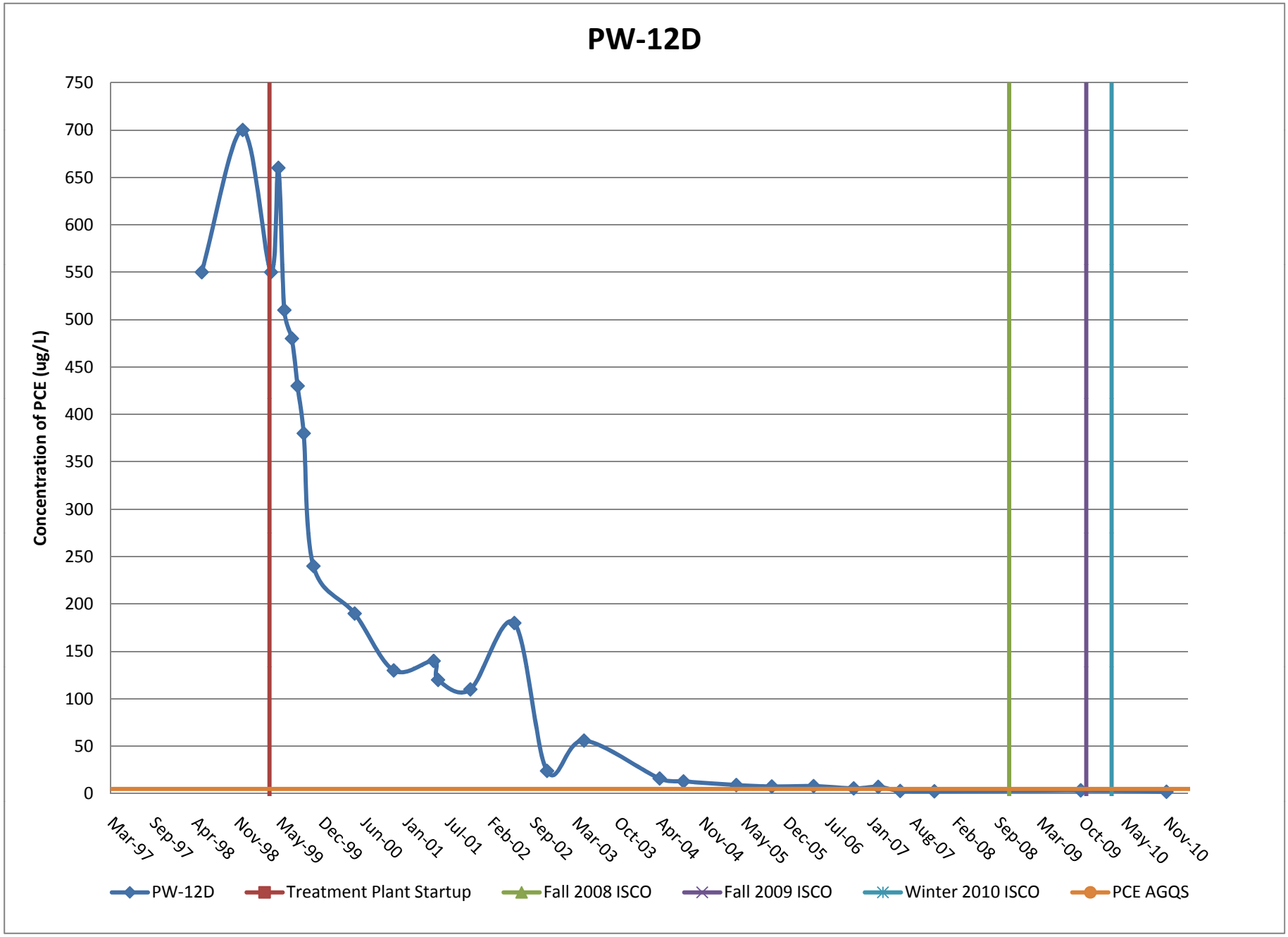

PW-02D
Concentration of PCE (ug/L)
2000
1750
1500
1250
1000
750
500
250
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-02D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

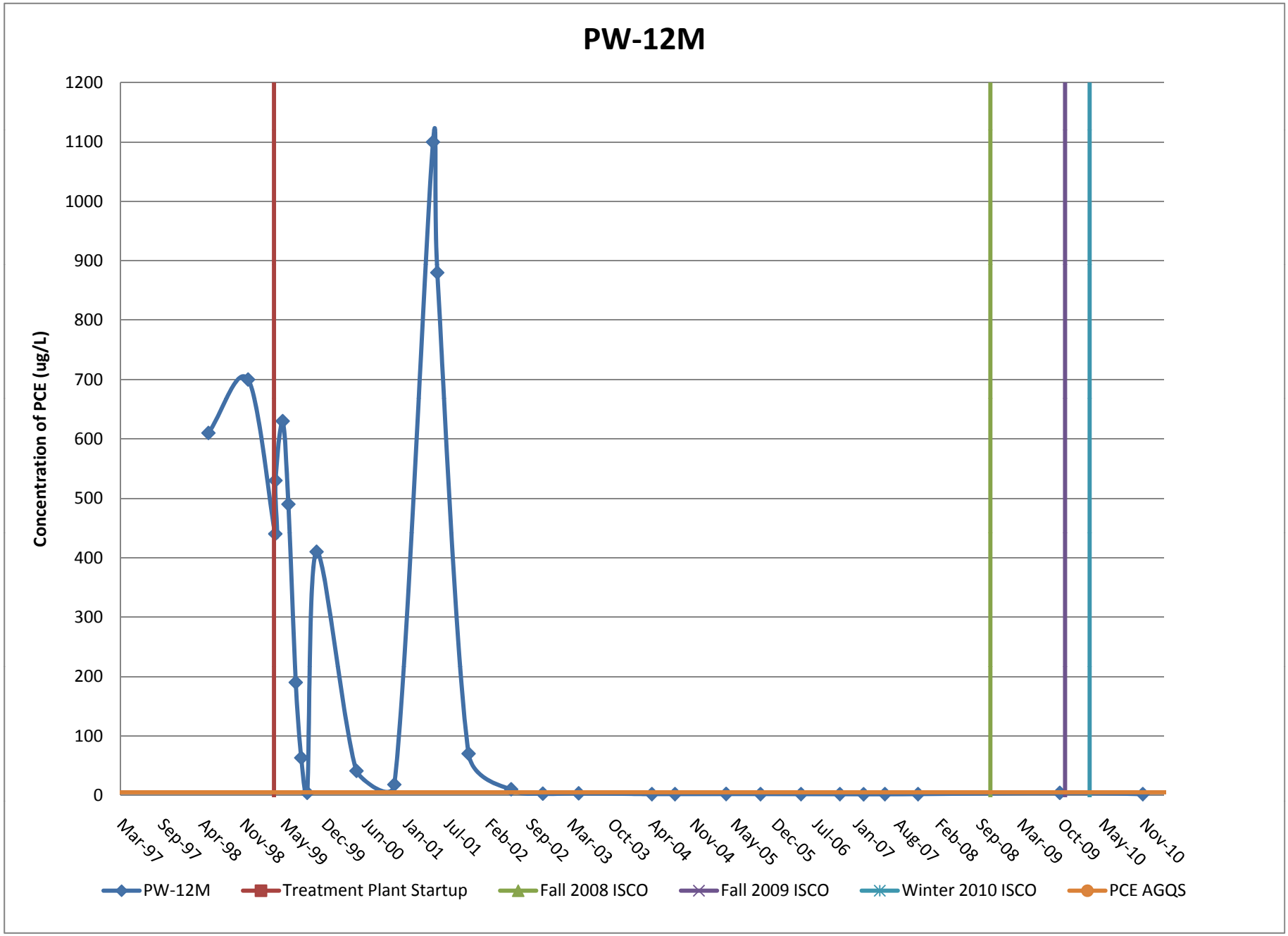

PW-02M
Concentration of PCE (ug/L)
2000
1750
1500
1250
1000
750
500
250
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-02M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

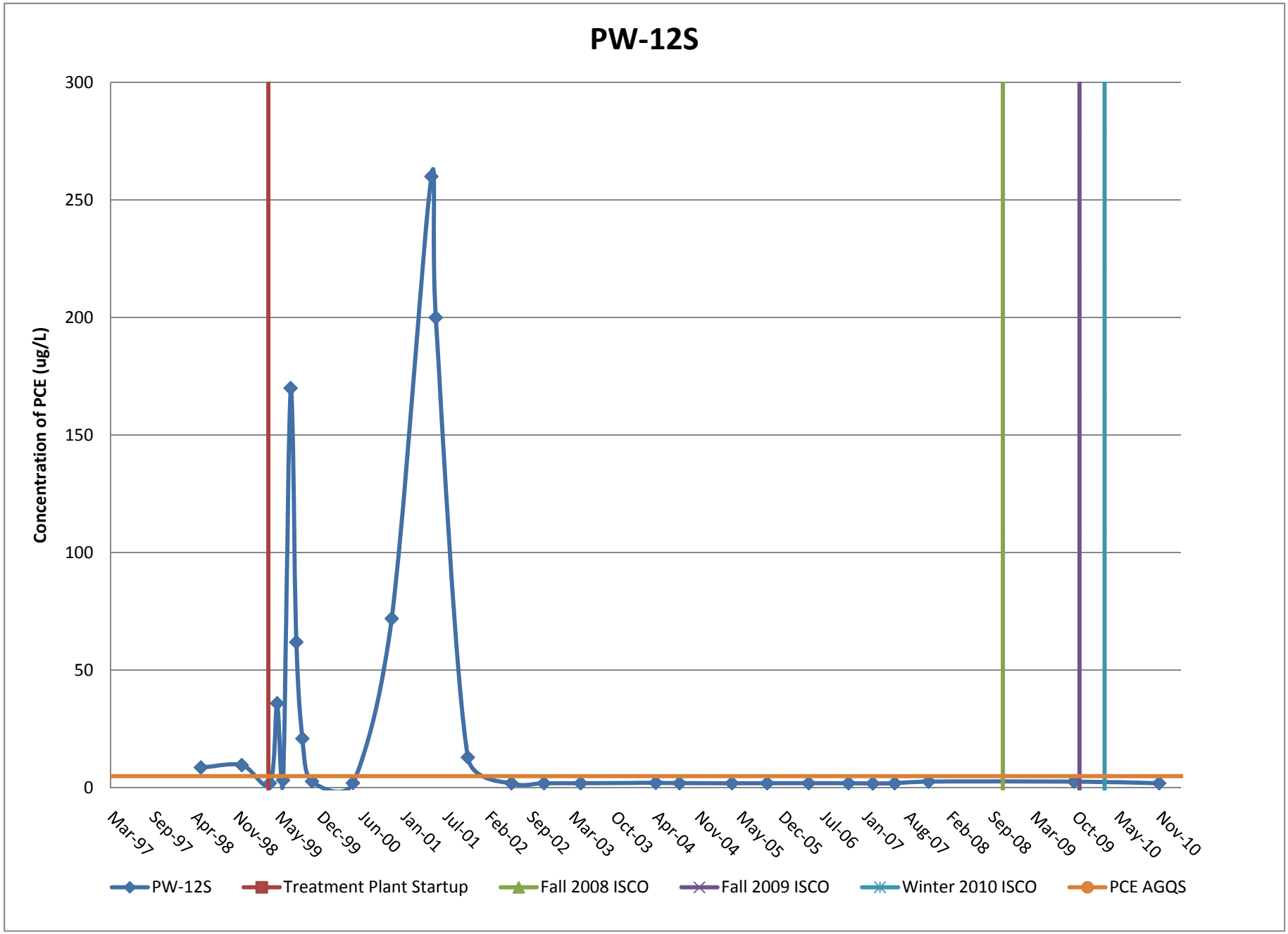

PW-02S
Concentration of PCE (ug/L)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-02S
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

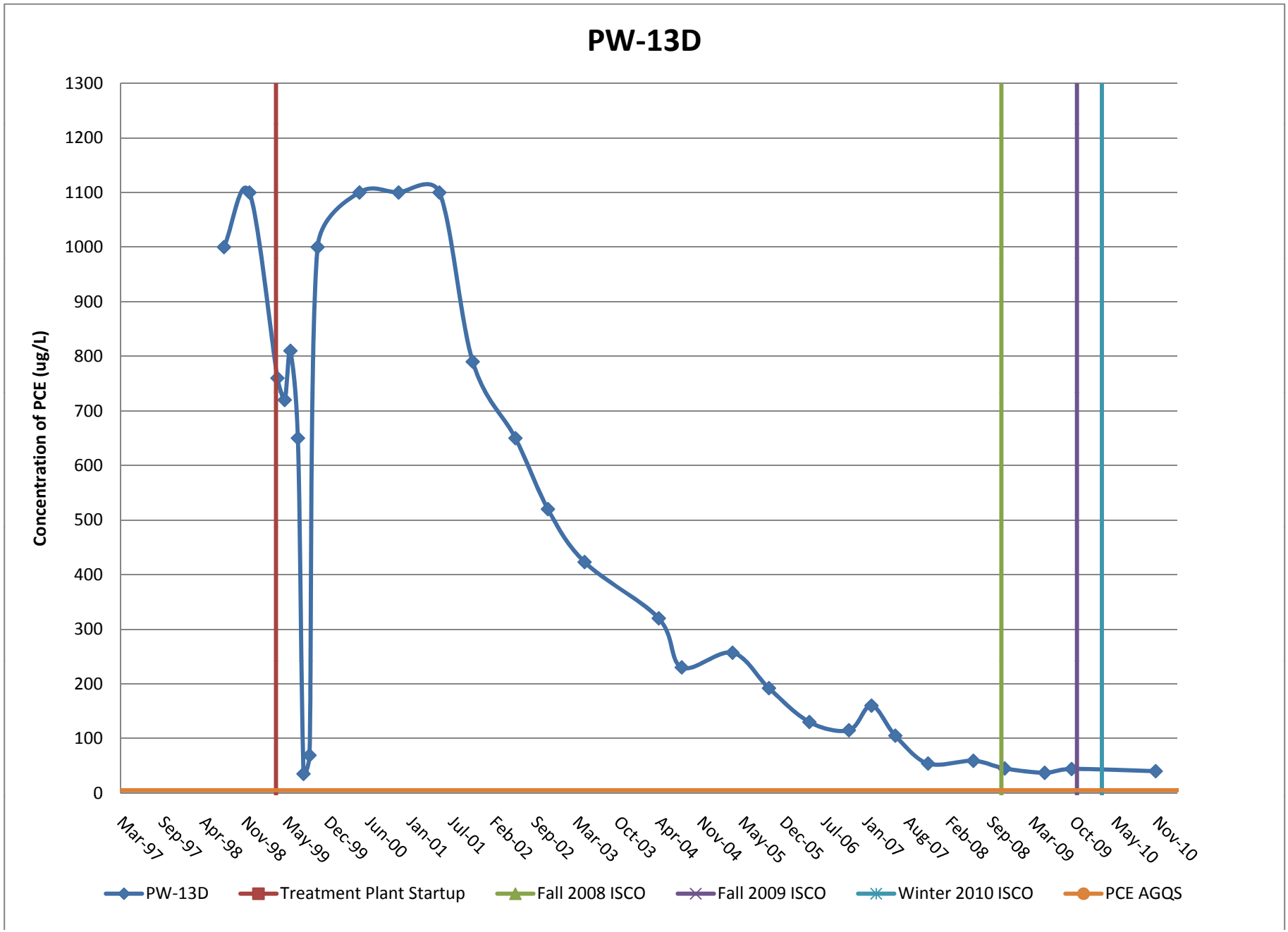

PW-11D
Concentration of PCE (ug/L)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-11D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

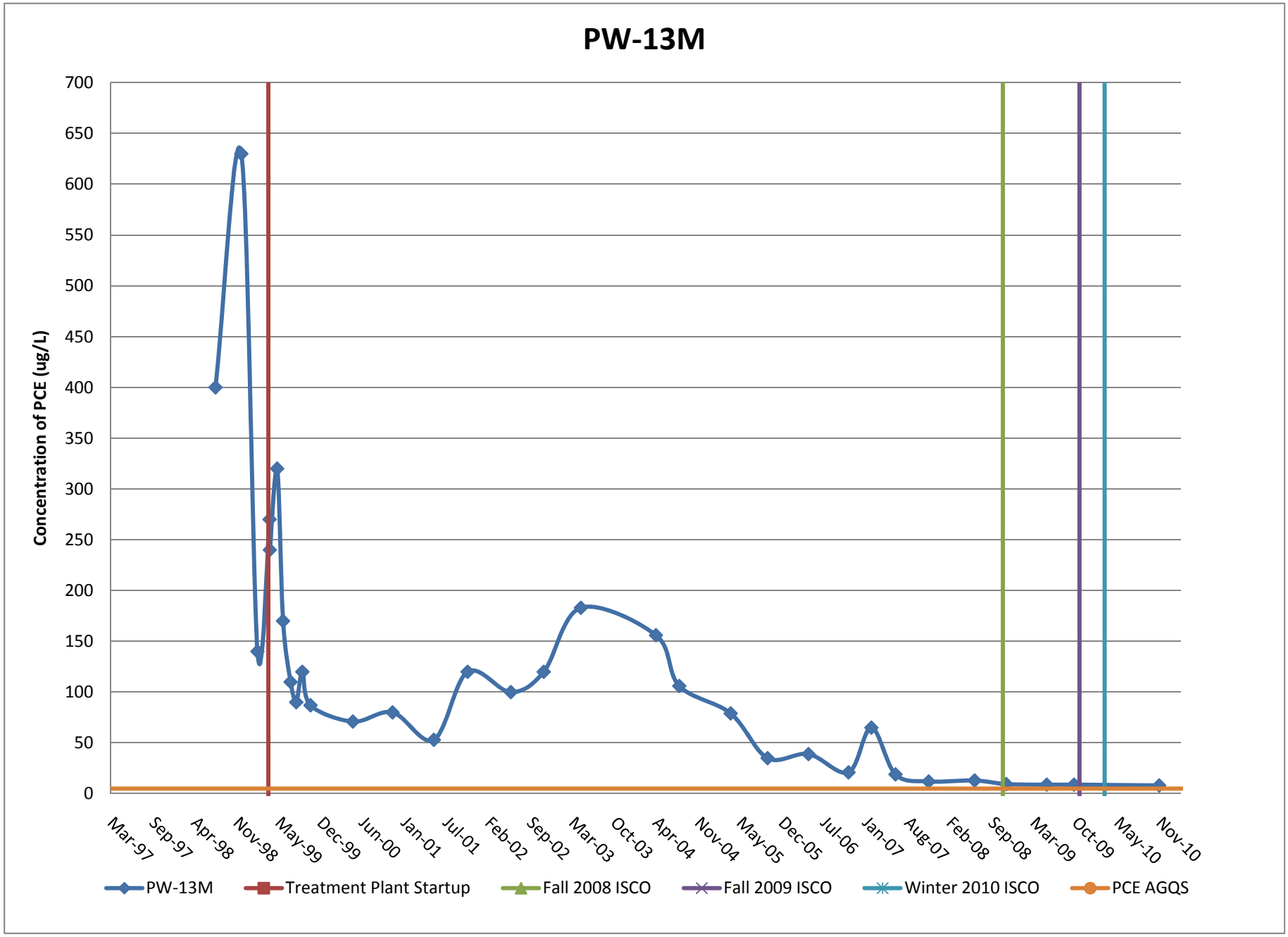

PW-11M
Concentration of PCE (ug/L)
50
40
30
20
10
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-11M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

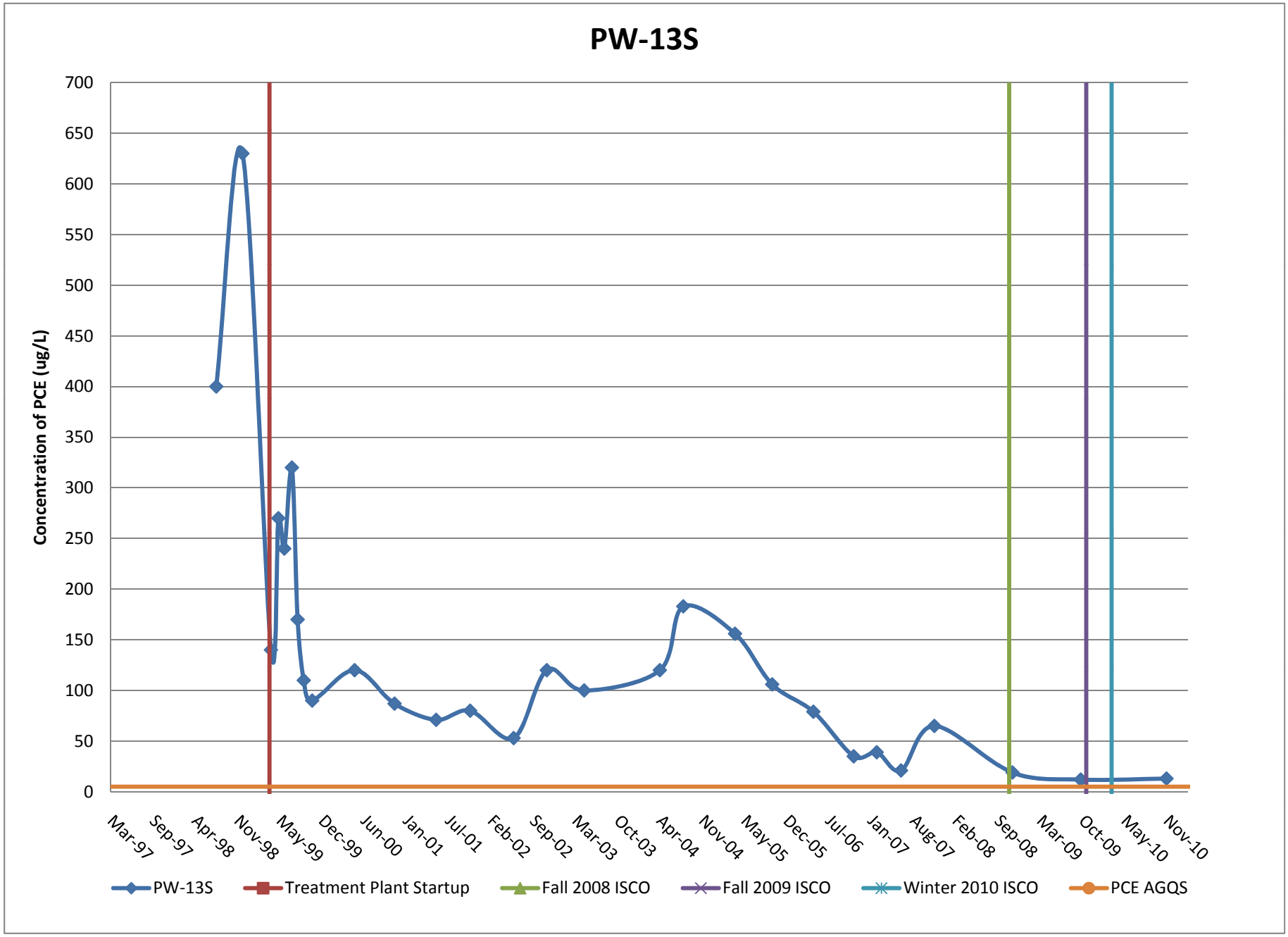

PW-12D
Concentration of PCE (ug/L)
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-12D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

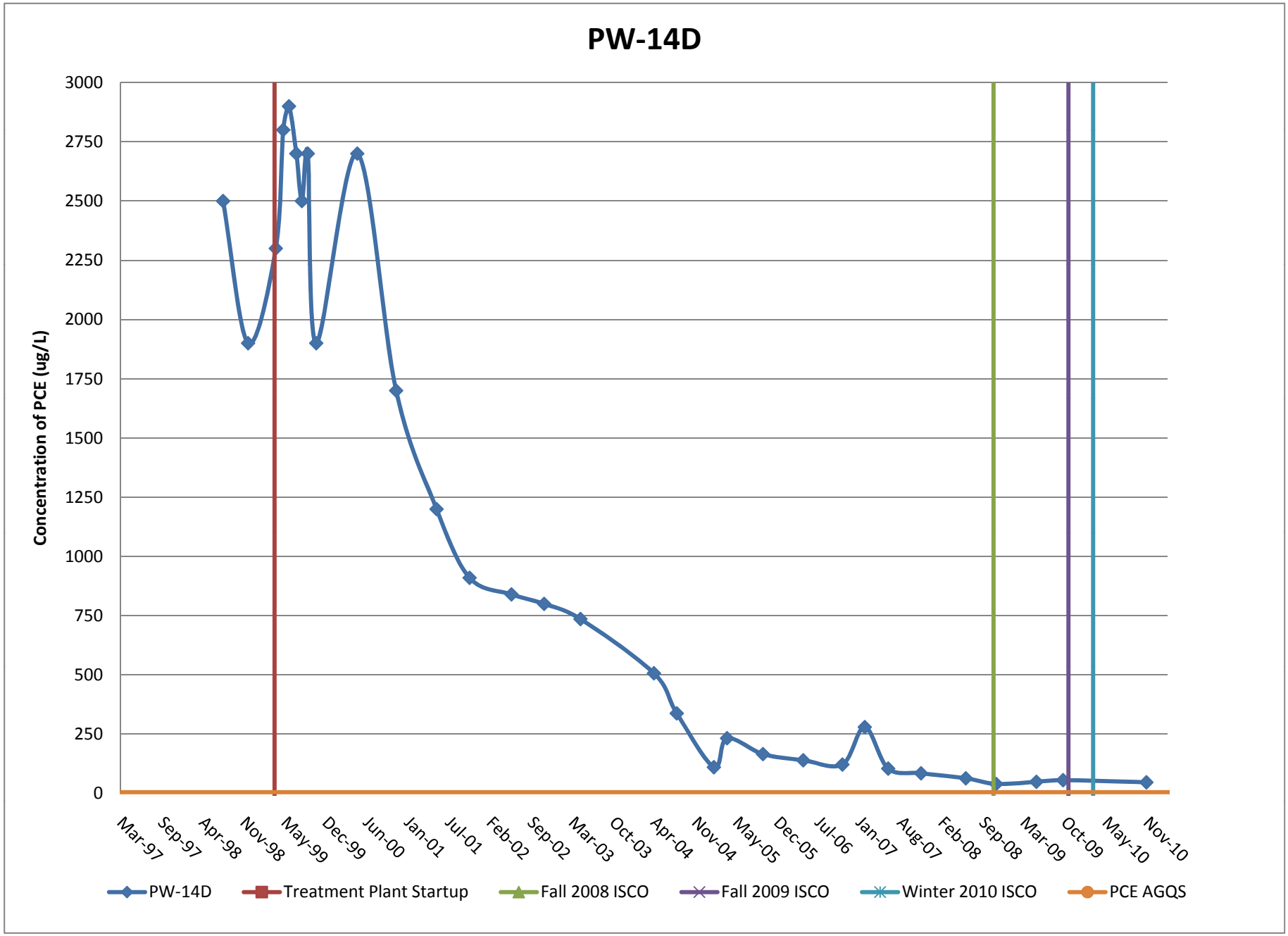

PW-12M
Concentration of PCE (ug/L)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-12M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

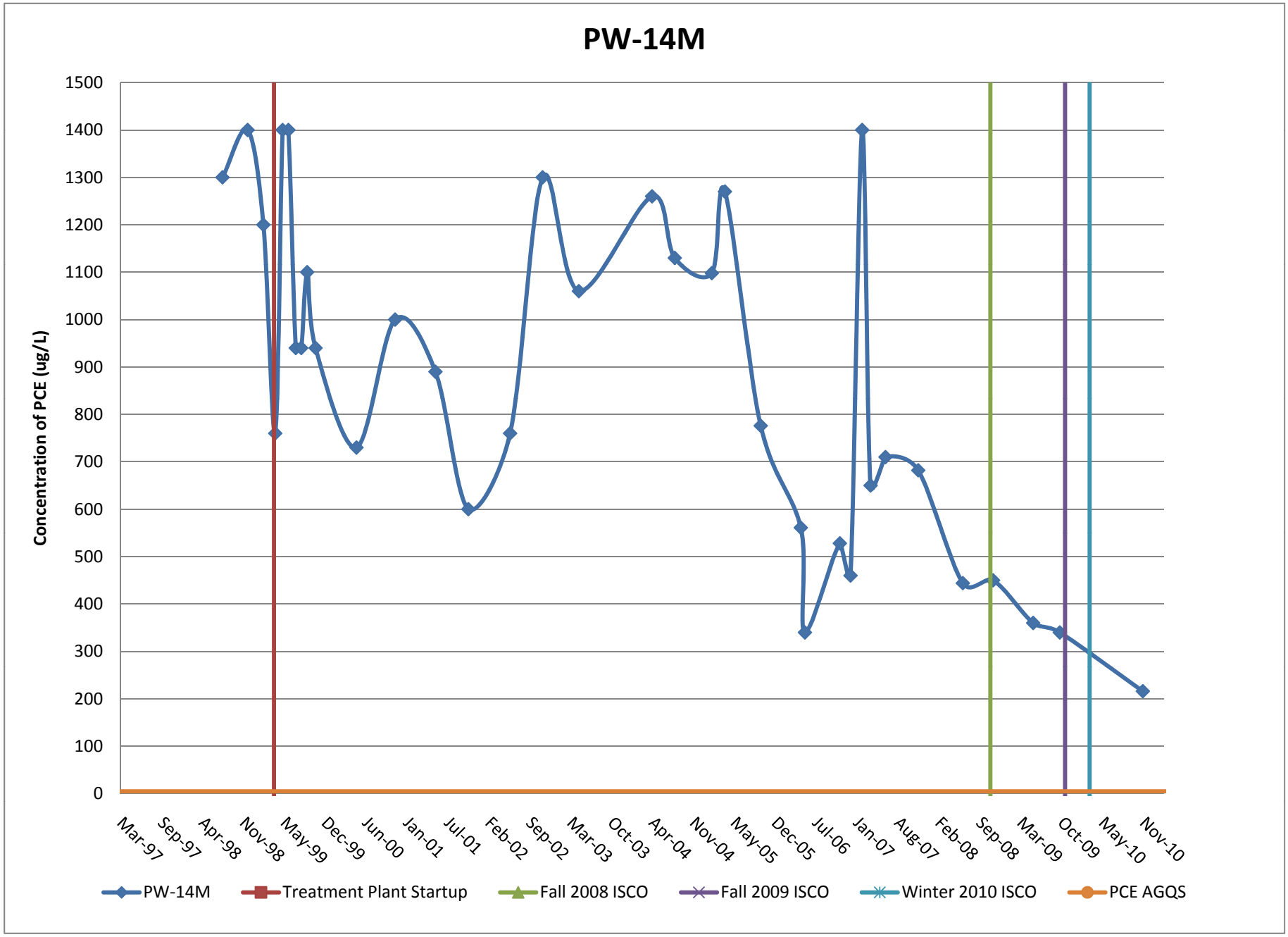

PW-12S
Concentration of PCE (ug/L)
300
250
200
150
100
50
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-12S
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

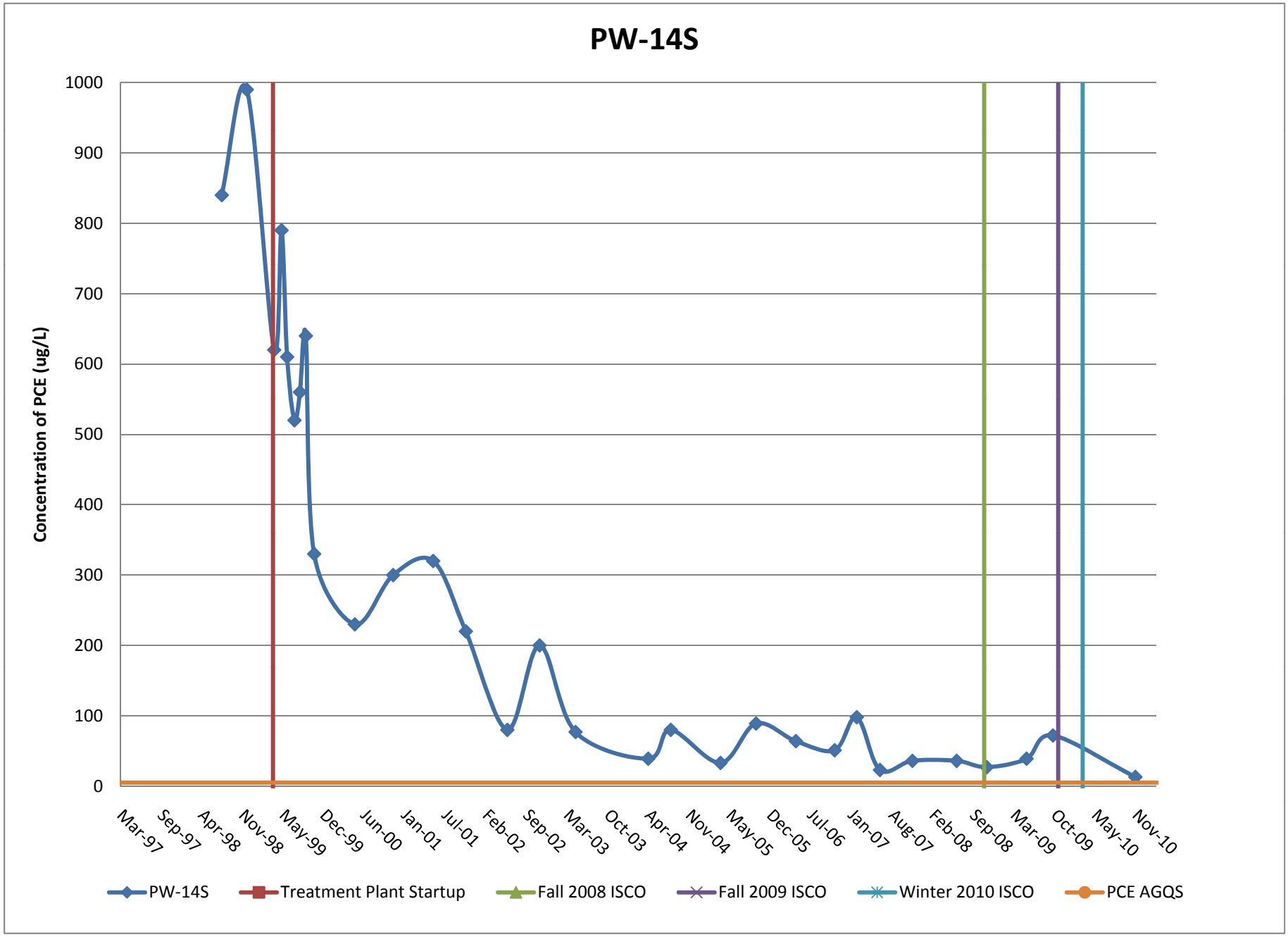

PW-13D
Concentration of PCE (ug/L)
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-13D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

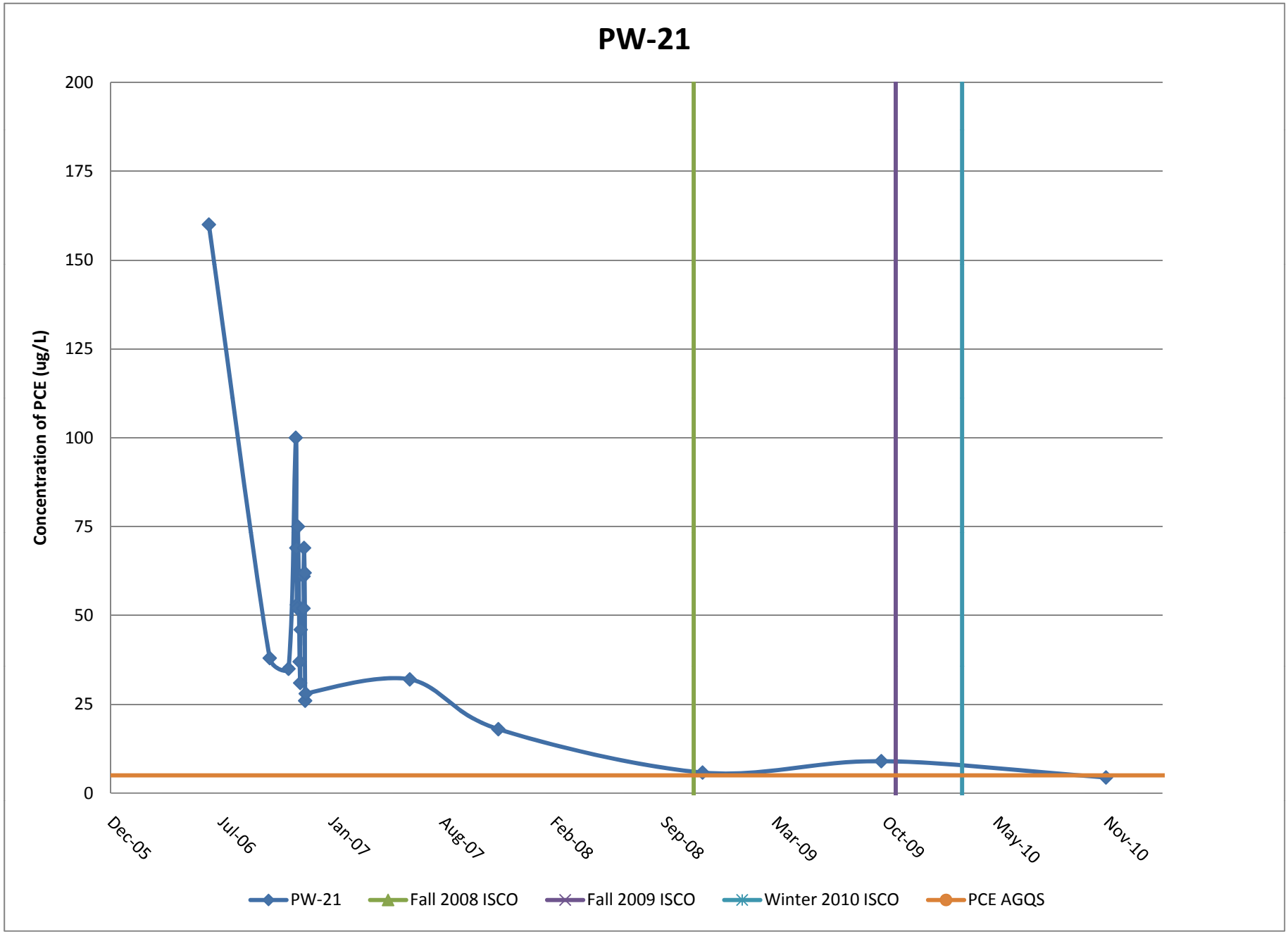

PW-13M
Concentration of PCE (ug/L)
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-13M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

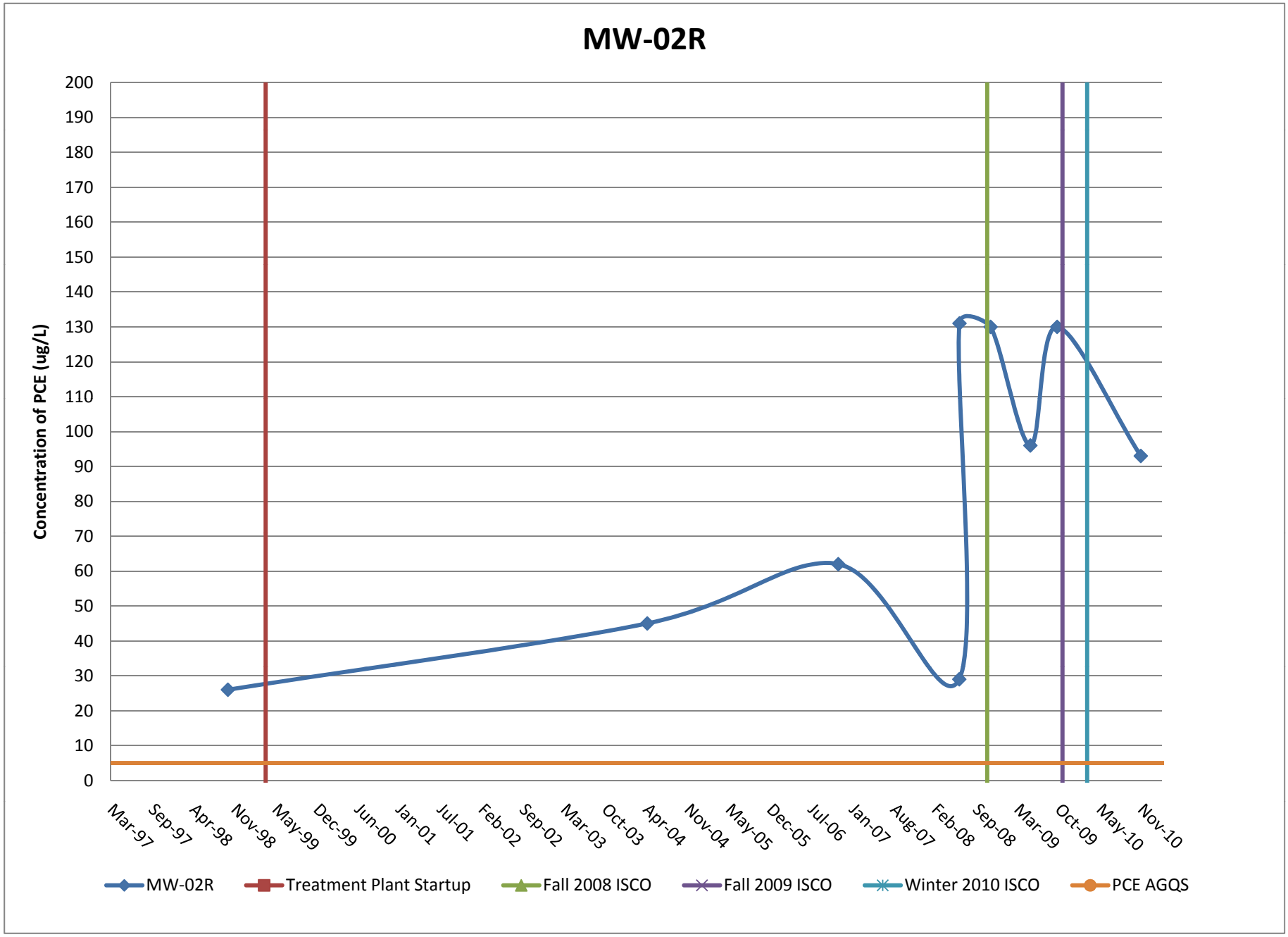

PW-13S
Concentration of PCE (ug/L)
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-13S
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

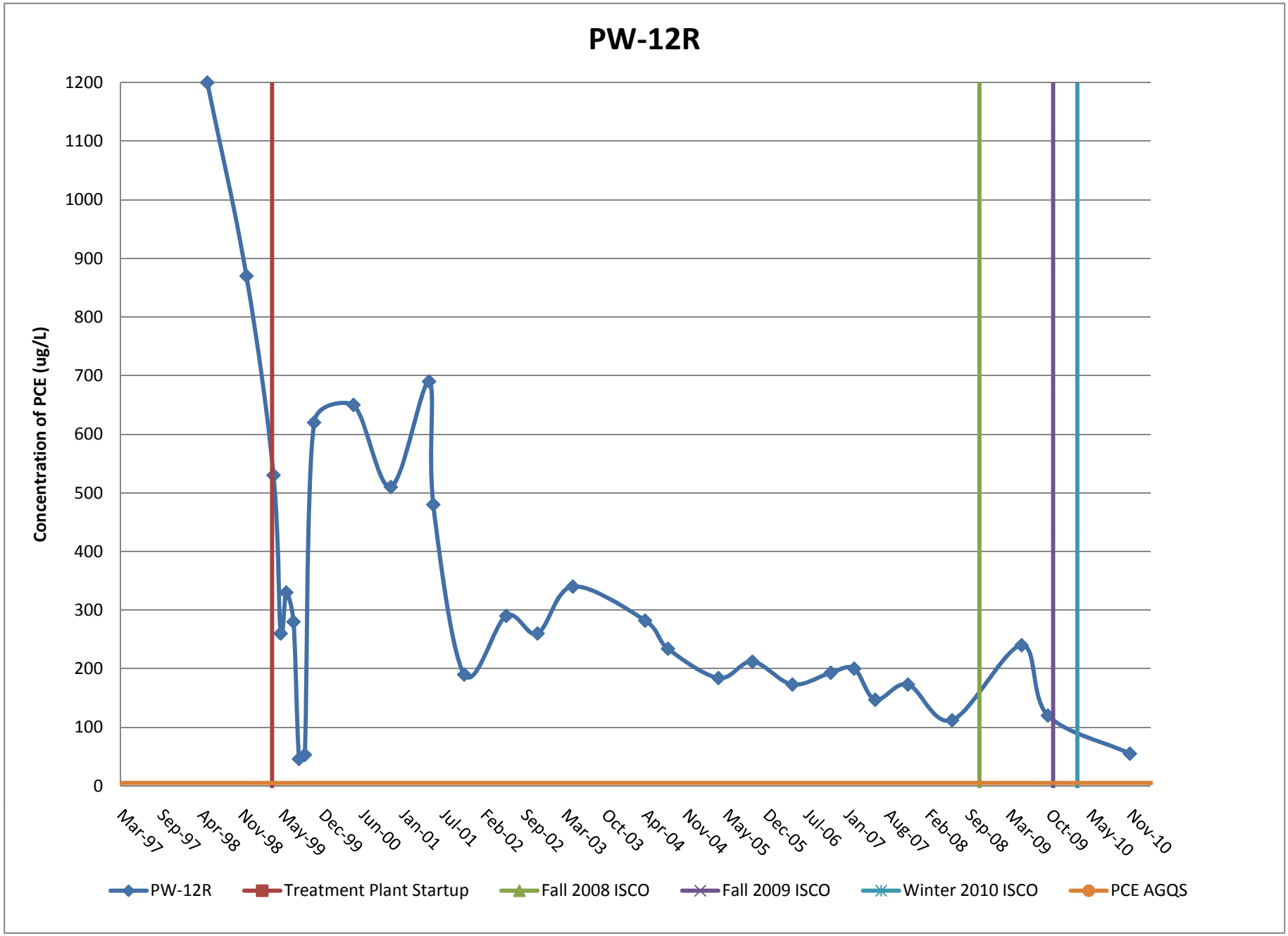

PW-14D
Concentration of PCE (ug/L)
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-14D
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

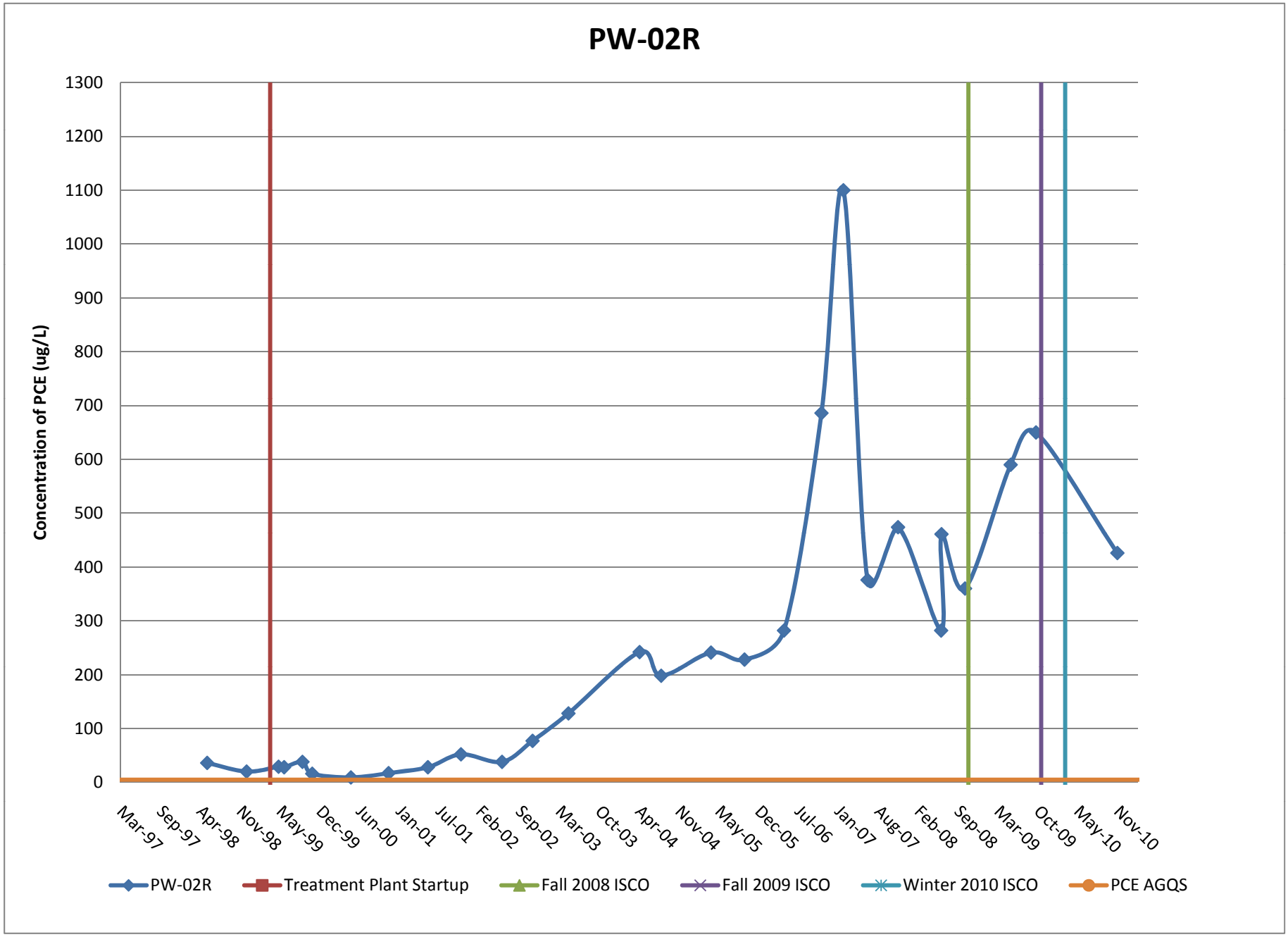

PW-14M
Concentration of PCE (ug/L)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-14M
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS


PW-14S
Concentration of PCE (ug/L)
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-14S
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS


PW-21
Concentration of PCE (ug/L)
200
175
150
125
100
75
50
25
0
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-21
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS


MW-02R
Concentration of PCE (ug/L)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
MW-02R
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS


PW-12R
Concentration of PCE (ug/L)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-12R
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS


PW-02R
Concentration of PCE (ug/L)
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Mar-97
Sep-97
Apr-98
Nov-98
May-99
Dec-99
Jun-00
Jan-01
Jul-01
Feb-02
Sep-02
Mar-03
Oct-03
Apr-04
Nov-04
May-05
Dec-05
Jul-06
Jan-07
Aug-07
Feb-08
Sep-08
Mar-09
Oct-09
May-10
Nov-10
PW-02R
Treatment Plant Startup
Fall 2008 ISCO
Fall 2009 ISCO
Winter 2010 ISCO
PCE AGQS

DRAFT

Annual Groundwater Quality Monitoring Report – 2010

Savage Municipal Water Supply Well Superfund Site

Milford, New Hampshire

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June 2, 2011

Disclaimer

This document is a DRAFT document prepared by the Settling Defendants under a government Consent Decree. This document has not undergone formal review by the United States Environmental Protection Agency (US EPA) and the New Hampshire Department of Environmental Services (NHDES). The opinions, findings, and conclusions expressed are those of the author and not those of US EPA and NHDES.

Table of Contents

Page

1 Introduction 1
1.1 Site Setting and History Overview 1
1.2 Report Organization 2

2 Groundwater and Surface Water Monitoring Program 3
2.1 Groundwater and Surface Water Elevation Monitoring Program 3
2.1.1 Groundwater Elevation Monitoring 3
2.1.2 Surface Water Elevation Monitoring 4
2.2 Groundwater Quality Monitoring Program 4
2.2.1 Sampling Scope 4
2.2.2 Sampling Approach 5
2.3 Monitoring Well Construction Summary 6

3 Remediation System Operations and Monitoring Results 8
3.1 System Operations 8
3.2 Groundwater and Surface Water Elevation Monitoring Results 9
3.3 Groundwater Quality Monitoring Results 10
3.3.1 Data Validation 10
3.3.2 VOC Concentrations 10
3.3.3 PCE Mass Estimates 12
3.3.4 Inorganic Constituents 15
3.3.5 1,4-Dioxane Analysis 15
3.4 Natural Attenuation Results 16

4 Recommendations for Future Monitoring 18
4.1 Groundwater Quality Monitoring 18
4.2 Groundwater Elevation Monitoring 18

5 Summary and Conclusions 19

References 20

Appendix A Field Notes
Appendix B Data Validation
Appendix C Groundwater Analytical Data
Appendix D PCE Concentration Isopleths over Time
Appendix E PCE Mass Remaining Calculations
Appendix F Proposed Fall 2010 Annual Groundwater Quality Monitoring Plan
Appendix G Summary of Monitoring Well Replacement Activities

List of Tables

Table 2.1 Water Level Monitoring Locations
Table 2.2 Groundwater Quality Monitoring Program
Table 2.3 Summary of Monitoring Well Construction Information

Table 3.1 Groundwater and Surface Water Elevations – June and November 2010
Table 3.2a Semi-Annual Groundwater Quality Monitoring Results – VOCs
Table 3.2b Annual Groundwater Quality Monitoring Results – VOCs
Table 3.3 Groundwater PCE Concentration Residuals (December 2010)
Table 3.4 Groundwater Quality Monitoring Results – Iron and Manganese
Table 3.5 Groundwater Quality Monitoring Results – 1,4 Dioxane
Table 3.6a MNA Wells – North Side of the Souhegan River
Table 3.6b MNA Wells – Eastern Extent/Plume Boundary
Table 3.6c MNA Wells – Southern Plume Boundary

List of Figures

Figure 1.1 Site Location Map

Figure 2.1 Water Elevation Monitoring Locations
Figure 2.2 Groundwater Quality Monitoring Locations
Figure 2.3 All Water Elevation and Quality Monitoring Locations

Figure 3.1 Summary of Extraction Well Operation
Figure 3.2 Summary of Injection Well and Surface Water Discharge Operation
Figure 3.3 Monthly Average Specific Capacity at Extraction Wells
Figure 3.4 Monthly Average Specific Capacity at Injection Wells
Figure 3.5a Groundwater Elevation Contours – June 14, 2010
Figure 3.5b Groundwater Elevation Contours – November 22, 2010
Figure 3.6 Groundwater Elevation Data – MW-108A, MW-119, and MW-121
Figure 3.7 Measured PCE Groundwater Concentrations (Dec. 2010) – Model Layers 1 and 2
Figure 3.8 Measured PCE Groundwater Concentrations (Dec. 2010) – Model Layer 3
Figure 3.9 Measured PCE Groundwater Concentrations (Dec. 2010) – Model Layer 4
Figure 3.10 Measured PCE Groundwater Concentrations (Dec. 2010) – Model Layer 5
Figure 3.11 Percent Reduction in Measured PCE Groundwater Concentrations (Nov./Dec. 2010) – Model Layers 1 and 2
Figure 3.12 Percent Reduction in Measured PCE Groundwater Concentrations (Nov./Dec. 2010) – Model Layer 3
Figure 3.13 Percent Reduction in Measured PCE Groundwater Concentrations (Nov./Dec. 2010) – Model Layer 4
Figure 3.14 Percent Reduction in Measured PCE Groundwater Concentrations (Nov./Dec. 2010) – Model Layer 5
Figure 3.15 PCE Concentration *versus* Time for Select Monitoring Wells
Figure 3.16 PCE Concentration *versus* Time for Extraction Wells
Figure 3.17 PCE Concentration in Combined Influent and Cumulative Estimated PCE Mass Removed
Figure 3.18 Comparison of Model-Predicted *versus* Estimated PCE Mass Remaining in OU-2
Figure 3.19 Measured 1,4 Dioxane Groundwater Concentrations (Nov./Dec. 2010)

1 Introduction

A groundwater remedy is currently in progress at the Operable Unit 2 (OU-2) portion of the Savage Municipal Water Supply Well Superfund Site located in Milford, New Hampshire (Site), where the fifth full year of continuous operation is now complete. The remediation system was initially operated from October to December of 2004 and was restarted in September of 2005. A baseline groundwater monitoring round, as defined in the Environmental Monitoring Work Plan (EMP; Gradient and MACTEC, 2004), was undertaken in August of 2004 prior to system startup. An interim baseline groundwater monitoring round was undertaken in September of 2005 prior to system restart (GeoSyntec and Gradient, 2005). This report presents the results of the remedy performance monitoring data collected in 2010, the fifth full year of continuous system operation.

1.1 Site Setting and History Overview

The Site is located in the western portion of the town of Milford, New Hampshire (Figure 1.1). The Consent Decree (CD) defines two areas to be remediated – the OK Tool Source Area, also called Operable Unit 1 (OU-1); and the Extended Plume, known as OU-2. The United States Environmental Protection Agency (US EPA) and the New Hampshire Department of Environmental Services (NHDES) are responsible for remediating OU-1, whereas the Settling Parties are responsible for addressing impacts within OU-2. A remedy consisting of a soil cover, slurry wall, soil vapor extraction system, and hydraulic control was implemented in 1999 at OU-1. A groundwater remedy, consisting of groundwater extraction, treatment, injection/surface water discharge, and natural attenuation, is being implemented at OU-2.

The Consent Decree defines OU-2 as "the area of the Site outside of the area defined as the OK Tool Source Area (OU-1)." OU-2 is bounded by North River Road to the north, OK Tool to the west, Elm Street and Tucker Brook to the south, and the Souhegan River to the east. The Savage Municipal Water Supply Well (Savage Well) is located approximately in the center of the Site (Figure 1.1). The Savage Well provided drinking water to the Town of Milford until the presence of volatile organic compounds (VOCs) was discovered in 1983. Located within Site boundaries are industrial, commercial, agricultural, and residential areas.

The detection of VOCs at the Savage Well led to investigations in the mid-1980s of potential sources – OK Tool Company, Hitchiner, and Hendrix, and eventually the placement of the Site on the National Priorities List (NPL) in September 1987. The Remedial Investigation/Feasibility Study (RI/FS) was completed in 1991. Investigations performed during the RI/FS revealed that the area is underlain by an unconfined, high yield sand and gravel aquifer, which is underlain by till and bedrock. Tetrachloroethylene (PCE) is the primary constituent of concern at the Site, although other chlorinated VOCs have also been detected.

The OU-2 Draft 100% Remedial Design (MACTEC, 2003) was approved by US EPA on January 22, 2004. The system was constructed in early to mid-2004 and began operations in October of the same year. Due to operational failure of the injection wells, the system was shut down after approximately five weeks of operation. In response to this, two of the injection wells (IW-1 and IW-2) were partially rehabilitated, a short-term metals treatment pilot test was conducted, an interim metals treatment plant was designed, and a temporary surface water discharge to the Souhegan River was built after receiving regulatory approval. The system was successfully restarted on September 6, 2005, and was operated for approximately ten weeks. At that point, the system was temporarily shut down for the construction of the permanent surface water discharge. The system resumed operation on January 26, 2006, and has operated continuously since then, experiencing only brief shutdown periods for regular operations and maintenance (O&M) activities, the installation of the fixed metals treatment system, and repair and redevelopment of injection well IW-3. The system was operational during this monitoring period, extracting and treating groundwater at the rate of approximately 414 gallons per minute (gpm), when pumping,[1] with recharge to groundwater and discharge to the Souhegan River.

1.2 Report Organization

Section 2 of this document presents a summary of the monitoring program implemented at the Site in this monitoring period. Section 3 presents the 2010 monitoring results, Section 4 presents recommendations for monitoring in 2011, and Section 5 presents the summary and conclusions.

[1] EW-1, EW-2 and EW-3 were not pumping for a total of approximately 66, 37 and 19 days, respectively, during this period.

2 Groundwater and Surface Water Monitoring Program

This chapter describes the groundwater and surface water monitoring program implemented during 2010, the fifth year of remedy operations. Groundwater sampling was carried out at select wells during the semi-annual monitoring round in June, and the annual sampling round in November and December.

2.1 Groundwater and Surface Water Elevation Monitoring Program

Groundwater and surface water elevation measurements were recorded manually and using dedicated data loggers at locations specified in the EMP. Table 2.1 lists the 84 monitoring wells, extraction wells, injection wells, and shallow piezometers where water elevations were measured. Surface water elevations were documented at 8 stream and staff gauges. Figure 2.1 presents water elevation monitoring locations.

2.1.1 Groundwater Elevation Monitoring

Electronic water level meters were utilized for recording the depth to water measurements. Prior to the measurement of water levels, all electronic meters were used in a single well to correlate the measurements between the meters used. At each location, the depth to groundwater, measuring point, time and meter serial number were recorded. At wells in which existing sampling equipment restricted access to the water elevation measurement, the sampling equipment was removed and the water level in the well was allowed to equilibrate before recording the depth to water. Groundwater elevation measurements were recorded within an eight-hour period on the same day.

In addition, continuous monitoring of groundwater at wells MW-119, and MW-121 is occurring using pressure transducers, as indicated in the EMP. A transducer malfunction ended the continuous monitoring at MW-108A in mid-November 2009 and is scheduled for re-installation. MW-119 and MW-121 are being continuously monitored to assist in evaluating the effect of injecting treated water at injection well IW-1. MW-119 and MW-121 are connected to the system PLC (Programmable Logic Controller), whereas MW-108A was a standalone individual transducer and data logger. The groundwater elevation data collected by these transducers are discussed in Section 3.

2.1.2 Surface Water Elevation Monitoring

Groundwater and surface water levels were measured to evaluate the potential impact of the remedial action on groundwater and surface water elevations near wetlands and agricultural areas. This was accomplished by monitoring piezometer P-101 on the banks of the discharge ditch between the extraction and injection locations, and piezometer P-102 in the low-lying wetlands downgradient of IW-3.

In addition, one staff gauge (S-1) in an unnamed wetland downgradient of IW-3, and several stream gauge locations (SG-1 through SG-6) were monitored along the discharge ditch and the Souhegan River to evaluate impacts to surface waters. At these locations, the water elevation on the staff or stream gauge was read and converted to true elevation based on the stream gauge survey data. The monitoring points included in this round are provided in Table 2.1 and the locations are shown on Figure 2.1.

2.2 Groundwater Quality Monitoring Program

2.2.1 Sampling Scope

Two rounds of groundwater quality monitoring were undertaken in 2010 – a semi-annual round, which included a smaller list of monitoring wells, and a more comprehensive, annual round. The scope of the semi-annual groundwater quality program consisted of 21 monitoring wells. Of these, 20 wells were sampled; one well, MW-10C, could not be located, was presumed to be destroyed, but was later found prior to the annual sampling round.

The scope of the "typical" annual sampling program was expanded based on US EPA's request due to the upcoming 5 Year Remedy Review to be undertaken for the Site in 2011 (Gradient, 2010a; US EPA, 2010; Appendix F). A total of 17 monitoring wells were added to the typical annual monitoring well network – resulting in a total of 68 groundwater sampling locations. These additional wells were included in the annual sampling round to understand the northern, eastern and southern edges of the plume, and to assess concentrations within the Monitored Natural Attenuation (MNA) area of the remedy as part of the 5 Year Remedy Review. Of the 68 proposed wells, one well, FH-30, could not be located.

As part of the 2010 annual sampling round, additional samples were also collected at two bedrock wells (MW-11R and MW-14R). Geophysical testing was undertaken by the USGS at these bedrock wells to characterize the major water bearing fractures. These tests also revealed that bedrock well MW-14R appeared to have a "leak" in the metal casing at approximately 50 ft bgs (approximately 20 feet above the bedrock surface) and groundwater from the overburden aquifer may be entering the bedrock well. Consequently, the well was repaired in August 2010 to address the leak (summarized in Gradient, 2010c, Appendix G). Therefore, this location will require continued monitored and evaluation to assess the effectiveness of these repairs.

At these two bedrock wells, groundwater samples were collected at discrete depth intervals based on findings from geophysical testing conducted by the USGS (Gradient, 2010a; US EPA, 2010; Appendix F). At MW-11R additional samples were collected at 94, 98, and 102 feet bgs, while at MW-14R an additional sample was collected from 72 ft bgs[2], in accordance without the proposed groundwater sampling plan (Gradient, 2010a; US EPA, 2010; Appendix F).

2.2.2 Sampling Approach

During the annual sampling round a combination of methodologies was used for sample collection – 48 wells[3] were sampled using polyethylene diffusion bags (PDBs) and 17 wells were sampled using low flow techniques. The sampling methodology choice was based on the results of a low flow *vs*. PDB correlation study undertaken as part of the 2004 baseline sampling event (MACTEC, 2005). Groundwater quality monitoring locations are presented on Figure 2.2; sample collection methodology and sampling frequency, along with sample collection depths, are indicated in Table 2.2. It should be noted that PDBs were deployed at the depth interval where maximum VOC concentrations were recorded in a previous concentration-depth profiling evaluation (MACTEC, 2005).

Standard Operating Procedures (SOPs) included in the EMP were used for groundwater sample collection. PDBs were installed and sampled after a two-week period. PDB deployment and retrieval information (date, time, depth, *etc.*) was documented and is attached in Appendix A. The 17 wells targeted for low-flow sampling were sampled using a peristaltic pump with dedicated tubing.

[2] Upon consultation with the USGS (USGS, 2010), additional samples will be collected from water bearing fractures at 77 and 108 ft bgs during the June 2011 sampling round, and instead only one additional sample (from 72 ft-bgs, 2 ft into the well screen) was to be collected during the Annual monitoring round in order to assess the well repair activities performed in August 2010.
[3] During the annual round, 13 of these wells were sampled using low flow techniques to collect 1,4 dioxane samples (Table 2.2).

Field low flow stabilization parameters were recorded at wells sampled using low flow procedures. These included temperature, pH, specific conductance, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity. The completed field calibration forms and field data forms are presented in Appendix A.

All samples were analyzed by Alpha Woods Hole Laboratories of Westborough, Massachusetts.[4] Samples were collected for VOCs and analyzed for target analytes by US EPA Method 8260B. Additional samples was collected from MW-11R and MW-111B for total recoverable and dissolved iron and manganese and analyzed by US EPA Method 6020.

To ensure that all data collected are scientifically valid, defensible, and of known precision and accuracy, quality assurance (QA) and quality control (QC) procedures, as outlined in the Savage Municipal Water Supply Well Superfund Site Quality Assurance Project Plan (QAPP), were implemented. The groundwater sampling event included the collection and analysis of appropriate types of QC samples as identified in Section 4.2.1 of the EMP. Sample collection documentation, sample ID designations, sample custody, sample handling, packing and shipping protocols were followed according to Section 4.0 of the EMP.

All data results were validated by Gradient in accordance with Section 2.5 of the EMP and the QAPP. The data validation report is provided in Appendix B.

2.3 Monitoring Well Construction Summary

At the request of the US EPA Region I (2008), a comprehensive monitoring well inspection program was performed during the annual monitoring round in 2009 to review and document the condition of all monitoring wells at OU-2. At this time a total of seven monitoring wells were identified as in need of replacement or repair for continued monitoring at the Site. As part of the 2009 annual report submittal (Gradient, 2010b) repair/replacement of these wells was proposed. These activities took place in August 2010. At that time three of the wells (MW-10C and MW-118A and B) were found to be intact and viable after further evaluation. The other four wells (MW-14R, MW-115A/B, and MW-120B) were repaired and were then included in the annual sampling program. A summary of these activities is provided in (Gradient, 2010c; Appendix G). Construction details for on-site monitoring wells, including

[4] In 2010, sample analysis was carried out at Alpha Woods Hole's Westborough lab instead of its Mansfield lab.

Global Positioning System (GPS) coordinates and well inspection details, are provided in Table 2.3. In addition, the locations of all monitoring wells, including those that are currently inactive or inoperable, are shown in Figure 2.3. The next comprehensive inspection will take place during the 2011 annual monitoring round.

As of December 2010, the monitoring well network at OU-2 has the following deficiencies:

- Five monitoring wells/piezometers are damaged and not functional – FH-19, FH-25, MI-11, MW-19C, MW-108B, and SPZ-1 (Table 2.3).
- Five monitoring wells are functional, but require minor repairs – MW-106,[5] MW-108A,[4] MW-22A, MW-5A, and FH-22 (Table 2.3).

[5] Well is currently part of the EMP groundwater sampling program.

3 Remediation System Operations and Monitoring Results

3.1 System Operations

The remediation system operated effectively during the fifth year of system operation, extracting and treating groundwater at the rate of approximately 414 gpm (when pumping) and an overall average injection rate of 377 gpm, with combined recharge to groundwater and discharge to the Souhegan River. Figure 3.1 (Summary of Extraction Well Operation) and Figure 3.2 (Summary of Injection Well and Surface Water Discharge Operation) provide daily values for water volumes extracted, injected, and discharged to surface water by the treatment system during the fifth year of system operation. Significant operational events (*e.g.,* restart, shutdown for system maintenance) are also identified on these figures.

Figures 3.3 and 3.4 provide monthly average specific capacity values at extraction wells and injection wells, respectively. The values were calculated based on flow rate and drawdown/mounding recorded by the SCADA (Supervisory Control and Data Acquisition) system. Extraction wells were redeveloped in 2010 since extraction rates had declined and iron fouling was visible on pumps; however, injection wells were not redeveloped at that time because injection rates were relatively stable. Specific capacity at the extraction wells, particularly EW-3, increased after redevelopment (Figure 3.3). The pressure transducers in IW-1 and IW-2 began malfunctioning in late 2009 and data recorded after this time is not considered reliable. Although specific capacity measurements are incomplete for IW-1 and IW-2 due to malfunctioning pressure transducers, IW-3 shows that the specific capacity was relatively stable throughout 2010 (Figure 3.4). The injection and extraction wells are scheduled to be redeveloped in the Fall of 2011.

Treatment system influent and effluent quality monitoring is currently conducted bi-weekly. The weekly photoionization detector (PID) headspace monitoring of the influent was discontinued, as this was not a reliable alternative to bi-weekly influent and effluent sampling and analysis (Gradient, 2010b). The influent and effluent quality monitoring data collected over the last four years demonstrate that there have been only minor temporal changes in influent quality and the effluent monitoring results have consistently met the remedial objectives prior to re-injection and discharge.

3.2 Groundwater and Surface Water Elevation Monitoring Results

Groundwater and surface water elevations were measured at 75 locations within OU-2 during the semi-annual round, and 82 locations during the annual monitoring rounds in 2010 (Table 3.1). Potentiometric contour maps generated using the data from the monitoring rounds in June and November are presented in Figures 3.5a and 3.5b, respectively. Groundwater elevation monitoring indicates that groundwater generally flows in an east-northeast direction and discharges to the Souhegan River. These data delineate the influence of the extraction wells on groundwater flow and demonstrate that the extraction portion of the remedy is performing as designed – successfully removing groundwater from the most impacted portion of the plume. During the November monitoring EW-1 was not operating (Figure 3.5b). Groundwater elevation monitoring data in the vicinity of the injection wells do not depict a significant mound; however, the groundwater surface gradient flattens out slightly indicating that injected groundwater is influencing this area, and thus flushing the portions of the plume downgradient. Finally, groundwater elevation data (Table 3.1) from piezometers P-101 and P-102 and surface water monitoring points S-1 and SG-1 through SG-4 indicate that the remedial actions are not significantly impacting the surrounding wetland and agricultural areas.

Continuous groundwater monitoring at wells MW-119 and MW-121 is being conducted as defined in the EMP. The pressure transducer in MW-108A malfunctioned in November 2009 and no further data has been collected at this location. Data recorded at these wells demonstrate seasonal fluctuation of groundwater elevation in the aquifer (ambient high and low water elevations) ranging from approximately 4 to 8 feet (Figure 3.6). Groundwater elevations recorded at these wells also reflect the regional changes in groundwater elevation due to precipitation and other events. Groundwater elevations recorded in 2010 at these wells were generally similar to 2009 gauging results. Increased precipitation in March 2010 had an observable effect on groundwater elevations at both wells. Due to some observed inconsistencies in the groundwater elevation monitoring data, the following wells will be resurveyed in 2011 to confirm the elevation of the reference point used to calculate groundwater elevations:

- IW-1, IW-1A, IW-2, IW-2A, IW-3, IW-3A, MW-119, MW-121, MW-17C, MW-10A, MW-10B, P-102, MW-111A, MW-111B, MW-111C, MW-106, and MW-117.

3.3 Groundwater Quality Monitoring Results

All groundwater samples obtained during the year were analyzed for VOCs, whereas selected samples were analyzed for iron, manganese, and 1,4 dioxane. VOC concentrations in groundwater from the semi-annual and annual monitoring events are presented in Tables 3.2a and 3.2b. Figure 3.15 presents PCE concentrations over time by monitoring well, and Appendices A and C present field monitoring data and groundwater analytical results, respectively.

3.3.1 Data Validation

As described in Section 2, QA/QC samples were collected during PDB and low-flow sampling activities as outlined in the Savage Municipal Water Supply Well Superfund Site QAPP. A Tier I data validation review was performed on received analytical data. The data were evaluated for "completeness" using Region I Data Validation Functional Guidelines for Evaluating Organic Analyses (US EPA Region I, 1996) and the Region I Tiered Organic and Inorganic Data Validation Guidelines (US EPA Region I, 1993). All of the data received for this monitoring round were verified as complete.

3.3.2 VOC Concentrations

Up to eight VOCs were detected in the groundwater samples collected during the semi-annual and annual sampling rounds in 2010 (Tables 3.2a and b). PCE was the most frequently detected compound and was present at the highest concentrations. PCE (19 of 23 wells), TCE (15 of 23 wells), and 1,1-dichloroethene (2 of 23 wells) exceeded the US EPA drinking water MCLs (US EPA, 2009) during the semi-annual round, while only PCE (31 of 67 wells) and TCE (13 of 67 wells) exceed the MCLs during the annual round. Previous investigations have indicated that the PCE plume originated at OU-1 and extends in an easterly direction into OU-2. Measured PCE groundwater concentrations as a function of depth are presented in Figures 3.7 through 3.10. Each figure displays PCE groundwater data[6] associated with the same depth range used in the groundwater flow and solute transport (PCE) model (US EPA, 2002). Consistent with previous sampling events, elevated PCE concentrations were detected near Trailer Park Road in deep overburden deposits located within a previously defined bedrock depression. Generally, PCE concentrations increase with depth within the overburden deposits. The highest PCE

[6] PCE groundwater concentration data contours were generated using Kriging in ArcGIS (ESRI, 2010), along with manual adjustments.

concentration was identified in monitoring well MW-120C (410 μg/L), which is screened directly above bedrock.

A comparison of measured PCE concentrations in this monitoring event to concentrations since 1989 indicates a continued reduction of PCE concentrations in the overburden aquifer (USGS, 2004; MACTEC, 2005; also see Appendix D). The USGS noted that between 1989 and 1994 the PCE plume shifted northward, in part due to a change in groundwater withdrawals at the Site (USGS, 2004). When vertical profiling was completed in 1995, the areal extent of and concentrations within the plume were as greatest in the lower portion of the aquifer. The baseline monitoring event in August 2004 confirmed that PCE concentrations were greatest in the northern portion of the site in the deeper portion of the aquifer, where the extraction wells were later installed (MACTEC, 2005). Since 2004, PCE concentrations have decreased in the overburden aquifer and the areal extent of the plume has also reduced. This is illustrated in Figures 3.11 through 3.14, which show significant reduction in PCE concentrations from August 2004 to December 2010. The observed decline in concentrations is consistent with natural attenuation of the PCE plume due to advection and dispersion, enhanced by the operation of the treatment system during this period. PCE concentrations measured at monitoring wells (Figure 3.15), extraction wells (Figure 3.16), and treatment plant influent (Figure 3.17) support this general conclusion since an overall reduction in concentrations continues to be observed over time. From system startup to 2010, PCE mass in OU-2 has declined by approximately 84%, from 1,830 kg in August 2004 to 296 kg in December 2010 (Figure 3.18 and Appendix E).

Although there has been a significant decline in PCE mass in OU-2 since 2004, treatment plant influent PCE concentrations appear to be reaching an asymptote (Figure 3.16 and 3.17). In addition, some monitoring wells (*e.g.*, MW-11R and MW-14A/B/R; Figure 3.15) have demonstrated relatively small concentration declines, while some wells (*e.g.*, MI-31, MW-103, and MW-105; Figure 3.15) have shown concentration increases in recent years. Future monitoring, along with the August 2010 repair of MW-14R (Appendix G), will help evaluate this issue further.

At this time it is still unclear how successful the repairs to MW-14R were. The repairs were conducted in August 2010 without incident or complications. pH readings during December 2009 were >12, suggesting infiltration from grout surrounding the steel casing. As of December 2010 the pH readings decreased slightly to between 10 and 11. If pH readings continue to decrease over time, this would suggest that the repairs were completed successfully. In addition, groundwater sampling results for

PCE are still within the same range as past sampling at the site. For instance, in December 2009 the results were 280 µg/L, while in June and December 2010 the results were 100 and 110 µg/L, respectively. The two samples collected from 72 and 86.5 ft bgs in December 2010 had very similar PCE concentrations (110 and 100 µg/L, respectively) and both were lower than the results from MW-14B (220 µg/L), screened in the lower overburden aquifer. Historically, PCE concentrations in MW-14B and MW-14R were very similar (Figure 3.15). Therefore, continued monitoring for pH and VOCs at MW-14R will provide additional insight into whether or not the well has successfully been isolated from the overburden aquifer.

The vertical profiling data collected at MW-11R indicates that the sampling depth of 90 ft bgs, the depth at which samples have been historically collected, is the most representative depth to collect samples at this location. While water bearing fractures were identified by the USGS at 94, 98, and 102 ft bgs (Gradient 2010a), PCE concentrations at these depth intervals were 91, 90, and 100 µg/L, respectively, while the PCE concentration at 90 ft bgs was 310 µg/L. This data supports continued future monitoring at MW-11R at 90 ft-bgs since this provides a conservative estimate of concentrations in bedrock and consistency with the prior dataset. Additional sampling within selected water bearing fractures can be conducted periodically to ascertain temporal variations.

3.3.3 PCE Mass Estimates

PCE Mass Removed by Treatment System

Estimated PCE mass removed by the treatment system (Figure 3.17) was calculated using combined influent concentrations measured every two weeks. The average influent concentration (µg/L) between two sampling events was used in conjunction with total volume of water extracted during that period (L) to obtain the total PCE mass removed (kg) during that period. The total PCE mass removed by the treatment system since the start of the remedy was estimated at 323 kg, which is expected to be an underestimate since this does not account for the VOCs lost by volatilization during the extraction process and as the water flows from the extraction wells to the treatment plant (where the influent sampling ports are located).

PCE Mass Remaining in the Aquifer

The 2004 baseline monitoring round (MACTEC, 2005), four quarterly monitoring rounds of Year 1 (Gradient, 2006a,b, 2007), and the December 2010 monitoring round of Year 5 were utilized to calculate PCE mass remaining in the OU-2 portion of the aquifer. PCE concentration contours were generated, by model layer, using the Kriging method for the December 2010 monitoring event (Figures 3.7 through 3.10). These contours were then combined with individual layer thickness and porosity[7] to obtain a value for the total dissolved PCE mass per layer. A retardation factor[8] was then applied to the total dissolved PCE mass to calculate the total PCE mass present in the aquifer. Total PCE mass remaining in the aquifer over time is presented in Figure 3.18 and calculations are provided in Appendix E.[9]

These calculations indicate that PCE mass in OU-2 has declined from approximately 1,830 kg[10] in August 2004 to approximately 296 kg in December 2010 (total mass reduction of 1,534 kg; Figure 3.18). The reduction in PCE mass is attributable to a combination of mass removed *via* the extraction system and natural attenuation. Note these mass calculations have some inherent uncertainty since concentrations measured at discrete points (*i.e.,* monitoring wells) are used to characterize concentrations over an extensive area (by interpolation), as well as the use of representative porosity and retardation values to account for dissolved and total PCE mass. However, given that a comparable data set and identical mass calculation methodology has been applied to all monitoring events, this uncertainty is consistent for all events and the observed trend of estimated mass decline is strong evidence that the PCE mass in the aquifer is declining and the remedy is performing effectively.

Of the estimated 1,534 kg of PCE mass reduction since August 2004, it is estimated that 21% (323 kg) has been removed by the treatment system, based on influent water concentrations measured at the treatment plant. As mentioned previously, this is an underestimate of the total mass removed by the treatment system since mass losses due to volatilization (from extraction wells to the treatment plant) are not accounted for.

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[7] Porosity (n) = 0.3.
[8] Retardation Factor (R) = 2 (Layers 1, 3, and 5) and 2.5 (Layers 2 and 4); based on Remedial Design Investigation Report (US EPA, 2002).
[9] Note the model-predicted mass remaining in the aquifer from 2004 on reflects the actual OU-2 remedial system operating conditions (*e.g.*, average water extraction and injection rates).
[10] The August 2004 mass remaining value presented in previous quarterly monitoring reports included both OU-2 and the portion of OU-1 outside the slurry wall. The mass remaining value presented here is for OU-2 alone.

Comparison to Groundwater Flow and Solute Transport Model

The numerical three-dimensional groundwater flow and solute transport model, initially developed by US EPA/USGS and updated in the 2002 Remedial Design Investigation (RDI; US EPA, 2002), was executed to simulate actual remedy operations (*i.e.,* actual extraction and injection well pumping rates). Model-predicted values for groundwater elevation and PCE concentration were compared to the measured values obtained from monitoring events conducted since system restart in September 2005.

Residual PCE concentrations (model-predicted minus measured values) in the aquifer for December 2010 were obtained for OU-2 wells (Table 3.3). Residual statistics of Mean, Minimum, Maximum, Median, Standard Deviation, and RMSE are also presented in Table 3.3.

These statistics demonstrate that model-predicted values are generally higher than actual measured values (mean residual = 19 µg/L and RMSE = 110 µg/L) – indicating that the model is conservative in its prediction of PCE concentration. These statistics are comparable to the final model calibration in 2001 (mean residual = 92 µg/L and RMSE = 426 µg/L; US EPA, 2002), which confirmed that the model was a reasonable mathematical representation of PCE transport at the Site. Residual statistics indicate that the remedy is progressing similarly in both the deeper layers (layers 4 and 5, the most highly contaminated portions of OU-2) and the shallower layers (layers 1 through 3).

An overall comparison of model-predicted total mass remaining to estimated total mass remaining based on measured concentrations in OU-2 from September 2001 to December 2010 is presented in Figure 3.18. Consistent with residual statistics, the model-predicted mass is consistently higher than mass estimated based on measured concentrations (model is conservative). However, this difference between model-predicted and measured mass is partly attributed to the inherent uncertainty involved in estimating total mass (*i.e.*, a slight discrepancy between model-predicted and measured values at discrete points can significantly impact the total mass calculation). This was apparent even in the final model calibration performed in 2001 (US EPA, 2002), where model-predicted mass (3,750 kg) was greater than mass estimated from measured values (3,000 kg; Figure 3.18). Nonetheless, the overall trend indicated by residual statistics and total mass calculations is that the remedy is performing effectively and progressing better than model predictions.

3.3.4 Inorganic Constituents

In the 2005 interim baseline monitoring round (GeoSyntec and Gradient, 2005), groundwater samples from four monitoring wells (MW-111A/B/C and MW-17C) were analyzed to determine if operation of the injection wells had any effect on groundwater quality in the vicinity of the wells. Low levels (on the order of 0.1 mg/L or lower) of iron (most representative indicator of aquifer matrix fouling due to injection) were detected at all wells, except MW-111C (on the order of 10 mg/L). It was determined that the higher iron concentrations recorded at MW-111C were associated with natural variability in iron concentrations rather than aquifer fouling caused by groundwater injection. Monitoring for iron and manganese has continued at the Site since 2005. In 2010, dissolved and recoverable iron and manganese were detected at bedrock well MW-11R (Table 3.4) during the June sampling round at relatively low concentrations compared to monitoring wells screened in the overburden. During the November and December sampling round, manganese (both dissolved and recoverable) was detected at MW-111B at low concentrations as well, while dissolved and recoverable iron were not detected at a detection limit of 50 µg/L. Based on these data, and prior iron and manganese monitoring data, continued sampling for these constituents is no longer necessary to ensure the proper operation of the selected remedy. Therefore, we are proposing to eliminate the annual sampling for iron and manganese at the Site (see Section 4.1).

3.3.5 1,4-Dioxane Analysis

A July 9, 2009 letter from NHDES requested that the Settling Parties perform sampling for 1,4-dioxane at OU-2 to determine if groundwater concentrations are below NHDES' current Ambient Groundwater Quality Standard (AGQS) of 3 µg/L (NHDES, 2009). In accordance with NHDES' request, influent and effluent samples for 1,4-dioxane analyses were collected in October 2009 and groundwater samples were collected from 17 wells in November and December 2009. At the request of the US EPA and NH DES, the Fall 2010 sampling event was expanded to include 1,4-dioxane analysis from 4 additional wells: FH-27, MW-34, MW-115A and MW-115B (Gradient, 2010a). Several of these monitoring wells, MW-17C, MW-102, MW-106, MW-107C, MW-111A, MW-111B, MW-111C, and MW-114, were previously sampled for 1,4-dioxane in 2003. Analyses were performed by Alpha Woods Hole of Westborough, MA, using US EPA Method 8270C with Selected Ion Monitoring (SIM).

The 1,4-dioxane results reported for the 2003, 2009 and 2010 sampling events are summarized in Table 3.5. All 2003 and 2010 monitoring well locations and results are also presented on Figure 3.19.

Overall, the data indicate that low levels of 1,4-dioxane are present in OU-2, concentrations are declining temporally (concentrations in 2009/20101 generally lower than 2003), and 1,4-dioxane is not present in the influent or effluent associated with the groundwater treatment system. 1,4-dioxane exceeded the NH DES AGQS at 6 sampling locations (MW-19B, MW-20B, MW-116A, MW-105, MW-14B, and MW-14R) during the annual sampling event. The four wells added to the 2010 sampling plan had no detectable 1,4-dioxane confirming that locations where 1,4-dioxane is present have already been identified. The declining trend of 1,4-dioxane is anticipated to continue over time, with the low levels encountered further attenuating due to plume dilution and dispersion. Consequently, no remedial actions are needed to address 1,4-dioxane at the Site.

3.4 Natural Attenuation Results

The Natural Attenuation portion of remedy at the Site is defined as the areas outside of the predicted influence of active groundwater extraction and injection (US EPA, 2002), which states "The areas of the aquifer which are not within the active extraction and/or injection remedy are at the eastern end of the aquifer and north of the Souhegan River. These areas are considered to be the areas of natural attenuation." The RDI identified 14 monitoring well locations within these zones to be used for evaluating the performance of the Natural Attenuation portion of the remedy. US EPA requested the sampling of additional wells to understand the current plume extent (US EPA, 2010; Gradient, 2010a). The Fall 2010 monitoring plan included 22 wells:

- North side of the Souhegan River (listed east to west; FH-4, FH-5, MW-112A, MW-24 A/B, MW-113A, FH-27, MW-31R, MW-114, MW-34 and FH-30);
- Eastern extent and boundary of plume (MW-115A/B, MW-22A, and MW-32B); and
- Southern plume boundary (MW-19A/B, MW-12A/B, MW-21B/C, and MI-10).

As indicated in the RDI report (US EPA, 2002), advection and dispersion are the dominant mechanisms affecting the attenuation of PCE at the Site, while biodegradation plays a relatively insignificant role (US EPA, 2002).

Natural Attenuation is progressing as predicted at the Site. PCE concentrations in monitoring wells located within the Natural Attenuation zone have generally been below the maximum contaminant levels (MCLs) with the exception of FH-27 (December 2010: 9.4 µg/L) and MW-19B (December 2010: 25 µg/L). However, PCE concentrations at these wells have declined by 81% and 51%, respectively,

since 2005, thus demonstrating that advection and dispersion are effectively attenuating VOCs in this part of the Site. Monitoring results for the Natural Attenuation wells over time are summarized in Table 3.6.

4 Recommendations for Future Monitoring

4.1 Groundwater Quality Monitoring

The Settling Parties are recommending that groundwater quality monitoring for iron and manganese be discontinued. Recent and historical iron and manganese sampling results from MW-111B indicate relatively low concentrations of iron and manganese in the aquifer, downgradient of the injection wells. These data, and the effectiveness of the metals treatment plant in removing iron and manganese from injected water, obviate the need for continued aquifer monitoring. Therefore, we are proposing to eliminate the annual sampling of these constituents in groundwater at the Site.

4.2 Groundwater Elevation Monitoring

New pressure transducers will be installed in MW-108A, IW-1 and IW-2 in early 2011. In addition, the following wells will be resurveyed in 2011 to confirm the elevation of the reference point used to calculate groundwater elevations:

- IW-1, IW-1A, IW-2, IW-2A, IW-3, IW-3A, MW-119, MW-121, MW-17C, MW-10A, MW-10B, P-102, MW-111A, MW-111B, MW-111C, MW-106, and MW-117.

5 Summary and Conclusions

Fifteen rounds of groundwater elevation and quality monitoring have been completed to assess remedy progression at the OU-2 portion of the Savage Municipal Water Supply Well Superfund Site. The data indicate that the remedy is operating as designed and effectively reducing contaminant mass in the aquifer. Specific conclusions based on the 2010 monitoring results are as follows:

- Overall, the OU-2 remedy is progressing effectively and remedy operations will continue in 2011. In 2010, groundwater was extracted and treated at an approximate rate of 414 gpm from the three extraction wells. After treatment, approximately 377 gpm was being injected into the subsurface, with the balance being discharged to the Souhegan River.
- PCE concentrations in a number of monitoring wells have been consistently less than 5 µg/L (the MCL for PCE) or below the quantitation limit (Figure 3.15). Influent PCE concentrations have also declined from approximately 500 µg/L to 25 µg/L (Figure 3.16).
- A comparison of PCE concentrations recorded in the first two years of remedy operations against the 2004 baseline and 2005 interim baseline monitoring rounds indicates a sharp decline in concentrations. In addition, since 2004, the overall PCE mass in OU-2 has decreased by approximately 1,534 kg (from 1,830 to 296 kg), an approximately 84% decline.
- The estimated PCE mass in the aquifer based on measurements is less than the model-predicted mass presented in the RDI report (US EPA, 2002), *i.e.,* remediation is progressing better than anticipated.

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Tables

Table 2.1
Water Level Monitoring Locations
Savage Well Superfund Site, Milford, NH

Water Level Monitoring Locations	
Monitoring Wells	
FH-4	MW-102
FH-9	MW-102B
FH-27	MW-103
MI-4	MW-103A
MI-10	MW-104
MI-11	MW-104A
MI-31	MW-105
MW-9C	MW-105A
MW-10A	MW-106
MW-10B	MW-107A
MW-10C	MW-107B
MW-11A	MW-107C
MW-11B	MW-108A
MW-11R	MW-108B
MW-12A	MW-109A
MW-12B	MW-109B
MW-13A	MW-110A
MW-13B	MW-110B
MW-14A	MW-111A
MW-14B	MW-111B
MW-14R	MW-111C
MW-17C	MW-112A
MW-19A	MW-113A
MW-19B	MW-114
MW-19C	MW-115A
MW-20A	MW-115B
MW-20B	MW-116A
MW-21B	MW-116R
MW-21C	MW-117
MW-22A	MW-118A
MW-24A	MW-118B
MW-31R	MW-119
MW-32B	MW-120A
MW-101A	MW-120B
MW-101B	MW-120C
MW-101C	
Injection Wells[1]	**Extraction Wells**
IW-1A	EW-1
IW-2A	EW-2
IW-3A	EW-3
Stream Gauges[2]	**Shallow Piezometers**
SG-1	P-101
SG-2	P-102
SG-3	PZ-A1
SG-4	PZ-A4
SG-5	PZ-A5
SG-6	PZ-B3
Bridge	PZ-B4
Staff Gauge	
S-1	

Notes:

[1] *IW-1A, IW-2A, IW-3A are piezometers 5 feet from Injection Wells.*

[2] *Stream discharge is not measured at these locations.*

Table 2.2
Groundwater Quality Monitoring Program
Savage Well Superfund Site, Milford, NH

Well ID	Sampling Frequency	Well Screen Top (ft-bgs)	Well Screen Bottom (ft-bgs)	Well Screen Length (ft)	PDB or Low Flow Pump Intake Depth (ft)	Iron & Manganese	VOC
Wells Sampled Using PDBs (48 wells/51 samples)							
MI-10	5 Yr Review	44.0	47.0	3	45.5		X
MW-9C	Annual	80.0	90.0	10	80.8		X
MW-10A	Annual	19.0	29.0	10	19.8		X
MW-10B	Annual	44.0	54.0	10	49.0		X
MW-10C	Semi-Annual	81.5	91.5	10	88.3		X
MW-11B	Annual	52.3	64.3	12	58.3		X
MW-12A	5 Yr Review	25.0	35.0	10	25.8		X
MW-12B	5 Yr Review	56.0	66.0	10	61.0		X
MW-13A	Annual	23.9	33.9	10	33.8		X
MW-13B	Annual	48.0	58.0	10	53.5		X
MW-14A	Semi-Annual	19.0	29.0	10	28.3		X
MW-14B [4]	Semi-Annual	50.0	60.0	10	50.8		X
MW-14R [4]	Semi-Annual	63.0	110.0	47	86.5		X
MW-14R [4]	5 Yr Review	63.0	110.0	47	72.0		X
MW-17C	Semi-Annual	85.0	95.0	10	85.8		X
MW-19A	5 Yr Review	23.5	33.5	10	24.3		X
MW-20A	Annual	15.2	25.2	10	16.0		X
MW-20B [4]	Semi-Annual	35.0	45.0	10	44.3		X
MW-21B	5 Yr Review	20.0	30.0	10	25.0		X
MW-21C	5 Yr Review	44.1	54.1	10	49.1		X
MW-22A	5 Yr Review	13.8	23.8	10	18.8		X
MW-31R	5 Yr Review	60.0	273.0	213	271.5		X
MW-32B	5 Yr Review	31.8	41.8	10	32.6		X
MW-101A	Annual	9.0	19.0	10	14.0		X
MW-101B	Annual	45.0	55.0	10	50.0		X
MW-102	Annual	61.5	71.5	10	62.3		X
MW-103	Semi-Annual	54.0	64.0	10	54.8		X
MW-103A	Annual	27.0	37.0	10	32.0		X
MW-104	Semi-Annual	24.0	34.0	10	29.0		X
MW-104A	Semi-Annual	10.0	20.0	10	17.5		X
MW-105 [4]	Semi-Annual	51.0	61.0	10	60.3		X
MW-105A [4]	Annual	21.0	31.0	10	21.8		X
MW-106 [4]	Annual	49.0	59.0	10	54.0		X
MW-107A	Annual	57.0	67.0	10	62.0		X
MW-107B [4]	Semi-Annual	70.0	80.0	10	70.8		X
MW-107C [4]	Semi-Annual	83.0	93.0	10	88.0		X
MW-108A	Annual	40.0	50.0	10	45.0		X
MW-109A [4]	Semi-Annual	10.0	20.0	10	15.0		X
MW-111A	Annual	38.0	48.0	10	47.5		X
MW-111C [4]	Semi-Annual	77.5	87.5	10	78.3		X
MW-112A	5 Yr Review	28.8	38.8	10	33.8		X
MW-113A	5 Yr Review	30.0	40.0	10	33.0		X

Table 2.2
Groundwater Quality Monitoring Program
Savage Well Superfund Site, Milford, NH

Well ID	Sampling Frequency	Well Screen Top (ft-bgs)	Well Screen Bottom (ft-bgs)	Well Screen Length (ft)	PDB or Low Flow Pump Intake Depth (ft)	Iron & Manganese	VOC
MW-114 [4]	Annual	42.0	52.0	10	42.8		X
MW-116A [4]	Semi-Annual	40.0	50.0	10	43.5		X
MW-120A	Annual	50.5	60.5	10	59.5		X
MW-120B	Annual	61.0	71.0	10	61.8		X
MW-120C	Semi-Annual	81.0	91.0	10	85.0		X
PZ-B3	Annual	11.5	16.5	5	14.0		X
PZ-B4	Annual	45.0	50.0	5	47.5		X
Wells Sampled Using Low Flow Sampling Procedures (18 wells/2 samples)							
FH-30	5 Yr Review	NA	NA	NA	NA		X
FH-27	Annual	36.0	41.0	5	38.5		X
MI-4	Annual	39.0	49.0	10	44.0		X
MI-31	Semi-Annual	36	54	18	45.0		X
MW-11R	Semi-Annual	70.5	115.5	45	90.0		X
MW-11R	5 Yr Review	70.5	115.5	45	94.0		X
MW-11R	5 Yr Review	70.5	115.5	45	98.0		X
MW-11R	5 Yr Review	70.5	115.5	45	102.0		X
MW-19B	Annual	36.0	49.0	13	44.0		X
MW-24A	Annual	19.5	29.5	10	24.5		X
MW-24B	5 Yr Review	31.0	41.0	10	36.0		X
MW-34	5 Yr Review	9.5	19.5	10	14.5		X
MW-101C	Semi-Annual	93.0	103.0	10	98.0		X
MW-102B	Annual	47.0	57.0	10	52.0		X
MW-109B	Semi-Annual	45.0	55.0	10	50.0		X
MW-110A	Annual	33.0	43.0	10	38.5		X
MW-110B	Semi-Annual	53.0	63.0	10	61.5		X
MW-111B	Annual	67.5	77.5	10	76.5	X	X
MW-115A	5 Yr Review	10.1	20.1	10	15.1		X
MW-115B	Annual	40.1	50.1	10	45.1		X
MW-118B	Annual	71.9	81.9	10	76.9		X
Grab Sample (1 well)							
FH-4	5 Yr Review						X
FH-5	5 Yr Review						X

Notes:
[1] *PDB = Passive Diffusion Bag.*
[2] *PDB deployment depth corresponds to interval that showed the highest VOC concentration in the August/September 2004 vertical profiling study.*
[3] *Analytical Methods used:* *VOCS - EPA Method 8260B*
Iron & Manganese - EPA Method 6020
[4] *Sampled using low flow techniques during the annual round in order to collect 1,4 dioxane samples.*
[5] *To be collected during the June 2011 sampling round.*
Wells highlighted in Pink represent 5 year review sampling locations.

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Table 2.3
Summary of Monitoring Well Construction Information
Savage Well Superfund Site, Milford, NH

	Location		Construction Data							
Well ID	**Easting**	**Northing**	**Surface Elevation (ft-amsl)**	**Bottom of Well Screen (ft bgs)**	**Screen Interval (ft)**	**Designation**	**Measured Total Well Depth (ft bgs)**	**Date of Installation**	**Date of Last Inspection**	**Well Condition**
Wells Within EMP Sampling Network										
Sample and Gauge										
FH-27	978958.00	126177.00	243.73	41.0	5	Monitoring Well	37.57	NA	11/20/2010	Viable
FH-30	981104.80	126341.00	NA	NA	NA	Monitoring Well	NM	NA	11/20/2010	Unable to locate well dense undergrowth newly fenced cow pasture (bull)
MI-4	978596.00	124893.00	253.01	49.0	10	Monitoring Well	47.49	4/14/1981	11/20/2010	Viable
MI-31	975786.00	124592.00	260.32	54.0	18	Monitoring Well	53.75	8/3/1983	11/20/2010	Viable
MW-9C	976552.24	124476.01	NA	90.0	10	Monitoring Well	90.05	11/3/1988	11/20/2010	Viable
MW-10A	976212.69	124932.54	259.3	29.0	10	Monitoring Well	28.04	11/10/1988	11/20/2010	Viable
MW-10B	976216.99	124928.25	259.35	54.0	10	Monitoring Well	53.15	11/17/1988	11/20/2010	Viable
MW-10C	976219.33	124930.40	NA	NA	NA	Monitoring Well	90.92	11/16/1988	11/20/2010	Viable
MW-11A	976433.00	125889.00	256.77	30.5	10	Monitoring Well	31.95	11/3/1988	11/20/2010	Viable
MW-11B	976435.20	125885.30	256.39	64.3	10	Monitoring Well	65.59	11/2/1988	11/20/2010	Viable
MW-11R	976435.00	125881.60	255.93	115.5	45	Monitoring Well	>101	11/1/1988	11/20/2010	Viable
MW-12A	978133.00	124281.00	254.71	35.0	10	Monitoring Well	34.72	12/5/1988	11/20/2010	Viable
MW-12B	978134.30	124287.40	255.04	66.0	10	Monitoring Well	66.52	12/1/1988	11/20/2010	Viable
MW-13A	977305.59	125082.87	256.14	33.9	10	Monitoring Well	34.07	11/29/1988	11/20/2010	Viable
MW-13B	977300.60	125081.10	255.44	58.0	10	Monitoring Well	59.65	11/26/1988	11/20/2010	Viable
MW-14A	978687.18	125647.24	250.13	29.0	10	Monitoring Well	29.60	11/22/1988	11/20/2010	Viable
MW-14B	978687.18	125647.24	250.34	60.0	10	Monitoring Well	61.20	11/21/1988	11/20/2010	Viable
MW-14R	978687.18	125647.24	250.14	110.0	47	Monitoring Well	>101	11/17/1988	11/20/2010	Viable
MW-17C	976212.80	124757.90	257.51	95.0	10	Monitoring Well	85.11	5/23/1989	11/20/2010	Viable
MW-19A	977236.65	124123.00	257.44	33.5	10	Monitoring Well	34.79	6/8/1989	11/20/2010	Viable
MW-19B	977236.65	124123.00	257.28	49.0	13	Monitoring Well	50.92	6/8/1989	11/20/2010	Viable
MW-20A	977469.20	124633.22	255.82	25.2	10	Monitoring Well	22.16	6/1/1989	11/20/2010	Viable
MW-20B	977469.20	124633.22	255.83	45.0	10	Monitoring Well	27.55	5/31/1989	11/20/2010	Viable
MW-21B	979001.00	124464.00	252.93	30.0	10	Monitoring Well	31.73	6/19/1989	11/20/2010	Viable
MW-21C	979001.00	124464.00	252.94	54.1	10	Monitoring Well	55.09	6/14/1989	11/20/2010	Viable
MW-22A	981102.00	126204.00	244.24	23.8	10	Monitoring Well	17.70	1/5/1990	11/20/2010	PVC sticks up out of protective casing, needs to be cut and re-surveyed
MW-24A	977644.44	126382.09	251.71	29.5	10	Monitoring Well	31.45	6/7/1989	11/20/2010	Viable
MW-24B	977644.44	126382.09	NA	41.0	10	Monitoring Well	NA	NA	11/20/2010	Viable
MW-31R	978979.00	126192.00	NA	NA	NA	Monitoring Well	>101	11/7/1989	11/20/2010	Viable
MW-32B	981367.00	125490.00	236.92	41.8	10	Monitoring Well	33.21	1/4/1990	11/20/2010	Viable
MW-34	979987.00	126490.70	NA	NA	NA	Monitoring Well	20.12	1/11/1990	11/20/2010	Viable
MW-101A	975979.48	125601.99	258.69	19.0	10	Monitoring Well	20.3	11/4/1998	11/20/2010	Viable
MW-101B	975983.68	125596.07	258.76	55.0	10	Monitoring Well	56.25	11/4/1998	11/20/2010	Viable
MW-101C	975981.26	125603.70	259.38	103.0	10	Monitoring Well	>101.00	11/4/1998	11/20/2010	Viable
MW-102	976772.88	125064.17	257.3	71.5	10	Monitoring Well	73.05	8/29/2001	11/20/2010	Viable
MW-102B	976774.75	125063.25	257.31	57.0	10	Monitoring Well	55.65	10/24/2003	11/20/2010	Viable
MW-103	977151.51	125418.03	254.18	64.0	10	Monitoring Well	55.00	8/31/2001	11/20/2010	Viable
MW-103A	977151.51	125418.03	254.25	37.0	10	Monitoring Well	36.60	10/28/2003	11/20/2010	Viable
MW-104	977685.28	125908.54	251.73	34.0	10	Monitoring Well	28.55	9/5/2001	11/20/2010	Viable
MW-104A	977685.28	125908.54	251.7	20.0	10	Monitoring Well	15.32	10/29/2003	11/20/2010	Viable
MW-105	977856.10	125290.37	252.9	61.0	10	Monitoring Well	54.70	9/6/2001	11/20/2010	Viable
MW-105A	977856.10	125290.37	253.55	31.0	10	Monitoring Well	29.69	10/28/2003	11/20/2010	Viable
MW-106	977165.78	124511.96	254.97	59.0	10	Monitoring Well	58.04	9/18/2001	11/20/2010	Viable (needs new roadbox)
MW-107A	976097.23	125337.30	258.77	67.0	10	Monitoring Well	66.35	11/5/2003	11/20/2010	Viable
MW-107B	976097.23	125337.30	258.75	80.0	10	Monitoring Well	69.68	11/4/2003	11/20/2010	Viable
MW-107C	976097.23	125337.30	258.74	93.0	10	Monitoring Well	86.80	11/4/2003	11/20/2010	Viable
MW-108A	976893.42	125763.85	254.05	50.0	10	Monitoring Well	47.80	10/31/2003	11/20/2010	Viable (needs new roadbox)
MW-109A	977968.25	125778.72	251.11	20.0	10	Monitoring Well	13.02	10/29/2003	11/20/2010	Viable
MW-109B	977968.25	125778.72	251.15	55.0	10	Monitoring Well	55.56	10/29/2003	11/20/2010	Viable
MW-110A	976549.82	125628.45	255.61	43.0	10	Monitoring Well	43.00	10/23/2003	11/20/2010	Viable
MW-110B	976549.82	125628.45	256.3	63.0	10	Monitoring Well	61.40	10/23/2003	11/20/2010	Viable
MW-111A	976921.30	124674.40	257.62	48.0	10	Monitoring Well	47.00	10/24/2003	11/20/2010	Viable
MW-111B	976921.30	124674.40	257.63	77.5	10	Monitoring Well	76.60	10/23/2003	11/20/2010	Viable
MW-111C	976921.30	124674.40	257.54	87.5	10	Monitoring Well	76.46	10/23/2003	11/20/2010	Viable
MW-112A	976126.67	126208.18	257.61	38.8	10	Monitoring Well	40.16	10/28/2003	11/20/2010	Viable
MW-113A	978267.41	126206.34	244.06	40.0	10	Monitoring Well	36.95	10/31/2003	11/20/2010	Viable
MW-115A	980575.27	126182.75	246	20.1	10	Monitoring Well	20.04	10/2003	11/20/2010	Viable
MW-114	979693.29	126214.28	246.93	52.0	10	Monitoring Well	49.29	10/30/2003	11/20/2010	Viable
MW-115B	980575.27	126182.75	245.00	50.1	10	Monitoring Well	51.20	10/2003	11/20/2010	Viable
MW-116A	978197.50	124855.16	253.49	50.0	10	Monitoring Well	50.29	12/11/2003	11/20/2010	Viable
MW-118B	980364.81	125488.45	245.94	81.9	10	Monitoring Well	NM	10/2003	11/20/2010	Viable
MW-120A	976368.09	125102.21	258.6	60.5	10	Monitoring Well	59.60	11/7/2003	11/20/2010	Viable
MW-120B	976368.09	125102.21	258.55	71.0	10	Monitoring Well	69.81	11/7/2003	11/20/2010	Viable
MW-120C	976368.09	125102.21	258.61	91.0	10	Monitoring Well	83.69	11/6/2003	11/20/2010	Viable
PZ-B3	979099.76	126058.69	247.69	16.5	5	Monitoring Well	19.39	6/12/1995	11/20/2010	Viable
PZ-B4	979120.48	126051.56	248.26	50.0	5	Monitoring Well	51.02	6/12/1995	11/20/2010	Viable
Gauge Only										
EW-1	976229.30	125558.06	257.25	NA	NA	Extraction Well	68.35	2/1/2003	11/20/2010	Viable
EW-2	976688.28	125708.95	230.23	NA	NA	Extraction Well	69.94	2/1/2003	11/20/2010	Viable
EW-3	977047.96	125710.48	255.25	NA	NA	Extraction Well	44.85	2/1/2003	11/20/2010	Viable
FH-4	975834.85	126598.92	NA	NA	NA	Extraction Well	NM	NA	11/20/2010	Active fish hatchery pumping wells total depth
FH-5	975988.30	127199.90	NA	NA	NA	Extraction well	NM	NA	11/20/2010	not measured with pumps on
FH-9	975997.00	127233.00	NA	NA	NA	Monitoring Well	52.59	NA	11/20/2010	Viable

Table 2.3
Summary of Monitoring Well Construction Information
Savage Well Superfund Site, Milford, NH

	Location		Construction Data							
Well ID	**Easting**	**Northing**	**Surface Elevation (ft-amsl)**	**Bottom of Well Screen (ft bgs)**	**Screen Interval (ft)**	**Designation**	**Measured Total Well Depth (ft bgs)**	**Date of Installation**	**Date of Last Inspection**	**Well Condition**
IW-1A	976205.00	124592.14	256.18	NA	NA	Injection Well Piezometer	11.18	2/1/2003	11/20/2010	Viable
IW-2A	976739.27	124409.45	258.29	NA	NA	Injection Well Piezometer	11.21	2/1/2003	11/20/2010	Viable
IW-3A	978233.94	124462.21	258.67	NA	NA	Injection Well Piezometer	14.39	2/1/2003	11/20/2010	Viable
MI-10	979677.01	124853.99	248.69			Monitoring Well	45.10	4/7/1983	11/20/2010	Viable
MW-116R	978197.50	124855.16	254.32	219.0	10	Monitoring Well	>101	12/11/2003	11/20/2010	Viable
MW-117	978211.40	124546.85	254.17	58.0	10	Monitoring Well	58.55	11/11/2003	11/20/2010	Viable
MW-118A	980364.81	125488.45	246.14	59.2	10	Monitoring Well	NM	10/2003	11/20/2010	Viable
MW-119	975973.58	124626.51	259.71			Monitoring Well	10.00	10/29/2003	11/20/2010	Viable
P-101	977511.49	125206.74	252.36	NA	10	Shallow Piezometer	18.89	11/12/2003	11/20/2010	Viable
P-102	978218.67	124549.53	254.06	NA	NA	Shallow Piezometer	1.09	11/11/2003	11/20/2010	Viable
S-1	978226.13	124555.74	265.07	NA	NA	Staff Gauge	NA	NA	11/20/2010	Viable
SG-1	976951.23	124232.82	-	NA	NA	Stream Gauge	NA	NA	11/20/2010	Viable
SG-2	976913.67	124814.96	263.4	NA	NA	Stream Gauge	NA	NA	11/20/2010	Viable
SG-3	976706.70	126092.51	253.36	NA	NA	Survey Point	NA	NA	11/20/2010	Destroyed in past, survey location
SG-4	977538.84	125192.67	254.95	NA	NA	Stream Gauge	NA	NA	11/20/2010	Viable
SG-5	978295.87	125590.93	259.29	NA	NA	Stream Gauge	NA	NA	11/20/2010	Viable
SG-6	978690.73	126067.84	240.84	NA	NA	Stream Gauge	NA	NA	11/20/2010	Destroyed
Bridge Gauge (USGSP-2)	975054.57	125394.76	267.4	NA	NA	Manual Gauge		NA	11/20/2010	Manual gauging point of Veterans Memorial Bridge
Wells Not Included in EMP Sampling Network										
FH-13	975717.70	126524.20	NA	NA	NA	Unknown	NM	NA	11/16/2009	Unable to locate well
FH-15	976951.60	126886.40	NA	NA	NA	Unknown	NM	NA	11/16/2009	Unable to locate well
IW-1	976205.00	124592.14	NA	NA	NA	Injection Well	NM	2/1/2003	11/16/2009	Sealed wellheads under pressure; unable to gauge
IW-2	976739.27	124409.45	NA	NA	NA	Injection Well	NM	2/1/2003	11/16/2009	Sealed wellheads under pressure; unable to gauge
IW-3	978233.94	124462.21	NA	NA	NA	Injection Well	NM	2/1/2003	11/16/2009	Sealed wellheads under pressure; unable to gauge
MI-88	NA	NA	NA	NA	NA	Former Supply Well	NM	NA	11/16/2009	Sealed wellhead not measured
MW-1A	974929.80	122712.20	NA	NA	NA	Unknown	NM	11/10/1988	11/16/2009	Unable to locate well
MW-1B	974926.70	122718.30	NA	NA	NA	Unknown	NM	11/10/1988	11/16/2009	Unable to locate well
MW-1C	974922.80	122726.70	NA	NA	NA	Unknown	NM	11/9/1988	11/16/2009	Unable to locate well
MW-3	975915.60	123237.10	NA	NA	NA	Monitoring Well	23.33	12/13/1988	11/16/2009	Viable
MW-4A	975307.90	123586.40	NA	NA	NA	Unknown	NM	10/25/1988	11/16/2009	Unable to locate well
MW-4B	975303.50	123583.80	NA	NA	NA	Unknown	NM	10/24/1988	11/16/2009	Unable to locate well
MW-4R	975299.90	123581.50	NA	NA	NA	Unknown	NM	10/19/1988	11/16/2009	Unable to locate well
MW-5A	975414.60	123981.80	NA	NA	NA	Monitoring Well	37.39	10/18/1988	11/16/2009	Protective casing leaning (likely hit by plow)
MW-5B	975408.30	123982.60	NA	NA	NA	Monitoring Well	59.12	10/18/1988	11/16/2009	Viable
MW-6A	975521.40	124481.80	NA	NA	NA	Monitoring Well	9.08	10/26/1988	11/16/2009	Viable
MW-6B	975521.20	124486.80	NA	NA	NA	Monitoring Well	66.29	10/25/1988	11/16/2009	Viable
MW-15A	982006.40	125915.30	NA	NA	NA	Unknown	NM	12/8/1988	11/16/2009	Unable to locate well
MW-15B	982001.40	125914.50	NA	NA	NA	Unknown	NM	12/7/1988	11/16/2009	Unable to locate well
MW-18A	975824.80	124273.40	NA	NA	NA	Monitoring Well	56.57	6/14/1989	11/16/2009	Viable
MW-18B	975824.10	124279.10	NA	NA	NA	Monitoring Well	85.05	6/13/1989	11/16/2009	Viable
MW-116B	978197.50	124855.16	NA	NA	NA	Monitoring Well	NM	12/11/2003	11/16/2009	Unable to locate well
P-16	979972.46	126486.53	NA	NA	NA	Unknown	12.87	NA	11/16/2009	Viable
PZ-A1	977302.27	125083.74	NA	NA	NA	Unknown	17.00	6/21/1995	11/16/2009	Viable
PZ-A4	977354.83	125209.56	NA	NA	NA	Unknown	17.40	6/15/1995	11/16/2009	Viable
PZ-A5	977354.83	125209.56	NA	NA	NA	Monitoring Well	52.02	6/15/1995	11/16/2009	Viable
Destroyed or Inoperable Wells										
FH-19	978898.80	126408.40	NA	NA	NA	Monitoring Well	NM	NA	11/16/2009	Unable to locate well
FH-22	978953.00	126400.00	NA	NA	NA	Monitoring Well	25.01	NA	11/16/2009	May not be able to fit PDB down due to bend in PVC
FH-25	979102.50	126406.50	NA	NA	NA	Monitoring Well	27.39	NA	11/16/2009	Destroyed
MI-11	979580.00	125311.00	NA	NA	NA	Monitoring Well	42.84	4/11/1983	11/16/2009	Destroyed
MW-19C	977236.65	124123.00	NA	NA	NA	Monitoring Well	NM	6/8/1989	11/16/2009	Destroyed
MW-108B	976893.42	125763.85	NA	NA	NA	Monitoring Well	NM	10/31/2003	11/16/2009	Destroyed
SPZ-1	976415.00	128177.00	NA	NA	NA	Unknown	NM	NA	11/16/2009	Unable to locate well

Notes:
1. Monitoring wells shaded in red indicate gauging point was to top of PVC riser; riser elevations generally are 0.5 to 3.0' above ground surface.
NM = Not Measured
NA = Not Available

Table 3.1
Groundwater and Surface Water Elevations - June and November 2010
Savage Well Superfund Site, Milford, NH

Well ID	Measurement Point	Reference Elevation (ft-amsl)	Groundwater Elevation (ft-amsl)	
			14-Jun-10	22-Nov-10
EW-1	TOR	261.35	248.49	258.14
EW-2	TOR	260.13	230.52	229.70
EW-3	TOR	259.30	249.89	250.85
FH-4	TOC	No Data	No Data	No Data
FH-5	TOC	No Data	No Data	No Data
FH-9	TOC	No Data	No Data	No Data
FH-27	TOC	248.80	242.98	243.61
IW-1A	TOR	263.02	259.22	259.53
IW-2A	TOC	263.36	258.25	258.66
IW-3A	TOR	259.38	254.49	253.78
MI-4	TOC	257.59	252.34	253.00
MI-10	TOR	255.12	248.87	249.66
MI-11	TOR	254.52	NM	NM
MI-31	TOC	267.23	261.62	260.18
MW-9C	TOR	No Data	No Data	No Data
MW-10A	TOR	262.38	258.66	259.32
MW-10B	TOR	262.36	258.66	259.32
MW-10C	TOR	262.56	NM	258.92
MW-11A	TOR	262.78	255.82	256.63
MW-11B	TOR	262.83	255.38	256.2
MW-11R	TOR	262.47	254.90	255.89
MW-12A	TOR	265.96	254.32	254.56
MW-12B	TOR	265.61	254.37	254.63
MW-13A	TOR	259.85	255.44	255.94
MW-13B	TOR	259.35	254.76	255.23
MW-14A	TOR	254.65	249.27	249.94
MW-14B	TOR	255.13	249.53	250.14
MW-14R	TOR	255.50	249.34	250.02
MW-17C	TOR	263.36	256.94	257.5
MW-19A	TOR	264.30	257.06	257.26
MW-19B	TOR	263.88	256.88	257.08
MW-19C	TOR	268.09	NM	NM
MW-20A	TOR	263.23	255.47	255.71
MW-20B	TOR	263.03	255.45	255.72
MW-21B	TOR	261.77	252.23	252.89
MW-21C	TOR	261.34	252.23	252.91
MW-22A	TOR	252.52	243.34	243.75
MW-24A	TOR	259.67	250.95	251.32
MW-31R	TOR	249.68	249.68	246.96
MW-32B	TOR	244.41	235.78	236.53
MW-101A	TOR	266.55	257.68	258.68
MW-101B	TOR	266.33	257.75	258.76
MW-101C	TOR	266.56	258.27	259.5
MW-102	TOR	261.88	256.48	257.13
MW-102B	TOR	259.66	256.48	257.14
MW-103	TOR	262.17	252.46	253.81
MW-103A	TOR	259.16	253.25	253.87
MW-104	TOR	258.18	250.78	251.37
MW-104A	TOR	257.52	250.74	251.32
MW-105	TOR	260.09	252.29	252.78
MW-105A	TOR	257.31	252.95	253.41
MW-106	TOR	257.11	254.56	254.81
MW-107A	TOR	264.37	257.66	258.76
MW-107B	TOR	264.20	257.58	258.71
MW-107C	TOR	264.23	257.57	258.72
MW-108A	TOR	258.52	252.90	253.49
MW-108B	TOR	No Data	NM	NM
MW-109A	TOR	255.76	250.20	250.79
MW-109B	TOR	255.44	250.28	250.83

Table 3.1
Groundwater and Surface Water Elevations - June and November 2010
Savage Well Superfund Site, Milford, NH

Well ID	Measurement Point	Reference Elevation (ft-amsl)	Groundwater Elevation (ft-amsl)	
			14-Jun-10	22-Nov-10
MW-110A	TOR	260.74	254.23	255.43
MW-110B	TOR	260.90	254.95	256.16
MW-111A	TOC	259.95	257.22	257.51
MW-111B	TOR	259.93	257.23	257.51
MW-111C	TOR	259.89	257.17	257.47
MW-112A	TOR	265.04	257.14	257.34
MW-113A	TOR	249.83	243.28	243.83
MW-114	TOR	252.84	246.23	246.74
MW-115A	TOR	253.10	NM	244.68
MW-115B	TOC	252.11	NM	244.65
MW-116A	TOR	259.70	253.08	253.44
MW-116R	TOR	258.35	253.58	254.34
MW-117	TOR	256.78	253.96	254.21
MW-118A	TOR	250.39	NM	245.79
MW-118B	TOR	250.40	NM	245.63
MW-119	TOR	265.43	259.61	260.19
MW-120A	TOR	262.97	257.65	258.56
MW-120B	TOR	262.44	NM	258.46
MW-120C	TOR	262.64	257.63	258.43
P-101	TOR	258.91	251.73	252.25
P-102	TOR	256.18	253.86	254.03
PZ-A1	TOR	No Data	No Data	No Data
PZ-A4	TOR	No Data	No Data	No Data
PZ-A5	TOR	261.45	253.54	254.09
PZ-B3	TOR	256.26	247.15	247.51
PZ-B4	TOR	256.21	247.45	248.14
S-1	TOR	267.52	269.99	265.09
SG-1	TOP	256.30	NM	NM
SG-2	TOP	264.37	262.72	262.74
SG-3	TOP	258.37	252.09	252.44
SG-4	TOP	257.98	254.75	254.95
SG-5	TOP	261.83	NM	259.19
SG-6	TOP	246.10	NM	NM
Bridge Gauge	TOP	278.85	266.85	267.10

Notes:

1. TOR = Top of Riser; TOC = Top of Casing; Top = Top of Staff; NM = Not Measured; amsl = above mean sea level.

2. Bridge Gauge = Measuring point on top of eastern side of Veteran's Memorial Bridge.

3. Groundwater elevations at the extraction wells were recorded manually using water level indicators deployed within the extraction wells. Groundwater elevations at the injection wells were recorded manually using water level indicators deployed at piezometers 5 feet away from the injection wells (IW-1A, IW-2A, IW-3A).

4. Continuous monitoring of ground water elevations (data loggers) was conducted at MW-119, and 121. Data from these wells is presented in Figure 3-6.

5. "No Data" was recorded for FH-4, 5, and 9 and MW-9C, and PZ-A1 and A4 due to unavailability of a reference elevation (top of casing).

6. "NM" was recorded for MI-11, 19C, and 108B and SG-6 because these wells were damaged or destroyed and could not be sampled; SG-1 and SG-5 due to the stream being dry.

7. "NM" was also recorded for MW-115A/B which was damaged during the June sampling, but later repaired and MW-10C, MW-118A/B and MW-120B were not located during the June sampling, but found later.

8. SG-3 stream gauge was destroyed several times. Measurement was obtained using survey.

9. Reference point elevations are taken from MACTEC 2004 Baseline Monitoring Report.

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Table 3.2a
Semi-Annual Groundwater Quality Monitoring Results - VOCs
Savage Well Superfund Site, Milford, NH

Well ID	**MCL [1]**	MI-31	MW-10C	MW-11R	MW-11R-DP	MW-14A	MW-14B	MW-14R	MW-17C	MW-20B	MW-101C	MW-103	MW-104
Date	**(µg/L)**	6/28/2010	--	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	1/U	No Sample	5/U	2.5/U	2.5/U	2.5/U	2.5/U	0.5/U	4.4	2/U	1.2/U	2
1,1,2-Trichloroethane	5	1.5/U	Taken	7.5/U	3.8/U	3.8/U	3.8/U	3.8/U	0.75/U	1.9/U	3/U	1.9/U	0.75/U
1,1-Dichloroethane	-	1.5/U		7.5/U	3.8/U	3.8/U	8.8	9.5	0.75/U	16	3/U	1.9/U	0.75/U
1,1-Dichloroethene	7	1/U	Well	5/U	2.5/U	2.6	6.4	5.5	0.5/U	9.8	2/U	1.2/U	0.5/U
2-Butanone (MEK)	-	10/U	Presumed	50/U	25/U	25/U	25/U	25/U	5.1	12/U	20/U	12/U	5/U
Acetone	-	10/U	Destroyed	50/U	25/U	27	27	26	28	31	20/U	30	28
Chlorobenzene	100	1/U		5/U	2.5/U	2.5/U	2.5/U	2.5/U	0.5/U	1.2/U	2/U	1.2/U	0.5/U
cis-1,2-Dichloroethene	70	1/U		22	21	11	9.7	13	0.5/U	22	9.8	39	0.5/U
Dichloromethane (Methylene chloride)	5	6/U		30/U	15/U	15/U	15/U	15/U	3/U	7.5/U	12/U	7.5/U	3/U
Tetrachloroethene	5	60		210	180	160	150	110	0.5/U	73	90	240	19
Trichloroethene	5	1.3		30	32	24	15	27	0.5/U	54	9.3	43	2.7

Well ID	**MCL [1]**	MW-104A	MW-105	MW-107B	MW-107B-DP	MW-107C	MW-109A	MW-109B	MW-110B	MW-111C	MW-116A	MW-120C
Date	**(µg/L)**	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	200	2	3.6	0.5/U	0.5/U	2/U	1.4	3.5	5/U	1/U	1/U	5/U
1,1,2-Trichloroethane	5	0.75/U	1.9/U	0.75/U	0.75/U	3/U	0.75/U	3.8/U	7.5/U	1.5/U	1.5/U	7.5/U
1,1-Dichloroethane	-	0.75/U	2.4	0.75/U	0.75/U	3/U	0.85	3.8/U	7.5/U	1.8	19	7.5/U
1,1-Dichloroethene	7	0.5/U	2.3	0.5/U	0.5/U	2/U	0.5/U	2.5/U	5/U	1.7	14	5/U
2-Butanone (MEK)	-	5/U	12/U	5	5	20/U	6.1	25/U	50/U	10/U	10/U	50/U
Acetone	-	28	26	26	28	31	38	25/U	50/U	30	31	50/U
Chlorobenzene	100	0.5/U	1.2/U	0.5/U	0.5/U	2/U	0.5/U	2.5/U	5/U	1/U	1/U	5/U
cis-1,2-Dichloroethene	70	0.5/U	6.2	1.9	2.3	3.4	3.4	6.4	16	18	5	19
Dichloromethane (Methylene chloride)	5	3/U	7.5/U	3/U	3/U	12/U	3/U	15/U	30/U	6/U	6/U	30/U
Tetrachloroethene	5	19	120	33	36	79	65	190	250	44	60	390
Trichloroethene	5	0.5/U	15	3.8	4	12	5.5	11	15	10	12	43

Notes:
1 - Maximum Contaminant Levels (US EPA,2009)
J = Compound detected below method quantitation limit, estimated value provided.
U = Compound not detected above method quantitation limit, quantitation limit provided.
B = Compound also detected in method blank.
DP = Duplicate Sample

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Table 3.2b
Annual Groundwater Quality Monitoring Results - VOCs
Savage Well Superfund Site, Milford, NH

Well ID	**MCL [1]**	FH-4	FH-5	FH-27	FH-30	PZ-B3	PZ-B4	MI-4	MI-10	MI-31	MW-9C	MW-10A	MW-10B
Date	**(µg/L)**	12/9/2010	12/9/2010	12/6/2010		12/9/2010	12/9/2010	12/6/2010	12/9/2010	12/6/2010	12/9/2010	12/9/2010	12/9/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	0.5/U	0.5/U	0.5/U	No Sample	0.5/U	0.5/U	0.5/U	0.5/U	0.84	0.5/U	3.9	0.5/U
1,1,2-Trichloroethane	5	0.75/U	0.75/U	0.75/U	Taken	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U
1,1-Dichloroethane	-	0.75/U	0.75/U	0.75/U		0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U
1,1-Dichloroethene	7	0.5/U	0.5/U	0.5/U		0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U
2-Butanone (MEK)	-	5/U	5/U	5/U	Could Not	5/U	5/U	5/U	5/U	5/U	5/U	5/U	5/U
Acetone	-	5/U	5/U	5/U	Locate	9.6	7.2	5/U	10	5/U	24	30	23
Chlorobenzene	100	0.5/U	0.5/U	0.5/U		0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U
cis-1,2-Dichloroethene	70	0.5/U	0.5/U	1.1		0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U
Dichloromethane (Methylene chloride)	5	3/U	3/U	3/U		3/U	3/U	3/U	3/U	3/U	3/U	3/U	3/U
Tetrachloroethene	5	0.5/U	0.5/U	9.4		0.97	0.5/U	0.5/U	0.5/U	120	3.1	1.6	2.5
Trichloroethene	5	0.5/U	0.5/U	2.9		0.5/U	0.5/U	0.5/U	0.5/U	2.2	0.5/U	0.5/U	0.5/U

Well ID	**MCL [1]**	MW-10B-R	MW-10C	MW-11B	MW-11R	MW-11R-DP	MW-11R(94')	MW-11R(98')	MW-11R(102')	MW-12A	MW-12B	MW-13A	MW-13B
Date	**(µg/L)**	12/9/2010	12/9/2010	12/9/2010	12/8/2010	12/8/2010	12/9/2010	12/9/2010	12/9/2010	12/9/2010	12/9/2010	12/9/2010	12/9/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	0.5/U	2.3	0.5/U	5/U	5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	3.4	2.8
1,1,2-Trichloroethane	5	0.75/U	0.75/U	0.75/U	7.5/U	7.5/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U
1,1-Dichloroethane	-	0.75/U	0.75/U	0.75/U	7.5/U	7.5/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U
1,1-Dichloroethene	7	0.5/U	0.5/U	0.5/U	5/U	5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U
2-Butanone (MEK)	-	5/U	5/U	5/U	50/U	50/U	5/U	5/U	5/U	5/U	5/U	5/U	5/U
Acetone	-	21	30	23	50/U	50/U	31	14	24	8.2	8.4	11	15
Chlorobenzene	100	0.5/U	0.5/U	0.5/U	5/U	5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U
cis-1,2-Dichloroethene	70	0.5/U	0.5/U	0.5/U	28	30	28	28	27	0.5/U	0.5/U	0.5/U	1.9
Dichloromethane (Methylene chloride)	5	3/U	3/U	3/U	30/U	30/U	3/U	3/U	3/U	3/U	3/U	3/U	3/U
Tetrachloroethene	5	2.6	10	0.5/U	310	310	91	90	100	0.5/U	0.5/U	3.5	28
Trichloroethene	5	0.5/U	0.5/U	0.5/U	38	40	34	39	38	0.5/U	0.5/U	2.1	3.8

Well ID	**MCL [1]**	MW-14A	MW-14B	MW-14R(72')	MW-14R(86.5')	MW-17C	MW-19A	MW-19B	MW-20A	MW-20B	MW-21B	MW-21C	MW-22A
Date	**(µg/L)**	12/9/2010	12/8/2010	12/8/2010	12/8/2010	12/9/2010	12/9/2010	12/8/2010	12/9/2010	12/7/2010	12/9/2010	12/9/2010	12/9/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	0.5/U	2.5/U	2/U	2/U	0.5/U	0.5/U	0.5/U	0.5/U	5.3	0.5/U	0.5/U	0.5/U
1,1,2-Trichloroethane	5	0.75/U	3.8/U	3/U	3/U	0.75/U	0.75/U	0.75/U	0.75/U	1.9/U	0.75/U	0.75/U	0.75/U
1,1-Dichloroethane	-	4.3	9.8	8.4	8.1	0.75/U	0.75/U	7.4	0.75/U	7.8	0.75/U	0.75/U	0.75/U
1,1-Dichloroethene	7	3.4	5.5	3.3	2.7	0.5/U	0.5/U	2.4	0.5/U	4.4	0.5/U	0.5/U	0.5/U
2-Butanone (MEK)	-	5/U	25/U	20/U	20/U	5/U	5/U	5/U	5/U	12/U	5/U	5/U	5/U
Acetone	-	9.5	25/U	20/U	20/U	39	11	5/U	11	12/U	10	8.7	11
Chlorobenzene	100	0.5/U	2.5/U	2/U	2/U	0.5/U	0.5/U	0.5/U	0.5/U	1.2/U	0.5/U	0.5/U	0.5/U
cis-1,2-Dichloroethene	70	16	8.7	9.8	9.2	0.5/U	0.5/U	1.8	0.5/U	6.8	0.5/U	0.5/U	0.5/U
Dichloromethane (Methylene chloride)	5	3/U	15/U	12/U	12/U	3/U	3/U	3/U	3/U	7.5/U	3/U	3/U	3/U
Tetrachloroethene	5	200	220	110	100	0.5/U	0.5/U	25	0.5/U	180	0.5/U	0.5/U	0.5/U
Trichloroethene	5	31	14	21	19	0.5/U	0.5/U	4.6	0.5/U	12	0.5/U	0.5/U	0.5/U

Table 3.2b
Annual Groundwater Quality Monitoring Results - VOCs
Savage Well Superfund Site, Milford, NH

Well ID	**MCL [1]**	MW-24A	MW-24B	MW-31R	MW-32B	MW-34	MW-101A	MW-101B	MW-101C	MW-102	MW-102B	MW-103	MW-103A
Date	**(µg/L)**	12/7/2010	12/7/2010	12/9/2010	12/6/2010	12/6/2010	12/9/2010	12/9/2010	12/8/2010	12/9/2010	12/7/2010	12/9/2010	12/9/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	2/U	0.5/U	2.1	2.1	1.3
1,1,2-Trichloroethane	5	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	3/U	0.75/U	0.75/U	0.75/U	0.75/U
1,1-Dichloroethane	-	0.75/U	0.75/U	0.9	0.75/U	0.75/U	0.75/U	0.75/U	3/U	0.75/U	0.75/U	0.79	0.75/U
1,1-Dichloroethene	7	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	2/U	0.5/U	0.5/U	1.2	0.5/U
2-Butanone (MEK)	-	5/U	5/U	5/U	5/U	5/U	5/U	5/U	20/U	5/U	5/U	5/U	5/U
Acetone	-	5/U	5/U	12	5/U	5/U	47	34	20/U	33	5/U	14	8
Chlorobenzene	100	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	2/U	0.5/U	0.5/U	0.5/U	0.5/U
cis-1,2-Dichloroethene	70	1.6	1.1	1.8	0.5/U	0.5/U	0.5/U	0.5/U	5.9	0.5/U	0.5/U	42	0.5/U
Dichloromethane (Methylene chloride)	5	3/U	3/U	3/U	3/U	3/U	3/U	3/U	12/U	3/U	3/U	3/U	3/U
Tetrachloroethene	5	16	8.5	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	100	2.8	3.1	280	1.4
Trichloroethene	5	3.3	2.5	2	0.5/U	0.5/U	0.5/U	0.5/U	7	0.5/U	0.5/U	60	0.5/U

Well ID	**MCL [1]**	MW-104	MW-104A	MW-105	MW-105A	MW-106	MW-107A	MW-107B	MW-107C	MW-108A	MW-109A	MW-109B	MW-110A
Date	**(µg/L)**	12/9/2010	12/9/2010	12/7/2010	12/7/2010	12/7/2010	12/9/2010	12/8/2010	12/8/2010	12/9/2010	12/7/2010	12/7/2010	12/7/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	1.6	1.4	1.2/U	0.91	2.7	0.5/U	0.5/U	5/U	0.5/U	1.6	5.6	1.6
1,1,2-Trichloroethane	5	0.75/U	0.75/U	1.9/U	0.75/U	0.75/U	0.75/U	0.75/U	7.5/U	0.75/U	0.75/U	3.8/U	0.75/U
1,1-Dichloroethane	-	0.75/U	0.75/U	5.2	0.75/U	5.7	0.75/U	0.75/U	7.5/U	0.75/U	0.85	3.8/U	0.75/U
1,1-Dichloroethene	7	0.5/U	0.5/U	3.4	0.5/U	3.3	0.5/U	0.5/U	5/U	0.5/U	0.5/U	2.5/U	0.5/U
2-Butanone (MEK)	-	5/U	5/U	12/U	5/U	5/U	5/U	5/U	50/U	5/U	5/U	25/U	5/U
Acetone	-	10	11	12/U	5/U	5/U	25	5/U	50/U	20	5/U	25/U	5/U
Chlorobenzene	100	0.5/U	0.5/U	1.2/U	0.5/U	0.5/U	0.5/U	0.5/U	5/U	0.5/U	0.5/U	2.5/U	0.5/U
cis-1,2-Dichloroethene	70	0.5/U	0.5/U	10	0.5/U	4.9	1.9	2.9	8.2	0.5/U	2.2	6.2	0.5/U
Dichloromethane (Methylene chloride)	5	3/U	3/U	7.5/U	3/U	3/U	3/U	3/U	30/U	3/U	3/U	15/U	3/U
Tetrachloroethene	5	19	22	300	7	74	26	51	260	0.93	42	180	4
Trichloroethene	5	0.65	0.57	21	0.5/U	7.1	1.6	3	12	0.5/U	3.3	9.6	0.5/U

Well ID	**MCL [1]**	MW-110B	MW-111A	MW-111B	MW-111B-DP	MW-111C	MW-112A	MW-113A	MW-114	MW-115A	MW-115B	MW-116A	MW-118B
Date	**(µg/L)**	12/8/2010	12/9/2010	12/6/2010	12/6/2010	12/7/2010	12/9/2010	12/9/2010	12/6/2010	12/6/2010	12/6/2010	12/6/2010	12/6/2010
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	200	0.5/U	1.4	1.5	1.4	3.9	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	1/U	0.5/U
1,1,2-Trichloroethane	5	0.75/U	0.75/U	0.75/U	0.75/U	1.5/U	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	1.5/U	0.75/U
1,1-Dichloroethane	-	0.75/U	0.75/U	0.75/U	0.75/U	3.9	0.75/U	0.75/U	0.75/U	0.75/U	0.75/U	12	0.75/U
1,1-Dichloroethene	7	0.5/U	0.5/U	0.5/U	0.5/U	2.5	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	6.8	0.5/U
2-Butanone (MEK)	-	5/U	5/U	5/U	5/U	10/U	5/U	5/U	5/U	5/U	5/U	10/U	5/U
Acetone	-	5/U	26	5/U	5/U	10/U	42	14	5/U	5/U	5/U	10/U	5/U
Chlorobenzene	100	0.5/U	0.5/U	0.5/U	0.5/U	1/U	0.5/U	0.5/U	0.5/U	0.5/U	0.5/U	1/U	0.5/U
cis-1,2-Dichloroethene	70	5.2	0.5/U	0.5/U	0.5/U	8.7	0.5/U	1.8	0.5/U	0.5/U	0.7	2.3	1.5
Dichloromethane (Methylene chloride)	5	3/U	3/U	3/U	3/U	6/U	3/U	3/U	3/U	3/U	3/U	6/U	3/U
Tetrachloroethene	5	89	2.1	39	39	190	0.5/U	5.8	2.2	0.98	4	86	4.3
Trichloroethene	5	5	0.5/U	1.4	1.5	24	0.5/U	4	2.9	0.5/U	1.9	5	2

Table 3.2b
Annual Groundwater Quality Monitoring Results - VOCs
Savage Well Superfund Site, Milford, NH

Well ID	**MCL [1]**	MW-120A	MW-120B	MW-120C
Date	**(µg/L)**	12/9/2010	12/9/2010	12/9/2010
Volatile Organic Compounds (µg/L)				
1,1,1-Trichloroethane	200	2.2	0.5/U	5/U
1,1,2-Trichloroethane	5	0.75/U	0.75/U	7.5/U
1,1-Dichloroethane	-	0.75/U	0.75/U	7.5/U
1,1-Dichloroethene	7	0.5/U	0.5/U	5/U
2-Butanone (MEK)	-	5/U	5/U	50/U
Acetone	-	22	24	50/U
Chlorobenzene	100	0.5/U	0.5/U	5/U
cis-1,2-Dichloroethene	70	0.5/U	0.5/U	28
Dichloromethane (Methylene chloride)	5	3/U	3/U	30/U
Tetrachloroethene	5	5.8	3.2	410
Trichloroethene	5	0.5/U	0.5/U	44

Notes:
1 - Maximum Contaminant Levels (US EPA,2009)
J = Compound detected below method quantitation limit, estimated value provided.
U = Compound not detected above method quantitation limit, quantitation limit provided.
B = Compound also detected in method blank.
DP = Duplicate Sample

Table 3.3
Groundwater PCE Concentration Residuals (December 2010)
Savage Well Superfund Site, Milford, NH

Model Layer	Well ID	Measured [1] (µg/L)	Modeled [2] (µg/L)	Residual (µg/L) (Modeled - Measured)
Layer 1	MW-104A	22	170	148
	MW-109A	42	81	39
	MW-115A	0.98	7.1	6.1
	PZ-B3	0.97	42	41
Layer 2	FH-4	0.0	2	1.9
	FH-27	9.4	23	14
	MW-101A	0.0	26	26
	MW-103A	1.4	74	72
	MW-104	19	262	243
	MW-105A	7.0	16	9.1
	MW-10A	1.6	17	16
	MW-112A	0.0	23	23
	MW-113A	5.8	171	165
	MW-118A	-	2.0	-
	MW-11A	-	97	-
	MW-12A	0.0	0.4	0.39
	MW-13A	3.5	11	7.2
	MW-14A	200	42	-158
	MW-19A	0.0	0.29	0.29
	MW-20A	0.0	3.7	3.7
	MW-21B	0.0	0.16	0.16
	MW-22A	0.0	5	5.0
	MW-24A	16	218	202
	MW-32B	0.0	1.2	1.2
Layer 3	FH-9	-	5.9	-
	MI-10	0.0	0.45	0.45
	MI-11	-	11	-
	MI-31	120	13	-107
	MI-4	0.0	7.3	7.3
	MW-101B	0.0	57	57
	MW-102B	3.1	58	55
	MW-103	280	131	-149
	MW-105	300	28	-272
	MW-106	74	6.7	-67
	MW-107A	26	109	83
	MW-108A	0.93	211	210
	MW-109B	180	115	-65
	MW-10B	2.5	29	26
	MW-110A	4.0	171	167
	MW-111A	2.1	4.0	1.9
	MW-114	2.2	54	52
	MW-115B	4.0	13	8.6
	MW-116A	86	8.9	-77
	MW-118B	4.3	3.6	-0.72
	MW-11B	0.0	218	218
	MW-12B	0.0	1.3	1.3
	MW-13B	28	22	-6
	MW-14B	220	78	-142
	MW-20B	180	11	-169
	MW-21C	0.0	0.23	0.23
	PZ-B4	0.0	83	83

Table 3.3
Groundwater PCE Concentration Residuals (December 2010)
Savage Well Superfund Site, Milford, NH

Model Layer	Well ID	Measured [1] (µg/L)	Modeled [2] (µg/L)	Residual (µg/L) (Modeled - Measured)
Layer 4	MW-102	2.8	89	86
	MW-107B	51	162	111
	MW-110B	89	245	156
	MW-111B	39	4.7	-34
	MW-117	-	0.72	-
	MW-120A	5.8	64	58
Layer 5	MW-101C	100	237	137
	MW-107C	260	381	121
	MW-10C	10	110	100
	MW-111C	190	14	-176
	MW-120C	410	117	-293
	MW-17C	0.0	31	31
	MW-9C	3.1	19	16
			Mean Error (µg/L):	**19**
			Minimum (µg/L):	**-293.5**
			Maximum (µg/L):	**243**
			Median (µg/L):	**9.1**
			Standard Deviation (µg/L):	**109**
			RMSE (µg/L):	**110**

Notes:
[1] - Measured values taken from December 2010 sampling event.
[2] - Model-predicted values obtained using updated numerical three-dimensional groundwater flow and solute transport model, initially developed by EPA/USGS and updated in the 2002 RDIR (US EPA, 2002).
Non-detects were taken as 0 µg/L.
"-" indicates that no sampling was done.
U - Not detected.
RMSE - Root Mean Square Error

Table 3.4
Groundwater Quality Monitoring Results - Iron and Manganese
Savage Well Superfund Site, Milford, NH

Well ID	MW-11R	MW-111B	MW-111B-DP
Date	6/28/2010	12/6/2010	12/6/2010
Inorganics (µg/L)			
Iron, Dissolved	2.9	0.05/U	0.05/U
Iron, Total Recoverable	15.0	0.05/U	0.05/U
Manganese, Dissolved	0.4	0.033	0.036
Manganese, Total Recoverable	0.5	0.035	0.033

Notes:
U = Compound not detected above method quantitation limit, quantitation limit provided.
DP = Duplicate Sample

Table 3.5
Groundwater Quality Monitoring Results - 1,4 Dioxane
Savage Well Superfund Site, Milford, NH

Sample Location	Sampling Date	1,4-dioxane (ug/L)
Monitoring Well Results		
FH-27	12/6/2010	0.5 U
MW-14B	--	NA
MW-14B	12/1/2009	**6.87**
MW-14B	12/8/2010	**5.57**
MW-14R	--	NA
MW-14R	11/30/2009	**8.73**
MW-14R	12/8/2010	**5.69**
MW-17C	12/1/2003	**10 U**
MW-17C	--	NA
MW-19B	--	NA
MW-19B	11/30/2009	**3.47**
MW-19B	12/8/2010	**4.52**
MW-20B	--	NA
MW-20B	12/1/2009	**4.96**
MW-20B	12/7/2010	**3.18**
MW-24A	--	NA
MW-24A	12/2/2009	0.50 U
MW-24A	12/7/2010	0.5 U
MW-34	12/6/2010	0.5 U
MW-102	12/1/2003	**10 U**
MW-102	--	NA
MW-102B	--	NA
MW-102B	12/1/2009	0.50 U
MW-102B	12/7/2010	0.5 U
MW-105	--	NA
MW-105	11/30/2009	2.6
MW-105	12/7/2010	**3.31**
MW-105A	--	NA
MW-105A	11/30/2009	0.50 U
MW-105A	12/7/2010	0.5 U
MW-106	12/1/2003	**10 U**
MW-106	12/1/2009	0.524
MW-106	12/7/2010	1.94
MW-107B	--	NA
MW-107B	12/2/2009	0.50 U
MW-107B	12/8/2010	0.5 U
MW-107C	12/10/2003	**10 U**
MW-107C	12/2/2009	0.505 U
MW-107C	12/8/2010	0.5 U
MW-109A	--	NA
MW-109A	12/1/2009	0.51 U
MW-109A	12/7/2010	0.5 U
MW-109B	--	NA
MW-109B	12/1/2009	0.867
MW-109B	12/7/2010	0.739
MW-111A	12/8/2003	**10 U**
MW-111A	--	NA
MW-111B	12/8/2003	**10 U**
MW-111B	12/2/2009	0.50 U
MW-111B	12/6/2010	0.5 U

Table 3.5
Groundwater Quality Monitoring Results - 1,4 Dioxane
Savage Well Superfund Site, Milford, NH

Sample Location	Sampling Date	1,4-dioxane (ug/L)
MW-111C	12/8/2003	**6 J**
MW-111C	12/2/2009	2.5
MW-111C	12/7/2010	1.47
MW-114	12/9/2003	**9 J**
MW-114	11/30/2009	0.676
MW-114	12/6/2010	0.769
MW-115A	12/6/2010	0.5 U
MW-115B	12/6/2010	0.669
MW-116A	--	NA
MW-116A	12/2/2009	**7.54**
MW-116A	12/6/2010	**5.85**

Notes:
Bolded results indicate that the result is above the 1,4-dioxane AGQS of 3 ug/L

J -Estimated value. Result is reported between the laboratory reporting limit and method detection limit.
NA - Not analyzed. Well location not sampled during collection event.
U -Not detected at the indicated reporting limit. The reporting limit was 10 ug/L in 2003, and in 2009, the reporting limit was reduced to 0.50 ug/L.

Table 3.6a
MNA Wells - North Side of the Souhegan River
Savage Well Superfund Site, Milford, NH

Well ID	MCL [1]	FH-27										
Date	(µg/L)	12/21/2005	4/11/2006	7/25/2006	11/7/2006	4/25/2007	8/14/2007	1/29/2008	9/2/2008	12/9/2008	11/30/2009	12/6/2010
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	200	2	1.2 (J)	1.1 (J)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethane	-	3.8	2.4	2	2	1.8 (J)	1.5 (J)	1.87 (J)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethene	7	2	1.2 (J)	2 (U)	2 (U)	1 (J)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	2 (U)	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	2 (U)	5 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	8	3.3	5.3	2.4	1.9 (J)	4.3	1.67 (J)	2.51	1.11 (J)	1.4	1.1
Dichloromethane (Methylene Chloride)	5	2 (U)	2 (U)	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	2 (U)	2 (U)	3 (U)	3 (U)
Tetrachloroethene	5	51	31	19	30	24	14	34.7	13.4	12	9.1	9.4
Trichloroethene	5	15	7.6	10	8.4	6.4	8.9	8	3.28	3.43	2.3	2.9

Well ID	MCL [1]	FH-4						
Date	(µg/L)	12/22/2005	4/13/2006	7/27/2006	11/7/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	2 (U)	5 (U)	5 (U)	2 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	MCL [1]	FH-5		
Date	(µg/L)	7/27/2006	8/16/2007	12/9/2010
Volatile Organic Compounds (µg/L)				
1,1,1-Trichloroethane	200	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	5 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (J)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	0.5 (U)

Well ID	MCL [1]	MW-24A										
Date	(µg/L)	12/20/2005	4/12/2006	7/26/2006	11/7/2006	4/25/2007	8/15/2007	1/30/2008	9/2/2008	12/9/2008	12/2/2009	12/7/2010
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	5 (U)	2 (U)	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	2 (U)	5 (U)	2 (U)	5 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	6	1 (J)	1 (J)	4	2 (U)	3	4.62	3.24	2.76	1.9	1.6
Dichloromethane (Methylene Chloride)	5	2 (U)	2 (U)	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	2 (U)	2 (U)	3 (U)	3 (U)
Tetrachloroethene	5	61	20	14	44	3	20	59.5	30	31.8	18	16
Trichloroethene	5	7.5	2	1 (J)	6.2	2 (U)	3.6	6.99	5.02	4.59	3.7	3.3

Table 3.6a
MNA Wells - North Side of the Souhegan River
Savage Well Superfund Site, Milford, NH

Well ID	MCL [1]	MW-24B
Date	(µg/L)	12/7/2010
Volatile Organic Compounds (µg/L)		
1,1,1-Trichloroethane	200	0.5 (U)
1,1,2-Trichloroethane	5	0.75 (U)
1,1-Dichloroethane	-	0.75 (U)
1,1-Dichloroethene	7	0.5 (U)
2-Butanone (MEK)	-	5 (U)
Acetone	-	5 (U)
Chlorobenzene	100	0.5 (U)
cis-1,2-Dichloroethene	70	1.1
Dichloromethane (Methylene Chloride)	5	3 (U)
Tetrachloroethene	5	8.5
Trichloroethene	5	2.5

Well ID	MCL [1]	MW-31R						
Date	(µg/L)	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	1.5 (J)	1.6 (J)	2 (U)	1.2 (J)	1.3 (J)	1.4 (J)	0.9
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	20	31	29	13 (B)	21.3	12
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	3	2	1.6 (J)	3.1	1.1 (J)	2.8	1.8
Dichloromethane (Methylene Chloride)	5	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	1.7 (J)	2 (U)	0.5 (U)
Trichloroethene	5	4.8	4.4	4	3	4.2	2.45	2

Well ID	MCL [1]	MW-34
Date	(µg/L)	12/6/2010
Volatile Organic Compounds (µg/L)		
1,1,1-Trichloroethane	200	0.5 (U)
1,1,2-Trichloroethane	5	0.75 (U)
1,1-Dichloroethane	-	0.75 (U)
1,1-Dichloroethene	7	0.5 (U)
2-Butanone (MEK)	-	5 (U)
Acetone	-	5 (U)
Chlorobenzene	100	0.5 (U)
cis-1,2-Dichloroethene	70	0.5 (U)
Dichloromethane (Methylene Chloride)	5	3 (U)
Tetrachloroethene	5	0.5 (U)
Trichloroethene	5	0.5 (U)

Well ID	MCL [1]	MW-112A							
Date	(µg/L)	9/9/2005	1/9/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)									
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	3.68 (J)	5 (U)
Acetone	-	5 (U)	5 (U)	23	30	29	33 (B)	18.7	42
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Table 3.6a
MNA Wells - North Side of the Souhegan River
Savage Well Superfund Site, Milford, NH

Well ID	MCL [1]	MW-113A						
Date	**(µg/L)**	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	8.6	2 (U)	2 (U)	14.2	5 (U)
Acetone	-	5 (U)	19	40	29	16 (B)	16.6	14
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (J)	2 (U)	1.53 (J)	1.8
Dichloromethane (Methylene Chloride)	5	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	1.3 (J)	1.1 (J)	3.3	2 (U)	2 (U)	5.8
Trichloroethene	5	1.2 (J)	1.4 (J)	2	4.2	1.1 (J)	2.62	4

Well ID	MCL [1]	MW-114										
Date	**(µg/L)**	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	8/16/2007	2/4/2008	9/4/2008	12/11/2008	11/30/2009	12/6/2010
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethane	-	2.2	1.1 (J)	2 (U)	2.3	2 (U)	1.4 (J)	1.16 (J)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	6.25	10.2	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	22	29	29	14 (B)	28	24.4	69.9	24	5 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	1 (J)	2 (U)	2 (U)	1.2 (J)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	2 (U)	2 (U)	3 (U)	3 (U)
Tetrachloroethene	5	11	5.8	5.3	17	5.9	8	6.56	3.45	2.44	2.5	2.2
Trichloroethene	5	5.7	3.8	4.2	7.8	3.8	6	4.09	3.47	2.83	2.5	2.9

Notes:
1 - Maximum Contaminant Levels (US EPA,2009)
J = Compound detected below method quantitation limit, estimated value provided.
U = Compound not detected above method quantitation limit, quantitation limit provided.
B = Compound also detected in method blank.
Well FH-30 is currently not found, therefore no data reported.

Table 3.6b
MNA Wells - Eastern Extent/Plume Boundary
Savage Well Superfund Site, Milford, NH

Well ID	MCL [1]	MW-22A						
Date	(µg/L)	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	7	2 (U)	2 (U)	2 (U)	5 (U)
Acetone	-	5 (U)	14	55	34	14 (B)	15.4	11
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (J)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	MCL [1]	MW-32B						
Date	(µg/L)	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/6/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)
Acetone	-	5 (U)	15	46	32	15 (B)	6.31	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	MCL [1]	MW-115A								
Date	(µg/L)	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	8/16/2007	2/4/2008	9/4/2008	12/6/2010
Volatile Organic Compounds (µg/L)										
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	2 (U)	13.6	5 (U)
Acetone	-	5 (U)	18	49	34	16 (B)	36	16.7	72.4	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	7.5	5 (U)	2 (U)	3 (U)
Tetrachloroethene	5	3.7	2.7	2.3	2.4	1.9 (J)	2.1	1.38 (J)	2 (U)	0.98
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	MCL [1]	MW-115B									
Date	(µg/L)	12/21/2005	4/11/2006	7/25/2006	11/7/2006	4/25/2007	8/14/2007	1/29/2008	9/2/2008	12/9/2008	12/6/2010
Volatile Organic Compounds (µg/L)											
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	1.1 (J)	1 (J)	1 (J)	2 (U)	1.2 (J)	1.2 (J)	1.19 (J)	1.02 (J)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	2 (U)	2 (U)	5 (U)
Acetone	-	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	2.5 (J)	5 (U)	5 (U)	2 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.7
Dichloromethane (Methylene Chloride)	5	2 (U)	2 (U)	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	2 (U)	2 (U)	3 (U)
Tetrachloroethene	5	13	9.3	10	12	9.6	11	12.3	9.82	8.72	4
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	1.9

Notes:
1 - Maximum Contaminant Levels (US EPA,2009)
J = Compound detected below method quantitation limit, estimated value provided.
U = Compound not detected above method quantitation limit, quantitation limit provided.
B = Compound also detected in method blank.

Table 3.6c
MNA Wells - Southern Plume Boundary
Savage Well Superfund Site, Milford, NH

Well ID	**MCL [1]**	**MI-10**						
Date	**(µg/L)**	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	16	2 (U)	2 (U)	5 (U)
Acetone	-	5 (U)	14	47	33	22 (B)	14.5	10
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	1.5 (J)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	**MCL [1]**	MW-12A						
Date	**(µg/L)**	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)
Acetone	-	5 (U)	17	35	40	16 (B)	16.8	8.2
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	1.3 (J)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	**MCL [1]**	**MW-12B**								
Date	**(µg/L)**	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	8/16/2007	2/4/2008	9/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)										
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	2 (U)	14.7	5 (U)
Acetone	-	5 (U)	15	37	46	17 (B)	32	16.9	73	8.4
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	3.2 (J)	5 (U)	2 (U)	3 (U)
Tetrachloroethene	5	1.3 (J)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Table 3.6c
MNA Wells - Southern Plume Boundary
Savage Well Superfund Site, Milford, NH

Well ID	MCL [1]	MW-19A							
Date	(µg/L)	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	8/16/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)									
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	2 (U)	5 (U)
Acetone	-	5 (U)	22	34	29	14 (B)	14	16.2	11
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	1.8 (J)	1.2 (J)	2 (U)	2 (U)	1.2 (J)	1 (J)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Well ID	MCL [1]	MW-19B										
Date	(µg/L)	12/22/2005	4/11/2006	7/25/2006	11/7/2006	4/26/2007	8/15/2007	1/31/2008	9/3/2008	12/10/2008	11/30/2009	12/8/2010
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)	0.75 (U)
1,1-Dichloroethane	-	14	8.9	13	8.1	3	13	10.5	11.7	8.97	5.1	7.4
1,1-Dichloroethene	7	5.3	3.7	5	3.2	1 (J)	6.5	4.03	4.55	3.57	1.7	2.4
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	5 (U)	5 (U)	2 (U)	5 (U)	5 (U)
Acetone	-	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	3.9 (J)	5 (U)	5 (U)	2 (U)	5 (U)	5 (U)
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2.2	1.2 (J)	1 (J)	1.2 (J)	2 (U)	2	2.22	11.2	15.4	3.6	1.8
Dichloromethane (Methylene Chloride)	5	2 (U)	2 (U)	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	2 (U)	3 (U)	3 (U)
Tetrachloroethene	5	51	32	39	29	13	44	44.7	39.6	24.8	15	25
Trichloroethene	5	4.9	3.1	3	2.9	1 (J)	4.4	5.92	5.29	3.03	3.6	4.6

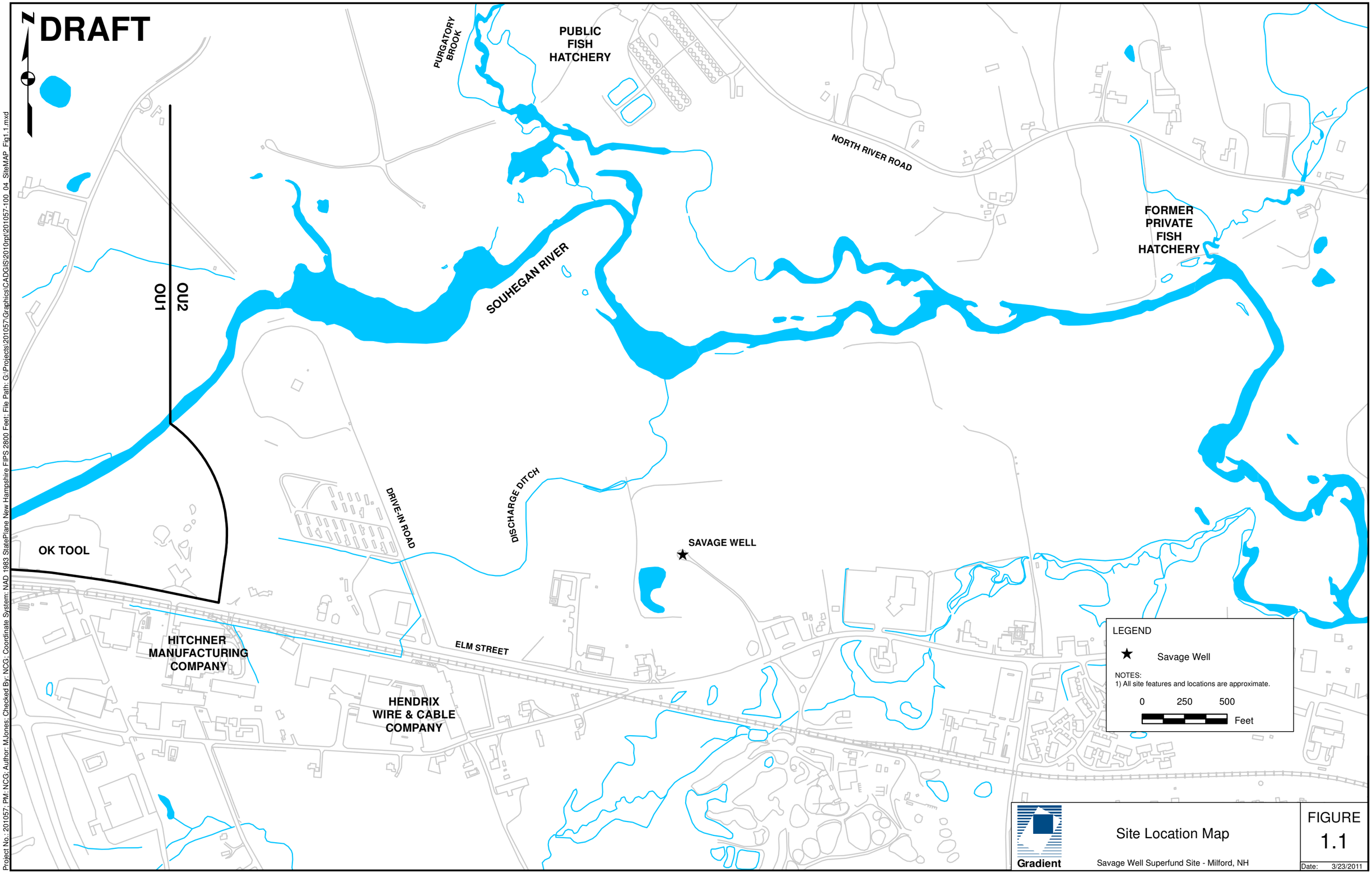
Well ID	MCL [1]	MW-21B						
Date	(µg/L)	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	10	5 (U)
Acetone	-	5 (U)	15	38	46	17 (B)	21.5	10
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Table 3.6c
MNA Wells - Southern Plume Boundary
Savage Well Superfund Site, Milford, NH

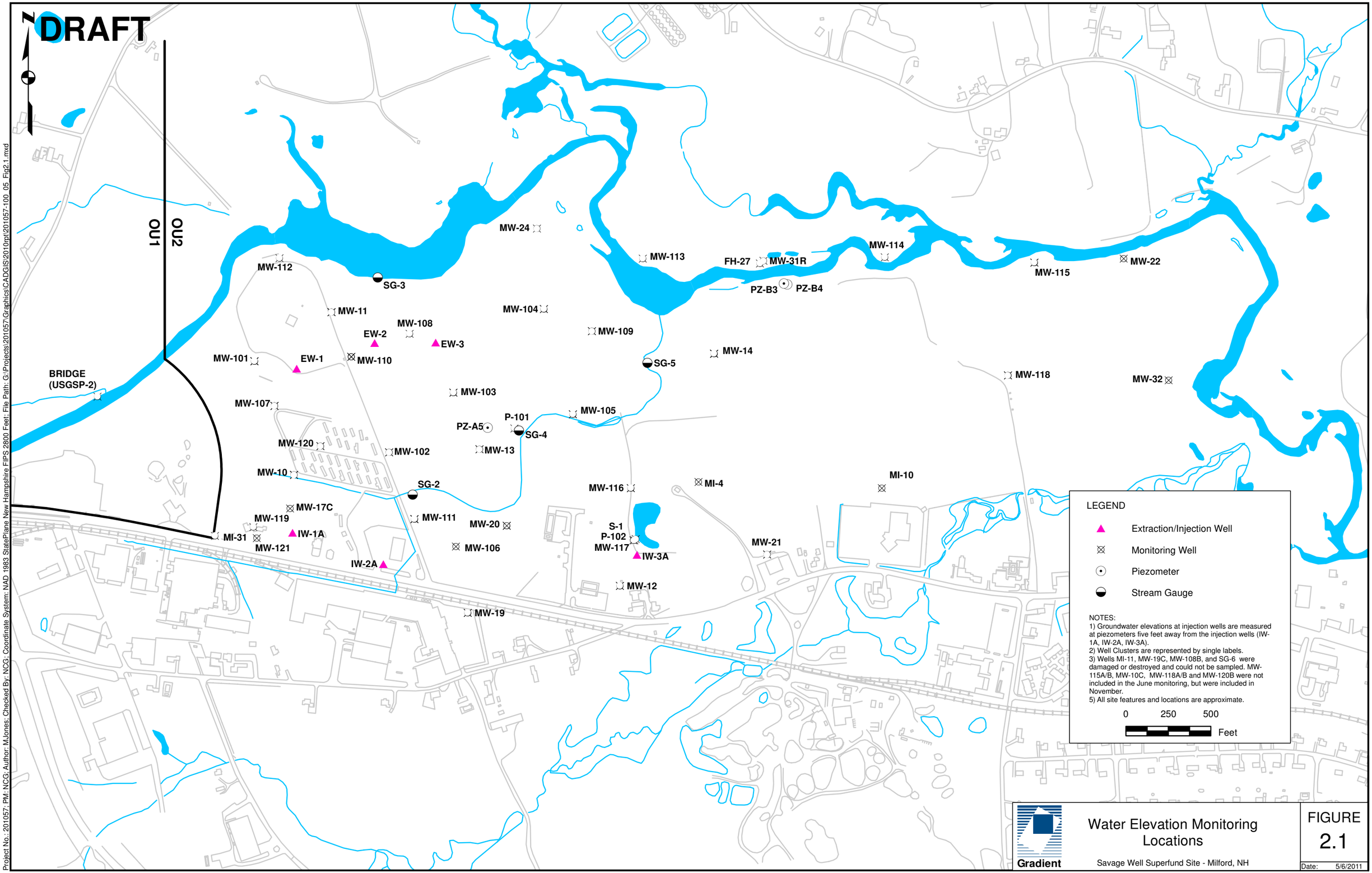
Well ID	**MCL [1]**	**MW-21C**						
Date	**(µg/L)**	1/10/2006	4/13/2006	7/27/2006	11/9/2006	4/27/2007	2/4/2008	12/9/2010
Volatile Organic Compounds (µg/L)								
1,1,1-Trichloroethane	200	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
1,1,2-Trichloroethane	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethane	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.75 (U)
1,1-Dichloroethene	7	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
2-Butanone (MEK)	-	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	1.79 (J)	5 (U)
Acetone	-	5 (U)	14	36	37	23 (B)	20.8	8.7
Chlorobenzene	100	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
cis-1,2-Dichloroethene	70	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)
Dichloromethane (Methylene Chloride)	5	5 (U)	2 (U)	5 (U)	5 (U)	5 (U)	5 (U)	3 (U)
Tetrachloroethene	5	3.8	2	2.5	2 (U)	1.4 (J)	1.2 (J)	0.5 (U)
Trichloroethene	5	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	2 (U)	0.5 (U)

Notes:
1 - Maximum Contaminant Levels (US EPA,2009)
J = Compound detected below method quantitation limit, estimated value provided.
U = Compound not detected above method quantitation limit, quantitation limit provided.
B = Compound also detected in method blank.

Figures



Project No.: 201057; PM: NCG; Author: MJones; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057-100_04_SiteMAP_Fig1.1.mxd



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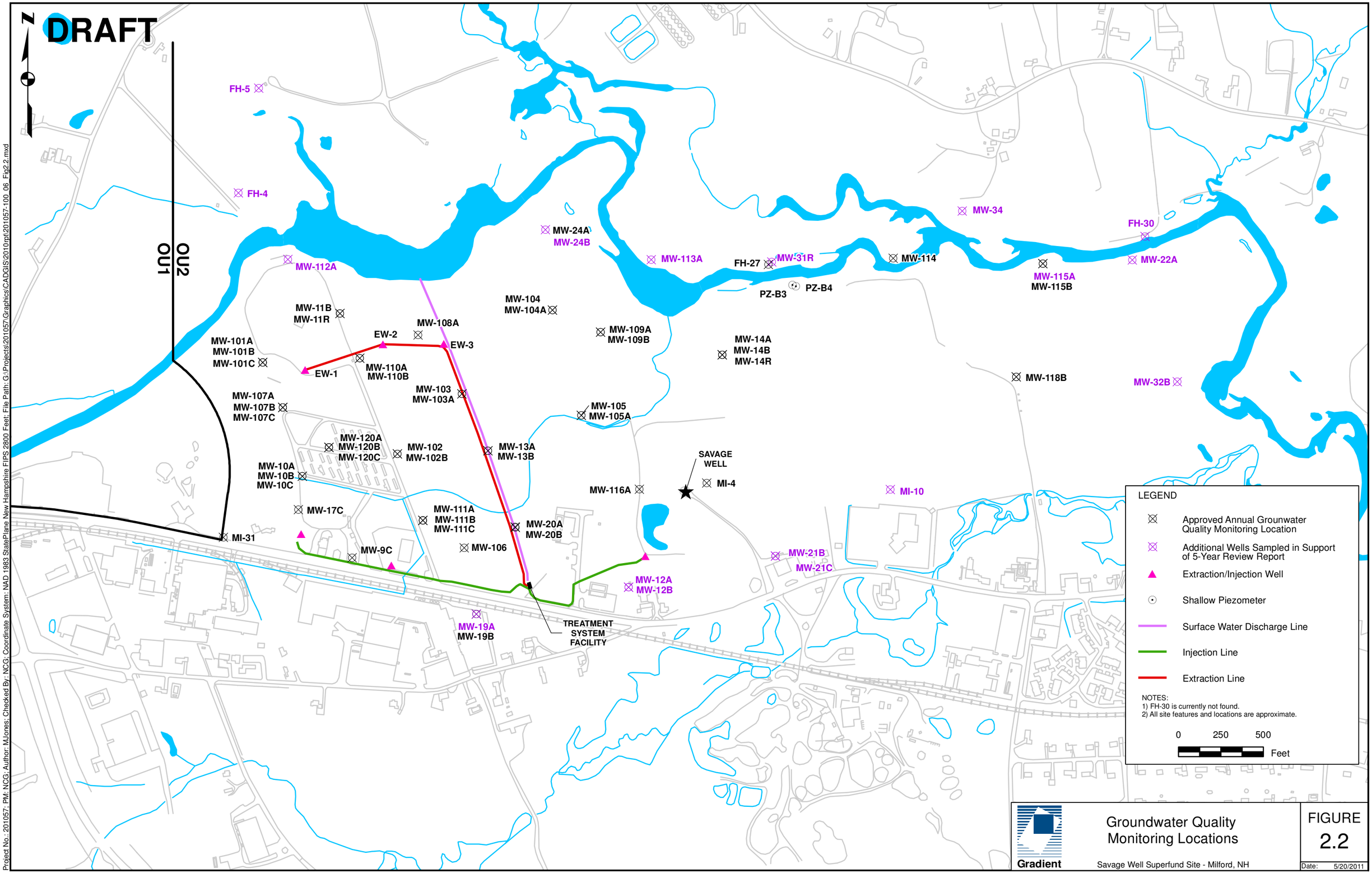
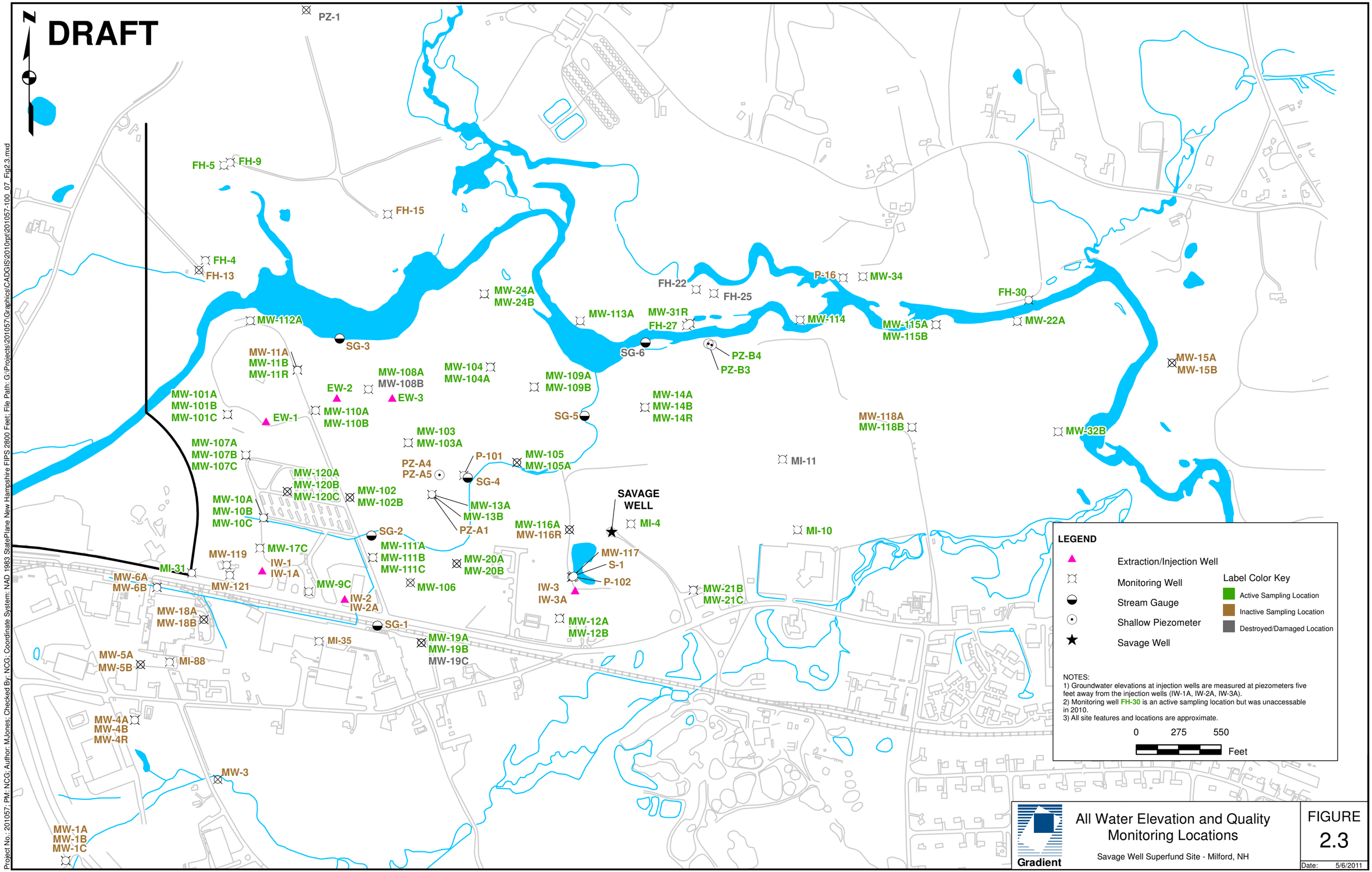
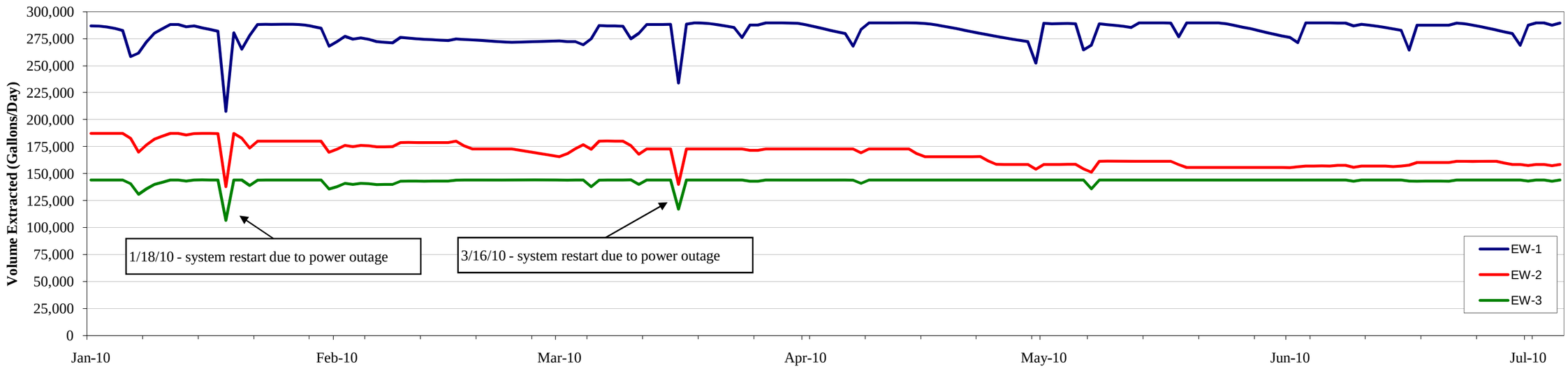
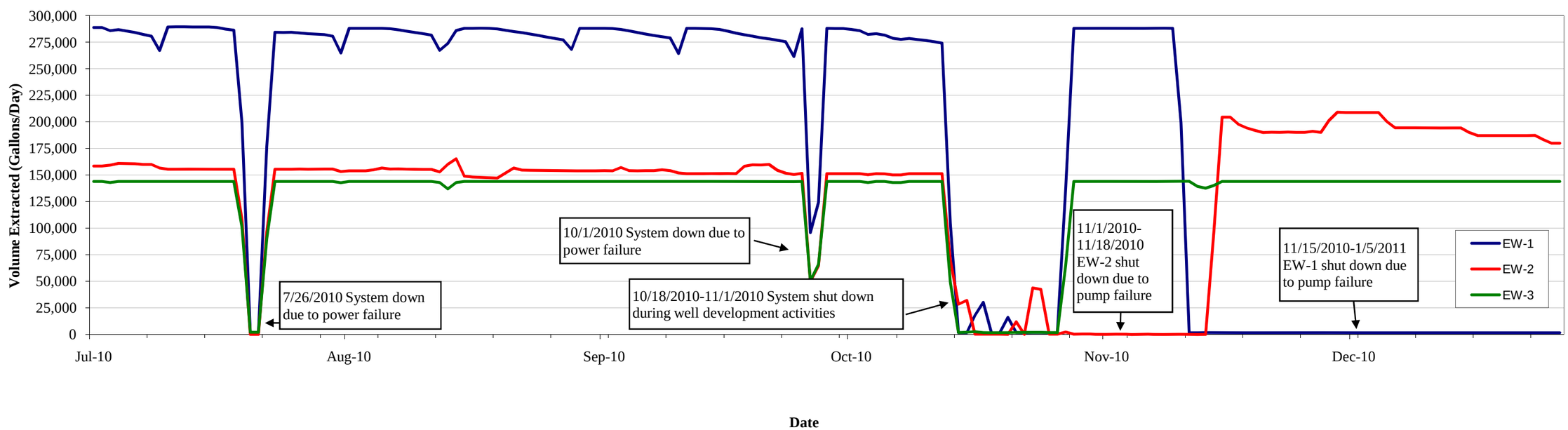

DRAFT
N
OU2
OU1
FH-5
FH-4
MW-112A
MW-24A
MW-24B
MW-113A
FH-27
MW-31R
MW-114
MW-34
FH-30
MW-22A
MW-115A
MW-115B
PZ-B3
PZ-B4
MW-104
MW-104A
MW-11B
MW-11R
MW-108A
EW-2
EW-3
EW-1
MW-101A
MW-101B
MW-101C
MW-110A
MW-110B
MW-109A
MW-109B
MW-14A
MW-14B
MW-14R
MW-118B
MW-32B
MW-103
MW-103A
MW-107A
MW-107B
MW-107C
MW-105
MW-105A
MW-120A
MW-120B
MW-120C
MW-102
MW-102B
MW-13A
MW-13B
SAVAGE WELL
MI-4
MW-10A
MW-10B
MW-10C
MW-116A
MI-10
MW-17C
MW-111A
MW-111B
MW-111C
MW-20A
MW-20B
MI-31
MW-9C
MW-106
MW-21B
MW-21C
MW-12A
MW-12B
MW-19A
MW-19B
TREATMENT SYSTEM FACILITY
LEGEND
Approved Annual Grounwater Quality Monitoring Location
Additional Wells Sampled in Support of 5-Year Review Report
Extraction/Injection Well
Shallow Piezometer
Surface Water Discharge Line
Injection Line
Extraction Line
NOTES:
1) FH-30 is currently not found.
2) All site features and locations are approximate.
0 250 500
Feet
Gradient
Groundwater Quality Monitoring Locations
Savage Well Superfund Site - Milford, NH
FIGURE
2.2
Date: 5/20/2011
Project No.: 201057; PM: NCG; Author: MJones; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057-100_06_Fig2.2.mxd


DRAFT
PZ-1
FH-5
FH-9
FH-15
FH-4
FH-13
MW-112A
SG-3
MW-11A
MW-11B
MW-11R
MW-101A
MW-101B
MW-101C
EW-1
EW-2
MW-110A
MW-110B
MW-108A
MW-108B
EW-3
MW-104
MW-104A
MW-24A
MW-24B
MW-113A
MW-109A
MW-109B
SG-5
SG-6
MW-31R
FH-27
FH-22
FH-25
PZ-B4
PZ-B3
MW-14A
MW-14B
MW-14R
P-16
MW-34
MW-114
MW-115A
MW-115B
FH-30
MW-22A
MW-118A
MW-118B
MW-32B
MW-15A
MW-15B
MW-107A
MW-107B
MW-107C
MW-103
MW-103A
PZ-A4
PZ-A5
P-101
SG-4
MW-105
MW-105A
MI-11
MW-120A
MW-120B
MW-120C
MW-102
MW-102B
MW-10A
MW-10B
MW-10C
MW-13A
MW-13B
PZ-A1
SAVAGE WELL
MI-4
MW-116A
MW-116R
MI-10
SG-2
MW-111A
MW-111B
MW-111C
MW-119
MW-17C
IW-1
IW-1A
MW-121
MI-31
MW-6A
MW-6B
MW-9C
IW-2
IW-2A
MW-20A
MW-20B
MW-106
MW-117
S-1
P-102
IW-3
IW-3A
MW-21B
MW-21C
MW-18A
MW-18B
SG-1
MW-12A
MW-12B
MI-35
MW-19A
MW-19B
MW-19C
MW-5A
MW-5B
MI-88
MW-4A
MW-4B
MW-4R
MW-3
MW-1A
MW-1B
MW-1C
LEGEND
Extraction/Injection Well
Monitoring Well
Stream Gauge
Shallow Piezometer
Savage Well
Label Color Key
Active Sampling Location
Inactive Sampling Location
Destroyed/Damaged Location
NOTES:
1) Groundwater elevations at injection wells are measured at piezometers five feet away from the injection wells (IW-1A, IW-2A, IW-3A).
2) Monitoring well FH-30 is an active sampling location but was unaccessable in 2010.
3) All site features and locations are approximate.
0 275 550
Feet
Gradient
All Water Elevation and Quality Monitoring Locations
Savage Well Superfund Site - Milford, NH
FIGURE
2.3
Date: 5/6/2011
Project No.: 201057; PM: NCG; Author: MJones; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057-100_07_Fig2.3.mxd

DRAFT

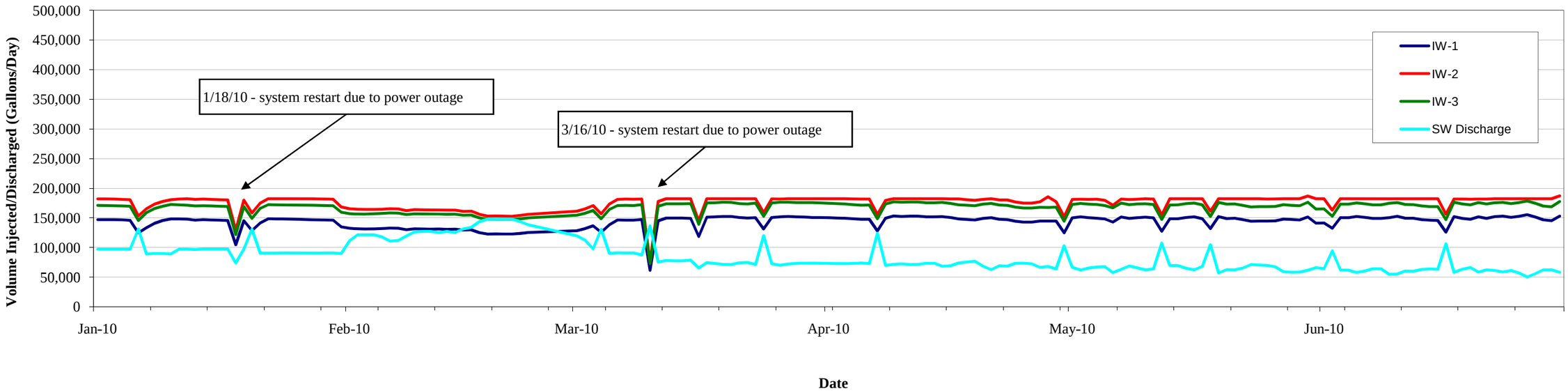
Figure 3.1
Summary of Extraction Well Operation
Savage Well Superfund Site, Milford, NH

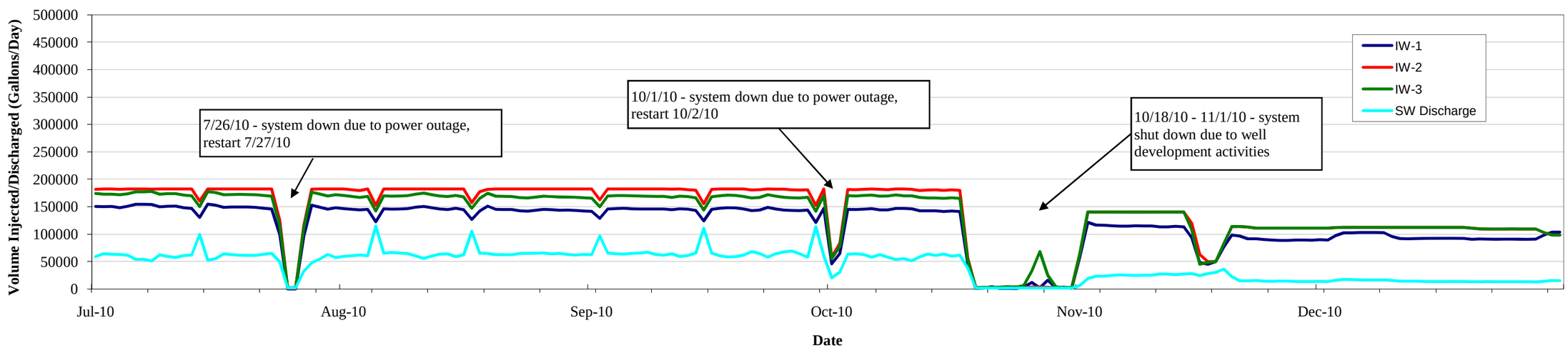




DRAFT

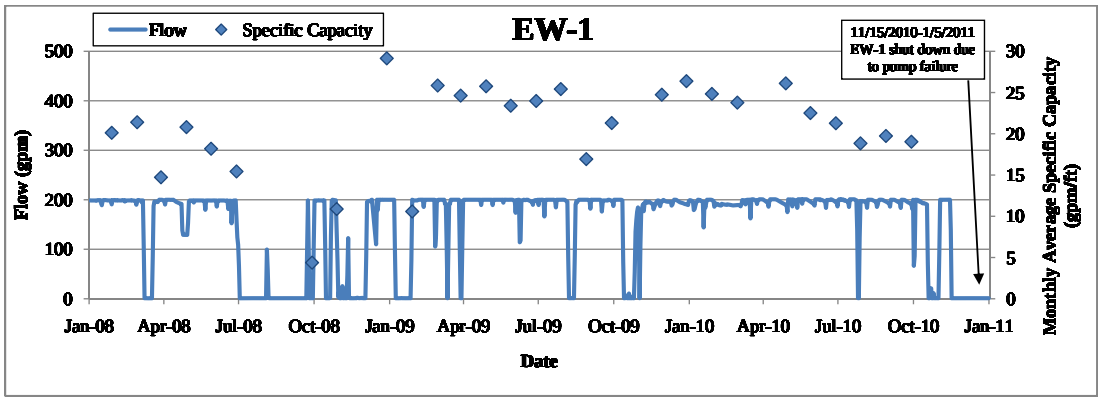
Figure 3.2
Summary of Injection Well and Surface Water Discharge Operation
Savage Well Superfund Site, Milford, NH

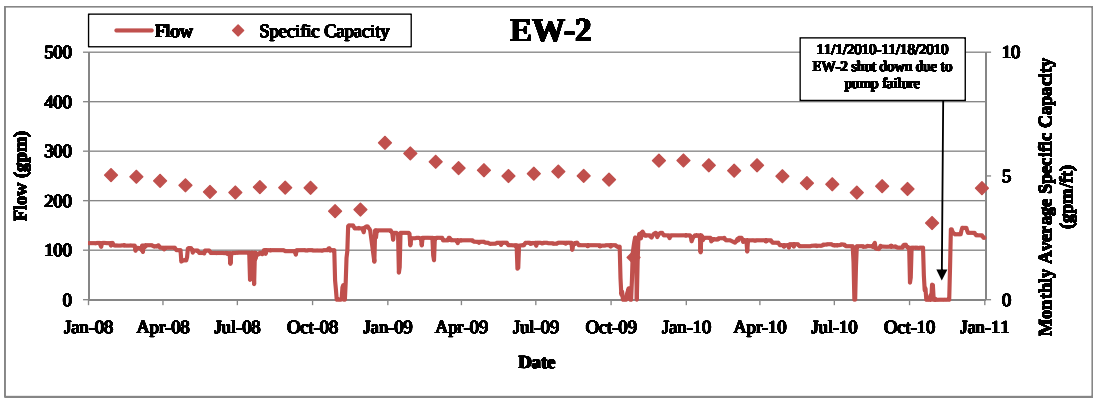


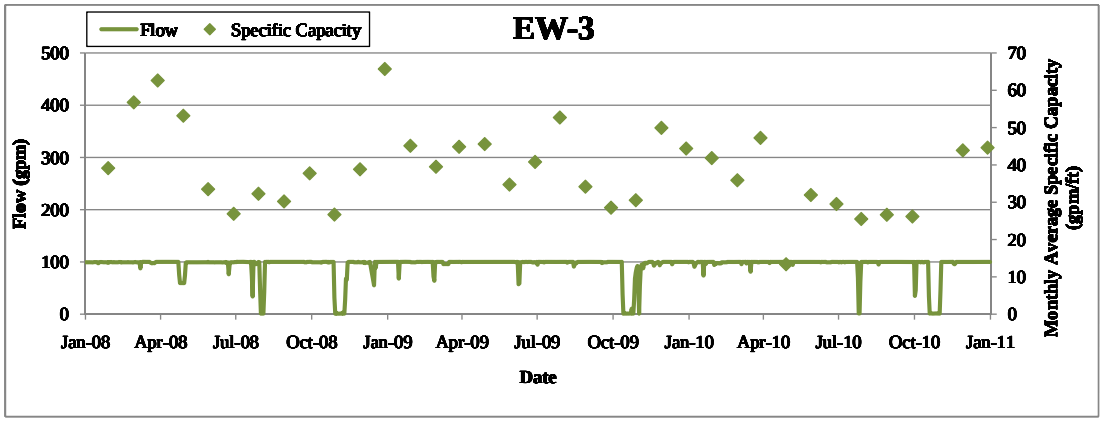


Notes:
1. SW = Surface Water

Figure 3.3
Monthly Average Specific Capacity at Extraction Wells
Savage Well Superfund Site, Milford, NH



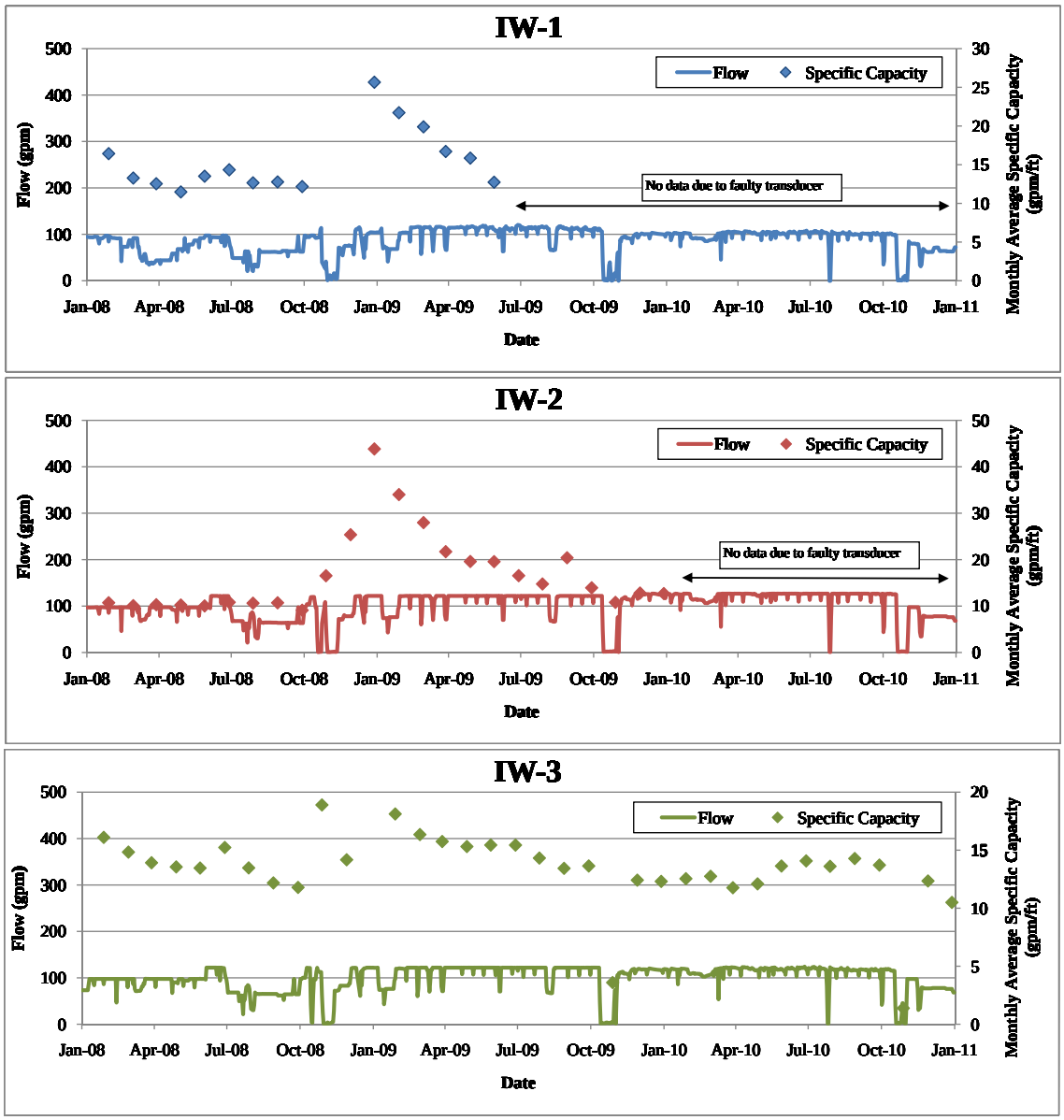




Notes:

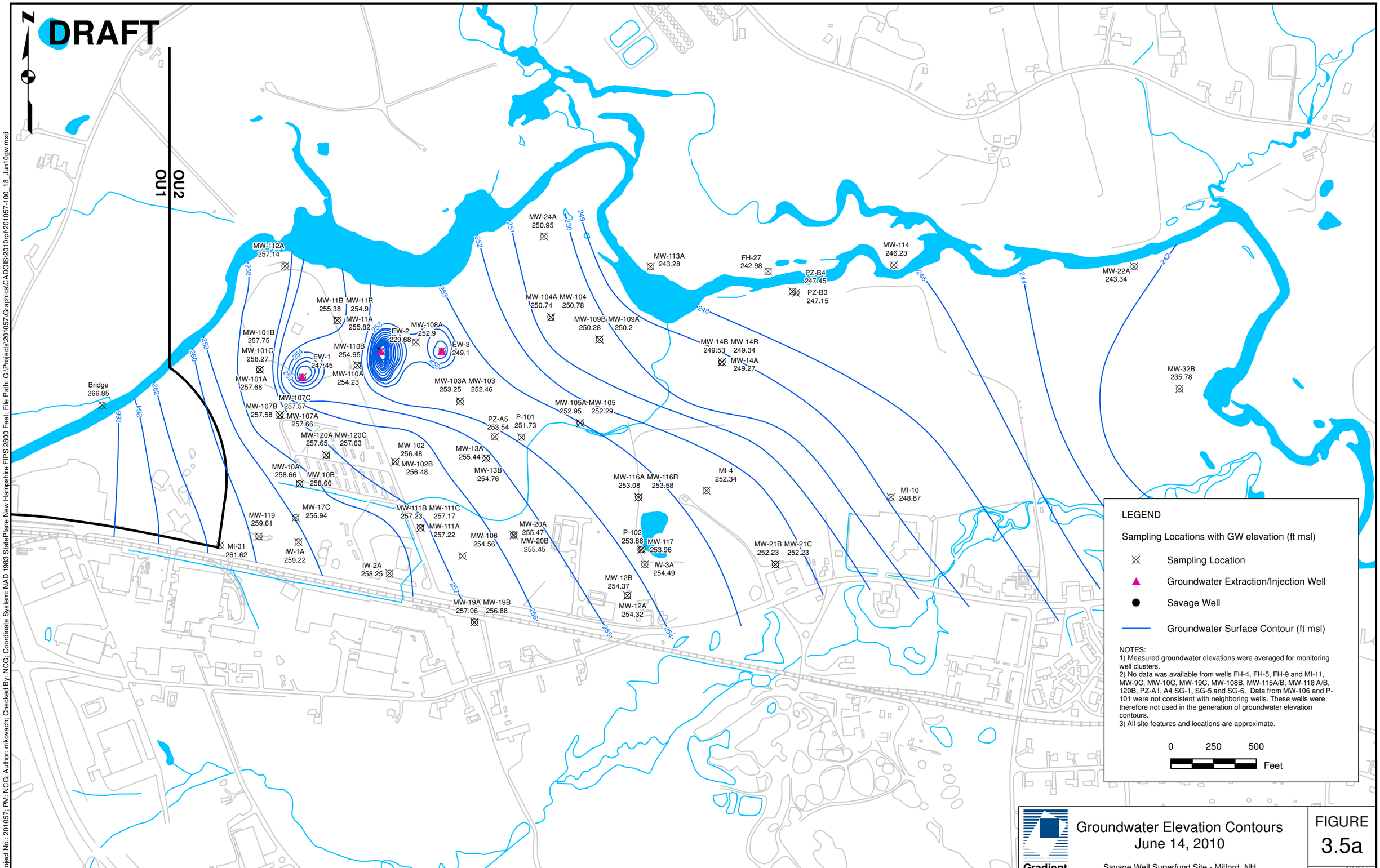
1. Specific capacity values were calculated using extraction well flow rate (gpm) divided by corresponding drawdown (ft) measured by pressure transducers within extraction wells.
2. For drawdown calculations, the annual average groundwater elevation measured near EWs was used (USGS, 1999; US EPA, 2002).
3. Monthly average specific capacity values are plotted at the end of each month (e.g. the monthly average for September 2005 is plotted on September 30, 2005).
4. Data for periods when the wells were not in operation were excluded from the calculation of specific capacity.

Figure 3.4
Monthly Average Specific Capacity at Injection Wells
Savage Well Superfund Site, Milford, NH



Notes:

1. *Specific capacity values were calculated using injection well flow rate (gpm) divided by corresponding mounding (ft) measued by pressure tranducers within injection wells.*
2. *Monthly average specific capacity values are plotted at the end of each month (e.g. the monthly average for September 2005 is plotted on September 30, 2005).*
3. *Erroneous data were excluded from the calculation of specific capacity.*
4. *Data for periods when the wells were not in operation were excluded form the calculation of specific capacity.*


DRAFT
N
OU1
OU2
MW-112A 257.14
MW-11B 255.38
MW-11R 254.9
MW-11A 255.82
MW-101B 257.75
MW-101C 258.27
MW-101A 257.68
EW-1 247.45
EW-2 229.68
MW-108A 252.9
EW-3 249.1
MW-110B 254.95
MW-110A 254.23
MW-103A 253.25
MW-103 252.46
MW-107C 257.57
MW-107B 257.58
MW-107A 257.66
Bridge 266.85
MW-120A 257.65
MW-120C 257.63
MW-102 256.48
MW-102B 256.48
MW-10A 258.66
MW-10B 258.66
MW-17C 256.94
MW-119 259.61
MI-31 261.62
IW-1A 259.22
IW-2A 258.25
MW-111B 257.23
MW-111C 257.17
MW-111A 257.22
MW-106 254.56
MW-19A 257.06
MW-19B 256.88
MW-24A 250.95
MW-104A 250.74
MW-104 250.78
MW-109B 250.28
MW-109A 250.2
MW-113A 243.28
FH-27 242.98
PZ-B4 247.45
PZ-B3 247.15
MW-114 246.23
MW-22A 243.34
MW-14B 249.53
MW-14R 249.34
MW-14A 249.27
MW-32B 235.78
MW-105A 252.95
MW-105 252.29
PZ-A5 253.54
P-101 251.73
MW-13A 255.44
MW-13B 254.76
MW-20A 255.47
MW-20B 255.45
MW-116A 253.08
MW-116R 253.58
MI-4 252.34
MI-10 248.87
P-102 253.86
MW-117 253.96
IW-3A 254.49
MW-21B 252.23
MW-21C 252.23
MW-12B 254.37
MW-12A 254.32
LEGEND
Sampling Locations with GW elevation (ft msl)
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Groundwater Surface Contour (ft msl)
NOTES:
1) Measured groundwater elevations were averaged for monitoring well clusters.
2) No data was available from wells FH-4, FH-5, FH-9 and MI-11, MW-9C, MW-10C, MW-19C, MW-108B, MW-115A/B, MW-118 A/B, 120B, PZ-A1, A4 SG-1, SG-5 and SG-6. Data from MW-106 and P-101 were not consistent with neighboring wells. These wells were therefore not used in the generation of groundwater elevation contours.
3) All site features and locations are approximate.
0 250 500
Feet
Gradient
Groundwater Elevation Contours
June 14, 2010
Savage Well Superfund Site - Milford, NH
FIGURE
3.5a
Date: 5/6/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\ppt\201057-100_18_Jun10gw.mxd

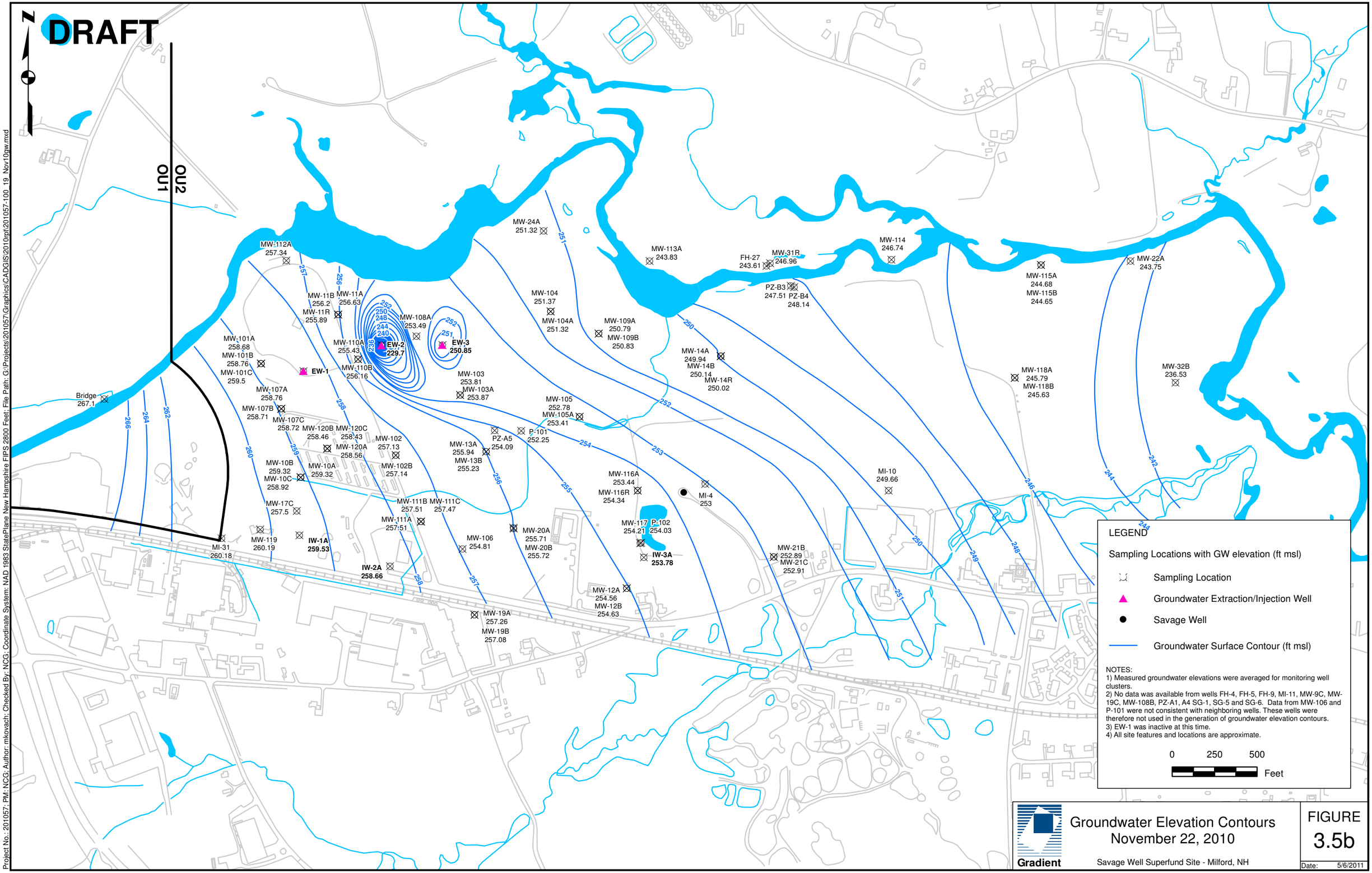
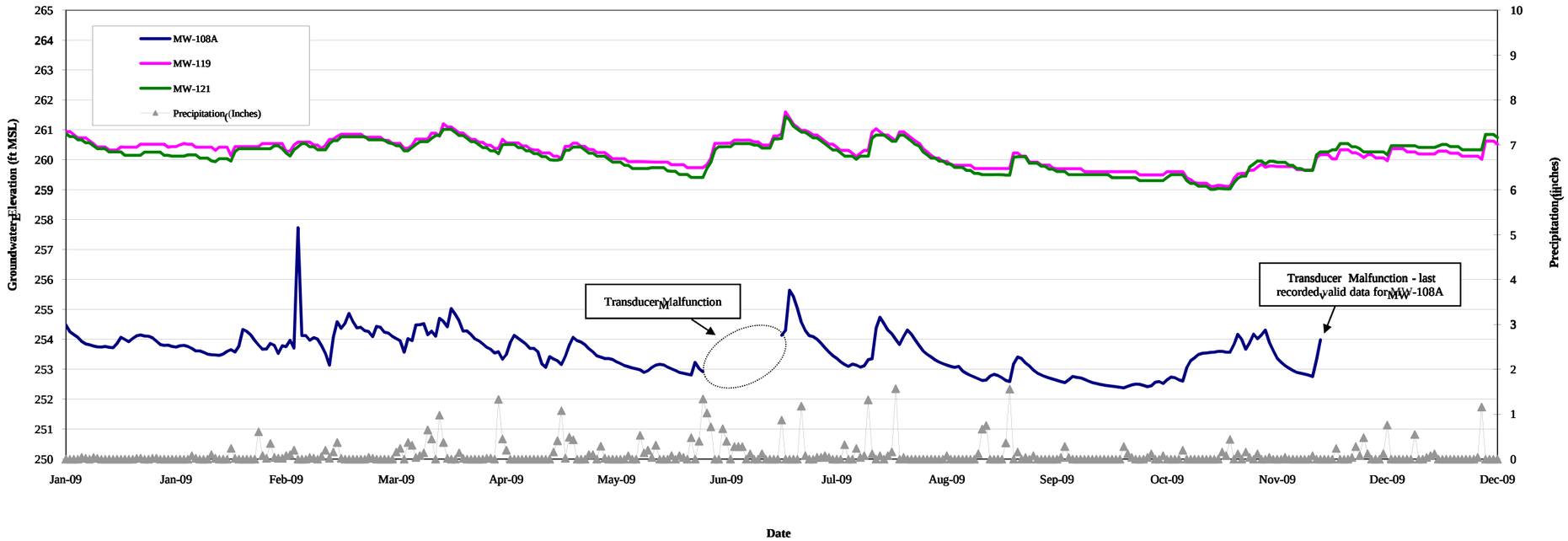
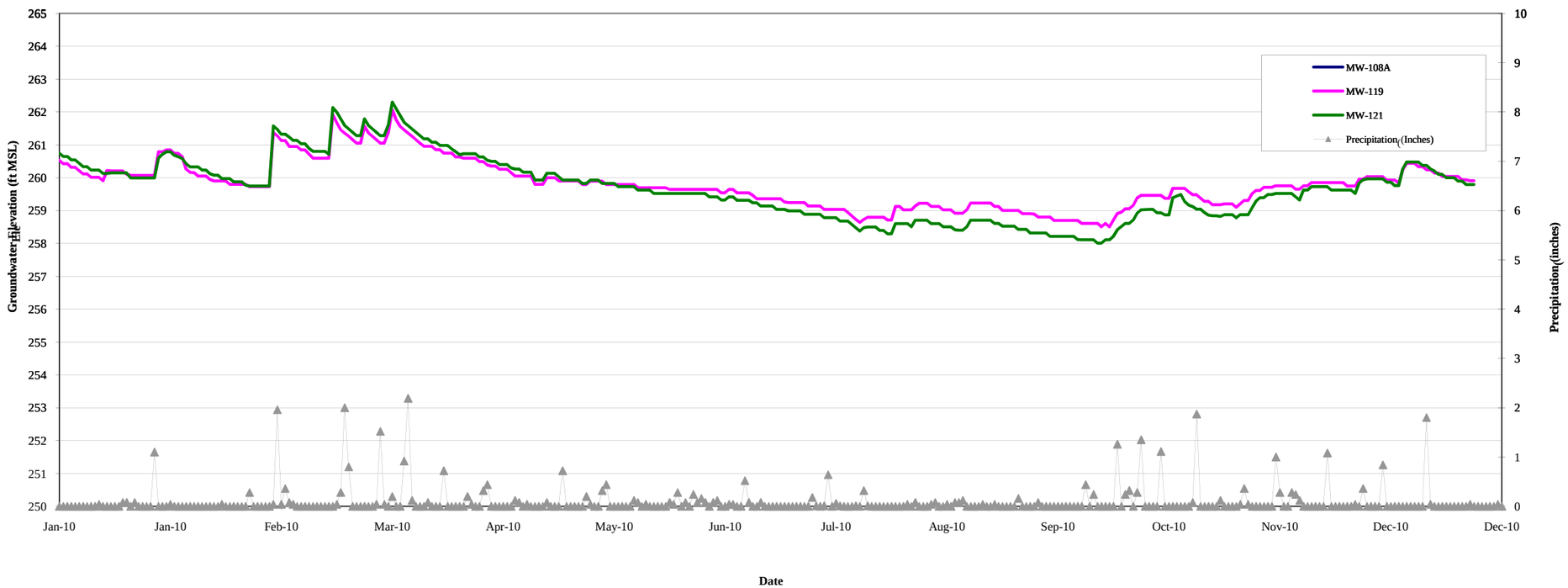
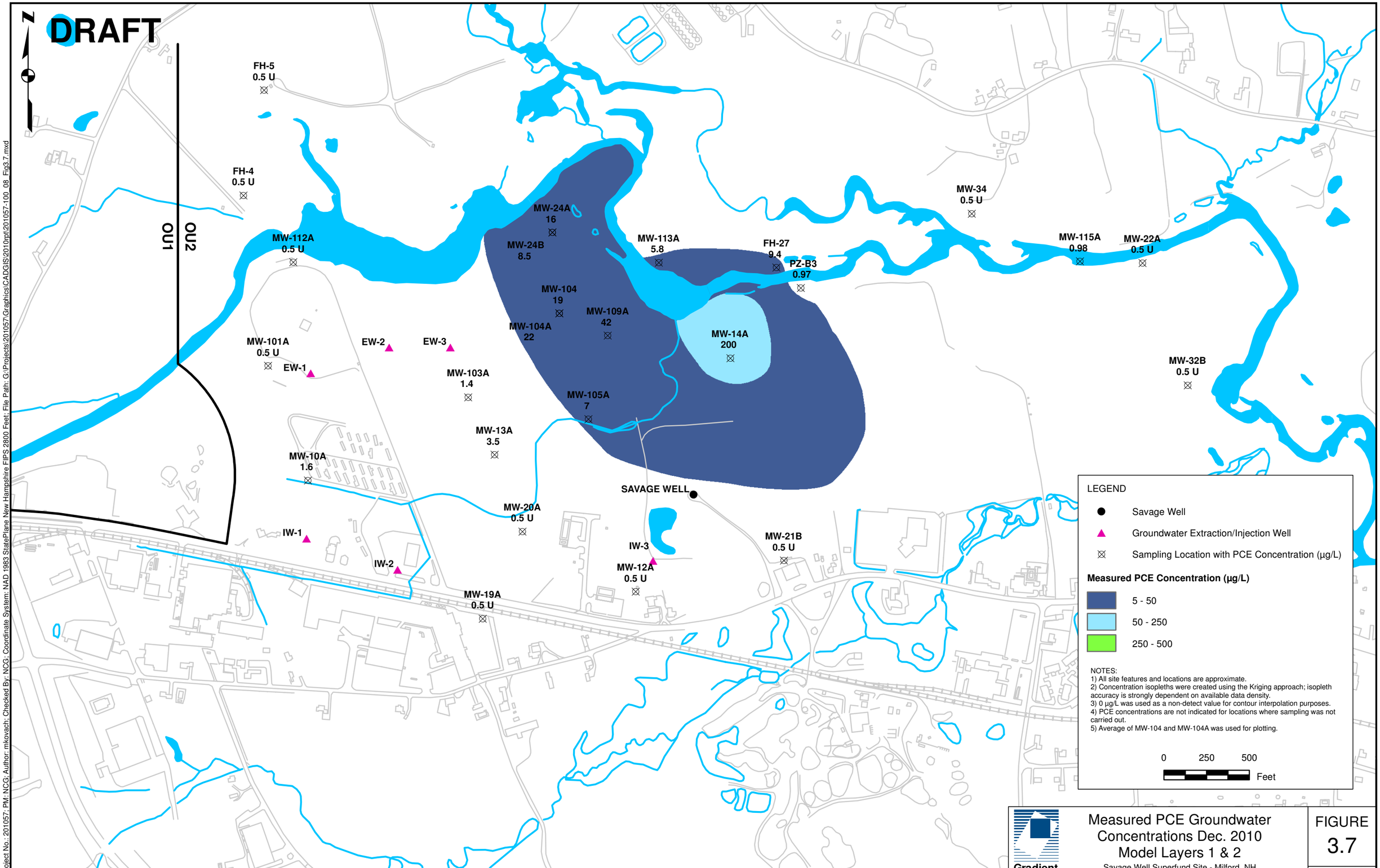
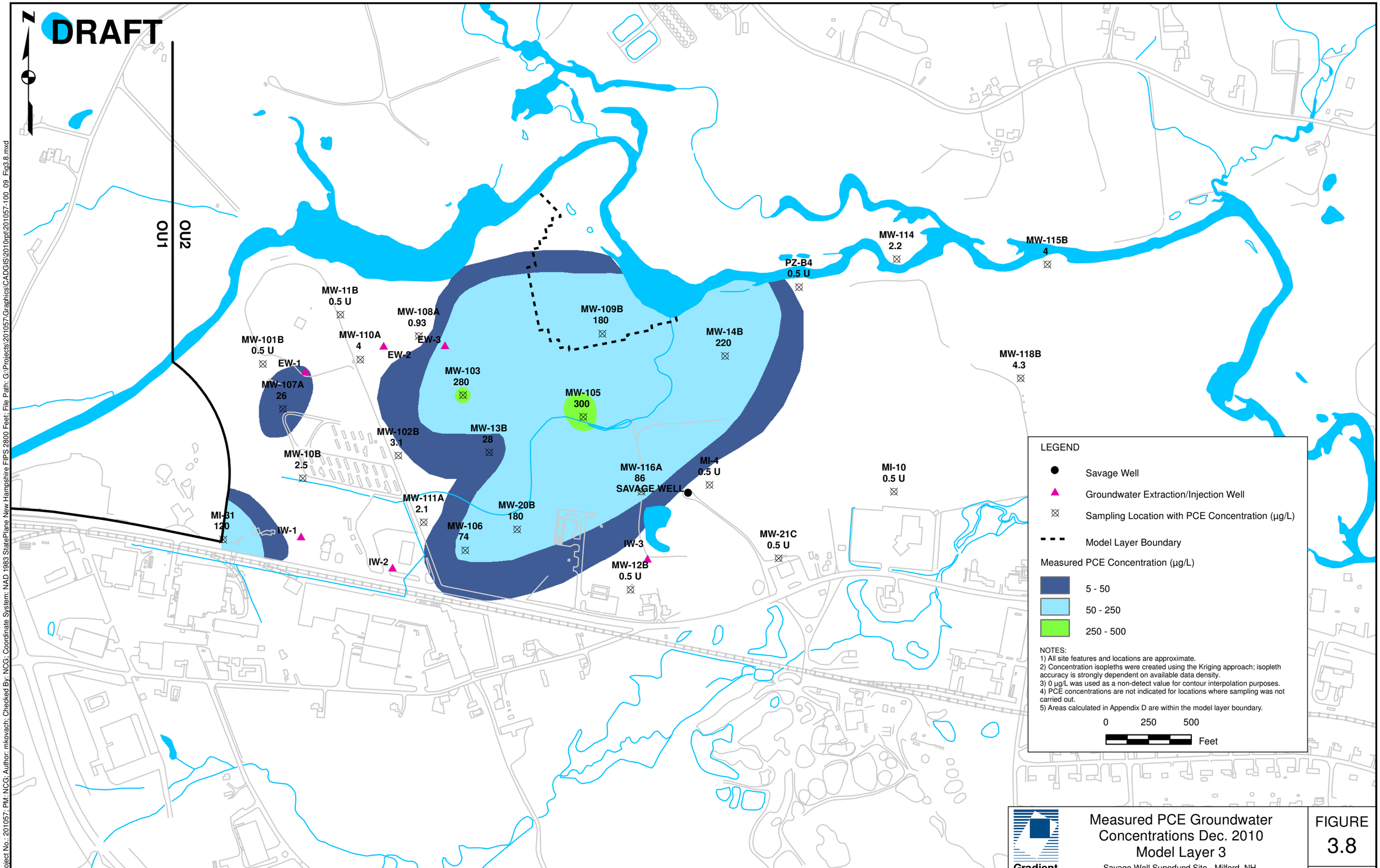

DRAFT
N
OU2
OU1
MW-24A 251.32
MW-112A 257.34
MW-113A 243.83
FH-27 243.61
MW-31R 246.96
MW-114 246.74
MW-115A 244.68
MW-115B 244.65
MW-22A 243.75
PZ-B3 247.51
PZ-B4 248.14
MW-11B 256.2
MW-11A 256.63
MW-11R 255.89
MW-104 251.37
MW-104A 251.32
MW-108A 253.49
MW-109A 250.79
MW-109B 250.83
MW-101A 258.68
MW-101B 258.76
MW-101C 259.5
MW-110A 255.43
EW-2 229.7
EW-3 250.85
EW-1
MW-110B 256.16
MW-14A 249.94
MW-14B 250.14
MW-14R 250.02
MW-118A 245.79
MW-118B 245.63
MW-32B 236.53
MW-103 253.81
MW-103A 253.87
Bridge 267.1
MW-107A 258.76
MW-107B 258.71
MW-107C 258.72
MW-105 252.78
MW-105A 253.41
MW-120B 258.46
MW-120C 258.43
MW-120A 258.56
MW-102 257.13
MW-102B 257.14
PZ-A5 254.09
P-101 252.25
MW-13A 255.94
MW-13B 255.23
MW-10B 259.32
MW-10C 258.92
MW-10A 259.32
MW-116A 253.44
MW-116R 254.34
MI-4 253
MI-10 249.66
MW-17C 257.5
MW-111B 257.51
MW-111C 257.47
MW-111A 257.51
MW-117 254.21
P-102 254.03
MW-119 260.19
IW-1A 259.53
MW-106 254.81
MW-20A 255.71
MW-20B 255.72
IW-3A 253.78
MI-31 260.18
IW-2A 258.66
MW-21B 252.89
MW-21C 252.91
MW-12A 254.56
MW-12B 254.63
MW-19A 257.26
MW-19B 257.08
LEGEND
Sampling Locations with GW elevation (ft msl)
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Groundwater Surface Contour (ft msl)
NOTES:
1) Measured groundwater elevations were averaged for monitoring well clusters.
2) No data was available from wells FH-4, FH-5, FH-9, MI-11, MW-9C, MW-19C, MW-108B, PZ-A1, A4 SG-1, SG-5 and SG-6. Data from MW-106 and P-101 were not consistent with neighboring wells. These wells were therefore not used in the generation of groundwater elevation contours.
3) EW-1 was inactive at this time.
4) All site features and locations are approximate.
0 250 500
Feet
Gradient
Groundwater Elevation Contours
November 22, 2010
Savage Well Superfund Site - Milford, NH
FIGURE
3.5b
Date: 5/6/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057-100_19_Nov10gw.mxd

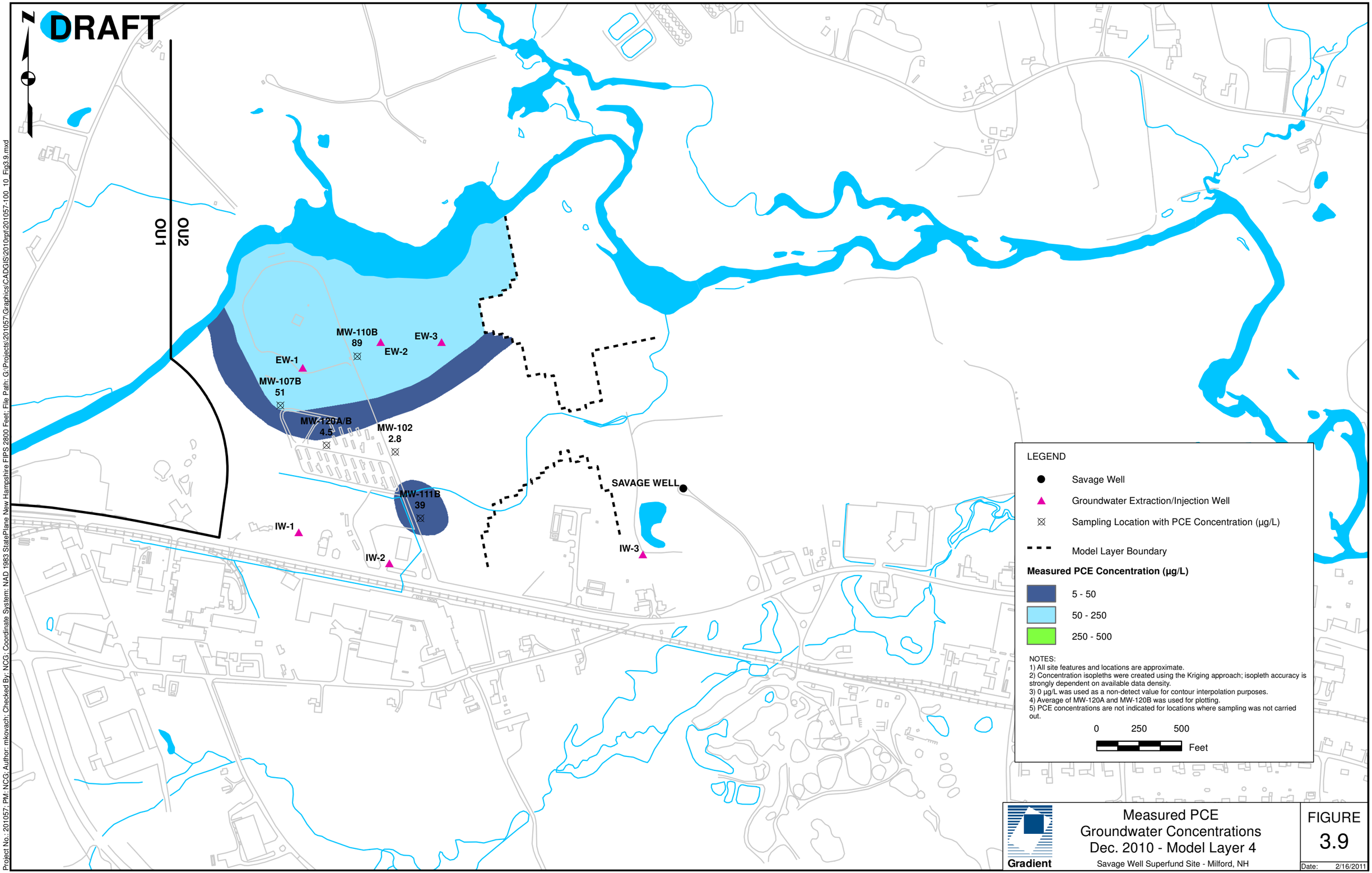
Figure 3.6
Groundwater Elevation Data - MW-108A, MW-119, and MW-121
Savage Well Superfund Site, Milford, NH

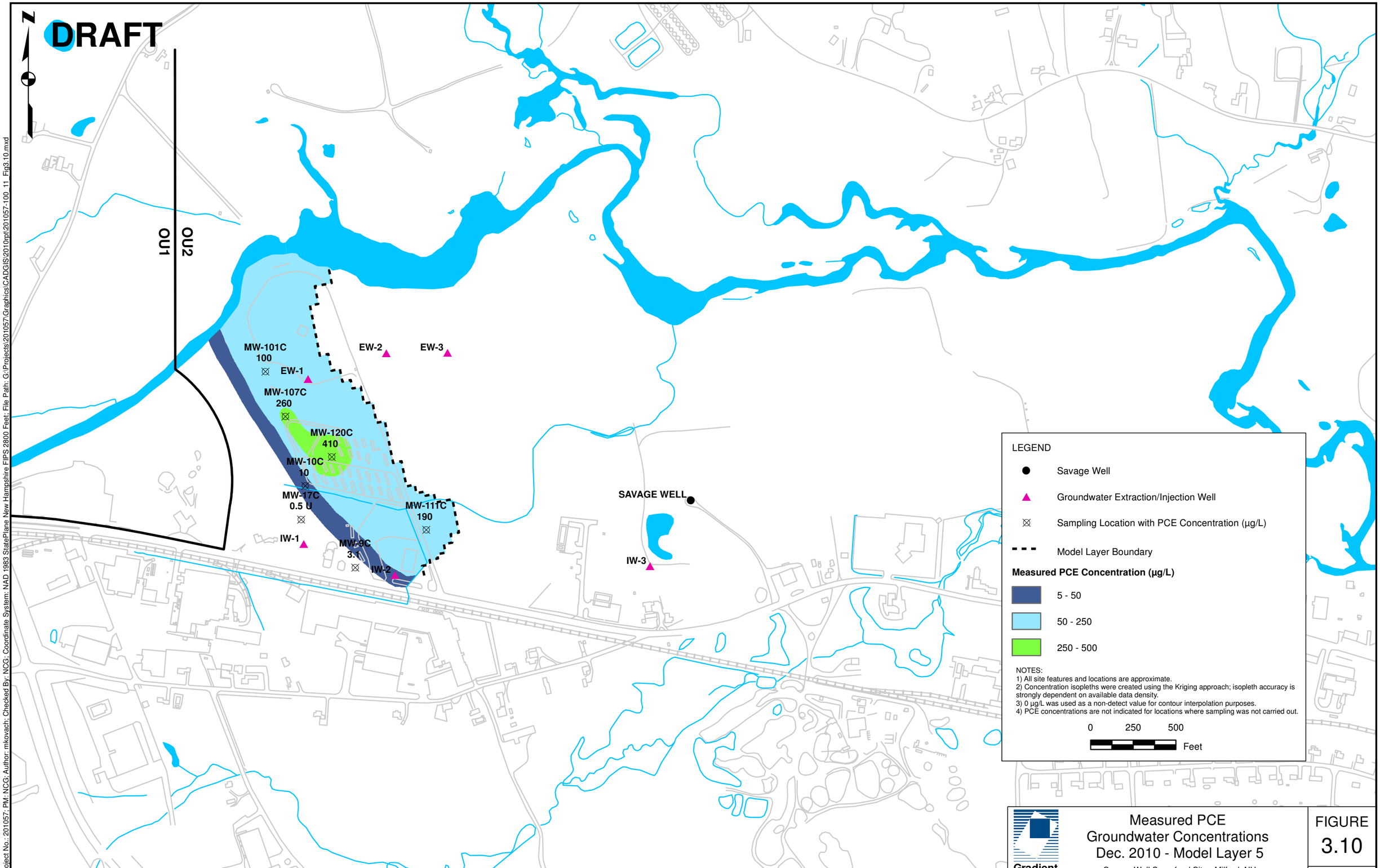


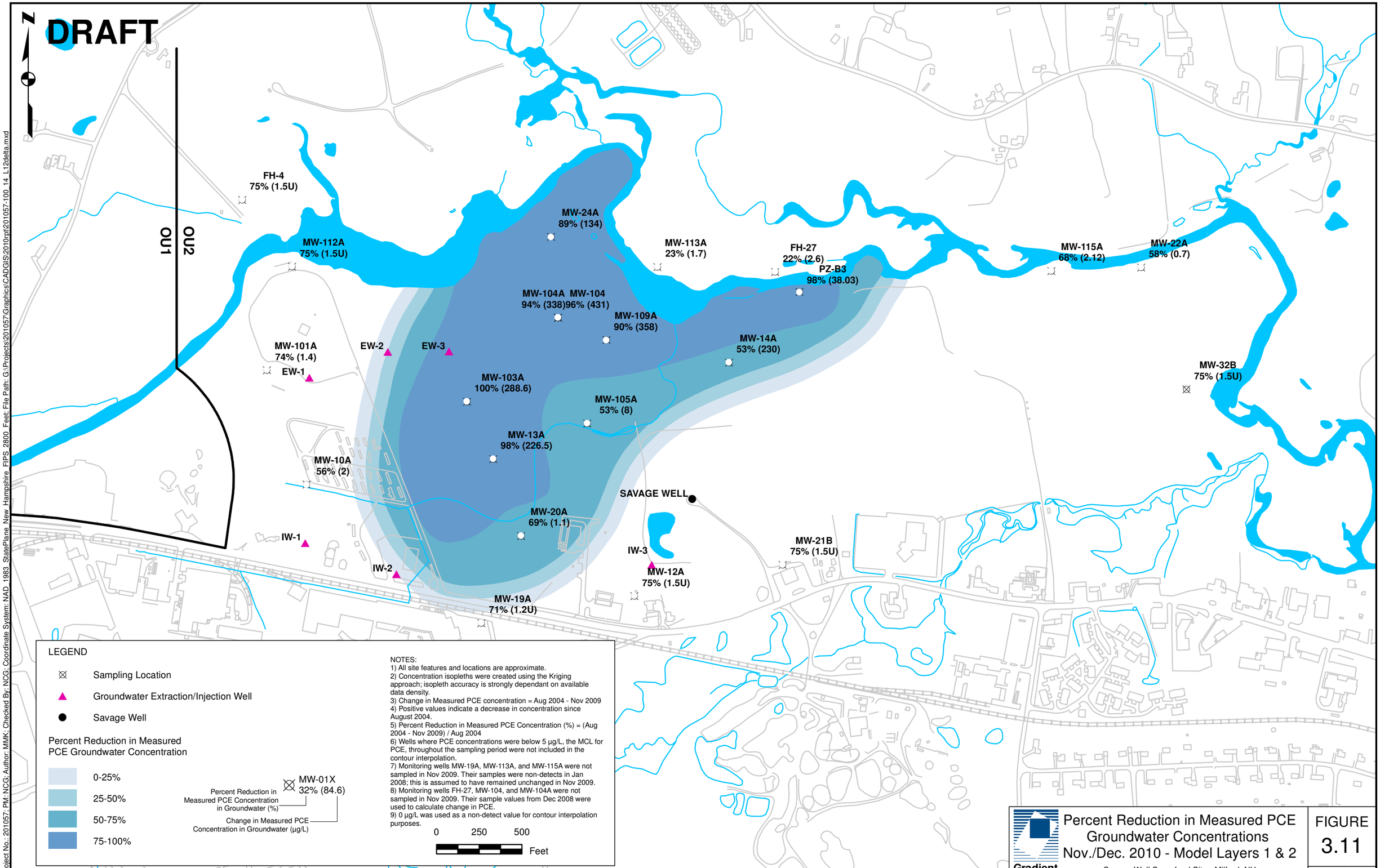


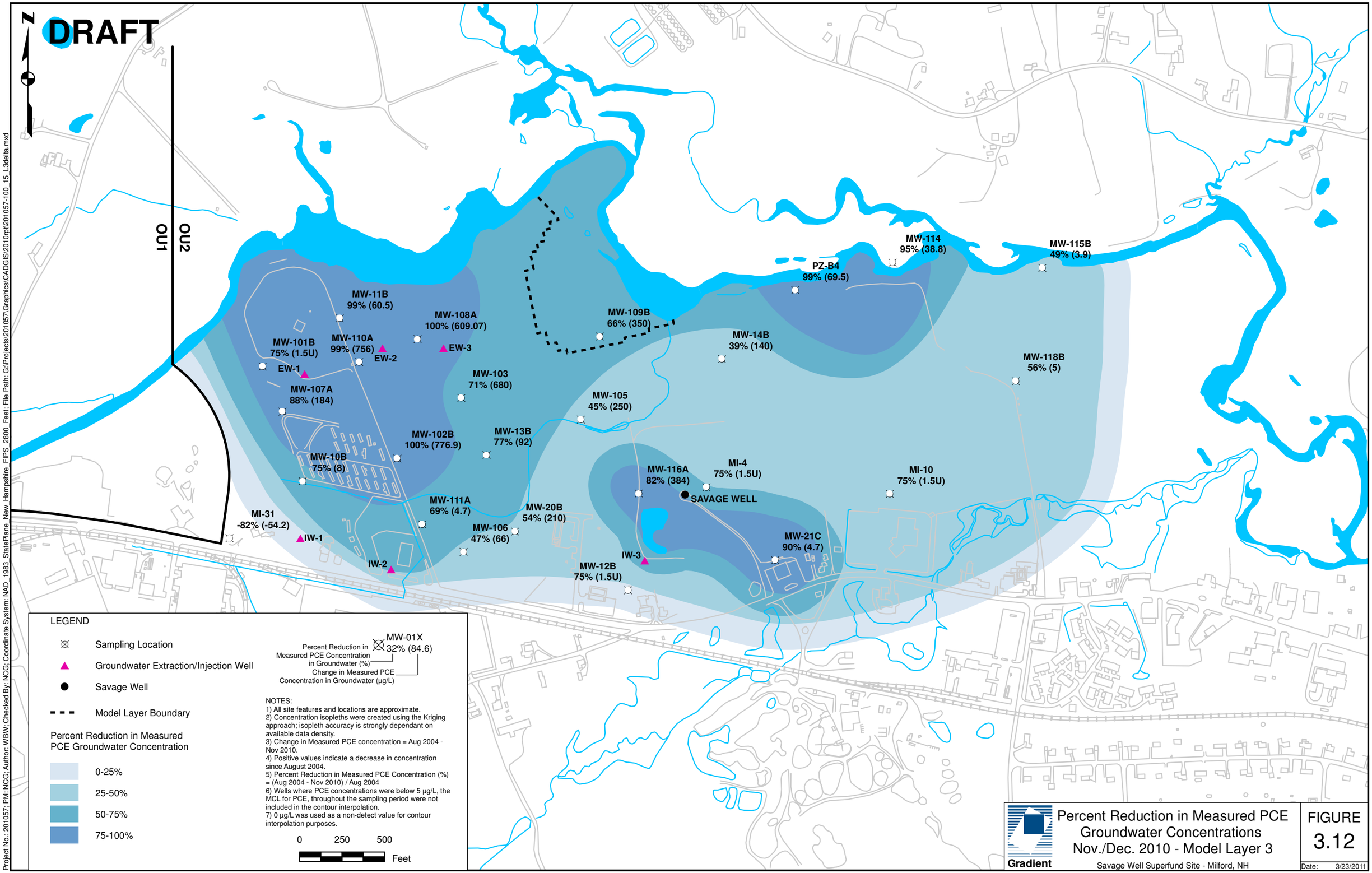

DRAFT
N
OU1
OU2
FH-5
0.5 U
FH-4
0.5 U
MW-112A
0.5 U
MW-24A
16
MW-24B
8.5
MW-113A
5.8
FH-27
9.4
PZ-B3
0.97
MW-34
0.5 U
MW-115A
0.98
MW-22A
0.5 U
MW-104
19
MW-109A
42
MW-104A
22
MW-14A
200
MW-101A
0.5 U
EW-2
EW-3
EW-1
MW-103A
1.4
MW-105A
7
MW-32B
0.5 U
MW-13A
3.5
MW-10A
1.6
SAVAGE WELL
MW-20A
0.5 U
IW-1
IW-3
MW-21B
0.5 U
IW-2
MW-12A
0.5 U
MW-19A
0.5 U
LEGEND
Savage Well
Groundwater Extraction/Injection Well
Sampling Location with PCE Concentration (µg/L)
Measured PCE Concentration (µg/L)
5 - 50
50 - 250
250 - 500
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependent on available data density.
3) 0 µg/L was used as a non-detect value for contour interpolation purposes.
4) PCE concentrations are not indicated for locations where sampling was not carried out.
5) Average of MW-104 and MW-104A was used for plotting.
0
250
500
Feet
Gradient
Measured PCE Groundwater Concentrations Dec. 2010 Model Layers 1 & 2
Savage Well Superfund Site - Milford, NH
FIGURE
3.7
Date: 2/16/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057-100_08_Fig3.7.mxd

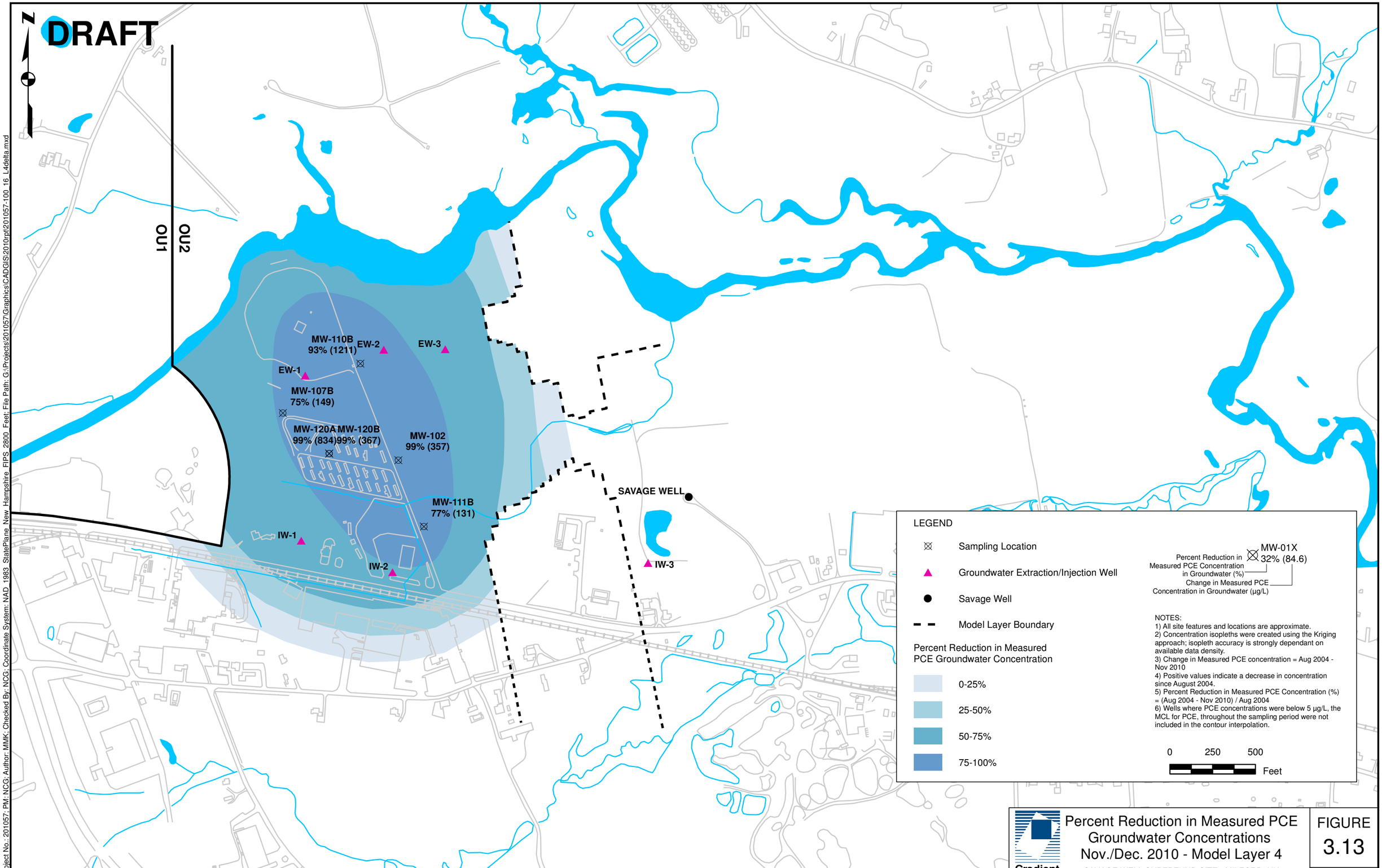

DRAFT
N
OU1
OU2
MW-11B
0.5 U
MW-108A
0.93
MW-110A
4
EW-3
EW-2
MW-101B
0.5 U
EW-1
MW-107A
26
MW-103
280
MW-109B
180
MW-14B
220
PZ-B4
0.5 U
MW-114
2.2
MW-115B
4
MW-118B
4.3
MW-105
300
MW-102B
3.1
MW-13B
28
MW-10B
2.5
MW-116A
86
SAVAGE WELL
MI-4
0.5 U
MI-10
0.5 U
MW-111A
2.1
MW-20B
180
MI-31
120
IW-1
MW-106
74
IW-3
MW-21C
0.5 U
IW-2
MW-12B
0.5 U
LEGEND
Savage Well
Groundwater Extraction/Injection Well
Sampling Location with PCE Concentration (µg/L)
Model Layer Boundary
Measured PCE Concentration (µg/L)
5 - 50
50 - 250
250 - 500
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependent on available data density.
3) 0 µg/L was used as a non-detect value for contour interpolation purposes.
4) PCE concentrations are not indicated for locations where sampling was not carried out.
5) Areas calculated in Appendix D are within the model layer boundary.
0
250
500
Feet
Gradient
Measured PCE Groundwater Concentrations Dec. 2010
Model Layer 3
Savage Well Superfund Site - Milford, NH
FIGURE
3.8
Date: 2/16/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057-100_09_Fig3.8.mxd


DRAFT
N
OU1
OU2
MW-110B
89
EW-3
EW-2
EW-1
MW-107B
51
MW-120A/B
4.5
MW-102
2.8
MW-111B
39
IW-1
IW-2
SAVAGE WELL
IW-3
LEGEND
Savage Well
Groundwater Extraction/Injection Well
Sampling Location with PCE Concentration (µg/L)
Model Layer Boundary
Measured PCE Concentration (µg/L)
5 - 50
50 - 250
250 - 500
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependent on available data density.
3) 0 µg/L was used as a non-detect value for contour interpolation purposes.
4) Average of MW-120A and MW-120B was used for plotting.
5) PCE concentrations are not indicated for locations where sampling was not carried out.
0
250
500
Feet
Gradient
Measured PCE
Groundwater Concentrations
Dec. 2010 - Model Layer 4
Savage Well Superfund Site - Milford, NH
FIGURE
3.9
Date: 2/16/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\pt\201057-100_10_Fig3.9.mxd


DRAFT
N
OU1
OU2
MW-101C
100
EW-1
EW-2
EW-3
MW-107C
260
MW-120C
410
MW-10C
10
MW-17C
0.5 U
MW-111C
190
IW-1
MW-9C
3.1
IW-2
SAVAGE WELL
IW-3
LEGEND
Savage Well
Groundwater Extraction/Injection Well
Sampling Location with PCE Concentration (µg/L)
Model Layer Boundary
Measured PCE Concentration (µg/L)
5 - 50
50 - 250
250 - 500
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependent on available data density.
3) 0 µg/L was used as a non-detect value for contour interpolation purposes.
4) PCE concentrations are not indicated for locations where sampling was not carried out.
0 250 500
Feet
Gradient
Measured PCE
Groundwater Concentrations
Dec. 2010 - Model Layer 5
Savage Well Superfund Site - Milford, NH
FIGURE
3.10
Date: 2/16/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\pt\201057-100_11_Fig3.10.mxd


DRAFT
N
OU1
OU2
FH-4
75% (1.5U)
MW-112A
75% (1.5U)
MW-24A
89% (134)
MW-113A
23% (1.7)
FH-27
22% (2.6)
PZ-B3
98% (38.03)
MW-115A
68% (2.12)
MW-22A
58% (0.7)
MW-104A
94% (338)
MW-104
96% (431)
MW-109A
90% (358)
MW-14A
53% (230)
MW-101A
74% (1.4)
EW-1
EW-2
EW-3
MW-103A
100% (288.6)
MW-105A
53% (8)
MW-13A
98% (226.5)
MW-32B
75% (1.5U)
MW-10A
56% (2)
SAVAGE WELL
MW-20A
69% (1.1)
IW-1
IW-2
IW-3
MW-12A
75% (1.5U)
MW-21B
75% (1.5U)
MW-19A
71% (1.2U)
LEGEND
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Percent Reduction in Measured PCE Groundwater Concentration
0-25%
25-50%
50-75%
75-100%
MW-01X
32% (84.6)
Percent Reduction in Measured PCE Concentration in Groundwater (%)
Change in Measured PCE Concentration in Groundwater (µg/L)
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependant on available data density.
3) Change in Measured PCE concentration = Aug 2004 - Nov 2009
4) Positive values indicate a decrease in concentration since August 2004.
5) Percent Reduction in Measured PCE Concentration (%) = (Aug 2004 - Nov 2009) / Aug 2004
6) Wells where PCE concentrations were below 5 µg/L, the MCL for PCE, throughout the sampling period were not included in the contour interpolation.
7) Monitoring wells MW-19A, MW-113A, and MW-115A were not sampled in Nov 2009. Their samples were non-detects in Jan 2008; this is assumed to have remained unchanged in Nov 2009.
8) Monitoring wells FH-27, MW-104, and MW-104A were not sampled in Nov 2009. Their sample values from Dec 2008 were used to calculate change in PCE.
9) 0 µg/L was used as a non-detect value for contour interpolation purposes.
0 250 500
Feet
Gradient
Percent Reduction in Measured PCE Groundwater Concentrations
Nov./Dec. 2010 - Model Layers 1 & 2
Savage Well Superfund Site - Milford, NH
FIGURE
3.11
Date: 3/23/2011
Project No.: 201057; PM: NCG; Author: MMK; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\rpt\201057-100_14_L12delta.mxd


DRAFT
N
OU1
OU2
MW-11B
99% (60.5)
MW-108A
100% (609.07)
MW-109B
66% (350)
MW-114
95% (38.8)
MW-115B
49% (3.9)
PZ-B4
99% (69.5)
MW-101B
75% (1.5U)
MW-110A
99% (756)
EW-2
EW-3
EW-1
MW-14B
39% (140)
MW-118B
56% (5)
MW-103
71% (680)
MW-107A
88% (184)
MW-105
45% (250)
MW-102B
100% (776.9)
MW-13B
77% (92)
MW-10B
75% (8)
MW-116A
82% (384)
MI-4
75% (1.5U)
MI-10
75% (1.5U)
SAVAGE WELL
MW-111A
69% (4.7)
MW-20B
54% (210)
MI-31
-82% (-54.2)
MW-106
47% (66)
IW-1
MW-21C
90% (4.7)
IW-3
IW-2
MW-12B
75% (1.5U)
LEGEND
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Model Layer Boundary
Percent Reduction in Measured PCE Groundwater Concentration
0-25%
25-50%
50-75%
75-100%
MW-01X
32% (84.6)
Percent Reduction in Measured PCE Concentration in Groundwater (%)
Change in Measured PCE Concentration in Groundwater (µg/L)
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependant on available data density.
3) Change in Measured PCE concentration = Aug 2004 - Nov 2010.
4) Positive values indicate a decrease in concentration since August 2004.
5) Percent Reduction in Measured PCE Concentration (%) = (Aug 2004 - Nov 2010) / Aug 2004
6) Wells where PCE concentrations were below 5 µg/L, the MCL for PCE, throughout the sampling period were not included in the contour interpolation.
7) 0 µg/L was used as a non-detect value for contour interpolation purposes.
0 250 500
Feet
Gradient
Percent Reduction in Measured PCE Groundwater Concentrations
Nov./Dec. 2010 - Model Layer 3
Savage Well Superfund Site - Milford, NH
FIGURE
3.12
Date: 3/23/2011
Project No.: 201057; PM: NCG; Author: WBW; Checked By: NCG; Coordinate System: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\rpt\201057-100_15_L3delta.mxd



Project No.: 201057; PM: NCG; Author: MMK; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\rpt\201057-100_16_L4delta.mxd

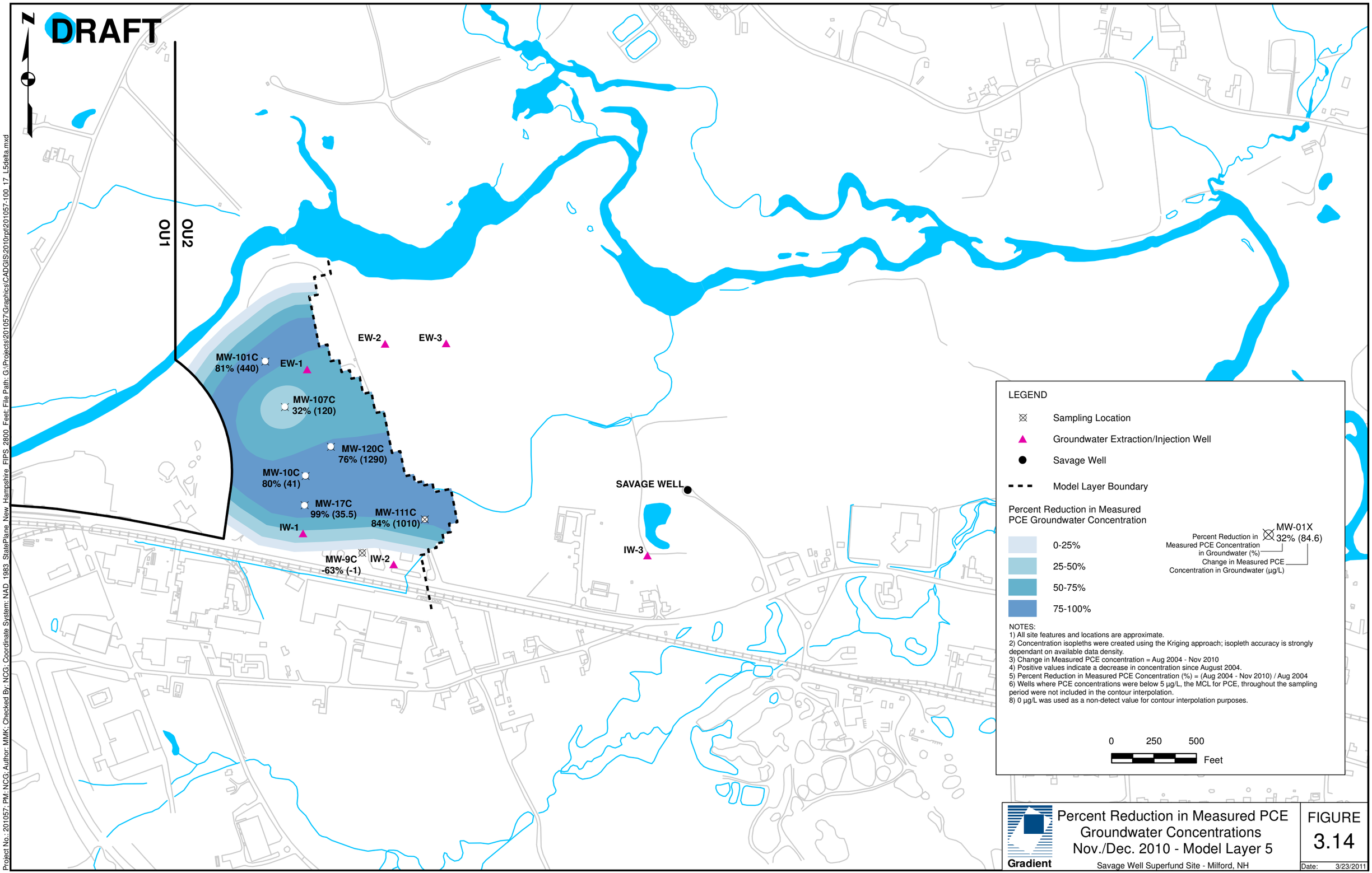
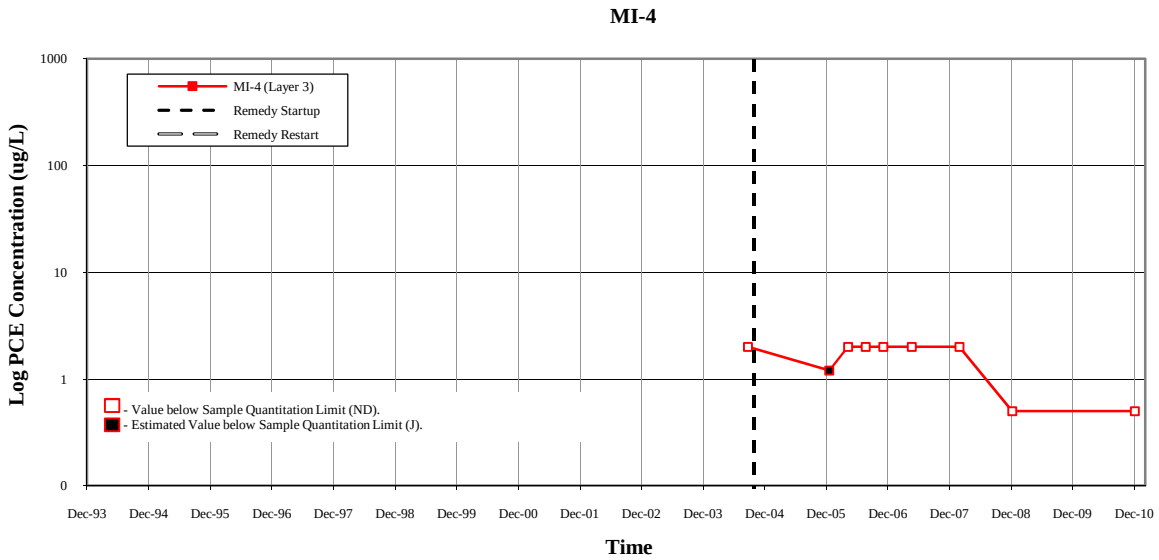
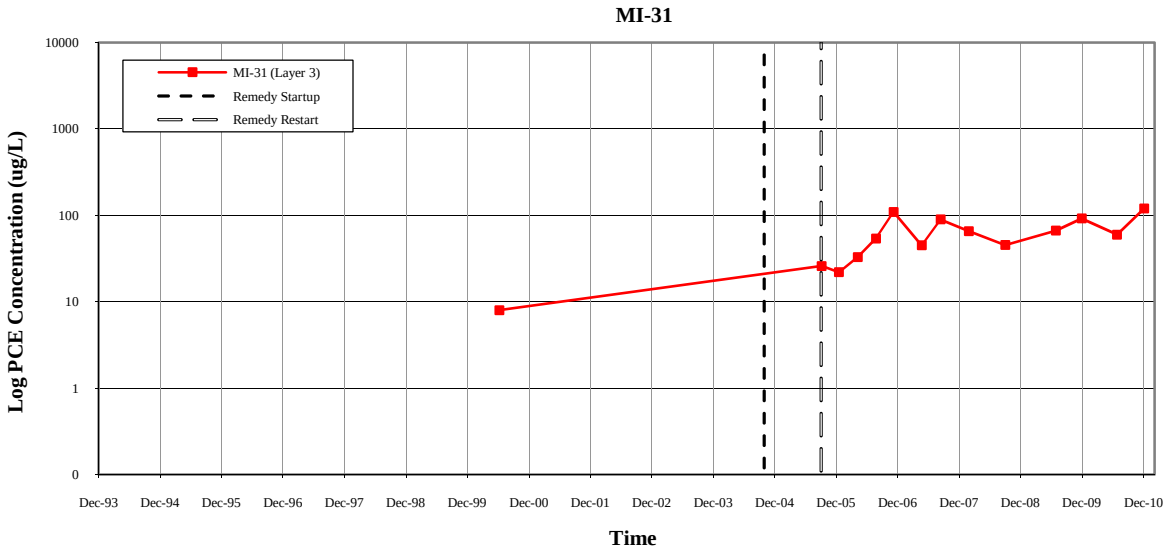

DRAFT
N
OU1
OU2
MW-101C
81% (440)
EW-1
EW-2
EW-3
MW-107C
32% (120)
MW-120C
76% (1290)
MW-10C
80% (41)
MW-17C
99% (35.5)
MW-111C
84% (1010)
IW-1
MW-9C
-63% (-1)
IW-2
SAVAGE WELL
IW-3
LEGEND
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Model Layer Boundary
Percent Reduction in Measured PCE Groundwater Concentration
0-25%
25-50%
50-75%
75-100%
MW-01X
32% (84.6)
Percent Reduction in Measured PCE Concentration in Groundwater (%)
Change in Measured PCE Concentration in Groundwater (µg/L)
NOTES:
1) All site features and locations are approximate.
2) Concentration isopleths were created using the Kriging approach; isopleth accuracy is strongly dependant on available data density.
3) Change in Measured PCE concentration = Aug 2004 - Nov 2010
4) Positive values indicate a decrease in concentration since August 2004.
5) Percent Reduction in Measured PCE Concentration (%) = (Aug 2004 - Nov 2010) / Aug 2004
6) Wells where PCE concentrations were below 5 µg/L, the MCL for PCE, throughout the sampling period were not included in the contour interpolation.
8) 0 µg/L was used as a non-detect value for contour interpolation purposes.
0 250 500
Feet
Gradient
Percent Reduction in Measured PCE Groundwater Concentrations
Nov./Dec. 2010 - Model Layer 5
Savage Well Superfund Site - Milford, NH
FIGURE
3.14
Date: 3/23/2011
Project No.: 201057; PM: NCG; Author: MMK; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CADGIS\2010\rpt\201057-100_17_L5delta.mxd

Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH





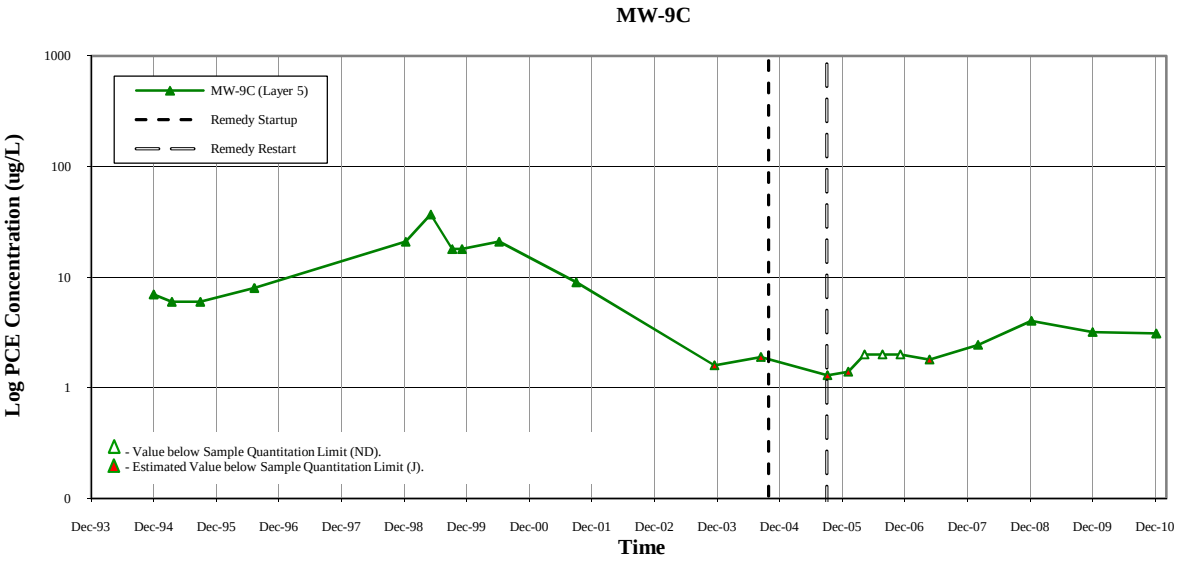
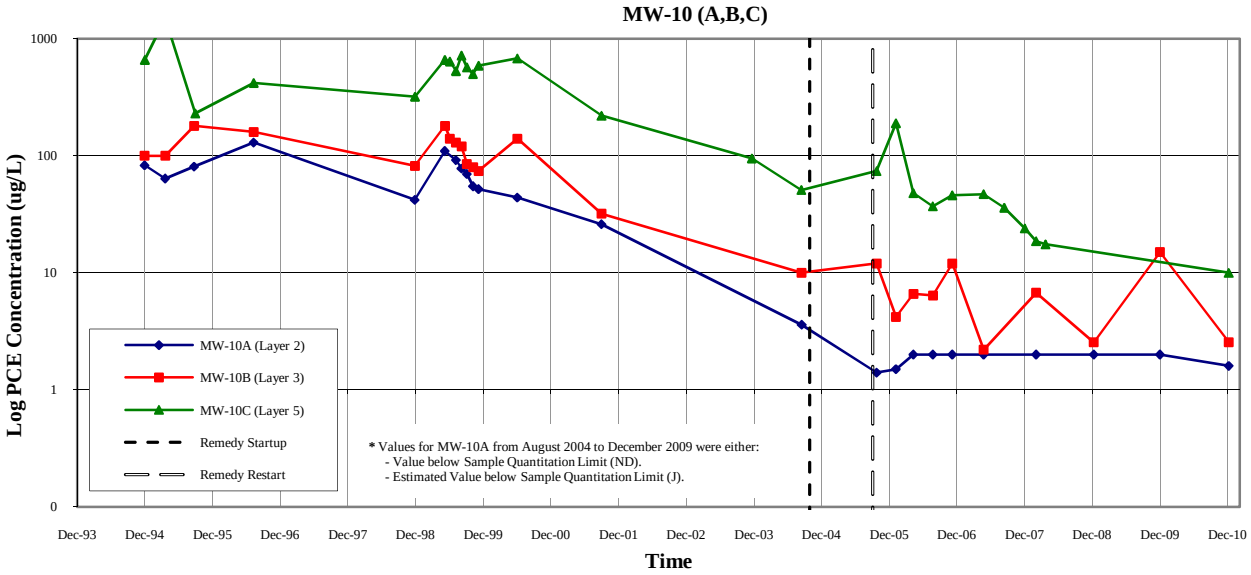
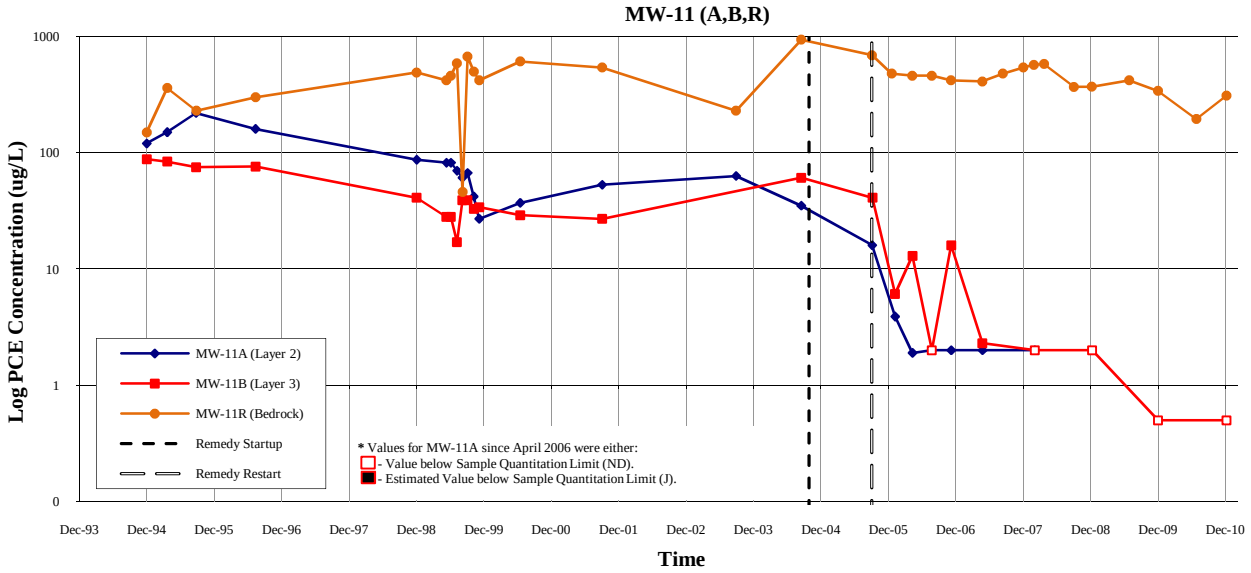


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH





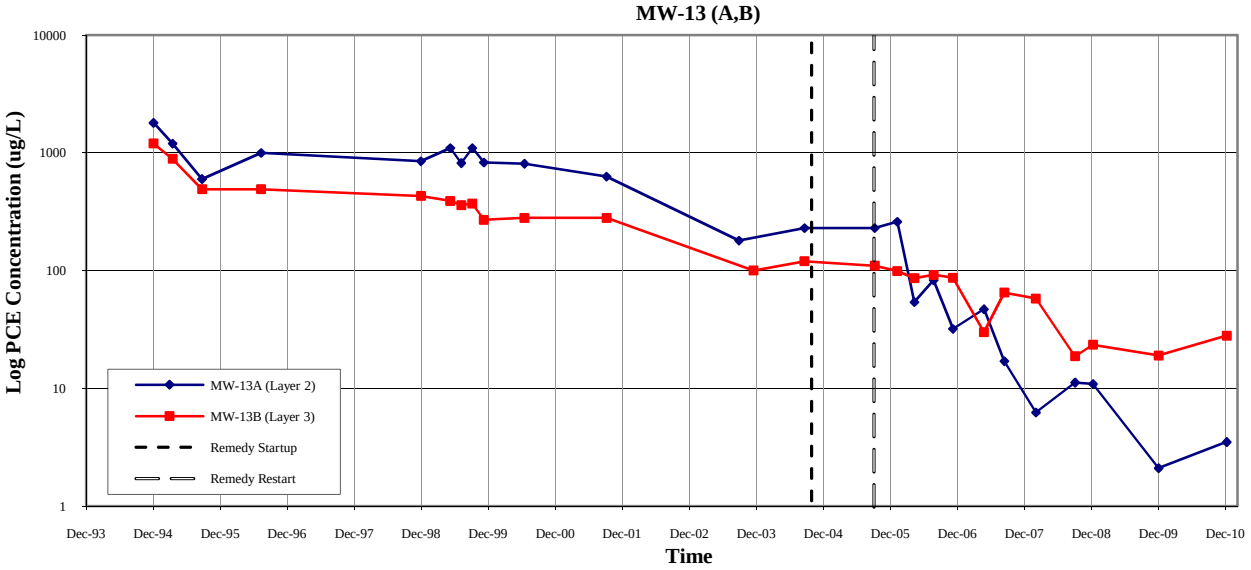


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

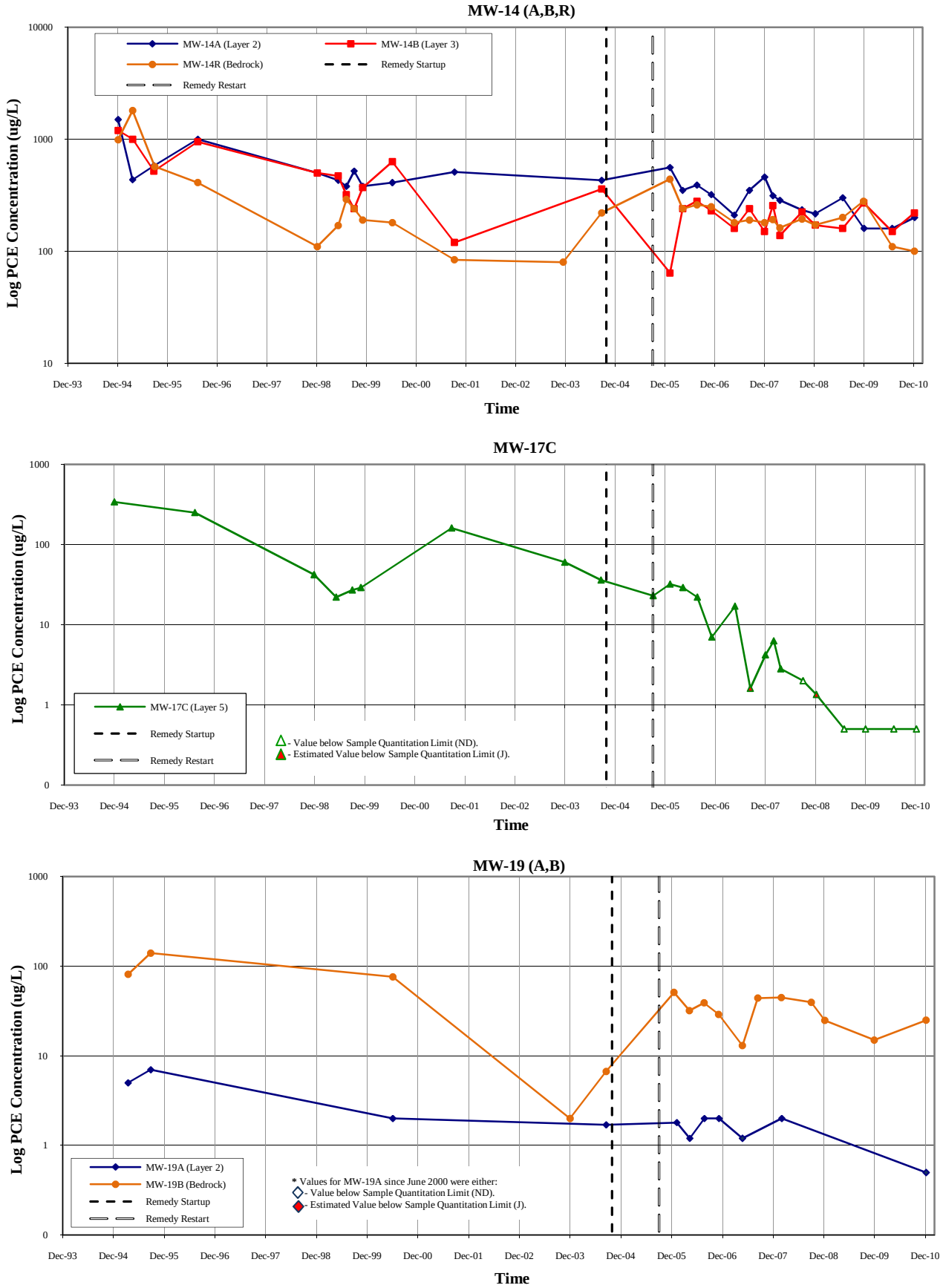
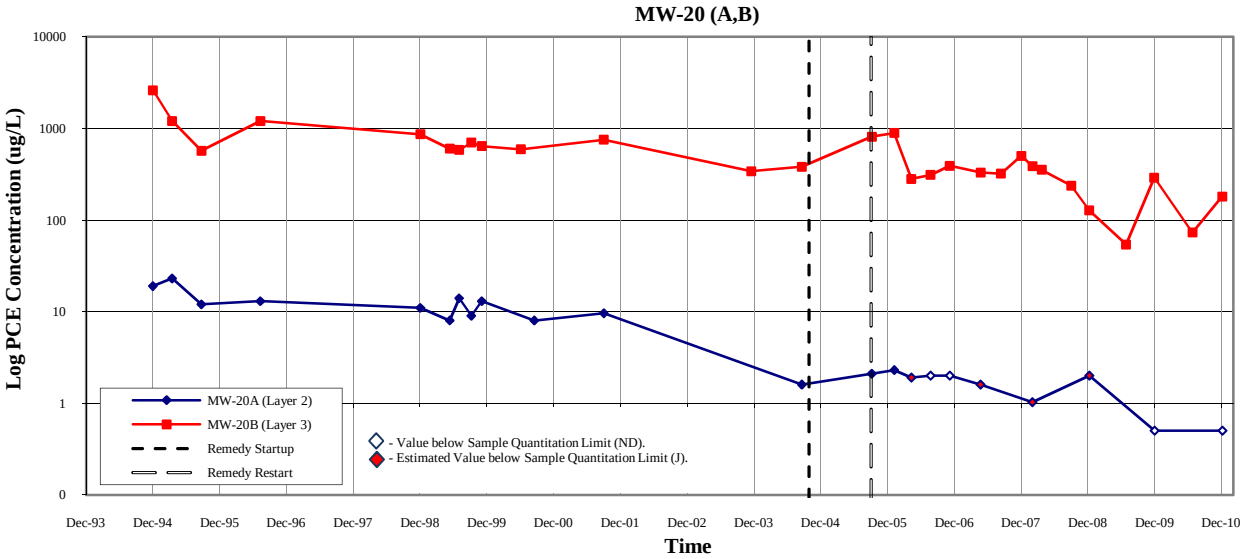
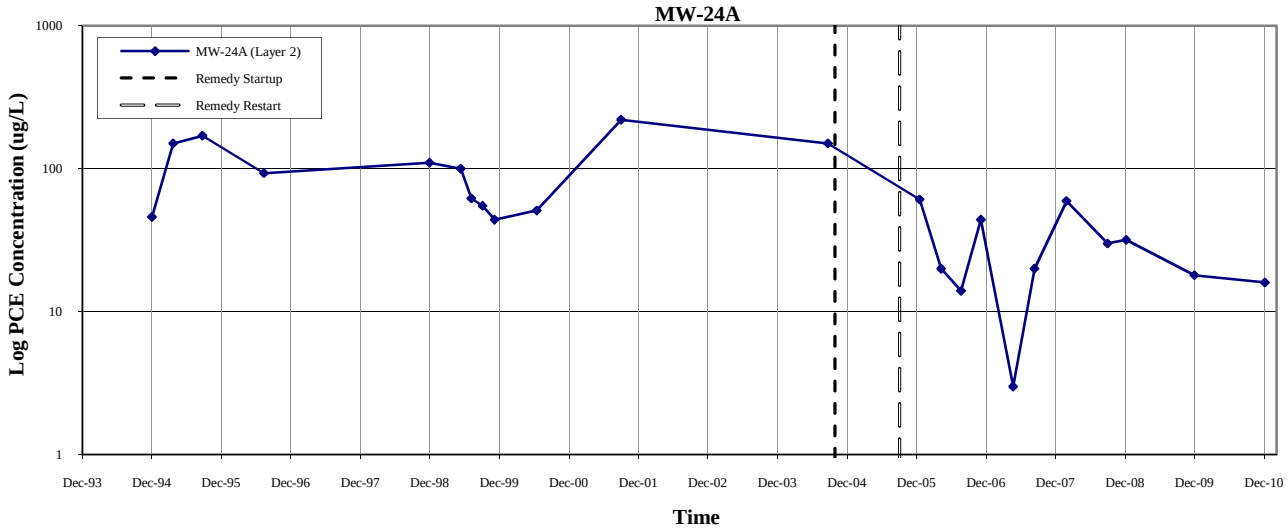


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH





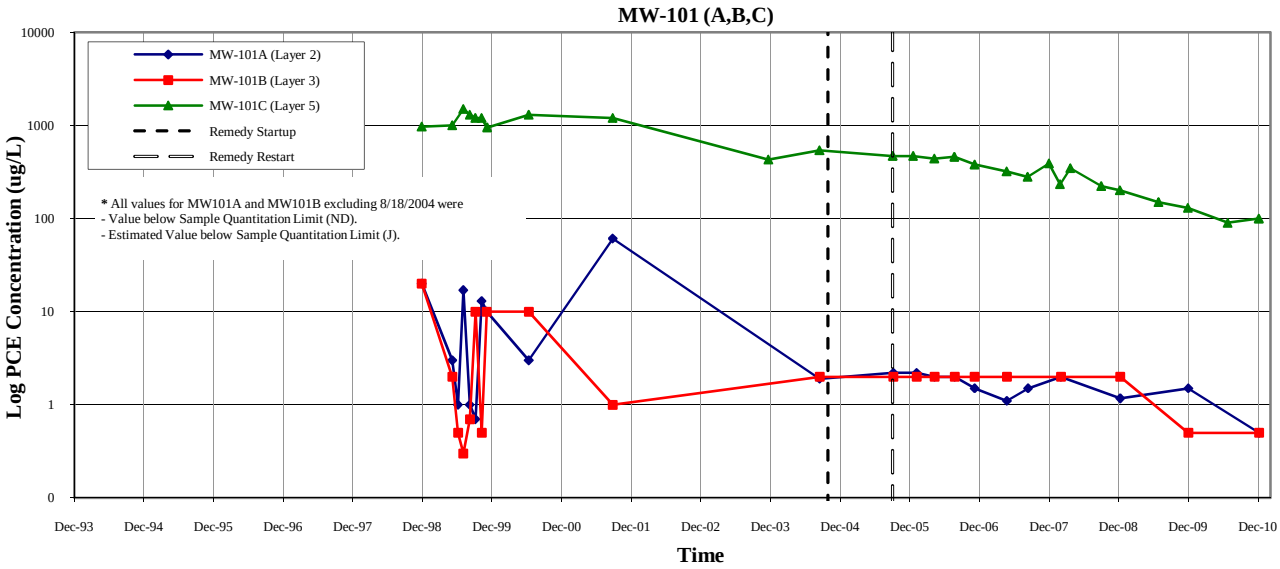


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

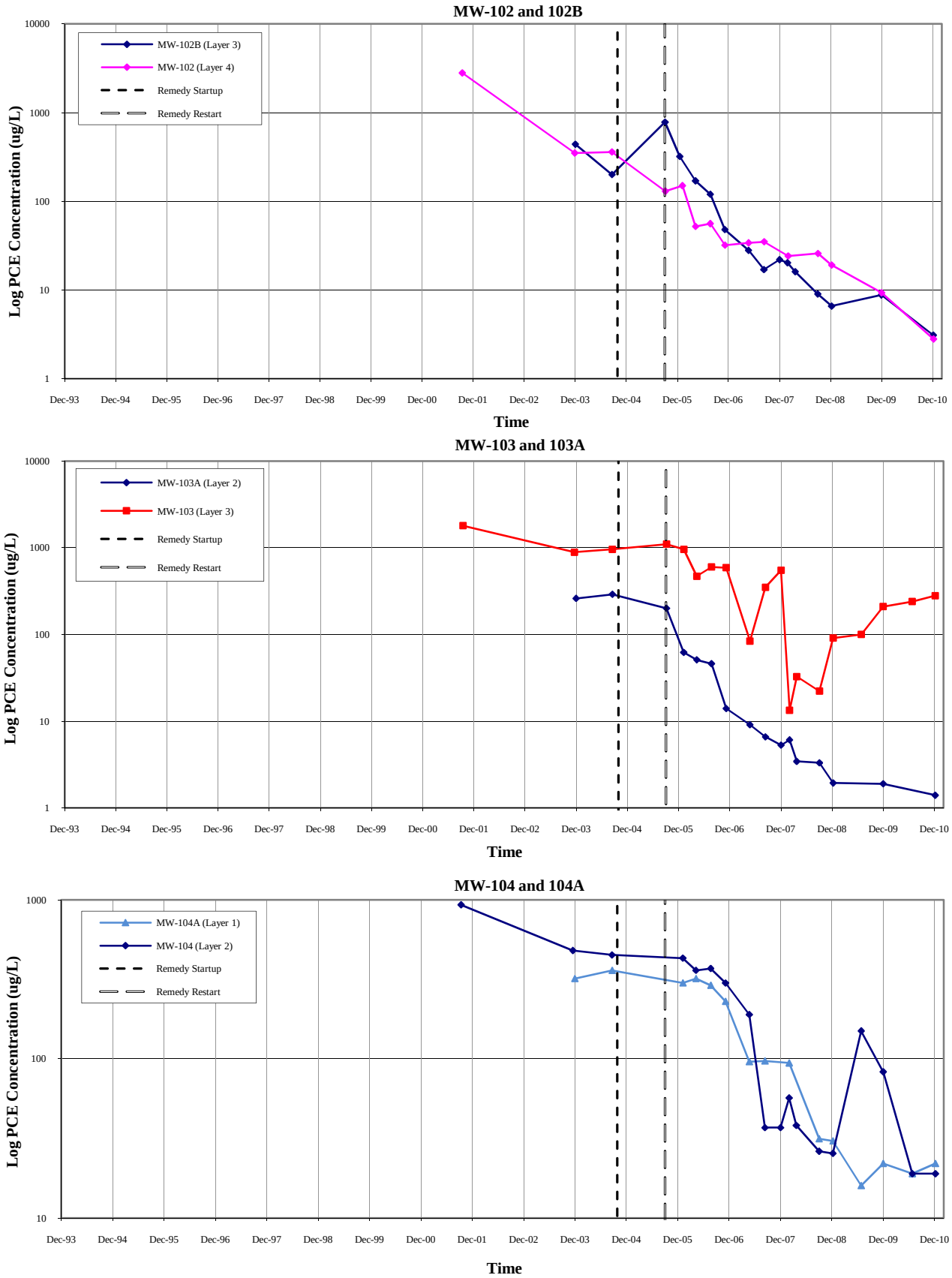


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

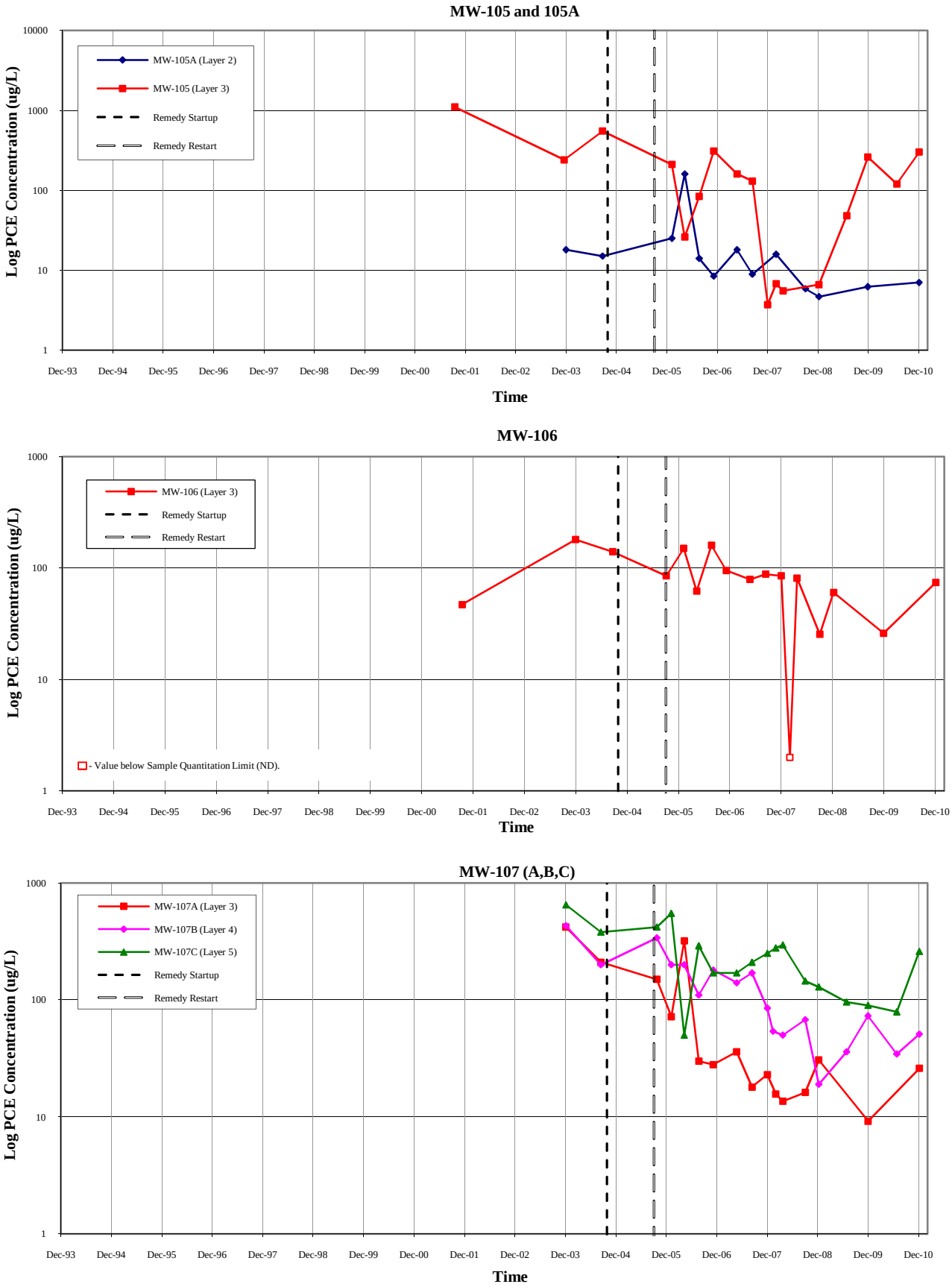


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

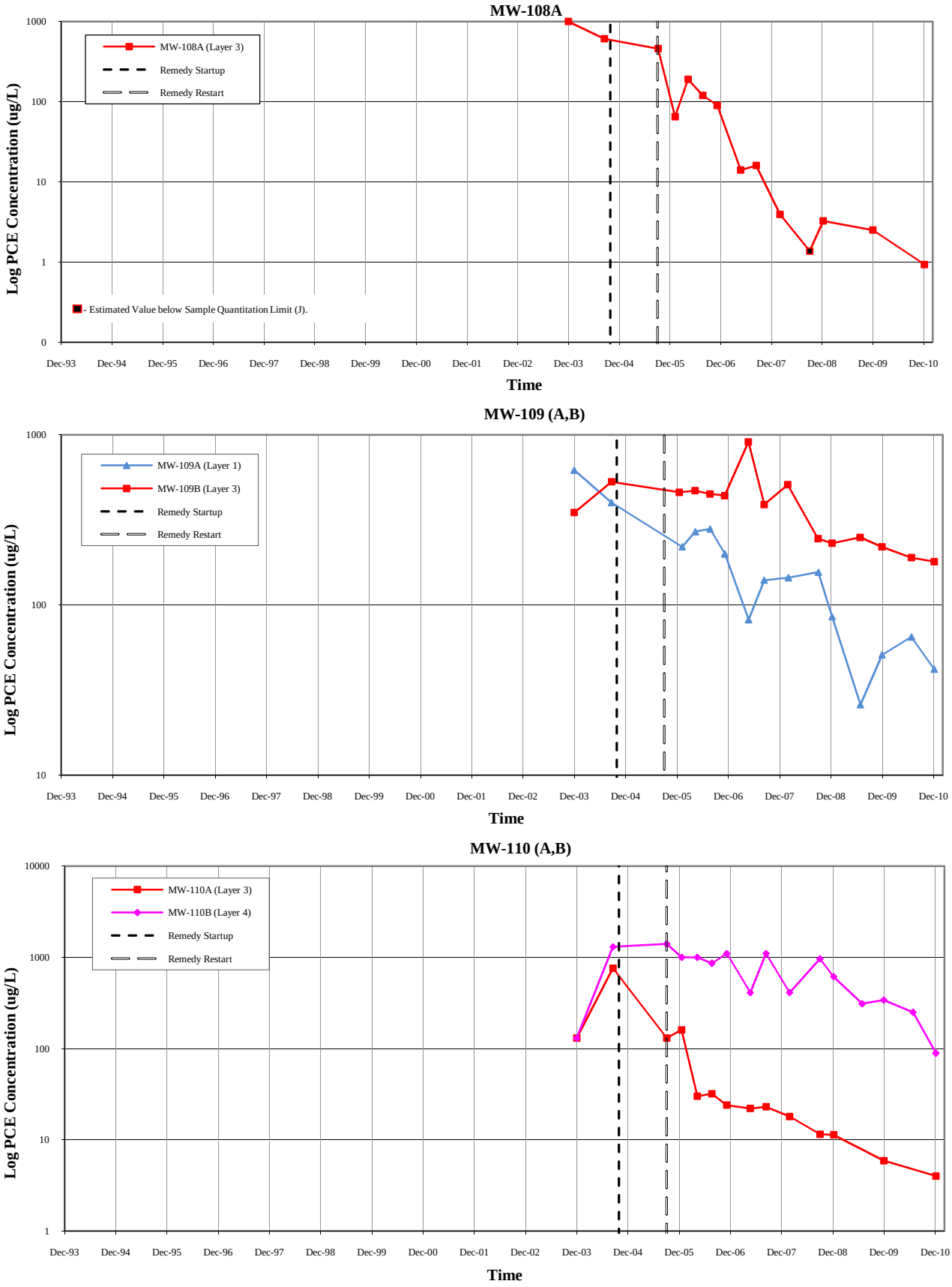


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

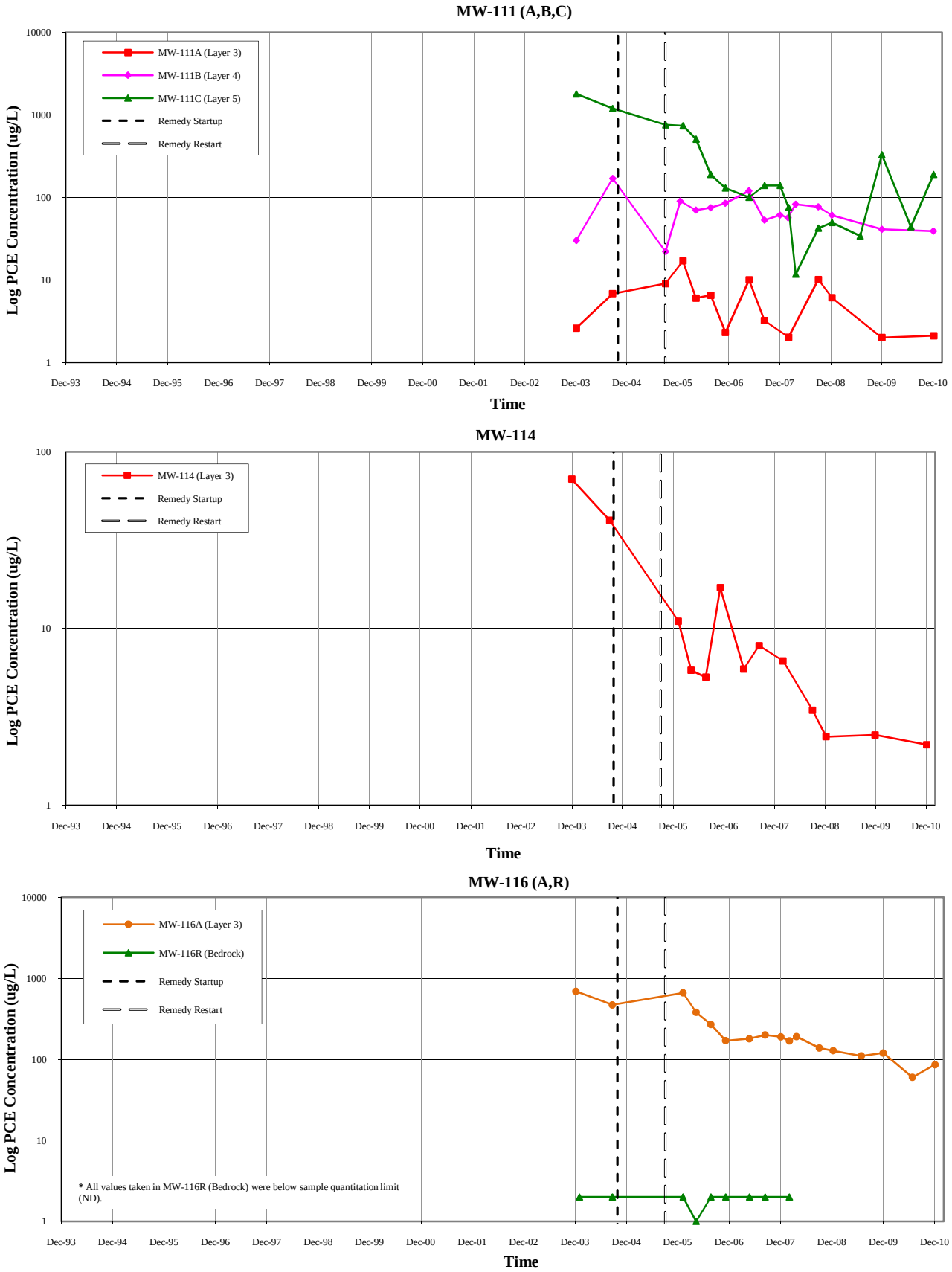


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

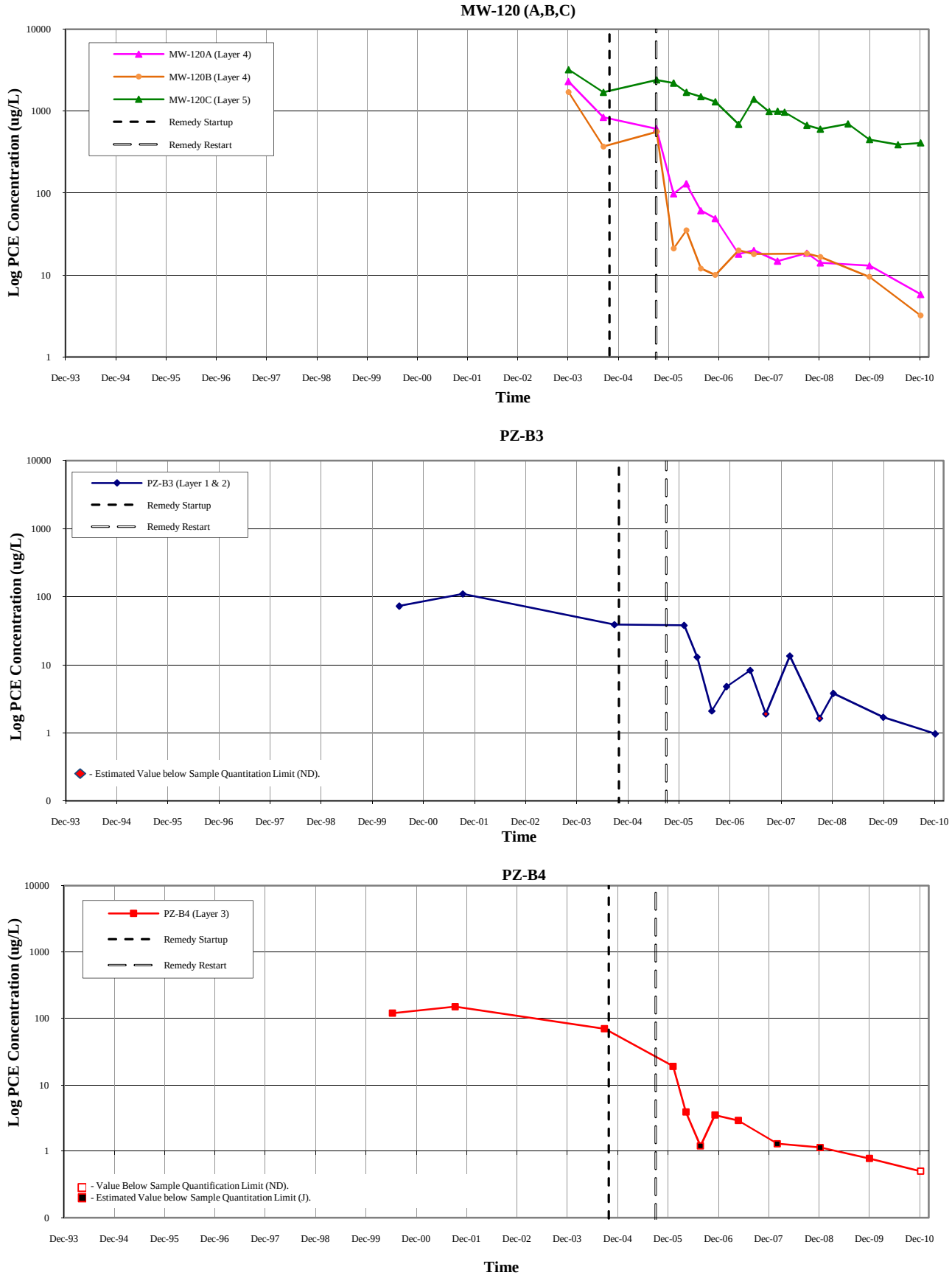


Figure 3.15
PCE Concentration *versus* Time for Select Monitoring Wells
Savage Well Superfund Site, Milford, NH

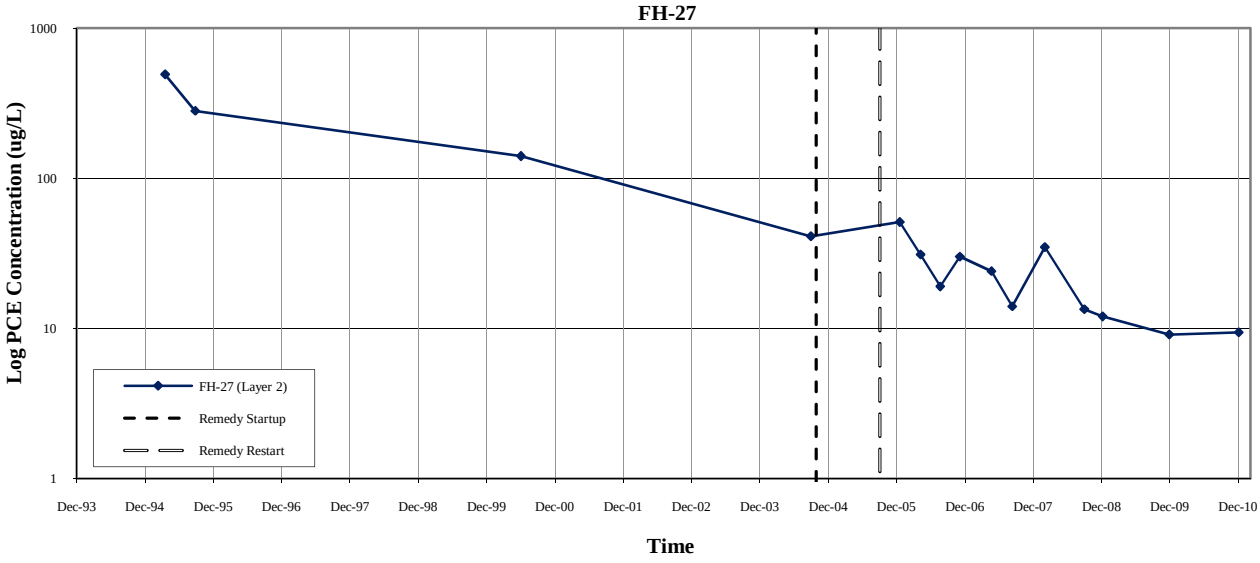


Figure 3.16
PCE Concentration versus Time for Extraction Wells
Savage Well Superfund Site, Milford, NH

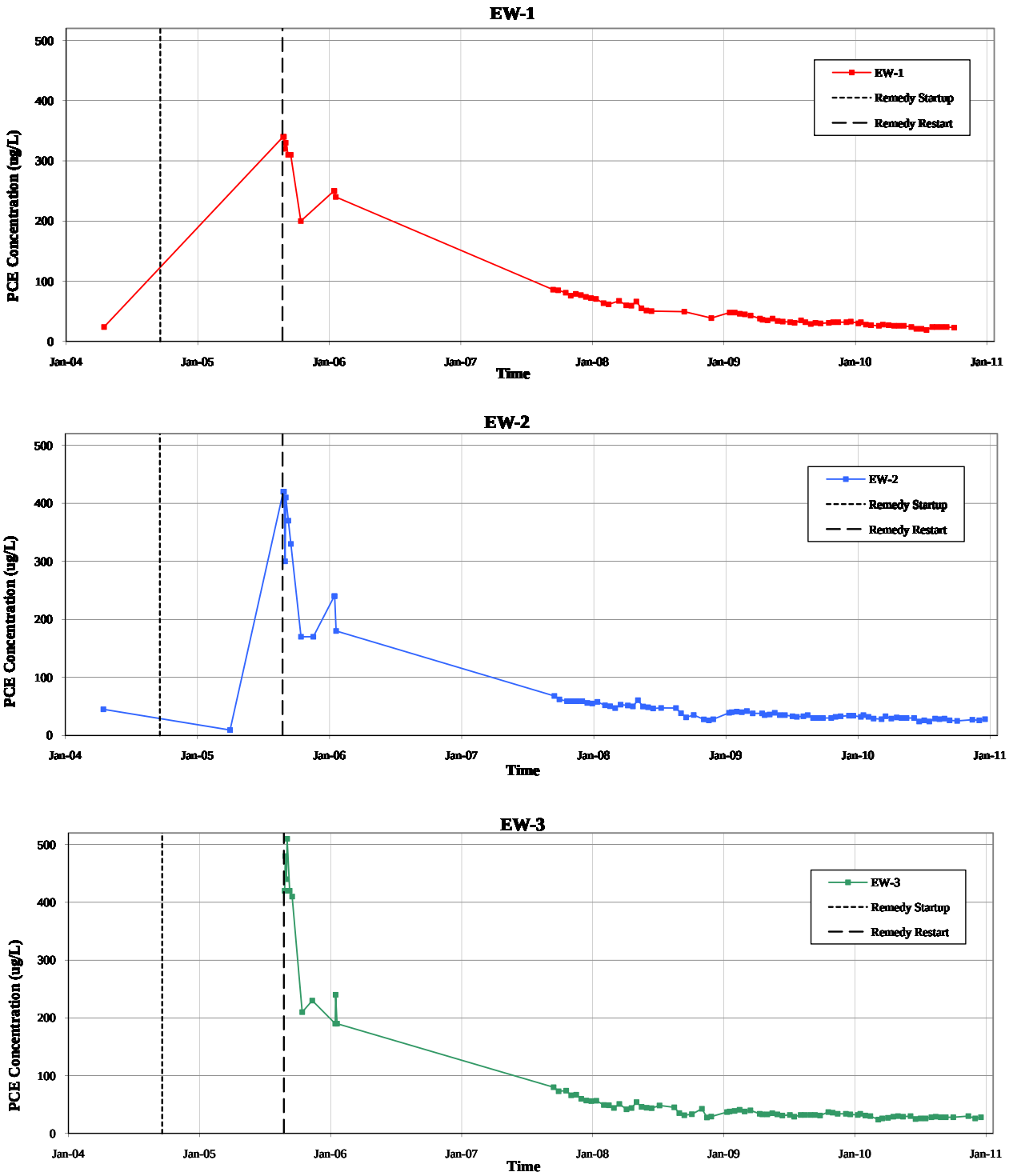
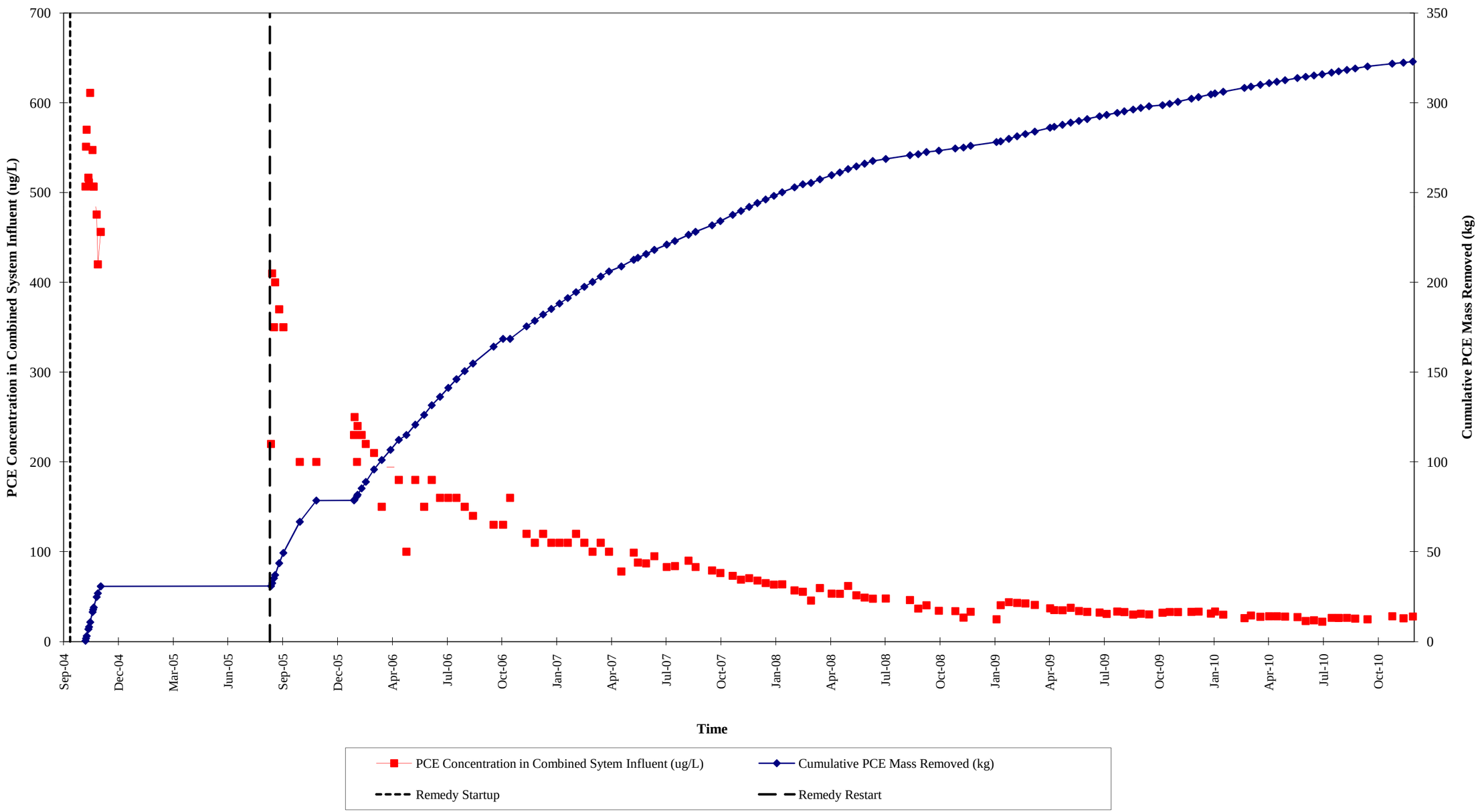
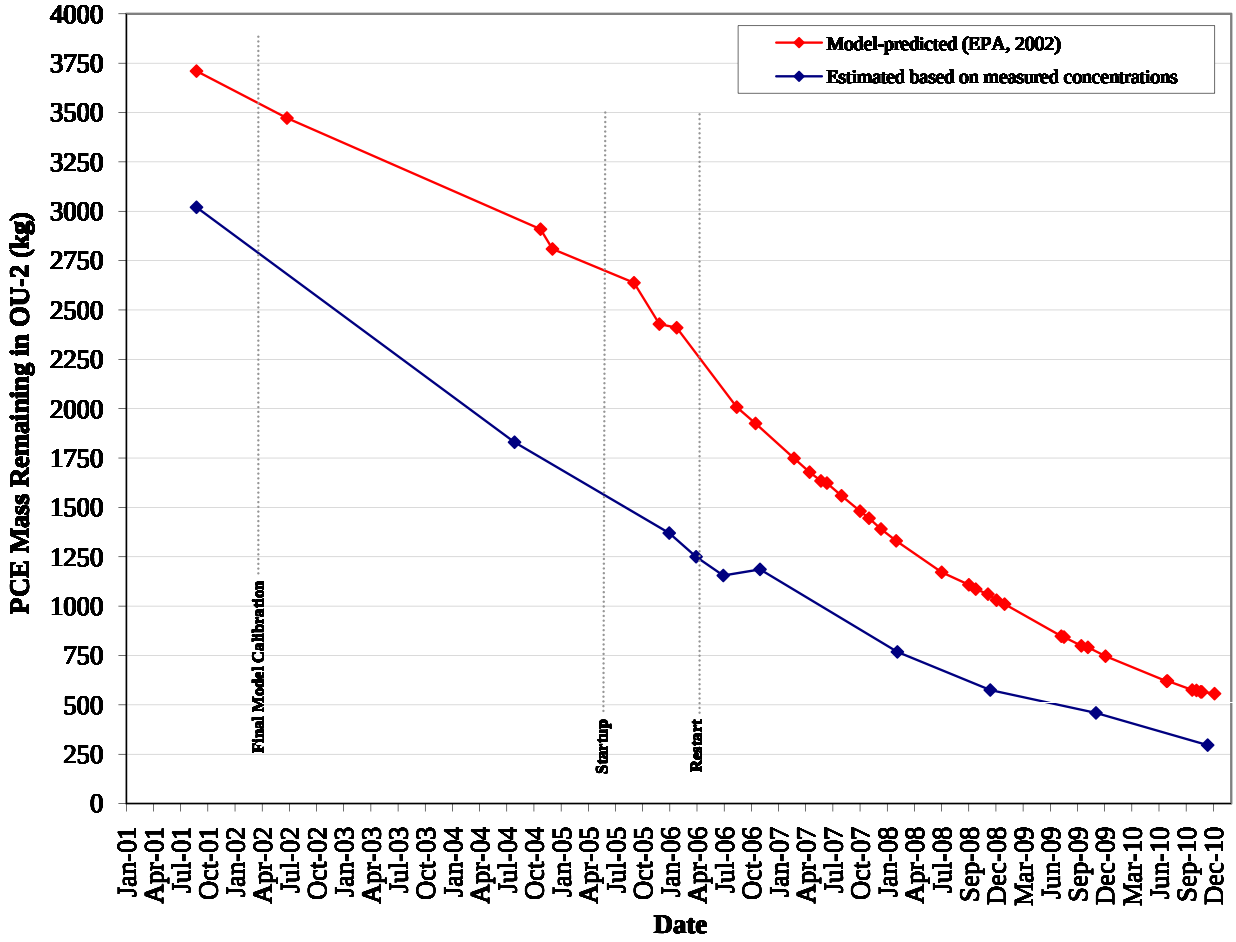


Figure 3.17
PCE Concentration in Combined Influent and Cumulative Estimated PCE Mass Removed
Savage Well Superfund Site, Milford, NH



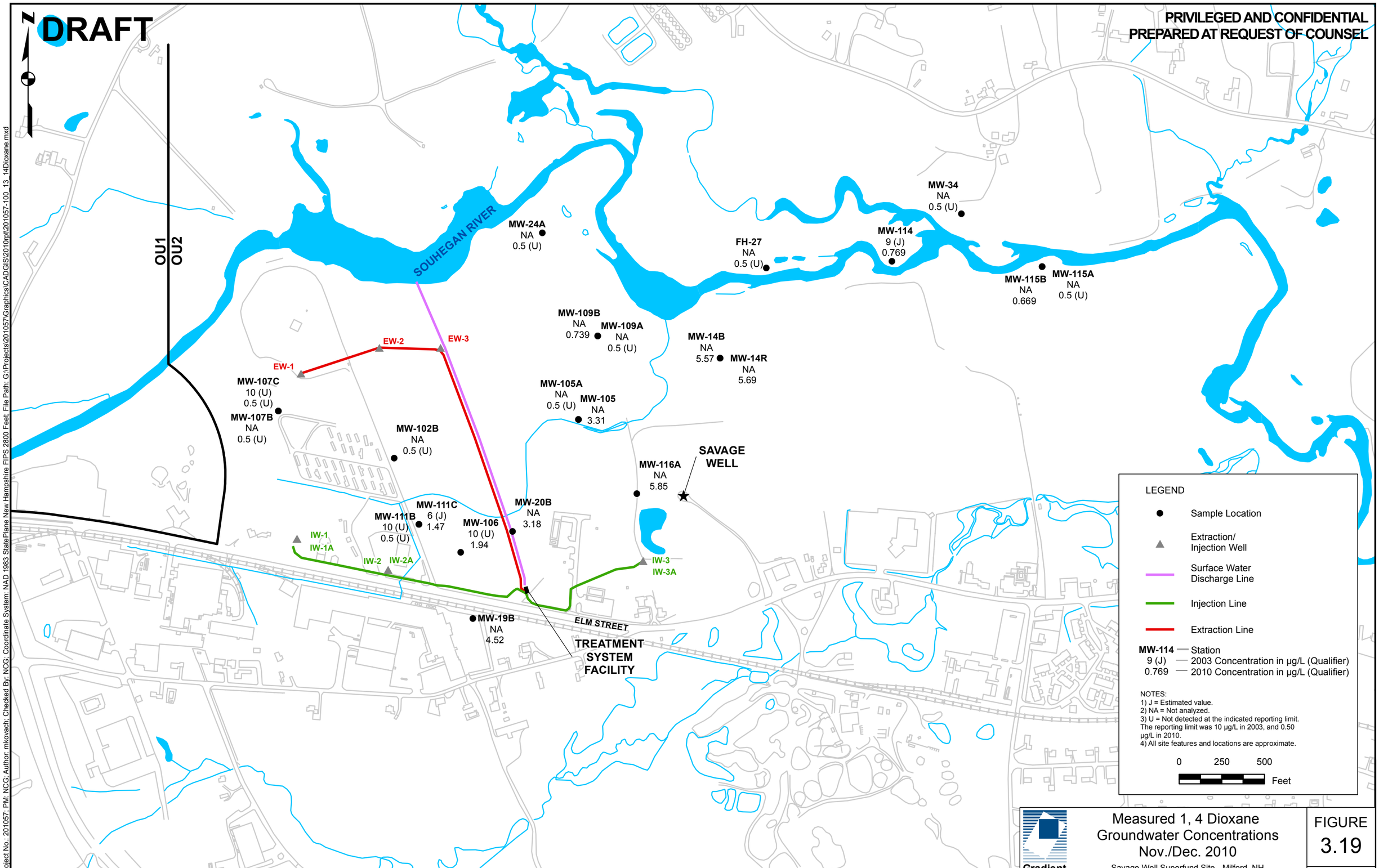
Notes:
1. PCE mass removal was calculated using combined influent concentrations measured every two weeks. The average influent concentration (mg/L) between two sampling events was used in conjunction with the total volume of water extracted during this period (L) to obtain the total PCE mass removed (mg) during this period.

Figure 3.18
Comparison of Model-Predicted *versus* Estimated PCE Mass Remaining in OU-2
Savage Well Superfund Site, Milford, NH



Notes:

1. *The 2001 estimated mass remaining in the aquifer (measurements) was based on plume contour maps presented in Figures 2-5 and 2-6 of the RDIR (US EPA, 2002). The 2004 estimated mass was based on contour maps presented in Figures 3-2 through 3-5 of the Baseline GW Monitoring Report (MACTEC, 2005). Mass estimates for other events are presented in 2006 quarterly reports 1 through 4 (January 2006 - November 2006) and this 2007 Annual Report. The September 2005 event consisted of a reduced well set that provided insufficient data for estimating mass remaining in the aquifer.*


DRAFT
PRIVILEGED AND CONFIDENTIAL
PREPARED AT REQUEST OF COUNSEL
N
OU1
OU2
SOUHEGAN RIVER
MW-24A
NA
0.5 (U)
FH-27
NA
0.5 (U)
MW-114
9 (J)
0.769
MW-34
NA
0.5 (U)
MW-115B
NA
0.669
MW-115A
NA
0.5 (U)
MW-109B
NA
0.739
MW-109A
NA
0.5 (U)
MW-14B
NA
5.57
MW-14R
NA
5.69
EW-1
EW-2
EW-3
MW-107C
10 (U)
0.5 (U)
MW-107B
NA
0.5 (U)
MW-105A
NA
0.5 (U)
MW-105
NA
3.31
MW-102B
NA
0.5 (U)
MW-116A
NA
5.85
SAVAGE
WELL
MW-111C
6 (J)
1.47
MW-111B
10 (U)
0.5 (U)
MW-106
10 (U)
1.94
MW-20B
NA
3.18
IW-1
IW-1A
IW-2
IW-2A
IW-3
IW-3A
MW-19B
NA
4.52
ELM STREET
TREATMENT
SYSTEM
FACILITY
LEGEND
Sample Location
Extraction/
Injection Well
Surface Water
Discharge Line
Injection Line
Extraction Line
MW-114 — Station
9 (J) — 2003 Concentration in µg/L (Qualifier)
0.769 — 2010 Concentration in µg/L (Qualifier)
NOTES:
1) J = Estimated value.
2) NA = Not analyzed.
3) U = Not detected at the indicated reporting limit.
The reporting limit was 10 µg/L in 2003, and 0.50 µg/L in 2010.
4) All site features and locations are approximate.
0
250
500
Feet
Gradient
Measured 1, 4 Dioxane
Groundwater Concentrations
Nov./Dec. 2010
Savage Well Superfund Site - Milford, NH
FIGURE
3.19
Date: 4/1/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CAD\GIS\2010\rpt\201057-100_13_14Dioxane.mxd

APPENDIX A

FIELD NOTES

Appendix A not included in this copy of the document.

APPENDIX B

DATA VALIDATION

Appendix B not included in this copy of the document.

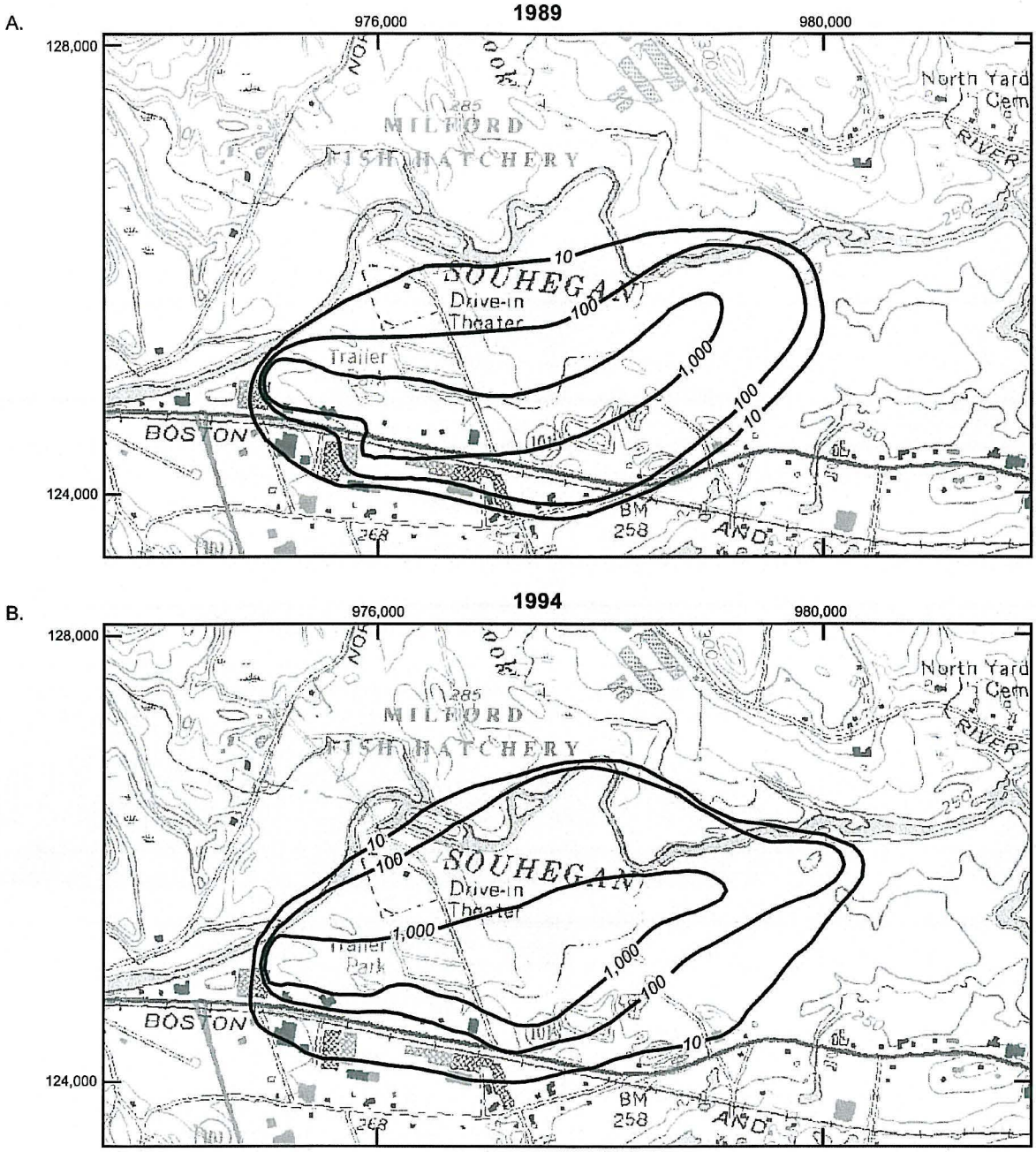
APPENDIX C

EDRS

Appendix C not included in this copy of the document.

APPENDIX D

PCE CONCENTRATION ISOPLETHS OVER TIME



Base from U.S. Geological Survey
Milford, N.H., 1:24,000, 1968, photorevision as of 1985
4,000-foot grid based on New Hampshire State Plane
coordinate system - NAD83

0 1,000 2,000 FEET
0 200 400 METERS

EXPLANATION

—10— Contour of PCE concentration, in parts per billion

Figure 4. Contours of maximum tetrachloroethylene (PCE) concentrations in (A) 1989, and (B) 1994, in the Savage Municipal Well Superfund site, Milford, N.H.

SOURCE: USGS, 2004.

Gradient

Max PCE Concentrations in 1989 and 1994

Savage Well Superfund Site - Milford, NH

FIGURE D.1

Date: 05/13/2011

File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057_100-02_Dfigs.DWG

Coordinates System:

Checked By: NCG

Drawn By: MMJ

PM: NCG

Project No.: 201057

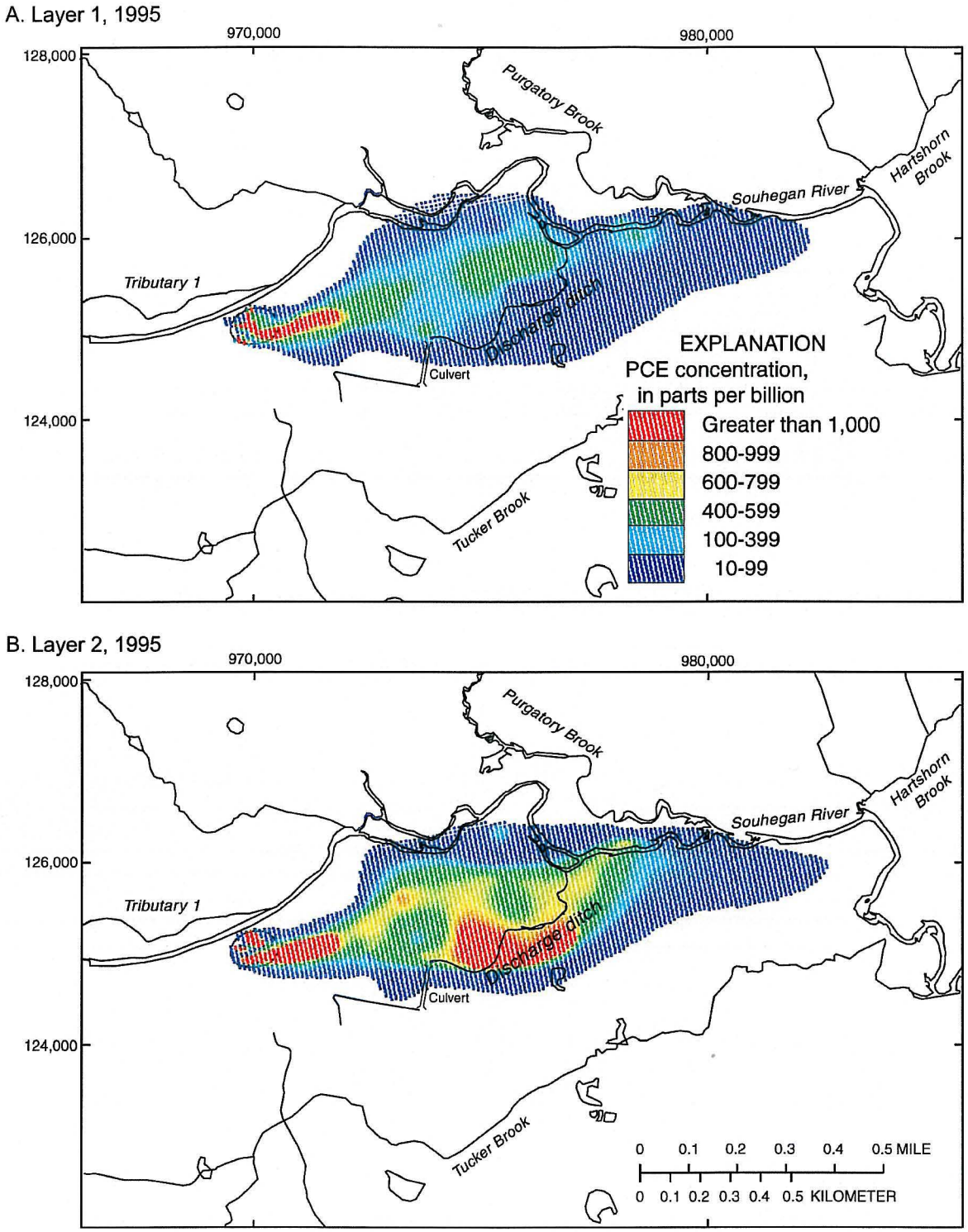


Figure 7. Contours of mean tetrachloroethylene (PCE) concentrations in model layers (A) 1 and (B) 2 as of 1995, Savage Municipal Well Superfund site, Milford, N.H.

SOURCE: USGS, 2004.

Gradient

Average PCE Concentrations in Layers 1 & 2 [1995]

Savage Well Superfund Site - Milford, NH

FIGURE D.2

Date: 05/13/2011

File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057_100-02_Dfigs.DWG
Coordinates System:
Checked By: NCG
Drawn By: MMJ
PM: NCG
Project No.: 201057

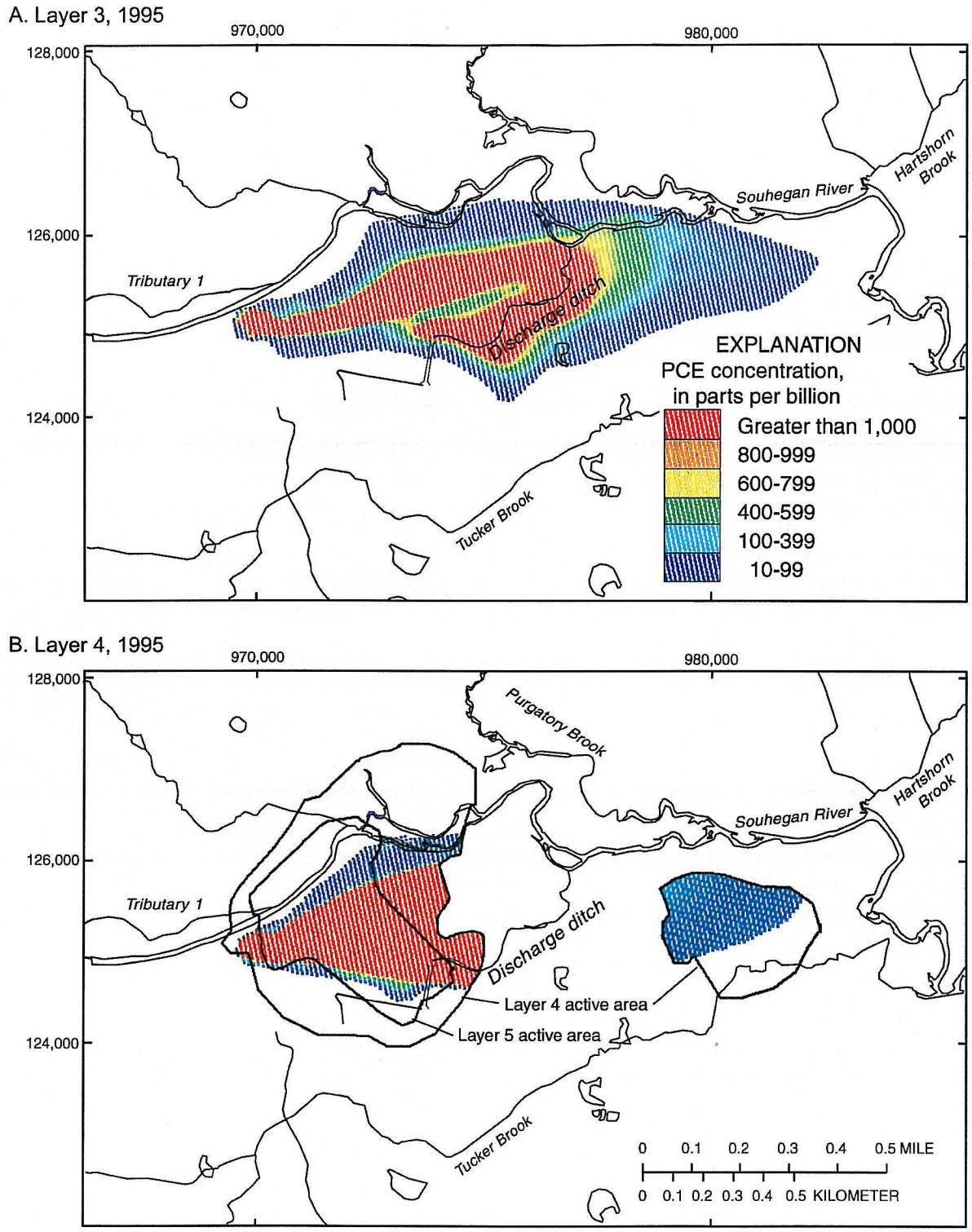


Figure 8. Contours of mean tetrachloroethylene (PCE) concentrations in model layers (A) 3 and (B) 4 as of 1995, Savage Municipal Well Superfund site, Milford, N.H.

SOURCE: USGS, 2004.

Gradient

Average PCE Concentrations in Layers 3 & 4 [1995]

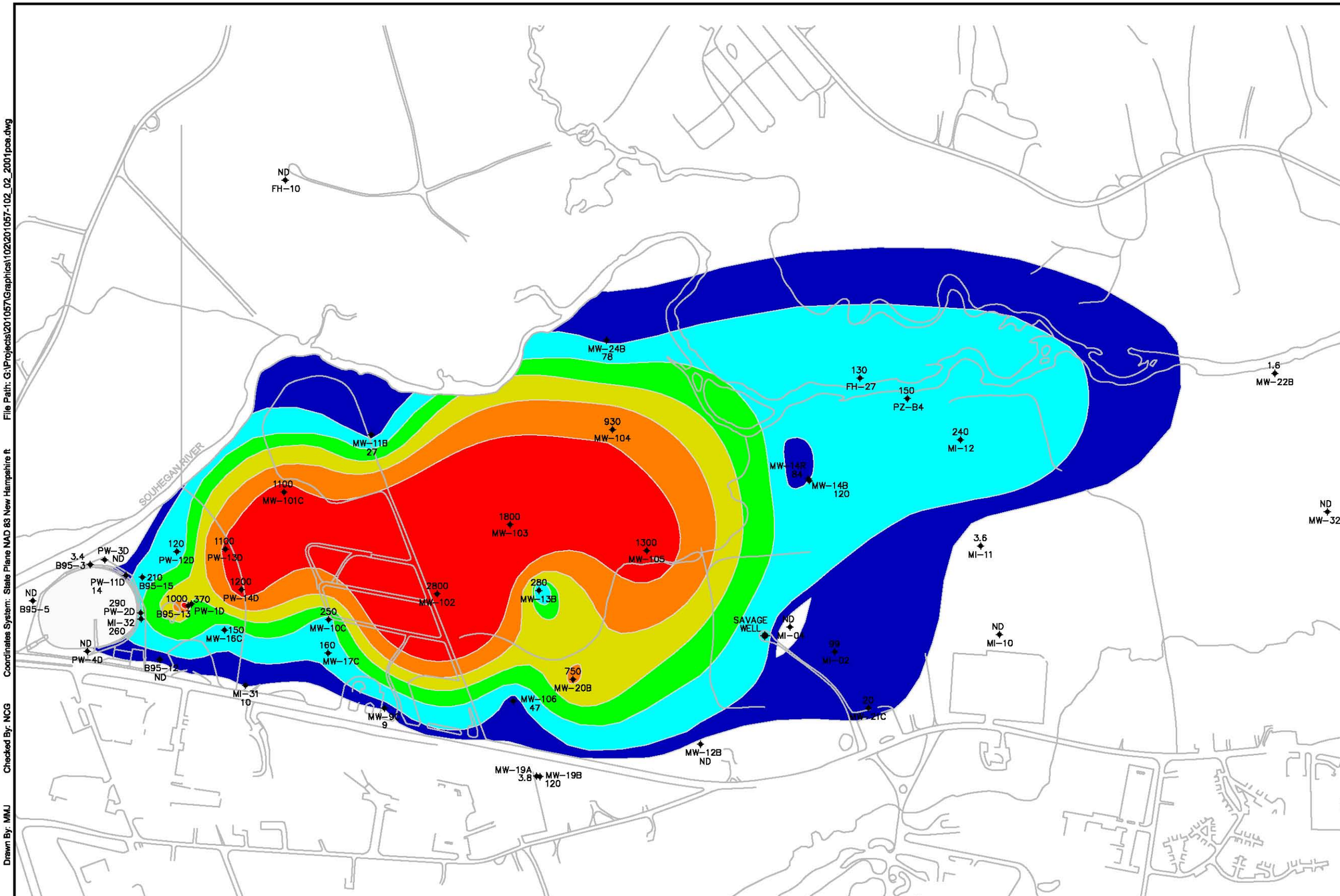
Savage Well Superfund Site - Milford, NH

FIGURE D.3

Date: 05/13/2011

File Path: G:\Projects\201057\Graphics\CADGIS\2010rpt\201057_100-02_Dfigs.DWG

Project No.: 201057 PM: NCG Drawn By: MMJ Checked By: NCG Coordinates System:



LEGEND

1.4
MW-22A
MEASURED PCE CONCENTRATIONS IN GROUNDWATER (µg/L)

MEASURED 2001 PCE CONCENTRATIONS (µg/L)

- 1000
- 700
- 500
- 300
- 100
- 5

ND = NOT DETECTED

NOTES:

1) OU1 LOCATIONS SAMPLED IN JUNE 2001. OU2 LOCATIONS SAMPLED IN SEPTEMBER 2001.

2) CONCENTRATION ISOPLETHS WERE CREATED USING THE KRIGING APPROACH; ISOPLETH ACCURACY IS STRONGLY DEPENDENT ON AVAILABLE DATA DENSITY.

3) THE SHALLOW AQUIFER IS DEFINED BY THE SHALLOWEST WELL AT EACH WELL CLUSTER. THE DEEP AQUIFER IS DEFINED BY THE DEEPEST WELL AT EACH WELL CLUSTER. IN CASES WHERE A THIRD WELL EXISTS, LOCATED BETWEEN THE SHALLOW AND DEEP WELL, IT WAS NOT CONSIDERED AS PART OF THIS ANALYSIS.

4) MONITORING WELL MW-19B IS A BEDROCK WELL WITH A MEASURED 2001 PCE CONCENTRATION OF 120 µg/L.

N

APPROX. SCALE IN FEET
0 250 500

Gradient

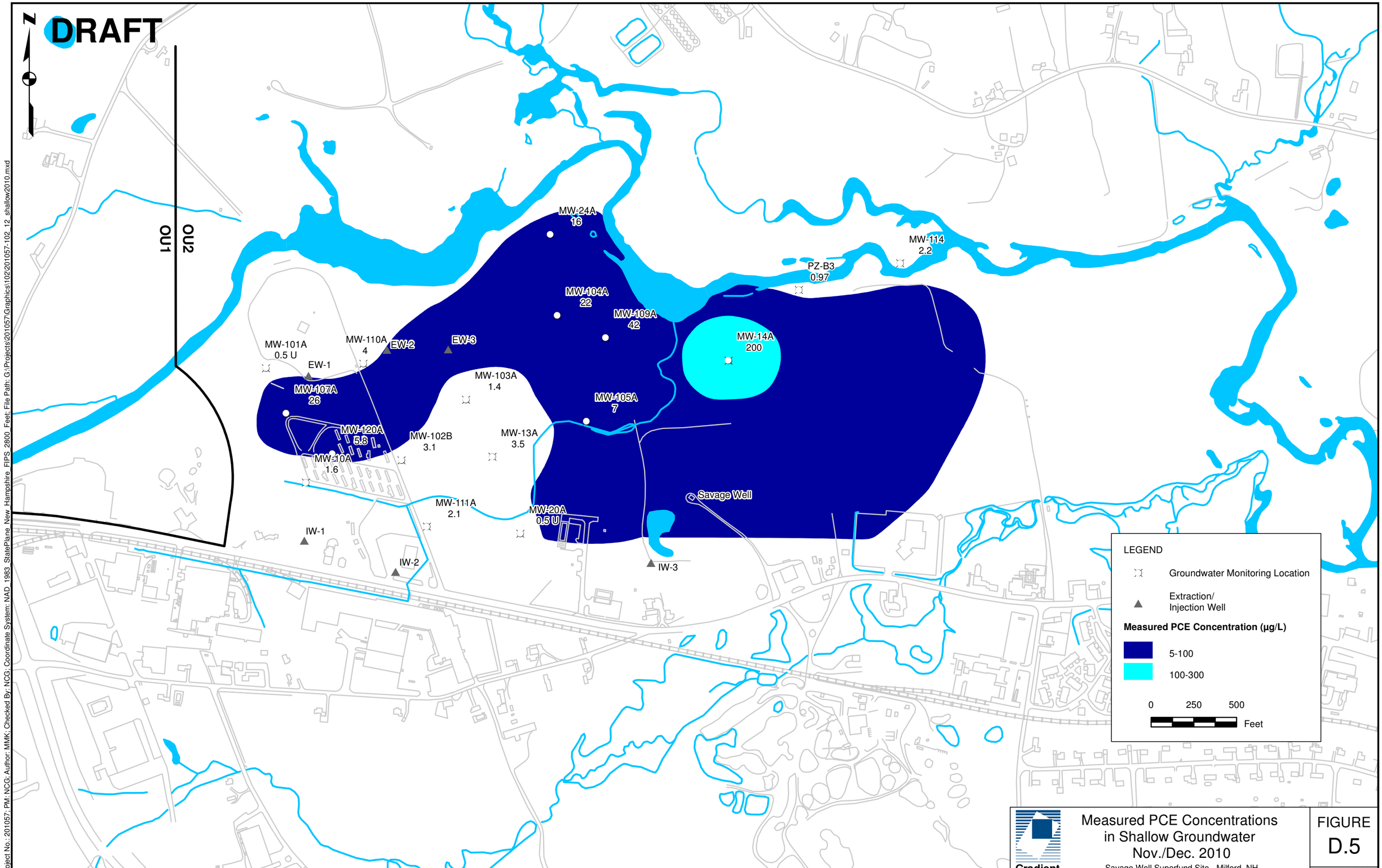
Measured 2001 PCE Groundwater Concentrations - Deep Aquifer

Savage Well Superfund Site - Milford, NH

FIGURE
D.4

Date: 05/13/2011

Project No.: 201057 PM: NCG Drawn By: MMJ Checked By: NCG Coordinates System: State Plane NAD 83 New Hampshire ft. File Path: G:\Projects\201057\Graphics\102\201057-102_02_2001pce.dwg


DRAFT
N
OU1
OU2
MW-24A
16
MW-104A
22
MW-109A
42
MW-14A
200
PZ-B3
0.97
MW-114
2.2
MW-101A
0.5 U
EW-1
MW-110A
4
EW-2
EW-3
MW-107A
26
MW-103A
1.4
MW-105A
7
MW-120A
5.8
MW-102B
3.1
MW-13A
3.5
MW-10A
1.6
MW-111A
2.1
MW-20A
0.5 U
Savage Well
IW-1
IW-2
IW-3
LEGEND
Groundwater Monitoring Location
Extraction/
Injection Well
Measured PCE Concentration (µg/L)
5-100
100-300
0
250
500
Feet
Gradient
Measured PCE Concentrations
in Shallow Groundwater
Nov./Dec. 2010
Savage Well Superfund Site - Milford, NH
FIGURE
D.5
Date: 5/13/2011
Project No.: 201057; PM: NCG; Author: MMK; Checked By: NCG; Coordinate System: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet; File Path: G:\Projects\201057\Graphics\102\201057-102_12_shallow2010.mxd

APPENDIX E

PCE MASS CALCULATIONS

PCE Mass Remaining Calculation for December 2010 -- OU-2

Savage Well Superfund Site, Milford, NH

Layer	PCE Conc. (ug/L)		Average Area (ft^2)	Thickness (ft)	Volume (ft^3)	Volume (L)	PCE Mass (kg)	PCE Mass Total (kg)
	Range	Average						
1	250-500	375	0	15	0	0	0.00	26
	50-250	150	219,299		3,289,481	93,144,930	8.38	
	5-50	27.5	2,396,089		35,941,329	1,017,714,672	16.79	
2	250-500	375	0	20	0	0	0.00	42
	50-250	150	219,299		4,385,974	124,193,240	13.97	
	5-50	27.5	2,396,089		47,921,772	1,356,952,896	27.99	
3	250-500	375	41,541	20	830,820	23,525,499	5.29	124
	50-250	150	2,126,822		42,536,444	1,204,461,948	108.40	
	5-50	27.5	1,089,980		21,799,601	617,277,491	10.19	
4	250-500	375	0	20	0	0	0.00	81
	50-250	150	1,192,020		23,840,398	675,064,710	75.94	
	5-50	27.5	407,408		8,148,158	230,723,242	4.76	
5	250-500	375	73,391	7.5	550,435	15,586,110	3.51	23
	50-250	150	943,700		7,077,747	200,413,497	18.04	
	5-50	27.5	165,122		1,238,418	35,067,044	0.58	
							Total PCE Mass Remaining (kg):	**296**

Notes:

*1. Total PCE Mass = PCE Groundwater Concentration * Retardation Factor (R) * Porosity (n) * Subsurface Volume*

2. Porosity (n) = 0.3

3. Retardation Factor (R) = 2 (Layers 1,3, and 5) and 2.5 (Layers 2 and 4); based on Remedial Design Investigation Report (US EPA, 2002).

APPENDIX F

FALL 2010 MONITORING PLAN

Gradient

December 13, 2010

Mr. Richard W. Hull
Remedial Project Manager
NH/RI Superfund Section
US Environmental Protection Agency (US EPA)
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: Revised Proposed Fall 2010 Annual Groundwater Quality Monitoring Plan
Savage Well Superfund Site, Operable Unit-2 (OU-2)

Dear Mr. Hull:

On behalf of Hitchiner Manufacturing Company, Inc. and Thomas & Betts Corporation (Settling Parties), Gradient is submitting this revised scope for the annual groundwater quality monitoring program to be implemented at the OU-2 portion of the Savage Well Superfund Site located in Milford, New Hampshire ("Site"). The scope of the annual sampling program, planned for the Fall of this year (November/December), has been expanded based on US EPA's request due to the upcoming 5 Year Remedy Review to be undertaken for the Site in 2011. This revision addresses and incorporates US EPA's comments provided to the Settling Parties in its November 4, 2010 conditional approval letter.

The expanded groundwater quality monitoring scope was developed in response to US EPA comments (US EPA, 2010)[1] and a meeting held on April 16, 2010 with US EPA, NH DES, and USGS representatives to discuss these comments. A total of 13 monitoring wells have been added to the "typical" annual monitoring well network – bringing the total number of monitoring wells to be monitored in the Fall to 64 (Table 1 and Figure 1). Groundwater samples from all monitoring wells will be analyzed for volatile organic compounds (VOCs), while a subset of 21 wells will be analyzed for 1,4-dioxane using the previously approved field sampling and quality assurance plans for the Site. The proposed well monitoring network is comprehensive, and these data together with the quarterly and/or semi-annual groundwater quality monitoring data collected in the approximately 5 years since the OU-2 remedy became operational will provide the data needed to assess the effectiveness of the remedy.

The following paragraphs provide a brief discussion and rationale for the expanded groundwater quality program.

1,4 Dioxane

In Fall 2009, in response to a request from NH DES, the influent and effluent to the groundwater treatments system and groundwater samples from 17 monitoring wells were collected and analyzed for 1,4-dioxane – a solvent stabilizer for which an ambient groundwater quality standard (AGQS) has been developed by NH DES. The 2009 sampling results indicated that low levels of 1,4-dioxane are present in OU-2, concentrations are declining temporally (compared to 2003), and 1,4-dioxane is not present in the influent or effluent associated with the groundwater treatment system. Although the detected 1,4-dioxane concentrations were low (maximum of 9 µg/l), concentrations at 5 wells exceeded the AGQS (3 µg/l). The highest 1,4-dioxane concentration was detected near (south of) the

[1] US EPA. 2010. Email from Mike Jasinski to Manu Sharma, Re: Request for Conference Call in March to discuss Savage OU2 Monitoring Program. February 25.

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Souhegan River (Figure 2). Consequently, US EPA and NH DES have requested that 1,4-dioxane analyses be conducted in additional wells located north of the Souhegan River to define the northern extent of the plume. Therefore, as part of the Fall 2010 sampling event, groundwater samples will be obtained from 21 monitoring wells (17 wells sampled in Fall 2009[2] and 4 additional wells: FH-27, MW-34, MW-115A, MW-115B) for 1,4-dioxane analysis (Table 1 and Figure 2). These samples will also be analyzed for VOCs.

Northern Portion of the Plume

New residential homes, with private wells, have been constructed along North River Road in recent years. Although the homes are a considerable distance (on the order of 1,000 to 2,000 feet) away from the OU-2 plume, hydraulically upgradient of the plume, and the private wells are screened in deep bedrock (no contamination has been detected in deep bedrock at OU-2), US EPA has requested that monitoring wells along the northern portion of the Site be included in the Fall 2010 monitoring program to understand the current plume extent. Therefore, a total of seven monitoring wells located in the northern portion of the Site, will be included in the Fall 2010 monitoring program (Table 1 and Figure 1):

- FH-4, MW-31R, MW-115A, and MW-22A: These wells were last monitored in February 2008, and tetrachloroethene (PCE) was not detected in these wells.
- MW-24B, MW-34, and FH-30: Have not been sampled for at least 5 years.

Groundwater quality at these wells will define the current northern extent of the plume. These data are also expected to confirm the prior understanding of the plume, *i.e.*, it discharges into the Souhegan River and does not migrate further to the north – an issue raised in the February US EPA comments.

Southern and Eastern Portion of the Site

At the request of US EPA, a total of 6 additional monitoring wells will be sampled to confirm and define the current southern and eastern extent of the groundwater plume (Table 1 and Figure 1):

- *Southern Extent:* Five additional monitoring wells will be sampled along the southern portion of the site (MW-12A/B, MW-21B/C, and MI-10). All five wells were previously sampled in 2008, when PCE was not detected in all but one well (MW-21B), where the PCE concentration was minimal (1.2J µg/L). These wells will be used to delineate the extent of the plume to the south, although considering that regional groundwater flow is to the northeast, significant changes in PCE concentrations are not anticipated.
- *Eastern Extent:* One additional monitoring well will be sampled along the eastern portion of the site (MW-32B). This well was previously sampled in February 2008, when PCE was not detected. This along with other wells included in the monitoring program will be used to delineate the current eastern extent of the plume.

[2] Note, it had been previously agreed with NH DES that two rounds of 1,4-dioxane monitoring will be conducted at these 17 monitoring wells.

Monitored Natural Attenuation (MNA) Evidence

In the meeting on April 16, 2010, US EPA asked that additional information be provided about the MNA portion of the OU-2 remedy in annual reports. The following is an excerpt (Section 3.4) from the 2009 annual groundwater monitoring report (Gradient, 2010)[3], which addressed this request.

> "The MNA portion of remedy at the Site is defined as the areas outside of the predicted influence of active groundwater extraction and injection (US EPA, 2002)[4], which states "*The areas of the aquifer which are not within the active extraction and/or injection remedy are at the eastern end of the aquifer and north of the Souhegan River. These areas are considered to be the areas of natural attenuation.*" The RDI goes on to identify 14 monitoring well locations within these zones to be used for evaluating the performance of the MNA portion of the remedy:
>
> - North side of the Souhegan River (FH-4, FH-5, MW-112, MW-113, FH-27, and MW-114);
> - Eastern extent and boundary of plume (MW-115A/B, MW-22, and MW-32); and
> - Southern plume boundary (MW-19A/B, MW-12A/B, MW-21A/B, and MI-10).
>
> As indicated in the RDI report (US EPA, 2002), advection and dispersion are the dominant mechanisms affecting the attenuation of PCE at the Site, while biodegradation plays a relatively insignificant role (US EPA, 2002)."

Natural attenuation of VOCs is progressing as predicted at the Site. PCE concentrations in monitoring wells located within the MNA zones have generally been below the maximum contaminant levels (MCLs) with the exception of FH-27 and MW-19B. However, PCE concentrations at these wells have declined by 82% and 70%, respectively, since 2005, thus demonstrating that advection and dispersion are effectively reducing VOC concentrations in this part of the aquifer. Monitoring results for the MNA wells over time are summarized in Table 3-6 of the 2009 annual report (Gradient, 2010).

Overall, attenuation of concentrations is taking place at the Site as previously predicted. However, at the request of the US EPA (2010)[5] a total of 4 additional monitoring wells (FH-5, MW-112A, MW-113A, and MW-19A) will be sampled for MNA monitoring purposes (Table 1 and Figure 1).

Bedrock Geophysical Logging Results

During the April 2010 meeting, we also discussed USGS' geophysical logging results for bedrock wells MW-14R and MW-11R and to consider modifying sampling depths to be aligned with bedrock fractures.

---

[3] Gradient. 2010. Annual Groundwater Quality Monitoring Report – 2009. Savage Municipal Water Supply Well Superfund Site. Milford, New Hampshire. Report to Hitchiner Manufacturing Co., Inc. (Milford, NH) and Thomas and Betts, Inc. (Memphis, TN). May 28.

[4] US EPA. 2002. Remedial design investigation report, Savage Well Superfund Site, Milford, New Hampshire (Final). Submitted to Hitchiner Manufacturing Company, Inc. (Milford, NH) and Thomas and Betts, Inc. (Memphis, TN). September 13.

[5] US EPA. 2010. Letter to Manu Sharma from Richard W. Hull re: Savage Municipal Water Supply Well Site, Milford, New Hampshire, Operable Unit 2: Conditional Approval of *Proposed Fall 2010 Annual Groundwater quality Monitoring Plan*. November 4.

- *MW-14R:* The USGS geophysical logging results indicated a potential leak in the casing at MW-14R that could have been introducing overburden groundwater into the bedrock well. The well has been repaired by the installation of a PVC screen within the bedrock and grouting of the overlying horizon to enable groundwater sample collection from bedrock and to eliminate overburden leakage (Gradient, 2010)[6]. Groundwater samples at MW-14R have been collected at a depth of 86.5 ft-bgs – the mid-point of the open bore hole – since the early 1990s, when the well was installed. Since over 15 years of groundwater quality data has been collected at this depth interval, we would like to continue to collect samples at this depth to ensure consistency in the data set. In addition, at the US EPA's request (US EPA, 2010)[5] groundwater samples will also be collected from key water bearing fractures (77, and 108 ft-bgs)identified by the USGS geophysical logging results. However, upon consultation with the USGS (Harte, 2010)[7], these samples will be collected during the June 2011 sampling round, and instead only one additional sample (from 72 ft-bgs, 2 ft into the well screen) will be collected during the Annual monitoring round in order to assess the well repair activities performed earlier this year.
- *MW-11R:* The USGS geophysical logging results at MW-11R indicated the presence of water bearing fracture(s) at: 94, 98, and 102 ft-bgs. Groundwater samples have been collected at this well at a depth of 90 ft-bgs (the mid-point of the open bore hole) since the well was installed in the early 1990s. For the reasons presented above for MW-14R (*i.e.*, ensure consistency with the over 15 years of data), we would like to continue to collect samples at this depth. In addition, at the US EPA's request (US EPA, 2010)[5], groundwater samples will also be collected from water bearing fractures at 94, 98, and 102 ft-bgs, as identified by the USGS geophysical logging results.

To summarize, the addition of 17 monitoring locations and other supplemental proposed monitoring data (*e.g.*, 1,4-dioxane, additional samples at MW-14R and MW-11R) will yield a comprehensive data set to adequately assess the effectiveness of the remedy at OU-2 as part of the 5 Year Review.

Please let me know if you have any questions or feedback on this proposed sampling plan, or if you need any additional information.

Yours truly,

GRADIENT

Manu Sharma, P.E.
Principal

[6] Gradient. 2010. Letter to Richard Hull re: Summary of Monitoring Well Replacement Activities. Savage Well Superfund Site, Operable Unit-2 (OU-2). October 12.
[7] Harte, 2010. Personal communication with Phil Harte of the USGS, December 9.

CC: R. Mongeon
B. Rand
G. Smith
J. Peltonen
T. Sullivan
O. Chopra

Table 1
Proposed 5 Year Review Groundwater Quality Monitoring Program
Savage Well Superfund Site, Milford, NH

Well ID	Sampling Frequency	Well Screen Top (ft-bgs)	Well Screen Bottom (ft-bgs)	Well Screen Length (ft)	PDB [1] or Low Flow Pump Intake Depth [2] (ft-bgs)	VOC [3]	1,4 Dioxane [3]
Wells Sampled Using PDBs (46 Wells)							
FH-30	5 Yr Review	NA	23.0	NA	18.0	X	
MI-10	5 Yr Review	44.0	47.0	3	45.5	X	
MW-9C	Annual	80.0	90.0	10	80.8	X	
MW-10A	Annual	19.0	29.0	10	19.8	X	
MW-10B	Annual	44.0	54.0	10	49.0	X	
MW-10C	Semi-Annual	81.5	91.5	10	88.3	X	
MW-11B	Annual	52.3	64.3	12	58.3	X	
MW-12A	5 Yr Review	25.0	35.0	10	25.8	X	
MW-12B	5 Yr Review	56.0	66.0	10	61.0	X	
MW-13A	Annual	23.9	33.9	10	33.8	X	
MW-13B	Annual	48.0	58.0	10	53.5	X	
MW-14A	Semi-Annual	19.0	29.0	10	28.3	X	
MW-14B [4]	Semi-Annual	50.0	60.0	10	50.8	X	X
MW-14R [4]	Semi-Annual	63.0	110.0	47	86.5	X	X
MW-14R [4]	5 Yr Review	63.0	110.0	47	72.0	X	
MW-14R	5 Yr Review	63.0	110.0	47	77.0	X[5]	
MW-14R	5 Yr Review	63.0	110.0	47	108.0	X[5]	
MW-17C	Semi-Annual	85.0	95.0	10	85.8	X	
MW-19A	5 Yr Review	23.5	33.5	10	24.3		
MW-20A	Annual	15.2	25.2	10	16.0	X	
MW-20B [4]	Semi-Annual	35.0	45.0	10	44.3	X	X
MW-21B	5 Yr Review	20.0	30.0	10	25.0	X	
MW-21C	5 Yr Review	44.1	54.1	10	49.1	X	
MW-22A	5 Yr Review	13.8	23.8	10	18.8	X	
MW-31R	5 Yr Review	60.0	273.0	213	271.5	X	
MW-32B	5 Yr Review	31.8	41.8	10	32.6	X	
MW-101A	Annual	9.0	19.0	10	14.0	X	
MW-101B	Annual	45.0	55.0	10	50.0	X	
MW-102	Annual	61.5	71.5	10	62.3	X	
MW-103	Semi-Annual	54.0	64.0	10	54.8	X	
MW-103A	Annual	27.0	37.0	10	32.0	X	
MW-104	Semi-Annual	24.0	34.0	10	29.0	X	
MW-104A	Semi-Annual	10.0	20.0	10	17.5	X	
MW-105 [4]	Semi-Annual	51.0	61.0	10	60.3	X	X
MW-105A [4]	Annual	21.0	31.0	10	21.8	X	X
MW-106 [4]	Annual	49.0	59.0	10	54.0	X	X
MW-107A	Annual	57.0	67.0	10	62.0	X	
MW-107B [4]	Semi-Annual	70.0	80.0	10	70.8	X	X
MW-107C [4]	Semi-Annual	83.0	93.0	10	88.0	X	X
MW-108A	Annual	40.0	50.0	10	45.0	X	
MW-109A [4]	Semi-Annual	10.0	20.0	10	15.0	X	X
MW-111A	Annual	38.0	48.0	10	47.5	X	
MW-111C [4]	Semi-Annual	77.5	87.5	10	78.3	X	X

Table 1
Proposed 5 Year Review Groundwater Quality Monitoring Program
Savage Well Superfund Site, Milford, NH

Well ID	Sampling Frequency	Well Screen Top (ft-bgs)	Well Screen Bottom (ft-bgs)	Well Screen Length (ft)	PDB [1] or Low Flow Pump Intake Depth [2] (ft-bgs)	VOC [3]	1,4 Dioxane [3]
MW-112A	5 Yr Review	28.8	38.8	10	33.8		
MW-113A	5 Yr Review	30.0	40.0	10	33.0		
MW-114 [4]	Annual	42.0	52.0	10	42.8	X	X
MW-116A [4]	Semi-Annual	40.0	50.0	10	43.5	X	X
MW-120A	Annual	50.5	60.5	10	59.5	X	
MW-120B	Annual	61.0	71.0	10	61.8	X	
MW-120C	Semi-Annual	81.0	91.0	10	85.0	X	
PZ-B3	Annual	11.5	16.5	5	14.0	X	
PZ-B4	Annual	45.0	50.0	5	47.5	X	
Wells Sampled Using Low Flow Sampling Procedures (17 Wells)							
FH-27	Annual	36.0	41.0	5	38.5	X	X
MI-4	Annual	39.0	49.0	10	44.0	X	
MI-31	Semi-Annual	36	54	18	45.0	X	
MW-11R	Semi-Annual	70.5	115.5	45	90.0	X	
MW-11R	5 Yr Review	70.5	115.5	45	94.0	X	
MW-11R	5 Yr Review	70.5	115.5	45	98.0	X	
MW-11R	5 Yr Review	70.5	115.5	45	102.0	X	
MW-19B	Annual	36.0	49.0	13	44.0	X	X
MW-24A	Annual	19.5	29.5	10	24.5	X	X
MW-24B	5 Yr Review	31.0	41.0	10	36.0	X	
MW-34	5 Yr Review	9.5	19.5	10	14.5	X	X
MW-101C	Semi-Annual	93.0	103.0	10	98.0	X	
MW-102B	Annual	47.0	57.0	10	52.0	X	X
MW-109B	Semi-Annual	45.0	55.0	10	50.0	X	X
MW-110A	Annual	33.0	43.0	10	38.5	X	
MW-110B	Semi-Annual	53.0	63.0	10	61.5	X	
MW-111B	Annual	67.5	77.5	10	76.5	X	X
MW-115A	5 Yr Review	10.1	20.1	10	15.1	X	X
MW-115B	Annual	40.1	50.1	10	45.1	X	X
MW-118B	Annual	71.9	81.9	10	76.9	X	
Grab Sample (1 Well)							
FH-4	5 Yr Review	--	--	--	--	X	
FH-5	5 Yr Review	--	--	--	--	X	

Notes:

[1] *PDB = Passive Diffusion Bag.*

[2] *PDB deployment depth corresponds to interval that showed the highest VOC concentration in the August/September 2004 vertical profiling study.*

[3] *Analytical Methods used:* *VOCS - EPA Method 8260B*
1,4 Dioxane - EPA Method 8270C w/ Selected Ion Monitoring (SIM)

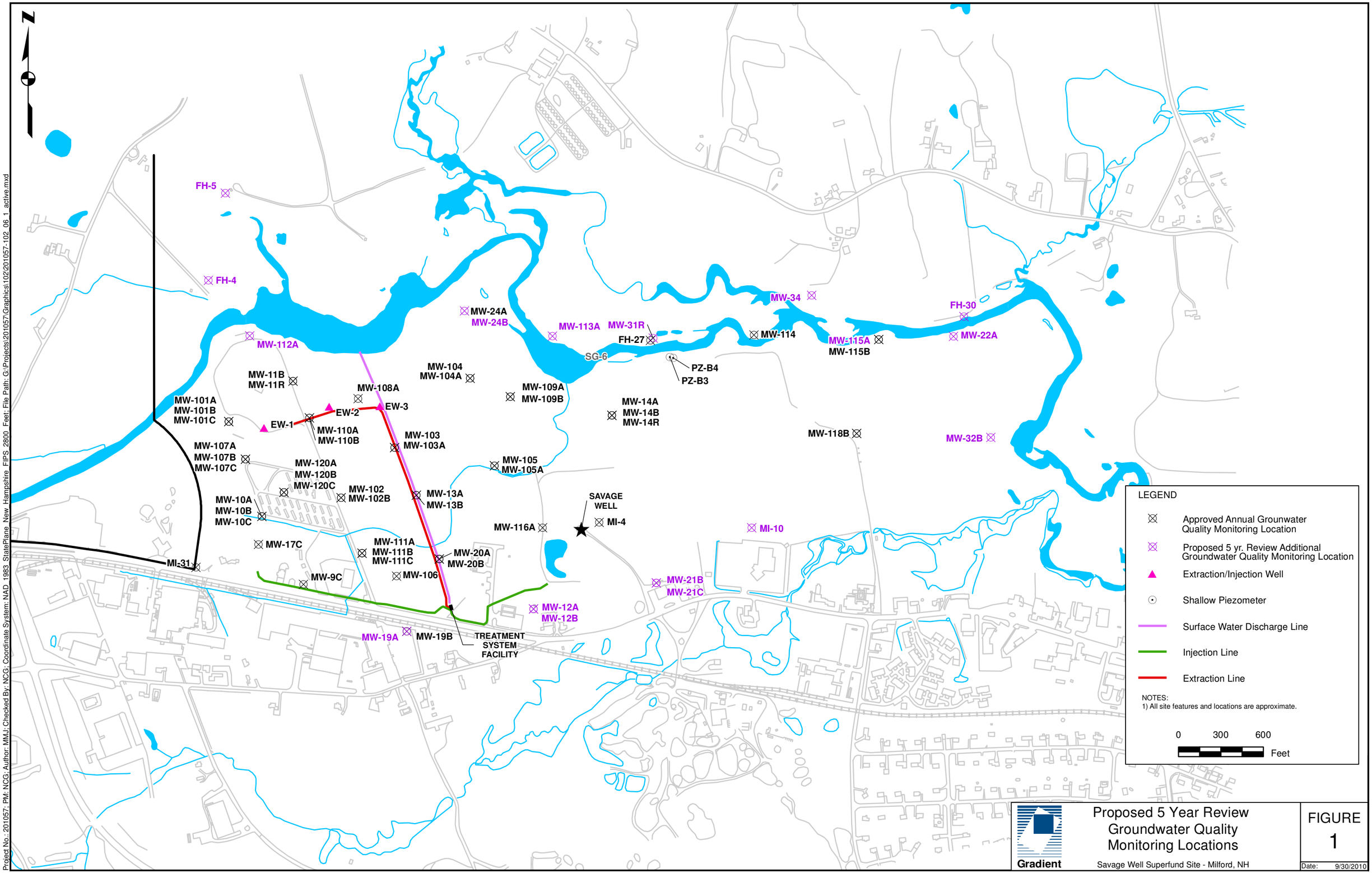
[4] *To be sampled using low flow techniques during the annual round in order to collect 1,4 dioxane samples.*

[5] *To be collected during the June 2011 sampling round.*

Wells highlighted in Pink represent proposed 5 year review sampling locations.

NA = Information Not Available.

ft-bgs = feet below ground surface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FH-4
MW-112A
MW-24A
MW-24B
MW-113A
MW-31R
FH-27
SG-6
PZ-B4
PZ-B3
MW-34
MW-114
MW-115A
MW-115B
FH-30
MW-22A
MW-11B
MW-11R
MW-104
MW-104A
MW-108A
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MW-14A
MW-14B
MW-14R
MW-101A
MW-101B
MW-101C
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MW-110B
MW-103
MW-103A
MW-118B
MW-32B
MW-107A
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MW-102B
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MW-13B
SAVAGE WELL
MI-4
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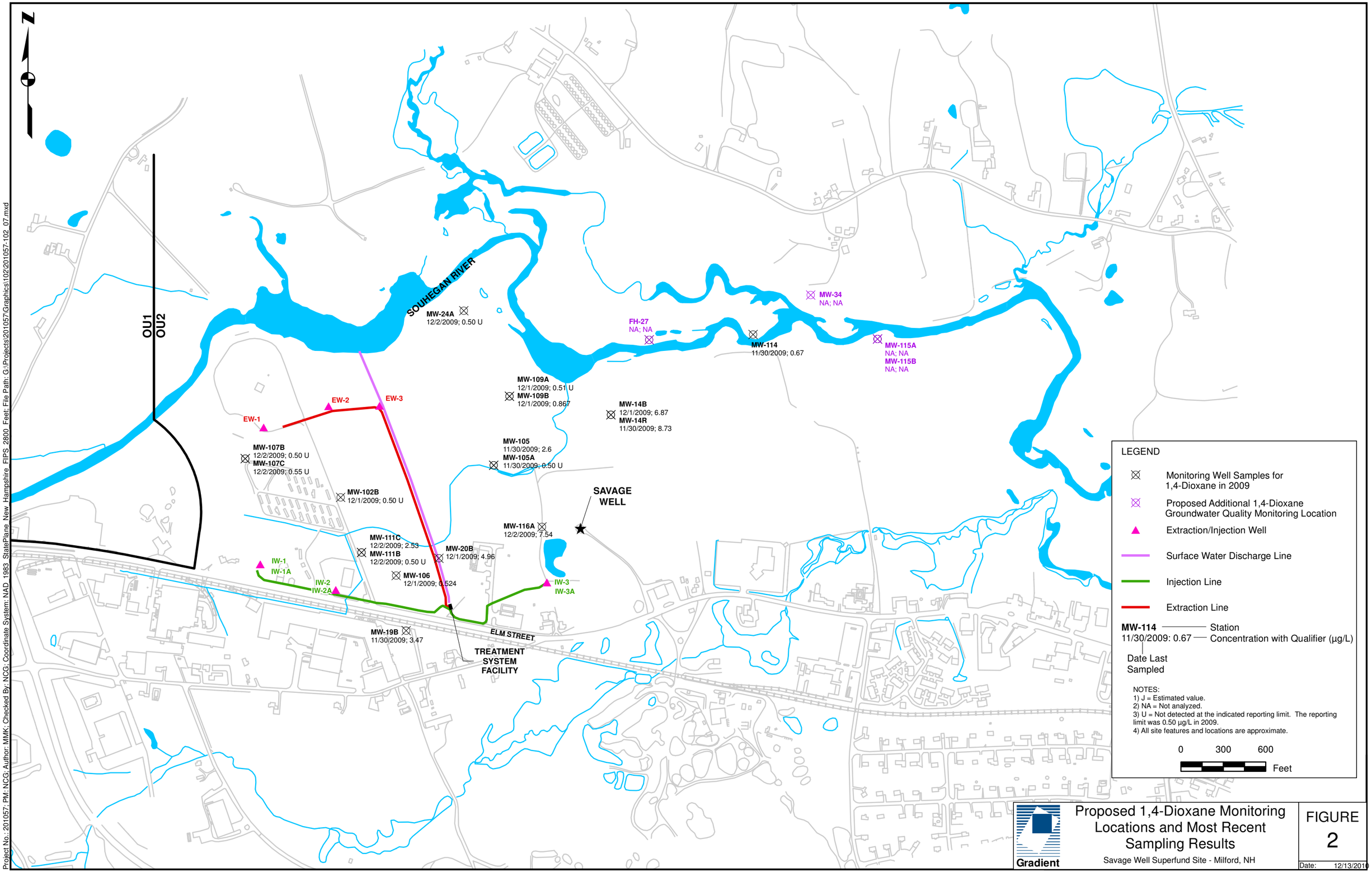
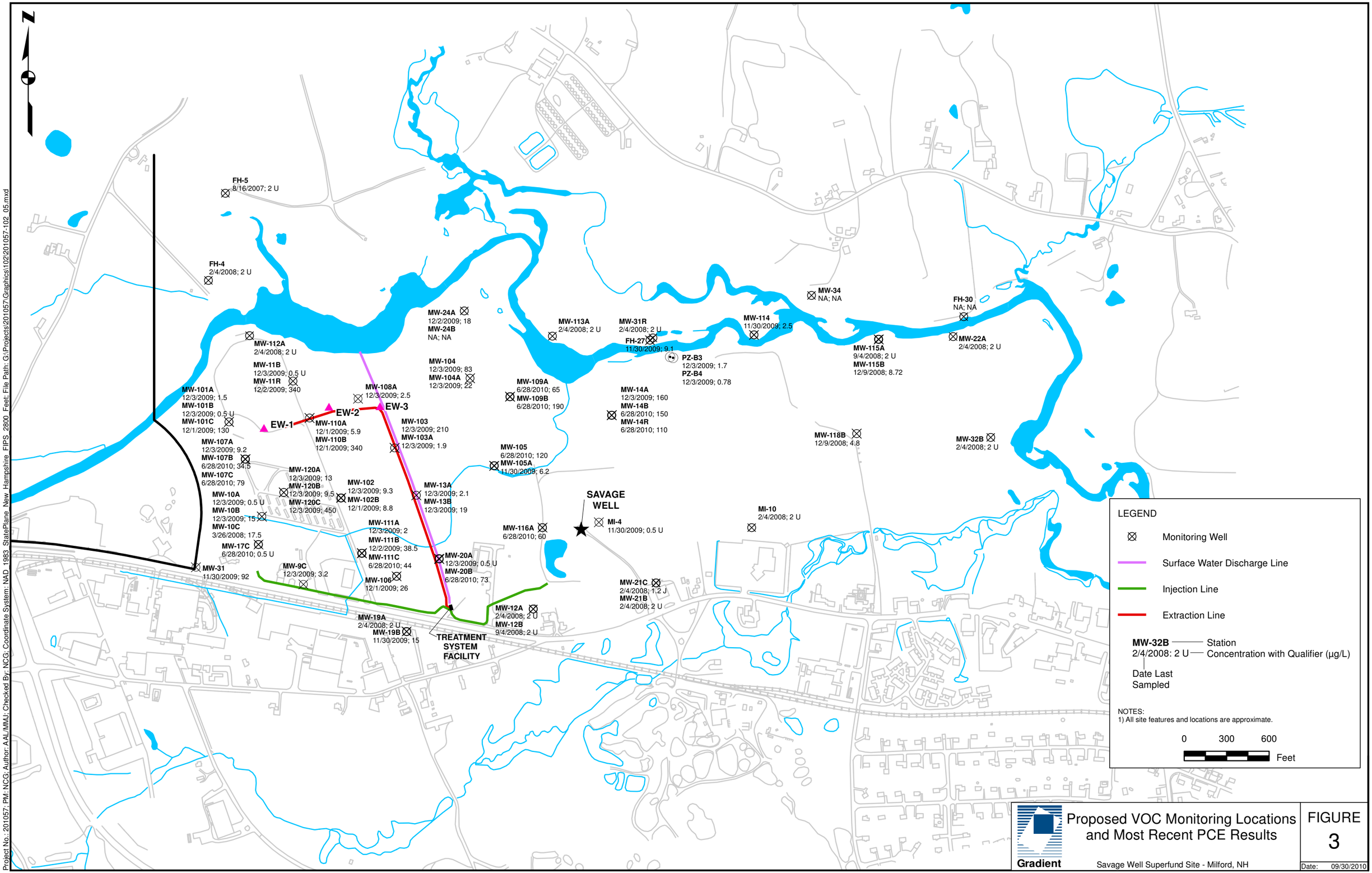
MW-116A
MI-10
MW-17C
MW-111A
MW-111B
MW-111C
MW-20A
MW-20B
MI-31
MW-9C
MW-106
MW-21B
MW-21C
MW-12A
MW-12B
MW-19A
MW-19B
TREATMENT SYSTEM FACILITY
LEGEND
Approved Annual Grounwater Quality Monitoring Location
Proposed 5 yr. Review Additional Groundwater Quality Monitoring Location
Extraction/Injection Well
Shallow Piezometer
Surface Water Discharge Line
Injection Line
Extraction Line
NOTES:
1) All site features and locations are approximate.
0
300
600
Feet
Gradient
Proposed 5 Year Review Groundwater Quality Monitoring Locations
Savage Well Superfund Site - Milford, NH
FIGURE
1
Date: 9/30/2010
Project No.: 201057; PM: NCG; Author: MMJ; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\102\201057-102_06_1_active.mxd


N
OU1
OU2
SOUHEGAN RIVER
MW-24A
12/2/2009; 0.50 U
FH-27
NA; NA
MW-114
11/30/2009; 0.67
MW-34
NA; NA
MW-115A
NA; NA
MW-115B
NA; NA
MW-109A
12/1/2009; 0.51 U
MW-109B
12/1/2009; 0.867
MW-14B
12/1/2009; 6.87
MW-14R
11/30/2009; 8.73
EW-1
EW-2
EW-3
MW-107B
12/2/2009; 0.50 U
MW-107C
12/2/2009; 0.55 U
MW-105
11/30/2009; 2.6
MW-105A
11/30/2009; 0.50 U
MW-102B
12/1/2009; 0.50 U
SAVAGE WELL
MW-116A
12/2/2009; 7.54
MW-111C
12/2/2009; 2.53
MW-111B
12/2/2009; 0.50 U
MW-20B
12/1/2009; 4.96
MW-106
12/1/2009; 0.524
IW-1
IW-1A
IW-2
IW-2A
IW-3
IW-3A
MW-19B
11/30/2009; 3.47
ELM STREET
TREATMENT SYSTEM FACILITY
LEGEND
Monitoring Well Samples for 1,4-Dioxane in 2009
Proposed Additional 1,4-Dioxane Groundwater Quality Monitoring Location
Extraction/Injection Well
Surface Water Discharge Line
Injection Line
Extraction Line
MW-114 — Station
11/30/2009: 0.67 — Concentration with Qualifier (µg/L)
Date Last Sampled
NOTES:
1) J = Estimated value.
2) NA = Not analyzed.
3) U = Not detected at the indicated reporting limit. The reporting limit was 0.50 µg/L in 2009.
4) All site features and locations are approximate.
0 300 600
Feet
Gradient
Proposed 1,4-Dioxane Monitoring Locations and Most Recent Sampling Results
Savage Well Superfund Site - Milford, NH
FIGURE
2
Date: 12/13/2010
Project No.: 201057; PM: NCG; Author: MMK; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\102\201057-102_07.mxd


FH-5
8/16/2007; 2 U
FH-4
2/4/2008; 2 U
MW-112A
2/4/2008; 2 U
MW-11B
12/3/2009; 0.5 U
MW-11R
12/2/2009; 340
MW-101A
12/3/2009; 1.5
MW-101B
12/3/2009; 0.5 U
MW-101C
12/1/2009; 130
MW-107A
12/3/2009; 9.2
MW-107B
6/28/2010; 34.6
MW-107C
6/28/2010; 79
MW-10A
12/3/2009; 0.5 U
MW-10B
12/3/2009; 15
MW-10C
3/26/2008; 17.5
MW-17C
6/28/2010; 0.5 U
MW-31
11/30/2009; 92
MW-9C
12/3/2009; 3.2
MW-24A
12/2/2009; 18
MW-24B
NA; NA
MW-104
12/3/2009; 83
MW-104A
12/3/2009; 22
MW-108A
12/3/2009; 2.5
EW-1
EW-2
EW-3
MW-110A
12/1/2009; 5.9
MW-110B
12/1/2009; 340
MW-103
12/3/2009; 210
MW-103A
12/3/2009; 1.9
MW-120A
12/3/2009; 13
MW-120B
12/3/2009; 9.5
MW-120C
12/3/2009; 450
MW-102
12/3/2009; 9.3
MW-102B
12/1/2009; 8.8
MW-111A
12/3/2009; 2
MW-111B
12/2/2009; 38.5
MW-111C
6/28/2010; 44
MW-106
12/1/2009; 26
MW-13A
12/3/2009; 2.1
MW-13B
12/3/2009; 19
MW-20A
12/3/2009; 0.5 U
MW-20B
6/28/2010; 73
MW-19A
2/4/2008; 2 U
MW-19B
11/30/2009; 15
TREATMENT SYSTEM FACILITY
MW-12A
2/4/2008; 2 U
MW-12B
9/4/2008; 2 U
MW-113A
2/4/2008; 2 U
MW-109A
6/28/2010; 65
MW-109B
6/28/2010; 190
MW-105
6/28/2010; 120
MW-105A
11/30/2009; 6.2
MW-116A
6/28/2010; 60
SAVAGE WELL
MI-4
11/30/2009; 0.5 U
MW-31R
2/4/2008; 2 U
FH-27
11/30/2009; 9.1
PZ-B3
12/3/2009; 1.7
PZ-B4
12/3/2009; 0.78
MW-14A
12/3/2009; 160
MW-14B
6/28/2010; 150
MW-14R
6/28/2010; 110
MW-21C
2/4/2008; 1.2 J
MW-21B
2/4/2008; 2 U
MW-114
11/30/2009; 2.5
MW-34
NA; NA
MI-10
2/4/2008; 2 U
MW-115A
9/4/2008; 2 U
MW-115B
12/9/2008; 8.72
FH-30
NA; NA
MW-22A
2/4/2008; 2 U
MW-118B
12/9/2008; 4.8
MW-32B
2/4/2008; 2 U
LEGEND
Monitoring Well
Surface Water Discharge Line
Injection Line
Extraction Line
MW-32B — Station
2/4/2008: 2 U — Concentration with Qualifier (µg/L)
Date Last Sampled
NOTES:
1) All site features and locations are approximate.
0 300 600
Feet
Gradient
Proposed VOC Monitoring Locations and Most Recent PCE Results
Savage Well Superfund Site - Milford, NH
FIGURE 3
Date: 09/30/2010
Project No.: 201057; PM: NCG; Author: AAL/MMJ; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\102\201057-102_05.mxd

United States Environmental Protection Agency
5 Post Office Square, Suite 100
Boston, MA 02109-3912

November 4, 2010

Mr. Manu Sharma, Principal
Gradient Corporation
20 University Road
Cambridge, MA 02138

Via Electronic Mail

Re: Savage Municipal Water Supply Well Site, Milford, New Hampshire, Operable Unit 2: Conditional Approval of *Proposed Fall 2010 Annual Groundwater quality Monitoring Plan*

Dear Mr. Sharma:

Detailed below are comments and conditions resulting from the Environmental Protection Agency's (EPA) review of the *Proposed Fall 2010 Annual Groundwater Quality Monitoring Plan* (the "Plan") submitted by Gradient Corporation on October 12, 2010.

1. In the **Monitored Natural Attenuation (MNA) Evidence** section of the Plan, you site a USEPA 2002 RDI as indicating that "biodegradation plays a relatively insignificant role in the attenuation of PCE at the Site…" In the following paragraphs, while indicating that PCE concentrations have declined in specific wells, you site that "…MNA is effectively degrading VOCs in this part of the site." In future reports, more specific and detailed information shall be provided to describe the mechanisms that are effecting the attenuation of PCE at the Site, rather then the general and conflicting description of degradation provided in the Plan.

2. Groundwater sampling at the recently repaired well MW-14R shall be conducted at a depth of 86.5 ft-bgs – the midpoint of the open borehole – as has been the practice since the well was installed. In addition, Gradient Corporation shall determine the location of water-bearing fractures within the borehole and collect water quality samples from those locations to begin establishing a baseline for any future compliance monitoring.

3. Groundwater sampling at well MW-11R shall be conducted at a depth of 90 ft-bgs - the midpoint of the open borehole – as has been the practice since the well was installed. In addition, water quality samples shall be collected form the midpoint of

the water bearing fractures at 94, 98 and 102 ft-bgs to begin establishing a baseline for any future compliance monitoring.

4. In addition to the MNA wells identified for monitoring in the Plan, the following MNA wells shall also be monitored: FH-4, FH-5, MW-112A, MW-113A and MW-19A.

Gradient shall respond to this Conditional Approval prior to initiating any of the groundwater quality monitoring outlined in the Plan.

If you have any questions, please contact me at (617) 918-1882.

Sincerely,

R. W. Hull

Richard W. Hull
Remedial Project Manager

cc:
Philip T. Harte, USGS
Robin Mongeon, NHDES
Steve Mangion, USEPA

APPENDIX G

WELL REPLACEMENT SUMMARY

Gradient

October 12, 2010

Mr. Richard W. Hull
Remedial Project Manager
NH/RI Superfund Section
US Environmental Protection Agency (US EPA)
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Re: Summary of Monitoring Well Replacement Activities
Savage Well Superfund Site, Operable Unit-2 (OU-2)

Dear Mr. Hull:

On behalf of Hitchiner Manufacturing Company, Inc. and Thomas & Betts Corporation (Settling Parties), Gradient is submitting this report summarizing the recent well replacement activities performed at the OU-2 portion of the Savage Well Superfund Site located in Milford, New Hampshire ("Site").

A total of seven monitoring wells had previously been identified as either having been damaged (MW-115A/B, MW-120B, MW-14R) or destroyed (MW-10C and MW-118A/B). However, after further evaluation MW-118A/B and MW-10C[1] were located in the field and determined to still be functional. Therefore, four monitoring wells were repaired or replaced between August 16 to 18, 2010, using the process described below.

Summary of Well Replacement/Repair Activities

Bedrock Well: MW-14R

Monitoring well MW-14R was repaired to address a leak in the steel casing at a depth of approximately 50 feet below ground surface (ft bgs), which was potentially allowing groundwater from the overburden portion of the aquifer to flow into this bedrock well. The following actions were taken to repair this well and a well completion log is attached to this letter:

- The well was redeveloped using pump and surge techniques to loosen and remove debris and grout fragments from the bottom of the well. Monitoring for pH will take place during the Fall 2010 monitoring round.
- A 1.5-inch diameter schedule 40 poly-vinyl chloride (PVC) monitoring point was constructed within the existing open hole bedrock well and grouted in-place to ensure that the leaking section of steel casing is no longer hydrologically connected to the bedrock portion of the well.
- The PVC well was installed with 40 feet (110 to 70 ft-bgs) of slotted PVC set in a uniformly-graded silica sand filter pack from 110 to 68 ft bgs. Approximately 68 feet of PVC riser was added to the slotted section, extending to the ground surface. A bentonite seal was installed from 68 to 65 ft bgs. The remaining annulus between

[1] Note, monitoring well MW-10C was located after a replacement well, with identical construction details, had been installed. The replacement well was completed (*i.e.*, not abandoned) and could be used in the future, if the original well were to be accidentally damaged or destroyed.

20 University Road, Cambridge, MA 02138 • (617) 395-5000 • fax: (617) 395-5001 • www.gradientcorp.com

the PVC and the steel casing, above the bentonite seal (*i.e.*, 65 ft-bgs to ground surface) was grouted using a cement-bentonite mixture.

- After the PVC well was constructed and the grout had set, the well was over pumped, to remove silt and sediment that may have gotten into the well during construction.

Overburden Monitoring Wells

Monitoring wells MW-115A/B and MW-120B were replaced or repaired using the following approach:

- Monitoring well MW-115A/B had been damaged approximately 2 ft bgs and appeared to have been struck by a vehicle. The PVC riser pipe was bent, making the well unusable. The stand pipes and concrete collars for MW-115A and B were removed and the PVC casing was cut below the damaged portion of the well. Using only a pressure coupling, a new piece of PVC casing was attached to the top of the remaining portion of the casing and the stand pipe was replaced. In addition, two concrete filled steel bollards were installed adjacent to these wells in order to protect them from future damage.
- The roadbox for MW-120B had been damaged and the well had filled with several feet of sediment and debris. In order to clear the debris, MW-120B was redeveloped using 1-inch diameter threaded PVC pipe and an air compressor to remove sediment and debris from the well.. Following the successful redevelopment of this well a new road box and concrete collar were installed. Steel bollards were not installed near this well because it is located on the edge of a residential front lawn.

An elevation survey will be performed during the Fall 2010 monitoring round to tie the repaired and newly installed wells back into the existing groundwater elevation monitoring datum. Please let me know if you have any questions or feedback on this proposed work plan, or if you need any additional information.

Yours truly,

GRADIENT

Manu Sharma, P.E.
Principal

CC: R. Mongeon
B. Rand
G. Smith
J. Peltonen
T. Sullivan
O. Chopra

GeoInsight
Practical in Nature

SOIL BORING/ WELL COMPLETION LOG

Project: Savage Well Monitoring Well Repairs	Boring No.: N/A Well ID: **MW-14R-A**
	Sheet: 1 Of: 1
Location: Milford, New Hampshire	Project Number: 4215-001
	Chkd By: MFD

Drilling Co.: Technical Drilling Services	Boring Location: Refer to Site Plan
Foreman: Chris	Well Elevation: NA Datum: NA
GeoInsight Geol: Jonathan Meunier	Date Started: 8/16/2010 Date Completed: 8/17/2010

DRILLING METHOD	SAMPLER
Vehicle: Truck Mounted	Type: 2 foot split-spoon
Model: Custom	Hammer(lb): 140
Method: Drive and Wash	Fall (in): 30"

GROUND WATER READINGS			
DATE	DEPTH	REFERENCE	STABILIZATION
		Top of Casing	
		Top of Casing	

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	WELL COMPLETION DETAIL	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
						Standpipe			
0									
30						Bentonite-cement grout mixture (0' to 65' BGS)			
60									
						Bentonite (65' to 68' BGS)			
						Sandpack (68' to 110' BGS)			
90									
						Refer to MW-14R Well Completion Log for Sample Descriptions.			
120									

GRANULAR SOILS BLOWS/ft.	DENSITY	COHESIVE SOILS BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

WELL CONSTRUCTION MATERIAL	TYPE	INTERVAL FEET BGS	LEGEND
Concrete		NA	
Backfill		NA	
Grout		0-65	
Bentonite		65-68	
Sandpack		68-110	
Riser (1.5-inch PVC)		0-70	
Screen (1.5-inch PVC 0.01-inch slotted)		70-110	

NOTES:

1) A 1.5-inch diameter polyvinyl chloride (PVC) monitoring well was installed within the existing 3-inch steel cased open borehole.
2) The bentonite-cement grout mixture was placed using 1-inch tremi-pipe.
3) Measurements were taken from ground surface.

Attachment 3 – OU1 Photographs

Photo No. 1 Influent Equalization Tanks

Photo No. 2 Tray Aerators

Attachment 3 – OU1 Photographs

Photo No. 3 Carbon Vessels

Photo No. 4 New Boilers

Attachment 3 – OU1 Photographs

Photo No. 5 View Across Source Area Toward Souhegan River

Photo No. 6 View Across Source Area to South

Attachment 3 – OU1 Photographs

Photo No. 7 View From Source Area to East

Photo No. 8 Air Photo of Source Area

Attachment 3 – OU1 Photographs

Photo No. 9 Fence Around Source Area

Photo No. 10 IW-2 Well Vault Panel

Attachment 3 – OU1 Photographs

Photo No. 11 INEEL Wells

Photo No. 12 Effluent Weir

Attachment 3 – OU1 Photographs

Photo No. 13 Inside IW-1 Well Vault

Attachment 4 – OU2 Photographs

Photo No. 1 Outfall for Discharge of Treated Water to Souhegan River

Photo No. 2 OU2 Looking West from GWTP Toward OU1

Attachment 4 – OU2 Photographs

Photo No. 3 Acid Storage Tanks

Photo No. 4 GWTP Influent Manifold

Attachment 4 – OU2 Photographs

Photo No. 5 GWTP Effluent Manifold

Photo No. 6 Air Strippers and Treated Effluent Pumps

Attachment 4 – OU2 Photographs

Photo No. 7 Reinjection Well in Vault

Photo No. 8 Back of GWTP Building and Container Housing Filter Vessels

Attachment 4 – OU2 Photographs

Photo No. 9 Front of GWTP Building

Photo No. 10 Multimedia Filter Vessels

Attachment 4 – OU2 Photographs

Photo No. 11 Air Stripper and Treated Effluent Pumps

Photo No. 12 Extraction Well in Vault

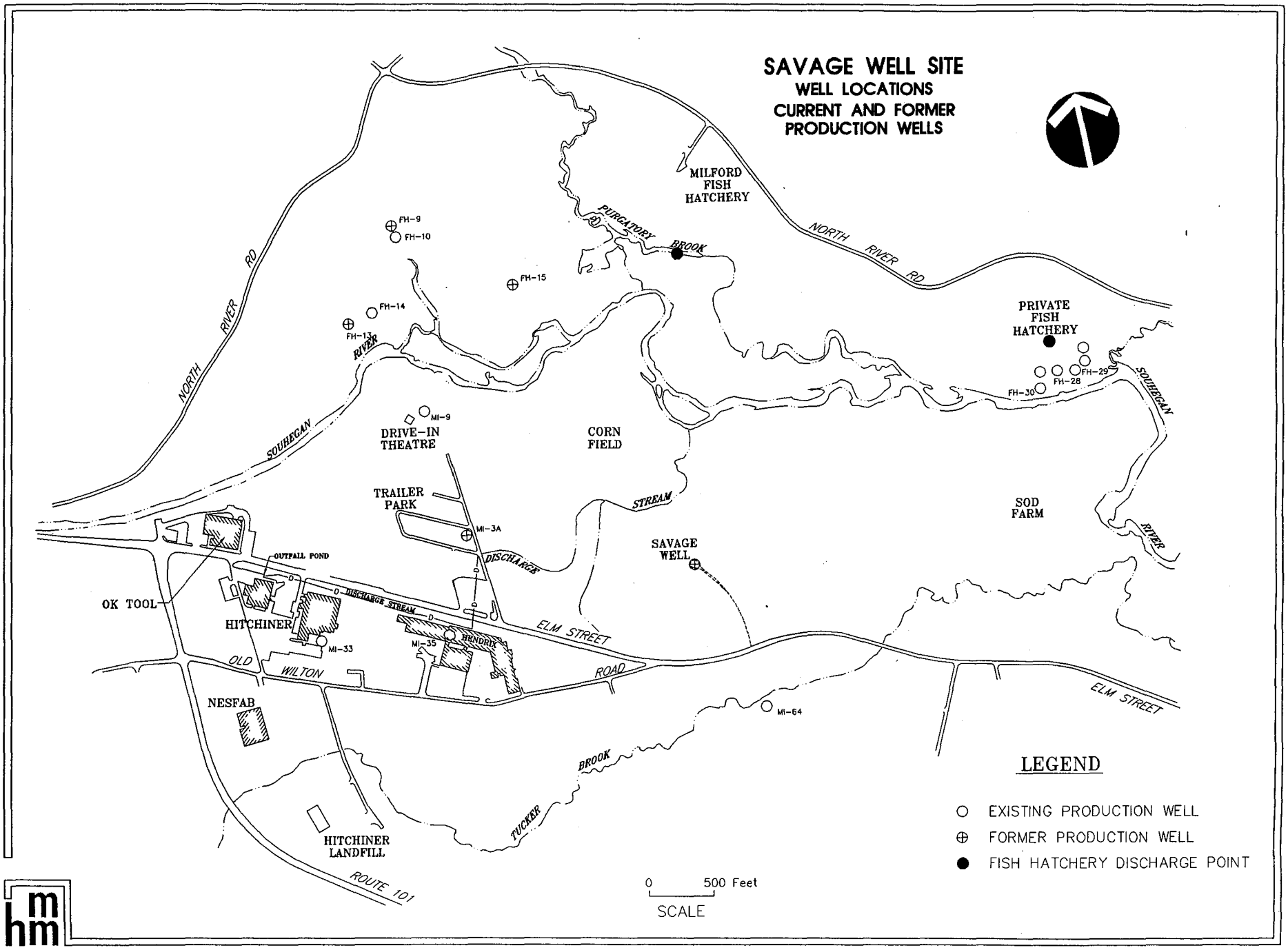


FIGURE 1-3

2176-F12

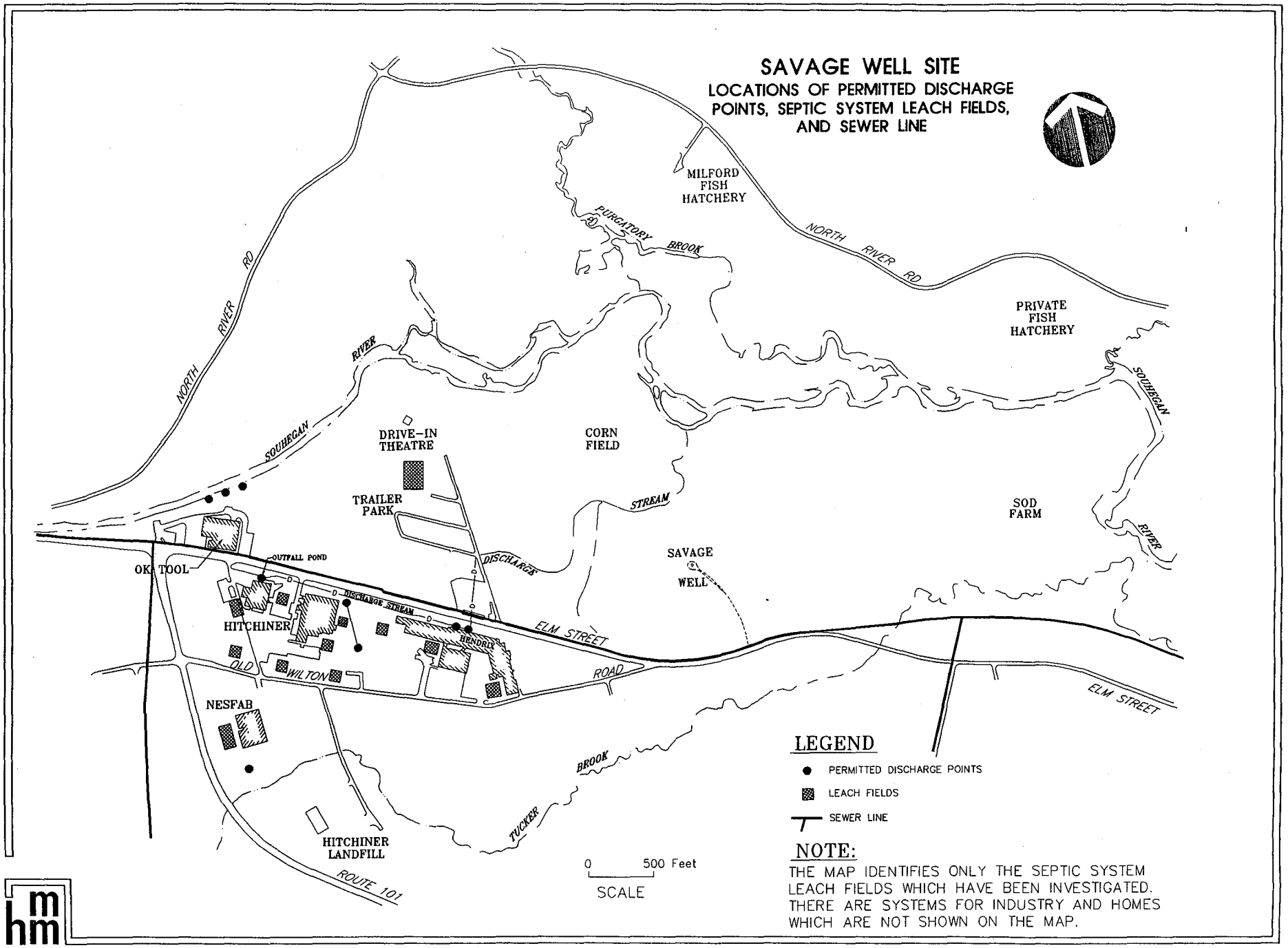


FIGURE 1-5

2176-F1

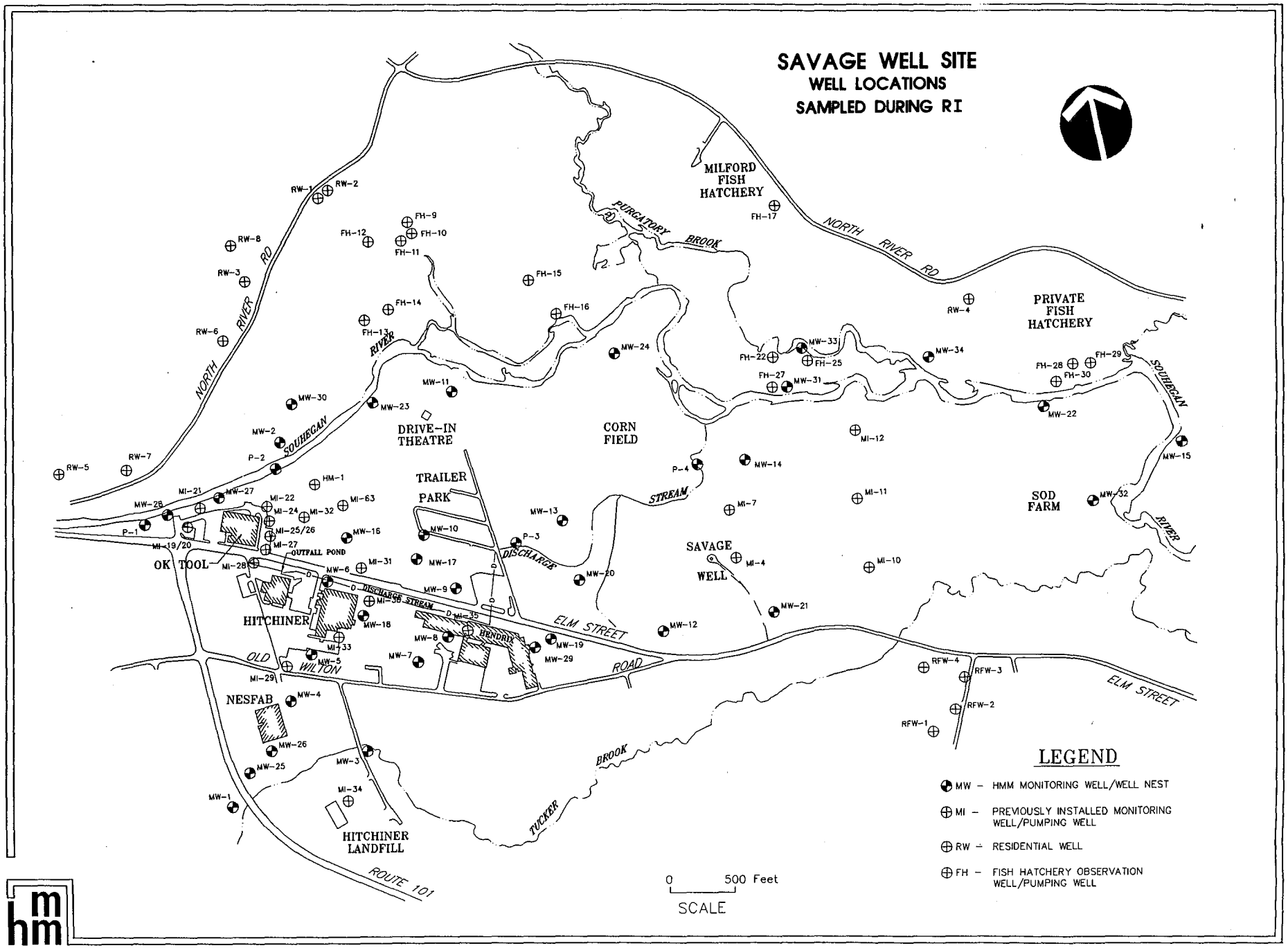
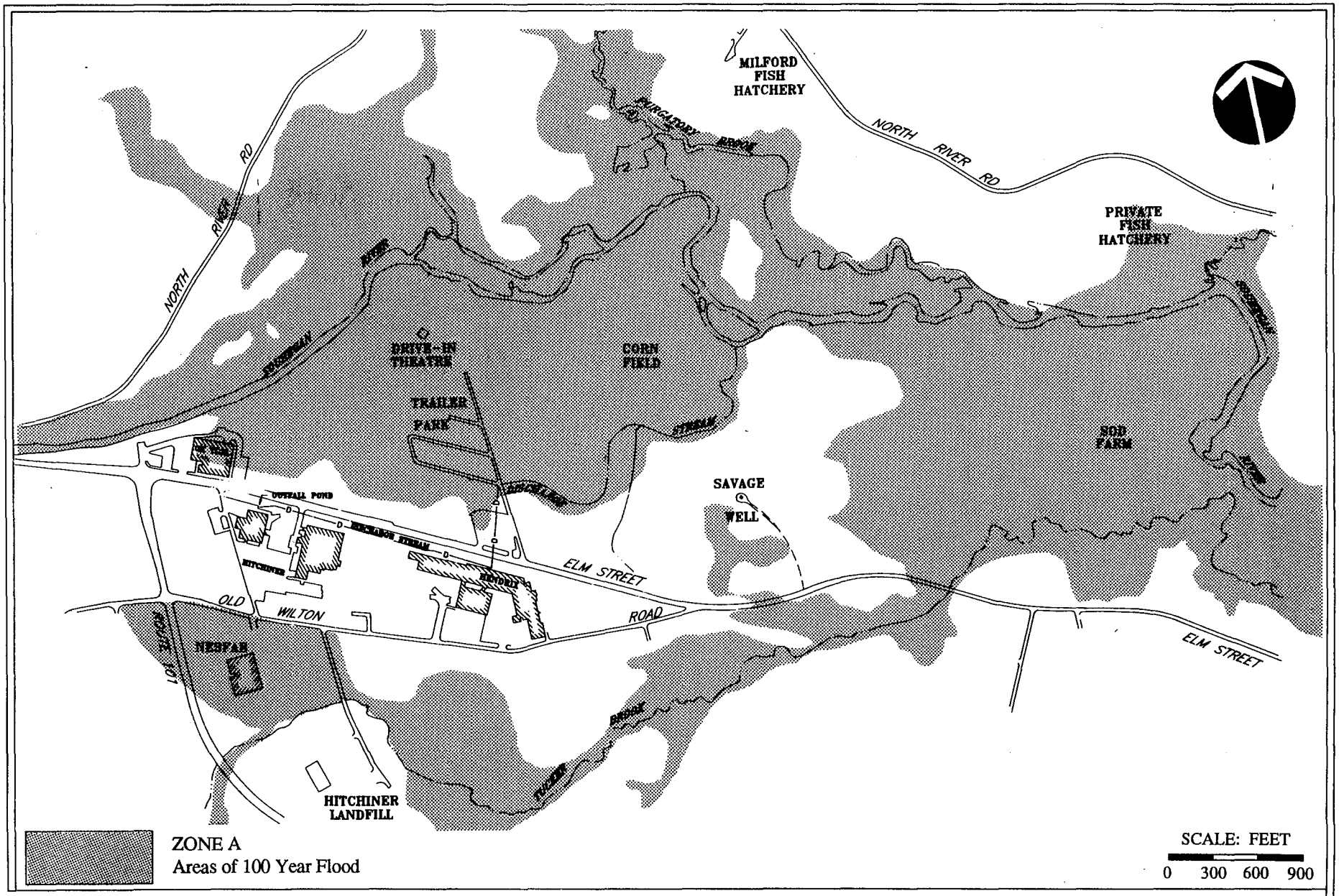


FIGURE 2-4

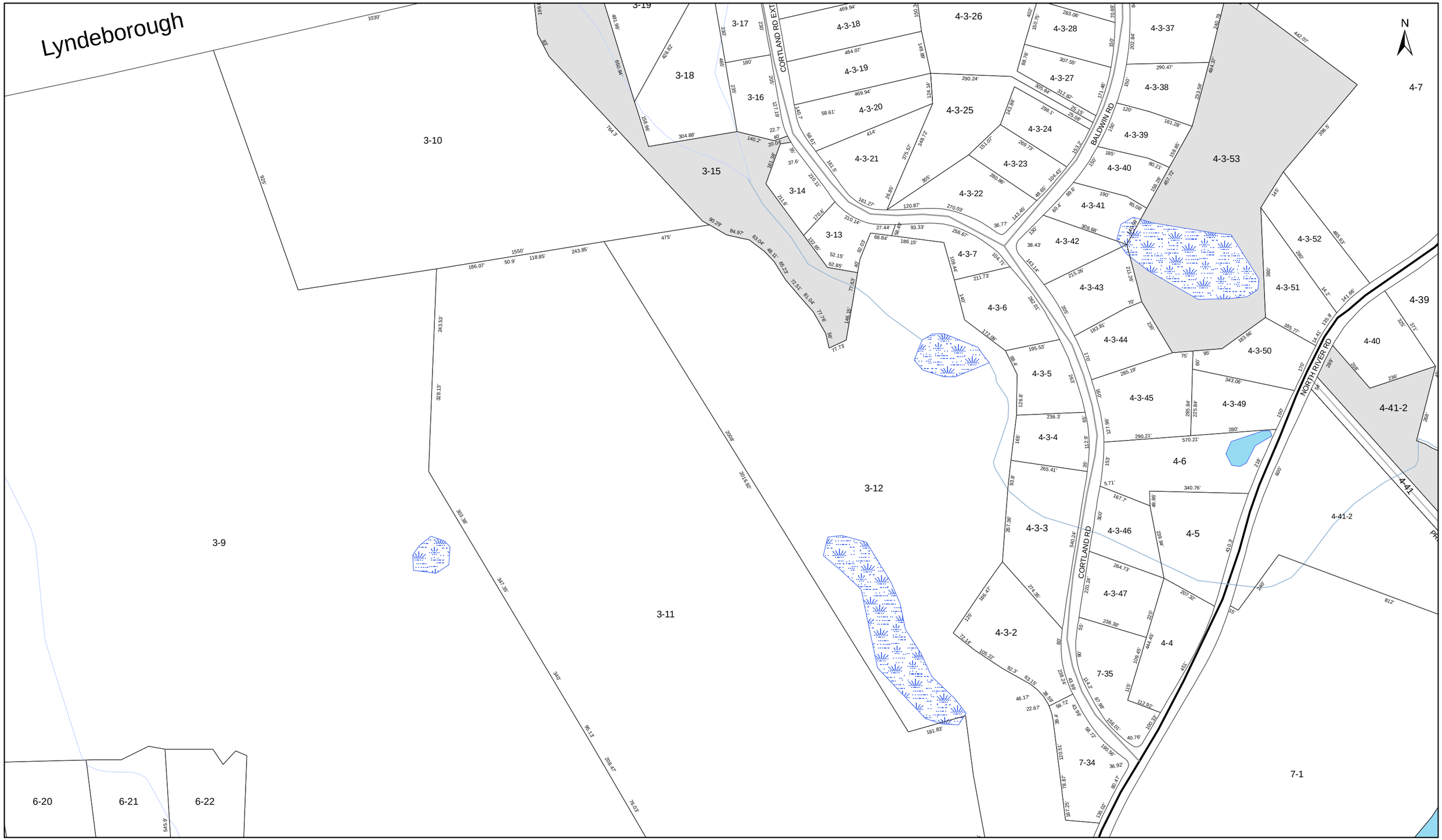
2176-F3



100 YEAR FLOOD MAP
SAVAGE WELL SITE

FIRM Flood Insurance Rate Map Town of MIlford, NH Hillsborough County, Community Panel Number 330096 0004B Effective Date: May 1, 1980

FIGURE 3-1



1 inch = 300 feet

0 150 300 600 Feet

This document has been prepared to show approximate lot location only. Information shown is not to be used for deed descriptions.

MILFORD, NH

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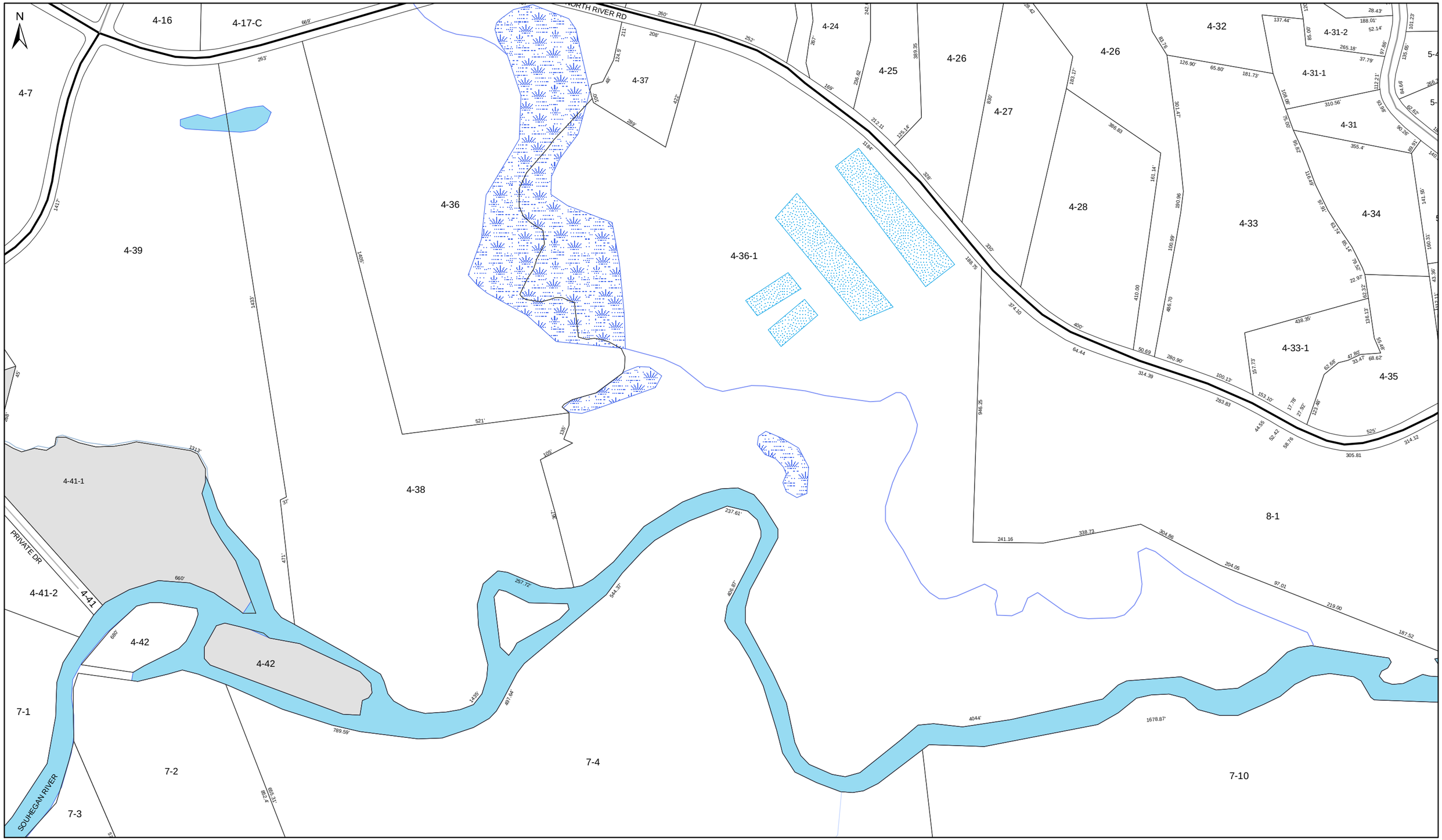
DATE:
April 1, 2010

C2
3,4,7



1 inch = 300 feet

0 150 300 600 Feet

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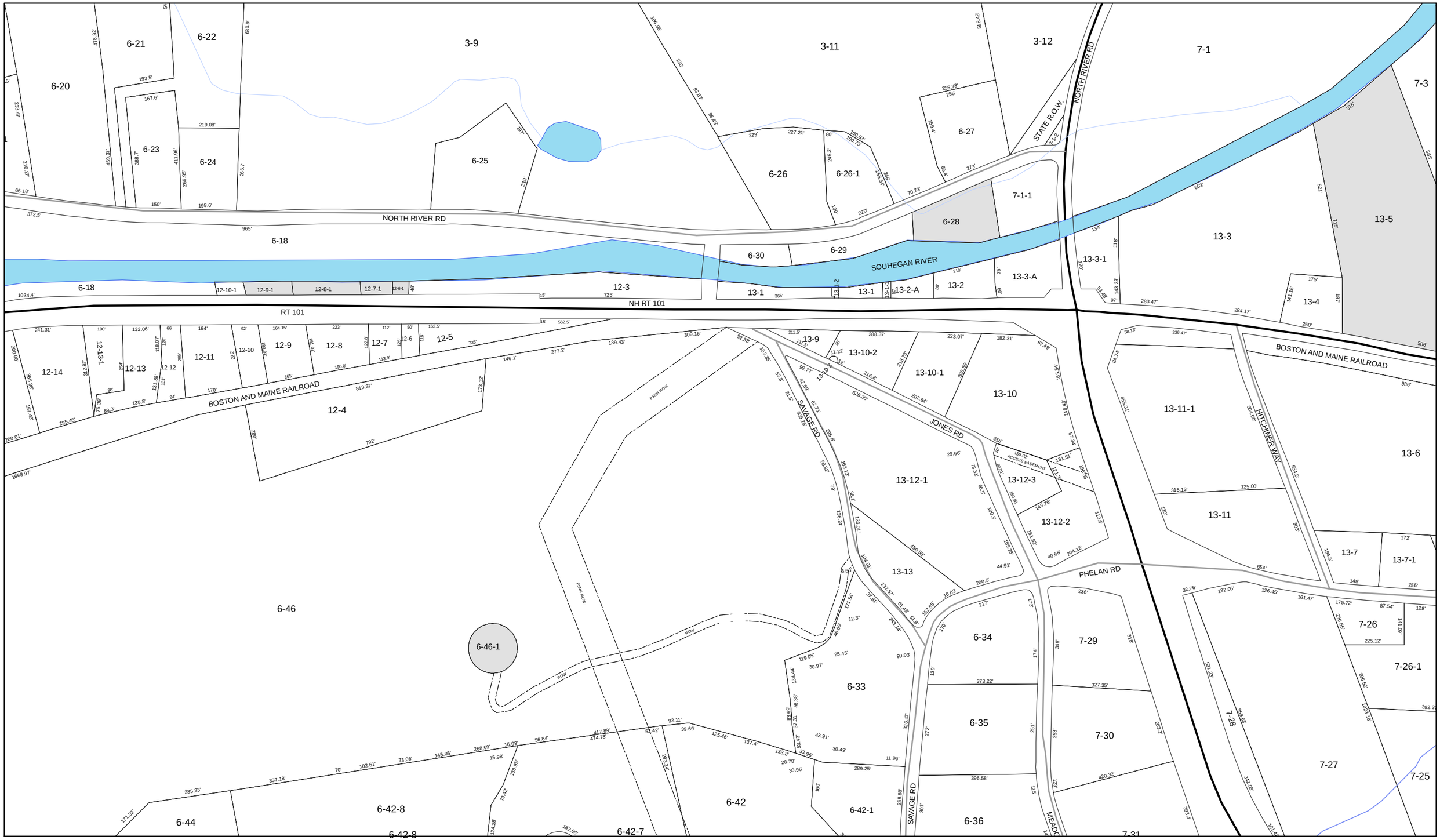
DATE:
April 1, 2010

C3

3,4,7



1 inch = 300 feet

0 150 300 600 Feet

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DATE:
April 1, 2010

D2
6,7,12,13

1 inch = 300 feet

0 150 300 600 Feet

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MILFORD, NH

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DATE:
April 1, 2010

D3

7,13,14,15

AT THE LIBRARY

FROM PAGE 10

Society" by Trenton Lee Stewart. Enjoy some pizza while discussing the book. Copies available on the teen display. Pizza & Pages is for fifth grade and older.

■ Chicks with Sticks Book Club, 3 p.m. March 3 in the AV Room. This month's selection is "Izzy, Willy-Nilly" by Cynthia Voigt. Bring your current knitting project and enjoy some snacks and discussion about the book. New members and beginning knitters welcome. Copies are available on the teen display. Chicks with Sticks is for grades six and older.

■ Geeks R Us Anime Club, 3:30 p.m. March 8 in the Keyes Meeting Room. Hang out and discuss your favorite anime or manga series, participate in related games and activities and create sketches of your favorite characters to share.

CHILDREN'S PROGRAMS

■ Storytimes for 18-24 months old are held 9:45 a.m. Mondays in the Keyes Room. Join us for rhymes, music, stories, bubbles and more till 10:15 a.m. Then, it's time for stay and play until 11 a.m. Older and younger siblings are welcome. No registration necessary. If school is cancelled due to inclement weather; storytimes are canceled, as well. No program Feb. 21.

■ Storytime for 2-3½ year olds are held 10:30-11 a.m. Mondays in the Children's Room. Join us for stories, music, rhymes and movement. Older and younger siblings are welcome. No registration necessary. If school is cancelled due to inclement weather; storytimes are canceled, as well. No program Feb. 21,

■ Baby Lapsit for birth-18 months is held at 10 a.m. Wednesdays in the Keyes Room. We will read together, enjoy bouncing rhymes, tickle songs and lots of movement from 10-10:30 a.m. Everyone is invited to stay and play from 10:30-11. Older siblings are welcome. Registration not required.

■ Storytime and Craft for 3½-6 year olds is from 1-2 p.m. Wednesdays or 10-11 a.m. Thursdays in the Keyes Meeting Room. Children will join Miss Mary Beth for stories, music, movement and a simple craft. All participants must be 3½ on or before Feb. 23. Registration is required. In the event that school is closed due to inclement weather; storytime will be cancelled. Registered storytimes are for those able to commit to a weekly time slot.

■ LEGO Block Party, 6:30-8 p.m. Feb. 28 in the Keyes Room. You bring your imagination, we supply the LEGOs. Due to space restrictions, registration is required and begins Feb. 14. Recommended for children 5 and older.

MONT VERNON

Daland Memorial Library, 5 N. Main St., 673-7888, www.dalandlibrary.wordpress.com.

CHILDREN'S WINTER PROGRAMS

There will be a play date for babies on the four Tuesdays in February. Children ages 0-36 months welcome. Registration required. Storytime is back for the winter. Preschool children ages 3-5 are welcome to join Thursdays in the morning or afternoon. Registration required. Call 673-7888 to register today.

WILTON

Public and Gregg Free Library, 7 Forest Road, 654-2581, wpl@tellink.net, www.wiltonlibrarynh.org.

ACOUSTIC ROTUNDA

On every other Wednesday from 3-6 p.m., the acoustically perfect rotunda is open to anyone who wishes to sing, recite, play an instrument or otherwise use the rotunda as a showcase for talent. Audiences also welcome. No registration, first come, first up. 654-2581.

COMPUTER TRAINING

A member of the Friends of the Wilton Public & Gregg Free Library provides hands-on one on one basic and advanced computer training sessions at the library. Call the library at 654-2581 to set up a time that is convenient for you and the instructor. The sessions are free and open to all.

STORYTIMES

Story time with Miss Margaret is held at 1:30 p.m. Tuesdays in the Children's Area. For infants through 6 years. Music and story time with Miss Karina is at 10 a.m. Thursdays.

CHILDREN'S EVENTS

Wii games are played at 3 p.m. Wednesdays and LEGOs and games are played at 3 p.m. Fridays, in the Children and Young Adult Area.

ARTIST FOR FEBRUARY

Wilton Library will present an exhibit of photographs by Betsy Hansen of Milford titled, "Tiny Toes to Panty Hose." The exhibit, a photographic chronicle of the daily life of women, will be on display in the rotunda gallery during February.

Encourage your local library to send in event news for this feature. A calendar of events at least a week ahead is most helpful, plus any special releases or photos. E-mail neighbors@nashuatelegraph.com by Monday for the following week's section.

With a little help from her friends

Amherst Middle School Theater Club presents the musical 'Dear Edwina Jr.'

Submitted photo

Edwina, played by Alyssa Lederhos, center, has a great group of friends who are trying to help her achieve her dream. Also pictured are Scott (Jack Kane), Lars (Matt Campbell), Kelli (Hannah Whitney), Annie (Brittany Ireland), Bobby (Michael Robicheau), Cordell (Tim Starrett) and Becky (Lauren McCormick).

AMHERST – The Amherst Middle School Theater Club will present its 2011 production, "Dear Edwina Jr."

Alyssa Lederhos leads the talented cast as Edwina Spoonapple, a Michigan girl who gives advice to neighborhood kids by way of a weekly musical revue from her garage.

With the help of her friends, Edwina responds to letters she's received with songs designed to solve the letter-writers' dilemmas.

Before she and her pals reach the finale of the musical within the musical, they've been downright infectious on subjects like how to behave at a party – "Frankenguest;" how to set a table – "Fork, Knife, Spoon;" how to make a shy friend feel comfortable – "Hola, Lola;" and how to save money – "Put It in the Piggy."

Edwina hopes her show will impress a talent scout who's looking for a replacement panelist for the Kalamazoo Advice-a-Palooza festival. Focused on her goal, Edwina has no patience for romantic advances from infatuated pal Scott.

By the time the show is over, Edwina has learned a lesson about the value of not wanting to be like everyone else, but doing what you love to do.

This show, which has received rave reviews Off-Broadway, is something the whole family will enjoy.

Tickets are on sale now at Amherst Middle School office, the Homestead, Black Forest Cafe and Bakery and Moulton's Market.

The show dates are Thursday through Saturday, March 17-19 at 7 p.m. and a 2 p.m. matinee Saturday.

Film examines architect's life, legacy

Milford Recreation presents documentary on the 'father of the skyscraper Feb. 26

Special to the Cabinet

MILFORD – The Milford Recreation Department will host the New England premiere of the award-winning documentary "Louis Sullivan: The Struggle for American Architecture" on Feb. 26 in the Milford Town Hall Auditorium.

This new documentary examines the life and legacy of one of America's most important yet rarely recognized artists, Chicago architect Louis Sullivan.

Louis H. Sullivan was one of the most influential architects to come out of the Chicago School of Architecture in the late 1800s. He is often called the "father of the skyscraper" and conceived the most famous phrase ever to come out of the profession, "form follows function."

"This film explores Sullivan's rapid rise to fame, his tragic decline and the ultimate triumph of his creative spirit," said Director Mark Richard Smith. "This is the first comprehensive exploration of Sullivan and his work, and we're excited to bring this award-winning film to New England for everyone to enjoy."

The showing in Milford will be attended by Smith, and film score composer Michael McLean. Pianist Laura Kennedy will assist, performing and discussing examples from the film score. A question-and-answer session will follow the screening.

Tickets are available at the Milford Recreation Department office in Milford Town Hall, the Toadstool Bookshops in Milford and Peterborough, and at the door the night of the screening. Tickets are $20 for adults and $15 for students and seniors.

"Louis" premiered at the Full Frame Documentary Film Festival in April 2010. That same month, at the Kansas City FilmFest, it was named Best Feature Documentary. The film was then awarded the Critics' Award for Excellence in Documentary Filmmaking at the St. Louis Filmmaker's Showcase in July. In November 2010 Louis will be presented at the St. Louis International Film Festival.

– *Submitted by Nicole Banks, director Milford Parks and Recreation Department*

RELIGION NEWS

AMHERST

CHRIST'S CHURCH

Christ's Church of Amherst is at 58 Merrimack Road. For more information, visit www.ccnh.org.

CHRISTIAN CHURCH

Amherst Christian Church is at 134 Hollis Road. For more information, visit www.amherstchristianchurch.org or call 672-1541.

CONGREGATIONAL CHURCH OF AMHERST

New member information sessions will be held Feb. 22 in the Parlor Room on the second floor. The church is at 11 Church St. on the Common in Amherst Village. For more information, call 673-3231 or visit www.ccamherst.org.

CONGREGATION BETENU

Temple holds regular Kabbalat Shabbat services Friday nights at 7:30. Congregation Betenu is a URJ/Reform synagogue at 5 Northern Blvd. Call 886-1633 or visit www.betenu.org or betenu@nii.net.

EARTHEN VESSELS MINISTRIES

Services are Sunday mornings at 11. Earthen Vessels Ministries is at P.O. Box 1247, Amherst, 305-6079. The priest is the Rev. Carol Baker. www.earthenvesselsministries.com.

FIRST BAPTIST CHURCH

The congregation and visitors are invited to luncheon every Sunday immediately following discussion groups at noon. Prayer Service is held Sundays at 6 p.m. First Baptist Church of Amherst is at 25½ Middle St. Call 673-4063 or visit amherstfirstbaptist.com.

MESSIAH LUTHERAN CHURCH OF AMHERST

Regular worship schedule is 10:30 a.m. The church is at 303 Route 101 (next to the flower shop) and can be reached at 673-2011 or at www.messiahnh.org or messiahnh@comcast.net.

NEW HOPE CHURCH

Sunday service is at 10 a.m. New Hope Church is at the Meeting Place between the Amherst post office and Citizens Bank, 199 Route 101, Amherst. Contact the Rev. John Rotch at 672-2434, newhopeag@hotmail.com or visit www.newhopeag.net.

SOUHEGAN CHRISTIAN CHURCH

Sunday School for all ages is at 9 a.m. Fellowship time is at 10 a.m. and worship service is at 10:30 a.m. The church is at 5 Route 101A, Unit 2. Call 672-6759 or visit www.sccofnh.org.

ST. LUKE ANGLICAN CHURCH

Holy Eucharist are 8 and 10 a.m. Sundays, followed by coffee and fellowship. The church is at 3 Limbo Lane, Amherst, and can be reached at 672-6054 or at www.st-luke.amherst.nh.us.

ST. PAUL EVANGELICAL LUTHERAN CHURCH

Sunday services begins at 9:30 a.m. Contact the Rev. Joel Petermann or the Rev. Brain Schuessler at 821-9891, e-mail at pastor@stpaul-amherst.org or visit www.stpaul-amherst.org. The church is at 3 Craftsman Lane in Amherst.

TREE OF LIFE INTERFAITH TEMPLE

Robert A. Jonas, Ed.D, M.T.S., director of The Empty Bell, a contemplative sanctuary in Northampton, Mass., will speak on "Frontiers in the Buddhist-Christian Dialogue" from 10 a.m.-1 p.m. Feb. 19 at the Tree of Life School. Call Amy at 546-2320 or amyb@treeoflifenh.com to reserve your space. Free.

The temple is at 5 Northern Blvd., Unit 8. Visit www.tolinterfaithtemple.org for more information on our temple, our seminary and more.

MILFORD

THE BRIDGE COMMUNITY CHURCH

Sunday Service and Sunday School are at 10:30 a.m. Adult Sunday School is at 9:30 a.m. Gatekeepers meet at 9:45 a.m. Sundays. The Bridge Community Church (formerly called First Baptist Church) is at 65 West St., Milford. Call the church at 673-5191 or visit www.bridgechurchnh.com.

BURNS HILL CHRISTIAN

Burns Hill Christian Fellowship is a nondenominational church dedicated to furthering the Kingdom of God in the Souhegan Valley. Sunday meeting begins at 10 a.m. at 37 Wilton Road (Pine Valley Mill) in Milford.

CHRISTIAN SCIENCE READING ROOM

On Feb. 22 at 2 p.m., there will be an event with programs from the February 2011 Christian Science Sentinel Radio CD, "Success, not failure" and "Defeating cancer." The Reading Room is at 42 South St. and is open 11 a.m.-3 p.m. Monday-Friday, from 9 a.m.-noon Saturday, 7-7:45 p.m. Wednesday, and 11:30 a.m.-12:30 p.m. the first Sunday of the month. Call 673-5274 or e-mail readingroom@csmilfordnh.org.

CHURCH OF OUR SAVIOUR

The Church of Our Saviour is at 10 Amherst St. Parking is available in the outer perimeter of the Rite Aid parking lot or in other nearby lots. For more information, visit www.coosmilford.org or call 673-3309.

COLONIAL HILLS BAPTIST

Colonial Hills Baptist Church holds Sunday school for grades 1-12 at 9 a.m.; morning services are at 10. There is Bible Study and Prayer Wednesdays at 7 p.m. The church is at 54 Melendy Road. www.chbcnh.org.

FIRST CHURCH OF CHRIST, SCIENTIST

On Feb. 20, the subject of our Bible Lesson sermon is "Mind." The Golden Text is from Romans (King James version). The sermon consists of selections from the Bible and from Science and Health with Key to the Scriptures by Mary Baker Eddy. The church is at 103 South St. For more information, call 673-5274.

FIRST CONGREGATIONAL

Worship is at 10 a.m. The church is at 10 Union St. Call 673-3713 for information or e-mail milforducc@firstccmnh.org. Visit www.firstccmnh.org for more information.

GRANITE BAPTIST CHURCH

Sunday morning children, youth and adult Bible Fellowship meets from 9-10 a.m. Worship service follows at 10:15 a.m. Sunday services are held at the Boys & Girls Club, 56 Mont Vernon St., Milford. Bible studies are held at other locations. For more information, call 769-4899 or visit www.granitebaptist.net.

MILFORD UNITED METHODIST

The Milford United Methodist Church is at 327 N. River Road. For more information, call 673-2669, e-mail office@milfordumc.org or visit www.MilfordUMC.org.

ST. PATRICK CHURCH

Masses are at 4 p.m. Saturdays and 7, 8:45 and 10:45 a.m. Sundays. Confession is at 3 p.m. Saturdays. Church is at 34 Amherst St.

UNITARIAN UNIVERSALIST

This Sunday's sermon topic is Islam. The Unitarian Universalist Congregation is at 20 Elm St., just past the Oval. Visit www.uucm.org or www.uua.org or call 673-1870.

MONT VERNON

CONGREGATIONAL CHURCH

Worship is at 10:30 a.m. Sunday. Mont Vernon Congregational Church is at the top of Route 13, at 4 S. Main St. For more information, call 673-3500 Tuesday or Thursday from 9 a.m.-1 p.m. or e-mail montvernonchurch@montvernonchurch.org or visit www.montvernonchurch.org.

WILTON

FIRST UNITARIAN CONGREGATIONAL SOCIETY

The church is on Isaac Frye Highway in Wilton Center. For more information, call 654-9518, e-mail admin@uuwilton.org or visit www.uuwilton.org.

GOOD NEWS BIBLE CHURCH

Awana is back at Good News Bible Church. For more information, visit www.goodnewswiltonnh.org or call 654-6396.

SECOND CONGREGATIONAL CHURCH

Church service Sunday is at 10:15 a.m. Sunday school is at 9 a.m. Worship is at 10:15 a.m. with the Rev. Cassie Emanuel. Choir practice is at 9:15 a.m. For more information, visit 2ccwilton.org or call 654-9045. The church is at 25 Gregg St.

EPA Begins First Five-Year Review at the Savage Municipal Water Supply Well Superfund Site

The U.S. Environmental Protection Agency (EPA) announces that the first Five-Year Review of the remediation activities implemented at the Savage Municipal Water Supply Well Superfund Site will be conducted this year. Five-Year Reviews are mandated under CERCLA, commonly known as the Superfund law. Implementation of the review is guided by Comprehensive Five-Year Review Guidance issued by EPA (OSWER Directive 9355.7-03B-P, June, 2001). The purpose of the Five-Year Review is to ensure that the selected remedy is effectively protecting public health and the environment. EPA is the lead agency at the site and will conduct the review. The Five-Year Review will be completed by October, 2011, and the results will be made available to the public.

The site consists of a municipal well and the underlying aquifer. The site covers approximately 235 acres and is located about five miles west of the center of Milford, New Hampshire. The site was added to the National Priorities List (NPL) and became a Superfund site in October, 1984.

The Savage Municipal Water Supply Well Site has been divided into two operable units. Operable Unit 1 is the former OK Tool area (OU1); Operable Unit 2 is the extended plume area (OU2). The long-term cleanup remedy selected for the site included:

- the installation of a subsurface barrier wall surrounding the most highly-contaminated groundwater at the former OK Tool area;
- the installation of groundwater monitoring and extraction wells;
- the construction and operation of two groundwater treatment systems;
- soil excavation and treatment;
- soil vapor extraction and treatment and monitored natural attenuation (MNA) of contaminants in groundwater.

The primary contaminants of concern at the site include two volatile organic compounds (VOCs) -- specifically trichloroethylene (TCE) and tetrachloroethylene (PCE). Groundwater monitoring, treatment, and MNA continue to be implemented at the former OK Tool area and in the extended plume area.

EPA has formed a team to plan and conduct the review and to complete a Five-Year Review report. The review process involves an evaluation of the cleanup approach taken at the site. The process will include:

- Interviewing local officials and community members
- Checking current site conditions and institutional controls
- Assessing monitoring records and reports

Public participation in the Five-Year Review Process is encouraged and welcomed. If you are interested in participating in the interview process, please contact Pam Harting-Barrat at 617-918-1318.

For further information please contact:
EPA Remedial Project Manager
Skip Hull hull.richard@epa.gov , 1-888-372-7341, ext. 81882; or 617-918-1882;
New Hampshire Department of Environmental Services (NHDES) Project Manager
Robin Mongeon robin.mongeon@des.nh.gov.
More information about cleanup activities at the Savage Municipal Water Supply Well Superfund site may be found on the EPA New England web site at: www.epa.gov/region1/superfund/sites

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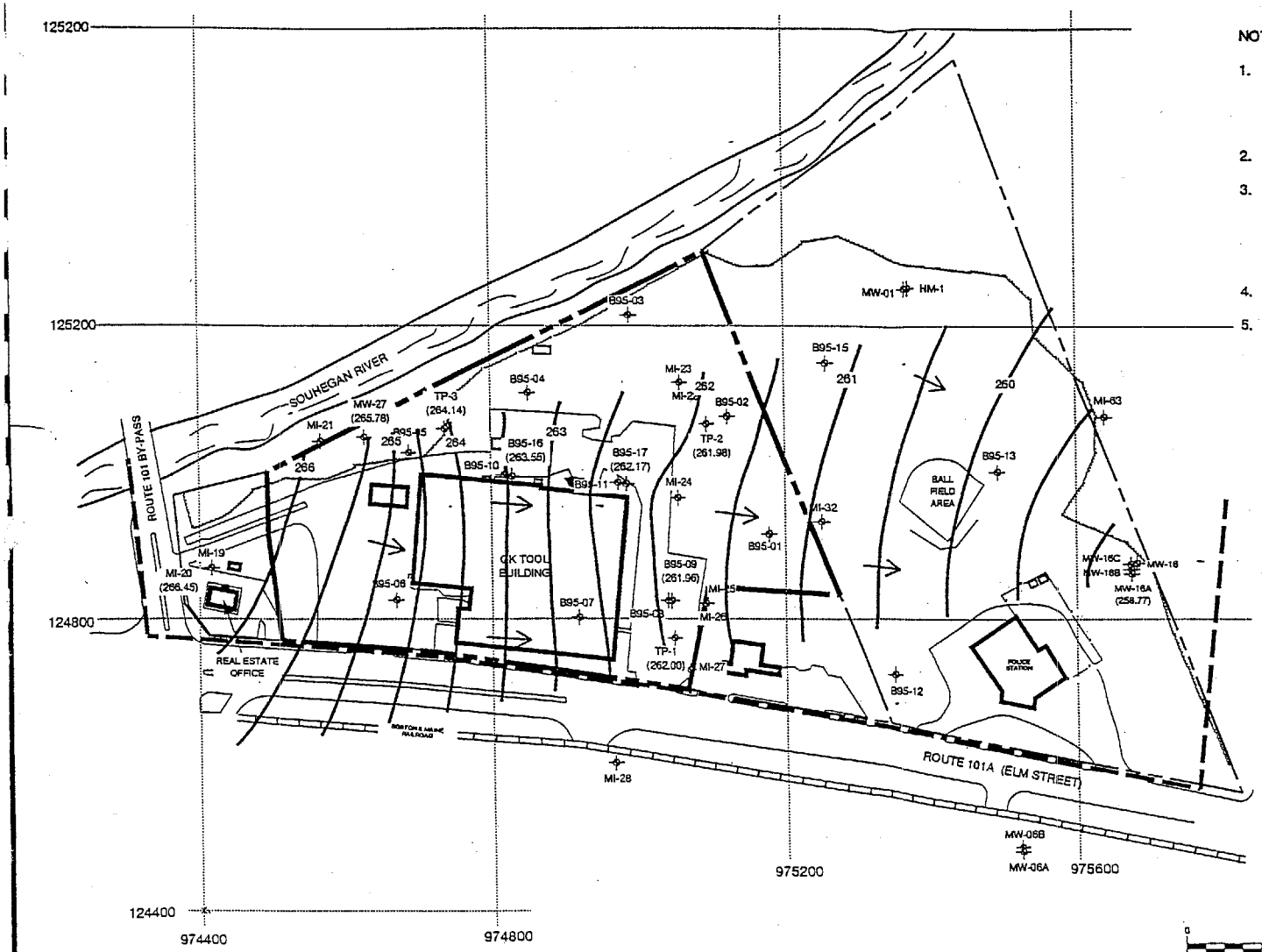


NOTES:

1. Aries developed the is plan from a plan titled "Boundary Plat prepared for Camp, Dresser, McKee, Inc., Route 101-A & North River RD., Milford, NH", dated October 31, 1995 prepared by Richard D. Bartlett & Associates, Inc.
2. Site feature locations are approximate.
3. Aries made ground water level readings in the monitoring wells at times and under conditions stated in the text. Aries made interpretations of this information in the text. Fluctuations in ground water levels may occur due to variations in season, precipitation, temperature and other factors.
4. Contours represent inferred lines of equal ground water elevation.
5. Contour lines are approximate and are based on data obtained from widely spaced observation points. Actual contours may vary from those shown.

LEGEND:

MI-32	Monitoring well.
262	Inferred ground water elevation in feet based on December 14, 1995 site data.
(258.77)	Ground water elevation in feet observed on December 14, 1995.
↓	Estimated ground water flow direction.
	Tree line.

0 150 225 300

APPROXIMATE SCALE: 1" = 150'

NORTH

CAMP DRESSER & McKEE INC.

environmental engineers, scientists, planners, & management consultants CDM

ACTION	INITIALS	NO.	DATE	REVISIONS
DESIGNED:				
DRAWN:				
CHECKED:				
APPROVED:				
95036\3 2-22/96		PROJECT No: 95036		

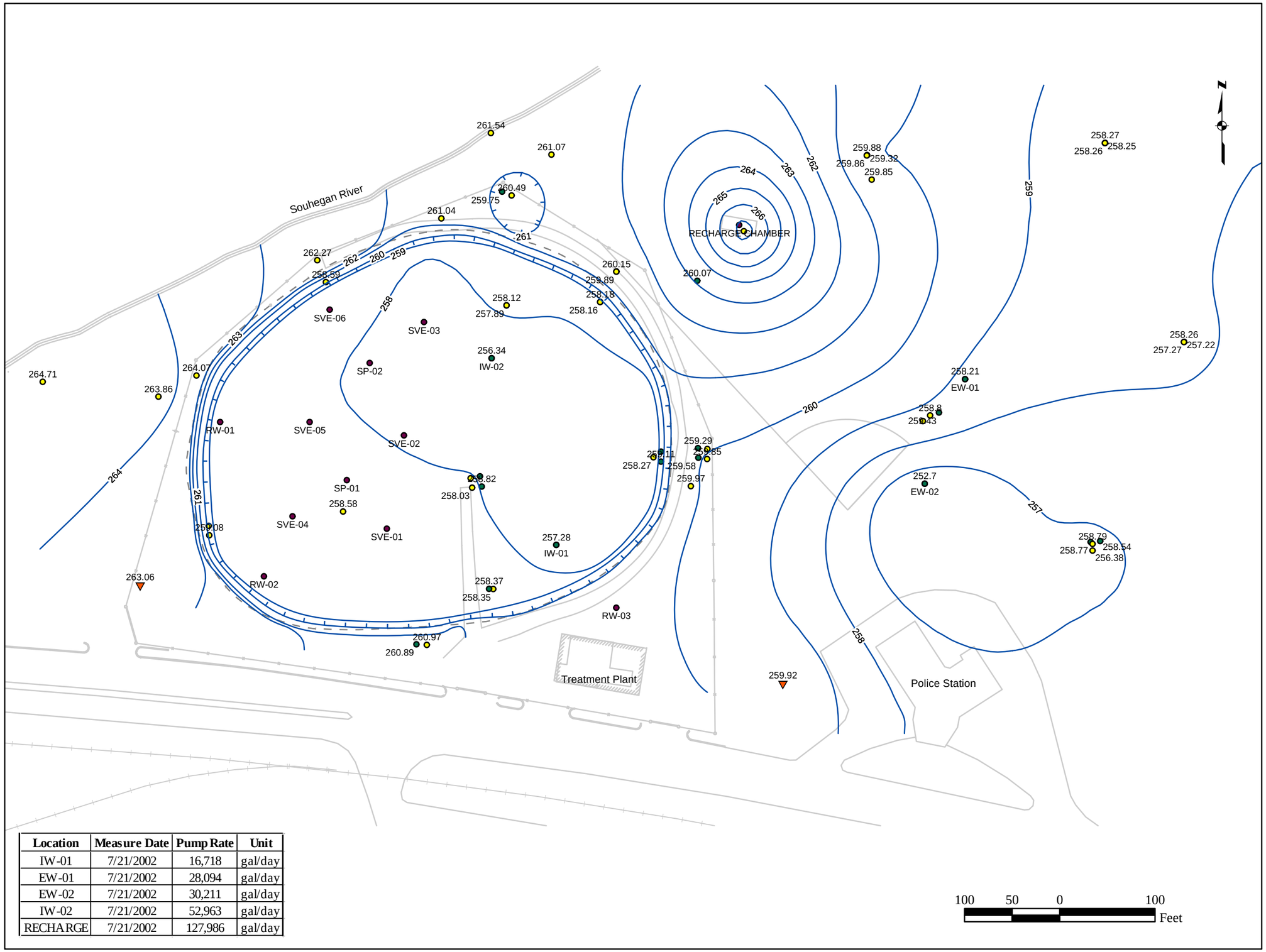
CONCEPTUAL REMEDIATION DESIGN REPORT

OK TOOL SOURCE AREA
SAVAGE WELL SUPERFUND SITE
MILFORD, NEW HAMPSHIRE

SHALLOW GROUND WATER ELEVATION CONTOURS

FEBRUARY 1996

FIGURE 2-2



Location	Measure Date	Pump Rate	Unit
IW-01	7/21/2002	16,718	gal/day
EW-01	7/21/2002	28,094	gal/day
EW-02	7/21/2002	30,211	gal/day
IW-02	7/21/2002	52,963	gal/day
RECHARGE	7/21/2002	127,986	gal/day

Legend

- Groundwater Elevation Contour
- Closed Contour
- Treatment System Features
- Base Map
- Railroad
- Barrier Wall

22 Jul 2002 Water Levels

- Deep Meaurement (Screen Midpoint Elevation < 195 feet)
- Shallow Meaurement (Screen Midpoint Elevation > 195 feet)
- Estimated GW Elevation Values (Data not available)

Notes:

1. The contours on this map correspond to groundwater elevations on a horizontal plane through a three-dimensional field of estimated values. The values were estimated using a three-dimensional geostatistical technique (kriging). They are based on the posted measurements, that were taken over a range of elevations. Therefore, the contour lines and the posted data are showing the same information, but at different elevations.
2. Shallow groundwater elevation maps are plotted at a horizontal plane elevation of 242 ft. amsl and deep groundwater elevation maps at 186 ft amsl.
3. The base map was developed from the Record Site Plan, 19 August 1999, prepared by Camp, Dresser & McKee, Inc.
4. Groundwater elevations based on data collected by USFilter and from the U.S. Geological Survey continuous water-level monitoring program under a cooperative agreement with the New Hampshire Department of Environmental Services and the U.S. Environmental Protection Agency, Region 1.
5. SVE system not operating.

FIGURE H-7

July 2002
Shallow Zone

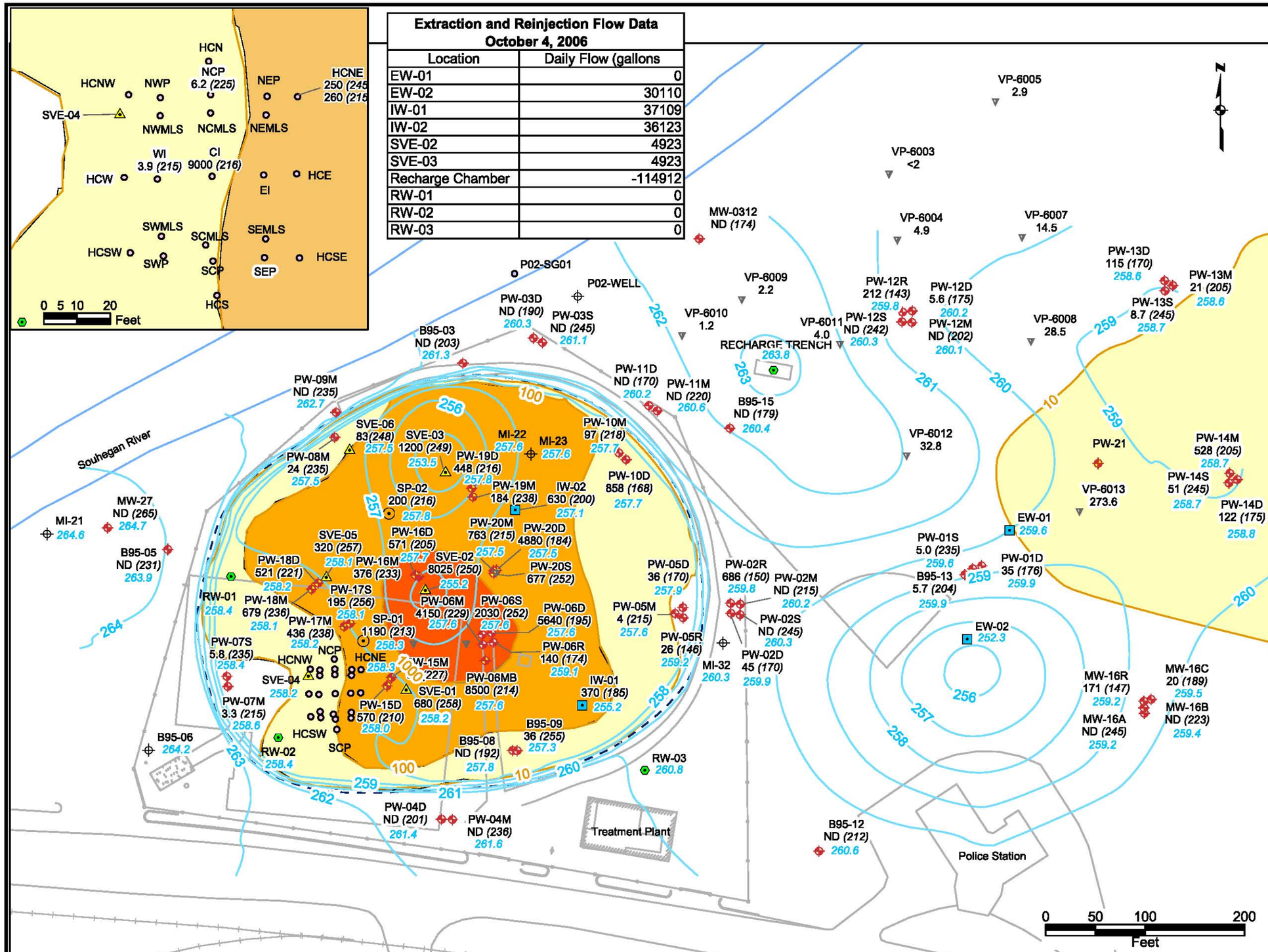
Groundwater Elevation Contour Map
OK Tool Source Area, OU1
Savage Municipal Well
Superfund Site, Milford, NH

USFilter

Path: Z:\databases\6153_OKTool\GISData\2002_fiveyear_rev\arcmap_docs\waterlev\200207_wl_shallow.mxd

Date: 1/14/2003

Extraction and Reinjection Flow Data October 4, 2006	
Location	Daily Flow (gallons
EW-01	0
EW-02	30110
IW-01	37109
IW-02	36123
SVE-02	4923
SVE-03	4923
Recharge Chamber	-114912
RW-01	0
RW-02	0
RW-03	0



LEGEND

Well Type

- Extraction
- INEEL Well
- Injection
- Monitoring
- MONITORING (NEW)
- River Gauge
- Sparge
- SVE
- Water level
- Barrier Wall
- 2004 vertical profile

Concentration (ug/L)

- 10-100
- 100-1,000
- 1,000-10,000
- concentration contour
- piezometric elevation (ft amsl)

Notes:

1. Concentrations are contoured in zones relative to the saturated thickness of the unconsolidated aquifer: shallow zone – near water table (4-17 feet depth, 255-268 ft elev.) lower middle zone – 3/5 total depth (32-70 ft depth, 199 to 236 ft elev.) basal zone – base of aquifer (53 to 116 ft depth, 153 to 215 ft elev.).
2. Contours are based on 3D Krig estimation employing data at all elevations.
3. Concentration estimates are less certain where sample data are sparse.
4. Sample concentrations are posted in ug/L in black text with sample elevation (ft amsl) in parentheses. Concentrations posted at vertical profiles are averages and do not include a depth.
5. Piezometric elevation contours based on measurements taken by Veolia water 4 Oct 2006 and provided by the USGS continuous water-level monitoring program under a cooperative agreement with the NHDES and the U.S. EPA, Region 1. Well water level elevations (ft amsl) posted in blue.
6. Map displayed in New Hampshire State Plane (US Survey feet) Projection, North American Datum of 1983.
7. Base map is based on Record Site Plan, 19 August 1999, Camp, Dresse & McKee, Inc.
8. Some site-specific features, such as the OK Tool building footprint, no longer exist. They are included on the map for historical reference.

FIGURE 9

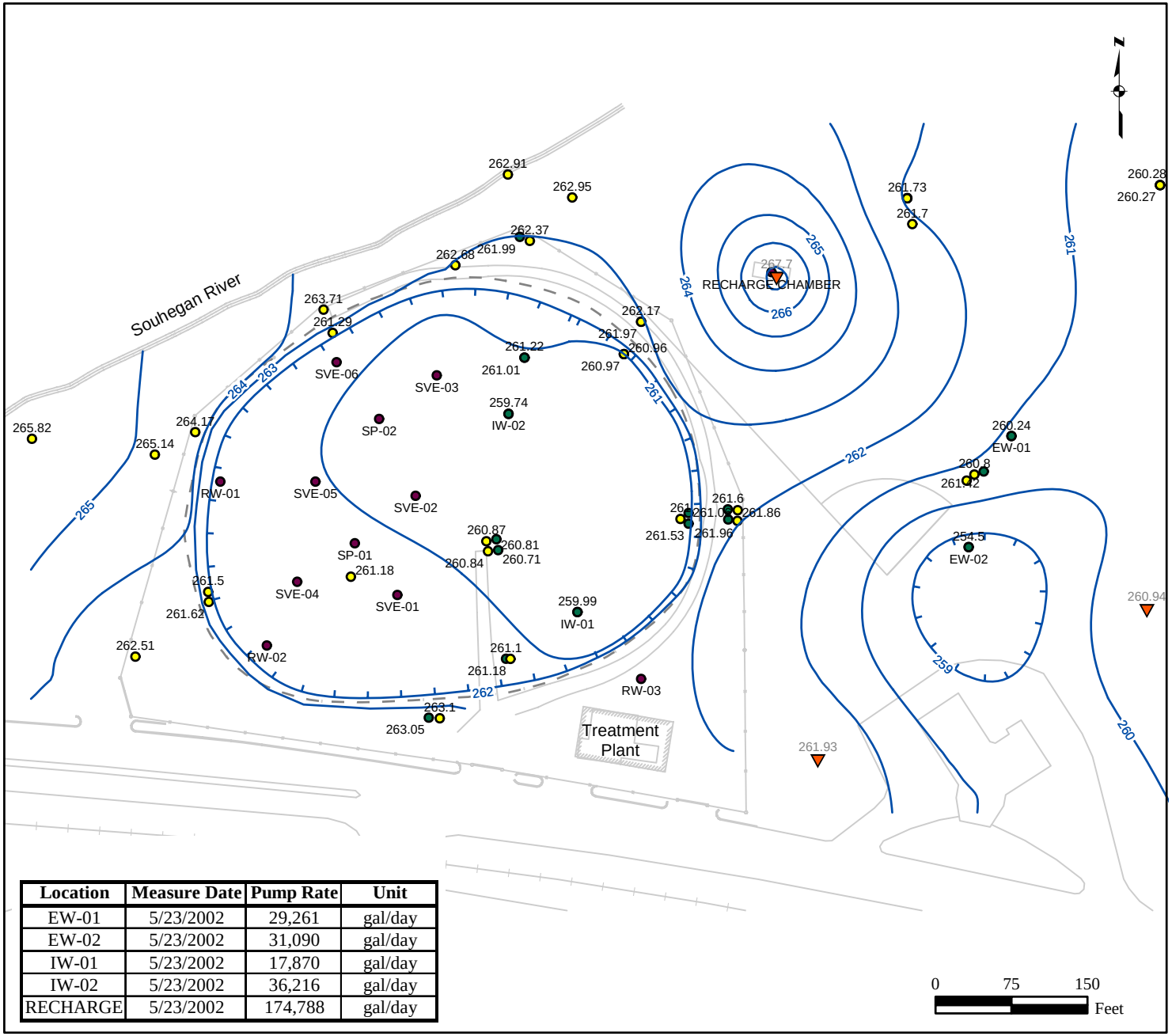
Map of estimated PCE concentrations and piezometric elevations in the shallow zone of the unconsolidated aquifer, October 2006

Savage Municipal Water Supply Well Superfund Site, OU1, Milford, NH

N.A. Water Systems

Path: C:\My Documents\Projects\6153_OKTool\maps\GIS\Oct-06 shallow map rev.mxd

Date: 5/16/2007



Location	Measure Date	Pump Rate	Unit
EW-01	5/23/2002	29,261	gal/day
EW-02	5/23/2002	31,090	gal/day
IW-01	5/23/2002	17,870	gal/day
IW-02	5/23/2002	36,216	gal/day
RECHARGE	5/23/2002	174,788	gal/day

Legend

- Groundwater Elevation Contour
- Closed Contour
- Treatment System Features
- Base Map
- Railroad
- Barrier Wall

23 May 2002 Water Levels

- Deep Meaurement (Screen Midpoint Elevation < 195 feet)
- Shallow Meaurement (Screen Midpoint Elevation > 195 feet)
- Estimated GW Elevation Values (Data not available)

Notes:

1. The contours on this map correspond to groundwater elevations on a horizontal plane through a three-dimensional field of estimated values. The values were estimated using a three-dimensional geostatistical technique (kriging). They are based on the posted measurements, that were taken over a range of elevations. Therefore, the contour lines and the posted data are showing the same information, but at different elevations.
2. Shallow groundwater elevation maps are plotted at a horizontal plane elevation of 242 ft. amsl and deep groundwater elevation maps at 186 ft amsl.
3. The base map was developed from the Record Site Plan, 19 August 1999, prepared by Camp, Dresser & McKee, Inc.
4. Groundwater elevations based on data collected by USFilter and from the U.S. Geological Survey continuous water-level monitoring program under a cooperative agreement with the New Hampshire Department of Environmental Services and the U.S. Environmental Protection Agency, Region 1.
5. SVE system not operating.
6. Elevation data not available for recharge chamber.

FIGURE H-5

May 2002 Shallow Zone

Groundwater Elevation Contour Map

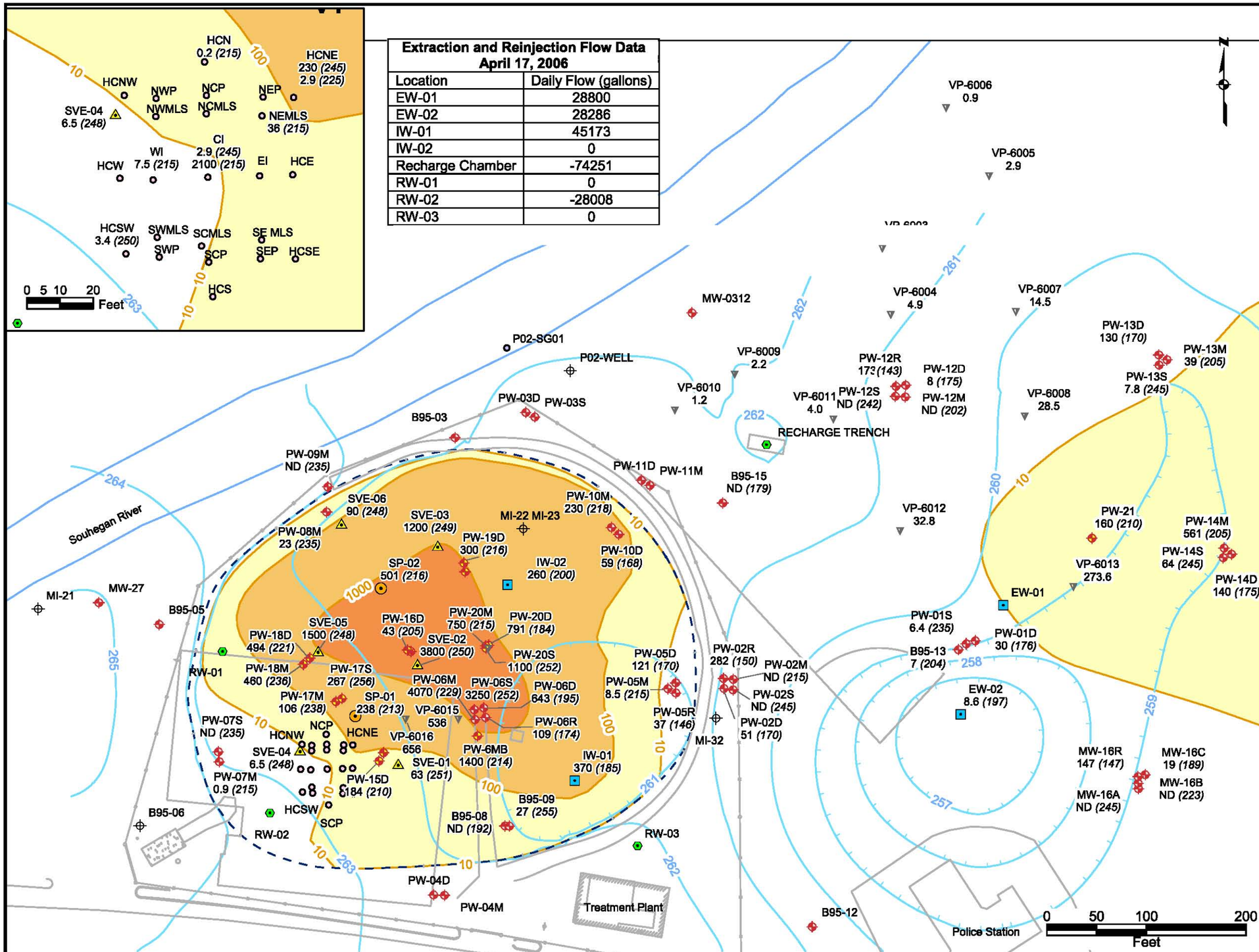
OK Tool Source Area, OU1, Savage Municipal Well Superfund Site, Milford, NH

USFilter

Path: Z:\databases\6153_OKTool\GISData\2002_fiveyear_rev\arcmap_docs\waterlev\200205_wl_shallow.mxd

Date: 1/23/2003

Extraction and Reinjection Flow Data April 17, 2006	
Location	Daily Flow (gallons)
EW-01	28800
EW-02	28286
IW-01	45173
IW-02	0
Recharge Chamber	-74251
RW-01	0
RW-02	-28008
RW-03	0



LEGEND

Well Type

- Extraction
- INEEL Well
- Injection
- Monitoring
- MONITORING (NEW)
- River Gauge
- Sparge
- SVE
- Water level
- Barrier Wall
- 2004 vert. profile

Concentration (ug/L)

- *1000-10,000*
- *100 - 1000*
- *10 - 100*

Notes:

1. Concentrations are contoured in zones relative to the saturated thickness of the unconsolidated aquifer: shallow zone – near water table (4-17 feet depth, 255-268 ft elev.) lower middle zone – 3/5 total depth (32-70 ft depth, 199 to 236 ft elev.) basal zone – base of aquifer (53 to 116 ft depth, 153 to 215 ft elev.).
2. Contours are based on 3D Krig estimation employing data at all elevations.
3. Concentration estimates are less certain where sample data are sparse.
4. Sample concentrations are posted in ug/L in black text with sample elevation (ft amsl) in parentheses. Concentrations posted at vertical profiles are averages and do not include a depth.
5. Water level elevation contours based on measurements taken by Veolia water 17 April 2006 and those provided by the USGS continuous water-level monitoring program under a cooperative agreement with the NHDES and the U.S. EPA, Region 1.
6. Map displayed in New Hampshire State Plane (US Survey feet) Projection, North American Datum of 1983.
7. Base map is based on Record Site Plan, 19 August 1999, Camp, Dresse & McKee, Inc.
8. Some site-specific features, such as the OK Tool building footprint, no longer exist. They are included on the map for historical reference.

FIGURE 12

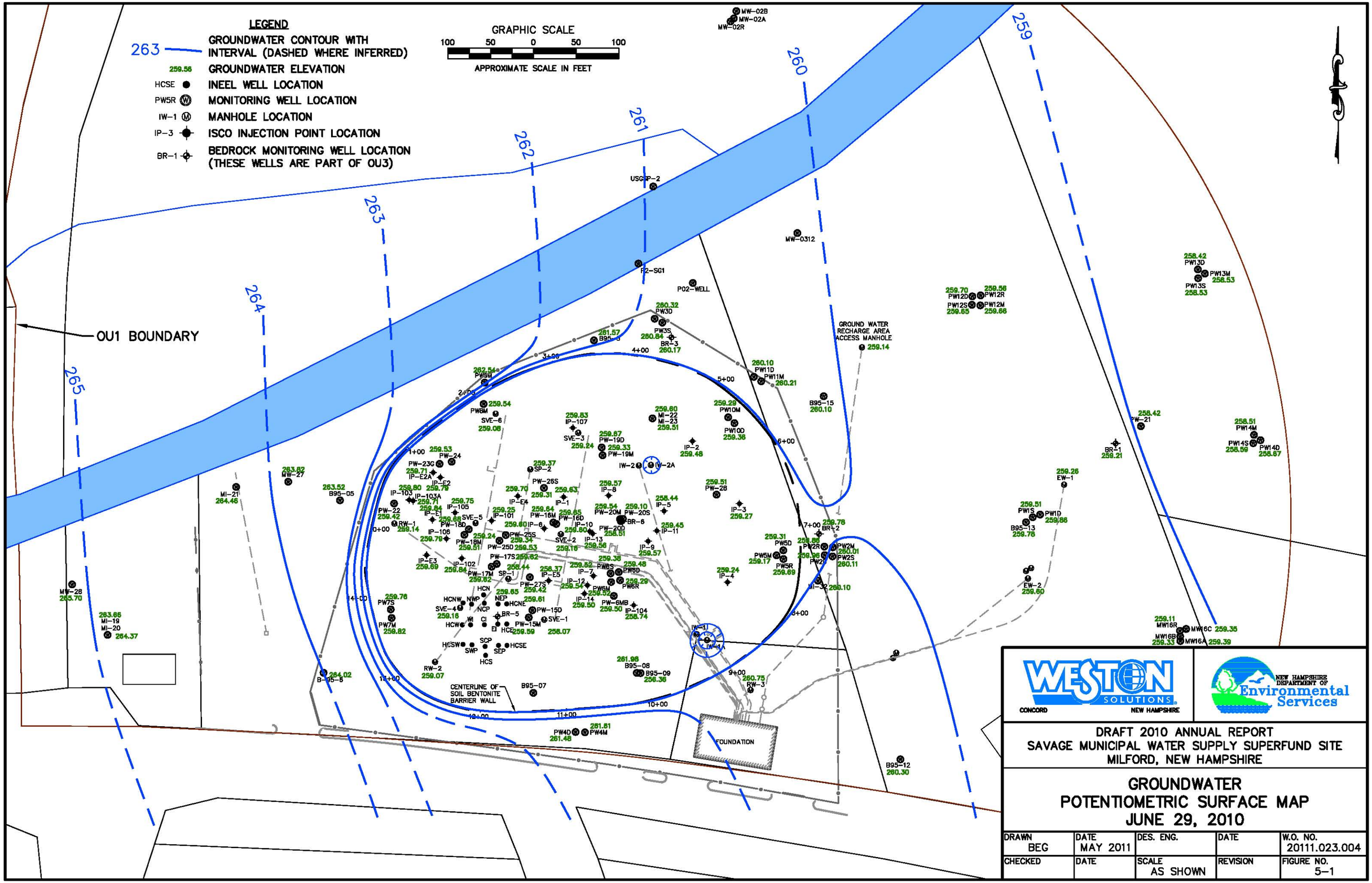
Map of estimated PCE concentrations and piezometric elevations in the shallow zone of the unconsolidated aquifer, April 2006

Savage Municipal Water Supply Well
Superfund Site, OU1, Milford, NH

N.A. Water Systems

Path: C:\My Documents\Projects\6153_OKTool\maps\GIS\April-06 shallow.mxd

Date: 11/17/2006



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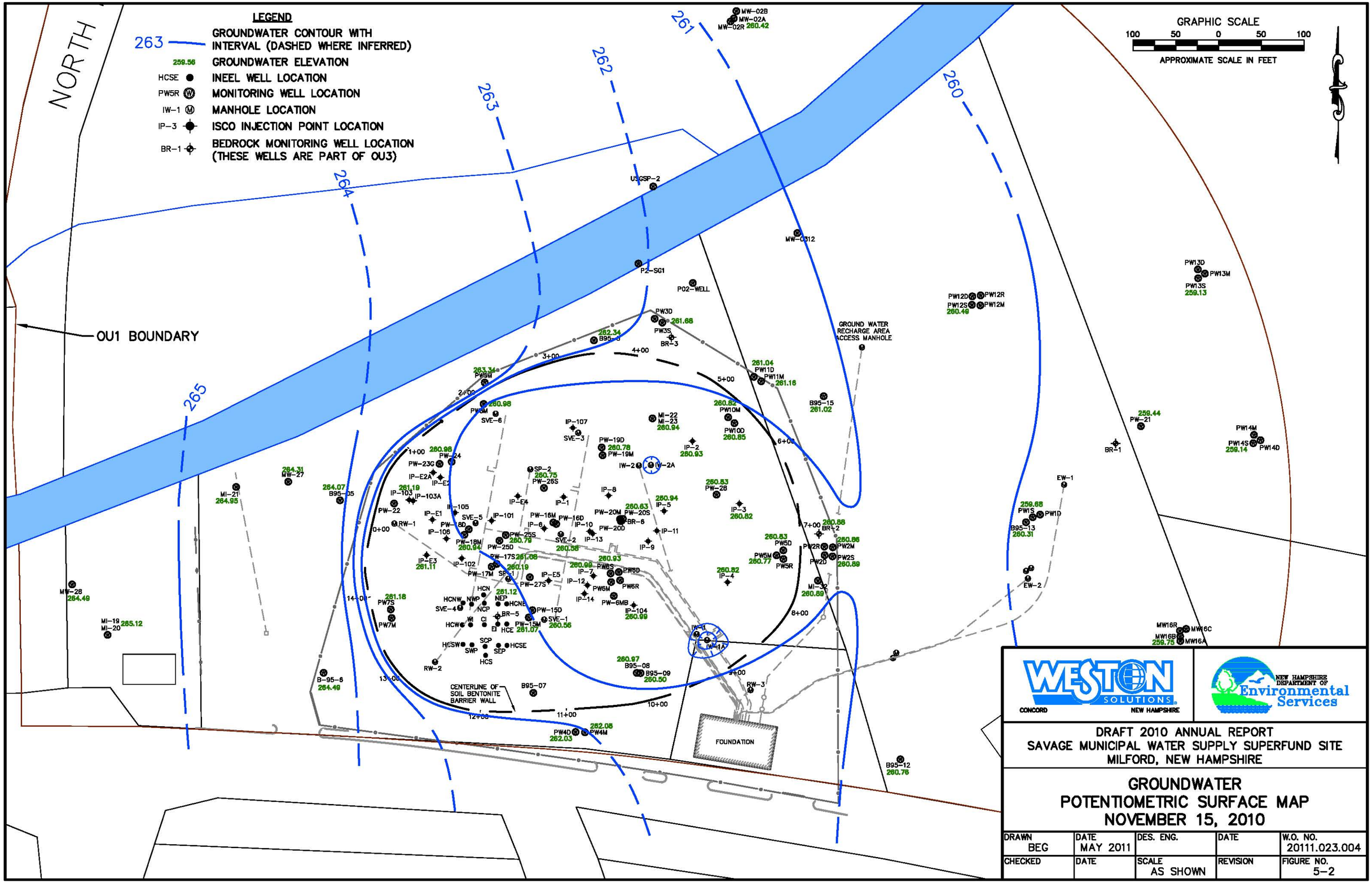
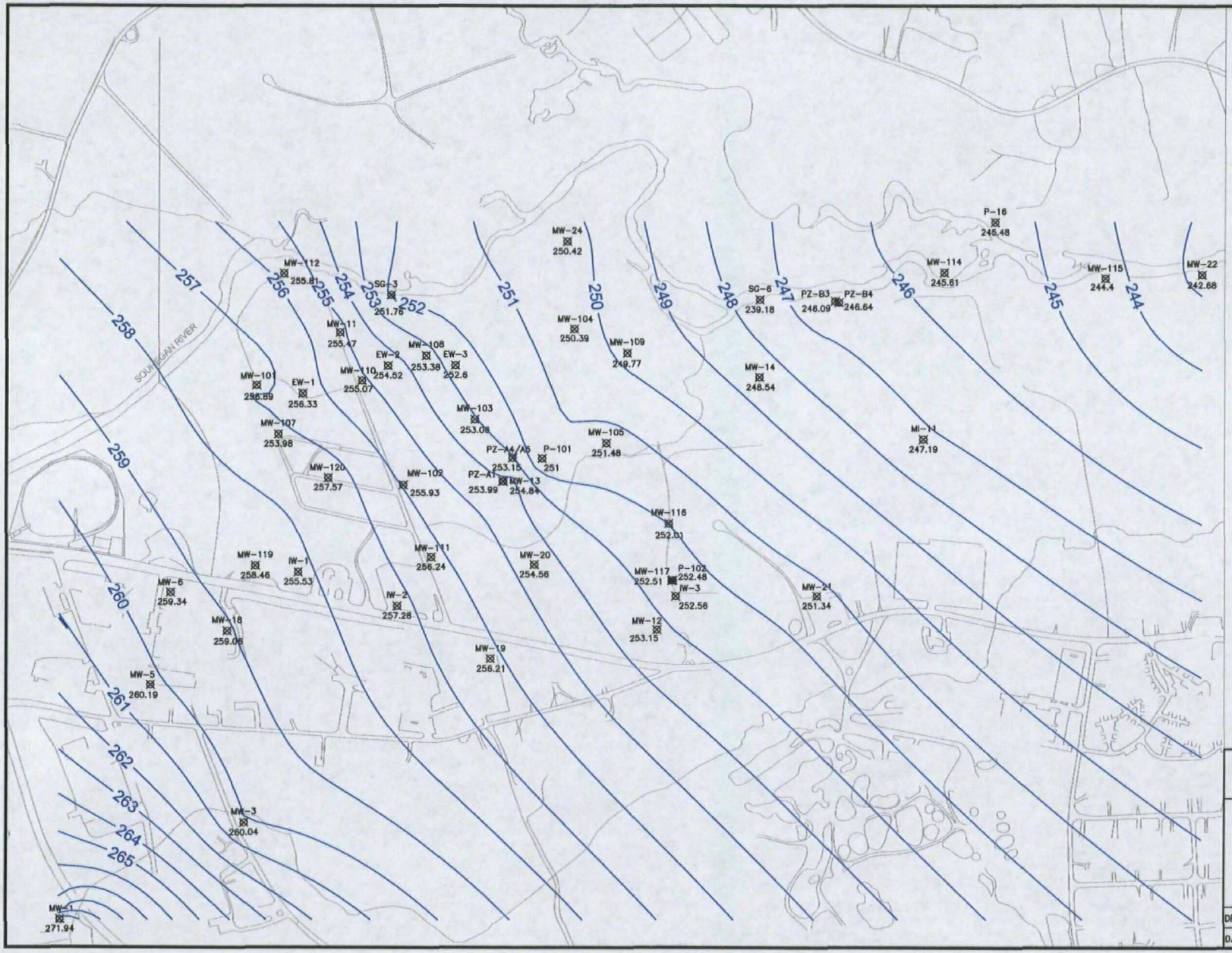


M:\Design\DWG\NHDES\savage\2011\draft 2010 annual report\FIG 5-2.dwg, Layout 1, 5/20/2011 9:31:12 AM, GIRARDEB, 1:1



LEGEND

MW-01 ⊠ 245.47 — MEASURED GROUNDWATER ELEVATION – AUGUST 2005 (FT-MSL)

257 — GROUNDWATER ELEVATION CONTOUR (FT-MSL)

NOTES:

1) FOR MONITORING WELL CLUSTERS, MEASURED GROUNDWATER ELEVATIONS WERE AVERAGED OVER DEPTH.

2) DATA FROM MW-107, IW-1, AND SG-6 WERE NOT UTILIZED IN THE GENERATION OF THE GROUNDWATER ELEVATION CONTOURS AS MEASURMENTS TAKEN AT THESE LOCATIONS APPEAR ANOMALOUS.

N

APPROX. SCALE IN FEET

0 500 1,000

Gradient CORPORATION

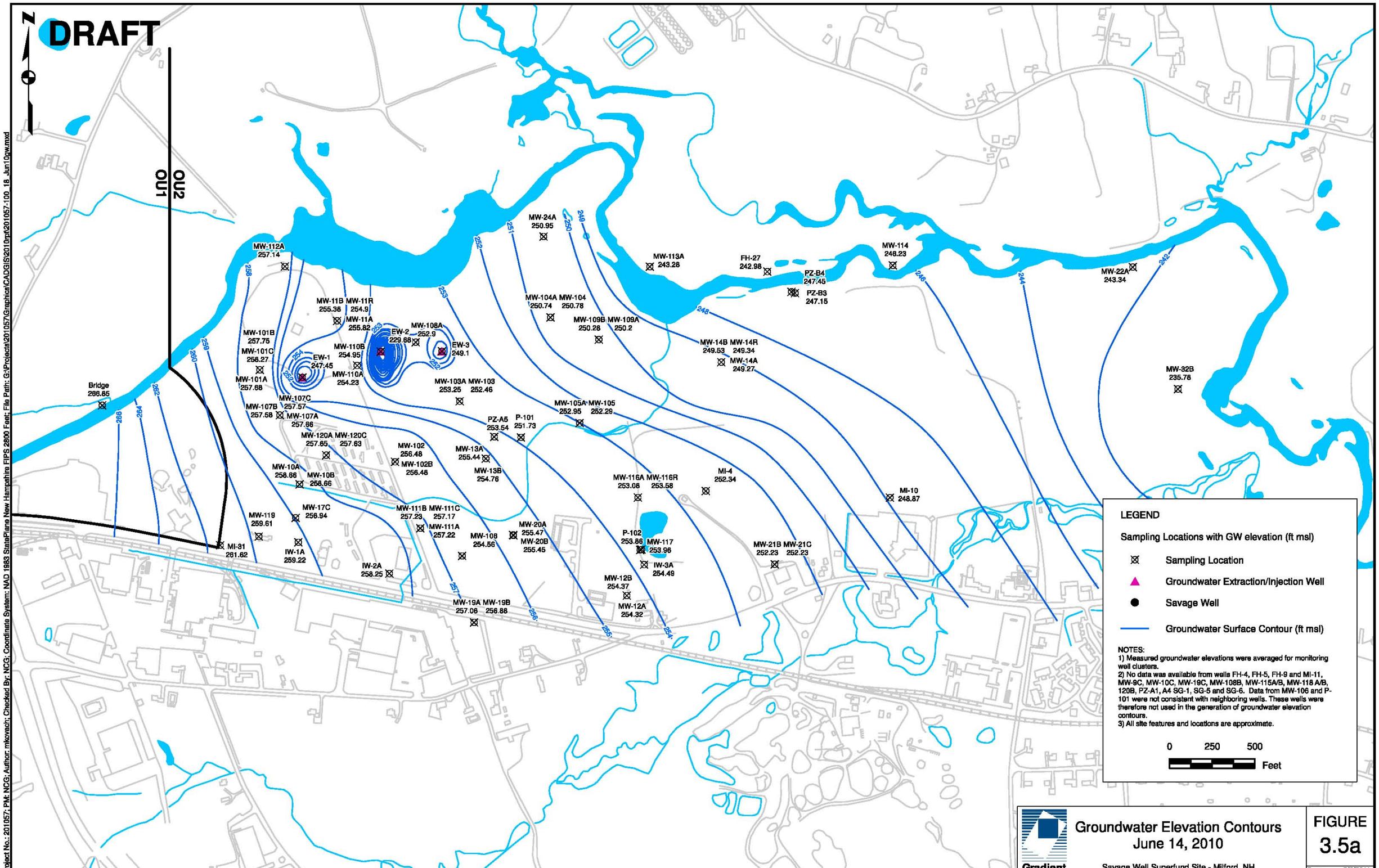
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617) 395-5000

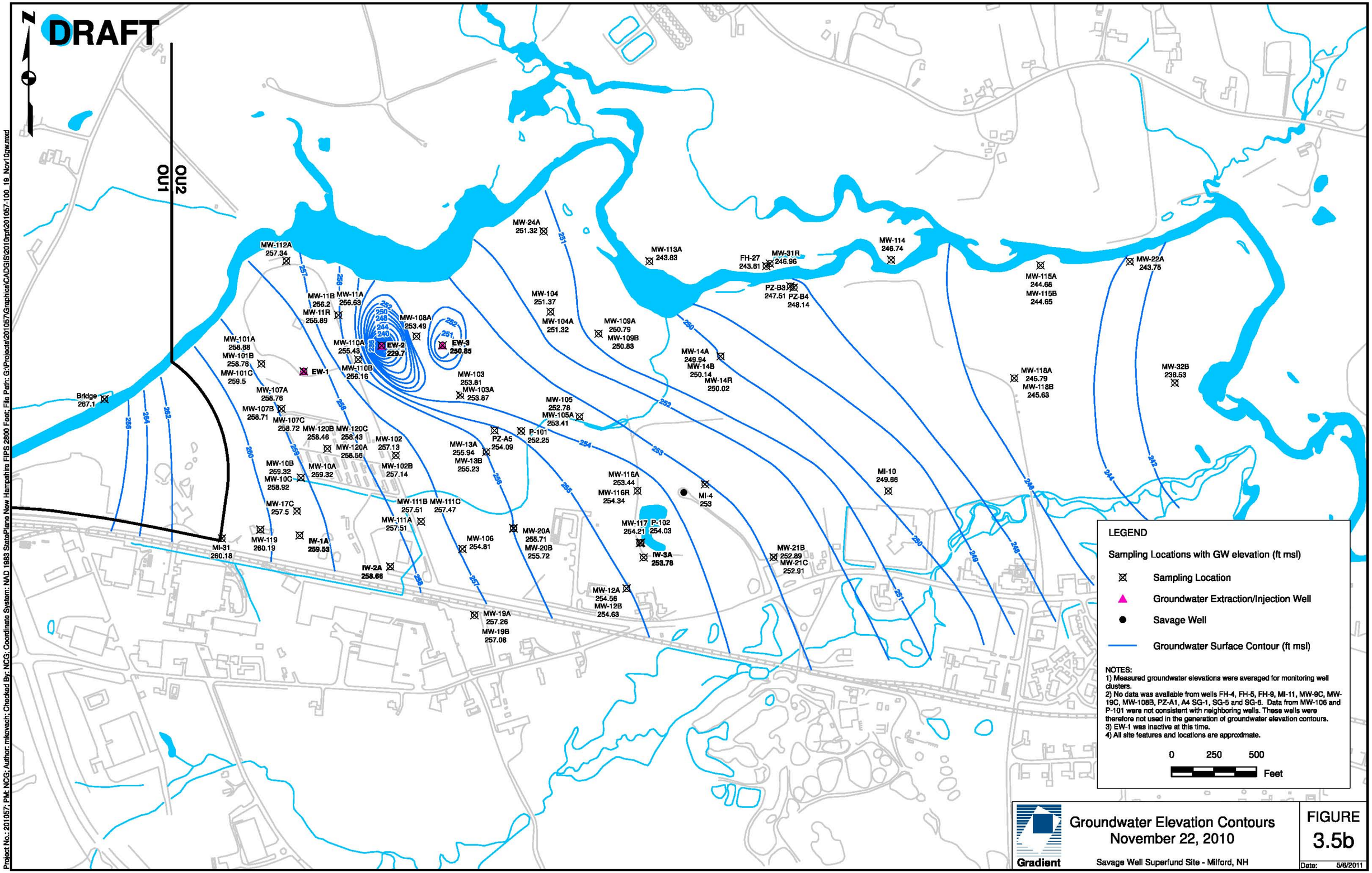
FIGURE 3-2

GROUNDWATER ELEVATION CONTOURS – AUGUST 2005

SAVAGE WELL SUPERFUND SITE – MILFORD, NH

DRAWN BY:	JMA	CHECKED BY:	ABB	PROJ. NO.:	201057
DATE:	11/17/05	DATE:	11/17/05	FILE:	GWE_2005


DRAFT
N
OU1
OU2
MW-112A 257.14
MW-11B 255.38
MW-11R 254.9
MW-11A 255.82
MW-101B 257.75
MW-101C 258.27
MW-101A 257.68
EW-1 247.45
EW-2 229.68
MW-108A 252.9
EW-3 249.1
MW-110B 254.95
MW-110A 254.23
MW-103A 253.25
MW-103 252.46
MW-107C 257.57
MW-107B 257.58
MW-107A 257.86
MW-120A 257.65
MW-120C 257.63
MW-102 256.48
MW-102B 256.48
MW-10A 258.66
MW-10B 258.66
MW-17C 256.94
MW-119 259.61
MI-31 261.62
IW-1A 259.22
IW-2A 258.25
MW-111B 257.23
MW-111C 257.17
MW-111A 257.22
MW-108 254.56
MW-19A 257.06
MW-19B 256.88
Bridge 266.85
MW-24A 250.95
MW-104A 250.74
MW-104 250.78
MW-109B 250.28
MW-109A 250.2
PZ-A5 253.54
P-101 251.73
MW-13A 255.44
MW-13B 254.76
MW-20A 255.47
MW-20B 255.45
MW-105A 252.95
MW-105 252.29
MW-113A 243.28
FH-27 242.98
PZ-B4 247.45
PZ-B3 247.15
MW-114 246.23
MW-14B 249.53
MW-14R 249.34
MW-14A 249.27
MW-116A 253.08
MW-116R 253.58
MI-4 252.34
P-102 253.86
MW-117 253.96
IW-3A 254.49
MW-12B 254.37
MW-12A 254.32
MW-21B 252.23
MW-21C 252.23
MI-10 248.87
MW-22A 243.34
MW-32B 235.78
LEGEND
Sampling Locations with GW elevation (ft msl)
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Groundwater Surface Contour (ft msl)
NOTES:
1) Measured groundwater elevations were averaged for monitoring well clusters.
2) No data was available from wells FH-4, FH-5, FH-9 and MI-11, MW-9C, MW-10C, MW-19C, MW-108B, MW-115A/B, MW-118 A/B, 120B, PZ-A1, A4 SG-1, SG-5 and SG-6. Data from MW-106 and P-101 were not consistent with neighboring wells. These wells were therefore not used in the generation of groundwater elevation contours.
3) All site features and locations are approximate.
0 250 500
Feet
Gradient
Groundwater Elevation Contours
June 14, 2010
Savage Well Superfund Site - Milford, NH
FIGURE
3.5a
Date: 5/6/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CAD\GIS\2010\rpt\201057-100_18_Jun10gw.mxd


DRAFT
N
OU1
OU2
MW-112A 257.34
MW-11B 256.2
MW-11A 256.63
MW-11R 255.69
MW-108A 253.49
MW-101A 258.88
MW-101B 258.76
MW-101C 259.5
MW-110A 255.43
EW-2 229.7
EW-3 250.85
EW-1
MW-110B 256.16
MW-107A 258.76
MW-107B 258.71
MW-107C 258.72
MW-120B 258.46
MW-120C 258.43
MW-120A 258.56
MW-102 257.13
MW-102B 257.14
Bridge 267.1
MW-10B 259.32
MW-10C 258.92
MW-10A 259.32
MW-17C 257.5
MW-111B 257.51
MW-111C 257.47
MW-111A 257.51
MI-31 260.18
MW-119 260.19
IW-1A 259.59
IW-2A 258.66
MW-106 254.81
MW-20A 255.71
MW-20B 255.72
MW-19A 257.26
MW-19B 257.08
MW-24A 251.32
MW-104 251.37
MW-104A 251.32
MW-103 253.81
MW-103A 253.87
MW-105 252.78
MW-105A 253.41
P-101 252.25
PZ-A5 254.09
MW-13A 255.94
MW-13B 255.23
MW-113A 243.83
FH-27 243.81
MW-31R 246.96
PZ-B3 247.51
PZ-B4 248.14
MW-109A 250.79
MW-109B 250.83
MW-14A 249.94
MW-14B 250.14
MW-14R 250.02
MW-116A 253.44
MW-116R 254.34
MI-4 253
MW-117 254.21
P-102 254.03
IW-3A 253.78
MW-12A 254.56
MW-12B 254.63
MW-21B 252.89
MW-21C 252.91
MI-10 249.86
MW-114 246.74
MW-115A 244.66
MW-115B 244.65
MW-118A 245.79
MW-118B 245.63
MW-22A 243.75
MW-32B 238.53
LEGEND
Sampling Locations with GW elevation (ft msl)
Sampling Location
Groundwater Extraction/Injection Well
Savage Well
Groundwater Surface Contour (ft msl)
NOTES:
1) Measured groundwater elevations were averaged for monitoring well clusters.
2) No data was available from wells FH-4, FH-5, FH-9, MI-11, MW-9C, MW-19C, MW-108B, PZ-A1, A4 SG-1, SG-5 and SG-6. Data from MW-106 and P-101 were not consistent with neighboring wells. These wells were therefore not used in the generation of groundwater elevation contours.
3) EW-1 was inactive at this time.
4) All site features and locations are approximate.
0 250 500
Feet
Gradient
Groundwater Elevation Contours
November 22, 2010
Savage Well Superfund Site - Milford, NH
FIGURE
3.5b
Date: 5/6/2011
Project No.: 201057; PM: NCG; Author: mkovach; Checked By: NCG; Coordinate System: NAD 1983 StatePlane New Hampshire FIPS 2800 Feet; File Path: G:\Projects\201057\Graphics\CAD\GIS\2010\rpt\201057-100_19_Nov10gw.mxd

[1]USGS 5-YEAR MODEL REVIEW-Savage, 2011

Appendix A: Groundwater Solute Transport Model of the Milford-Souhegan Glacial Drift Aquifer: Draft Five Year Remedy Review of the Savage Municipal Well Superfund Site, 2011

Outline

A1.Introduction
A2.Model Description
A3.Evaluation of Model
- A3.1.Remedial Simulations
- A3.2.Model Input
  - A3.2.1.Tetrachloroethylene Mass
  - A3.2.2.Properties
    - A3.2.2.a.Physical
    - A3.2.2.b.Chemical
  - A3.2.3.River
  - A3.2.4.Recharge
  - A3.2.5.Well Extraction and other Stresses
- A3.3.Model Results
  - A3.3.1.Residual Analysis
  - A3.3.2.Tetrachloroethylene Mass

A4.Additional Model Evaluation
- A4.1.Comparison to Proposed Remedial Operations
- A4.2.Comparison to Actual Remedial Operations
- A4.3.Model Adjustments
- A4.4. Additional Sources of PCE

A5.Preliminary Conclusions
A6.Use of Model as a Predictive Tool for Remedy Protection
A7.References

[1] USGS_5YR_MOD_REVIEW_aug[1]1_2011.docx; 8/2/2011

A1. Introduction

Groundwater flow and transport modeling of the Savage Superfund site was used to design the remedial system for the tetrachloroethylene (PCE) plume of the MSGD (Milford-Souhegan Glacial Drift) aquifer (Harte,2004, U.S. EPA, 2002). Currently (2011), modeling is being used to track the overall performance of the remedial system by comparing temporal trends in model-computed and observed PCE concentrations and PCE mass (Gradient Corp., 2009).Understanding model performance-how well the model compares to observed PCE trends-is important to predict PCE remedial timeframes, to understand flow and transport properties of the MSGD aquifer, and to gauge the relative efficiency of the current remedial system. All of these components are intrinsic parts in assessing whether the remedy is protective of public health, safety, and the environment.

A2. Model Description

The model refers to "*The numerical three-dimensional groundwater flow and solute transport model, initially developed by USGS/EPA (USGS, 2004; U.S. EPA, 2002) and latter updated in the 2002 RDI report (Gradient Corp., 2002).* The numerical three-dimensional groundwater flow and solute transport model is a five-layer model of the MSGD aquifer; the bedrock is not explicitly simulated. The original USGS/EPA model is referred to as the "**USGS/EPA model**" in this document whereas the model described in the 2002 RDI report is referred to as the "**model**". The model was executed to simulate actual remedy operations (i.e. actual extraction and injection well pumping rates of OU2) (Gradient Corp. 2009).

The model solves the groundwater flow and solute transport equation for single species (PCE). Output from model simulations is compared to observed PCE concentrations to evaluate model performance. The model was originally calibrated in 2001 and has not been recalibrated although annual comparisons are made between model computed and observed PCE concentrations from a network of OU2 monitoring wells (Gradient Corp., 2009).

Cell discretization, the model grid, and layering has been unaltered since the original flow model of the western MSGD aquifer (Harte et al., 1999). However, cell thickness, hydraulic properties, and other features have been adjusted over time based on new data and model calibration (*Gradient Corp., 2002)*.

A3. Evaluation of Model

Model input and selected model output was checked by examining ASCII model input files and Visual MODFLOW (VMS) files. During checking of VMS files it became apparent that different model time periods had different Visual MODFLOW versions (either 4.3 or 4.4), which restricted inspection of VMS files because of version incompatibilities.

A3.1.Remedial Simulations

The model uses average annual recharge and river conditions to simulate hydrologic conditions in the MSGD aquifer (Neal Grasso, written commun., Gradient Corp, December 23, 2010). The OU2 remedy extraction and injection, which started in 2005, were adjusted based on actual usage *(*Gradient Corp. 2009). OU1 remedy operations (extraction/injection) and extraction from the State Fish Hatchery and other active extraction wells (excluding OU2 remedy wells) in the MSGD aquifer have not been adjusted in the model to reflect actual changes in extraction/injection rates over time.

Model simulations are extended from previous simulations in monthly time increments (Neal Grasso, written commun., Gradient Corp, December 23, 2010). The model output of PCE from the previous simulations is used as the input for the starting PCE concentrations of the next simulation.

All model simulations are performed using MODFLOW-96 for formulation of groundwater flow (Harbaugh and McDonald, 1996), MT3D99 for solute transport (Zheng and Wang, 1999), and the built in pre- and post-processor, Visual MODFLOW Version 4.3 (Neal Grasso, written commun., December 23, 2010). The USGS/EPA model uses a combination of platforms including MODFLOW-96 , MODFLOW-2000 (Harbaugh et al., 2000), MODFLOW-GWT (Harte, 2004), as well as MODFLOW-96, MT3D99, and Visual MODFLOW Version 4.3.

A3.2.Model Input

Model input can be divided into several categories including starting PCE mass (concentrations of the plume), physical properties of the MSGD aquifer including hydraulic conductivity, and chemical properties like retardation of PCE. Other important model input factors include specified flows (groundwater recharge, well extractions, etc.), and physical components of the remedial system like the barrier wall.

A3.2.1.Tetrachloroethylene Mass

Starting (initial) PCE concentrations is a critical component in model input design. For the site model, each model simulation uses the previous simulation as a starting concentration point however, the initial modeling of the OU2 remedial system used model computed PCE concentrations from 2001 (Andy Bittner, written commun., June 23, 2011).Model output from 2001 had a total mass, which includes dissolved and sorbed mass, of 4,226 (Table 1). The OU2 area by itself had a total (dissolved and sorbed) PCE mass of 3,660 kg. The latter constitutes the PCE mass values shown in Fig. 3.18 of Gradient reports (2008, 2009).

Table 1. PCE mass from model simulations. [Mass is estimated from observed PCE concentrations and estimated sorbed phase of PCE]

Model	Year	OU2 Total (dissolved and sorbed) PCE (kg)	Combined OU1,OU2, Dissolved PCE (kg)	Combined OU1, OU2, Sorbed PCE (kg)	Combined OU1,OU2, Total (dissolved and sorbed) PCE (kg)	Comments
Gradient	1995				5,947	
Gradient	1998				5,657	OU1 constant source cells added
Gradient	2001	3,660			4,226	Starting mass for remedial simulations. Estimated from model.
USGS/EPA	1995		2,100	3,400	5,600	
USGS/EPA	1998		1,200	1,500	2,700	

Simulated PCE mass from 2001 was computed from simulations that began in 1995, ran from 1995-1998, and from 1998-2001. During 1995-1998 period, additional mass was added inside the barrier to simulate transfer of PCE to dissolved phases from a DNAPL or residual source (Gradient Corp., 2002). Post 1998, no additional mass is added in simulations. These mass estimates are reproduced in Table 1. The RDI report (Gradient Corp., 2002) indicates that during calibration with the 2001 PCE data set, it was necessary to increase the starting PCE mass in selected parts of the aquifer (Gradient Corp., 2002).

In contrast, USGS/EPA remedial simulations that began in 1998 as described in Harte (2004) had an initial starting mass of 2.7 Mg (1.2 Mg dissolved and 1.5 Mg sorbed). The 1998 starting mass was computed by adjusting the 1995 PCE plume, interpolated from a comprehensive vertical profiling program of the aquifer, by spatially derived ratios determined from commonly sampled wells between 1995 and 1998 (Harte, 2004). This method of specifying initial PCE concentrations to the model allowed for use of an updated comprehensive data set, which was initially based on profiling, to interpolate PCE concentrations and create an initial PCE plume for simulation.

A3.2.2 Properties

Physical properties of the aquifer affect flow and advective transport of PCE. Chemical properties also affect transport of PCE but also affect the amount of stored PCE mass on sediments of the aquifer.

A3.2.2.a. Physical

Groundwater flow is computed in the model with MODFLOW-96 and the BCF package option. Hydraulic conductivity, porosity, storage (for transient), model layer thickness are specified per model cell.

The distribution of hydraulic conductivity assigned to the model is shown in Figs. 3-2-3.6 of the RDI (Gradient Corp., 2002). Model hydraulic conductivity is uniform within zones of the aquifer and varies by layer after Harte et al. (1999). Horizontal anisotropy is not simulated but vertical anisotropy varies from ½ to 1/10th of the horizontal hydraulic conductivity.

The distribution of hydraulic conductivity in the model is similar to that of the USGS/EPA model with one exception. The high hydraulic conductivity zone (147 ft/d, Fig. 3-5, Gradient Corp., 2002) in model layer four was reduced in the USGS/EPA model from 147 ft/d to 60 ft/d to conform with hydraulic conductivities of the stratified-drift deposits at the same elevations (model layer four).

The barrier wall is simulated in the model using the hydraulic barrier package of MODFLOW (Hsieh and Freckleton, 1993). Groundwater flow is essentially restricted by adjusting the intercell hydraulic conductivity. Groundwater transport across the barrier is affected by the reduced rates of flow. However, work shown by Harte et al. (2006) shows that unrealistically high rates of dispersion across the barrier can occur unless the transport equation is reformulated and a low rate of dispersivity is assigned to the barrier. Harte (2006) showed that it was necessary to increase the hydraulic conductivity of the barrier for layer 5 in the USGS/EPA model to account for additional leakage needed to offset increased extraction inside the barrier during 2003-2006. Therefore, the hydraulic conductivity of the barrier in layer 5 of the model is specified too low as presently constituted according to work done by Harte (2006) and should be increased to match the USGS/EPA model.

Dispersion of a solute around the average flow of the solute is simulated by use of the dispersivity coefficient and equation. Dispersivity was set at 54 ft in the longitudinal direction, 0.54 ft in the transverse, and 0.54 ft in the vertical. In contrast, the USGS/EPA model used a different transverse and vertical dispersivity of 12 and 1.2 ft, respectively. The increased dispersion simulated in the USGS/EPA model allows for better replication of transient conditions in the aquifer.

A3.2.2.b.Chemical

Dissolved and sorbed PCE are simulated assuming a linear isotherm relation and is controlled by the retardation factor. Retardation factors for the model were based on work done in the USGS/EPA model (Harte, 2004); retardation varies between 2 and 2.5 based on the model layer.

PCE biodegradation is not simulated in the model or the USGS/EPA model. However, the USGS/EPA model simulates a small rate of volatilization of PCE that results in less than 0.01 percent attenuation of the PCE plume.

A3.2.3.River

The model uses the river package of Modflow-96, which essentially simulates the river as a specified-head boundary. River stage, river dimensions, and riverbed hydraulic conductance have not been significantly adjusted since earlier calibration work by Harte (1999) except for areas near the New Hampshire State Fish Hatchery wells.

The amount of flow in the discharge ditch has not been examined since well extraction from the industrial well (MI-88) has been reduced and flow discharges to the ditch altered. This could cause problems with accurately simulating groundwater flow in areas near the ditch.

River stage is kept at long-term steady state levels. Trends in streamflow and river stage have not been investigated to identify whether model levels should be adjusted.

A3.2.1.Recharge

Recharge rates were initially developed in Harte (1999) for average annual and monthly periods. However, rates in the model have not been adjusted to account for seasonal or annual differences in precipitation.

A3.2.1.Well Extraction and other Stresses

Well extraction and injections have changed significantly with time. OU2 remedial rates of extraction and injection have been adjusted over time in the model. Rates of extraction and injection from the OU1 remedial system and extraction from the State Fish Hatchery wells, an important area of large extraction, have not been adjusted and accurately represented in the model. Table 2 contains a summary of extraction and injection rates in cfs units. Some uncertainty exists in the extraction rate for well MI-88 (Hitchiner industrial well). Previous reporting indicated that the well was shut down in 2002. However, examination of well extraction rates used in the model show a small rate of extraction (Gradient Corp., CD, 2010). It is important to determine the amount of use at well MI-88 and whether extracted water is discharged to the ditch.

Table 2.Approximate flow rates for wells in the MSGD aquifer, Savage Superfund Site, Milford, New Hampshire. [Units in cfs; negative means withdrawal; red means corrected]

		MODEL LOCATIONS			YEAR													
Area	Name	LAYER	Row	Column	1999	2000	2001	2002	Early 2003	2004	2004-05	fall 2005	2006	2007	Spring 2008	Dec-08	2009	2010
	mi-88	2-3	128	39	-0.38	-0.38	-0.38	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
State	fh4	2-3	40	55	-2.578	-2.578	-2.578	-2.578	-2.578	-2.62	-2.62	-2.62	-2.62	-2.62	-2.62	--	-2.42	-2.42
State	fh-5	3	28	59	-1.63	-1.63	-1.4	-1.3	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.36	?
OU2	ou2-ew1	2-4	73	60	0	0	0	0	0	0	0	start	--	-0.446	--	-0.423	-0.115	-0.437
OU2	ou2-ew2	2-4	70	67	0	0	0	0	0	0	0	start	--	-0.265	--	-0.301	-0.289	-0.278
OU2	OU2-EW3	2-3	72	74	0	0	0	0	0	0	0	start	--	-0.208	--	-0.223	-0.22	-0.206
OU2	OU2-IW1	2-5	111	53	0	0	0	0	0	0	0	start	--	0.223	--	0.223	0.171	0.223
OU2	OU2-IW3	1-3	131	93	0	0	0	0	0	0	0	start	--	0.167	--	0.256	0.189	0.261
OU2	OU2-IW2	3-5	122	62	0	0	0	0	0	0	0	start	--	0.223	--	0.256	0.189	0.274
OU1	rw3	1-2	93	34	0	0	0	0	0.038	0	some flow	some flow	some flow	0	0	0	0	0
OU1	rw-2	1-2	89	27	0.01	0	some flow	0	0	0	0	0	some flow	0	0	0	0	0
OU1	EW2	3-4	91	41	-0.056	-0.035	-0.042	-0.035	-0.034	-0.047	-0.047	-6E-05	-0.045	-0.045	0	0	0	-0.01
OU1	EW1	4-5	87	42	-0.028	-0.032	-0.067	-0.067	-0.018	-0.047	-0.047	-2E-04	0	0	0	0	0	trace flow
OU1	IW2	3-4	82	32	-0.008	-0.034	-0.027	-0.058	-0.069	0	-0.047	-2E-04	-0.069	-0.069	-0.032	0	0	0
OU1	IW1	4-5	90	33	-0.022	-0.03	-0.03	-0.025	-0.069	0.068	-0.145	-2E-04	-0.069	-0.069	-0.085	0	0	0
OU1	IW2A	1	82	32	0	0	0	0	0	0	0	0	0	0	0	-0.01	-0.01	-0.01
OU1	IW1A	1	90	33	0	0	0	0	0	0	0	0	0	0	0	-0.045	-0.045	-0.028

Several model layer assignments are incorrect in the model. These include OU1 well IW2 (correct simulated layers are 3-4), and several OU2 remedy wells (EW1, EW3, IW3; Table 2).

A3.3.Model Results

Model output from several times was examined to evaluate model performance. These periods include January 2009, and December 2007, 2008, 2009, and 2010.

A3.3.1.Residual Analysis

Model residual analysis identifies model performance by comparing model computed and observed PCE concentrations. Residual analysis was done for 2007, 2008, 2009, and 2010 (earlier data sets were not available for review). The model results and observed data sets are provided by Gradient Corp. in Table 3.3 of several annual reports (Gradient Corp. 2011, CD). The wells used in the residual analysis include: MW-113A,MW-118A,MW-11A,MW-12A,MW-13A,MW-14A,MW-19A,MW-20A,MW-21B,MW-22A,MW-24A,MW-32B,FH-9,MI-10,MI-11,MI-31,MI-4,MW-101B,MW-102B,SB-07(MW-103),SB-10(MW-105),SB-11(MW-106),MW-107A,MW-108A,MW-109B,MW-10B,MW-110A,MW-111A,MW-114,MW-115B,MW-116A,MW-118B,MW-11B,MW-12B,MW-13B,MW-14B,MW-20B,MW-21C,PZ-B4,SB-05(MW-102),MW-107B,MW-110B,MW-111B,MW-117,MW-120A,MW-101C,MW-107C,MW-10C,MW-111C,MW-120C,MW-17C,and MW-9C (Figure 1).

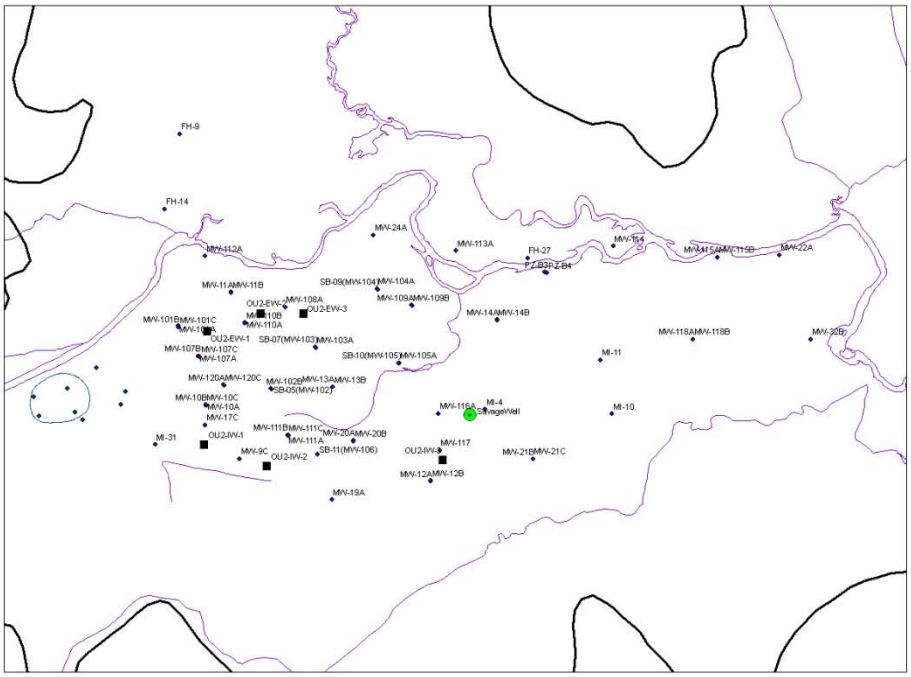


Figure 1 Wells used in residual analysis (based on Gradient Corp. Table 3-3, 2009).

Model summary residual statistics as provided show a mean residual difference (model computed minus observed) between 97.4 to 18.6 ppb (Table 3), which appears to be trending downward over time. This suggests the model PCE concentrations increasingly compares favorably to observed PCE concentrations as a whole.

Table 3. Statistical summary of PCE residuals for model simulation [All units in ppb; Data from Gradient Corp.; Wells shown in Figure 1].

	2007	2008	2009	2010
MEAN	97.4	96.6	45.4	18.6
MINIMUM	-538.4	-276.3	-309.5	-293.0
MAXIMUM	584.9	504.4	409.3	243.0
MEDIAN	30.0	63.1	35.5	9.1
STANDARD DEVIATION	202.5	164.0	153.8	108.9
RMSE	27.9	28.1	23.9	14.3
COUNT	64	45	44	59

A graphical comparison of model residuals by model layer as a function of observed concentrations (Figures 2 and 3) shows that the model is over predicting well concentrations (model-computed concentrations>observed concentrations) in areas of low observed concentrations and under predicting

well concentrations in areas of high observed concentrations in all model layers for 2007 and 2010. Viewed in this format, model performance looks less favorable. Ideally, residuals would be evenly distributed along the line marked as “Optimal Residual Distribution” and show no bias with concentration or layer.

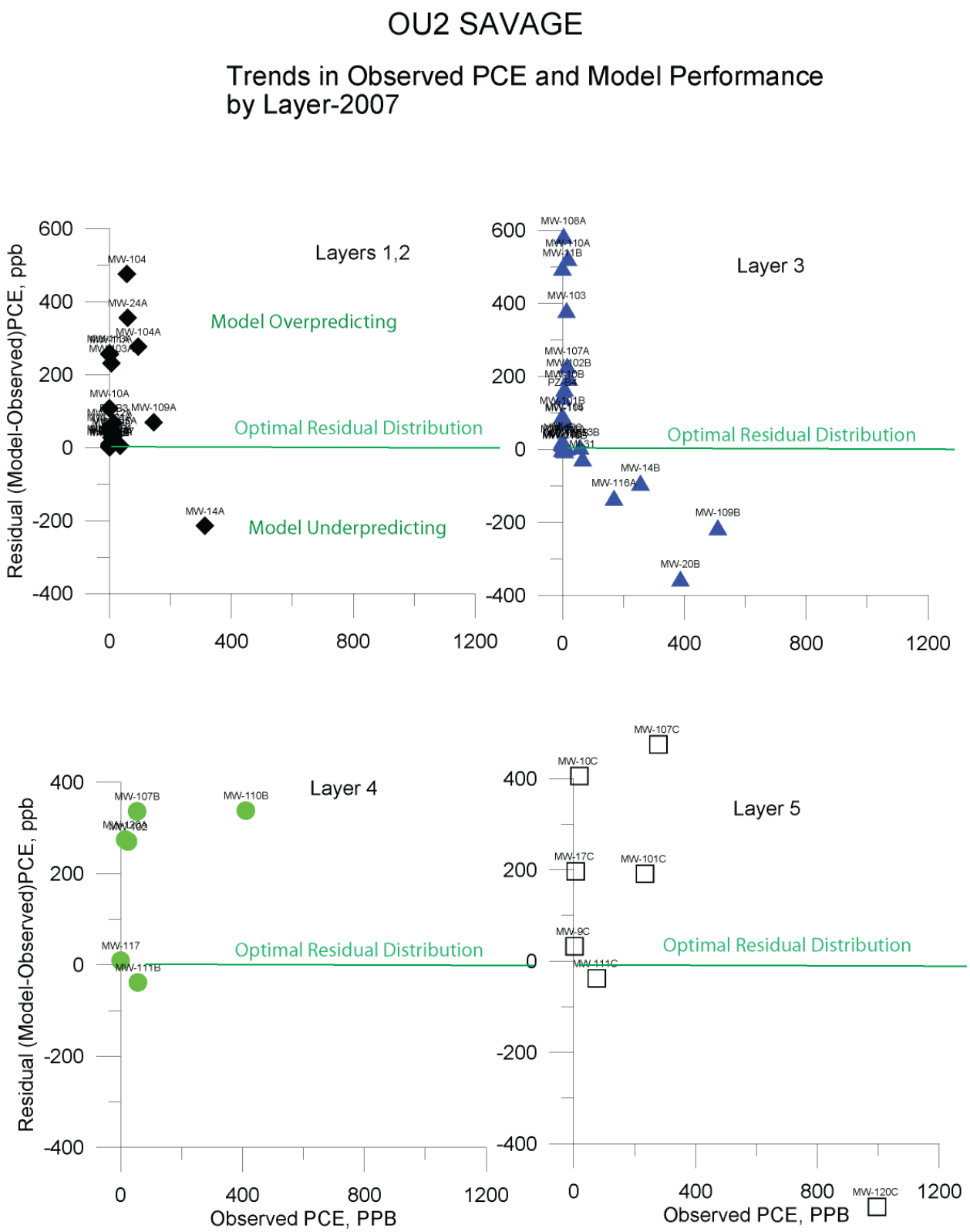


Figure 2 PCE residual graphs per model layer, 2007 (December).

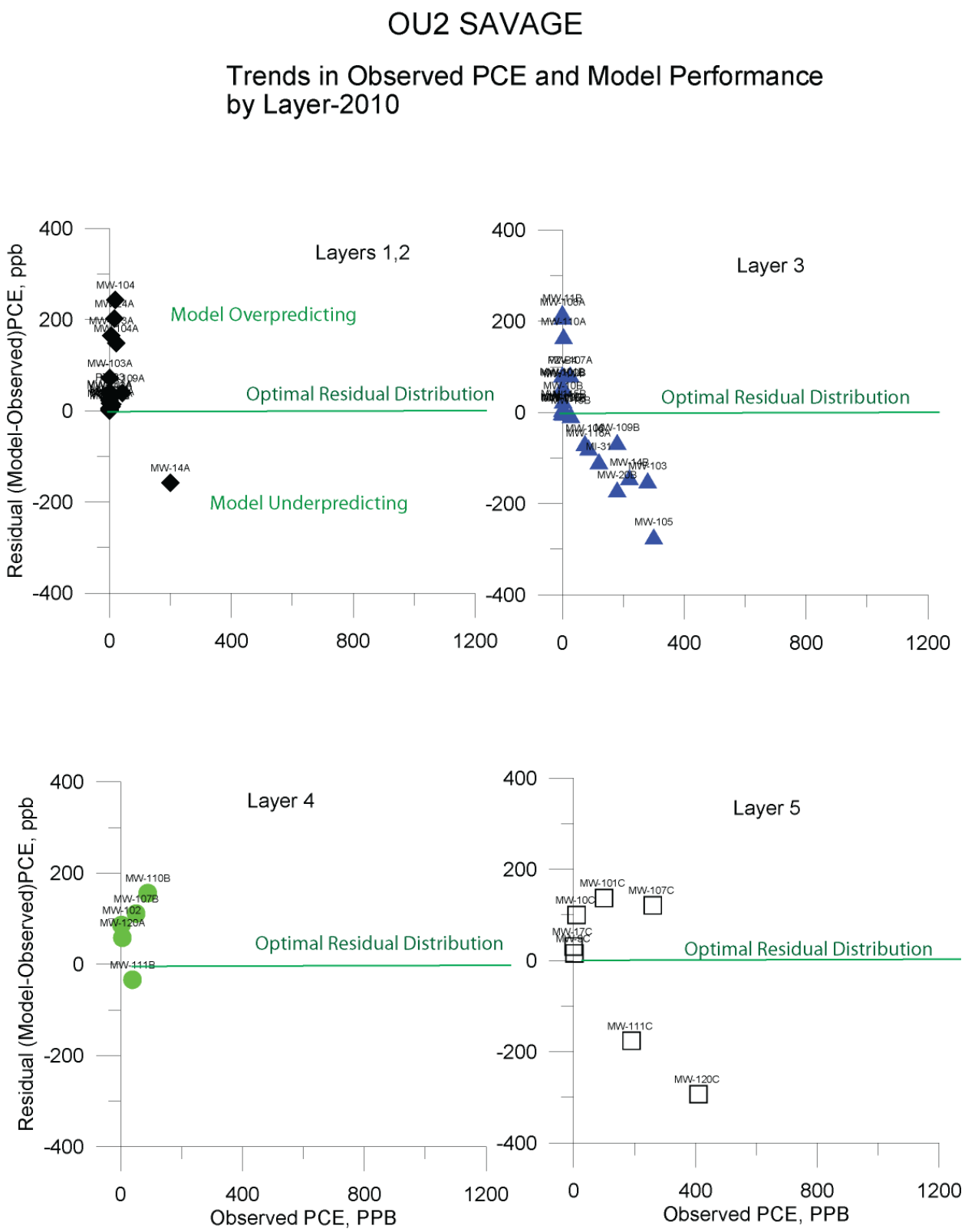


Figure 3. PCE residual graphs per model layer, 2010 (December).

Spatial PCE residual maps (2010) for layers 1 and 2 (combined), layer 3, and layers 4 and 5 (combined) show the model is over predicting concentrations by the extraction wells (OU2-EW1,2,3) and under predicting near the discharge ditch and to the east (Figures 4-6) . The latter were areas where injected groundwater by OU2-IW2 and OU2-IW3 were envisioned to accelerate flushing and transport of PCE to ultimately discharge to the Souhegan River.

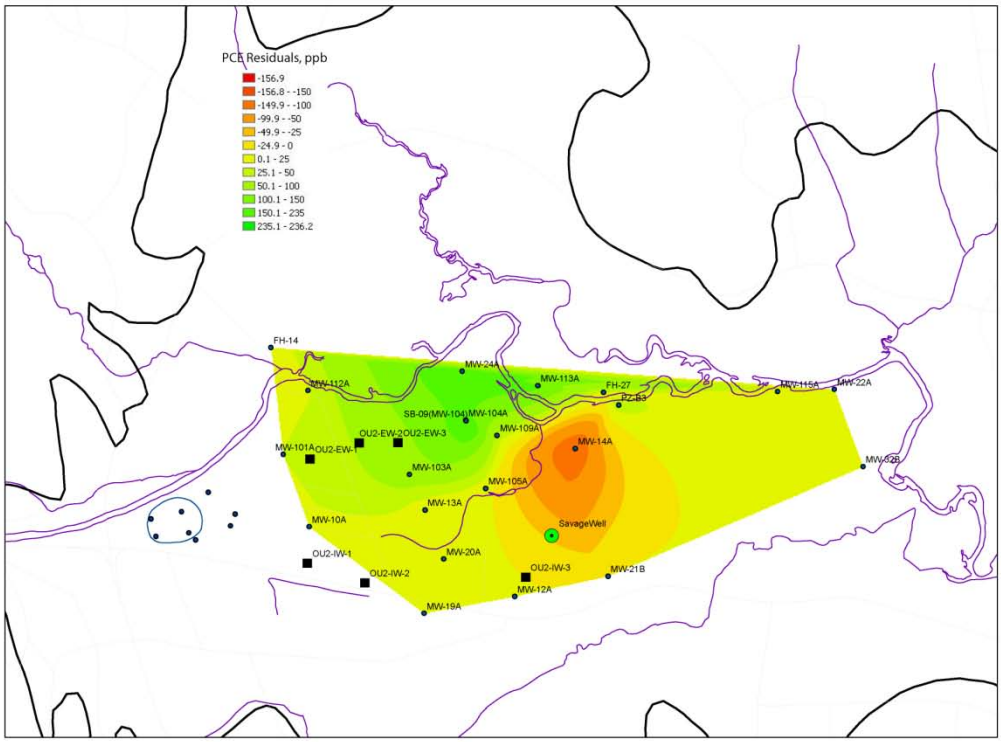


Figure 4. Map of PCE residuals for layer 1 and 2, 2010.

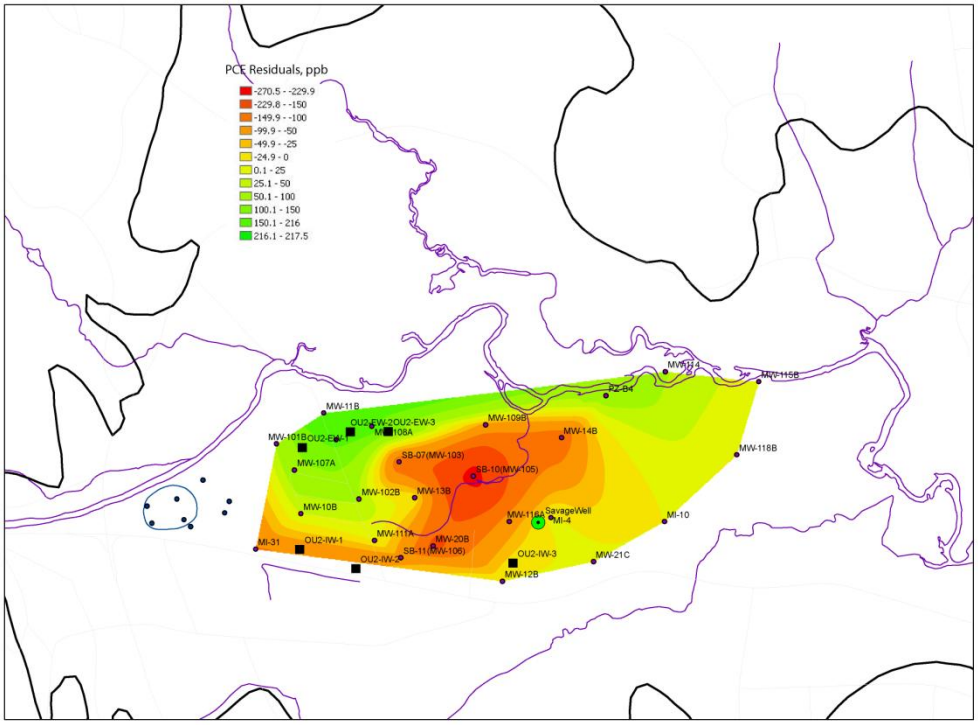


Figure 5. Map of PCE residuals for layer 3, 2010.

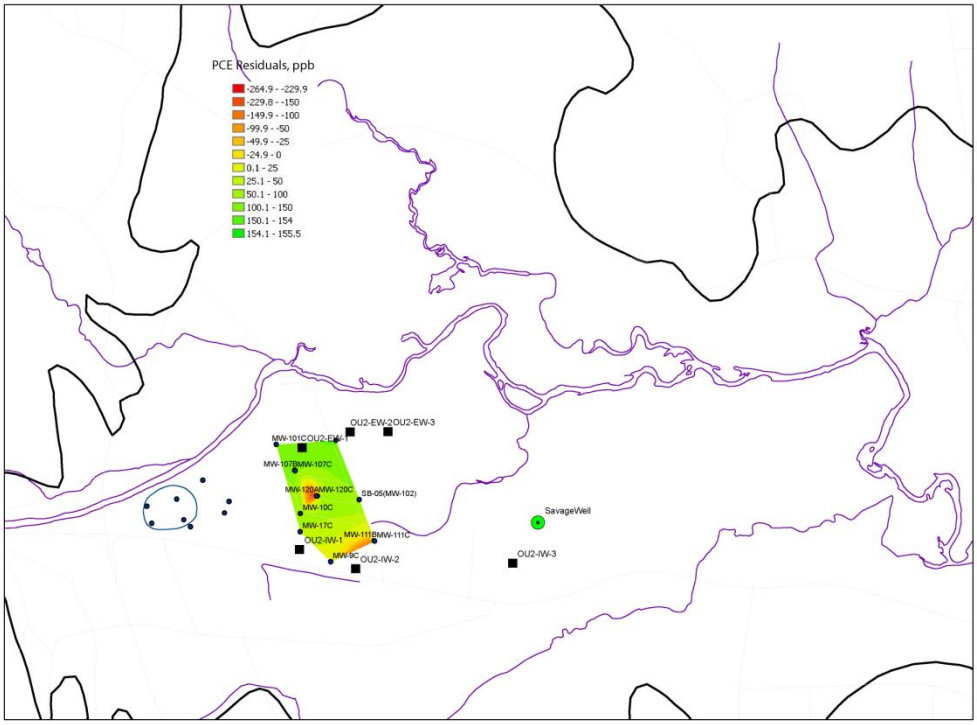


Figure 6. Map of PCE residuals for layers 4 and 5, 2010.

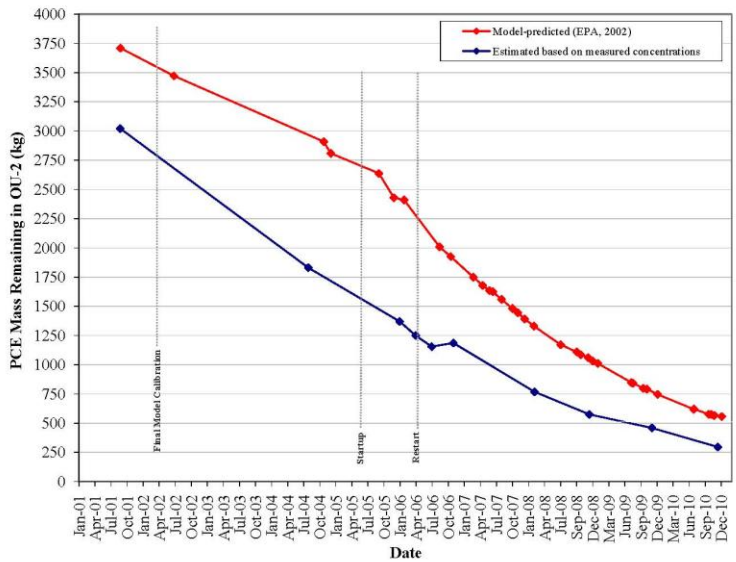
A3.3.2. Tetrachloroethylene Mass

Estimated PCE mass from observations and model computed PCE mass have been tracked over time. Figure 6 is a reproduction of a graph showing PCE mass from Gradient Corp. (Fig. 3.18; 2009). Each curve on the graph represents combined PCE mass from both dissolved and sorbed PCE phases for the OU2 area only. The graphs can be used to estimate the attenuated mass of PCE for the MSGD aquifer. For example, from June 2007 to June 2008, the observed PCE mass declined by 375 Kg whereas the model computed declined by 450 kg. Because the model computed mass decreased more than the observed, the spread between the two curves is decreasing and the two curves are converging

The above analysis indicates that the rate of attenuation in the model is too high. Individual components of the solute transport budget could be examined to identify where adjustments could be made in the model to better replicate observations. For example, comparison between PCE mass extracted from OU2 remedy wells in the model with observations and estimates of mass extracted from same wells would help determine if simulated capture areas and transport rates are reasonable approximations.

DRAFT

Figure 3.18
Comparison of Model-Predicted *versus* Estimated PCE Mass Remaining in OU-2
Savage Well Superfund Site, Milford, NH



Notes:
1. The 2001 estimated mass remaining in the aquifer (measurements) was based on plume contour maps presented in Figures 2-5 and 2-6 of the RDIR (US EPA, 2002). The 2004 estimated mass was based on contour maps presented in Figures 3-2 through 3-5 of the Baseline GW Monitoring Report (MACTEC, 2005). Mass estimates for other events are presented in 2006 quarterly reports 1 through 4 (January 2006 - November 2006) and this 2007 Annual Report. The September 2005 event consisted of a reduced well set that provided insufficient data for estimating mass remaining in the aquifer.

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Printed: 5/17/2011

Page 1 of 1

Gradient

Figure 7. Graph of PCE mass (From Gradient Corp. Fig. 3-18).

A4. Additional Model Evaluation

The model-simulated results were compared to simulated results from the USGS/EPA model as an additional evaluation tool. This comparison allowed for a (1) check on model results, (2) rigorous assessment of solute transport processes in the MSGD aquifer, and (3) assessment of the predictive capabilities of the model.

Differences in simulation from the different computer platforms used in model evaluation (Visual MODFLOW, MT3D99, MOC3D, etc.) were previously investigated and shown to have a small affect on model output (U.S. EPA, 2002). Therefore, model comparisons between USGS/EPA model and the model (Gradient Corp., 2009) offer insight into the effect of model input, simulation period, transport processes, and remedial operation, on model-output results.

A4.1.Comparison to Proposed Remedial Operations

Simulations initially performed in the U.S. EPA report (2002) assumed OU2 remedial operations started simultaneously with OU1 remedial operations in 1999. Simulations were also initially done assuming a two year lag time between the beginning of OU1 (1999) and OU2 (2001) remedial operations. Model output from the latter simulation is presented in this section (column 2; Table 4).

Table 4. Statistical summary of model computed PCE concentrations at monitoring wells in OU2 from a simulation comparison of actual and proposed OU2 remedy operations [Units equal ppb; Wells shown in Figure 1]

	2010 MODEL PCE (GRADIENT CORP.); ACTUAL OU2 REMEDY	2010 USGS/EPA MODEL PCE; PROPOSED OU2 REMEDY	2010 OBSERVED PCE
OU2 REMEDY START TIME	2005	2001	2005
MEAN	65.9	4.4	51
MINIMUM	0.2	0	0
MAXIMUM	381	34	410
STANDARD DEVIATION	83.5	7.8	92.3
NUMBER OF WELLS	64	64	59

It appears that starting the remedy in 2001, as initially simulated, instead of the actual start time in 2005 has a significant effect on model-computed PCE concentrations (Table 4). Based on this model comparison, most PCE concentrations in OU2 would be below 100 ppb at this time if the remedy started in 2001. This suggests that at this rate of attenuation and projecting outward for another 4 years under the current remedial operation, almost all PCE concentrations in OU2 should be below 100 ppb. To test this theory, additional model simulations were performed (discussed below).

A4.2.Comparison of Actual Remedy Operations

Simulated extraction/injections in OU2 using the USGS/EPA model (2002) were adjusted to better match actual OU2 remedy operations. This step allowed for a more direct comparison of model output from the two models.

The volumetric flow budgets for the models shows that model-computed river leakage into the MSGD aquifer –the amount of streamflow lost to the MSGD aquifer- is 1 cfs higher in the model (Gradient Corp. data; written commun., 2011) than the USGS/EPA model (Table 5). This higher rate of river leakage may be problematic given that observed low flows in the Souhegan River are around 5 cfs or just 20 % more than the model-computed river leakage.

Table 5. Volumetric budgets from models (Gradient and USGS/EPA model) for December 2009 output.

	Gradient Corp. December 2009 output					USGS December 2009 output			
	STRESS PERIOD LENGTH ~ 1 MONTH					STRESS PERIOD LENGTH 4.4 YEARS			
Input					Input	STORAGE			9.07E-08
	CONSTANT	HEAD		0		CONSTANT	HEAD		0
	WELLS			0.9113		WELLS			0.7296
*****	RIVER	LEAKAGE		3.9881		RIVER	LEAKAGE		2.956
	HEAD	DEP		0.4078		HEAD	DEP		0.4321
	RECHARGE			3.1202		RECHARGE			3.2644
	TOTAL	IN		8.4274		TOTAL	IN		7.3821
Output					Output				
						STORAGE			3.70E-07
	CONSTANT	HEAD		0		CONSTANT	HEAD		0
	WELLS			5.1304		WELLS			3.9432
	RIVER	LEAKAGE		3.0714		RIVER	LEAKAGE		3.3536
	HEAD	DEP		0.1027		HEAD	DEP		0.0847
	RECHARGE			0		RECHARGE			0
	TOTAL	OUT		8.3044		TOTAL	OUT		7.3815
	IN	-	OUT	0.123		IN	-	OUT	0.00062
	PERCENT	DISCREPANCY		1.47		PERCENT	DISCREPANCY		0.01

The USGS/EPA model–computed PCE concentrations are less than the model PCE concentrations even after matching remedy operations (Table 6). OU2 remedy operations were adjusted in the USGS/EPA model to better match actual operations and simulation from the model as reported by Gradient Corp. (Neal Grasso, written commun. 2011). Differences in PCE between the two models still result and are partly attributed to differences in the initial mass of simulated PCE. The USGS/EPA model starting mass is 2,700 kg whereas the model starting mass is 4,226 kg. Also, examination of model computed PCE concentrations shows that elevated PCE concentrations occur near the OU1 barrier wall from excessive dispersion of PCE across the barrier (Figure 8; data from Gradient Corp. VMS files, January 2009), which does not occur in the USGS/EPA model. This process of excessive dispersion was examined by Harte et al (2006) and was shown to result from numerical issues arising from problems with the dispersive equation and simulation of low permeability barriers. The problem is correctable with the use of a modified transport package (Hornberger et al. 2002). These high PCE concentrations are inflating PCE concentrations in OU2 of the model, which results in some of the differences between the two models (Table 6). Observed PCE concentrations by OU1 EW1 and EW2 are at least 100 ppb less than model-computed PCE.

Although the model is overestimating dispersion across the barrier, gross model PCE residual statistics match observations better than the USGS/EPA model. However, examination of PCE spatial residuals show spatial bias as presented in section **A3.3.1.Residual Analysis.** Several conclusions can be inferred from this comparison including (1) the initial mass estimates (4,226 kg) used in the model (RDI report; Gradient Corp., 2002) better approximates actual mass, and (2) the rate of attenuation in the model is too high in some areas.

Table 6. Statistical summary of model computed PCE concentrations at monitoring wells in OU2 from a simulation of actual OU2 remedial operations [Units equal ppb; Wells shown in Figure 1]

	2010 MODEL PCE (GRADIENT CORP.)-; ACTUAL OU2 REMEDY	2010 USGS/EPA MODEL PCE; -ACTUAL OU2 REMEDY	2010 OBSERVED PCE
OU2 REMEDY START TIME	2005	2005	2005
MEAN	65.9	10.5	51
MINIMUM	0.2	0	0
MAXIMUM	381	85	410
STANDARD DEVIATION	83.5	20.7	92.3
NUMBER OF WELLS	64	64	59

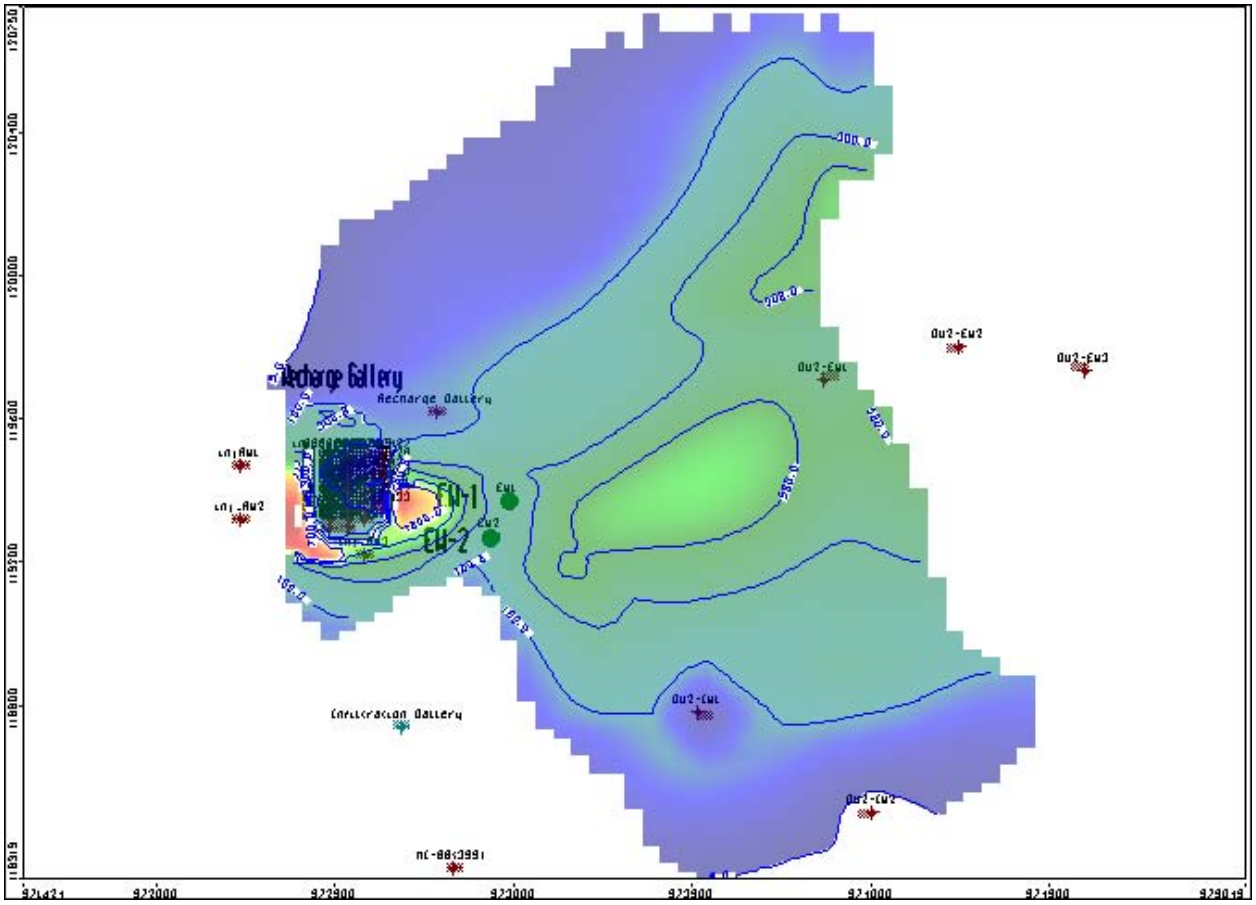

Figure 8 Model computed PCE concentrations showing elevated PCE by the OU1 barrier from numerical dispersion [Gradient Corp. data from VMS files, January 2009; Concentrations by OU1 EW1 and EW2 are too high compared to observed data]

A4.3.Model Adjustments

The previous model comparisons indicate that the simulated rate of attenuation in the models (both USGS/EPA and Gradient model simulations) is too large in some areas of the aquifer. It also showed that the initial starting mass should be at least 4,226 kg of PCE as used in the model simulations by Gradient Corp. (2002,2009) and that the initial starting mass used in some of the USGS/EPA model simulations is too low (2,700 kg).

Observed PCE concentrations in the lowermost layers of the aquifer such as layer 5 of the model show concentrations above 400 ppb as of 2010 (Neal Grasso, Gradient Corp., written commun., 2011) whereas model-computed PCE typically underestimates concentrations in that layer. One important controlling factor in the rate of attenuation and solute transport of PCE is the retardation factor. To test the effect of retardation on PCE concentrations in layer 5, the retardation was increased from 2.5 to 4 for that layer. Results are provided in Table 7 and shows that the maximum model-computed PCE concentration increases from 85 ppb (Table 6) to 281 ppb (Table 7) in the USGS/EPA model.

Table 7. Statistical summary of model-computed PCE concentrations at monitoring wells in OU2 from a simulation of actual OU2 remedy operations and adjustment of retardation factor for layer 5 [Units equal ppb; Wells shown in Figure 1]

	2010 MODEL PCE (GRADIENT CORP.)-; ACTUAL OU2 REMEDY	2010 USGS/EPA MODEL PCE; -ACTUAL OU2 REMEDY	2010 OBSERVED PCE
OU2 REMEDY START TIME	2005	2005	2005
MEAN	65.9	22.8	51
MINIMUM	0.2	0	0
MAXIMUM	381	281	410
STANDARD DEVIATION	83.5	47.4	92.3
NUMBER OF WELLS	64	62	59

The comparison in Table 7 highlights that an improved match between model and observed PCE can be made if a higher retardation factor is used in layer 5 of the model. However, it still is apparent from the comparison that the initial starting mass of PCE is underestimated in the USGS/EPA model as discussed previously. A simulation was done with additional mass in layer 5 (starting mass was increased by 36% in layer 5) that resulted in additional improvement in the model-computed PCE (Table 8). Maximum model-computed PCE concentration increased from 281 ppb (Table 6) to 361 ppb (Table 7) in the USGS/EPA model.

Table 8. Statistical summary of model-computed PCE concentrations at monitoring wells in OU2 from a simulation of actual OU2 remedy operations and adjustment of starting mass (36% increase) for layer 5 [Units equal ppb; Wells shown in Figure 1]

	2010 MODEL PCE (GRADIENT CORP.)-; ACTUAL OU2 REMEDY	2010 USGS/EPA MODEL PCE; -ACTUAL OU2 REMEDY	2010 OBSERVED PCE
OU2 REMEDY START TIME	2005	2005	2005
MEAN	65.9	28.1	51
MINIMUM	0.2	0	0
MAXIMUM	381	361	410
STANDARD DEVIATION	83.5	62	92.3
NUMBER OF WELLS	64	62	59

A graph of residuals of PCE from simulation results presented in Table 8 shows that there is a tendency for both models to under predict PCE concentrations-in high PCE concentration areas of the aquifer (Figure 9). However, for low PCE concentration areas of the aquifer, model-computed PCE from the USGS/EPA model better matches observed PCE concentrations suggesting that model-input transport properties in those areas of the aquifer are representative of field conditions as a whole.

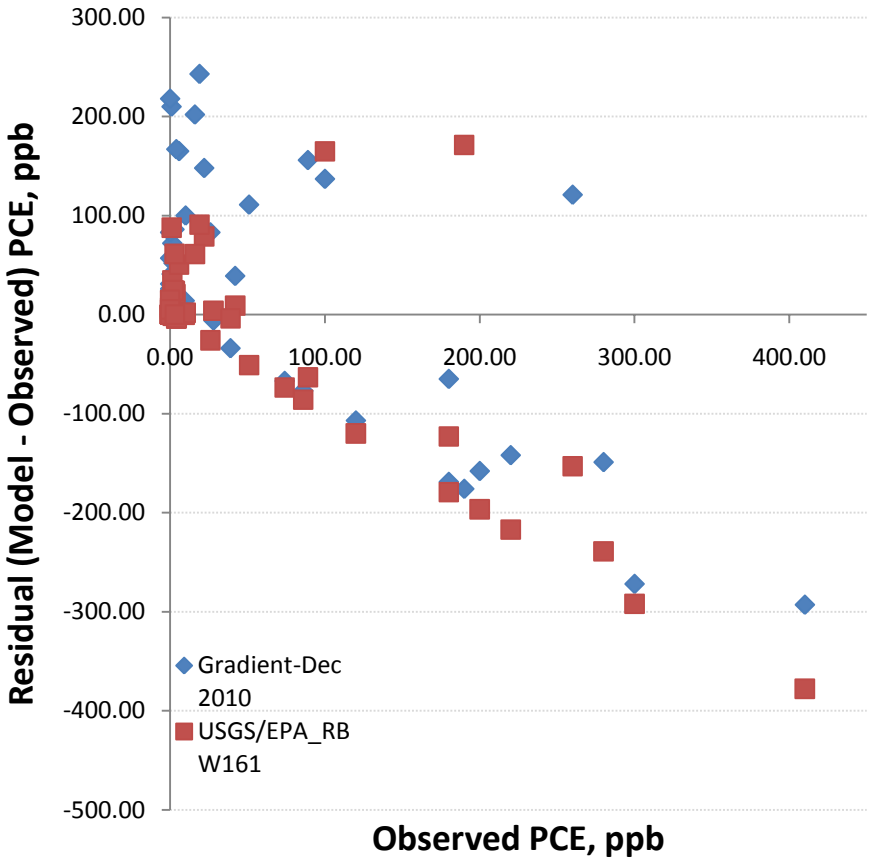

Figure 9. PCE residuals for simulation presented in Table 8 [Gradient Corp. data, 2011; Poor match at high PCE concentrations suggest underestimation of initial mass]

A4.4.Additional Sources of PCE

PCE mass is underestimated in the MSGD aquifer. Previous work by Harte (2004) indicated that PCE mass along the southern boundary of the plume may be greater than previously estimated. Work presented here indicates that PCE mass in the lower parts of the aquifer may be greater than previously estimated. Additional mass of PCE may also exist near the OU1/OU2 boundary from back diffusion of PCE in high carbon or low permeability layers or from previously unaccounted for areas with PCE concentrations (a larger plume than estimated). A graph of observed PCE concentrations illustrates the effect of additional PCE mass on PCE concentrations in the aquifer (Figure 10). Observed PCE concentrations from one well near the OU1/OU2 boundary shows static PCE concentrations for several years (Figure 10; well PW-14M) although the most recent well sample from that well had a reported PCE concentration of 350 ppb (½ of 2006 levels). Model-computed PCE concentrations for wells PW-14S and PW-14D show higher concentrations than observed but similar rates of decline whereas observed PCE

concentrations at PW-14M show negligible decline for several years indicating additional PCE mass is sustaining relatively high concentrations. Additional PCE mass or potential source areas in OU1 were discussed by CDM Inc. (2001) and can include additional mass from a larger PCE plume and(or) increased amount of PCE adsorption sites.

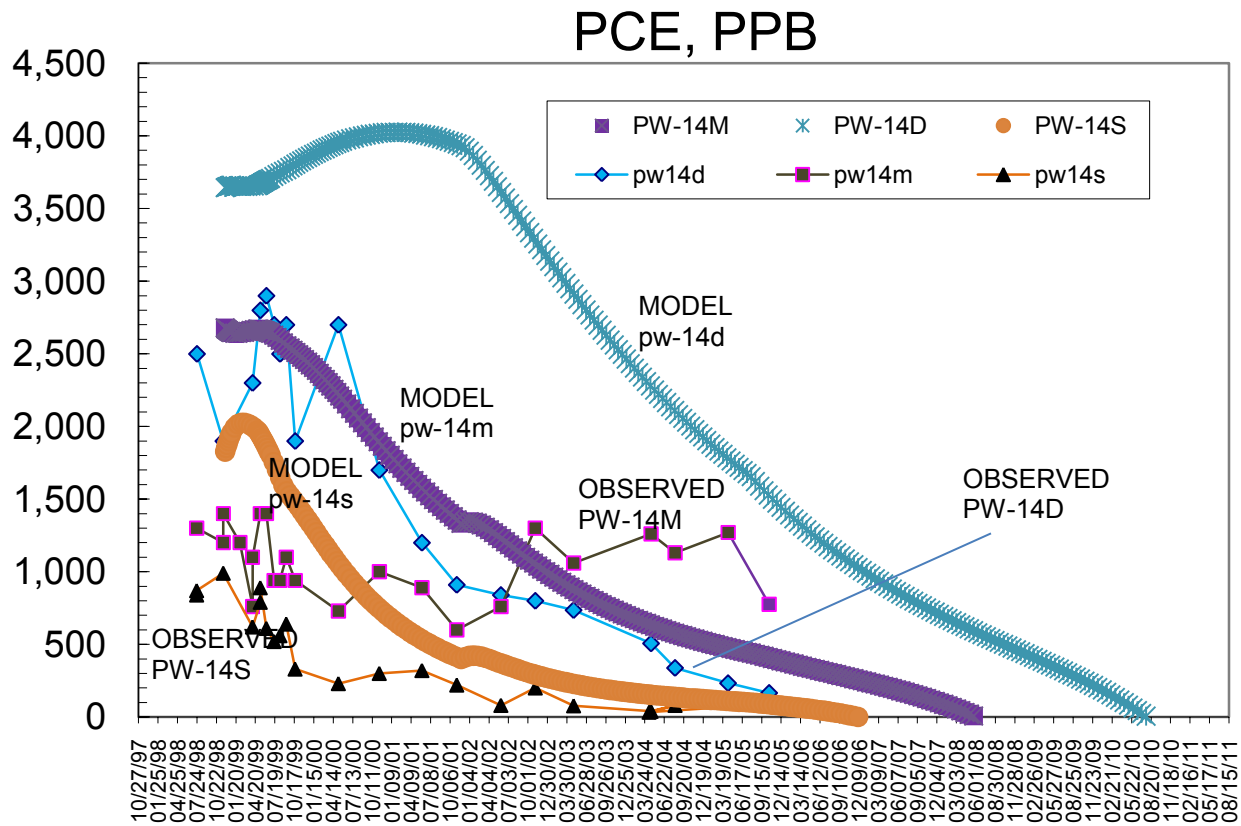

Figure 10. Graph of model-computed PCE concentrations and observed PCE concentrations for PW-14 cluster wells. [Stable PCE concentrations at PW-14M suggest additional mass of PCE in aquifer]

A5. Preliminary Conclusions

From the model evaluation and assessment, the following critique is offered to improve model comparisons presented in annual reports, the evaluation of solute transport processes in the aquifer, and the assessment of remedial performance:

- PCE residual analysis would benefit from inclusion of wells within the OU1 remedy area but external to the barrier including PW13, PW14, and MW16 cluster wells,
- Extracted mass from OU2 remedy extraction wells (EW1,EW2,EW30) could be compared to model-computed extracted mass, and
- Graphs of model-computed and observed PCE concentrations for selected wells, particularly in lower layers of the aquifer, could be shown with residual statistics.

During the review, it became apparent that several model adjustments could be made to improve model simulations and fit. These included:

- Increase retardation in lower layers of the aquifer from 2.5 to 4,
- Adjust well extraction/injection rates to better match actual conditions,
- Consider converting the river package to the streamflow routing package to insure river leakage does not exceed streamflow,
- Accurately monitor the rate of extraction from MI-88 (if any) and the amount of discharge in the adjacent ditch,
- Correct well extraction/injection layers at several wells,
- Decrease numerical dispersion across the barrier, and
- Reassess the amount of PCE mass in several areas of the aquifer, which is likely higher in several areas of the aquifer than previously estimated.

After these improvements are made, the model can be rerun to provide a further comparison of PCE residuals for the MSGD aquifer.

A6. Use of Model as a Predictive Tool

The model evaluation and analysis was aimed at assessing the reliability of the model as a predictive tool in quantifying PCE transport and assessing the effectiveness of remedial operations. Some improvements in the model were suggested in the previous section. Once these are done, the model can be used to test whether remedial operational changes are warranted to expedite the remedy. For example, slow recalcitrant zones of PCE (slow transport and attenuation) are apparent in several areas of the aquifer. Given the current remedial infrastructure, the model could be used to test if modifications in extraction and injection can accelerate flushing more efficiently in these areas. Under current remedial operations, maximum model-computed PCE concentrations in OU2 are shown in Figure 11 based on a high retardation factor of 4 for layer 5. This illustrates the utility of the model to help evaluate PCE trends in the aquifer based on transport properties and remedial operations.

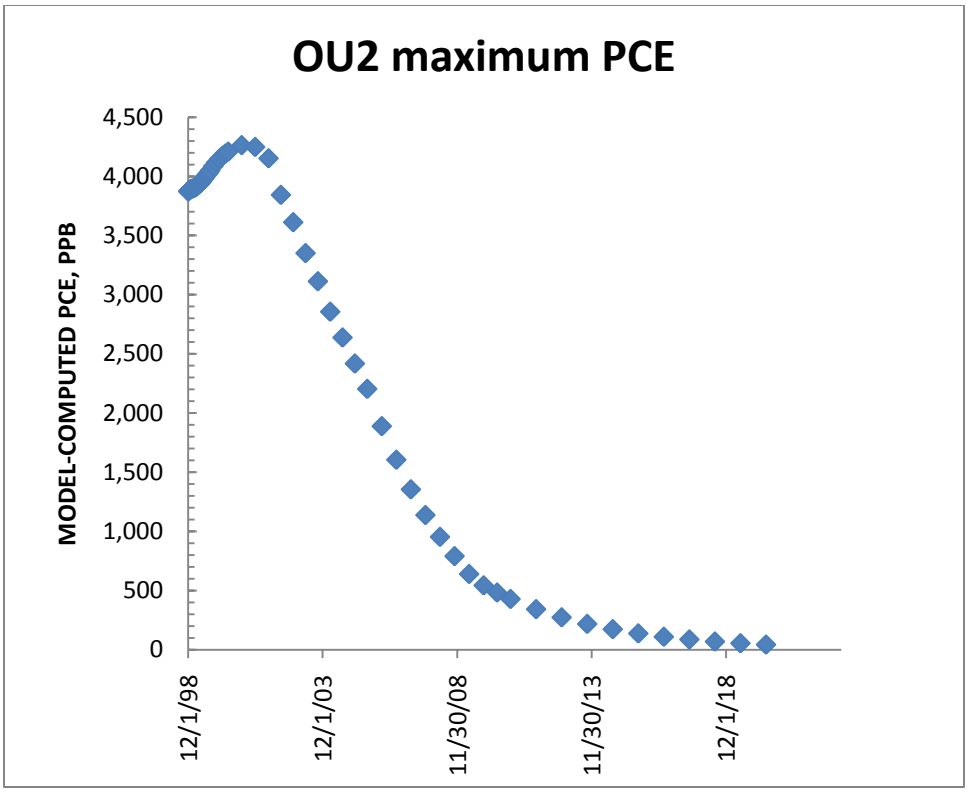

Figure 11. Graph of model-computed PCE concentrations showing maximum PCE concentrations in OU2 under current remedial operation with a high retardation factor in layer 5. [A maximum PCE concentration of 500 ppb is computed in 2010 that decreases to 42 ppb in 2020]

New receptors or withdrawal wells (if any) in the MSGD aquifer should be simulated to identify their probability of capturing PCE, influencing the water budget, and (or) altering flowpaths. New withdrawal wells from residential housing have been installed in the underlying bedrock over the last 10-15 years (NHDES data, 2011). The model does not simulate flow and transport in the underlying bedrock.

While it is difficult to simulate solute transport of PCE in fractured rock without comprehensive knowledge of discrete fracture networks, the gross impact of residential withdrawals on the interaction of flow between the bedrock and MSGD aquifer, and in the bedrock itself can be assessed through numerical simulation. In other words, it is possible to look at through numerical simulation how strong of a potential pull do the new withdrawals in the bedrock have on known contaminant areas in the bedrock and the MSGD aquifer. In addition, it is possible to assess the potential amount of PCE load from discharge of PCE from the bedrock to the MSGD aquifer. Both assessments would help remedial managers in formulating monitoring and remedial strategies in the bedrock.

The model resolution or discretization is too coarse inside the barrier wall in OU1 and cannot simulate all transport processes in that area without further model enhancements (P.T. Harte, written commun., 2006). Active remediation with Insitu Chemical Oxidation (ISCO) has accelerated clean up of PCE inside the barrier and PCE concentrations have decreased (Weston, Inc., 2009). Nevertheless, the potential for

long-term transport of PCE across and under the barrier exists, which can be assessed with numerical simulation by automatic calibration to PCE concentrations outside of the barrier. This work would help evaluate the need for sustained OU1 remedial operation of extraction and injection wells in capturing PCE transport into OU2.

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Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Savage Well OU2	**Date of inspection:** 7/20/11
Location and Region: Milford, NH Region 1	**EPA ID:**
Agency, office, or company leading the five-year review: EPA/NHDES/Weston	**Weather/temperature:** 92° Clear Skies

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☑ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Mike Davy _____ _____
   Name Title Date
   Interviewed ☑ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** Tony Jones _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

04

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☑ O&M manual — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☑ As-built drawings — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☑ Maintenance logs — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☑ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☑ Effluent discharge — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☑ Waste disposal, POTW — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

7. **Groundwater Monitoring Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☑ Water (effluent) — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☑ Readily available — ☑ Up to date — ☐ N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☑ PRP in-house ☑ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other _____

2. **O&M Cost Records**

☑ Readily available ☑ Up to date
☑ Funding mechanism/agreement in place
Original O&M cost estimate _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost
From _____ To _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☑ Gates secured ☐ N/A

Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☑ N/A
Remarks_____
_____

3. **Land use changes off site** ☑ N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks_____

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☑ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☑ Good condition ☑ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☑ Good condition ☐ Needs Maintenance
Remarks Good conditions

3. **Spare Parts and Equipment**
☑ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks Filters, coupling. List w/O+M manual of things to keep on hand
~~H_2O_3~~ Hydrogen Peroxide - Spare pump

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☑ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☑ Air stripping ☐ Carbon adsorbers
   ☑ Filters Sand Backwash
   ☑ Additive (*e.g.*, chelation agent, flocculent) Hydrogen Peroxide, HCL
   ☐ Others
   ☑ Good condition ☐ Needs Maintenance
   ☑ Sampling ports properly marked and functional
   ☑ Sampling/maintenance log displayed and up to date
   ☑ Equipment properly identified
   ☑ Quantity of groundwater treated annually 410 to 420 gpm
   ☐ Quantity of surface water treated annually
   Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☑ Good condition ☐ Needs Maintenance
   Remarks

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☑ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks Sump for

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☑ Good condition ☐ Needs Maintenance
   Remarks

5. **Treatment Building(s)**
   ☐ N/A ☑ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks

6. **Monitoring Wells** (pump and treatment remedy)
   ☑ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks View EW-1, IW-7 and Sanhegan discharge
   Photo 1

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Adequate Pig + Piston

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. Pumps, corrode (cast iron) Initial/Stainless lasted until 100 yr Flood.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None that haven't been corrected

Savage Well Superfund Site 5-Year Review Interview Questions – PRPs

1. What is your overall impression (general sentiment) of the project?

Groundwater remediation at the Operable Unit 2 (OU2) portion of the Savage Well Superfund site is progressing as anticipated. The OU2 remediation system, which began operations in October 2004, has made significant progress in improving groundwater quality in the OU2 portion of the aquifer. As of December 2010, the total PCE mass remaining in OU2 is estimated to be 296 kg compared to a pre-remedy (August 2004) baseline estimate of 1,830 kg – an 84% reduction in mass. PCE concentrations at most monitoring wells have declined sharply, and the aerial extent of the PCE plume has reduced, compared to pre-remediation conditions. As of December 2010, PCE concentrations in 36 of the 67 OU2 wells monitored were below the ICL for PCE (5 μg/l), or were not detected by the laboratory. Influent PCE concentrations from the three extraction wells have also declined from an average of approximately 500 μg/L in 2004 to 25 μg/L in December 2010. Overall, the remedy is progressing better than the model predictions presented in the RDI report.

2. What is the current status of remediation (*e.g.*, budget and schedule)? What is your estimation of the time until cleanup goals are achieved?

See response to question 1.

3. Have any problems or difficulties been encountered which have impacted construction progress or implementability since initiation of the selected remedy?

In 2004, when the OU2 groundwater remediation system began operations, problems were initially experienced at the injection wells, which are used at OU2 to inject treated groundwater. The specific capacity of the injection wells (a measure of the well's ability to accept water) significantly declined due to fouling of the wells by iron and manganese precipitates. Investigations indicated that the sequestering agent, which was being used to keep metals in solution and prevent them from precipitating, was not effective. Consequently, a conventional metals treatment system, consisting of pH adjustment and metals removal, was constructed in August 2005, and the use of the sequestering agent was discontinued. The injection wells were redeveloped and have continued to perform since then. These initial remediation system issues had a short-term effect on remedy operations, but the system has now been operating effectively and continuously for approximately 6 years.

4. Is the remedy functioning as expected? How well is the remedy performing?

See response to question 1.

5. What is your interpretation of the monitoring data? Are there any trends that show contaminant levels are decreasing?

Groundwater quality data continues to demonstrate that the OU2 remedy is effectively reducing PCE concentrations in the overburden aquifer. As previously indicated, PCE mass in OU2 has declined by 84% since the remedy began operating. PCE concentrations at a vast majority of the monitoring wells have declined[1].

[1] See Draft Annual Groundwater Quality Monitoring Report for 2010, dated June 2, 2011.

6. Please describe the continuous on-site O&M presence, including staff and activities

Performance of the remediation system is monitored remotely by accessing (dialing into) the data recording system. This enables a complete review of the remediation system's status (*e.g.*, groundwater extraction, injection rates, water levels at key wells and sumps) and minimizes the need for routine site visits. Nonetheless, an operator visits the site and treatment plant once a week to inspect the plant and extraction/injection wells, perform permit sampling/monitoring, and undertake critical preventative maintenance tasks.

7. Please summarize the significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years. How do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

See response to Question 9.

8. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

See response to Question 3.

9. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

The scope of the groundwater quality monitoring program was streamlined after two years of quarterly monitoring. The current monitoring program includes key wells that are monitored on a semi-annual basis. The streamlined monitoring program provides the data needed to evaluate the effectiveness and progression of the remediation in a cost-effective manner. The cost saving from the reduced monitoring program is approximately $66,000 per year.

10. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

None.

11. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details

There was one vandalism incident in March, 2011. Graffiti was painted at the treatment plant building, as part of other similar incidents reported along Elm Street. This was immediately addressed, and no problems have been reported since then.

12. Do you have any comments, suggestions, or recommendations regarding the project?

None.

INTERVIEW DOCUMENTATION FORM

The following is a list of individuals interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Mr. Robert Courage	Former Town Director	Town of Milford	4/27/2011
Mr. Guy Scaife	Town Administrator	Town of Milford	4/27/2011
Mr. Michael Clark	Resident	Town of Milford	6/14/2011
Ms. Gail Cassarino	Resident	Town of Milford	6/14/2011

INTERVIEW RECORD

Site Name: Savage Municipal Water Supply Well Superfund Site	**EPA ID No.:** NHD980671002	
Subject: Five-Year Review	**Time:**	**Date: 4/27/2011**
Type: ■ **Telephone** □ Visit □ Other **Location of Visit:**	□ Incoming ■ Outgoing	

Contact Made By:

Name: Mr. Richard Hull	**Title: Project Manager**	**Organization: USEPA**

Individual Contacted:

Name: Mr. Robert Courage	**Title: Former Town Director**	**Organization: Town of Milford, NH**

Telephone No: (603) 249-5190 **Fax No: NA** **E-Mail Address: robertcourage@comcast.net**	**Street Address: NA** **City, State, Zip: Milford, NH 03055**

Summary Of Conversation

See Attached.

INTERVIEW RECORD

Site Name: Savage Municipal Water Supply Well Superfund Site	**EPA ID No.:** NHD980671002	
Subject: Five-Year Review	**Time:**	**Date: 4/27/2011**
Type: ■ **Telephone** □ Visit □ Other **Location of Visit:**	□ Incoming ■ Outgoing	

Contact Made By:

Name: Mr. Richard Hull	**Title: Project Manager**	**Organization: USEPA**

Individual Contacted:

Name: Mr. Guy Scaife	**Title: Town Administrator**	**Organization: Milford, NH**

Telephone No: (603) 249-0601 **Fax No: NA** **E-Mail Address: gscaife@milford.nh.gov**	**Street Address: NA** **City, State, Zip: Milford, NH 03055**

Summary Of Conversation

See Attached.

INTERVIEW RECORD

Site Name: Savage Municipal Water Supply Well Superfund Site	**EPA ID No.:** NHD980671002	
Subject: Five-Year Review	**Time:**	**Date: 6/14/2011**
Type: ■ **Telephone** □ Visit □ Other **Location of Visit:**	□ Incoming ■ Outgoing	

Contact Made By:

Name: Ms. Robin Mongeon	**Title: Project Manager**	**Organization: NHDES**

Individual Contacted:

Name: Mr. Michael Clark	**Title: Resident**	**Organization: Town of Milford**

Telephone No: (603) 673-5321 **Fax No: NA** **E-Mail Address: NA**	**Street Address: 577 North River Road** **City, State, Zip: Milford, NH 03055**

Summary Of Conversation

See Attached.

INTERVIEW RECORD

Site Name: Savage Municipal Water Supply Well Superfund Site	**EPA ID No.:** NHD980671002	
Subject: Five-Year Review	**Time:**	**Date: 6/14/2011**
Type: ■ **Telephone** □ Visit □ Other **Location of Visit:**	□ Incoming ■ Outgoing	

Contact Made By:

Name: Ms. Robin Mongeon	**Title: Project Manager**	**Organization: NHDES**

Individual Contacted:

Name: Ms. Gail Cassarino	**Title: Resident**	**Organization: Town of Milford**

Telephone No: (603) 249-5715 **Fax No: NA** **E-Mail Address: NA**	**Street Address: 544 North River Road** **City, State, Zip: Milford, NH 03055**

Summary Of Conversation

See Attached.

Savage Well Superfund Site 5-Year Review Interview Questions

Interviewee: Mr. Robert Courage

Background: Mr. Courage was the Director of the Town of Milford DPW for 38 years and was involved with the installation of the Savage Well. He was also with the DPW at the time of the discovery of contamination at the well and involved in decommissioning the well. Mr. Courage previously served on the Board of Selectmen for three years and currently serves on the Board of Water and Sewer Commissioners.

1. What is your overall impression of the project and Site over the last 5 years?
The site looks good and has heard that the remedy is showing good results.

2. What is your opinion of the remedy?
No opinion directly of the selected remedy as he is not familiar with the specifics of the remedy or its implementation.

3. Do you have any concerns with the Site or Site remedy?
No concerns.

4. Was your previous impression different? Why is it different?
Did not have a previous impression because he was not familiar with the details of the site or the remedy.

5. Are you aware of any issues the 5-year review should focus on?
Mr. Courage is concerned with the future availability of the aquifer as a water supply for the Town of Milford. He would like the 5-year review to address the current and future water supply needs that could be met by the remediated aquifer and wells.

6. Who should we speak to in the community to solicit local input?
NA

7. Is the town actively involved with any Site activity or should it be?
NA

8. Have there been any changes in the Site or surrounding area in the last five years?
NA

9. Has there been any land-use or zoning changes at the Site or surrounding area?
No known zoning changes. It is Mr. Courage's understanding that the sale of the contaminated Savage Well to Hitchner included a provision for the possible future sale of the well back to the Town.

10. Are any changes planned in the surrounding area?
Water and Sewer Commission is currently looking at a possible well location near the eastern boundary of OU2, off of Elm Street along Riverway West. Mr. Courage also believes that there is a golf course under development within OU2 at the eastern boundary.

11. Have any developers shown interest in the Site?
Not aware of any interest other than the police station property at OU1, in conjunction with the Brox property sale.

12. What effects have site operations had on the surrounding community?
No know adverse impacts to the community.

13. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
Not aware of any concerns.

14. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Not aware of any issues.

15. Do you feel well informed about the site's activities and progress?
Does not feel informed of the progress made at the site and believes that there would be a benefit to including the Water and Sewer commissioners in any future informational meetings.

16. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
Overall, believes that the site is being managed appropriately and that the remedy is performing well and that EPA is "doing the right thing".

Savage Well Superfund Site 5-Year Review Interview Questions

Interviewee: Mr. Guy Scaife, Administrator, Town of Milford

History: Mr. Scaife has been the Town Administrator for about 4.5 years.

1. What is your overall impression of the project and Site over the last 5 years?
Overall, believes work is progressing well and that the remedy is appropriate. No concerns with implementation of the remedy.

2. What is your opinion of the remedy?
Believes remedy is performing well.

3. Do you have any concerns with the Site or Site remedy?
Mr. Scaife is concerned about communications relative to OU2. He would like to receive information in a timelier manner, especially relative to the progress at OU2. Mr. Scaife feels that the Town has not received timely information regarding progress at OU2.

4. Was your previous impression different? Why is it different?
Mr. Scaife was previously under the impression that the remedy would be implemented and complete within a shorter time period than the current estimate. He had previously been informed that a time period of 7 years would be realistic.

5. Are you aware of any issues the 5-year review should focus on?
How to better communicate site progress to the Town and other stake holders.

6. Who should we speak to in the community to solicit local input?
Mr. Scaife previously suggested interviewing Mr. Courage.

7. Is the town actively involved with any Site activity or should it be?
The Town is actively trying to find a buyer for the police station property at OU1 and is currently in negotiations with a prospective buyer.

8. Have there been any changes in the Site or surrounding area in the last five years?
Police station was vacated four years ago.

9. Are there any land-use or zoning changes at the Site or surrounding area?
There have been no zoning changes to the site or surrounding area.

10. Are any changes planned in the surrounding area?
No.

11. Have any developers shown interest in the Site?
Yes; police station property as part of a larger sale that includes the Brox property.

12. What effects have site operations had on the surrounding community?
Not aware of any.

13. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
Not aware of any.

14. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Not aware of any.

15. Do you feel well informed about the site's activities and progress?
Mr. Scaife believes he receives good and relevant information regarding the activities at OU1, but would like more frequent updates regarding OU2 and the site overall.

16. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
Mr. Scaife would like better and more frequent updates regarding progress at the site.

Savage Well Superfund Site 5-Year Review Interview Questions for Residents

Summary of Phone call interview by Robin Mongeon, NHDES with Michael Clark, 577 North River Road, Lot 4-5
June 14, 2011

1. What is your overall impression of the project?
   He mentioned that he saw drilling of a new well across the street, but was not familiar with what is currently going on at the site. (A new deep bedrock well, BR-4 was recently installed as part of the ongoing bedrock investigation for OU-3)

2. Do you have any concerns with the Site or Site remedy?
   He was wondering if there was any contamination found in the new well across the street(BR-4). I told him no.

3. Are you aware of any issues the current 5-year review should focus on?
   No.

4. What effects have site operations had on the surrounding community, or on your property?
   None.

5. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   No.

6. Do you feel you need to be better informed about the site's activities and progress?
   He was not familiar with what is currently going on at the site. He said that if any contamination is found during any new work, he would like to be notified.

7. Do you have any comments, suggestions, or recommendations regarding the site's management?
   No.

Savage Well Superfund Site 5-Year Review Interview Questions for Residents

Summary of Phone call interview by Robin Mongeon, NHDES with Gail Cassarino, 544 North River Road, Lot 4-40
June 14, 2011

1. What is your overall impression of the project?
   She was not familiar with what is currently going on at the site.

2. Do you have any concerns with the Site or Site remedy?
   No concerns.

3. Are you aware of any issues the current 5-year review should focus on?
   No.

4. What effects have site operations had on the surrounding community, or on your property?
   None.

5. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   No.

6. Do you feel you need to be better informed about the site's activities and progress?
   She was not familiar with what is currently going on at the site. She said more information would be nice.

7. Do you have any comments, suggestions, or recommendations regarding the site's management?
   She said more information would be nice.

LEAD MODEL FOR WINDOWS Version 1.0 Build 251

==========
Model Version: 1.0 Build 251
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research
==========
The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	5.530
1-2	5.780
2-3	6.490
3-4	6.240
4-5	6.010
5-6	6.340
6-7	7.000

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 31.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 26.100 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	23.000	26.100
1-2	23.000	26.100

2-3	23.000	26.100
3-4	23.000	26.100
4-5	23.000	26.100
5-6	23.000	26.100
6-7	23.000	26.100

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

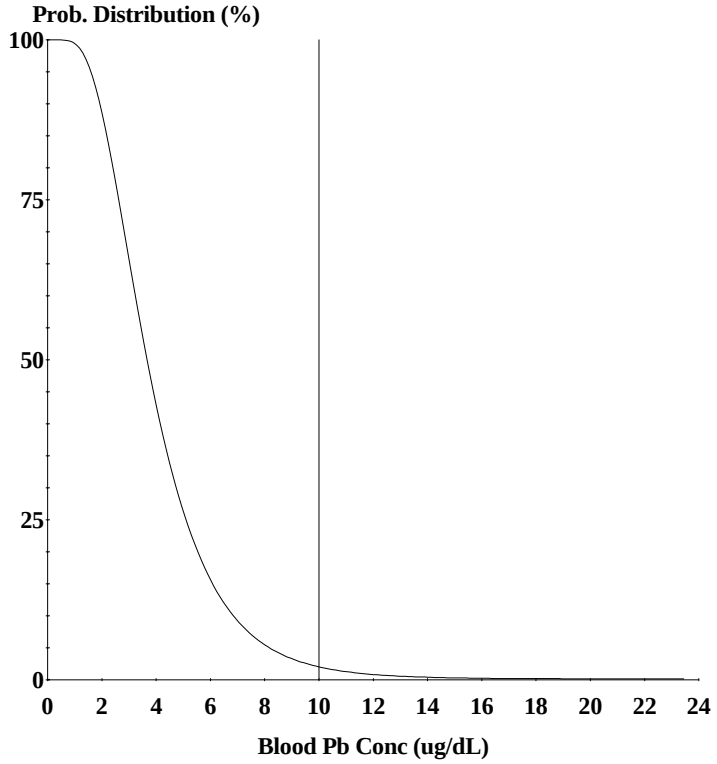
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/dL)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	2.580	0.000	2.893
1-2	0.034	2.632	0.000	7.058
2-3	0.062	2.982	0.000	7.406
3-4	0.067	2.900	0.000	7.635
4-5	0.067	2.821	0.000	8.002
5-6	0.093	2.988	0.000	8.475
6-7	0.093	3.309	0.000	8.646

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	0.588	6.082	3.3
1-2	0.911	10.636	4.3
2-3	0.919	11.369	4.2
3-4	0.930	11.532	4.0
4-5	0.696	11.585	3.8
5-6	0.629	12.186	3.7
6-7	0.596	12.644	3.5



Cutoff = 10.000 ug/dl
Geo Mean = 3.836
GSD = 1.600
% Above = 2.074

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research