FISCAL YEAR 2012 ANNUAL PERFORMANCE REPORT NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

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> **Twin Cities Army Ammunition Plant**
> **470 West Highway 96, Suite 100**
> **Shoreview, Minnesota**
> **55126-3218**

Prepared for:

> **Commander**
> **Twin Cities Army Ammunition Plant**
> **470 West Highway 96, Suite 100**
> **ATTN: DAIM-BD-TW**
> **Shoreview, Minnesota 55126-3218**

WENCK ASSOCIATES, INC.
ALLIANT TECHSYSTEMS INC.
CONESTOGA-ROVERS & ASSOCIATES, INC.
STANTEC CONSULTING CORPORATION

May 2013
Final Report

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

May 9, 2013

REPLY TO THE ATTENTION OF: SR-6J

Mr. Michael R. Fix
Remedial Project Manager
Twin Cities Army Ammunition Plant
470 West Highway 96, Suite 100
Shoreview, MN 55126

RE: Consistency Test for the Fiscal Year 2012 Annual Performance Report, Twin Cities Army Ammunition Plant, Arden Hills, Minnesota

Dear Mr. Fix:

Staff at the U.S. Environmental Protection Agency (U.S. EPA) and the Minnesota Pollution Control Agency (MPCA) have completed review of the Fiscal Year 2012 Annual Performance Report for the Twin Cities Army Ammunition Plant (FY12 APR). Our review of the FY12 APR included the following documents and communications:

- Fiscal Year 2012 Annual Performance Report, Draft Final Report, Prepared for the Commander, Twin Cities Army Ammunition Plant by Wenck Associates, Inc., Alliant Techsystems, Inc., Conestoga-Rovers, Inc., and Stantec Consulting Corporation, February 2013;
- U.S. EPA comments on the Draft FY12 APR (March 19, 2013);
- MPCA comments on the Draft FY12 APR (April 4, 2013);
- U.S. Army (Army) responses to U.S. EPA and MPCA comments and redline changes (April 15, 2013);

Based upon our review, you are hereby advised that, in accordance with Chapter XIV of the Federal Facility Agreement, the Fiscal Year 2012 Annual Performance Report passes the Consistency Test.

If you have any questions, please contact Deepa deAlwis at (651) 757-2572 or Tom Barounis at (312) 353-5577.

Sincerely

Tom Barounis

Tom Barounis
Remedial Project Manager
U.S. Environmental Protection Agency
Region 5

Tom Barounis

for

Deepa de Alwis
Project Manager
Closed Landfill and Superfund Section
Remediation Division
Minnesota Pollution Control Agency

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Fiscal Year 2012 Annual Performance Report

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APPENDICES

List of Acronyms

ATK	-	Alliant Techsystems Inc.
APR	-	Annual Performance Report
Army	-	United States Army
Barr	-	Barr Engineering
BGRS	-	Boundary Groundwater Recovery System
COC	-	Chemical of Concern
CRA	-	Conestoga-Rovers & Associates, Inc.
DNAPL	-	Dense Non-Aqueous Phase Liquid
EE/CA	-	Engineering Evaluation/Cost Analysis
ERIS	-	Environmental Restoration Information System
ESD	-	Explanation of Significant Difference
EW	-	Extraction Well
FFA	-	Federal Facility Agreement
FS	-	Feasibility Study
FY	-	Fiscal Year
GAC	-	Granular Activated Carbon
GOS	-	TGRS Global Operation Strategy
gpm	-	gallons per minute
HBV	-	Health Based Value
HRC	-	Hydrogen Release Compound™
HRL	-	Health Risk Limits
IRA	-	Interim Remedial Action
LUC	-	Land Use Control
LUCRD	-	Land Use Control Remedial Design
MCES	-	Metropolitan Council Environmental Services
MCLs	-	Maximum Contaminant Levels
MCLGs	-	Maximum Contaminant Level Goals
MDH	-	Minnesota Department of Health

List of Acronyms (Cont.)

MDL	-	Method Detection Limit
MNA	-	Monitored Natural Attenuation
MOS	-	TGRS Micro Operation Strategy
MNARNG	-	Minnesota Army National Guard
MPCA	-	Minnesota Pollution Control Agency
MW	-	Monitoring Well
NB/AH	-	New Brighton/Arden Hills
NBCGRS	-	New Brighton Contaminated Groundwater Recovery System
NBM	-	New Brighton Municipal
O&M	-	Operation and Maintenance
OM	-	Operating Minimum
OS	-	TGRS Operating Strategy
OU	-	Operable Unit
OU1TG	-	OU1 Technical Group
PAR	-	Performance Assessment Report
PCBs	-	Polychlorinated Biphenyls
PGAC	-	Permanent Granular Activated Carbon
PGRS	-	Plume Groundwater Recovery System
PLC	-	Programmable Logic Controller
PM	-	Preventative Maintenance
POTW	-	Publicly-Owned Treatment Works
ppb	-	parts per billion
QAPP	-	Quality Assurance Project Plan
RAB	-	Restoration Advisory Board
RAWP	-	Remedial Action Work Plan
RD/RA	-	Remedial Design/Remedial Action
ROD	-	Record of Decision

List of Acronyms (Cont.)

scfm	-	Standard Cubic Feet per Minute
SDWA	-	Safe Drinking Water Act
Stantec	-	Stantec Consulting Corporation (formerly SECOR International, Inc.)
Shaw	-	Shaw Environmental & Infrastructure, Inc. (formerly Stone & Webster)
SVE	-	Soil Vapor Extraction
SW	-	Surface Water
TCAAP	-	Twin Cities Army Ammunition Plant
TGRS	-	TCAAP Groundwater Recovery System
TWISS	-	Tecumseh/Wenck Installation Support Services
µg/L	-	Micrograms per liter
USAEC	-	United States Army Environmental Command
USACHPPM	-	US Army Center for Health Promotion & Preventive Medicine
USEPA	-	United States Environmental Protection Agency
VOC	-	Volatile Organic Compound
Wenck	-	Wenck Associates, Inc.
WWP	-	Wet Well Pump

List of Chemical Abbreviations

Note: The abbreviations below are those that were required for data entry into the U.S. Army Environmental Center (USAEC) Installation Restoration Data Management Information System (IRDMIS), which was replaced by the USAEC Environmental Restoration Information System (ERIS) in November 2001. These abbreviations, though not used in ERIS, are still used in some tables and appendices presented in this report.

111TCE	-	1,1,1-Trichloroethane
112TCE	-	1,1,2-Trichloroethane
11DCE	-	1,1-Dichloroethene
11DCLE	-	1,1-Dichloroethane
12DCE	-	1,2-Dichloroethenes (*cis* and *trans* isomers)
12DCLB	-	1,2-Dichlorobenzene
12DCLE	-	1,2-Dichloroethane
12DCLP	-	1,2-Dichloropropane
13DCLB	-	1,3-Dichlorobenzene
14DCLB	-	1,4-Dichlorobenzene
2CLEVE	-	2-Chloroethyl vinyl ether
AG	-	Silver
BRDCLM	-	Bromodichloromethane
C12DCE	-	cis-1,2-Dichloroethene
C13DCP	-	cis-1,3-Dichloropropene
C2H3CL	-	Vinyl chloride
C2H5CL	-	Chloroethane
C6H6	-	Benzene
CCL3F	-	Trichlorofluoromethane
CCL4	-	Carbon tetrachloride
CH2CL2	-	Methylene chloride
CH3CL	-	Chloromethane
CHBR3	-	Bromoform
CHCL3	-	Chloroform

List of Chemical Abbreviations (Cont.)

CLC6H5	-	Chlorobenzene
CU	-	Copper
CYN	-	Cyanide
DBRCLM	-	Dibromochloromethane
EDTA	-	Ethylenediaminetetraacetic Acid
ETC6H5	-	Ethylbenzene
HG	-	Mercury
MEC6H5	-	Toluene
P4	-	Phosphorus
PB	-	Lead
SB	-	Antimony
T12DCE	-	trans-1,2-Dichloroethene
T13DCP	-	trans-1,3-Dichloropropene
TCLEA	-	Tetrachloroethane
TCLEE	-	Tetrachloroethene
TCLTFE	-	1,1,2-Trichloro-1,2,2-trifluoroethane
TRCLE	-	Trichloroethene
XYLEN	-	Xylenes
ZN	-	Zinc

1.0 Executive Summary

This Fiscal Year 2012 (FY 2012) Annual Performance Report (APR):

- Summarizes the status of remedy implementation; and
- Addresses how the remedies are performing,

for each of the three operable units related to the New Brighton/Arden Hills Superfund Site. Figure 2-1 shows the approximate locations of the three operable units. Fiscal Year 2012 is defined as the period from October 1, 2011 through September 30, 2012.

Records of Decision (RODs) have been signed for each of the three operable units (OUs):

- OU1 ROD signed 1993, Amended 2006
- OU2 ROD signed 1997, Amended 2007, 2009, and 2012
- OU3 ROD signed 1992, Amended 2006

The RODs, and subsequent Amendments and Explanations of Significant Differences, present the major components of the final remedies for the media of concern. This report looks at each of the major components and addresses:

1. *Are the remedies being implemented? (Compliance check with the RODs and ROD Amendments)*
2. *Are the remedies doing what they are supposed to?*

Table 1-1 summarizes the status of remedial actions at the end of FY 2012. Following are highlights of the accomplishments for each operable unit, as well as other activities during FY 2012.

Operable Unit 1 (OU1)

OU1 consists of the "north" plume of Volatile Organic Compound (VOC) groundwater contamination. The final remedy for OU1 consists of pumping from six municipal wells (New Brighton Municipal wells NBM #3, #4, #5, #6, #14, and #15) and treating the extracted groundwater through the Permanent Granular Activated Carbon (PGAC) system. Treated water is piped to the New Brighton water supply system for distribution as potable water. Other remedy components include providing alternate water supply and/or well abandonment to affected private wells, and drilling advisories for new well construction. Highlights for FY 2012 are:

- The Minnesota Department of Health (MDH) Special Well Construction Area remains in effect. The MDH has the regulatory responsibility to assure that wells constructed in the advisory area meet appropriate well construction and human health requirements. In FY 2012, there were no new recommendations for abandonment or alternate water supply.
- The PGAC treated 1.41 billion gallons of water and removed 528 pounds of VOCs during FY 2012. Approximately 22,619 pounds of VOCs have been removed since system startup.
- The effluent of the PGAC was in compliance with the applicable Safe Drinking Water Act criteria for the OU1 chemicals of concern.
- The treated groundwater was beneficially used in the New Brighton and Fridley municipal water supply systems.
- FY 2012 was a minor sampling event. The statistical trend analysis, as developed by the OU1 Technical Group, indicate that aquifer restoration is occurring.

Operable Unit 2 (OU2)

OU2 is defined as the area occupied by TCAAP in 1983, when the New Brighton/Arden Hills Superfund Site was placed on the National Priorities List. The remedial action requirements were set forth in the OU2 ROD (1997), ROD Amendment #1 related to Site C-2 (2007), ROD Amendment #2 related to Site I groundwater (2009), ROD Amendment #3 related to various soil sites (2009), Explanation of Significant Differences #1 related to groundwater (2009), Explanation of Significant Differences #2 related to various soil sites (2009), and ROD Amendment #4 related to Building 102 shallow groundwater, aquatic sites, and various soil sites (2012). Highlights for activities within OU2 during FY 2012 are:

- Shallow Soil Sites
  - No activities other than ongoing Army implementation of land use controls.

- Deep Soil Sites
  - No activities other than ongoing Army implementation of land use controls.

- Site A Shallow Groundwater
  - In accordance with the "Site A Shallow Groundwater: 10-Year Evaluation Report" (July 2008), and with regulatory approval, the groundwater extraction system was shut down on September 24, 2008, in order to evaluate Monitored Natural Attenuation (through abiotic degradation) as a potential remedy component in lieu of groundwater extraction and discharge. The groundwater system remains in stand-by mode in the event that MNA does not adequately control plume migration and one or more extraction wells need to be restarted.
  - As predicted in the 10-Year Report, water quality results for the fourth year of MNA show some wells with increasing VOC concentrations and some wells with decreasing concentrations.
  - Monitoring results from the four contingency wells located along the north side of County Road I did not exceed the approved trigger levels.

- The four years of water quality results since the extraction system was shut down appear to show that a “wave” of higher concentrations is moving through the Site A area. The higher concentrations likely originated from an area within a stagnation zone (i.e., an area between two adjacent extraction well capture zones that existed when the extraction system was operating), and these higher concentrations are now moving downgradient and shifting along the axis following system shutdown. The maximum concentration observed in this “wave” is decreasing as it travels downgradient.
- Changes to monitoring frequencies at some wells that were recommended (and approved) in the FY 2010 APR were implemented starting in FY 2012.
- Continued monitoring and evaluation of MNA is recommended prior to any decision on whether or not to formally change the remedy to MNA; however, it appears that one to two more years of monitoring will be adequate to allow such a determination to be made.
- The MDH Special Well Construction Area remains in effect. In FY 2012, there were no locations identified in need of well abandonment or alternate water supply.

- Site C Shallow Groundwater
    - In accordance with the “Site C Groundwater Extraction System Evaluation Report” (November 2008), and with regulatory approval, the groundwater extraction system was shut down on November 13, 2008. The system was shut off because lead concentrations in the three extraction wells had been below the groundwater cleanup level since March 2008 (i.e., the area of lead concentrations that exceeded the groundwater cleanup level was not even reaching the extraction wells, so operation of the extraction system was no longer required to contain the plume). The groundwater system remains in stand-by mode in the event that one or more extraction wells need to be restarted.

- Only one monitoring well located near the source area exceeded the groundwater cleanup level for lead in FY 2012.
- None of the groundwater or surface water contingency locations exceeded the approved trigger levels in FY 2012.
- The change to an annual monitoring frequency for the wells and surface water locations that was recommended (and approved) in the FY 2010 APR was implemented starting in FY 2012.
- Continued monitoring is recommended prior to any decision on whether or not to formally change the remedy to eliminate the groundwater extraction component.

- Site I Shallow Groundwater
  - Sampling at Site I indicated no significant changes in VOC concentrations in Unit 1 monitoring wells in FY 2012. Five of the eight wells scheduled for sampling and hydraulic monitoring were dry, and one other well had insufficient water to collect samples. Therefore, groundwater samples were collected from three of the nine wells scheduled for sampling in FY 2012.
  - Although six wells were unable to be sampled, previous investigations indicate the Unit 1 groundwater is discontinuous and does not extend beyond Site I; rather, the Unit 1 contaminants leak downward into Unit 3, which is hydraulically contained by the TGRS.
  - Sampling of Site I has been moved from June to March/April to coincide with typically higher groundwater elevations; groundwater sampling occurred on March 28, 2012.

- Site K Shallow Groundwater
  - At Site K, the groundwater extraction trench and treatment system continued to operate as designed. The system captured and treated 4,669,250 gallons of water and maintained a continuous zone of capture downgradient of the

former Building 103. A total of 14.5 pounds of VOCs were removed in FY 2012.

  - Groundwater samples were collected from all eleven wells scheduled for sampling in FY 2012. With the exception of relatively stable trichloroethene concentrations in 01U615 and 01U611, the overall trend throughout Site K Unit 1 monitoring wells continues to show a gradual decrease in trichloroethene concentrations over the last fifteen years of sampling.
  - In addition to the 11 routinely wells sampled, well 01U609 was sampled in June 2012 to monitor the effectiveness of the granular potassium permanganate placement during the 2009 Site K soils excavation.

- Building 102 shallow groundwater
  - Some of the FY 2012 (and FY 2011) monitoring results were not consistent with historical results, with increases in VOC concentrations noted in some wells. It appears that high groundwater levels may have contributed to the increasing trends. A meeting between the Army, MPCA, and USEPA will be held in early FY 2013 to discuss the need for revisions to the monitoring locations and/or frequencies.
  - The well adjacent to Rice Creek continued to show that shallow groundwater discharging to Rice Creek was below the cleanup levels for this site.

- Aquatic Sites
  - In June 2012, Pond G surface water was treated to raise the hardness.
  - The two Pond G surface water monitoring events in FY 2012 both indicate that surface water treatment was successful, i.e., the surface water lead results were in compliance with the Minnesota surface water standard.

- Deep Groundwater
  - The TCAAP Groundwater Recovery System (TGRS) operated in accordance with the OU2 ROD.

- The TGRS operated at a rate sufficient to support the conclusion that the 5 μg/L TRCLE contour is hydraulically contained. In FY 2012, the total extraction well water pumped averaged 1,831 gpm, which is greater than the Global Operation Strategy (GOS) Operating Minimum (OM) (1,745 gpm).
- In FY 2012, the TGRS extracted and treated approximately 964,996,900 gallons of water. The mass of VOCs removed was 1,801 pounds and is 33 pounds less than that achieved in FY 2011. The total VOC mass removed by the TGRS through FY 2012 is 207,180 pounds.
- Groundwater analytical data of the source area shows a general decrease in TRCLE concentration. This demonstrates that the TGRS is effectively removing VOC mass from the aquifer.
- Effluent VOC concentrations were below contaminant-specific requirements for all sampling events.

<u>Operable Unit 3 (OU3)</u>

- Operable Unit 3 (OU3): Deep Groundwater
  - Groundwater monitoring in FY 2012 was conducted during the annual event. The statistical evaluation only included one well for this annual event, but recent data showed the South Plume is decreasing to stable in concentration at its center and stable at its edge. In addition, there is evidence of the North Plume commingling with the South Plume at the boundary between the two plumes and perhaps even toward the center of the South Plume.

<u>Other Investigation and/or Remediation Activities Not Prescribed by a Current ROD</u>

- Round Lake Feasibility Study
  - In February 2012, after receipt of final core dating results, the MPCA and USEPA completed their final analysis of the 2011 sediment data, and they provided their recommended preliminary remediation goals for Round Lake

sediments at a meeting with the Army and the other stakeholders in February 2012. In March 2012, the Army provided responses to the stakeholder comments on the Round Lake portion of the April 2010 FS, which had been placed on hold pending collection and evaluation of the 2011 sediment data. A comment resolution meeting was then held in April 2012, and a TCAAP Restoration Advisory Board meeting was held in May 2012, primarily to discuss the status of the Round Lake FS.

  - With USEPA and MPCA agreement, the Army initiated a strategy to revise the FS in segments, with the intent to gain agreement/approval at key steps along the way. In accordance with this strategy, the Army submitted revised Sections 1 through 5 of the Round Lake FS in August 2012. The USEPA and MPCA provided comments in September 2012. The Army was preparing responses to comments at the end of FY 2012.

- Site A, 135 Primer/Tracer Area, and MNARNG EBS Area Soil Removal Actions
  - In February 2012, the USEPA and MPCA provided consistency for a QAPP for additional soil investigation to support preparation of an EE/CA for various soil areas of concern located at Site A, the 135 Primer/Tracer Area, and Minnesota Army National Guard (MNARNG) environmental baseline survey (EBS) areas. This soil investigation work was conducted in March – June 2012.
  - In July 2012, the Army submitted a Draft-Final EE/CA, which documented this investigation work and presented a recommended removal action (soil excavation and offsite disposal). The USEPA and MPCA provided comments on the Draft-Final EE/CA in August and September 2012, and the Army provided response to those comments in September 2012. The MPCA approved the Army responses in September 2012. At the end of FY 2012, the USEPA was reviewing the Army responses.
  - Also at the end of FY 2012, the Army collected additional soil samples to provide more complete delineation of the perimeters of the two areas of concern. This additional sampling work will ultimately be documented in a removal action work plan that will be submitted by the Army in FY 2013.

Table 1-1

Status of Remedial Actions: FY 2012

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 1: Deep Groundwater				
#1: Alternate Water Supply/Well Abandonment	Yes	Yes	No	
#2: Drilling Advisories	Yes	Yes	No	
#3: Extract Groundwater	Yes	Yes	No	
#4: Removal of VOCs by GAC (Discharge Quality)	Yes	Yes	No	
#5: Discharge of Treated Water	Yes	Yes	No	
#6: Groundwater Monitoring with Verification of Continuing Aquifer Restoration	Yes	Yes	No	
Overall Remedy	Yes	Yes	No	
Operable Unit 2: Shallow Soil Sites				
#1-7: Soil Remediation				
Site A	Yes	Yes	Yes	
Site C	Yes	Yes	Yes	
Site E	Yes	Yes	Yes	
Site H	Yes	Yes	Yes	
Site 129-3	Yes	Yes	Yes	
Site 129-5	Yes	Yes	Yes	

Table 1-1 (continued)

Status of Remedial Actions: FY 2012

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Shallow Soil Sites (continued)				
#1-7: Soil Remediation (continued)				
Grenade Range	Yes	Yes	Yes	
Outdoor Firing Range	Yes	Yes	Yes	
135 PTA Stormwater Ditch	Yes	Yes	Yes	
535 Primer/Tracer Area	Yes	Yes	Yes	
Site K Soils	Yes	Yes	Yes	
Trap Range Site	Yes	Yes	Yes	
Water Tower Area	Yes	Yes	Yes	
#8: Groundwater Monitoring	Yes	Yes	Yes	
#9: Characterization of Dumps				
Site B	Yes	Yes	Yes	
Site 129-15	Yes	Yes	Yes	
#10: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy	Yes	Yes	Partially	

Table 1-1 (continued)

Status of Remedial Actions: FY 2012

Remedy Component		Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Deep Soil Sites					
#1:	Groundwater Monitoring	Yes	Yes	Yes	
#2:	Restrict Site Access During Remediation	Yes	Yes	Yes	Long-term land use controls are addressed by Remedy Component #8.
#3:	SVE Systems	Yes	Yes	Yes	
#4:	Enhancements to SVE Systems	Yes	Yes	Yes	Neither system required operation with enhancements. Both SVE systems have been dismantled.
#5:	Maintain Existing Site Caps	Yes	Yes	Yes	This remedy component was intended to minimize short-circuiting of airflow when the SVE systems were operating. The long-term land use controls for the cap/cover that must be maintained at Sites D and G (due to shallow soil contamination at Site D and the Site G dump) are addressed by Remedy Component #8.
#6:	Maintain Surface Drainage Controls	Yes	Yes	Yes	
#7:	Characterize Shallow Soils and Dump	Yes	Yes	Yes	
#8:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy		Yes	Yes	Partially	

Table 1-1 (continued)

Status of Remedial Actions: FY 2012

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Site A Shallow Groundwater				
#1: Groundwater Monitoring	Yes	Yes	No	
#2: Groundwater Containment/Mass Removal	Yes	Yes	No	The groundwater extraction system was shut off on 9/24/08 and is currently in standby while implementation of MNA is evaluated. If MNA is ultimately deemed an acceptable remedy, a ROD modification will be prepared to document the change in this remedy component.
#3A Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
#3B: Drilling Advisory/Alternate Water Supply/Well Abandonment	Yes	Yes	No	
#4: Discharge of Extracted Water	Yes	Yes	No	See comment for Remedy Component #2.
#5: Source Characterization/Remediation	Yes	Yes	Yes	
Overall Remedy	Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2012

Remedy Component		Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Site C Shallow Groundwater					
#1:	Groundwater and Surface Water Monitoring	Yes	Yes	No	
#2:	Groundwater Containment	Yes	Yes	No	Since the lead plume no longer extends to the extraction wells, the groundwater extraction system was shut off on 11/13/08 and is currently in standby while ongoing groundwater and surface water monitoring continue.
#3:	Discharge of Extracted Water	Yes	Yes	No	See comment for Remedy Component #2.
#4:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy		Yes	Yes	No	
Operable Unit 2: Site I Shallow Groundwater					
#1:	Groundwater Monitoring	Yes	Yes	No	
#2:	Additional Investigation	Yes	Yes	Yes	
#3:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy		Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2012

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Site K Shallow Groundwater				
#1: Groundwater Monitoring	Yes	Yes	No	
#2: Sentinel Wells	Yes	Yes	Yes	
#3: Hydraulic Containment	Yes	Yes	No	
#4: Groundwater Treatment	Yes	Yes	No	
#5: Treated Water Discharge	Yes	Yes	No	
#6: Discharge Monitoring	Yes	Yes	No	
#7: Additional Investigation	Yes	Yes	Yes	
#8: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy	Yes	Yes	No	
Operable Unit 2: Building 102 Shallow Groundwater				
#1: Monitored Natural Attenuation	Yes	Yes	No	
#2: Groundwater Monitoring	Yes	Yes	No	
#3: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy	Yes	Yes	No	

Status of Remedial Actions: FY 2012

Remedy Component		Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Aquatic Sites					
#1:	Pond G Surface Water Treatment	Yes	Yes	Yes	
#2:	Pond G Surface Water Monitoring	Yes	Yes	No	
Overall Remedy		Yes	Yes	No	
Operable Unit 2: Deep Groundwater					
#1:	Hydraulic Containment and Contaminant Mass Removal	Yes	Yes	No	
#2:	Groundwater Treatment	Yes	Yes	No	
#3:	Treated Water Discharge	Yes	Yes	No	
#4:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
#5:	Review of New Technologies	Yes	Yes	No	
#6:	Groundwater Monitoring	Yes	Yes	No	
Overall Remedy		Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2012

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 3: Deep Groundwater				
#1: Monitored Natural Attenuation	Yes	Yes	No	
#2: Groundwater Monitoring	Yes	Yes	No	
#3: Drilling Advisories	Yes	Yes	No	
Overall Remedy	Yes	Yes	No	

2.0 Introduction

2.1 PURPOSE

This Fiscal Year 2012 Annual Performance Report (APR) is intended to:

- Summarize the status of remedy implementation; and
- Address how the remedies are performing,

for remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH Site). Fiscal Year 2012 (FY 2012) extended from October 1, 2011 through September 30, 2012.

The NB/AH Superfund Site has been divided into three areas designated “Operable Units.” Operable Unit 1 (OU1) encompasses deep groundwater sometimes referred to as the “North Plume.” Operable Unit 2 (OU2) includes soil, sediment, surface water, and groundwater contamination on the area that comprised the Twin Cities Army Ammunition Plant (TCAAP) in 1983, when the NB/AH Site was placed on the National Priorities List (NPL). OU2 also includes the Site A groundwater plume that extends off the north end of the federally-owned property. Operable Unit 3 (OU3) consists of the deep groundwater sometimes referred to as the “South Plume.” Figure 2-1 shows the approximate locations of the three operable units.

Records of Decision (RODs) have been signed for each of the three operable units (OUs):

- OU1 ROD signed 1993, Amended 2006
- OU2 ROD signed 1997, Amended 2007, 2009, and 2012
- OU3 ROD signed 1992, Amended 2006

The RODs, and subsequent Amendments and Explanations of Significant Differences (ESDs), present the major components of the final remedies for the media of concern.

Monitoring activities and submittal of this report are in fulfillment of the Federal Facility Agreement (FFA) signed in 1987 between the United States Army (Army), United States Environmental Protection Agency (USEPA), and Minnesota Pollution Control Agency (MPCA).

Assessment of performance is answered with two questions:

1. *Are all of the remedies being implemented? (Compliance check with the RODs)*
2. *Are the remedies performing as required?*

To address these two questions, this report is broken into the three Operable Units. Using each ROD (along with subsequent modifications), the report addresses the major components of the selected remedy for each media. Performance standards are then presented for each of the major remedy components. The performance standards are used to determine when a remedy component has been successfully implemented and/or completed.

For some of the remedy components, the performance standards are clearly defined in the RODs (e.g., soil or groundwater cleanup levels). For other remedy components (e.g., alternate water supply) the performance standards are less clear in the RODs, but may have been agreed to through Work Plans or design documents.

With the performance standards identified, this report then addresses the two questions described above, often through a series of sub-questions. The questions are written in the text in an attempt to make the report focused and user friendly. To the extent possible, answers are in the form of figures, graphs, etc.

In addition to reporting on FY 2012, this document presents proposed monitoring for future years (Appendix A). Monitoring locations or frequencies that are new in this year's report are shown highlighted in yellow. The monitoring plan shows FY 2012 through FY 2016. The monitoring plan covers a moving 5-year time span (i.e., next year FY 2012 will drop off and FY 2017 will be added).

This report represents the collaboration of work performed by the Army and Alliant Techsystems Inc. (ATK). On behalf of the Army, Wenck Associates, Inc. (Wenck) prepared Sections 2.0 through 7.0, 10.0, 11.0 and 14.0 of this report. On behalf of ATK, Stantec Consulting Corporation (Stantec) prepared Sections 8.0 and 9.0, and Conestoga-Rovers & Associates, Inc. (CRA) prepared Sections 12.0 and 13.0. Wenck, Stantec, and CRA all contributed to Section 1.0.

2.2 BRIEF OVERVIEW OF TCAAP

TCAAP was constructed between August 1941 and January 1943 in the northern portion of the Minneapolis – St. Paul metropolitan area, in Ramsey County, and is surrounded by the cities of New Brighton, Arden Hills, Mounds View, and Shoreview, Minnesota (Figure 2-1).

TCAAP primarily produced and proof-tested small-caliber ammunition and related materials for the Army. Other uses included manufacture of munitions-related components, handling/storage of strategic and critical materials for other government agencies, and various non-military tenant activities. Production began in 1942 and then alternated between periods of activity and standby related to wars. The last manufacturing operations ceased in 2005.

During periods of activity, solvents were utilized as part of some manufacturing operations. Disposal of solvents and other wastes at the TCAAP property resulted in soil contamination and also groundwater contamination, which has migrated beyond the original TCAAP boundary. Groundwater contamination was first discovered in July 1981, which led to investigation of the soil and groundwater on and off the TCAAP property. It was determined that TCAAP was the source of contamination, and so the TCAAP property and area of affected groundwater contamination was placed on the National Priorities List (NPL) in 1983 as the New Brighton/Arden Hills Superfund Site.

A number of known and potential contaminant source areas were initially identified on the TCAAP property: Sites A, B, C, D, E, F, G, H, I, J, K, 129-3, 129-5, and 129-15 (see Figure 2-2 for locations). The 1997 OU2 ROD specified requirements for all of these sites except Site F (which was remediated prior to 1997) and Site J (a sewer line that was determined not to have a release of contamination). Other areas have also undergone investigation and/or remediation, namely the Grenade Range, Outdoor Firing Range, Trap Range, 135 Primer/Tracer Area (and adjacent stormwater ditch), 535 Primer/Tracer Area, Water Tower Area, and Building 102. These areas are also shown on Figure 2-2.

Since 1983, when the NB/AH Site was placed on the NPL, the size of TCAAP has periodically shrunk as a result of property transfers. Some property has been transferred out of federal-ownership to the Minnesota Department of Transportation, Ramsey County, and the City of Arden Hills. Other property is still owned by the federal government, but control has been reassigned to the Army Reserve or the National Guard Bureau. The National Guard Bureau has licensed the property it controls to the Minnesota Army National Guard. Figure 2-3 shows the property presently under federal ownership, along with the organizations responsible for control. The remaining 585 acres that is still controlled by TCAAP is in the process of being transferred out of federal control. It is likely that within the next few years, there will no longer be an organization or property called TCAAP. These property transfers do not alter the responsibilities of the U.S. Army under the FFA.

2.3 HYDROGEOLOGIC UNITS AND WELL NOMENCLATURE

For purposes of studies and work related to the NB/AH Superfund Site, four hydrogeologic units have been designated: Unit 1 through Unit 4. Descriptions of these four units are presented in Appendix B, along with a description of the nomenclature system used for well designations (e.g., 03U704). A well-designation cross-reference guide is included in Table B-1 in Appendix B. The well index includes all wells that are owned by or have been used by the Army in the past to gather groundwater elevation or water quality data, sorted by Minnesota unique number. Well information in the Appendix includes the Army designation (IRDMIS number), Minnesota unique number, and any other name(s) the wells may have. The Appendix also includes information about each well. Locations of wells that are included in the monitoring plan are shown on Figure B-2 (OU1/OU3 wells) and Figure B-3 (OU2 wells) in Appendix B. With a known well name, the location of that well can be determined using the "Edit, Find" or "Edit, Search" function and typing in the well name, which will highlight the desired well name on the figure. Available information concerning a well, including well logs and other information, can be viewed in the Appendix B Attachment, which is sorted by Minnesota unique number.

See the instructions on the attached CD for more information on using Appendix B.

2.4 DATA COLLECTION, MANAGEMENT, AND PRESENTATION

Performance monitoring data was collected in accordance with the:

- FY 2012 Monitoring Plan for Groundwater Monitoring Wells
- FY 2012 Monitoring Plan for Remedial Treatment Systems
- FY 2012 Monitoring Plan for Surface Water
- New Brighton Water System Sampling and Analysis Plan

Data was collected principally by four parties: Wenck on behalf of the Army; CRA and Stantec on behalf of ATK; and Barr Engineering (Barr) on behalf of the City of New Brighton. Appendix C presents information on data collection, management, and presentation. Data tables are presented following the text at the end of each section in which it is referenced. The comprehensive groundwater level and groundwater quality databases from 1987 through FY 2012 are contained in Appendix D.1.

Is the data complete and representative (are we making decisions based on complete and technically-sound information)?

Yes. The data was collected in accordance with the FY 2012 Monitoring Plan. Data was collected, verified, and validated in accordance with two separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring", (Wenck, Revision 10, March 22, 2011) and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater", (Wenck, Revision 4, March 22, 2011). The Building 102 QAPP is applicable to only that specific site, and all other sites are covered by the Performance Monitoring QAPP.

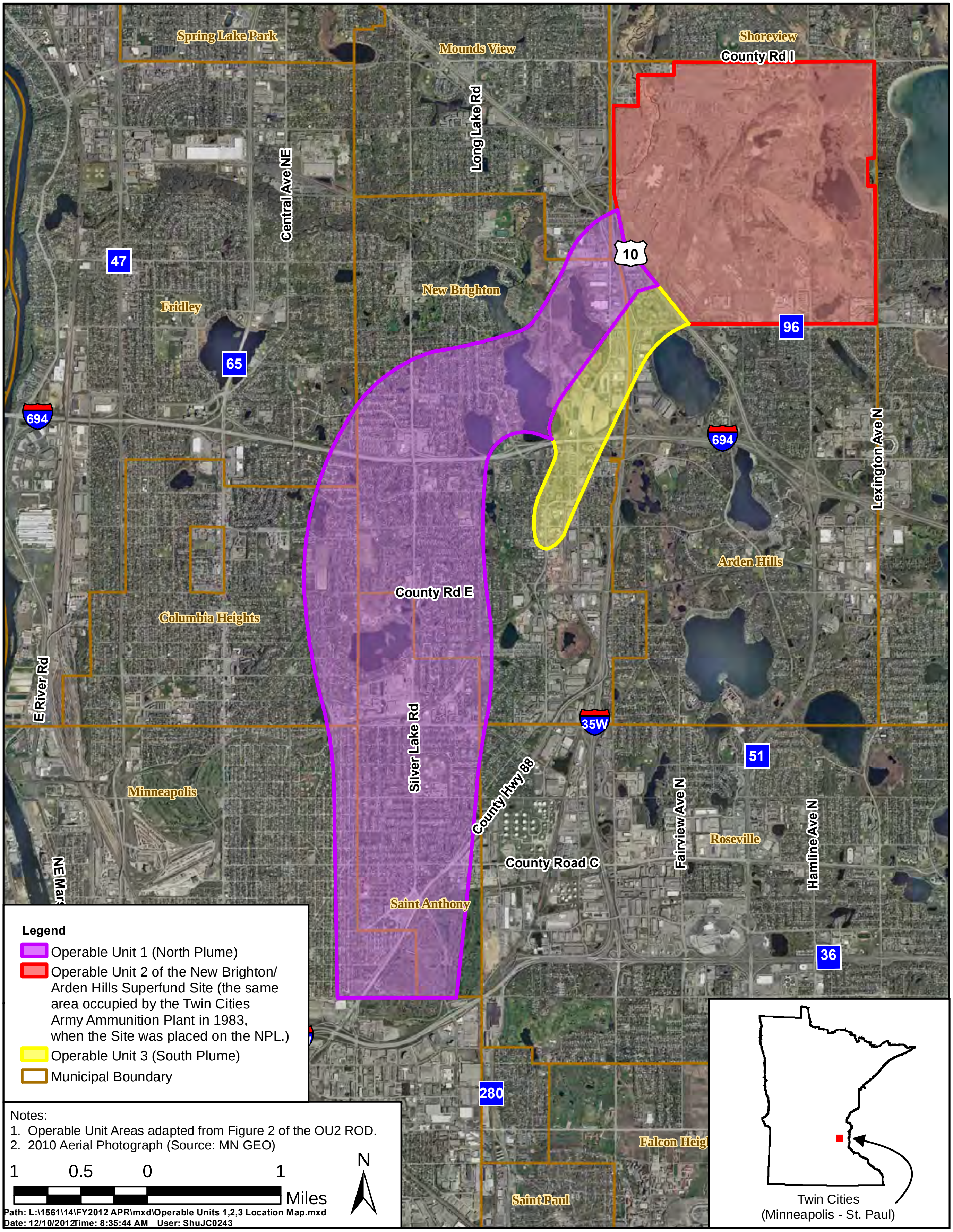
The data tables in the various report sections and the comprehensive water quality databases (Appendix D.1) show the data qualifiers that were assigned to the data as a result of data verification and/or data validation. The data qualifiers assigned to FY 2012 data are explained in the footnotes of the data tables in the various report sections. Data verification (performed on 100 percent of the data) and data validation (performed on a minimum of 10 percent of the data) were provided to the USEPA and MPCA via submittal of quarterly Data Usability Reports (DURs) covering the data collected in FY 2012. The final MPCA/USEPA approval letter for the FY 2012 DURs is included in Appendix C.3.

With regard to completeness, Appendix C.2 summarizes any deviations from the FY 2012 Monitoring Plan. The field and laboratory completeness goals for performance monitoring are both 95%, except that the completeness goals for TGRS effluent, Site K effluent, Pond G, and well inventory are 100%. Actual field and laboratory completeness were both 100%, meeting the overall completeness goals (wells that were dry, frozen or inoperative were not considered as missed samples, nor were well inventory locations where the well owner refused sample collection or was nonresponsive). Also, the actual field and laboratory completeness for the subset of samples with 100% completeness goals was 100%, meeting this goal. For Building 102 shallow groundwater, the field and laboratory completeness goals are both 95%, except that the completeness goals for well 01U048 (adjacent to Rice Creek) are 100%. Actual field and laboratory completeness were 100%, meeting the completeness goals.

With regard to QC samples, both QAPPs specify that field duplicates, equipment rinse blanks, and matrix spike/matrix spike duplicates are to be collected at overall frequencies of 10%, 10%, and 5%, respectively. Actual QC sample frequencies met these goals, with respective frequencies of 21%, 11% and 14% for performance monitoring; and 17%, 17% and 8% for Building 102 shallow groundwater.

With regard to data validation, the performance monitoring QAPP specifies that data validation be completed at an overall rate of 10%, with 100% validation of Site A antimony data, Pond G, and well inventory samples. The actual validation rate was 71%, and all of the data requiring 100% data validation was fully validated, meeting the specified validation rates for performance monitoring. For Building 102 shallow groundwater, the QAPP specifies a 100% data validation rate, and all of the data was fully validated.

The data for FY 2012 is deemed to be representative and meet data quality objectives based on: 1) adherence to QAPP-specified sampling and laboratory analytical procedures; 2) completion of data verification and data validation; and 3) comparability to historical results (any substantial deviations from historical and/or anticipated results are discussed within the site-specific sections of this report).



ANNUAL PERFORMANCE REPORT

Conceptual Illustration of Operable Units

Wenck

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Business Professionals
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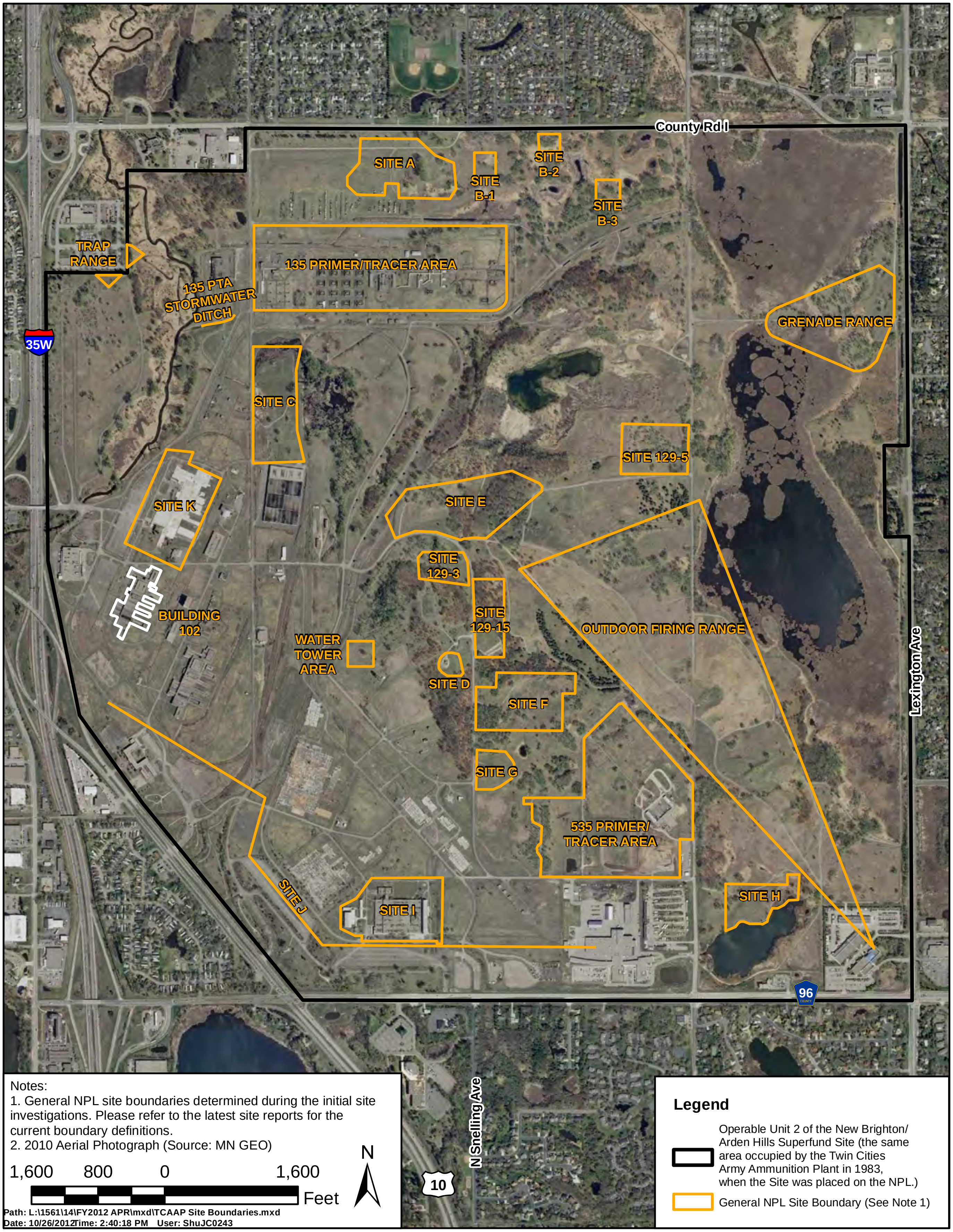
FY 2012

Figure 2-1



Notes:
1. General NPL site boundaries determined during the initial site investigations. Please refer to the latest site reports for the current boundary definitions.
2. 2010 Aerial Photograph (Source: MN GEO)

Path: L:\1561\14\FY2012 APR\mxd\TCAAP Site Boundaries.mxd
Date: 10/26/2012 Time: 2:40:18 PM User: ShuJC0243

Legend

Operable Unit 2 of the New Brighton/ Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)

General NPL Site Boundary (See Note 1)

ANNUAL PERFORMANCE REPORT

Operable Unit 2 Site Boundaries

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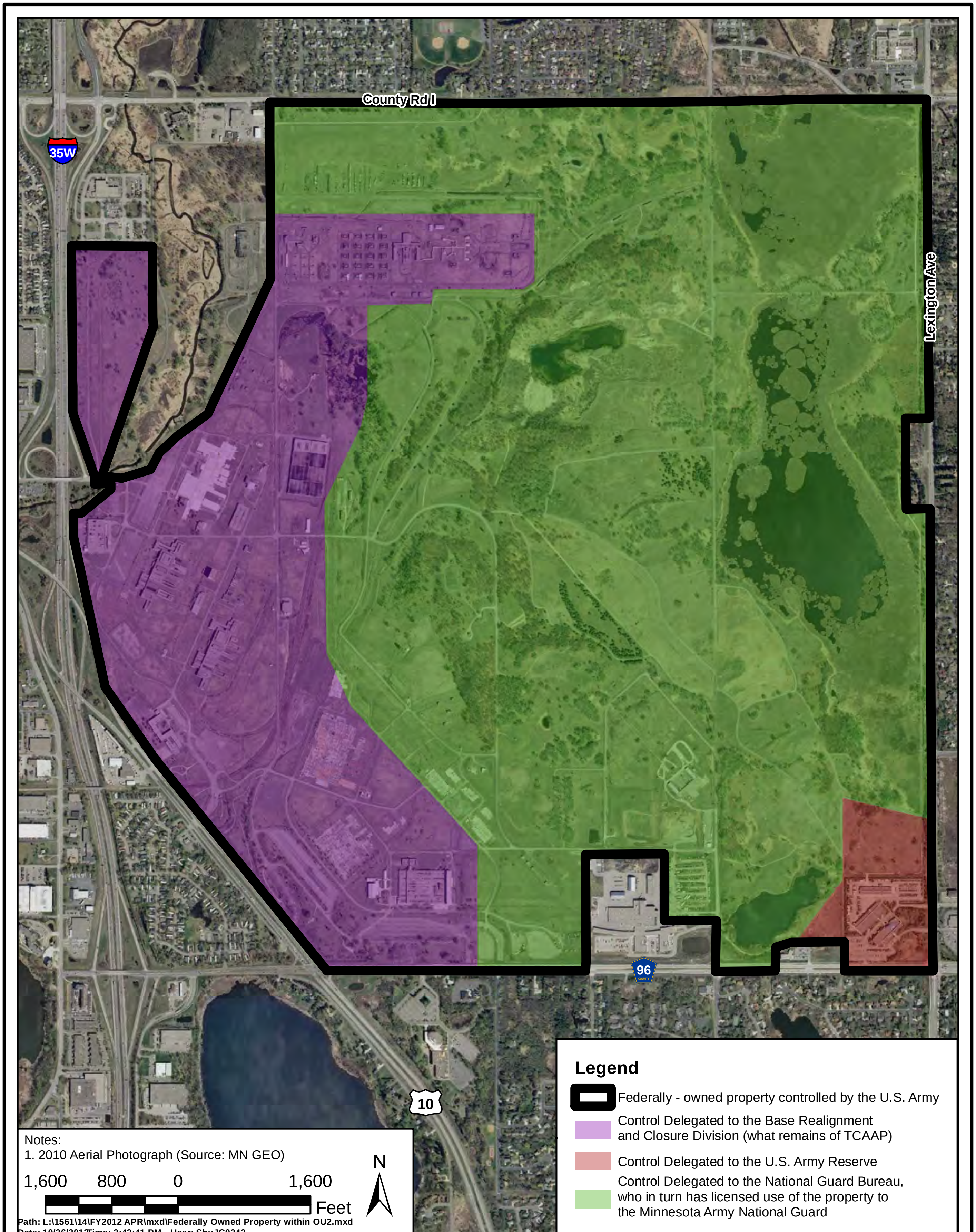
FY 2012

Figure 2-2



ANNUAL PERFORMANCE REPORT

Federally - Owned Property
Within Operable Unit 2

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FY 2012

Figure 2-3

3.0 Operable Unit 1: Deep Groundwater

The reference for the OU1 ROD is:

RECORD OF DECISION
Groundwater Remediation
Operable Unit 1
At New Brighton/Arden Hills Superfund Site
1993, Amended 2006

The 2006 ROD amendment formalized the adoption of the statistical analysis of groundwater quality presented in the Annual Performance Reports since FY 2003.

Following are the six primary elements of the amended ROD, with the changed elements shown in italics:

1. Providing alternate water supplies to residents with private wells within the North Plume.

2. Implementing drilling advisories that would regulate the installation of new private wells within the North Plume as a Special Well Construction Area.

3. *Extracting groundwater from the North Plume using the New Brighton Contaminated Groundwater Recovery System (NBCGRS), subject to the following:*

   a. the initial aggregate groundwater extraction rate shall be consistent with the long-term operating history of the NBCGRS;

   b. future decreases in the aggregate extraction rate shall be determined by the Army, USEPA, and MPCA using a transparent public process and rational *engineering, scientific, and economic analyses at least as rigorous as those employed in the feasibility study that was the basis for the original remedy selection;*

c. *future changes to the aggregate or individual well extraction rates shall be made so as to assure that the rate of restoration of the aquifer will not be slowed or result in a duration of remedy longer than was contemplated by the original ROD;*

d. *the facilities comprising the NBCGRS may be modified as necessary to assure the restoration of the full areal and vertical extent of the aquifer in a timeframe as contemplated in 3.c, above.*

4. Pumping the extracted groundwater to the PGAC Water Treatment Facility in New Brighton for removal of VOCs by a pressurized granular activated carbon (GAC) system.

5. Discharging all of the treated water to the New Brighton municipal distribution system.

6. *Monitoring the groundwater to verify effectiveness of the remedy through measurement of overall plume shrinkage (geographically) and decreasing contaminant concentrations*.

The last requirement (No. 6) is met by evaluating the groundwater chemical data according to statistical methods contained in the "OU1 Technical Group Technical Memorandum Statistical Evaluation Method For Water Quality Data, Operable Unit 1", dated December 2004 (and any subsequent addendums or revisions approved by the USEPA and MPCA). The statistical analysis is conducted annually and is reported in the Annual Performance Reports.

Groundwater extraction is provided by six municipal wells: New Brighton Municipal (NBM) #3, #4, #5, #6, #14, and #15. The extracted water is treated in the Permanent Granular Activated

Carbon (PGAC) treatment facility for removal of VOCs, and is then used as part of the municipal water supply. NBM #3 through #6 were pre-existing wells. NBM #14 and NBM #15 began pumping in December 1996 and March 1998, respectively.

The remedy also relies on provision of an alternate water supply and/or well abandonment, as necessary, to manage risks for existing private water supply wells, and land use controls (drilling advisory) to prevent new water supply wells from being constructed into the affected portion of the aquifer.

The six major components of the remedy prescribed by the amended ROD are evaluated in the following sections.

3.1 REMEDY COMPONENT #1: ALTERNATE WATER SUPPLY/WELL ABANDONMENT

Description: "Providing an alternative water supply to residents with private wells within the North Plume." (OU1 ROD, page 2)

- Clarified by the OU1 Alternate Water Supply Plan (Montgomery Watson, October 1995) to delete "residents with" since the remedy applies to other wells in addition to residential wells. This plan also identifies the criteria for determining what wells are eligible for an alternate water supply.
- Clarified by the OU1 Alternate Water Supply Plan to also include well abandonment.
- Clarified by the OU1 Alternate Water Supply Plan (page i-2) to also encompass OU3 and the OU2 Site A shallow groundwater plume.

Performance Standard (how do you know when you're done):

- For alternate water supply, when the owners of all wells that meet all of the following criteria have been offered and provided with an alternate water supply (or when the well owners have rejected the offers):

    i. The well is located within the area affected by groundwater plumes that originate at OU2, as shown on Figures E-2 and E-3 in Appendix E; and

    ii. The well is completed in an affected aquifer; and

    iii. The well contains detectable concentrations of the New Brighton/Arden Hills Superfund Site-related chemicals of concern identified on page 18 of the OU1 ROD (or page 26 of the OU3 ROD, or Table 1 of the OU2 ROD, as appropriate for the well location); and

    iv. The well is used in a manner to cause exposure (uses are defined in the Alternate Water Supply Plan); and

    v. The well owner does not already have an alternate water supply.

  If eligible well owners refuse the offer to have an alternate water supply provided, this also satisfies the performance standard.

- For well abandonment, when the owners of all wells that meet all of the following criteria have been offered and provided abandonment (or when the well owners have rejected the offers):

    i. The well is located within the area affected by groundwater plumes that originate at OU2; and

    ii. The well is completed in an affected aquifer; and

    iii. The well contains detectable concentrations of the New Brighton/Arden Hills Superfund Site-related chemicals of concern identified on page 18 of the OU1 ROD (or page 26 of the OU3 ROD, or Table 1 of the OU2 ROD, as appropriate for the well location); and

iv. The well was constructed prior to the MDH Special Well Construction Area advisory; and

v. The well is being used by the well owner or use was discontinued due to contamination; and

vi. The well is used in a manner to cause exposure (uses are defined in the Alternate Water Supply Plan).

If eligible well owners refuse the offer for abandonment, this also satisfies the performance standard. An exception to abandonment would be if the well is needed for groundwater monitoring.

Is this remedy component being implemented?

Yes. The Alternate Water Supply and Well Abandonment Program has been implemented and is an ongoing program maintained by the Army. The process of identifying wells eligible for alternate water supply and/or abandonment is accomplished by maintaining a "well inventory" (information on the well inventory is presented in Appendix E). The well inventory is a database that was initially developed in 1992, and which has been periodically updated since then (now annually). For the purposes of the well inventory, a study area was established which encompasses the groundwater plume (the study area boundary is the same as the MDH Special Well Construction Area). The well inventory is intended to include all wells within the study area. Within the study area, areas of concern are defined by the edge of the groundwater plume, plus additional buffer area. The wells are grouped into categories based on factors such as location relative to the area of concern, type of use, active/non-active status, sealed, etc. Wells in categories with the potential to be impacted are periodically sampled to see if they qualify for alternate water supply and/or abandonment.

Thus, maintenance of the well inventory consists of the following tasks:

1. Check if the area of concern needs to be adjusted based on the extent of contamination,
2. Check if there are any previously unknown wells to be added to the database (in coordination with the MDH as described in Appendix E),
3. Sample wells on a prescribed schedule,
4. Take the appropriate course of action depending on the results,
5. Update the well inventory database with any new information (e.g., water quality results, owner information, construction information, well re-categorizing),
6. Report findings through the Annual Performance Report.

The following questions and answers summarize developments since the last Annual Performance Report with respect to Operable Unit 1.

Did the area of concern within OU1 change during FY 2012, as defined by the 1 μg/l contour line?

No, the area of concern (the 1 μg/l contour line) did not change during FY 2012 as it was not a "major" sampling year. Therefore, the area of concern during FY 2012 remained the same as during FY 2011. The well inventory study area encompasses the FY 2012 area of concern. The next scheduled "major" sampling event is FY 2013.

Were any additional water supply wells discovered within the area of concern for OU1 that are completed within an aquifer of concern?

No. (see Appendix E for additional information)

Were any water supply wells within the area of concern for OU1 sampled during FY 2012 (outside of those included in the OU1 performance monitoring plan)? If yes, what were the findings?

No water supply wells within the area of concern for OU1 were sampled during FY 2012.

Were any well owners offered an alternate water supply and/or well abandonment during FY 2012? No.

For OU1, are there any well owners that meet the criteria, but have not yet been provided an alternate water supply? No.

For OU1, are there any wells that meet the criteria, but have not yet been abandoned? No.

Is any sampling of water supply wells (excluding those included in the OU1 performance monitoring plan) proposed prior to the next report?

Yes. Although FY 2012 was not a sampling event for well inventory wells, as shown in Appendix A.1, the next major event is upcoming in FY 2013. Therefore, these wells are scheduled to be sampled in June 2013.

Are there any changes or additional actions required for this remedy component? No.

3.2 REMEDY COMPONENT #2: DRILLING ADVISORIES

Description: "Implementing drilling advisories that would regulate the installation of new private wells within the North Plume as a Special Well Construction Area." (OU1 ROD, page 2)

Performance Standard (how do you know when you're done):

For initial implementation, when the MDH has issued a Special Well Construction Area Advisory. Implementation will continue until such time that the groundwater concentrations are below the cleanup levels.

Has the MDH issued a Special Well Construction Area Advisory?

Yes. It was issued in June 1996. In addition to covering OU1, the Special Well Construction Area also encompasses OU3 and the OU2 Site A shallow groundwater plume. In June 1999, the MPCA requested that the MDH extend the boundary of the Special Well Construction Area further to the southwest to the Mississippi River and Marshall Avenue to ensure that the southern boundary fully encompassed the plume. The MDH revised the Special Well Construction Area in December 1999. The current boundary is shown on Figure E-1 (Appendix E).

Are any changes or additional actions required for this remedy component? No.

3.3 REMEDY COMPONENT #3: EXTRACT GROUNDWATER

Description: "Extracting groundwater from the North Plume using the New Brighton Contaminated Groundwater Recovery System (NBCGRS), subject to the following:

a. the initial aggregate groundwater extraction rate shall be consistent with the long-term operating history of the NBCGRS;

b. future decreases in the aggregate extraction rate shall be determined by the Army, USEPA, and MPCA using a transparent public process and rational engineering, scientific, and economic analyses at least as rigorous as those employed in the feasibility study that was the basis for the original remedy selection;

c. future changes to the aggregate or individual well extraction rates shall be made so as to assure that the rate of restoration of the aquifer will not be slowed or result in a duration of remedy longer than was contemplated by the original ROD;

d. the facilities comprising the NBCGRS may be modified as necessary to assure the restoration of the full areal and vertical extent of the aquifer in a timeframe as contemplated in 3.c, above." (2006 OU1 ROD Amendment, page 5-2 & 5-3)

Through January 2008, the remedy component consisted of recovering deep (Unit 4) groundwater using three primary City of New Brighton municipal wells (NBM #4, #14, and #15) with three alternate wells (NBM #3, #5, and #6). NBM #3 and #4 were existing wells completed in both the Prairie du Chien and Jordan. NBM #5 and #6 were existing wells completed in the Jordan. NBM #14 and NBM #15 were constructed in the Prairie du Chien as part of the remedy and began pumping in December 1996 and March 1998, respectively. The locations of the recovery wells are shown on Figure 3-1.

The extracted groundwater is used as part of the New Brighton water supply system, and as such, New Brighton took the lead on design and construction of the system, and is responsible for operation of the system. New Brighton contracted Barr Engineering to provide design and construction oversight services. The Army is paying for the OU1 remedy.

In 2006, New Brighton proposed to the Army modifying the agreement between the two parties to allow more flexibility in how they operate the NBCGRS, and to increase removal of contaminant mass from the aquifer. In November 2007, the USEPA and MPCA provided consistency approval of the revised pumping rates. Appendix A.5 (Table D-1 and Table D-2 from the settlement agreement between the Army and New Brighton) presents the new pumping rates in effect as of January 2008.

The revised pumping approach does not affect the approved statistical analysis used to evaluate the effectiveness of the remedy as set forth by the OU1 ROD Amendment. The Army has made it clear to New Brighton that if the changes somehow cause statistical evaluation results that are not in compliance with the OU1 ROD Amendment, then the pumping allocations will revert back to the previous scheme.

Performance Standard (how do you know when you're done):
When the NBCGRS is operating consistent with long-term NBCGRS operating rates.

During FY 2012, did the OU1 extraction system operate according to the New Brighton operational plan and consistent with past operations?
Yes. Based on past operations, the target average daily pumping rate is 3.168 million gallons per day (MGD) as shown in Appendix A.5. Table 3-1 shows the volume of water pumped by the NBCGRS during FY 2012 was 1,410 million gallons, which translates to a daily average of 3.863 MGD. Hence, the pumping in FY 2012 exceeded the target and the system was operated in compliance with the amended ROD.

Are any changes or additional actions required for this remedy component? No.

3.4 REMEDY COMPONENT #4: REMOVAL OF VOCS BY GAC

Description: "Pumping the extracted groundwater to the Permanent Granular Activated Carbon (PGAC) Water Treatment Facility in New Brighton for removal of VOCs by a pressurized GAC system." (OU1 ROD, page 2)

- Treatment by the PGAC (along with iron and manganese removal and chlorination) makes the recovered groundwater suitable for municipal drinking water purposes. The PGAC is located approximately one-third mile south of Interstate 694 near Silver Lake Road. The City of New Brighton is responsible for operation and maintenance of the PGAC, with cost reimbursement from the Army for the operations related to the remedy.

Performance Standard (how do you know when you're done):
When the treated water meets the Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) established by the Safe Drinking Water Act (SDWA) for the chemicals of concern, as identified on page 18 of the OU1 ROD.

Did the treated water meet the MCLs and non-zero MCLGs established by the SDWA for the OU1 chemicals of concern?
Yes. Table 3-2 shows that the PGAC effluent met the performance standard during FY 2012.

Treatment of extracted groundwater in the PGAC water treatment facility (remedy component #4) continues to provide effective treatment prior to its discharge into the City of New Brighton municipal water distribution system (remedy component #5). The treatment system is comprised of eight GAC vessels plumbed in parallel. Another eight GAC vessels are plumbed in series with the first eight to provide back-up treatment. The GAC vessels are labeled A or B and water is normally run in series (i.e., water passes through A then B, or B then A, depending on whether the most recent carbon change-out was the A or B vessel). Routine sampling occurs between the two sets of GAC vessels, such that when a detection occurs, a clean set of GAC vessels is present downstream of the sampling point. Upon detection, change-out of carbon in the lead vessels is conducted as soon as possible (typically about 1 to 2 months later). Upon changing carbon, the direction of flow is reversed so that the eight vessels with the new carbon become the downstream vessels (the "clean" vessels are always rotated into the downstream position).

Table 3-2 shows that two carbon change-outs occurred in FY 2012: one in April-May 2012 and one in September-October 2012.

Is any sampling of the treated water proposed prior to the next report?
Yes. Sampling will continue to be performed by the City of New Brighton or their contractor.

Are any changes or additional actions required for this remedy component? No.

3.5 REMEDY COMPONENT #5: DISCHARGE OF TREATED WATER

Description: "Discharging all of the treated water to the New Brighton municipal distribution system." (OU1 ROD, page 2)

Performance Standard (how do you know when you're done):
When the connection to the New Brighton municipal supply system has been completed and water is being discharged.

Is the treated water being discharged to the New Brighton municipal distribution system?
Yes.

Are any changes or additional actions required for this remedy component? No.

3.6 REMEDY COMPONENT #6: GROUNDWATER MONITORING WITH VERIFICATION OF CONTINUING AQUIFER RESTORATION

Description: "Monitoring the groundwater to verify the effectiveness of the remedy through measurement of overall plume shrinkage (geographically) and decreasing contaminant concentrations." (2006 OU1 ROD Amendment, page 5-3)

Performance Standard (how do you know when you're done):
When performance groundwater monitoring verifies aquifer restoration.

Is this remedy component being implemented?
Yes. Performance monitoring programs have been established to collect the data required to verify the effectiveness of remedy components #1 through #6. Table 3-3 summarizes the performance monitoring requirements, implementing parties, and the specific documents that contain the monitoring plans.

Were the groundwater monitoring requirements for this remedy met?
Yes, FY 2012 was a minor sampling year.

Is any groundwater monitoring proposed prior to the next report? Yes.

- Monitoring of the extraction wells and treatment system effluent will be performed by the City of New Brighton in accordance with the "New Brighton Water System Sampling and Analysis Plan," June 1997.
- Other groundwater monitoring will be in accordance with the Groundwater Monitoring Plan included as Appendix A.1. The next "major" event will be in FY 2013.

Does groundwater monitoring show aquifer restoration is occurring? Yes.

Trend graphs for trichloroethene in NBM #3, #4, #5, #6, #14, and #15 are shown in Figure 3-2. Historical water quality values for the wells can be found in Appendix D. At both NBM #3 and NBM #4, trichloroethene decreased between the start of pumping and 1998, and have been relatively stable since then, though both show a slight upward trend since 1998. At NBM #5, trichloroethene continued to trend downward slightly in FY 2012. At NBM #6, trichloroethene has trended down since 1998, but appears to be leveling off since 2010. At NBM #14, the trichloroethene concentrations show a continuing trend below or at the cleanup level for TCE in OU1 (5 µg/L), with the exception of the March, April and July 2012 sampling events. At NBM #15, the trichloroethene continued to show a downward trend compared with historical values, although the trend has leveled out somewhat since 2009 and appeared to increase slightly in 2012. Overall, the water quality data from the extraction wells supports the interpretation that the system is providing aquifer restoration.

The trichloroethene plumes in the aquifers were not mapped in FY 2012 because it was a minor sampling year.

The OU1 Technical Memorandum was prepared to develop statistical methods specifically selected to evaluate the long-term progress of remediation, plume evolution, and aquifer restoration in OU1. The OU1 Technical Memorandum states the objective of the statistical evaluation as follows:

> “Verify progress in cleanup of the plume through measurement of overall geographic plume shrinkage and decreasing contaminant concentrations.”

The OU1TG identified five issues that need to be statistically addressed, now and over time, to achieve this objective:

1. Measure changing concentrations immediately downgradient of the TGRS, as this area is the first to be affected by any potential escape of contaminants from TCAAP.

2. Measure changes in the geographical size of the plume over time.

3. Measure changes in concentrations immediately downgradient of the NBCGRS, as this is the first area to be affected by any potential escape of contaminants from NBCGRS capture.

4. Measure any unforeseen changes in plume configuration. This addresses the possibility that changing flow patterns may cause a shift in the plume but not necessarily any change in size. A plume shift may require a redistribution of pumping.

5. Measure the long-term trends in overall VOC concentrations (as an indicator of contaminant mass). This provides an overall picture of remedial progress.

The OU1TG developed a series of five well groups designed to address each of the issues listed above. For each group, the appropriate statistical tools were specified and the statistical response threshold was identified that would trigger closer scrutiny by the Army and regulators (USEPA and MPCA). Table D.2.8 in Appendix D.2 shows the factors to consider and potential additional actions that may be implemented if statistical threshold is triggered. As Table D.2.8 shows, a threshold trigger initiates a closer look at the data and the context of the data in terms of remedy performance or potential risk. A threshold trigger does not automatically require any specific action. The five groups, corresponding to the five issues discussed above, are:

1. Group 1: Downgradient of the TGRS. This zone is the area downgradient of the TGRS capture zone. This zone should show overall reductions over time in response to TGRS mass removal and containment. However, it is also the stagnation zone of the TGRS so groundwater velocities are reduced and response may be slow. Furthermore, individual wells near the stagnation zone may show increases in contaminant concentrations during some points in time, as the plume shifts in response to changes in pumping.

2. Group 2: Plume Edge Wells. This zone includes wells that define the edges of the plume downgradient of the TGRS. These are wells with low concentrations of VOCs (<100 µg/l) that will indicate a reduction in overall plume size if VOC concentrations continue to decline.

3. Group 3: Downgradient Sentinel Wells. This is a zone downgradient of the NBCGRS stagnation zone. This group includes three wells but more accurately is defined as a geographic area immediately downgradient of the NBCGRS. This group should help demonstrate improvement due to the VOC mass removal by the NBCGRS over time, analogous to Group 1 and the TGRS.

4. Group 4: Lateral Sentinel Wells. These are "clean" wells downgradient of the TGRS that are beyond the current plume boundaries. These wells should help

identify large, unexpected, lateral changes in plume configuration, such as a shifting or expansion of the plume boundary.

5. Group 5: Global Plume Mass Wells. This group includes all the monitoring wells necessary to construct a contour map of the VOC plume. Production wells are not used in Group 5 since the data may not be comparable to monitoring well data. Some wells located within OU2 are included in Group 5 to support the contouring near the OU2 boundary. This group reflects the overall VOC mass in the aquifer and should show an overall reduction in VOC mass over time.

In October 2005, the Army received a consistency determination on:

Modification #1 to:
OU1 Technical Group Technical Memorandum Statistical Evaluation Method For Water Quality Data, Operable Unit 1" prepared by the Army, dated December 2004.

This modification created well Group 6 to address the Jordan portion of the Unit 4 aquifer.

6. Group 6: Jordan Wells. The group includes all Jordan monitoring wells, the Prairie du Chien wells nested with them, and New Brighton Municipal Wells 3, 4, 5, and 6. The inclusion of the Prairie du Chien wells is to facilitate comparing the trends between it and the Jordan at these locations. This group will help identify any changes in the plume occurring in the Jordan portion of the aquifer.

Additional detail on the well groups and analysis is presented in the OU1 Technical Memorandum, Modification #1, and Appendix D.2.

FY 2012 was a minor sampling year, so new comprehensive plume mapping was not completed. Three wells were sampled in FY 2012, in support of continuing data needs for statistical Group 6 and ten wells were sampled for Group 1. Table 3-4 presents groundwater quality data for OU1. These data were collected to support the statistical analysis developed by the OU1TG.

The statistical analysis in Appendix D.2 follows the format described in the OU1 Technical Memorandum and Modification #1.

Table 3-5 presents a summary of the statistical results for all groups, from Appendix D.2, reflecting the data collected through FY 2012. Table 3-5 includes an assessment of the statistical thresholds that were triggered in the analysis and brief comments addressing these threshold triggers. Further discussion is presented below.

<u>Group 1</u>:

The Group 1 (downgradient of the TGRS) response threshold *was not* triggered for the North Plume sub-group, with a decreasing outcome. North Plume statistics continued to show a decreasing trend in FY 2012. The Area Weighted Concentration (AWC) concentration for the Group 1 North Plume was 46 µg/L in FY 2012, up from 36 µg/L in FY 2011. This value represents a weighted estimate of the average total VOC concentration just downgradient of the TGRS.

The Group 1 (downgradient of the TGRS) response threshold *was* triggered for the South Plume sub-group, with a stable outcome. The AWC for the South Plume was 4 µg/L and has been 4 or 5 µg/L over the analysis period (since 2006). The analysis of this sub-group is driven by the concentration at 03U801. The concentration in FY 2012 was 30 µg/L. Historically, this well peaked at 11,000 µg/L in 1993 and has consistently been below 70 µg/L since 1998. It has been stable at between 39 µg/L and 15 µg/L since 2002. Upgradient of the TGRS (within the capture zone) in this area, the South Plume concentrations continue to be over 100 µg/L.

<u>Group 2</u>:

04U877 was stable in FY 2012, therefore a threshold was triggered. However, the concentrations are below 2.0 µg/l, and are therefore not of concern. In addition, the raw trend is decreasing.

Group 3 and Group 5:

No statistical analyses were performed for Groups 3 and 5 in FY 2012.

Group 4:

No statistical analyses were performed for Group 4 in FY 2012.

Group 6:

The three wells installed and sampled since FY 2005 provide additional data points between OU2 and the NBCGRS to help complete the understanding of the extent and magnitude of VOC concentrations in the Jordan portion of the aquifer.

04J847 remains stable and therefore the threshold was triggered. To examine the history more thoroughly a second trend was run utilizing all ten rounds of data collected since 2005. This represents a broader history of sampling at this well. This 'extended trend' is included in Appendix D.2.3. The extended trend is decreasing, suggesting improvement over the seven years of monitoring. Based on this extended trend, continued annual monitoring is appropriate at this well given its stability and central location in the plume.

04J849 continued to show No Trend, which triggered the threshold for Group 6. However, the concentrations are below 0.5 µg/l, with no detection during the last five sampling events, and are therefore not of concern. It is likely the trend is an artifact of analytical variability at these levels.

Well 04J822 shows an improved trend from increasing in FY 2007 to decreasing in FY 2010, 2011, and 2012. This well is in the central part of the plume and downgradient of the hot spot at well nest 04U847 to the northeast. The trend suggests there is not a horizontal expansion of the plume.

The New Brighton Municipal well trends were analyzed using a linear regression for data since 1998 (see Appendix D.2.5). Due to the large number of data points, regression was considered superior to the Mann-Kendall analysis. Data from FY 1998 were used to reflect the approximate time window used throughout the statistical analysis and to avoid skewing the analysis from the earlier high concentrations. All the New Brighton wells showed downward concentration trends, except NBM #3 and #4, which show a slight upward trend. This suggests that overall concentrations are decreasing at the New Brighton municipal well field, which agrees with the decreasing mass removal observed over the life of the system.

Overall Statistical Assessment:

There were individual threshold triggers identified in FY 2012. These triggers highlight specific areas of the plume that are changing over time. This type of behavior is expected in a large complex flow system such as OU1. The thresholds triggered do not suggest any problems with the remedial systems, but suggest movement within the established plumes. The area weighted analysis for Group 1 shows continuing overall improvement or stability in the plumes. Overall, therefore, the limited FY 2012 monitoring data indicates that aquifer restoration is occurring in the Prairie du Chien and Jordan.

Overall, the data meet the statistical criteria developed in this document for assessing the remedial progress in the OU1 aquifers. There are no additional actions needed to address the individual threshold triggers identified. The data show continuing improvement in the OU1 plume through FY 2012. The statistical behavior of the OU3 plume is addressed in Section 13.0.

How much VOC mass has been removed (at each well and total)?

Table 3-1 shows that the NBCGRS removed 528 pounds of VOCs during FY 2012. The total cumulative VOCs removed by the NBCGRS is 22,619 pounds. The relative contribution from each extraction well is also shown on Table 3-1.

Figure 3-3 shows the annual VOC mass removed (listed at the top of the graph), annual pumping volumes, and the trend in annual mass removal per unit volume pumped since FY 1997 (when NBM #14 was brought online). The mass removal in FY 2012 slightly decreased compared to FY 2011. The trend in annual mass removal per unit volume pumped increased slightly in FY 2008 from FY 2007 and then decreases slightly every year after that. The mass removal has been on a general decreasing trend since FY 1998, when the last extraction well was brought online (NBM #15). This overall decline in the mass removal trend agrees with the trichloroethene trends in OU1 deep groundwater, which generally show a decreasing trend, and suggests that aquifer restoration is progressing.

Are any changes or additional actions required for this remedy component? No.

Table 3-1

OU1 Pumping / VOC Mass Removal Data

Fiscal Year 2012

	WELL #3			WELL #4			WELL #5			WELL #6			WELL #14			WELL #15			System Totals	
MONTH	VOC (µg/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (µg/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (µg/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (µg/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (µg/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (µg/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	TOTAL WATER TREATED BY EXTRACTION SYSTEM (mgallons)	TOTAL VOC'S REMOVED BY EXTRACTION SYSTEM (lbs)
TOTAL GALLONS PUMPED AND VOC'S REMOVED THROUGH SEPTEMBER 30, 2011																			23,809	22,091
OCTOBER	62	35.057	18.140	58	7.197	3.484	60	30.782	15.414	47	6.710	2.632	3	0.209	0.005	17	35.949	5.101	116	44.779
NOVEMBER	68	27.856	15.809	61	6.376	3.246	57	33.372	15.876	52	5.853	2.540	2	0.363	0.006	19	34.381	5.452	108	42.932
DECEMBER	73	12.400	7.555	68	13.336	7.569	54	34.920	15.738	48	11.127	4.458	2	0.137	0.002	21	35.438	6.211	107	41.535
JANUARY	76	12.013	7.620	74	13.919	8.596	57	35.462	16.870	43	12.173	4.369	2	0.161	0.003	18	35.481	5.330	109	42.791
FEBRUARY	80	17.216	11.495	74	20.258	12.511	57	20.732	9.863	47	1.136	0.446	2	9.694	0.178	18	33.276	4.999	102	39.494
MARCH	65	20.632	11.193	60	25.743	12.891	NS	0.000	0.000	63	0.114	0.060	8	35.581	2.287	32	35.601	9.508	118	35.941
APRIL	62	20.382	10.547	55	16.821	7.721	NS	29.644	0.000	67	0.855	0.478	14	2.685	0.314	47	36.045	14.139	106	33.201
MAY	62	27.361	14.158	62	10.909	5.645	51	34.040	14.489	50	11.227	4.685	3	0.179	0.005	28	40.091	9.369	124	48.354
JUNE	61	24.125	12.282	61	11.724	5.969	53	33.163	14.669	49	18.233	7.456	3	8.246	0.213	23	39.459	7.574	135	48.168
JULY	62	25.317	13.100	64	8.296	4.431	53	34.592	15.301	44	12.281	4.510	6	5.924	0.292	39	43.112	14.033	130	51.671
AUGUST	69	27.930	16.084	62	11.280	5.837	52	34.116	14.806	45	12.557	4.716	4	0.182	0.006	31	44.233	11.444	130	52.897
SEPTEMBER	59	25.519	12.566	57	9.596	4.565	51	33.301	14.174	42	12.569	4.406	5	0.421	0.016	29	43.306	10.482	125	46.212
Subtotal			150.549			82.465			147.201			40.755			3.326			103.642		
% of Total Mass			28.5			15.6			27.9			7.7			0.6			19.6		
TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2012																			1,410	528
TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP																			25,219	22,619

Table 3-2

OU1, PGAC Effluent Water Quality
Fiscal Year 2012

	Influent Well Monitoring						Operational Performance Monitoring															
Sampling	Well	Well	Well	Well	Well	Well	Contactor #1		Contactor #2		Contactor #3		Contactor #4		Contactor #5		Contactor #6		Contactor #7		Contactor #8	
Date	#3	#4	#5	#6	#14	#15	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
GAC replaced in contactors 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A September 13-September 30, 2011. "B" Vessels become the Lead Vessels.																						
4-Oct-11	62	58	60	47	3	17	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
15-Nov-11	68	61	57	52	2	19	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
21-Dec-11	73	68	54	48	2	21	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
11-Jan-12	76	74	57	43	2	18	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
1-Feb-12	80	74	57	47	2	18	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
Well #5 pulled out for scheduled maintenance February 21-April 3, 2012, and was not in operation at time of March or April sampling, therefore not sampled.																						
5-Mar-12	65	60	NS	63	8	32	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
2-Apr-12	62	55	NS	67	14	47	NS	0	NS	1.1	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
GAC replaced in contactors 1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B April 17-May 4, 2012. "A" Vessels become the Lead Vessels.																						
7-May-12	62	62	51	50	3	28	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
11-Jun-12	61	61	53	49	3	23	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
10-Jul-12	62	64	53	44	6	40	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
7-Aug-12	69	62	52	45	4	31	0	NS	0	NS	0	NS	0	NS	0	NS	NS	NS	0	NS	0	NS
4-Sep-12	59	57	51	42	5	29	0	NS	1.2	NS	2.3	NS	1.6	NS	0	NS	0	NS	0	NS	0	NS
GAC replaced in contactors 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A September 18-October 5, 2012. "B" Vessels become the Lead Vessels.																						

Notes:

1) All water quality results shown are for Total VOCs (µg/l).

2) NS = Not Sampled.

Table 3-3

Summary of OU1 Monitoring Requirements
Fiscal Year 2012

Remedy Component	Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1: Alternate Water Supply/Well Abandonment	a. Water quality data for the perimeter of the plume to define the area of concern	Army	OU1 Groundwater Monitoring Plan in the Annual Report
	b. Water quality data for water supply wells to determine eligibility for alternate supply/abandonment	Army	Well Inventory Report
#2: Drilling Advisories	a. Verification that drilling advisories are in place and functioning as intended	Army/MDH	N/A
#3: Extract Groundwater	a. Pumping volume and rates for each extraction well for comparison to target flowrates	New Brighton	New Brighton Water System Sampling and Analysis Plan
	b. Water levels from monitoring wells to draw contour maps, if desired	Army	OU1 Groundwater Monitoring Plan in the Annual Report
	c. Water quality, to assist in evaluation of statistical improvements in groundwater quality	Army	OU1 Groundwater Monitoring Plan in the Annual Report
#4: Removal of VOCs	a. Effluent water quality to demonstrate compliance with the Safe Drinking Water Act	New Brighton	New Brighton Water System Sampling and Analysis Plan
#5: Discharge of Treated Water	a. Verification of discharge	New Brighton	N/A
#6: Groundwater Monitoring with Verification of Continuing Aquifer Restoration	a. Water quality, to assist in evaluation of statistical improvements in groundwater quality.	Army	OU1 Groundwater Monitoring Plan in the Annual Report
	b. Water quality data throughout the North Plume to evaluate remedial progress	Army	OU1 Groundwater Monitoring Plan in the Annual Report

Table 3-4
OU1 Groundwater Quality Data

Fiscal Year 2012

			Trichloro-ethene (µg/l)	1,1-Dichloro-ethene (µg/l)	cis-1,2-Dichloro-ethene (µg/l)	1,1,1-Trichloro-ethane (µg/l)	1,1,2-Trichloro-ethane (µg/l)	1,1-Dichloro-ethane (µg/l)
OU1 Cleanup Level [(1)]			5	6	70	200	3	70
04U871		6/27/12	**18**	1.3	JP 0.31	JP 0.62	<1	3.7
04U872		6/26/12	3.6	<1	<1	<1	<1	JP 0.33
04U877		6/26/12	1.2	<1	<1	<1	<1	JP 0.33
04U877	D	6/26/12	1.1	<1	<1	<1	<1	JP 0.32
04J822		6/25/12	**47**	**8.2**	1.3	8.4	<1	4.9
04J847		6/25/12	**880**	**50**	7.9	33	<2	38
04J849		6/25/12	<1	<1	<1	<1	<1	<1

Notes:

(1) Cleanup levels for OU1 deep groundwater are from page 18 of the OU1 ROD. Bolding (in red color) indicates exceedance of the cleanup level.

D Duplicate sample.

JP The value is below the reporting level, but above the method detection limit. Results should be considered estimated.

Table 3-5
Group 1, 2, 3, 5, and 6 Mann-Kendall Summary and MAROS Conclusion

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 2 Wells:									
04U877	-7	6	Decreasing	86.40%	0.5940	S or NT	**Stable**	Yes	Raw trend is decreasing
Group 3	--	--	--	--	--	--	--	--	Not sampled in FY 2012
Group 5	--	--	--	--	--	--	--	--	Not sampled in FY 2012
Group 1 NP	-9	6	Decreasing	93.20%	0.2421	Probable	**Decreasing**	No	Decreasing trend
Group 1 SP	-5	6	Decreasing	76.50%	0.0980	S or NT	**Stable**	Yes	Stable below 5 µg/L.

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance

MAROS Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

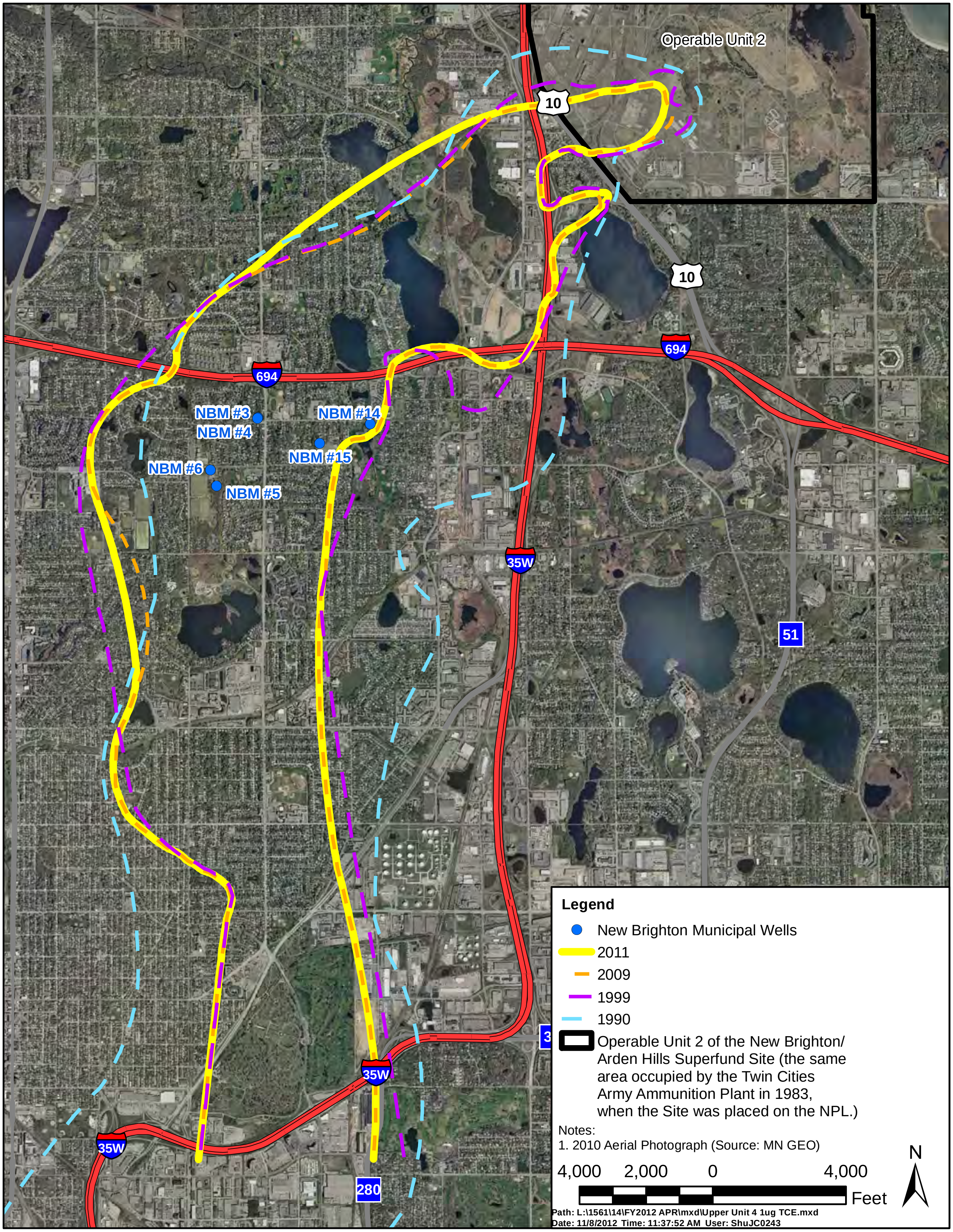
Table 3-5
Group 1, 2, 3, 5, and 6 Mann Kendall Summary and MAROS Conclusion

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 6 OU1 Jordan Wells:									
04J822	-13	6	Decreasing	99.17%	0.2992	Definite	**Decreasing**	No	
04J847	0	6	Zero	41.78%	0.0960	S or NT	**Stable**	Yes	Consistent results, mean 773 µg/L
04J849	-5	6	Decreasing	76.50%	2.4495	S or NT	**No Trend**	Yes	All detections below 0.5 µg/l, 5 of 6 ND
04J847 (ext.)	-15	10	Decreasing	99.86%	0.1226	Definite	**Decreasing**	No	Extended trend for all ten data sets since FY 2004

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance

MAROS Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing



ANNUAL PERFORMANCE REPORT

Upper Unit 4,
1 µg/l Trichloroethene Isoconcentration Map

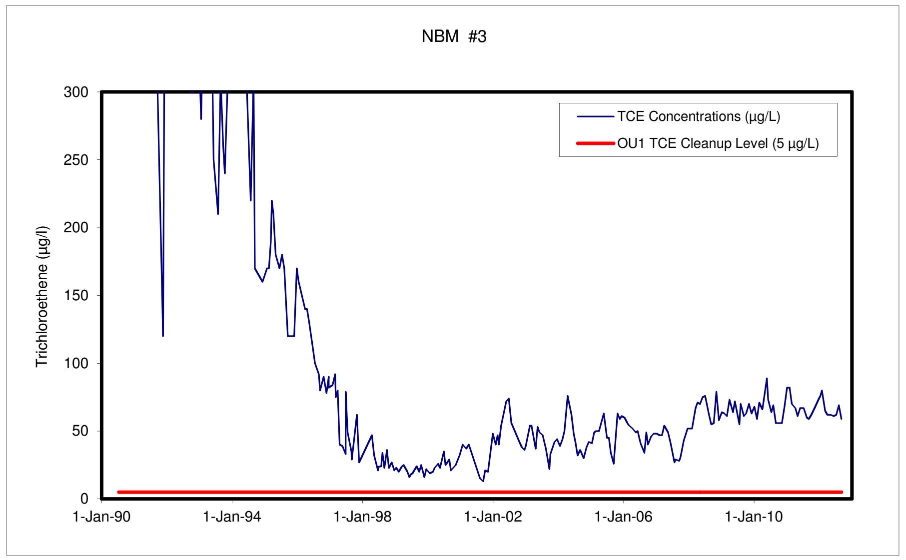
Engineers - Scientists
Business Professionals
www.wenck.com

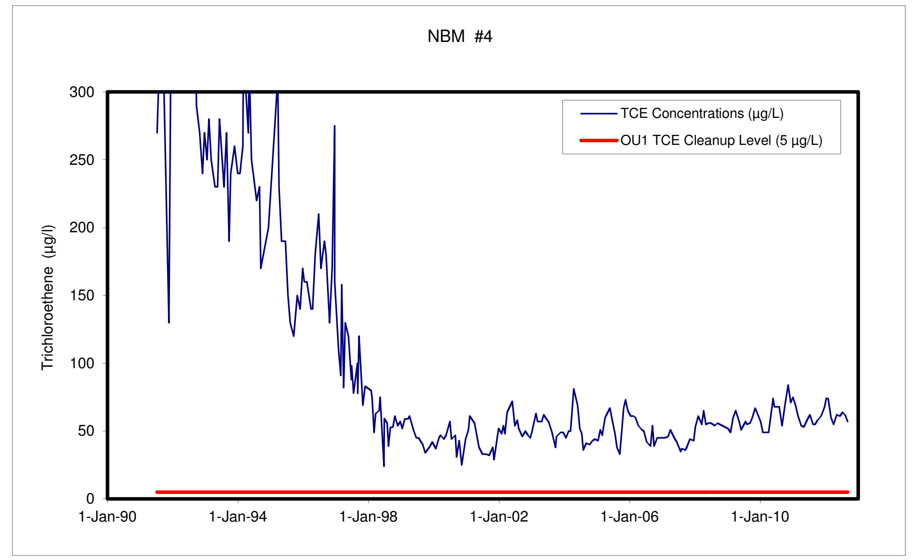
Wenck
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

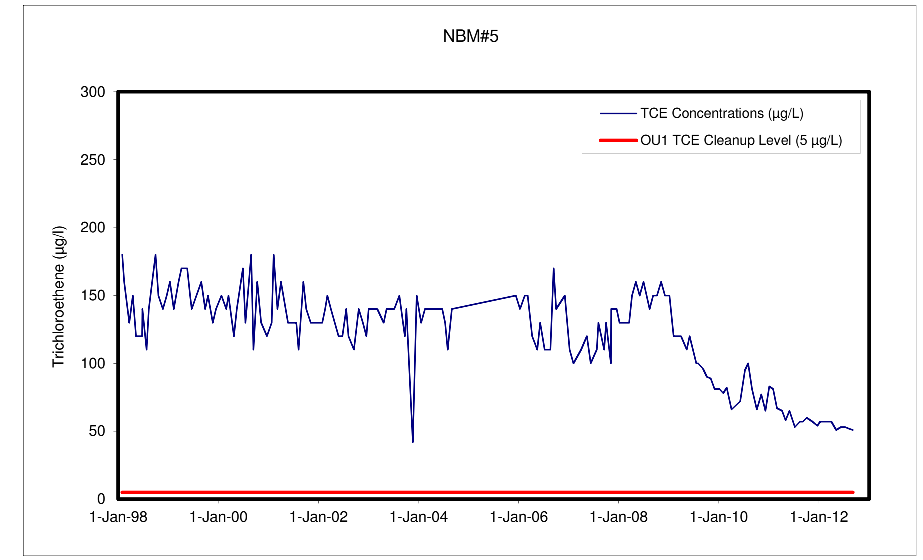
FY 2012

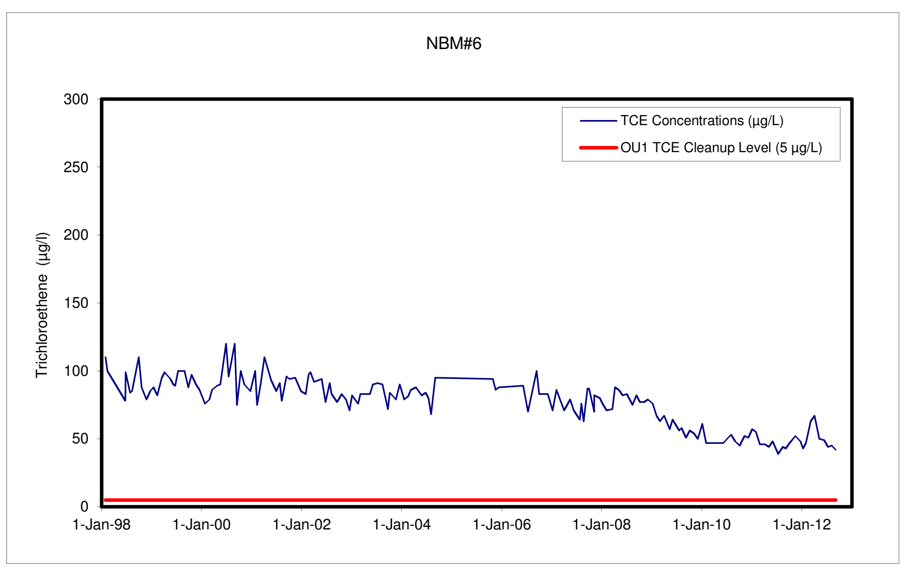
Figure 3-1

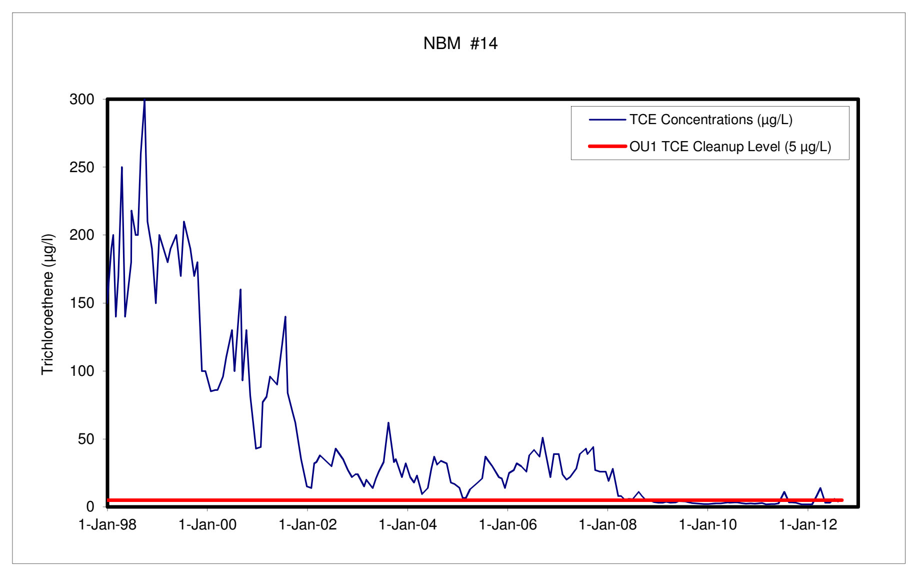
FIGURE 3-2
NEW BRIGHTON MUNICIPAL WELLS: TRICHLOROETHENE WATER QUALITY TRENDS
Annual Performance Report











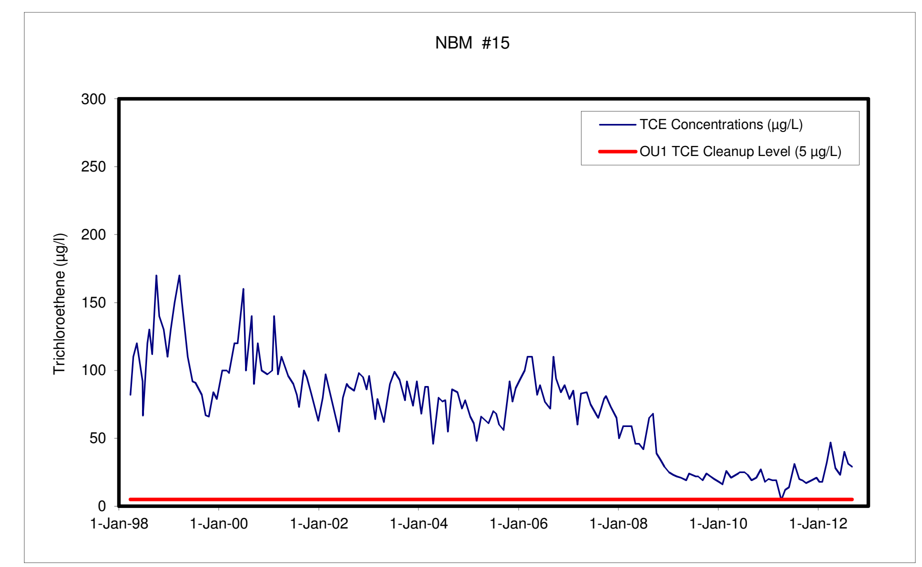
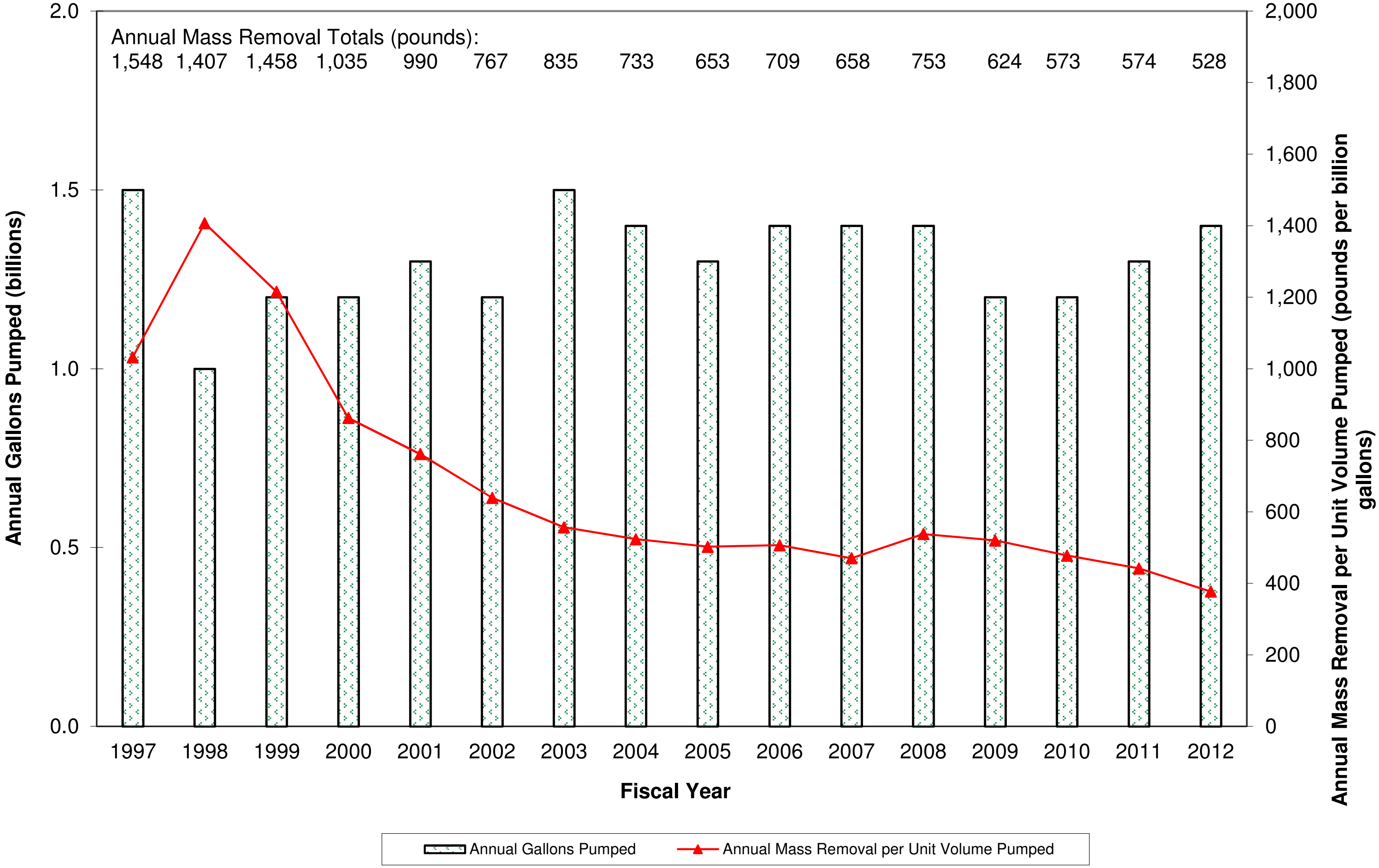


FIGURE 3-3
OU1, NBCGRS MASS REMOVAL HISTORY
Annual Performance Report



4.0 Operable Unit 2: Shallow Soil and Dump Sites

The reference for the OU2 ROD is:

Twin Cities Army Ammunition Plant
New Brighton/Arden Hills Superfund Site
Operable Unit 2
RECORD OF DECISION
1997
Amendment #1: 2007
Amendment #2 and #3: 2009
ESD #1 and #2: 2009
Amendment #4: 2012

Sections 4.0 through 12.0 of this report address the various media and requirements prescribed by the OU2 ROD and/or subsequent Amendments and ESDs. This section, 4.0, specifically addresses the shallow soil and dump sites.

Through the OU2 Remedial Investigation/Feasibility Study (RI/FS) process, Sites A, C, E, H, 129-3, and 129-5 were found to have inorganic and/or organic contaminants above the cleanup goals specified in Table 1 of the OU2 ROD. Unpermitted landfills, or dumps, were identified within Sites A, B, E, H, and 129-15. The OU2 ROD (page 2) describes nine remedy components to address the shallow soil and dump sites.

The requirements for Site C-2 soil and sediment were later modified through ROD Amendment #1 (note: Site C groundwater and surface water is addressed separately in Section 7.0). Because the depth to groundwater is shallow at Site C-2, it was not feasible to remove all of the contaminated soil and sediment. The Amendment modified remedy component #2 related to excavation of soil, to allow the placement of a 4-foot thick soil cover over areas where contamination remains in-place above the cleanup levels. ROD Amendment #1 also specified an additional remedy component for Site C-2, namely land use controls.

OU2 ROD Amendment #2 addressed shallow groundwater at Site I, which is discussed in Section 8.0.

OU2 ROD Amendment #3 affected the shallow soil and dump sites in four principal ways:

- The Amendment documented as final remedies the additional actions performed for shallow soil at Site D and the dump at Site G, after completion of the deep soil requirements set forth for these two sites in the OU2 ROD (see Section 5.0 of this report for discussion of the deep soil).
- The Amendment documented the use of soil covers as part of the final remedy at Sites E, G, H, and 129-15.
- The Amendment documented final remedies for five sites with soil contamination that were not originally included in the OU2 ROD: Grenade Range, Outdoor Firing Range, 135 Primer/Tracer Area Stormwater Ditch, Trap Range, and Water Tower Area. At these sites, either previous removal actions had been completed that reduced soil contamination to below cleanup levels, or investigations had determined that no action or no further action was needed. The Amendment incorporated remedies for these sites into the overall remedy for OU2.
- The Amendment specified land use controls as an additional remedy component for shallow soil and dump Sites D, E, G, H, 129-15, Grenade Range, and Outdoor Firing Range. Land use controls are not needed for the 135 Primer/Tracer Area Stormwater Ditch or Trap Range because contamination levels are suitable for unlimited use/ unrestricted exposure. The water tower area is located within the area having blanket land use restrictions as specified in the LUCRD.

ESD #1 is discussed in Section 6.0 (Site A shallow groundwater), Section 9.0 (Site K shallow groundwater), and Section 12.0 (OU2 deep groundwater).

ESD #2 specified land use controls as an additional remedy component for Sites A, C-1, 129-3, and 129-5. ESD #2 also documented that no further action is required at Site B. Site B is located within the area having blanket land use restrictions.

ROD Amendment #4 was signed in January 2012. This ROD amendment documents previously-completed soil removal actions conducted at two sites: the 535 Primer/Tracer Area and Site K. No further action is required for the soils located in the vicinity of the excavation areas at these two sites; however, both sites are located within the area having blanket land use restrictions. This ROD amendment also addressed Building 102 shallow groundwater, discussed in Section 10.0, and OU2 aquatic sites, discussed in Section 11.0.

4.1 REMEDY COMPONENTS #1 THROUGH #9: SOIL REMEDIATION

The nine remedy components specified in the OU2 ROD (page 2) have been completed for the shallow soils and dumps at Sites A, C, D, E, G, H, K, 129-3, 129-5, 129-15, Grenade Range, Outdoor Firing Range, 135 Primer/Tracer Area Stormwater Ditch, 535 Primer Tracer Area, and Water Tower Area. Remedy Components #1 through #8 addressed the characterization, excavation, sorting, treatment, disposal, site restoration, site access restrictions (during remedial actions), and limited period of post-remediation groundwater monitoring. Remedy Component #9 addressed the characterization of dumps at Sites B and 129-15. The characterization work at both sites led to a determination that no further action was required at Site B and construction of a cover at Site 129-15, which were documented through ESD #2 and OU2 ROD Amendment #3, respectively.

4.2 REMEDY COMPONENT #10: LAND USE CONTROLS

Description: OU2 ROD Amendments and ESDs made land use controls a part of the remedy for shallow soil and dump sites where contamination remains in-place above levels that allow for unlimited use and unrestricted exposure. Land use controls are also necessary to protect the integrity of the soil covers constructed at various sites.

Performance Standard (how do you know when you're done):

Initial implementation will be done when the USEPA and MPCA have provided consistency approval for an OU2 Land Use Control Remedial Design (LUCRD) document. Implementation will continue indefinitely unless further action is taken that would allow for unlimited use and unrestricted exposure.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, and is it being implemented?

Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2011; however, this revision did not affect land use controls for shallow soil sites.

Was an annual site inspection for land use controls conducted in FY 2012?

Yes. On July 12, 2012, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs?

No.

5.0 Operable Unit 2: Deep Soil Sites

For purposes of the OU2 ROD, Sites D and G were considered deep soil sites because VOC contamination extended to depths between 50 and 170 feet. Some additional shallow soil contaminants were also present at Site D, and Site G also contains a dump. The OU2 ROD (pages 2-3) describes seven remedy components to be implemented for these two sites:

- Remedy Component #1: Groundwater Monitoring
- Remedy Component #2: Restrict Site Access (During Remedial Actions)
- Remedy Component #3: SVE Systems
- Remedy Component #4: Enhancements to the SVE Systems
- Remedy Component #5: Maintain Existing Site Caps
- Remedy Component #6: Maintain Surface Drainage Controls
- Remedy Component #7: Characterize Shallow Soils and Dump

For Remedy Component #1, ongoing groundwater monitoring in the vicinity of these two sites is completed as part of OU2 deep groundwater monitoring (Section 12.0) and is not discussed separately in this section.

Remedy Components #2 to #6 were related to continued operation of the SVE systems (that had been installed in 1986), along with modifications to the systems to enhance performance. The caps were in-place primarily to minimize short-circuiting of air flow, and also to minimize infiltration. Studies conducted after the 1997 ROD showed that enhancements to the SVE systems were not necessary, and in fact, the soil VOC concentrations had achieved the soil VOC cleanup levels. The systems were turned off in 1998 and were subsequently removed, hence completing Remedy Components #2 to #6 related to deep soil.

Regarding Remedy Component #7, additional shallow soil investigation work (for non-VOC contaminants) was completed at Site D, and characterization work of the dump was completed at Site G. Thus, this remedy component has been completed. The investigation/characterization work led to removal of shallow soils at Site D and construction of a cover at Site G, which were documented through OU2 ROD Amendment #3.

In summary, the deep soil requirements of the OU2 ROD have been completed. There are ongoing land use control requirements for the shallow soil at Site D and dump at Site G that are addressed in Section 4.0.

6.0 Operable Unit 2: Site A Shallow Groundwater

Shallow groundwater at Site A has been impacted by VOCs and antimony. The selected remedy in the OU2 ROD incorporates the use of a groundwater extraction system, which began operation May 31, 1994. When operating, this system discharged the extracted groundwater to the sanitary sewer for treatment at a Publicly-Owned Treatment Works (POTW). However, as further discussed below, the groundwater system was shut off (with regulatory approval) on September 24, 2008, while implementation of Monitored Natural Attenuation (MNA) is evaluated as a potential remedy component in lieu of groundwater extraction and discharge. The groundwater system has not been removed and will be kept in place in the event that MNA does not adequately control plume migration and one or more extraction wells need to be restarted. The ROD prescribes five major components of the remedy, and until a decision is made to formally change the remedy, the original components of the ROD will be retained in this section (with discussion that is appropriate to the ongoing evaluation period for MNA).

The original 8-well groundwater extraction system that was selected in the OU2 ROD began operation May 31, 1994. On July 11, 2000, with regulatory approval, EW-5 through 8 (the "second line" of extraction wells) were shut down due to their VOC concentrations having declined below cleanup levels. In July 2008, the USEPA and MPCA approved the "Site A Shallow Groundwater: 10-Year Evaluation Report." The 10-Year Report was prepared to fulfill a requirement of the ROD, which states that for shallow groundwater contamination at Site A, "should aquifer restoration not be attained within the ten-year lifespan of the remedy, additional remedial measures will be addressed". Since the 10-year mark had been reached and contamination was still present above the cleanup levels, the 10-Year Report was prepared to discuss the status of the site and to evaluate any potential changes to the remedy that would be beneficial. MNA (through abiotic degradation) was the recommended alternative for Site A that was approved by the USEPA and MPCA.

In September 2008, the USEPA and MPCA approved the “Site A Shallow Groundwater: Monitoring and Contingency Plan,” and EW-1 through 4 (the “first line” of extraction wells) were then shut off on September 24, 2008. The Monitoring and Contingency Plan presented the monitoring plan to be implemented at the point that the extraction wells were shut off, and presented the contingency actions that will be taken by the Army if groundwater monitoring indicates that any of the identified trigger points are exceeded. These monitoring and contingency actions were incorporated into the APR, and thus any changes to monitoring and contingency actions must be approved by the USEPA and MPCA through revisions to the APR.

The decision to proceed with MNA was based in part on the MPCA and USEPA natural attenuation study at this site (2000), and also on follow-up MPCA/USEPA microcosm studies that have verified that abiotic degradation of VOCs in Site A groundwater is occurring at substantial rates. Such degradation acts to reduce contaminant mass and mobility by breaking down the contaminants as they move downgradient. The decision to proceed with MNA was also based on the absence of any likely receptors. The closest potential groundwater receptor is located approximately 1,000 feet downgradient from 01U352 (EW-2), and this domestic well has not been operable for many years (and even when it was, the water was only used for irrigation purposes). Beyond this unlikely receptor, there are no other existing downgradient receptors between it and Rice Creek, which is approximately 1,800 feet away.

If, after the initial trial period of extraction system shutdown, MNA is proven to be an acceptable long-term remedy for Site A shallow groundwater, the remedy will be formally changed. This change would presumably require an Explanation of Significant Difference (ESD), at a minimum, or possibly a ROD amendment. The length of the trial period was originally anticipated to be three to five years; however, review of future water quality data in future APRs will ultimately determine when the USEPA, MPCA, and Army are comfortable that the extraction system can be dismantled and the remedy can be formally changed to MNA. The end of FY 2012 was the end of the fourth year since the extraction wells were shut off.

6.1 REMEDY COMPONENT #1: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track plume migration and remedy performance." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a performance groundwater monitoring program has been established and ongoing monitoring is in compliance with the program.

Is this remedy component being implemented?
Yes. Table 6-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. The FY 2012 Monitoring Plan is included in Appendix A, and the FY 2012 water quality monitoring locations and frequencies are also summarized on Figure 6-1. Figure 6-2 presents groundwater elevation contours based on measurements in June 2012.

Were the groundwater monitoring requirements for this remedy met? Yes.

Is any groundwater sampling proposed prior to the next report? Yes.

- Groundwater sampling of water supply wells related to alternate water supply and well abandonment will be in accordance with recommendations in Appendix E. The next "major" event will be in FY 2013.
- Other groundwater monitoring at Site A will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component? Possibly. Based on the increasing trends noted in some site monitoring wells, a meeting between the Army, MPCA, and USEPA will be held in early FY 2013 to discuss whether there is a need for revisions to the monitoring locations and/or frequencies.

6.2 REMEDY COMPONENT #2: GROUNDWATER CONTAINMENT AND MASS REMOVAL

Description: "Use of existing gradient control wells to contain the contaminant plume and remove mass." (OU2 ROD, page 3)

Is this remedy component being implemented?

No. As discussed previously, since the groundwater extraction system is currently shut off for evaluation of MNA, this remedy component is not currently being implemented.

6.3 REMEDY COMPONENT #3A: LAND USE CONTROLS

Description: The OU2 ROD (page 3) listed the following: "Institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary." For ease of discussion, the requirement has been broken into two pieces, with this section focusing on the land use controls. OU2 ESD #1 clarified the land use control component to include protection of the groundwater monitoring and extraction system infrastructure.

Performance Standard (how do you know when you're done):

For initial implementation, when the MDH has issued a Special Well Construction Area Advisory, and when the USEPA and MPCA have provided consistency approval for an OU2 Land Use Control Remedial Design (LUCRD) document. Implementation will continue until such time that the groundwater concentrations are below the cleanup levels.

Has the MDH issued a Special Well Construction Area Advisory for the area impacted by Site A?

Yes, it was issued in June 1996 and revised in December 1999; however, this revision did not affect the boundary for the Site A vicinity.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site A groundwater, and is it being implemented?

Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2011; however, this revision did not affect land use controls for Site A.

Was an annual site inspection for land use controls conducted in FY 2012?

Yes. On July 12, 2012, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs?

No.

6.4 REMEDY COMPONENT #3B: ALTERNATE WATER SUPPLY/WELL ABANDONMENT

Description: The OU2 ROD (page 3) listed the following: "Institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary." For ease of discussion, the requirement has been broken into two pieces, with this section focusing on the alternate water supplies and well abandonment.

Performance Standard (how do you know when you're done):

When well owners who qualify have been offered and provided with alternate water supply and/or have had their wells abandoned (or the offers have been rejected).

Is the remedy component being implemented?

Yes. The OU1 Alternate Water Supply and Well Abandonment Program is underway and was expanded to cover the area affected by the OU2 Site A shallow groundwater plume. See Section 3.1 of this report for more information on this program.

Did the boundary of the Site A plume get any bigger during FY 2012, as defined by the 1 μg/L contour?

Yes. Table 6-2 presents the FY 2012 groundwater quality data for Site A. Using this data, Figure 6-3 shows the tetrachloroethene concentrations and Figure 6-4 shows the cis-1,2-dichloroethene concentrations. The latter is a degradation product of the former, and represents the larger areal footprint. The cis-1,2-dichloroethene footprint increased from the previous year. However, offsite wells to the north (01U901, 01U902, 01U903, 01U904) all remained well below cleanup goals.

Were any additional water supply wells discovered within the area of concern for the Site A plume that are completed within the aquifer of concern? No.

Were any water supply wells within the Site A plume sampled during FY 2012? If yes, what were the findings? No wells were sampled.

Were any well owners offered an alternate supply and/or well abandonment in FY 2012? No.

Within the Site A plume, are there any well owners that meet the criteria, but have not yet been provided an alternate water supply? No.

Within the Site A plume, are there any wells that meet the criteria, but have not yet been abandoned? No.

Is any sampling of water supply wells proposed prior to the next report? No. Although FY 2013 is a major sampling year, there are no water supply wells within the Site A plume area that require sampling at this time.

Are any changes or additional actions required for this remedy component? No.

6.5 REMEDY COMPONENT #4: DISCHARGE OF EXTRACTED WATER

Description: "Discharge of extracted groundwater to a publicly-owned treatment works (POTW)." (OU2 ROD, page 3)

Is this remedy component being implemented?

No. As discussed previously, since the groundwater extraction system is currently shut off for evaluation of MNA, this remedy component is not currently being implemented.

6.6 REMEDY COMPONENT #5: SOURCE CHARACTERIZATION/ REMEDIATION

Description: "Source characterization/remediation." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):

For characterization, when the investigation has answered the questions needed to prepare remedial design documents. For remediation, when the contaminant concentrations in soil are below the cleanup levels specified in Table 1 of the OU2 ROD.

Is this remedy component being implemented?

Yes. Characterization work has been completed. Stone & Webster performed investigation work in 1997 and the final "Site A Investigation Report" was issued December 12, 1997. The report delineated the extent of both VOC-contaminated and metal-contaminated soils requiring remediation. The source of VOC-contaminated soils was found to be the “1945 Trench”.

Remediation has been completed. Shaw completed removal of metal-contaminated soils in FY 1999. Construction of an air sparging/soil vapor extraction (AS/SVE) system to remediate VOC-contaminated soils was completed by Stone & Webster in FY 2000, which began operation in early FY 2001. The AS system was shut off permanently in June 2001 due to a lack of increase in SVE VOC levels and due to concern regarding potential plume spreading. The AS system was being implemented voluntarily by the Army and was not a requirement of the OU2 ROD. Soil samples were collected within the source area in July 2002 (and previously in August 2001). In both events, the results showed minimal reduction in soil VOC concentrations. Since it appeared that many years of SVE system operation would be required before soil cleanup levels would be reached (if ever), the Army ceased SVE system operation on August 21, 2002, and submitted a work plan clarification to the USEPA and MPCA for excavation of the VOC-contaminated soils in the source area. The work plan clarification received regulatory approval in early FY 2003, and 688 cubic yards of contaminated soil were excavated by Shaw and transported off-site to a permitted disposal facility (see Figure 6-3 and 6-4 for the location of the soil excavation area at the former 1945 Trench). The Site A Former 1945 Trench Closeout Report (prepared by Shaw) received regulatory consistency in FY 2004.

Are any changes or additional actions required for this remedy component? No.

6.7 OVERALL REMEDY FOR SITE A SHALLOW GROUNDWATER

Performance Standard (how do you know when you’re done):
When the cleanup levels in Table 1 of the OU2 ROD have been attained throughout the areal and vertical extent of the Site A plume (OU2 ROD, page 54).

Has the Site A shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD been attained throughout the areal and vertical extent of the Site A plume)?

No. Table 6-2 presents the FY 2012 groundwater quality data and highlights the values that exceed a cleanup level. FY 2012 was the fourth year of data obtained for evaluation of MNA performance. In the June 2012 sampling event, tetrachloroethene exceeded the cleanup level of 7 µg/L in only one well near the source area: 01U126 (10 µg/L). The other wells with exceedances of cleanup levels during FY 2012 were 01U353 (EW-3), 01U158 (located downgradient from EW-3), 01U157 (located downgradient from EW-2/EW-3), 01U139 (located downgradient from 01U157) and 01U140 (located downgradient from 01U158). These five wells exceeded the cleanup level of 70 µg/L for cis-1,2-dichloroethene. 01U158 and 01U157 were above the cleanup level in only the December 2011 sampling event. 01U353 was above the cleanup level in only the June 2012 sampling event. 01U139 and 01U140 were above the cleanup level in both sampling events.

What impact is MNA having on contaminant concentrations?

As evident in Table 6-2, and on Figure 6-3 and 6-4, tetrachloroethene and trichloroethene continue to be degraded to cis-1,2-dichloroethene via natural attenuation. This degradation occurs within the distance between the source area and the first line of extraction wells. Figure 6-5 shows the cis-1,2-dichloroethene concentrations plotted on geologic cross sections for Site A to illustrate the vertical extent of contamination (the cross section locations are illustrated on Figure 6-4). Cis-1,2-dicholorethene continues to be degraded as the plume migrates via an abiotic process that likely involves the presence of the mineral magnetite in soils at Site A.

After the extraction system was shut off, the axis of the highest cis-1,2-dichloroethene concentrations shifted to the south during FY 2009, as evidenced by the concentration trends in the extraction wells (Figure 6-6). In June 2008, just prior to shutting the extraction system off, the cis-1,2-dichloroethene concentration in EW-2 was much higher than in EW-3 (350 versus 4.3 µg/L), with EW-1 and EW-4 both less than 3 µg/L. In December 2008, about three months after the extraction system was shut off, the cis-1,2-dichloroethene concentration in EW-2 decreased down to 16 µg/L and has remained near or below this level. Conversely, EW-3 remained at a relatively low concentration in December 2008 and March 2009, but increased sharply in subsequent events, reaching 950 µg/L in December 2009 and thereafter declining to 16 µg/L (below the cleanup level) in December 2011. EW-3 then increased again to 130 µg/L during the June 2012 sampling event. VOC concentrations in EW-1 and EW-4 have remained low. This data shows that the axis of the highest concentrations of cis-1,2-dicloroethene shifted from the vicinity of EW-2 to the vicinity of EW-3.

The overall cis-1,2-dichloroethene trend at EW-3 (a significant increase followed by a significant decrease) appears to be the result of a one-time "wave" of higher concentrations that is moving through the Site A area and shifting ground water elevations. Such an area of higher concentrations could have been held in a stagnation zone between two adjacent extraction well capture zones (most likely between EW-2 and EW-3), and then when the extraction system was shut off, that area of higher concentrations started moving downgradient in a one-time event, creating the concentration "wave" that was observed at EW-3 between December 2009 and July 2011. A similar cis-1,2-dichloroethene concentration trend (increase followed by decrease) has now been observed at 01U158 and 01U157; which supports the idea of a one-time "wave" (see Figure 6-7). Prior to shutting the extraction system off, the cis-1,2-dichloroethene in 01U158 had been about 1 µg/L. Then, after shutting the extraction system off (and lagging behind the "wave" observed at EW-3), the concentration increased to 410 µg/L in April 2011, which was the peak concentration observed. Thereafter, the concentration declined in the last two events of FY 2012, reaching 67 µg/L in June 2012. However, as the "wave" continues to move downgradient, the next well downgradient from 01U158 has shown a similar (presumably temporary) increase in cis-1,2-dichloroethene concentrations. 01U140 is the next well downgradient (Figure 6-2), and an increase in the cis-1,2-dicloroethene concentration in 01U140 was observed from FY 2010 to FY 2012 (2.1 to 100 µg/L). This appears to be the beginning of the arrival of the "wave" at 01U140 (note that the monitoring frequency of 01U140 was increased to semiannual beginning in FY 2012). A small increase has also been observed in a well downgradient of 01U140 (01U904), which increased from 2.1 µg/L in December 2011 to 11 µg/L in the June 2012 sampling event (still well below the cleanup level of 70 µg/L). Note that increases in the cis-1,2-

dicloroethene concentrations in wells downgradient of EW-1 through 4 were anticipated (10-Year Report), and were the reason for the increased monitoring frequency in some of the Site A wells.

The passing of this one-time "wave" of higher concentrations is not of concern from a risk standpoint. In addition to the one-time nature of the event, the peak observed concentration is declining as it moves downgradient (the peak of 410 µg/L at 01U158 was half the peak of 950 µg/L at EW-3, and the apparent peak observed at 01U140 of approximately 100 µg/L is one quarter of the peak observed at 01U158). In addition, there are no receptors downgradient, as discussed at the beginning of Section 6.0.

Another apparent trend that was observed during FY 2012 was the slight shifting of the "wave" to the north along its axis of migration and the spreading of the wave horizontally along its axis. As a result, 01U157 increased to over the cleanup goal of 70 µg/L in December 2011 (73 µg/L), and then back down below the goal in June 2012 (36 µg/L). 01U139 increased over the cleanup level to 110 µg/L in December 2011, and further increased to 260 µg/L in June 2012. The peak level observed at 01U139 in June 2012 is just over half of the peak observed at 01U158 (410 µg/L). It may be that the "wave" is still in the process of shifting and spreading, or it may also be related to unusually high groundwater levels as discussed below.

Finally, EW-3 increased above the cleanup goal of 70 µg/L again in June 2012 (130 µg/L). The most likely explanation for this increase is the unusually high groundwater levels observed at the site during the June 2011 event (groundwater levels measured at EW-3 in June 2011 were at least four feet higher than any other observed groundwater level measured back to remediation system shut down in 2008), and which remained high in the June 2012 event. The unusually high groundwater levels may have brought groundwater into better contact with source area soil that is normally located at or just above the water table in periods with lower groundwater levels. Now, a year after the initial groundwater level spike in June 2011, a new, lower initial concentration "wave" of VOCs may be staring its journey through the network of monitoring wells at Site A.

Were any trigger levels exceeded at any of the contingency locations?

No. The four contingency locations are 01U901, 902, 903 and 904, which are the four monitoring wells located along the north side of County Road I. The trigger level is equal to groundwater cleanup levels and no compounds of concern at Site A exceeded their respective cleanup levels in these four wells in FY 2012 (Table 6-2). Concentrations of the only detected compound of concern in these four wells, cis-1,2-dichloroethene, increased slightly in comparison to the FY 2011 concentrations (most notably in 01U904, as discussed previously), as shown on Figure 6-8. All of the FY 2012 cis-1,2-dichloroethene results in these wells were at or below 11 µg/L, versus the cleanup level (trigger level) of 70 µg/L.

Can it be determined whether MNA is an adequate long-term remedy for Site A in lieu of groundwater extraction and discharge? (If MNA is determined to be adequate, a recommendation to formally change the remedy should be made.)

No, the determination cannot be made yet. FY 2012 was the fourth year of evaluation following extraction system shutdown, and a time period of three to five years was anticipated before this determination could be made. However, as previously discussed, the cis-1,2-dichloroethene concentration trends in several wells support the conclusion that a one-time "wave" of higher concentrations is moving downgradient. Additional monitoring is still needed to fully confirm that this is a "wave" effect; however, it appears likely that after another year or two of monitoring, it could be concluded that MNA is an adequate long-term remedy.

Do additional remedial measures need to be addressed?

No. Continued monitoring will provide the additional data needed for evaluation of MNA as a potential remedy. However, as discussed previously, based on the increasing trends noted in some site monitoring wells, a meeting between the Army, MPCA, and USEPA will be held in early FY 2013 to discuss whether there is a need for revisions to the monitoring locations and/or frequencies.

Table 6-1

Summary of Site A Shallow Groundwater Monitoring Requirements
Fiscal Year 2012

Remedy Component	Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1: Groundwater Monitoring	Outlined below		
#2: Containment and Mass Removal	a. None. The groundwater extraction system was shut down in September 2008 and implementation of Monitored Natural Attenuation (MNA) is being evaluated.		
#3A: Land Use Controls	a. None		
#3B: Alternate Water Supply/Well Abandonment	a. See OU1, Remedy Component #1 which also includes the area north of Site A		
#4: Discharge of Extracted Water	a. None (see #2 above).		
#5: Source Characterization/ Remediation	a. None. VOC-contaminated soils in the source area (1945 Trench) were excavated and transported to a permitted offsite disposal facility in FY 2003.		
OR: Overall Remedy (Attainment of cleanup goals)	a. Water quality data throughout the Site A plume to evaluate attainment and to verify that Natural Attenuation is adequately controlling plume migration.	Army	Site A Monitoring Plan in the Annual Performance Report

Table 6-2
Site A Groundwater Quality Data

Fiscal Year 2012

			Tetra-chloro-ethene (µg/l)	Tri-chloro-ethene (µg/l)	1,1-Di-chloro-ethene (µg/l)	1,2-Di-chloro-ethane (µg/l)	cis-1,2-Di-chloro-ethene (µg/l)	Chloro-form (µg/l)	Benzene (µg/l)	Antimony (µg/l)
Site A Cleanup Level (1)			7	30	6	4	70	60	10	6
01U039		12/15/11	<1	<1	<1	<1	<1	<1	<1	---
01U039		6/13/12	<1	<1	<1	<1	<1	<1	<1	---
01U102		6/13/12	1.6	<1	<1	<1	<1	<1	<1	---
01U103		6/13/12	<1	<1	<1	<1	<1	<1	<1	5.2
01U108		6/13/12	1.2	JP 0.38	<1	<1	<1	<1	<1	---
01U115		6/13/12	<1	JP 0.73	<1	<1	4.3	<1	<1	---
01U116		6/12/12	<1	JP 0.45	<1	<1	JP 0.63	<1	<1	---
01U117		6/13/12	3.8	1.7	<1	<1	12	<1	<1	---
01U126		6/13/12	**10**	1.0	<1	<1	<1	<1	<1	---
01U127		6/13/12	<1	<1	<1	<1	<1	<1	<1	---
01U138		6/12/12	<1	JP 0.37	<1	<1	<1	<1	<1	---
01U139		12/15/11	<1	1.0	<1	<1	**110**	<1	1.6	---
01U139	D	12/15/11	<1	1.0	<1	<1	**110**	<1	1.5	---
01U139		6/13/12	<1	1.5	JP 0.33	<1	**260**	<1	4.4	---
01U140		12/15/11	<1	JP 0.34	<1	<1	**80**	<1	1.7	---
01U140		6/13/12	<1	JP 0.43	<1	<1	**100**	<1	JP 0.81	---
01U140	D	6/13/12	<1	JP 0.38	<1	<1	**97**	<1	JP 0.97	---
01U157		12/15/11	JP 0.36	2.0	<1	<1	**73**	<1	2.2	---
01U157		6/13/12	<1	1.8	<1	<1	36	<1	2.4	---
01U158		12/15/11	<1	JP 0.74	<1	<1	**90**	<1	1.5	---
01U158	D	12/15/11	<1	JP 0.71	<1	<1	**86**	<1	1.6	---
01U158		6/13/12	<1	1.2	<1	<1	67	<1	JP 0.90	---
01U350		6/13/12	4.2	JP 0.86	<1	<1	<1	<1	<1	---
01U901		12/15/11	<1	<1	<1	<1	<1	<1	<1	---
01U901		6/12/12	<1	<1	<1	<1	JP 0.33	<1	<1	---
01U902		12/15/11	<1	<1	<1	<1	2.9	<1	<1	---
01U902		6/12/12	<1	<1	<1	<1	4.0	<1	<1	<1
01U903		6/12/12	<1	<1	<1	<1	JP 0.42	<1	<1	---
01U904		12/15/11	<1	<1	<1	<1	2.1	<1	<1	---
01U904		6/12/12	<1	<1	<1	<1	11	<1	<1	<1
01U904	D	6/12/12	<1	<1	<1	<1	11	<1	<1	JP 0.35 UCB.96

Table 6-2
Site A Groundwater Quality Data

Fiscal Year 2012

			Tetra-chloro-ethene (µg/l)	Tri-chloro-ethene (µg/l)	1,1-Di-chloro-ethene (µg/l)	1,2-Di-chloro-ethane (µg/l)	cis-1,2-Di-chloro-ethene (µg/l)	Chloro-form (µg/l)	Benzene (µg/l)	Antimony (µg/l)
Site A Cleanup Level (1)			7	30	6	4	70	60	10	6
Extraction Wells:										
01U351 (EW-1)		6/12/12	JP 0.34	<1	<1	<1	1.1	<1	<1	---
01U352 (EW-2)		12/15/11	<1	<1	<1	<1	13	<1	1.3	---
01U352 (EW-2)		6/12/12	<1	<1	<1	<1	11	<1	<1	---
01U353 (EW-3)		12/15/11	<1	JP 0.35	<1	<1	16	<1	<1	---
01U353 (EW-3)		6/12/12	<1	JP 0.40	<1	<1	**120**	<1	3.4	---
01U353 (EW-3)	D	6/12/12	JP 0.31	JP 0.45	<1	<1	**130**	<1	3.6	---
01U354 (EW-4)		12/15/11	JP 0.35	JP 0.33	<1	<1	<1	<1	<1	---
01U354 (EW-4)		6/12/12	<1	JP 0.87	<1	<1	<1	<1	<1	---

Notes:

(1) Cleanup levels for Site A Shallow Groundwater are from Table 1 of the OU2 ROD. Bolding (in red color) indicates exceedance of the cleanup level.

--- Not Sampled.

D Duplicate sample.

JP The value is below the reporting level, but above the method detection limit. Results should be considered estimated.

UCB The sample result was less than 5 times the level detected in a calibration blank (the result for the blank is listed after "UCB"). The sample result can be considered non detect at an elevated detection limit.

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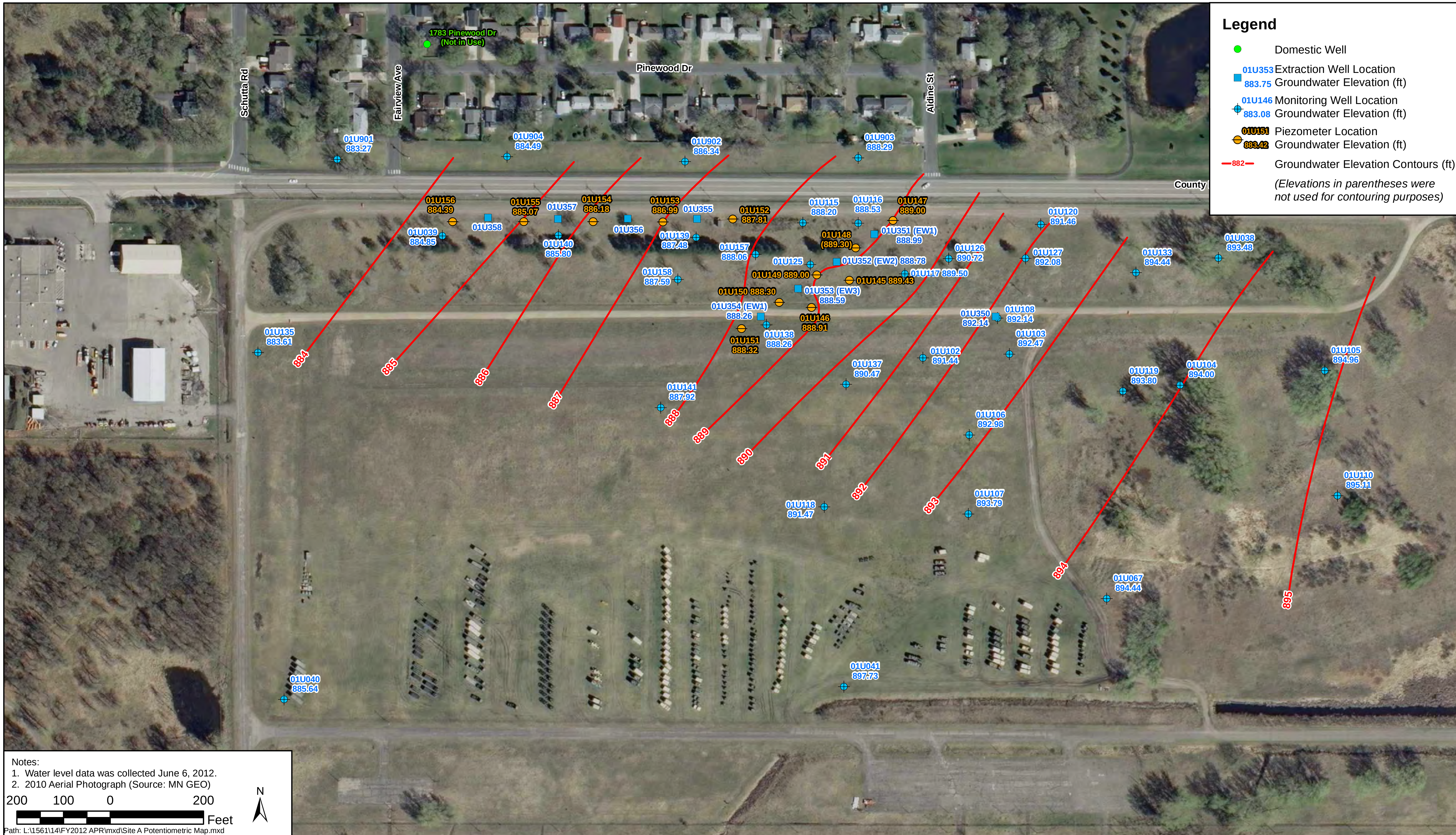
Site A, Groundwater Monitoring Plan	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure 6-1



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Site A, Unit 1, Potentiometric Map - Summer 2012

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Figure 6-2

ANNUAL PERFORMANCE REPORT

Site A, Unit 1, Tetrachloroethene Isoconcentration Map, Summer 2012

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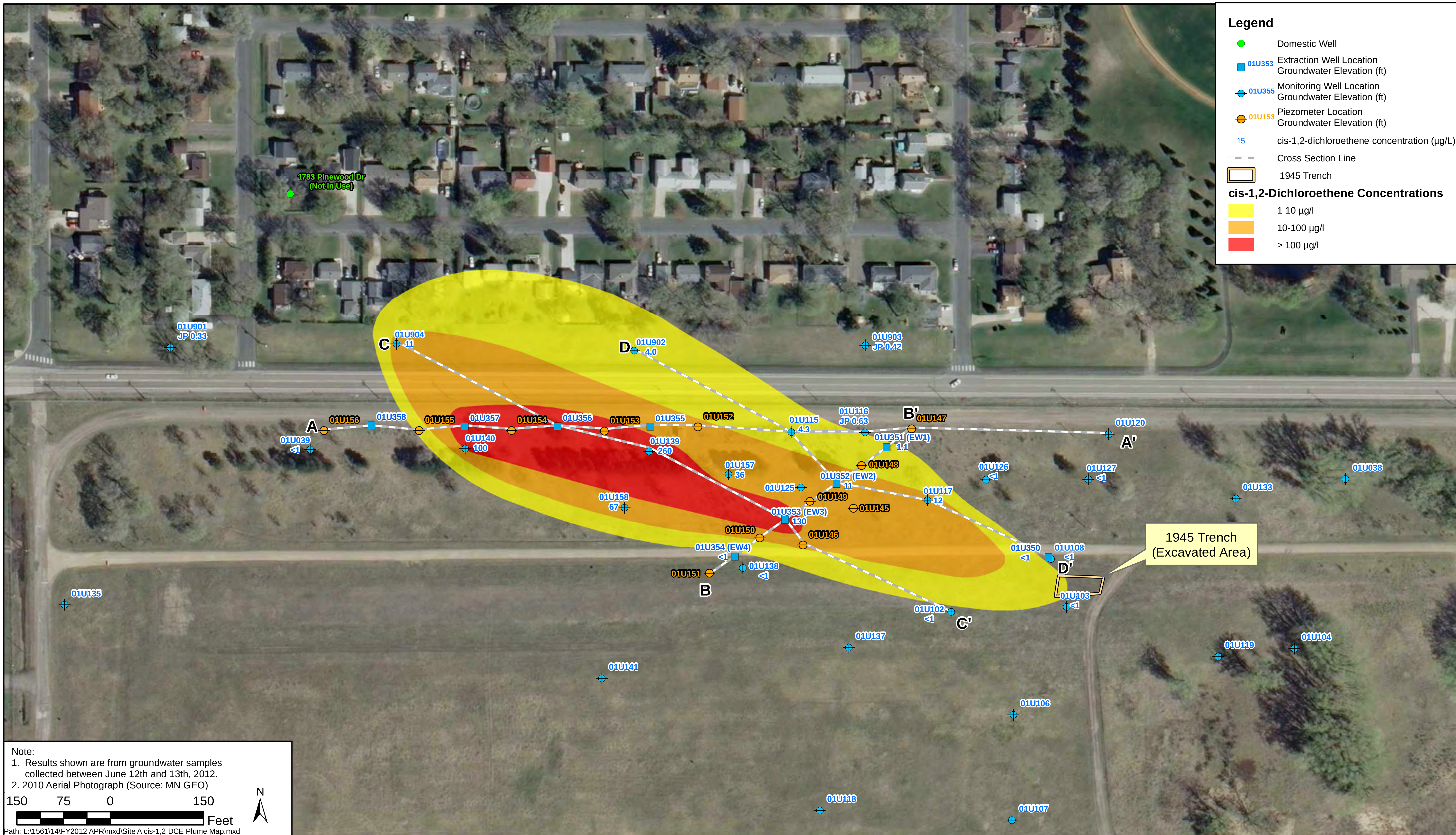
Figure 6-3



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Site A, Unit 1, cis-1,2-Dichloroethene Isoconcentration Map, Summer 2012

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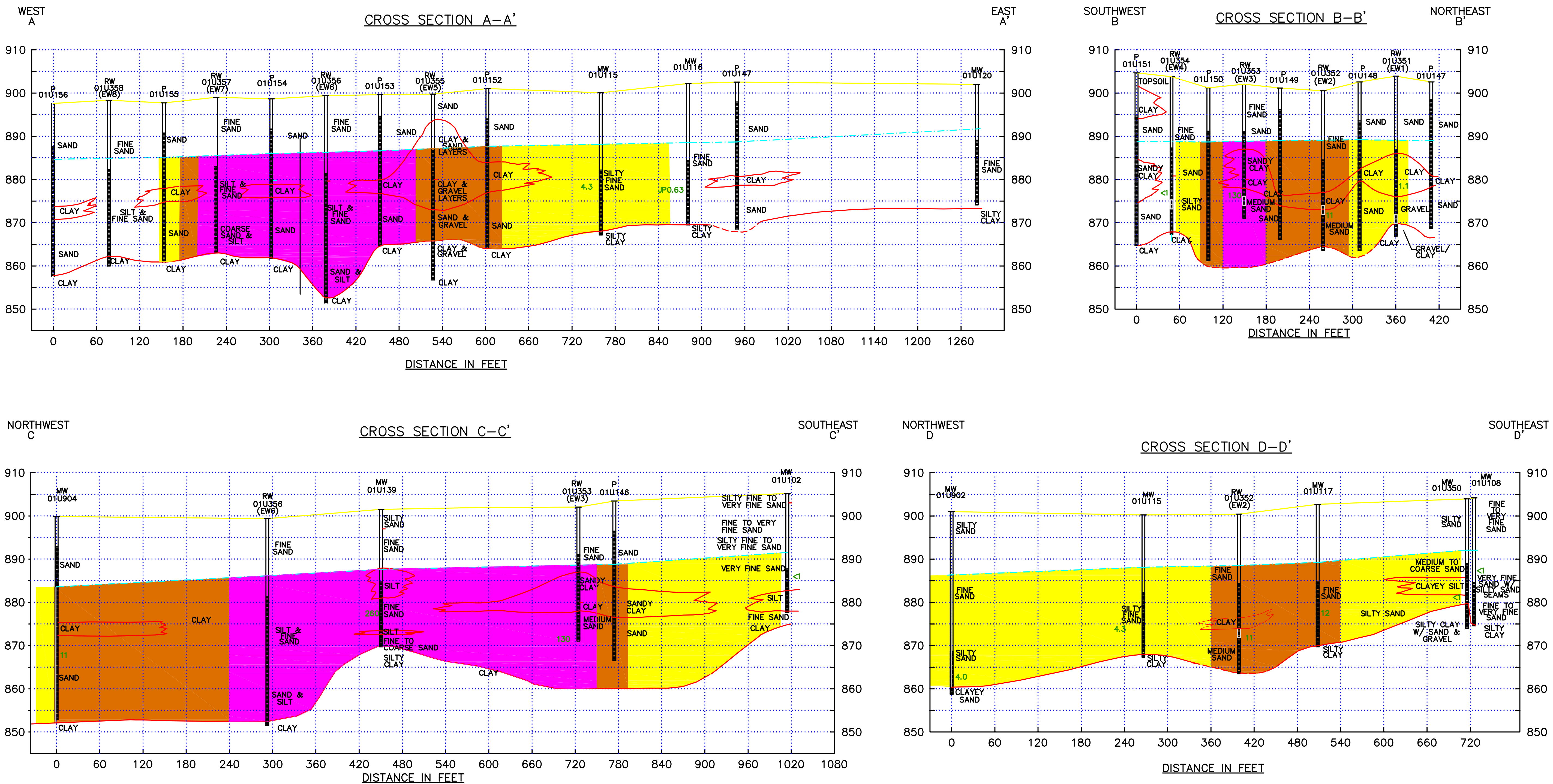
Figure 6-4



NOTES:

1. RESULTS ARE FROM GROUNDWATER SAMPLES COLLECTED BETWEEN JUNE 12 AND JUNE 13, 2012.

2. CONSTRUCTION INFORMATION ON RECOVERY WELLS AND PIEZOMETERS WAS GENERATED BY DAHL AND ASSOCIATES, INC. AS PART OF THE SITE A REMOVAL ACTION SYSTEM CONSTRUCTION. CONSTRUCTION INFORMATION ON MONITORING WELLS WAS PROVIDED BY FEDERAL CARTRIDGE COMPANY.

SCALE

V.E. = 6X

LEGEND

GEOLOGIC CONTACT

INFERRED GEOLOGIC CONTACT

SCREENED INTERVAL OF WELL

PUMP LOCATION

885.0 WATER LEVEL SURFACE

SLIGHT CHANGE IN GEOLOGIC UNIT (MARK LOCATED ALONG WELL STAFF)

MW MONITORING WELL

RW RECOVERY WELL

P PIEZOMETER

MW 01U117 12 cis–1,2–DICHLOROETHENE CONCENTRATION (µg/l)

cis–1,2–DICHLOROETHENE CONCENTRATIONS

1–10 µg/l

10–100 µg/l

>100 µg/l

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cis–1,2–Dichloroethene Cross Sections A–A', B–B', C–C' and D–D', Summer 2012

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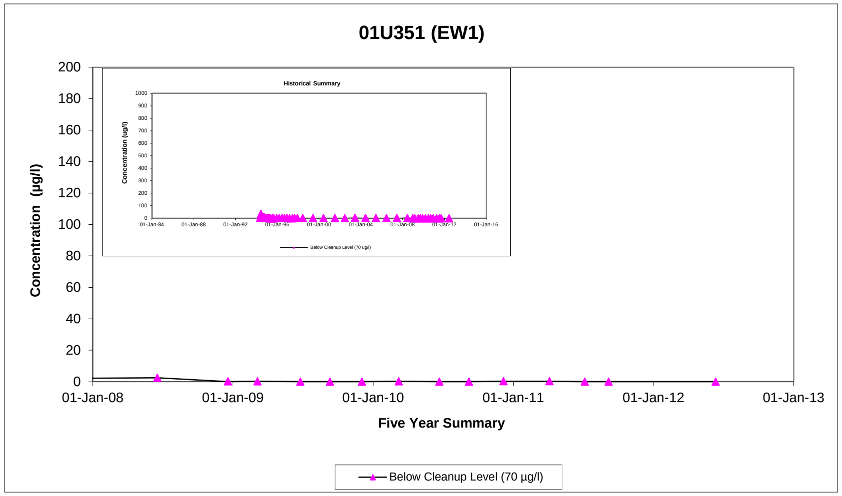
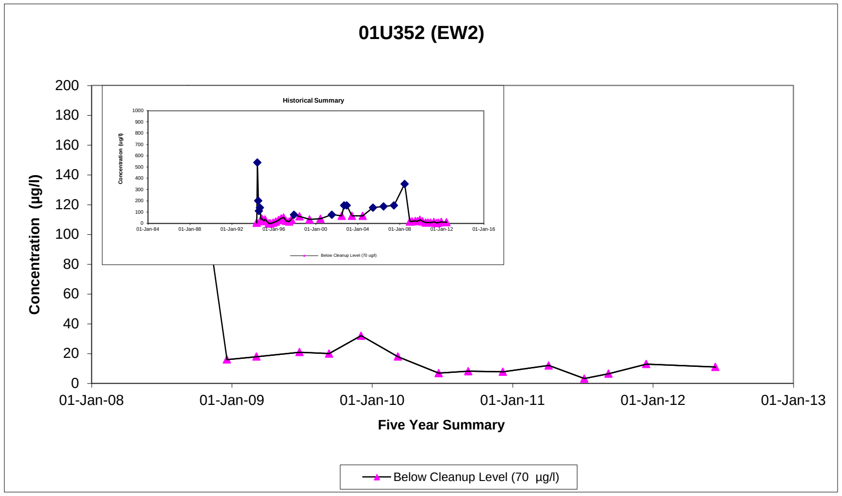
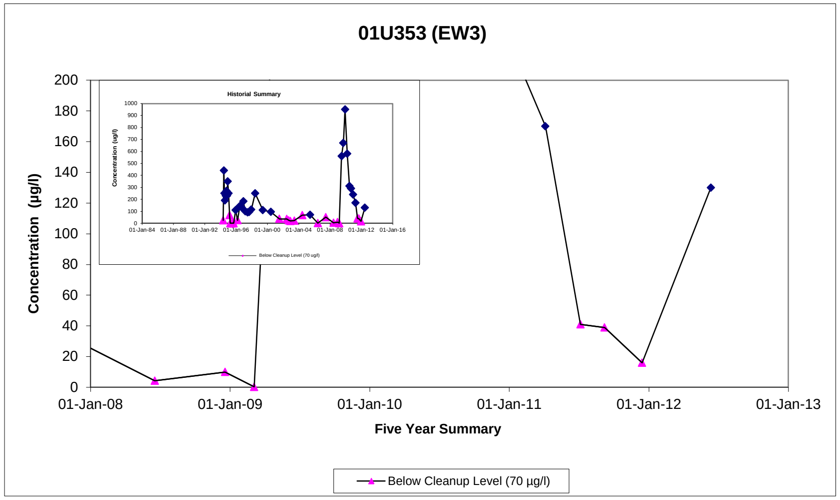
Figure 6–5

FIGURE 6-6
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: EXTRACTION WELLS
FY 2012 ANNUAL PERFORMANCE REPORT







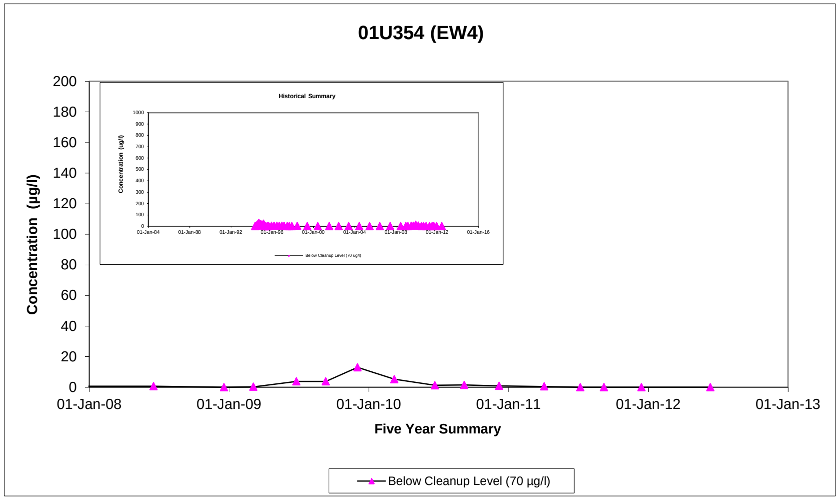
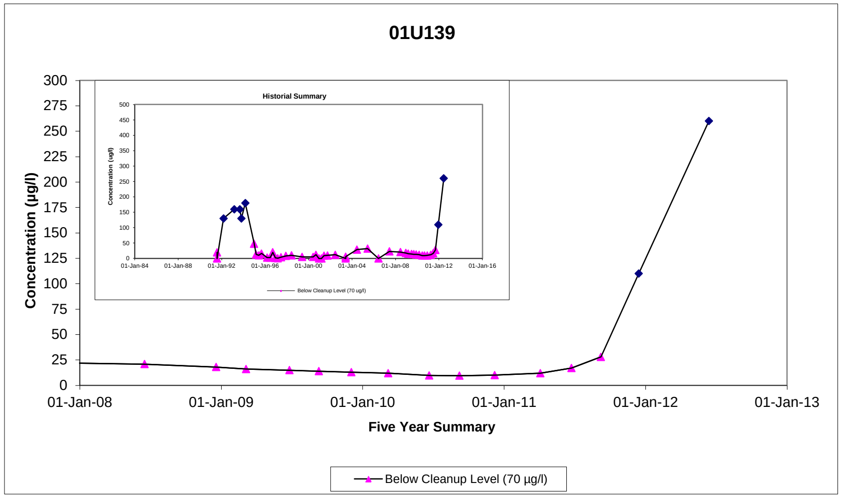
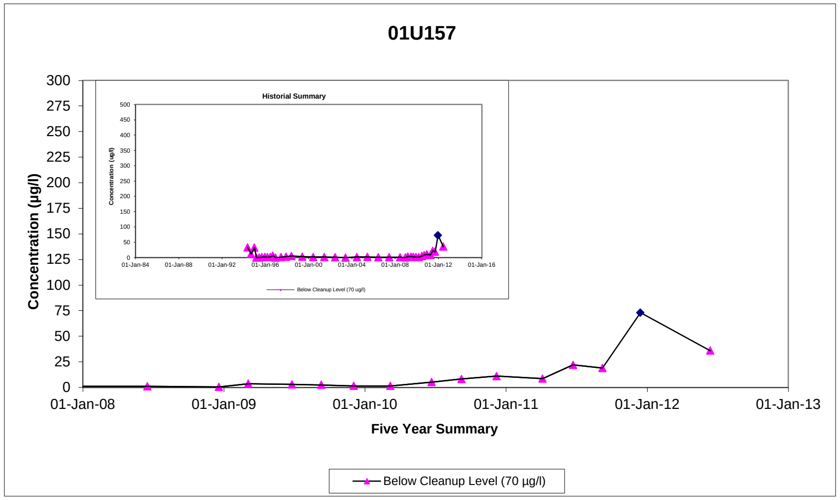
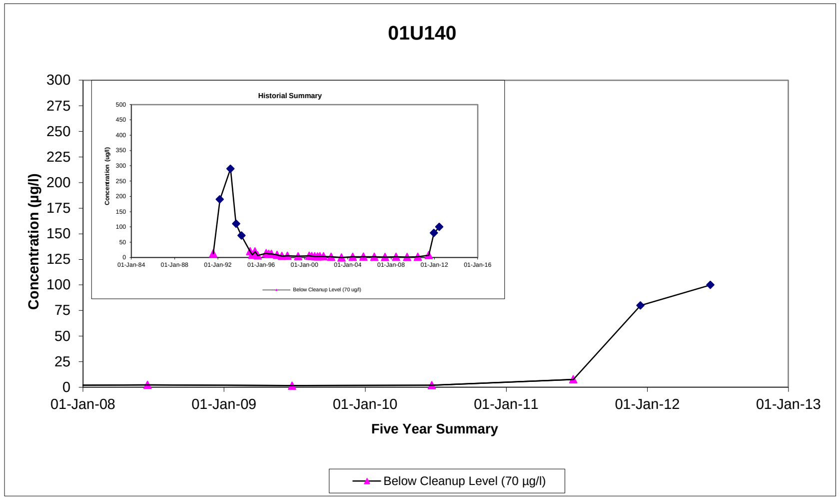


FIGURE 6-7
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: MONITORING WELLS
FY 2012 ANNUAL PERFORMANCE REPORT







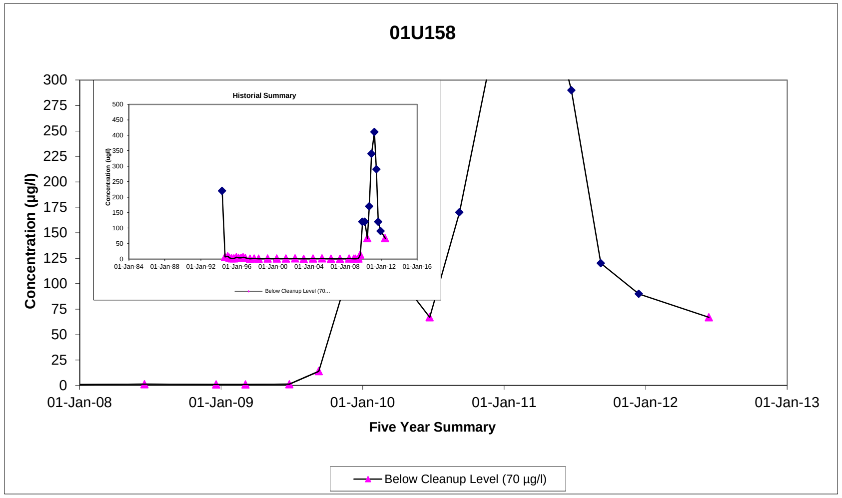


FIGURE 6-8

SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: CONTINGENCY LOCATIONS

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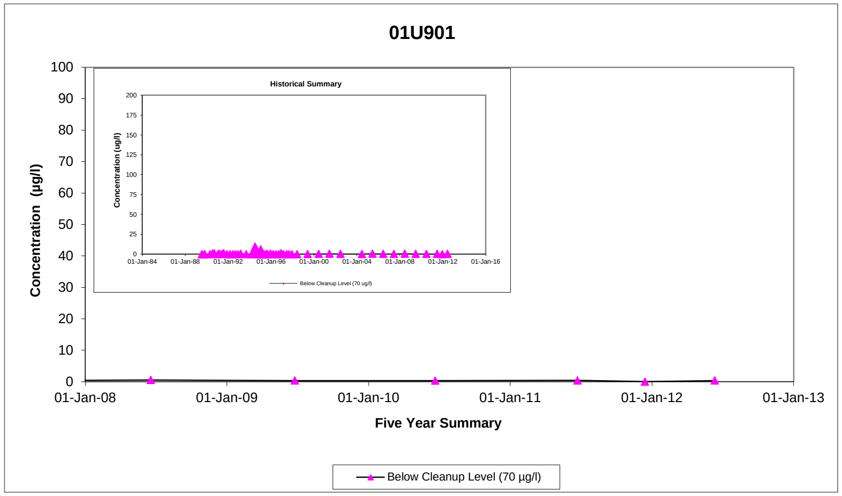
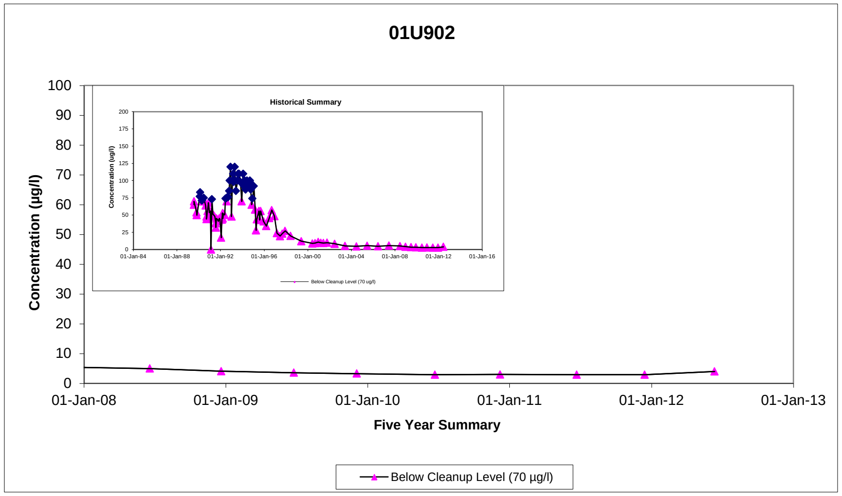
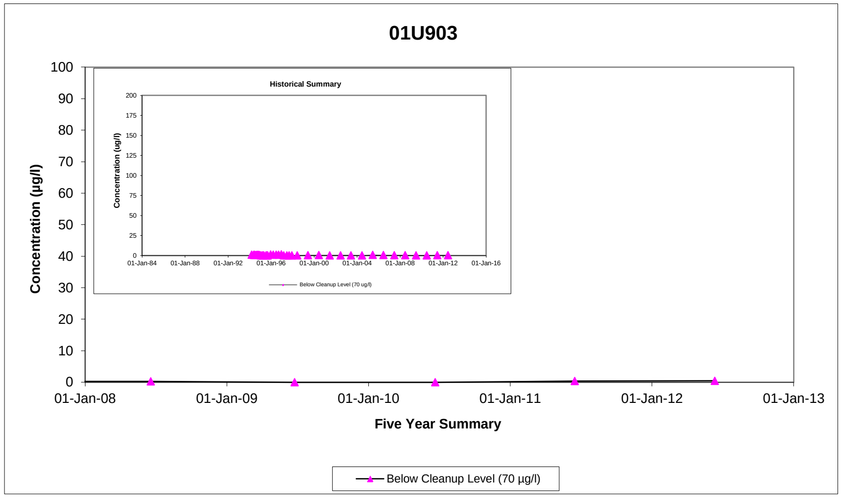
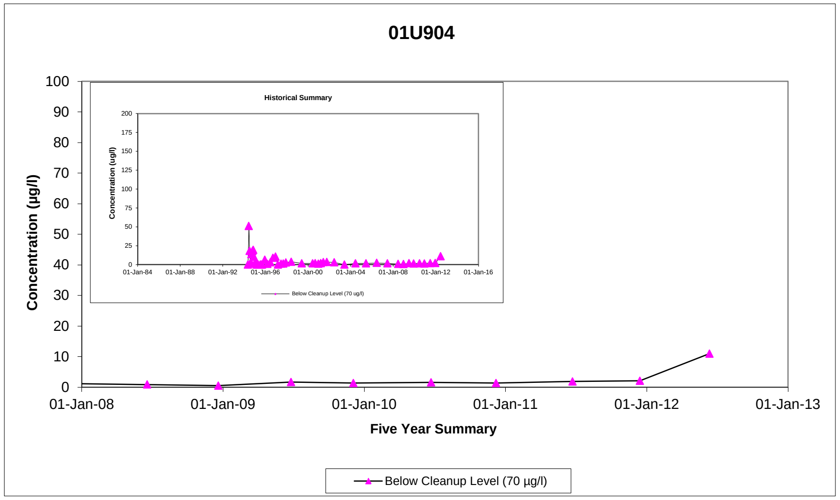








7.0 Operable Unit 2: Site C Shallow Groundwater

Impacts to Site C shallow groundwater had not occurred at the time of the OU2 ROD (1997). In FY 1997, the U.S. Army Environmental Command (USAEC) sponsored a technology demonstration project to phytoremediate lead-contaminated soil at Site C. During the growing seasons, ethylenediaminetetraacetic acid (EDTA) and acetic acid were applied to the soils to improve the metals uptake by the crops and had the unintended consequence of causing migration of lead from the soils into the shallow groundwater at Site C, which is present within a few feet from the ground surface. In FY 2000, the MPCA took enforcement action, requiring that the Army implement corrective actions. Initially, the Army installed a groundwater recovery trench to contain the lead plume (operated between November 2000 and July 2001). On July 6, 2001, the Army began operating three extraction wells to contain the plume (replacing recovery trench operation), with discharge of extracted groundwater (treated as necessary) to a POTW. In FY 2004, a Stipulation Agreement was signed which resolved the enforcement action and directed that response actions be conducted under the authority of the FFA. The 2007 OU2 ROD Amendment #1 incorporated the existing groundwater extraction system as the final remedy.

On November 13, 2008, the groundwater system was shut off (with regulatory approval), since the lead concentrations in the three extraction wells had been below the groundwater cleanup level since March 2008 (i.e., the area of lead concentrations that exceeded the groundwater cleanup level was not even reaching the extraction wells, so operation of the extraction system was no longer required to contain the plume). The recommendation to shut the extraction system off was presented in the “Site C Groundwater Extraction System Evaluation Report,” which was approved by the USEPA and MPCA in November 2008. The groundwater system has not been removed and will be kept in place in the event that one or more extraction wells need to be restarted. The 2007 ROD Amendment #1 prescribes four major components of the remedy, and until a decision is made to formally change the remedy, the original components of ROD

Amendment #1 will be retained in this section (with discussion that is appropriate to the current remedy implementation status).

The Evaluation Report also presented the monitoring plan to be implemented at the point that the extraction wells were shut off, and presented the contingency actions that will be taken by the Army if groundwater and/or surface water monitoring indicates that any of the stated trigger points are exceeded. These monitoring and contingency actions have been incorporated into the APR, and thus any changes to monitoring and contingency actions must be approved by the USEPA and MPCA through revisions to the APR.

If, after an initial trial period of extraction system shutdown, it is proven that extraction system operation is no longer necessary, the remedy could be formally changed. This change would presumably require an Explanation of Significant Difference (ESD), at a minimum, or possibly a ROD amendment. However, given that groundwater cleanup levels may be reached throughout Site C within a few years, it may not be necessary to go through the process of formally changing the remedy. Future APRs will ultimately determine when the USEPA, MPCA, and Army are comfortable that the extraction system can be dismantled, and will also monitor the progress towards reaching the groundwater cleanup levels throughout the Site.

7.1 REMEDY COMPONENT #1: GROUNDWATER AND SURFACE WATER MONITORING

Description: "The existing Site C groundwater monitoring program will be revised as needed."
"A new surface water monitoring plan will be prepared."
(OU2 ROD Amendment #1, page 39-40)

Performance Standard (how do you know when you're done):
When a performance groundwater and surface water monitoring program has been established and ongoing monitoring is in compliance with the program.

Is this remedy component being implemented?
Yes. Table 7-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. The FY 2013 Monitoring Plan is included in Appendix A, and the water quality monitoring locations and frequencies are also summarized on Figure 7-1. Figure 7-2 presents groundwater elevation contours based on measurements in June 2012. The inferred groundwater flow direction confirms that the monitoring plan specifies the appropriate locations to track plume migration. Note that the changes in sampling frequencies at some of the groundwater and surface water locations that were proposed (and approved) in the FY 2010 APR began in FY 2012 and will continue during FY 2013 (see discussion in Section 7.5).

Were the monitoring requirements for this remedy met? Yes.

Is any sampling proposed prior to the next report? Yes. Groundwater and surface water monitoring at Site C will be in accordance with the monitoring plan shown in Appendix A.1 and A.3, respectively.

Are any changes or additional actions required for this remedy component? No.. Monitoring locations and frequencies are to remain unchanged during FY 2013.

7.2 REMEDY COMPONENT #2: GROUNDWATER CONTAINMENT

Description: "Three extraction wells, EW-1 through EW-3, will continue collecting contaminated groundwater." (OU2 ROD Amendment #1, page 38)

Is this remedy component being implemented?

No. As discussed previously, since the area of lead concentrations that exceed the groundwater cleanup level no longer extends to the extraction wells, the extraction system has been shut off and this remedy component is not currently being implemented.

7.3 REMEDY COMPONENT #3: DISCHARGE OF EXTRACTED WATER

Description: "Extracted groundwater will be pretreated onsite (as necessary) to meet the sanitary sewer discharge limit." (OU2 ROD Amendment #1, page 38)

Is this remedy component being implemented?

No. As discussed previously, since the area of lead concentrations that exceed the groundwater cleanup level no longer extends to the extraction wells, the extraction system has been shut off and this remedy component is not currently being implemented.

7.4 REMEDY COMPONENT #4: LAND USE CONTROLS

Description: "LUCs will be established to protect the groundwater extraction, treatment, and monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer." (OU2 ROD Amendment #1, page 39)

Performance Standard (how do you know when you're done):

For initial implementation, when the USEPA and MPCA have provided consistency approval for an OU2 Land Use Control Remedial Design (LUCRD) document. Implementation will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site C groundwater, and is it being implemented?

Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2012; however, this revision did not affect land use controls at Site C.

Was an annual site inspection for land use controls conducted in FY 2012?

Yes. On July 12, 2012, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs?

No.

7.5 OVERALL REMEDY FOR SITE C SHALLOW GROUNDWATER

Performance Standard (how do you know when you're done):

When the cleanup levels in Table 1 of OU2 ROD Amendment #1 have been attained throughout the areal and vertical extent of the Site C plume.

Has the Site C shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD Amendment #1 been attained throughout the areal and vertical extent of the Site C plume)?

No. Table 7-2 and 7-3 present the FY 2012 groundwater and surface water quality data, respectively, and highlight the values that exceed the lead cleanup level. Figure 7-3 shows the lead results for groundwater and surface water. Figure 7-4 and 7-5 show the lead concentrations plotted on geologic cross sections for Site C to illustrate the vertical extent of contamination (the cross section locations are illustrated on Figure 7-3). In FY 2012, lead exceeded the groundwater cleanup level of 15 µg/L in the monitoring well nearest the source area (MW-13), with a concentration of 58 µg/L. This was the only well that exceeded the groundwater cleanup level during FY 2012. Surface water monitoring results were all below the surface water cleanup level in FY 2012.

The water quality trends for MW-3, 13, 14, and 15 are shown on Figure 7-6. MW-13, located closest to the source area, had a slight increase from the FY 2011 result, but overall, a steadily decreasing trend is evident. The MW-3 result decreased from the FY 2011 result and remained below the groundwater cleanup level of 15 µg/L. This well continues to show a decreasing trend overall. The MW-14 result decreased from the FY 2011 result and dropped below the groundwater cleanup level. The MW-15 result increased from FY 2011, but remained below the groundwater cleanup level.

Were any trigger levels exceeded at any of the contingency locations?

No. The Site C contingency locations and trigger levels are shown in Table 7-4. Depending on the location, the trigger level is either equal to the groundwater cleanup level or the surface water cleanup level. The groundwater results (Table 7-2) and surface water results (Table 7-3) show that none of the trigger levels were exceeded in FY 2012. If a trigger level were to be exceeded, the Army would implement the contingency action(s) specified in the footnotes to Table 7-4.

Can it be determined whether the extraction system should be dismantled? (If the extraction system should be dismantled and site closure is not yet possible, a recommendation to formally change the remedy should be made.)

No, the determination cannot be made yet. FY 2012 was the fourth year of evaluation following extraction system shutdown. The somewhat elevated concentration at MW-13 suggests that additional monitoring is needed before this determination can be made. However, the decreasing lead concentration trends (overall) in the two monitoring wells closest to the source area (MW-3 and 13) continue to suggest that, overall, this site is trending towards meeting the cleanup levels, especially given that only one monitoring well remains above the cleanup level (MW-13).

Do additional remedial measures need to be addressed?

No. Continued monitoring will provide the additional data needed to determine if the extraction system can be dismantled.

Table 7-1

Summary of Site C Shallow Groundwater Monitoring Requirements
Fiscal Year 2012

Remedy Component	Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1: Groundwater and Surface Water Monitoring	Outlined below		
#2: Groundwater Containment	a. None. The groundwater extraction system was shut down in November 2008, since the area of groundwater that exceeded the groundwater cleanup level no longer extended to the extraction wells.		
#3: Discharge of Extracted Water	a. None (see #2 above).		
#4: LUCs to Restrict Well Installation and to Protect the Remedy Infrastructue	a. None.		
OR: Overall Remedy (Attainment of cleanup goals)	a. Groundwater quality data throughout the Site C plume to evaluate attainment and to verify that the groundwater extraction system can remain off. Also surface water data in the plume vicinity to verify that groundwater does not impact surface water above surface water standards.	Army	Site C Monitoring Plan in the Annual Report

Table 7-2
Water Quality Data for Site C Groundwater

Fiscal Year 2012

Sample Location		Date Collected	Lead (Dissolved) (µg/l)	L	D
Groundwater Cleanup Level[1]:			15		
Monitoring Wells:					
01U561 (MW1)		6/18/12	0.15	U	
01U562 (MW2)		6/18/12	0.15	U	
01U563 (MW3)		6/18/12	5.6		
01U564 (MW4)		6/18/12	0.15	U	
01U566 (MW6)		6/18/12	0.15	U	
01U567 (MW7)		6/18/12	0.27	J	
01U568 (MW8)		6/18/12	0.15	U	
01U570 (MW10)		6/18/12	0.27	J	
01U571 (MW11)		6/18/12	0.15	U	
01U571 (MW11)	D	6/18/12	0.15	U	
01U572 (MW12)		6/18/12	0.15	U	
01U573 (MW13)		6/18/12	**58**		
01U574 (MW14)		6/18/12	4.8		
01U575 (MW15)		6/18/12	8.0		
01U576 (MW16)		6/18/12	0.15	U	
01U045		6/18/12	0.15	U	
01U046		6/18/12	0.15	U	
01U085		6/18/12	0.15	U	

Table 7-2
Water Quality Data for Site C Groundwater

Fiscal Year 2012

Sample Location		Date Collected	Lead (Dissolved) (µg/l)	L	D
Groundwater Cleanup Level[1]:			15		
Extraction Wells:					
01U551 (EW1)		6/18/12	0.15	U	
01U552 (EW2)		6/18/12	0.15	U	
01U552 (EW2)	D	6/18/12	0.15	U	
01U553 (EW3)		6/18/12	0.24	J	

Notes:

Laboratory Concentration Qualifiers (L):

U Analyte was not detected above the Method Detection Limit (MDL).

J Reported value is between the Method Detection Limit (MDL) and the Reporting Limit (RL).

Data Validation Qualifiers (D):

(None)

Other Notes:

D Duplicate

(1) The cleanup level for Site C Groundwater is from Table 1 of OU2 ROD Amendment #1. Bolding (in red color) indicates exceedance of the cleanup level.

Table 7-3
Water Quality Data for Site C Surface Water

Fiscal Year 2012

Sample Location		Date Collected	Lead (Dissolved) (µg/l)	L	D
Surface Water Cleanup Level[(1)]:			6.9		
SW 05		6/18/12	0.15	U	
SW 05		6/19/12	0.15	U	
SW 05	D	6/19/12	0.15	U	
SW 05		6/20/12	0.17	J	
SW 06		6/18/12	0.56		
SW 06		6/19/12	0.15	U	
SW 06		6/20/12	0.15	U	
NE Wetland		6/18/12	0.26	J	
NE Wetland		6/19/12	0.26	J	
NE Wetland		6/20/12	0.15	U	

Notes:

Laboratory Concentration Qualifiers (L):

U Analyte was not detected above the Method Detection Limit (MDL).

J Reported value is between the Method Detection Limit (MDL) and the Reporting Limit (RL).

Data Validation Qualifiers (D):

(None)

Other Notes:

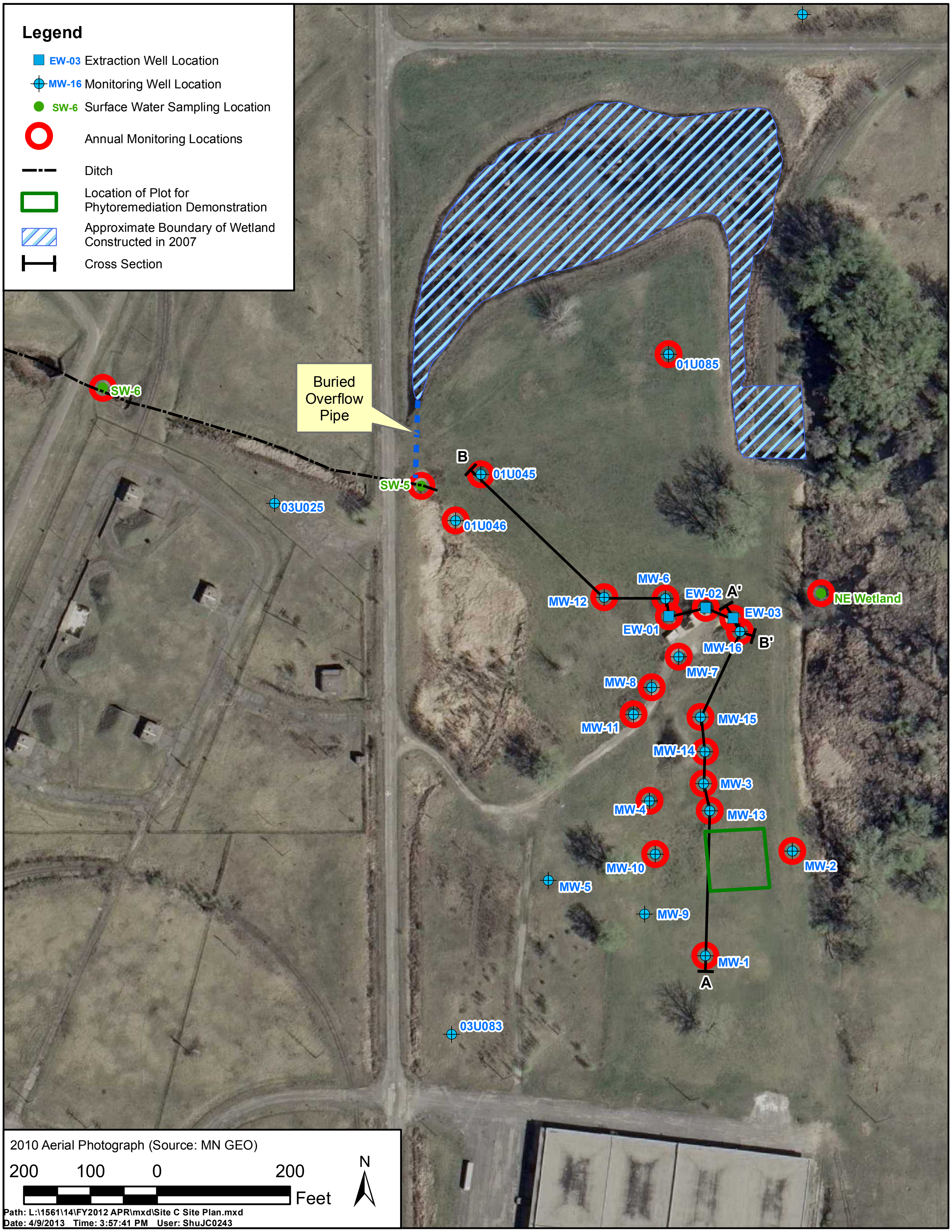
D Duplicate

(1) The cleanup level for Site C Surface Water is from Table 1 of OU2 ROD Amendment #1.

Table 7-4
Contingency Locations for Site C Monitoring

	Contingency Role	
	Trigger for Contingency Action[1]	Contingency Action
MW-4	If 3-event moving average > 15 µg/l	Note 3
MW-6	If 3-event moving average > 6.9 µg/l	Note 3
MW-7	If 3-event moving average > 15 µg/l	Note 3
MW-8	If 3-event moving average > 15 µg/l	Note 3
MW-11	If 3-event moving average > 15 µg/l	Note 3
MW-12	If 3-event moving average > 6.9 µg/l	Note 3
01U046	If 3-event moving average > 6.9 µg/l	Note 4
EW-1	If 3-event moving average > 15 µg/l	Note 5
EW-2	If 3-event moving average > 15 µg/l	Note 5
EW-3	If 3-event moving average > 15 µg/l	Note 5
SW5 [2]	If one sampling event > 6.9 µg/l	Note 4
SW6 [2]	If one sampling event > 6.9 µg/l	Note 6
NE Wetland [2]	If one sampling event > 6.9 µg/l	Note 4

Notes:
1) Water quality monitoring is for dissolved lead in monitoring/extraction wells and surface water.
2) Surface water sampling is performed on three consecutive days and results are averaged for comparison to the trigger.
3) Army notify USEPA/MPCA within 1 week from receipt of data and submit an evaluation report within 30 days from notification.
4) Army notify USEPA/MPCA within 1 week from receipt of data; turn GW Extraction System back on; initiate monthly sampling of SW-5, SW-6, the NE Wetland, and the replacement wetland; and submit an evaluation report within 30 days from notification.
5) Army notify USEPA/MPCA within 1 week from receipt of data; turn GW Extraction System back on; and submit an evaluation report within 30 days from notification.
6) Army notify USEPA/MPCA within 1 week from receipt of data; turn GW Extraction System back on; initiate monthly sampling of SW-5, SW-6, the NE Wetland, and the replacement wetland; and submit an evaluation report within 30 days from notification. If SW-6 exceedance continues for 3 consecutive months, contain the surface water at SW-6, treat (if necessary) and discharge to sanitary sewer.



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Site C, Monitoring Plan

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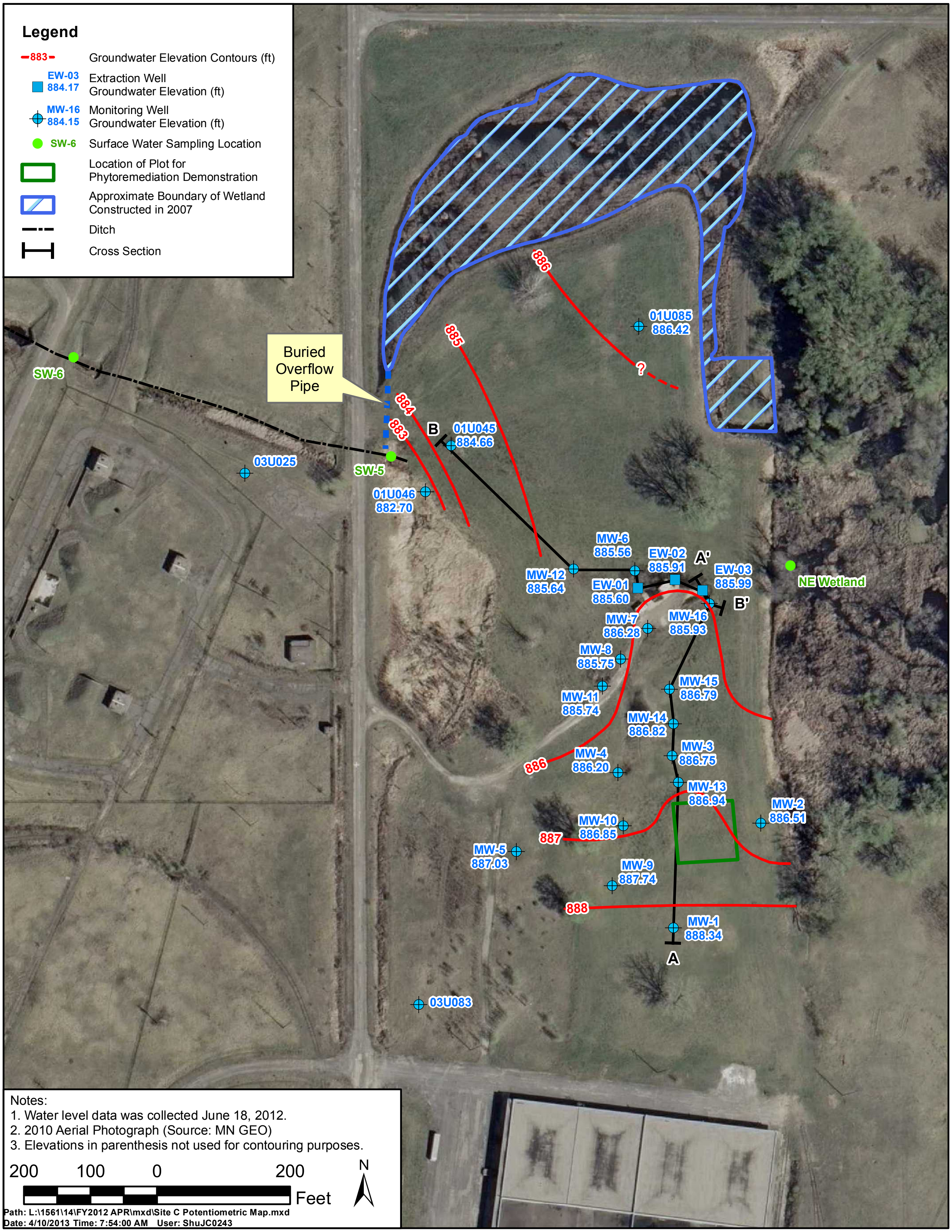
Figure 7-1



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Site C, Unit 1, Potentiometric Map, Summer 2012

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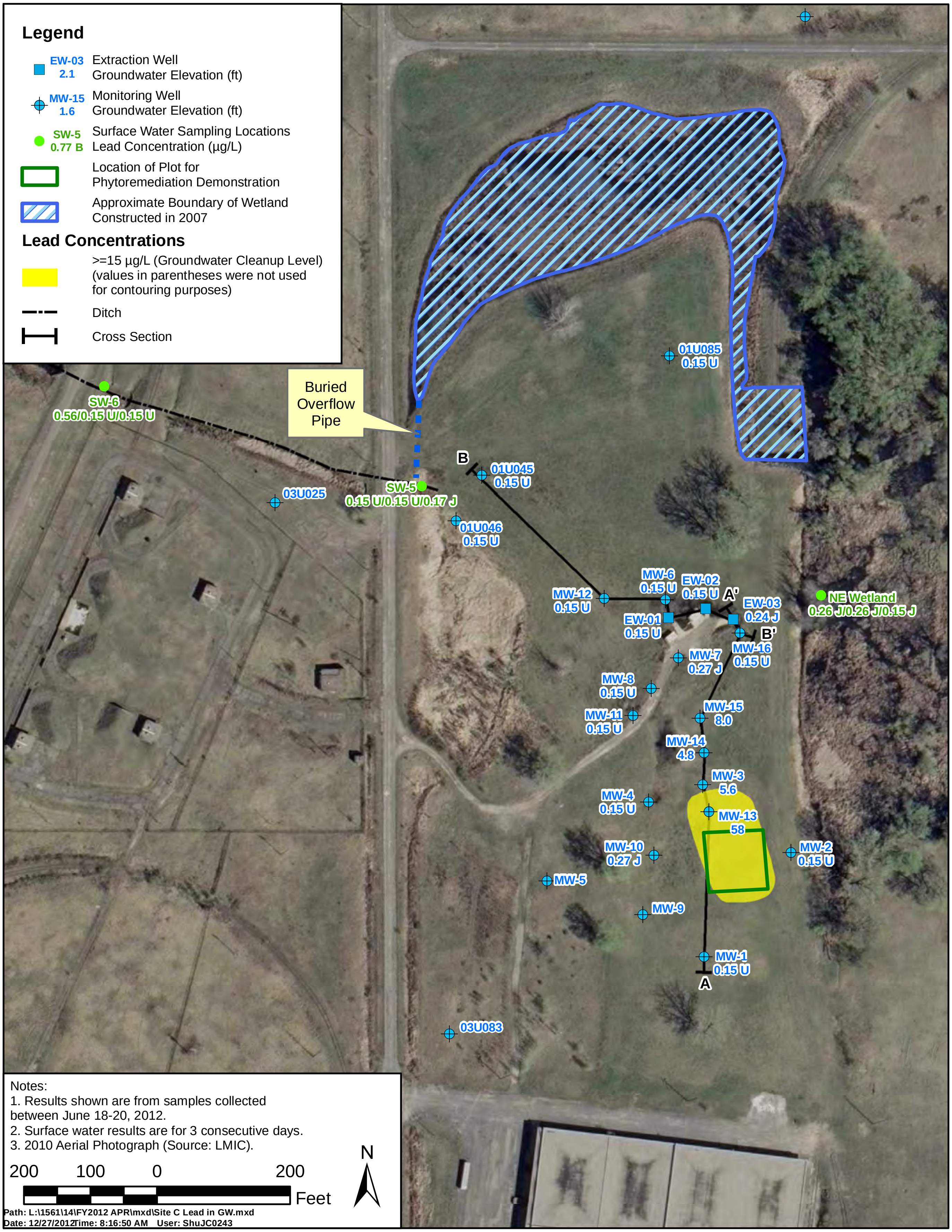
Figure 7-2



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Site C, Unit 1, Lead Results, Summer 2012

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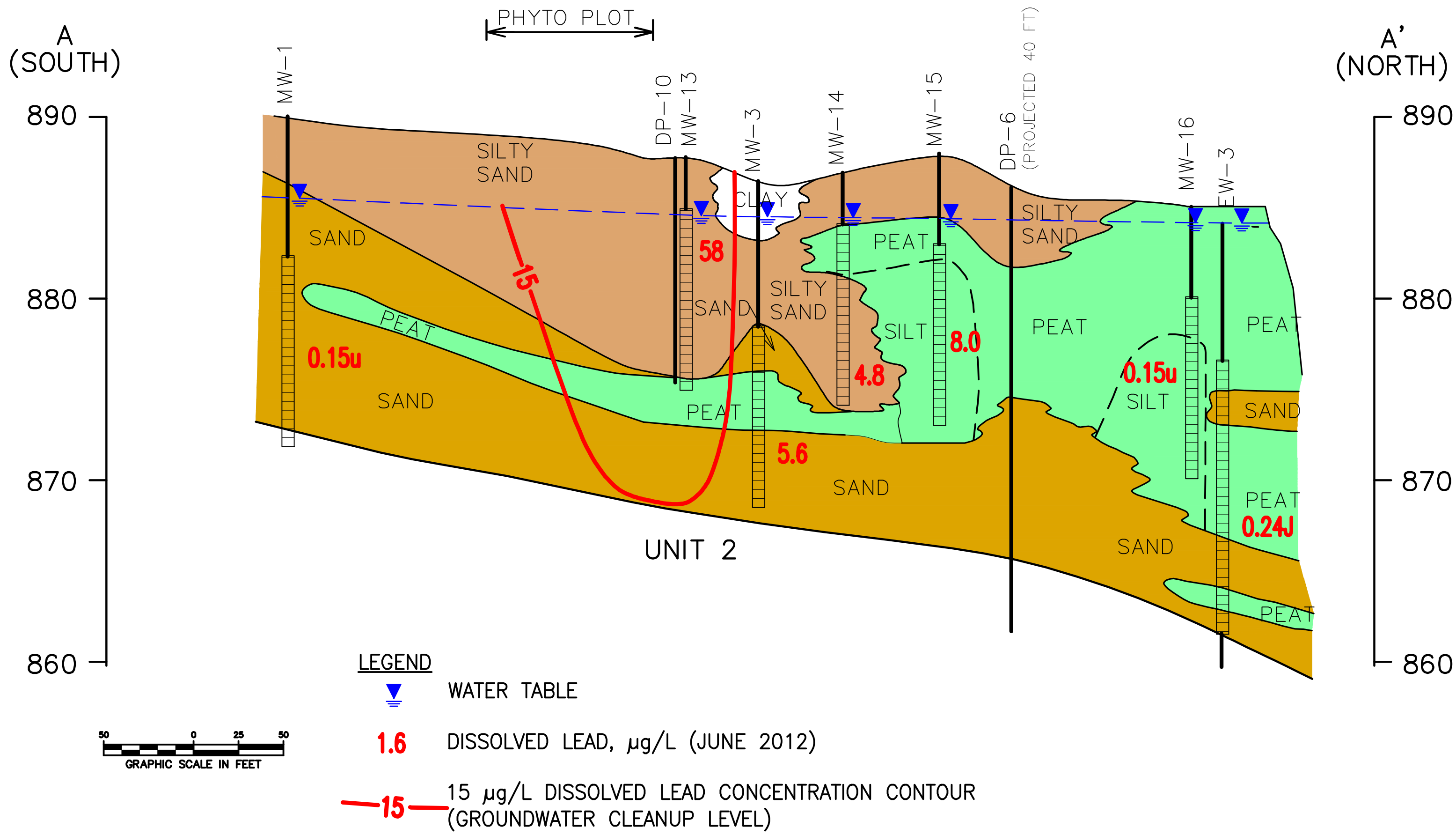
Figure 7-3



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Site C, Cross-Section A-A'

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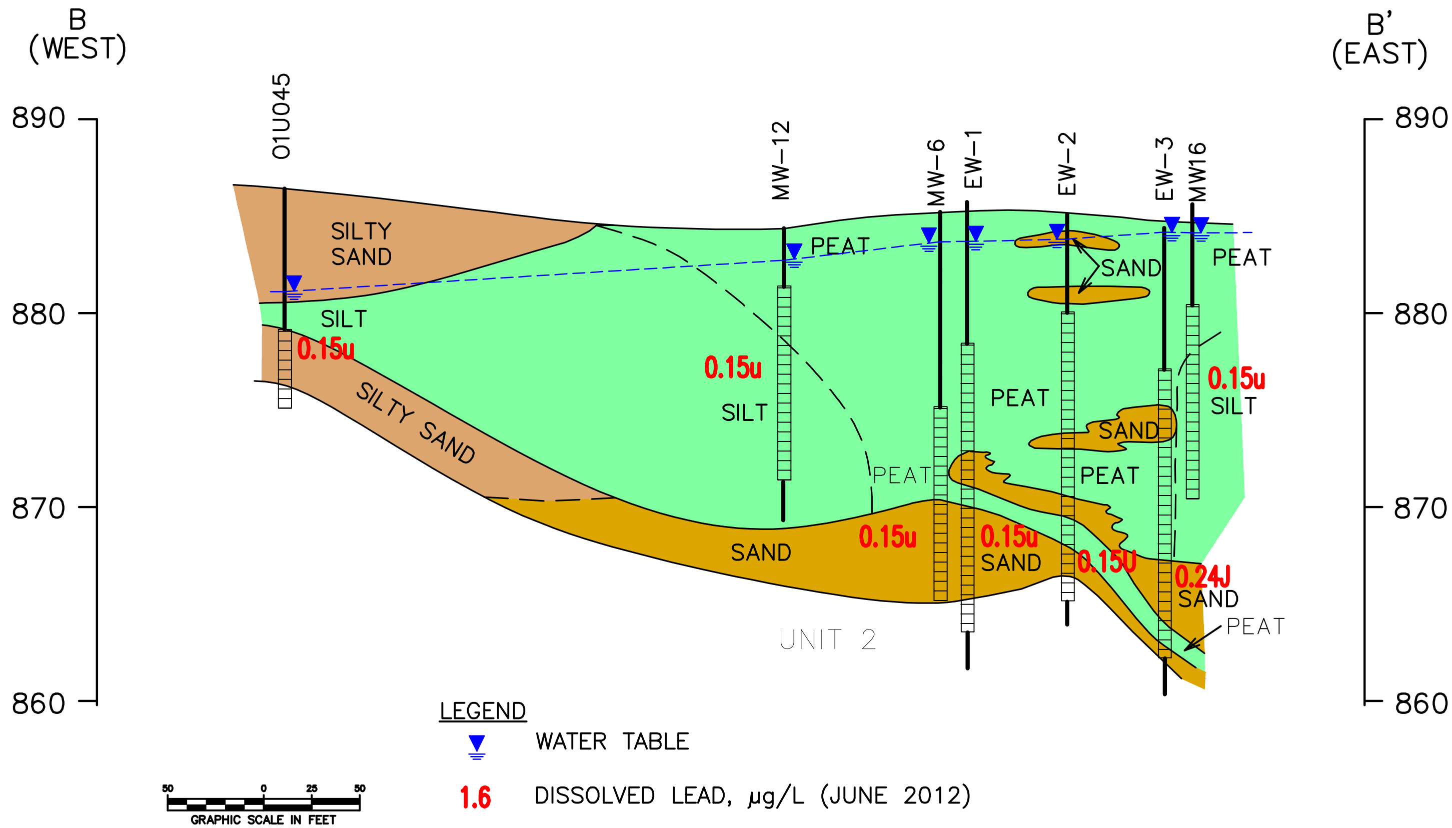
P.O. Box 249
(763) 479-4200

FY 2012

Figure 7-4



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ANNUAL PERFORMANCE REPORT

Site C, Cross-Section B-B'

Wenck

Wenck Associates, Inc. Environmental Engineers

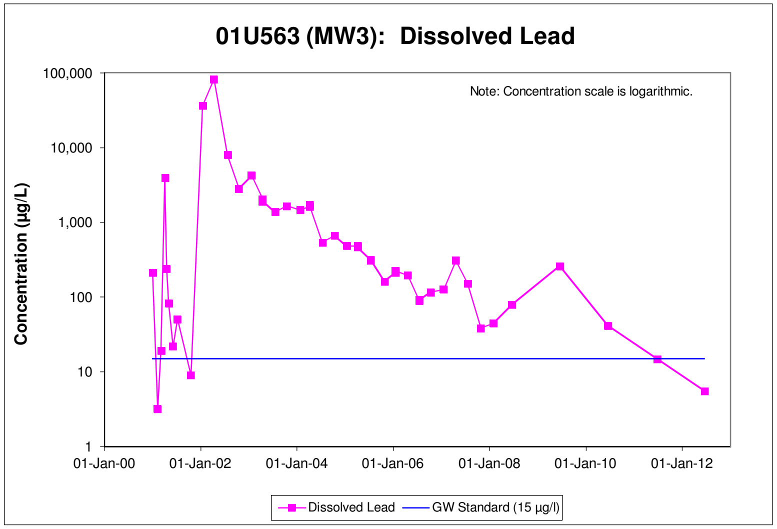
1800 Pioneer Creek Ctr. Maple Plain, MN 55359

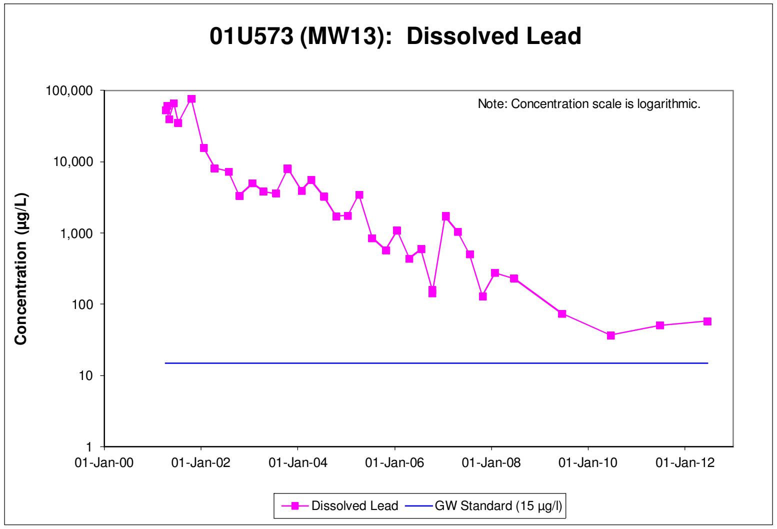
P.O. Box 249 (763) 479-4200

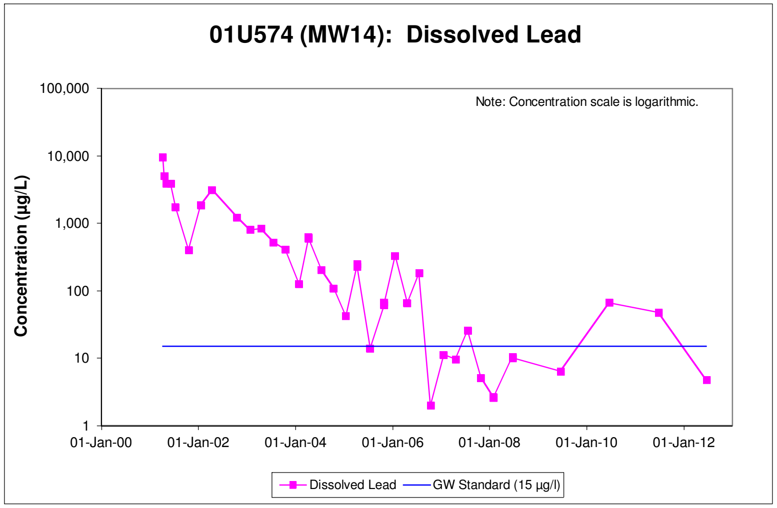
FY 2012

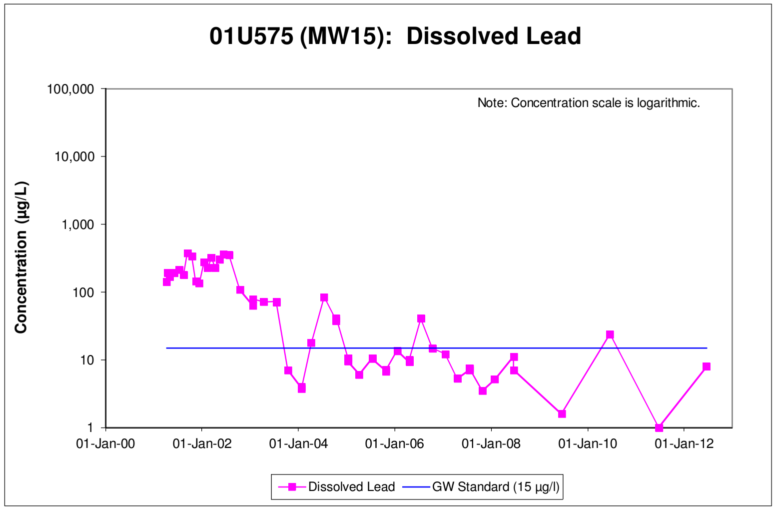
Figure 7-5

FIGURE 7-6
SITE C, LEAD WATER QUALITY TRENDS: MONITORING WELLS
FY 2012 ANNUAL PERFORMANCE REPORT









8.0 Operable Unit 2: Site I Shallow Groundwater

VOCs have been identified in the Unit 1 (perched aquifer) at Site I. The selected remedy in the OU2 ROD (1997) consisted of four components:

- Groundwater monitoring
- Groundwater extraction
- POTW discharge
- Additional characterization

The additional investigation and Predesign Investigation Work Plan (Work Plan) were completed in FY 2000. Based on these documents, the remedy was proposed to consist of a dual-phase vacuum extraction system, which combined groundwater extraction with soil vapor extraction, to be installed beneath Building 502. A pilot test of dual-phase extraction subsequently determined that the technology was not feasible due to the low permeability of the Unit 1 aquifer beneath the building.

OU2 ROD Amendment #2 (2009) revised the requirements for shallow groundwater to the following:

- Groundwater monitoring
- Additional characterization
- Land use controls

These three major remedy components are evaluated in the following sections.

8.1 REMEDY COMPONENT #1: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a monitoring plan has been established and ongoing monitoring is in compliance with the plan.

Is the remedy component being implemented?
Yes. Table 8-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. Appendix A summarizes the FY 2012 monitoring plan and any deviations are explained in Appendix C.2.

Eight Unit 1 monitoring wells were planned for sampling at Site I (Building 502) during FY 2012. These wells were 01U064, 01U632, 01U636, 01U639, 01U640, I01MW, I02MW, I05MW and I04MW (482089) as an alternate. Figure 8-1 shows these well locations. For FY 2012, both monitoring wells 01U639 and I04MW were included on the list of monitoring locations. Of the two wells, well 01U639 is the primary sampling location and I04MW is the alternate sampling location in the event monitoring well 01U639 is dry. If it is not possible to collect a groundwater sample from 01U639, then an attempt is made to collect a sample from I04MW. Well 01U639 is selected as the primary location because there are more years of analytical data associated with this location.

Wells 01U632, 01U639, I01MW, I02MW and I05MW were dry at the time of sampling and hydraulic monitoring (see Figure 8-2 for Unit 1 groundwater elevations and Figure 8-3 for Site I geologic cross section). Well 01U636 had sufficient water to conduct hydraulic monitoring but had insufficient levels to conduct sampling with less than 1 inch of water in the well. Groundwater samples were collected from wells 01U064, 01U640 and I04MW. The groundwater samples were analyzed using EPA Method 8260 for VOCs.

The lack of water in Site I monitoring wells during previous years monitoring events has resulted in conducting the annual sampling in March or April to coincide with the typically higher groundwater elevation in early spring.

Is any groundwater sampling proposed prior to the next report? Yes. Groundwater monitoring at Site I will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component? No.

8.2 REMEDY COMPONENT #2: ADDITIONAL INVESTIGATION

Description: "Additional characterization of the Unit 1 and Unit 2 soil and groundwater." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the work has been completed according to an Agency approved work plan.

Has the remedy component been implemented?
Yes. The results of the additional investigation were included in the Work Plan. The additional investigation resulted in a pilot study to evaluate the applicability of dual-phase vacuum extraction technology to the site. The report concluded that neither dual-phase extraction nor groundwater extraction is feasible at Site I. The May 2009 OU2 ROD Amendment removed the groundwater extraction and POTW discharge component of the remedy.

Are any changes or additional actions required for this remedy component? No.

8.3 REMEDY COMPONENT #3: LAND USE CONTROLS

Description: "LUCs will be established to protect the groundwater extraction, treatment, and monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer." (OU2 ROD Amendment #1, page 39)

Performance Standard (how do you know when you're done):
Implementation of the land use controls will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site I groundwater, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the Revision 2, OU2 LUCRD in June 2011 and it is being implemented by the Army.

Was an annual site inspection for land use controls conducted in FY 2012?
On July 12, 2012, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs?
No.

8.4 OVERALL REMEDY FOR SITE I SHALLOW GROUNDWATER

Performance Standard (how do you know when you're done):
When the cleanup levels in Table 1 of the OU2 ROD have been attained throughout the areal and vertical extent of the Site I plume (OU2 ROD, page 55).

Has the Site I shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD been attained throughout the areal and vertical extent of the Site I plume)?

No. Table 8-2 presents the FY 2012 groundwater quality data and highlights the values that exceed a cleanup level. Groundwater was present in sufficient volumes to collect groundwater monitoring samples from three Site I monitoring well (01U064, 01U640, and I04MW)**.** The concentration of vinyl chloride in 01U064 has decreased over time, but was still above the cleanup level in FY 2012.

Do additional remedial measures need to be addressed? No.

TABLE 8-1

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
FISCAL YEAR 2012
SITE I, OU2
ARDEN HILLS, MINNESOTA

Remedy Component		Monitoring Requirements	Responsible Party	Document Containing the Monitoring Plan
#1: Groundwater Monitoring	a.	Groundwater quality and water levels to track remedy progress.	ATK	Site I Monitoring Plan in Annual Performance Report
#2: Additional Investigation	a.	None (completed)		
#3: Land Use Controls	a.	None		
OR: Overall Remedy	a.	Water quality data to evaluate attainment.	ATK	Site I Monitoring Plan in Annual Performance Report

TABLE 8-2

GROUNDWATER QUALITY DATA
FISCAL YEAR 2012
SITE I, OU2
ARDEN HILLS, MINNESOTA

		Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
Site I Cleanup Level [1]		30	70 (total DCE)		0.2
Location	Date	µg/l	µg/l	µg/l	µg/l
01U064	3/28/2012	0.31 (J)	13	0.94 (J)	**0.52 (J)**
01U632	3/28/2012	Dry	Dry	Dry	Dry
01U636	3/28/2012	NS	NS	NS	NS
01U639	3/28/2012	Dry	Dry	Dry	Dry
01U640	3/28/2012	1.2	<1	<1	<1
482086 (I01MW)	3/28/2012	Dry	Dry	Dry	Dry
482088 (I02MW)	3/28/2012	Dry	Dry	Dry	Dry
482089 (I04MW)	3/28/2012	29	0.96 (J)	<1	<1
482089 (I04MW) D	3/28/2012	28	0.77 (J)	<1	<1
482087 (I05MW)	3/28/2012	Dry	Dry	Dry	Dry

Notes:

(1) Cleanup levels for Site I Shallow Groundwater are from the OU2 ROD
J - Value is estimated, analyte is between the method detection limit and reporting limit.
D - Duplicate Sample
NS - Not sampled due to insufficient water in the wells
Bolding indicates exceedances of cleanup levels

LEGEND:

UNIT 1 MONITORING WELLS

NOTE:

WELL NOMENCLATURE:
ERIS OR MN UNIQUE # NAME
(COMMON NAME)

0 50 100 200 Feet

1 inch = 100 feet

N

Geographic Information Systems

Z:\TCAAP\GIS\Site I\2012\Figure 8-1 (Site I MW Map) (121812)11x17.mxd

Stantec

4444 Centerville Road, Suite 140, White Bear Lake, MN 55127 Phone 651.653.9112 www.stantec.com

PREPARED FOR:	SITE I MONITORING WELL LOCATION MAP	FIGURE:
ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		8-1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
182602386	TF	AG	AG	12/18/12

LEGEND:

- UNIT 1 MONITORING WELLS
- UNIT 3 MONITORING WELLS
- 948.38 GROUNDWATER ELEVATION (FEET AMSL)
- NM NOT MEASURED
- A — A' GEOLOGIC CROSS SECTION LOCATION

NOTE:

WELL NOMENCLATURE:
ERIS OR MN UNIQUE # NAME
(COMMON NAME)

0 50 100 200 Feet

1 inch = 100 feet

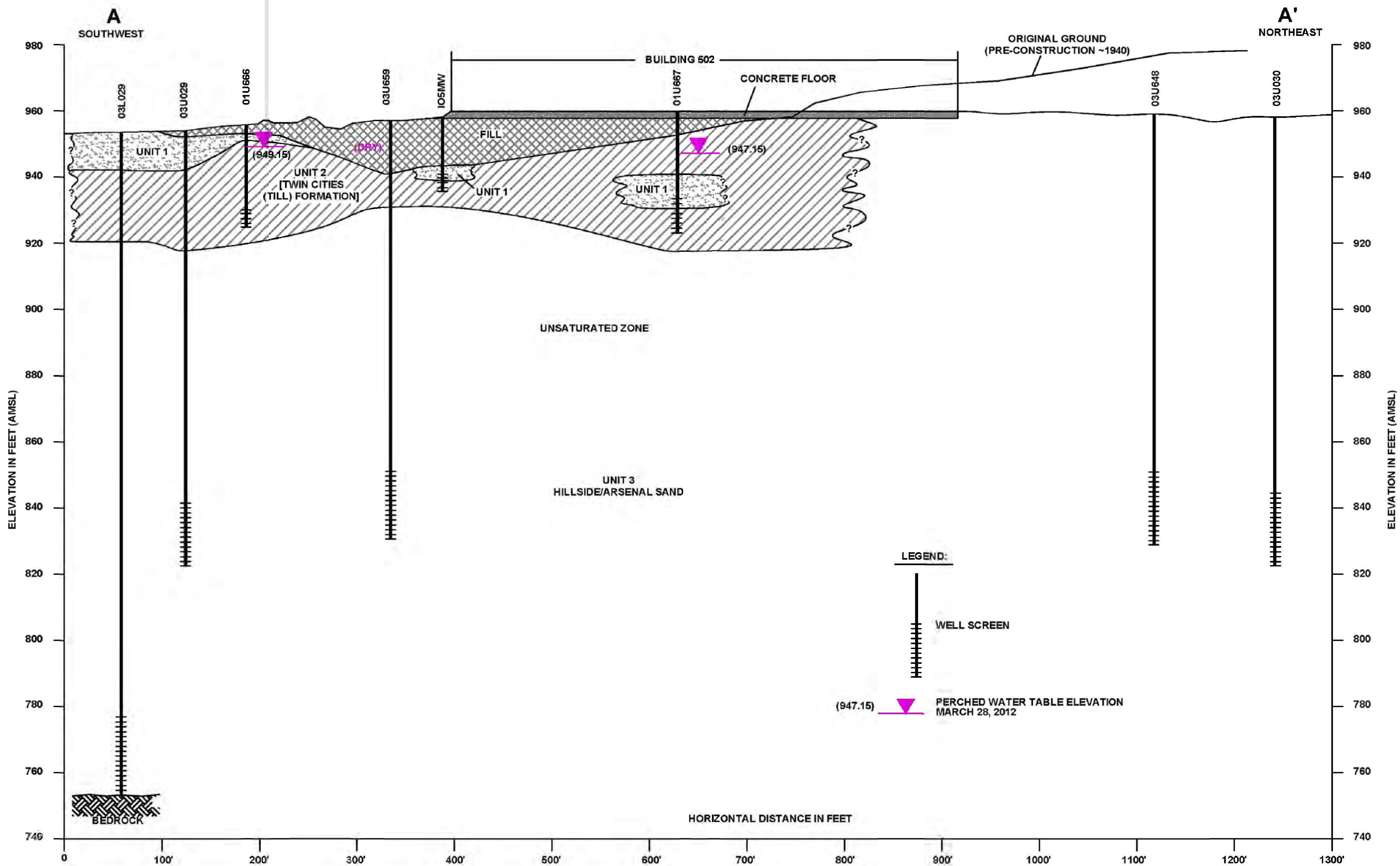
N

Geographic Information Systems

Z:\TCAAP\GIS\Site I\2012\Figure8-2 - Geo X Section.mxd

Stantec 4444 Centerville Road, Suite 140, White Bear Lake, MN 55127 Phone 651.653.9112 www.stantec.com

PREPARED FOR:		SITE I, UNIT 1		FIGURE:
ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		03/28/12 GROUNDWATER ELEVATION MAP AND GEOLOGIC CROSS SECTION		8-2
JOB NUMBER: 182602386	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 12/18/12



Geographic Information Systems

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PREPARED FOR:
ALLIANT TECHSYSTEMS
TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

GEOLOGIC CROSS SECTION A-A'

FIGURE: 8-3

JOB NUMBER: 182602386 | DRAWN BY: KM | CHECKED BY: AG | APPROVED BY: AG | DATE: 12/18/12

9.0 Operable Unit 2: Site K Shallow Groundwater

VOC contamination has been identified in the Unit 1 (perched aquifer) at former Building 103. The limits of the VOC plume in the perched groundwater have been defined to be beneath and immediately northwest of former Building 103.

The remedy selected in the OU2 ROD consisted of seven components that incorporated the existing groundwater extraction trench and air stripper, which began operation in August 1986. The remedy also included additional investigation of the unsaturated soils beneath the building slab. OU2 ESD #1 added land use controls as a remedy component in 2009.

9.1 REMEDY COMPONENT #1: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a monitoring plan is established and monitoring is in compliance with the plan.

Is the remedy component being implemented?
Yes. Table 9-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. Appendix A summarizes the FY 2012 monitoring plan and any deviations are explained in Appendix C.2.

Water levels are collected annually from the monitoring wells and bundle piezometers in the vicinity of the groundwater collection and treatment system. The comprehensive monitoring well sampling round was conducted in June 2012. Figure 9-1 presents the sampling and water level monitoring locations. Figure 9-1 also shows the cross-section alignment.

Is any groundwater sampling proposed prior to the next report? Yes. Groundwater monitoring at Site K will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component? No.

9.2 REMEDY COMPONENT #2: SENTINEL WELLS

Description: "Installation of sentinel wells at the bottom of Unit 1 and top of Unit 3." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the wells have been installed according to a regulator approved work plan.

Is the remedy component being implemented?
Yes. The upper Unit 3 sentinel well was installed in February 2000. The sentinel well was installed to monitor the potential for VOCs to migrate through the Unit 2 till and into the Unit 3 aquifer.

Existing piezometers were used to accomplish the deep Unit 1 sentry monitoring. Piezometers 01U625D, 01U626D, 01U627D, and 01U628D were used since they monitor the base of the Unit 1 aquifer near the trench. The issue is the potential for Dense Non-Aqueous Phase Liquids (DNAPLs) to migrate beneath the trench along the Unit 1/Unit 2 interface. These four piezometers are screened at that interface.

Figure 9-1 shows the location of the upper Unit 3 sentinel well (03U621) and the piezometers.

What are the results of the Unit 1 piezometer and Unit 3 sentinel well sampling?
The piezometers (Unit 1 sentinel wells) were sampled in March 2000 and the results were discussed in the FY 2000 APR. The results did not indicate the presence of DNAPLs at the

Unit 2/Unit 3 interface. This was a one-time sampling event, as required by the MPCA/USEPA approved Predesign Investigation Work Plan, Site K, TCAAP, CRA, February 1999, and as documented in the Predesign Investigation Report, Site K, TCAAP, CRA, December 2001, for which concurrence was received.

The Unit 3 sentinel well (03U621) was sampled in March, July, and September 2000, of FY 2000, and in January 2001 for the quarterly sampling required by the Work Plan. After that, the well was incorporated into the regular TCAAP monitoring plan. The well was sampled in June 2012 for FY 2012. The results of the sample collected during FY 2012 are presented in Table 9-2. There were no COCs detected in the Unit 3 sentinel well at concentrations above the method detection limit.

Are any changes or additional actions required for this remedy component? No.

9.3 REMEDY COMPONENT #3: HYDRAULIC CONTAINMENT

Description: "Use of existing interceptor/recovery trench to contain the plume and remove impacted groundwater." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the trench is operating as designed and capturing all groundwater exceeding the cleanup levels presented in Table 1 of the OU2 ROD, as described below.

Is the remedy component being implemented?
Yes. The groundwater collection system continues to provide capture (as described later) of the Unit 1 groundwater, upgradient of the trench and beneath the Building 103 slab, as designed.

Is the system providing hydraulic capture of the plume?

Yes. Water level data are presented in Table 9-3. Figure 9-2 presents a plan view of the groundwater contours from the June 2012 round of groundwater level measurements. At nested wells, the numerically lowest water elevation was used to create the plan view contours. Monitoring wells downgradient of the extraction trench show consistently higher water levels than those near and upgradient of the trench. This demonstrates that the horizontal hydraulic gradient has been reversed toward the extraction trench due to system operation.

Vertical capture was also effective as illustrated on Figure 9-3. As seen in the figure, groundwater both upgradient and downgradient of the trench is captured and collected. The upward gradient beneath the trench indicates that groundwater does not migrate below the trench. The monitoring coverage provided by the bundle piezometers demonstrates complete vertical and horizontal hydraulic capture.

Figure 9-4 presents the trichloroethene concentrations from the June 2012 annual sampling event. The plume was originally defined based on data from all of the monitoring wells. The current monitoring well network is used to confirm the plume contours and measure the progress of remediation. Thus, the contours on Figure 9-4 were drawn with consideration of the extensive historical data. Comparison of Figure 9-4 to the groundwater elevation contour maps indicates that the VOC plume is hydraulically contained by the treatment system.

Are any changes or additional actions required for this remedy component? No.

9.4 REMEDY COMPONENT #4: GROUNDWATER TREATMENT

Description: "Treatment of contaminated groundwater using air stripping."
(OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the air stripping facility is treating water to the cleanup standards.

Is the remedy component being implemented?
Yes. During FY 2012, the treatment system functioned and was operational 98% of the time. During FY 2012, a regular maintenance schedule was maintained. Appendix F.1 summarizes operational data and events at the groundwater extraction and treatment system.

Are any changes or additional actions required for this remedy component? No.

9.5 REMEDY COMPONENT #5: TREATED WATER DISCHARGE

Description: "Discharge of treated groundwater to Rice Creek." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the system is operating as designed with treated water discharge to the storm sewer that, in turn, discharges to Rice Creek. The water is required to meet the substantive requirements of Document No. MNU000579 (MPCA), which contains the state-accepted discharge limits for surface water. Sampling and analysis are performed to monitor performance (see below).

Is the remedy component being implemented?
Yes. See discussion in Section 9.6.

Are any changes or additional actions required for this remedy component? No.

9.6 REMEDY COMPONENT #6: DISCHARGE MONITORING

Description: "Monitoring to track compliance with discharge requirements." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a monitoring plan is established and is being implemented in accordance with the plan.

Is the remedy component being implemented?
Yes. Treatment system monitoring consisted of quarterly influent and effluent sampling. Influent and effluent analytical results are presented in Table 9-4 (organics) and Table 9-5 (inorganics). The discharge met all the treatment requirements during FY 2012.

Are any changes or additional actions required for this remedy component? No.

9.7 REMEDY COMPONENT #7: ADDITIONAL INVESTIGATION

Description: "Additional characterization of the unsaturated Unit 1 soil." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the additional investigation has been completed according to a regulator approved work plan.

Is the remedy component being implemented?
Yes. The Work Plan was approved in FY 1999. A report of the investigation results received a consistency determination from the Agencies on December 6, 2001. The report defined the extent of VOC contaminated soils beneath Building 103 and refined the location of the source area. The report and subsequent follow up sampling resolved anomalous dissolved zinc, lead,

and nickel data at two monitoring wells. Zinc, lead, and nickel are no longer groundwater concerns.

Are any changes or additional actions required for this remedy component? No.

9.8 REMEDY COMPONENT #8: LAND USE CONTROLS

Description: "LUCs will be established to protect the groundwater extraction, treatment, and monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer." (OU2 ROD Amendment #1, page 39)

Performance Standard (how do you know when you're done):
Implementation of the land use controls will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site K groundwater, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the Revision 2, OU2 LUCRD in June 2011 and it is being implemented by the Army.

Was an annual site inspection for land use controls conducted in FY 2012?
On July 12, 2012, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs? No.

9.9 OVERALL REMEDY FOR SITE K

Performance Standard (how do you know when you're done):

When the cleanup levels in Table 1 of the OU2 ROD have been attained throughout the areal and vertical extent of the Site K plume (OU2 ROD, page 55).

Has the Site K shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD been attained throughout the areal and vertical extent of the Site K plume)?

No. Overall, the remedy for Site K continued to operate consistent with past years and in compliance with the required performance criteria.

Table 9-6 presents the VOC mass removal and monthly flow rates. The treatment system captured and treated 4,669,250 gallons of water resulting in the removal of 14.5 pounds of VOCs from the aquifer in FY 2012. The cumulative mass removal is 298.9 pounds of VOCs.

As shown on Figure 9-4, trichloroethene concentrations range from non-detect to 11,000 μg/L. The FY 2012 concentrations at wells 01U615 and 01U611, which monitor the core of the plume, showed an increase from 2,500 μg/L to 3,400 μg/L in 01U615 and an increase from 8,700 μg/L to 11,000 μg/L in 01U611 compared to the concentrations measured in FY 2011. The FY 2012 concentration of trichloroethene at 01U615 compares with historical concentrations from the last fifteen years of sampling, which have ranged from 1,800 μg/L to 7,300 μg/L. Trichloroethene concentrations at monitoring well 01U611 have been relatively stable over the last ten years of monitoring. Figure 9-5 shows trichloroethene and total 1,2-dichloroethene versus time for 01U611 and 01U615. With the exception of relatively stable trichloroethene concentrations in 01U615 and 01U611 the overall trend throughout Site K continues to show a gradual decrease in trichloroethene concentrations over the last fifteen years of sampling. Water levels measured during the FY 2012 monitoring were 1.0 feet higher at 01U615 and 0.37 feet higher at 01U611 compared to FY 2011 elevations. These wells have historically exhibited fluctuating groundwater elevations.

Three wells (01U128, 01U617, and 01U621) continue to exhibit low and relatively consistent concentrations of 1,2-dichloroethene downgradient of the groundwater collection system's capture zone. The concentrations at these wells were consistent with those measured in FY 2011 and previous years and are below the cleanup levels for Site K.

Do additional remedial measures need to be addressed? No.

9.10 OTHER RELATED ACTIVITY IN FY 2012

Well 01U609 was sampled in June 2012 to monitor the effectiveness of the granular potassium permanganate placement during the 2009 Site K soils excavation. The TCE concentration was 18,000 µg/L and is presented in Table 9-2. Although well 01U609 is not included in the Site K Monitoring Plan presented in Appendix A.1, the laboratory analytical results are presented in Table 9-2. TCE concentrations have remained relatively stable since the addition of potassium permanganate; therefore, future Site K annual sampling events will not include sampling of 01U609. In comparison with four previous sampling events conducted at this well, one of which was collected prior to the placement of the potassium permanganate and one which was conducted 4 months after, the TCE concentration over time does not exhibit any apparent trend.

TABLE 9-1

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
FISCAL YEAR 2012
SITE K, OU2
ARDEN HILLS, MINNESOTA

	Remedy Component		Monitoring Requirements	Responsible Party	Documents Containing the Monitoring Plan
#1:	Groundwater Monitoring		Outlined below		
#2:	Sentinel Wells	a.	Water quality to monitor potential migration.	ATK	Site K Monitoring Plan in Annual Performance Report
#3:	Hydraulic Containment	a.	Water levels for use in drawing contour maps showing capture.	ATK	Site K Monitoring Plan in Annual Performance Report
		b.	Pumping volumes and rates for reporting and mass removal calculation.	ATK	Site K Monitoring Plan in Annual Performance Report
#4:	Groundwater Treatment		None		
#5:	Treated Water Discharge		None		
#6:	Discharge Monitoring	a.	Treated effluent water quality for comparison to substantive requirements criteria for discharge maximum daily concentration.	ATK	Site K Monitoring Plan in Annual Performance Report
#7:	Additional Investigation	a.	None (completed).		

TABLE 9-2

GROUNDWATER QUALITY DATA
FISCAL YEAR 2012
SITE K, OU2
ARDEN HILLS, MINNESOTA

		Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene
Site K Cleanup Level [(1)]		30	70 (total DCE)	
Location	Date	µg/l	µg/l	µg/l
01U128	6/4/2012	<1.0	2.4	0.31 (J)
01U603 (OW103)	6/1/2012	<1.0	<1.0	<1.0
01U604	6/1/2012	<1.0	<1.0	<1.0
01U611 (OW111)	6/1/2012	**11000**	**2500**	**2300**
01U615 (OW115)	6/1/2012	**3000**	**710**	**65**
01U615 (OW115) D	6/1/2012	**3400**	**730**	**65**
01U617 (OW117)	6/1/2012	<1.0	11	0.79 (J)
01U618 (OW118)	6/1/2012	7.3	7.1	1.1
01U619 (OW119)	6/1/2011	0.41 (J)	<1.0	<1.0
01U621 (OW121)	6/4/2012	<1.0	0.49 (J)	<1.0
03U621	6/4/2012	<1.0	<1.0	<1.0
K04MW (482083)	6/1/2012	<1.0	<1.0	<1.0
01U609*	6/1/2012	**18,000**	**1800**	**170**

Notes:

(1) Cleanup levels for Site K Shallow Groundwater are from the OU2 ROD.
D - Duplicate analysis.
J - Value is estimated, analyte is between the method detection limit and reporting limit.
* - Monitoring Well 01U609 not included in Site K Monitoring Plan and will not be sample in future Site K annual sampling events.
Bolding indicates exceedance of the cleanup level.

Table 9-3

GROUNDWATER ELEVATION MONITORING
Fiscal Year 2012
SITE K, OU2
ARDEN HILLS, MINNESOTA

Well ID	*TOC Elevation*	*Depth to Water (ft. BGS)*	*Groundwater Elevation 6/1/2012*
01U047	880.31	5.24	875.07
01U048	885.32	9.77	875.55
01U052	886.51	10.48	876.03
01U065	883.90	8.99	874.91
01U128	883.69	7.37	876.32
01U601	892.68	6.51	886.17
01U602	889.35	2.98	886.37
01U603	887.31	7.04	880.27
01U604	888.98	9.19	879.79
01U605	887.76	8.15	879.61
01U607	891.01	4.47	886.54
01U608	889.30	2.06	887.24
01U609	889.33	3.09	886.24
01U611	889.29	2.97	886.32
01U612	886.91	6.85	880.06
01U613	892.07	6.33	885.74
01U615	888.66	8.53	880.13
01U616	890.37	7.64	882.73
01U617	887.72	7.61	880.11
01U618	891.52	8.54	882.98
01U619	891.75	5.15	886.60
01U620	888.65	6.72	881.93
01U621	886.57	5.53	881.04
01U624A	889.88	8.22	881.66
01U624B	889.88	8.25	881.63
01U624C	889.91	8.27	881.64
01U624D	889.89	8.25	881.64
01U625A	886.92	6.26	880.66
01U625B	886.91	6.24	880.67
01U625C	886.91	6.26	880.65
01U625D	886.92	6.27	880.65
01U626A	886.87	6.86	880.01
01U626B	886.88	6.70	880.18
01U626C	886.88	6.64	880.24
01U626D	886.88	6.60	880.28
01U627A	886.46	5.97	880.49
01U627B	886.47	6.10	880.37
01U627C	886.47	6.15	880.32
01U627D	886.48	6.15	880.33
01U628A	887.82	7.43	880.39
01U628B	887.83	7.49	880.34
01U628C	887.82	7.57	880.25
01U628D	887.84	7.59	880.25
482085 (K01MW)	891.24	4.15	887.09
482084 (K02MW)	891.35	3.94	887.41
482083 (K04MW)	887.66	3.94	883.72
03U621	887.01	32.24	854.77

TABLE 9-4

TREATMENT SYSTEM CONCENTRATIONS (ORGANICS)
FISCAL YEAR 2012
SITE K, OU2
ARDEN HILLS, MINNESOTA

Location	*Sample Date*	1,1-Dichloroethane		1,1-Dichloroethene		1,2-Dichloroethane		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		Trichloroethene		Vinyl chloride	
Effluent	12/1/2011	<1		<1		<1		<1		<1		<1		<1	
Effluent	3/7/2012	<1		<1		<1		<1		<1		<1		<1	
Effluent	6/4/2012	<1		<1		<1		0.37	JP	<1		0.87	JP	<1	
Effluent	9/12/2012	<1		<1		<1		3.1		<1		2.7		<1	
Influent	12/1/2011	<1		<1		<1		74		13		140		0.58	JP
Influent	12/1/2011	<1	D	<1	D	<1	D	76	D	14	D	150	D	0.62	D,JP
Influent	3/7/2012	<1		<1		<1		5.8		0.7	JP	86		<1	
Influent	3/7/2012	<1	D	<1	D	<1	D	6.5	D	0.86	D,JP	95	D	<1	D
Influent	6/4/2012	<1		<1		<1		100		14		310		0.68	JP
Influent	6/4/2012	<1	D	<1	D	<1	D	100	D	14	D	300	D	0.69	D, JP
Influent	9/12/2012	<1		<1		<1		100		18		170		0.48	JP
Influent	9/12/2012	<1	D	<1	D	<1	D	100	D	18	D	180	D	0.43	D, JP
MDL	12/1/2011, 3/7/2012, 6/4/2012, 9/12/2012	0.30		0.30		0.30		0.30		0.30		0.30		0.30	
RL		1		1		1		1		1		1		1	
REQ.		--		7.0		3.8		70		100		10		0.18	

Notes:
Results are reported in µg/L unless otherwise noted.
RL - Reporting Limit
D - Duplicate Analysis
JP - Value Estimated. Result is less than reporting level but greater than method detection limit.
MDL - Method Detection Limit
REQ - Substantive Requirement Document Concentration Limit, Maximum Daily Effluent Concentration

TABLE 9-5

TREATMENT SYSTEM CONCENTRATIONS (INORGANICS)
FISCAL YEAR 2012
SITE K, OU2
ARDEN HILLS, MINNESOTA

Location	*Sample Date*	*Phosphorus Total*		*Copper*		*Cyanide*		*Lead*		*Mercury*		*Silver*		*Zinc*
Effluent	12/1/2011	350	JP, UCB 0.242	5.60		5.00	U	0.45	JP	0.035	U	0.15	U	9.4
Effluent	3/7/2012	250	JP	4.10		3.90	U	0.36	JP, UCB 0.17	0.036	UMB 0.0397	0.15	U	14
Effluent	6/5/2012	150	U	1.30	JP	3.90	U	0.15	U	0.031	U	0.15	U	6.1
Effluent	9/12/2012	810		1.50	JP	3.90	U	0.29	JP	0.031	U	0.15	U	6.4
MDL	12/1/2011	150		0.30		5.00		0.15		0.035		0.15		0.30
	3/7/2012	150		0.30		3.90		0.15		0.031		0.15		0.41
	6/5/2012	150		0.30		3.90		0.15		0.031		0.15		0.41
	9/12/2012	150		0.30		3.90		0.15		0.031		0.15		0.41
RL		500		2		10		2		0.100		2		3
REQ.		1000		21		17		106		0.2		3.4		134

Notes:
Results are reported in µg/L unless otherwise noted.
RL - Reporting Limit
MDL - Method Detection Limit
REQ - Substantive Requirement Document Concentration Limit, Maximum Daily Effluent Concentration
JP - Analyte value is between the MDL and RL.
U- Analyte not detected above Method Detection Limit
UCB# - Contamination present in initial calibration blank and continuing calibration blank; # = concentration present in Blanks
UMB# - Contamination present in method blank, # = concentration present in Blank

TABLE 9-6

SUMMARY OF MONTHLY VOC REMOVAL
FISCAL YEAR 2012
SITE K, TCAAP
ARDEN HILLS, MINNESOTA

Month	Total Monthly Flow (million gallons)	Total VOC Influent Concentration	Total VOC Effluent Concentration	Total VOCs in Treatment Center Discharge (g)	Total VOC Mass Removed (g)	Total VOC Mass Removed (lb)
Cumulative As Of September 2011 (FY11)						284.4
October[(1)]	0.49884	240.62	0	0.00	453.72	1.00
November[(1)]	0.37475	240.62	0	0.00	340.85	0.75
December	0.34129	240.62	0	0.00	310.42	0.68
January[(1)]	0.31127	375.90	0	0.00	442.28	0.97
February[(1)]	0.25255	375.90	0	0.00	358.85	0.79
March	0.31524	375.90	0	0.00	447.93	0.99
April[(1)]	0.38102	424.68	1.24	1.79	609.86	1.34
May[(1)]	0.58698	424.68	1.24	2.75	939.52	2.07
June	0.61429	424.68	1.24	2.88	983.23	2.17
July[(1)]	0.61682	288.48	5.8	13.52	659.09	1.45
August[(1)]	0.55830	288.48	5.8	12.24	596.56	1.31
September	0.43219	288.48	5.8	9.48	461.80	1.02
Totals - FY12	4.66925			42.7	6604.1	14.5
Cumulative To Date						298.9

Notes:
[(1)] Influent and Effluent VOC concentrations from 12/01/11, 03/07/12, 06/04/12 and 09/12/12 quarterly samples, respectively.
Calculations based on compounds with concentrations above the CRDL only.

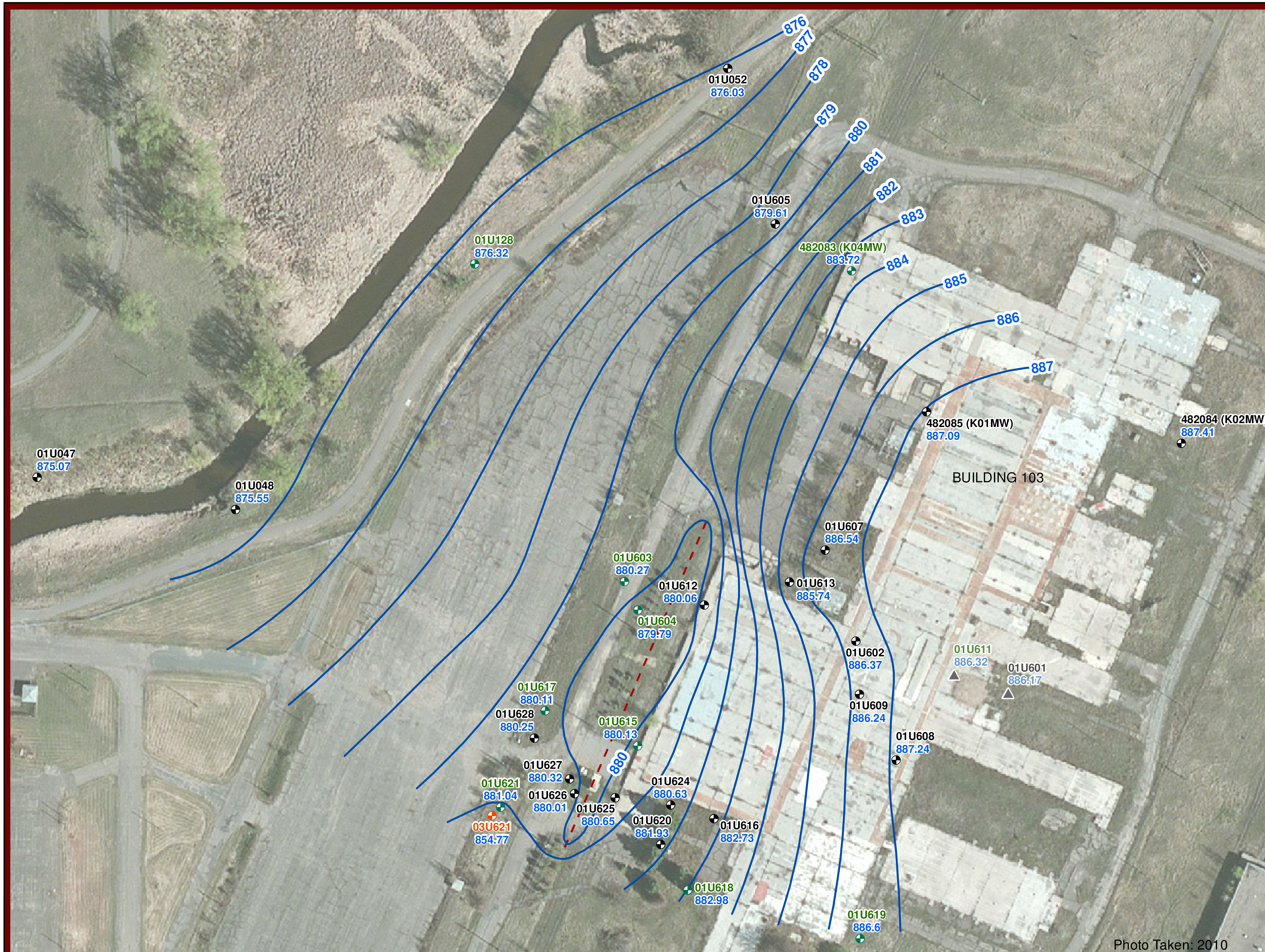
Geographic Information Systems

Z:\TCAAP\GIS\Site K\2012\Figure9-1.mxd

Stantec

4444 Centerville Road, Suite 140, White Bear Lake, MN 55127 Phone 651.653.9112 www.stantec.com

PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE K MONITORING WELL LOCATION MAP		FIGURE: 9-1
JOB NUMBER: 182602386	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 12/18/12



Legend

- ANNUAL WELLS
- MONITORING WELLS
- CLASS 3 SENTINAL WELL
- POTENTIOMETRIC SURFACE
- TRENCH LOCATION
- 874.10 GROUNDWATER ELEVATION (FEET AMSL)
- ▲ NOT USED FOR CONTOURING

NOTE:

1) WELL NOMENCLATURE: ERIS OR MN UNIQUE # NAME (COMMON NAME)
2) BUILDING 103 DEMOLISHED IN 2006; CONCRETE SLAB REMAINS

0 60 120 240 Feet

1 inch = 120 feet

N

Geographic Information Systems

Z:\TCAAP\GIS\Site K\2012\Figure9-2.mxd

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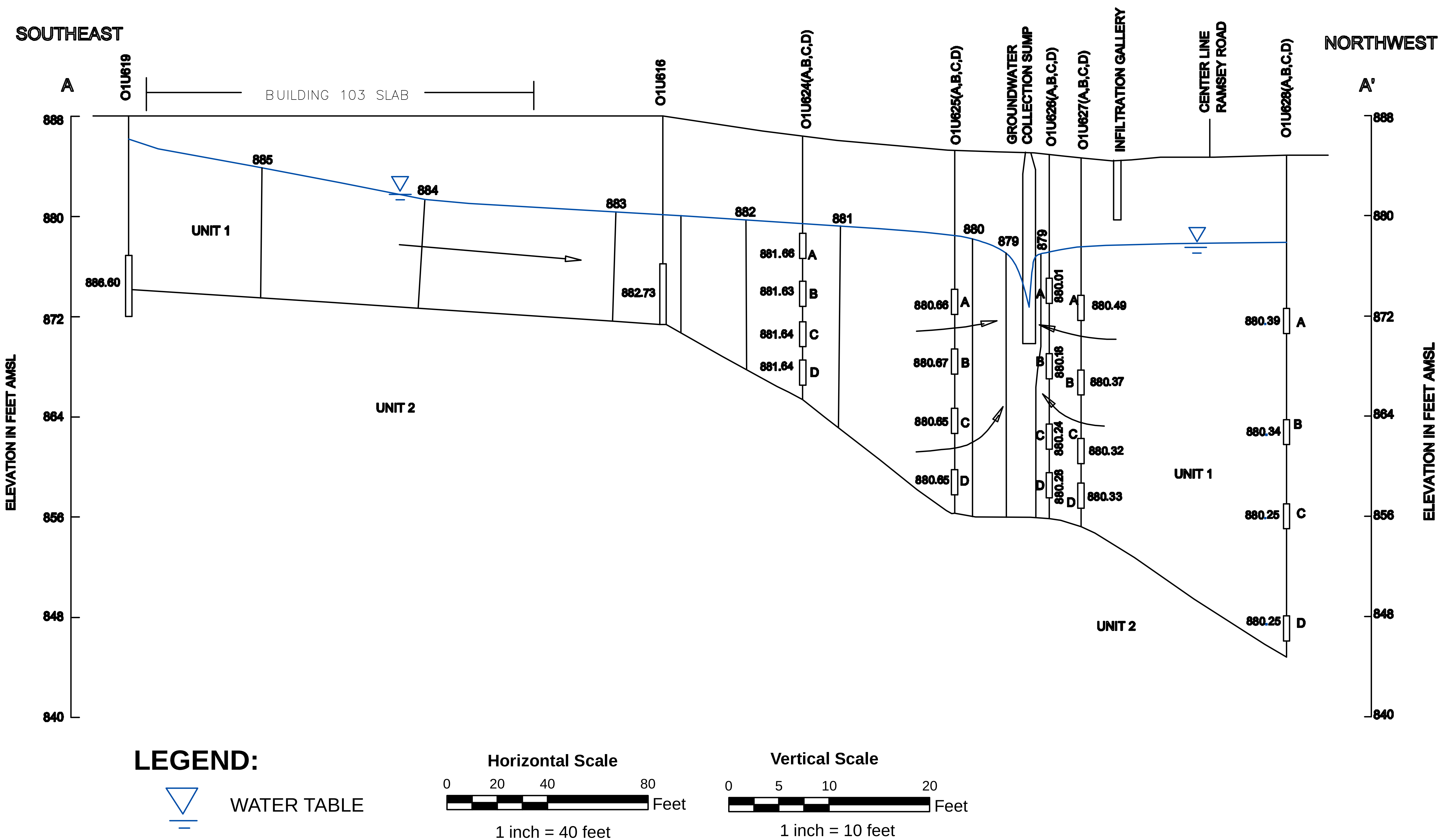
PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE K, UNIT 1 AND UNIT 3 GROUNDWATER ELEVATION DATA 06/01/12		FIGURE: 9-2	
JOB NUMBER: 182602386	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 12/18/12	



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PREPARED FOR:
ALLIANT TECHSYSTEMS
TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE K
HYDROGEOLOGIC CROSS SECTION A-A'
06/01/12 (Q115)

FIGURE: 9-3

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
182602386	TF	AG	AG	12/18/12

Legend

- ANNUAL WELLS
- MONITORING WELLS
- CLASS 3 SENTINAL WELL
- TRENCH LOCATION
- TRICHLOROETHENE CONCENTRATION CONTOUR
- 4400 TRICHLOROETHENE CONCENTRATION (µg/L)
- ND NOT DETECTED
- J VALUE IS ESTIMATED

NOTE:

1) WELL NOMENCLATURE:
ERIS OR MN UNIQUE # NAME
(COMMON NAME)

2) BUILDING 103 DEMOLISHED
IN 2006; CONCRETE SLAB
REMAINS

0 60 120 240
Feet
1 inch = 120 feet

N

Geographic Information Systems

Z:\TCAAP\GIS\Site K\2012\Figure9-4.mxd

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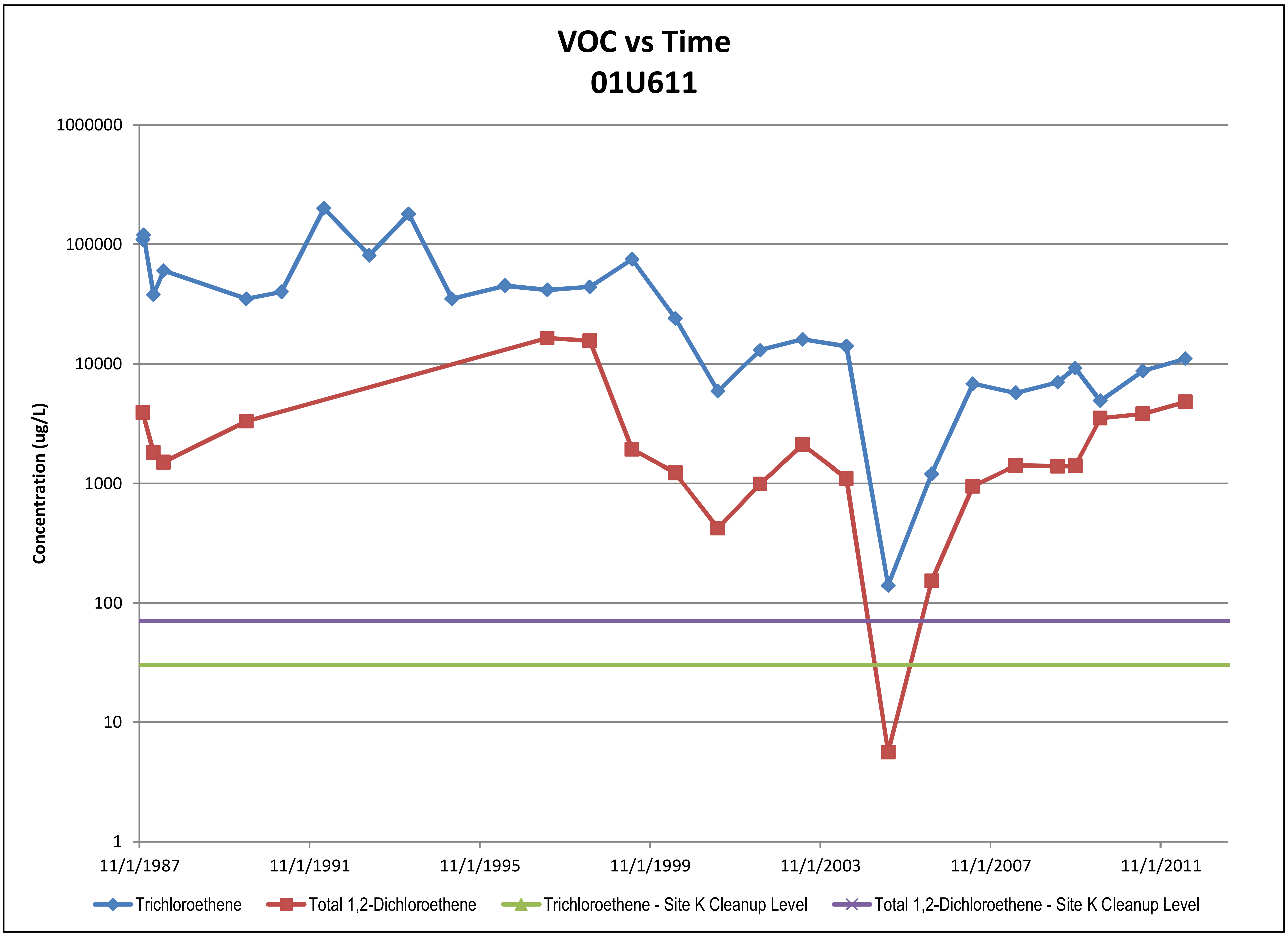
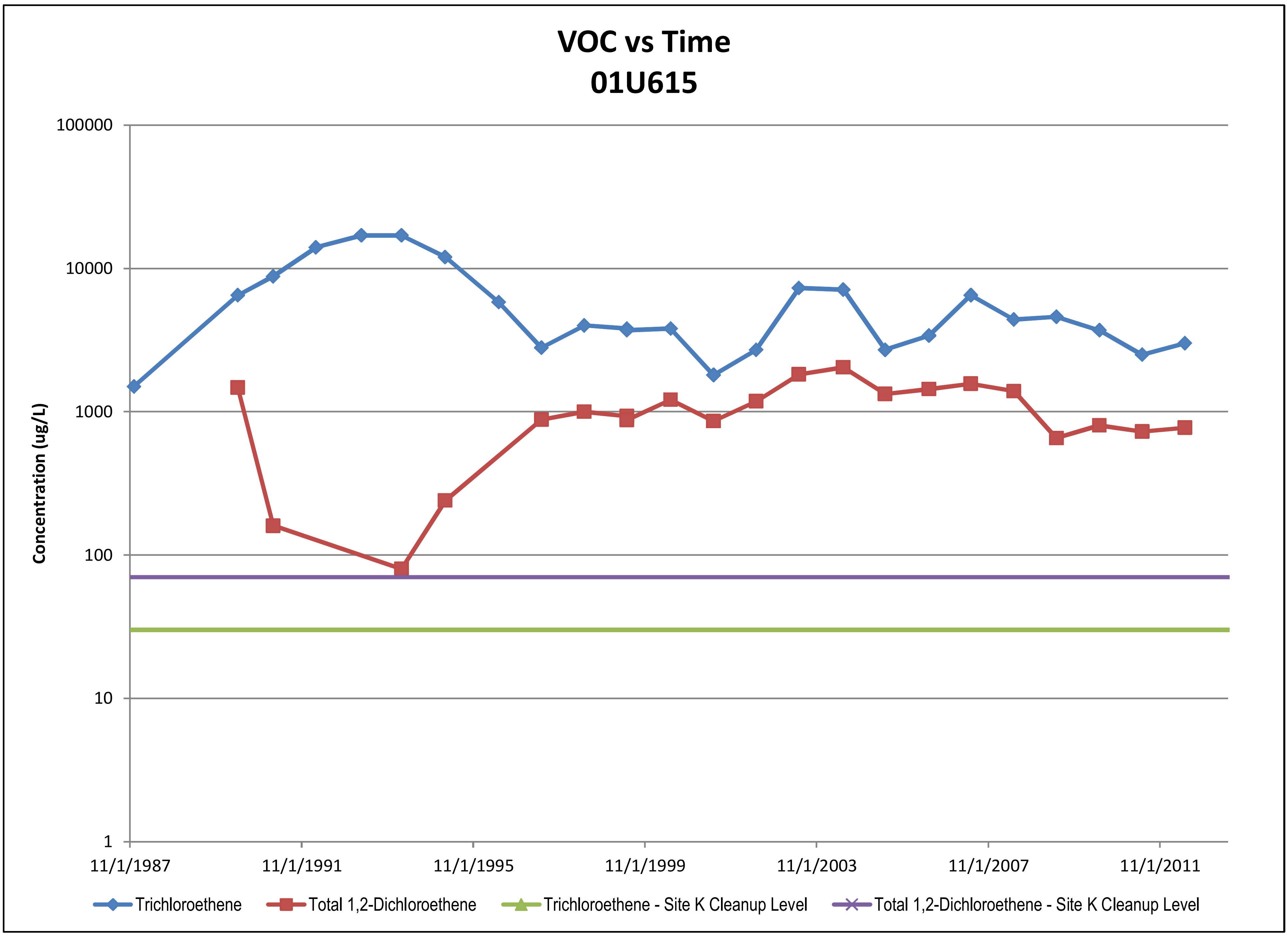
PREPARED FOR:		SITE K, UNIT 1 AND UNIT 3		FIGURE:
ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		TCE CONCENTRATION MAP 06/01/12 (Q115)		9-4
JOB NUMBER: 182602386	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 12/18/12





Geographic Information Systems

Z:\TCAAP\GIS\Site K\2012\Figure 9-5.mxd

Stantec 4444 Centerville Road Suite 140, White Bear Lake, MN 55127 Phone 651-653-9112 www.stantec.com

PREPARED FOR:		SITE K VOC VS TIME	FIGURE:
ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		MW-01U615 & MW-01U611 PLOTS	9-5
JOB NUMBER: 182602386	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 01/18/13

10.0 Operable Unit 2: Building 102 Shallow Groundwater

Building 102, located as shown on Figure 10-1, was constructed in 1942 and used periodically until the 1980s for the production of small caliber ammunition and various other munitions components. Between March 2002 and February 2004, shallow (Unit 1) groundwater contamination was discovered emanating from beneath Building 102 (discovered during the Phase I and Phase II Environmental Site Assessment in support of the future transfer of the remaining TCAAP property).

Additional groundwater investigation was conducted and is documented in a Groundwater Investigation Report approved by the USEPA and MPCA in FY 2006. The Army then proceeded to address the remedy for Building 102 shallow groundwater as a non-time critical removal action under CERCLA. To support the EE/CA, additional groundwater investigation was conducted in FY 2007 and FY 2008 to further define the extent and magnitude of groundwater contamination. Delineation was completed and COCs were identified, including trichloroethene and related chlorinated VOCs (trichloroethene was found to be degrading to cis 1,2-dichloroethene and vinyl chloride through abiotic degradation). The EE/CA documenting the additional investigation work and recommending a remedy for the Building 102 shallow groundwater was approved by the USEPA and MPCA in FY 2008.

The Army Action Memorandum documenting the final remedy selection for Building 102 groundwater (monitored natural attenuation) was signed early in FY 2009. The remedy also includes LUCs to prohibit installation of water supply wells into the contaminated portion of the Unit 1 aquifer and to protect the groundwater monitoring system infrastructure (i.e., monitoring wells). OU2 ROD Amendment #4 formally documented selection of MNA and LUCs for the Building 102 groundwater remedy and thereby added this Site to the OU2 remedy.

10.1 REMEDY COMPONENT #1: MONITORED NATURAL ATTENUATION

Description: "Use of naturally-occurring abiotic degradation to limit plume mobility and to ultimately restore the aquifer." (OU2 ROD Amendment #4, page 4-1)

Performance Standard (how do you know when you're done):
When a monitoring program is established and monitoring is in compliance with the regulator approved Annual Monitoring Plan.

Is the remedy component being implemented?
Yes. Appendix A summarizes the FY 2012 monitoring plan and any deviations are explained in Appendix C.2. Details of the groundwater monitoring program are discussed in Section 10.2.

10.2 REMEDY COMPONENT #2: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance and to verify that groundwater reaching Rice Creek does not exceed state surface water standards." (OU2 ROD Amendment #4, page 4-1)

Performance Standard (how do you know when you're done):
When a performance groundwater monitoring program has been established and ongoing monitoring is in compliance with the program.

Is this remedy component being implemented?
Yes. Table 10-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. The FY 2012 Monitoring Plan is included in Appendix A, documenting the water quality monitoring locations and frequencies. Building 102 groundwater level data collected in June 2012 is shown as groundwater elevation contours on Figure 10-2 (Site K water levels are also contoured on this figure to provide a more

complete water level map in the site vicinity). Groundwater quality data collected in FY 2012 is shown in Table 10-2. Groundwater quality data for June 2012 is also shown on plume maps for three of the chemicals of concern: trichloroethene (Figure 10-3), cis-1,2-dichlororethene (Figure 10-4), and vinyl chloride (Figure 10-5). The June 2012 results for vinyl chloride (the chemical that has historically had the largest areal extent) are shown on geologic cross-sections A-A' (Figure 10-6) and B-B' (Figure 10-7).

Were the groundwater monitoring requirements for this remedy met? Yes.

Is any groundwater sampling proposed prior to the next report? Yes. Groundwater monitoring at Building 102 will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component? Yes. The June 2011 results for 01U/01L584 and 01L582 had been noted in the FY 2011 APR to be inconsistent with historical results (i.e., unexpected increases in VOC concentrations). The recommendation in the FY 2011 APR was that if the June 2012 results confirm the increases in these wells, the adequacy of the monitoring locations should be reviewed. The June 2012 results did confirm the increasing trend at these three wells, and a meeting between the Army, MPCA, and USEPA will be held in early FY 2013 to discuss the need for revisions to the monitoring locations and/or frequencies, potentially including additional monitoring locations downgradient of 01L582.

10.3 REMEDY COMPONENT #3: LAND USE CONTROLS

Description: "LUCs to restrict installation of water supply wells into the contaminated portion of the Unit 1 aquifer and to protect the infrastructure related to this alternative (monitoring wells)." (OU2 ROD Amendment #4, page 4-2)

Performance Standard (how do you know when you're done):
Implementation of the land use controls will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Building 102 groundwater, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2011; however, this revision did not affect land use controls for Building 102.

Was an annual site inspection for land use controls conducted in FY 2012?
Yes. On July 12, 2012, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs?
No.

10.4 OVERALL REMEDY FOR BUILDING 102 SHALLOW GROUNDWATER

Performance Standard (how do you know when you're done):
When the cleanup levels in OU2 ROD Amendment #4 have been attained throughout the areal and vertical extent of the Building 102 plume (OU2 ROD Amendment #4, page 2-13).

Has the Building 102 shallow groundwater remedy been completed (i.e., have the cleanup levels in the table on Page 2-13 of OU2 ROD Amendment #4 been attained throughout the areal and vertical extent of the Building 102 plume)?
No. As shown in Table 10-2, cleanup levels have not been reached throughout the areal extent of the plume and the site cannot be closed. Concentrations of trichloroethene, cis-1,2-

dichlororethene, and/or vinyl chloride exceed their respective cleanup levels in six of the monitoring wells at this site.

What impact is MNA having on contaminant concentrations?

Natural attenuation continues to occur at this site, with trichloroethene being the primary VOC evident in the source area vicinity (01U579 and 01U580), and with primarily degradation products being present in downgradient wells (e.g., primarily cis-1,2-dichloroethene in 01L582, and only vinyl chloride in 01U048). Significant changes that were noted in the FY 2012 groundwater quality results include:

- 01U579 and 01U580 (source area): Trichloroethene continued to decreased. Historically, the concentrations in these two wells have shown relative large increases and decreases.
- 01U/01L584 (just downgradient of the source area on the west side): This well had historically had low to non-detect results for VOCs; however, the FY 2012 results for trichloroethene, cis-1,2-dichloroethene, and vinyl chloride were all increased from FY 2011, which confirmed the FY 2011 increase from historical low to non-detect results. The plume appears to have shifted and/or widened in the vicinity of this well nest (see Figures 10-3, 10-4, 10-5 and 10-7).
- 01L582 (further downgradient of the source area): cis-1,2-Dichloroethene increased from 19 to 140 µg/L in FY 2011, and then to 300 µg/L in FY 2012. Vinyl chloride increased from 0.19 to 0.71 µg/L in FY 2011, and then to 1.7 µg/L in FY 2012.
- 01U048 (adjacent to Rice Creek): Vinyl chloride was the only VOC detected in this well. Vinyl chloride increased from <0.05 to 0.046 µg/L in FY 2011, and then to 0.073 µg/L in FY 2012.

The FY 2012 (and FY 2011) results for 01U/01L584 and 01L582 are not consistent with historical results, which had been very stable prior to FY 2011. It appears that high groundwater levels may have contributed to the increasing trends noted above, either by putting groundwater in contact with more contaminated source area soils that had previously been above the water table, and/or by causing slight shifts in the location or size of the plume. Groundwater levels steadily increased from December 2008 through June 2012, with historic highs being reached in June 2011 and increasing to even higher levels in June 2012. At well 01L582, the June 2011 groundwater elevation was almost 4 feet higher than in December 2008, and in June 2012 was another 0.5 feet higher than in FY 2011. The drought conditions in the latter half of 2012 resulted in a 3.5 foot decrease in the groundwater elevation at 01L582 from June 2012 to mid-November 2012. It is possible that the decreasing groundwater levels may cause a reversal of the increasing VOC trends noted above, though this can only be determined from future monitoring.

Were any trigger levels exceeded at the contingency location?

No. The contingency location is 01U048, located next to Rice Creek. The trigger level is equal to groundwater cleanup levels and no compounds of concern for Building 102 groundwater exceeded their respective cleanup levels in FY 2012 (Table 10-2). The concentration of the only detected compound of concern in this well, vinyl chloride, increased slightly in comparison to the FY 2011 concentration, as noted above. The FY 2012 vinyl chloride result of 0.073 µg/L was a little less than half the cleanup level (trigger level) of 0.18 µg/L.

Do additional remedial measures need to be addressed?

No. However, the increasing trends in some of the monitoring wells warrant additional evaluation to verify that MNA is adequately limiting the extent of the plume. As noted previously, a meeting between the Army, MPCA, and USEPA will be held in early FY 2013 to discuss the need for revisions to the monitoring locations and/or frequencies, potentially including additional monitoring locations downgradient of 01L582.

Table 10-1

Summary of Building 102 Shallow Groundwater Monitoring Requirements
Fiscal Year 2012

Remedy Component	Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1: Monitored Natural Attenuation (abiotic degradation)	a. Outlined below		
#2: Groundwater Monitoring	a. Outlined below		
#3: LUCs to Restrict Well Installation and to Protect the Remedy Infrastructue	a. None.		
OR: Overall Remedy (Attainment of cleanup goals)	a. Groundwater quality data throughout the Building 102 plume to evaluate attainment and to verify that groundwater reaching Rice Creek does not exceed state surface water standards.	Army	Building 102 Monitoring Plan in the Annual Report

TABLE 10-2
BUILDING 102 GROUNDWATER QUALITY DATA

Fiscal Year 2012

			Trichloroethene (µg/l)	cis-1,2-Dichloroethene (µg/l)	1,1-Dichloroethene (µg/l)	Vinyl Chloride (µg/l)	Vinyl Chloride(2) (µg/l)
Building 102 Cleanup Level (1)			5	70	6	0.18	0.18
01U048		6/1/12	<1	<1	<1	<1	0.073
01U578		6/1/12	<1	<1	<1	<1	---
01U579		6/1/12	**7.4**	JP 0.88	<1	<1	---
01U580		6/1/12	**8.2**	JP 0.33	<1	<1	---
01U581		6/1/12	<1	JP 0.35	<1	<1	---
01U581	D	6/1/12	<1	<1	<1	<1	---
01L581		6/1/12	**10**	6.9	<1	<1	---
01L581	D	6/1/12	**10**	6.9	<1	<1	---
01U582		6/1/12	<1	1.0	<1	<1	<.05
01U582	D	6/1/12	---	---	---	---	<.05
01L582		6/1/12	**12**	**300**	1.2	**1.6**	**1.7**
01U583		6/1/12	<1	<1	<1	<1	---
01L583		6/1/12	<1	<1	<1	<1	---
01U584		6/1/12	**200**	**82**	JP 0.37	**JP 0.36**	---
01L584		6/1/12	**240**	**120**	JP 0.49	**JP 0.65**	---

Notes:

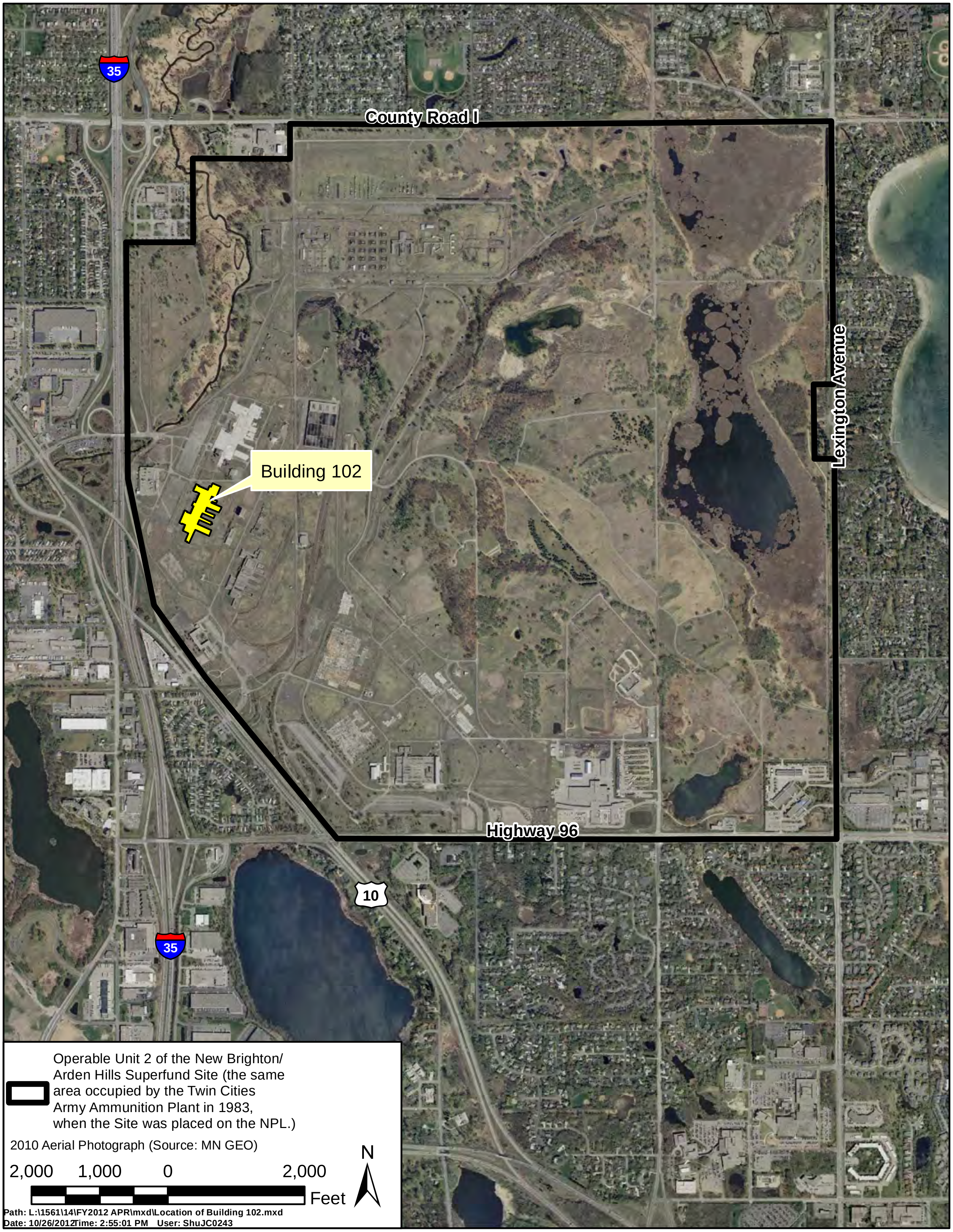
(1) Cleanup levels for Building 102 Groundwater are from Table 3-5 of the Building 102 Groundwater EE/CA. Bolding (in red color) indicates exceedance of the cleanup level.

(2) This analysis of vinyl chloride is by Method 8260C-SIM to obtain a lower reporting limit for vinyl chloride.

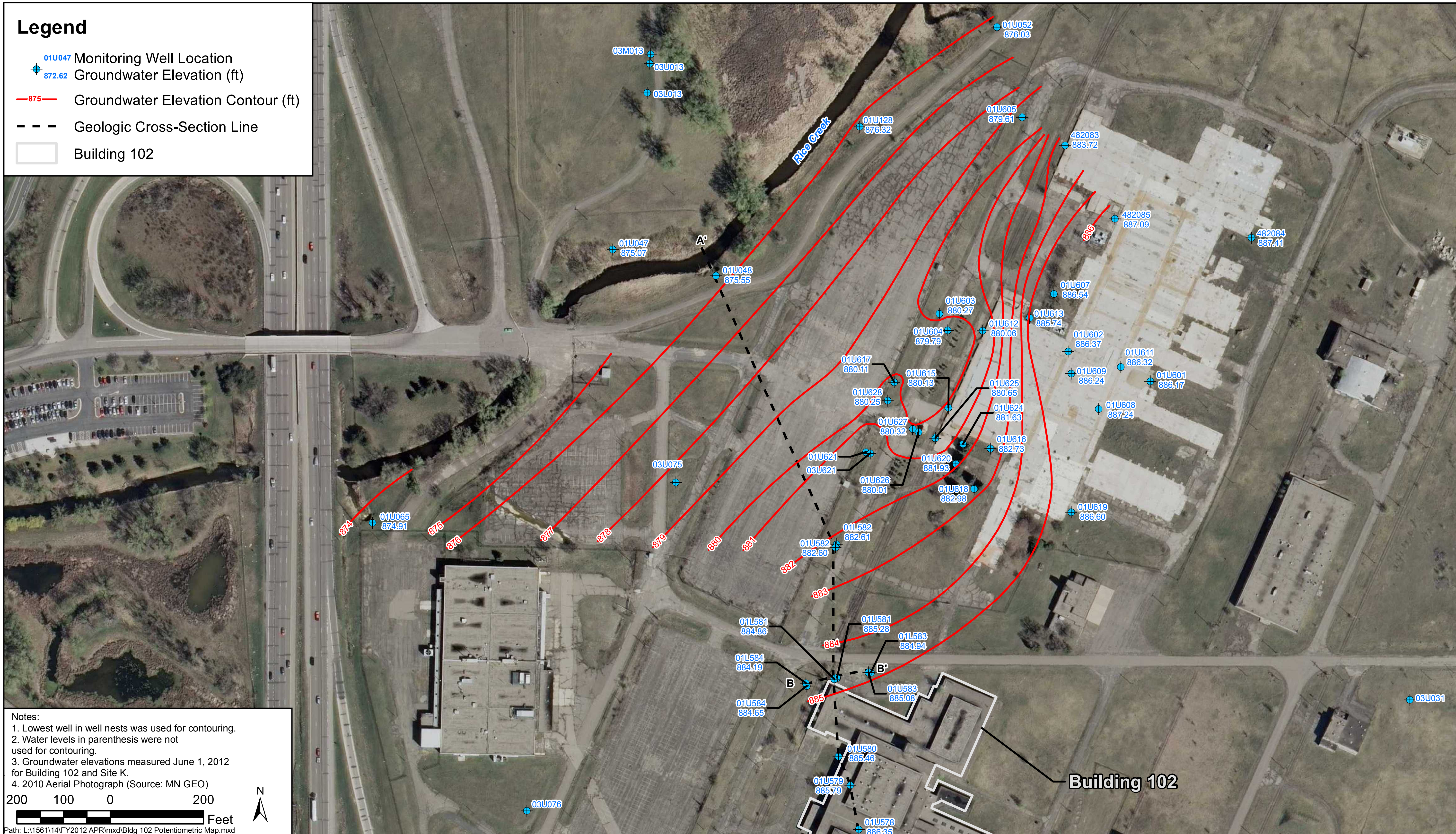
--- Not sampled.

D Duplicate sample.

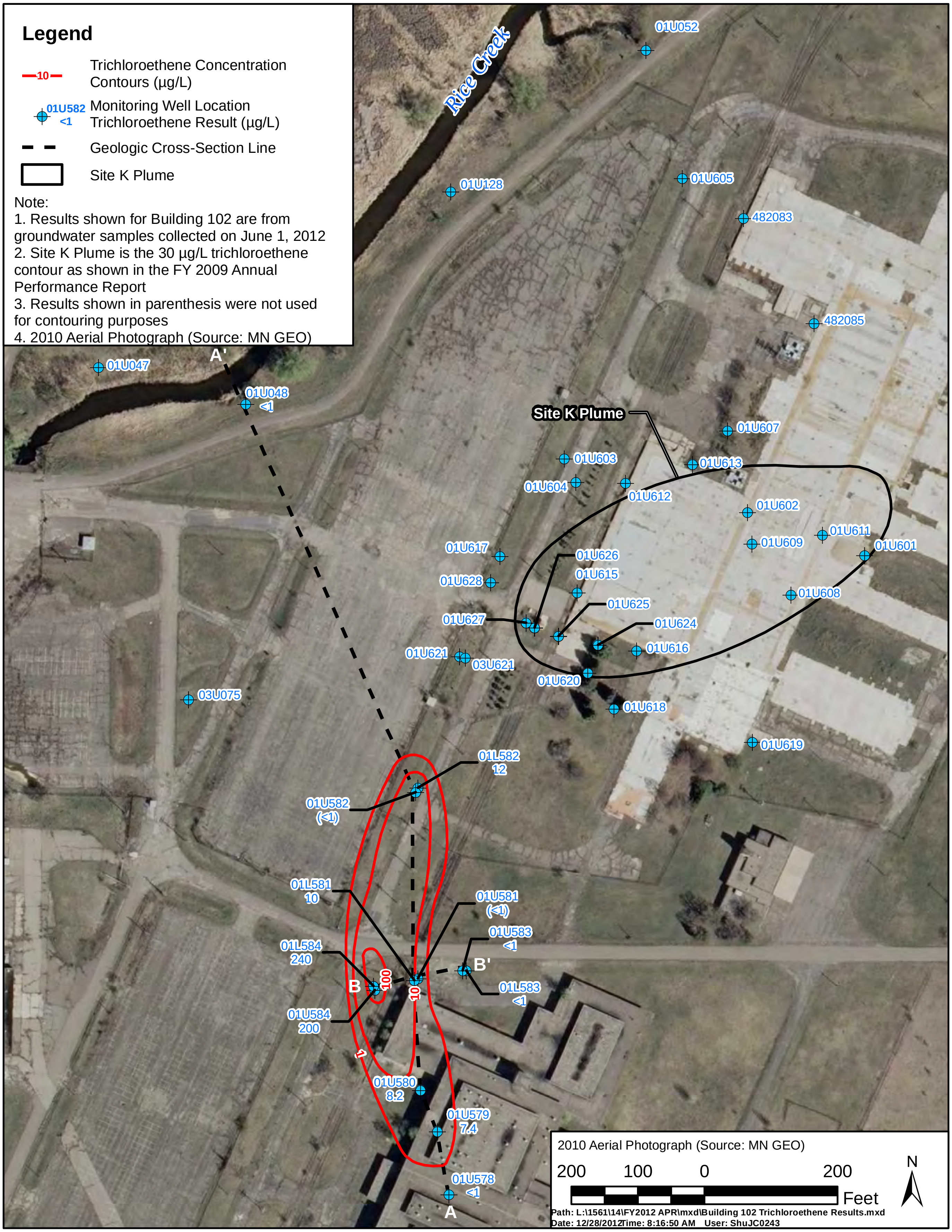
JP The value is below the reporting level, but above the method detection limit. Results should be considered estimated.



ANNUAL PERFORMANCE REPORT	Wenck	FY 2012
Location of Building 102	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure 10-1



ANNUAL PERFORMANCE REPORT	Wenck	FY 2012
Building 102, Unit 1, Potentiometric Map - Summer 2012	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure 10-2



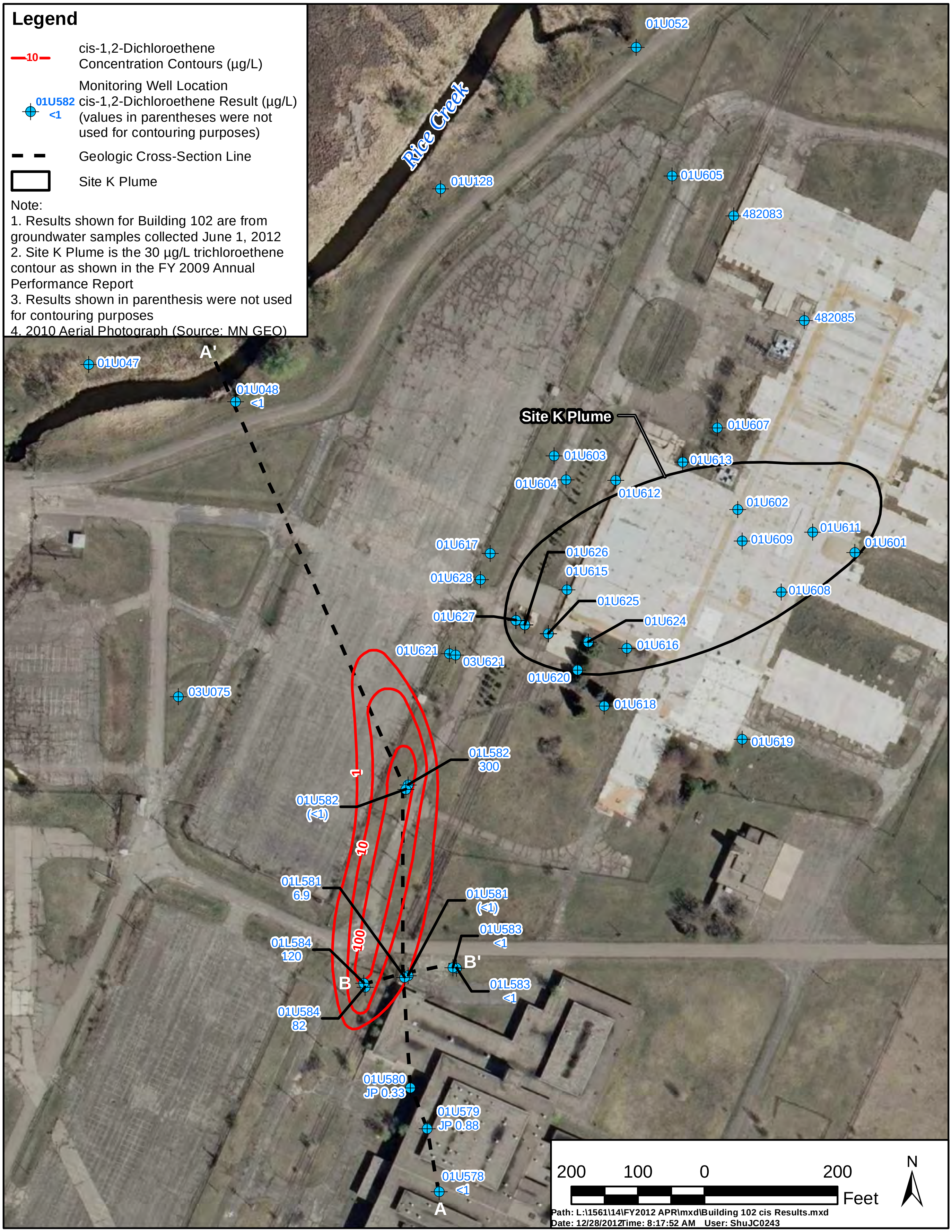
ANNUAL PERFORMANCE REPORT

Trichloroethene Results - Summer 2012

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2012

Figure 10-3



ANNUAL PERFORMANCE REPORT

cis-1,2-Dichloroethene Results - Summer 2012

Wenck

Engineers - Scientists
Business Professionals
www.wenck.com

1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2012

Figure 10-4

Legend

0.2 — Vinyl Chloride Concentration Contours (µg/L)

01U582 <1 — Monitoring Well Location, Vinyl Chloride Result (µg/L)

Geologic Cross-Section Line

Site K Plume

Note:
1. Results shown for Building 102 are from groundwater samples collected June 1, 2012
2. Site K Plume is the 30 µg/L trichloroethene contour as shown in the FY 2009 Annual Performance Report
3. Results shown in parenthesis were not used for contouring purposes
4. 2010 Aerial Photograph (Source: MN GEO)

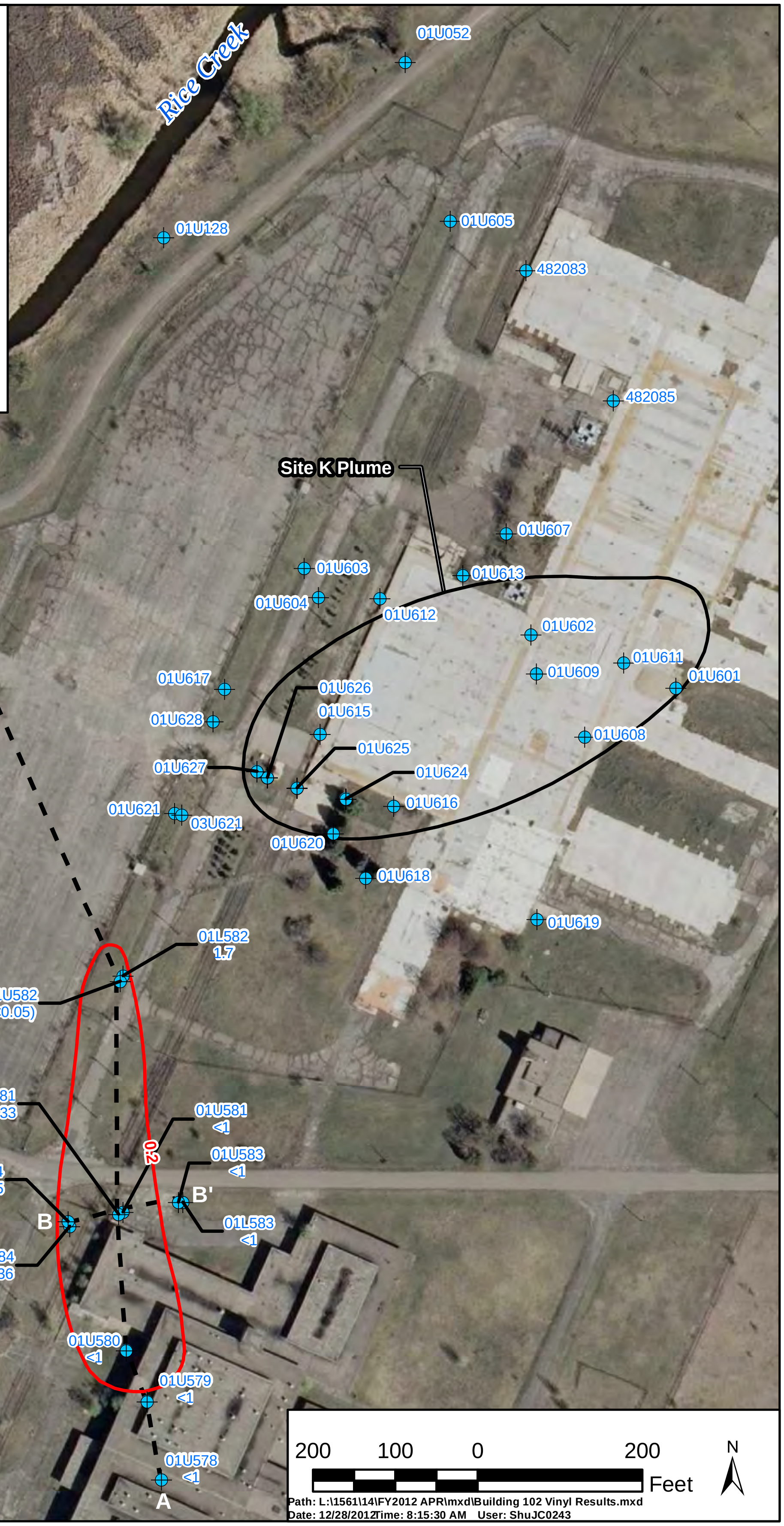


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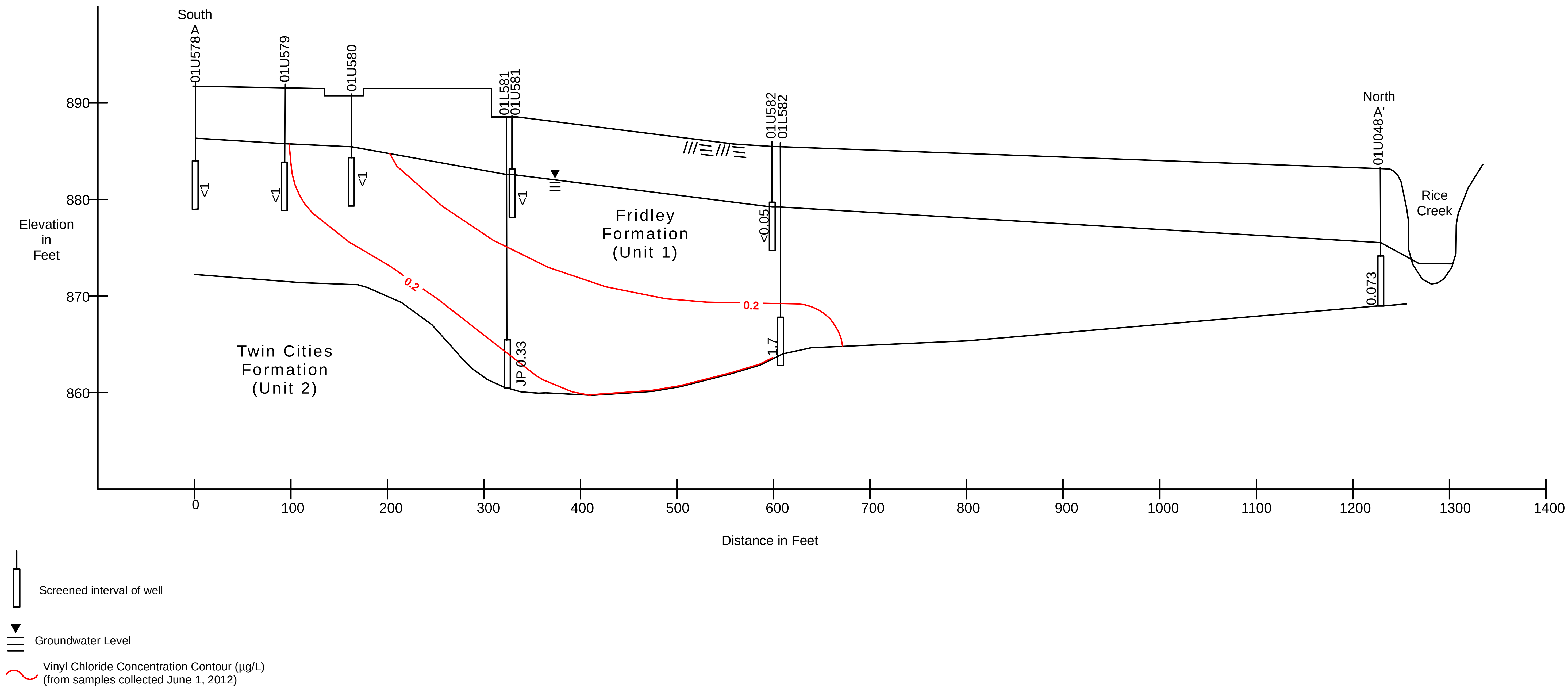
Figure 10-5



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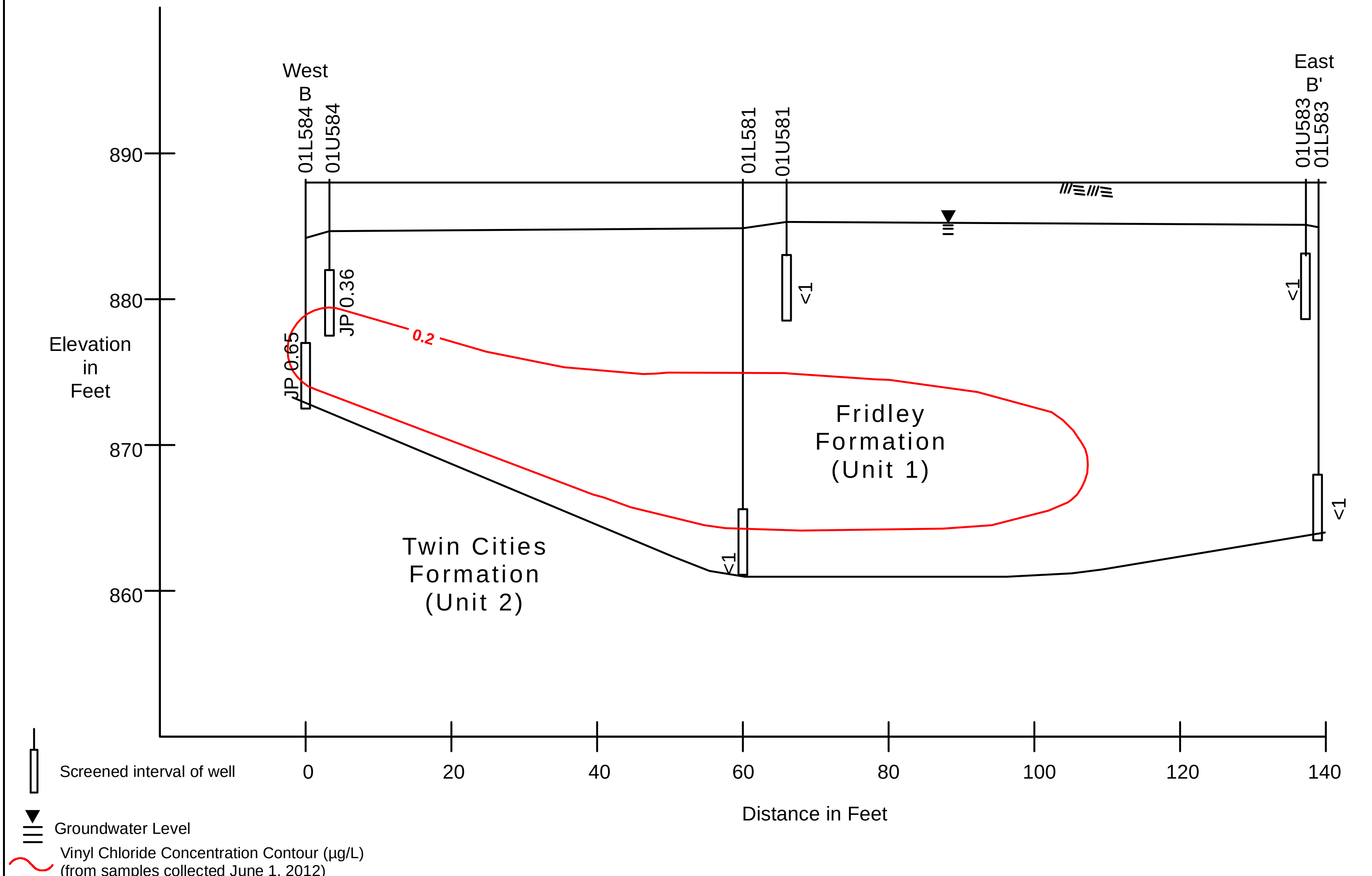

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Date: 11/2/2012 Time: 7:25:44 AM User: ShuJC0243

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Geologic Cross Section B-B'

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Figure 10-7

11.0 Operable Unit 2: Aquatic Sites

The Tier II Ecological Risk Assessment Report for aquatic sites, prepared by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM), was approved by the MPCA and USEPA in December 2004. In June 2005, the Army submitted a draft feasibility study (FS) for aquatic sites to support the risk management decisions with respect to “No Further Action” or “Implement a Remedy” for each aquatic site. As a result of comments on the draft FS, it was agreed to conduct additional sampling of Marsden Lake and Pond G, which was completed in 2008. Revised draft FS versions were submitted in January 2009, and then in April 2010. After review of the 2010 draft FS, the USEPA and MPCA requested that the Army prepare a work plan for collection of additional Round Lake sediment data. Given the time required to collect the additional data, the Army, USEPA, and MPCA agreed to separate the FS into two documents: one for Round Lake and one for the OU2 aquatic sites, i.e., Rice Creek, Sunfish Lake, Marsden Lake North, Marsden Lake South, and Pond G. These sites are located as shown on Figure 11-1.

The USEPA and MPCA provided consistency for the Rice Creek, Sunfish Lake, Marsden Lake, and Pond G Feasibility Study in January 2011. No Action was recommended for Rice Creek, Sunfish Lake, Marsden Lake North, and Marsden Lake South. A remedy was recommended for Pond G (surface water hardness adjustment) in order to attain compliance with the Minnesota surface water standard for lead (Class 2Bd chronic standard). OU2 ROD Amendment #4, which documents selection of the recommended alternatives, was signed in January 2012.

The USEPA and MPCA provided consistency for the Pond G RD/RA Work Plan in March 2012, and the pond was treated in June 2012. The remainder of this section evaluates the performance of this remedy.

11.1 REMEDY COMPONENT #1: POND G SURFACE WATER TREATMENT

Description: "Chemical alteration of Pond G surface water hardness." (OU2 ROD Amendment #4, page 4-2)

Performance Standard (how do you know when you're done):
When Pond G surface water has been treated to raise the hardness of the water. Minnesota's surface water lead standard is dependent on the hardness of the water body and the lead standard decreases with decreasing hardness, meaning that the relatively low hardness of Pond G results in a relatively low standard for lead. Hence, the increase in water hardness is intended to increase the standard for lead, thereby achieving compliance with the standard.

Is the remedy component being implemented?
Yes. Pond G was treated on June 6, 2012, using both agricultural limestone (calcium carbonate) and calcium chloride. Bench testing conducted just prior to the pond treatment indicated that the agricultural limestone alone would not achieve the target hardness increase, and hence calcium chloride was also added, with USEPA and MPCA approval. OU2 ROD Amendment #4 had also noted the possible benefit of adding lime to the surrounding watershed soils. The Army applied agricultural limestone to the soils on August 29, 2012. Details of the surface water monitoring program to verify treatment effectiveness are discussed in Section 11.2.

11.2 REMEDY COMPONENT #2: POND G SURFACE WATER MONITORING

Description: "A monitoring period is part of this alternative to verify the effectiveness of the remedy. Monitoring will include multiple sampling events of the Pond G surface water, which will be completed prior to the end of the review period for the next CERCLA Section 121(c) 5-year review (the review period ends September 30, 2013)." (OU2 ROD Amendment #4, page 4-3)

Performance Standard (how do you know when you're done):

When a performance surface water program has been established and the specified monitoring is in compliance with the program.

Is this remedy component being implemented?

Yes. The FY 2012 Monitoring Plan is included in Appendix A, documenting the surface water monitoring requirements. Two Pond G surface water monitoring events were scheduled for FY 2012, and these were conducted as shown in Table 11-1.

Were the surface water monitoring requirements for this remedy met? Yes.

Is any surface water sampling proposed prior to the next report? Yes. Surface water monitoring at Pond G will be in accordance with the monitoring plan shown in Appendix A.3.

Are any changes or additional actions required for this remedy component? No.

11.3 OVERALL REMEDY FOR POND G

Performance Standard (how do you know when you're done):

Monitoring will include multiple sampling events of the Pond G surface water, which will be completed prior to the end of the review period for the next CERCLA Section 121(c) 5-year review (the review period ends September 30, 2013). This 5-year review, which must be completed and signed in 2014, will review the adequacy of the Pond G remedy and, if demonstrated to be an effective remedy, the Pond G site will be closed with no long-term maintenance, monitoring, or LUC requirements. (OU2 ROD Amendment #4, page 4-3).

Has the Pond G remedy been completed (i.e., has the 5-year review concluded that the Pond G remedy is adequate and that the site can be closed)?

No. The specified 5-year review will be conducted and signed in 2014.

Has the surface water treatment resulted in compliance with the state surface water standard for lead?

Yes. The two Pond G surface water monitoring events conducted in FY 2012 indicate that treatment was successful in raising the hardness of the pond, and that the surface water lead results were in compliance with the state surface water standard (see Table 11-1). The Pond G RD/RA Work Plan specified that two surface water sampling events would be conducted in FY 2012, in May and August. Note that the May event was shifted into June due to a slight delay in completing the bench testing work. Also note that each surface water monitoring consists of three consecutive days of sample collection, with analysis for both total lead and hardness. For each sampling event, the calculated average of the three hardness results is used to calculate the Minnesota surface water quality standard for lead, and then the calculated average of the three lead results is compared to the calculated surface water standard to determine compliance with the standard. Lastly, when bench testing work indicated that calcium chloride would need to be added to the water in addition to the lime, the MPCA requested that chloride be analyzed in the first sampling event to verify that the chloride surface water standard was not exceeded. As shown in Table 11-1, the chloride standard was met in the June 2012 sampling event.

Do additional remedial measures need to be addressed?

No.

Table 11-1
Water Quality Data for Pond G Surface Water

Fiscal Year 2012

Sample Location		Date Collected	Chloride (mg/L)	L	D	Total Hardness (as $CaCO_3$) (mg/L)	L	D	Total Lead (µg/L)	L	D	Calculated Lead Standard for Each Event (µg/L)	Lead Standard was Met (y/n)?
Event #1													
PG1		6/18/12	110			280			0.15	U			
PG1		6/19/12	99			250			0.15	U			
PG1		6/20/12	100			310			0.15	U			
PG1	D	6/20/12	97			270			0.15	U			
	Average:		**103**			**273**			**0.075**			**11.4**	**Yes**
Event #2													
PG1		8/28/12	NA			260			0.40	J	JD4.7		
PG1		8/29/12	NA			250			0.38	J	JD4.7		
PG1		8/30/12	NA			250			0.90		JD4.7		
PG1	D	8/30/12	NA			260			1.2		JD4.7		
	Average:					**255**			**0.61**			**10.5**	**Yes**

Notes:

Laboratory Concentration Qualifiers (L):

U Analyte was not detected above the Method Detection Limit (MDL).

J Reported value is between the Method Detection Limit (MDL) and the Reporting Limit (RL).

JD The reported value for a laboratory duplicate failed to meet the ±RL criteria (the difference in values is listed after the"JD"). Results shouls be considered estimated.

Data Validation Qualifiers (D):

(None)

Other Notes:

D Duplicate

NA Not Analyzed

(1) Average results are calculated by first averaging any sample/duplicate pairs into a single result for that date, and then averaging the
the three sampling dates. For any result that is non detect, a value of half the MDL is used in the calculation.

(2) The lead standard is calculated using the average total hardness and the calculation specified in MN Rule 7050.0222 (Class 2Bd Chronic Standard).

(3) The chloride standard is 230 mg/L as specified in MN Rule 7050.0222 (Class 2Bd Chronic Standard).

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OU2 Aquatic Site Locations

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FY 2012

Figure 11-1

12.0 Operable Unit 2: Deep Groundwater

The selected remedy for the Deep Groundwater in the OU2 ROD consists of five remedial components that include continued use of the TGRS, with modifications to improve VOC contaminant removal from the source area. It also includes an annual review of new and emerging technologies potentially applicable to the Deep Groundwater. This report documents all performance and monitoring data collected from October 2011 through September 2012.

Historical Design and Evaluation of TGRS Remedial Action

In September 1987, a Record of Decision (1987 ROD) was prepared by the USEPA in order to implement the Interim Response Action Plan (IRAP) for TCAAP. The 1987 ROD provided specific criteria for the Boundary Groundwater Recovery System (BGRS). Following extensive interagency negotiations on the FFA and the ROD, the BGRS was started on October 19, 1987.

The BGRS consisted of six Unit 3 extraction wells (B1 through B6), that were connected by forcemain to an air stripping treatment facility. The initial six BGRS extraction wells (B1 through B6) were installed and pumping tests were conducted prior to start up of the BGRS. These pumping tests were documented in the BGRS Extraction Well Pumping Test Report.

Following the initial 90-day operation of the BGRS, the IRA–BGRS Performance Assessment Report (PAR) was prepared. The PAR assessed the hydraulic and treatment performance of the BGRS. The PAR presented an extensive database collected during the initial 90-day period of BGRS operation and prior pertinent data. The PAR also included a summary of the geology, hydrogeology, and remediation history for TCAAP. The PAR was subsequently approved by the MPCA and USEPA.

A pumping test on well B9 was conducted in August 1988 and formed the basis of the final design of the TGRS. This test, and the previous pumping tests, were utilized to determine the pumping rate required to achieve the necessary zone of capture for the TGRS; based on the plume size at that time. The PAR stated that the overall pumping rate needed for the 17 extraction wells was 2,450 gpm. During the detailed design of the TGRS, the system was designed with the capacity to operate at a maximum theoretical rate of 2,900 gpm. The additional pumpage was included to provide a safety margin for the calculations and to allow for fluctuations in system operation.

The PAR made recommendations for expansion of the BGRS into the TGRS in order to meet the Phase II remediation criteria established in the 1987 ROD. These modifications were completed and the expanded system began operation on January 31, 1989.

The 1989 Annual Monitoring Report was the first report covering the fully configured TGRS. It concluded that the TGRS developed a continuous zone of capture that was approximately 4,500 feet wide at the TCAAP boundary. The zone of capture widened to approximately 8,300 feet upgradient of the boundary. This zone of capture was demonstrated at average system pumping rates of 2,400 to 2,700 gpm.

The 1989 Annual Monitoring Report was wider in scope than subsequent annual monitoring reports for the TGRS. The 1989 report was both a performance assessment report and a monitoring report. The 1989 report represented the first year of operation of the expanded TGRS. Thus, a more detailed and exhaustive performance assessment was appropriate and possible, as there were data available from non-pumping conditions for detailed comparison with pumping conditions. Between 1990 and 2002, the system continued to operate at an essentially steady state condition, so the TGRS was evaluated by comparing the pumping rates to those achieved for the 1989 evaluation.

In FY 2003, the Army received agency approval on the TGRS Operating Strategy (OS) document. The OS was based in part on findings from the 1989 Annual Monitoring Report and presented a Global Operation Strategy (GOS) for the entire TGRS extraction system and a Micro

Operation Strategy (MOS) for selected well groups. Evaluations now consider and compare actual pumping rates to the GOS and MOS rates presented in the Final TGRS OS.

TGRS Modifications

Since 1990, a number of modifications have been made to the TGRS operation in response to changes in plume configuration or operational issues. A brief summary of the major changes is presented below:

1. Source control well SC4 was shut down in November 1996 in response to insignificant VOC mass removal by this well. SC4 operated at an average extraction rate of 29 gpm in 1989 and 45 gpm prior to shut down.
2. Boundary extraction well B12 was shut down in November 1996. The plume in the B12 area had dropped below cleanup standards for several years. Well B12 operated at an average extraction rate of 139 gpm in 1989 and 190 gpm prior to shut down.
3. As per the OS, boundary extraction well B2 was shut down and replaced with well B13 that began production in December 2002. The well screen in B2 became fouled and flow rates decreased from an average of nearly 200 gpm in the early 1990s to 52 gpm in 2002. During FY 2003, well B13 operated at maximum pumping capacity of nearly 100 gpm. The original design capacity for B13 was 200 gpm.
4. As per the OS, boundary extraction wells B7 and B10, and source control well SC3 were officially shut down in December 2002 due to the low TRCLE concentrations.
5. As per the OS, a larger capacity pump was installed at well B9 in December 2002 to raise the pumping rate from 150 gpm to approximately 300 gpm.
6. In July 2004, the TGRS was modified (Modification #3) as approved by the Agencies in May 2004. Pumps in Wells B1 and B13 were replaced and the pump in Well B13 was lowered to allow pumping below the well screen.
7. In March 2011, the TGRS was modified to allow for 2 air stripping tower treatment instead of the original design of 4 air stripping tower treatment. Wet Well Pumps 1 and 2 (WWP#1 and WWP#2 located in Wet Wells 1 and 2) and blowers 1 and 2 were shut

down and the valves to Towers 1 and 2 were closed. Groundwater is effectively treated by air stripping Towers 3 and 4 while Towers 1 and 2 remain in standby.

8. Flow rates at individual wells have been modified from time to time due to plume configuration changes, operational issues, and to maintain the OS.

12.1 REMEDY COMPONENT #1: HYDRAULIC CONTAINMENT AND CONTAMINANT REMOVAL FROM THE SOURCE AREA

Description: "Groundwater extraction to hydraulically contain the contaminated source area to the 5 μg/L TRCLE concentration contour and optimize the removal of contaminants from the source area through pumping of select wells." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the TGRS is containing the contaminated source area to the 5 μg/L TRCLE contour and the system is operated to maximize the contaminant removal from the source area.

Is the remedy component being implemented?
Yes. The TGRS was operated in FY 2012 consistent with the requirements of the OU2 ROD. Table 12-1 presents the cleanup requirements for the TGRS from the OU2 ROD.

During FY 2012, the average extraction well water pumped was approximately 1,831 gpm. The total extraction well water pumping rate was above the GOS Total System Operational Minimum (1,745 gpm) where the Army and the agencies agree that OU2 ROD requirements are met with an adequate safety factor. Additionally, all of the individual well groupings were above their respective MOS minimums for FY 2012.

How is the system operated and what preventative maintenance measures were conducted during the year?

Summary of Operations

Beginning in FY 2003, the system operation changed to conform to the OS. Under the OS, groundwater is extracted from 9 wells along the southwest boundary of TCAAP (B1, B3, B4, B5, B6, B8, B9, B11, and B13) and three wells downgradient of interior source areas on TCAAP (SC1, SC2, and SC5). Prior to this, wells B2, B7, B10, B12, SC3 and SC4 were also operating components of the system. Submersible pumps in the extraction wells discharge into a common pressurized forcemain that carries the water to the treatment system. The treatment system is located adjacent to Building 116. The TGRS layout is presented on Figure 12-1.

The TGRS was designed and constructed with three options for treated water discharge: recharge at the Arsenal Sand and Gravel Pit, discharge to Rice Creek, and discharge to the elevated water tank. Water stored in the elevated tank was "softened" and then "polished" with granular activated carbon (GAC) prior to distribution at the Facility. Due to the Army discontinuing all non-environmental services at the Facility in September 2007, the elevated water tank and the water softening and polishing equipment are no longer used. As such, the Arsenal Sand and Gravel Pit receives all of the extracted and treated water from the TGRS.

System Operation Specifications

In general, the influent and effluent water flow rates at the treatment plant are designed to be equal, thereby providing continuous operation of all processes and equipment. The following is a summary of the system design parameters:

- The groundwater extraction system, including the treatment center and 17 TGRS extraction wells, was originally designed to provide a theoretical hydraulic capacity of 2,900 gpm and a sustained daily average capacity of 2,730 gpm
- The influent to the treatment plant is divided between Towers 1 and 2, each receiving up to a maximum of 1,450 gpm.

- Wet Well Pumps 1 and 2 (WWP#1 and WWP#2 located in Wet Wells 1 and 2) transfer water to Towers 4 and 3, respectively. Each pump and tower handles up to a maximum of 1,450 gpm.
- Wet Well Pumps 3 and 4 (WWP#3 and WWP#4 located in Wet Well 3) discharge treated water to an end use at a combined rate of up to a maximum of 2,900 gpm.
- Air blowers provide air to the towers. The blowers for Towers 1 and 2 are designed to provide 6,000 – 7,000 standard cubic feet per minute (scfm) each. The blowers for Towers 3 and 4 are designed to provide 9,000 – 14,000 scfm each.

As stated earlier, the TGRS was modified to allow for 2 air stripping tower treatment instead of the original design of 4 air stripping tower treatment. This modification resulted in a reduction of energy use while still meeting the effluent discharge limit of 5 µg/L TCE. Wet Well Pumps 1 and 2 (40 horsepower each) and blowers 1 and 2 (5 horsepower each) were shut down and the valves to Towers 1 and 2 were closed. Since March 2010, groundwater has been effectively treated by air stripping Towers 3 and 4 while Towers 1 and 2 remain in standby.

Water level sensors within the wet wells communicate with the programmed logic controller (PLC) according to changing water levels. A complete and balanced operation should provide continuing water levels above the low-level sensors and below the high-level sensors. However, given the probability of unbalanced flows for any number of reasons (e.g., changing hydraulic heads, maintenance, repairs, temporary malfunctions), the PLC has provisions within its program to cycle-off the extraction well(s) or wet well pumps according to high water levels occurring in the wet wells; and in turn, cycle-off the wet well pumps according to low levels occurring within these wet wells.

The system operates such that the wet well pumps cycle rather than the extraction well pumps. The rationale behind this is that there are a relatively small number of motors, starters and electrically controlled valves associated with the wet wells when compared with the extraction well field. This also provides for more continuous and complete hydraulic capture within the aquifer units. However, the extraction well field will cycle if necessary, starting with the least contaminated extraction well, B7 (if operating), and followed by the other extraction wells in a predetermined sequence.

In summary, the priority of operation is as follows:

- Maintain constant operation of all extraction wells and air stripping towers above the operating minimum;
- Maintain the desired flow rates at individual wells;
- If operating in four tower mode, maintain the WWP#1 and WWP#2 pumping rate equal to or slightly above the combined pumping rate of the extraction well field; and
- Maintain treatment center WWP#3 and WWP#4 pumping rate equal to or slightly above the WWP#1 and #2 pumping rate (if operating in four tower mode) or slightly above the combined pumping rate of the extraction well field (if operating in two tower mode).

FY 2012 Maintenance and Inspection Activity

During FY 2012, the following inspection and maintenance activities occurred**:**

Preventive Maintenance (PM): The extensive PM program allowed the operations staff to identify and repair or replace equipment to avoid a downtime failure. The program consists of monthly, quarterly and annual maintenance tasks. When required, further repair work was scheduled rather than waiting for the failure to occur. A broad range of system-specific information was collected during this year's PM. This information is used to direct future repair work.

Electrical Inspection and Temperature Survey: A system-wide electrical inspection and infrared temperature survey was performed to identify loose connections and overheating components. Component overheating often precedes equipment failure. Electrical components that were identified as failing were replaced.

Verification of Flow Meters: As part of the routine PM, flow meters in the pumphouses were compared to a factory-calibrated flow meter. Flow volume measurements before and after conducting maintenance on the meters were compared to verify the consistency of measurements. Meters found to be out of calibration were replaced or recalibrated.

Daily Tracking of Flow Rates: Pumphouse and treatment center meter readings were recorded in the course of the daily inspections. Daily meter readings were tabulated and the flow rates were calculated and reviewed by the operations staff. Early detection of changes in flow rate was critical in early identification of failing equipment. By early detection of flow rate changes, equipment repair was typically scheduled before a failure occurred.

Did the system operate at a rate sufficient for complete capture?

Yes. At 1,831 gpm, the total extraction well water pumped was above the GOS Total System Operational Minimum (1,745 gpm) where the Army and the agencies agree that capture is achieved with an adequate safety factor. Figure 12-2 plots the daily average flow rate from October 1, 2011 through September 30, 2012, and shows that the TGRS operated above the OM for the majority of the time (340 days or 93 percent of the time) in FY 2012. The total TGRS extraction rates were above 1,745 gpm for each month in FY 2012.

The monthly and annual volume of water pumped is presented in Table12-2 and 12-3.

Table 12-2 presents the pumphouse metered monthly flow volumes of each extraction well. The individual pumphouse flow meters are used to determine the amount of groundwater extracted from the various MOS well groups, individual extraction wells, and the total amount of groundwater extracted during the fiscal year. Table 12-3 presents the combined pumphouse-metered flow volume (extraction wells) and the flow volumes metered at various stages in the treatment center along with historical data. These flow meters are used to evaluate the flow of water through the treatment process to ensure proper system operation.

As shown on Table 12-3, the TGRS successfully captured and treated approximately 964,996,900 gallons of contaminated water from October 2011 through September 2012 based on the sum of the individual pumphouse flow meters. This converts to an average flow rate of 1,831 gpm.

The TGRS as a whole was operational 98.0 percent of the time (i.e., 358.7 days out of 366 days in FY 2012).

Monthly Flow Reports

Each month a Monthly Flow Report is prepared. The report includes the month's meter totalizer readings, calculated flow volumes and operational notes. Flow volumes are presented on a daily basis and are totaled to provide a monthly flow volume. A compilation of FY 2012 operational notes is presented in Appendix F-2. During FY 2012, the sum of the individual pumphouse flow meters was used to measure total flow volumes in monthly reports for comparison with Operating Strategy limits. Daily variation in readings at individual wells is primarily due to differences in the time of day when meter readings were taken.

How much down time occurred during the year?

The down time for each extraction well, over the last five years, is presented in Table 12-4. A summary of average down time for the pumphouses and the treatment center by the category of failure is presented in Table 12-5. A description of each down time event, organized chronologically, is presented in Appendix F-2. The same descriptions organized by affected pumphouse, treatment center, and forcemain is presented in Appendix F-3.

Treatment center and extraction well down times resulted primarily from failure and subsequent repair of components in the pumphouses, treatment center, and electrical service. The treatment center and extraction wells were shut down for repairs much less in FY 2012 than they were in FY 2011. The decreased downtime is primarily due to less preventative maintenance. Preventative maintenance-related down time decreased from 6.9 days in FY 2011 to 0.02 days in FY 2012 (FY 2011 included a major cleaning of the air stripping towers, which only happens approximately every 10 years).

Description of Down Time Categories

Pumphouse component failures accounted for an average of 5.3 days down time per pumphouse. There was slightly more down time due to pumphouse maintenance in FY 2012 than there was in FY 2011. The major pumphouse repairs causing down time were:

- Pump and/or motor failure and replacement at Pumphouses B4, B9, B11, and B13
- Well redevelopment at Pumphouses B4, B13, and SC2
- Replacement of I/O adapter cards at Pumphouses B8 and B11

Treatment center component failures and repairs that caused pumphouse down time consisted of electric check valve maintenance, malfunctions and repairs, and electrical control equipment failures and subsequent repairs. Treatment center component failures, repairs, and adjustments accounted for an average of 0.4 days down time per pumphouse. The major treatment center repairs causing substantial down time were PLC issues in February and June.

Electrical service system failures accounted for an average of 0.8 days down time per pumphouse. Electrical storm damage and power grid failures were the primary causes of down time.

Preventative maintenance procedures accounted for an average of 0.02 days of down time per pumphouse. Preventative maintenance procedures are described in the project Operation and Maintenance Manual.

System modifications accounted for 0.0 days down time per pumphouse. No system modifications were made in FY 2012.

Forcemain issues accounted for 0.0 days down time per pumphouse. There was no down time related to forcemain issues in FY 2012.

Were there any major operational changes during the year? No.

Did the system achieve hydraulic capture?

Yes. The total extraction well water pumped was above the GOS Operational Minimum where the Army and the agencies agree that capture is achieved with an adequate safety factor. A positive sign with respect to capture is the generally stable or decreasing TRCLE concentrations evident at many wells across the TGRS boundary since FY 2001.

Groundwater elevation measurements were collected in June 2012. Appendix D contains the water level database for the monitoring wells.

How much VOC mass was removed by the system and how is it changing with time?

As discussed above, the TGRS extracted and treated approximately 964,996,900 gallons of water from October 2011 through September 2012. Based on the monthly influent and effluent VOC concentrations and the monthly flow totals as measured by the extraction well flow meters, the TGRS removed a total of 1,801 pounds of VOCs from October 2011 through September 2012. The VOC mass removal in FY 2011 was 1,834 pounds. The decrease in FY 2012 reflects an overall decrease in plume concentration.

Average VOC influent concentrations decreased from 232 μg/L in FY 2011 to 225 μg/L in FY 2012 (3.0 percent lower). Table 12-6 summarizes the individual VOC mass contribution of each extraction well and the entire system. Overall, the TGRS has removed over 100 tons (207,180 lbs) of VOCs from the aquifers since 1987 and 13.5 tons of VOCs since the end of FY 2001 (the TGRS OS was based on data through 2001). If the annual VOC mass removal from the TGRS is less than 1,709 pounds (50 percent of the FY 2001 mass removal) then the Army and agencies have agreed that review of the OS operating minimum rates should be conducted and potentially reduced. At 1,801 pounds in FY 2012, the VOC mass removal from the TGRS is at 53 percent of the FY 2001 mass removal.

The total mass removed is based on the monthly TGRS influent and effluent sampling and flow through the treatment system. The monthly sampling of the treatment system provides the best estimate of overall mass removal, compared to the individual extraction well sampling, due to the larger number of samples and consistency in the month-to-month analytical results.
The percent contributions for each well are based on the average flows from each well and the semi-annual VOC results from each well.

VOC samples were collected semi-annually from the operating extraction wells that comprise the TGRS. Well B2 is shut down, but was temporarily operated for June 2012 sampling. Wells B7, B10, B12, SC3, and SC4 are shut down, and were not sampled, as they are now sampled biennially (next event in June 2013). Table 12-7 presents a summary of the sampling results for the extraction wells. Variations in detection limits from round to round are the result of varying sample dilution performed by the laboratory. Dilutions are required due to the high concentrations of some analytes. The locations of the extraction wells are presented on Figure 12-1.

Appendix G-1 presents TRCLE versus time graphs for each extraction well. As shown, TRCLE concentrations have declined in each well and now many wells appear to be stable or still declining. Since FY 2001, the following extraction wells have shown the most improvement (greater than 50 percent reduction) in TRCLE concentrations:

- SC3 (5.5 μg/L in FY 2001 to 0.35 μg/L in FY 2011 – 94% reduction)
- B10 (5.1 μg/L in FY 2001 to 0.39 μg/L in FY 2011 – 92% reduction)
- B6 (230 μg/L in FY 2001 to 45 μg/L in FY 2012 – 80% reduction)
- B4 (500 μg/L in FY 2001 to 110 μg/L in FY 2012 – 78% reduction)
- B5 (410 μg/L in FY 2001 to 100 μg/L in FY 2012 – 76% reduction)
- SC2 (100 μg/L in FY 2001 to 30 μg/L in FY 2012 – 70% reduction)
- B11 (4.8 μg/L in FY 2001 to 1.5 μg/L in FY 2012 – 69% reduction)
- B3 (8.7 μg/L in FY 2001 to 2.9 μg/L in FY 2012 – 67% reduction)

These trends reflect the overall decline in OU2 deep groundwater contaminant concentrations. In addition, as discussed below, there has been a reduction in overall TGRS influent concentrations over the previous several years.

As Table 12-6 illustrates, eight wells, B1, B4, B5, B6, B9, B13, SC1 and SC5, that are located in the centers of the plume, achieve the largest rates of VOC removal. These eight wells together accounted for nearly 99 percent of the VOC mass removed.

The source control wells, SC1 through SC5, together accounted for over 72 percent of the VOC mass removed while accounting for only 8.5 percent of the water pumped by the system. SC5, in particular, removed over 65 percent of the total VOC mass at a rate of only approximately 91 gpm (4.9 percent of the total water pumped by the system). This illustrates the efficiency of extracting groundwater from near the source areas.

What do the long-term trends in the monitoring wells show?

A large majority of wells on and off TCAAP exhibit decreasing trends in TRCLE concentration, indicating an overall improvement in water quality both up gradient and down gradient of the TGRS. Due to the complexity of the flow system, changes in flow direction over time, and the variation in chemical transport properties across the study area, the trends may not reflect a uniform or easily predictable pattern.

Several wells were identified in previous APRs or when reviewing the FY 2012 database that have inconsistent or upward trends in TRCLE concentrations that warrant further observation and discussion:

Well	*Trend Observation*
03L806	Trend identified in FY 2001 APR. Dropped from 1000's of ppb in early 1990s. TRCLE decreased steadily from 410 ppb in 2001 to 140 ppb in 2005. From 2006 to 2011, TRCLE concentrations varied between 120 ppb and 240 ppb with no apparent trend. In 2012, TRCLE increased to 490 ppb. Maintain annual sampling frequency.
04U806	Trend identified in FY 2001 APR. Dropped from 1000's of ppb in early to mid-1990s. TRCLE decreased steadily from 470 ppb in 2001 to 96 ppb in 2007. Since 2008, TRCLE concentrations have varied between 130 ppb and 380 ppb with no apparent trend (190 ppb in 2012). Maintain annual sampling frequency.
03U094	Trend identified during FY 2004 data review. TRCLE increased from 170 ppb in 2003 to 470 ppb in 2005. Since 2008, TRCLE concentrations have stabilized between 100 ppb and 120 ppb (100 ppb in 2011). Maintain biennial sampling frequency (next event 2013).
03M806	Trend identified during FY 2003 data review. TRCLE concentrations dropped from near 900 ppb in 1987, to below 100 ppb from 1993 through 1996. Increased to 1300 ppb, a historical high concentration, in 2003. TRCLE concentrations have generally decreased from 680 ppb in 2008 to 270 ppb in 2012. Maintain annual sampling frequency.
03U711	Trend identified in FY 2001 APR. Dropped from near 1000 ppb in 1994 to 75 ppb in 1999. TRCLE concentrations have decreased from 250 ppb in 2004 to 54 ppb in 2011. Maintain biennial sampling frequency (next event 2013).
03L809	Trend identified in FY 2001 APR. Dropped from over 3,000 ppb to 67 ppb through 1998. TRCLE concentrations have decreased from 220 ppb in 2007 to 90 ppb in 2011. Maintain biennial sampling frequency (next event 2013).

Well	*Trend Observation*
04U843	Trend identified in FY 2001 APR. Below 15 ppb from late 1980s through 1997, increased to between 22 ppb and 38 ppb from 1998 through 2001, dropped to below 1 ppb in 2003 but has been increasing at 87 ppb in 2007, 98 ppb in 2009, and 140 ppb in 2011. Well is nearly 1 mile from TGRS and is part of the OU1 sampling program and discussed in greater detail in Section 3.0. Maintain biennial sampling frequency (next event 2013).
04U841	Trend identified in FY 2001 APR. Below 10 ppb through 1995, increased to 25 ppb in 2001, decreased to 5 ppb in 2003, increased to 24 ppb by 2007, 18 ppb in 2009, and 20 ppb in 2011. Appears to be stabilizing around 20 ppb. Well is nearly 0.5 mile from TGRS and is part of the OU1 sampling program discussed in Section 3.0. Maintain biennial sampling frequency (next event 2013).
03U822	Trend identified during FY 2003 data review. Below 25 ppb through 1998, peaked at 375 ppb in 1999, decreased from 2003 (280 ppb) to 120 ppb in 2009. Increased slightly in 2011 to 140 ppb. Well is approximately 1 mile from TGRS and is part of the OU1 sampling program discussed in Section 3.0. Maintain biennial sampling frequency (next event 2013).
03L822	Trend identified in FY 2001 APR. Increased from below 5 ppb during early 1990s to over 600 ppb from 1999 through 2003. Steady decrease from 620 ppb in 2003 to 180 ppb in 2011. Well is approximately 1 mile from TGRS and is part of the OU1 sampling program discussed in Section 3.0. Well historically showed 1,1,1-trichloroethane as major contaminant. Maintain biennial sampling frequency (next event 2013).

12.2 REMEDY COMPONENT # 2: GROUNDWATER TREATMENT

Description: "Groundwater treatment using air stripping." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the air stripping treatment facility is treating water and meeting the clean up requirements in Table 1 of the OU2 ROD.

Is the remedy component being implemented?
Yes. The air stripping treatment facility has been operating since 1986.

Did the treatment system meet the treatment requirements in the OU2 ROD?
Yes. Influent and effluent water was sampled on a monthly basis during FY 2012. The influent/effluent database for FY 2012 is contained in Appendix G-2. Figure 12-3 presents a graph of influent TRCLE versus time. This graph is cumulative and includes data from before 1989, when the system consisted of only six extraction wells. The average FY 2012 influent TRCLE concentration was 180 μg/L, down from 183 μg/L in FY 2011. FY 2012 represents the tenth year since the TGRS was reconfigured to achieve greater pumping in the centers of the VOC plumes and less pumping on the edges of the plumes where VOC concentrations are much lower. The decreasing TRCLE concentration could be due in part to the overall decrease in plume concentration.

Figure 12-3 also presents a graph of the effluent TRCLE concentration versus time. As indicated, the effluent was below 5 μg/L TRCLE for all sampling events in FY 2012. A review of the FY 2012 database indicates that the effluent has also remained below the treatment requirements for all other VOC compounds specified in the OU2 ROD. Comparison of influent and effluent concentrations for all specified VOC compounds indicates an average removal efficiency of 99.2 percent. As expected, effluent concentrations of TRCLE increased slightly after the treatment was changed to two tower operation (two tower operation was tested in

February 2011 and went into full operation in March 2011). The maximum effluent TRCLE concentration in FY 2012 was 1.9 μg/L, which is still well below the discharge limit.

What was the mass of VOCs emitted into the air?

The air stripping towers remove VOCs with an efficiency of approximately 99.2 percent. Thus, the air emissions are essentially equal to the VOC mass removal rates presented in Table 12-6. Air emissions therefore averaged 4.9 pounds/day based on the VOC mass removal rates. The total VOC emissions from October 2011 through September 2012 were 1,801 pounds.

12.3 REMEDY COMPONENT #3: TREATED WATER DISCHARGE

Description: "Discharge of treated water to the on-site gravel pit." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):

When the gravel pit is accommodating the discharge from the treatment system and allowing it to recharge to the aquifer.

Is the remedy component being implemented?

Yes. Based on visual observation during FY 2012, there were no noticeable changes in Gravel Pit performance. The Gravel Pit is accommodating the TGRS discharge as designed.

12.4 REMEDY COMPONENT #4: INSTITUTIONAL CONTROLS

Description: "Institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater." (OU2 ROD, page 4)

Performance Standard (how do you know when you're done):
When a special well construction area and alternate water supply have been established and private wells in impacted areas have been sealed.

Is the remedy component being implemented?
Yes. There are no private users of groundwater on the property and the potable water supply is no longer used. The property is a government reservation, is fenced, and access is restricted to authorized personnel.

12.5 REMEDY COMPONENT #5: REVIEW OF NEW TECHNOLOGIES

Description: "Reviews of new and emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration. Reviews shall be performed by the Army and reported annually in accordance with the consistency provisions of the TCAAP FFA." (OU2 ROD, page 4)

The intent is to consider new technologies of merit, which is not on any set schedule. To have merit, a new technology must have promise in reducing cost and the time for cleanup. There may be years where no technologies are considered. It is envisioned that at any time, any interested party (Army, USEPA, and MPCA) can suggest new technologies for consideration. If a technology is agreed to have merit by the Army, USEPA, and MPCA, then the Army will evaluate the technology. The level of effort for evaluations can range from simple literature searches to extensive treatability studies. On an annual basis, the Army will report on:

- Whether or not any new technologies were identified and considered to have merit that year
- The progress or results of any evaluations during that year
- Any planned evaluations for the following year

Performance Standard (how do you know when you're done):

When the Army reports on the status of any reviews of emerging technologies in the annual monitoring report.

Is the remedy component being implemented?

Yes. Beginning with the FY 1997 Annual Performance Report, the Army reports annually on the status of any reviews of emerging technologies.

- In September 2002, the MPCA and USEPA announced they would be conducting a natural attenuation microcosm study using carbon dating. In October 2002, Army drilled a boring at Site G to collect soil for the study. The study results were published in 2004.
- The MPCA identified a study involving the addition of vegetable oil to groundwater that is being monitored at the Navy site in Fridley, Minnesota, as a potential technology of interest.

Were any new technologies identified and considered to have merit during FY 2012?

No. The Army's review did not identify any new or emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration.

What is the status and/or findings of any previously initiated reviews of emerging technologies?

MPCA continued its research into natural attenuation processes at TCAAP. The MPCA and USEPA published the results of the microcosm study for deep groundwater sediments in 2004 showing that abiotic degradation of cis-DCE is an important factor contributing to the natural attenuation of this compound at the site. (*Non-biological Removal of cis-dichloroethylene and 1,1-dichloroethylene in aquifer sediment containing magnetite.* Environmental Science and Technology, 38: 1746-1752.)

Are any new reviews planned at this time for the coming year?

No. The Army will continue to look for emerging and new technologies, and attend relevant conferences that highlight emerging and new technologies. However, reviews of specific technologies are not planned in FY 2012.

12.6 REMEDY COMPONENT #6: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance." (OU2 ROD, page 4)

Performance Standard (how do you know when you're done):

When a regulator approved monitoring plan is in place and monitoring is conducted according to the plan.

Is the remedy component being implemented?

Yes. Monitoring in FY 2012 was consistent with the OU2 ROD. Water level measurements and water quality samples were collected as stated in Appendix A.1. Appendix A summarizes the FY 2012 monitoring plan and any deviations are explained in Appendix C-2. Monitoring was as follows:

Groundwater

TGRS groundwater level measurements were collected during December 2011 and June 2012 according to the monitoring plan. Appendix D contains the comprehensive groundwater quality and water level database for the TGRS monitoring wells. Water quality samples were collected from TGRS wells according to the monitoring plan. Groundwater samples were collected at wells stated in Appendix A.1. All wells were sampled for VOC (8260B) analysis. FY 2012 was a "small round" year in the biennial sample program, so samples were collected for only a select list of wells. Table 12-8 presents the groundwater quality data for FY 2012.

Results from the 2012 groundwater sampling showed that most of the wells sampled continued to have declining or stable TRCLE concentrations. The most notable decreases were at 03U708 (steady decrease from 270 μg/L in 2002 to 35 μg/L in 2012) and at 03M806 (decrease from 680 μg/L in 2008 to 270 μg/L in 2012).

Several wells showed a slight increase in TRCLE concentration in 2012; however, the general trend at most wells since 1999 appears to be declining or stable. The increases were most notable at 03L806 (200 μg/L in 2011 to 490 μg/L in 2012) and 03U093 (84 μg/L in 2011 to 140 μg/L in 2012). Concentrations at both of these wells have fluctuated up and down over the last several years; however the 2012 results were the highest concentrations since 1992 at 03L806 (1,800 μg/L) and since 1999 at 03U093 (145 μg/L). Well 03U093 is within the hydraulic capture zone of the TGRS system, while 03L806 is likely in a hydraulic stagnation zone. Both of these wells are currently sampled on an annual basis and will continue to be monitored. No further sampling beyond the scheduled events is necessary at this time.

The TGRS OS estimated the width of the 5 μg/L TRCLE plume at the source area to be 3,600 feet based on FY 2001 analytical data. Since that time, 13.5 tons of VOCs have been removed from the groundwater. TRCLE concentrations are decreasing across the site, especially at the following wells that have been below 5 μg/L since 2001: B10, SC4, 03L021, 03L833, 03U099, 03U701, 04J702, 04U701, 04U702, and 04U833. Monitoring well 03U672 along the southern end outside 5 μg/L TRCLE plume has decreased from 3.1 μg/L in 2001 to not detectable (below 1 μg/L) since 2003.

In July 2012, the agencies approved a request by CRA (on behalf of the Army and ATK) to abandon monitoring wells 03U658, 03U004, 03M004, and 03L004. Additional sampling was conducted on August 28, 2012 and no detectable concentrations of VOCs were reported. The wells were formally abandoned in November 2012.

<u>Treatment System</u>

The TGRS treatment system influent and effluent was sampled monthly during FY 2012 in accordance with the FY 2012 monitoring plan. Groundwater samples from the extraction wells were collected in December 2011 and June 2012 in accordance with the FY 2012 monitoring plan.

Is additional monitoring proposed prior to the next report?

No additional monitoring for FY 2013 is proposed beyond that presented in the Monitoring Plan (Appendix A) of the FY 2011 APR. Table 12-9 and Appendix A of this report provide FY 2013 monitoring requirements.

12.7 OVERALL REMEDY FOR DEEP GROUNDWATER

Did the TGRS meet the requirements of the OU2 ROD? Yes.

- Hydraulic capture in Unit 3 extends beyond the 5 μg/L TRCLE contour. This meets the VOC capture criterion in the OU2 ROD. Hydraulic capture in Unit 4 extends beyond the 5 μg/L TRCLE contour. This meets the VOC capture criterion in the OU2 ROD.
- The total extraction well water pumped was above the Total System Operational Minimum (1,745 gpm). The FY 2012 annual average extraction rate was 1,831 gpm.
- The TGRS extracted and treated 964,996,900 gallons of water and removed 1,801 pounds of VOCs from October 2011 to September 2012. Average VOC influent concentrations decreased by 3.0% from FY 2011.
- Groundwater analytical data of the source area show a general decrease in TRCLE concentration. This demonstrates that the TGRS is effectively removing VOC mass from the aquifer.
- Effluent VOC concentrations were below contaminant-specific requirements for all sampling events.

Do any additional measures need to be addressed?

Not at this time.

TABLE 12-1

GROUNDWATER CLEANUP LEVELS
TGRS, OU2
ARDEN HILLS, MINNESOTA

Substance	***Expected Level in Discharge (ppb)***	***Operable Unit 2 Rod Requirements (ppb)***
Volatile Organic Compounds (VOCs)		
cis-1,2-Dichloroethene plus trans-1,2-Dichloroethene	<1	70
1,1-Dichloroethene	<1	6
1,1,1-Trichloroethane	<1	200
1,2-Dichloroethane	<1	4
Trichloroethene	<5	5
1,1-Dichloroethane	<1	70
Tetrachloroethene	<1	5

TABLE 12-2

EXTRACTION WELL WATER PUMPED
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)												
	B1	***B3***	***B4***	***B5***	***B6***	***B8***	***B9***	***B11***	***B13***	***SC1***	***SC2***	***SC5***	***TOTAL***
October 2011	11,231,000	7,536,200	7,957,200	10,294,300	10,045,800	8,181,800	13,912,300	4,932,500	3,301,600	1,484,100	2,292,500	4,245,700	85,415,000
(gpm)	252	169	178	231	225	183	312	110	74	33	51	95	1,913
November 2011	10,785,500	7,289,500	7,694,000	10,026,900	9,700,800	6,355,700	13,414,100	4,751,200	3,149,900	1,304,600	2,785,800	3,922,900	81,180,900
(gpm)	250	169	178	232	225	147	311	110	73	30	64	91	1,879
December 2011	11,209,100	7,583,800	7,926,400	10,213,300	9,957,800	6,698,100	13,900,800	4,600,700	3,219,800	1,410,800	1,743,300	4,265,500	82,729,400
(gpm)	251	170	178	229	223	150	311	103	72	32	39	96	1,853
January 2012	11,415,500	7,712,000	7,916,800	9,693,000	10,059,100	6,379,000	14,032,900	3,896,700	3,250,500	1,281,000	1,287,900	4,188,900	81,113,300
(gpm)	256	173	177	217	225	143	314	87	73	29	29	94	1,817
February 2012	10,401,300	7,251,300	7,598,200	8,968,500	9,550,400	5,816,400	12,870,700	4,274,000	3,039,100	1,356,900	1,187,100	3,775,400	76,089,300
(gpm)	249	174	182	215	229	139	308	102	73	32	28	90	1,822
March 2012	11,271,600	7,736,800	7,891,300	9,128,000	9,951,000	6,599,300	14,018,100	4,232,100	3,166,500	1,451,600	1,112,900	3,737,000	80,296,200
(gpm)	253	173	177	204	223	148	314	95	71	33	25	84	1,799
April 2012	10,718,500	7,433,000	7,553,700	8,739,500	9,719,100	6,608,900	13,276,100	3,627,400	2,793,000	1,461,400	786,500	3,679,500	76,396,600
(gpm)	248	172	175	202	225	153	307	84	65	34	18	85	1,768
May 2012	10,804,300	7,962,900	7,631,500	9,172,600	10,475,800	7,140,500	13,741,800	4,542,600	3,490,300	1,523,300	615,200	4,376,400	81,477,200
(gpm)	242	178	171	205	235	160	308	102	78	34	14	98	1,825
June 2012	10,295,700	7,755,800	7,399,100	8,531,600	9,790,400	6,417,500	13,203,700	4,932,600	3,415,900	1,498,800	215,800	4,160,100	77,617,000
(gpm)	238	180	171	197	227	149	306	114	79	35	5	96	1,797
July 2012	10,663,600	8,039,600	7,801,200	8,987,300	10,690,100	6,669,300	13,475,100	5,069,800	3,187,900	1,547,100	157,500	4,080,200	80,368,700
(gpm)	239	180	175	201	239	149	302	114	71	35	4	91	1,800
August 2012	10,564,200	8,034,100	8,863,500	9,057,700	10,168,300	6,865,200	13,771,300	4,767,700	3,410,600	1,524,400	2,307,100	3,713,300	83,047,400
(gpm)	237	180	199	203	228	154	308	107	76	34	52	83	1,860
September 2012	10,318,900	7,759,600	8,824,900	8,863,500	9,253,800	6,064,500	12,344,400	4,721,600	3,403,400	1,498,600	2,646,600	3,566,100	79,265,900
(gpm)	239	180	204	205	214	140	286	109	79	35	61	83	1,835
TOTAL FY 2012	**129,679,200**	**92,094,600**	**95,057,800**	**111,676,200**	**119,362,400**	**79,796,200**	**161,961,300**	**54,348,900**	**38,828,500**	**17,342,600**	**17,138,200**	**47,711,000**	**964,996,900**
Operational Minimum (gpm)	225	170	195	195	210	135	275	80	110	20	30	100	1,745

	B1, B11, B13	B4, B5, B6	B4, B5, B6, B8, B9	Total System
FY12 Average Flow Rate (gpm)	423	619	1,077	1,831
MOS Operational Minimum (gpm)	415	600	1,010	1,745

TABLE 12-3

TREATMENT CENTER WATER METER TOTALS
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)									
	Extraction Wells	*Meter 1*	*Meter 2*	*Total Meters 1 & 2*	*Meter 3*	*Meter 4*	*Total Meters 3 & 4*	*Meter 5*	*Meter 6*	*Total Meters 5 & 6*
October 2011	85,415,000	0	0	0	183,000	69,114,000	69,297,000	0	0	0
November 2011	81,180,900	0	0	0	112,000	72,168,000	72,280,000	0	0	0
December 2011	82,729,400	0	0	0	13,000	74,828,000	74,841,000	0	0	0
January 2012	81,113,300	0	0	0	19,000	73,441,000	73,460,000	0	0	0
February 2012	76,089,300	0	0	0	313,000	67,485,000	67,798,000	0	0	0
March 2012	80,296,200	0	0	0	7,000	67,860,000	67,867,000	0	0	0
April 2012	76,396,600	0	0	0	10,000	69,804,000	69,814,000	0	0	0
May 2012	81,477,200	0	0	0	3,000(1)	70,461,000	70,464,000	0	0	0
June 2012	77,617,000	0	0	0	0(1)	71,881,000	71,881,000	0	0	0
July 2012	80,368,700	0	0	0	0(1)	67,854,000	67,854,000	0	0	0
August 2012	83,047,400	0	0	0	0(1)	70,622,000	70,622,000	0	0	0
September 2012	79,265,900	0	0	0	35,000(1)	72,947,000	72,982,000	0	0	0
TOTAL FY 2012	964,996,900	0	0	0	695,000	848,465,000	849,160,000	0	0	0

Notes:
(1) - Meter 3 was removed for maintenance from 5/24/12 to 9/13/12

TABLE 12-3

TREATMENT CENTER WATER METER TOTALS
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)									
	Extraction Wells	*Meter 1*	*Meter 2*	*Total Meters 1 & 2*	*Meter 3*	*Meter 4*	*Total Meters 3 & 4*	*Meter 5*	*Meter 6*	*Total Meters 5 & 6*
FY 1989	1,033,353,676	501,826,000	560,836,000	1,062,662,000	383,736,000	587,596,000	971,332,000	493,681,000	582,955,000	1,076,636,000
FY 1990	1,008,415,750	493,915,000	526,417,000	1,020,332,000	371,391,000	588,642,000	960,033,000	487,946,000	543,726,000	1,031,672,000
FY 1991	1,382,327,590	666,166,000	708,313,000	1,374,479,000	523,702,000	789,947,000	1,313,649,000	601,307,000	649,621,000	1,250,928,000
FY 1992	1,401,346,600	68,289,000	724,328,000	1,407,227,000	557,169,000	772,509,000	1,329,678,000	767,707,000	677,735,000	1,445,442,000
FY 1993	1,388,206,172	666,814,000	725,341,000	1,392,155,000	504,027,000	651,149,000	1,155,176,000	729,078,000	762,791,000	1,491,869,000
FY 1994	1,245,663,275	660,700,000	659,953,000	1,320,653,000	457,210,000	715,668,000	1,172,878,000	653,913,000	550,131,000	1,204,044,000
FY 1995	1,369,361,500	706,114,000	683,982,000	1,390,096,000	500,275,000	739,744,000	1,240,019,000	495,616,000	274,507,000	770,123,000
FY 1996	1,341,763,220	734,443,000	629,327,000	1,363,770,000	503,518,000	754,399,000	1,257,917,000	4,000	600,035,000	600,039,000
FY 1997	1,213,035,110	688,312,000	568,804,600	1,257,116,600	538,625,000	586,515,000	1,125,140,000	13,000	578,900,000	578,913,000
FY 1998	1,196,007,900	624,784,000	540,353,000	1,220,604,000	511,065,000	603,871,000	1,114,936,000	58,000	178,076,000	178,134,000
FY 1999	1,158,224,870	623,500,000	496,773,200	1,177,206,200	398,620,000	718,384,000	1,117,004,000	26,000	17,000	43,000
FY 2000	1,148,448,350	635,724,000	489,669,000	1,183,258,000	389,709,000	663,807,000	1,053,516,000	0	0	0
FY 2001	1,113,163,360	614,341,000	443,167,000	1,113,164,000	318,517,000	718,661,000	1,037,178,000	0	0	0
FY 2002	917,318,879	491,082,800	434,959,700	926,042,500	225,460,000	650,839,000	876,299,000	0	0	0
FY 2003	904,295,450	545,281,000	345,993,000	891,274,000	125,965,000	750,518,000	876,483,000	0	0	0
FY 2004	908,718,760	518,391,900	376,889,660	895,281,560	216,177,000	680,633,000	896,810,000	0	0	0
FY 2005	895,339,710	520,073,000	363,275,000	883,348,000	224,823,000	658,405,000	883,228,000	0	0	0
FY 2006	929,715,590	534,305,000	377,499,000	911,804,000	266,299,000	669,900,000	936,199,000	0	0	0
FY 2007	945,317,300	447,901,000	487,701,000	935,602,000	281,061,000	833,161,000	1,114,222,000	0	0	0
FY 2008	943,318,161	424,289,615	512,634,095	936,923,709	217,134,430	778,717,620	995,852,050	0	0	0
FY 2009	925,232,745	357,698,000	552,505,000	910,203,000	173,004,000	795,057,000	968,061,000	0	0	0
FY 2010	933,789,205	368,260,000	556,160,000	924,420,000	61,957,000	894,152,000	956,109,000	0	0	0
FY 2011	952,379,000	183,460,000	268,747,000	452,207,000	15,479,000	890,850,000	906,329,000	0	0	0
FY 2012	964,996,900	0	0	0	695,000	848,465,000	849,160,000	0	0	0

TABLE 12-4

PUMPHOUSE DOWN TIME (DAYS)
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Well Name	*FY12 Down Time (Days)*	*FY11 Down Time (Days)*	*FY10 Down Time (Days)*	*FY09 Down Time (Days)*	*FY08 Down Time (Days)*
B1	1.5	6.2	18.0	9.5	4.4
B2	(1)	(1)	(1)	(1)	(1)
B3	1.6	26.4	7.4	12.1	9.5
B4	6.0	6.4	9.3	16.4	34.7
B5	2.0	4.5	7.7	8.6	3.4
B6	1.9	5.7	12.0	10.2	4.5
B7	(1)	(1)	(1)	(1)	(1)
B8	3.7	4.2	8.2	23.2	21.7
B9	3.6	21.1	7.9	9.4	5.4
B10	(1)	(1)	(1)	(1)	(1)
B11	9.5	3.1	8.7	8.7	6.0
B12	(1)	(1)	(1)	(1)	(1)
B13	7.4	6.4	7.4	16.1	15.2
SC1	7.6	17.8	17.2	10.8	5.8
SC2	35.0	37.0	7.5	14.2	11.9
SC3	(1)	(1)	(1)	(2)	(1)
SC4	(1)	(1)	(1)	(1)	(1)
SC5	7.3	33.3	13.8	21.0	3.9

Note:

(1) The extraction well was not in operation during the fiscal year.
(2) The extraction well was in operation for only part of the fiscal year.

TABLE 12-5

DOWN TIME (DAYS) BY CATEGORY
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Category	*Down Time (Days)*
Pumphouse Component	5.3
Treatment Center Component	0.4
Electrical Service	0.8
Miscellaneous	0.8
Preventive Maintenance	0.0
System Modification	0.0
Forcemain	0.0
Total System Equivalent	7.3
Anticipated Down Time for Fiscal Year 2013	
Pumphouse Component	3.5
Treatment Center Component	3.0
Electrical Service	1.0
Miscellaneous	0.1
Preventive Maintenance	3.5
System Modification	1.0
Forcemain	2.0

TABLE 12-6

VOC MASS LOADING SUMMARY
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Well	*Percent Contribution to VOC Mass Removal*	*FY 2012 Total Pounds VOCs Mass Removed*
B1	6.2%	112.0
B2[1]	0.0%	0.0
B3	0.2%	3.0
B4	5.4%	97.2
B5	5.8%	104.8
B6	2.6%	46.6
B7[1]	0.0%	0.0
B8	0.7%	11.9
B9	4.8%	87.0
B10[1]	0.0%	0.0
B11	0.0%	0.6
B12[1]	0.0%	0.0
B13	2.2%	39.2
SC1	6.7%	119.8
SC2	0.3%	5.8
SC3[1]	0.0%	0.0
SC4[1]	0.0%	0.0
SC5	65.1%	1,173
Fiscal Year 2012 Total (lbs)		***1,801***
Daily Average (lbs/day)		***4.9***

Notes:

[1] Extraction well was not in operation during the fiscal year.

TABLE 12-6

VOC MASS LOADING SUMMARY
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

HISTORICAL TOTAL

Fiscal Year		*Pounds VOC Mass Removed*
2012		1,801
2011		1,834
2010		2,096
2009		2,167
2008		2,292
2007		2,507
2006		2,552
2005		2,663
2004		3,291
2003	(First year of reconfigured system)	3,041
2002		2,852
2001		3,418
2000		4,499
1999		4,878
1998		6,132
1997		6,210
1996		10,655
1995		13,355
1994		15,070
1993		20,165
1992		24,527
1991		26,760
1990		18,005
1989	(First year of full scale system)	19,510
1988		4,800
1987		2,100
Total		***207,180***

TABLE 12-7

VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS (µg/L)
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Location	*Alias*	*Date*	*Dup*	*1,1,1-Trichloroethane* µg/L	*1,1-Dichloroethane* µg/L	*1,1-Dichloroethene* µg/L	*1,2-Dichloroethane* µg/L	*cis-1,2-Dichloroethene* µg/L	*Tetrachloroethene* µg/L	*Trichloroethene* µg/L
03F302	B1	12/5/11		4.3	0.94 JP	1.2	< 1	4.4	2.3	99
03F302	B1	5/29/12		4.3	0.87 JP	1.1	< 1	5.3	2	98
03F303	B2	5/29/12		< 1	0.54 JP	1.3	0.33 JP	1.4	0.99 JP	28
03F304	B3	12/5/11		< 1	0.47 JP	0.59 JP	< 1	< 1	< 1	3.6
03F304	B3	5/29/12		< 1	0.37 JP	0.4 JP	< 1	< 1	< 1	2.9
03F305	B4	12/5/11		7.5	4.6	4	< 1	2.1	< 1	120
03F305	B4	5/29/12		7.3	3.9	3.5	< 1	2.3	< 1	110
03F306	B5	12/5/11		3.4	3.4	3.1	< 1	0.7 JP	5.8	110
03F306	B5	12/5/11	D	3.6	3.5	3.4	< 1	0.74 JP	5.7	110
03F306	B5	5/29/12		3.2	3.3	2.9	< 1	0.82 JP	5.8	100
03F307	B6	12/5/11		0.89 JP	0.89 JP	1.1	< 1	< 1	< 1	51
03F307	B6	5/29/12		0.74 JP	0.77 JP	0.83 JP	< 1	< 1	< 1	45
PJ#309	B8	12/5/11		1.1	0.74 JP	0.99 JP	< 1	< 1	< 1	17
PJ#309	B8	5/29/12		0.99 JP	0.71 JP	0.82 JP	< 1	0.32 JP	< 1	16
PJ#310	B9	12/5/11		3.7	3.4	3.6	< 1	1.1	< 1	60
PJ#310	B9	5/29/12		3.5	3.3	3.4	< 1	1.2	< 1	56
03F312	B11	12/5/11		< 1	< 1	< 1	< 1	< 1	< 1	1.6
03F312	B11	5/29/12		< 1	< 1	< 1	< 1	< 1	< 1	1.5
03F319	B13	12/5/11		1.1	0.36 JP	0.43 JP	< 1	2.9	0.43 JP	97
03F319	B13	5/29/12		1.8	0.51 JP	0.57 JP	< 1	5.2	0.47 JP	150
03U301	SC1	12/5/11		7.4	0.95 JP	1.6 JP	< 2	47	< 2	860
03U301	SC1	5/29/12		7.5	0.93 JP	1.5 JP	< 2	55	< 2	790
03U301	SC1	5/29/12	D	7.5	0.93 JP	1.5 JP	< 2	56	< 2	830

TABLE 12-7

VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS (µg/L)
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Location	*Alias*	*Date*	*Dup*	*1,1,1-Trichloroethane µg/L*	*1,1-Dichloroethane µg/L*	*1,1-Dichloroethene µg/L*	*1,2-Dichloroethane µg/L*	*cis-1,2-Dichloroethene µg/L*	*Tetrachloroethene µg/L*	*Trichloroethene µg/L*
03U314	SC2	12/5/11		9.5	0.68 JP	0.99 JP	< 1	0.35 JP	< 1	39
03U314	SC2	5/29/12		2.3	0.51 JP	< 1	< 1	0.4 JP	< 1	30
03U317	SC5	12/5/11		690	16	32	1.5 JP	1.9 JP	5.3	2400
03U317	SC5	5/29/12		750	17	36	< 10	< 10	5.3 JP	2500
03U317	SC5	5/29/12	D	780	17	36	< 10	< 10	5.1 JP	2300

Notes:

D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

TABLE 12-8

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

			1,1,1-Trichloroethane	*1,1-Dichloroethane*	*1,1-Dichloroethene*	*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*Tetrachloroethene*	*Trichloroethene*
TGRS Cleanup Level (1)			***200***	***70***	***6***	***4***	***70***	***5***	***5***
Location	***Date***	***Dup***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
03L004	8/28/12		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L802	6/1/12		< 1	< 1	< 1	< 1	< 1	< 1	2.4
03L806	5/31/12		2.1	69	36	0.81 JP	7	0.58 JP	490
03M004	8/28/12		< 1	< 1	< 1	< 1	< 1	< 1 JMS	< 1
03M802	6/1/12		< 1	< 1	< 1	< 1	< 1	< 1	6.4
03M806	5/31/12		< 1	51	29	0.48 JP	4.6	< 1	270
03U093	5/30/12		78	0.41 JP	5.2	< 1	2.2	< 1	140
03U099	5/30/12		1.6	< 1	< 1	< 1	< 1	< 1	3.9
03U658	8/28/12		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U658	8/28/12	D	< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U708	5/30/12		4	1.2	1.4	< 1	0.82 JP	1.8	35
03U801	5/30/12		< 1	< 1	< 1	< 1	0.62 JP	< 1	28
03U806	5/31/12		< 1	0.89 JP	0.66 JP	< 1	0.32 JP	1.3	57
04J077	5/30/12		5	6.6	6.3	< 1	1.8	< 1	100
04U711	5/30/12		< 1	< 1	< 1	< 1	< 1	< 1	0.48 JP
04U802	5/31/12		< 1	< 1	< 1	< 1	< 1	< 1	0.5 JP
04U806	5/31/12		1.5	22	12	< 1	2.4	0.41 JP	190
04U833	5/31/12		< 1	< 1	< 1	< 1	< 1	< 1	1.1
PJ#806	5/31/12		0.4 JP	0.77 JP	0.59 JP	< 1	< 1	< 1	23
PJ#806	5/31/12	D	0.41 JP	0.77 JP	0.61 JP	< 1	< 1	< 1	22

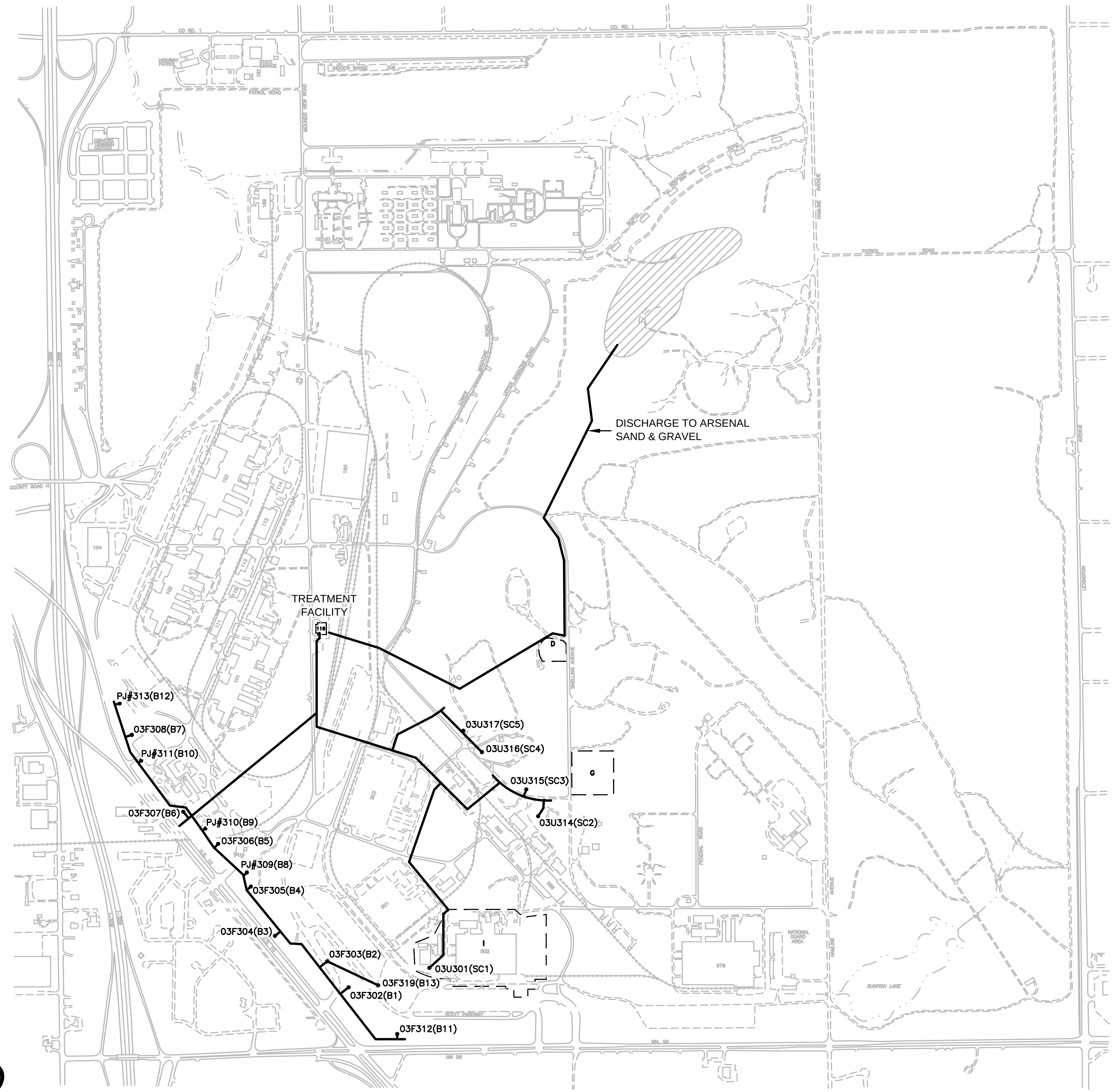
Notes:

(1) Cleanup levels for TGRS are from the OU2 ROD. Shading indicates exceedence of the cleanup level.
D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.
JMS - Result is qualified as estimated due to low matrix sprike recovery (<75%).

TABLE 12-9

SUMMARY OF OU2 DEEP GROUNDWATER MONITORING REQUIREMENTS
TGRS, OU2
ARDEN HILLS, MINNESOTA

Remedy Component	*Monitoring Requirements*	*Implementing Party*	*Documents Containing the Monitoring Plan*
#1 Hydraulic Containment and Mass Removal	a. Water levels to draw contour maps showing hydraulic zone of capture	ATK/Army	Deep groundwater monitoring plan in Annual Report
	b. Pumping volumes and rates for comparison to design rates	ATK/Army	Deep groundwater monitoring plan in Annual Report
	c. Influent and extraction well water quality for overall mass removal calculations	ATK/Army	Deep groundwater monitoring plan in Annual Report
#2 Groundwater Treatment	• Outlined below		
#3 Treated Water Discharge	• Effluent monitoring to verify attainment of treatment requirements	ATK/Army	Deep groundwater monitoring plan in Annual Report
#4 Land Use Controls	• None		
#5 Review of New	• None		
#6 Groundwater Monitoring	a. Water levels to draw contour maps showing hydraulic zone of capture	ATK/Army	Deep groundwater monitoring plan in Annual Report
	b. Groundwater quality to verify attainment of clean up goals	ATK/Army	Deep groundwater monitoring plan in Annual Report
Overall Remedy	a. Groundwater quality to verify attainment of clean up goals	ATK/Army	Deep groundwater monitoring plan in Annual Report



0 400 1200ft

LEGEND

PRIMARY ROAD
SECONDARY ROAD
RAILROAD
DRAINAGE
BUILDING
BUILDING REMOVED
SOURCE AREA
WELL LOCATION

EXTRACTION WELL NAME CROSS REFERENCE

B1	03F302
B2	03F303
B3	03F304
B4	03F305
B5	03F306
B6	03F307
B7	03F308
B8	PJ#309
B9	PJ#310
B10	PJ#311
B11	03F312
B12	PJ#313
B13	03F319
SC1	03U301
SC2	03U314
SC3	03U315
SC4	03U316
SC5	03U317

figure 12-1

TGRS LAYOUT
OPERABLE UNIT 2
Arden Hills, Minnesota

079853-43(001)GN-SP001 Jan 08/2013

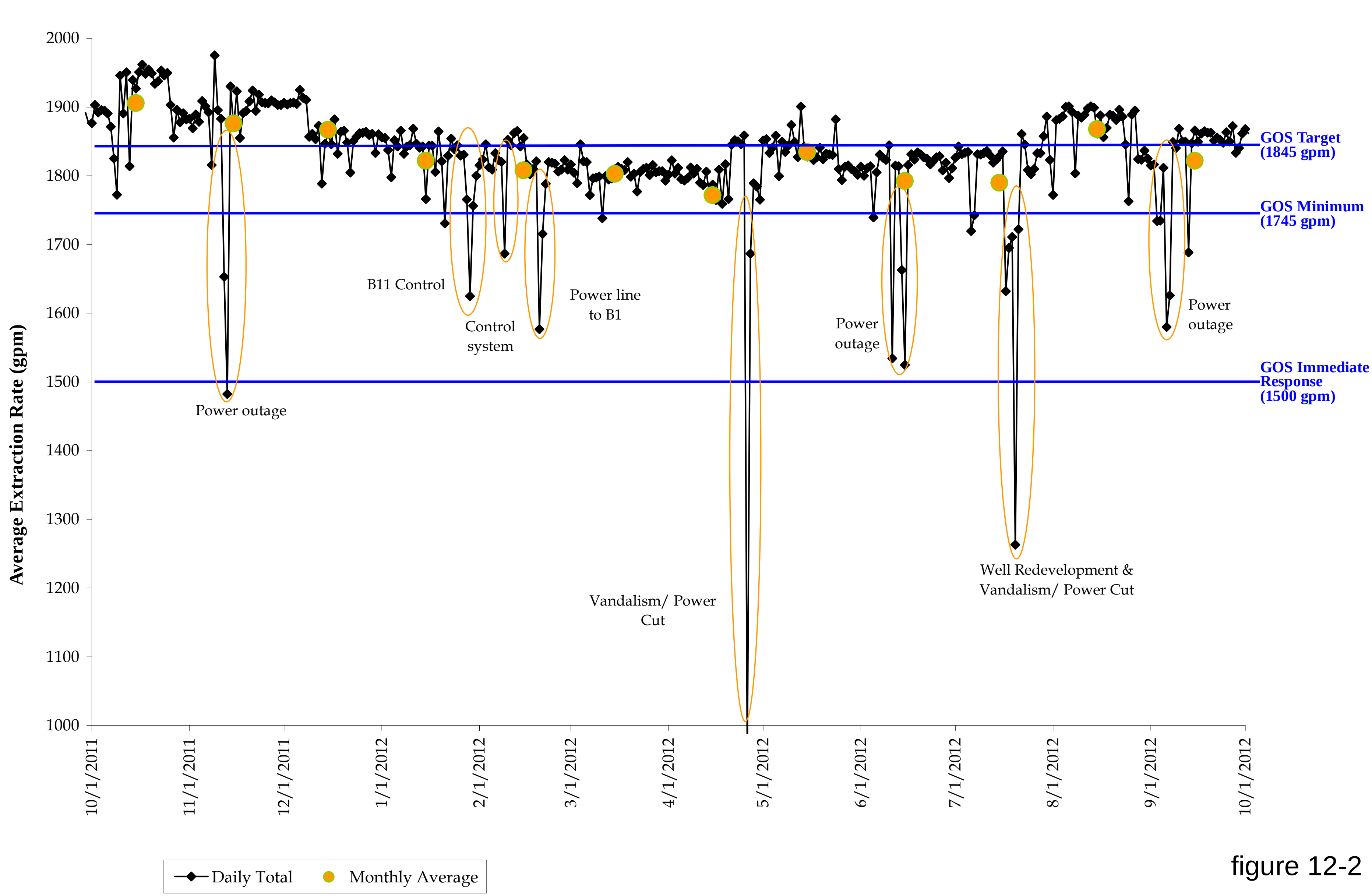
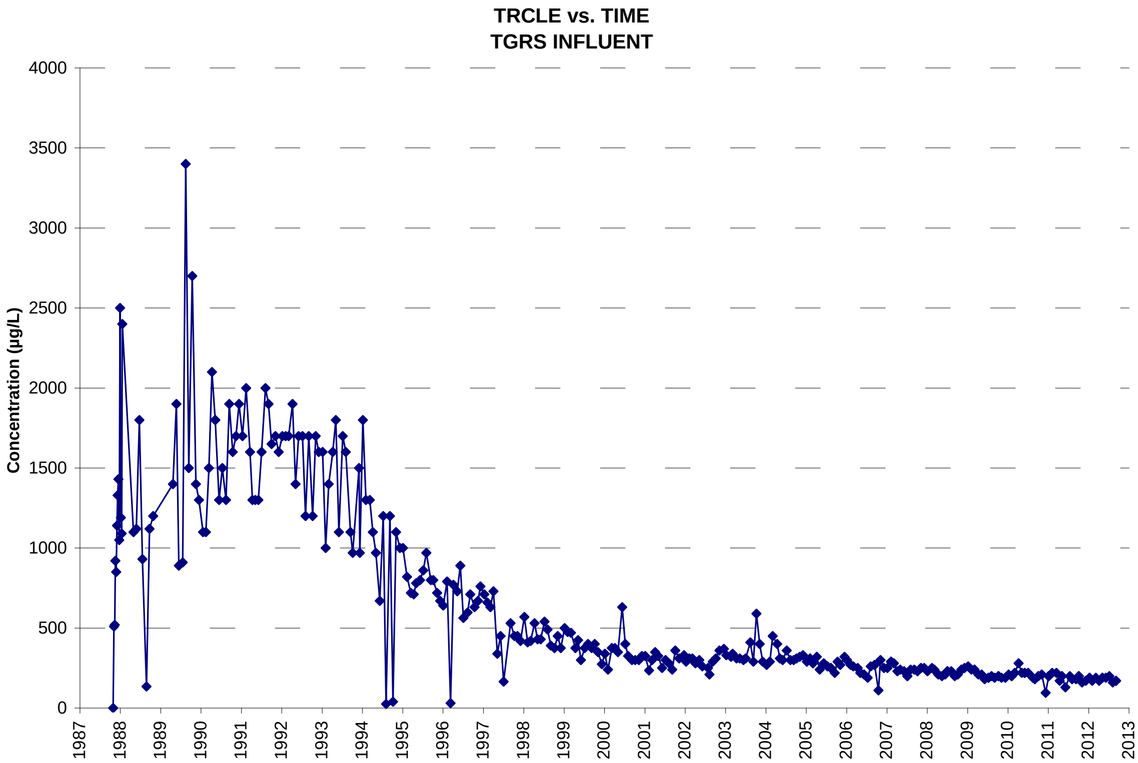
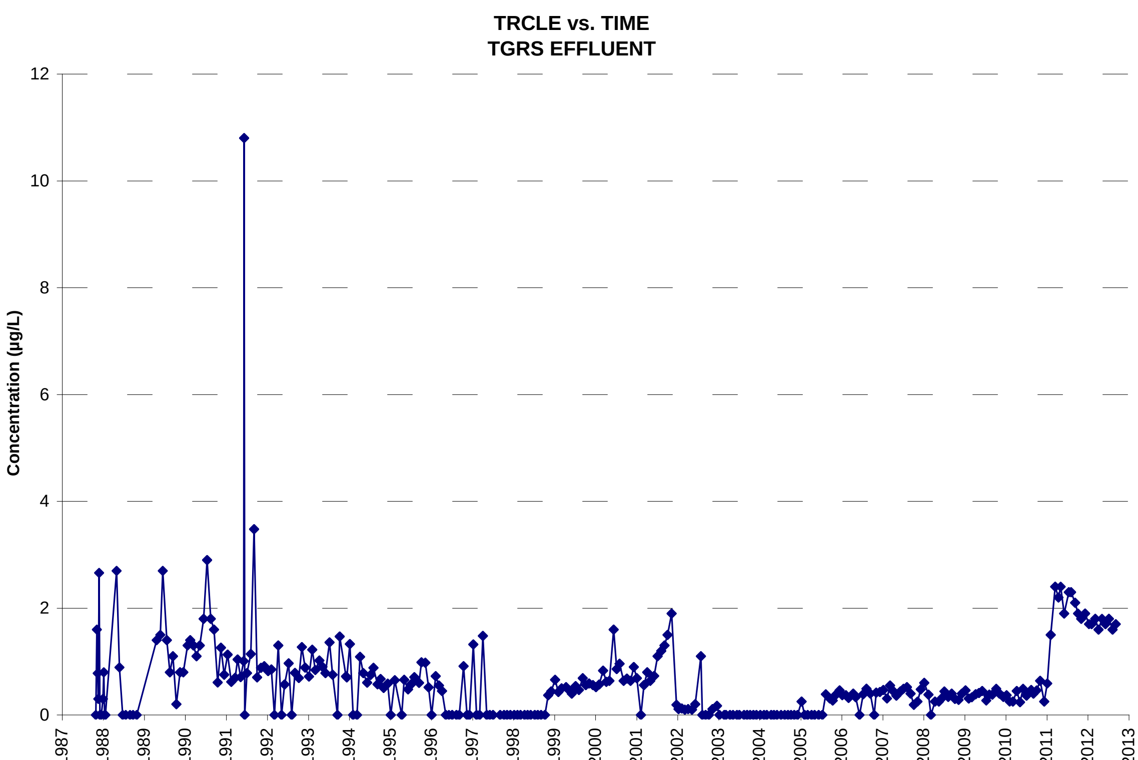


figure 12-2

TGRS FY2012 TOTAL DAILY FLOW RATES
OPERABLE UNIT 2
Arden Hills, Minnesota

079853-43(001)GIS-SP001 JAN 08/2013





NOTE: SAMPLES REPORTING CONCENTRATIONS OF NON-DETECT WERE PLOTTED AS ZERO. WHEN DUPLICATE SAMPLES WERE COLLECTED, THE HIGHER CONCENTRATION WAS REPORTED.

figure 12-3

TGRS TREATMENT SYSTEM PERFORMANCE
OPERABLE UNIT 2
Arden Hills, Minnesota

079853-43(001)GIS-SP002 JAN 08/2013

13.0 Operable Unit 3: Deep Groundwater

RECORD OF DECISION
Groundwater Remediation
Operable Unit 3
at New Brighton/Arden Hills Superfund Site
September 1992

RECORD OF DECISION AMENDMENT
For Operable Unit 3
New Brighton/Arden Hills Superfund Site
August 2006

A ROD Amendment was finalized in August 2006 that significantly changed the remedy for OU3. The basis for the OU3 ROD Amendment was the "Groundwater Statistical Evaluation, OU3" technical memorandum, which received consistency on May 2, 2005. This document presented a statistical evaluation showing that the South Plume has been receding since at least 1996, including the period after the Plume Groundwater Recovery System (PGRS) was shut off in 2001. The South Plume had receded well upstream of the PGRS and the PGRS was basically pumping clean water. The ROD Amendment removed the need for a pump and treat remedy, eliminating the PGRS extraction well and treatment train.

The PGRS was an off-post groundwater extraction and treatment system and municipal potable water supply. The PGRS consisted of New Brighton Municipal Well #13 (NBM #13) and a GAC treatment plant. New Brighton used the water for municipal supply. The PGRS was designed to contain the South Plume of VOC contamination emanating from the former TCAAP property and to prevent further downgradient migration. Recovered groundwater was treated and used by the City of New Brighton to fulfill its municipal water supply demand. Figure 13-1 presents an OU3 site plan.

The PGRS began operating on May 3, 1994. In 1997, the PGRS influent dropped below the ROD required limits for all VOCs. In December 1999, under an agreement with the Agencies, the PGRS pumping rate was reduced from a nominal rate of 1,000 gpm to 400 gpm to help determine if the VOC reductions in concentration were the result of actual plume decreases or the result of dilution from over pumping. In conjunction with the flow rate decrease, a quarterly monitoring program was undertaken to monitor for potential "rebound" in VOC concentrations. By the end of FY 2000, no rebound was observed and a review of the historical database for all of OU3 and the associated source area in OU2 revealed that the entire South Plume had dramatically decreased in size and concentration since the early 1990s. The VOC concentration decreases were such that the leading edge of the South Plume, at the PGRS, dropped below the ROD requirements.

The results of this evaluation were presented to the Agencies on September 6, 2000, and a report titled "Plume History Evaluation, Operable Unit 3", CRA, was submitted to the Agencies on October 10, 2000. The report documents the history of plume size and concentration reductions throughout OU3. Based on the dramatic reductions in plume size and concentration, the report recommended shutting down the PGRS. The Agencies subsequently accepted the recommendation. The City of New Brighton stopped significant pumping in August 2001 and the PGRS was maintained in standby status. During the period May 2003 through September 2003, the PGRS was operated solely to satisfy peak water supply demands and then was placed back into standby status. The PGRS remained in standby status throughout FY 2004, FY 2005, and FY 2006. The City conducted an evaluation of its municipal system to, in part, determine the future use of the PGRS extraction well and treatment system. The City decided the PGRS treatment system and well NBM #13 were not part of the City's long-term water supply plan. During FY 2007, the PGRS treatment system was dismantled and NBM #13 was abandoned.

13.1 REMEDY COMPONENT #1: MONITORED NATURAL ATTENUATION

Description: "Monitored natural attenuation."
(OU3 ROD Amendment, page 17)

Performance Standard (how do you know when you're done):
When a monitoring program is established and monitoring is in compliance with the regulator approved Annual Monitoring Plan.

Is the remedy component being implemented?
Yes. Appendix A summarizes the FY 2012 monitoring plan and any deviations are explained in Appendix C.2. Details of the groundwater monitoring program are discussed in Section 13.2.

13.2 REMEDY COMPONENT #2: GROUNDWATER MONITORING

Description: "Monitoring of the groundwater for VOCs to verify the effectiveness of the selected remedy and the natural attenuation of the South Plume."
(OU3 ROD Amendment, page 17)

Performance Standard (how do you know when you're done):
When a monitoring program is established and monitoring is in compliance with the regulator approved Annual Monitoring Plan.

Is the remedy component being implemented?
Yes. Appendix A summarizes the FY 2012 monitoring plan and any deviations are explained in Appendix C.2.

Groundwater samples were collected from two OU3 wells in FY 2012 as part of the OU1, OU2, and OU3 annual sampling round. Samples were collected as specified in the monitoring plan and analyzed for VOCs by method SW846 8260. Well locations are shown on Figure 13-1. The specific purpose of monitoring each well is provided in Appendix A. Water elevations were also measured during the monitoring event and are presented in Appendix D.1.

Table 13-1 presents a summary of the analytical results. TRCLE was detected above 1.0 μg/L in the downgradient sentry well, 04U863, for the first time since December 1999. However, the reported TRCLE concentration of 1.2 μg/L is well below the cleanup standard of 5 μg/L. The other well sampled in FY 2012, 03M848, had a TRCLE concentration of 190 μg/L with a duplicate result of 180 μg/L.

Previous sampling has shown 1,1,1-Trichloroethane and its degradation products 1,1-dichloroethane and 1,1-dichloroethene present in wells at the boundary between OU1 and OU3, indicating a commingling of the North Plume and the South Plume at this location. No boundary wells were sampled in 2012; however, these parameters have been detected at low concentrations at 03M848, a center-of-plume well, for several years, including FY 2012.

What were the results of the Statistical Analyses?

The Mann-Kendall statistical analysis was updated for the center-of-plume well (03M848) sampled in 2012. A summary of the statistical analyses is presented in Table 13-2. A spreadsheet and graph presenting the Mann-Kendall test results for the well are provided in Appendix H.

The trend for 03M848, which has historically been the center of the South Plume, changed from stable to no trend as concentrations have increased slightly for the last two sampling events after being stable for several sampling events. The TRCLE concentrations at 03M848 have decreased from 1400 μg/L in FY 1996 to 700 μg/L in FY 1999 to 450 μg/L as recently as FY 2003 to the current concentration of 190 μg/L in FY 2012. However, TRCLE concentrations at 03M848 have ranged only between 130 μg/L and 190 μg/L for the last seven years indicating that the TRCLE concentration at the well may be stabilizing. The recent low-level detections of 1,1,1-trichloroethane and/or its degradation products at 03M848, may indicate that the North

Plume is not only beginning to commingle with the South Plume at the OU1-OU3 boundary, but may be present even toward the center of the South Plume. The possible commingling of the plumes at this well may be a factor in the statistical trends.

Are contingency actions warranted?

No. The OU3 ROD Amendment requires contingency actions to be considered when the Mann-Kendall statistical analysis shows that a well at the edge of the South Plume has an increasing trend. No edge-of-plume wells were analyzed in FY 2012.

What groundwater monitoring is proposed before the next report?

The OU3 monitoring requirements presented in Table 13-3 are proposed. Appendix A presents the FY 2012 – FY 2016 monitoring plan.

13.3 REMEDY COMPONENT #3: DRILLING ADVISORIES

Description: "Continued implementation of the drilling advisories that regulates the installation of new private wells within OU3 as a Special Well Construction Area."
(OU3 ROD Amendment, page 17)

Performance Standard (how do you know when you're done):

When the Minnesota Department of Health (MDH) has issued a Special Well Construction Area Advisory.

Has the MDH issued a Special Well Construction Area Advisory?

Yes. It was issued in June 1996. The Special Well Construction Area encompasses OU1, OU3, and the OU2 Site A shallow groundwater plume. In June 1999, the MPCA requested that the MDH extend the boundary of the Special Well Construction Area further to the southwest to the Mississippi River and Marshall Avenue to ensure that the southern boundary fully encompassed the plume. The MDH revised the Special Well Construction Area in December 1999. The current boundary is shown on Figure E-1 (Appendix E).

Are any changes or additional actions required for this remedy component? No.

13.4 OVERALL REMEDY FOR OU3

Is the Remedy for OU3 Operating in Compliance with the OU3 ROD and OU3 ROD Amendment?

Yes. In FY 2012, groundwater monitoring took place as prescribed in the Annual Monitoring Plan. The annual sampling round of FY 2012 indicates that the South Plume footprint remains stable, with stable concentrations at the center of the plume.

Are any changes or additional actions required for OU3?

No. A comprehensive biennial groundwater sampling event will take place in FY 2013 as planned. No additional actions are necessary since no increasing trends were identified by the statistical analysis.

Monitoring well 04U861 was abandoned in February 2006 at the request of the City of New Brighton to allow for property redevelopment. The Army initially committed to replacing 04U861 when the City completed the property redevelopment. With the redevelopment schedule uncertain and the questionable value of any information to be gained from a replacement well, the Army and ATK requested to forego replacement of the monitoring well in a letter to USEPA and MPCA dated September 6, 2012. To date, the Army and ATK have not yet received a response from the agencies for this request.

TABLE 13-1

GROUNDWATER QUALITY DATA (µg/L)
OPERABLE UNIT 3
FISCAL YEAR 2012

			1,1,1-Trichloroethane	*1,1,2-Trichloroethane*	*1,1-Dichloroethane*	*1,1-Dichloroethene*	*cis-1,2-Dichloroethene*	*Trichloroethene*
OU3 Cleanup Level [(1)]			**200**	**3**	**70**	**6**	**70**	**5**
Location	***Date***	***Dup***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
03M848	6/1/12		0.4 JP	< 1	1.2	1.2	12	190
03M848	6/1/12	D	0.41 JP	< 1	1.2	1.2	11	180
04U863	6/1/12		< 1	< 1	< 1	< 1	< 1	1.2

Notes:

(1) Cleanup levels for OU3 are from the OU3 ROD. Shading indicates exceedence of the cleanup level.
D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

TABLE 13-2

MANN-KENDALL STATISTICAL SUMMARY
OPERABLE UNIT 3
FISCAL YEAR 2012

Well	*Kendall S*	*Number of Data Points*	*Raw Trend*	*Confidence*	*Coefficient of Variance*	*Raw Trend Decision*	*MAROS Conclusion*	*June 2012 TRCLE Conc.*
Center of Plume Wells								
03M848	6	6	Increasing	81.46%	0.1619	Stable or No Trend	No Trend	190

TABLE 13-3

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
OPERABLE UNIT 3
FISCAL YEAR 2012

	Remedy Component		Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1	Monitored Natural Attenuation		Outlined below.		
#2	Groundwater Monitoring	a.	Water levels for use in drawing contour maps.	ATK	OU3 Monitoring Plan in Annual Report
		b.	Groundwater sampling to track progress of clean-up and attenuation of plume.	ATK	OU3 Monitoring Plan in Annual Report
#3	Drilling Advisories	a.	Verification that drilling advisories are in place and functioning as intended.	Army/MDH	NA
OR:	Overall Remedy	a.	Water quality monitoring to verify attainment of clean-up goals.	ATK	OU3 Monitoring Plan in Annual Report

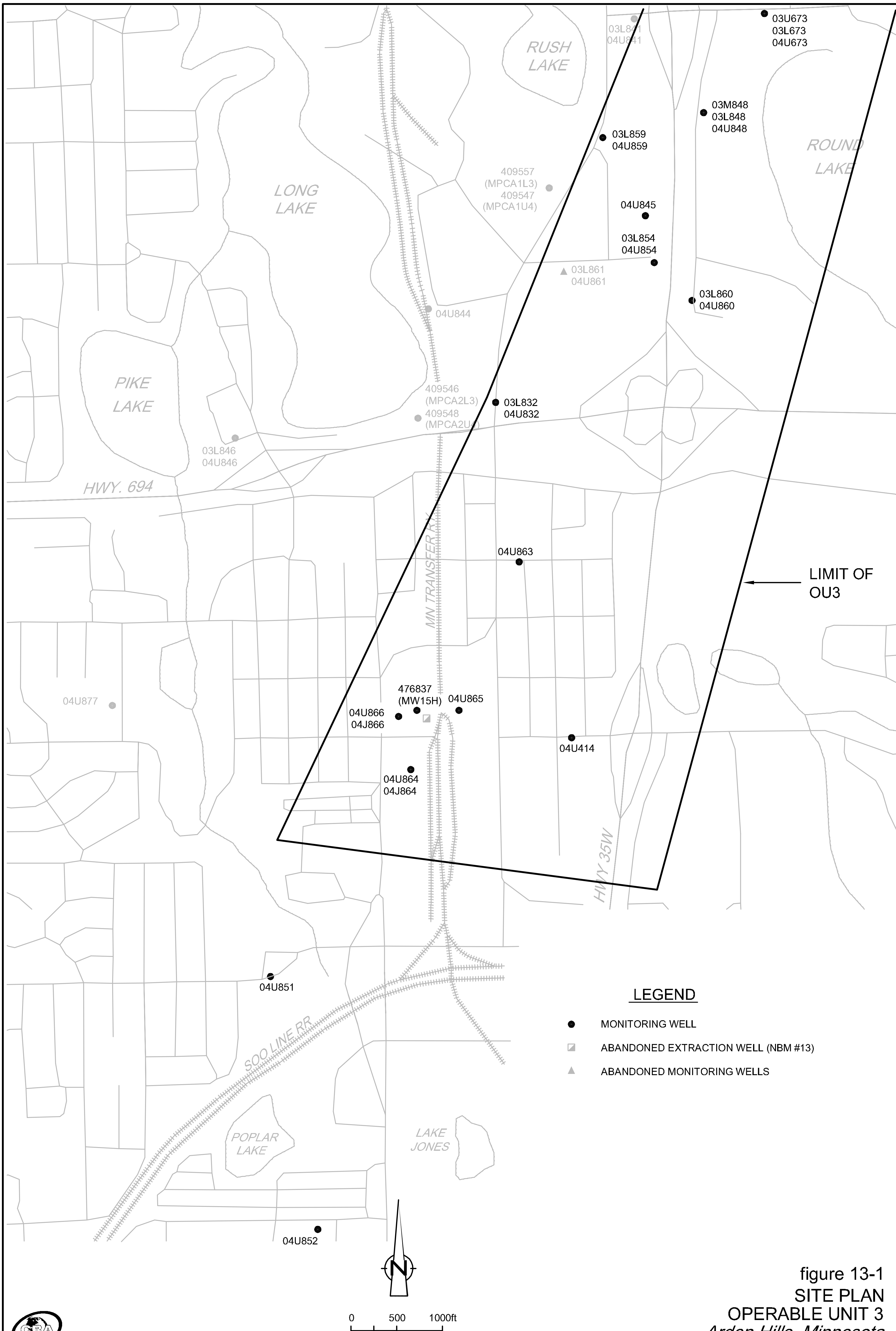


figure 13-1
SITE PLAN
OPERABLE UNIT 3
Arden Hills, Minnesota

079853-43(001)GN-SP002 Jan 08/2013

14.0 Other Installation Restoration Activities During FY 2012

This section summarizes the status of other activities that are related to the Installation Restoration Program, but are not required in the RODs for OU1 through OU3.

14.1 DEEP GROUNDWATER BACKGROUND MONITORING

The Army voluntarily conducts monitoring at locations near the upgradient side of OU2 (the northeast corner and east side) to assess the quality of deep groundwater entering the operable unit. The five wells that are sampled for this purpose include 03U007, 03U009, 03L007, 04U007, and 04U510. Locations of these wells are shown on Figure B-3 in Appendix B. However, since this was a minor sampling year with respect to OU2 deep groundwater, none of these wells were sampled in FY 2012. These locations will be sampled in FY 2013 as shown in Appendix A.1 (the wells are listed under TCAAP Groundwater Recovery System in the appendix).

14.2 ROUND LAKE

The Tier II Ecological Risk Assessment Report for aquatic sites (including Round Lake), prepared by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM), was approved by the MPCA and USEPA in December 2004. In June 2005, the Army submitted a draft feasibility study (FS) for aquatic sites to support the risk management decisions with respect to "No Further Action" or "Implement a Remedy" for each aquatic site. As a result of comments on the draft FS, it was agreed to conduct additional sampling of Marsden Lake and Pond G, which was completed in 2008. A revised FS was submitted in

January 2009. Based on comments received and resolution thereof, the Army then submitted a revised (redlined) FS in April 2010. After review of this report, USEPA and MPCA requested that the Army prepare a work plan for collection of additional Round Lake sediment data. Given the time required to collect the additional data, the Army, USEPA, and MPCA agreed to separate the FS for aquatic sites into two documents: one for Round Lake, and one for Rice Creek, Sunfish Lake, Marsden Lake, and Pond G.

The USEPA and MPCA provided consistency for the QAPP for Round Lake Sediment Investigation in January 2011. The sediment sampling work was completed in January – February 2011. A Draft Summary of Investigation Findings was submitted in May 2011, and a meeting between Army, USEPA, MPCA, MN DNR, USFWS, and the TCAAP RAB was held in June 2011 for preliminary discussion of the findings. After receipt of final core dating results in February 2012, the MPCA and USEPA completed their final analysis of the 2011 sediment data, and they provided their recommended preliminary remediation goals for Round Lake sediments at a meeting with the Army and the other stakeholders in February 2012. In March 2012, the Army provided responses to the stakeholder comments on the Round Lake portion of the April 2010 FS, which had been placed on hold pending collection and evaluation of the 2011 sediment data. A comment resolution meeting was then held in April 2012, and a TCAAP Restoration Advisory Board meeting was held in May 2012, primarily to discuss the status of the Round Lake FS. With USEPA and MPCA agreement, the Army initiated a strategy to revise the FS in segments, with the intent to gain agreement/approval at key steps along the way. In accordance with this strategy, the Army submitted revised Sections 1 through 5 of the Round Lake FS in August 2012. The USEPA and MPCA provided comments in September 2012. The Army was preparing responses to comments at the end of FY 2012.

14.3 135 PRIMER/TRACER AREA

The Preliminary Assessment report received regulatory approval in FY 2002. It was recommended that a Site Inspection be conducted. The Site Inspection (SI) investigation report received MPCA and USEPA approval in FY 2005. The SI report recommended that an Engineering Evaluation/Cost Analysis (EE/CA) be conducted to determine what, if any, remediation is required to address contamination observed in the soil. The 135 Primer/Tracer Area (PTA) is on property that is proposed to be transferred out of federal ownership. The Army is anticipating transfer of the western portion of the 135 PTA to Ramsey County as a no-cost public conveyance for purposes of a public trail corridor. Accountability for the eastern portion may be transferred to the National Guard Bureau, who would in turn license use of the property to the Minnesota Army National Guard.

For the western portion, in anticipation of the property transfer, Ramsey County conducted soil investigation work on this portion of the 135 PTA in early FY 2012. A Phase II Environmental Site Assessment report documenting this work was submitted to the MPCA (VIC Program) in December 2011. Final USEPA and MPCA approval of the QAPP that had governed this work was still being sought at the end of FY 2012.

For the eastern portion, in February 2012, the USEPA and MPCA provided consistency for a QAPP for additional soil investigation to support preparation of an EE/CA. This soil investigation work was conducted in March – June 2012. In July 2012, the Army submitted a Draft-Final EE/CA, which documented this investigation work and presented a recommended removal action (soil excavation and offsite disposal). The USEPA and MPCA provided comments on the Draft-Final EE/CA in August and September 2012, and the Army provided response to those comments in September 2012. The MPCA approved the Army responses in September 2012. At the end of FY 2012, the USEPA was reviewing the Army responses.

14.4 SITE A - SOIL AREA OF CONCERN

Soil samples collected in December 2009 as part of Minnesota Army National Guard (MNARNG) environmental baseline survey (EBS) work indicated that metals contamination was present near the southern edge of the prior soil excavation area work that was completed in 1999.

In February 2012, the USEPA and MPCA provided consistency for a QAPP for additional soil investigation to support preparation of an EE/CA. This soil investigation work was conducted in March – June 2012. In July 2012, the Army submitted a Draft-Final EE/CA, which documented this investigation work and presented a recommended removal action (soil excavation and offsite disposal). The USEPA and MPCA provided comments on the Draft-Final EE/CA in August and September 2012, and the Army provided response to those comments in September 2012. The MPCA approved the Army responses in September 2012. At the end of FY 2012, the USEPA was reviewing the Army responses.

14.5 NATIONAL GUARD EBS - SOIL AREAS OF CONCERN

Soil samples collected in June 1999 as part of MNARNG environmental baseline survey (EBS) work indicated that metals contamination was present at two areas of concern located just north of the southwest corner of the National Guard area (within a former open storage area and adjacent to a concrete foundation). In February 2012, the USEPA and MPCA provided consistency for a QAPP for additional soil investigation to support preparation of an EE/CA. This soil investigation work was conducted in March – June 2012. In July 2012, the Army submitted a Draft-Final EE/CA, which documented this investigation work and presented a recommended removal action (soil excavation and offsite disposal). The USEPA and MPCA provided comments on the Draft-Final EE/CA in August and September 2012, and the Army provided response to those comments in September 2012. The MPCA approved the Army responses in September 2012. At the end of FY 2012, the USEPA was reviewing the Army responses. Also at the end of FY 2012, the Army collected additional soil samples to provide more complete delineation of the perimeters of the two areas of concern. This additional sampling work will ultimately be documented in a removal action work plan that will be submitted by the Army in FY 2013.

14.6 PROPERTY TRANSFER-RELATED ENVIRONMENTAL ACTIVITIES

In 2002, the remaining 774 acres that were still under the control of TCAAP were declared excess to the needs of the Department of Defense. The Army Base Realignment and Closure Office funded environmental site assessment (ESA) work to collect information regarding the environmental condition of the property in order to facilitate property transfer. The work included document reviews and field sampling of various media. The findings were published in "Environmental Site Assessment for 774-Acre Excess Parcel, Phase I and Phase II Report, Twin Cities Army Ammunition Plant" (Plexus Scientific Corporation, February 20, 2004, final report). Based on comments from the MPCA and USEPA, additional samples were collected and analyzed in FY 2005. The Army prepared an "ESA Addendum Report" that was approved in FY 2006. Originally, it was proposed to transfer approximately 585 acres through a negotiated sale with the City of Arden Hills, who in turn had an agreement with a developer. In FY 2007, the developer collected additional samples of various media on the property proposed for transfer to Arden Hills. Some, but not all of the data from this work was made available to the regulators and Army. In FY 2009, the developer withdrew from its agreement with Arden Hills, who in turn withdrew its offer to purchase with the federal government. The federal government was then working towards a public auction of the remaining TCAAP property; however, in FY 2011, Ramsey County initiated discussions with the federal government regarding purchase of the property for the potential purpose of locating a new Minnesota Vikings stadium (and other development), and the public auction has been postponed pending the outcome with Ramsey County. In FY 2012, the decision was made to locate the Vikings stadium in Minneapolis; however, at the end of FY 2012, Ramsey County was still contemplating whether to purchase the TCAAP property even without locating the stadium on it. No property transfer-related environmental investigation or cleanup work was performed in FY 2012.

15.0 References

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Appendix A

FY 2012 – FY 2016 Monitoring Plans

A.1 Groundwater Monitoring Wells

APPENDIX A.1
FY 2012 – FY 2016 MONITORING PLAN
FOR GROUNDWATER MONITORING WELLS

Unit Designations:

01U - Upper Fridley Formation
01L - Lower Fridley Formation
03U - Upper Hillside Formation
03M - Middle Hillside Formation
03L - Lower Hillside Formation
SP - St. Peter
PC - Prairie du Chien
J - Jordan
SL - St. Lawrence
UNK - Unknown

Notes:

(A) Indicates that the monitoring is the responsibility of ATK.
(B) Indicates that the monitoring is the responsibility of the Army.
(1) "L (A or B)" denotes a water level measurement by the appropriate party.
(2) "Q (A or B)" denotes a water quality sampling by the appropriate party. The required analyte list for each specific site is shown in Appendix A.4.
(3) The designations refer to the following purposes:
- ❖ Operable Unit 1 Water Quality
  - 1.a = To contour the perimeter of the plume which defines the area of concern for alternate water supply/well abandonment
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Operable Unit 1 Water Levels
  - 3.b = To contour water levels for evaluation of containment
- ❖ Site A Water Quality
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site A Water Levels
  - OR = Overall remedy. To evaluate groundwater flow direction relative to plume location
- ❖ Site C Water Quality
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site C Water Levels
  - OR = Overall remedy. To evaluate groundwater flow direction relative to plume location
- ❖ Site I Water Quality
  - 1.a = To track remedy progress
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site I Water Levels
  - 1.a = To track remedy progress
- ❖ Site K Water Quality
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site K Water Levels
  - 3.a = To contour water levels for evaluation of containment
- ❖ TGRS Water Quality
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ TGRS Water Levels
  - 1.a = To contour water levels for evaluation of containment
- ❖ Operable Unit 3 Water Quality
  - OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Operable Unit 3 Water Levels
  - 2.a = To contour water levels for evaluation of MNA remedy

(4) Sampling performed by the City of Saint Anthony. Army collects sample only if in production and not being sampled by City of Saint Anthony, otherwise Army uses Saint Anthony data.
(5) Sample extraction well annually or biennially, as shown, since it is no longer being pumped.
(6) Wells 04U414 and 04U851 monitored every 5 years during event preceding 5-year review
(7) Of the two wells, well 01U639 will be the primary sampling location and 482089 (I04MW) will be the alternate sampling location. If it is not possible to collect a groundwater sample from 01U639, then an attempt will be made to collect a sample from 482089 (I04MW).
(8) Flexibility will be maintained to allow for groundwater sampling to occur in either March or April depending on current conditions.

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Operable Unit 1			Note: Changes from the monitoring plan presented in the previous Annual Performance Report are highlighted in this appendix.								
03U	03U811			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
03U	03U821			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
03U	03U822			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03U	03U831			---	---	---	---	---	---	---	abandoned 2006
03U	409550	PCA 6U3		---	Q,L(B)	---	Q,L(B)	---	OR	None	
03U	409596	BS118U3		---	---	---	---	---	---	---	aband.2007, may need replacement
03M	03M843			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	03L811			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
03L	03L822			---	Q,L(B)	---	Q,L(B)	---	OR	None	
03L	03L832			---	Q,L(B)	---	Q,L(B)	---	OR	None	
03L	03L841			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	03L846			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	03L853			---	---	---	---	---	---	---	
03L	409556	PCA4L3		---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	409557	PCA1L3		---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	409597	BS118L3		---	---	---	---	---	---	---	aband. 2007, may need replacement
PC	04U821			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U834			---	Q,L(B)	---	Q,L(B)	---	OR	None	
PC	04U836	MW-1		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U837	MW-3		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U838	MW-5		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U839	MW-7		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U841			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U843			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U844			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U846			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U847			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U849			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U850			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U855			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U871			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
PC	04U872			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
PC	04U875			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U877			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
PC	04U879			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U880			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
PC	04U881			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
PC	04U882			---	Q,L(B)	---	Q,L(B)	---	OR	None	
PC	04U883			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
PC	191942	BS118U4		---	---	---	---	---	---	---	aband. 2007, may need replacement
PC	200154	UM Golf Course		---	Q(B)	---	Q(B)	---	1.a, OR	---	
PC	200814	American Linen		---	---	---	---	---	---	---	
PC	206688	Cloverpond		---	Q(B)	---	Q(B)	---	1.a, OR	---	
PC	234547	Honeywell Ridgeway		---	---	---	---	---	---	---	
PC	409547	PCA1U4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	409548	PCA2U4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	409549	PCA3U4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	409555	PCA5U4		---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	512761	Gross Golf Course #2		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	554216	New Brighton #14									See Appendix A.2
PC	582628	New Brighton #15									See Appendix A.2
J	04J822			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
J	04J834			---	Q,L(B)	---	Q,L(B)	---	OR	None	
J	04J835			---	---	---	---	---	---	---	
J	04J836	MW-2		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J837	MW-4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J838	MW-6		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J839	MW-8		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J847			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
J	04J849			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
J	04J882			---	Q,L(B)	---	Q,L(B)	---	OR	None	
J	200524	St. Anthony #5	(4)	---	Q(B)	---	Q(B)	---	OR	---	Army gets St. Anthony Data
J	200803	St. Anthony #4	(4)	---	Q(B)	---	Q(B)	---	OR	---	Army gets St. Anthony Data
J	206796	New Brighton #5									See Appendix A.2
J	206797	New Brighton #6									See Appendix A.2
PC/J	200804	St. Anthony #3	(4)	---	Q(B)	---	Q(B)	---	OR	---	Army gets St. Anthony Data
PC/J	200812	Gross Golf #1		---	---	---	---	---	---	---	
PC/J	206792	New Brighton #4									See Appendix A.2
PC/J	206793	New Brighton #3									See Appendix A.2
PC/J	233221	R&D Systems, N. Well		---	---	---	---	---	---	---	
PC/J	234549	Reiner		---	---	---	---	---	1.a, OR	---	Well out of service
PC/J	PJ#318			---	Q,L(B)	---	Q,L(B)	---	OR	None	
UNK	234546	Honeywell Ridgeway		---	Q(B)	---	Q(B)	---	OR	---	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Operable Unit 2											
Site A Shallow Groundwater											
01U	01U038			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U039			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U040			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U041			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U063			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U067			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U102			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U103			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual, including antimony
01U	01U104			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U105			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U106			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U107			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U108			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U110			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U115			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U116			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U117			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U118			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U119			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U120			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U125			---	---	---	---	---	---	---	
01U	01U126			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U127			Q,L(B)	L(B)	L(B)	L(B)	L(B)	OR	OR	
01U	01U133			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U135			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	

APPENDIX A.1

FY 2012 - FY 2016 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
01U	01U136			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U137			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U138			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U139			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U140			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U141			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U145	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U146	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U147	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U148	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U149	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U150	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U151	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U152	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U153	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U154	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U155	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U156	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U157			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U158			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U350			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U351	EW-1		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U352	EW-2		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U353	EW-3		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U354	EW-4		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U355	EW-5		---	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U356	EW-6		---	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U357	EW-7		---	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U358	EW-8		---	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U901			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U902			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual VOCs, annual antimony
01U	01U903			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U904			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual VOCs, annual antimony

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Site C Shallow Groundwater											
01U	01U045			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U046			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U085			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U551	EW-1		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U552	EW-2		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U553	EW-3		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U561	MW-1		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U562	MW-2		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U563	MW-3		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U564	MW-4		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U565	MW-5		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U566	MW-6		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U567	MW-7		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U568	MW-8		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U569	MW-9		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U570	MW-10		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U571	MW-11		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U572	MW-12		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Qtrly thru FY11, then annual
01U	01U573	MW-13		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U574	MW-14		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U575	MW-15		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U576	MW-16		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Site I Shallow Groundwater											
01U	01U064		(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	01U632		(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	01U636		(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	01U639		(7) (8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	01U640		(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	01U666		(8)	L(A)	L(A)	L(A)	L(A)	L(A)	---	1a, OR	GW elevations in Mar/Apr
01U	01U667		(8)	L(A)	L(A)	L(A)	L(A)	L(A)	---	1a, OR	GW elevations in Mar/Apr
01U	01U668		(8)	L(A)	L(A)	L(A)	L(A)	L(A)	---	1a, OR	GW elevations in Mar/Apr
01U	482086	I01MW	(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	482087	I05MW	(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	482088	I02MW	(8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	482089	I04MW	(7) (8)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	482090	I03MW	(8)	L(A)	L(A)	L(A)	L(A)	L(A)	---	1a, OR	GW elevations in Mar/Apr

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Site K Shallow Groundwater											
01U	01U047			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U048			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U052			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U065			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U128			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U601			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U602			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U603			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U604			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U605			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U607			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U608			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U609			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U611			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U612			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U613			L(A)	L(A)	L(A)	L(A)	L(A)	OR	3.a	
01U	01U615			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U616			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U617			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U618			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U619			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U620			L(A)	L(A)	L(A)	L(A)	L(A)	OR	3.a	
01U	01U621			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U624			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U625			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U626			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U627			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U628			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	482083	K04-MW		Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	482084	K02-MW		L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	482085	K01-MW		L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
03U	03U621			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Building 102 Shallow Groundwater											
01U	01U048			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U578			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U579			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U580			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U581			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U582			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U583			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U584			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L581			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L582			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L583			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L584			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	

APPENDIX A.1

FY 2012 - FY 2016 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Deep Groundwater (TGRS)											
03F	03F302	B1									See Appendix A.2
03F	03F303	B2	(5)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03F	03F304	B3									See Appendix A.2
03F	03F305	B4									See Appendix A.2
03F	03F306	B5									See Appendix A.2
03F	03F307	B6									See Appendix A.2
03F	03F308	B7	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03F	03F312	B11									See Appendix A.2
03F	03F319	B13									See Appendix A.2
03U	03U001			---	L(A)	---	L(A)	---	---	1.a	
03U	03U002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U003			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U004			---	---	---	---	---	---	---	Abandoned FY13
03U	03U005			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U007			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
03U	03U008			---	L(A)	---	L(A)	---	---	1.a	
03U	03U009			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
03U	03U010			---	L(A)	---	L(A)	---	---	1.a	
03U	03U011			---	L(A)	---	L(A)	---	---	1.a	
03U	03U012			---	L(A)	---	L(A)	---	---	1.a	
03U	03U013			---	L(A)	---	L(A)	---	---	1.a	
03U	03U014			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U015			---	L(A)	---	L(A)	---	---	1.a	
03U	03U016			---	L(A)	---	L(A)	---	---	1.a	
03U	03U017			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U018			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U019			---	L(A)	---	L(A)	---	---	1.a	
03U	03U020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U021			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U022			---	L(A)	---	L(A)	---	---	1.a	
03U	03U023			---	L(A)	---	L(A)	---	---	1.a	
03U	03U024			---	L(A)	---	L(A)	---	---	1.a	
03U	03U025			---	L(A)	---	L(A)	---	---	1.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
03U	03U026			---	L(A)	---	L(A)	---	---	1.a	
03U	03U027			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U028			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U029			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U030			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U031			---	L(A)	---	L(A)	---	---	1.a	
03U	03U032			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U075			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U076			---	L(A)	---	L(A)	---	---	1.a	
03U	03U077			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U078			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U079			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U082			---	L(A)	---	L(A)	---	---	1.a	
03U	03U083			---	L(A)	---	L(A)	---	---	1.a	
03U	03U084			---	L(A)	---	L(A)	---	---	1.a	
03U	03U087			---	L(A)	---	L(A)	---	---	1.a	
03U	03U088			---	L(A)	---	L(A)	---	---	1.a	
03U	03U089			---	L(A)	---	L(A)	---	---	1.a	
03U	03U090			---	L(A)	---	L(A)	---	---	1.a	
03U	03U092			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U093			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U094			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U096			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U097			---	---	---	---	---	---	---	
03U	03U099			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U111			---	L(A)	---	L(A)	---	---	1.a	
03U	03U112			---	L(A)	---	L(A)	---	---	1.a	
03U	03U113			---	L(A)	---	L(A)	---	---	1.a	
03U	03U114			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U121			---	---	---	---	---	---	---	
03U	03U129			---	---	---	---	---	---	---	
03U	03U301	SC1									See Appendix A.2
03U	03U314	SC2									See Appendix A.2
03U	03U315	SC3	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U316	SC4	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U317	SC5									See Appendix A.2
03U	03U521			---	---	---	---	---	---	---	
03U	03U647			---	L(A)	---	L(A)	---	---	1.a	
03U	03U648			---	L(A)	---	L(A)	---	---	1.a	
03U	03U658			---	---	---	---	---	---	---	Abandoned FY13

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
03U	03U659			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U671			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U672			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U674			---	L(A)	---	L(A)	---	---	1.a	
03U	03U675			---	---	---	---	---	---	---	
03U	03U676			---	L(A)	---	L(A)	---	---	1.a	
03U	03U701			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U702			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U703			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U704			---	L(A)	---	L(A)	---	---	1.a	
03U	03U705			---	L(A)	---	L(A)	---	---	1.a	
03U	03U706			---	L(A)	---	L(A)	---	---	1.a	
03U	03U707			---	L(A)	---	L(A)	---	---	1.a	
03U	03U708			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U709			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U710			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U711			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U715			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U716			---	L(A)	---	L(A)	---	---	1.a	
03U	03U801			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U803			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U804			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U805			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	519288	E101-MW		---	---	---	---	---	---	---	
03U	519289	E102-MW		---	---	---	---	---	---	---	
03U	519290	E103-MW		---	---	---	---	---	---	---	
03M	03M001			---	L(A)	---	L(A)	---	---	1.a	
03M	03M002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03M	03M003			---	L(A)	---	L(A)	---	---	1.a	
03M	03M004			---	---	---	---	---	---	---	Abandoned FY13
03M	03M005			---	L(A)	---	L(A)	---	---	1.a	
03M	03M007			---	L(A)	---	L(A)	---	---	1.a	
03M	03M010			---	L(A)	---	L(A)	---	---	1.a	
03M	03M012			---	L(A)	---	L(A)	---	---	1.a	
03M	03M013			---	L(A)	---	L(A)	---	---	1.a	
03M	03M017			---	L(A)	---	L(A)	---	---	1.a	
03M	03M020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03M	03M713			---	L(A)	---	L(A)	---	---	1.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
03M	03M802			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03M	03M806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03L	03L001			---	L(A)	---	L(A)	---	---	1.a	
03L	03L002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L003			---	L(A)	---	L(A)	---	---	1.a	
03L	03L004			---	---	---	---	---	---	---	Abandoned FY13
03L	03L005			---	L(A)	---	L(A)	---	---	1.a	
03L	03L007			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
03L	03L010			---	L(A)	---	L(A)	---	---	1.a	
03L	03L012			---	L(A)	---	L(A)	---	---	1.a	
03L	03L013			---	L(A)	---	L(A)	---	---	1.a	
03L	03L014			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L017			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L018			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L021			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L027			---	L(A)	---	L(A)	---	---	1.a	
03L	03L028			---	L(A)	---	L(A)	---	---	1.a	
03L	03L029			---	L(A)	---	L(A)	---	---	1.a	
03L	03L077			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L078			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L079			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L080			---	L(A)	---	L(A)	---	---	1.a	
03L	03L081			---	L(A)	---	L(A)	---	---	1.a	
03L	03L084			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L113			---	L(A)	---	L(A)	---	---	1.a	
03L	03L802			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03L	03L806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03L	03L809			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L833			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U001			---	L(A)	---	L(A)	---	---	1.a	
PC	04U002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U003			---	L(A)	---	L(A)	---	---	1.a	
PC	04U007			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
PC	04U012			---	L(A)	---	L(A)	---	---	1.a	
PC	04U020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U027			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U077			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U510			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
PC	04U701			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U702			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U708			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U709			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U711			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
PC	04U713			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U714			---	L(A)	---	L(A)	---	---	1.a	
PC	04U802			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
PC	04U806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
PC	04U833			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
J	04J077			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
J	04J702			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
J	04J708			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
J	04J713			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
J	04J714			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#003			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#027			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#309	B8									See Appendix A.2
PC/J	PJ#310	B9									See Appendix A.2
PC/J	PJ#311	B10	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC/J	PJ#313	B12	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC/J	PJ#802			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
---	Staff Gauges			---	L(A)	---	L(A)	---	---	---	

Unit 1 Wells

01U	01U035			---	---	---	---	---	---	---	
01U	01U043			---	---	---	---	---	---	---	
01U	01U044			---	---	---	---	---	---	---	
01U	01U045			---	---	---	---	---	---	---	
01U	01U046			---	---	---	---	---	---	---	
01U	01U060			---	---	---	---	---	---	---	
01U	01U072			---	---	---	---	---	---	---	
01U	01U085			---	---	---	---	---	---	---	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Operable Unit 3											
03U	03U673			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03M	03M848			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	2.a	
03L	03L673			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L832			---	L(A)	---	L(A)	---	---	2.a	
03L	03L848			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L854			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L859			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L860			---	L(A)	---	L(A)	---	---	2.a	
03L	03L861			---	---	---	---	---	---	---	Abandoned FY06
03L	476837	MW15H		---	---	---	---	---	---	---	
PC	04U414	414U4	(6)	---	Q,L(A)	---	---	---	OR	2.a	
PC	04U673			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U832			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	Contingency Action for FY08
PC	04U845			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	Contingency Action for FY08
PC	04U848			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U851		(6)	---	Q,L(A)	---	---	---	OR	2.a	
PC	04U852			---	---	---	---	---	---	---	Abandoned FY09
PC	04U854			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U859			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U860			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U861			---	---	---	---	---	---	---	Abandoned FY06
PC	04U863	323U4		Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	2.a	
PC	04U864	324U4		---	---	---	---	---	---	---	Abandoned FY09
PC	04U865	325U4		---	---	---	---	---	---	---	Abandoned FY09
PC	04U866	326U4		---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	520931	NBM #13		---	---	---	---	---	---	---	Abandoned FY07
J	04J864	324 J		---	---	---	---	---	---	---	Abandoned FY09
J	04J866	326 J		---	Q,L(A)	---	Q,L(A)	---	OR	2.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 12	June 13	June 14	June 15	June 16	Water Quality	Water Level	Comments
Well Inventory											
(Entries under "Notes" refer to the well inventory category)											
---	249608	Rapit Printing Inc	1a	---	Q(B)	---	---	---	Well Inventory	---	2520 Larpenteur Ave
---	S00444	Minneapolis Parks & Rec Dep	1a	---	Q(B)	---	---	---	Well Inventory	---	Ontario & E River Rd (Erie), Dartmoth Triangle
---	200173	KSTP Radio TV	1b	---	Q(B)	---	---	---	Well Inventory	---	3415 University Ave
---	200180	Town & Country Golf Course	1b	---	Q(B)	---	---	---	Well Inventory	---	2279 Marshal Ave
---	200522	Windsor Green	1b	---	Q(B)	---	---	---	Well Inventory	---	Silver Lake Rd & Cty Rd E
---	200523	Windsor Green	1b	---	Q(B)	---	---	---	Well Inventory	---	Silver Lake Rd & Cty Rd E
---	234338	Bosell	1b	---	Q(B)	---	---	---	Well Inventory	---	1575 14th Ave NW
---	234421	BioClean (BioChem)	1b	---	Q(B)	---	---	---	Well Inventory	---	2151 Mustang Dr
---	234469	Palkowski, T.	1b	---	Q(B)	---	---	---	Well Inventory	---	2816 Hwy 88
---	234544	R&D Systems	1b	---	Q(B)	---	---	---	Well Inventory	---	2201 Kennedy St NE
---	249632	Montzka, Harold	1b	---	Q(B)	---	---	---	Well Inventory	---	2301 N Upland Crest NE
---	433298	Town & Country Golf Course	1b	---	Q(B)	---	---	---	Well Inventory	---	2279 Marshall Ave
---	509052	Shriners Hospital	1b	---	Q(B)	---	---	---	Well Inventory	---	2025 E River Rd
---	756236	Alcan	1c	---	Q(B)	---	---	---	Well Inventory	---	150 26th Ave SE
---	S00437	Northern Star Co	1c	---	Q(B)	---	---	---	Well Inventory	---	3171 5th St SE
---	107405	Dimmick, Kay	2a	---	Q(B)	---	---	---	Well Inventory	---	4355 Hwy 10
---	200176	Waldorf Paper Products	2b	---	Q(B)	---	---	---	Well Inventory	---	2236 Myrtle Ave
---	249007	Walton, Toni	2b	---	Q(B)	---	---	---	Well Inventory	---	4453 Old Hwy 10
---	537801	Midway Industrial	2b	---	Q(B)	---	---	---	Well Inventory	---	4759 Old Hwy 8
---	S00002	Midland Hills Country Club	2b	---	Q(B)	---	---	---	Well Inventory	---	2001 N Fulham St
---	200076	Old Dutch Foods, Inc	2c	---	Q(B)	---	---	---	Well Inventory	---	2375 Terminal Rd
---	236029	R&D Systems, South Well	2c	---	Q(B)	---	---	---	Well Inventory	---	2201 Kennedy St NE
---	236439	Waldorf Paper Products	2c	---	Q(B)	---	---	---	Well Inventory	---	2250 Wabash Ave
---	249185	Novotny, Mark	4a	---	Q(B)	---	---	---	Well Inventory	---	1706 Malvern St
---	S00295	Moncada, Jairo	7a	---	---	---	---	---	Well Inventory	---	2531 Summer St
---		Amundsen, Jason & Lucy	4a	---	Q(B)	---	---	---	Well Inventory	---	2816 St. Anthony Blvd
---		Hermes, Margo	4a	---	Q(B)	---	---	---	Well Inventory	---	2935 Old Hwy 8
---		Macdonald, Jason	4a	---	Q(B)	---	---	---	Well Inventory	---	1672 14th Ave NW
---		Purdy, Garland	7b	---	---	---	---	---	Well Inventory	---	2816 Silver Lake Rd

A.2 Remedial Treatment Systems

APPENDIX A.2
FY 2012 - FY 2016 MONITORING PLAN
FOR REMEDIAL TREATMENT SYSTEMS

OU1: DEEP GROUNDWATER [1]

Location	Sampling Frequency	Parameters
• Extraction Wells NBM#4, #14, and #15	- Monthly	- Pumping Volumes
(and also NBM#3, #5, and #6)	- Monthly	- Water Quality [2]
• PGAC Effluent	- Monthly	- Water Quality [2]

OU2: SITE K REMEDIAL ACTION

Location	Sampling Frequency	Parameters
• Extracted Groundwater	- Monthly	- Pumping Volume
• Treatment System Effluent [Outfall 391 (010)]	- See Appendix A.3	- See Appendix A.3

OU2: TCAAP GROUNDWATER RECOVERY SYSTEM (TGRS)

Location	Sampling Frequency	Parameters
• Extraction Wells	- Monthly	- Pumping Volumes
	- Semi-Annually	- Water Levels
	- Semi-Annually	- Water Quality [2]
• Treatment System Influent	- Monthly	- Pumping Volumes
	- Monthly	- Water Quality [2]
• Treatment System Effluent	- Monthly	- Water Quality [2]

Notes:

(1) Performed by the City of New Brighton using their Sampling and Analysis Plan.

(2) The required analyte list for each specific site is presented in Appendix A.4.

A.3 Surface Water

APPENDIX A.3
FY 2012 - FY 2016 MONITORING PLAN
FOR SURFACE WATER

Analysis	Analytical Method	Units	Site K Effluent (Outfall 010)	Site C Surface Water Locations (SW-5)	(SW-6)	(NE Wetland)	Pond G
Flow Rate	---	gal/day	Continuous				
Total Flow	---	gal	M				
pH	(field)	(pH)	Q				(Note 1)
Hardness	(field)	(pH)	Q				(Note 1)
Cyanide	9012A	µg/l	Q				
Copper	6020	µg/l	Q				
Lead	6020	µg/l	Q	A	A	A	(Note 1)
Mercury	7470A	µg/l	Q				
Phosphorus (Total)	365.4	µg/l	Q				
Silver	6020	µg/l	Q				
Zinc	6020	µg/l	Q				
Trichloroethene	8260C	µg/l	Q				
1,1-Dichloroethene	8260C	µg/l	Q				
1,1-Dichloroethane	8260C	µg/l	Q				
Cis-1,2-Dichloroethene	8260C	µg/l	Q				
Trans-1,2-Dichloroethene	8260C	µg/l	Q				
Vinyl Chloride	8260C	µg/l	Q				
1,2-Dichloroethane	8260C	µg/l	Q				

Notes:

M = Measurement required once per month

Q = Analysis required once per quarter

A = Annually in June

(1) Pond G sampling for pH, hardness, and total lead is scheduled for: May, August, and November 2012; and March, June, and September 2013. Also, total chloride is scheduled for May 2012 only.

A.4 Site Specific Lists of Required Analytes

APPENDIX A.4
SITE SPECIFIC LISTS OF REQUIRED ANALYTES

Note: Cleanup levels (in µg/l) from each Record of Decision are shown below for use in determining the required method detection limits. Also note that these lists represent the minimum list of analytes. A larger analyte list may be utilized by the monitoring organization, if so desired.

OU1 (DEEP GROUNDWATER) (1)

1,1-Dichloroethane	70
1,1-Dichloroethene	6
cis-1,2-Dichloroethene	70
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	3
Trichloroethene	5

SITE A (SHALLOW GROUNDWATER) (2)

Antimony*	6
1,1-Dichloroethene	6
1,2-Dichloroethane	4
Benzene	10
Chloroform	60
cis-1,2-Dichloroethene	70
Tetrachloroethene	7
Trichloroethene	30

*Antimony is only monitored at these wells:
01U103, 01U902 and 01U904 (June only)

SITE C (SHALLOW GROUNDWATER) (3)

Lead	15

SITE I (SHALLOW GROUNDWATER) (2)

1,2-Dichloroethene (cis and trans)	70
Trichloroethene	30
Vinyl Chloride	0.2

SITE K (SHALLOW GROUNDWATER) (2)

1,2-Dichloroethene (cis and trans)	70
Trichloroethene	30

OU2 (DEEP GROUNDWATER) (2)

1,1,1-Trichloroethane	200
1,1-Dichloroethane	70
1,1-Dichloroethene	6
1,2-Dichloroethane	4
cis-1,2-Dichloroethene	70
Tetrachloroethene	5
Trichloroethene	5

OU3 (DEEP GROUNDWATER) (4)

1,1-Dichloroethane	70
1,1-Dichloroethene	6
cis-1,2-Dichloroethene	70
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	3
Trichloroethene	5

Notes:

(1) From Page 18 of the OU1 Record of Decision.
(2) From Table 1 of the OU2 Record of Decision.
(3) From Table 1 of the OU2 Record of Decision - Amendment #1.
(4) From Page 26 of the OU3 Record of Decision.

Analytical Methods:

VOCs: SW-846 Method 8260C

Antimony & Lead: SW-846 Method 6020

APPENDIX A.4 (cont'd)
SITE SPECIFIC LISTS OF REQUIRED ANALYTES

OTHER INSTALLATION RESTORATION ACTIVITIES

BUILDING 102 SHALLOW GROUNDWATER(5)

Vinyl Chloride(6)	0.18
cis-1,2-Dichloroethene	70
Trichloroethene	5
1,1-Dichloroethene	6

WELL INVENTORY SAMPLING

VOCs (report full VOC list)

Notes:
(5) From Page 2-13 of the OU2 Record of Decision - Amendment #4.
(6) Vinyl chloride is also analyzed by SW-846 Method 8260C - SIM at wells 01U048, 01U582, and 01L582.

Analytical Methods:
VOCs: SW-846 Method 8260C (see Note 6 above)
Metals: SW-846 Method 6020

A.5 New Brighton Operating Rates

Table D-1
Remedial Production Ranges for Normal Operation
(Effective January 2008)

NBCGRS Well	Estimated Physical Capacity Range			Remedial Production Range		Flow Rate Equivalents (24-hr Production Basis)	
	Normal Individual Low (gpm)	Normal Individual High (gpm) (See Note 1)	Peak Combined High (gpm) (See Note 1)	Lower Limit (MGD)	Upper Limit (MGD)	Lower Limit (gpm)	Upper Limit (gpm)
3 (See Note 2)	300	600	400	0.000	0.576	0	400
4 (See Note 2)	500	1,100	900	1.152	1.296	800	900
3 + 4 (See Note 2)	800	n/a	1,300	1.152	1.872	800	1,300
5	400	850	750	0.864	1.080	600	750
6	400	850	750	0.000	1.080	0	750
5 + 6 (See Note 3)	800	1,700	1,500	0.864	2.160	600	1,500
14	500	1,200	1,000	0.000	1.440	0	1,000
15	500	1,200	1,000	1.152	1.440	800	1,000
TOTAL WELL CAPACITY	2,600	n/a	4,800	**3.168**	**6.912**	**2,200**	**4,800**
TREATMENT CAPACITY		3,200	5,000				
NBCGRS SYSTEM LIMIT		3,200	4,800				

NOTES:

1. During peak production periods with all wells running, individual well capacities are limited by interference, high drawdown, and high system head losses
2. While shown individually to illustrate normal operational intent, enforceable target is for combined Well 3 plus Well 4 since the wells are located in close proximity and effectively operate as a single point source. Wells 3 and 4 can be used interchangeably to produce total daily target.
3. While shown individually to illustrate normal operational intent, enforceable target is for combined Well 5 plus Well 6 since the wells are located in close proximity and effectively operate as a single point source. Wells 5 and 6 can be used interchangeably to produce total daily target.

15 FEB 2008
Michael R. Fix
Twin Cities Army Ammunition Plant

2/15/08
Grant M. Wyffels
City of New Brighton

Table D-2
Alternate Remedial Production Ranges for Contingent Events
(Effective January 2008)

Event	Normal Operation			Well 3 and/or 4 Down			Well 5 and/or 6 Down			Well 14 Down			Well 15 Down		
Well / Pair	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)
3 + 4	2	1.152	1.872	NA	**0.000**	**0.000**	2	1.440	1.872	2	1.152	1.872	1	1.440	1.872
5 + 6	3	0.864	2.160	2	1.728	2.160	NA	**0.000**	**0.000**	3	0.864	2.160	2	1.728	2.160
14	4	0.000	1.440	3	1.152	1.440	3	1.152	1.440	NA	**0.000**	**0.000**	3	0.720	1.152
15	1	1.152	1.440	1	1.152	1.440	1	1.152	1.440	1	1.152	1.440	NA	**0.000**	**0.000**
Total		3.168	6.912		4.032	5.040		3.744	4.752		3.168	5.472		3.888	5.184

Appendix B

FY 2012 Well Index

APPENDIX B
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE WELL INDEX

FISCAL YEAR 2012

Purpose

The purpose of the well index is to identify all wells, both past and present, that:

- Have been used to collect water quality data or groundwater elevations in regard to work at the New Brighton/Arden Hills Superfund Site (including private wells and offsite monitoring wells sampled by the Army); or
- Are owned by the Army; or
- Are located within the boundaries of OU2 (the former TCAAP property)

In addition, the well index aims to identify the current status (in use, sealed, abandoned, etc.) of these wells.

The well index does not include wells identified in the Well Inventory Update (Appendix E) that have not been sampled by the Army at any point in history.

The list contained in the well index is by no means a compilation of all available data. Other data may exist regarding an individual well that was not discovered or searched out during the course of this effort. The list is intended to be a reasonable effort to gather the data concerning the wells that is readily available. Therefore, if additional data is desired concerning a certain well, it may be possible to search out and obtain that data from records not searched during the course of the investigation.

Background

OU2 and OU1/OU3 wells have been installed in four hydrogeologic units beneath the site. These hydrogeologic units, as referred to in this report, are conceptually illustrated on Figure B-1 and are described below:

Unit 1: This unit, referred to as the Fridley Formation, consists of alluvium and lacustrine deposits above the Twin Cities Formation (Unit 2). The formation is made up of fine- to medium-grained sand and clayey silt, which acts as an unconfined aquifer with an estimated hydraulic conductivity of 8.3×10^{-3} cm/sec (International Technology Corp. 1992). The Unit 1 deposits are discontinuous at the New Brighton/Arden Hills Superfund Site (NB/AH Site) and range in thickness from zero to 50 feet. They are predominantly limited to the north, east, and southwest portions of the site. Groundwater in Unit 1 is also discontinuous.

Unit 2: Known as the Twin Cities Formation, Unit 2 consists of Quaternary aged glacial till and, similar to Unit 1, is discontinuous at the NB/AH Site . Unit 2 is generally regarded as an aquitard to vertical migration of groundwater; however, sand and gravel lenses may contain water.

Unit 3: This unit consists primarily of the Quaternary aged Hillside Sand Formation, which is continuous beneath OU2. Near the center of OU2, the Hillside Sand Formation is overlain by the Arsenal Sand, which forms a kame. There is no distinct lithologic contact between the Hillside Sand and the Arsenal Sand, and both are considered included in Unit 3. Unit 3 ranges in thickness from 25 to 450 feet. For monitoring purposes, the Unit 3 aquifer thickness has been arbitrarily subdivided into thirds designated as upper, middle, and lower.

Unit 4: This unit consists collectively of bedrock from the Prairie du Chien Group and Jordan Formation (Ordovician and Cambrian periods, respectively). For monitoring purposes, the Prairie du Chien Group is referred to as Upper Unit 4, while the Jordan Formation is Lower Unit 4. The Jordan Formation varies from fine- to coarse-grained quartz sandstone. The Prairie du Chien Group in the NB/AH Site area consists of a finely crystalline dolomite of the Oneota Formation, as well as quartz sandstone and dolomite members of the Shakopee Formation. A more detailed description of the bedrock geology can be found in the Remedial Investigation Report (Argonne National Laboratory, 1991).

In order to identify the hydrogeologic unit in which each well is completed, the United States Army Environmental Center (USAEC), formerly the United States Army Toxic and Hazardous Materials Agency (USATHAMA), developed a standardized identification system for wells at the NB/AH Site (referred to as the Army Designation or IRDMIS number). Well designations consist of six characters, such as 03U093. The first two characters represent the hydrogeologic unit in which the well is completed, as follows:

01	-	Unit 1
03	-	Unit 3
04	-	Unit 4: Prairie du Chien Group or Jordan Formation
PJ	-	Unit 4: Prairie du Chien Group and Jordan Formation

The third character represents the relative position of the well screen or open hole within the specified hydrogeologic unit, as follows:

U	-	upper portion
M	-	middle portion
L	-	lower portion
J	-	Jordan Sandstone
F	-	fully penetrating Unit 3
#	-	open hole (total or partial thickness)

The remaining three characters represent the well number, as follows:

001 thru 500	USAEC wells and additional wells installed by others adjacent to an existing well with the 001-500 designation.
501 thru 600	NB/AH Site wells.
601 thru 800	OU2 Alliant wells.
801 thru 999	OU1/OU3 Alliant wells.

OU1/OU3 wells installed by parties other than USAEC, the Army, or Alliant are designated by their Minnesota unique number. Table B-1 is sorted by unique number, but includes the IRDMIS number and any other name(s) the wells may have. The well type in this table is abbreviated as follows:

UN	-	Unknown
MUNI	-	Municipal
MON	-	Monitoring
DOM	-	Domestic
IND	-	Industrial
P.S.	-	Public Supply
COM	-	Commercial
IRR	-	Irrigation
ABAND	-	Abandoned
PIEZ.	-	Piezometer
REM	-	Remedial

In recent years, as property transfer of the remaining land that is still indentified as TCAAP becomes more imminent, it became apparent that an updated well index with more information concerning each well would be of importance to pass on to future land owners. In addition, as groundwater quality continues to improve and contaminant plumes continue to shrink in vertical and horizontal extent, the index will function as a check to make sure that all Army owned wells are sealed and that all traces of the wells are removed from the area.

The FY 2012 Appendix B Table B-1 shows the most current well index. The well index continues to be a work in progress. Additional records continue to surface regarding individual wells, as new wells are drilled and old wells are sealed and removed.

Figures B-2 and B-3 show the location of wells identified in Table B-1. With a known well name, the location of that well can be determined using the “Edit, Find” or “Edit, Search” function and then typing in the desired well name, which will highlight this well name on the figure.

The Appendix B Attachment contains available documentation for each well, including boring logs (if available). The attachment is sorted by Minnesota unique number. To view the information concerning a well, click in the desired well number in the bookmarks with the mouse.

FY 2012 Update

During FY 2012 effort was undertaken to update the existing well index. Onsite (OU2 wells) were surveyed with a Trimble R8 GPS to confirm and correct horizontal locations of the wells. The as-surveyed horizontal location of all OU2 wells was then updated in Appendix B and used in the creation of figures for FY 2012. During the surveying two wells were discovered to be sealed and/or removed (MN Unique #s 231845 and 440894). Four additional wells were sealed and records were added to the database (MN Unique #s 234145, 234146, 234147, 421426). No other significant changes were made compared with the FY 2011 version of the index. The well index, Table B-1, was compared with the wells indentified in Appendix D, which contains historical water quality and groundwater elevation data. A number of wells were identified in Appendix D that do not exist in the well index. More efforts will continue to be made in the coming years to add information concerning the location and status of these wells to the well index in Appendix B.

Future updates to Appendix B

- The repository at the current TCAAP office is planned to be searched for additional well information.
- The well maintenance permit and well owner columns are intended to be completed for each well in the index.

Appendix B Table B-1 and Attachment

Available Well Information
Sorted by Minnesota Unique Well Number

Appendix B Table B-1 contains a summary of all information available concerning a certain well, and is sorted by Minnesota unique well number.

To search for detailed records regarding a well, open the appropriate file below and select the bookmark corresponding to the Minnesota unique well number of the well being searched. If the unique number is unknown for a well, it is included and sorted in the Appendix B Attachment by IRDMIS name or OTHER. Records included in the Appendix B Attachment that may or may not be available for each well include:

- The County Well Index well log,
- Access agreement(s),
- Correspondence related to the well,
- Field notes and boring logs,
- Well construction diagrams,
- Documentation of well modifications, and
- Sealing records.

Appendix B Attachment

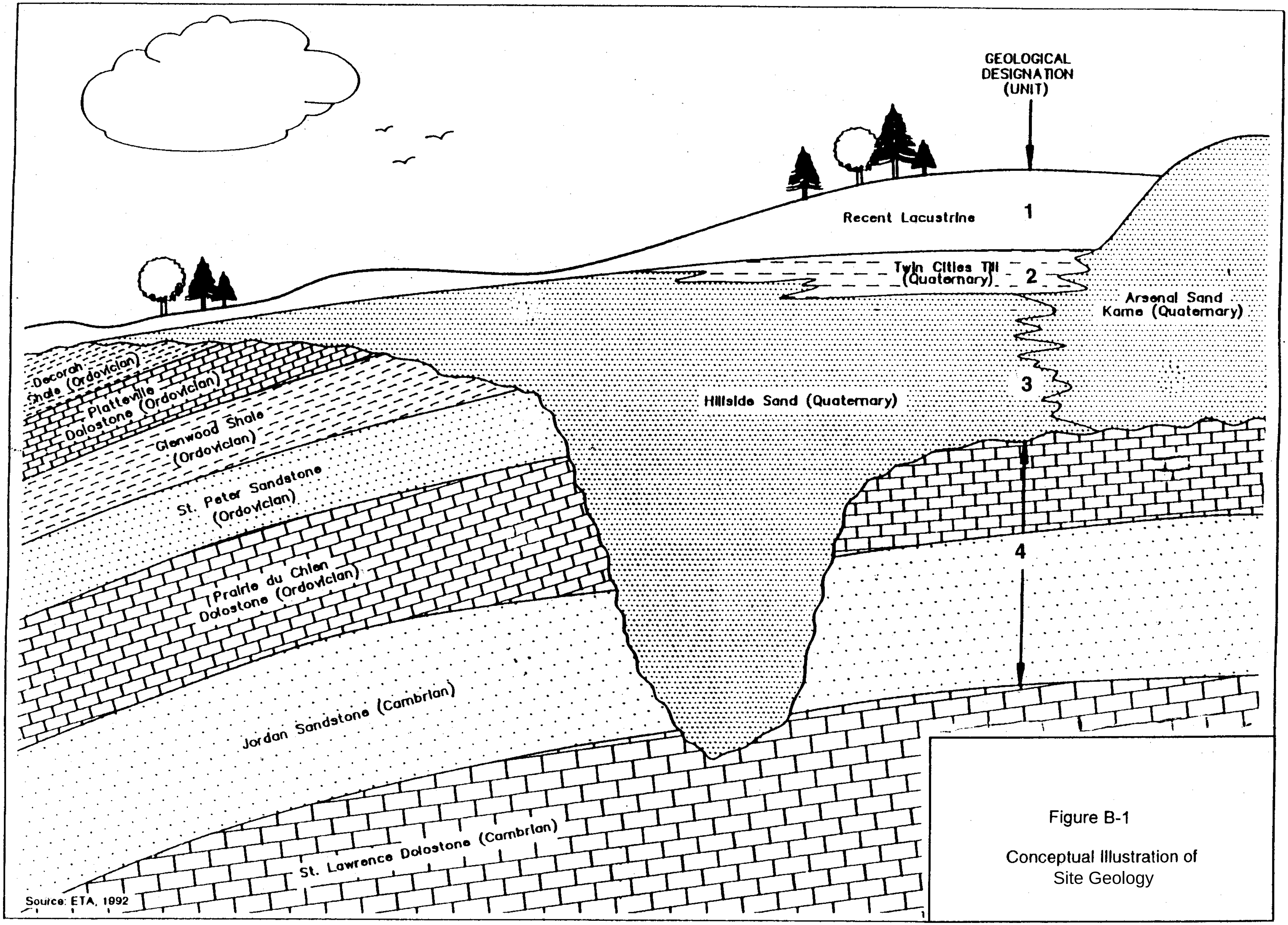


Figure B-1

Conceptual Illustration of Site Geology

ANNUAL PERFORMANCE REPORT	Wenck	FY 2012
OU1 & OU3 Well Location	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure B-2

ANNUAL PERFORMANCE REPORT

OU2 Well Location

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2012

Figure B-3

Appendix C

FY 2012 Data Collection and Management

C.1 Data Collection, Management, and Presentation

APPENDIX C.1

DATA COLLECTION, MANAGEMENT, AND PRESENTATION

1.0 INTRODUCTION

A groundwater monitoring program was initiated in January 1984 to obtain water level and water quality data at OU1, OU2 and OU3. Each year has been divided into quarters with each quarter assigned a number. Accordingly, FY 2012 was comprised of Quarter 113 (October through December), Quarter 114 (January through March), Quarter 115 (April through June), and Quarter 116 (July through September). Water sampling, water level measurements, and laboratory analyses were conducted in accordance with three separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring", (Wenck, Revision 10, March 22, 2011) and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater", (Wenck, Revision 4, March 22, 2011). The Building 102 QAPP is applicable to only that specific site, and all other sites are covered by the Performance Monitoring QAPP.

Prior to November 1, 2001, data collected from OU1, OU2 and OU3 was stored in the U.S. Army Environmental Command (USAEC) Installation Restoration Data Management Information System (IRDMIS). USAEC replaced the IRDMIS System on November 1, 2001, with a new system, the Environmental Restoration Information System (ERIS), which incorporated all of the data that had previously been entered into IRDMIS. The Army has continued to enter data into ERIS; however, ERIS is not being used as the primary database for the OU1, OU2 and OU3 data. The historical databases in Appendix D.1 are the primary databases.

2.0 GROUNDWATER LEVELS AND GROUNDWATER QUALITY

2.1 Data Collection and Management

Groundwater level and groundwater quality data were collected in accordance with the FY 2012 Annual Monitoring Plan (Appendix A), which established the monitoring responsibilities for both the Army and Alliant. Water level monitoring and water sampling were conducted by Wenck for the Army and by CRA and Stantec for Alliant. Laboratory analysis of samples from all sites was performed by ALS Laboratory Group, Salt Lake City, Utah. Appendix A.4 contains lists of required analytes, as referenced by the monitoring plans in Appendix A. The lists are site-specific, based on the chemicals of concern. At sites other than Site C, halogenated volatile organic compounds are the parameters of primary interest, though some of the sites (or specific wells at a site) are sampled for aromatic volatile organic compounds and/or metals. At Site C, dissolved lead is the only chemical of concern. Appendix C.2 presents deviations from the FY 2012 Annual Monitoring Plan.

Data verification and validation was conducted in accordance with procedures and requirements outlined in the two QAPPs. Data qualifiers assigned to data through data verification and/or data validation appear in the data tables included within the individual sections of this report, with qualifier definitions given in footnotes to the tables. Data qualifiers are also included in the historical databases (Appendix D.1), which include a database of organic water quality, a database of inorganic water quality (excluding Site C), and a database for Site C water quality (for both groundwater and surface water). Data verification was performed by Wenck for the Wenck-collected data, CRA for the CRA-collected data, and Diane Short & Associates, Inc., Lakewood, Colorado, for the Stantec-collected data. Data validation was performed by CRA for the CRA-collected data, and Diane Short & Associates for the Wenck- and Stantec-collected data. Data verification and validation information from the three sampling firms was compiled by Wenck into quarterly Data Usability Reports (DURs) that were submitted to the MCPA and USEPA for review. If any MPCA/USEPA-requested revisions were necessary, a final DUR was resubmitted. The final MPCA/USEPA approval letter for the FY 2012 DURs is included in Appendix C.3.

For water level measurements, the depth to water from the surveyed top of the well casing elevation was measured. Groundwater elevations were calculated by subtracting the depth to water from the surveyed top of the well casing elevation and are included in the historical water elevation database (Appendix D.1).

2.2 Groundwater Elevation Contour Maps

The most extensive water level monitoring event performed during FY 2012 was in June (Quarter 115). This data was used to prepare groundwater elevation contour maps for deep groundwater at OU2 and for shallow groundwater at Sites A, C, K and Building 102. The ongoing Site I annual monitoring was moved from June to March/April to coincide with typically higher groundwater elevations. Groundwater elevation contour maps are included within the individual sections of this report. There was not a comprehensive water level event for deep groundwater at OU1/OU3 and OU2.

2.3 Groundwater Quality Contour Maps and Cross-Sections

The most extensive sampling event performed during FY 2012 was in June (Quarter 115). This data was used to prepare groundwater quality isoconcentration contour maps and/or cross-sections for shallow groundwater at Site A, Site C, Site K and Building 102. Contour maps were generated by hand, based on the observed contaminant concentrations and the extent of past site contamination. These maps are included within the individual sections of this report.

For deep groundwater at OU1/OU3 and OU2, groundwater quality isoconcentration maps and cross-sections were not prepared since this was a minor sampling year.

For Site A shallow groundwater, an isoconcentration map is provided for cis-1,2-dichloroethene, since this is the chemical of concern with the largest aerial extent at Site A, and also for tetrachloroethene, which illustrates the source area and contaminant degradation. Cross-sections were also prepared for Site A to illustrate the vertical distribution of cis-1,2-dichloroethene. The isoconcentration maps for Site A were prepared only for Unit 1, since this is the only contaminated aquifer.

For Site C shallow groundwater, an isoconcentration map is provided for dissolved lead, since this is the only chemical of concern at Site C. Results for surface water monitoring is also shown on this same map to show that impacts to surface water are not occurring as a result of the shallow groundwater contamination. Cross-sections were also prepared for Site C to illustrate the vertical distribution of dissolved lead. The isoconcentration map for Site C was prepared only for Unit 1, since this is the only contaminated aquifer.

For Site K shallow groundwater, an isoconcentration map is provided for trichloroethene, since this is the primary chemical of concern on a concentration basis. The isoconcentration map for Site K was prepared only for Unit 1, since this is the only contaminated aquifer.

For Building 102 shallow groundwater, an isoconcentration map is provided for vinyl chloride, since this is the chemical of concern that has historically had the largest aerial extent at Building 102, and also for trichloroethene and cis-1,2-dichloroethene, which illustrates the source area and contaminant degradation. Cross-sections were also prepared for Building 102 to illustrate the vertical distribution of vinyl chloride. The isoconcentration maps for Building 102 were prepared only for Unit 1, since this is the only contaminated aquifer.

Contaminant concentrations for recovery wells that are actively pumping are shown in parentheses on the isoconcentration maps. These values were considered, but were generally not used alone to prepare the isoconcentration contours. Concentrations of recovery wells generally represent an average contaminant value for all groundwater being drawn to the well; hence, the concentrations do not necessarily represent a discrete location or depth. Contaminant concentrations for recovery wells that are not actively pumping are fully utilized for purposes of contouring.

C.2 Deviations from Monitoring Program

APPENDIX C.2
DEVIATIONS FROM MONITORING PROGRAM

Fiscal Year 2012

<u>OU2 Site I</u>

March 2012:
Well I01MW: No sample collected, well was dry.
Well I02MW: No sample collected, well was dry.
Well I05MW: No sample collected, well was dry.
Well 01U064: Bailed dry after 1.5 gallons removed (just over 1 well volume).
Well 01U632: No sample collected, well was dry.
Well 01U636: No sample collected, insufficient water for sample (0.16 feet of water in well).
Well 01U639: No sample collected, well was dry, sample was taken from alternate location I04MW.
Well 01U640: Bailed dry after 0.10 gallons removed (just over 1 well volume).

<u>OU2 Site K</u>

June 2012:
Well 01U611: Bailed dry after 1.25 gallons removed (just over 1 well volume).
Well 03U621: Pumped dry after 14 gallons removed (just over 1 well volume).

<u>OU2 Deep Groundwater</u>

August 2012:
Well 03L004: Well sampled prior to USEPA/MPCA-approved sealing in early FY 2013.
Well 03M004: Well sampled prior to USEPA/MPCA-approved sealing in early FY 2013.
Well 03U004: Well sampled prior to USEPA/MPCA-approved sealing in early FY 2013.
Well 03U658: Well sampled prior to USEPA/MPCA-approved sealing in early FY 2013.

<u>OU2 Aquatic Sites</u>

May 2012:
Pond G: This event was shifted into June 2012 due to a slight delay in completing the bench testing.

C.3 Regulatory Approvals of Data Usability Reports

Minnesota Pollution Control Agency

520 Lafayette Road | St. Paul, MN 55155-4194 | 651-296-6300 | 800-657-3864 | 651-282-5332 TTY | www.pca.state.mn.us

January 17, 2013

Mr. Mike Fix
Commander's Representative
Twin Cities Army Ammunition Plant
470 West Highway 96
Suite 100
Shoreview, MN 55126

RE: Approval of Data Usability Report Numbers 73, 74, 75 and 76

Dear Mr. Fix:

This letter shall serve to document that the U.S. Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA) have completed their review of the U.S. Army's (Army) subject Data Usability Reports (DURs) Numbers 73, 74, 75 and 76. The U.S. EPA and MPCA's review included the following documents and communications:

- Data Usability Report No. 73 (DUR 73): Twin Cities Army Ammunition Plant (TCAAP) FY 2012 Performance Monitoring Program, 1st Quarter Monitoring (October-December 2011), February 14, 2012; EPA comments (March 15, 2012); MPCA had no comments (email dated March 23, 2012); Army responses to comments (March 28, 2012) and DUR 73 Final Report dated April 9, 2012.

- Data Usability Report No. 74 (DUR 74): TCAAP FY 2012 Performance Monitoring Program, 2nd Quarter Monitoring (January-March 2012), May 31, 2012; EPA comments (July 6, 2012); MPCA comments (July 10, 2012); Army responses to comments (August 2, 2012) and DUR 74 Final Report dated September 24, 2012.

- Data Usability Report No. 75 (DUR 75): TCAAP FY 2012 Performance Monitoring Program, 3rd Quarter Monitoring (April-June 2012); EPA comments (October 23, 2012); MPCA comments (November 15, 2012); Army responses to comments (December 2, 2012) and DUR 75 Final Report dated December 19, 2012.

- Data Usability Report No. 76 (DUR 76): TCAAP FY 2012 Performance Monitoring Program, 4th Quarter Monitoring (July-September 2012), November 29, 2012; EPA comments (January 2, 2013); MPCA had no comments (email January 2, 2013); Army responses to comments (January 7, 2013) and DUR 76 Final Report dated January 8, 2013.

Based upon our review of the referenced documentation, the U.S. EPA and MPCA agree that the subject DURs are acceptable for use in FY 2012 the Annual Performance Report. You are hereby advised that the U.S. EPA and MPCA approve the Data Usability Report Numbers 73, 74, 75 and 76. If you have any questions, please contact Thomas Barounis at 312-353-5577 or Deepa de Alwis at 651-757-2572.

Sincerely,

for Tom Barounis
Remedial Project Manager
U.S. EPA, Region V

Deepa de Alwis
Project Manager
Closed Landfill and Superfund
Remediation Division

TB/DA:csa

Appendix D

Comprehensive Groundwater Quality and Groundwater Level Databases

D.1 Comprehensive Groundwater Quality and Groundwater Level Databases

APPENDIX D.1
COMPREHENSIVE GROUNDWATER QUALITY AND GROUNDWATER LEVEL DATABASES

The historical groundwater tables are located on this CD in a directory named Appendix D.1. This directory contains four Microsoft Excel files:

File	Contents
Compelev_FY12	Groundwater elevations
Comporwq _FY12	Groundwater quality: organic data
Compinwq _FY12	Groundwater quality: inorganic data (excluding Site C)
Site C wq _FY12	Groundwater quality: inorganic data (Site C only)

D.2 Operable Unit 1 Statistical Analysis

D.2.1 Well Groups and Statistical Evaluation Criteria Tables

Table D.2.1
Statistical Evaluation
Well Groups

Group 1 – Downgradient of TGRS

03U806	04U806	03L802	03U801
03M806	PJ#806	04U802	03U711
03L806	03M802	PJ#802*	04U711

Group 2 – Areal Extent of Plume

03U805	409557	04U841	04U875
03U672	04U673	04U843	04U877
03L848	04U832	04U833	206688
03L673	04U845	04U846	04U849
03L833	04U854	04U861 abandoned	04U821
03L859	04U859	409549	191942 abandoned

Group 3 ** – Downgradient Sentinel

04U871	04U875	04U851	

Group 4 – Lateral Sentinel

03U831 abandoned	03L846	409556	409548
03U811	03L832	04U855	04U839
03U804	03L861 abandoned	04U879	04U838
03U673	03L854	04U860	04U848
03U672	03L841	409547	04J839
03M843	03L811	04U863	

Group 5 – Global Plume

04J077	04U702	04U848	04U877
04J702	04U709	04U851	04U879
04J708	04U711	04U852 abandoned	04U880
04J713	04U713	04U855	04U881
04J834	04U802	04U859	04U882
04J864 abandoned	04U806	04U860	200154
04J866	04U832	04U861 abandoned	234546
04J882	04U833	04U863	234549 out of service
04U002	04U834	04U864 abandoned	409547
04U020	04U841	04U865 abandoned	409548
04U027	04U843	04U866	409549
04U077	04U844	04U871	409555
04U673	04U845	04U872	512761
04U701	04U846	04U875	PJ#318

Group 5 Unit 3 wells (evaluated as individual trends)

03L822	03U821	03U822	03L822
409550	409596	409597	03U831abandoned

Group 6 – Jordan Aquifer

04J077	04J838	04U713	04U882
04J702	04J839	04U834	NBM#3
04J708	04J882	04U836	NBM#4
04J713	04J847	04U837	NBM#5
04J822	04J849	04U838	NBM#6
04J834	04U077	04U839	
04J836	04U702	04U847	
04J837	04U708	04U849	

* PJ#802 will not be monitored or used for evaluation unless 04U802 shows TCE concentrations greater than 1 ppb.

** Group 3 is analyzed as a rectangular area taken from the Group 5 contouring.

Table D.2.2

MAROS Decision Matrix

Mann-Kendall S	Confidence	Coefficient of Variance	Trend Conclusion
S > 0	> 95%	NA	Increasing
S > 0	90-95%	NA	Probably Increasing
S > 0	< 90%	NA	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	NA	Probably Decreasing
S < 0	>95%	NA	Decreasing

Table D.2.3
Summary of Groups, Purpose, and Statistical Tests

Well Group	**Purpose**	**Measure**	**Time Window/ Monitoring Frequency**	**Test**	**Response Threshold**
Group 1	AWC Immediately Downgradient of TGRS	AWC Trend	6 years/annual	Mann-Kendall and MAROS	Stable, Increasing, or No Trend
Group 2	Defining Plume Size (Low Concentration Edges)	Individual Well Trend for TCE	12 years/biennial	Mann-Kendall and MAROS	Increasing or No Trend
Group 3	AWC Immediately Downgradient of NBCGRS	AWC Trend	12 years/biennial	Mann-Kendall and MAROS	Stable, Increasing, or No Trend
Group 4	Lateral (Clean) Sentinel Wells	Individual Well Concentration	12 years/biennial	Individual Concentrations	Greater than ROD goals
Group 5	Global Plume Mass Reduction	AWC Trend	12 years/biennial	Mann-Kendall and MAROS	Stable, Increasing, or No Trend
Group 6	Evaluating and comparing trends in Jordan Aquifer	Individual Well Trend for TCE	12 years/biennial	Mann-Kendall and MAROS	Stable, Increasing or No Trend

Note: A Response Threshold is the test result(s) that triggers further response. See text for additional explanation of response process.

AWC = Area-Weighted Concentration.

Table D.2.4
Group 1 – Downgradient of TGRS, Evaluation Process

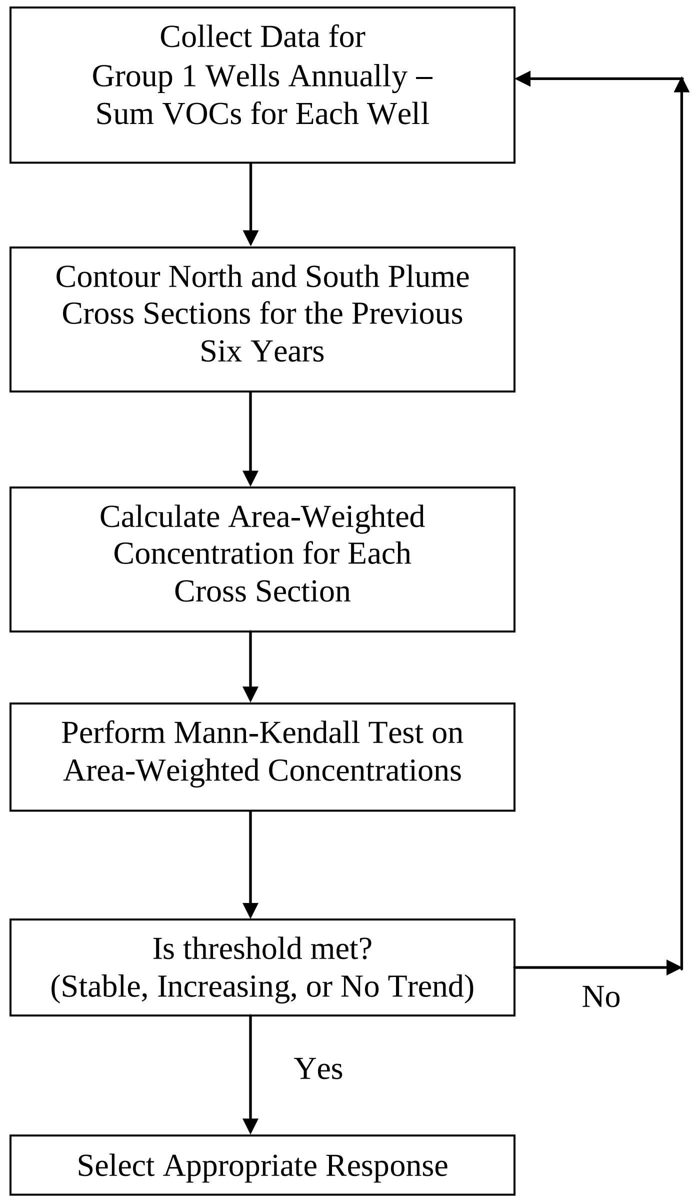


Table D.2.5
Group 2 – Areal Extent of Plume, Evaluation Process

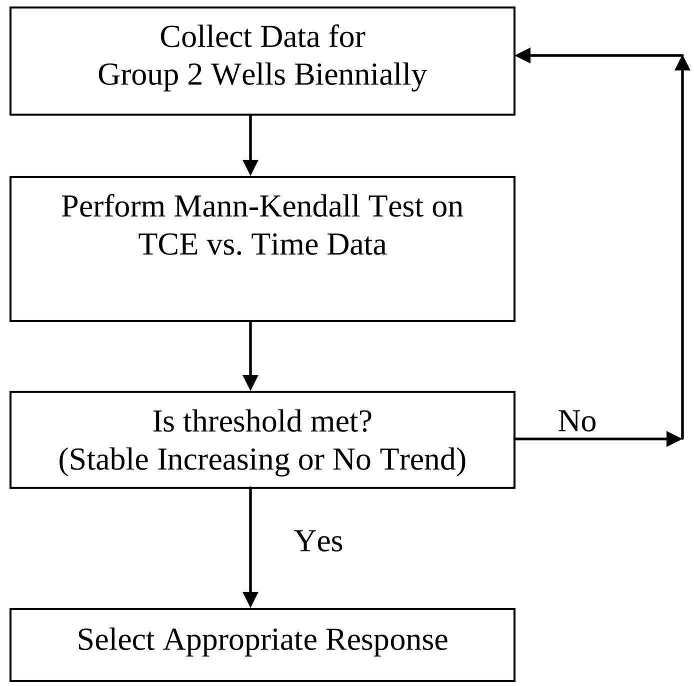


Table D.2.6
Group 3 and Group 5 – Downgradient Sentinel and Global Plume, Evaluation Processes

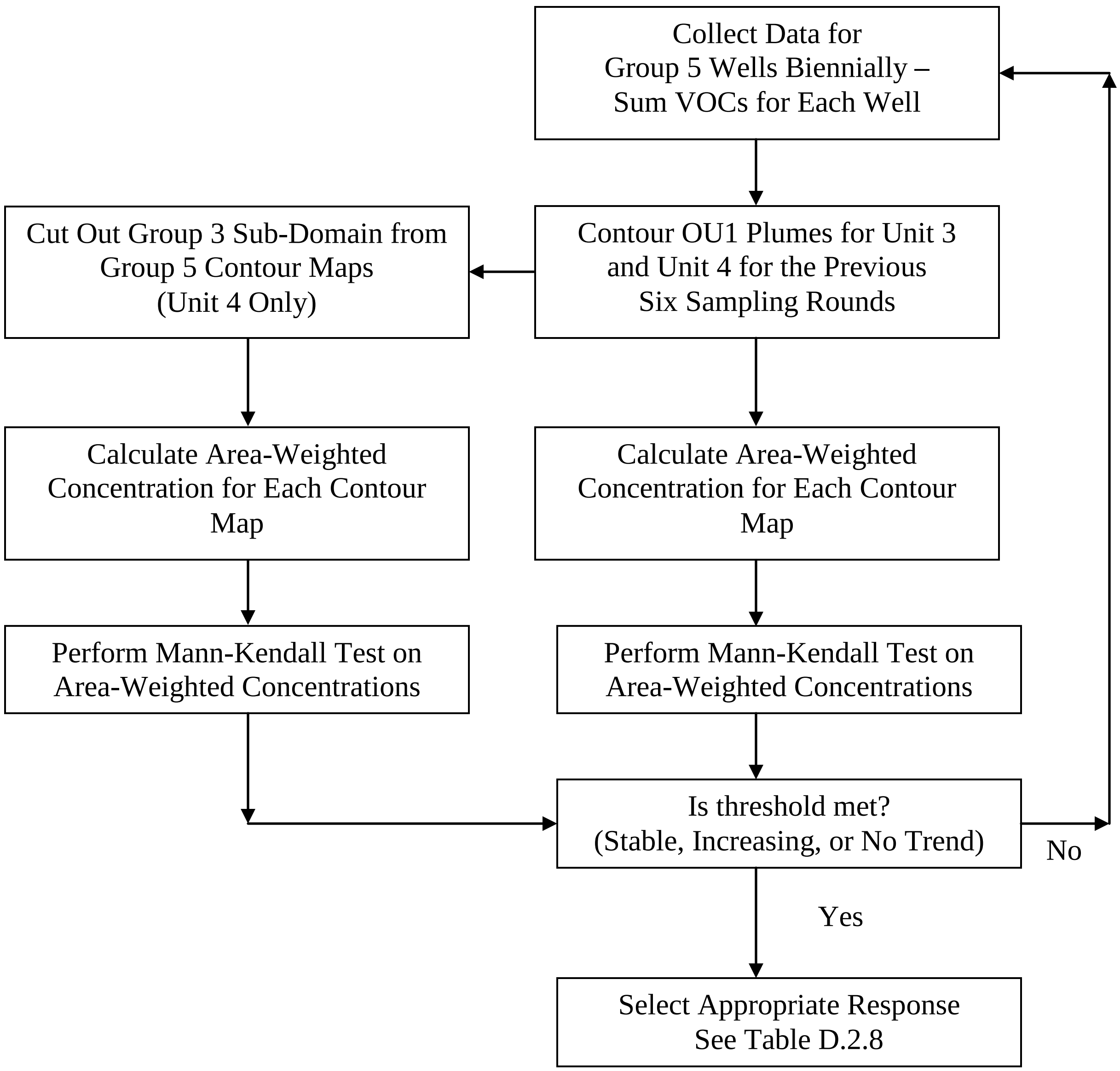


Table D.2.7
Group 4 – Lateral Sentinel Wells, Evaluation Process

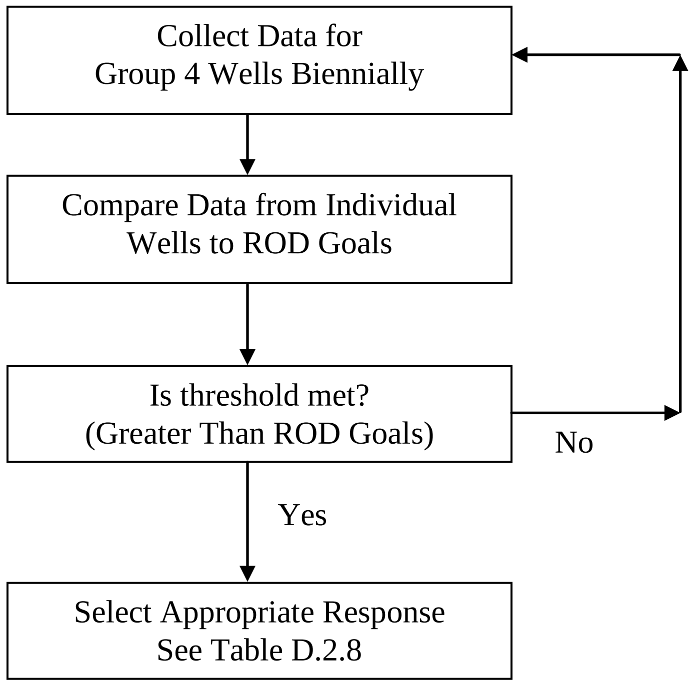


Table D.2.8

Responses to Threshold Indicators

Factors to Consider

- Contaminant concentrations
- Location (vertical and horizontal)
- Surrounding data
- Risks to human health or the environment
- Need for urgency in response

Possible Evaluation Responses

- Perform additional or confirmation sampling
- Write up in the Annual Performance Report
- Perform separate evaluation and write-up (Tech Memo)

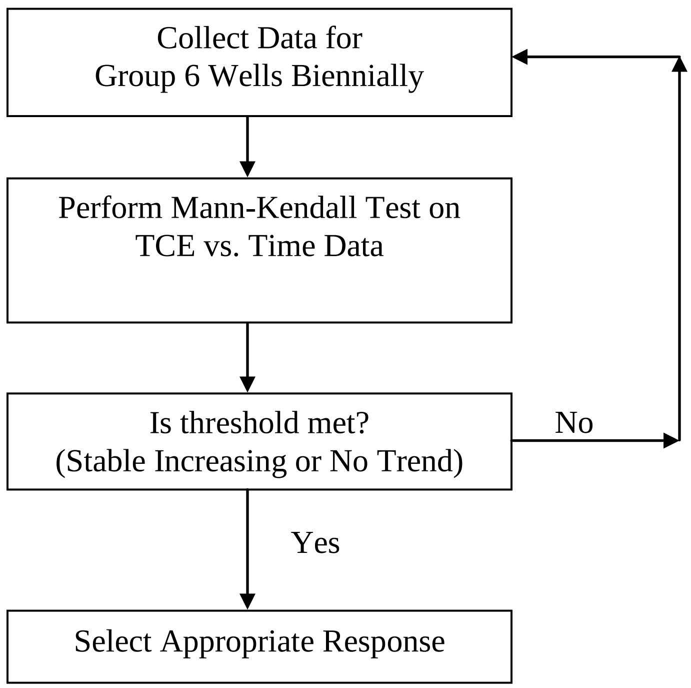
Possible Long-Term Responses

- Increase sampling frequency
- Modify operation of remedial system(s)
- Perform new remedy evaluation
- Install additional monitoring well(s)
- Modify the Special Well Construction Area
- Control risk at the receptors

Note: Threshold responses to be described and evaluated in the Annual Performance Reports.

Table D.2.9

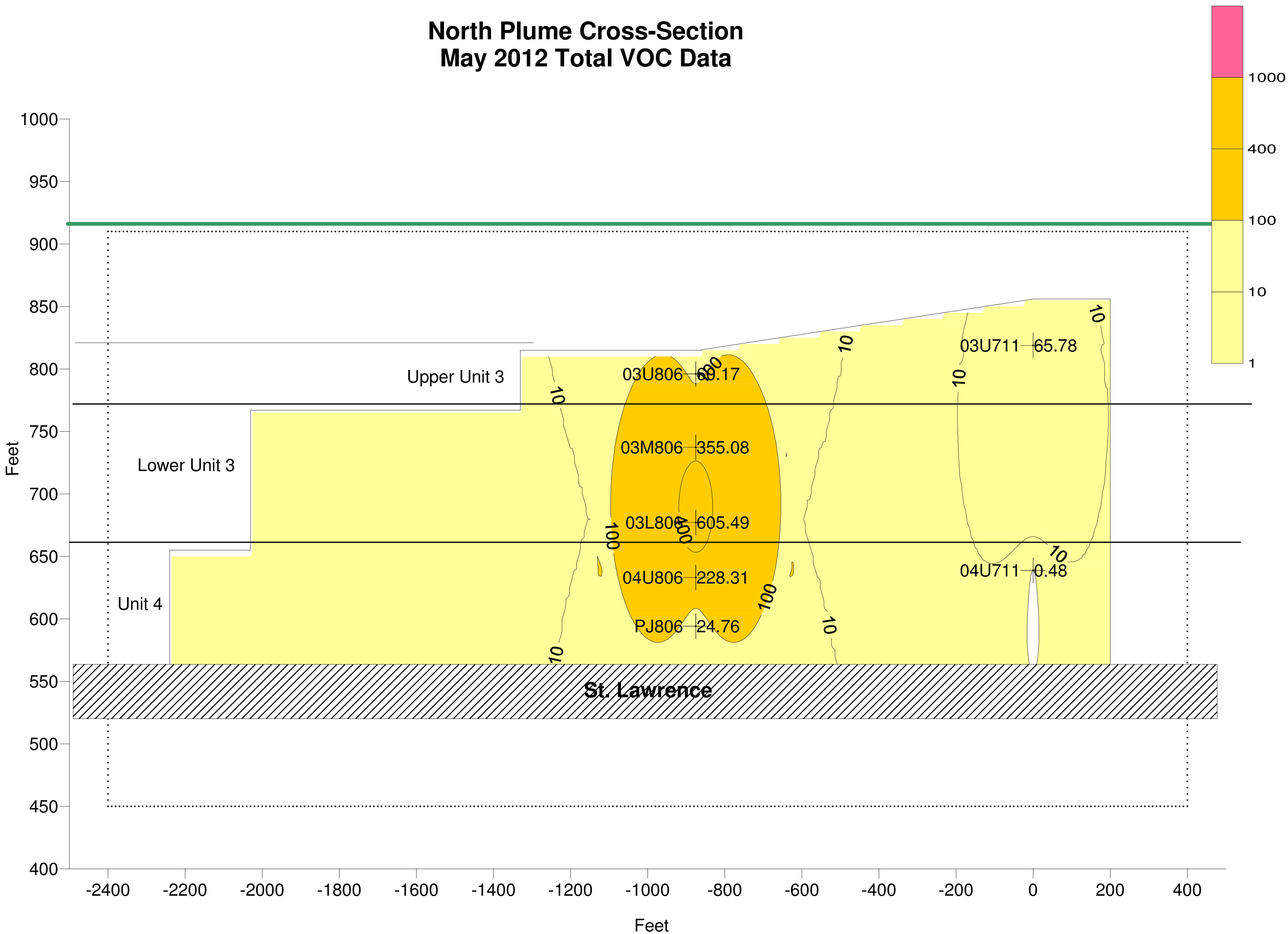
Group 6 – Jordan Aquifer, Evaluation Process



D.2.2 Group 1 Kriging Evaluation

2012

North Plume Cross-Section
May 2012 Total VOC Data



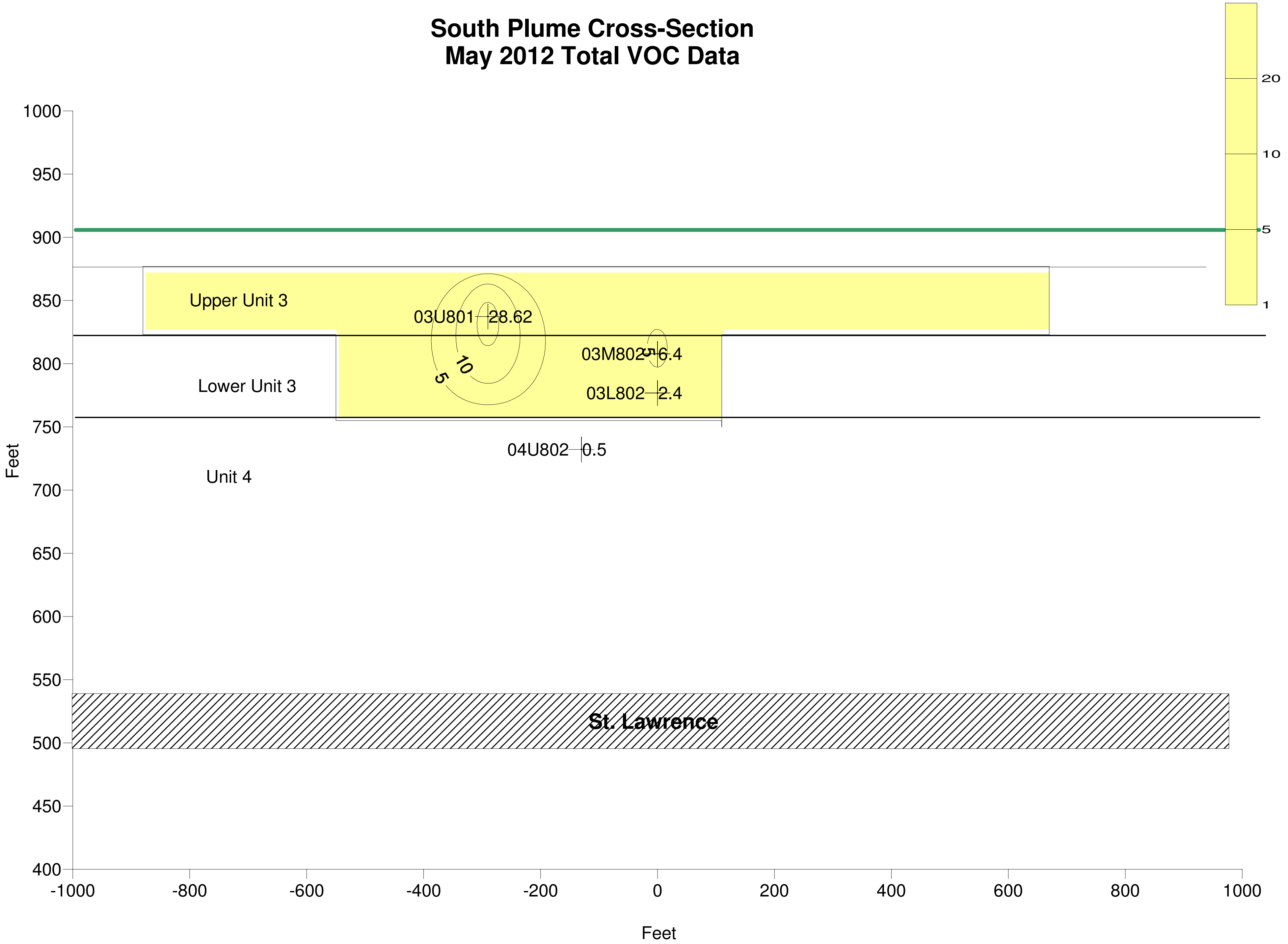

South Plume Cross-Section
May 2012 Total VOC Data
Upper Unit 3
Lower Unit 3
Unit 4
St. Lawrence
03U801 28.62
03M802 6.4
03L802 2.4
04U802 0.5
10
5
20
10
5
1
Feet
Feet
1000
950
900
850
800
750
700
650
600
550
500
450
400
-1000
-800
-600
-400
-200
0
200
400
600
800
1000

TABLE 1

VOC CONCENTRATIONS IN TGRS MONITORING WELLS

Location	Date	1,1,1-Trichloroethane µg/L	1,1-Dichloroethane µg/L	1,1-Dichloroethene µg/L	1,2-Dichloroethane µg/L	cis-1,2-Dichloroethene µg/L	Tetrachloroethene µg/L	Trichloroethene µg/L	Total VOCs
03L802	6/1/12	ND	ND	ND	ND	ND	ND	2.40	2.4
03M802	6/1/12	ND	ND	ND	ND	ND	ND	6.40	6.4
03U801	5/30/12	ND	ND	ND	ND	0.62	ND	28.00	28.62
04U802	5/31/12	ND	ND	ND	ND	ND	ND	0.50	0.5
03L806	5/31/12	2.1	69	36	0.81	7	0.58	490	605.49
03M806	5/31/12	ND	51	29	0.48	4.6	ND	270	355.08
03U711	6/9/2011*	6.3	1.6	2.3	ND	0.66	0.92	54	65.78
03U806	5/31/12	ND	0.89	0.66	ND	0.32	1.3	57	60.17
04U711	5/30/12	ND	ND	ND	ND	ND	ND	0.48	0.48
04U806	5/31/12	1.5	22	12	ND	2.4	0.41	190	228.31
PJ#806	5/31/12	0.4	0.77	0.59	ND	ND	ND	23	24.76

Notes:

South Plume

North Plume

ND=Non-detect

Assumptions:

non-detect values were treated as 0

Any value with a data qualifier (e.g. JP) treated as the detection.

D.2.3 Group 1, 2, 3, 5, and 6 Mann-Kendall Evaluations

Summary Table

Table 3-5
Group 1, 2, 3, 5, and 6 Mann-Kendall Summary and MAROS Conclusion

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 2 Wells:									
04U877	-7	6	Decreasing	86.40%	0.5940	S or NT	**Stable**	Yes	Raw trend is decreasing
Group 3	--	--	--	--	--	--	--	--	Not sampled in FY 2012
Group 5	--	--	--	--	--	--	--	--	Not sampled in FY 2012
Group 1 NP	-9	6	Decreasing	93.20%	0.2421	Probable	**Decreasing**	No	Decreasing trend
Group 1 SP	-5	6	Decreasing	76.50%	0.0980	S or NT	**Stable**	Yes	Stable below 5 µg/L.

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance

MAROS Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Table 3-5
Group 1, 2, 3, 5, and 6 Mann Kendall Summary and MAROS Conclusion

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 6 OU1 Jordan Wells:									
04J822	-13	6	Decreasing	99.17%	0.2992	Definite	**Decreasing**	No	
04J847	0	6	Zero	41.78%	0.0960	S or NT	**Stable**	Yes	Consistent results, mean 773 µg/L
04J849	-5	6	Decreasing	76.50%	2.4495	S or NT	**No Trend**	Yes	All detections below 0.5 µg/l, 5 of 6 ND
04J847 (ext.)	-15	10	Decreasing	99.86%	0.1226	Definite	**Decreasing**	No	Extended trend for all ten data sets since FY 2004

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance

MAROS Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Mann-Kendall Plots

Well: Group 1 NP

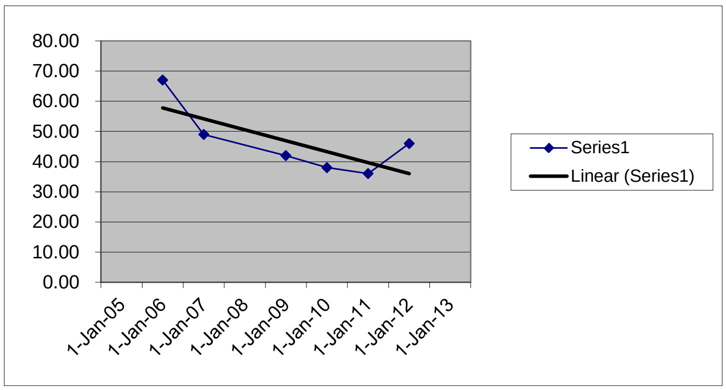
Date	TCE (ug/l)	Mann-Kendall Calculation:					
6/8/2006	67.00	1					
6/11/2007	49.00	1	-1				
6/11/2009	42.00	1	-1	-1			
6/16/2010	38.00	1	-1	-1	-1		
6/9/2011	36.00	1	-1	-1	-1	-1	
6/25/2012	46.00	1	-1	-1	1	1	1

N		6	5	4	3	2	1	15
	sum		-5	-4	-1	0	1	-9
Possibles		15						

Mean 46.33
STNDEV 11.21903
COV 0.242137

Trend: Negative

Confidence (lookup) 93.2%



S -9

tau -0.6

Decsion Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **Group 1 SP**

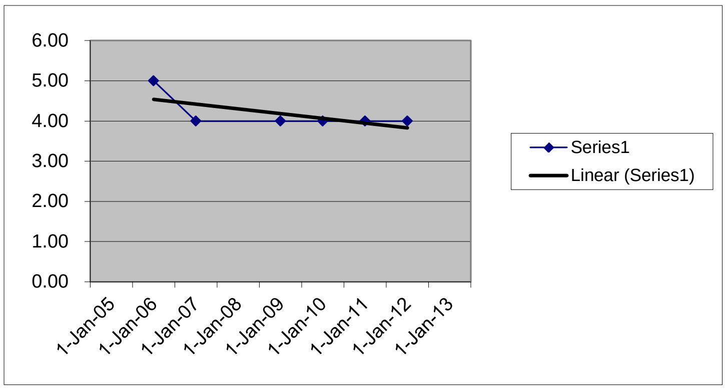
Date	TCE (ug/l)	Mann-Kendall Calculation:					
6/8/2006	5.00	1					
6/11/2007	4.00	1	-1				
6/11/2009	4.00	1	-1	0			
6/11/2010	4.00	1	-1	0	0		
6/9/2011	4.00	1	-1	0	0	0	
6/25/2012	4.00	1	-1	0	0	0	0

N		6	5	4	3	2	1	15
	sum		-5	0	0	0	0	-5
Possibles		15						

Mean 4.17
STNDEV 0.408248
COV 0.09798

Trend: Negative

Confidence (lookup) 76.5%



S -5

tau -0.33333

Decsion Matrix

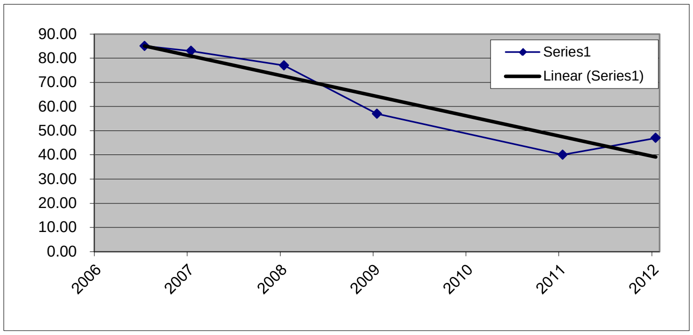
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **04J822**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
12/11/2006	85.00	1					
6/13/2007	83.00	1	-1				
6/25/2008	77.00	1	-1	-1			
6/16/2009	57.00	1	-1	-1	-1		
6/28/2011	40.00	1	-1	-1	-1	-1	
6/25/2012	47.00	1	-1	-1	-1	-1	1

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	-2	1	-13
Possibles		15						

Mean	64.83
STNDEV	19.395017
COV	0.2991519
Trend:	Negative
Confidence (lookup)	99.2%



S	-13
tau	-0.86667

Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04J847

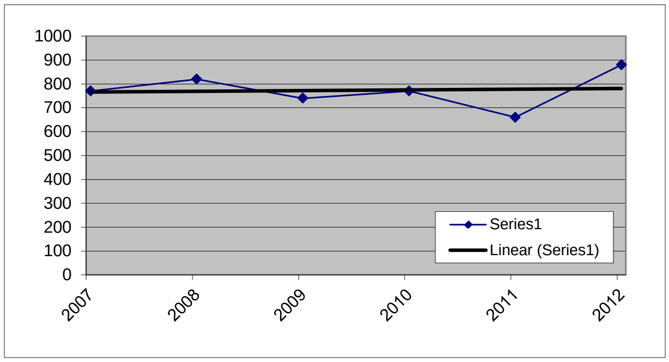
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/18/2007	770	1					
6/25/2008	820	1	1				
6/9/2009	740	1	-1	-1			
6/10/2010	770	1	0	-1	1		
6/30/2011	660	1	-1	-1	-1	-1	
6/25/2012	880	1	1	1	1	1	1

N		6	5	4	3	2	1	15
	sum		0	-2	1	0	1	0
Possibles		15						

Mean 773.33
STNDEV 74.20692
COV 0.095957

Trend: Zero

Confidence (lookup) 41.8%



S 0

tau 0

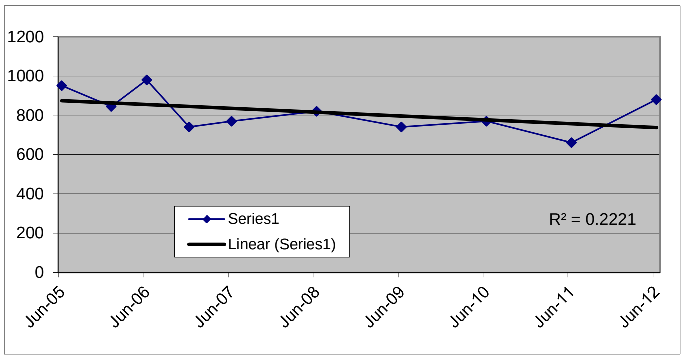
Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **04J847 (ext.)**

Date	TCE (µg/L)	Mann-Kendall Calculation:										
6/15/2005	950	1										
1/11/2006	845	1	-1									
6/6/2006	980	1	1	1								
12/11/2006	740	1	-1	-1	-1							
6/18/2007	770	1	-1	-1	-1	1						
6/25/2008	820	1	-1	-1	-1	1	1					
6/18/2009	740	1	-1	-1	-1	0	-1	-1				
6/10/2010	770	1	-1	-1	-1	1	0	-1	1			
6/30/2011	660	1	-1	-1	-1	-1	-1	-1	-1	-1		
6/25/2012	880	1	-1	1	-1	1	1	1	1	1	1	
	N	10	9	8	7	6	5	4	3	2	1	45
	sum		-7	-4	-7	3	0	-2	1	0	1	-15
	Possibles	45										

Mean	815.50
STNDEV	99.95694
COV	0.122571
Trend:	Negative
Confidence (lookup)	99.9%



S	-15
tau	-0.33333

Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04J849

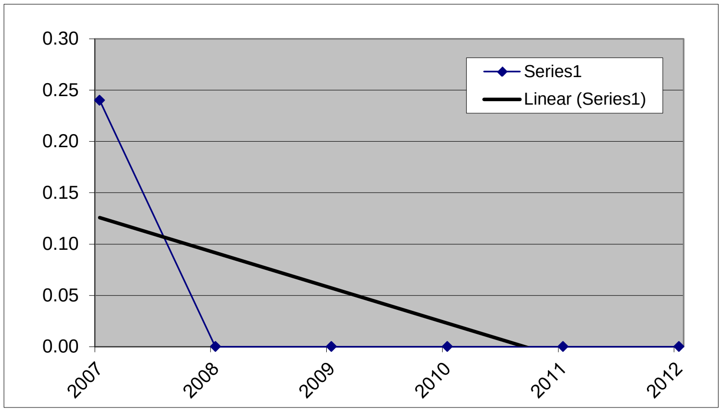
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/12/2007	0.24	1					
6/25/2008	0.00	1	-1				
6/16/2009	0.00	1	-1	0			
6/8/2010	0.00	1	-1	0	0		
6/14/2011	0.00	1	-1	0	0	0	
6/25/2012	0.00	1	-1	0	0	0	0

N		6	5	4	3	2	1	15
	sum		-5	0	0	0	0	-5
Possibles		15						

Mean 0.04
STNDEV 0.09798
COV 2.44949

Trend: Negative

Confidence (lookup) 76.5%



S -5

tau -0.33333

Decision Matrix

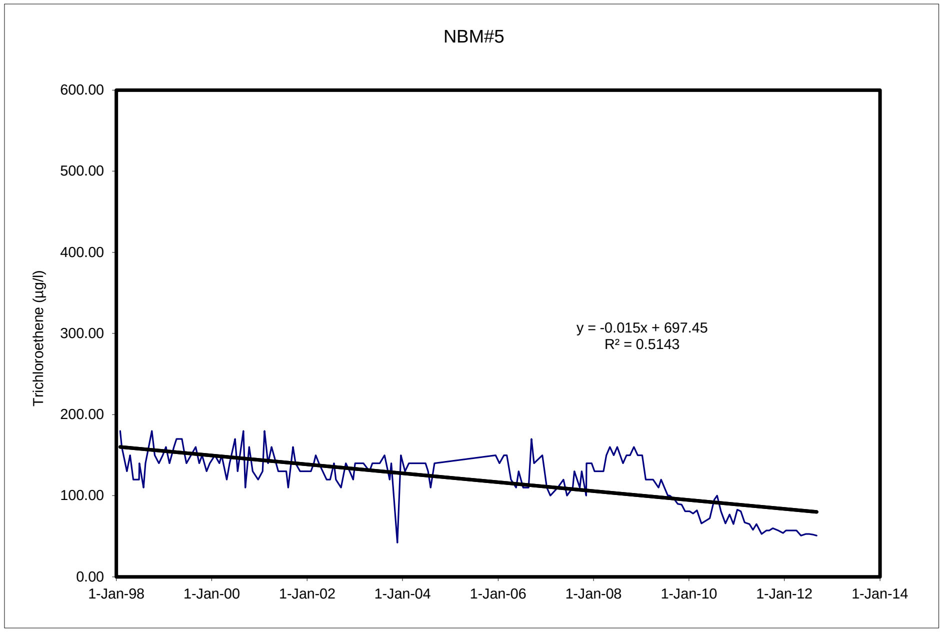
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

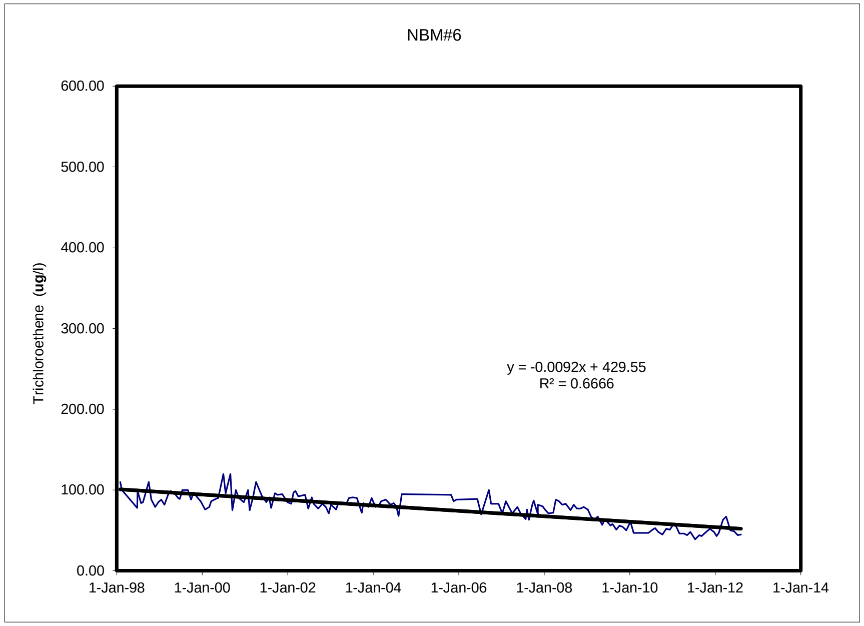
D.2.4 Group 3 and Group 5 Kriging Evaluation

not completed for FY 2012.

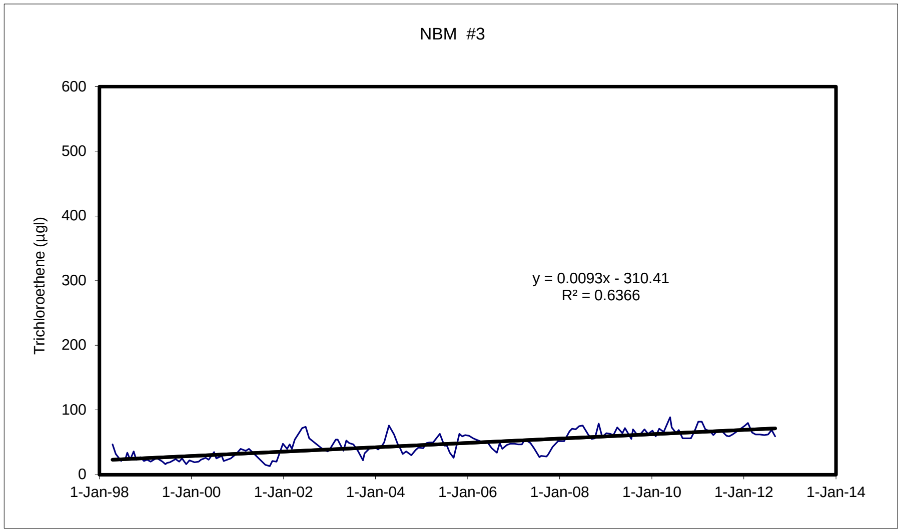
D.2.5 Group 6 New Brighton Municipal Well Regression Analysis

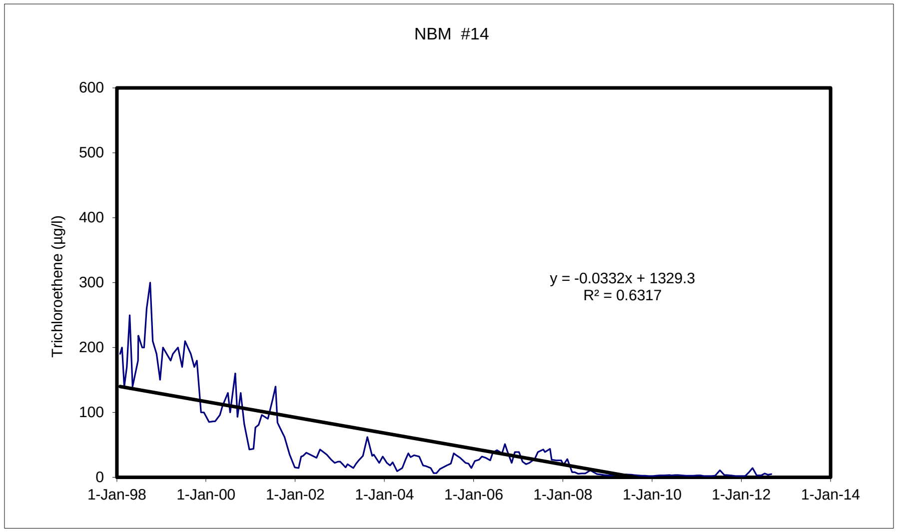
NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE

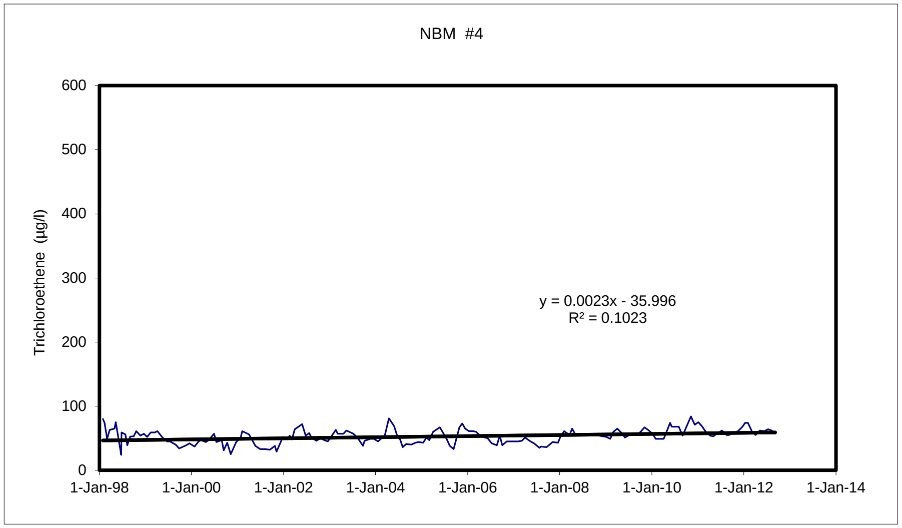


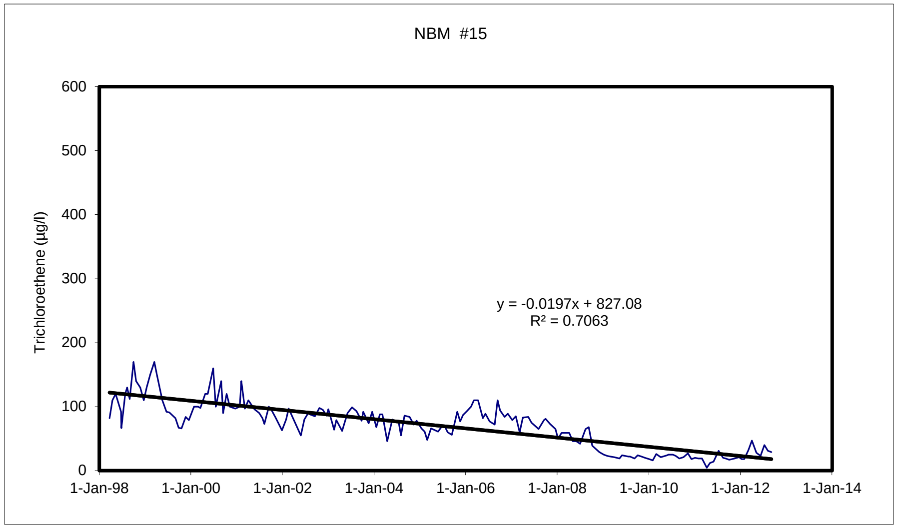


NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE









Appendix E

Well Inventory Update, FY 2012

APPENDIX E
WELL INVENTORY UPDATE

FISCAL YEAR 2012

Purpose

The purpose of well inventory is to identify wells that have been impacted or could potentially be impacted by contaminants from the New Brighton/Arden Hills Superfund Site.

Background

Developing and maintaining the well inventory is a process that was initiated in 1991, with the work efforts documented in several update reports since that time. Beginning in FY 1999, the update reporting was incorporated into the Annual Performance Reports.

The well inventory "study area," as defined by the Minnesota Pollution Control Agency, is shown on Figure E-1, and coincides with the Minnesota Department of Health (MDH) Special Well Construction Area.

The aquifers of concern are defined by the 1 μg/L trichloroethene contour for the Unit 3 and Unit 4 aquifers, and the 1 μg/L cis-1,2-dichloroethene contour for the Unit 1 aquifer north of OU2.

The "area of concern" for the Unit 3 and Unit 4 aquifers is created by adding a quarter mile buffer area outside the 1 μg/L trichloroethene contour. The area of concern for the Unit 3 and Unit 4 aquifers is shown on Figure E-2.

The area of concern for the Unit 1 aquifer north of OU2 is delineated by city streets. The area of concern for the Unit 1 aquifer is shown on Figure E-3.

Wells within the study area are categorized based on location, depth/aquifer, and use. Well categories for the well inventory are described in Table E-1.

Program Requirements

The well inventory program requirements have evolved over time, with changes documented through the update reports. A flowchart that describes the annual requirements for maintaining the well inventory database is shown on Figure E-4. Requirements are summarized below.

Near the beginning of each fiscal year, a database of study area wells is acquired from the MDH. This MDH database query is limited to study area wells that were constructed, sealed, or disclosed in the previous fiscal year. The MDH database consists of three lists:

1. Constructed Wells (generated through drillers submitting Water Well Records);
2. Sealed Wells (generated through drillers submitting Well Sealing Records); and
3. Disclosed Wells (made known through property transfer).

With the new MDH information, the well inventory database is updated by recategorizing wells, as necessary, and by adding any new wells that are within the study area. Any new wells found in Categories 1a, 1b, 1c, 2a, 2b, 2c, or 4a are targeted for sampling in that fiscal year; however, an attempt to reclassify any new category 4a wells will be made prior to sampling. Wells that are not sampled due to non-responsive well owners are targeted for sampling in the next major sampling event.

Category 4 wells are those with an unknown depth or unknown location, or both. Ideally, there should be no wells in Category 4. Each year, an attempt is made to reclassify Category 4 wells into one of the other categories. This is accomplished through phone calls, letters, and/or site visits in an attempt to obtain additional information. Any wells which are re-classified as Category 1a, 1b, 1c, 2a, 2b, or 2c are targeted for sampling in that fiscal year.

"Major" well inventory sampling events occur every four years and are shown in Appendix A.1. The major sampling events are scheduled to coincide with the biennial sampling events for performance purposes as delineated in the APR. For each major event, all wells in Categories 1a, 1b, 1c, 2a, 2b, 2c, and 4a are targeted for sampling. After every sampling event, each well owner is mailed a copy of their testing results. Wells that are not sampled due to non-responsive well owners are targeted for sampling in the next major sampling event.

For each sampling event, if any well has a detection which exceeds the applicable New Brighton/Arden Hills Superfund Site groundwater cleanup level for that contaminant (or an additivity of 1.0, similar to the MDH Hazard Index calculation), the well is evaluated using the flow chart presented in Figure E-4 to determine the timing of additional sampling. Wells that are used for drinking water are sampled again within one month of data validation. Wells that are not used for drinking water, but have possible contact exposure risks, are sampled the next fiscal year. If a cleanup level exceedance is confirmed (two consecutive events), and the contaminant concentrations in the well are proportional to contaminant concentrations of the New Brighton/Arden Hills Superfund Site OU1 plume, the Army offers to abandon the well and/or provide an alternate water supply.

The annual reporting requirements for the New Brighton/Arden Hills Superfund Site well inventory will include:

- A list of any wells found or reclassified.
- Analytical results and a summary of sampling efforts from that fiscal year.
- Recommendations for participation in the Well Abandonment/Alternate Water Supply Program.
- An updated well inventory database that lists wells by well category.
- An updated database listing water quality of wells.

FY 2012 Update

The updated MDH database was provided to Wenck on January 10, 2012. MDH generates the database from specific Township, Range, and Section data. This comprehensive database was screened to extract the lists of wells that were constructed, disclosed, or sealed between October 1, 2010 and September 30, 2011. Further investigative efforts were primarily focused on determining each well's location (inside or outside the study area and/or area of concern), status (active, inactive, or sealed), and water use (supply/non-supply).

Newly constructed active and inactive wells, and wells of unknown status that were determined to be located within the study area, are presented in Table E-3. Seventeen wells were identified within the study area. Three of the wells were for the purpose of dewatering, six of the wells were environmental boreholes, and eight were monitoring wells. All were classified into Category 6.

Disclosed wells that were identified as being in use, inactive, or of unknown status (but not sealed) and that were determined to be located within the study area are identified in Table E-4. Two of the wells were outside of the area or aquifer of concern and were classified into Category 3. One wells was disclosed and later sealed; therefore, it was classified into Category 7a.

Sealed wells were found by reviewing the MDH sealed well list, by screening the MDH disclosed and new construction lists (which also contain sealed wells), and by talking with well owners. Wells identified as sealed are shown in Table E-5. Disclosed wells that were located within the area of concern and that the MDH identified as having a change in status from active or inactive to sealed were further investigated for confirmation of their sealed status. Any wells that were already in the well inventory database that the MDH identified as having a change in status from active or inactive to sealed are shown in Table E-5 with strikeouts through the old well category entry. Wells identified as sealed in the MDH database updates were assigned to Category 7a (documented as sealed/abandoned). Wells that were determined to be sealed through conversations with well owners were assigned to Category 7b (undocumented as sealed, or improperly abandoned).

Nineteen Category 4 wells were studied in FY 2012. This study was accomplished through mapping of well locations, internet searches, telephone calls, letters, and/or site visits in an attempt to reclassify Category 4 wells that were in the existing well inventory database into one of the other categories. Contact information was updated as well as reclassification of some wells of the other categories. Contact information was updated as well as reclassification of some wells out of Category 4 due to new information and/or responses. One well was reclassified from Category 4 to Category 7a based on the discovery of a typo and information received from the MDH in the County Well Index. One well was reclassified from Category 4 to Category 7b based on conversations with the well owner. Three wells were removed entirely from the database after investigation revealed a location outside of the Study Area. No new wells were added to Category 4a or 4b. Therefore, the total number of wells in Category 4 at the end of FY 2012 was 14. An investigation summary is included in Table E-6.

During the FY 2012 well inventory, any new Category 1a, 1b, 1c, 2a, 2b, 2c, and 4a wells were to be sampled. Through the FY 2012 well inventory update effort, no new wells were added to these categories; therefore, no wells were sampled. Therefore, no analytical data from well sampling was collected during the FY 2012 well inventory update (see Table E-2.)

Information contained in Tables E-3 through E-6 has been updated in the well inventory database (Filename "Well Inventory Main Database FY 2012", an Excel file included on this CD).

Recommendations

- At this time no wells are recommended for the Army to offer alternate water supply or well abandonment.
- The next "major" sampling event is in FY 2013. Wells to be sampled in FY 2013 are:
    - All wells in Categories 1a, 1b, 1c, 2a, 2b, 2c, and 4a
    - Any previously undiscovered wells determined to be in Categories 1a, 1b, 1c, 2a, 2b, 2c, or 4a based on the FY 2010-FY2012 review of the MDH database.
    - Any Category 4b wells that are determined, from further investigation, to be in Category 1a, 1b, 1c, 2a, 2b, 2c, or 4a.

TABLE E-1
WELL INVENTORY CATEGORY DESCRIPTIONS

Category	*Subcategory*	*Explanation*
1		Water supply wells screened in an aquifer of concern, inside the 1 µg/l contour. Wells are divided into the following subcategories:
	1a	• Drinking water well
	1b	• Nondrinking but possible contact water
	1c	• Nondrinking, noncontact water
	1d	• Well is inoperable or has not been used for several years
	1e	• Well for which the owner has refused (or has been unresponsive to) an Army offer for abandonment, or for which the water use has been deemed acceptable
2		Water supply wells in an area of concern, inside the buffer lines, but outside the 1 µg/l contour, screened in an aquifer of concern. Wells are divided into the following subcategories:
	2a	• Drinking water well
	2b	• Nondrinking but possible contact water
	2c	• Nondrinking, noncontact water
	2d	• Well is inoperable or has not been used for several years
3		Water supply wells within the Study Area that are either outside the area of concern, or are within the area of concern but are not screened in an aquifer of concern.
4		Water supply wells with missing information, divided into the following subcategories:
	4a	• Unknown depth or aquifer, but located in the area of concern.
	4b	• Unknown location, but potentially located within the Study Area. Wells with both an unknown depth and an unknown location are included in 4b.
5		Wells that are in the study area, but that have been field checked and not located. No further action is recommended for these wells.
6		Nonsupply wells (primarily monitoring wells).
7		Sealed or abandoned wells. Wells are divided into the following subcategories:
	7a	• Documented as sealed/abandoned
	7b	• Undocumented as sealed, or improperly abandoned

TABLE E-2

WELL INVENTORY SAMPLING RESULTS
Fiscal Year 2012

No sampling conducted in FY12

TABLE E-3
CONSTRUCTED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Use	Depth	Date Drilled
767864	3	MINNEAPOLIS, CITY OF, ATTN: JOE KLEJWA, PUBLIC WORKS	1095 12TH AVENUE SE MINNEAPOLIS	Minneapolis	Dewatering	156	4/1/2011
767866	3	MINNEAPOLIS, CITY OF, ATTN: JOE KLEJWA, PUBLIC WORKS	11TH AVENUE SE MINNEAPOLIS	Minneapolis	Dewatering		11/1/2011
768530	6	TWIN CITIES ARMY AMMUNITION PLANT	470 HIGHWAY 96 SHOREVIEW 55126	Shoreview	Env. Boring	40	4/1/2011
768531	6	TWIN CITIES ARMY AMMUNITION PLANT	470 HIGHWAY 96 SHOREVIEW 55126	Shoreview	Env. Boring	31	4/1/2011
768547	6	ST. PAUL, CITY OF, JOE MUELLER	RAYMOND AVENUE ST. PAUL 55108	St. Paul	Env. Boring	18	1/1/2011
768549	6	ST. PAUL, CITY OF, JOE MUELLER	RAYMOND AVENUE ST. PAUL 55108	St. Paul	Env. Boring	26	1/1/2011
768550	6	ST. PAUL, CITY OF, JOE MUELLER	RAYMOND AVENUE ST. PAUL 55108	St. Paul	Env. Boring	21	1/1/2011
778188	6	MN CHEMICAL, ATTN: STEVE BAKER	2285 W HAMPDEN AVENUE ST. PAUL 55114	St. Paul	Monitoring	16	10/1/2010
778189	6	MN CHEMICAL, ATTN: STEVE BAKER	2285 W HAMPDEN AVENUE ST. PAUL 55114	St. Paul	Monitoring	14	10/1/2010
778190	6	MN CHEMICAL, ATTN: STEVE BAKER	2285 W HAMPDEN AVENUE ST. PAUL 55114	St. Paul	Monitoring	17	10/1/2010
778191	6	MN CHEMICAL, ATTN: STEVE BAKER	2285 W HAMPDEN AVENUE ST. PAUL 55114	St. Paul	Monitoring	17	10/1/2010
780876	6	ST. PAUL, CITY OF, JOE MUELLER	RAYMOND AVENUE ST. PAUL 55108	St. Paul	Env. Boring	21	1/1/2011
782662	6	CHEVRON ENVIRONMENTAL MANAGEMENT CO., ATTN: JOHN FRARY	3650 STINSON BOULEVARD NE MINNEAPOLIS 55418	Minneapolis	Monitoring	29	11/1/2010
782664	6	CHEVRON ENVIRONMENTAL MANAGEMENT CO., ATTN: JOHN FRARY	3650 STINSON BOULEVARD NE MINNEAPOLIS 55418	Minneapolis	Monitoring	15	11/1/2010
782665	6	CHEVRON ENVIRONMENTAL MANAGEMENT CO., ATTN: JOHN FRARY	3650 STINSON BOULEVARD NE MINNEAPOLIS 55418	Minneapolis	Monitoring	16	11/1/2010
783275	6	RAEES CHOHAN	765 53RD AVENUE NE FRIDLEY 55421	Fridley	Monitoring	20	5/1/2011
785574	3	ST. PAUL, CITY OF	EUSTIS AVENUE ST. PAUL	St. Paul	Dewatering	207	11/1/2011

Indicates wells that were both constructed and later sealed during FY 2011.

TABLE E-4
WELLS DISCLOSED THROUGH PROPERTY TRANSFER

Unique Number	Category	Last Name or Business Name	Street	City	Use	Status	Date Sealed	Depth	Aquifer	Date Drilled
757485	7a	~~Opus Northwest,~~ Big Ten Campus Associates, LLC	312 ONTARIO STREET	Minneapolis		Sealed				
	3	JERRY B. ELLEFSON	1918 GRANT ROAD	Arden Hills		In Use				
166079	3	~~Radermacher,~~ Rose	5584 SCHUTTA ROAD	Shoreview	Domestic	In Use		117	QBAA	

Disclosed Wells that were later sealed

TABLE E-5
SEALED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
272013	7a	FAHRENHOLZ	2836 SILVER LAKE ROAD	ST. ANTHONY	Water Supply	8/17/2011
H000111777	7a	Severson	3916 MACALASTER DRIVE	ST. ANTHONY	Sealed	
H000143740	7a	Mulligan	2809 PAHL AVENUE	ST. ANTHONY	Sealed	
H000282438	7a	MFJ Co., LLP	2160 MUSTANG DRIVE	MOUNDS VIEW	Monitoring	11/11/2010
H000282450	7a	MPCA	4700 HIGHWAY 10	ARDEN HILLS	Monitoring	12/29/2010
H000289639	7a		3650 STINSON BOULEVARD NE	MINNEAPOLIS	Monitoring	6/6/2011
H000289817	7a	Drews	2609 ST. ANTHONY BOULEVARD	ST. ANTHONY	Water Supply	7/18/2011
H000291124	7a	CHEVRON ENVIRONMENTAL	3650 STINSON BOULEVARD	MINNEAPOLIS	Monitoring	11/17/2010
H000291141	7a	MPCA	4700 HIGHWAY 10	ARDEN HILLS	Monitoring	5/12/2011
H000291191	7a	Patio Enclosures	2123 OLD HIGHWAY 8 NW	NEW BRIGHTON	Monitoring	10/11/2010
H000293566	7a	Reo Solutions	1151 TENTH STREET NW	NEW BRIGHTON	Water Supply	4/8/2011
H000293977	7a	MNDOT		ARDEN HILLS	Env. Boring	3/1/2011
H000293978	7a	MNDOT		ARDEN HILLS	Env. Boring	3/2/2011
H000293979	7a	TCAAP	470 HIGHWAY 96	SHOREVIEW	Env. Boring	4/15/2011
H000293980	7a	Ramsey County		ARDEN HILLS	Env. Boring	3/14/2011
H000293981	7a	Ramsey County		ARDEN HILLS	Env. Boring	3/4/2011
H000293982	7a	City of Arden Hills		ARDEN HILLS	Env. Boring	3/30/2011
H000294237	7a	MNDOT		ARDEN HILLS	Monitoring	4/15/2011
H000294238	7a	MNDOT		ARDEN HILLS	Monitoring	4/15/2011
H000296386	7a	Meritex	2285 WALNUT STREET	ROSEVILLE	Monitoring	8/16/2011
H000296387	7a	Meritex	2285 WALNUT STREET	ROSEVILLE	Monitoring	8/16/2011
H000296388	7a	Meritex	2285 WALNUT STREET	ROSEVILLE	Monitoring	8/16/2011
H000296389	7a	Meritex	2285 WALNUT STREET	ROSEVILLE	Water Supply	8/16/2011
H000296769	7a	Kommany	4643 HIGHWAY 10	ARDEN HILLS	Water Supply	7/21/2011
H000297575	7a	Croix Oil Co.	2398 COUNTY ROAD E	NEW BRIGHTON	Monitoring	7/21/2011
H000298316	7a	Olson	1120 LONG LAKE ROAD	NEW BRIGHTON	Water Supply	9/9/2011
H000298503	7a	Waldron	2525 ST. ANTHONY BOULEVARD	ST. ANTHONY	Water Supply	9/13/2011
271860	7a	Thomas	2177 W COUNTY ROAD B	ROSEVILLE	Water Supply	10/15/2010
271997	7a	Bethel University	3707 HAMLINE AVENUE	ARDEN HILLS	Water Supply	7/6/2011
462311	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
462314	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
462315	7a	Tesoro Cos.	2288 COUNTY ROAD C W	ROSEVILLE	Monitoring	5/23/2011
462316	~~6,~~ 7a	MW-212		Roseville	Monitoring	5/23/2011
473279	~~6,~~ 7a	Soo Line Railroad Company	28th & Central Avenue	Minneapolis	Monitoring	10/26/2010
492768	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
492769	7a	Tesoro Cos.	2288 COUNTY ROAD C W	ROSEVILLE	Monitoring	5/23/2011
538816	7a	Tesoro Cos.	2288 COUNTY ROAD C W	ROSEVILLE	Monitoring	5/23/2011
556480	~~6,~~ 7a	Amoco Oil Company	2288 County Road C West	Roseville	Monitoring	5/23/2011
582966	~~6,~~ 7a	CP Rail System	2827 Central Ave NE	Minneapolis	Monitoring	10/26/2010
656978	~~6,~~ 7a	U of M	2525 4th St SE	Minneapolis	Monitoring	6/10/2011
656979	~~6,~~ 7a	U of M	2525 4th St SE	Minneapolis	Monitoring	6/10/2011
661518	~~6,~~ 7a	U of M	2525 4th St SE	Minneapolis	Monitoring	8/23/2010
668811	~~6,~~ 7a	U of M	2525 4th St SE	Minneapolis	Monitoring	8/23/2010
668812	~~6,~~ 7a	U of M	2525 4th St SE	Minneapolis	Monitoring	8/23/2010
668813	~~6,~~ 7a	U of M	2525 4th St SE	Minneapolis	Monitoring	8/23/2010
674094	~~6,~~ 7a	Tesoro Refining and Marketing	2288 County Road C West	Roseville	Monitoring	5/23/2011
674778	~~6,~~ 7a	U of M	5th St SE and Oak St	Minneapolis	Monitoring	4/15/2011
682733	~~6,~~ 7a	U of M	1715 5th St SE	Minneapolis	Monitoring	4/15/2011
682735	~~6,~~ 7a	U of M	1715 5th St SE	Minneapolis	Monitoring	4/15/2011
682736	~~6,~~ 7a	U of M	1715 5th St SE	Minneapolis	Monitoring	4/5/2011
682737	~~6,~~ 7a	U of M	1715 5th St SE	Minneapolis	Monitoring	4/15/2011
751340	~~6,~~ 7a	Ameripride Services	700 INDUSTRIAL BOULEVARD NE	MINNEAPOLIS	Monitoring	2/15/2011
751341	~~6,~~ 7a	Ameripride Services	700 INDUSTRIAL BOULEVARD NE	MINNEAPOLIS	Monitoring	2/15/2011
751342	~~6,~~ 7a	Ameripride Services	700 INDUSTRIAL BOULEVARD NE	MINNEAPOLIS	Monitoring	2/15/2011
751343	~~6,~~ 7a	Ameripride Services	700 INDUSTRIAL BOULEVARD NE	MINNEAPOLIS	Monitoring	2/15/2011
751344	~~6,~~ 7a	Ameripride Services	700 INDUSTRIAL BOULEVARD NE	MINNEAPOLIS	Monitoring	2/15/2011
751345	~~6,~~ 7a	Ameripride Services	700 INDUSTRIAL BOULEVARD NE	MINNEAPOLIS	Monitoring	3/3/2011
752260	~~6,~~ 7a	U of M	2525 FOURTH STREET SE	MINNEAPOLIS	Monitoring	8/23/2010
752840	~~6,~~ 7a	Savant Properties	812 FOURTH STREET SE	MINNEAPOLIS	Monitoring	8/30/2010
752841	~~6,~~ 7a	Savant Properties	816 FOURTH STREET SE	MINNEAPOLIS	Monitoring	8/30/2010
752842	~~6,~~ 7a	Savant Properties	811 FOURTH STREET SE	MINNEAPOLIS	Monitoring	8/30/2010
752843	7a	Savant Properties, LLC	813 FOURTH STREET SE	MINNEAPOLIS	Monitoring	4/30/2010
756220	7a	Wolkerstofer Co.	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	5/24/2011
756221	7a	Wolkerstofer Co.	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	5/24/2011
756222	7a	Wolkerstofer Co.	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	5/24/2011
756223	7a	Wolkerstofer Co.	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	5/24/2011
756224	7a	Wolkerstofer Co.	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	5/24/2011
756225	7a	Wolkerstofer Co.	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	5/24/2011
757483	~~6,~~ 7a	Opus Northwest	810 WASHINGTON AVENUE SE	MINNEAPOLIS	Monitoring	5/10/2011
757484	~~6,~~ 7a	Opus Northwest	818 WASHINGTON AVENUE SE	MINNEAPOLIS	Monitoring	5/10/2011
757485	~~6,~~ 7a	Big Ten Campus Associates, LLC	312 ONTARIO STREET SE	MINNEAPOLIS	Monitoring	5/10/2011
H000003796	7a	Fernandez	1966 SHARONDALE AVENUE	ROSEVILLE	Sealed	
H000009397	7a	Clos	2539 RAINBOW LANE	NEW BRIGHTON	Sealed	
H000052004	7a	GREATER METROPOLITAN HOUSING CORP.	627 NINTH AVENUE NW	NEW BRIGHTON	Sealed	
H000052005	7a	GREATER METROPOLITAN HOUSING CORP.	627 NINTH AVENUE NW	NEW BRIGHTON	Sealed	
H000067697	7a	Margen Properties, LLC	1837 ROSELAWN AVENUE W	ROSEVILLE	Sealed	
H000097711	7a	Aasland	1330 NE 69TH AVENUE	FRIDLEY	Water Supply	8/21/1990
H000097721	7a	DETERMAN WELDING AND TANK SERVICE, INC.	1241 72ND AVENUE NE	FRIDLEY	Monitoring	11/17/1989
H000097722	7a	DETERMAN WELDING AND TANK SERVICE, INC.	1241 72ND AVENUE NE	FRIDLEY	Monitoring	11/17/1989
H000097723	7a	DETERMAN WELDING AND TANK SERVICE, INC.	1241 72ND AVENUE NE	FRIDLEY	Monitoring	11/17/1989
H000097728	7a	Peterson	1340 64TH AVENUE NE	FRIDLEY	Water Supply	9/20/1989
H000118398	7a	PARK PLAZA COOPERATIVE	1130 FIRESIDE DRIVE	FRIDLEY	Sealed	
H000131758	7a	Graham	1980 CLEVELAND AVENUE N	ROSEVILLE	Sealed	
H000263761	7a	Demos	1850 RYAN AVENUE W	ROSEVILLE		10/27/1986

TABLE E-5
SEALED WELLS

H000269163	7a	BIG TEN CAMPUS ASSOCIATES, LLC	814 WASHINGTON AVENUE SE	MINNEAPOLIS	Sealed	
H000276086	7a	Amble	1225 AMBLE ROAD	ARDEN HILLS	Water Supply	10/4/2010
H000284393	7a	MET Council		MINNEAPOLIS	Monitoring	2/16/2010
H000286238	7a	Henderson	FRIDLEY	FRIDLEY	Water Supply	12/2/2010
H000289753	7a	Larson	5890 STINSON BOULEVARD	FRIDLEY	Water Supply	10/11/2010
H000289800	7a	Lowe	1857 GRANT ROAD	NEW BRIGHTON	Water Supply	1/4/2011
H000289811	7a	Jones	1691 CRYSTAL AVENUE	ARDEN HILLS	Water Supply	6/2/2011
H000289823	7a	Talbot Realty	19263 STOWE AVENUE	ARDEN HILLS	Water Supply	8/15/2011
H000289888	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000289892	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000289900	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290165	7a	MET Council	1 MALCOLM AVENUE SE	MINNEAPOLIS	Monitoring	10/28/2010
H000290243	7a	Boehm	7656 GREENFIELD AVENUE	MOUNDS VIEW	Other	5/5/2011
H000290665	7a	City of St. Paul	RAYMOND AVENUE	ST. PAUL	Env. Boring	1/10/2011
H000290669	7a	U of M		MINNEAPOLIS	Monitoring	4/21/2011
H000290976	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290977	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290978	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290979	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290980	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290981	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290982	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290983	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290984	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290985	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290986	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290988	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290989	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290990	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000290991	7a	Tesoro Cos.	2288 W COUNTY ROAD C	ROSEVILLE	Monitoring	5/23/2011
H000291127	7a	Pinnacle Engineering	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	12/8/2010
H000291128	7a	Pinnacle Engineering	348 FIRST STREET SW	NEW BRIGHTON	Monitoring	1/7/2011
H000291142	7a	MPCA	1700 VALENTINE AVENUE	ARDEN HILLS	Monitoring	5/10/2011
H000291206	7a	Everest Properties, LLC	441 OLD HIGHWAY 8 NW	NEW BRIGHTON	Monitoring	10/20/2010
H000291943	7a	City of Minneapolis	HURON STREET SE	MINNEAPOLIS	Monitoring	11/1/2010
H000291944	7a	Morita	2400 HIGHWAY 10 NE	MOUNDS VIEW	Monitoring	11/1/2010
H000291955	7a	BOYER TRUCK RENTAL FACILITY	743 TAFT STREET NE	MINNEAPOLIS	Monitoring	11/17/2010
H000291966	7a	City of Minneapolis		MINNEAPOLIS	Monitoring	11/24/2010
H000292018	7a	Ashland, Inc.	7315 HIGHWAY 65 NE	FRIDLEY	Monitoring	1/26/2011
H000292276	7a	Thomas	2177 W COUNTY ROAD B	ROSEVILLE	Water Supply	10/4/2010
H000292341	7a	Diesel Dogs	2091 ENERGY PARK DRIVE	ST. PAUL	Monitoring	10/14/2010
H000292344	7a	Mittero	2314 E HENNEPIN AVENUE	MINNEAPOLIS	Monitoring	11/2/2009
H000292361	7a	Hillcrest Development, LLP	80 SECOND AVENUE SE	NEW BRIGHTON	Monitoring	12/28/2010
H000292379	7a	CB Richard Ellis	5275 QUINCY STREET	MOUNDS VIEW	Monitoring	12/9/2010
H000292388	7a	Alerus Financial	2436 COUNTY HIGHWAY 10	MOUNDS VIEW	Monitoring	2/25/2011
H000292389	7a	Alerus Financial	2442 COUNTY HIGHWAY 10	MOUNDS VIEW	Monitoring	2/25/2011
H000292488	7a	Schaefer	7600 GROVELAND ROAD	MOUNDS VIEW	Water Supply	4/5/2011
H000292500	7a	Schaefers	1703 HILLVIEW ROAD	SHOREVIEW	Water Supply	5/18/2011
H000292581	7a	APPLEWOOD POINTE COOPERATIVE	3010 CLEVELAND AVENUE N	ROSEVILLE	Water Supply	1/25/2011
H000292583	7a	Hawthorne Associates, LP	3353 UNIVERSITY AVENUE SE	MINNEAPOLIS	Other	2/7/2011
H000292700	7a	City of St. Paul	2286 CAPP ROAD	ST. PAUL	Monitoring	2/16/2011
H000292791	7a	Federal Home Loan	1748 TATUM STREET	FALCON HEIGHTS	Water Supply	6/1/2011
H000292893	7a	Terra General Contractors	705 RAYMOND AVENUE	ST. PAUL	Water Supply	5/20/2011
H000292908	7a	Uthe	7315 HIGHWAY 65 NE	FRIDLEY	Monitoring	12/20/2010
H000293253	7a	Oshea	1831 FULHAM STREET	LAUDERDALE	Water Supply	11/24/2010
H000293481	7a	City of Minneapolis		MINNEAPOLIS	Monitoring	3/3/2011
H000293655	7a	Smith	2406 LONG LAKE ROAD	NEW BRIGHTON	Water Supply	5/9/2011
H000293860	7a	Ironton Asset Fund, LLC	735 RAYMOND AVENUE	ST. PAUL	Monitoring	9/17/2011
H000293911	7a	Ahlgren	1563 FULHAM STREET	ST. PAUL	Other	3/10/2011
H000294455	7a	Senior Housing Partners, LLC	3151 LAKE JOHANNA BOULEVARD	ARDEN HILLS	Monitoring	6/22/2011
H000294521	7a	Quick	2208 ROSEWOOD LANE	ROSEVILLE	Water Supply	8/2/2011
H000294524	7a	Schlemmer	6875 CHANNEL ROAD	FRIDLEY	Water Supply	8/9/2011
H000294708	7a	City of Minneapolis		MINNEAPOLIS	Monitoring	4/8/2011
H000294794	7a	Ameristar Laser Cuttings	800 24TH AVENUE SE	MINNEAPOLIS	Monitoring	6/10/2011
H000294915	7a	John Schuster Group	1973 TATUM STREET N	ROSEVILLE	Water Supply	7/1/2011
H000295834	7a	Amsrud	2069 CEDAR DRIVE	NEW BRIGHTON	Water Supply	7/19/2011
H000295841	7a	Benedix	2083 LONGVIEW DRIVE	NEW BRIGHTON	Water Supply	9/20/2011
H000295878	7a	NAWF	3115 LONG LAKE ROAD	ROSEVILLE	Monitoring	7/5/2011
H000295908	7a		1240 73½ AVENUE	FRIDLEY	Monitoring	6/2/2011
H000295944	7a	St. Croix	2091 ENERGY DRIVE	ST. PAUL	Monitoring	6/29/2011
H000295968	7a	HILL	2181 RICE CREEK ROAD	NEW BRIGHTON	Water Supply	11/1/2011
H000295969	7a	Berg	5108 RED OAK DRIVE	MOUNDS VIEW	Water Supply	8/26/2011
H000295971	7a	Gatton	2244 ORIOLE AVENUE	NEW BRIGHTON	Water Supply	9/15/2011
H000295975	7a	Zwieg	2286 THORNDALE AVENUE	NEW BRIGHTON	Water Supply	6/7/2011
H000296060	7a	Peterson	1917 STOWE AVENUE	NEW BRIGHTON	Water Supply	8/29/2011
H000296335	7a	Holden	1881 BECKMAN AVENUE	ARDEN HILLS	Water Supply	6/28/2011
H000297376	7a	Milton	3673 HAMLINE AVENUE	ARDEN HILLS	Water Supply	8/4/2011
H000297379	7a	Soldner	1923 NOBLE ROAD	ARDEN HILLS	Water Supply	8/18/2011
H000298321	7a	Carlson	2040 STOWE AVENUE	ARDEN HILLS	Water Supply	9/16/2011
H000298978	7a	Landmark Senior Living, LLC	6490 CENTRAL AVENUE NE	FRIDLEY	Water Supply	10/6/2011
H000299069	7a	Schmiesing	636 CLEVELAND AVENUE SW	NEW BRIGHTON	Water Supply	10/13/2011
H000299176	7a	Bianchi	1725 FAIRVIEW AVENUE	FALCON HEIGHTS	Water Supply	8/22/2011
	7a	BIG TEN CAMPUS ASSOCIATES, LLC	814 WASHINGTON AVENUE SE	MINNEAPOLIS	Sealed	
705472	~~6,~~ 7a	Canadian Pacific Railway	2800 Central Ave NE	Minneapolis	Monitoring	10/26/2010
763229	~~6,~~ 7a	Gateway Washington, Inc.	2100 Snelling Avenue N	Roseville	Monitoring	5/16/2011
763230	~~6,~~ 7a	Gateway Washington, Inc.	2100 Snelling Avenue N	Roseville	Monitoring	5/16/2011

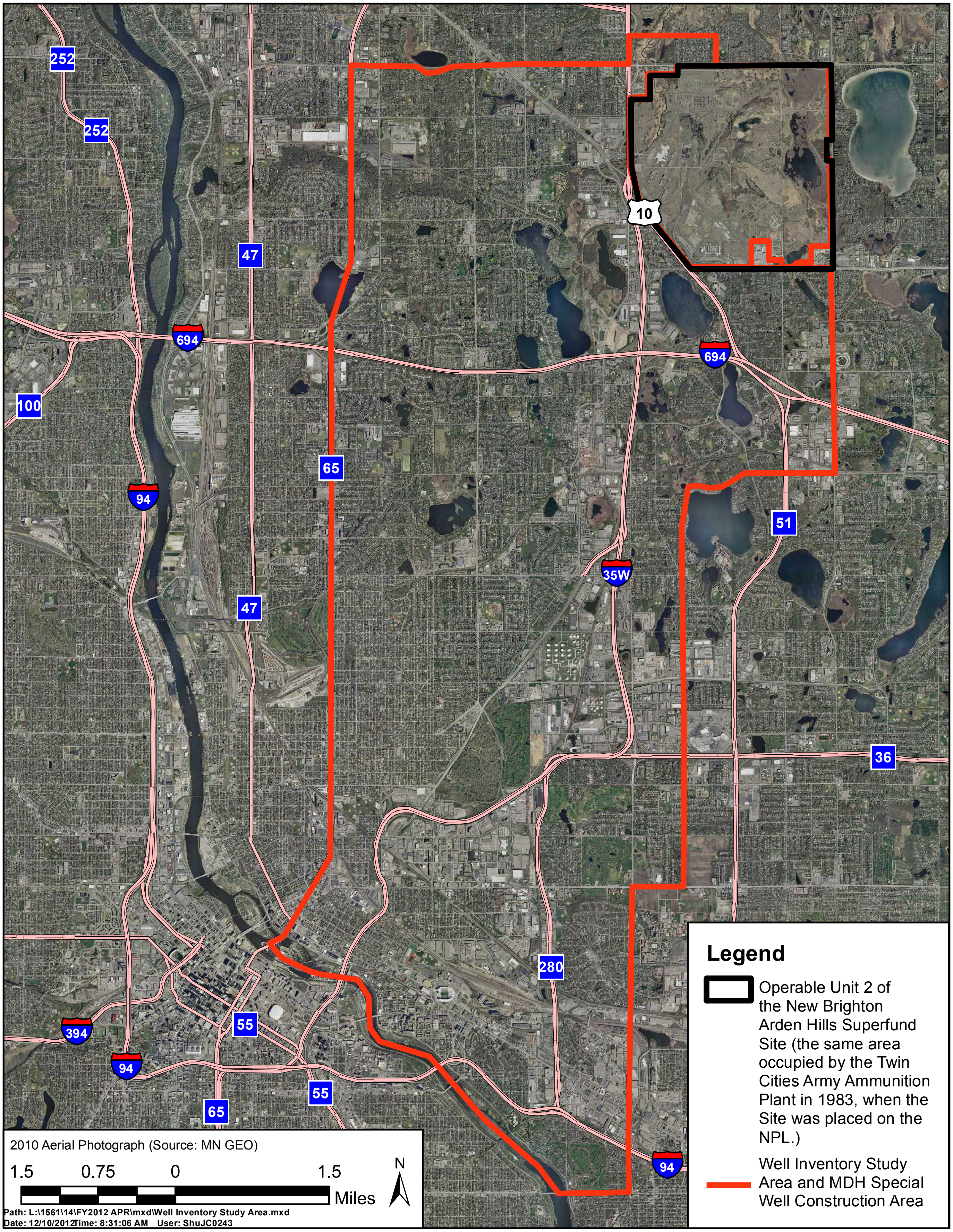
TABLE E-5
SEALED WELLS

763231	~~6,~~ 7a	Gateway Washington, Inc.	2100 Snelling Avenue N	Roseville	Monitoring	5/16/2011

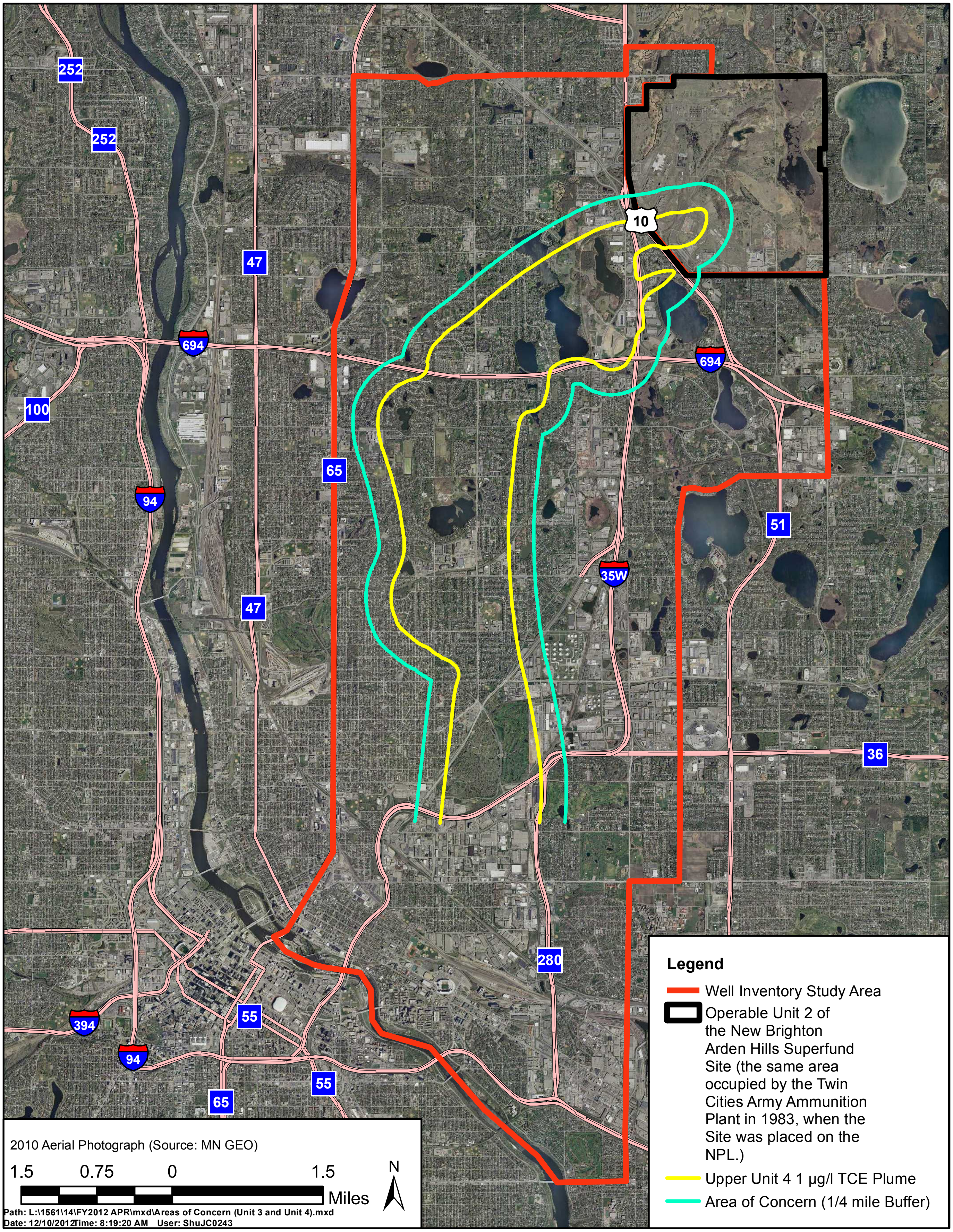
TABLE E-6
FY 2012 FIELD INVESTIGATION AND SAMPLING SUMMARY

Unique Number	*Category*	*Last Name or Business Name*	*Street*	*City*	*Date Last Sampled*	*Status*	*Depth*	*Comments*
S00295	7a	Moncada	2531 Summer St	Lauderdale		Unknown		Discovered typo in well address. Well at updated address has been sealed.
	4a	Amundsen	2816 St. Anthony Blvd	St. Anthony		Not in Use		Sent letter in FY12. No response.
	4a	Hermes	2935 Old Hwy 8	Roseville	6/16/2009	Active		No letter sent in FY12.
249185	4a	Novotny	1706 Malvern St	Lauderdale		Unknown		Sent letter in FY12. No response.
	7b	Purdy	2816 Silver Lake Rd	St. Anthony		Inactive		Sent letter in FY12. Received email indicating well had been sealed. No other documentation provided. Moved to Category 7b.
126463		B & M Construction	Nordeen Estates			Active	216	Located outside of study area. Will be deleted from the database.
S00650	4b	CME		New Brighton	6/24/1984			Could not locate.
239465	4b	Lennox				Active	256	Could not locate.
234434	4b	Marquart		Arden Hills		Unknown		Could not locate.
		Murray Heights				Not In Use		Located outside of study area. Will be deleted from the database.
105271	4b	Nelson				Active	137	Could not locate.
S00471	4b	R Komarek/Nelson-Miller Cons				Inactive		Could not locate.
S00551	4b	Tamarack Care Temp			2/17/1982	Unknown		Could not locate.
105242		Weber, Nordeen Jr.				Domestic	214	Located outside of study area. Will be deleted from the database.
201192	4b					Unknown		Could not locate.
234532	4b					Unknown		Could not locate.
234537	4b					Unknown		Could not locate.
234545	4b				PHASE I	Unknown		Could not locate.
234658	4b				6/7/1982	Unknown		Could not locate.

Well to be deleted from Well Inventory Database.

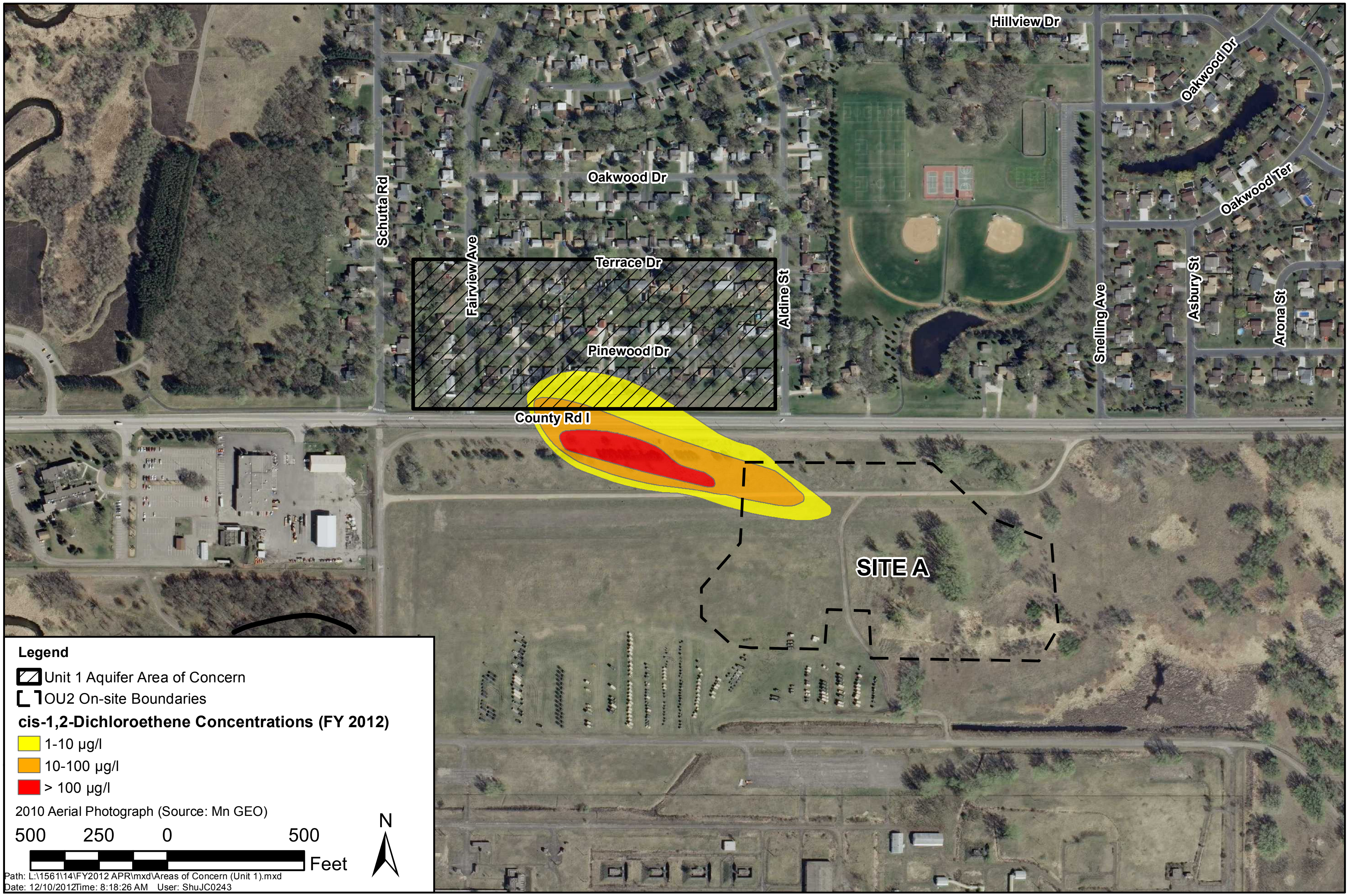


ANNUAL PERFORMANCE REPORT	Wenck	FY 2012
Well Inventory Study Area	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure E-1



Path: L:\1561\14\FY2012 APR\mxd\Areas of Concern (Unit 3 and Unit 4).mxd
Date: 12/10/2012 Time: 8:19:20 AM User: ShuJC0243

ANNUAL PERFORMANCE REPORT	Wenck Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	FY 2012
Areas of Concern (Unit 3 and Unit 4)		Figure E-2



ANNUAL PERFORMANCE REPORT

Area of Concern (Unit 1)

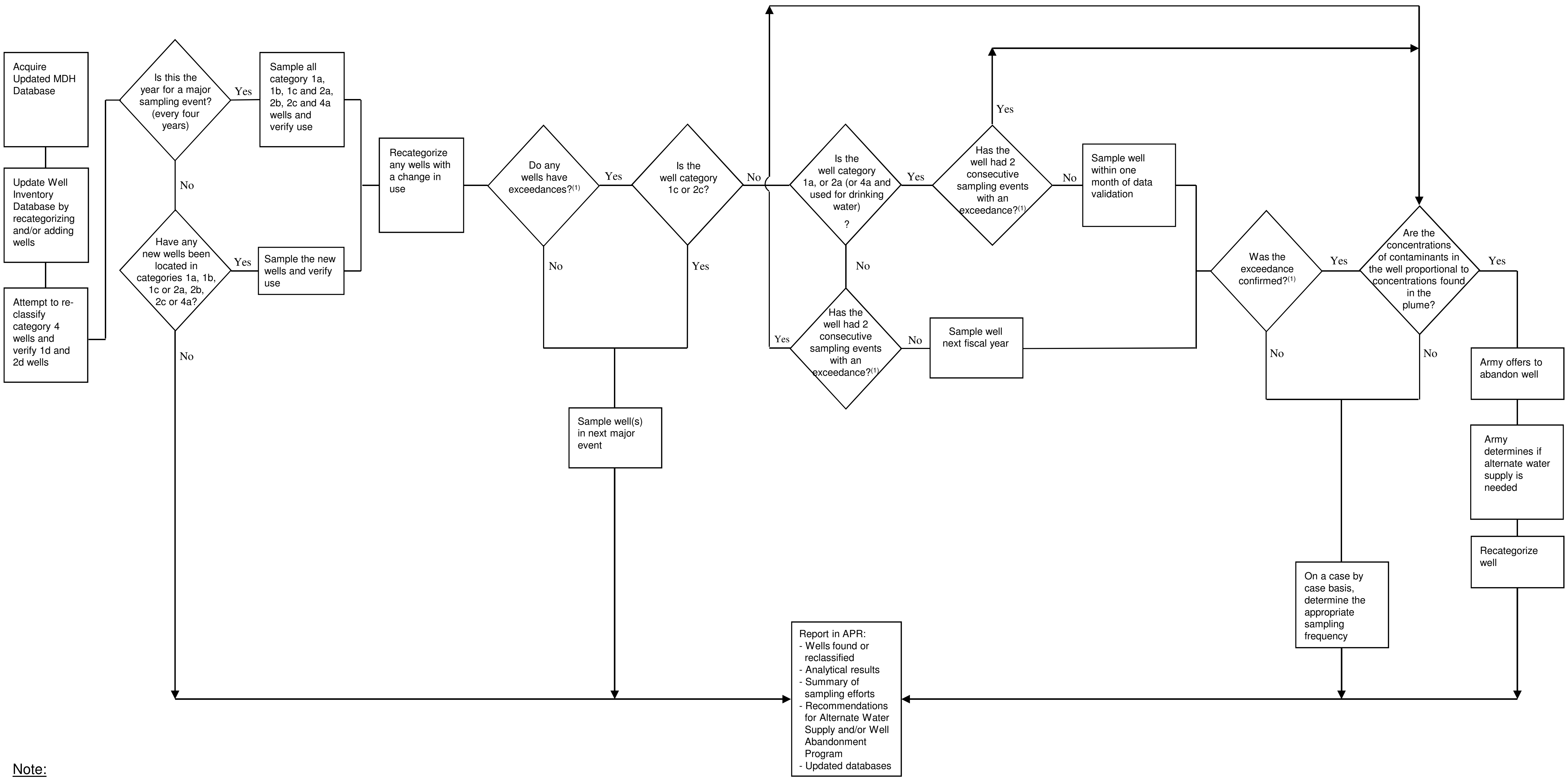
Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2012

Figure E-3

Figure E-4

Annual Requirements for Maintaining Well Inventory Database



Note:

(1) = Exceedance of a New Brighton/Arden Hills Superfund Site Groundwater Cleanup Level

WELL INVENTORY DATABASE

The Well Inventory Database is located on
this CD in the following Microsoft Excel file:

Well Inventory Main Database FY 2012.xls

Appendix F

Site K and TGRS Operational Data

F.1 Inspection and Maintenance Activities, Fiscal Year 2012, Site K, OU2

APPENDIX F.1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
SITE K, TCAAP
ARDEN HILLS, MINNESOTA

October 2011

1)	10/10/11 - Treatment system building broken into. No damage to the system.
2)	10/28/11 - Performed monthly O&M

November 2011

1)	11/1/11 - In suspense, system OK.
2)	11/10/11 - In suspense, system OK
3)	11/14/11 - In suspense, system OK
4)	11/16/11 - System shut down for annual cleaning. Restarted system on 11/17/11. Total down time approximately 27.25 hours.

December 2011

1)	12/1/11 - In suspense, system OK, collected quarterly influent and effluent samples.
2)	12/9/11 - In suspense, system OK
3)	12/16/11 - In suspense, system OK
4)	12/21/11 - Performed monthly O&M

January 2012

1)	1/10/12 - In suspense, system OK, performed monthly O&M.
2)	1/12/12 - In suspense, system OK.
3)	1/23/12 - In suspense, system OK.
4)	1/26/12 - In suspense, system OK.
5)	1/27/12 - In suspense, system OK.

February 2012

1)	2/1/12 - In suspense, system OK.
2)	2/2/12 - In suspense, system OK.
3)	2/6/12 - In suspense, system OK.
4)	2/8/12 - In suspense, system OK.
5)	2/9/12 - Performed monthly O&M.
6)	2/17/12 - In suspense, system OK.
7)	2/23/12 - In suspense, system OK.
8)	2/27/12 - In suspense, system OK.
9)	2/28/12 - In suspense, system OK.

March 2012

1)	3/1/12 - No power to system until 1500. Approximate downtime 15 hours.
2)	3/5/12 - Low building temperature fault due to malfunctioning heater - system dow
3)	3/7/12 - System restarted at 10:45. Approximate downtime 55 hours. Collected monthly influent and effluent samples, performed monthly O&M.
4)	3/29/12 - In suspense, system OK.

5)	3/30/12 - In suspense, system OK.

April 2012

1)	4/12/12 - In suspense, system OK. Performed monthly O & M.
2)	4/16/12 - In suspense, system OK.

May 2012

1)	5/2/12 - Increased flow to 11.3. Increased static pressure to 20".
2)	5/7/12 - Increase flow to 14.2 gpm.
3)	5/10/12 - Performed monthly O&M.

June 2012

1)	6/11/12 - Performed Monthly O & M.

July 2012

1)	7/23/12 - Performed monthly O & M

August 2012

1)	8/23/12 - Reduced flow to 10.5 gpm.
2)	8/27/12 - System down - no power.
3)	8/28/12 - Power out, restored approximately 17:00 hrs.
4)	8/29/12 - Performed monthly O & M.

September 2012

1)	9/12/12 - Collected quarterly influent and effluent samples
2)	9/20/12 - Performed monthly O & M

F.2 Maintenance Activities, Fiscal Year 2012, TGRS, OU2

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

October 2011

10/8/2011 Pumphouses SC2 and SC5; Lost a leg of power to the pumphouses. A power pole was cut down near the power station on the way to Building 502. Xcel Energy was contacted and they repaired the problem.

Down time: 31 hours at SC2 and 41 hours at SC5.

10/11/2011 Treatment system and Pumphouses; Turned the TGRS off for monthly preventive maintenance.

Down time: None.

10/13/2011 Pumphouse SC5; The water level probe has mineral build-up. Removed the probe, replaced the sensor and re-installed the probe.

Down time: 20.5 hours.

10/26/2011 Pumphouse SC2; The forcemain pressure gauge has failed. Replaced the pressure gauge with a new one from inventory.

Down time: None.

10/27/2011 Treatment System; The flow meter for pump 4 is slowing with time. Installed the flow meter from pump 3 in the pump 4 discharge piping and disassembled and repaired the pump 4 flow meter. Re-installed the pump 4 flow meter in the pump 3 discharge piping.

Down time: None.

November 2011

11/2/2011 Pumphouse B8; Loud spraying noise down the well. Removed the lift system and found worn threads on the drop pipe at the joint where the black steel meets the stainless steel. Replaced the top three black steel drop pipes and the motor.

Down time: 4 hours.

11/8/2011 Treatment System and Well Field; Turned the TGRS off as part of the monthly preventive maintenance work.

Down time: 2 hours at B3; 1 hour at B4.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/11/2011 Pumphouse SC1; Light was off on the PLC in Building 116. Further inspection finds there is no power to the pumphouse and that there was a grass fire near the old electrical substation. Contacted Xcel Energy and they repaired the problem.

Down time: 28 hours.

11/12/2011 Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem.

Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.

11/13/2011 Pumphouse SC5; The light was flashing on the PLC in Building 116. Reset the PLC and the pump restarted normally.

Down time: 24 hours.

11/15/2011 Pumphouses SC1, SC2 and SC5; Power is off at the pumphouses. Contacted Xcel Energy and they repaired the problem.

Down time: 8.5 hours at SC5.

11/17/2011 Pumphouses B11, SC2 and SC5; Power is again off at the pumphouses. Contacted Xcel Energy and they repaired the problem.

Down time: 9 hours at SC5.

December 2011

12/1-8/2011 Pumphouse SC5; The flow meter was fouled and recorded incorrect totals for each day. Removed and replaced the meter with a re-built one from inventory. Adjusted the flow rates to the calibrated meter flow rates for the days noted.

Down time: None.

12/8/2011 Pumphouses SC2 and SC5; Changed out the flow meters with new ones.

Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

12/13/2011 Pumphouses B11 and SC1; The pump running lights were off on the PLC. Further inspection showed a bad solenoid valve at B11. Removed and replaced the solenoid valve and associated piping and re-started the pump. Normal operation was observed. SC1 was off because it shares communication lines with B11.

Down time: 26 hours each at B11 and SC1.

January 2012

1/4/2012 Pumphouse B11; The light is flashing on the PLC. Reset the PLC and the pump re-started normally.

Down time: 24 hours.

1/15/2012 Pumphouse B4; The light on the PLC in Building 116 was not lit. At the pumphouse it was found the water level control board was not functioning. Repaired the board and re-started the pump. Observed normal operation.

Down time: 12 hours.

1/20/2012 Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B11 and re-started the pump. The pump started normally and B8 and SC1 re-started normally also.

Down time: 19 hours at B8, 18 hours at B11 and 15 hours at SC1.

1/28-31/2012 Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B8 and re-started the pump. The pump started normally and B11 and SC1 re-started normally also.

Down time: 19 hours at B8; 66 hours at B11; 59 hours at SC1.

February 2012

2/5/2012 Treatment System; Call from Time Communications. Upon arrival, ECV 4 would not open on command. Flushed the control piping, exercised and reset the opening and closing speed control valves and changed the opening side filter. Re-started the pump and observed normal operation.

Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/8-9/2012	Pumphouses B8, B11 and SC1; Lights are not lit on PLC. Pumps do not turn on in "Auto". Changed out all communication cards but all to no avail. Turned pump B11 on in "Hand" temporarily. Additional troubleshooting finds a loose daisy chain wire on the I/O scanner module at the PLC. Re-installed the wire and switched out the sub I/O scanner module with a new one and re-started the TGRS. Observed normal operation. Down time: 23 hours at each B8 and SC1.
2/14/2012	Pumphouse B1; The piping below the ARV was leaking. Replaced the piping and ARV with new and observed normal operation. Down time: None.
2/14/2012	Pumphouse B5; Increased the pressure on the pilot to decrease the flow rate. Down time: None.
2/15/2012	Pumphouse B6; Attempted to set the flow rate to target but could not set the pressure with the pilot. Replaced the pilot with a re-built from inventory and set the flow rate to target. Down time: None.
2/19-20/2012	Pumphouse B9; The side of the valve body was leaking out of the threaded plug and dripping onto the electrical junction box on the floor. Turned the pump off and removed and replaced the plug. Re-started the pump and observed normal operation. Down time: 19 hours.
2/21/2012	Pumphouse B1; The light was flashing on the PLC. Reset the PLC and the light went out. At the pumphouse, the pump was off and there was a blown 50 amp fuse in the pump disconnect box. Contacted Laughlin Electric and they found a broken wire at the top of a power pole above the B1 disconnect near the B2 pumphouse. Laughlin repaired the broken wire and the pump re-started normally. Down time: 13 hours.
2/27/2012	Pumphouse B9; Replaced the gasket on the flow meter cover and installed a new one-quarter inch ball valve on the pressure gauge piping. Re-started the pump and observed normal operation. Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/28/2012 Pumphouse B3; A fitting on the ECV control piping was leaking. Removed the old fitting and replaced it with a new one from inventory. Re-started the pump and observed normal operation.

Down time: None.

March 2012

3/6-7/2012 Treatment System; ECV 4 was flashing on the PLC indicating a valve closing issue. Changed the filter, flushed the control piping and cycled the valve three times. The valve still would not close, changed out the solenoid valve and normal closing operation was observed.

Down time: 2 hours at B3.

3/13/2012 Pumphouse B3; Water was observed dripping from the control piping. Removed and replaced portions of the ECV control piping.

Down time: None.

3/16/2012 Treatment System; Noticed a fault light on the B3/B4 sub I/O scanner module in the control cabinet. Troubleshooting found a loose pigtail wire on the card input. Re-attached the wire and reset the system. The fault light did not illuminate.

Down time: None.

3/20-22/2012 Pumphouse SC1; Portions of the pumphouse forcemain were leaking and were plugged with iron and manganese build up. Replaced the worn and plugged pieces with new ones.

Down time: 28 hours.

3/27/2012 Pumphouse B9; The ECV would not open or close at start up or shutdown. Portions of the control piping were blocked with sand. Replaced the control piping as necessary. Cycled the valve and observed normal operation.

Down time: None.

3/28/2012 Pumphouse B8; The ARV was leaking. Removed, cleaned and replaced the ARV. No leaks were observed.

Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

April 2012

4/12/2012 Pumphouses B8 and B11; The COM light is illuminated red on the B8/B11 I/O scanner module card in the control panel. A daisy chain wire was not firmly attached in the sequence. Re-attached the wire and the light came on normally.

Down time: None.

4/14-16/2012 Pumphouse B13; The pressure on the flow increased due to a problem with the electric check valve control pilot. Replaced the pilot and re-set the flow rate.

Down time: 32.5 hours.

4/16/2012 Pumphouse B9; A leak was noticed at the pitless adapter. Thein Well pulled the lift system up, replaced the 4" x 3" swage nipple and re-installed the lift system.

Down time: None.

4/16/2012 Pumphouse B11; The flow rate was slowing with time and there was a spraying sound coming from down well. Thein Well pulled the lift system. Holes were found in the threads of several of the sticks of riser pipe. They replaced the riser pipe with new and re-started the pump.

Down time: 2 hours.

4/17-19/2012 Pumphouse B13; The flow rate is slowing with time; Thein Well removed the lift system and replaced the pump and riser pipe. They re-started the pump and normal operation resumed.

Down time: 39 hours.

4/17/2012 Pumphouse B4; The flow rate is slowing with time. Thein Well removed the lift system and replaced the pump and added a 6-foot long piece of riser pipe. They re-started the pump and observed normal operation.

Down time: 4.5 hours.

4/18/2012 Pumphouse SC5; The flow rate is slowing with time. Thein Well removed the lift system and replaced the pump and motor. They re-started the pump and observed normal operation.

Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

4/19/2012 Pumphouse SC5; The light is flashing on the PLC in Building 116. Re-set the PLC and the light came on normally. Likely the storm last night knocked out power to the well.

Down time: 17 hours.

4/26/2012 Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site.

Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

4/28-30/2012 Pumphouse B11; The pump was not pumping. Attempted to re-start the pump and heard a loud grinding noise coming from inside the well. Thein Well pulled the lift system and replaced the pump and the motor. They re-started the pump and normal operation was observed.

Down time: 75 hours.

4/28-30/2012 Pumphouse B3; There is a loud spraying sound coming from inside the well. Thein Well pulled the lift system and replaced the riser pipe. They re-started the pump and observed normal operation.

Down time: None.

May 2012

5/1/2012 Pumphouse B3; Flow rate slowed due to a fouled solenoid valve. Removed, cleaned and re-installed the solenoid valve and re-started the pump. Normal operation observed.

Down time: 2 hours.

5/6/2012 Pumphouse SC5; The light was flashing on the PLC in Building 116. Reset the PLC and the light stayed on steady. At the pumphouse, the pump was running normally. Likely a lightning strike temporarily knocked out power to the pumphouse.

Down time: 11 hours.

5/14/2012 Emergency crews (police and medical) were on site to recover the remains of a body that was found.

Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/23/2012	Treatment System; The autodialer battery was dead. Replaced the battery with a new one. Down time: None.
5/23/2012	Pumphouse B11; The flow rate slowed due to blockage in the ECV control piping pilot. Flushed the control piping and reset the pilot and observed normal operation. Down time: 10 hours.
5/23/2012	Pumphouse B4; The flow rate averaged slower for the day due to preventive maintenance work performed during the day. Down time: 1 hour.
5/24/2012	Treatment System; The cold water flow meter from pump 3 is out of calibration. Removed the meter and sent it in for repair and calibration. Down time: None.
5/26/2012	Pumphouses B8, B11 and SC2; The lights were off on the PLC in Building 116. Likely the current storm knocked out power to the communication cards. Replaced the I/O adapter card in SC3 (the SC2 light was not on because the SC2 and SC3 communication cards are paired together). Also, reset the communication cards in the B11 pumphouse and re-started the B11 pump. The B8 and SC2 pumps were not off upon arrival, only the B11 pump was off. Down time: None.

June 2012

6/5/2012	Treatment System and Pumphouses; Turned the TGRS off to complete a portion of the monthly maintenance work. Down time: 1.5 hours at B4.
6/10/2012	Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem. Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/13/2012	Pumphouse SC2; The cold water flow meter no longer totals flow. Removed, cleaned and re-installed the flow meter. Normal operation was observed. Down time: None.
6/14/2012	Pumphouse SC2; The light was flashing on the PLC probably due to the storm. Reset the PLC and the light stayed on steady. Down time: 12 hours at SC2.
6/14-15/2012	Pumphouses B5 and B6; The B5 and B6 pump running indicator lights on the PLC were lit normally but the pumps were off at the pumphouses. Troubleshooting found a bad sub I/O scanner module at the PLC. Replaced the module with one from inventory and the pumps re-started normally. Down time: 24 hours at each B5 and B6.
6/12-14/2012	Treatment System; ECV 3 would not close. Replaced 3 of the closing side check valves and portions of the control piping. Cycled the pump and valve 3 times and observed normal operation. Down time: None.
6/20/2012	Pumphouses B5 and B8; Replaced the worn 1/4" ball valves on the control piping. Down time: None.
6/20/2012	Treatment System; Portions of the ECV 4 control piping were becoming fouled causing the valve to either close too slowly or not close at all. Replaced sections of control piping as necessary. Down time: None.
6/26/2012	Pumphouse B13; Turned the pump off and disassembled portions of the pumphouse piping to determine the amount of iron bacteria build up in the piping. Down time: 1.5 hours at B13.
6/28/2012	Pumphouse SC2; Turned the pump off to minimize the potential for the motor to burn out. The current maximum flow rate is 2 gpm because the well needs to be re-developed. The pump will be restarted after well development work which is scheduled for July 16, 2012. Down time: 43 hours at SC2.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

July 2012

7/3/2012	Building 116; Laughlin Electric installed motion detecting security lighting around the outside of Building 116. Down time: None.
7/4/2012	7/4/2012; The daily inspection was not performed today due to Independence Day. Down time: None.
7/5/2012	Treatment System; ECV 4 would not close. Removed, cleaned and re-installed the solenoid valve body. Cycled the valve and observed normal operation. Down time: None.
7/6/2012	Treatment System; On Site when the extraction wells began to shut down. Drove to the treatment system and the TGRS was off. Reset the entire system by cycling power from on to off and back on again. The system restarted normally. Also reset the autodialer. Uncertain as to the cause of the shut down. Down time: None.
7/6/2012	Building 116; Inspected, reset and re-positioned the new security lighting around Building 116. Down time: None.
7/7/2012	Treatment System; On site when the extraction wells began to shut down again. At the treatment center, the TGRS was again off. The sub I/O scanner modules in the cabinet were very warm to the touch. Opened the cabinet doors and positioned a room fan to blow air into the communication cards. Cycled the power to the entire PLC and reset the autodialer. The system restarted normally. Down time: None.
7/17/2012	Pumphouse B9; Replaced the pump, motor and drop pipe. Down time: 18 hours.
7/17-21/2012	Pumphouse B4; Turned the pump off for re-development work. Down time: 91 hours.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

7/20/2012 Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM.

Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.

7/20/2012 Pumphouse B9; The power outage blew the output card in the pumphouse. Replaced the output card and restarted the pump.

Down time: Already accounted for above.

7/20/2012 Treatment System; ECV 4 would not close on command. Replaced the solenoid valve.

Down time: None.

7/23-26/2012 Pumphouse B13; Turned the pump off for re-development work.

Down time: 68 hours.

7/1-29/2012; Pumphouse SC2; The pump was turned off and the well was re-developed.

Down time: 698 hours.

August 2012

8/1/2012 Pumphouses SC2 and SC5; No power to the pumphouses. A red tailed hawk shorted the wires leading to the transformers which blew the fuses at the power pole near SC4. Contacted Xcel Energy and they replaced the fuses. Re-started the pumps and observed normal operation.

Down time: 22 hours at SC2 and 17 hours at SC5.

8/8/2012 Pumphouse SC2; The light is flashing on the PLC. Turned the TGRS off. At SC2, the pump was off. Switched the control to off and the ECV closed. Switched the control back to auto and drove back to the PLC. Re-started the system and SC2 restarted normally.

Down time: 22 hours.

8/8/2012 Treatment System; Removed and recalibrated the airflow gauges for blowers 3 and 4.

Down time: None.

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8/10/2012 Pumphouse SC2; There was water spraying out the ARV. Closed the valve to the ARV and installed a new ARV.

Down time: None.

8/23-25/2012 Treatment System; ECV 3 would not open on command causing the well field to cycle. Flushed the control piping, changed the filter and exercised the opening and closing speed control valves. Replaced the solenoid valve with a new valve body. Cycled the valve and observed normal operation.

Down time: 4.5 hours at B13 and B6. Three hours at B4 and SC5.

September 2012

9/2/2012 Treatment System; Call out from Time Communications, "TGRS fail". At the treatment center, the treatment system and well field were off. The sub I/O scanner modules in the cabinet were very warm to the touch. Opened the cabinet doors and positioned a room fan to blow air into the communication cards. Cycled the power to the entire PLC and reset the autodialer. The system restarted normally.

Down time: B9 for 3 hours.

9/3/2012 Daily Inspection was not performed due to the Labor Day holiday. Meter readings were estimated.

Down time: None.

9/6/2012 Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9.

Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

9/6/2012 Pumphouse B4; The pump would not re-start after the blown fuse at the power pole due to the ECV not opening on command. Cleaned the strainer screen, flushed the control piping and reset the opening and closing speed control valves. Re-started the pump and observed normal operation.

Down time: None, the down time is already accounted for above.

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MAINTENANCE ACTIVITIES
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TGRS, OU2
ARDEN HILLS, MINNESOTA

9/6-7/2012	Pumphouse B9; The pump would not re-start after the blown fuse at the power pole due to a communication error at the pumphouse. Troubleshooting indicated a blown AC power supply card. Replaced the power supply card and re-started the pump. Normal operation observed. Down time: 19.5 hours.
9/10/2012	Treatment System; ECV 3 would not close on command. Flushed the control piping, changed the filter and exercised the speed control valves. Cycled the valve 3 times and observed normal closing operation. Down time: None.
9/12/2012	Treatment System; Turned the TGRS off to install a re-built cold water flow meter at pump 4. Down time: B3, B5, B6, B8 and B13 for 1.5 hours each. B4 for 2.5 hours.
9/13/2012	Treatment System; Installed the cold water flow meter that was in pump 4, in the pump 3 flow tube. Down time: None.
9/13/2012	Pumphouse B11; The ECV control piping had some build-up. Removed and replaced portions of the control piping as necessary. Re-started the pump and observed normal operation. Down time: None.
9/17/2012	Treatment System; The blower 3 air meter reading was below the normal flow rate. Removed and replaced the flow meter tubing and cleaned the meter. Hooked the meter back up and observed a normal air flow rate. Down time: None.
9/20/2012	Pumphouse B1; The solenoid valve was plugged with build-up. Replaced the solenoid valve body with a new one and re-started the pump. Observed normal ECV operation. Down time: None.

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9/27/2012 Pumphouse B8; The pressure gauge ball valves were leaking. Changed them out with new valves.

Down time: None.

9/28/2012 Forcemain Line; Opened the only two blow off valves on the influent forcemain (near SC2 and SC5) to release the trapped air from the forcemain.

Down time: None.

F.3 Maintenance Activities by Location, Fiscal Year 2012, TGRS, OU2

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Pumphouse B1

11/12/2011	Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem. Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.
2/14/2012	Pumphouse B1; The piping below the ARV was leaking. Replaced the piping and ARV with new and observed normal operation. Down time: None.
2/21/2012	Pumphouse B1; The light was flashing on the PLC. Reset the PLC and the light went out. At the pumphouse, the pump was off and there was a blown 50 amp fuse in the pump disconnect box. Contacted Laughlin Electric and they found a broken wire at the top of a power pole above the B1 disconnect near the B2 pumphouse. Laughlin repaired the broken wire and the pump re-started normally. Down time: 13 hours.
4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.
6/10/2012	Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem. Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.
7/20/2012	Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM. Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.

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9/6/2012 Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9.

Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

9/20/2012 Pumphouse B1; The solenoid valve was plugged with build-up. Replaced the solenoid valve body with a new one and re-started the pump. Observed normal ECV operation.

Down time: None.

Pumphouse B3

11/8/2011 Treatment System and Well Field; Turned the TGRS off as part of the monthly preventive maintenance work.

Down time: 2 hours at B3; 1 hour at B4.

11/12/2011 Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem.

Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.

2/28/2012 Pumphouse B3; A fitting on the ECV control piping was leaking. Removed the old fitting and replaced it with a new one from inventory. Re-started the pump and observed normal operation.

Down time: None.

3/6-7/2012 Treatment System; ECV 4 was flashing on the PLC indicating a valve closing issue. Changed the filter, flushed the control piping and cycled the valve three times. The valve still would not close, changed out the solenoid valve and normal closing operation was observed.

Down time: 2 hours at B3.

3/13/2012 Pumphouse B3; Water was observed dripping from the control piping. Removed and replaced portions of the ECV control piping.

Down time: None.

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4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.
4/28-30/2012	Pumphouse B3; There is a loud spraying sound coming from inside the well. Thein Well pulled the lift system and replaced the riser pipe. They re-started the pump and observed normal operation. Down time: None.
5/1/2012	Pumphouse B3; Flow rate slowed due to a fouled solenoid valve. Removed, cleaned and re-installed the solenoid valve and re-started the pump. Normal operation observed. Down time: 2 hours.
6/10/2012	Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem. Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.
7/20/2012	Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM. Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.
9/6/2012	Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9. Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

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Pumphouse B4

11/8/2011	Treatment System and Well Field; Turned the TGRS off as part of the monthly preventive maintenance work. Down time: 2 hours at B3; 1 hour at B4.
11/12/2011	Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem. Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.
1/15/2012	Pumphouse B4; The light on the PLC in Building 116 was not lit. At the pumphouse it was found the water level control board was not functioning. Repaired the board and re-started the pump. Observed normal operation. Down time: 12 hours.
4/17/2012	Pumphouse B4; The flow rate is slowing with time. Thein Well removed the lift system and replaced the pump and added a 6-foot long piece of riser pipe. They re-started the pump and observed normal operation. Down time: 4.5 hours.
4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.
5/23/2012	Pumphouse B4; The flow rate averaged slower for the day due to preventive maintenance work performed during the day. Down time: 1 hour.
6/5/2012	Treatment System and Pumphouses; Turned the TGRS off to complete a portion of the monthly maintenance work. Down time: 1.5 hours at B4.

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6/10/2012 Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem.

Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.

7/17-21/2012 Pumphouse B4; Turned the pump off for re-development work.

Down time: 91 hours.

9/6/2012 Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9.

Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

9/6/2012 Pumphouse B4; The pump would not re-start after the blown fuse at the power pole due to the ECV not opening on command. Cleaned the strainer screen, flushed the control piping and reset the opening and closing speed control valves. Re-started the pump and observed normal operation.

Down time: None, the down time is already accounted for above.

Pumphouse B5

2/14/2012 Pumphouse B5; Increased the pressure on the pilot to decrease the flow rate.

Down time: None.

4/26/2012 Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site.

Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

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TGRS, OU2
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6/10/2012 — Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem.

Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.

6/14-15/2012 — Pumphouses B5 and B6; The B5 and B6 pump running indicator lights on the PLC were lit normally but the pumps were off at the pumphouses. Troubleshooting found a bad sub I/O scanner module at the PLC. Replaced the module with one from inventory and the pumps re-started normally.

Down time: 24 hours at each B5 and B6.

6/20/2012 — Pumphouses B5 and B8; Replaced the worn 1/4" ball valves on the control piping.

Down time: None.

7/20/2012 — Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM.

Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.

9/6/2012 — Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9.

Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

Pumphouse B6

11/12/2011 — Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem.

Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.

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2/15/2012 — Pumphouse B6; Attempted to set the flow rate to target but could not set the pressure with the pilot. Replaced the pilot with a re-built from inventory and set the flow rate to target.

Down time: None.

4/26/2012 — Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site.

Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

6/10/2012 — Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem.

Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.

6/14-15/2012 — Pumphouses B5 and B6; The B5 and B6 pump running indicator lights on the PLC were lit normally but the pumps were off at the pumphouses. Troubleshooting found a bad sub I/O scanner module at the PLC. Replaced the module with one from inventory and the pumps re-started normally.

Down time: 24 hours at each B5 and B6.

9/6/2012 — Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9.

Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

Pumphouse B8

11/2/2011 — Pumphouse B8; Loud spraying noise down the well. Removed the lift system and found worn threads on the drop pipe at the joint where the black steel meets the stainless steel. Replaced the top three black steel drop pipes and the motor.

Down time: 4 hours.

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11/12/2011	Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem. Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.
1/20/2012	Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B11 and re-started the pump. The pump started normally and B8 and SC1 re-started normally also. Down time: 19 hours at B8, 18 hours at B11 and 15 hours at SC1.
1/28-31/2012	Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B8 and re-started the pump. The pump started normally and B11 and SC1 re-started normally also. Down time: 19 hours at B8; 66 hours at B11; 59 hours at SC1.
2/8-9/2012	Pumphouses B8, B11 and SC1; Lights are not lit on PLC. Pumps do not turn on in "Auto". Changed out all communication cards but all to no avail. Turned pump B11 on in "Hand" temporarily. Additional troubleshooting finds a loose daisy chain wire on the I/O scanner module at the PLC. Re-installed the wire and switched out the sub I/O scanner module with a new one and re-started the TGRS. Observed normal operation. Down time: 23 hours at each B8 and SC1.
3/28/2012	Pumphouse B8; The ARV was leaking. Removed, cleaned and replaced the ARV. No leaks were observed. Down time: None.
4/12/2012	Pumphouses B8 and B11; The COM light is illuminated red on the B8/B11 I/O scanner module card in the control panel. A daisy chain wire was not firmly attached in the sequence. Re-attached the wire and the light came on normally. Down time: None.

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4/26/2012 Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site.

Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

5/26/2012 Pumphouses B8, B11 and SC2; The lights were off on the PLC in Building 116. Likely the current storm knocked out power to the communication cards. Replaced the I/O adapter card in SC3 (the SC2 light was not on because the SC2 and SC3 communication cards are paired together). Also, reset the communication cards in the B11 pumphouse and re-started the B11 pump. The B8 and SC2 pumps were not off upon arrival, only the B11 pump was off.

Down time: None.

6/10/2012 Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem.

Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.

6/20/2012 Pumphouses B5 and B8; Replaced the worn 1/4" ball valves on the control piping.

Down time: None.

7/20/2012 Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM.

Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.

9/6/2012 Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9.

Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

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9/27/2012	Pumphouse B8; The pressure gauge ball valves were leaking. Changed them out with new valves. Down time: None.

Pumphouse B9

11/12/2011	Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem. Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.
2/19-20/2012	Pumphouse B9; The side of the valve body was leaking out of the threaded plug and dripping onto the electrical junction box on the floor. Turned the pump off and removed and replaced the plug. Re-started the pump and observed normal operation. Down time: 19 hours.
2/27/2012	Pumphouse B9; Replaced the gasket on the flow meter cover and installed a new one-quarter inch ball valve on the pressure gauge piping. Re-started the pump and observed normal operation. Down time: None.
3/27/2012	Pumphouse B9; The ECV would not open or close at start up or shutdown. Portions of the control piping were blocked with sand. Replaced the control piping as necessary. Cycled the valve and observed normal operation. Down time: None.
4/16/2012	Pumphouse B9; A leak was noticed at the pitless adapter. Thein Well pulled the lift system up, replaced the 4" x 3" swage nipple and re-installed the lift system. Down time: None.
4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/10/2012	Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem. Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.
7/17/2012	Pumphouse B9; Replaced the pump, motor and drop pipe. Down time: 18 hours.
7/20/2012	Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM. Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.
7/20/2012	Pumphouse B9; The power outage blew the output card in the pumphouse. Replaced the output card and restarted the pump. Down time: Already accounted for above.
9/2/2012	Treatment System; Call out from Time Communications, "TGRS fail". At the treatment center, the treatment system and well field were off. The sub I/O scanner modules in the cabinet were very warm to the touch. Opened the cabinet doors and positioned a room fan to blow air into the communication cards. Cycled the power to the entire PLC and reset the autodialer. The system restarted normally. Down time: B9 for 3 hours.
9/6/2012	Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9. Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

9/6-7/2012	Pumphouse B9; The pump would not re-start after the blown fuse at the power pole due to a communication error at the pumphouse. Troubleshooting indicated a blown AC power supply card. Replaced the power supply card and re-started the pump. Normal operation observed. Down time: 19.5 hours.

Pumphouse B11

11/17/2011	Pumphouses B11, SC2 and SC5; Power is again off at the pumphouses. Contacted Xcel Energy and they repaired the problem. Down time: 9 hours at SC5.
12/13/2011	Pumphouses B11 and SC1; The pump running lights were off on the PLC. Further inspection showed a bad solenoid valve at B11. Removed and replaced the solenoid valve and associated piping and re-started the pump. Normal operation was observed. SC1 was off because it shares communication lines with B11. Down time: 26 hours each at B11 and SC1.
1/4/2012	Pumphouse B11; The light is flashing on the PLC. Reset the PLC and the pump re-started normally. Down time: 24 hours.
1/20/2012	Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B11 and re-started the pump. The pump started normally and B8 and SC1 re-started normally also. Down time: 19 hours at B8, 18 hours at B11 and 15 hours at SC1.
1/28-31/2012	Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B8 and re-started the pump. The pump started normally and B11 and SC1 re-started normally also. Down time: 19 hours at B8; 66 hours at B11; 59 hours at SC1.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/8-9/2012	Pumphouses B8, B11 and SC1; Lights are not lit on PLC. Pumps do not turn on in "Auto". Changed out all communication cards but all to no avail. Turned pump B11 on in "Hand" temporarily. Additional troubleshooting finds a loose daisy chain wire on the I/O scanner module at the PLC. Re-installed the wire and switched out the sub I/O scanner module with a new one and re-started the TGRS. Observed normal operation. Down time: 23 hours at each B8 and SC1.
4/12/2012	Pumphouses B8 and B11; The COM light is illuminated red on the B8/B11 I/O scanner module card in the control panel. A daisy chain wire was not firmly attached in the sequence. Re-attached the wire and the light came on normally. Down time: None.
4/16/2012	Pumphouse B11; The flow rate was slowing with time and there was a spraying sound coming from down well. Thein Well pulled the lift system. Holes were found in the threads of several of the sticks of riser pipe. They replaced the riser pipe with new and re-started the pump. Down time: 2 hours.
4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.
4/28-30/2012	Pumphouse B11; The pump was not pumping. Attempted to re-start the pump and heard a loud grinding noise coming from inside the well. Thein Well pulled the lift system and replaced the pump and the motor. They re-started the pump and normal operation was observed. Down time: 75 hours.
5/23/2012	Pumphouse B11; The flow rate slowed due to blockage in the ECV control piping pilot. Flushed the control piping and reset the pilot and observed normal operation. Down time: 10 hours.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/26/2012	Pumphouses B8, B11 and SC2; The lights were off on the PLC in Building 116. Likely the current storm knocked out power to the communication cards. Replaced the I/O adapter card in SC3 (the SC2 light was not on because the SC2 and SC3 communication cards are paired together). Also, reset the communication cards in the B11 pumphouse and re-started the B11 pump. The B8 and SC2 pumps were not off upon arrival, only the B11 pump was off. Down time: None.
9/6/2012	Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9. Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.
9/13/2012	Pumphouse B11; The ECV control piping had some build-up. Removed and replaced portions of the control piping as necessary. Re-started the pump and observed normal operation. Down time: None.

Pumphouse B13

11/12/2011	Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem. Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.
4/14-16/2012	Pumphouse B13; The pressure on the flow increased due to a problem with the electric check valve control pilot. Replaced the pilot and re-set the flow rate. Down time: 32.5 hours.
4/17-19/2012	Pumphouse B13; The flow rate is slowing with time; Thein Well removed the lift system and replaced the pump and riser pipe. They re-started the pump and normal operation resumed. Down time: 39 hours.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.
6/10/2012	Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem. Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.
6/26/2012	Pumphouse B13; Turned the pump off and disassembled portions of the pumphouse piping to determine the amount of iron bacteria build up in the piping. Down time: 1.5 hours at B13.
7/20/2012	Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM. Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.
7/23-26/2012	Pumphouse B13; Turned the pump off for re-development work. Down time: 68 hours.
9/6/2012	Pumphouses B1, B13, B3, B4, B5, B6, B8, B9 and B11; Power is off to the well houses. Contacted Xcel Energy to repair the problem. A red-tailed hawk had blown a fusible switch at the top of the power pole near Gate 4. Xcel Energy repaired the problem and the TGRS was re-started. All well pumps re-started normally except B4 and B9. Down time: B1, B3 and B13 for 1.5 hours each. B5 for 2 hours. B6 and B8 for 2.5 hours each. B4 for 3.5 hours and B9 for 4.5 hours.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

Pumphouse SC1

11/11/2011 Pumphouse SC1; Light was off on the PLC in Building 116. Further inspection finds there is no power to the pumphouse and that there was a grass fire near the old electrical substation. Contacted Xcel Energy and they repaired the problem.

Down time: 28 hours.

11/15/2011 Pumphouses SC1, SC2 and SC5; Power is off at the pumphouses. Contacted Xcel Energy and they repaired the problem.

Down time: 8.5 hours at SC5.

12/13/2011 Pumphouses B11 and SC1; The pump running lights were off on the PLC. Further inspection showed a bad solenoid valve at B11. Removed and replaced the solenoid valve and associated piping and re-started the pump. Normal operation was observed. SC1 was off because it shares communication lines with B11.

Down time: 26 hours each at B11 and SC1.

1/20/2012 Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B11 and re-started the pump. The pump started normally and B8 and SC1 re-started normally also.

Down time: 19 hours at B8, 18 hours at B11 and 15 hours at SC1.

1/28-31/2012 Pumphouses B8, B11 and SC1; The lights on the PLC were off. Re-set the PLC but the lights remained off. Replaced the I/O adapter card at B8 and re-started the pump. The pump started normally and B11 and SC1 re-started normally also.

Down time: 19 hours at B8; 66 hours at B11; 59 hours at SC1.

2/8-9/2012 Pumphouses B8, B11 and SC1; Lights are not lit on PLC. Pumps do not turn on in "Auto". Changed out all communication cards but all to no avail. Turned pump B11 on in "Hand" temporarily. Additional troubleshooting finds a loose daisy chain wire on the I/O scanner module at the PLC. Re-installed the wire and switched out the sub I/O scanner module with a new one and re-started the TGRS. Observed normal operation.

Down time: 23 hours at each B8 and SC1.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

3/20-22/2012 Pumphouse SC1; Portions of the pumphouse forcemain were leaking and were plugged with iron and manganese build up. Replaced the worn and plugged pieces with new ones.

Down time: 28 hours.

4/26/2012 Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site.

Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

Pumphouse SC2

10/8/2011 Pumphouses SC2 and SC5; Lost a leg of power to the pumphouses. A power pole was cut down near the power station on the way to Building 502. Xcel Energy was contacted and they repaired the problem.

Down time: 31 hours at SC2 and 41 hours at SC5.

10/26/2011 Pumphouse SC2; The forcemain pressure gauge has failed. Replaced the pressure gauge with a new one from inventory.

Down time: None.

11/15/2011 Pumphouses SC1, SC2 and SC5; Power is off at the pumphouses. Contacted Xcel Energy and they repaired the problem.

Down time: 8.5 hours at SC5.

11/17/2011 Pumphouses B11, SC2 and SC5; Power is again off at the pumphouses. Contacted Xcel Energy and they repaired the problem.

Down time: 9 hours at SC5.

12/8/2011 Pumphouses SC2 and SC5; Changed out the flow meters with new ones.

Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

4/26/2012 Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site.

Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

5/26/2012 Pumphouses B8, B11 and SC2; The lights were off on the PLC in Building 116. Likely the current storm knocked out power to the communication cards. Replaced the I/O adapter card in SC3 (the SC2 light was not on because the SC2 and SC3 communication cards are paired together). Also, reset the communication cards in the B11 pumphouse and re-started the B11 pump. The B8 and SC2 pumps were not off upon arrival, only the B11 pump was off.

Down time: None.

6/13/2012 Pumphouse SC2; The cold water flow meter no longer totals flow. Removed, cleaned and re-installed the flow meter. Normal operation was observed.

Down time: None.

6/14/2012 Pumphouse SC2; The light was flashing on the PLC probably due to the storm. Reset the PLC and the light stayed on steady.

Down time: 12 hours at SC2.

6/28/2012 Pumphouse SC2; Turned the pump off to minimize the potential for the motor to burn out. The current maximum flow rate is 2 gpm because the well needs to be re-developed. The pump will be restarted after well development work which is scheduled for July 16, 2012.

Down time: 43 hours at SC2.

7/1-29/2012 Pumphouse SC2; The pump was turned off and the well was re-developed.

Down time: 698 hours.

8/1/2012 Pumphouses SC2 and SC5; No power to the pumphouses. A red tailed hawk shorted the wires leading to the transformers which blew the fuses at the power pole near SC4. Contacted Xcel Energy and they replaced the fuses. Re-started the pumps and observed normal operation.

Down time: 22 hours at SC2 and 17 hours at SC5.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

8/8/2012 Pumphouse SC2; The light is flashing on the PLC. Turned the TGRS off. At SC2, the pump was off. Switched the control to off and the ECV closed. Switched the control back to auto and drove back to the PLC. Re-started the system and SC2 restarted normally.

Down time: 22 hours.

8/10/2012 Pumphouse SC2; There was water spraying out the ARV. Closed the valve to the ARV and installed a new ARV.

Down time: None.

Pumphouse SC3

5/26/2012 Pumphouses B8, B11 and SC2; The lights were off on the PLC in Building 116. Likely the current storm knocked out power to the communication cards. Replaced the I/O adapter card in SC3 (the SC2 light was not on because the SC2 and SC3 communication cards are paired together). Also, reset the communication cards in the B11 pumphouse and re-started the B11 pump. The B8 and SC2 pumps were not off upon arrival, only the B11 pump was off.

Down time: None.

Pumphouse SC5

10/8/2011 Pumphouses SC2 and SC5; Lost a leg of power to the pumphouses. A power pole was cut down near the power station on the way to Building 502. Xcel Energy was contacted and they repaired the problem.

Down time: 31 hours at SC2 and 41 hours at SC5.

10/13/2011 Pumphouse SC5; The water level probe has mineral build-up. Removed the probe, replaced the sensor and re-installed the probe.

Down time: 20.5 hours.

11/12/2011 Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem.

Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/13/2011	Pumphouse SC5; The light was flashing on the PLC in Building 116. Reset the PLC and the pump restarted normally. Down time: 24 hours.
11/15/2011	Pumphouses SC1, SC2 and SC5; Power is off at the pumphouses. Contacted Xcel Energy and they repaired the problem. Down time: 8.5 hours at SC5.
11/17/2011	Pumphouses B11, SC2 and SC5; Power is again off at the pumphouses. Contacted Xcel Energy and they repaired the problem. Down time: 9 hours at SC5.
12/1-8/2011	Pumphouse SC5; The flow meter was fouled and recorded incorrect totals for each day. Removed and replaced the meter with a re-built one from inventory. Adjusted the flow rates to the calibrated meter flow rates for the days noted. Down time: None.
12/8/2011	Pumphouses SC2 and SC5; Changed out the flow meters with new ones. Down time: None.
4/18/2012	Pumphouse SC5; The flow rate is slowing with time. Thein Well removed the lift system and replaced the pump and motor. They re-started the pump and observed normal operation. Down time: None.
4/19/2012	Pumphouse SC5; The light is flashing on the PLC in Building 116. Re-set the PLC and the light came on normally. Likely the storm last night knocked out power to the well. Down time: 17 hours.
4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/6/2012 Pumphouse SC5; The light was flashing on the PLC in Building 116. Reset the PLC and the light stayed on steady. At the pumphouse, the pump was running normally. Likely a lightning strike temporarily knocked out power to the pumphouse.

Down time: 11 hours.

6/10/2012 Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem.

Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.

7/20/2012 Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM.

Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.

8/1/2012 Pumphouses SC2 and SC5; No power to the pumphouses. A red tailed hawk shorted the wires leading to the transformers which blew the fuses at the power pole near SC4. Contacted Xcel Energy and they replaced the fuses. Re-started the pumps and observed normal operation.

Down time: 22 hours at SC2 and 17 hours at SC5.

TREATMENT SYSTEM

10/11/2011 Treatment system and Pumphouses; Turned the TGRS off for monthly preventive maintenance.

Down time: None.

10/27/2011 Treatment System; The flow meter for pump 4 is slowing with time. Installed the flow meter from pump 3 in the pump 4 discharge piping and disassembled and repaired the pump 4 flow meter. Re-installed the pump 4 flow meter in the pump 3 discharge piping.

Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/8/2011	Treatment System and Well Field; Turned the TGRS off as part of the monthly preventive maintenance work. Down time: 2 hours at B3; 1 hour at B4 and SC5.
11/12/2011	Treatment System and Well Field; Power went off at the treatment system. Further inspection finds there is a fusible switch open on a power pole in the old motor pool parking area. Contacted Xcel Energy and they repaired the problem. Down time: 4 hours at B1, B8, B9 and SC5; 10 hours at B3, B4 and B13; 2 hours at B6.
2/5/2012	Treatment System; Call from Time Communications. Upon arrival, ECV 4 would not open on command. Flushed the control piping, exercised and reset the opening and closing speed control valves and changed the opening side filter. Re-started the pump and observed normal operation. Down time: None.
3/6-7/2012	Treatment System; ECV 4 was flashing on the PLC indicating a valve closing issue. Changed the filter, flushed the control piping and cycled the valve three times. The valve still would not close, changed out the solenoid valve and normal closing operation was observed. Down time: 2 hours at B3.
3/16/2012	Treatment System; Noticed a fault light on the B3/B4 sub I/O scanner module in the control cabinet. Troubleshooting found a loose pigtail wire on the card input. Re-attached the wire and reset the system. The fault light did not illuminate. Down time: None.
4/26/2012	Treatment System and Pumphouses; Power is out. A copper thief cut down a live power pole across the street (west of) Building 190. Xcel Energy responded and restored power to the site. Down time: 10.5 hours at B1, B13, B4, B5, B6, B8, B9 and SC2; 8 hours at B11 and SC5; 2.5 hours at SC1 and 12.5 hours at B3.
5/23/2012	Treatment System; The autodialer battery was dead. Replaced the battery with a new one. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/24/2012	Treatment System; The cold water flow meter from pump 3 is out of calibration. Removed the meter and sent it in for repair and calibration. Down time: None.
6/5/2012	Treatment System and Pumphouses; Turned the TGRS off to complete a portion of the monthly maintenance work. Down time: 1.5 hours at B4.
6/10/2012	Treatment System and Pumphouses; Blown fuse at the top of the power pole at the northwest corner of Building 116. The top of the switch was damaged. Contacted Xcel Energy and they repaired the problem. Down time: 2 hours each at B4, B6, B8 and B9; 3 hours each at B1, B3 and B5; 4.5 hours each at B13 and SC5.
6/12-14/2012	Treatment System; ECV 3 would not close. Replaced 3 of the closing side check valves and portions of the control piping. Cycled the pump and valve 3 times and observed normal operation. Down time: None.
6/20/2012	Treatment System; Portions of the ECV 4 control piping were becoming fouled causing the valve to either close too slowly or not close at all. Replaced sections of control piping as necessary. Down time: None.
7/5/2012	Treatment System; ECV 4 would not close. Removed, cleaned and re-installed the solenoid valve body. Cycled the valve and observed normal operation. Down time: None.
7/6/2012	Treatment System; On Site when the extraction wells began to shut down. Drove to the treatment system and the TGRS was off. Reset the entire system by cycling power from on to off and back on again. The system restarted normally. Also reset the autodialer. Uncertain as to the cause of the shut down. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

7/7/2012	Treatment System; On site when the extraction wells began to shut down again. At the treatment center, the TGRS was again off. The sub I/O scanner modules in the cabinet were very warm to the touch. Opened the cabinet doors and positioned a room fan to blow air into the communication cards. Cycled the power to the entire PLC and reset the autodialer. The system restarted normally. Down time: None.
7/20/2012	Treatment System and Pumphouses; Call out from autodialer at 2 AM, "TGRS fail". Upon arrival, the TGRS was down and there was no power to the entire site. Contacted Xcel Energy and they responded. Copper thieves had cut down a power pole on the way to Building 502. Xcel Energy restored power at 8:45 AM. Down time: 5 hours each at B1, B8 and B13; 6 hours each at B3, B5, B9 and SC5.
7/20/2012	Treatment System; ECV 4 would not close on command. Replaced the solenoid valve. Down time: None.
8/8/2012	Treatment System; Removed and recalibrated the airflow gauges for blowers 3 and 4. Down time: None.
8/23-25/2012	Treatment System; ECV 3 would not open on command causing the well field to cycle. Flushed the control piping, changed the filter and exercised the opening and closing speed control valves. Replaced the solenoid valve with a new valve body. Cycled the valve and observed normal operation. Down time: 4.5 hours at B13 and B6. Three hours at B4 and SC5.
9/2/2012	Treatment System; Call out from Time Communications, "TGRS fail". At the treatment center, the treatment system and well field were off. The sub I/O scanner modules in the cabinet were very warm to the touch. Opened the cabinet doors and positioned a room fan to blow air into the communication cards. Cycled the power to the entire PLC and reset the autodialer. The system restarted normally. Down time: B9 for 3 hours.
9/10/2012	Treatment System; ECV 3 would not close on command. Flushed the control piping, changed the filter and exercised the speed control valves. Cycled the valve 3 times and observed normal closing operation. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

9/12/2012 Treatment System; Turned the TGRS off to install a re-built cold water flow meter at pump 4.

Down time: B3, B5, B6, B8 and B13 for 1.5 hours each. B4 for 2.5 hours.

9/13/2012 Treatment System; Installed the cold water flow meter that was in pump 4, in the pump 3 flow tube.

Down time: None.

9/17/2012 Treatment System; The blower 3 air meter reading was below the normal flow rate. Removed and replaced the flow meter tubing and cleaned the meter. Hooked the meter back up and observed a normal air flow rate.

Down time: None.

FORCEMAIN

9/28/2012 Forcemain Line; Opened the only two blow off valves on the influent forcemain (near SC2 and SC5) to release the trapped air from the forcemain.

Down time: None.

BUILDING 116

7/3/2012 Building 116; Laughlin Electric installed motion detecting security lighting around the outside of Building 116.

Down time: None.

7/6/2012 Building 116; Inspected, reset and re-positioned the new security lighting around Building 116.

Down time: None.

TCAAP

5/14/2012 Emergency crews (police and medical) were on site to recover the remains of a body that was found.

Down time: None.

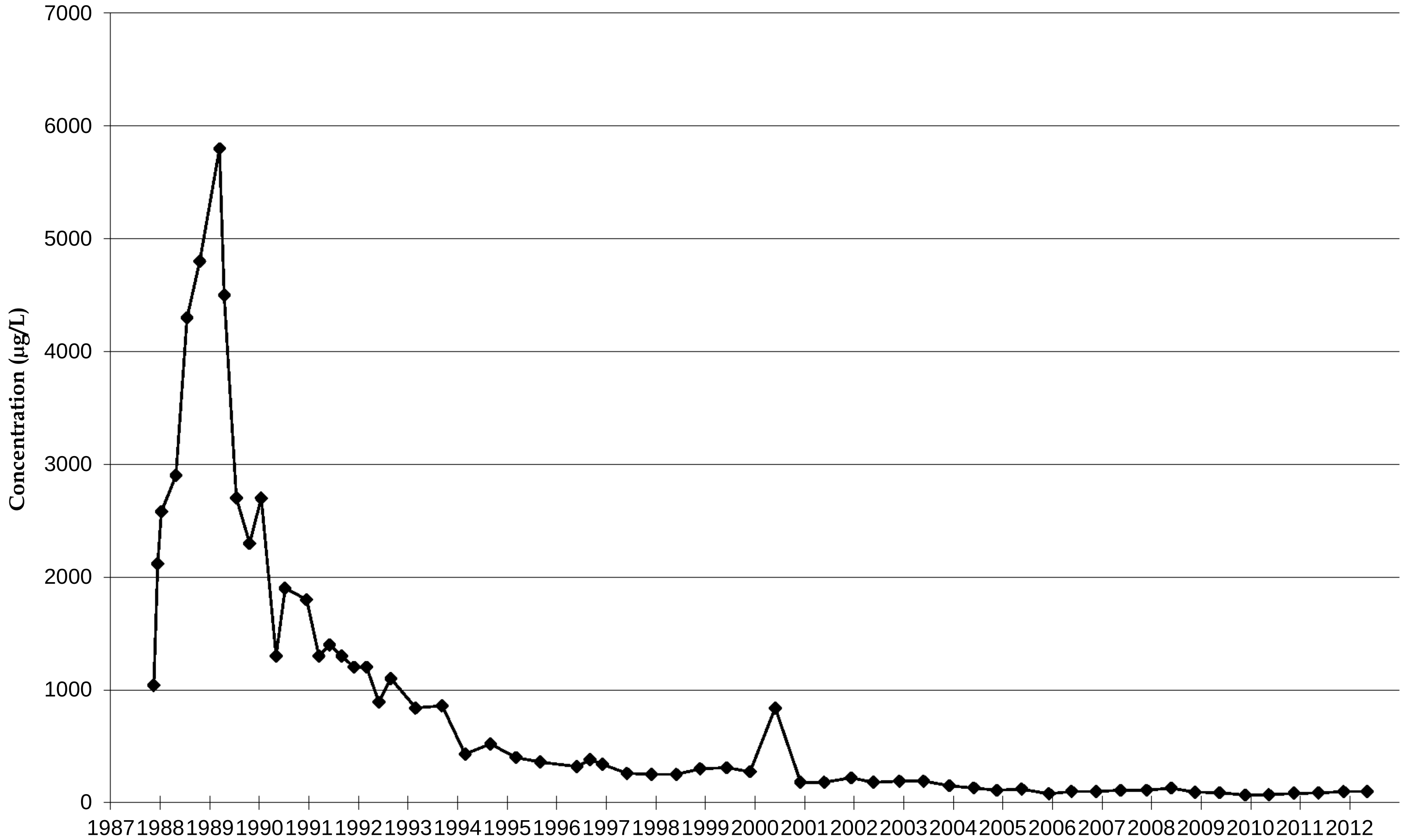
Appendix G

TGRS Chemical Data

G.1 TGRS Extraction Wells – TRCLE vs. Time

APPENDIX G-1

EXTRACTION WELL B1 - TRCLE VS.TIME

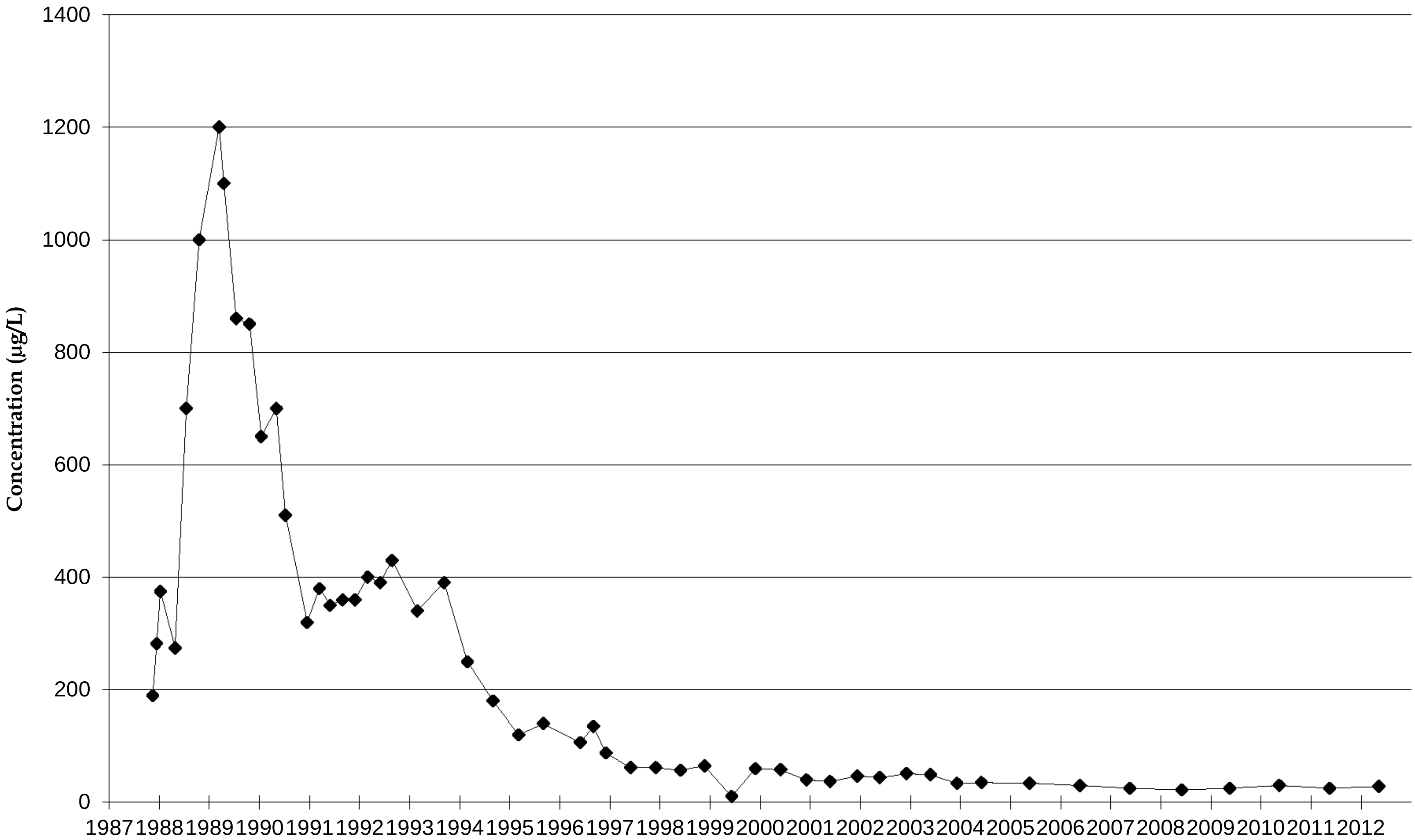


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B2 - TRCLE VS. TIME

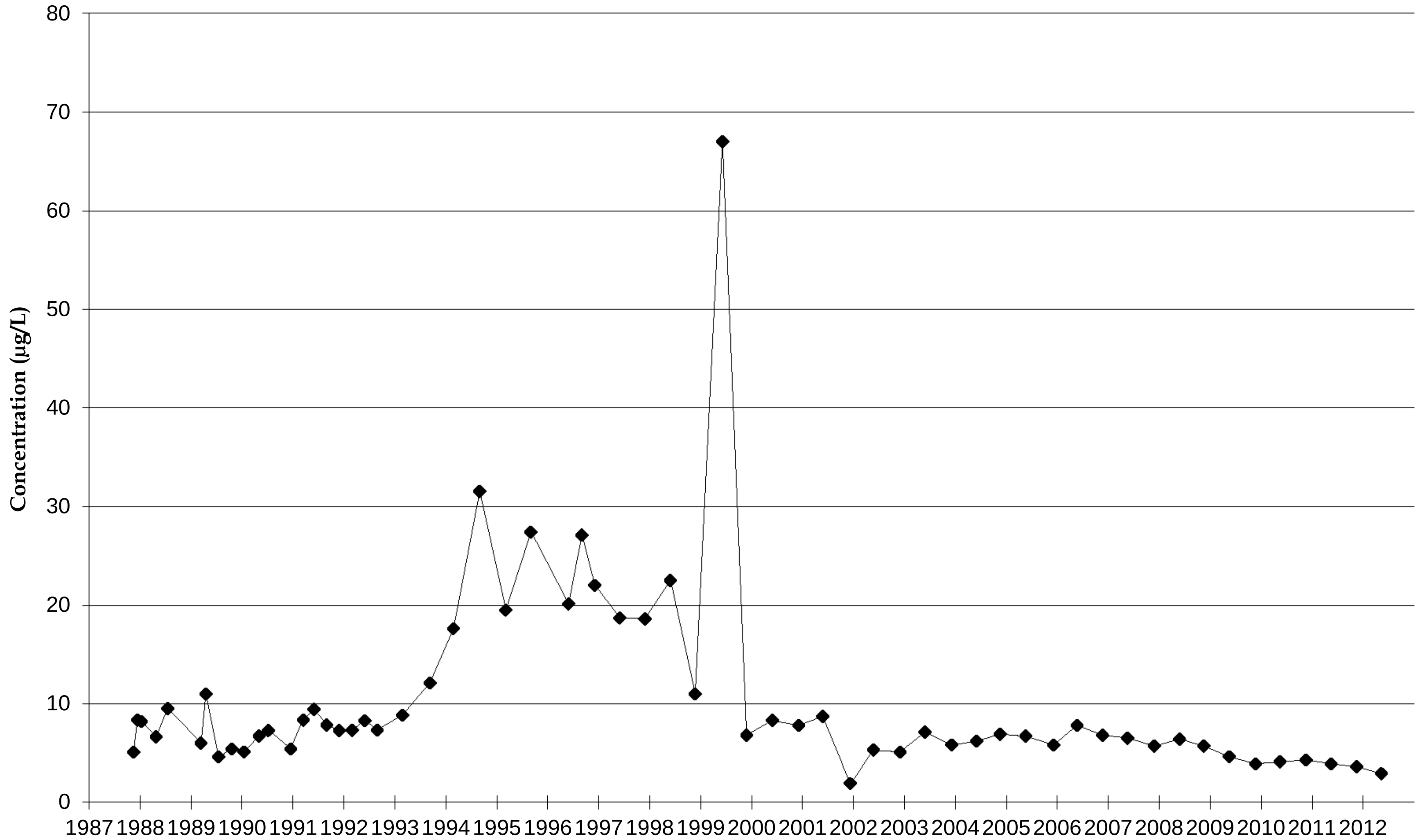


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B3 - TRCLE VS. TIME

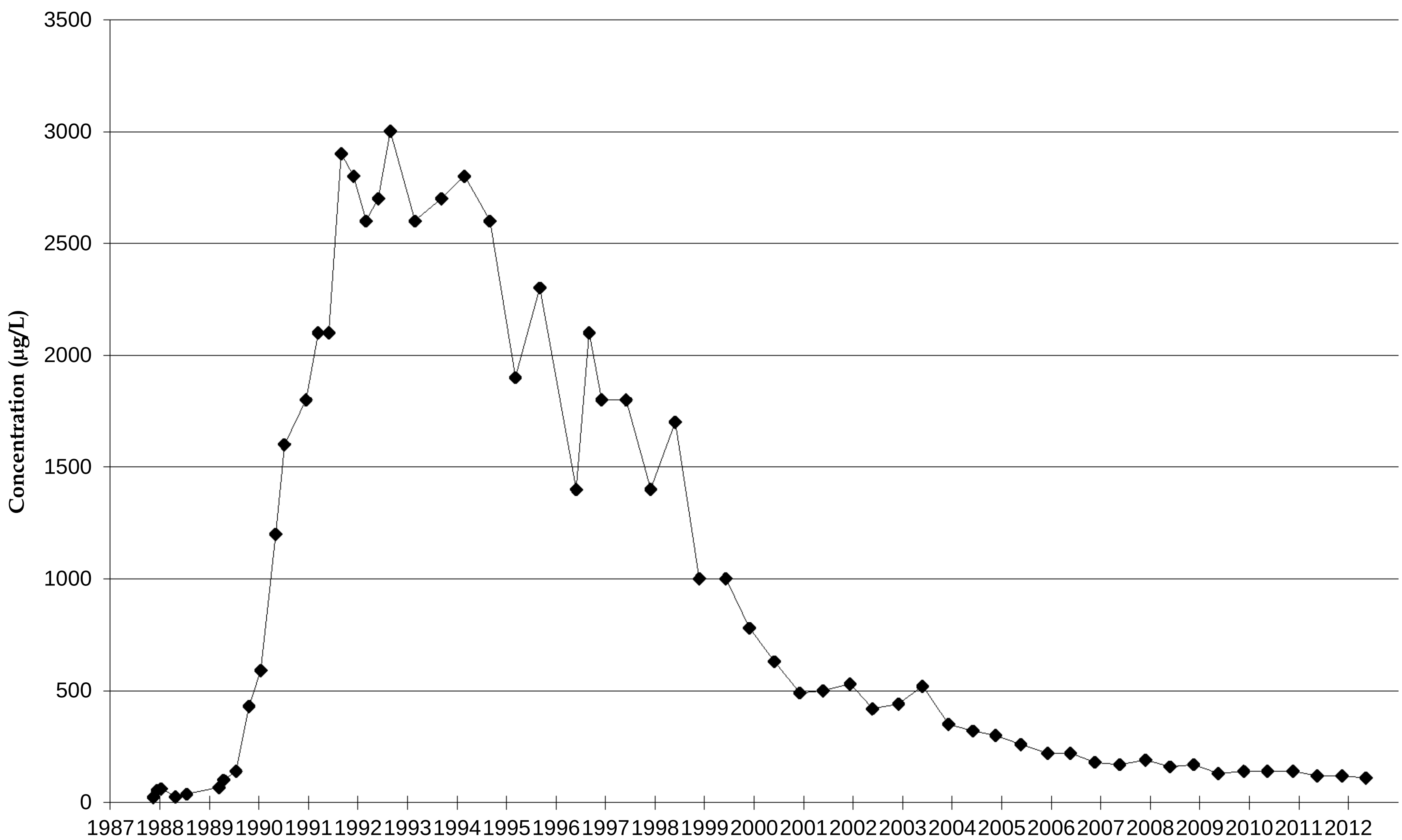


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B4 - TRCLE VS. TIME

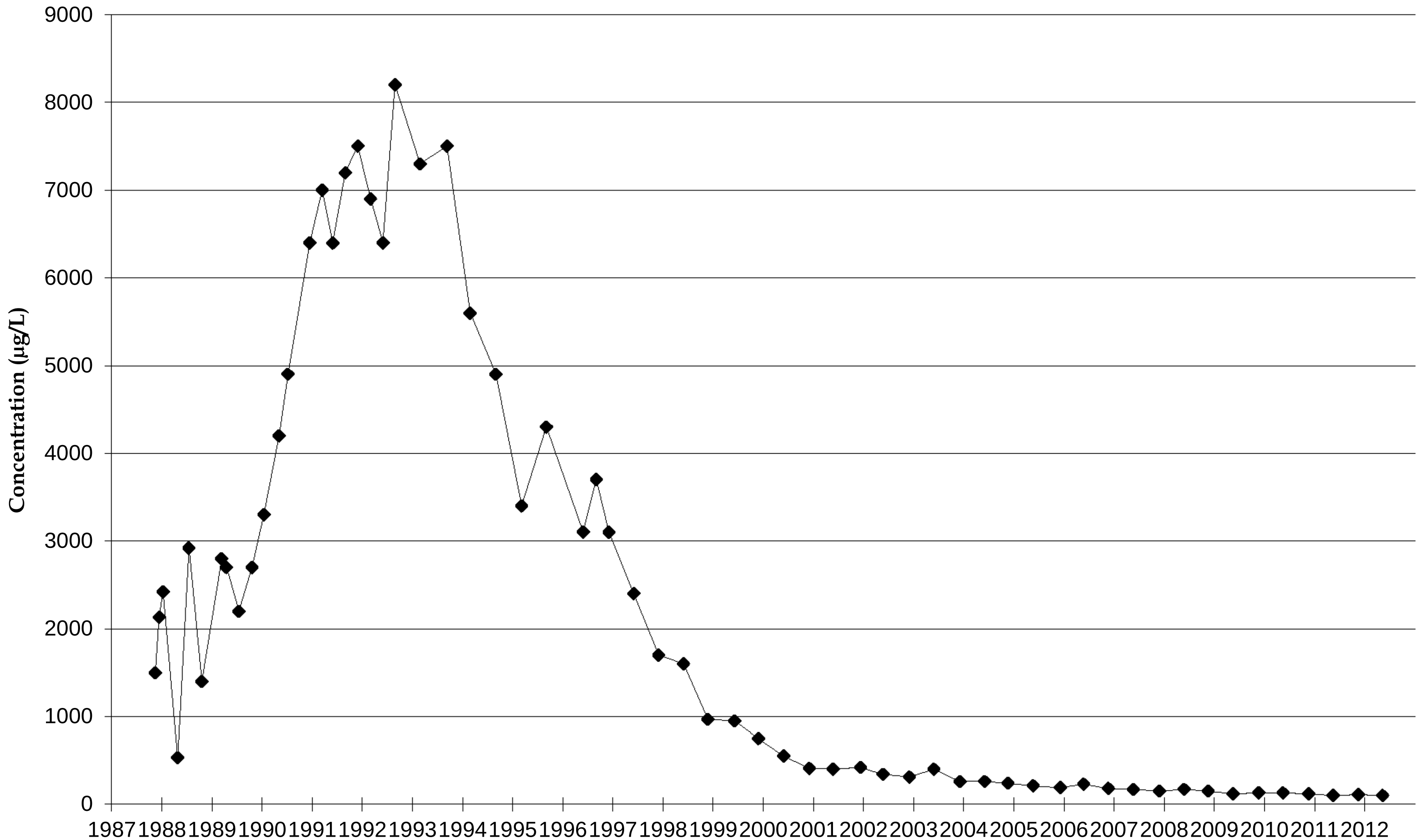


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B5 - TRCLE VS. TIME

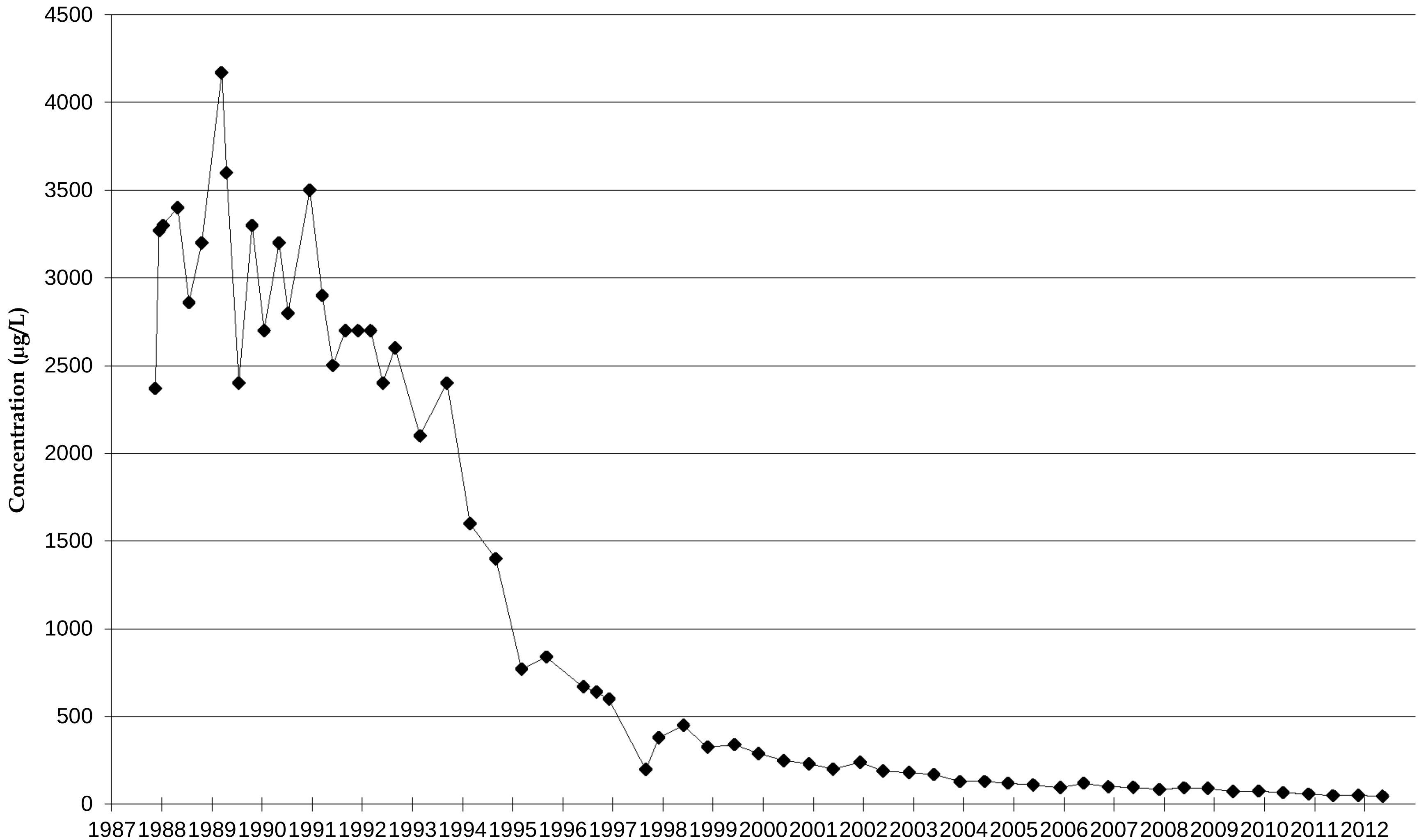


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B6 - TRCLE VS. TIME

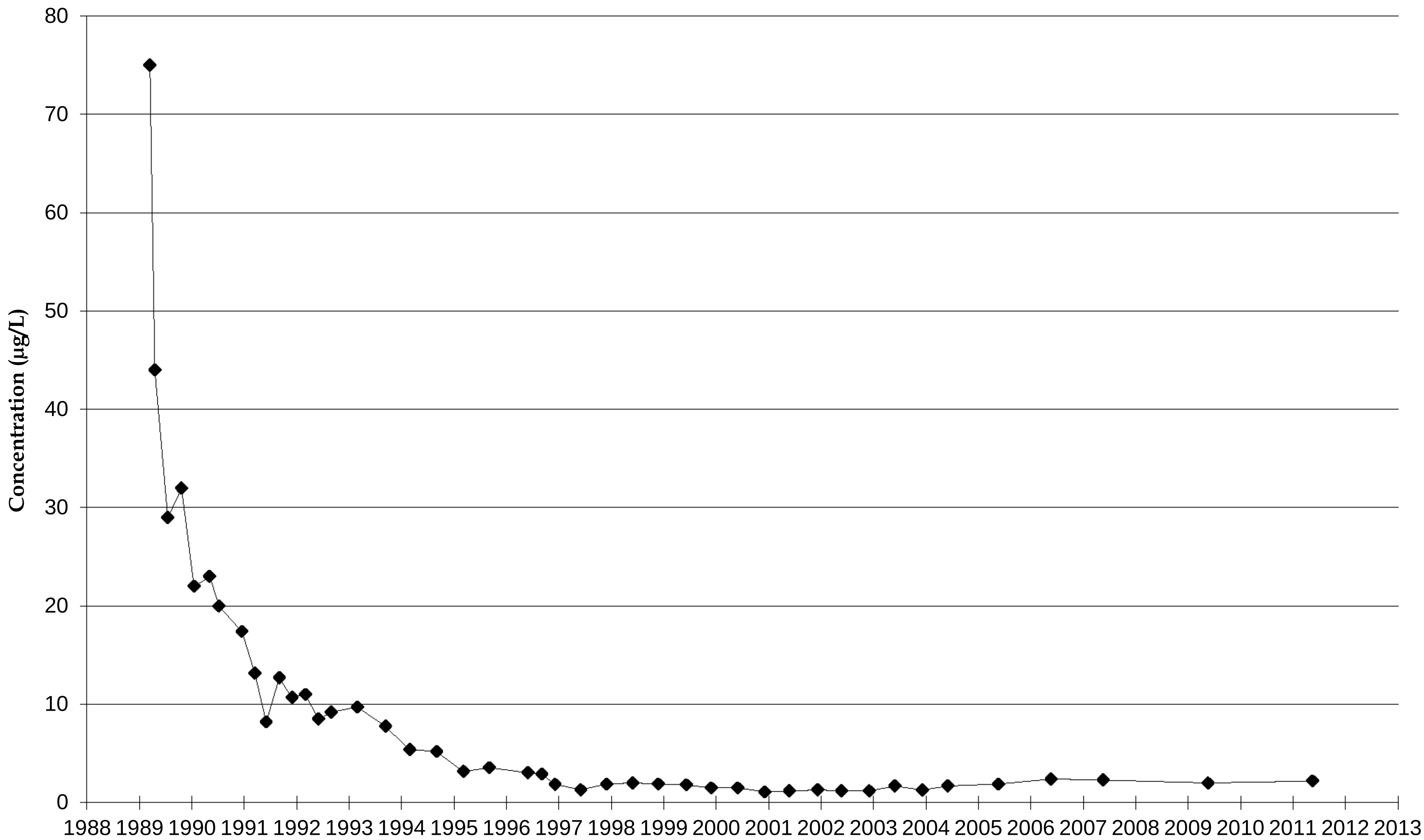


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B7 - TRCLE VS. TIME

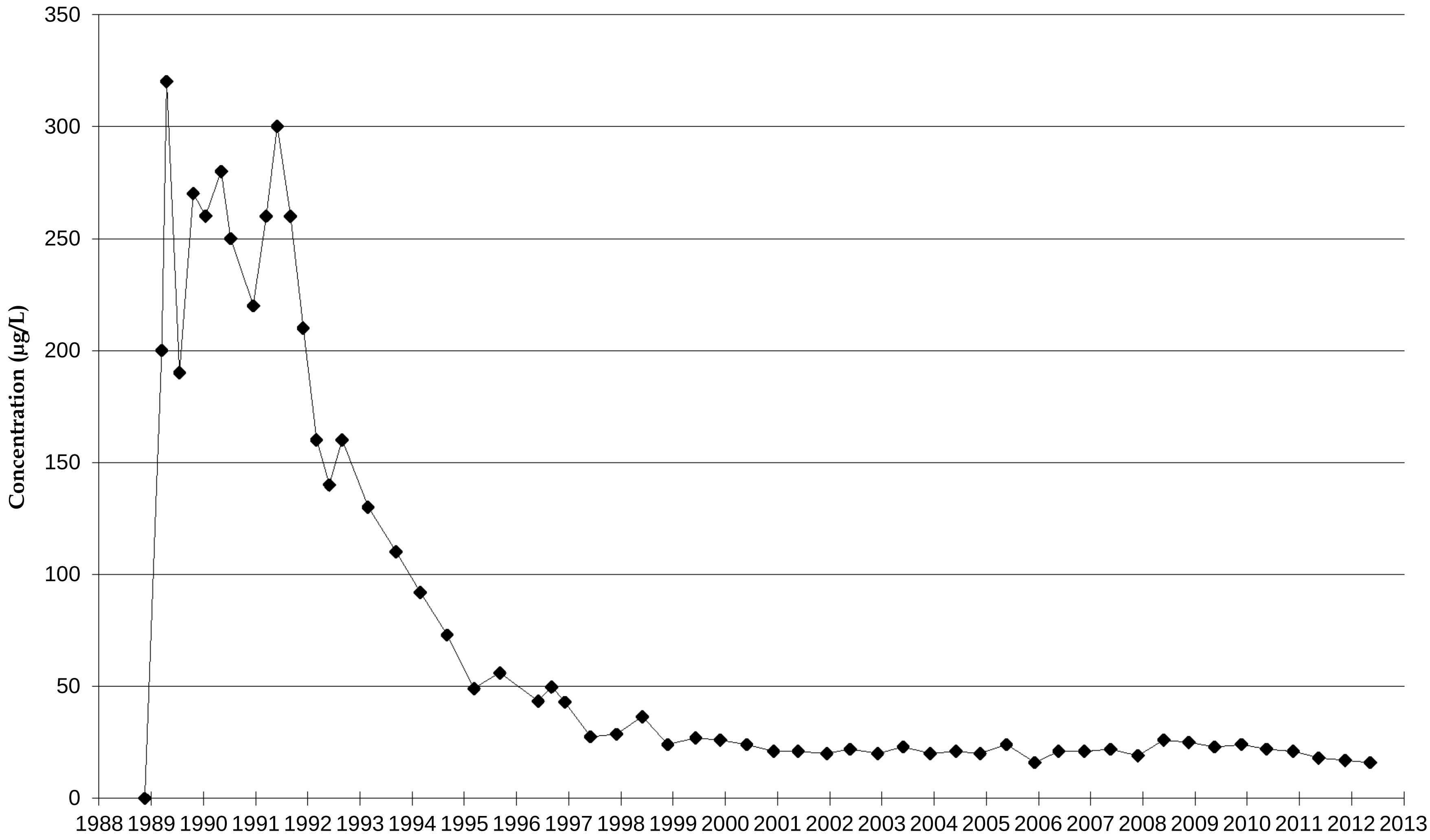


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B8 - TRCLE VS. TIME

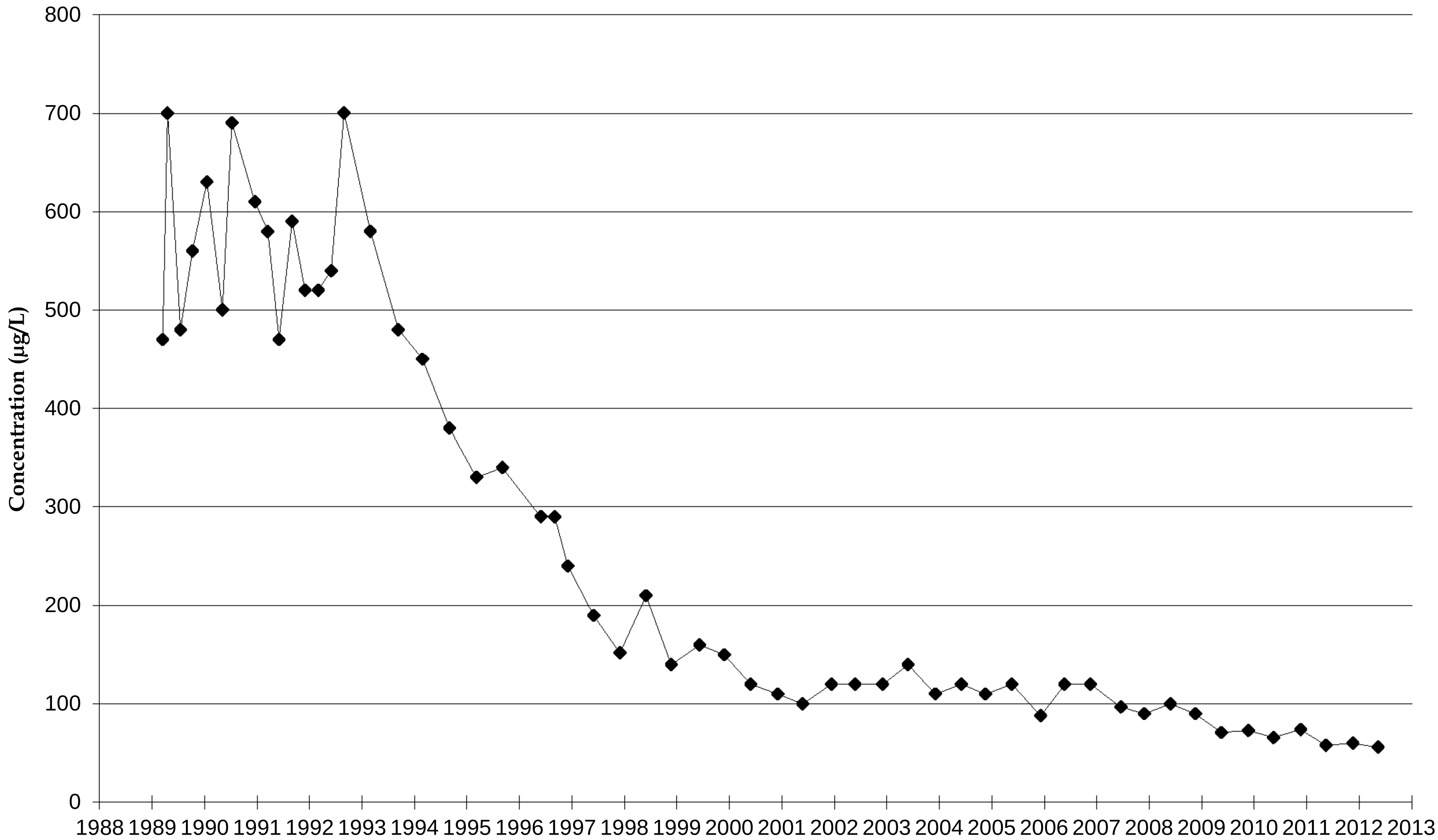


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B9 - TRCLE VS. TIME

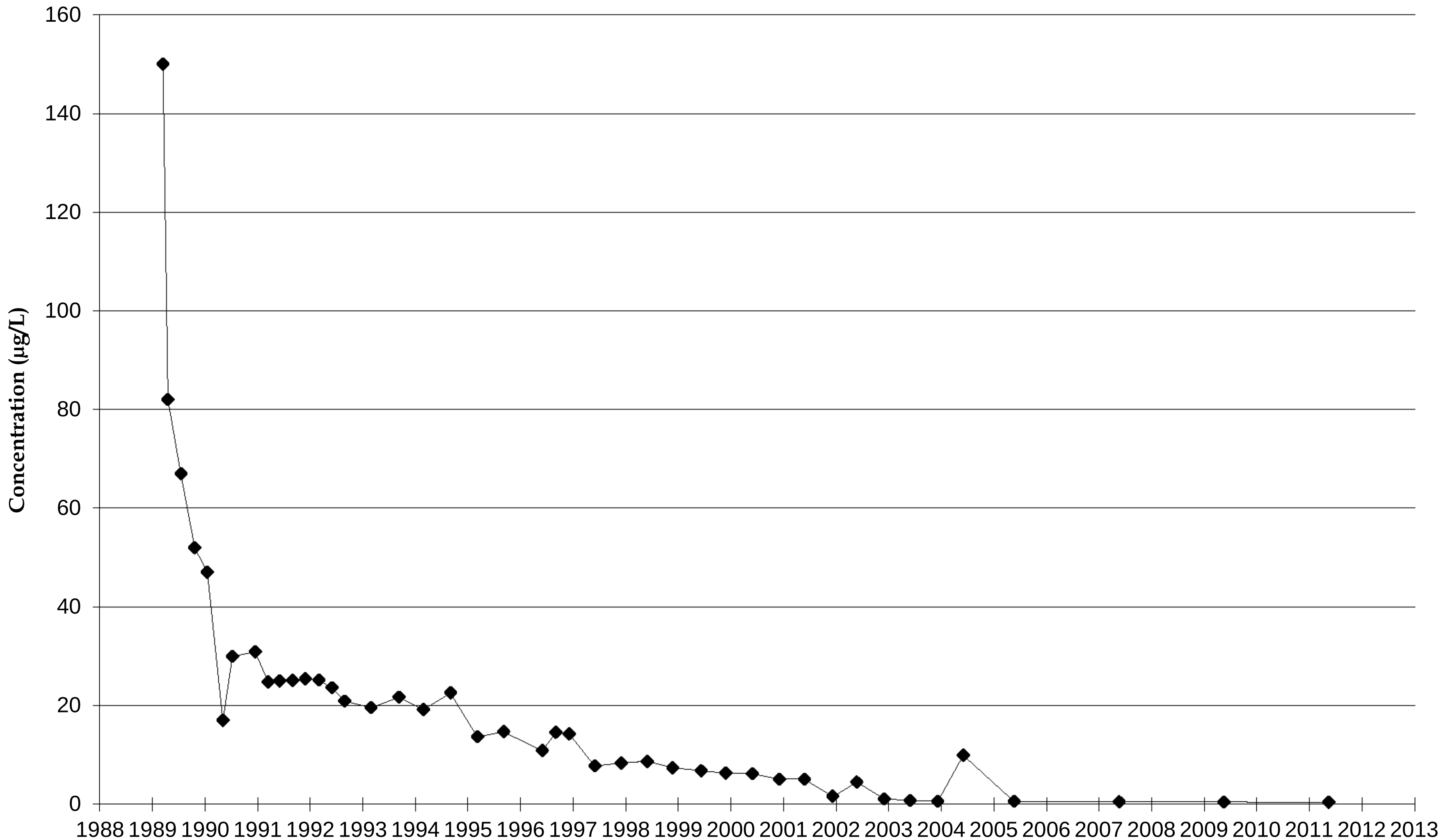


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B10 - TRCLE VS. TIME

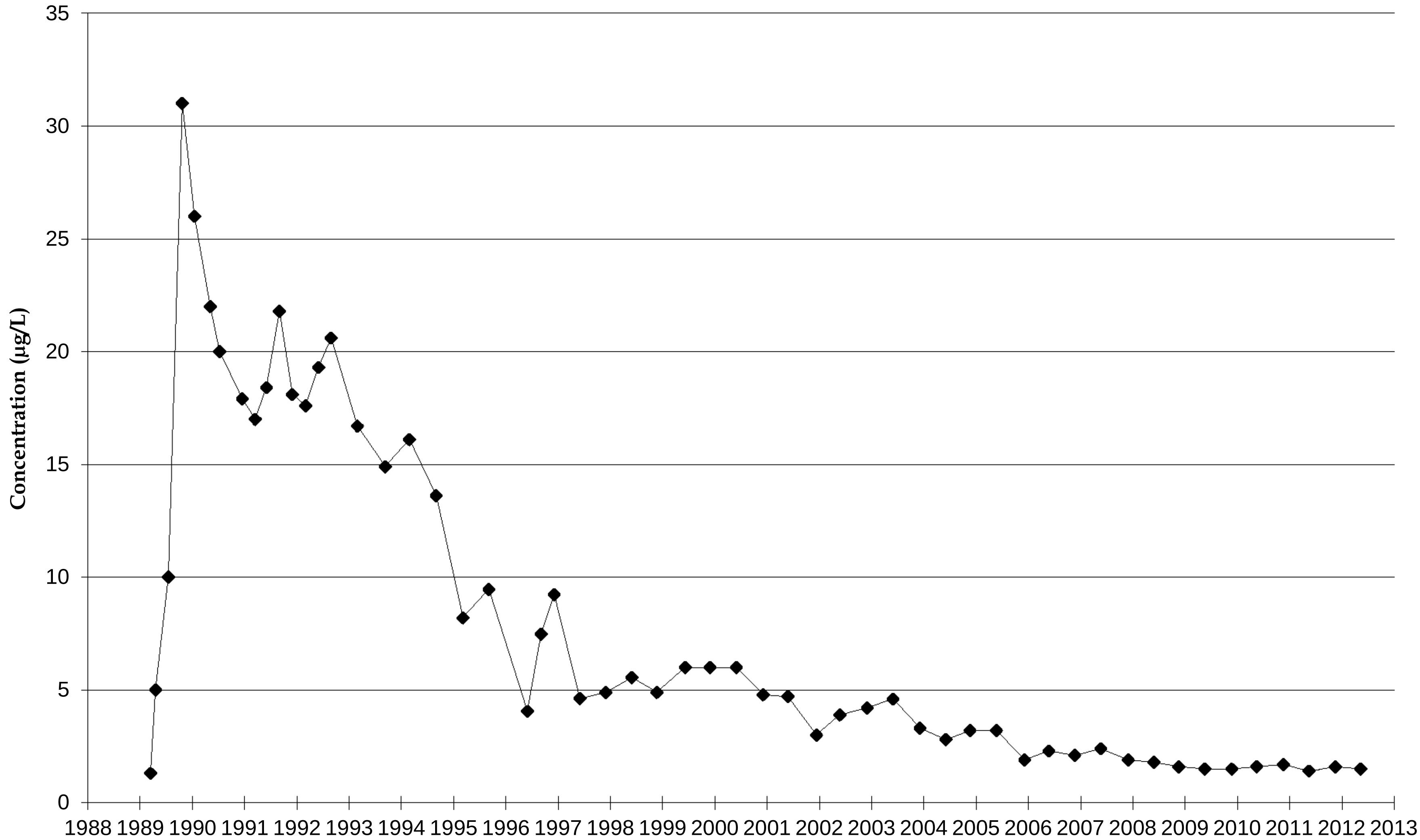


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B11 - TRCLE VS. TIME

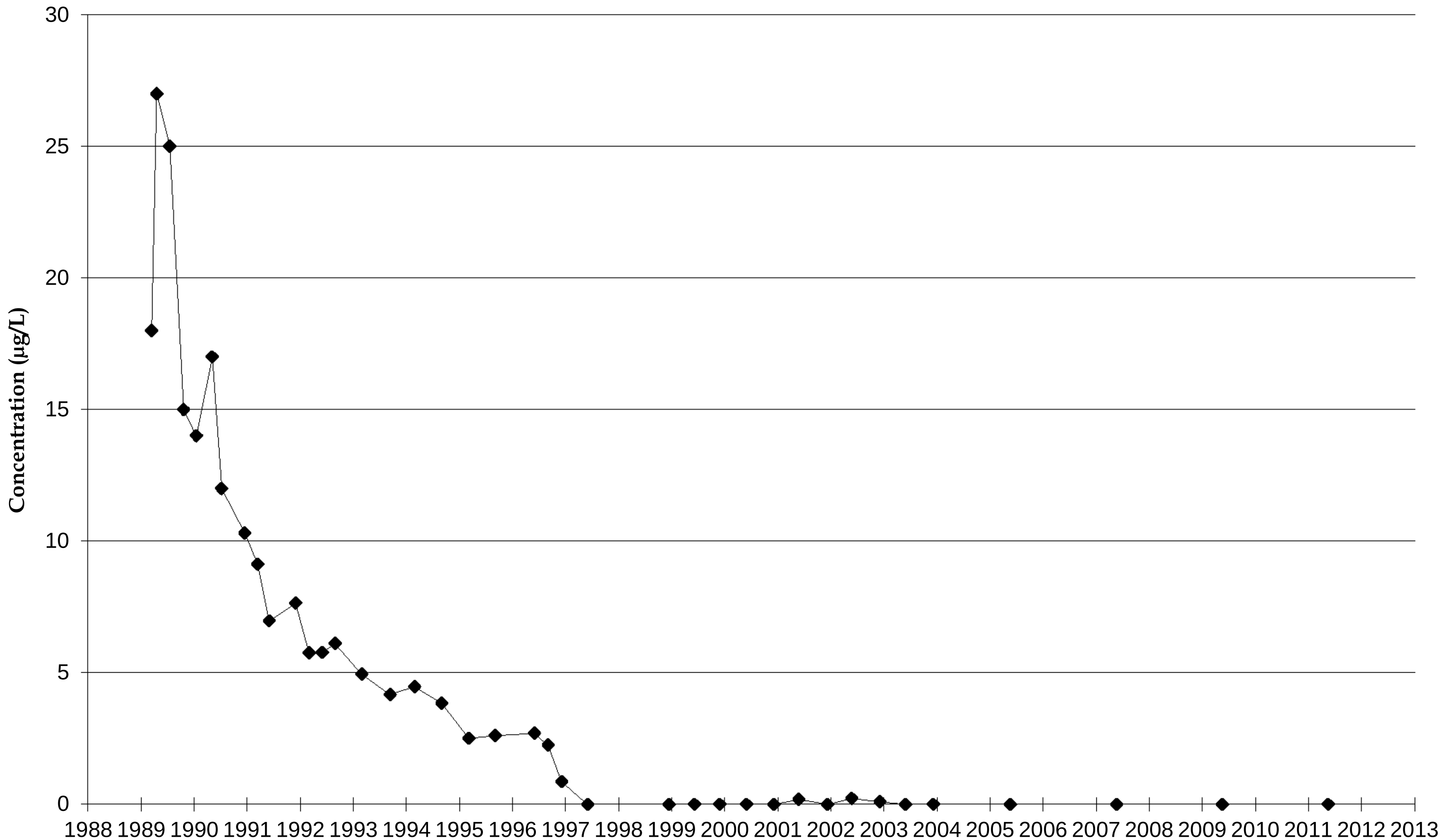


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B12 - TRCLE VS. TIME

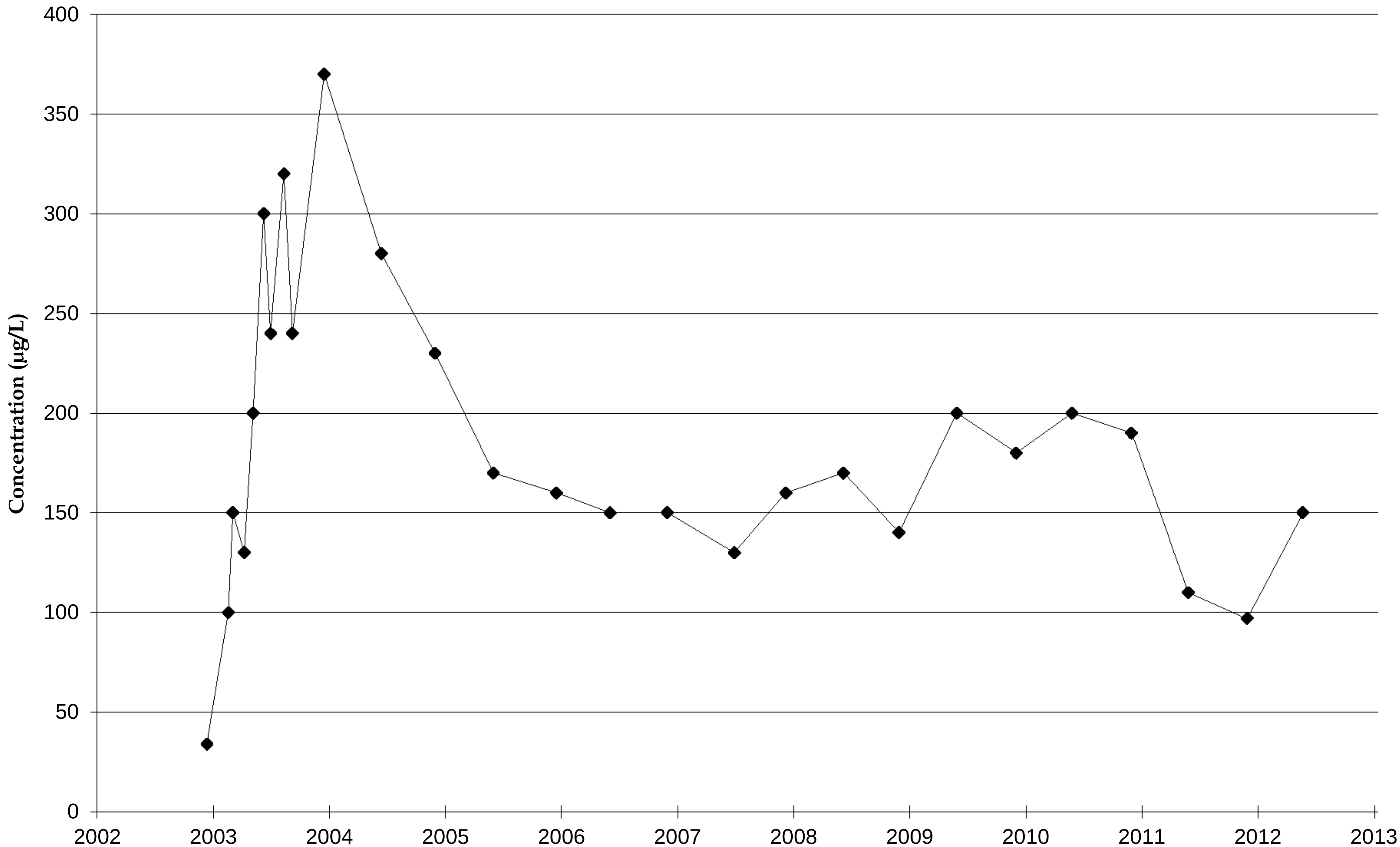


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL B13 - TRCLE VS. TIME

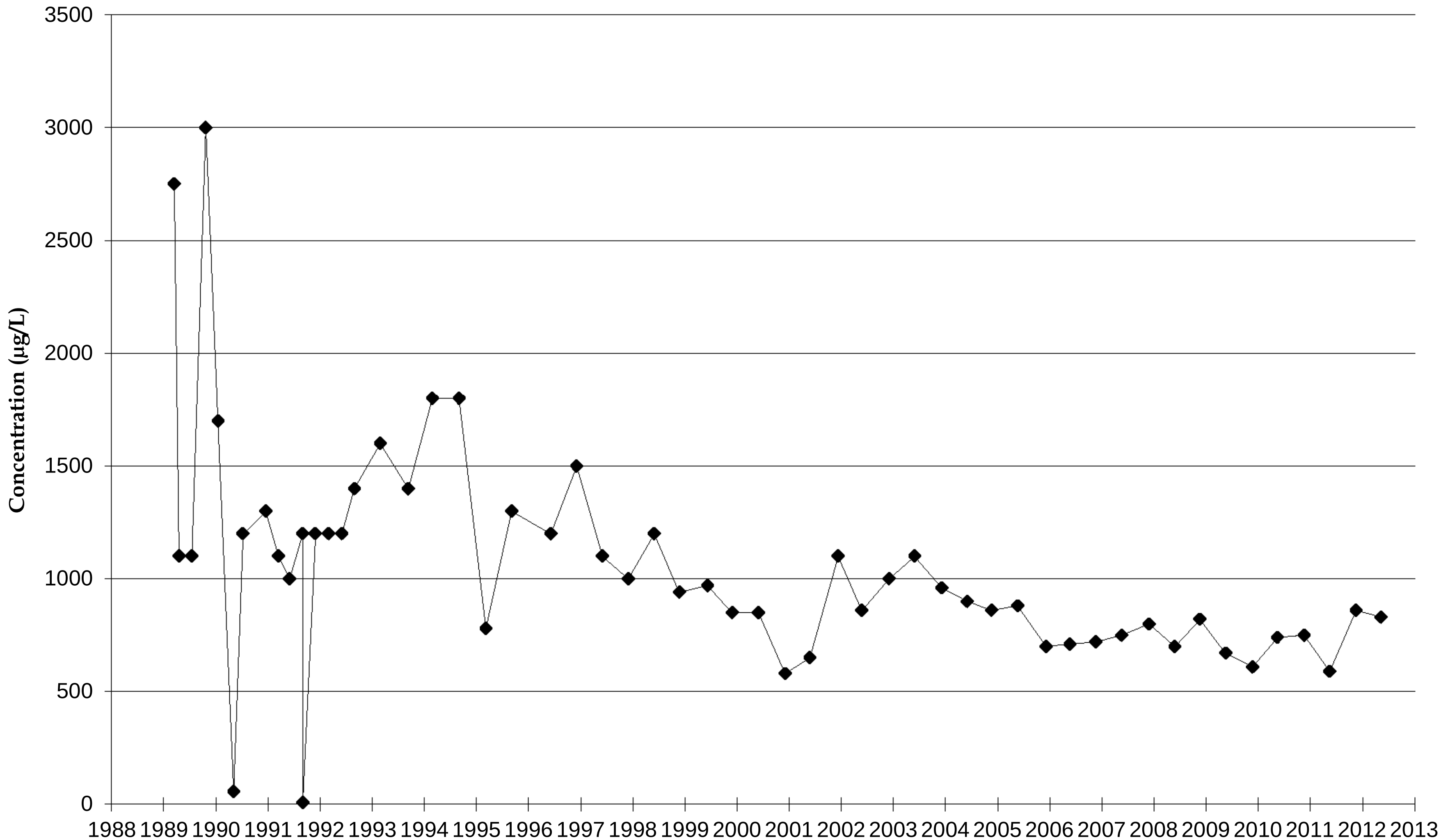


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL SC1 - TRCLE VS. TIME

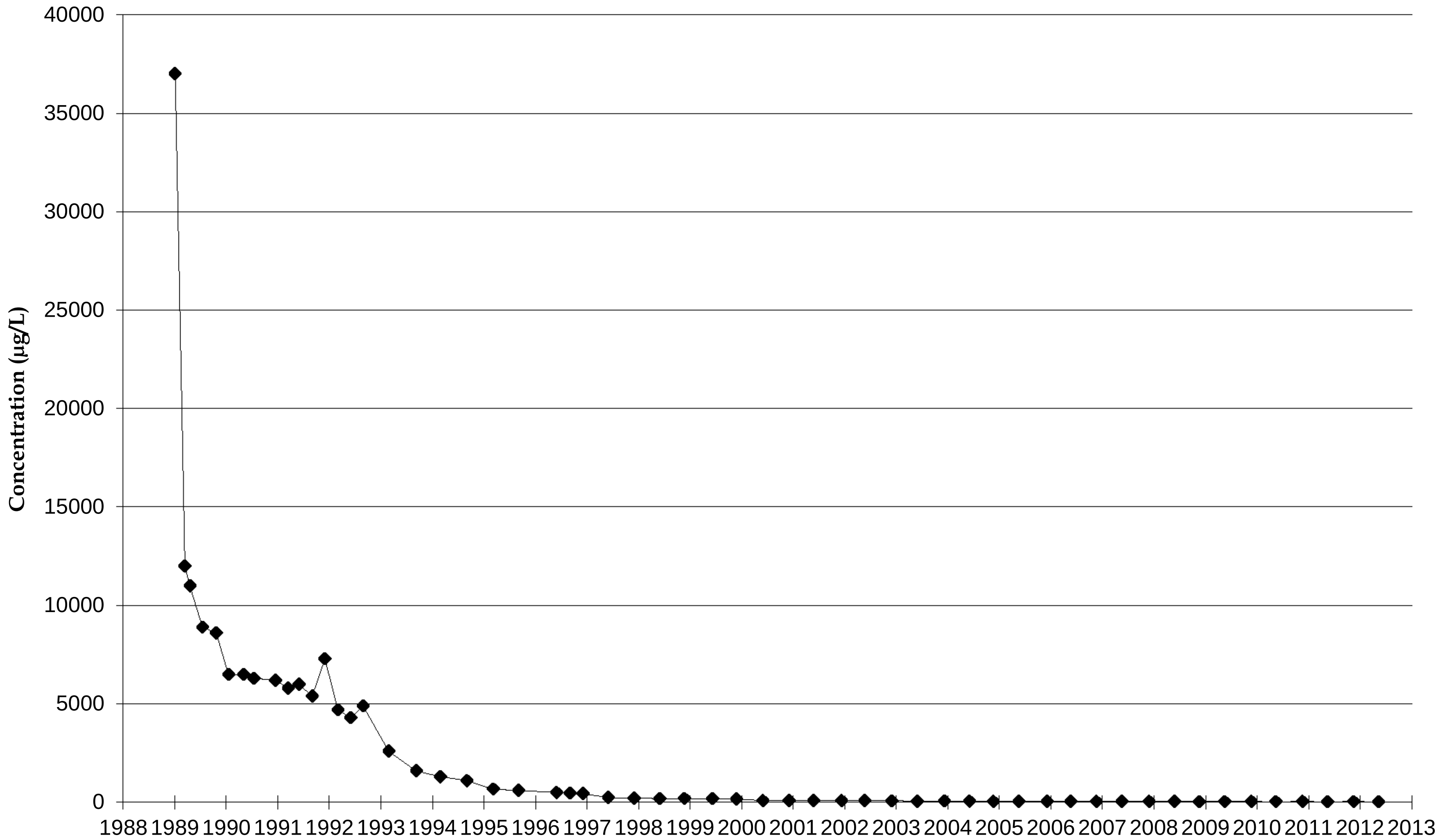


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL SC2 - TRCLE VS. TIME

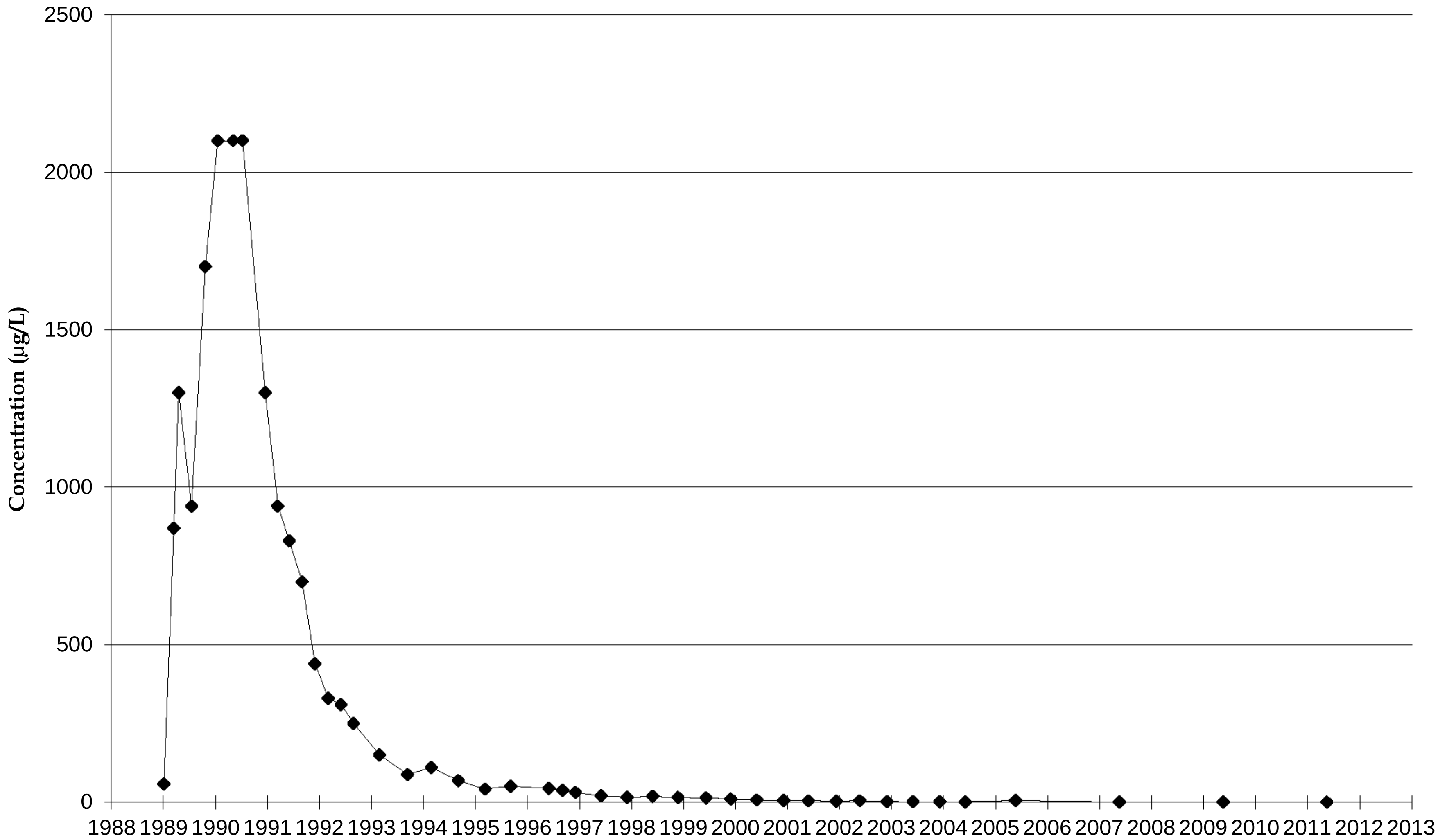


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL SC3 - TRCLE VS. TIME

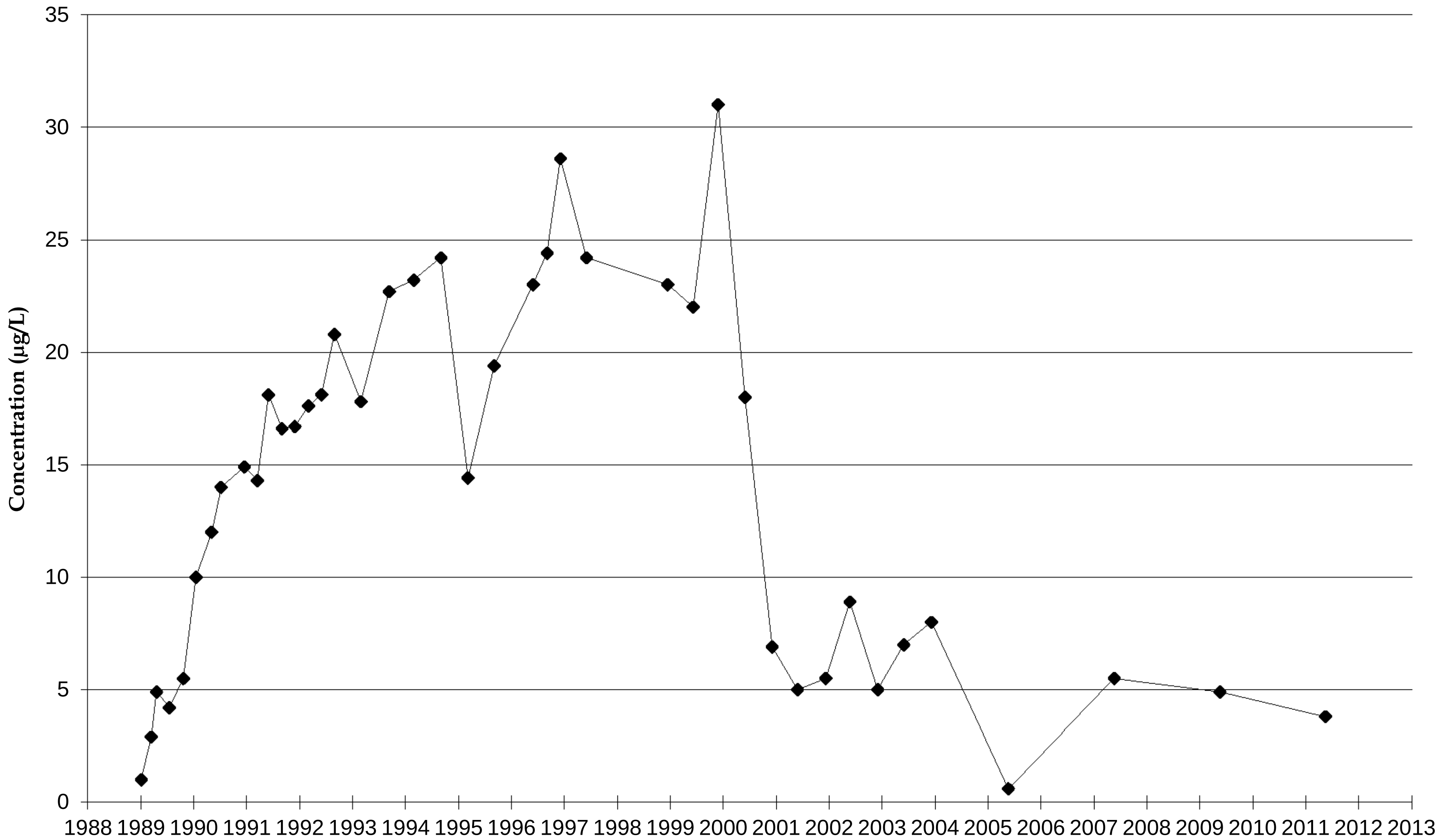


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL SC4 - TRCLE VS. TIME

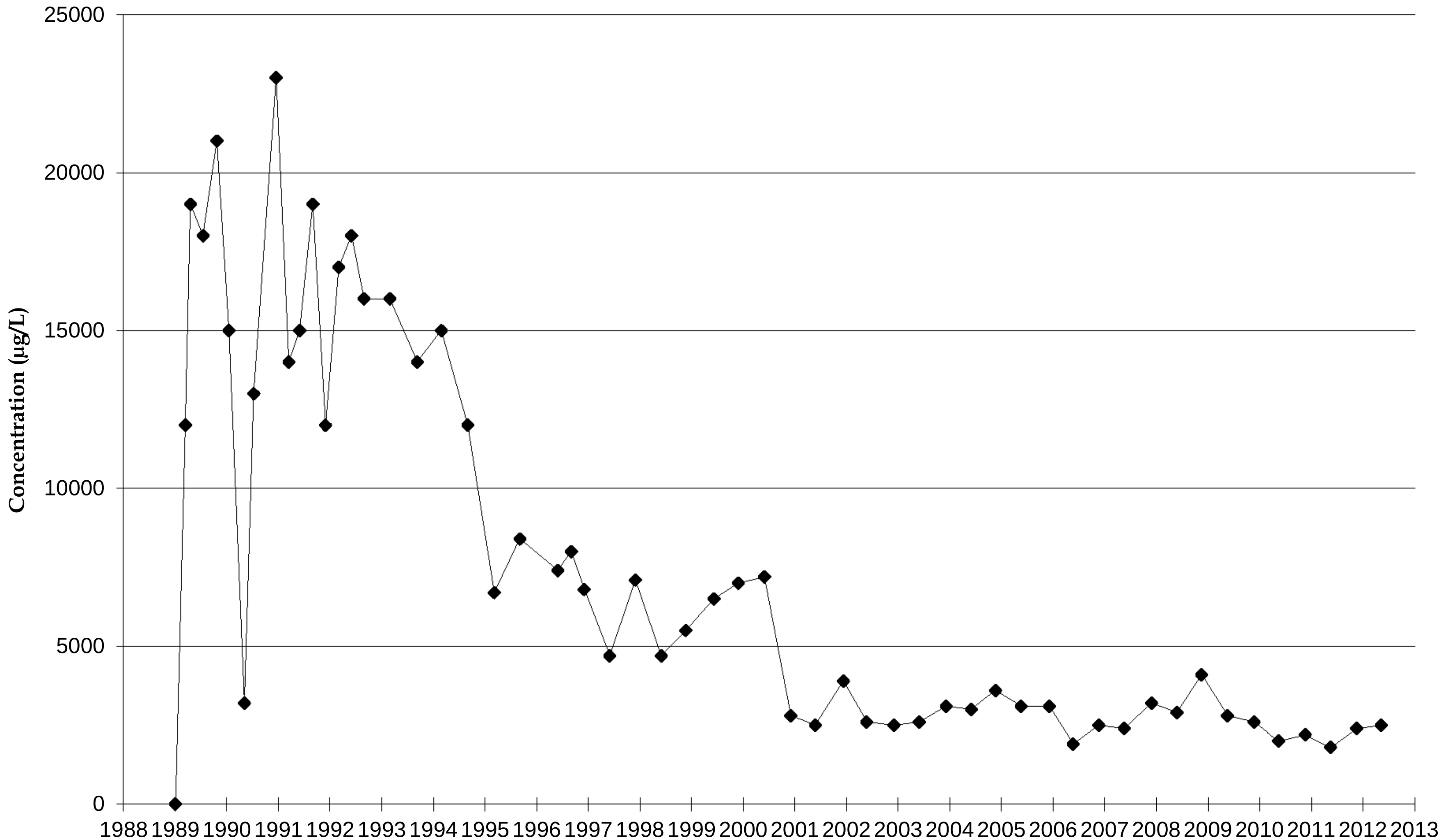


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

APPENDIX G-1

EXTRACTION WELL SC5 - TRCLE VS. TIME



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 079853 (1)

G.2 Influent/Effluent Database (µg/L), Fiscal Year 2012, TGRS, OU2

APPENDIX G-2

INFLUENT/EFFLUENT DATABASE (µg/L)
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

			1,1,1-Trichloroethane	*1,1-Dichloroethane*	*1,1-Dichloroethene*	*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*Tetrachloroethene*	*Trichloroethene*
TGRS Cleanup Level (1)			**200**	**70**	**6**	**4**	**70**	**5**	**5**
Location	*Date*		*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
TGRSE	10/3/11		0.3 JP	< 1	< 1	< 1	< 1	< 1	1.9
TGRSE	11/1/11		< 1	< 1	< 1	< 1	< 1	< 1	1.8
TGRSE	11/1/11	D	< 1	< 1	< 1	< 1	< 1	< 1	1.6
TGRSE	12/5/11		< 1	< 1	< 1	< 1	< 1	< 1	1.8
TGRSE	12/5/11	D	< 1	< 1	< 1	< 1	< 1	< 1	1.9
TGRSE	1/9/12		< 1	< 1	< 1	< 1	< 1	< 1 JMS 71.1/65.5	1.7
TGRSE	2/2/12		0.43 JMS 128/127	< 1	< 1	< 1	< 1	< 1	1.5
TGRSE	2/2/12	D	0.41 JP	< 1	< 1	< 1	< 1	< 1	1.7
TGRSE	3/5/12		0.32 JP	< 1	< 1	< 1	< 1	< 1	1.8
TGRSE	3/5/12	D	< 1	< 1	< 1	< 1	< 1	< 1	1.7
TGRSE	4/4/12		< 1	< 1	< 1	< 1	< 1	< 1	1.6
TGRSE	4/4/12	D	< 1	< 1	< 1	< 1	< 1	< 1	1.6
TGRSE	5/3/12		< 1	< 1	< 1	< 1	< 1	< 1	1.8
TGRSE	6/4/12		< 1	< 1	< 1	< 1	< 1	< 1	1.6
TGRSE	6/4/12	D	< 1	< 1	< 1	< 1	< 1	< 1	1.7
TGRSE	7/5/12		< 1	< 1	< 1	< 1	< 1	< 1	1.7
TGRSE	7/5/12	D	< 1	< 1	< 1	< 1	< 1	< 1	1.8
TGRSE	8/6/12		< 1	< 1	< 1	< 1	< 1	< 1 JMS 73.3/74.4	1.6
TGRSE	8/6/12	D	< 1	< 1	< 1	< 1	< 1	< 1	1.6
TGRSE	9/4/12		< 1	< 1	< 1	< 1	< 1	< 1	1.7

APPENDIX G-2

INFLUENT/EFFLUENT DATABASE (µg/L)
FISCAL YEAR 2012
TGRS, OU2
ARDEN HILLS, MINNESOTA

			1,1,1-Trichloroethane	*1,1-Dichloroethane*	*1,1-Dichloroethene*		*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*Tetrachloroethene*		*Trichloroethene*
TGRS Cleanup Level (1)			200	70	6		4	70	5		5
Location	*Date*		*µg/L*	*µg/L*	*µg/L*		*µg/L*	*µg/L*	*µg/L*		*µg/L*
TGRSI	10/3/11		37	2.7	2.9	<	1	2.4	1.2		200
TGRSI	10/3/11	D	41	2.9	3.6	<	1	2.4	1.3		190
TGRSI	11/1/11		30	2.1	2.6	<	1	1.7	1.1		160
TGRSI	12/5/11		31	2.5	2.3	<	1	1.9	0.91	JP	170
TGRSI	1/9/12		45	2.9	4.4	<	1	2.2	1.2		190
TGRSI	1/9/12	D	46	3	4.2	<	1	2.3	1.2		190
TGRSI	2/2/12		42	2.3	2.8	<	1	2.2	1		170
TGRSI	3/5/12		38	2.5	2.6	<	1	2	1		190
TGRSI	4/4/12		39	2.6	3.5	<	1	2.5	1.2		170
TGRSI	5/3/12		47	2.8	4.3	<	1	2.9	1.2		190
TGRSI	5/3/12	D	47	2.8	4.2	<	1	2.8	1.2		190
TGRSI	6/4/12		36	2.5	3.2	<	1	2.6	1.1		190
TGRSI	7/5/12		37	2.5	3.3	<	1	2.7	1.1		200
TGRSI	8/6/12		28	2.2	1.9	<	1	2.5	0.73	JP	160
TGRSI	9/4/12		27	2.3	2.9	<	1	2.7	0.94	JP	170
TGRSI	9/4/12	D	29	2.4	3.2	<	1	2.6	0.94	JP	170

Notes:

(1) Cleanup levels for TGRS are from the OU2 ROD.
D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.
JMS - Result is qualified as estimated due to low matrix spike recovery (<75%).

Appendix H

Operable Unit 3 Statistical Analysis

TABLE H.1

MAROS DECISION MATRIX

Kendall S	*Confidence*	*Coefficient of Variance*	*Trend*
S > 0	> 95%	NA	Definitely Increasing
S > 0	90-95%	NA	Probably Increasing
S > 0	< 90%	NA	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	NA	Probably Decreasing
S < 0	>95%	NA	Definitely Decreasing

TABLE H.2

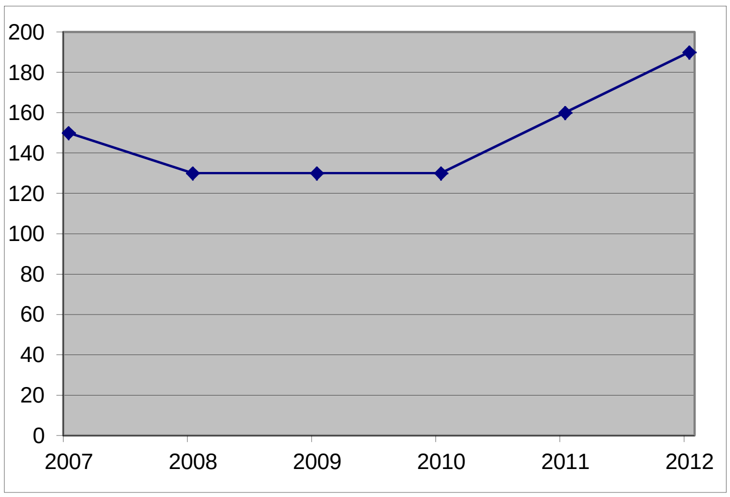
CONFIDENCE VALUES FOR SIX DATA PAIRS

Kendall S	*Confidence*
1	50.00%
3	64.00%
5	76.50%
7	86.40%
9	93.20%
11	97.20%
13	99.17%
15	99.86%

WELL 03M848
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2012

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/21/2007	**150**	1								
6/18/2008	**130**	1	-1							
6/17/2009	**130**	1	-1	0						
6/8/2010	**130**	1	-1	0	0					
6/24/2011	**160**	1	1	1	1	1				
6/1/2012	**190**	1	1	1	1	1	1			
N		6	5	4	3	2	1	0		15
	sum		-1	2	2	2	1	0	Kendall S	6
Possibles		15								
									Kendall tau	0.4

Mean	148.33
STNDEV	24.0139
COV	0.1619
Trend:	Positive
Confidence (lookup)	81.46%



Raw Data
03M848

Date	TCE	Date	TCE
12/2/1987	440	6/1/2003	450
4/19/1990	190	6/21/2005	230
7/19/1990	190	6/13/2006	190
9/17/1990	330	6/21/2007	150
3/18/1991	310	6/18/2008	130
6/4/1991	730	6/17/2009	130
9/3/1991	700	6/8/2010	130
3/18/1992	640	6/24/2011	150
6/3/1992	>50.10	6/24/2011	160 D
6/3/1992	570 D	6/1/2012	190
9/3/1992	>50.10	6/1/2012	180 D
3/9/1993	1300		
3/9/1993	970 D		
3/17/1994	910		
3/16/1995	59		
6/21/1996	1400		
6/26/1997	510		
6/29/1998	660		
6/4/1999	700		
6/4/1999	650 D		
6/12/2001	370		

Appendix I

Annual Site Inspection Checklist for Land Use Controls

ANNUAL SITE INSPECTION CHECKLIST FOR LAND USE CONTROLS

Operable Unit 2, New Brighton/Arden Hills Superfund Site

Date: JULY 12, 2012

Inspected by: MIKE FIX, MIKE MURRAY, MARY LEE, MATT BOWERS

Period Covered: From prior annual inspection (7/14/10) to above date

	BLANKET LUCs			OTHER LUC AREAS	SITES WITH ADDITIONAL LUCs FOR SOIL COVERS							
				Area w/Restricted Commercial Use	C	D	E	G	H	I	129-15	Outdoor Firing Range
Property owner:	BRAC	N.G.	Reserve	N.G.	BRAC	N.G.	N.G.	N.G.	N.G.	BRAC	N.G.	N.G.
Soil LUCs												
Are there any land uses that result in a non-compliant exposure versus the exposure assumptions described in the LUCRD?	NO	NO	NO	NO	(Soil LUCs are covered under the Blanket LUCs)							
Soil Cover LUCs												
Has there been any excavation activity or any other man-made soil disturbance at the site?	N/A	N/A	N/A	N/A	NO	NO	No	NO	No	N/A	NO	NO
Are there any areas of the soil cover that have inadequate vegetative cover?	N/A	N/A	N/A	N/A	NO	NO	NO	NO	NO	N/A	NO	NO
Has there been any damage to run-on/runoff controls (swales, berms, riprap, etc.)?	N/A	N/A	N/A	N/A	No	No	No	No	NO	N/A	NO	NO
Has there been any damage to or removal of the signs marking the edge of the soil cover?	N/A	N/A	N/A	N/A	No	NO	No	NO	NO	N/A	NO	NO
If the soil cover has a permeability requirement, is there any woody vegetation present that exceeds 2-inch diameter?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
Has there been any damage to or removal of the concrete slab that serves as a protective cover?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A
Groundwater LUCs												
Have any wells been installed that withdraw water from a contaminated aquifer, without MDH/MPCA/USEPA approval?	NO	NO	NO	(Groundwater LUCs are covered under the Blanket LUCs)								
Has there been any damage to or interference with any groundwater remedy infrastructure (wells, piping, treatment systems, etc.)?	NO	NO	NO									

Comments (Attach additional pages as necessary):

BRAC = Base Realignment and Closure Division N.G. = MN Army National Guard/National Guard Bureau Reserve = U.S. Army Reserve

Certification:

Based on the annual site inspection, the undersigned hereby certifies that the above-named property owners and above-described land use controls have been complied with for the period noted. Alternatively, any known deficiences and completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

Michael R. Fix (Commander's Representative)

Description of Deficiency(ies) attached? ☐ Yes ☒ No (none were identified)