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INSTALLATION RESTORATION PROGRAM
TWIN CITIES ARMY AMMUNITION PLANT

FIVE-YEAR REVIEW REPORT OF THE FINAL REMEDY FOR THE NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

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JULY 2014
FINAL REPORT

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

INSTALLATION RESTORATION PROGRAM
TWIN CITIES ARMY AMMUNITION PLANT

FIVE-YEAR REVIEW REPORT OF THE FINAL REMEDY FOR THE NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

Approved by U.S. Army

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Prepared by U.S. Army Corps of Engineers, Omaha District

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List of Acronyms

Alliant	Alliant Techsystems Inc.
ACM	Asbestos-Containing Material
APR	Annual Performance Report
ARAR	Applicable or Relevant and Appropriate Requirements
Army	U.S. Army
BGRS	Boundary Groundwater Recovery System
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical of Concern
DNAPL	Dense Non-Aqueous Phase Liquids
EE/CA	Engineering Evaluation/Cost Analysis
ERA	Ecological Risk Assessment
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
FY	Fiscal Year
GAC	Granular Activated Carbon
GOS	Global Operating Strategy
gpm	Gallons per Minute
HRC	Hydrogen Release Compound
HRL	Health Risk Limit
IRIS	Integrated Risk Information System
LUCs	Land Use Controls
LUCRD	Land Use Control Remedial Design
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal

List of Acronyms (Cont.)

MDH	Minnesota Department of Health
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MNA	Monitored Natural Attenuation
MPCA	Minnesota Pollution Control Agency
NB/AH	New Brighton/Arden Hills
NBCGRS	New Brighton Contaminated Groundwater Recovery System
NBM	New Brighton Municipal
NFA	No Further Action
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PGAC	Permanent Granular Activated Carbon
PGRS	Plume Groundwater Recovery System
POTW	Publicly-Owned Treatment Works
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RAA	Risk Assessment Advice
RAB	Restoration Advisory Board
RAL	Recommended Allowable Limit
RAO	Remedial Action Objective
RD/RA	Remedial Design/Remedial Action
RfDo	Oral Reference Dose
ROD	Record of Decision

List of Acronyms (Cont.)

SDWA	Safe Drinking Water Act
SFo	Oral Slope Factor
SRV	Soil Reference Value
SVE	Soil Vapor Extraction
SWCA	Special Well Construction Area
TBC	To Be Considered
TCE	Trichloroethene
TCAAP	Twin Cities Army Ammunition Plant
TGRS	TCAAP Groundwater Recovery System
µg/L	Micrograms per Liter
USACHPPM	United States Army Center for Health Promotion and Preventative Medicine
USAEC	United States Army Environmental Command
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
Wenck	Wenck Associates, Inc.

Executive Summary

This five-year review was performed by the United States Army for the New Brighton/Arden Hills Superfund Site, which is related to the Twin Cities Army Ammunition Plant. The previous five-year review of the Site was signed on 21 August 2009, and the passage of another five years has triggered this review. The time period for events documented in this report is October 2008 through March 2013. The scope of this review includes operable units and sites that at the end of the review period had remedies in-place and have hazardous substances remaining at levels that do not allow for unlimited use and unrestricted exposure.

The conclusion supported by this review is that the remedies are functioning as intended and are currently protective of human health and the environment.

The next five-year review is due 21 August 2019, or 5 years from the U.S. Environmental Protection Agency concurrence date if the date is earlier than 21 May 2014.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: New Brighton/Arden Hills/TCAAP Site		
EPA ID: MN7213820908		
Region: 5	**State:** MN	**City/County:** Ramsey

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** U.S. Army (TCAAP)
Author name (Federal or State Project Manager): Michael R. Fix
Author affiliation: U.S. Army (TCAAP)
Review period: August 2013 – March 2014
Date of site inspection: 9/11/2013
Type of review: Statutory
Review number: 4
Triggering action date: 8/21/2009
Due date *(five years after triggering action date)*: 8/21/2014

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1 and OU3

Issues and Recommendations Identified in the Five-Year Review:

OU: 2	**Issue Category: Remedy Performance**			
	Issue: For Building 102 shallow groundwater, uncertain if an acceptable level of attenuation is occurring prior to groundwater reaching Rice Creek.			
	Recommendation: For Building 102 shallow groundwater, evaluate if an acceptable level of attenuation is occurring prior to groundwater reaching Rice Creek [Refer to Note 1 in the Protectiveness Statement below.]			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	End of FY2014

OU: 2	**Issue Category: Remedy Performance**			
	Issue: For Site A shallow groundwater, uncertain if Monitored Natural Attenuation (MNA) will adequately control plume migration.			
	Recommendation: For Site A shallow groundwater, evaluate if MNA will adequately control plume migration.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	Ongoing (evaluate in Annual Performance Reports)

OU: 2	**Issue Category: Remedy Performance**			
	Issue: For Site A shallow groundwater, uncertain if a vapor intrusion risk exists north of County Road I.			
	Recommendation: For Site A shallow groundwater, evaluate whether a vapor intrusion risk exists north of County Road I [Refer to Note 1 in the Protectiveness Statement below.]			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	End of FY2014

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable): NA*
1	Protective	

Protectiveness Statement:

The remedy at OU1 is protective of human health and the environment. The alternate water supply and well abandonment program, along with the special well construction area (SWCA), are mitigating potential risks associated with private wells. The permanent granular activated carbon (PGAC) treatment system is reliably providing a safe municipal water supply. Water quality trends indicate that progress towards aquifer restoration continues to occur.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):NA*
2	Short-term Protective	

Protectiveness Statement:

The remedy at OU2 is protective of human health and the environment in the short term, based on the following: 1) For soil sites where the remedy has been completed (Sites A, C, D, E, H, 129-3, 129-5, 129-15), the site's availability for industrial use has been restored. Review of the toxicity data upon which the health risk assessments for these sites were based showed that no changes have occurred that could potentially affect the protectiveness of the remedies. The protective soil covers at Sites C, D, E, G, H, and 129-15, in conjunction with land use controls, effectively prevent exposure to contaminated soils/debris. 2) The groundwater containment systems are meeting their containment objectives and the treatment systems are meeting their discharge requirements. For Site A shallow groundwater, the alternate water supply and well abandonment program, along with the SWCA, are mitigating potential risks associated with private wells. Also at Site A, MNA is adequately controlling plume migration (in lieu of groundwater extraction system operation). Water quality trends indicate that progress towards aquifer restoration continues to occur in both shallow and deep groundwater. Review of the ARARs upon which the groundwater cleanup levels were based showed that six groundwater COCs were potentially affected by HRL revisions. The HRL revisions had no impacts to Site C groundwater and had no short-term impacts to the groundwater cleanup levels for Sites A, I, and K shallow groundwater or OU2 deep groundwater; however, if any of these four sites approach the point of site closure, then a change in cleanup level(s) may be appropriate. No changes to the cleanup levels are needed in the short term.

However, in order for the remedy to be protective in the long term, additional investigation work needs to be performed at Building 102 to assess whether an acceptable level of attenuation is still occurring prior to groundwater reaching Rice Creek [see Note 1 below]; monitoring needs to continue at Site A to determine if MNA will adequately control plume migration; and vapor intrusion risk needs to be assessed at Site A in the area north of County Road I [see Note 2 below].

[Note 1: Although the following described work was conducted beyond the cutoff date for this five-year review (March 31, 2013), due to the importance of this work relative to the remedy protectiveness determination, the following should be noted: upon approval of the QAPP addendum by the USEPA and MPCA in June 2013, the groundwater investigation work at Building 102 was conducted in July 2013 and then documented in Supplemental Investigation Report for Building 102 Groundwater, which was approved by the USEPA and MPCA in March 2014. The report concluded that a significant level of attenuation was occurring at the point groundwater had travelled halfway from 01L582 to Rice Creek. A more detailed discussion of these results will appear in the next five-year review.]

[Note 2: Although the following described work was conducted beyond the cutoff date for this five-year review (March 31, 2013), due to the importance of this work relative to the remedy protectiveness determination, the following should be noted: upon approval of the QAPP by the USEPA and MPCA in June 2013, the Site A soil vapor investigation work was conducted in July 2013 and then documented in Site A Vapor Intrusion Investigation Report, which was approved by

the USEPA and MPCA in February 2014. The report concluded that no significant vapor intrusion risk existed for the homes along County Road I. A more detailed discussion of these results will appear in the next five-year review.]

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable): NA*
3	Protective	

Protectiveness Statement:

The OU3 remedy is protective of human health and the environment. The alternate water supply and well abandonment program, along with the special well construction area (SWCA), are mitigating potential risks associated with private wells. Water quality trends indicate that progress towards aquifer restoration continues to occur.

1.0 Introduction

A five-year review was performed for the New Brighton/Arden Hills (NB/AH) Superfund Site, which is related to the Twin Cities Army Ammunition Plant (TCAAP). This five-year review was conducted to meet the statutory mandate under CERCLA §121(c). In general, five-year reviews are required whenever a remedial action results in hazardous substances, pollutants, or contaminants remaining on site that are above levels allowing for unlimited use and unrestricted exposure.

The NB/AH Site has three operable units, for which Records of Decision (RODs) were signed between 1992 and 1997. The previous five-year review of the NB/AH Site was signed on August 21, 2009, and the passage of another five years has triggered this review. The prior report covered data from Fiscal Year (FY) 2004 through FY 2008 (October 1, 2003, through September 30, 2008). This five-year review covers the period from FY 2009 through mid-FY 2013 (October 1, 2008 through March 31, 2013).

On behalf of the United States Army (Army), the United States Army Corps of Engineers (USACE), performed this statutory five-year review under Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), for review by the United States Environmental Protection Agency (USEPA), Region 5, and the Minnesota Pollution Control Agency (MPCA). The review was initiated in mid-FY 2013, including notification of stakeholders, and the majority of the technical review was completed by December 2013. The USEPA Comprehensive Five-Year Review Guidance (June 2001) was utilized as the primary guidance for conducting the five-year review and preparing this report.

This five-year review evaluates the remedies specified in the RODs for the three operable units at the NB/AH Site: Operable Unit (OU) 1, OU2, and OU3. It also includes the removal actions

that were implemented at the Grenade Range and Outdoor Firing Range. USEPA policy is to include removal actions in five-year reviews if, after the remedy is in-place (construction completed), hazardous substances remain on-site at levels that do not allow for unlimited use and unrestricted exposure (applicable to both of these sites).

There are four soil areas of concern, the 135 Primer/Tracer Area, Site A, and the National Guard environmental baseline survey, that are being addressed but are not included in this five-year review since the decision document was not signed and/or the remedy is not in-place. In addition, Round Lake is currently in the remedial investigation/feasibility study stage with the need for a remedy yet to be determined. A discussion of the status of these sites is included in Section 1.0 of Appendix A.

There are three sites where removal actions have been completed since the last five-year review which resulted in a no further action (NFA) remedy selection: the stormwater outfall from the 135 Primer/Tracer Area (documented in OU2 ROD Amendment #3), and the 535 Primer/Tracer Area and Site K soil removals (documented in OU2 ROD Amendment #4). A discussion of these removal action sites is included in Section 3.1.2 as background information; however, since the sites do not contain hazardous substances at levels that would prevent unlimited use and unrestricted exposure, they are not included in this review.

Sites B, F, and J do not contain hazardous substances at levels that would prevent unlimited use and unrestricted exposure and are not included in this review. A brief discussion of Site B is included in Section 3.0, since it is a site that was included in the OU2 ROD. A brief discussion of Sites F and J, which were not included in the OU2 ROD, is also included in Section 2.4 of Appendix A, as background information.

The level of detail in this five-year review report is sufficient for the intended purpose of evaluating whether the remedies remain protective. For additional information on the background, investigations, and remedial actions for the various operable units and individual

sites, the reader may refer to other key documents such as the Annual Performance Reports, Installation Action Plans (produced annually), RODs (and subsequent modifications), site closeout reports, and other "Reviewed Documents" cited in the report.

2.0 Operable Unit 1 (OU1)

2.1 REMEDIAL ACTIONS

2.1.1 Remedy Selection

The OU1 ROD was signed in September 1993, and the 2006 ROD Amendment documented the change to using statistical analysis of groundwater quality to show aquifer restoration, in lieu of showing containment in the vicinity of County Road E. Following are the components of the selected remedy, with the changed elements shown in italics:

- Providing an alternative water supply to residents with private wells within the north plume.

- Implementing drilling advisories that would regulate the installation of new private wells within the north plume as a Special Well Construction Area (SWCA).

- *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.

- Pumping the extracted groundwater to the permanent granular activated carbon (PGAC) water treatment facility in New Brighton for removal of volatile organic compounds (VOCs) by a pressurized granular activated carbon (GAC) system.

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

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

The ROD (and amendment) addressed the Remedial Action Objectives, which were previously developed as part of the OU1 Feasibility Study (July 1993), as follows:

- Prevent human exposure to water contaminated with carcinogens in excess of the Maximum Contaminant Levels (MCLs), Recommended Allowable Limits (RALs), and Health Risk Limits (HRLs) and having a total excess cancer risk for all contaminants of greater than 10^{-4} to 10^{-6}.

- Prevent human exposure to water with concentrations of noncarcinogens greater than MCLs, RALs, and HRLs or having a threshold noncancer hazard index greater than 1.0.

- Restore the aquifer to its highest use, i.e., potability, as defined by the most stringent and promulgated state and federal standards. Aquifer remediation would be considered complete when levels of contaminants are less than the applicable MCLs, RALs, or HRLs (as promulgated).

- Contain the plume within the boundary of County Road E (to the extent practicable) while also maximizing mass removal.

- Prevent ecological exposure to contaminants.

Although the objective to "contain the plume within the boundary of County Road E" was replaced in the amended ROD, given that the amendment still requires extraction of groundwater at a rate that is consistent with the long-term operating history, substantial containment and mass removal still occur under the amended remedy. The objective is still generally applicable in that context.

2.1.2 Remedy Implementation

Groundwater extraction is provided by pumping six municipal wells: New Brighton Municipal (NBM) #3, #4, #5, #6, #14 and #15. Collectively, these extraction wells comprise the extraction points of the NBCGRS. NBM #3 through #6 were pre-existing wells. NBM #14 and NBM #15 began pumping in December 1996 and March 1998, respectively.

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 approved the revised pumping allocations, which were then implemented in January 2008. Under the new pumping scenario, NBM #15 is considered the highest priority because it is located near the center of the plume and has the highest contaminant concentrations of the wells completed in the

Prairie du Chien. Well pair NBM #3/4 is the second priority because it has the next highest concentrations in the Prairie du Chien. Well pair NBM #5/6 is the next highest priority because these wells are completed in the underlying Jordan formation and have the highest contaminant concentrations of all the extraction wells. Finally, NBM #14 was assigned the lowest priority because it is near the edge of the plume in the Prairie du Chien with relatively low contaminant concentrations.

The pumping priorities reflect a desire to still focus on the core of the Prairie du Chien plume (wells NBM #15 and NBM #3/4), while starting to enhance mass removal in the Jordan (well pair NBM #5/6).

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.

The extracted water is treated in the PGAC treatment facility for removal of VOCs, and is then used as part of the municipal water supply. The PGAC is located approximately one-third mile south of Interstate 694 near Silver Lake Road. The PGAC was initially brought on-line in June 1990. In 1995, the Army provided the City of New Brighton with funding for the modifications to the PGAC that were required to implement the terms of the OU1 ROD (e.g., treating the added groundwater flow from NBM# 14 and #15).

The Alternate Water Supply and Well Abandonment Program has been implemented and is an ongoing program maintained by the Army. The OU1 Alternate Water Supply Plan (Montgomery Watson, October 1995) provided documentation of the original program, including three key clarifications to the remedy component: 1) the program applies to other wells, in addition to residential wells (relative to the statement “residents with”); 2) the program includes well abandonment; and 3) the program includes the OU3 deep groundwater plume and that portion of

the OU2 Site A shallow groundwater plume that extends off the north end of TCAAP. The OU1 Alternate Water Supply Plan identified the criteria for determining which wells are eligible for an alternate water supply and/or abandonment. The process of identifying wells eligible for alternate water supply and/or abandonment is accomplished by maintaining a "well inventory." The well inventory is a database that was initially developed in 1992, and is currently updated annually as part of the Annual Performance Report (APR). 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 Minnesota Department Health (MDH) Special Well Construction Area that is discussed in Section 2.1.3). 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.

The well inventory database identifies the water supply wells within the study area, of which 27 are currently in categories with the potential to be impacted. These 27 wells are sampled every four years to determine if they qualify for alternate water supply and/or abandonment. If new wells are discovered that have the potential to be impacted, they are sampled as soon as practical to determine if there is a concern. If at any time a well is found to be eligible for alternate water supply and/or abandonment, the Army sends a letter offer to the owner. If accepted, the Army schedules and pays for the work. Since inception of the program, two well owners have been provided an alternate water supply and eleven wells have been properly abandoned. During the current five-year review period, no new wells were identified that qualify for an alternate water supply or abandonment. Also, in 2000, the MDH prepared a Health Consultation that re-evaluated the risks associated with private well use for 18 wells at 7 locations. MDH concluded that the uses did not pose a health hazard.

Groundwater monitoring is conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR. The Army conducts the sampling related to

OU1 performance monitoring and the private well sampling related to the Alternate Water Supply and Well Abandonment Program. Barr Engineering, on behalf of the City of New Brighton, conducts extraction well and treatment system effluent sampling, the results of which are also provided to and used by the Army.

The statistical analysis of groundwater quality to evaluate aquifer restoration is included in the APR each year. Since the OU1 sampling plan only includes a major sampling event every other year (with a small number of wells sampled in the minor years), the number of wells which undergo the statistical analysis alternates accordingly.

2.1.3 Land Use Controls

Land use controls (LUCs) are required to ensure the protectiveness of the OU1 remedy, until such time that the groundwater cleanup levels are achieved. LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health and the environment (Department of Defense Policy on Land Use Controls Associated with Restoration Activities, 2001). The OU1 ROD prescribed the following LUC: "Implementing drilling advisories that would regulate the installation of new private wells within the north plume as a Special Well Construction Area (SWCA)." In Minnesota, the drilling of wells is regulated by the MDH, including the legal authority to create a SWCA to prohibit water supply wells within contaminated portions of aquifers. The MDH created the SWCA for the New Brighton/Arden Hills Superfund Site in June 1996. In addition to covering OU1, the SWCA also encompasses OU3 and the portion of the OU2 Site A shallow groundwater plume that extends off the north end of OU2. In June 1999, the MPCA requested that the MDH extend the boundary of the SWCA further to the southwest, to the Mississippi River and Marshall Avenue, to ensure that the southern boundary fully encompassed the plume. The MDH made this revision to the SWCA in December 1999. More information regarding the SWCA can be found on the MDH webpage at http://www.health.state.mn.us/divs/eh/wells/swca/, and information from this website is also included in Appendix F, for reference. Figures 2-4

through 2-6 show the physical area of groundwater contamination within OU1 – the area that does not support unlimited use and unrestricted exposure of the groundwater due to the contaminant plume. The current SWCA boundary is shown on Figure 2-1, which encompasses the entire OU1 groundwater plume. The objective of the LUC is to prevent uses of contaminated groundwater that pose an unacceptable risk to human health. The long-term stewardship for the LUC rests with the MDH, within its authority to regulate the construction and use of wells. The LUC for OU1 is summarized in Table 2-1.

2.1.4 System Operations/Operation and Maintenance

The City of New Brighton operates and maintains the PGAC facility and associated extraction wells and distribution system. The primary maintenance item for the PGAC system is changing out the GAC (each of the 16 treatment vessels contains 20,000 pounds of GAC, and the GAC in 8 of these vessels is replaced in each change-out event). The Operation and Maintenance (O&M) procedures have been sufficient to ensure reliable water treatment to the drinking water standards as required by the OU1 ROD, and to ensure that the pumping targets for extraction well flow rates are met with adequate consistency. No significant O&M problems are evident.

Annual O&M costs ranged from $1.9 million in FY2009 to $2.5 million in FY2012. These costs are in line with the amount budgeted for FY2012 of $2.4 million. Additional information on the O&M cost breakdown is attached to the OU1 site inspection checklist (Appendix B1).

2.2 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The prior five-year review concluded that the components of the OU1 remedy remained protective of human health and the environment, that the alternate water supply and well abandonment program, along with the SWCA, were mitigating potential risks associated with private wells, and that the PGAC was reliably providing a safe municipal water supply.

There were no issues identified, and the only recommendation and follow-up action was to continue with implementation of the remedy.

2.3 FIVE-YEAR REVIEW PROCESS

2.3.1 Administrative Components

The review was initiated in early-to-mid 2013, including notification of the project stakeholders: the USEPA, MPCA, Alliant Techsystems (Alliant), Army National Guard, U.S Army Environmental Command (USAEC), USACE, City of New Brighton, and the Restoration Advisory Board (RAB).

2.3.2 Community Notification and Involvement

A notice indicating that a five-year review was to be performed for the NB/AH Site was published during the week of November 18, 2013, in the following newspapers: Minneapolis Star Tribune, Moundsview/New Brighton Sun Focus, and the Shoreview Press (Appendix C). The notice invited anyone interested in this process to contact TCAAP (Mike Fix). The City of New Brighton indicated an interest in participating in the drafting process.

A notice indicating that the five-year review has been completed, including contact information and the location of the public repository for the report (470 West Hwy 96, Suite 100, Shoreview, MN 55126, will be sent to these same newspapers after the report is finalized.

2.3.3 Document Review

The primary documents reviewed for OU1 were the following:

- Record of Decision - Groundwater Remediation, Operable Unit 1, September 1993

- Record of Decision Amendment - Operable Unit 1, May 2006
- TCAAP Final APRs for Fiscal Years 2009, 2010, 2011, and 2012
- Previous Five Year Review Report, August 2009

The OU1 ROD (and amendment) was the source of information for remedial action objectives and cleanup levels. The FY 2011 APR was the primary source for monitoring data, since this report contains the most recent major sampling event for OU1. The FY 2012 APR was the primary source for determining status at the end of this five-year review period.

2.3.4 Data Review

The status of OU1 remedial actions is summarized in Table 2-2.

The first remedy component, the alternate water supply program, has resulted in the Army providing an alternate water supply connection for two well owners. As part of this program, a total of 11 impacted private wells have also been properly abandoned. At the end of FY 2012 and within the timeframe of data reviewed for this Five-year Review (Oct 2008 – Mar 2013), there were no additional private wells that were scheduled to receive an alternate supply and/or well abandonment, or that were eligible to receive an Army offer to enter the program.

The SWCA designated by MDH (and as amended in 1999) satisfies remedy component #2 and is accomplishing its purpose of notifying water well installers of the contaminated groundwater in the area and preventing the installation of water supply wells into the contaminated portion of the aquifer through the well construction permitting controlled by the MDH.

Groundwater extraction (remedy component #3) is being accomplished through continual pumping of the previously-described New Brighton municipal wells (note that aquifer restoration, which is part of this remedy component, is discussed with remedy component #6 below). The NBCGRS has generally been meeting its overall pumping targets. The overall

target average pump rate is 3.168 million gallons per day or 1,157 million gallons per year. Looking at the pumping data for FY 2009, FY 2010, FY 2011, and FY 2012, the NBCGRS, exceeded the monthly target rate of 96.4 million gallons in all months with the exception of: October, February, and April during FY 2009; October, April, and May during FY 2010; and October, November, February, and April during FY 2011. Looking at the total NBCGRS pumping volume for FY 2009, FY 2010, FY 2011, and FY 2012 of 1,222, 1,202, 1,266, and 1,410 million gallons, respectively, it is clear that the NBCGRS pumped substantially more than the yearly target rate. The overall adherence to the pumping targets supports the interpretation that the extraction system is operating in compliance with the amended ROD and is providing containment in the Prairie du Chien by maintaining the historical pumping rates at the NBCGRS. Pumping volumes and VOC mass removal for FY 2009, FY 2010, FY 2011, and FY 2012 are shown in Tables 2-3, 2-4, 2-5, and 2-6, respectively. Approximately 22,619 pounds of VOCs have been removed since system startup through the end of FY 2012. Historical annual mass removal and gallons pumped by the NBCGRS are shown on Figure 2-2.

Figure 2-3 shows groundwater elevation data, groundwater elevation contours, the 1 microgram per liter (µg/l) TCE plume contour, and approximate capture limit for Upper Unit 4 (Prairie du Chien) based on data from summer 2011. The contours on Figure 2-3 show the influence of pumping and suggest that the extraction system is providing containment of the contamination in the Prairie du Chien. The trichloroethene (TCE) plume in Upper Unit 3, Lower Unit 3, and Upper Unit 4 is shown on Figures 2-4, 2-5, and 2-6, respectively.

Trend graphs for TCE in NBM #3, #4, #5, #6, #14 and #15 are shown on Figure 2-7. At both NBM #3 and NBM #4, TCE decreased between the start of pumping in 1991 and 1998 and have been relatively stable since then. NBM#3 shows a slight upward trend since 1998. At NBM #5 and #6, TCE was trending downward in FY 2011, but remained within the historical range. At NBM #14, the TCE concentrations show a continuing trend below the cleanup level for TCE in OU1 (5µg/L), with the exception of the July 2011 sampling event. At NBM #15, the TCE continued to show a downward trend compared with historical values, although the trend has

leveled out somewhat since 2009. Overall, the water quality data from the extraction wells supports the interpretation that the system is providing aquifer restoration. The shorter term stability needs to be considered in the context of the overall plume behavior, as discussed with remedy component #6 below.

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 NBCGRS PGAC water treatment system at WTP1 consists of 16 GAC contactor vessels arranged in pairs, each pair having an "A" and a "B" vessel. Each contactor vessels contains about 20,000 pounds (dry weight) of GAC. The eight contactor vessel pairs are connected to a set of common manifold pipes (i.e. the eight pairs operate in parallel). Water is delivered to each contactor pair from the manifold pipes through an arrangement of valves that make up the control stand located between the vessels of the contactor pair. The control stand valves control the flow of water through the vessels to provide various modes of operation. Figure 2-8 shows the layout of WTP1. Figure 2-9 shows a schematic of the three-way valve piping and control stand in place at each contactor pair. In normal operation, the A and B vessels within a pair are operated in series mode in order to provide redundancy to assure that the effluent has been treated to remove TCAAP contaminants to non-detectable concentrations. In series mode, water passes from top to bottom through the GAC in the lead vessel, and then again from top to bottom through the GAC in the lag vessel of the pair. Either vessel (A or B) can be in the lead position and the other vessel will then be in the lag position. GAC in the lead vessel is removed and replaced with virgin GAC every six months. Once that virgin GAC has been prepared for use, and sampling and analysis confirm that the water quality meets all standards, then the control stand valves are reset to place that virgin GAC in the lag position, and the vessel that had previously been in the lag position is placed in the lead position. This assures that there is always a full bed of fresh unused (virgin) carbon in the lag position to remove any residual contaminants that may break through the lead vessel as that GAC reaches saturation (e.g. is unable to retain any additional contaminant mass). Spent GAC is trucked offsite for thermal regeneration (and thermal destruction of the

contaminants) and disposition. Each month samples are collected and analyzed from the effluent of the lead vessel of each contactor pair. Generally, the lead vessels have sufficient capacity to remove all of the contaminants to non-detectable concentrations for the full six-months of operation between GAC change-out events. However, on occasion the monthly lead vessel effluent monitoring results identify breakthrough prior to the scheduled GAC change-out event. This can occur, for example, if high volumes of water have been treated or if repairs or other factors have required some change in the operation. In this case, the sampling point shifts to the effluent of the lag vessel in the following month's sampling event in order to assure that the effluent of the contactor pair continues to meet the standard of non-detectable concentrations of TCAAP contaminants, as well as applicable drinking water standards for all other parameters. This is also confirmed with sampling of the combined effluent of all contactor pairs. PGAC effluent water quality for FY 2012 is documented in Table 2-7, showing the effectiveness of the treatment system. Table 2-7 shows that one carbon change-out occurred in FY 2012 in May 2012. It should be noted that carbon change-outs occurred immediately prior to and after FY 2012: one in September 2011 and one in October 2012.

Remedy component #6, groundwater monitoring, continues to be conducted to verify the performance of the remedy. Each fiscal year, a revolving, five-year monitoring plan is prepared by the Army and submitted to the USEPA and MPCA for approval via the APR. Although it covers five years, it is submitted on an annual basis to allow for minor changes to be made which streamline or improve the quality of the monitoring data to be collected.

Based on OU1 groundwater quality data presented in the FY 2009 and FY 2011 APRs, two VOCs exceed the cleanup levels specified in the OU1 ROD: TCE and 1,1-dichloroethene. The maximum TCE concentrations were 740 µg/l in FY 2009 and 750 µg/l in FY 2011 with a cleanup level of 5 µg/l. Maximum 1,1-dichloroethene concentrations were 49 μg/l in FY 2009 and 48 μg/l in FY 2011 with a cleanup level of 6 μg/l.

The statistical analysis of groundwater quality for the most recent major OU1 groundwater sampling event (FY 2011) indicated that, overall, there has been continuing improvement in the OU1 plume. The remedy component of decreasing contaminant concentrations is evident in the data presented in Appendix D.2 of the FY 2011 APR, with the area weighted concentration of the global plume mass wells having decreased from 51 µg/l in 1997 to 38 µg/l in 2011 (the global plume mass wells include approximately 50 wells throughout Unit 4 which reflect the overall VOC mass in the plume). It should be noted that the FY 2011 area weighted concentration is a slight increase over the area weighted concentrations of 32 µg/l reported in the FY 2009 APR; however, the trend in the global plume mass wells was found to be stable. In addition, the FY 2011 area weighted concentration is only slightly above the calculated mean value of 36.67 µg/l (calculated from 2001 to 2011 data). Trend graphs for all of the OU1 monitoring wells that are routinely monitored are included in Appendix B of the FY 2011 APR. These graphs illustrate the long-term changes that have occurred throughout OU1. Wells both upgradient and downgradient of the NBCGRS generally show decreasing or stable concentration trends. Decreases in concentrations can be attributed to a combination of:

1) Plume containment at the TCAAP boundary,
2) Mass removal through the OU1 extraction system, and
3) Natural attenuation.

Natural attenuation is not the prescribed remedy for OU1. However, in 2000, USEPA and MPCA published the results of a case study on natural attenuation at TCAAP. The report concluded, "that natural biodegradation complements the on-going efforts to extract contaminated groundwater at the source, and should greatly reduce the time required to reduce the concentration of contaminants to USEPA drinking water standards." Later USEPA/MPCA research concluded that the degradation process was abiotic due to reactive iron-bearing minerals within sampled soils; however, the conclusion that natural attenuation is occurring remains valid. Although the OU1 ROD states that contaminants are estimated to remain in the aquifer at

concentrations approaching but still exceeding cleanup levels for more than 100 years, natural attenuation will act to reduce the amount of time required to reach cleanup levels.

2.3.5 Site Inspection

The Army, MPCA, Minnesota National Guard, Wenck Associates, and USACE participated in a site inspection of the sites within OU2 on September 11, 2013; however, the above parties agreed that a site visit to the PGAC was not necessary, given the ongoing operational reliability and steady performance that the City of New Brighton has achieved in their operation of the PGAC. However, a site inspection checklist for OU1 was completed and is included as Appendix B.1.

2.3.6 Interviews

The Army assisted in identifying individuals who may be key to better understanding site status. Eight individuals were contacted via email on November 15, 2013 to participate in an interview on a voluntary basis. Responses were received by the following six people:

- Marty Skoglund, Environmental Program manager, Minnesota Army National Guard
- Lyle Salmela, RAB Co-chair
- Heather Worthington, Deputy County Manager, Ramsey County
- Karie Blomquist, ATK Corporate Safety & Environment
- Mike Fix, TCAAP Remedial Program Manager / Commander's Representative
- Thomas Barounis, USEPA Region V

Interview questions and responses are included in Appendix G. In general, interviewees had a positive overall impression of the project with respect to human health and environmental protection and felt remedies were being well maintained. In addition, all interviewees felt well informed of project activities. It appears the biggest impact to surrounding communities has

been the need to treat the large groundwater plume at the municipal water supply. Communities have expressed concerns about site impacts at various times in the past, but current concerns are not focused on restoration. Community concerns and input, voiced during participation in the Restoration Advisory Board, are currently focused on the property transfer and associated redevelopment of portions of TCAAP property. Instances of vandalism and trespassing were acknowledged, primarily to steal copper and other scrap metal; however, these instances have not impacted restoration activities. In addition, since the time that the County has occupied the transferred portions of TCAAP, trespass has declined significantly.

2.4 TECHNICAL ASSESSMENT

2.4.1 *Question A:* Is the Remedy functioning as intended by the decision documents?

The review of remedial action objectives, documents, and monitoring data indicate that the remedy is functioning as intended by the ROD (as amended). Decreasing contaminant concentration trends indicate that aquifer restoration is occurring. The PGAC continues to reliably treat recovered groundwater to drinking water standards as required by the OU1 ROD. The alternate water supply program continues to function as intended.

The O&M procedures remain adequate, given that the extraction system is effectively removing mass and is substantially containing contamination in the Prairie du Chien aquifer, and given that the PGAC continues to reliably treat recovered groundwater to drinking water standards. No changes to O&M procedures appear to be necessary. There have not been frequent equipment breakdowns, significant periods of unanticipated downtime, or O&M cost issues that would suggest any potential remedy problems. No opportunities for optimization were identified.

The LUC for OU1 is the MDH SWCA, which continues to function as intended. No changes are necessary for this remedy component.

2.4.2 *Question B:* Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The assumed route of exposure to contaminated groundwater remains valid (i.e., ingestion, inhalation during showering, and absorption through the skin during showering or bathing). No new exposure routes are applicable. No changes in land use have occurred that would have a bearing on the remedy. No new contaminants or contaminant sources have been identified.

The cleanup levels for OU1 are listed in Table A-2 found in Appendix A. These were based on consideration of the following Applicable or Relevant and Appropriate Requirements (ARARs), as identified in the OU1 ROD:

- MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) specified in the National Primary Drinking Water Regulations (40 CFR Part 141), which apply to public water supplies, and which were established by the USEPA in accordance with the Safe Drinking Water Act (SDWA).

- HRLs specified in Minnesota Rules (4717.7100 to 4717.7800), which can be applied to private water supplies, and which were established by the MDH in accordance with Minnesota's Groundwater Protection Act of 1989.

- RALs for Drinking Water Contaminants, Release 3, January 1991, prepared by the MDH.

The MDH RALs are no longer in use and have been superseded by the MDH's establishment of HRLs (now specified in Minnesota Rules (4717.7810 through 4717.7900). State of Minnesota MCLs are another potential ARAR that was not identified in the OU1 ROD; however, the State of Minnesota adopted the Federal MCLs. Therefore, consideration of State of Minnesota MCLs

would have no impact on potential cleanup levels. The cleanup levels developed in the OU1 ROD utilized the lowest value among the MCL, non-zero MCLG, HRL, and RAL. At the time of the OU1 ROD, two of the MCLs were identified as proposed, and only two HRLs were available (both identified as proposed). The review of the current regulations revealed that, for five of the six OU1 Chemicals of Concern (COCs), there are MCLs, MCLGs, and/or HRLs that have been established (none of which are qualified as proposed). One COC, 1,1-Dichloroethane, does not have an MCL, MCLG, or HRL. The cleanup level was based on the RAL of 70 µg/l, which is no longer in use. In 2009, the Minnesota Department of Health published a guidance value of 100 µg/l as the chronic Risk Assessment Advice (RAA) for 1,1-Dichloroethane. Using the current regulations, and applying the same methodology for identifying cleanup levels (i.e., using the lowest value among the MCL, non-zero MCLG, and HRL), yields the same cleanup levels that are listed in Table A-2 (found in Appendix A), except for 1,1-Dichloroethane and cis-1,2-Dichloroethene. 1,1-Dichloroethane has none of these promulgated values available; however, its cleanup level is below the MDH RAA. The chronic HRL for cis-1,2-Dichloroethene is 50 µg/l which is lower than the MCL-based cleanup level of 70 µg/l. However, the FY11 and FY12 sampling results show no exceedances of the lower value. No changes to the cleanup levels need to be considered based on this review.

It was noted that on July 1, 2007, the MDH HRLs were revised such that for any HRL that was set higher than the MCL, the new HRL is set equal to the MCL. For OU1, this affected two COCs: TCE and 1,1,1-trichloroethane. The HRL for TCE was revised from 30 to 5 µg/l and the HRL for 1,1,1-trichloroethane was revised from 600 to 200 µg/l. However, since the OU1 cleanup levels were already equal to the MCL for these two chemicals, there was no impact to the established cleanup levels.

In 2013, MDH updated its drinking water guidance for TCE due to new toxicity and health effects information. Although not an ARAR, the updated Health Based Value (HBV) for TCE is 0.4 µg/l, which is lower than the HRL and Federal MCL of 5 µg/l. The new guidance value does not affect current protectiveness because recovered groundwater is being treated in the City of

New Brighton PGAC facility and land use controls prevent use of contaminated groundwater. This new guidance value may need to be considered when OU1 nears closure,

The remedial action objectives for OU1 remain valid. No new objectives are proposed.

2.4.3 *Question C:* Has any other information come to light that could call into question the protectiveness of the remedy?

No information has been obtained that could call into question the protectiveness of the remedy.

2.4.4 Technical Assessment Summary

Based on the remedial action objectives, the data reviewed, and the site inspection, the remedy is functioning as intended by the OU1 ROD (as amended). O&M information and costs do not suggest any potential remedy problems. No changes in land use or exposure scenarios have occurred that would affect the protectiveness of the remedy. The ARARs used in establishing cleanup levels have undergone some changes (proposed values in regulations have become final, MDH RALs are no longer applicable, more MDH HRLs have been established, and some HRLs have been revised); however, none of these changes suggest that revisions to the cleanup levels should be considered. No information has been obtained that could call into question the protectiveness of the remedy.

2.5 ISSUES

None.

2.6 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

None.

2.7 PROTECTIVENESS STATEMENT

The remedy at OU1 is protective of human health and the environment.

The alternate water supply and well abandonment program, along with the SWCA, are mitigating potential risks associated with private wells. The PGAC is reliably providing a safe municipal water supply. Water quality trends indicate that progress towards aquifer restoration continues to occur.

3.0 Operable Unit 2 (OU2)

3.1 REMEDIAL ACTIONS

3.1.1 Remedy Selection

The OU2 ROD, signed December 1997, prescribed the following components for the selected remedy. Components added with the 2007 ROD Amendment #1, the 2009 ROD Amendment #2, the 2009 ROD Amendment #3, the 2009 Explanation of Significant Differences (ESDs), and the 2012 ROD Amendment #4 are shown in italics.

1) Shallow Soil Sites: Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range had inorganic and/or organic contaminants above site cleanup goals. Unpermitted landfills, or dumps, exist within Sites A, B, E, H, and 129-15. Sites B and 129-15 are included solely as dumps. The selected remedy for the shallow soil sites will attain the site cleanup levels specified in the OU2 ROD and will include the following activities:

   - Identification/characterization of contaminated soil boundaries, surface and subsurface debris for Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range;
   - Excavation and sorting of hazardous and non-hazardous materials, debris and ordnance for Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range;
   - Removal and disposal of ordnance, debris and oversized material for Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range;

- On-site treatment (stabilization) of hazardous soils from Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range in the TCAAP Corrective Action Management Unit (CAMU);
- Off-site disposal of contaminated soils above site specific cleanup goals from Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range;
- Backfill/regrade excavations on Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range;
- Restrict site access and use during remedy implementation;
- Five-year period of groundwater monitoring to verify no adverse remedy impacts at Sites A, C, E, H, 129-3, and 129-5;
- *Three-year period of Groundwater monitoring at the Grenade Range (ROD Amendment #3);*
- *Construct a protective soil cover over PAH-impacted soil at the 1900 Yard Range of the Outdoor Firing Range (ROD Amendment #3);*
- Characterization of dumps at Sites B and 129-15 to determine their contents. If contents are found to be toxic, hazardous, or contaminated, then a remedy for the landfill will be utilized and documented through a post-ROD Amendment or ESD. If the contents are not toxic, hazardous, or contaminated, a no further action remedy would be employed; and
- *After partial excavation of contaminated soil at Site C, construct a protective soil cover to create a barrier between the ground surface and the contaminants remaining in-place, installing a minimum of 4 feet of clean soil above contaminated soil and also above the contaminated sediment in the north-south and east-west surface water ditches in the site vicinity, thus backfilling the ditches, and implement LUCs to protect the soil cover and restrict land use to industrial. Also*

construct a new wetland to replace the loss of existing wetland due to backfilling the ditches (ROD Amendment #1).

- *The OU2 ROD Amendments and ESDs made LUCs 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. LUCs are also necessary to protect the integrity of the soil covers constructed at various sites (ROD Amendment #3 and ESDs).*

2) Deep Soil Sites (D and G): These sites were impacted primarily by VOC contaminants at depths of 50 to 170 feet. Some additional shallow soil contaminants existed at Site D. Site G also contains a dump. The selected remedy for these sites will attain the site cleanup levels specified in Table 1 of the OU2 ROD and will include the following activities:

- Groundwater monitoring;
- Restrict site access and use during remedy implementation;
- Install and operate deep soil vapor extraction (SVE) systems with a modified shallow SVE system;
- Evaluate and potentially use enhancements to the SVE systems;
- Maintain existing site caps;
- Maintain surface controls; and
- Following the completion of the SVE remediation of deep soils, characterize the Site D shallow soils and the Site G dump to determine the appropriate action.

3) Shallow Groundwater Sites (A, C, I, K, and Building 102): Sites A, I, K, and Building 102 have been primarily impacted by VOCs, and Site C has been impacted by lead. The selected remedy for Site A shallow groundwater will attain

the site cleanup levels specified in Table 1 of the OU2 ROD and includes the following activities:

- Groundwater monitoring to track plume migration and remedy performance;
- Use of existing gradient control wells to contain the contaminant plume and remove mass;
- Institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary (OU2 ESD #1 clarified the LUC component to include protection of the groundwater monitoring and extraction system infrastructure);
- Discharge of extracted groundwater to a publicly owned treatment works (POTW); and
- Source characterization/remediation.

The selected remedy for Site C shallow groundwater will attain the site cleanup levels specified in Table 1 of the 2007 ROD Amendment #1 and includes the following activities:

- *Groundwater and surface water monitoring to verify plume containment and remedy performance, and with a contingency plan to contain and treat contaminated surface water, if necessary (ROD Amendment #1);*
- *Use of existing gradient control wells to contain the contaminant plume (ROD Amendment #1);*
- *Discharge of extracted groundwater to a POTW (ROD Amendment #1); and*

- *LUCs to restrict new well installations within the plume area and to protect the extraction, treatment, and monitoring systems (ROD Amendment #1).*

The selected remedy for Site I shallow groundwater will attain the site cleanup levels specified in Table 1 of the OU2 ROD and includes the following:

- Groundwater monitoring to track remedy performance;
- Additional characterization of the Unit 1 and Unit 2 soil and groundwater; and
- *LUCs to protect the groundwater monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer (ROD Amendment #1).*

The selected remedy for Site K shallow groundwater will attain the site cleanup levels specified in Table 1 of the OU2 ROD and will include the following activities:

- Groundwater monitoring to track remedy performance;
- Installation of sentinel wells at the bottom of Unit 1 and to the top of Unit 3;
- Use of the existing interceptor/recovery trench to contain the plume and remove impacted groundwater;
- Treatment of extracted groundwater using air stripping;
- Discharge of treated groundwater to Rice Creek;
- Monitoring to track compliance with discharge requirements;
- Additional characterization of the unsaturated Unit 1 soil; and
- *LUCs 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 (ROD Amendment #1).

The selected remedy for Building 102 shallow groundwater will attain the site cleanup levels specified in the 2012 OU2 ROD Amendment #4 and will include the following:

- *Use of naturally-occurring abiotic degradation to limit plume mobility and to ultimately restore the aquifer (Amendment #4);*
- *Groundwater monitoring to track remedy performance and to verify that groundwater reaching Rice Creek do not exceed state surface water standards (Amendment #4); and*
- *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)(Amendment #4).*

4) Aquatic Site: Pond G. The selected remedy for Pond G will comply with the Class 2B Minnesota surface water quality standard for lead per the 2012 OU2 ROD Amendment #4 and includes the following:

- *Chemical alteration of Pond G surface water hardness; and*
- *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 (Amendment #4)*

5) Deep Groundwater: Includes the deep groundwater plume that underlies the southwestern portion of OU2 and originated primarily from Sites D, G, and I. The selected remedy for Deep Groundwater will attain the site cleanup levels specified in Table 1 of the OU2 ROD and includes the following activities:

- Groundwater extraction to hydraulically contain the contaminated groundwater source area to the 5 μg/l TCE concentration contour and optimize the removal of contaminants from the source area through pumping of selected wells;
- Groundwater treatment using air stripping;
- Discharge of treated groundwater to the on-site gravel pit;
- Institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater;
- Reviews of new and emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration. Reviews shall be performed by Army and reported on annually in accordance with the consistency provisions of the TCAAP Federal Facility Agreement; and
- Groundwater monitoring to track remedy performance.

The ROD addressed the RAOs for the shallow soil sites, the deep soil sites, and groundwater, which were previously developed as part of the OU2 Feasibility Study (March 1997), as follows (the objectives added with the ROD Amendments are shown in italics). The 2012 ROD Amendment #4 also addressed the Remedial Action Objective for Building 102 Groundwater and Pond G which were previously developed as part of the 2008 Engineering Evaluation/Cost Analysis (EE/CA) and the 2010 Feasibility Study, respectively.

1) Shallow Soil Sites:

Defined as the surface soils 0 to 12 feet below ground surface. The following remedial action objectives are designed to protect human health and the environment under the current and most probable future land use (industrial) scenario from exposure to contaminants in shallow soils at the TCAAP site:

a) Prevent on-site human exposure by means of ingestion and dermal contact with contaminants in the surface soils *(or surface water sediments at Site C)*.

b) Prevent human exposure by means of ingestion, dermal contact, and inhalation of contaminants in shallow soils *(or surface water sediments at Site C)* during any future construction activities at the site.

c) Prevent the migration of contaminants from shallow soils to waters of the state that would result in dissolved contaminant concentrations in excess of ARARs and To Be Considered (TBCs).

2) Deep Soil Sites (D and G): Defined as soils from 12 feet below ground surface extending down to the water table. The following remedial action objective is designed to protect human health and the environment from exposure to contaminants in deep soils at the TCAAP site:

a) Prevent the migration of contaminants from deep soils to groundwater that would result in dissolved contaminant concentrations in excess of groundwater ARARs and TBCs.

3) Groundwater: Defined as the groundwater directly beneath the TCAAP (OU2) site. The remedial action objectives are designed to protect human health and the

environment from exposure to contaminants in groundwater beneath the TCAAP site.

a) Prevent human exposure to water contaminated with carcinogens in excess of ARARs and having a total excess cancer risk from all contaminants of greater than 10^{-4} to 10^{-6}.

b) Prevent human exposure to water with concentrations of noncarcinogens greater than ARARs and having a threshold noncancer hazard index greater than 1.0.

c) Contain and control contaminated groundwater in the shallow Unit 1 groundwater aquifer to prevent further spreading and minimize the level of contaminants through mass removal.

d) For Site C, protect human and ecological receptors from unacceptable risk associated with ingestion and dermal exposure to surface water above surface water chronic standards (Amendment #1).

e) Restore the contaminated aquifers to concentrations below ARARs and TBCs.

f) Contain the deep Units 3 and 4 groundwater plume source area while also maximizing mass removal.

g) For Building 102 Groundwater, protect human receptors from exposure to contaminated groundwater above acceptable risk levels (Amendment #4).

h) For Building 102 Groundwater, prevent contaminated groundwater from discharging into surface water above regulatory limits (Amendment #4).

i) For Building 102 Groundwater, minimize further degradation of the shallow Unit 1 groundwater (Amendment #4).

4) Aquatic Site: Pond G. The remedial action objective is designed to protect the aquatic ecosystem.

a) Comply with the Class 2B Minnesota surface water quality standard (Amendment #4).

3.1.2 Remedy Implementation

Shallow soil site remediation was initiated in FY 1998 beginning with Site A. The TCAAP CAMU was constructed to aid in cleanup of the sites. The CAMU consisted of a bermed, asphalt pad with lined ponds for storage of rainwater from the pad. As envisioned in the OU2 ROD, the CAMU was intended to be a central staging area, where soils from each of the individual sites would be brought for treatment prior to loading for off-site disposal at a permitted landfill. However, discovery of asbestos-containing material (ACM) at shallow soil sites in FY 1999 rendered further use of the CAMU impractical, because the additional safeguards necessary to control asbestos during handling defeated the cost savings associated with the central processing pad. It was found to be more convenient and cost-effective to treat the soil at each individual site. The CAMU was removed in late FY 2002 and early FY 2003. Closure included decontamination and removal of the storage pad and storm water holding ponds, testing beneath the pad and ponds, and groundwater monitoring. The CAMU Closeout Report received consistency (i.e. regulatory approval) in FY 2004, which states that there were no adverse impacts to soil or groundwater due to CAMU operations and that no LUCs are required for this area.

Shallow Soil Sites

The shallow soil site remediation work has been completed at Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range. Protective soil covers have been constructed over portions of Sites E and H where ACM remains in-place, over portions of Site C where metals-contaminated soils (and sediment from the former surface water ditches) remain in-place, and at the 1900 Yard Range of the Outdoor Firing Range where PAH-contaminated soils remain in place. Construction of a new wetland at Site C (to replace the loss of existing wetlands when the ditches were backfilled) has been completed. The five-year period of groundwater monitoring to verify no adverse remedy impacts to groundwater beneath shallow soil sites was conducted from FY 2003 through FY 2007, and was temporarily extended for Site H (see Section 3.3.4). This sampling has been completed and was conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR. For the Grenade Range, the three-year period of groundwater monitoring to verify no adverse remedy impacts to groundwater beneath the site was initiated in FY 1999 and completed in FY 2004 with no further monitoring required. The investigation of the dump at Site 129-15 has been completed, the selected remedy (protective soil cover) has been constructed, and the selected remedy documented in the 2009 OU2 ROD Amendment #3.

Deep Soil Sites (D and G)

The remediation of VOC contamination (both shallow and deep soils) has been completed and the SVE systems have been dismantled. Investigation of Site D non-VOC contaminants has been completed, the selected remedy (excavation, treatment by stabilization, and off-site disposal) has been completed, and the selected remedy documented in the 2009 ROD Amendment #3. This amendment also documents the protective soil cover to be maintained at Site D where PCB-contaminated soil was "secured-in-place". The Site D Closeout Report recommended that Site D be added to the list of shallow soil sites for the five-year period of groundwater monitoring (to verify no adverse remedy impacts), and this monitoring has been completed. The Site G dump was determined to have been adequately characterized, and the selected remedy, a protective soil cover, has been completed. Remedy selection for the Site G

dump is documented in the 2009 ROD Amendment #3. Groundwater monitoring (for VOCs) near the vicinity of these sites is being conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR.

Site A Shallow Groundwater

The containment system, which began operation May 31, 1994, originally consisted of eight extraction wells installed along two lines downgradient of the source area. The four extraction wells that were furthest from the source area were shut off on July 11, 2000, since their VOC concentrations were below cleanup levels. In FY 2008, the Army prepared (and the USEPA and MPCA approved) an evaluation report of the remedy for Site A shallow groundwater, which recommended that the four operating extraction wells be shut off and that monitored natural attenuation (MNA) be implemented. Natural attenuation is occurring through an abiotic process, as further discussed in Section 3.3.4. Following USEPA and MPCA approval of a monitoring and contingency plan, the extraction wells were shut off on September 24, 2008, and were placed in standby. If ongoing monitoring shows that MNA is not adequately controlling plume migration, then the extraction well(s) will be turned back on. Otherwise, when the Army, USEPA, and MPCA are satisfied that MNA is effective, a ROD amendment or ESD will be prepared to formally document the change. The length of the trial MNA period was originally anticipated to be three to five years; however, review of future water quality data in APRs will ultimately determine when the USEPA, MPCA, and Army are comfortable that the extraction system can be dismantled and the remedy formally changed to MNA. Groundwater quality trends continue to be observed to ensure stabilization at acceptable levels. An additional year or two of monitoring is anticipated to provide final confirmation that a formal change to MNA should be made. The end of FY 2012 was the end of the fourth year since the extraction wells were shut off. When operating, extracted groundwater was discharged directly (i.e., no pretreatment is necessary) to the sanitary sewer for treatment at a POTW. The MDH SWCA (issued in June 1996) encompasses the portion of the Site A plume that extends off the north end of TCAAP (see discussion in Section 2.1.3), and the Alternate Water Supply and Well Abandonment Program has been implemented and is maintained by the Army (refer to Section

2.1.2 for additional information). Source characterization has been completed, and the selected remedy (excavation and off-site disposal) has also been completed, as documented in 2009 ESD #1. Sampling is conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR.

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 USAEC sponsored a technology demonstration project to phytoremediate lead-contaminated soil at Site C. During the growing seasons, ethylenediaminetetraacetic acid 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 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 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 after review and approval of an extraction system evaluation report), since the groundwater concentrations in the three extraction wells had been below the groundwater cleanup level since March 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 extraction system evaluation report presented the monitoring plan and contingency actions to be implemented at the point that the extraction wells were shut off, and these were subsequently incorporated into the APR. If it is proven that extraction system operation is no longer necessary, the remedy could be formally changed through either an ESD or 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. As discussed in Section 3.4.1, only one monitoring well with steadily decreasing trends currently exceeds the groundwater cleanup level. Based on this data, cleanup goals could potentially be reached within the next few years.

Site I Shallow Groundwater

Additional investigation work is complete. Results led to proposing a dual-phase extraction remedy (combining groundwater extraction and soil vapor extraction). However, pilot testing of a dual-phase extraction system determined that the technology was not feasible due to low permeability of the soils (a conclusion agreed to by USEPA and MPCA). The 2009 ROD Amendment #2 changed the preferred remedy from groundwater pump and treat to a groundwater monitoring based remedy. The monitoring based remedy is appropriate since the Unit 1 plume is not migrating offsite; rather, the Unit 1 contaminants leak downward into Unit 3, where groundwater contamination is hydraulically contained by the TCAAP Groundwater Recovery System (TGRS). Sampling is conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR.

Site K Shallow Groundwater

The containment system, which began operation August 1986, consists of a groundwater extraction trench. Extracted groundwater is treated by air stripping prior to discharge to a storm sewer that, in turn, discharges to Rice Creek. Effluent water quality must meet the substantive requirements of Document No. MNU000579 (MPCA), which contains the state-accepted discharge limits for surface water. Sentinel well installation, one at the bottom of Unit 1 and one at the top of Unit 3, has been completed. These wells monitor the potential for VOCs to migrate through Unit 2 and into Unit 3.

The additional investigation work has been completed and the source area was further defined. Although not required by the OU2 ROD, pilot studies of two groundwater remediation technologies were conducted: Hydrogen Release Compound (HRC) and direct hydrogen

injection with gas-permeable membranes. The use of HRC was not effective. The direct hydrogen injection yielded promising results, but was determined to not be cost effective. Sampling is conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR. As designed, the groundwater collection system provides hydraulic capture of Unit 1 groundwater, upgradient of the trench and beneath the existing slab of former building 103.

Building 102 Shallow Groundwater

Building 102 was not included in the original OU2 ROD. Building 102, the large building located immediately south of Site K, 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 in FY 2006. This report recommended that an EE/CA be performed. 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 TCE and related chlorinated VOCs. The EE/CA documenting the additional investigation work and recommending a remedy for the Building 102 groundwater (monitored natural attenuation) was approved in FY 2008. The Army Action Memorandum documenting the final remedy selection for Building 102 groundwater was signed early in FY 2009. The 2012 ROD Amendment #4 formally documented selection of MNA and LUCs for the Building 102 groundwater remedy. Sampling is conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR.

Aquatic Sites

The Aquatic Sites (Rice Creek, Sunfish Lake, Marsden Lake North, Marsden Lake South, and Pond G) were not included in the original OU2 ROD.

Between 1992 and 2004, ecological risk assessment work was conducted for five water bodies: Rice Creek, Sunfish Lake, Pond G, Marsden Lake, and Round Lake. The first four are located on the original TCAAP property (i.e. in OU2), while Round Lake is off the installation (outside OU2). Work on the feasibility study was initiated in 2005 and a draft report was submitted in June 2005. It was set aside until 2007 due to ongoing negotiations outside the Superfund program. During 2007 and 2008, meetings were again held to resume the feasibility study discussions. As a result of comments on the 2005 draft feasibility study, it was agreed to conduct additional sampling of Marsden Lake and Pond G, which was completed in 2008. Revised versions of the draft feasibility study were submitted in January 2009 and in April 2010. After review of the 2010 draft feasibility study, the regulators 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 and regulators agreed to separate the feasibility study into two documents; one for Round Lake and one for the OU2 aquatic sites (Rice Creek, Sunfish Lake, Marsden Lake North, Marsden Lake South, and Pond G).

Regulators approved the feasibility study for the aquatic sites (Rice Creek, Sunfish Lake, Marsden Lake North, Marsden Lake South, and Pond G) 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. OU2 ROD Amendment #4, signed in 2012, documents selection of the recommended alternatives for the aquatic sites. With respect to Pond G, the ROD amendment formally documented selection of surface water hardness adjustment and thereby added this site to the OU2 remedy.

Regulators approved the Pond G Remedial Design/Remedial Action (RD/RA) Work Plan in March 2012, and the pond was treated in June 2012.

Deep Groundwater

The Boundary Groundwater Recovery System (BGRS) was started on October 19, 1987, and consisted of six Unit 3 extraction wells located on TCAAP near the southwest property boundary. Six additional boundary extraction wells (in Unit 3 and Unit 4), and five source control wells (Unit 3) were added to this system, which became the TGRS. The expanded TGRS system began operation on January 31, 1989, providing hydraulic containment of contaminated groundwater to the 5 μg/l TCE concentration contour and providing source area contaminant removal. Due to narrowing of the plume width and due to modifications in the TGRS operating strategy, operation of some of the TGRS extraction wells has been ceased (B7, B10, B12, SC3, and SC4) and one extraction well has been replaced (B13 replaced B2). In FY 2003, the Army received agency approval on the TGRS Operating Strategy document, which satisfies the ROD requirement to optimize the TGRS. The Operating Strategy 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 for selected well groups. Since then, evaluations have compared actual pumping rates to those rates presented in the Operating Strategy. The TGRS system operation has changed to conform to the Operating Strategy since FY 2003. Under the Operating Strategy, groundwater is extracted from 8 wells along the southwest boundary of TCAAP (B1, B3, B4, B5, B6, B8, B9, and B13) and three wells downgradient of interior source areas on TCAAP (SC1, SC2, and SC5). Wells B2, B7, B10, B11, B12, SC3 and SC4 are not currently operating components of the system. Water from the extraction wells discharge into a common pressurized 12-inch force main that carries the extracted groundwater to the TGRS air stripping treatment system.

The TGRS treatment system was modified in FY 2011 and since then groundwater has been effectively treated by two air stripping towers instead of the original design of 4 air stripping towers. This modification resulted in a reduction of energy use while still meeting the effluent

discharge limit of 5 µg/L TCE. The TGRS discharges treated water to the former Arsenal Sand and Gravel Pit.

New and emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration are discussed in the APR. Sampling is conducted in accordance with groundwater monitoring plans that are reviewed and updated annually as part of the APR. LUCs are being implemented by the Army.

No Further Action Remedy Selection

Site B

At Site B, characterization revealed that a no further action remedy was appropriate. Very little debris was observed in investigation trenches, indicating that little disposal had occurred at this site. The contents of the dump were determined not to be toxic, hazardous, or contaminated. No constituents were found to exceed the risk-based Preliminary Remediation Goals (PRGs), and no COCs were identified for Site B. The Site B Closeout Report received consistency in FY 2001. ESD #2, finalized in 2009, documented that No Further Action was the final remedy for Site B. Since Site B does not contain hazardous substances at levels that would prevent unlimited use and unrestricted exposure, it is not covered by this five-year review.

135 Primer/Tracer Area, Stormwater Outfall

A stormwater outfall from the 135 Primer/Tracer Area resulted in contamination of ditch sediments with polycyclic aromatic hydrocarbons (PAHs). This contamination was on a parcel of land (Rice Creek Area) that was transferred to Ramsey County, and action at this area was expedited to facilitate the transfer. In fall 2005, approximately 1,256 tons of contaminated sediments were excavated and transported for off-site disposal at a permitted landfill, achieving unrestricted use cleanup levels. The closeout report for this removal action was approved in FY 2006. Amendment #3 to the OU2 ROD, signed in 2009, states that the completed removal action constitutes the final remedy for the ditch, with no further action required and unrestricted use.

Since the stormwater ditch does not contain hazardous substances at levels that would prevent unlimited use and unrestricted exposure, it is not covered by this five-year review.

535 Primer/Tracer Area

The 535 Primer/Tracer Area consists of Building 535 and building foundations and grounds that were used for production of component primers and tracing compounds associated with TCAAP small caliber ammunition production. The EE/CA recommending a remedy for contaminated soils (excavation, stabilization (if necessary) and disposal in an off-site permitted landfill) received regulatory approval in January 2009. The Army then prepared the Action Memorandum, signed March 20, 2009, which selected the recommended remedy. The remedy was implemented from August to September 2009. The quantity of contaminated soils removed and disposed was 148 tons of lead-contaminated soils and 734 tons of PAH-contaminated soils. The removal action work was documented in the closeout report which received regulatory approval in January 2010. It should be noted that the closeout report for the soil removal stated that "because the cleanup levels were based on industrial use, LUCs will be required." Later review of the data from the excavation areas revealed that sample locations were actually less than the residential soil reference values if a revised method of calculating the benzo[a]pyrene equivalent was used. In effect, the revised method utilized a different method for handling "non-detect" results. Amendment #4 to the OU2 ROD, signed in 2012, states that the completed removal action eliminated the risks and potential risks to human health and the environment associated with the contaminated soil in the vicinity of the 535 Primer/Tracer excavation areas; therefore, no further action is necessary. The soil in the vicinity of the 535 Primer/Tracer soil excavation areas is cleaned up for unrestricted use, with no LUCs required. Since the535 Primer/Tracer soil excavation areas do not contain hazardous substances at levels that would prevent unlimited use and unrestricted exposure, it is not covered by this five-year review.

It should be noted, LUCs for soils in other areas within the 535 Primer/Tracer Area (outside the excavation areas) are as defined in the OU2 Land Use Control Remedial Design (LUCRD), approved by the USEPA and MPCA in September 2010.

Site K Soil Removal

Site K consists of former Building 103 and surrounding area. The OU2 ROD prescribed a remedy for shallow groundwater contamination at Site K and required further source area investigation, but did not include a remedy for VOC-contaminated soil beneath Building 103 because there was active production in the building at that time. Since then, production operations have ceased and the building was removed in FY 2006 (the concrete slab remains). An EE/CA was approved in late FY 2008, which recommended excavation and off-site disposal at a permitted landfill for the contaminated soil. The Army Action Memorandum was signed early in FY 2009. The remedy was implemented from June to August 2009. The quantity of contaminated soil removed and disposed was 41 tons. The removal action work was documented in the completion report which received regulatory approval in August 2009. Post-excavation verification testing demonstrated that the remaining soil concentrations were not only below the industrial use soil reference values (SRVs), but also below the residential SRVs. Amendment #4 to the OU2 ROD, signed in 2012, states that the completed removal action eliminated the risks and potential risks to human health and the environment associated with the contaminated soil in the vicinity of the Site K excavation area; therefore, no further action is necessary. The soils in the vicinity of the soil excavation area are acceptable for unrestricted use (with respect to unsaturated soils) and no LUCs are required. Since these Site K soils do not contain hazardous substances at levels that would prevent unlimited use and unrestricted exposure, it is not covered by this five-year review.

It should be noted, LUCs for soils in other areas within Site K (outside the excavation areas) are as defined in the OU2 LUCRD, approved by the USEPA and MPCA in September 2010. The groundwater remedy (and associated LUCs) will continue to be implemented until groundwater cleanup levels are attained.

3.1.3 Land Use Controls

LUCs are required to ensure the protectiveness of the various OU2 remedies. LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health and the environment (Department of Defense Policy on Land Use Controls Associated with Restoration Activities, 2001). The OU2 ROD prescribed the following LUCs:

- For soil sites: "Restrict site access and use during remedy implementation."
- For shallow groundwater Site A: "Institutional controls to restrict new well installations."
- For deep groundwater: "Institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater."

Beginning with the first five-year review in 1999, it was realized that the requirements for land use controls set forth in the OU2 ROD were incomplete. For example, the ROD prescribed institutional controls for soil sites during remedial construction, but did not make it clear that controls were needed into perpetuity because the sites were to be remediated to site-specific "industrial use" levels. Also, controls were not specified for shallow groundwater at Sites I and K, and the control for Site A was focused on the portion of the plume off-TCAAP, and not contamination on-TCAAP. Accordingly, the Army began discussions with the USEPA and MPCA regarding how best to clarify the true needs for LUCs and the process for approval and enforcement. In the meantime, the Army implemented the ROD-prescribed "short-term" LUCs through restricting public access to the installation. At about the same time the installation-level LUC discussions began, there was a federal-level debate between the Department of Defense and USEPA regarding LUCs in RODs and enforceability. This federal-level debate slowed down progress at the TCAAP-level. The federal-level debate was resolved in 2003. At about this time, the Army, USEPA, and MPCA were contemplating revising the remedy for Site C shallow soil (along with adding remedies for sediment, groundwater, and surface water at Site C). It was agreed to

use the Site C ROD Amendment as the vehicle to flesh out and resolve LUC issues, which would then pave the way for other OU2 ROD modifications to address LUCs for all the sites. Recognizing that this process could still take some time, the Army elected in 2003 to implement interim LUCs on a voluntary basis. The interim LUCs consisted of land use approvals being needed from the TCAAP Commander's Representative for property controlled by the Base Realignment and Closure Division, and land use approvals being needed from the Site Coordinator for property controlled by the Army National Guard. The LUC issues between the Army, USEPA, and MPCA were resolved in 2009 through signature of two ESDs and two Amendments to the OU2 ROD that set forth and clarified the requirement for LUCs as part of the OU2 remedies. Also, a LUCRD was prepared and approved by the USEPA and MPCA in September 2010 and revised in June 2011. The LUCRD includes the LUC areas (with maps), the LUC objectives, and LUC implementation mechanisms. The LUCRD also addresses "blanket" soil and groundwater LUCs for the remaining federally-owned property within OU2. "Blanket LUCs" were implemented because past investigative work focused on areas suspected to have had a release of hazardous substances to the environment, and not the entire OU2 land area. Although there is not a decision document for the land outside the individual investigated/remediated areas, the U.S. Army has elected to implement "blanket LUCs" for soil and groundwater across a significant portion of the federally-owned property as a practical way to address this matter. The following exceptions are made with respect to the "blanket" soil LUCs:

- Through the land transfer process, 113 acres of mostly open space along Rick Creek were transferred to Ramsey County without any use restrictions.
- The MPCA and USEPA have agreed the former staff housing area is presumed suitable for residential use (unrestricted use).
- Site F was remediated to unrestricted use levels.
- An area known as the "watchable wildlife area" was cleared for unrestricted use.
- A portion of the cantonment area within the Arden Hills Army Training Site was revised to uses compatible with a restricted commercial exposure scenario.

The LUCs for OU2 are summarized in Table 2-1.

3.1.4 System Operations/Operation and Maintenance

Soil Sites

For the soil sites, O&M procedures are limited to maintaining the cautionary signs around the perimeter of each protective soil cover. These signs are in place at all of the soil cover sites. O&M would also include repair of any damage that compromises the thickness requirements for a protective soil cover; however, no such damage occurred during the period of this five-year review. Costs for O&M were not obtained or evaluated, due to the minimal nature of the O&M effort.

Groundwater Sites A and C

For the groundwater at Site A and Site C, the Army maintains groundwater recovery systems; however, these systems have been shut off since 2008 to evaluate MNA effectiveness. If MNA eventually becomes the approved remedy for Site A and Site C shallow groundwater, the O&M costs will remain much lower going forward.

Groundwater Sites K and the TGRS

Alliant operates and maintains the Site K groundwater recovery system directly and also operates and maintains the TGRS in accordance with an Army/Alliant apportionment agreement. The O&M procedures at both sites have been sufficient to ensure reliable water treatment to the applicable standards and to ensure that the pumping targets for groundwater extraction rates are met with adequate consistency.

At Site K, the groundwater extraction trench and treatment system continue to operate as designed and no significant O&M problems are evident. Annual O&M costs are proprietary and, therefore, not included in the site inspection checklists (Appendix B). No significant O&M problems are evident.

The TGRS continues to operate at a rate deemed sufficient for complete capture of the 5 μg/L TCE contour and to maintain hydraulic containment. APRs since 2007 have noted that annual TGRS extraction averaging greater than 1745 gallons per minute (the GOS total operation minimum) is a point "where the Army and agencies agree that capture is achieved with an adequate safety factor. No significant O&M problems are evident. Annual O&M costs are summarized in the site inspection checklists (Appendix B). O&M costs for this site have been less than or comparable to the original O&M cost estimates.

3.2 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The prior five-year review concluded that the components of the OU2 remedy remained protective of human health and the environment in the short term. There were several other issues noted for OU2 in the prior five-year review.

It was noted that the remedy for Site I shallow groundwater was not functioning as intended because pilot testing of a dual-phase extraction system determined the technology was not feasible due to low permeability of the soils (a conclusion agreed to be USEPA and MPCA). Since the last five-year review, the 2009 OU2 ROD Amendment #2 changed the preferred remedy from a groundwater pump and treat to a groundwater monitoring based remedy. The monitoring-based remedy is appropriate since the Unit 1 plume is not migrating offsite; rather, the Unit 1 contaminants leak downward into Unit 3, where they are hydraulically contained by the TGRS.

It was noted that two OU2 ROD amendments and two ESDs were in progress at the end of FY 2008 that would formally adopt LUCs as a component of the remedies. The noted ROD Amendments (#2 and #3) and the ESDs (#1 and #2) were approved in 2009. In addition, preparation of the OU2 LUCRD was in progress at the end of FY 2008. The LUCRD was approved by USEPA and MPCA in September 2010 and revised in June 2011. Together, these documents formally adopt LUCs as a component of the OU2 remedies.

It was noted that since there are no potential receptors at TCAAP, vapor intrusion is not an issue at TCAAP under the current land use. If TCAAP land use changes in the future, it would be appropriate to evaluate whether the vapor intrusion exposure pathway is complete, and if so, whether it poses an unacceptable risk to human health.

It was noted that the HRL changes had no short-term impacts to the groundwater cleanup levels for Sites A, I, and K; however, if any of these three sites approach the point of site closure, then a change in cleanup level(s) may be appropriate. The MDH continues to evaluate additional HRL revisions.

It was noted that the need to operate the Site A groundwater extraction system to achieve groundwater containment and mass removal is being evaluated, and ongoing monitoring is being conducted to determine if MNA will adequately control plume migration. Since the recovery wells were shut off near the end of the last five-year review period (on September 24, 2008), data was not yet available for evaluation. Currently, the system remains shut off and monitoring data was reviewed for this five-year review.

3.3 FIVE-YEAR REVIEW PROCESS

3.3.1 Administrative Components

Administrative components were as described for OU1 (see Section 2.3.1).

3.3.2 Community Notification and Involvement

Community notification was conducted as described for OU1 (see Section 2.3.2).

3.3.3 Document Review

The primary documents reviewed for OU2 were the following:

- Record of Decision - Operable Unit 2, 1997
- Record of Decision Amendment #1 - Operable Unit 2, Site C-2, 2007
- Record of Decision Amendment #2 - Operable Unit 2, Site I Groundwater, 2009
- Record of Decision Amendment #3 - Operable Unit 2, 2009
- Record of Decision Amendment #4 - Operable Unit 2, 2012
- Explanation of Significant Differences #1 - Operable Unit 2, Changes for Groundwater Sites, 2009
- Explanation of Significant Differences #2 - Operable Unit 2, Changes for Soil Sites, 2009
- TCAAP Final APRs for Fiscal Years 2009, 2010, 2011, and 2012
- Previous Five Year Review Report, August 2009
- TGRS Operating Strategy, 2003 (and subsequent modifications)
- Land Use Control Remedial Design - Operable Unit 2, 2011

The OU2 ROD and amendments were the source of information for remedial action objectives and cleanup levels. The FY 2012 APR was the primary source for determining status at the end of this five-year review period and for monitoring data at the sites which are monitored annually. The FY 2011 APR was the primary source for monitoring data for OU2 deep groundwater, since this report contains the most recent major sampling event. Site closeout reports were also reviewed, as necessary.

3.3.4 Data Review

The status of OU2 remedial actions is summarized in Table 2-2.

Shallow Soil Sites

Shallow soil site remediation has been completed. After the OU2 LUCRD was approved in 2010, closeout reports that were pending a formalized LUC agreement were finalized. The status at the end of FY 2012 was as follows:

Site A 16,226 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Site A Closeout Report (metals-contaminated soils) was conditionally approved in 2004, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010. VOC-contaminated soils are discussed under *Site A Shallow Groundwater* below.

An additional removal action was initiated for impacted soil at Site A with a Removal Action Work Plan approved by USEPA and MPCE in March 2013. Results of the removal action will be included in subsequent APRs and will be evaluated in the next Five-year Review.

Site C Remediation is complete. 21,450 cubic yards of metals- and VOC-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. High groundwater elevations that are present at Site C prompted an evaluation of options for completing soil remediation at this site, and the revised remedy selection is documented in the 2007 ROD Amendment #1. A protective soil cover was constructed over some of the grids at Site C where metals-contaminated soils (and sediment from the former surface water ditches) remain in-place above the cleanup levels. Through the LUCRD, the Army has designated a single area encompassing the individual grids to manage as the soil cover area. The general location of the soil cover area is shown on Figure 3-1. The Site C Closeout Report was conditionally approved in 2009, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010.

Site E Remediation is complete. 21,097 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Also, a protective soil cover was constructed over a portion of Site E (Area E1-2 west dump) where debris with ACM remains in-place. The location of the protective soil cover is shown on Figure 3-1. Testing did not show any metals-contaminated soil in the area under this cover. The Site E Closeout Report was conditionally approved in 2002, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010. The 2009 OU2 ROD Amendment #3 documented the soil cover as part of the final remedy for Site E.

Site H Remediation is complete. 8,615 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Also, a protective soil cover was constructed over a portion of Site H (Area H1-3 dump) where debris with ACM remains in-place. The location of the protective soil cover is shown on Figure 3-1. Testing did not show any metals-contaminated soil in the area under this cover. The Site H Closeout Report was conditionally approved in 2002, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010. The 2009 OU2 ROD Amendment #3 documented the soil cover as part of the final remedy for Site H.

Site 129-3 Remediation is complete. 3,460 cubic yards of metals-, nitroglycerine-, and VOC-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Site 129-3 Closeout Report was conditionally approved in 2002, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010.

Site 129-5 Remediation is complete. 100 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The

Site 129-5 Closeout Report was conditionally approved in 2001, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010.

Site 129-15 Characterization work at Site 129-15 revealed that a protective soil cover was required due to lead and PAH contamination, and cover construction has been completed. The location of the protective soil cover is shown on Figure 3-1. The Site 129-15 Closeout Report was conditionally approved in 2002, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010. The 2009 OU2 ROD Amendment #3 documented the soil cover as part of the final remedy for Site 129-15.

Grenade Range Remediation is complete. 2,179 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Grenade Range Closeout Report was conditionally approved in 2001, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010.

Outdoor Firing Range Remediation is complete. 990 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. A protective soil cover was constructed over a portion of the Outdoor Firing Range (at the 1900 Yard Range) where PAH-contaminated soils will remain in-place. The location of the protective soil cover is shown on Figure 3-1. The Outdoor Firing Range Closeout Report was conditionally approved in 2001, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010.

CAMU Use of the CAMU is completed. Closure included decontamination and removal of the storage pad and storm water holding ponds, testing beneath the pad and ponds, and groundwater monitoring. It was determined that there were no impacts to soil or groundwater from use of the CAMU. The CAMU Closeout Report received consistency in

FY 2004, which states that there were no adverse impacts to soil or groundwater due to CAMU operations, and that no LUCs are required for this area.

The five-year period of groundwater monitoring to verify no adverse remedy impacts at Sites A, E, H, 129-3, and 129-5 was conducted from FY 2003 through FY 2007. Since Site C shallow groundwater was known to be impacted (related to the Phytoremediation Demonstration), it was not monitored under the same "five-year program" as the other shallow soil sites and is been addressed separately. Also, Site D was added to the list of monitoring sites based on the recommendation in the Site D Closeout Report. As documented in the FY 2007 APR, the five-year monitoring remedy component was deemed complete for Sites A, D, E, 129-3, and 129-5 since groundwater monitoring results were below TCAAP background groundwater concentrations. At Site H, although monitoring results were well below the HRL, the results exceeded the Minnesota chronic surface water standard for Sunfish Lake, which borders Site H. The groundwater monitoring at Site H was extended in order to evaluate the situation. Copper results documented in the FY 2009 APR exceeded the background value for Unit 1 groundwater but were well below the HRL (see Table 3-1 for the FY 2009 data and Figure 3-2 for the well location). However, as noted in the FY 2009 APR, the 2004 Tier II Ecological Risk Assessment Report evaluated metals, including copper, in Sunfish Lake. In this assessment, copper was eliminated as a contaminant of concern based on water and sediment sampling in Sunfish Lake. Therefore, based on the risk assessment and the FY 2009 sampling results for copper at Site H, the FY 2009 recommended (and the MPCA/USEPA approved) ceasing any further Site H groundwater monitoring, and the monitoring component for groundwater quality was complete.

Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D.

Deep Soil Sites (D and G)

Remedy component #1 for deep soil sites requires groundwater monitoring in the vicinity of the sites. Table 3-2 presents the FY 2011 data for the deep groundwater COCs, including the well

nearest Site D (03U093) and the well nearest Site G (03U094). The table shows that only the cleanup level for TCE is exceeded in these two wells. The FY 2009 and FY 2010 data show consistent results. The FY 2012 data also show consistent results for the Site D well (03U093). Sample frequency was reduced to bi-annual for the Site G well (03U094) as part of the FY 2011 APR; therefore the well was not sampled in FY 2012.

During the years of SVE operation (1986 to 1998), TCE concentrations in groundwater (in units of μg/l) decreased from the 10,000's to the 100's. TCE concentrations have remained within the approximate 100 μg/l range since SVE operation ceased. The most dramatic improvement has been at 03U093 (Figure 3-3).Overall, these results indicate that SVE systems at Sites D and G effectively minimized (or eliminated) further contamination of the deep groundwater beneath these sites. However, the TCE concentrations are still approximately 20 times greater than the cleanup level and the trend at 03U093 over the past five years has been relatively stable. This suggests that residual contamination is acting as an ongoing source for groundwater contamination. The residual source has not been defined and could be in either the saturated or unsaturated zone. It is possible that natural attenuation will cause reductions in contaminant concentrations in the future, as suggested by the findings of the USEPA's Natural Attenuation Study (2000).

Control of site access during cleanup of the soils (remedy component #2) was accomplished through maintenance of the existing TCAAP facility fence and locking gates.

The third remedy component was to install and operate deep SVE systems with modified shallow SVE. The intent of this remedy component was to add additional deep vents at both sites, as needed, to address the presumed existence of contaminated soils below the existing SVE systems. Also, the existing systems were to be modified, as needed, to improve VOC mass removal. The site investigation conducted in FY 2000 showed that Site D soils (shallow and deep) were below the Site D VOC cleanup levels, and that Site G soils (shallow and deep) were below the subsequently-developed, higher cleanup goal for TCE, as documented in "Technical

Memorandum, Soil Leaching Values, Site G," dated July 31, 2002. Therefore, deep SVE systems and modifications to the shallow SVE systems were not required at either site. The Site D and Site G SVE systems were dismantled in FY 2001 and FY 2003, respectively. The Site D Shallow and Deep Soil VOC Investigation and Closeout Report received regulatory consistency in FY 2002. The Site G (VOC) Closeout Report was conditionally approved in 2004, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010.

Remedy component #4 was to evaluate enhancements to the SVE systems. No enhancements to either SVE system were required, since soil cleanup levels were reached without the need for any such modifications.

Remedy components #5 and #6 were to maintain existing clay caps and existing surface drainage controls. The caps for Sites D and G were originally intended to minimize infiltration of precipitation and to minimize short-circuiting of air during SVE system operation. With achievement of the soil cleanup goals at Site D, there is no longer a need for a cap or drainage controls relative to VOCs in the soil. At Site G, the revised cleanup goal for TCE was based on maintaining a cap with a specified permeability over the area with TCE contamination. No significant problems have been observed relative to the clay cap or surface drainage controls.

Characterization of Site D shallow soils and the Site G dump (remedy component #7) has been completed. For Site D, remediation work has been completed. 1,381 cubic yards of metals- and nitroglycerin-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Site D Closeout Report for shallow soils was conditionally approved in 2002, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010. The remedy selection was documented through the 2009 OU2 ROD Amendment #3. This amendment also documents the protective soil cover to be maintained at Site D where PCB-contaminated soil was "secured-in-place". The location of the Site D cover is shown on Figure 3-1.

For Site G, a protective soil cover was constructed. The original clay cap for the SVE system serves as the cover for the top portion of the dump, and a protective soil cover was constructed on the side slopes of the dump. The location of the Site G cover is shown on Figure 3-1. The Site G Closeout Report was conditionally approved in 2004, pending resolution of LUCs. Final consistency was provided after the LUCRD was approved in 2010. The remedy selection was documented through the 2009 OU2 ROD Amendment #3 (and also the modified TCE cleanup level).

Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D.

Site A Shallow Groundwater

Groundwater monitoring (remedy component #1) continues to be conducted to evaluate plume migration and remedy performance. The plume extent in FY 2012 is shown on Figure 3-4, and recent groundwater quality data is shown in Table 3-3. Tetrachloroethene is only above the cleanup goal in one well (01U126) located near the source area (at 10 µg/l versus the cleanup level of 7 µg/l). (Reference Section 3.4.2 for an in-depth discussion of Health Risk Limit revisions.) The only other exceedances of cleanup levels were in extraction wells 01U353, 01U139, and 01U140. In these wells, cis-1,2-dichloroethene was 130, 260, and 100 µg/l, respectively (versus the cleanup level of 70 µg/l). The four monitoring wells north of County Road I continue to have cis-1,2-dichloroethene concentrations below the cleanup level (70 µg/l), exhibiting adequate control of plume migration. However, based on increasing trends noted in some site monitoring wells (Figures 3-5, 3-6, and 3-7), a meeting between the Army, MPCA, and USEPA was held in December 2012 to discuss the potential need for changes to the monitoring plan and a soil vapor intrusion investigation. At this meeting, the MPCA requested that the Army begin semiannual monitoring of 01U355 through 01U358, and also requested that the Army conduct a soil vapor intrusion investigation along County Road I. The latter request was made because no soil vapor sampling had ever been conducted at Site A, and because the potentially increasing VOC groundwater concentrations in the wells north of County Road I

raised the question of whether such increases could cause an increase in soil gas VOC concentrations leading to a vapor intrusion risk. A vapor intrusion report had been prepared previously: "Off-TCAAP Vapor Intrusion Pathway Analysis, Operable Unit 1, Operable Unit 3, and Operable Unit 2 (Site A)" prepared by Tecumseh/Wenck Installation Support Services, May 2005. This report concluded that the vapor intrusion pathway for the offsite Site A plume was incomplete, since the concentrations in groundwater were below the USEPA generic screening criteria. However, no actual soil vapor sampling was conducted for that report. The MPCA requested that soil vapor sampling be conducted since their 2008/2010 vapor intrusion guidance is newer than the 2005 report, and since that guidance states that groundwater screening levels should not be used as a single line of evidence for decisions regarding vapor intrusion risk. Based on this MPCA request, the Army prepared a vapor intrusion investigation QAPP, which was under review by the USEPA and MPCA at the end of March 2013. *[Although the following described work was conducted beyond the cutoff date for this five-year review (March 31, 2013), due to the importance of this work relative to the remedy protectiveness determination, the following should be noted: upon approval of the QAPP by the USEPA and MPCA in June 2013, the soil vapor investigation work was conducted in July 2013 and then documented in Site A Vapor Intrusion Investigation Report, which was approved by the USEPA and MPCA in February 2014. The report concluded that no significant vapor intrusion risk existed for the homes along County Road I. A more detailed discussion of these results will appear in the next five-year review.]*

The need to operate the groundwater extraction system to achieve groundwater containment and mass removal (remedy component #2) was evaluated in FY 2008. The Army prepared (and the USEPA and MPCA approved) an evaluation report of the remedy for Site A shallow groundwater, which recommended that the four operating extraction wells be shut off and that MNA be implemented ("Site A Shallow Groundwater: 10-Year Evaluation Report", Wenck, July 2008). Following USEPA and MPCA approval of a monitoring and contingency plan, the four operating extraction wells were shut off on September 24, 2008, and were placed in standby. If ongoing monitoring shows that MNA is not adequately controlling plume migration, then the

extraction well(s) will be turned back on. Adequate control will be exhibited if tetrachloroethene and TCE are degraded to cis-1,2-dicloroethene, and if cis-1,2-dichloroethene is then degraded to concentrations that are below the cleanup level (70 µg/l) in the four monitoring wells along the north side of County Road I. Otherwise, when the Army, USEPA, and MPCA are satisfied that MNA is effective, a ROD modification will be prepared to formally document the change. 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 01U352/353, and this 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.

The Site A groundwater extraction system removed a cumulative total of approximately 55 pounds of VOCs prior to its shutdown on September 24, 2008.

The SWCA includes the off-site portion of the Site A groundwater plume. In addition, the USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010. Revision 2 of the OU2 LUCRD was approved in FY 2011; however, this revision did not affect land use controls at Site A. Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D. Remedy component #3A is therefore in place. Also, the 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 (both on-site and off-site). Remedy component #3B is therefore in place. Currently, there are no well owners that need to be contacted and there are no

pending water supply connections or well abandonments. The established program continues to meet the intent of this remedy component.

Remedy component #4, discharge of extracted groundwater to a POTW, is not currently being implemented since the extraction system is not currently in operation.

The fifth remedy component, source characterization and remediation, has been completed. (Note that removal of metal-contaminated soils has been completed as previously discussed under *Shallow Soil Sites*; however, the source of the VOC contamination was the focus of this remedy component). The source of VOC contamination in groundwater was found to be a disposal trench identified as the "former 1945 Trench". Construction of an air sparging/soil vapor extraction system to remediate VOC-contaminated soils was initially completed; however, soil samples collected to evaluate system performance indicated that it was uncertain if cleanup levels would ever be reached. Hence, the Army ceased operation of this system and obtained approval from the USEPA and MPCA to excavate the VOC-contaminated soils in the source area. 688 cubic yards of VOC-contaminated soil (non-hazardous soil) were excavated and transported off-site to a permitted disposal facility. The 1945 Trench soils were remediated to unrestricted use levels, and the Site A Former 1945 Trench Closeout Report received consistency in FY 2004.

Site C Shallow Groundwater

Groundwater and surface water monitoring (remedy component #1) continue to be conducted to evaluate plume migration and remedy performance. Groundwater elevation contours from summer 2012 are shown on Figure 3-8. Lead concentrations in groundwater from 2012 are shown on Figure 3-9, and groundwater quality data is shown in Table 3-4. Lead is only above the cleanup goal in one well located near the source area (MW-13 at 58 µg/l, versus the cleanup level of 15 µg/l). The water quality trend for MW-13 is shown on Figure 3-10, showing the dramatic decrease from a peak concentration of 77,000 µg/l in late 2001. The three extraction wells have all been below the cleanup level since March 2008, indicating that the plume has

attenuated to a degree in which the area of concern for Site C groundwater no longer extends to the extraction wells and is receding towards the source area. Surface water monitoring is conducted to verify that no State of Minnesota chronic surface water standards are being exceeded. The monitoring locations are shown on Figures 3-8 and 3-9. Throughout the period of this five-year review, surface water monitoring results have shown compliance with the surface water standard for lead, and the contingency trigger for containing and treating contaminated surface water has never been reached.

The second remedy component, use of gradient control wells to contain the contaminant plume, is no longer being implemented. On November 13, 2008, the groundwater system was shut off (with regulatory approval). The Site C groundwater extraction system removed a cumulative total of approximately 102 pounds of lead through the end of FY 2008. Since the extraction system has been shut off, the third remedy component, discharge of extracted water, is no longer being implemented.

The forth remedy component, land use controls, is being implemented. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010. Revision 2 of the OU2 LUCRD was approved in FY 2011; however, this revision did not affect land use controls at Site C. Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D.

Site I Shallow Groundwater

Groundwater monitoring continues to be conducted as required by remedy component #1. When water is available for sampling, monitoring results between 2009 and 2012 show chlorinated VOCs (TCE and vinyl chloride) slightly above cleanup levels in three monitoring wells (01U632, 01U064, and 104MW). Groundwater elevations from 2011 are shown on Figure 3-11. Groundwater quality data from 2011 is shown in Table 3-5. The most recent data from 2012 was not chosen for inclusion because many wells were dry during the 2012 sample event.

Remedy component #2, additional characterization of soil and groundwater, has been completed. The additional investigation resulted in a pilot study to evaluate the applicability of dual-phase vacuum extraction technology (combining groundwater extraction and soil vapor extraction) at the site. The report on the dual-phase vacuum extraction pilot test, approved by the USEPA and MPCA, concluded that neither dual-phase extraction nor groundwater extraction is feasible. The pilot test found that the soil permeability is low. The report recommended that no further remedial action be considered until the building is demolished. The 2009 OU2 ROD Amendment #2 revised the preferred remedy from groundwater pump and treat to a groundwater monitoring based remedy.

Remedy component #3, land use controls, is being implemented. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010. Revision 2 of the OU2 LUCRD was approved in FY 2011; however, this revision did not affect land use controls at Site I. Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D.

Site K Shallow Groundwater

Groundwater monitoring continues to be conducted at Site K (remedy component #1). Water levels continue to be collected annually from the monitoring wells and piezometers located in the vicinity of the groundwater collection and treatment system as shown in Figure 3-12. Results continue to show that chlorinated VOCs are present above cleanup levels. Within the five year period of this review, TCE and cis-1,2-dichloroethene range up to 18,000 µg/l and 2,500 µg/l, respectively, versus cleanup levels of 30 and 70 µg/l. Currently, three sampled wells are impacted with VOCs above cleanup levels, 01U611 (OW111), 01U615 (OW115), and 01U609.

Remedy component #2 required installation of sentinel wells at the bottom of Unit 1 and the top of Unit 3 (to determine if any vertical migration is occurring). The upper Unit 3 sentinel well (03U621) was installed in February 2000. Existing piezometers (01U625D, 01U626D, 01U627D and 01U628D) were used to accomplish the deep Unit 1 sentry monitoring. These

piezometers monitor the base of the Unit 1 aquifer near the trench. Monitoring results verified that dense non-aqueous phase liquids (DNAPLs) are not migrating beneath the trench along the Unit 1/Unit 2 interface and continue to verify that contamination has not migrated into Unit 3. Monitoring of sentinel well 03U621 over the last five years continues to show contamination has not migrated into Unit 3; VOCs have not been detected.

Hydraulic containment using the interceptor/recovery trench (remedy component #3) is being achieved as shown by comparison of the most recent groundwater contour map (Figure 3-12) and the most recent plume map (Figure 3-13). The monitoring wells downgradient of the extraction trench have shown consistently higher water levels than those near and upgradient of the trench, demonstrating that the horizontal hydraulic gradient has been reversed toward the extraction trench due to system operation. Vertical capture of the groundwater, both upgradient and downgradient of the trench, has been effective. The monitoring coverage provided by the piezometers has demonstrated complete vertical and horizontal hydraulic capture. Based on 2012 data, the trench extracts groundwater at an approximate rate of 9 gallons per minute (gpm) (monthly groundwater extraction volumes during FY 2012 are shown in Table 3-6).

Groundwater treatment is accomplished via an air stripping treatment system (remedy component #4). The fluidized-bed type air stripping facility has treated water to the cleanup standard since June 21, 1999. Overall, the treatment system functioned and was operational 98% of the time based on 2012 data. In addition, the regular maintenance schedule showed minimum maintenance issues.

Discharge of treated water to Rice Creek and the associated discharge monitoring are required by remedy components #5 and #6. The treated water consistently meets the substantive requirements of Document No. MNU000579 (MPCA). Influent and effluent analytical data for FY 2012 is shown in Table 3-7. 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 through the end of FY 2012 is 298.9 pounds of VOCs (Table 3-6).

Additional investigation of the unsaturated Unit 1 soil (remedy component #7) has been completed. The investigation results report, approved by the USEPA and MPCA, defined the extent of VOC contaminated soils beneath the former Building 103 slab and refined the location of the source area.

Remedy component #8, land use controls, is being implemented. 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 K. Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D.

Building 102 Shallow Groundwater

Monitored natural attenuation (remedy component #1) is being implemented. Groundwater monitoring (remedy component #2) to track monitored natural attention and verify that contaminated groundwater is not reaching Rice Creek is being performed. Groundwater quality data collected in FY 2012 is shown in Table 3-8. Groundwater quality data for June 2012 is also shown on plume maps for three chemicals of concern: TCE (Figure 3-14), cis-1,2-dichloroethene (Figure 3-15), and vinyl chloride (Figure 3-16). Natural attenuation continues to occur at this site, with TCE being the primary VOC evident in the source area vicinity (01U579 and 01U580), and with primarily degradation products being present in downgradient wells. Plume maps verify that contaminated groundwater is not reaching Rice Creek; however, the well adjacent to Rice Creek (01U048) has had increases in vinyl chloride; from <0.05 to 0.046 µg/L in FY 2011, and then to 0.073 µg/L in FY 2012. The FY 2012 vinyl chloride result of 0.073 µg/L is a little less than half the cleanup level (trigger level) of 0.18 µg/L. Additionally, the June 2011 and 2012 results at well locations 01U/01L584 and 01L582 showed an increasing trend when compared to historical VOC concentrations. In the FY 2012 APR, it is suggested that high groundwater levels may have contributed to the increasing trends, either by putting groundwater in contact with 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. It is possible that decreasing groundwater levels may cause a reversal of the increasing VOC trends, but this will be determined from future monitoring. Since the FY 2011/2012 results for 01U/01L584 and 01L582 were not consistent with historical results, which had been very stable prior to FY 2011, in December 2012 the MPCA and the USEPA requested that the Army conduct supplemental groundwater investigation work. The purpose of the investigation will be to acquire additional VOC data in groundwater at a location approximately halfway between 01L582 and 01U048, which is located adjacent to Rice Creek. 01L582 had been functioning as a "mid-sentinel well" before Rice Creek; however, the increasing VOC concentrations in 01L582 in FY 2011/2012 caused increased concern regarding whether an acceptable level of attenuation was still occurring prior to groundwater reaching Rice Creek. At the end of March 2013, the Army was preparing an addendum to the TCAAP Performance Monitoring QAPP that describes the planned additional groundwater investigation work. *[Although the following described work was conducted beyond the cutoff date for this five-year review (March 31, 2013), due to the importance of this work relative to the remedy protectiveness determination, the following should be noted: upon approval of the QAPP addendum by the USEPA and MPCA in June 2013, the groundwater investigation work was conducted in July 2013 and then documented in Supplemental Investigation Report for Building 102 Groundwater, which was approved by the USEPA and MPCA in March 2014. The report concluded that a significant level of attenuation was occurring at the point groundwater had travelled halfway from 01L582 to Rice Creek. A more detailed discussion of these results will appear in the next five-year review.]*

Remedy component #4, land use controls, is being implemented. 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. Annual LUC inspections of OU2 sites are being conducted by the Army, National Guard, and Wenck; the most recent inspection checklist is included in Appendix D.

Aquatic Sites

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 alternative, was signed in January 2012.

Remedy component #1, chemical alteration of Pond G surface water hardness, was implemented. 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. The Army applied agricultural limestone to the soils on August 29, 2012.

Remedy component #2, Pond G surface water monitoring, was implemented. Monitoring included multiple sampling events of the Pond G surface water in 2012/2013. OU2 ROD Amendment #4 specified that the next five-year review would document the final determination on the effectiveness of the Pond G remedy, as based on the monitoring completed prior to that review. Review of the Pond G remedy is based primarily on the Remedial Action Completion and Aquatic Site Close Out Report, finalized in November 2013.

As approved by USEPA and MPCA, sampling events were reduced from six planned events to four and were conducted in June 2012, August 2012, April 2013, and May 2013. The surface water sampling location is shown on Figure 3-17 and the surface water monitoring results are shown in Table 3-9. The June 2012 results showed that Pond G hardness had been significantly elevated, as intended with the surface water treatment, to a level of 273 mg/L. This corresponds to a surface water lead standard of 11.4 µg/L (the standard is hardness-dependent). Lead was not detectable in any of the June 2012 samples, and the lead standard was met. Chloride was also monitored in this first event to provide a one-time verification that the chloride standard was not exceeded when calcium chloride was added. The average result of 103 mg/L was well below the chloride standard of 230 mg/L.

For the August 2012 event, the average hardness result was 255 mg/L. The lead results for this event yielded an average result of 0.61µg/L. This was still well below the calculated surface water lead standard of 10.5µg/L. For the April 2013 event, the average hardness result was 60 mg/L. Lead was not detectable in any of the April 2013 samples, and the calculated lead standard of 1.6 µg/L was met. For the May 2013 event, the average hardness result was 68 mg/L. Lead was not detectable in any of the May 2013 samples, and the calculated lead standard of 2.0 µg/L was met.

The results of the four surface water monitoring events indicate the remedial action objective of complying with the Minnesota Class 2B surface water standard has been achieved. The EPA and MPCA reviewed the 2013 Remedial Action Completion and Aquatic Site Close Out Report and provided consistency on November 15, 2013. Since the completed remedy does not result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, this site will not be included in future five-year reviews.

Deep Groundwater

Hydraulic containment and source area contaminant removal (remedy component #1) is being accomplished through operation of the TGRS. The TGRS layout is shown on Figure 3-18. Plume maps for Upper Unit 3, Lower Unit 3, and Upper Unit 4 are shown on Figures 3-19, 3-20,

and 3-21. Groundwater contour maps showing the capture boundary in the three impacted hydrogeologic units are shown on Figures 3-22, 3-23, and 3-24. These maps are based on the last full round of monitoring conducted in FY 2011. Comparison of capture boundaries with the plume maps clearly shows that the TGRS achieves containment at the TCAAP boundary. The flow rates at individual wells have been modified from time to time due to plume configuration changes, operational issues, and to maintain the Operating Strategy.

The TGRS Operating Strategy was completed in June 2003. Subsequent modifications to the Operating Strategy provided the following base pumping rates to ensure acceptable hydraulic containment:

Estimated Base Containment Rate:	1,200 gpm
Immediate Response Minimum (25% Safety Factor):	1,500 gpm
Operational Minimum:	1,745 gpm
Operational Target:	1,845 gpm

The TGRS influent and effluent water flow rates are designed to be equal, thereby providing continuous operation of all processes and equipment. The TGRS was modified in March 2011, to allow for two air-stripping tower treatment instead of the original four air-stripping tower treatment. To accomplish this modification, 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 air stripper towers 1 (AS #1) and 2 (AS #2) were closed. Based on this system modification, the air stripping towers #3 and #4 are operating in a parallel arrangement, without the original design option of further VOC treatment removal with secondary air-stripper towers working in a series-parallel configuration. A decrease of energy use resulted from this modification while still meeting the effluent discharge limit of 5 µg/L TCE. The groundwater is being effectively treated by air stripping towers #3 and #4 while air stripping towers #1 and #2 remain in standby.

During FY 2012, the average flow rate for the extraction wells was approximately 1,831 gpm (Table 3-11). At this flow rate, 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. The TGRS operated above the Operational Minimum for the majority of the time (340 days or 93 percent of the time) as indicated in FY 2012 data (Figure 3-25)

The TGRS extracted and treated approximately 964,996,900 gallons of water in FY 2012 (as shown in Table 3-11). Based on the monthly influent and effluent VOC concentrations and the monthly flow totals, measured by the extraction well flow meters, the TGRS removed a total of 1,801 pounds of VOCs in FY 2012. The amount of VOC mass removed in FY 2012 is less when compared with previous FY 2011 mass removal data (1,834 pounds) reflecting an overall decrease in plume concentration. Overall, through the end of FY 2012, 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 Operating Strategy was based on data through 2001). At 1,801 pounds in FY 2012, the VOC mass removal from the TGRS is at 53 percent of the FY 2001 mass removal. Note that 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 a review of the minimum operating rates defined in the Operating Strategy should be conducted and potentially reduced.

Annual mass removal totals are shown in Table 3-12, with a well-by-well breakdown for FY 2012. 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. Together, these eight wells accounted for nearly 99 percent of the VOC mass removed. The source control wells SC5 and SC1 accounted for over 71 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. Annual mass removal has been on a declining trend since the maximum of 26,760 pounds in 1991.

Groundwater treatment is accomplished through treatment using air strippers, (remedy components #2). Treatment has been very effective as shown on the influent/effluent TCE trend in TRCLE concentration graphs (Figure 3-26). This figure also shows that TCE in the influent is slowly declining (1,500 to 2,000 µg/l during the early operational period (late 1980's) to an average of 180 µg/l in FY 2012). FY 2012 represents the tenth year since the TGRS was reconfigured to achieve greater pumping in the center of the VOC plumes and less pumping on the edges of the plumes where VOC concentrations are much lower. The decreasing TCE concentration could be due in part to the overall decrease in plume concentration.

Figure 3-26 also indicates that the effluent TCE is below 5 µg/L. Results from the FY 2012 database indicate that the effluent has also remained below the treatment requirements for all other VOC compounds specified in the OU2 ROD. Comparison of influent/effluent concentrations for all specified VOC compounds indicates an average removal efficiency of 99.2 percent. Effluent concentrations of TCE increased slightly after the treatment was modified to two towers in March 2011, therefore requiring decreasing the pumping rate of well SC-5 in order to maintain a TCE effluent below 5 µg/L. The maximum effluent TCE concentration in FY 2012 was 1.9 µg/L, which is still well below the discharge limit. Air emissions averaged 4.9 pounds/day based on the VOC mass removal rates. The total VOC emissions from FY 2012 were 1,801 pounds, equivalent to the VOC mass removal rate.

Discharge of treated water to the on-site gravel pit (remedy component #3) continues to be an effective means of treated water disposal.

Although the SWCA does not currently cover the TCAAP facility, the Army has controlled drilling of wells on the plant (if property is transferred outside of federal-control, the MDH could expand the SWCA to encompass such property). The Alternate Water Supply and Well

Abandonment Program is underway, which also covers the TCAAP facility itself. This program continues to meet the intent of remedy component #4.

Reviews of new technologies (remedy component #5) are discussed at TRC meetings and are presented in the APR, as applicable. In September 2004, the MPCA and USEPA conducted a natural attenuation microcosm study using a 14C-dichloroethylene tracer to determine the fate of this chemical in the groundwater. As of the end of FY 2012, the Army has not identified any new or emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration.

Groundwater monitoring (remedy component #6) continues to be conducted to track remedy performance. Results from the 2011 groundwater sampling showed that most of the wells sampled continued to have declining or stable TCE concentrations. The most notable decreases were at 03U708 (steady decrease from 270 µg/L in 2002 to 39 µg/L in 2011), 03M806 (decrease from 680 µg/L in 2008 to 320 µg/L in 2011), and 03U711 (steady decrease from 250 µg/L in 2004 to 54 µg/L in 2011). Well 03U003 also showed a significant decrease in TCE concentration from 99 µg/L in 2009 to 41 µg/L in June 2011. Several wells showed a slight increase in TCE concentration in 2011; however, the general trend at most wells since 1999 appears to be declining or stable.

The TGRS Operating Strategy estimated the width of the 5 µg/L TCE plume at the source area to be 3,600 feet based on FY 2001 analytical data. TCE 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 TCE plume has decreased from 3.1 µg/L in 2001 to not detectable (below 1 µg/L) since 2003. As a result, the width of the TCE plume is narrowing. Figure 3-27 shows FY 2011 TRCLE data with the 5 µg/L TCE contours for FY 2001 and FY 2011. Based on these contours, the estimated width of the source area TCE plume has decreased approximately 17 percent from 3,600 feet to 3,000 feet or approximately 83 percent of

the FY 2001 width. According to the TGRS Operating Strategy, overall TGRS operating goals will be reviewed if the source area plume width shrinks to 75 percent of the FY 2001 width (2,700 feet). At the boundary, the TCE plume narrowing is more pronounced, having decreased approximately 24 percent from 4,600 feet to 3,500 feet or approximately 76 percent of the FY 2001 width.

Because monitoring has shown the plume width to be shrinking, extraction wells B-7, B-10, and B-12 have been shutdown in response to this shrinking plume width.

3.3.5 Site Inspection

The Army, MPCA, Minnesota National Guard, Wenck Associates, and USACE participated in a site inspection of the sites within OU2 on September 11, 2013. Site inspection checklists for OU2 sites are included in Appendix B.

All of the OU2 shallow soil sites; Sites D and G; Sites A, C, I, and K shallow groundwater; and OU2 deep groundwater (TGRS) were observed during the site inspection. The TGRS and Site K treatment systems were visited and discussed, and no significant O&M problems were identified for these systems.

At Site K, the groundwater extraction trench and treatment system continued to operate as designed to capture, treat, and maintain a continuous zone of capture downgradient of former Building 103. Minimal maintenance was required which resulted in very limited operational downtime.

At the TGRS, the two air stripping treatment mode is adequately treating groundwater pumped from the extraction well field by meeting the clean up requirements before being discharged to the Arsenal Sand and Gravel Pit. Based on recorded inspections performed and O&M activities conducted at the treatment system and extraction wells, most of downtime resulted primarily

from failure and subsequent repair of components in the pumphouses, treatment center, and electrical service. The TGRS was shut down for repairs slightly less in FY 2012 as compared with FY 2011, this was due to the air stripper modification (to allow for two towers instead of four), power outages, programmable logic controller troubleshooting, and the air stripper tower cleaning that occurred in FY 2011. Treatment center component failures and repairs that caused pumphouse down time have mostly consisted of electric check valve maintenance, flow meter replacement, malfunctions and repairs, and electrical control equipment failures and subsequent repairs. However, this has not affected the operations necessary to capture and treat groundwater above the global operating minimum flow of 1,745 gpm. The TGRS has operated above the global operating minimum about 93 percent the time.

Both Site K and the TGRS groundwater containment and treatment systems are meeting their containment objectives, and the treatment systems are meeting their discharge requirements.

For the shallow sites with covers, vegetative cover was observed to be adequate and no problems with cover erosion or disturbance were observed. The signs located around the perimeters of the soil covers (to warn against digging or disturbing the soil) were observed to be in place and in good condition. Monitoring wells were observed to be secure and in good condition with few exceptions. One monitoring well (Site A, 01U356) was found to have a cracked cover that could easily be removed, and the identification of two monitoring wells (TGRS, 04J714/04U714) were partially removed and appeared to have identical identification numbers. At some of the soil sites where groundwater monitoring is no longer a remedy component, it was noted that monitoring wells remained in place that could be abandoned.

Photographs from the site inspection are included in Appendix E. No significant problems or issues were identified as a result of any of the site inspections.

3.3.6 Interviews

Interviews were conducted, as discussed previously under the OU1 discussion (Section 2.3.6).

3.4 TECHNICAL ASSESSMENT

3.4.1 *Question A:* Is the Remedy functioning as intended by the decision documents?

The review of remedial action objectives, documents, and monitoring data indicate that the OU2 remedies are functioning as intended by the ROD, as discussed below.

Shallow Soil Sites

For the shallow soil sites, the remedy that has been selected is intended to remove soils that are contaminated above the cleanup goals specified in the OU2 ROD. The soil excavation, treatment, and off-site disposal remedy has effectively accomplished this objective. Remediation has been completed at Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range. Due to high groundwater levels, a protective soil cover was constructed over portions of Site C as a means of preventing access to metals-contaminated soils (and sediments from the former surface water ditches). Due to the discovery of debris with ACM, protective soil covers were constructed over portions of the dumps at Sites E and H as a means of preventing access to the ACM. The protective soil covers, in conjunction with land use controls, effectively accomplish these added objectives.

For Dump Site 129-15, following site characterization, the selected remedy was to construct a protective soil cover over the site as a means of preventing access to the lead and PAH contamination. Also, the protective soil cover at the 1900 Yard Range of the Outdoor Firing Range was constructed to prevent access to PAH-contaminated soils. The protective soil covers, in conjunction with land use controls, effectively accomplishes this objective.

O&M procedures include maintaining the cautionary signs around the perimeter of each protective soil cover. These signs are in place at all of the soil cover sites. These signs help ensure the short- and long-term protectiveness of the remedy by helping to prevent disturbance of protective soil covers. O&M would also include repair of any damage that compromises the thickness requirements for the protective soil covers; however, no such damage occurred during the period of this five-year review.

On July 12, 2012, the Army, the National Guard, and Wenck conducted the annual inspection of OU2 sites per the LUCRD. The checklist that was completed during the inspection is included as Appendix D. No deficiencies or items requiring additional action were identified.

Deep Soil Sites (D and G)

The SVE systems at Sites D & G were installed to remove VOCs from soil in the unsaturated zone. The systems were very effective, removing over 220,000 pounds of VOCs from startup in 1986 through shutdown in FY 1998. The SVE systems reduced the VOC concentrations in both shallow and deep soils at both sites to below cleanup levels. Having completed their objective, the SVE systems have been dismantled.

For the Site D shallow soils, the remedy that has been selected is intended to remove soils that are contaminated above the cleanup goals. The soil excavation, treatment, and off-site disposal remedy has effectively accomplished this objective, with remediation now complete at Site D.

The protective soil cover at Site D is intended to prevent access to PCBs that were "secured-in-place". The protective soil cover, in conjunction with land use controls, effectively accomplishes this objective. The protective soil cover at Site G is intended to prevent access to dump materials and also reduces infiltration of precipitation, minimizing leaching of any remaining VOCs. The protective soil cover, in conjunction with land use controls, effectively accomplishes this objective.

O&M procedures are limited to two items. The first is maintaining the cautionary signs around the perimeter of each protective soil cover. These signs help ensure the short- and long-term protectiveness of the remedy by helping to prevent disturbance of protective soil covers. The second item is to annually remove any woody vegetation (greater than 2-inch diameter) to prevent deep rooting into the Site G cover. This O&M procedure helps maintain the integrity of the cover, thereby minimizing infiltration of precipitation and helping to ensure the short- and long-term protectiveness of the remedy. O&M would also include repair of any damage that compromises the thickness requirements for the protective soil covers; however, no such damage occurred during the period of this five-year review.

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

Site A Shallow Groundwater

As stated previously, the need to operate the groundwater extraction system to achieve groundwater containment and mass removal (remedy component #2) is currently being evaluated. The four operating extraction wells were shut off on September 24, 2008, and placed in standby, and ongoing monitoring is being conducted to determine if MNA will adequately control plume migration. The four monitoring wells north of County Road I continue to have cis-1,2-dichloroethene concentrations below the cleanup level (70 µg/l), exhibiting adequate control of plume migration. Based on increasing trends noted in some site monitoring wells, the MPCA/USEPA has requested the Army conduct a vapor intrusion investigation to help verify that the remedy is performing adequately. The Army has prepared a vapor intrusion investigation QAPP, which was under review by the USEPA and MPCA at the end of March 2013. *[As noted previously, soil vapor investigation work conducted beyond the cutoff date for this five-year review (March 31, 2013) determined that no significant vapor intrusion risk existed for the homes along County Road I.]*

The MDH SWCA and alternate water supply program continue to function as intended.

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

Site C Shallow Groundwater

As stated previously, since the area of lead concentrations that exceed the groundwater cleanup level does not even reach the extraction wells, operation of the extraction system is not currently required to contain the plume. For this reason, the extraction system was shut off on November 13, 2008. There is only one monitoring well near the source area that currently exceeds the groundwater cleanup level, and with a steadily decreasing trend, it is clear that aquifer restoration is occurring.

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

Site I Shallow Groundwater

Per the OU2 ROD Amendment #2, signed in 2009, a groundwater monitoring based remedy is being implemented. The monitoring-based remedy is appropriate since the Unit 1 plume is not migrating offsite; rather, the Unit 1 contaminants leak downward into Unit 3, where they are hydraulically contained by the TGRS. The concentration of TCE and vinyl chloride has decreased over time, but remains above cleanup levels.

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

Site K Shallow Groundwater

Evaluation of groundwater elevation contours and water quality trends support the interpretation that the extraction system is effectively containing the contamination. With the exception of relatively stable TCE concentrations at two wells (01U615 and 01U611), the overall trend

throughout Site K continues to show decreasing VOC concentrations indicating that aquifer restoration is occurring.

The O&M procedures remain adequate, given that the extraction system is effectively containing contamination and that the surface water discharge limits continue to be met. No changes to O&M procedures appear to be necessary. There have not been frequent equipment breakdowns, significant periods of unanticipated downtime, or O&M cost issues that would suggest any potential remedy problems.

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

Building 102 Shallow Groundwater

Monitored natural attenuation is being implemented. Natural attenuation continues to occur at this site, with TCE being the primary VOC evident in the source area vicinity, and with primarily degradation products being present in downgradient wells. Plume maps verify that contaminated groundwater is not reaching Rice Creek; however, the well adjacent to Rice Creek has had recent increases in vinyl chloride. These increases have not reached the cleanup level for vinyl chloride, which is the action trigger level. The June 2011 and 2012 analytical results showed an increasing trend in two wells when compared to historical VOC concentrations. Additional investigation will be conducted to verify adequate plume attenuation at a location approximately halfway between 01L582 and 01U048, which is located adjacent to Rice Creek. At the end of March 2013, the Army was preparing an addendum to the TCAAP Performance Monitoring QAPP that describes the planned additional groundwater investigation work. *[As noted previously, groundwater investigation work conducted beyond the cutoff date for this five-year review (March 31, 2013) determined that a significant level of attenuation was occurring at the point groundwater had travelled halfway from 01L582 to Rice Creek.]*

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

Aquatic Sites

The results of four surface water monitoring events indicate the remedial action objective of compliance with the Minnesota Class 2B surface water standard has been achieved for Pond G. The EPA and MPCA reviewed the 2013 Remedial Action Completion and Aquatic Site Close Out Report and provided consistency on November 15, 2013. Since the completed remedy does not result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, this site will not be included in future five-year reviews.

Deep Groundwater

Evaluation of groundwater elevation contours, pumping rates, and water quality trends support the interpretation that the TGRS achieves containment at the TCAAP boundary. The TGRS modification to treatment using two air stripper towers is effectively treating groundwater to meet the effluent limit of 5 μg/L TCE. TGRS operation has continued to narrow the width of the plume at the TCAAP boundary. The VOC mass removal has decreased reflecting an overall decrease in plume concentration. Decreasing VOC contaminant concentrations indicate that aquifer restoration is occurring. The treatment system continues to reliably treat recovered groundwater to meet the discharge requirements for discharge to the Arsenal Sand and Gravel Pit.

The O&M procedures remain adequate, given that the extraction system is effectively containing the contamination and that the treatment system reliably treats recovered groundwater to meet discharge requirements. No changes to O&M procedures appear to be necessary. Since FY 2011, system operation downtime has decreased due to preventative maintenance. There have not been frequent equipment breakdowns, significant periods of unanticipated downtime, or elevated O&M cost issues that would suggest any potential remedy problems.

The annual inspection for LUCs (Appendix D) did not reveal any items that required additional action.

3.4.2 *Question B:* Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The remedial action objectives for OU2 sites remain valid, subject to the modified objectives in the previously-discussed ROD Amendment #1 for Site C-2.

A human health risk assessment for TCAAP was performed by the USEPA in 1991, prior to cleanup of source areas. The risk assessment evaluated the potential health risks associated with exposure to the source areas on TCAAP as well as the contaminated groundwater both on and off the original TCAAP. The risk assessment involved calculating the potential increase in the risk of cancer and the potential risk of non-cancer effects, such as liver damage and reproductive abnormalities. It also evaluated the ways by which people could be exposed to the contaminants. The risk assessment performed by the USEPA was updated in the OU2 Feasibility Study to accommodate the additional COCs identified during various site investigations that were conducted subsequent to the USEPA's risk assessment. Since ARARs existed for all of the OU2 groundwater COCs, health risk-based remediation goals were not developed for this medium. For OU2 soils, site-specific, health risk-based remediation goals were developed. The exposure assessment equations, contaminant toxicity equations, and quantitative site-specific risk evaluations were documented in Appendix C of the OU2 ROD (methodology was based on the 1989 USEPA Risk Assessment Guidance for Superfund).

The Grenade Range and the Outdoor Firing Range were not included in the health risk assessment in the OU2 ROD. However, the land use (industrial scenario), exposure scenarios, and methods that were used for health risk assessment and for determination of cleanup levels (where required) followed the same methodology as was documented in Appendix C of the OU2 ROD.

The cleanup levels for COCs for OU2 soil and groundwater sites are listed in Table A-2 of Appendix A. Most of the OU2 cleanup levels were established in Table 1 of the OU2 ROD;

however, a few of these cleanup levels were subsequently modified and a few were established subsequent to the signing of the OU2 ROD (as discussed in this section). The validity of the original exposure assumptions, toxicity data, and cleanup levels is discussed below, first for OU2 groundwater and then for OU2 soils.

OU2 Groundwater

The potential receptors and exposure routes, as stated in the OU2 ROD, were as follows:

> *People who might be at risk from exposure to contaminated groundwater include TCAAP workers and local residents who rely on private drinking wells that extract contaminated groundwater. The potential pathways by which these receptors might be exposed include ingestion, inhalation during showering, and adsorption through the skin (dermal contact) during showering or bathing with contaminated groundwater.*

The potential receptors and routes of exposure remain valid, with one clarification: the TCAAP potable water treatment plant (which utilized treated effluent from the TGRS system as its water supply) is no longer in operation and there are no longer any workers being supplied drinking water at TCAAP. No new exposure routes are applicable. No changes in land use have occurred that would have a bearing on the remedy. No new groundwater COCs have been added to any of the groundwater sites and no cleanup levels for COCs have been modified since the OU2 ROD was signed. However, as discussed previously, with approval of the 2007 ROD Amendment #1, Site C shallow groundwater was added as an additional OU2 groundwater site that is subject to this five-year review. With approval of the 2012 ROD Amendment #4, shallow groundwater at Building 102 was added.

The cleanup levels for OU2 groundwater sites that are listed Table A-2 of Appendix A were based on consideration of the following ARARs, as identified in Table 3 of the OU2 ROD, Table 1 of the 2007 ROD Amendment, and Appendix B of the 2012 ROD Amendment #4:

- MCLs and non-zero MCLGs specified in the National Primary Drinking Water Regulations (40 CFR Part 141), which apply to public water supplies, and which were established by the USEPA in accordance with the SDWA.

- MCLs for the State of Minnesota, as specified in the Minnesota Rules (Chapter 4720), which apply to public water supplies. (Note that the State of Minnesota adopted the Federal MCLs, and therefore an added consideration of State of Minnesota MCLs has the same impact on potential cleanup levels as the Federal MCLs.)

- HRLs specified in Minnesota Rules (4717.7100 to 4717.7800), which can be applied to private water supplies, and which were established by the MDH in accordance with Minnesota's Groundwater Protection Act of 1989.

- Lead action level, as specified in USEPA National Primary Drinking Water Regulations, 40 CFR, Part 141.80.

The lifetime health advisory values established by the USEPA Office of Water were identified as guidance that was TBC for development of groundwater cleanup levels. The cleanup levels developed in the OU2 ROD (Table 1 thereof) utilized the lowest value among the Federal MCL, Federal non-zero MCLG, Minnesota MCL, and HRL for deep groundwater. For Sites A, I, and K shallow groundwater sites, only the HRL was used. For Site C shallow groundwater, the lead action level in the USEPA National Primary Drinking Water Regulations was used. For all OU2 groundwater COCs, the review of current regulations revealed that there have been no changes in the Federal MCL, Federal MCLGs, Minnesota MCLs, or lead action level. However, on July 1, 2007, the MDH HRLs were revised such that for any HRL that was set higher than the MCL, the new HRL is set equal to the MCL. The HRLs (now specified in Minnesota Rules 4717.7810 through 4717.7900) were also revised in 2009, 2011, and 2013. For OU2 deep groundwater, this affected four COCs: TCE, tetrachloroethene, 1,1,1-trichloroethane, and cis-1,2-Dichloroethene.

The HRL for TCE was revised from 30 to 5 µg/l and the HRL for tetrachloroethene was revised from 7 to 5 µg/l. The HRL for 1,1,1-trichloroethane was revised from 600 to the MCL-based value of 200 µg/l as of July 1, 2007; however, the chronic HRL was revised to 9,000 µg/l in 2009, using more recent toxicity values and intake rates. The chronic HRL for cis-1,2-Dichloroethene is 50 µg/l which is lower than the HRL-based cleanup level of 70 µg/l. Since the OU2 deep groundwater cleanup levels were already equal to the MCL for these chemicals, the only impact to the established cleanup level is for cis-1,2-Dichloroethene.

For Site A shallow groundwater, TCE, cis-1,2-Dichloroethene, and tetrachloroethene, which were discussed above, are COCs. The HRLs for benzene and chloroform were also revised. The HRL for benzene was revised from 10 to 5 µg/l as of July 1, 2007, and revised again in 2009 to 2 µg/l. The HRL for chloroform was revised from 60 to 30 µg/l in 2009. Since cleanup levels for these four COCs were based on the HRL, the impact of the lower HRLs must be considered. Considering the most recent Site A groundwater quality data (Table 3-3), TCE is below the revised HRL in all wells, so there is no short-term impact. Tetrachloroethene is above the revised HRL in only one well (the same number as above the old HRL); however, since this well is relatively close to the source area (and not off-TCAAP), there is no short-term impact. Benzene is above the revised HRL in three wells, and since these wells are not off-TCAAP, there is no short-term impact. Chloroform is below the revised HRL in all wells. Given that there is no short-term impact, and given that this site is not nearing closure, there is no reason to pursue a change in the cleanup level. However, this issue will be noted in Section 3.5, with the recommendation that a change in cleanup level be further considered when this site nears closure, and if such a change is needed, that the change be documented in a ROD modification.

For Sites I and K shallow groundwater, TCE is a COC at both sites, and since the cleanup level at both sites was based on the HRL, the impact of the lower HRL must be considered. Generally, the TCE concentration in any given well at either site will either be above both the old and the revised HRL, or will be below both the old and the revised HRL, suggesting that there is no short-term impact. Furthermore, at Site I, contaminants leak downward from Unit 1 to Unit 3

(deep groundwater), where they would be captured by the TGRS and where the cleanup level is already equal to the revised HRL. At Site K, the contaminated groundwater that exceeds the revised HRL is being captured by the groundwater recovery system. Given that there is no short-term impact, and given that neither of these sites is nearing closure, there is no reason to pursue a change in the cleanup level at either site. However, this issue is noted in Section 3.5, with the recommendation that a change in cleanup level be further considered when either of these sites nears closure, and if such a change is needed, that the change be documented in a ROD modification.

For Sites I and K shallow groundwater, cis-1,2-DCE is a COC at both sites, and since the cleanup level at both sites was based on the HRL, the impact of the lower HRL must be considered. Given that there is no short-term impact, and given that neither of these sites is nearing closure, there is no reason to pursue a change in the cleanup level at either site. However, this issue is noted in Section 3.5, with the recommendation that a change in cleanup level be further considered when either of these sites nears closure, and if such a change is needed, that the change be documented in a ROD modification.

For Building 102 Groundwater, TCE, cis-1,2-dichloroethene, 1,1-dichlorethene, and vinyl chloride are COCs. The cleanup levels, established in the 2012 ROD Amendment #4, were based on the MDH HRLs. Review of current regulations revealed that there have been no changes in the MDH HRLs for TCE or vinyl chloride. The HRL for 1,1-dichlorethene changed from 6 µg/L (the cleanup level in the ROD Amendment) to 200 µg/L as a result of reassessment of toxicity. Considering the most recent Building 102 groundwater quality data (Table 3-8), 1,1-dichloroethene is below the cleanup level in all wells, and given that the revised HRL is much higher, there is no impact. The chronic HRL for cis-1,2-Dichloroethene is 50 µg/l which is lower than the HRL-based cleanup level of 70 µg/l. Based on data in Table 3-8, cis-1,2-dichloroethene is above the cleanup level and the revised HRL in three wells.

With regard to the USEPA lifetime health advisory levels identified as TBC (Tables 3 and 4 of the OU2 ROD), only four of the COCs had values established. Review of the current (2012) USEPA lifetime health advisory levels indicated that, for those COCs that have established values, the advisory levels equal or exceed the cleanup levels, with the exception of benzene and cis-1,2-Dichloroethene. The life-time health advisory for benzene is 3 µg/L, compared to the cleanup level of 10 µg/L, and the life-time health advisory for cis-1,2-Dichloroethene is 10 µg/L, compared to the cleanup level of 70 µg/l.

In 2013, MDH updated its drinking water guidance for TCE due to new toxicity and health effects information. Although not an ARAR, the updated Health Based Value (HBV) for TCE is 0.4 µg/l, which is lower than the HRL and Federal MCL of 5 µg/l. The new guidance value does not affect current protectiveness because land use controls prevent use of contaminated groundwater. This new guidance value may need to be considered when OU1 nears closure,

Based on the above review, no changes to any of the cleanup levels for OU2 groundwater need to be considered at this time. If the Site A, I, or K shallow groundwater or OU2 deep groundwater sites approach the point of site closure, then a change in cleanup level(s) should be further considered.

OU2 Soils

The current land use for the federally controlled portion of TCAAP, which is the area that contains all of the contaminant source areas with LUCs, is a military facility. The risk evaluation developed for TCAAP (in the OU2 ROD) assumed a continued "industrial use scenario". The following assumptions were made relative to potential receptors and exposure routes, as stated in the OU2 ROD:

> *People who might be at risk from exposure to contaminated soil include TCAAP workers or occupants. Incidental ingestion and dermal contact are the only significant routes for receptors to be exposed to contaminants in surface soils at the site. If future activities*

require excavation, however, workers may be exposed to contaminants by inhalation, as well as through incidental ingestion and dermal contact.

When considering exposure routes at sites where the cleanup levels were health risk-based values, the OU2 ROD noted that contaminated soils existing at depths greater than 12 feet did not require excavation/remediation, since soils below that depth are not considered accessible.

The risk assessment evaluated both cancer and non-cancer effects. The cancer risk evaluation was based on the exposure assumption that an individual would be exposed to contaminated soils via dermal contact and ingestion over an exposure period equal to 25 years. The calculation of soil cleanup levels under the industrial scenario was based on an adult receptor (body weight of 70 kg), with a soil ingestion rate of 50 mg/day and a dermal exposure on 0.31 m^2 of body surface, both occurring 250 days out of each year. A chemical was identified as a COC when the increased cancer risk reached one in one million. For non-cancer risk, a chemical was identified as a COC when the Hazard Index was greater than one.

For Site 129-15, a special industrial exposure scenario was utilized. The special exposure scenario was a one-time commercial, industrial or utility construction event where excavation exposes subsurface soils for a limited time. This exposure scenario assumed that excavated soils are managed to eliminate or greatly reduce exposure to fugitive dusts. The assumed exposure was one 40-day exposure (i.e., a two-month construction period) per year, for two years. This exposure represents the expected time that construction workers would be exposed to contaminated soils as a result of excavating soil for such construction projects as laying foundations and installing utility lines. The calculation of soil cleanup levels utilized the same adult receptor body weight, soil ingestion rate, and dermal exposure surface area as described above for other sites.

The potential receptors and routes of exposure remain valid. No new exposure routes are applicable. No changes in land use have occurred that would have a bearing on the remedy.

In addition to consideration of health risk-based remediation goals, cleanup levels were selected based on consideration of background soil concentrations, ARARs (if available), and soil leaching-based goals. Leaching based-goals were calculated by the MPCA using a soil model, as documented in Appendix C of the OU2 ROD, for those constituents for which evidence of soil leaching existed (specifically, if a constituent existed in groundwater above drinking water or health-based standards). Cleanup levels were selected using the following hierarchy of precedence:

1) The background level takes precedence as the minimum remediation goal.
2) ARARs take precedence over the remaining criteria.
3) The more stringent of health risk-based or leaching-based goals takes precedence.

For health risk-based goals, the lower of the cancer and non-cancer values were used (including adjustment for multiple contaminants, where necessary). The methodology for selection of cleanup levels is documented in the OU2 ROD.

Although most of the cleanup levels shown in Table A-2 of Appendix A are identical to those developed in the OU2 ROD, a few changes occurred in the final COC lists and in the cleanup level numbers. Based on additional site investigation work conducted subsequent to the OU2 ROD, COCs were added at Site A (tetrachloroethene and TCE), Site D (antimony, lead, and nitroglycerine), and 129-15 (lead). PCBs were not listed as a COC at Site D in the OU2 ROD; however, PCBs that were "secured in-place" (as discussed previously) are known to exist at concentrations that exceed the ARAR of 10 mg/kg that was cited in the OU2 ROD, which led to the Army's designation of a protective soil cover over the area of PCB-contaminated soils at Site D. Nitroglycerine was listed as a COC for Site 129-3 in the OU2 ROD; however, no cleanup level was established. This cleanup level was calculated at the time of soil remediation work at Site 129-3. The background number for arsenic in TCAAP soils was raised from 4 to 10 mg/kg, as documented in a June 14, 1999 MPCA letter to the Army, and this resulted in the cleanup levels at Sites C, H, and 129-15 being raised to 10 mg/kg. However, at Site 129-15, the

highest arsenic concentration detected in soils was 5 mg/kg, and arsenic was dropped as a COC. Lastly, the Site G cleanup level for TCE was raised to 36.1 mg/kg, which was based on a revised soil leaching analysis that specifically accounted for the lower permeability of the Site G cover (regulatory consistency for this change was provided July 24, 2002). For cleanup levels that were established subsequent to the OU2 ROD, the health risk calculations were noted to be based on the same methodology and input parameters that were documented in Appendix C of the OU2 ROD.

To verify the protectiveness of the remedy, three areas were reviewed: ARARs were checked; the toxicity values used in risk assessment calculations were checked for any changes; and, for any cleanup levels that were soil leaching-based, the drinking water or health-based standard that was utilized in the leaching number development was checked for any changes.

Lead and PCBs were the only COCs for which health–based guidance could be utilized to establish TBC values. The lead cleanup level of 1,200 mg/kg (industrial scenario) was calculated by the USEPA using the Exposure Model for Assessing Risks Associated with Adult Exposure to Lead in Soil, as documented in Appendix C of the OU2 ROD. This model is still in use and appears to remain a valid approach. For PCBs, since there is a protective soil cover being maintained at Site D where PCB-contaminated soils were "secured in-place" (i.e., soils are known to contain PCBs at concentrations higher than the cleanup level of 10 mg/kg), the PCB guidance that was used to establish the TBC value was not reviewed.

The toxicity values used in risk assessment calculations were checked. To perform this check, the current toxicity data was obtained from the Integrated Information System Database (IRIS). IRIS is updated monthly and the check was performed in January 2014.

For Sites A, C, D, E, G, H, 129-3, 129-5, and 129-15, toxicity data that was used to calculate health-risk based goals is presented in Tables I-1 and I-3 through I-10 in Appendix C of the OU2 ROD. For the Grenade Range and the Outdoor Firing Range, the toxicity data that was used to

calculate health-risk based goals is presented in the EE/CAs for each site. The oral reference doses (RfDo) and/or oral slope factors (Sfo) listed in these documents were checked against IRIS. The following changes in values were found:

1) **Sites A, E, and 129-5:** Barium: the RfDo in IRIS was found to be 0.2, versus the value in the OU2 ROD of 0.07. Given that the reference dose value is higher, the calculated non-cancer PRG would also increase, and no change to the barium cleanup level needs to be considered.

2) **Site C:** Beryllium: the RfDo in IRIS was found to be 2E-03, versus the value in the OU2 ROD of 5E-03. Recalculation of the non-cancer PRG results in lowering the PRG from 180 to 72 mg/kg. However, since the beryllium cleanup level is 0.7 mg/kg, no change to the beryllium cleanup level needs to be considered.

3) **Site C:** Thallium: several RfDos are listed in IRIS for the different salts of thallium, ranging from 8E-05 to 9E-05, versus the value in the OU2 ROD of 7E-05. Given that these reference dose values are higher, the calculated non-cancer PRG would also increase, and no change to the thallium cleanup level needs to be considered.

4) **Sites C, E, and 129-3:** Manganese: the RfDo in IRIS was found to be 1.4E-01 versus the value in the OU2 ROD of 2.4 E-02. Given that this reference dose value is higher, the calculated non-cancer PRG would also increase, and no change to the manganese cleanup level needs to be considered.

The COCs for which the cleanup levels were soil leaching-based were TCE (Sites A, D, G and 129-3), tetrachloroethene (Site A), lead (Grenade Range), and cadmium (Grenade Range). For the deep groundwater sites (Sites D, G, and 129-3), the MPCA soil model utilized the TCE MCL of 5 µg/L. Since the lowest value among the Federal MCL, non-zero MCLG, Minnesota MCL, and HRL continues to be 5 µg/L, no changes to the TCE cleanup levels for Sites D, G and 129-3

need to be considered. For Site A, which is shallow groundwater, the MPCA soil model utilized the TCE and tetrachloroethene HRLs of 30 and 7 µg/L. Since these two HRLs were lowered on July 1, 2007 (both to 5 µg/L), the potential effect on the Site A TCE or tetrachloroethene cleanup levels needs to be considered. After remediation of the Site A VOC source area (former 1945 Trench), the concentrations of TCE and tetrachloroethene in the remaining soils were about two orders below the leaching-based cleanup levels, so it is unlikely this degree of change to the HRL values will be of concern relative to the low concentrations that remain onsite. Furthermore, with regard to groundwater concentrations, since the TCE concentrations throughout the Site A plume have decreased to below even the revised HRL, and the tetrachloroethene concentrations only exceed the revised HRL in one well near the source area, leaching does not seem to be adversely affecting aquifer restoration. Further consideration of impacts to the Site A soil cleanup levels is not necessary. For cadmium and lead at the Grenade Range, the MPCA soil model utilized the Minnesota HRL for cadmium of 4 µg/l and the lead action level of 15 µg/l (as specified in the USEPA National Primary Drinking Water Regulations). Since the applicable standards have not changed, no changes to the cadmium or lead cleanup levels need to be considered.

Based on the above review, no changes to any of the cleanup levels for OU2 soils need to be considered.

3.4.3 *Question C:* Has any other information come to light that could call into question the protectiveness of the remedy?

No information has been obtained that could call into question the protectiveness of the remedy for the current land use.

3.4.4 Technical Assessment Summary

Based on the remedial action objectives, data reviewed, and the site inspection, the remedies are functioning as intended by the OU2 ROD. The need to operate the Site A groundwater extraction system to achieve groundwater containment and mass removal is currently being evaluated, and ongoing monitoring is being conducted to determine if MNA will adequately control plume migration. Work plans (QAPPs) for additional soil vapor investigation at Site A and for additional groundwater investigation at Building 102 were prepared/reviewed, with the work conducted in the summer of 2013 *[As noted previously, the soil vapor investigation determined that no significant vapor intrusion risk existed for the homes along County Road I]*. O&M information and costs do not suggest any potential remedy problems. No changes in land use or exposure scenarios have occurred that would affect the protectiveness of the remedy.

There were only four changes in toxicity values that were used in determining health risk-based cleanup levels for soils; however, none of these changes suggest that changes to the cleanup levels should be considered.

Regarding changes to the ARARs used in establishing groundwater cleanup levels, there have been no changes to Federal MCLs, non-zero MCLGs, Minnesota MCLs, or lead action level. However, six of the OU2 groundwater COCs were potentially affected by revised HRLs, including TCE, tetrachloroethene, 1,1,1-trichlororethane, cis-1,2-dichloroethene, benzene, and chloroform. Since the HRL changes for TCE and tetrachloroethene were to change the HRL value to match the MCL value, there was no impact on OU2 deep groundwater cleanup levels or leaching-based soil cleanup levels at sites located above deep groundwater, since these groundwater cleanup levels and soil-leaching calculations were based on the MCL. The HRL for 1,1,1-trichloroethane increased to a value higher than the current MCL. The HRL changes for benzene, cis-1,2-dichloroethene, and chloroform resulted in lower HRL values, which are also lower than current MCLs. Since the groundwater cleanup levels for TCE at Sites A, I and K are all based on the HRL (and also tetrachloroethene, benzene, and chloroform at Site A), impacts to

these cleanup levels were further considered. However, based on the lack of any short-term impacts due to the HRL change and based on the fact that none of these sites are nearing site closure, no changes to the groundwater cleanup levels at these three sites need to be considered at this time. If the Site A, I, or K shallow groundwater sites approach the point of site closure, then a change in cleanup level(s) should be further considered, as reiterated in the next section.

Lastly, since the leaching-based soil cleanup levels at Site A for TCE and tetrachloroethene were based on HRLs, these cleanup levels were further considered. However, based on the low residual concentrations of these two chemicals in soils following soil remediation work (residual concentrations were approximately two orders of magnitude below the leaching-based cleanup levels), and based on the lack of any exceedances of the revised TCE HRL and only one exceedances of the revised tetrachloroethene HRL near the source area, further consideration of impacts to these two soil cleanup levels is not necessary.

In summary, no information has been obtained that could call into question the protectiveness of the remedy.

Even though the following two items do not affect either current or future protectiveness, they have been noted during previous five-year reviews and are retained for potential application in the future.

- Vapor intrusion is not an issue within the OU2 boundary (on-TCAAP) under the current land use. If land use changes within the OU2 boundary in the future (due to property transfer or other reasons), it would be appropriate to evaluate whether the vapor intrusion exposure pathway is complete for the new use, and if so, whether it poses an unacceptable risk to human health. *[It should be noted that the vapor intrusion investigation conducted for the offsite portion of the Site A groundwater plume has been completed and found no significant risk.]*

- The HRL changes had no short-term impacts to the groundwater cleanup levels for Sites A, I, K, or OU2 deep groundwater; however, if any of these three sites approach the point of site closure, then a change in cleanup level(s) may be appropriate. Currently, the LUCs that are in place prevent use of groundwater and assure protectiveness. The MDH continues to evaluate additional HRL revisions.

3.5 ISSUES

For Site A shallow groundwater, based on increasing VOC trends noted in some site monitoring wells, ongoing monitoring is being conducted to determine if MNA will adequately control plume migration. In addition, based on the potentially increasing VOC groundwater concentrations that could lead to a vapor intrusion risk, the MPCA requested that the Army conduct a soil vapor intrusion investigation along County Road I. Based on the MPCA request, the Army prepared a vapor intrusion investigation QAPP, which was under review by the USEPA and MPCA at the end of March 2013. *[As noted previously, soil vapor investigation work conducted beyond the cutoff date for this five-year review (March 31, 2013) determined that no significant vapor intrusion risk existed for the homes along County Road I.]*

For Building 102 shallow groundwater, since the FY 2011/2012 groundwater results were not consistent with historical results, in December 2012 the MPCA and the USEPA requested that the Army conduct supplemental groundwater investigation work. The purpose of the work is to assess whether an acceptable level of attenuation is still occurring prior to groundwater reaching Rice Creek. At the end of March 2013, the Army was preparing an addendum to the TCAAP Performance Monitoring QAPP that describes the planned additional groundwater investigation work. *[As noted previously, groundwater investigation work conducted beyond the cutoff date for this five-year review (March 31, 2013) determined that a significant level of attenuation was occurring at the point groundwater had travelled halfway from 01L582 to Rice Creek.]*

Issues	Affects Protectiveness (Y/N)	
	Current	Future
For Building 102 shallow groundwater, uncertain if an acceptable level of attenuation is occurring prior to groundwater reaching Rice Creek. *[Refer to the clarifying note in Section 3.3.4, page 3-42 regarding subsequently completed groundwater investigation work.]*	No	Yes
For Site A shallow groundwater, uncertain if MNA will adequately control plume migration.	No	Yes
For Site A shallow groundwater, uncertain if a vapor intrusion risk exists north of County Road I. *[Refer to the clarifying note in Section 3.3.4, page 3-35 regarding subsequently completed vapor intrusion investigation work.]*	No	Yes

3.6 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

For Site A shallow groundwater, the Army will continue monitoring to determine if MNA is adequately controlling plume migration. In addition, the Army will finalize the vapor intrusion investigation QAPP, perform the investigation, and evaluate whether VOCs in groundwater could lead to a vapor intrusion risk.

For Building 102 shallow groundwater, the Army will finalize the addendum to the TCAAP Performance Monitoring QAPP, perform the additional groundwater investigation work, and evaluate whether impacted groundwater may reach Rice Creek.

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current	Future
For Building 102 shallow groundwater, evaluate if an acceptable level of attenuation is occurring prior to groundwater reaching Rice Creek. *[Refer to the clarifying note in Section 3.3.4, page 3-42 regarding subsequently completed groundwater investigation work.]*	Army	MPCA & USEPA	End of FY 2014	No	Yes
For Site A shallow groundwater, evaluate if MNA will adequately control plume migration.	Army	MPCA & USEPA	Ongoing (evaluate in APRs)	No	Yes
For Site A shallow groundwater, evaluate whether a vapor intrusion risk exists north of County Road I. *[Refer to the clarifying note in Section 3.3.4, page 3-35 regarding subsequently completed vapor intrusion investigation work.]*	Army	MPCA & USEPA	End of FY 2014	No	Yes

3.7 PROTECTIVENESS STATEMENT

The remedy at OU2 is protective of human health and the environment in the *short term*, based on the following:

> For soil sites where the remedy has been completed (Sites A, C, D, E, H, 129-3, 129-5, 129-15), the site's availability for industrial use has been restored. Review of the toxicity data upon which the health risk assessments for these sites were based showed that no changes have occurred that could potentially affect the protectiveness of the remedies. The protective soil covers at Sites C, D, E, G, H, and 129-15, in conjunction with land use controls, effectively prevent exposure to contaminated soils/debris.
>
> The groundwater containment systems are meeting their containment objectives and the treatment systems are meeting their discharge requirements. For Site A shallow groundwater, the alternate water supply and well abandonment program, along with the SWCA, are mitigating potential risks associated with private wells. Also at Site A, MNA is adequately controlling plume migration (in lieu of groundwater extraction system operation). Water quality trends indicate that progress towards aquifer restoration continues to occur in both shallow and deep groundwater. Review of the ARARs upon which the groundwater cleanup levels were based showed that six groundwater COCs were potentially affected by HRL revisions. The HRL revisions had no impacts to Site C groundwater and had no *short-term* impacts to the groundwater cleanup levels for Sites A, I, and K shallow groundwater or OU2 deep groundwater; however, if any of these four sites approach the point of site closure, then a change in cleanup level(s) may be appropriate. No changes to the cleanup levels are needed in the *short term*.

However, in order for the remedy to be protective in the *long term*, additional investigation work needs to be performed at Building 102 to assess whether an acceptable level of attenuation is still occurring prior to groundwater reaching Rice Creek *[Refer to the clarifying note in Section 3.3.4,*

page 3-42 regarding subsequently completed groundwater investigation work.]; monitoring needs to continue at Site A to determine if MNA will adequately control plume migration; and vapor intrusion risk needs to be assessed at Site A in the area north of County Road I *[Refer to the clarifying note in Section 3.3.4, page 3-35 regarding subsequently completed vapor intrusion investigation work.]*.

4.0 Operable Unit 3 (OU3)

4.1 REMEDIAL ACTIONS

4.1.1 Remedy Selection

The OU3 ROD, signed September 1992, prescribes the following components for the selected remedy:

- Extraction of groundwater at the leading edge of the south plume.
- Treatment of extracted groundwater for the removal of VOCs by a pressurized GAC system.
- Discharge of treated groundwater to the potable water supply of the City of New Brighton.
- Monitoring of the groundwater to verify the effectiveness of the remedy.

The ROD addressed the Remedial Action Objectives, which were previously developed as part of the OU3 Feasibility Study (July 1992), as follows:

- Restore the contaminated aquifer for future use by reducing contaminant levels to those which will adequately protect human health and the environment;
- Control contaminant migration to prevent further spread of VOC plumes;
- Prevent the near term and future exposure of human receptors to contaminated groundwater above MCLs both on and off Site;
- Monitor groundwater in a manner to verify effectiveness of remedial measures.

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 such that it 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 OU3 ROD Amendment, signed August 2006, prescribes the following components for the selected remedy:

- Monitored Natural Attenuation
- Monitoring of the groundwater for VOCs to verify the effectiveness of the selected remedy and the natural attenuation of the South Plume.
- Continued implementation of the drilling advisory that regulates the installation of new private wells within OU3 through a Special Well Construction Area.

4.1.2 Remedy Implementation

The PGRS consisted of New Brighton Municipal Well #13 (NBM #13) and a GAC treatment plant. The PGRS began operation on May 3, 1994, and treated water was used as part of the municipal water supply. In 1997, the PGRS influent dropped to below the ROD-required limits for all VOCs. In August 2001, based on further reductions in plume size and concentration, the USEPA and MPCA approved an interim operational change to cease PGRS operation for remediation purposes, with an increase in groundwater monitoring. After August 2001, the PGRS was maintained in standby status. The City of New Brighton periodically used NBM #13 for peak demand water supply from May 2003 through September 2003 and then placed it back in standby status. For remediation purposes, the extraction well was maintained 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.

The Alternate Water Supply and Well Abandonment Program has been implemented and is an ongoing program maintained by the Army. See Section 2.1.2 under OU1 for additional information on the program.

Groundwater monitoring is conducted in accordance with plans that are reviewed and updated annually as part of the APR. Alliant conducts the sampling related to OU3 performance monitoring, and the Army conducts private well sampling related to the Alternate Water Supply and Well Abandonment Program.

4.1.3 Land Use Controls

LUCs are required to ensure the protectiveness of the OU3 remedy, until such time that the groundwater cleanup levels are achieved. LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health and the environment (Department of Defense Policy on Land Use Controls Associated with Restoration Activities, 2001). The original OU3 ROD (1992) did not prescribe any LUCs; however, the OU3 plume was contained within the SWCA that was established for OU1. The OU3 ROD Amendment (2006) formally adopted the need for a LUC as part of the remedy and prescribed the following: "Continued implementation of the drilling advisory that regulates the installation of new private wells within OU3 through a Special Well Construction Area." In Minnesota, the drilling of wells is regulated by the MDH, including the legal authority to create a SWCA to prohibit water supply wells within contaminated portions of aquifers. The MDH created the SWCA for the New Brighton/Arden Hills Superfund Site in June

1996. In addition to covering OU3, the SWCA also encompasses OU1 and the portion of the OU2 Site A shallow groundwater plume that extends off the north end of OU2. In June 1999, the MPCA requested that the MDH extend the boundary of the SWCA further to the southwest, to the Mississippi River and Marshall Avenue, to ensure that the southern boundary fully encompassed the plume. The MDH made this revision to the SWCA in December 1999. More information regarding the SWCA can be found on the MDH webpage at the following location: http://www.health.state.mn.us/divs/eh/wells/swca/ , and information from this website is also included in Appendix F, for reference. Figures 2-4 through 2-6 show the physical area of groundwater contamination within OU3 – the area that does not support unlimited use and unrestricted exposure of the groundwater within the contaminant plume. The current SWCA boundary is shown on Figure 2-1, which encompasses the entire OU3 groundwater plume. The objective of the LUC is to prevent uses of contaminated groundwater that pose an unacceptable risk to human health. The long-term stewardship for the LUC rests with the MDH, within its authority to regulate the construction and use of wells. The LUC for OU3 is summarized in Table 2-1.

4.1.4 System Operations/Operation and Maintenance

The City of New Brighton operated and maintained the OU3 treatment facility and associated extraction well and distribution system. The PGRS was dismantled in FY 2007, so there are no O&M procedures.

Annual O&M costs were about $200,000 per year from 1999 to 2001 (when the PGRS was operational), versus the original O&M cost estimate of $276,000. With the PGRS in standby status, the costs dropped to about $30,000 per year. Now that the system has been dismantled, there are no costs associated with O&M.

4.2 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The prior five-year review concluded that the components of the OU3 remedy remained protective of human health and the environment. There were no issues identified or follow-up actions recommended.

4.3 FIVE-YEAR REVIEW PROCESS

4.3.1 Administrative Components

Administrative components were as described for OU1 (see Section 2.3.1).

4.3.2 Community Notification and Involvement

Community notification was conducted as described for OU1 (see Section 2.3.2).

4.3.3 Document Review

The primary documents reviewed for OU3 were the following:

- Record of Decision - Groundwater Remediation, Operable Unit 3, September 1992
- Record of Decision Amendment, Operable Unit 3, August 2006
- TCAAP Final APRs for Fiscal Years 2009, 2010, 2011, and 2012
- Plume History Evaluation, Operable Unit 3, October 2000
- Previous Five Year Review Report, August 2009
- Groundwater Statistical Evaluation, Operable Unit 3, May 2005

The OU3 ROD Amendment was the source of information for remedial action objectives and cleanup levels. The FY 2011 APR was the primary source for monitoring data, since this report

contains the most recent major sampling event for OU3. The FY 2012 APR was the primary source for determining status at the end of this five-year review period.

4.3.4 Data Review

The status of the OU3 remedial action components is summarized in Table 2-2.

Groundwater monitoring, as required by remedy components #1 and #2, is conducted to verify performance of the remedy. Each fiscal year, a revolving, five-year monitoring plan is prepared by the Army and submitted to the USEPA and MPCA for approval via the APR. Although it covers five years, it is submitted on an annual basis to allow for minor changes to be made that streamline or improve the quality of the monitoring data to be collected.

In FY 2011, groundwater samples were collected from 16 wells as part of the comprehensive biennial sampling round. All of the wells sampled contained TCE concentrations similar to or below those reported for the previous sampling event (either 2009 or 2010). TCE concentrations in the downgradient sentry well, 04U863, remained less than 1.0 µg/L, as it has been since December 1999. TCE concentrations were also less than 1.0 µg/L in wells 03L854, 04U860, 04U866, and 04J866. Three wells, 03L848, 03U673, and 04U848, had TCE concentrations greater than 1.0 µg/L, but below the cleanup standard of 5 µg/L. The other eight wells had TCE concentrations above the cleanup standard of 5 µg/L, ranging from 7.2 µg/L to 160 µg/L. 1,1,1-Trichloroethane and its degradation products 1,1-dichloroethane and 1,1-dichloroethene were present in three wells at the boundary between OU1 and OU3 (03L859, 04U859, and 04U832), indicating a commingling of the North Plume and the South Plume at these locations. These parameters have also been detected at low concentrations at 03M848, a center-of-plume well, for several years, including FY 2011. In FY 2012, groundwater samples were collected from two wells as part of the annual sampling round. TCE was detected above 1.0 µg/L in the downgradient sentry well, 04U863, for the first time since December 1999. However, the reported TCE 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 TCE concentration of 190 µg/L with a duplicate result of 180 µg/L, consistent with historical results.

The Mann-Kendall statistical analysis was updated for nine edge-of-plume and center-of-plume wells in FY 2011 and for center-of-plume well 03M848 in FY 2012. Based on the most recent 2012 statistical analysis, the trend for 03M848 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 TCE 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, TCE concentrations at 03M848 have ranged only between 130 µg/L and 190 µg/L for the last seven years indicating that the TCE 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 beginning to commingle with the South Plume at this well and may be a factor in the statistical trends. The statistical analysis for well 04U859, which is classified as a center-of-plume well and is at the boundary with OU1, shows no trend. It had previously showed a stable trend. The presence of 1,1,1-trichloroethane, and its degradation products, which have historically been present in 04U859, indicates that the North Plume is present at this location and may be a factor in analysis. The trend for wells 409548, 04U832, 04U845, and 04U848 located at the edge-of-plume remained unchanged since the last statistical analysis. A definitely decreasing trend was again noted at well 409548, no trend continued at well 04U832, a stable trend continued for well 04U845, and no trend continued at 04U848. Wells 03L673 and 04U673 changed from no trend to stable and well 03L848 changed from stable to no trend. In summary, based on the data collected in FY 2011 and 2012, the center of the South Plume, represented by 03M848, appears to indicate stabilizing concentrations, while the edge of the South Plume appears to remain stable. A stable trend at the edge of the plume indicates that the South Plume is not expanding. In addition, the presence of 1,1,1-trichloroethane, and its degradation products near the OU1-OU3 boundary indicates that the North Plume is commingling with the South Plume and may be a factor in the trends noted at

the wells near the boundary. Recent data show that the North Plume may be present even toward the center of the South Plume. The OU3 plume is shown on Figures 2-4, 2-5, and 2-6.

The SWCA designated by MDH (and as amended in 1999) satisfies remedy component #3 and is accomplishing its purpose of notifying water well installers of the contaminated groundwater in the area and preventing the installation of water supply wells into the contaminated portion of the aquifer through the well construction permitting controlled by the MDH.

4.3.5 Site Inspection

Given that the PGRS was dismantled, the site inspection is no longer necessary.

4.3.6 Interviews

Interviews were conducted, as discussed previously under OU1 (See Section 2.3.6).

4.4 TECHNICAL ASSESSMENT

4.4.1 *Question A:* Is the Remedy functioning as intended by the decision documents?

The review of remedial action objectives, documents, and monitoring data suggest that the remedy is functioning as intended by the ROD. The south edge of the plume is stable, as intended by the remedy. Decreasing contaminant concentrations indicate that aquifer restoration is occurring (particularly the northward movement of the leading edge of the plume). The alternate water supply program continues to function as intended.

There are no O&M procedures, given that the treatment system has been dismantled. No changes to O&M procedures are necessary.

The LUC for OU3 is the MDH SWCA, which continues to function as intended. No changes are necessary for this remedy component.

4.4.2 *Question B:* Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The assumed route of exposure to contaminated groundwater remains valid (i.e., ingestion, inhalation during showering, and absorption through the skin during showering or bathing). No new exposure routes are applicable. No changes in land use have occurred that would have a bearing on the remedy. No new contaminants or contaminant sources have been identified.

The cleanup levels for OU3 are listed Table A-2 of Appendix A. These were based on consideration of the following ARARs, as identified in the OU3 ROD:

- MCLs and non-zero MCLGs specified in the National Primary Drinking Water Regulations (40 CFR Part 141), which apply to public water supplies, and which were established by the USEPA in accordance with the SDWA.

- RALs for Drinking Water Contaminants, Release 3, January 1991, prepared by the MDH.

The MDH RALs are no longer in use and have been superseded by the MDH's establishment of HRLs (previously specified in Minnesota Rules 4717.7100 to 4717.7800, now in 4717.7810 through 4717.7900), which can be applied to private water supplies. HRLs were not cited in the OU3 ROD as ARARs (the OU3 ROD was signed a year earlier than the OU1 ROD). State of Minnesota MCLs are another potential ARAR that was not identified in the OU3 ROD; however, the State of Minnesota adopted the Federal MCLs. Therefore, consideration of State of Minnesota MCLs would have no impact on potential cleanup levels. The cleanup levels developed in the OU3 ROD utilized the lowest value among the MCL, non-zero MCLG, and

RAL. The review of the current regulations revealed that for five of the six OU3 COCs, there are MCLs, MCLGs, or HRLs that have been established. One COC, 1,1-Dichloroethane, does not have an MCL, MCLG, or HRL. The cleanup level was based on the RAL of 70 µg/L, which is no longer in use. In 2009, the Minnesota Department of Health published a guidance value of 100 µg/L as the chronic Risk Assessment Advice (RAA) for 1,1-Dichloroethane. Using the current regulations, and applying the same basic methodology for identifying cleanup levels (i.e., using the lowest value among the MCL, non-zero MCLG, and HRL), yields the same cleanup levels that are listed in Table A-2 of Appendix A, except for 1,1-Dichloroethane (which has none of these promulgated values available; however, its cleanup level is below the MDH RAA). No changes to the cleanup levels need to be considered, based on this review.

It was noted that on July 1, 2007, the MDH HRLs were revised such that for any HRL that was set higher than the MCL, the new HRL is set equal to the MCL. For OU3, this affected two COCs: TCE and 1,1,1-trichloroethane. The HRL for TCE was revised from 30 to 5 µg/L and the HRL for 1,1,1-trichloroethane was revised from 600 to 200 µg/L. However, since the OU3 cleanup levels were already equal to the MCL for these two chemicals, there was no impact to the established cleanup levels.

In 2013, MDH updated its drinking water guidance for TCE due to new toxicity and health effects information. Although not an ARAR, the updated Health Based Value (HBV) for TCE is 0.4 µg/l, which is lower than the HRL and Federal MCL of 5 µg/l. The new guidance value does not affect current protectiveness because land use controls prevent use of contaminated groundwater. This new guidance value may need to be considered when OU1 nears closure,

The remedial action objectives for OU3 remain valid. No new objectives are proposed.

4.4.3 *Question C:* Has any other information come to light that could call into question the protectiveness of the remedy?

No information has been obtained that could call into question the protectiveness of the remedy.

4.4.4 Technical Assessment Summary

Based on the remedial action objectives and data reviewed, the remedy is functioning as intended by the OU3 ROD (as amended). No changes in land use or exposure scenarios have occurred that would affect the protectiveness of the remedy. The ARARs used in establishing cleanup levels have undergone some changes (proposed values in regulations have become final, MDH RALs are no longer applicable, more MDH HRLs have been established, and some HRLs have been revised); however, none of these changes suggest that a change to the cleanup levels should be considered. No information has been obtained that could call into question the protectiveness of the remedy.

4.5 ISSUES

None.

4.6 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

None.

4.7 STATEMENT OF PROTECTIVENESS

The OU3 remedy is protective of human health and the environment.

The alternate water supply and well abandonment program, along with the SWCA, are mitigating potential risks associated with private wells. Water quality trends indicate that progress towards aquifer restoration continues to occur.

5.0 Next Review

The next five-year review is due 21 August 2019, or 5 years from the USEPA concurrence date if the date is earlier than 21 May 2014.

6.0 Approvals

The remedies reviewed in this report are protective of human health and the environment, continue to comply with ARARs, and continue to be cost-effective. Specific to OU2, the remedy is protective in the *short term*; however, in order for the remedies to be protective in the *long-term*, monitoring is required at Site A to assess if MNA will adequately control plume migration, and additional soil vapor investigation at Site A *[refer to note below]* and groundwater investigation at Building 102 *[refer to note below]* need to be completed.

[With respect to the additional soil vapor investigation at Site A needed for the remedy to be protective in the long-term, the following should be noted: upon approval of the QAPP by the USEPA and MPCA in June 2013, the soil vapor investigation work was conducted in July 2013 and then documented in Site A Vapor Intrusion Investigation Report, which was approved by the USEPA and MPCA in February 2014. The report concluded that no significant vapor intrusion risk existed for the homes along County Road I. A more detailed discussion of these results will appear in the next five-year review.

With respect to the additional groundwater investigation at Building 102 needed for the remedy to be protective in the long-term, the following should be noted: upon approval of the QAPP by the USEPA and MPCA in June 2013, the groundwater investigation work was conducted in July 2013 and then documented in Supplemental Investigation Report for Building 102 Groundwater, which was approved by the USEPA and MPCA in March 2014. The report concluded that a significant level of attenuation was occurring at the point groundwater had travelled halfway from 01L582 to Rice Creek. A more detailed discussion of these results will appear in the next five-year review.

Although the work described above at Site A and Building 102 was conducted beyond the cutoff date for this five-year review (March 31, 2013), due to the importance of this work relative to the remedy protectiveness determination, the work was noted as part of this five-year review.]

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION V

Signature: _____ Date: 8/19/2014

Printed Name: THOMAS SHORT

Title: SUPERFUND BRANCH CHIEF

MINNESOTA POLLUTION CONTROL AGENCY

Signature: _____ Date: 8/11/14

Printed Name: Kathryn J. Sather

Title: Remediation Division Director

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Tables

Table 2-1

Land Use Controls Summary

Media, Engineered Controls, & Areas That Do Not Support Unlimited Use/Unrestricted Exposure	Land Use Control Objective	Title of Land Use Control Instrument Implemented
OU1 – Deep Groundwater: North plume of deep groundwater contamination off the installation as depicted in Figures 2-4 to 2-6.	Prevent uses of contaminated groundwater that pose an unacceptable risk to human health, until cleanup levels are achieved.	Special Well Construction Area administered by the Minnesota Department of Health.
OU2 – Deep Groundwater: Plume of deep groundwater contamination on the installation as depicted in Figures 3-19 to 3-21. (See Note)	Prevent uses of contaminated groundwater that pose an unacceptable risk to human health, until cleanup levels are achieved. Prevent activities that would reduce the effectiveness of groundwater remedial actions set forth in decision documents and subsequent design or monitoring plans for each individual area.	Land Use Control Remedial Design (LUCRD)
OU2 – Shallow Groundwater: Plumes of shallow groundwater contamination at Site A (Figure 3-4), Site C (Figure 3-9), Site I (Figure 3-11), Site K (Figure 3-13), and Building 102 (Figures 3-14 to 3-16). (See Note)	Prevent uses of contaminated groundwater that pose an unacceptable risk to human health, until cleanup levels are achieved. Prevent activities that would reduce the effectiveness of groundwater remedial actions set forth in decision documents and subsequent design or monitoring plans for each individual area.	LUCRD
OU2 – Soil: Areas remediated to site-specific “industrial use” cleanup levels (all or portions of Sites A, C, D, E, H, 129-3, 129-5, Grenade Range, Outdoor Firing Range, and the 535 Primer/Tracer Area). (See Note)	Prevent exposure to contaminated soil at levels that pose an unacceptable risk to human health.	LUCRD
OU2 – Covers: Areas with soil contamination remaining in-place that have a soil cover to prevent exposure (all or portions of Sites C, D, E, G, H, 129-15, and Outdoor Firing Range). At Site G only, the cover is designed to minimize infiltration.	Prevent disturbance of soil covers which would result in exposure to the underlying contaminated soil of sufficient magnitude as to pose an unacceptable risk to human health.	LUCRD
OU3 – Deep Groundwater: South plume of deep groundwater contamination off the installation as depicted in Figures 2-4 to 2-6.	Prevent uses of contaminated groundwater that pose an unacceptable risk to human health, until cleanup levels are achieved.	Special Well Construction Area administered by the Minnesota Department of Health.

Note: In addition to the individual areas shown above, the OU2 LUCRD also addresses soil and groundwater LUCs for the remaining federally-owned property within OU2. Although there is not a decision document for the land outside the individual areas, the U.S. Army has elected to implement “blanket” LUCs for soil and groundwater across a significant portion of the federally-owned property. The “blanket” soil LUCs include the following excepted areas: through the land transfer process, 113 acres of mostly open space along Rice Creek were transferred to Ramsey County without any use restrictions; the former staff housing area is presumed suitable for residential (unrestricted) use; Site F is remediated to unrestricted use levels; an area known as the “watchable wildlife area” is cleared for unrestricted use; a portion of the cantonment area within AHATS may be used with a restricted commercial exposure scenario.

Table 2-2

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 2-2 (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 2-2 (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 2-2 (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 2-2 (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 2-2 (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	

Table 2-2 (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: 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 2-2 (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	

Table 2-3
OU1 Pumping / VOC Mass Removal Data

Fiscal Year 2009

	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, 2008																			20,119	20,321
OCTOBER	68	5.583	3.169	63	33.000	17.351	170	0.410	0.582	90	1.428	1.073	5	23.549	0.983	46	22.507	8.641	86.5	31.800
NOVEMBER	91	0.137	0.104	65	36.291	19.688	170	0.515	0.731	85	19.111	13.558	5	1.470	0.056	39	40.303	13.118	98	47.258
DECEMBER	69	7.485	4.310	67	35.396	19.793	170	7.427	10.538	92	16.817	12.913	4	0.192	0.006	33	35.946	9.900	103	57.464
JANUARY	76	10.626	6.740	62	33.368	17.266	170	11.172	15.851	89	13.346	9.913	3	0.163	0.004	29	35.734	8.649	104	58.428
FEBRUARY	76	1.752	1.111	59	29.687	14.618	140	12.456	14.554	79	14.014	9.240	3	0.213	0.006	26	32.025	6.949	90	46.482
MARCH	73	0.266	0.162	72	34.896	20.969	140	12.837	14.999	73	14.456	8.807	4	0.247	0.008	25	35.301	7.366	98	52.315
APRIL	87	0.116	0.084	78	33.859	22.042	140	9.805	11.457	79	12.076	7.962	3	0.190	0.005	25	36.405	7.596	92.5	49.149
MAY	76	1.706	1.082	68	34.720	19.705	130	13.338	14.471	67	15.080	8.432	3	0.360	0.010	22	36.733	6.745	102	50.449
JUNE	85	3.978	2.822	60	35.990	18.022	140	21.173	24.739	74	23.825	14.714	4	0.190	0.007	28	36.212	8.462	121	68.772
JULY	65	4.584	2.487	67	34.966	19.552	110	22.675	20.817	65	21.343	11.578	4	0.214	0.007	25	38.547	8.043	122	62.489
AUGUST	83	6.282	4.352	65	30.512	16.552	110	16.495	15.143	68	15.158	8.603	4	0.189	0.006	25	35.589	7.426	104	52.085
SEPTEMBER	72	33.944	20.397	66	3.564	1.963	110	16.681	15.314	60	3.890	1.948	3	0.148	0.003	22	41.230	7.570	99.5	47.200
Subtotal			46.821			207.522			159.196			108.741			1.100			100.465		
% of Total Mass			7.5			33.3			25.5			17.4			0.2			16.1		
TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2009																			1,222	624
TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP																			21,341	20,944

Table 2-4

OU1 Pumping / VOC Mass Removal Data

Fiscal Year 2010

	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, 2009																			21,341	20,944
OCTOBER	75	30.365	19.007	72	0.147	0.088	100	12.927	10.789	66	2.378	1.310	3	0.207	0.004	28	40.444	9.451	86	40.653
NOVEMBER	83	34.346	23.792	80	1.887	1.260	100	27.838	23.234	65	0.645	0.350	2	0.306	0.006	25	38.638	8.062	104	56.707
DECEMBER	75	15.693	9.823	75	16.682	10.442	94	18.428	14.457	59	15.512	7.638	2	0.309	0.005	23	39.805	7.641	106	50.011
JANUARY	80	23.715	15.834	68	18.301	10.386	94	15.706	12.322	72	15.709	9.440	2	0.148	0.003	21	39.562	6.934	113	54.922
FEBRUARY	71	18.174	10.769	59	16.008	7.883	91	21.634	16.431	56	2.399	1.121	2	0.516	0.010	19	38.278	6.070	97	42.287
MARCH	85	15.764	11.183	0	0.000	0.000	96	16.958	13.587	0	0.002	0.000	3	3.131	0.071	30	38.480	9.635	74	34.478
APRIL	79	18.069	11.914	0	0.035	0.000	78	23.191	15.097	0	0.002	0.000	0	0.197	0.000	24	38.831	7.778	80	34.791
MAY	100	5.509	4.598	86	3.751	2.692	82	17.014	11.644	0	0.027	0.000	3	0.143	0.004	27	42.663	9.614	69	28.554
JUNE	86	30.936	22.204	81	11.254	7.608	84	23.669	16.593	0	5.035	0.000	3	7.696	0.199	29	39.559	9.575	118	56.184
JULY	77	34.212	21.986	81	6.683	4.518	110	7.621	6.997	60	40.593	20.327	3	0.141	0.004	29	39.737	9.618	129	63.454
AUGUST	81	34.310	23.194	79	9.278	6.117	110	9.206	8.452	61	35.751	18.201	3	0.273	0.007	26	40.156	8.714	129	64.690
SEPTEMBER	66	22.429	12.355	63	1.140	0.599	93	32.345	25.105	56	1.661	0.776	3	0.213	0.005	22	38.116	6.999	96	45.843
Subtotal			186.660			51.594			174.707			59.164			0.318			100.089		
% of Total Mass			32.6			9.0			30.5			10.3			0.1			17.5		
TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2010																			1,202	573
TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP																			22,543	21,517

Table 2-5
OU1 Pumping / VOC Mass Removal Data

Fiscal Year 2011

	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, 2010																			22,543	21,517
OCTOBER	NS	0.615	0.000	82	11.585	7.928	77	29.816	19.161	54	1.477	0.666	2	0.988	0.020	25	35.467	7.400	80	35.178
NOVEMBER	NS	20.932	0.000	98	2.067	1.691	89	25.172	18.698	61	1.951	0.993	3	0.186	0.004	31	38.636	9.996	89	31.384
DECEMBER	81	30.665	20.730	85	8.949	6.349	76	16.930	10.739	60	8.283	4.148	2	0.190	0.004	21	35.584	6.237	101	48.209
JANUARY	97	26.760	21.664	89	13.000	9.656	97	14.150	11.455	68	12.982	7.368	3	0.165	0.004	23	35.548	6.824	103	56.975
FEBRUARY	96	27.307	21.879	82	9.688	6.630	94	23.801	18.672	64	11.633	6.214	3	4.777	0.112	22	16.428	3.016	94	56.527
MARCH	83	34.396	23.827	72	10.396	6.247	78	38.453	25.032	54	15.600	7.031	2	11.729	0.176	NS	0.000	0.000	111	62.318
APRIL	79	29.624	19.532	64	3.400	1.816	75	17.274	10.813	54	3.557	1.603	2	2.053	0.036	5	29.195	1.096	85	34.899
MAY	73	35.329	21.524	63	7.646	4.020	68	31.138	17.672	52	9.639	4.183	2	0.164	0.003	13	37.817	4.103	122	51.509
JUNE	80	23.333	15.579	68	13.669	7.758	76	32.852	20.838	57	16.792	7.988	3	1.174	0.025	16	38.471	5.137	126	57.330
JULY	NS	19.820	0.000	73	1.936	1.180	62	31.746	16.427	46	5.563	2.136	11	17.032	1.564	36	39.425	11.845	116	33.154
AUGUST	71	33.863	20.066	65	11.314	6.138	66	34.298	18.893	52	11.445	4.967	3	0.264	0.007	23	35.496	6.814	127	56.889
SEPTEMBER	70	33.037	19.301	65	12.204	6.621	66	23.858	13.142	51	10.075	4.288	3	0.187	0.005	22	34.653	6.363	114	49.723
Subtotal			184.102			66.033			201.541			51.585			1.960			68.832		
% of Total Mass			32.1			11.5			35.1			9.0			0.3			12.0		
TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2011																			1,266	574
TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP																			23,809	22,091

Table 2-6
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 2-7

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 3-1
Groundwater Quality Data for Shallow Soil Site Monitoring at Site H

Fiscal Year 2009

	Site H		TCAAP Unit 1 Groundwater Background [1]	MDH HRL
	01U060 6/26/09	01U060 D 6/26/09		
Antimony	JP 2 UB2.2	JP 2 UB2.2	<10	6
Arsenic	JP 2.2	JP 1.7	6.8	(Note 2)
Copper	**9.5**	**9.6**	4 [3]	1,000*
Lead	JP 0.4 UB0.6	JP 0.23 UB0.6	4.2	15 [4]
Manganese	880	690	7,500	1,000*

Notes:

All Results in µg/l.

MDH HRL = Minnesota Department of Health, Health Risk Limit (* indicates a Health Based Value, rather than a HRL).

(1) Background values for Unit 1 groundwater from Appendix C, Table 6 in the OU2 ROD.
Bolding (in red color) indicates exceedance of the respective background value.

(2) No HRL has been established for this analyte.

(3) The calculated chronic surface water standard for copper (hardness-dependent) was 7.1 µg/l. This calculated standard is based on Sunfish Lake monitoring conducted in FY 2008 (the lake hardness was determined to be 59.7 mg/l).

(4) No HRL has been established for this analyte. MDH utilizes 15 µg/l as the Action Level "at the tap".

D Duplicate sample.

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

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

TABLE 3-2

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2011
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*
03L002	6/14/11		1.1	0.8 JP	1.7	< 1	< 1	< 1	19
03L007	6/13/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L014	6/17/11		29	1.9	2.2	< 1	1	< 1	87
03L017	6/14/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L018	6/20/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L020	6/13/11		0.48 JP	< 1	< 1	< 1	< 1	< 1	8.6
03L020	6/13/11	D	0.47 JP	< 1	< 1	< 1	< 1	< 1	8.4
03L021	6/16/11		< 1	< 1	< 1	< 1	< 1	< 1	3.2
03L077	6/15/11		2.5	< 1	1	< 1	< 1	< 1	34
03L078	6/14/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L079	6/14/11		< 1	< 1	< 1	< 1	< 1	< 1	1.6
03L084	6/16/11		< 1	< 1	< 1	< 1	< 1	< 1	0.33 JP
03L084	6/16/11	D	< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L802	6/8/11		< 1	< 1	< 1	< 1	< 1	< 1	2.3
03L806	6/8/11		< 1	47	26	< 1	2.9	0.44 JP	200
03L809	6/13/11		2.9	0.96 JP	1.8	< 1	0.58 JP	< 1	90
03L833	6/9/11		< 1	< 1	< 1	< 1	< 1	< 1	2.7
03M002	6/16/11		1.3	3.3	2.4	< 1	0.58 JP	< 1	43
03M020	6/13/11		2	0.49 JP	0.45 JP	< 1	< 1	< 1	30
03M802	6/8/11		< 1	< 1	< 1	< 1	< 1	< 1	7.9
03M806	6/8/11		< 1	42	25	< 1	4.2	< 1	320
03U002	7/26/11		2.7	0.85 JP	0.97 JP	< 1	0.38 JP	< 1	22
03U003	11/1/10		16	1.7	3.3	< 1	6.1	< 1	100
03U003	6/21/11		2.3	0.41 JP	0.53 JP	< 1	0.85 JP	< 1	41
03U004	6/21/11		< 1	< 1	< 1	< 1	< 1	< 1	0.44 JP
03U005	6/13/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U007	6/13/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1

TABLE 3-2

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2011
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***
03U009	6/17/11		< 1	< 1	< 1	< 1	< 1	< 1	0.5 JP
03U014	6/17/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U017	6/14/11		0.34 JP	< 1	< 1	< 1	< 1	< 1	1.5
03U018	6/20/11		12	0.32 JP	1.1	< 1	6.5	< 1	26
03U020	6/13/11		15	0.9 JP	2.6	< 1	0.66 JP	< 1	54
03U021	6/16/11		99	4.5	11	< 1	2.7	< 1	230
03U021	6/16/11	D	100	4.5	11	< 1	2.4	< 1	240
03U027	6/14/11		0.94 JP	< 1	0.33 JP	< 1	0.64 JP	< 1	10
03U028	6/15/11		2.4	< 1	0.62 JP	< 1	3.6	< 1	41
03U029	6/15/11		1.5	< 1	< 1	< 1	1.9	< 1	21
03U030	6/17/11		< 1	< 1	< 1	< 1	1.6	0.36 JP	22
03U032	6/21/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U075	6/14/11		< 1	< 1	< 1	< 1	< 1	< 1	0.41 JP
03U077	6/15/11		1	< 1	< 1	< 1	< 1	< 1	14
03U078	6/14/11		2.8	< 1	0.8 JP	< 1	0.56 JP	21	95
03U079	6/14/11		1.5	< 1	< 1	< 1	< 1	< 1	19
03U092	6/20/11		0.56 JP	< 1	< 1	< 1	3	< 1	18
03U092	6/20/11	D	0.51 JP	< 1	< 1	< 1	3	< 1	18
03U093	6/20/11		57	0.38 JP	4.7	< 1	1.7	< 1	84
03U094	6/22/11		32	8.1	5.9	< 1	7.2	< 1	100
03U096	6/22/11		0.81 JP	1.3	0.48 JP	< 1	< 1	< 1	6.8
03U099	6/17/11		1.4	< 1	< 1	< 1	< 1	< 1	4.9
03U114	6/20/11		0.67 JP	< 1	< 1	< 1	< 1	< 1	4.6
03U659	6/15/11		2.7	< 1	0.42 JP	< 1	4.4	< 1	41
03U671	6/16/11		6.4	2.3	2.4	< 1	0.95 JP	2.8	60
03U672	6/13/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U701	6/16/11		< 1	< 1	< 1	< 1	< 1	< 1	1.6

TABLE 3-2

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2011
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*
03U702	6/6/11		< 1	< 1	< 1	< 1	< 1	< 1	0.92 JP
03U702	6/6/11	D	< 1	< 1	< 1	< 1	< 1	< 1	0.92 JP
03U703	6/17/11		2.2	< 1	0.59 JP	< 1	2.5	11	52
03U708	6/7/11		5.9	2.2	2.4	< 1	0.98 JP	2.1	39
03U709	6/7/11		2.9	1.1	1.4	< 1	0.31 JP	< 1	32
03U709	6/7/11	D	2.8	1.2	1.4	< 1	0.38 JP	< 1	32
03U710	6/21/11		4	< 1	0.68 JP	< 1	0.83 JP	< 1	45
03U711	6/9/11		6.3	1.6	2.3	< 1	0.66 JP	0.92 JP	54
03U715	6/20/11		9.2	< 1	1.1	< 1	< 1	< 1	28
03U801	6/9/11		< 1	< 1	< 1	< 1	0.53 JP	< 1	30
03U803	6/9/11		< 1	< 1	< 1	< 1	< 1	< 1	1.6
03U804	6/9/11		< 1	< 1	< 1	< 1	< 1	< 1	0.75 JP
03U805	6/9/11		0.61 JP	12	4.6	< 1	1.3	0.57 JP	2.1
03U806	6/8/11		< 1	0.85 JP	0.63 JP	< 1	< 1	1.3	56
04J077	6/15/11		3.6	3.5	3.6	< 1	1.2	< 1	63
04J702	6/6/11		< 1	< 1	< 1	< 1	< 1	< 1	1.7
04J708	6/7/11		0.36 JP	0.46 JP	0.33 JP	< 1	< 1	< 1	3.9
04J713	6/7/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
04U002	6/14/11		< 1	< 1	< 1	< 1	< 1	< 1	1.7
04U002	6/14/11	D	< 1	< 1	< 1	< 1	< 1	< 1	1.7
04U007	6/13/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
04U020	6/13/11		< 1	< 1	< 1	< 1	< 1	< 1	0.83 JP
04U027	6/14/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
04U077	6/15/11		2.9	0.8 JP	1.6	< 1	< 1	< 1	50
04U510	6/17/11		< 1	< 1	< 1	< 1	< 1	< 1	< 1
04U701	6/16/11		< 1	< 1	< 1	< 1	< 1	< 1	4
04U702	6/6/11		< 1	< 1	< 1	< 1	< 1	< 1	1.8

TABLE 3-2

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2011
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***
04U708	6/7/11		< 1	< 1	< 1	< 1	< 1	< 1	0.44 JP
04U709	6/7/11		1.4	0.52 JP	1.4	< 1	< 1	< 1	21
04U711	6/9/11		< 1	< 1	< 1	< 1	< 1	< 1	0.69 JP
04U711	6/9/11	D	< 1	< 1	< 1	< 1	< 1	< 1	0.62 JP
04U713	6/7/11		< 1	< 1	< 1	< 1	< 1	< 1	0.31 JP
04U802	6/8/11		< 1	< 1	< 1	< 1	< 1	< 1	1
04U806	6/8/11		< 1	21	13	< 1	1.9	0.4 JP	150
04U833	6/9/11		< 1	< 1	< 1	< 1	< 1	< 1	0.84 JP
PJ#806	6/8/11		< 1	0.81 JP	0.55 JP	< 1	< 1	< 1	23

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.

Table 3-3
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 3-3
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.

Table 3-4
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 3-4
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 3-5

GROUNDWATER QUALITY DATA
FISCAL YEAR 2011
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	4/21/2011	0.68 (J)	10	0.63 (J)	**0.31 (J)**
01U632	4/21/2011	**140**	27	0.43 (J)	<1
01U636	4/21/2011	<1	<1	<1	<1
01U639	4/21/2011	NS	NS	NS	NS
01U640	4/21/2011	<1	<1	<1	<1
482086 (I01MW)	4/21/2011	<1	<1	<1	<1
482088 (I02MW)	4/21/2011	Dry	Dry	Dry	Dry
482089 (I04MW)		29	<1	<1	<1
482089 (I04MW) D	4/21/2011	27	0.31 (J)	<1	<1
482087 (I05MW)	4/21/2011	3.3	0.73 (J)	<1	<1

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

TABLE 3-6

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.

TABLE 3-7

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 3-8
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.

Table 3-9
Water Quality Results for Pond G Surface Water

Remedial Action Completion and Aquatic Site Close Out Report - Pond G

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**
Event #3													
No sampling was conducted since the pond was dry.													
Event #4													
PG1		4/29/13	NA			59			0.45	U			
PG1		4/30/13	NA			59			0.45	U			
PG1	D	4/30/13	NA			67			0.45	U			
PG1		5/1/13	NA			57			0.45	U			
	Average:					**60**			**0.23**			**1.6**	**Yes**
Event #5													
PG1		5/22/13	NA			73			0.45	U			
PG1		5/23/13	NA			63			0.45	U			
PG1		5/24/13	NA			77			0.45	U			
PG1	D	5/24/13	NA			61			0.45	U			
	Average:					**68**			**0.23**			**2.0**	**Yes**
Event #6													
No sampling was conducted due to the accelerated schedule for the TCAAP Five Year Review.													

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):

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

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). Chloride monitoring was only required in the first sampling event.

Table 3-10

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 3-11

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 3-12

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.

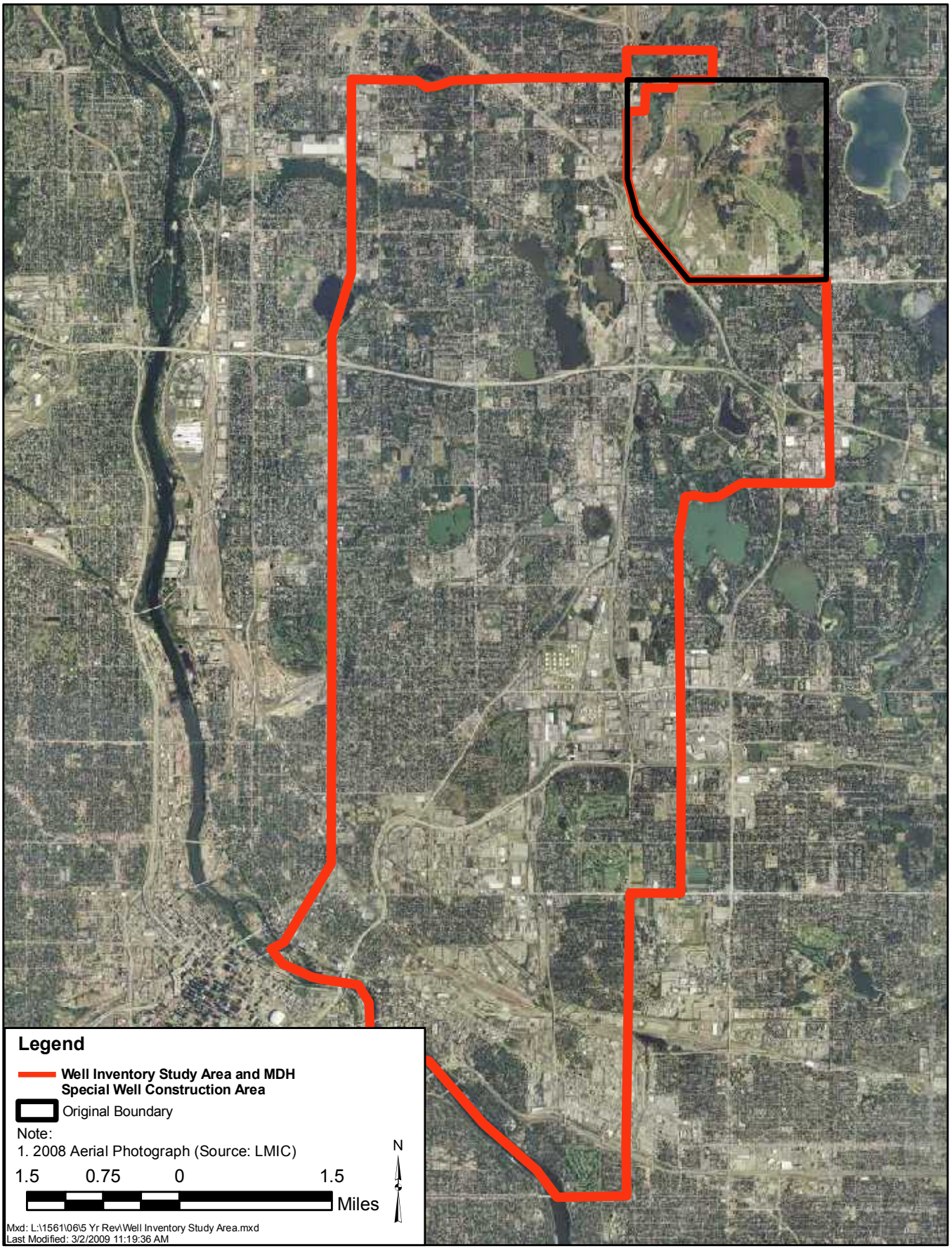
TABLE 3-12

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***

Figures



TWIN CITIES ARMY AMMUNITION PLANT

Special Well Construction Area

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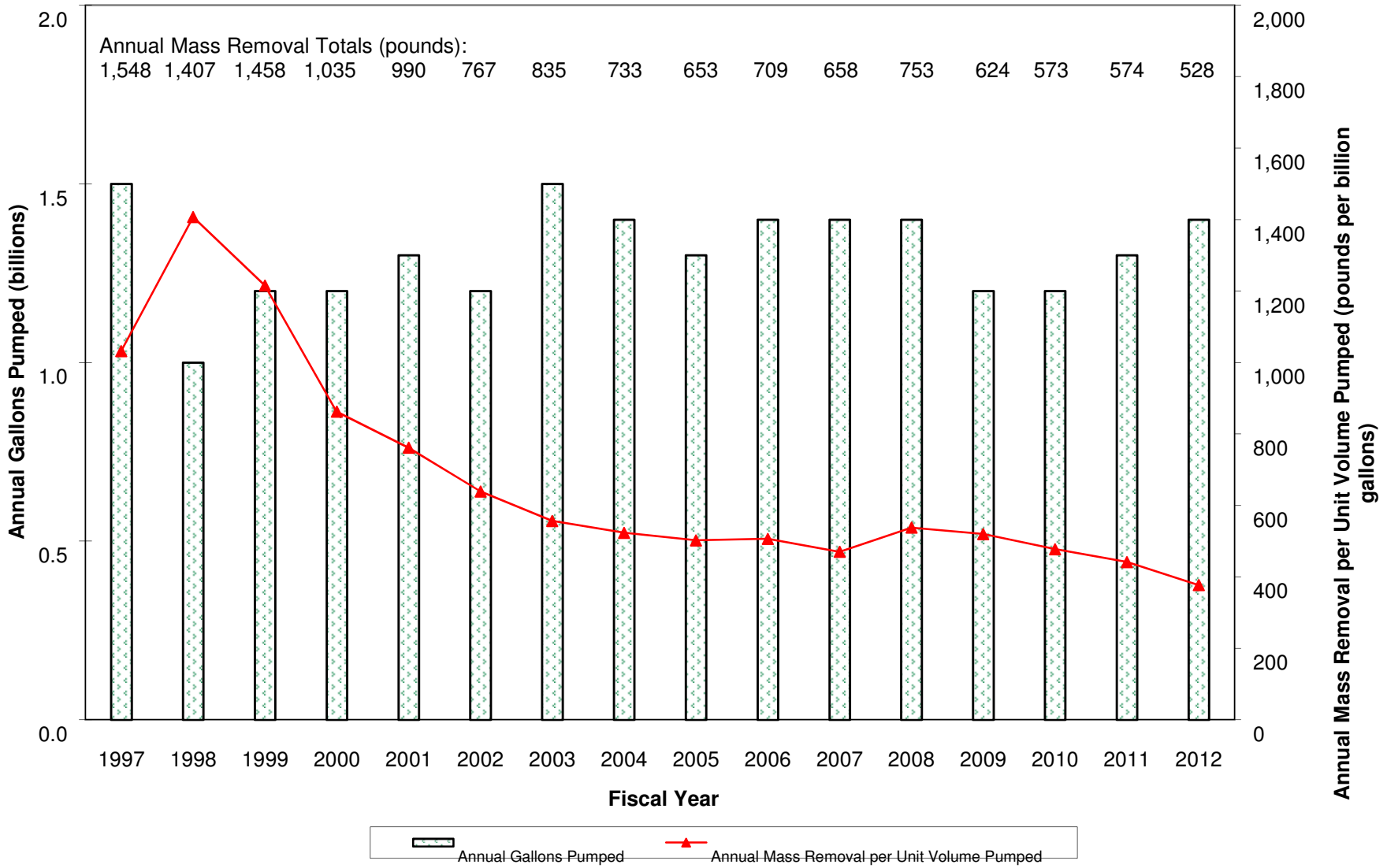
Figure 2-1

FIGURE 2-2
OU1, NBCGRS MASS REMOVAL HISTORY
2012 Annual Performance Report



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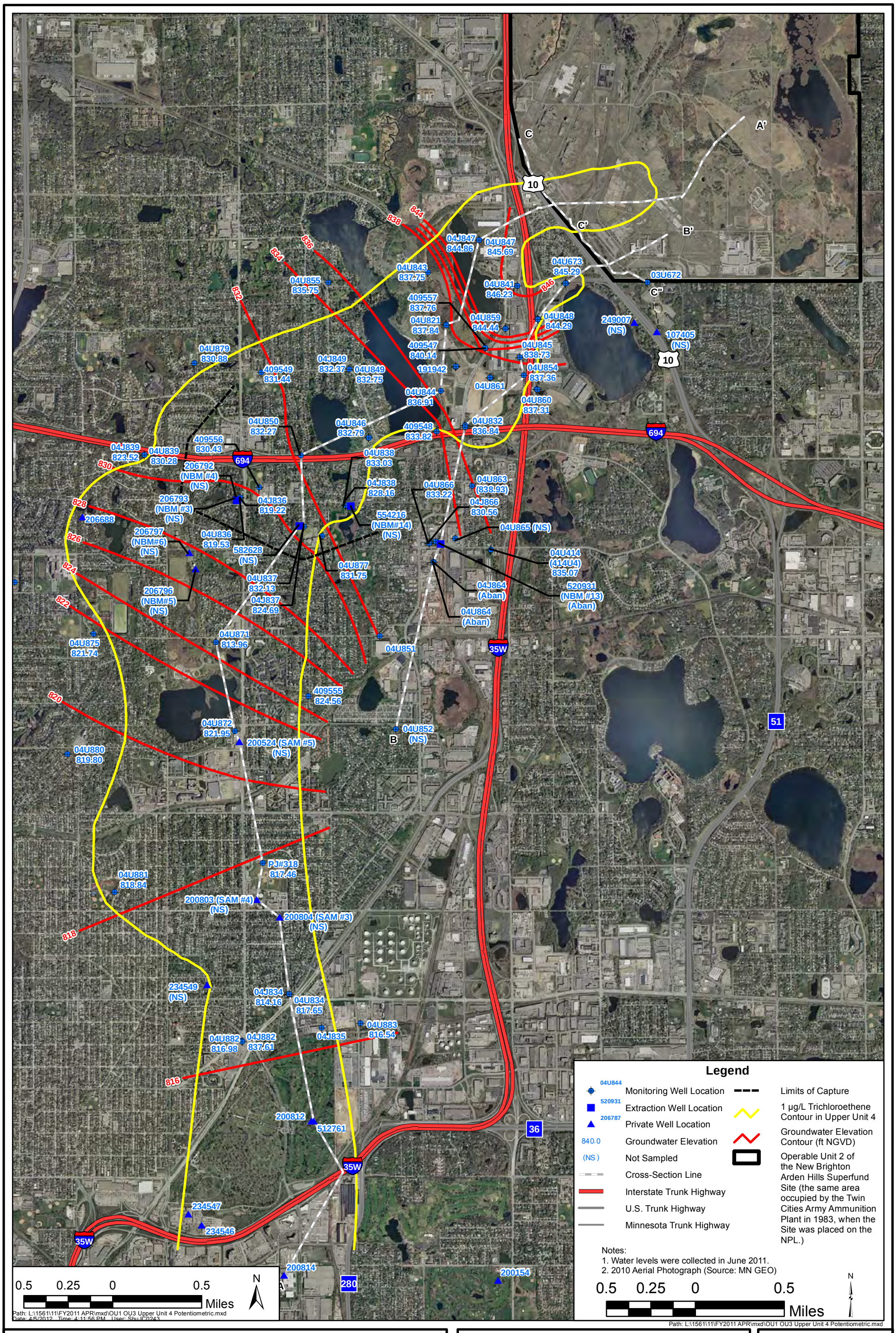

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OU1 & OU3, Upper Unit 4, Potentiometric Map, Summer 2011

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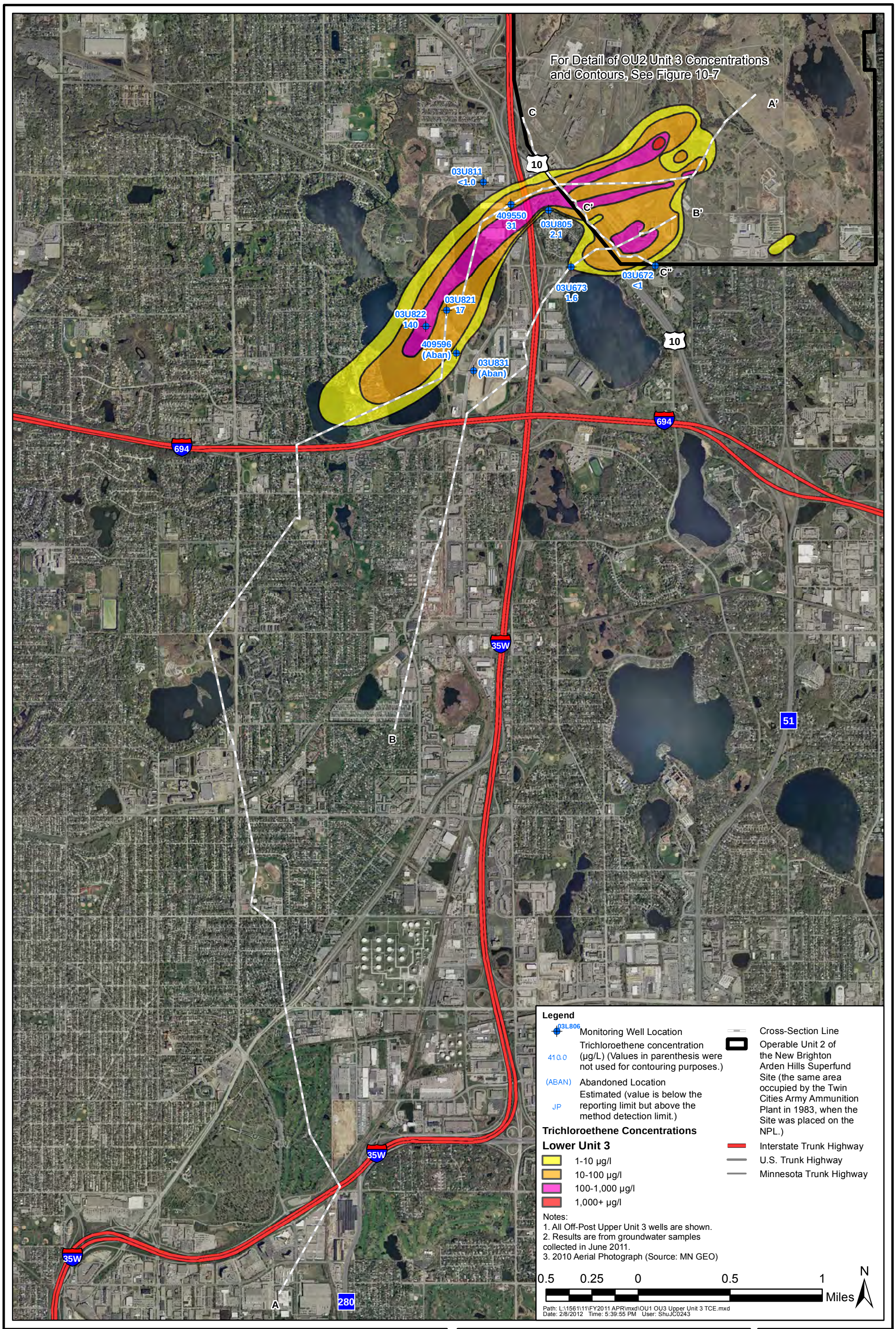
Figure 2-3



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OU1 & OU3, Upper Unit 3, Trichloroethene Isoconcentration Map Summer 2011

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Figure 2-4

For Detail of OU2 Lower Unit 3 Concentrations and Contours, See Figure 10-8

A'
C
C'
B'
C''
B
A

03L811 JP 0.55
03L809 90
03M843 (<1)
03L841 <1
03L673 95
03L853 (NS)
03L848 4.5
03L859 7.2
03M848 (160)
03L822 180
409557 58
409597 (Aban)
03L854 JP 0.36
03L861 (Aban)
03L860 (NS)
03L832 1.7
03L846 <1
409556 <1
249632 (NS)
476837 (NS)

10
694
35W
51
280

Legend

- 03L822 Monitoring Well Location
- 410.0 Trichloroethene concentration (µg/L) (Values in parentheses were not used for contouring purposes)
- (NS) Not Sampled
- (ABAN) Abandoned Location
- JP Estimated Value (Value is below the reporting limit but above the method detection limit)

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l

- Cross-Section Line
- 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.)
- Interstate Trunk Highway
- U.S. Trunk Highway
- Minnesota Trunk Highway

Notes:
1. All Off-Post Lower Unit 3 wells are shown
2. Off-Post Middle Unit 3 wells with data are shown with data in parenthesis, but were not used for contouring
3. Results are from groundwater samples collected in June 2011.
4. 2010 Aerial Photograph (Source: MN GEO)

0.5 0.25 0 0.5 1 Miles

N

Path: L:\1561\11\FY2011 APR\mxd\OU1 OU3 Lower Unit 3 TCE.mxd
Date: 1/6/2012 Time: 3:20:29 PM User: ShuJC0243

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OU1 & OU3, Lower Unit 3, Trichloroethene Isoconcentration Map Summer 2011

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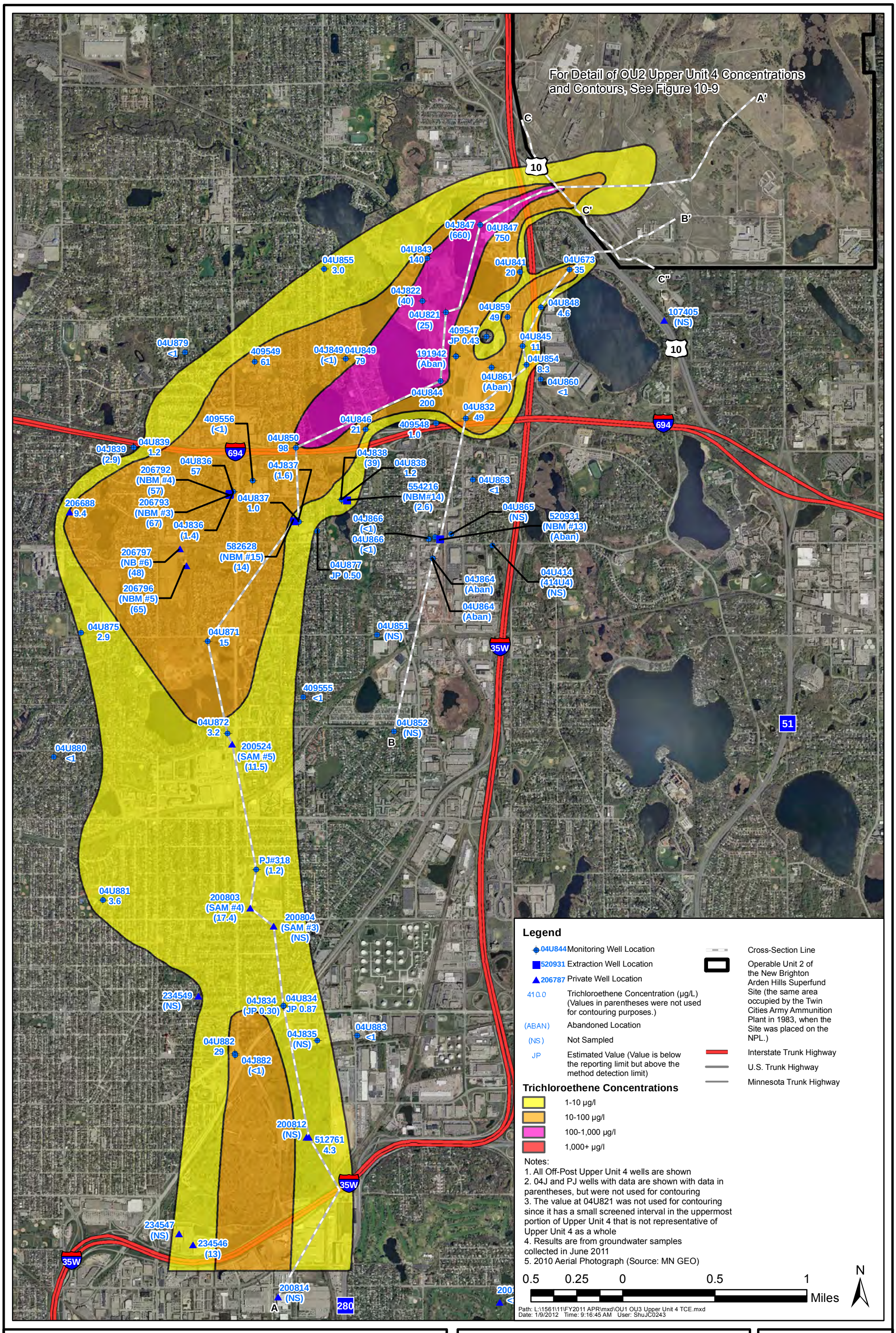
Figure 2-5



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OU1 & OU3, Upper Unit 4, Trichloroethene Isoconcentration Map Summer 2011

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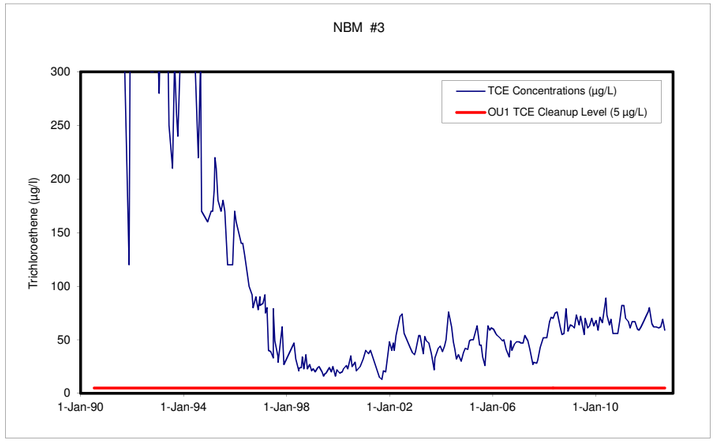
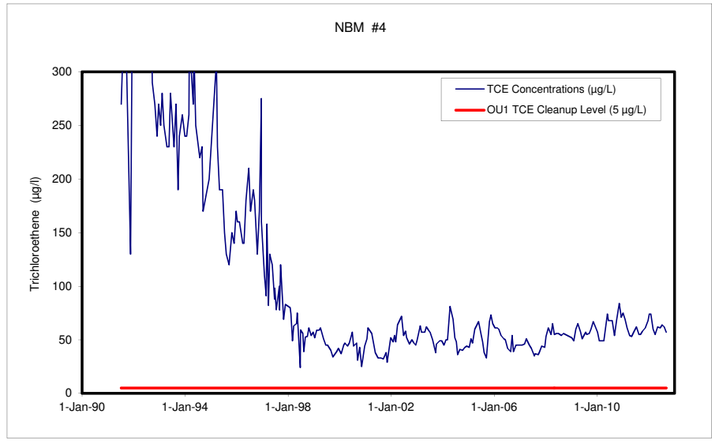
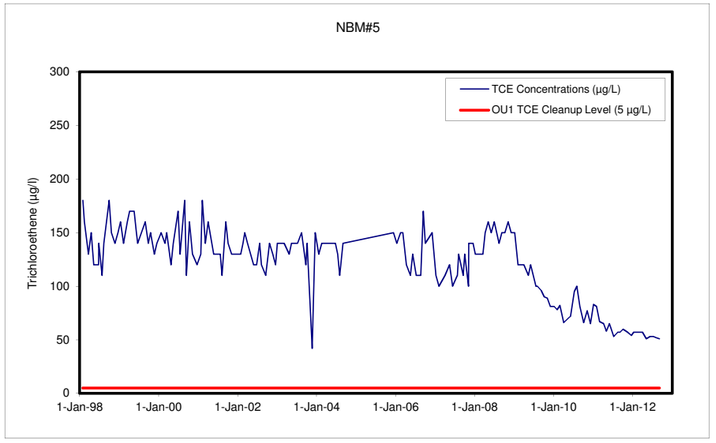
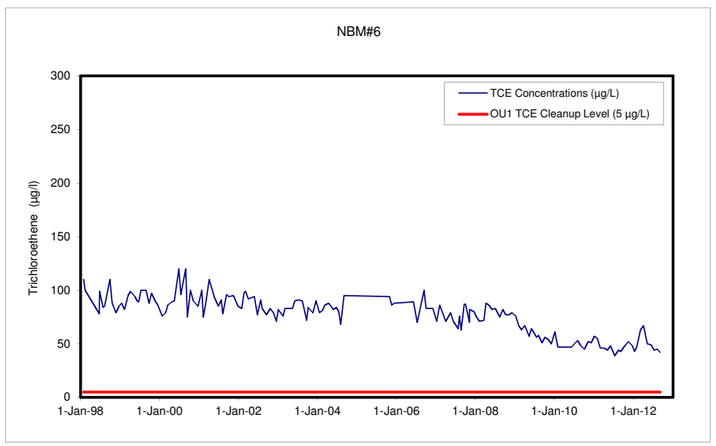
Figure 2-6

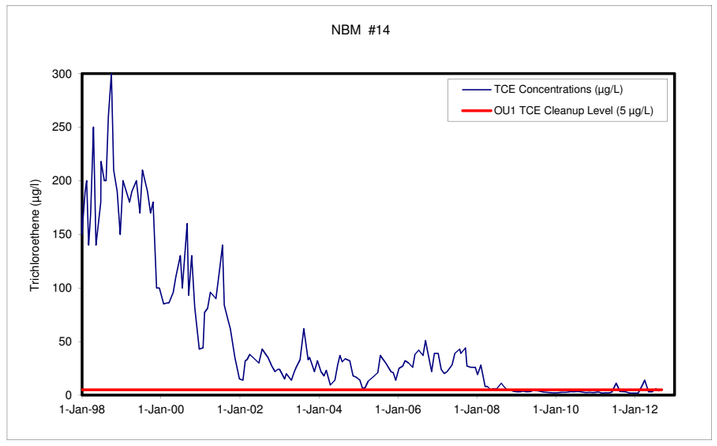
FIGURE 2-7
NEW BRIGHTON MUNICIPAL WELLS: TRICHLOROETHENE WATER QUALITY TRENDS
2012 Annual Performance Report

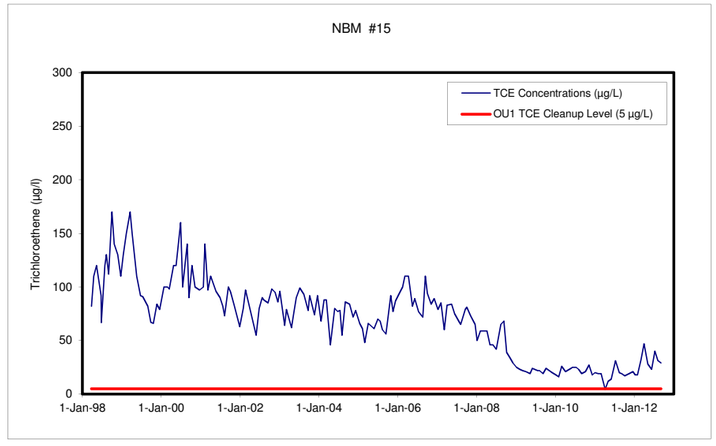












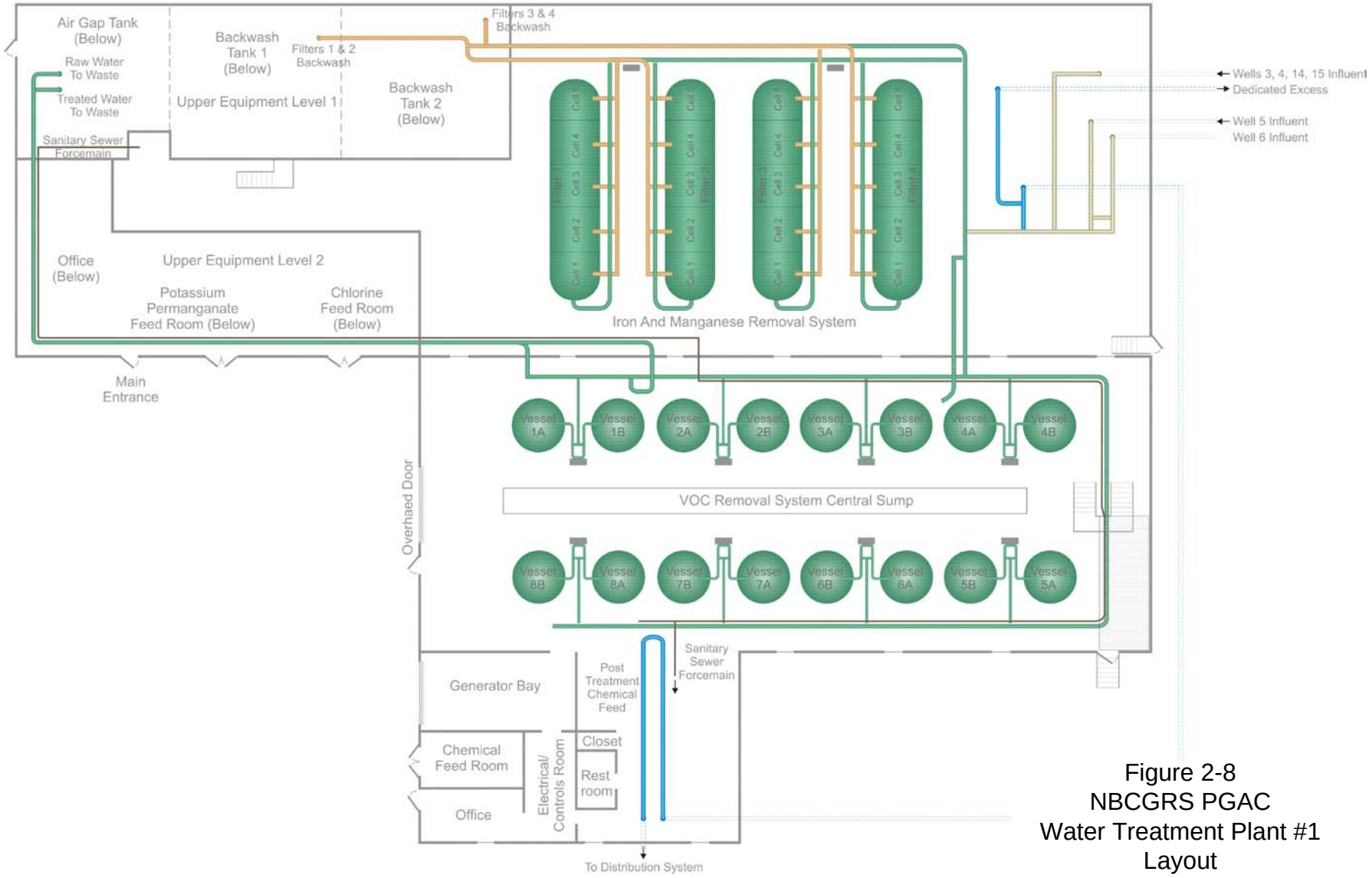


Figure 2-8
NBCGRS PGAC
Water Treatment Plant #1
Layout

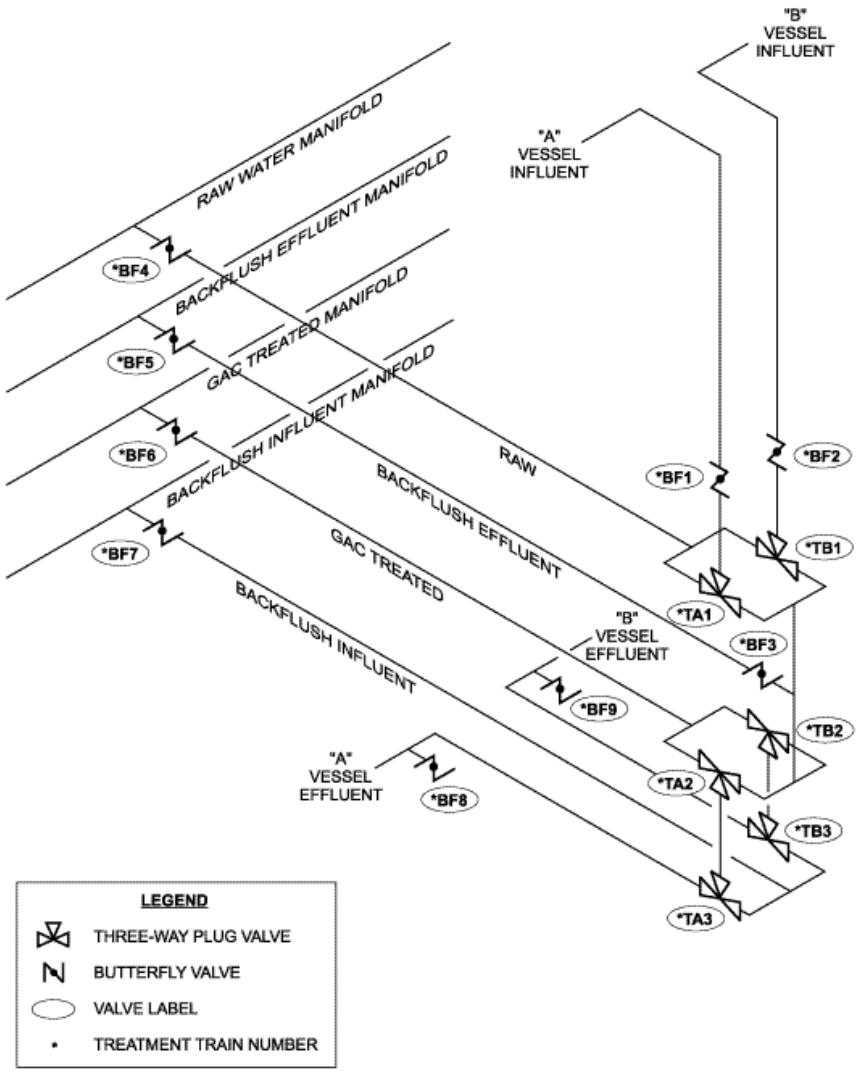
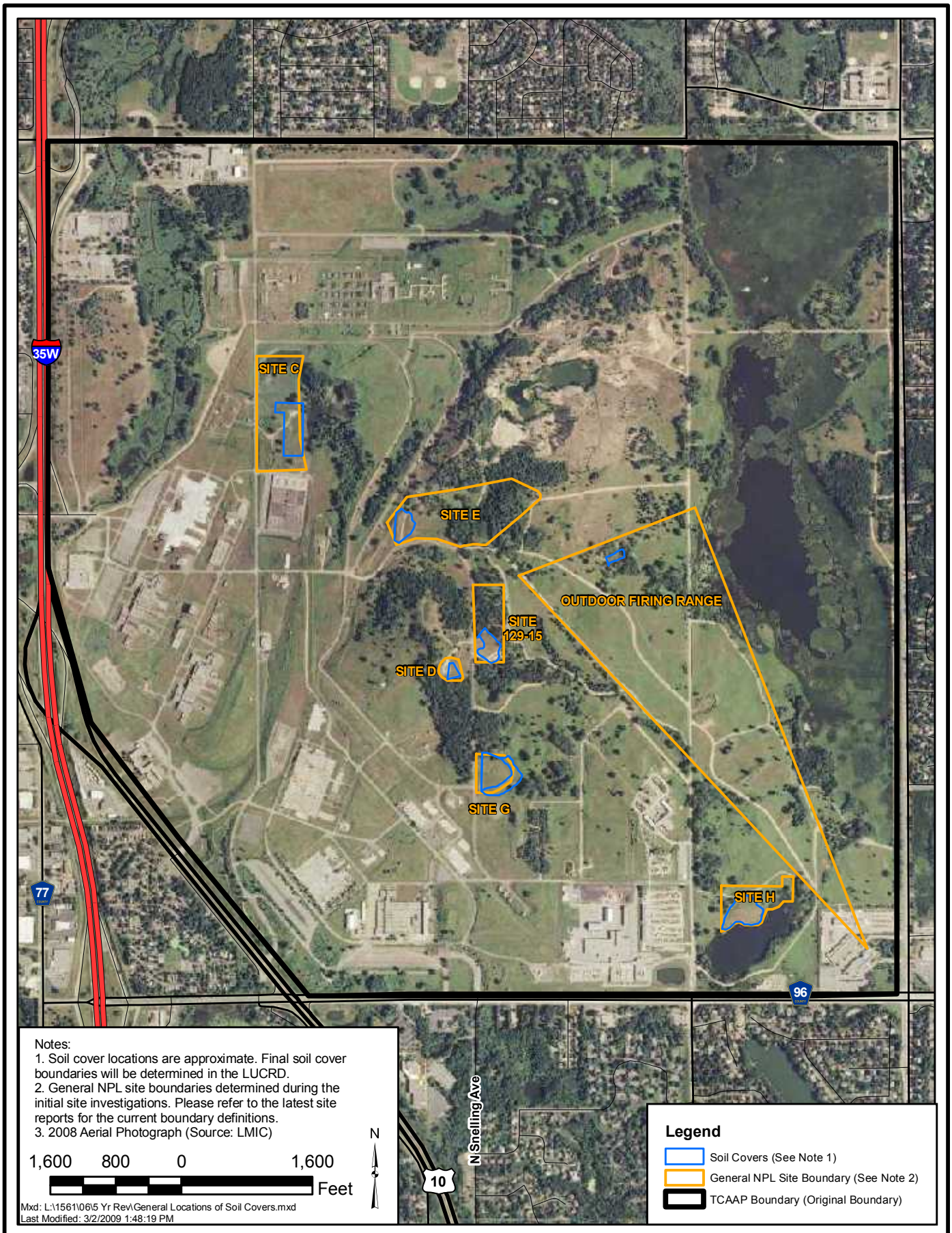


Figure 2-9
NBCGRS PGAC
Water Treatment Plant #1
Contactor Vessel Pair Control Stand Arrangement



TWIN CITIES ARMY AMMUNTION PLANT

General Locations of Soil Covers

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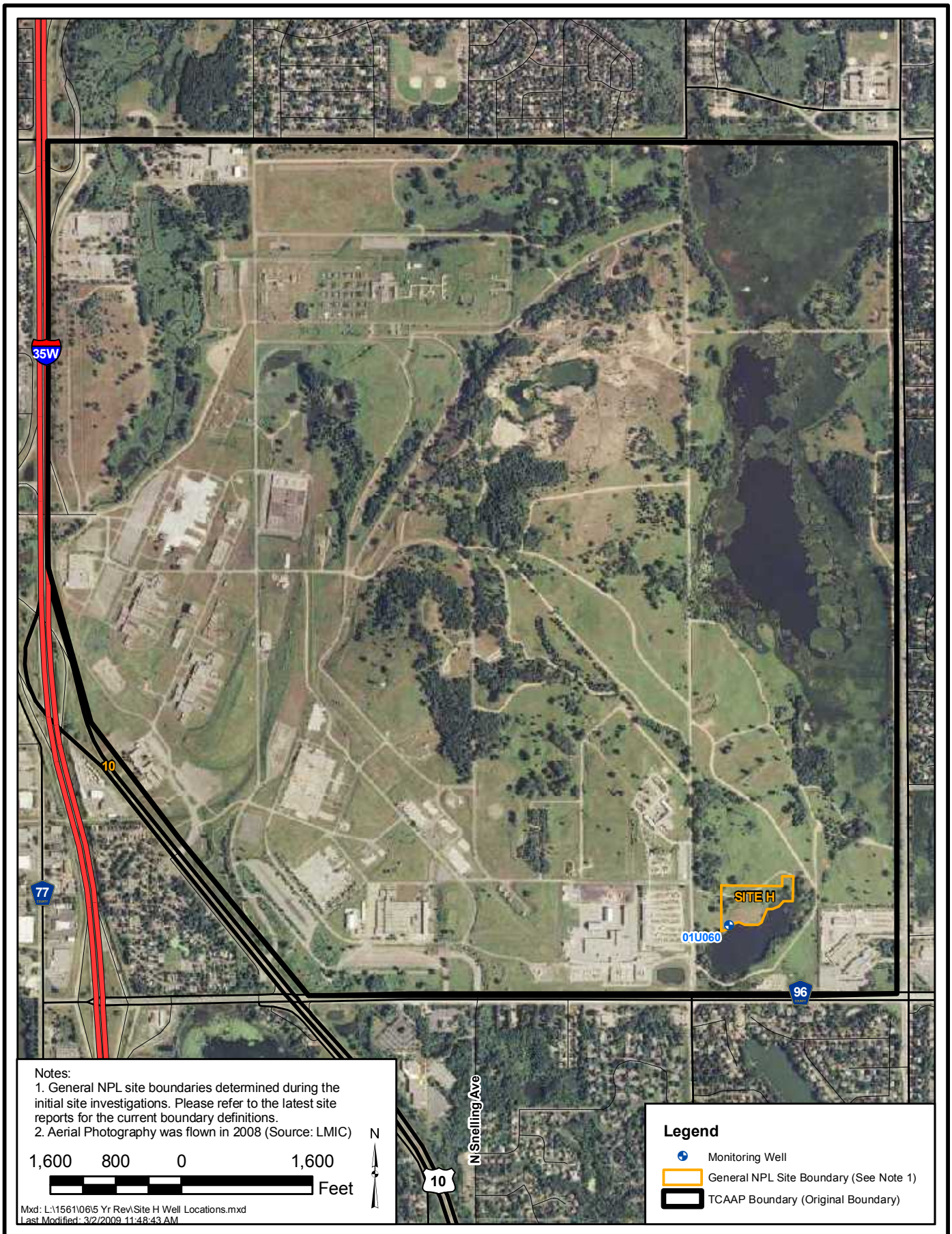
Figure 3-1



TWIN CITIES ARMY AMMUNTION PLANT

Well Location for Shallow Soil Site Monitoring at Site H

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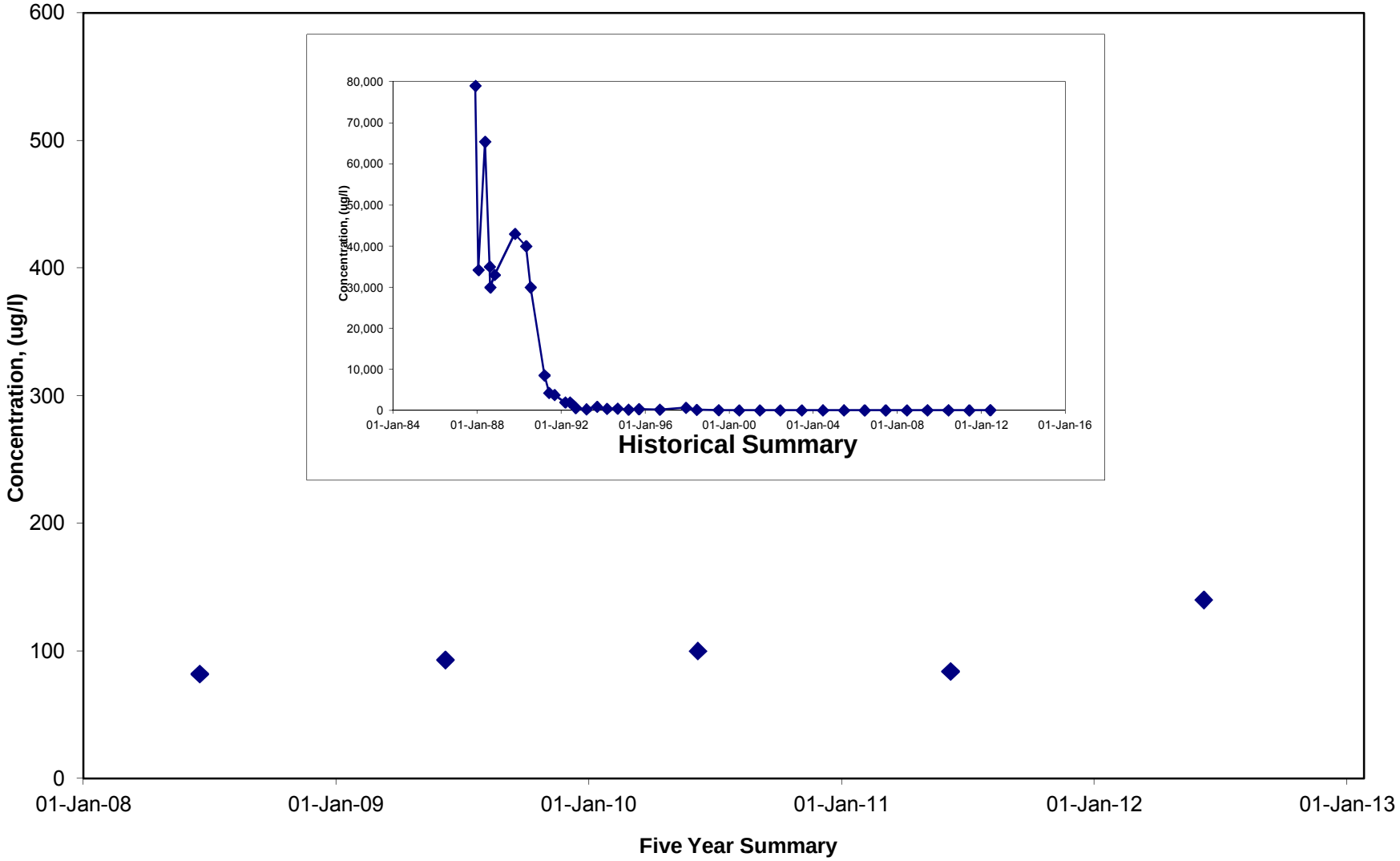
Figure 3-2

Figure 3-3
Site D, Well 03U093, Trichloroethene Water Quality Trend
Twin Cities Army Ammunition Plant



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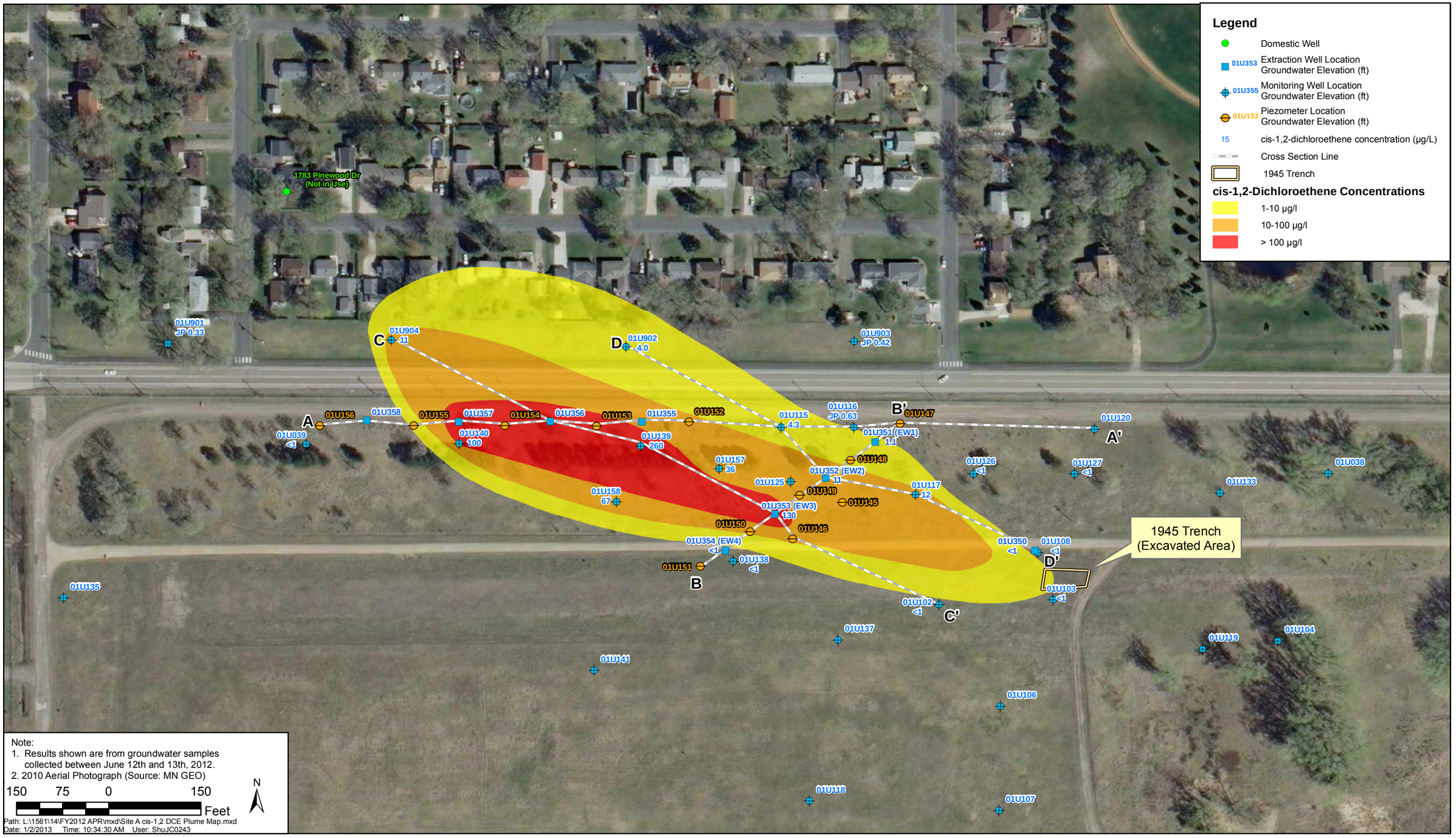

ANNUAL PERFORMANCE REPORT

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

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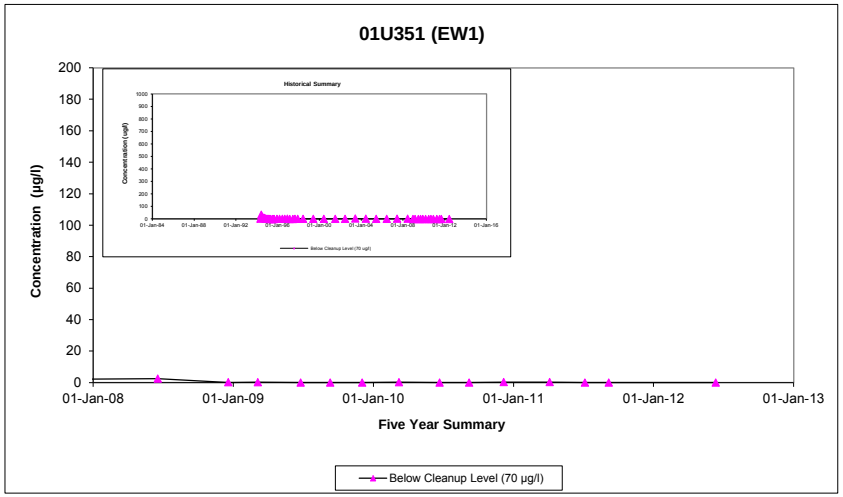
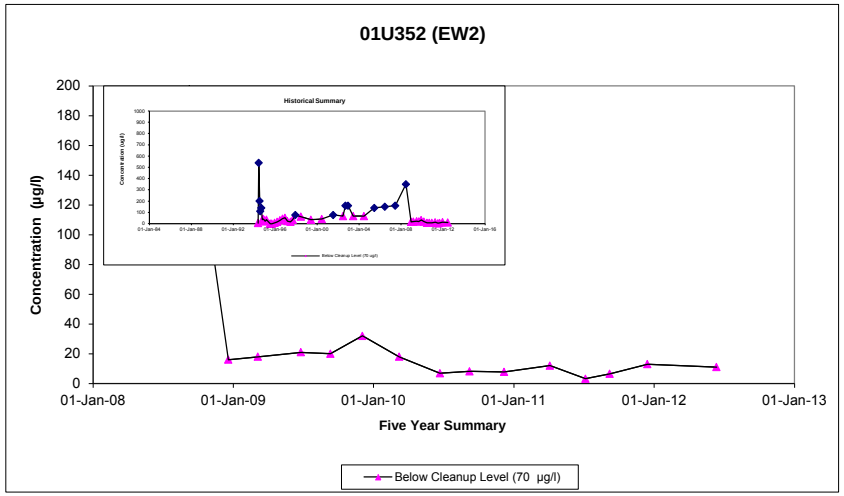
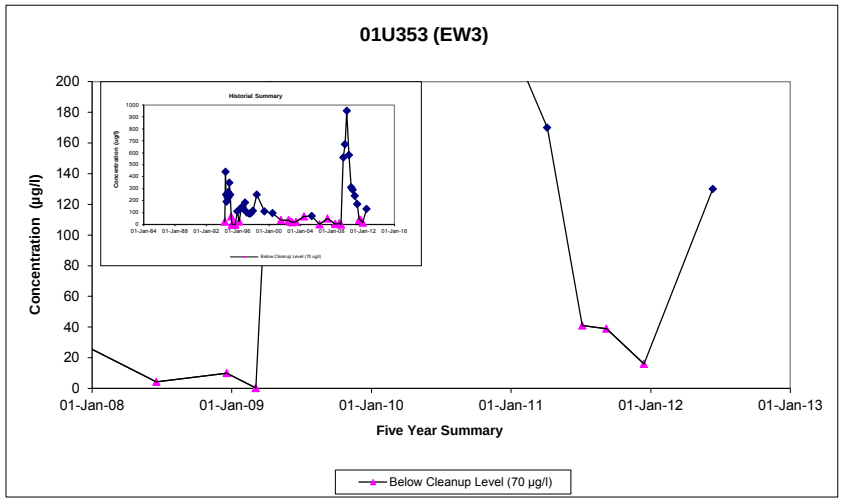
Figure 3-4

FIGURE 3-5
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: EXTRACTION WELLS
FY 2012 ANNUAL PERFORMANCE REPORT







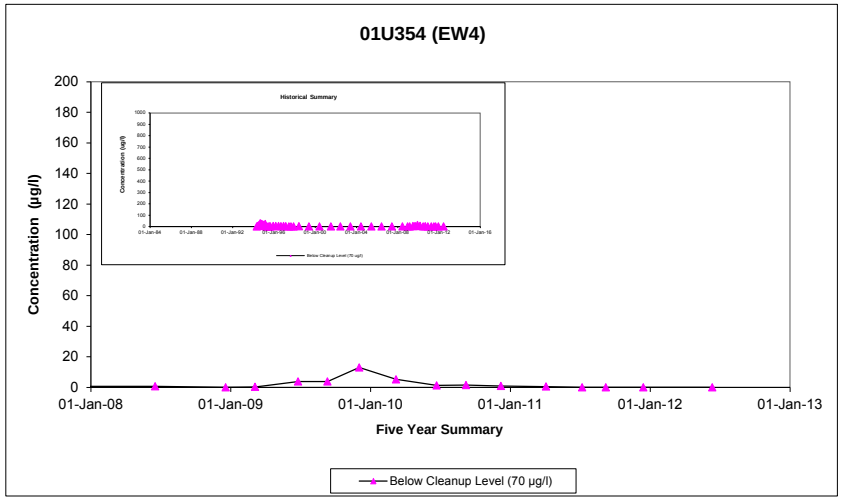
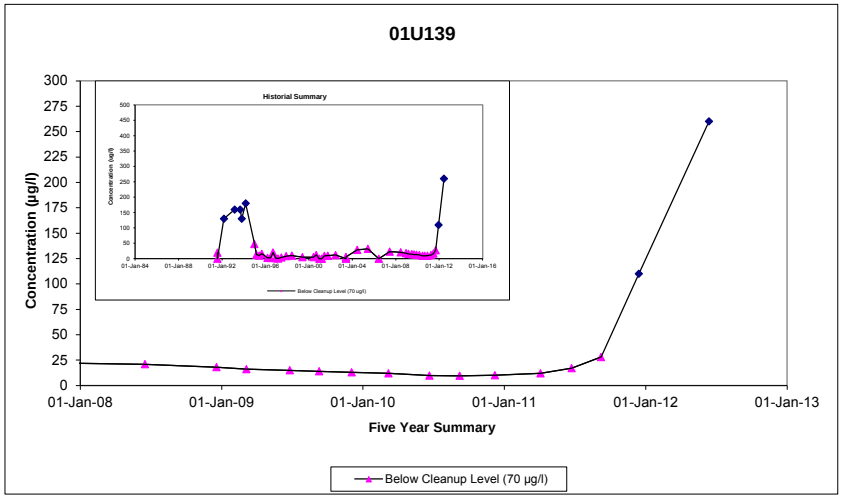
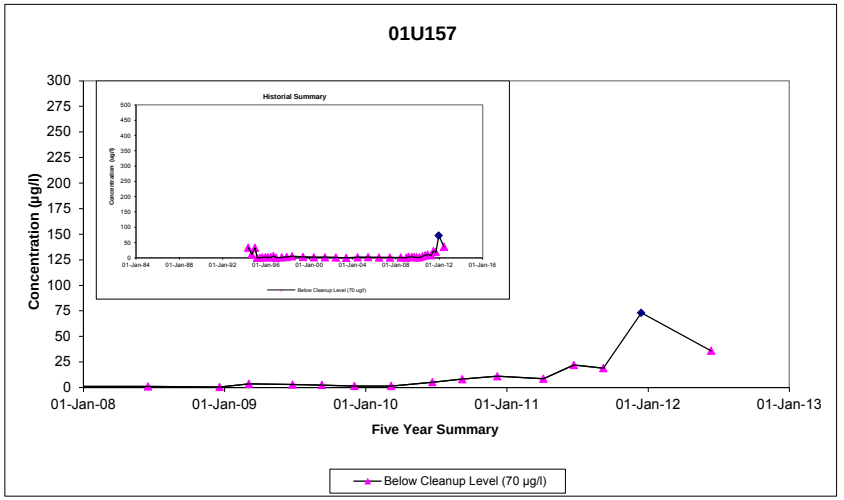
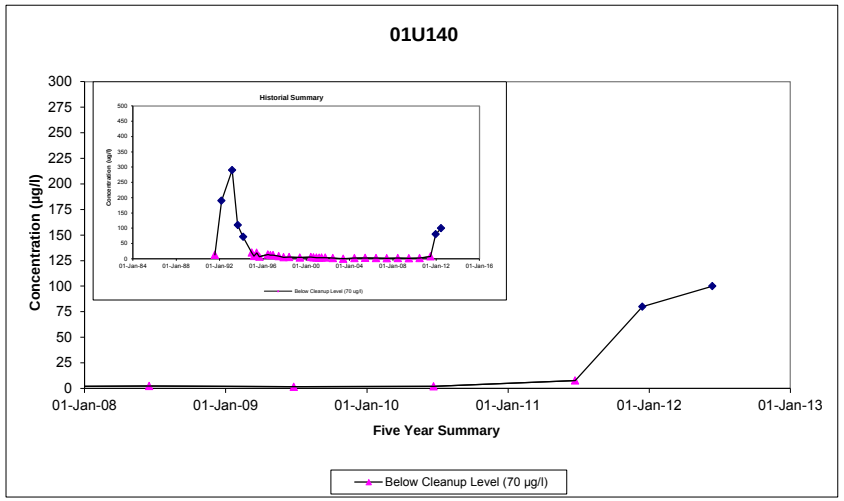


FIGURE 3-6
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: MONITORING WELLS
FY 2012 ANNUAL PERFORMANCE REPORT







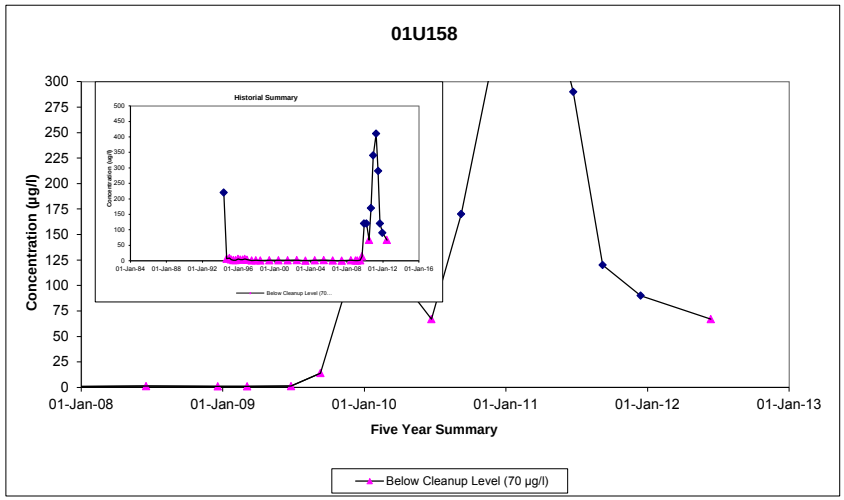
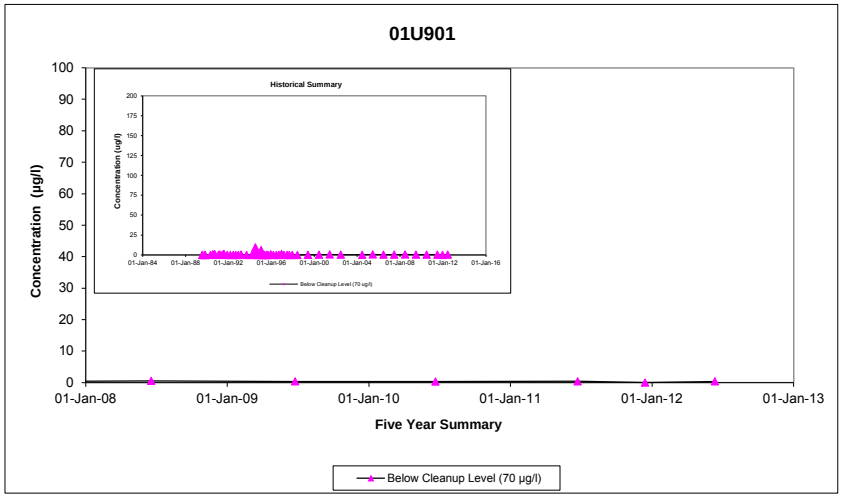
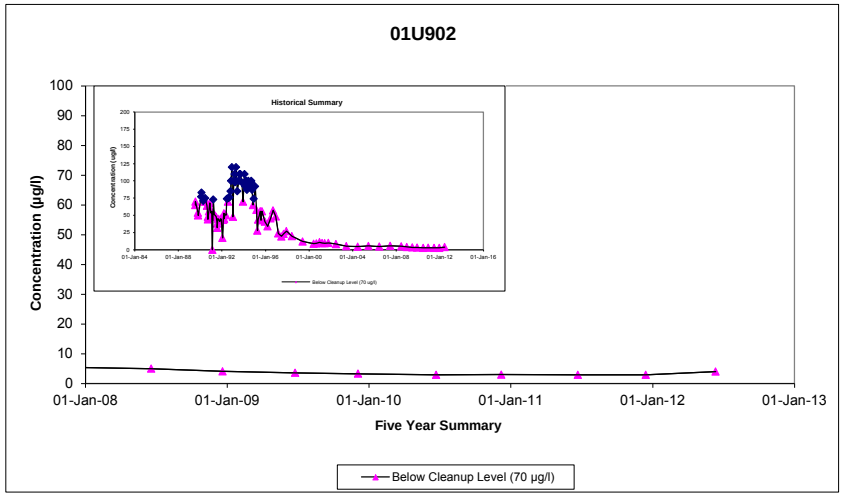
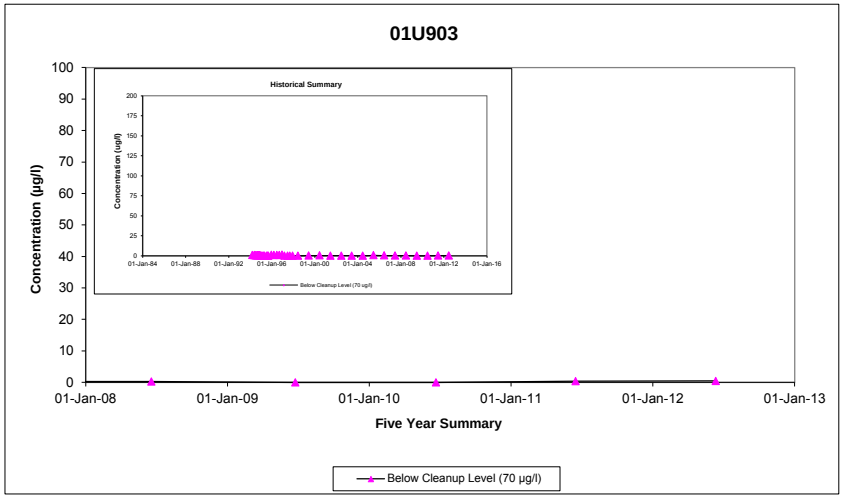
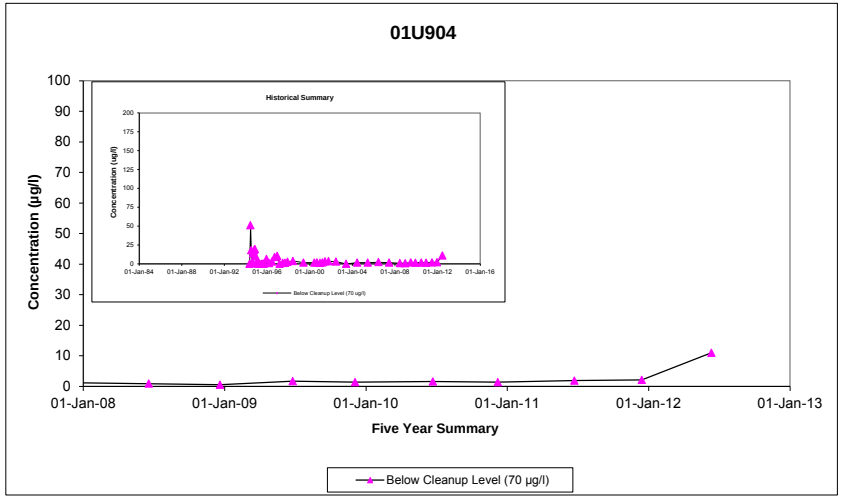


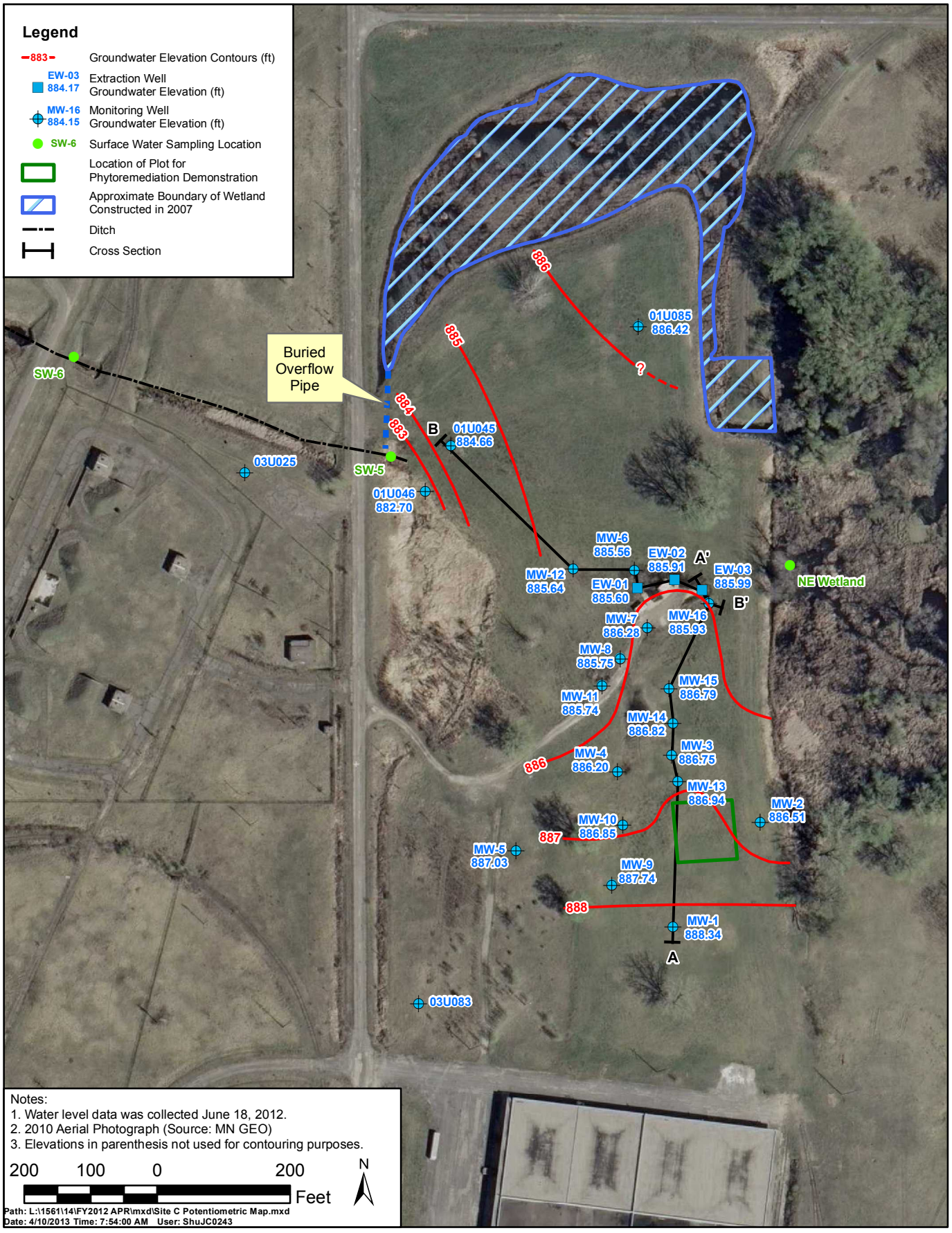
FIGURE 3-7
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: CONTINGENCY LOCATIONS
FY 2012 ANNUAL PERFORMANCE REPORT











ANNUAL PERFORMANCE REPORT

Site C, Unit 1, Potentiometric Map, Summer 2012

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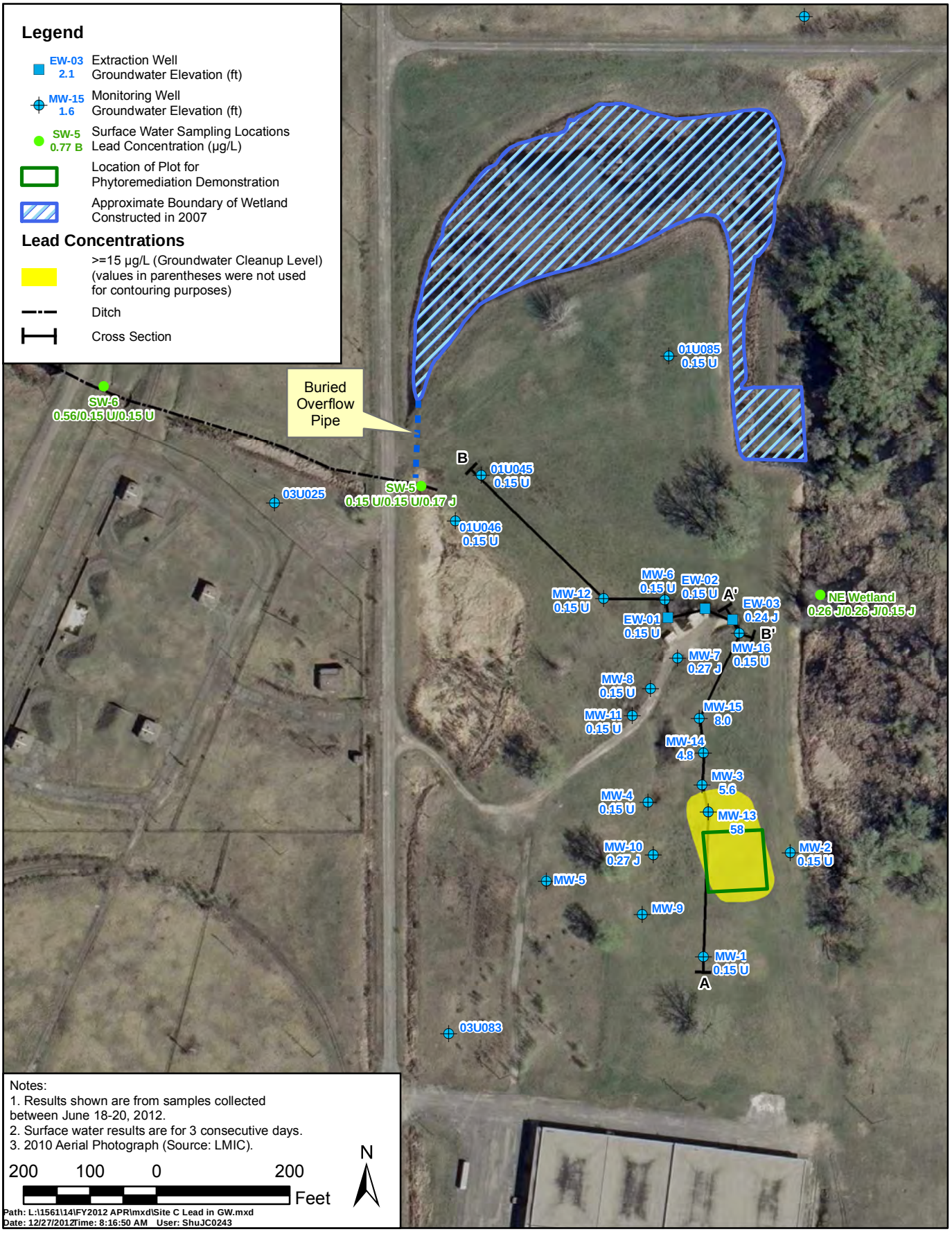
Figure 3-8



ANNUAL PERFORMANCE REPORT
Site C, Unit 1, Lead
Results, Summer 2012

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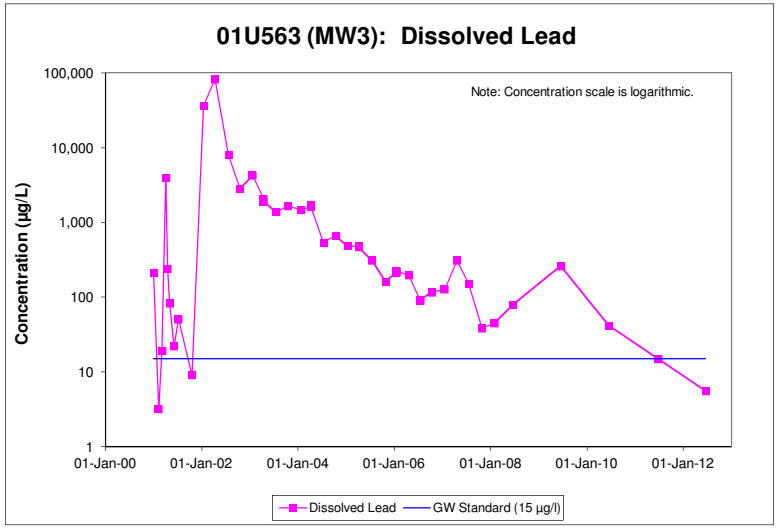
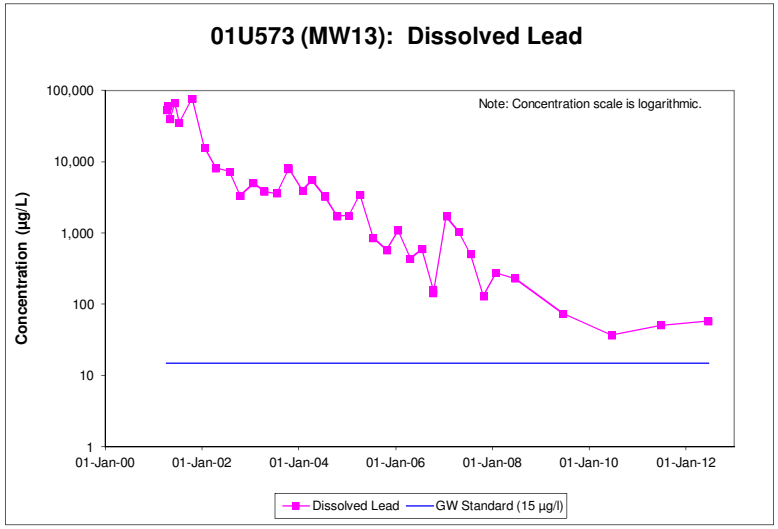
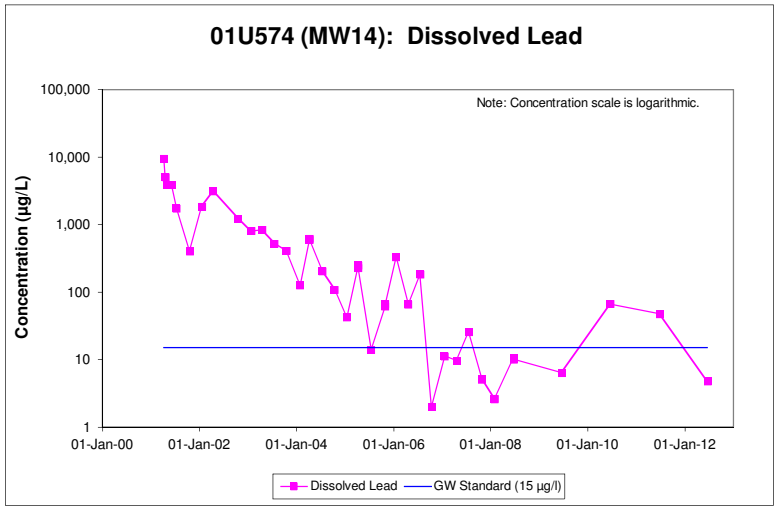
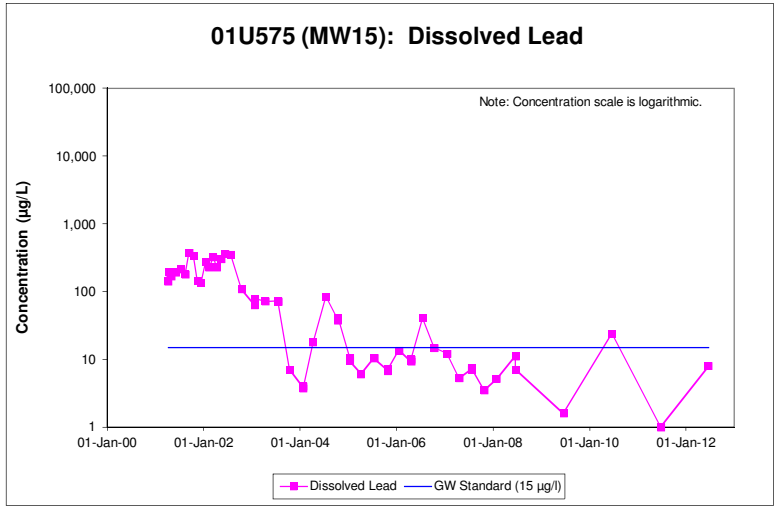
Figure 3-9

FIGURE 3-10
SITE C, LEAD WATER QUALITY TRENDS: MONITORING WELLS
FY 2012 ANNUAL PERFORMANCE REPORT









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\2011\Figure8-2 - Geo X Section.mxd

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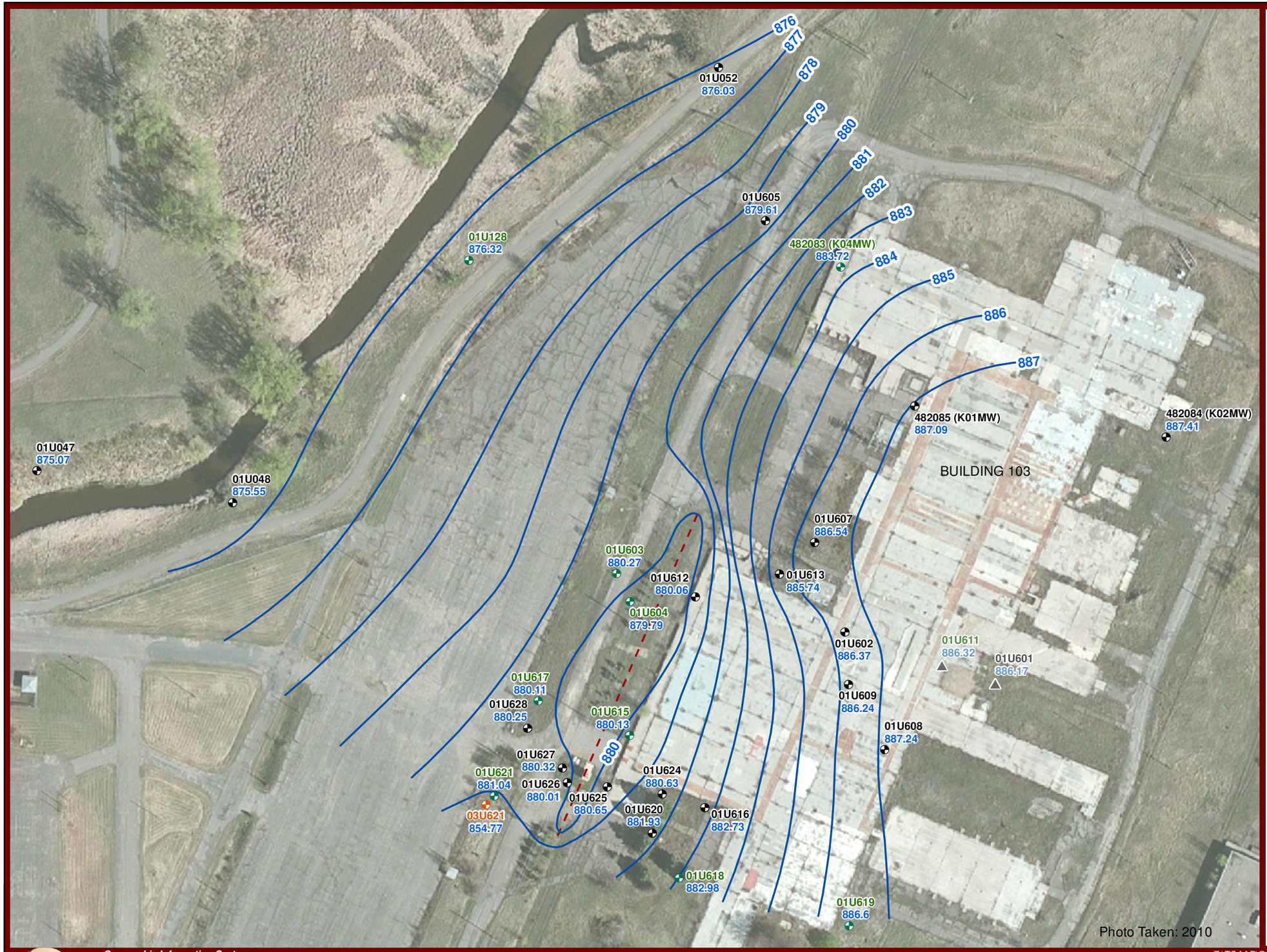
PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE I, UNIT 1 04/21/11 GROUNDWATER ELEVATION MAP AND GEOLOGIC CROSS SECTION		FIGURE: 3-11
JOB NUMBER: 182602386	DRAWN BY3 TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 04/03/12



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

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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: 3-12

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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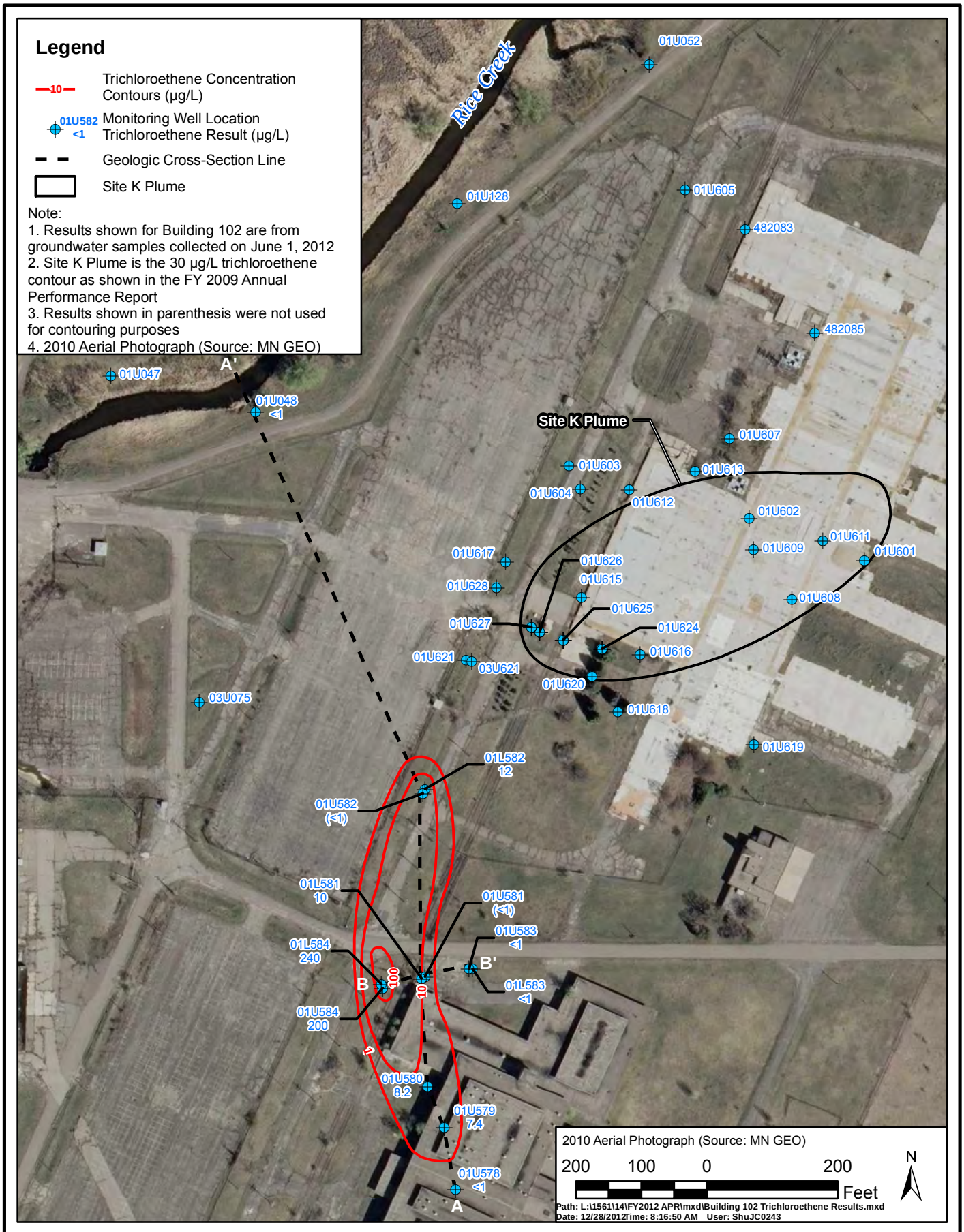
PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE K, UNIT 1 AND UNIT 3 TCE CONCENTRATION MAP 06/01/12 (Q115)		FIGURE: 3-13
JOB NUMBER: 182602386	DRAWN BY:3 TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 12/18/12



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Trichloroethene Results - Summer 2012

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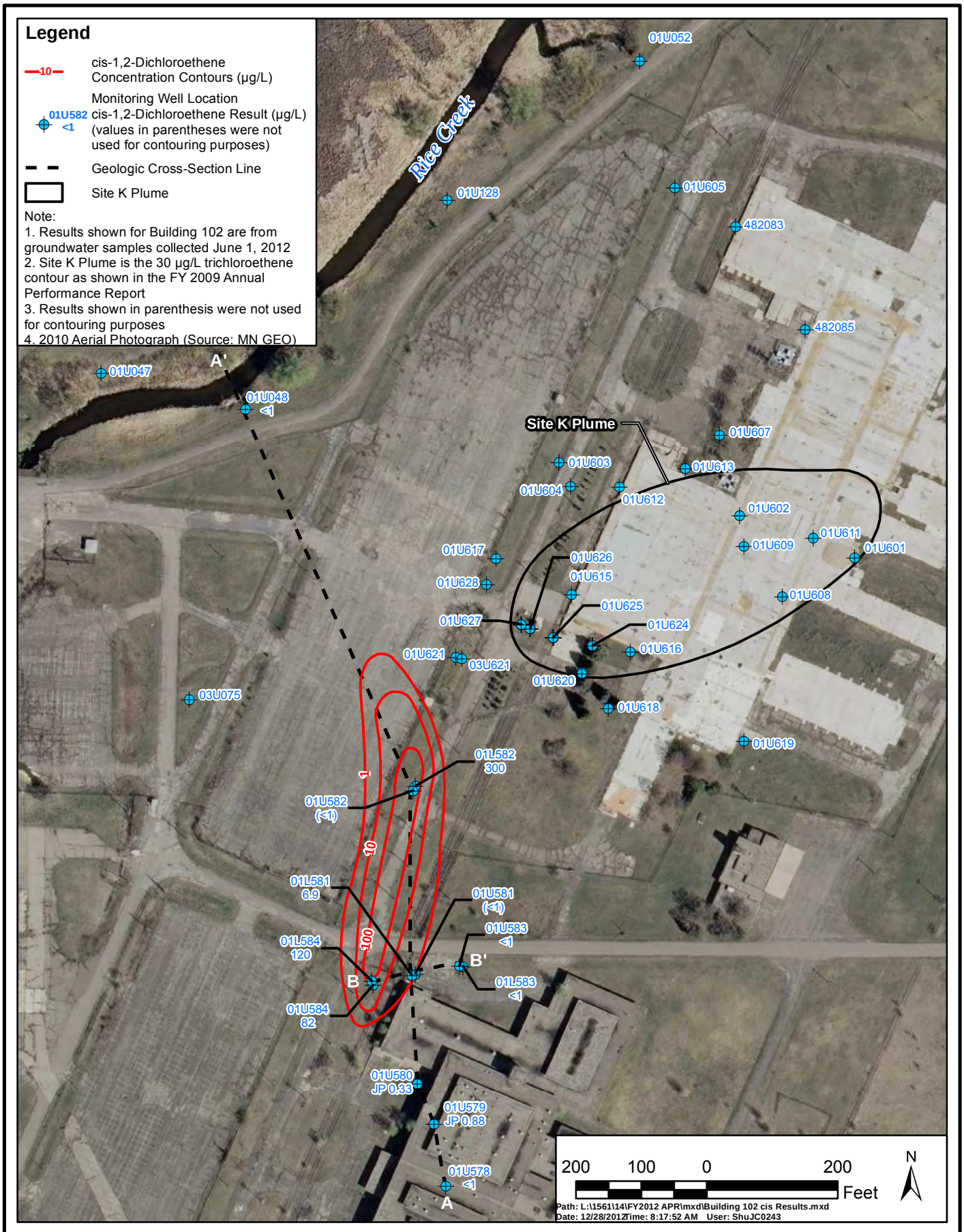
Figure 3-14



ANNUAL PERFORMANCE REPORT

cis-1,2-Dichloroethene Results - Summer 2012

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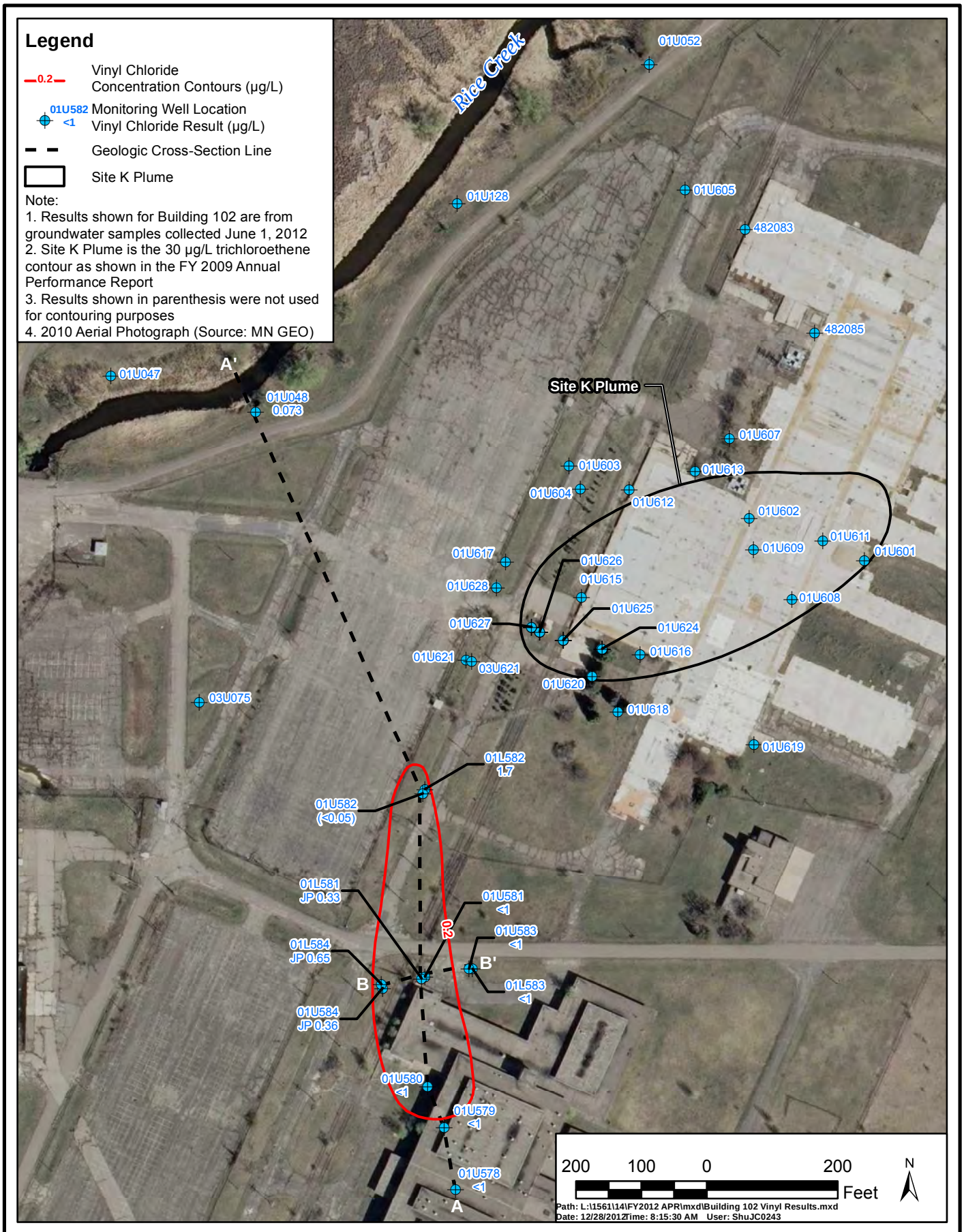
Figure 3-15



ANNUAL PERFORMANCE REPORT

Vinyl Chloride Results - Summer 2012

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Figure 3-16

SITE CLOSE OUT REPORT - POND G

Pond G Surface Water Sampling Location

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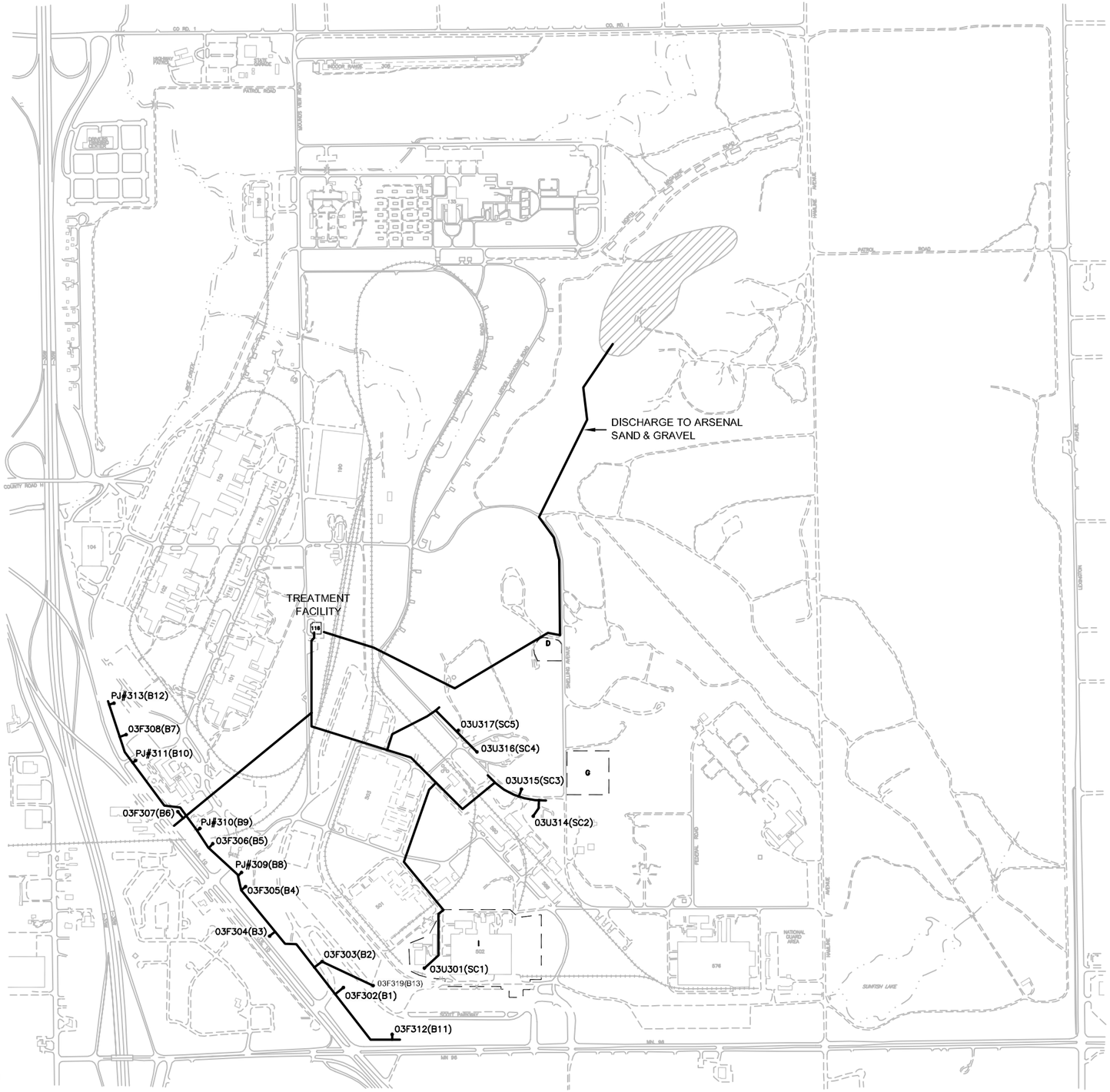
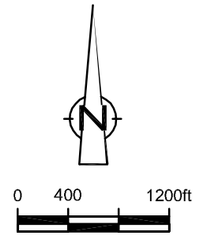
Figure 3-17





LEGEND

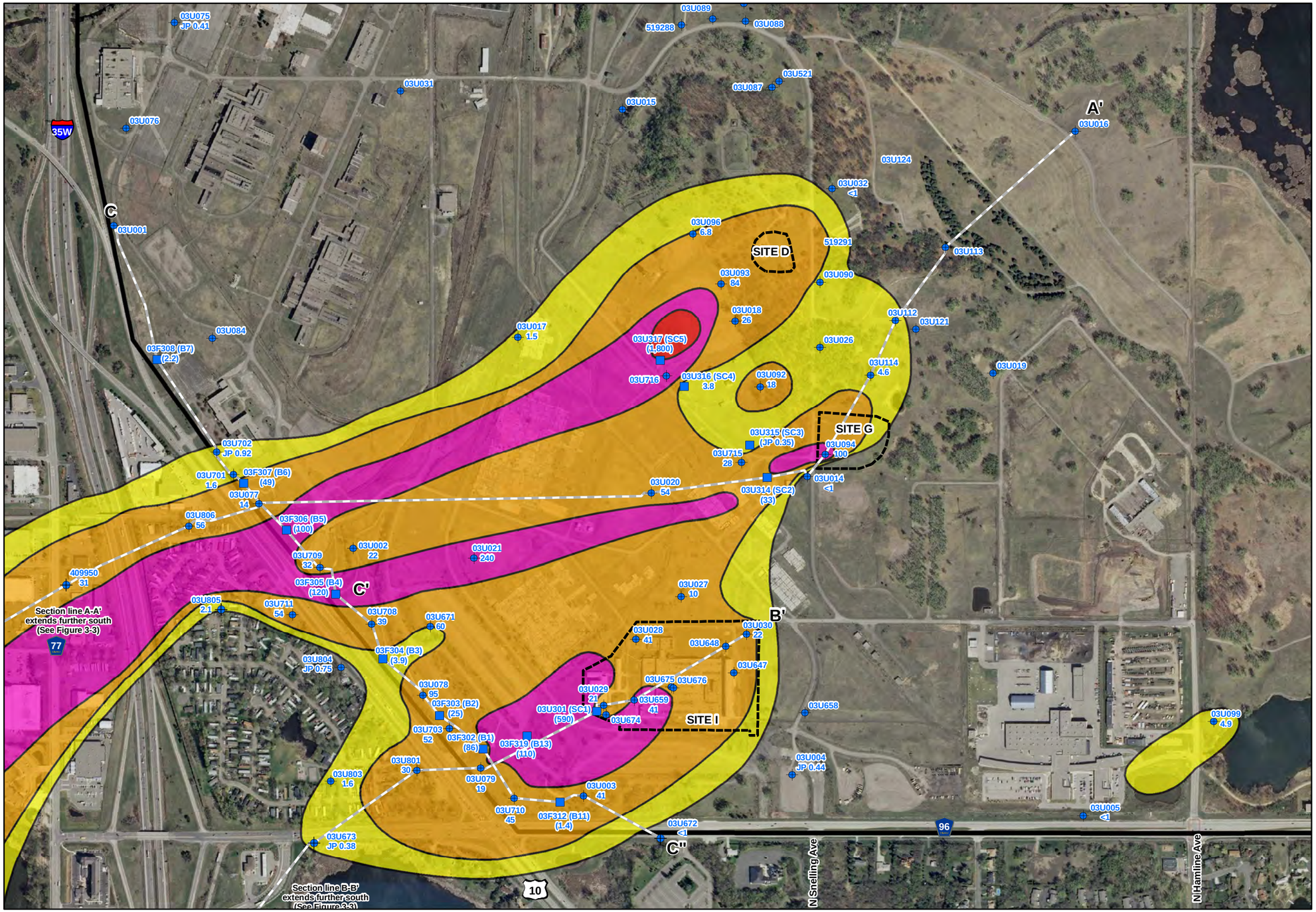
- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION

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 3-18

TGRS LAYOUT
TWIN CITIES ARMY AMMUNITION PLANT
Arden Hills, Minnesota



Legend

- 03F306 Extraction Well Location
- 03U021 Monitoring Well Location
- 15 Trichloroethene concentrations (µg/L) (Values in parentheses were not used for contouring purposes.)
- JP Estimated Value (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l
- 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.)

Notes:
1. 03F and 03U extraction wells are shown with data in parentheses, but concentrations were not used for contouring (except for SC-3 and SC-4, which were used for contouring since they are being sampled as monitoring wells and since they are screened only within Upper Unit 3.
2. Results are from groundwater samples collected in June 2011.
3. 2010 Aerial Photograph (Source: MN GEO)

N
W E
S

700 350 0 700
Feet

Path: L:\1561\11\FY2011 APR\mxd\OU2 Upper Unit 3 TCE_Iso_map.mxd

ANNUAL PERFORMANCE REPORT

OU2, Upper Unit 3, Trichloroethene Isoconcentration Map, Summer 2011

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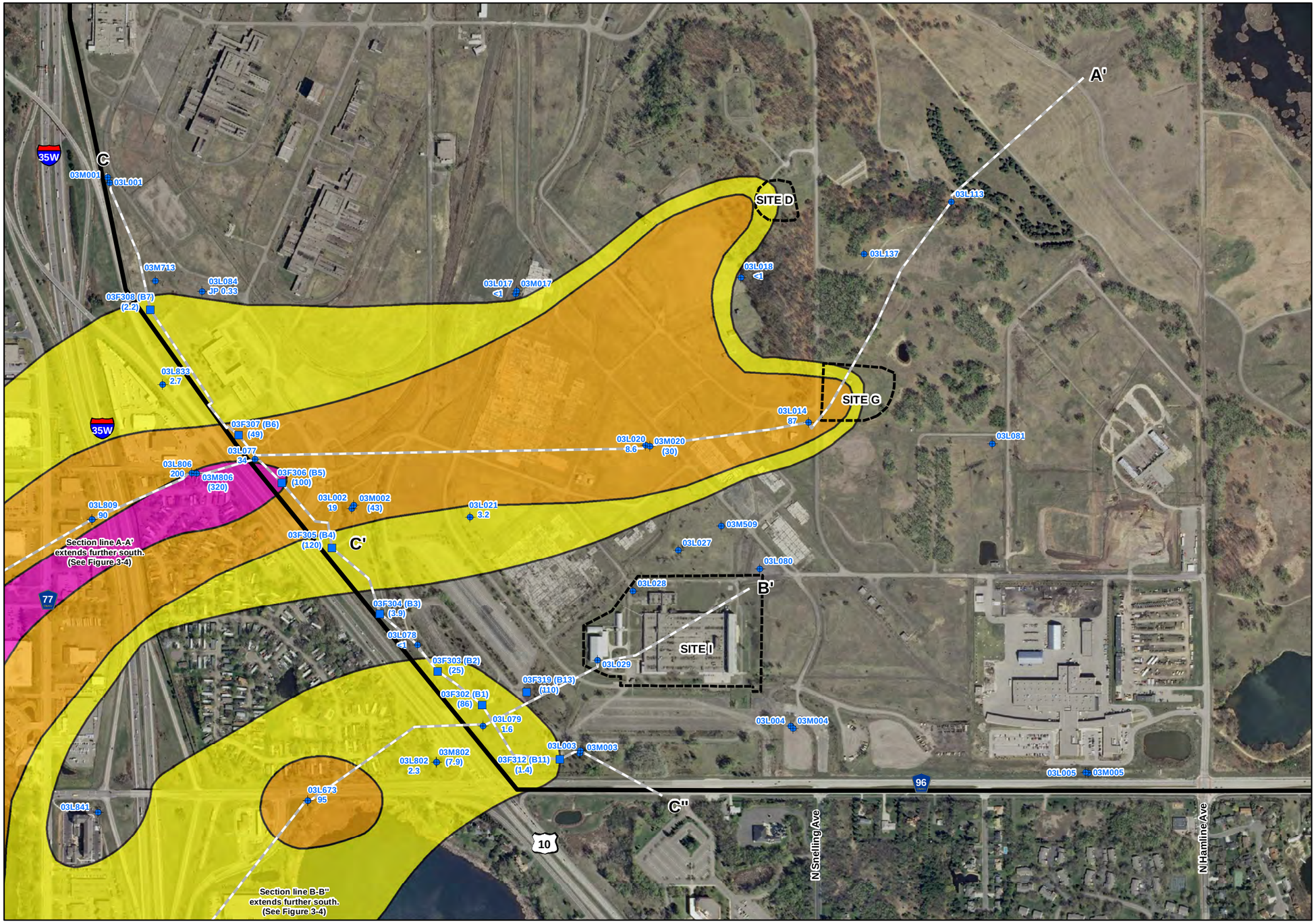
Figure 3-19



Legend

- 03L077 — Monitoring Well Location
- 03F303 — Extraction Well Location
- 410.0 — Trichloroethene concentrations (µg/L) (Values in parentheses were not used for contouring purposes)
- JP — Estimated (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary
- 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.)

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l

Notes:
1. Middle Unit 3 wells with data are shown with data in parentheses, but were not used for contouring.
2. 03F extraction wells are shown with data in parentheses, but were not used for contouring.
3. Results are from groundwater samples collected in June 2011.
4. 2010 Aerial Photograph (Source: MN GEO)

N
W E
S

700 350 0 700
Feet

Path: L:\1561\11\FY2011 APR\mxd\OU2 Lower Unit 3 TCE_Iso_map.mxd

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OU2, Lower Unit 3, Trichloroethene Isoconcentration Map, Summer 2011

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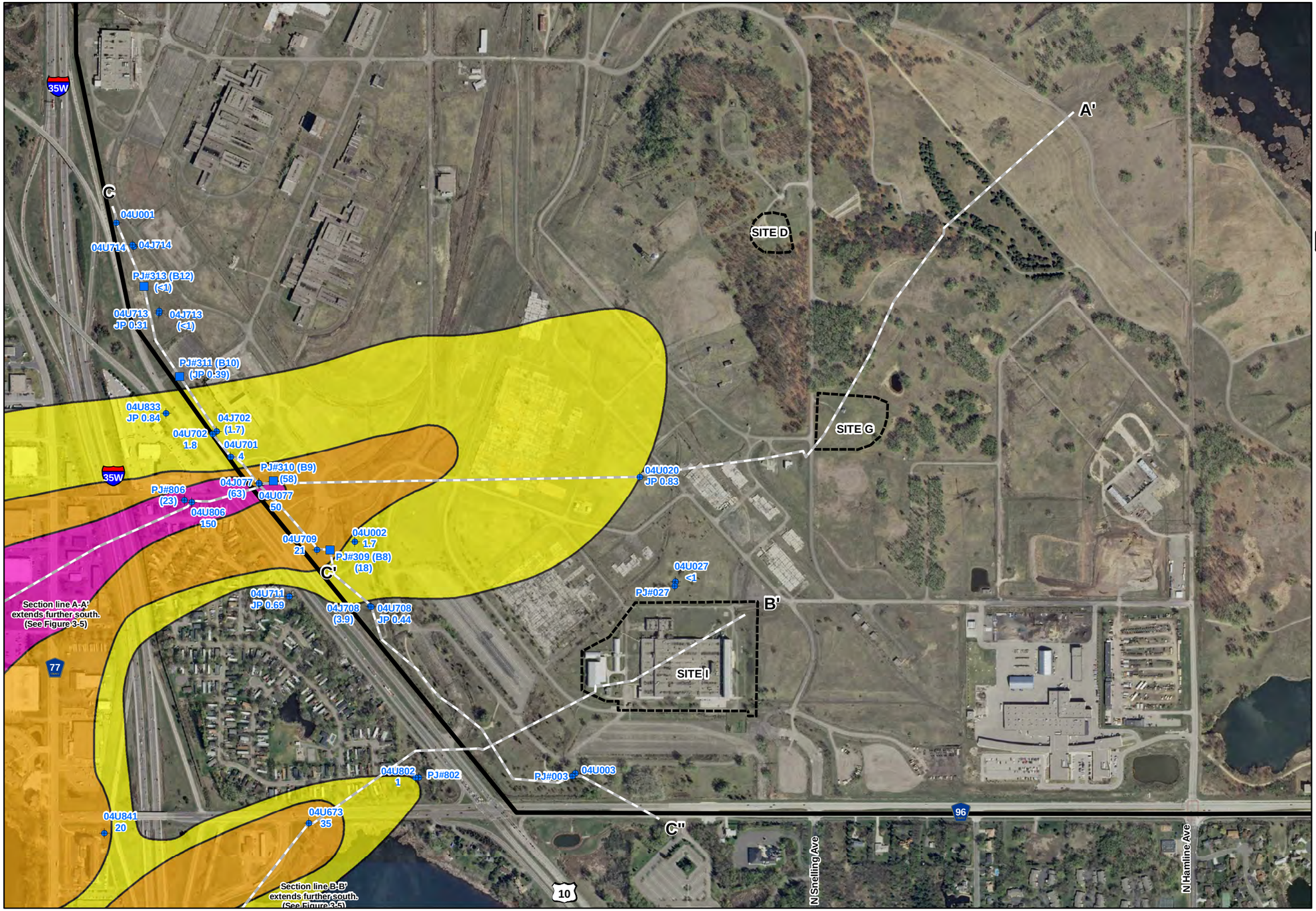
Figure 3-20



Legend

- PJ#309 Extraction Well Location
- 04U701 Monitoring Well Location
- 55 Trichloroethene Concentrations (µg/L) (Values in parentheses were not used for contouring purposes.)
- JP Estimated (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary
- 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.)

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l

Notes:
1. All 04J wells (Jordan Wells) with data are shown wth data in parentheses, but were not for countouring.
2. All PJ# Extraction wells are shown with data in parentheses, but were not used for countouring.
3. PJ# monitoring wells are shown with data in parentheses, but were not used for countouring.
4. Results are from groundwater samples collected in June 2011.
5. 2011 Aerial Photograph (Source: MN GEO)

N
W E
S

700 350 0 700
Feet

Path: L:\1561\11\FY2011 APR\mxd\OU2 Upper Unit 4 TCE_Iso_map.mxd

ANNUAL PERFORMANCE REPORT

OU2, Upper Unit 4, Trichloroethene Isoconcentration Map, Summer 2011

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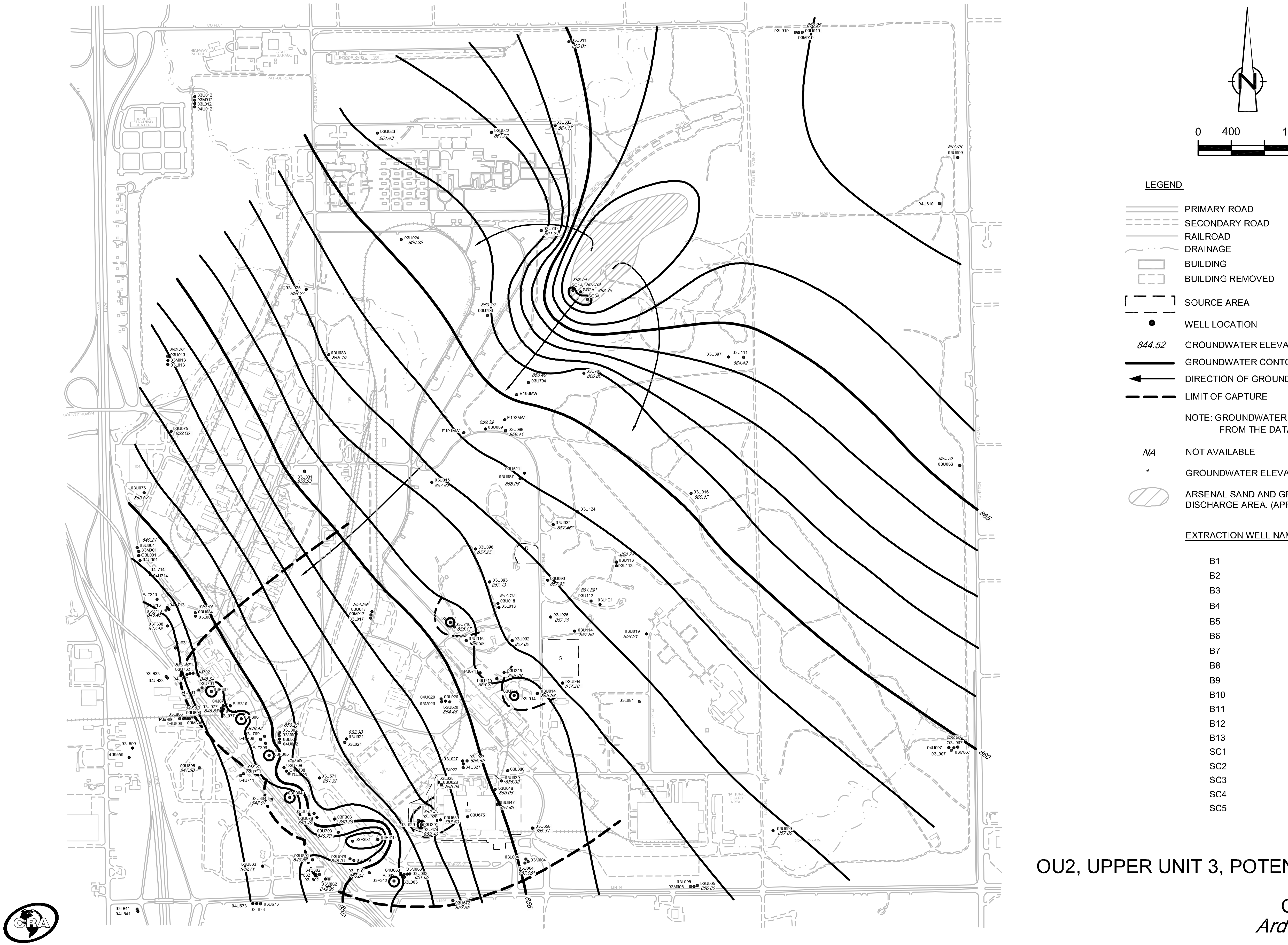
Figure 3-21



LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION
- *844.52* GROUNDWATER ELEVATION IN FEET AMSL
- GROUNDWATER CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- LIMIT OF CAPTURE

NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.

- *NA* NOT AVAILABLE
- * GROUNDWATER ELEVATION NOT USED IN CONTOURING
- ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

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 3-22

OU2, UPPER UNIT 3, POTENTIOMETRIC MAP
6/2/2011 (Q111)
OPERABLE UNIT 2
Arden Hills, Minnesota

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION
- *844.52* GROUNDWATER ELEVATION IN FEET AMSL
- GROUNDWATER CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- LIMIT OF CAPTURE

NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.

- *NA* NOT AVAILABLE
- * GROUNDWATER ELEVATION NOT USED IN CONTOURING
- ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

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 3-23

OU2, LOWER UNIT 3, POTENTIOMETRIC MAP
6/2/2011 (Q111)
OPERABLE UNIT 2
Arden Hills, Minnesota

076720-43(001)GN-SP003 Dec 12/2011

0 400 1200ft

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION
- *844.52* GROUNDWATER ELEVATION IN FEET AMSL
- GROUNDWATER CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- LIMIT OF CAPTURE

NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.

- *NA* NOT AVAILABLE
- * GROUNDWATER ELEVATION NOT USED IN CONTOURING
- ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

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 3-24

OU2, UPPER UNIT 4, POTENTIOMETRIC MAP 6/2/2011 (Q111) OPERABLE UNIT 2

Arden Hills, Minnesota

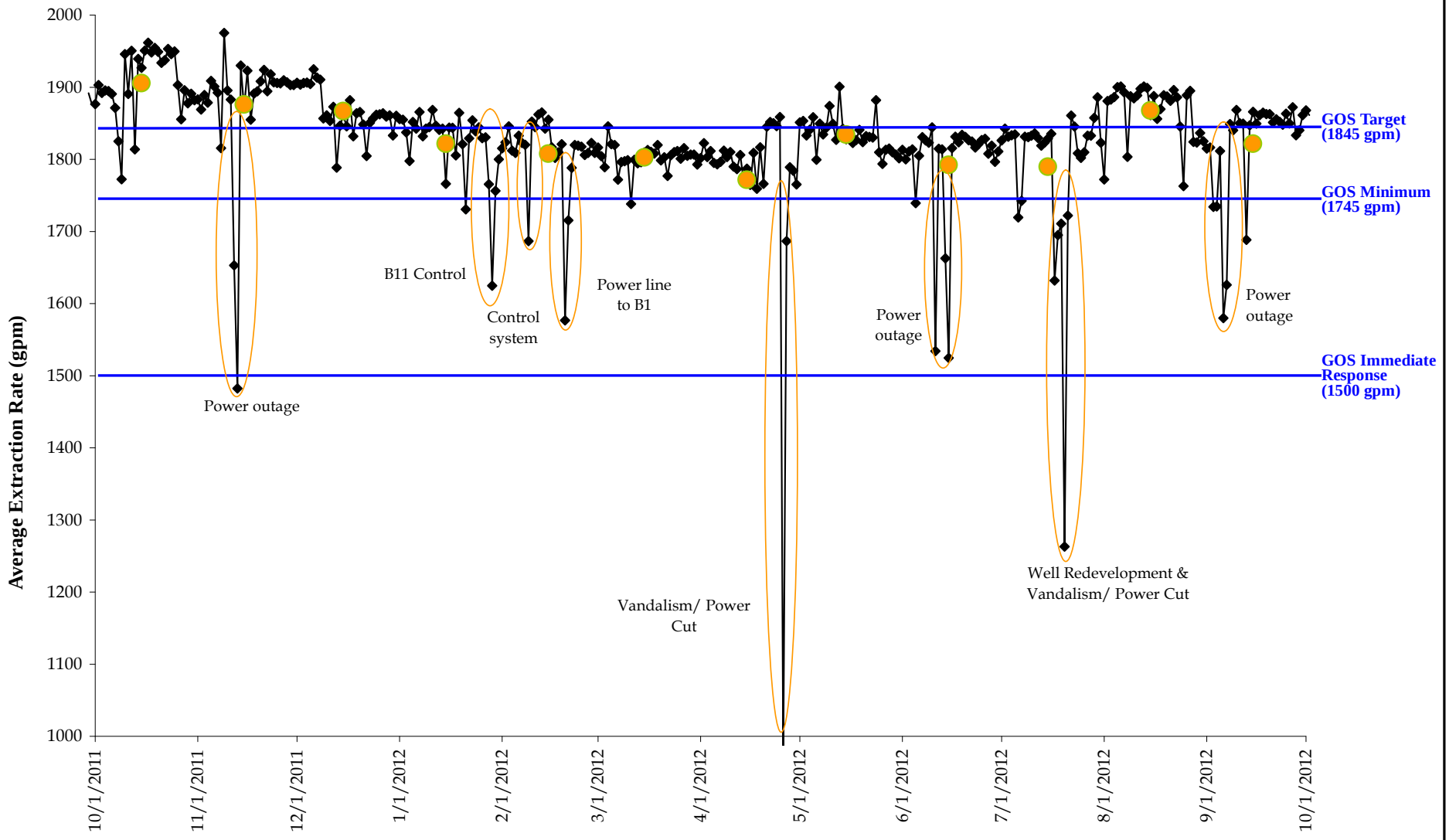
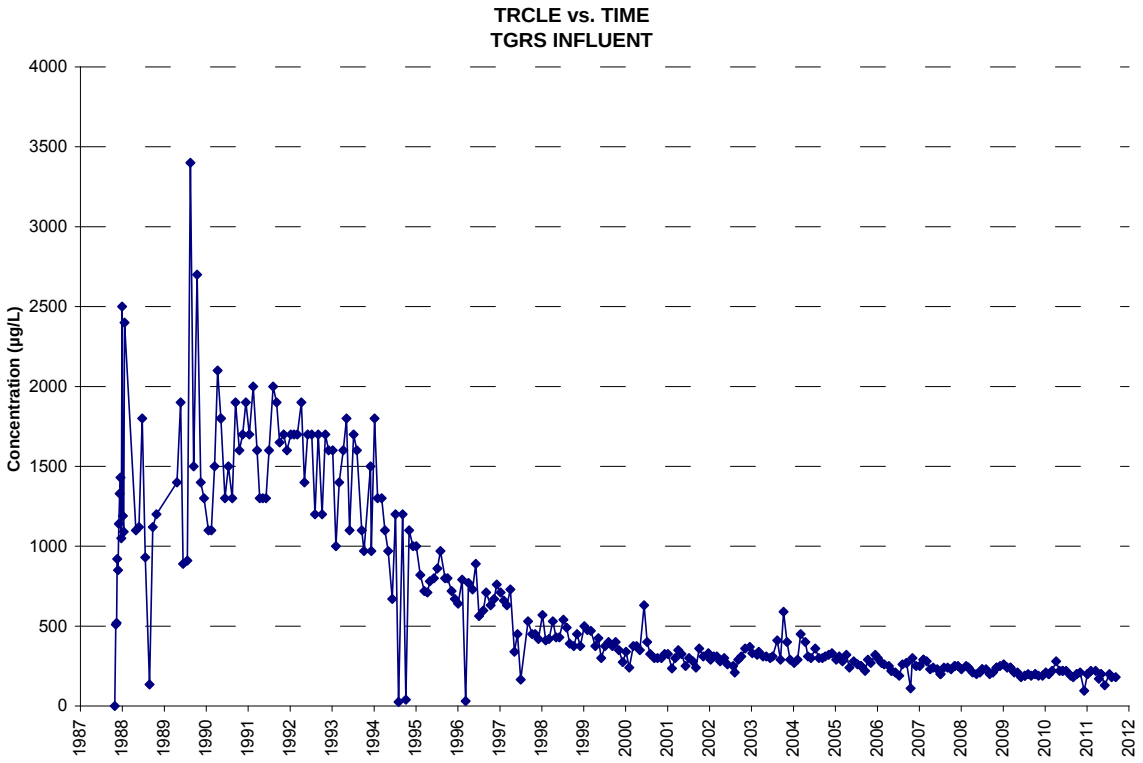
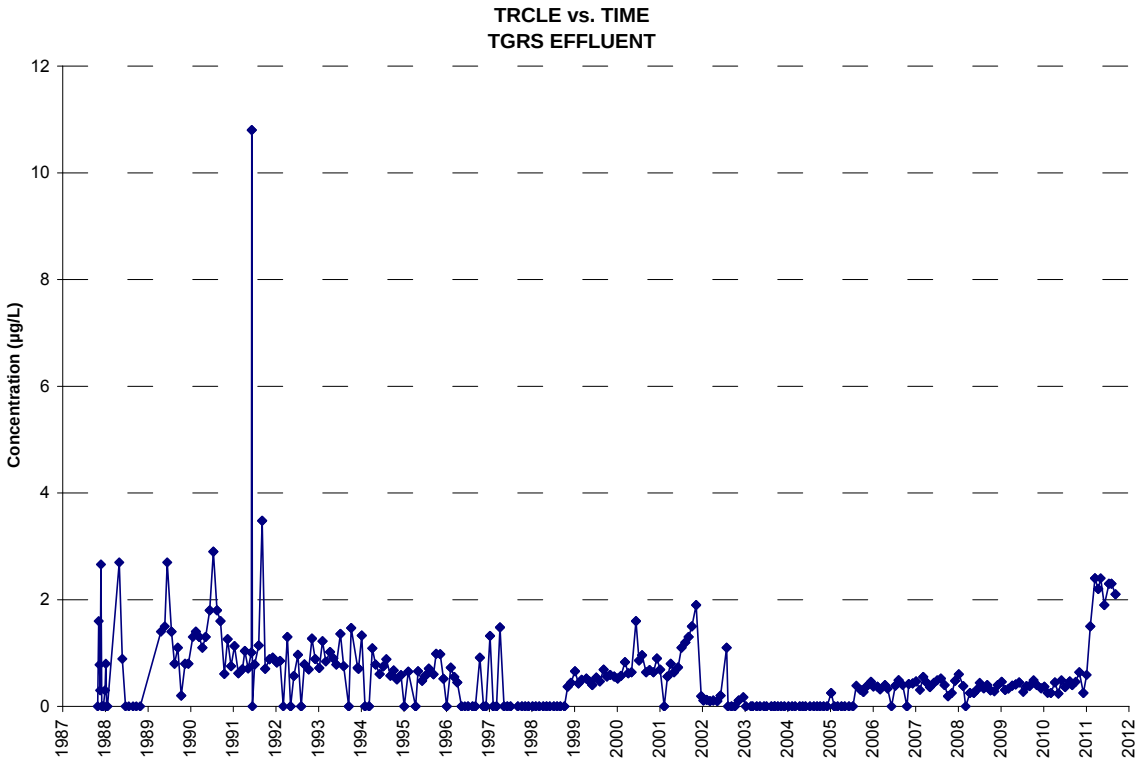


figure 3-25

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 3-26

TGRS TREATMENT SYSTEM PERFORMANCE
OPERABLE UNIT 2
Arden Hills, Minnesota

076720-43(001)GIS-SP002 DEC 01/2011

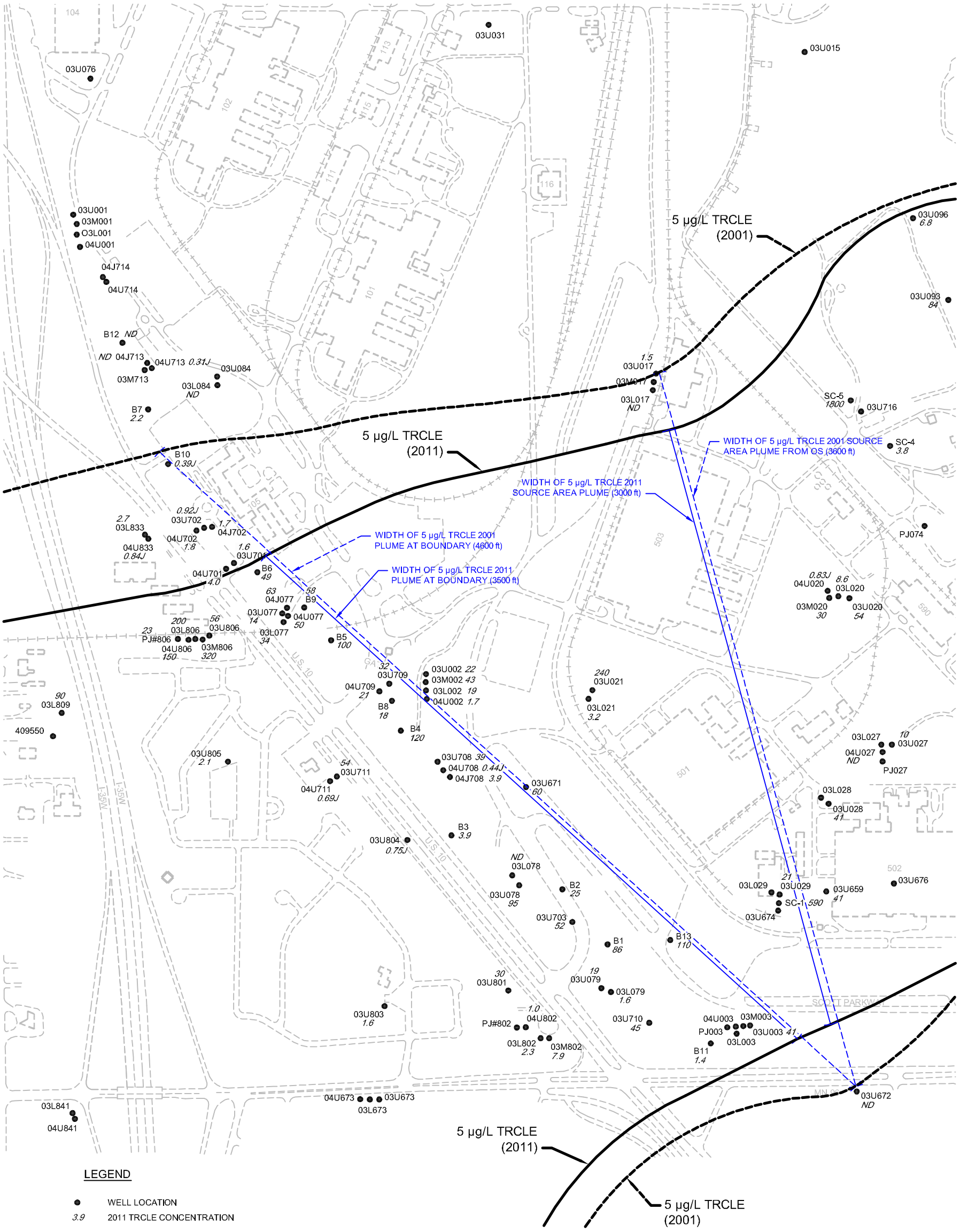


figure 3-27

TGRS ANNUAL MONITORING DATA - WEST PORTION
TRCLE CONCENTRATIONS (µg/L) JUNE 2011
OPERABLE UNIT 2
Arden Hills, Minnesota

076720-43(001)GN-SP007 Feb 07/2012

Appendix A

Site Chronology and Background

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New Brighton/Arden Hills Superfund Site
Five-Year Review Report
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List of Acronyms

CERCLA	- Comprehensive Environmental Response, Compensation, and Liability Act
EE/CA	- Engineering Evaluation/Cost Analysis
FFA	- Federal Facility Agreement
FY	- Fiscal Year
MPCA	- Minnesota Pollution Control Agency
NB/AH	- New Brighton/Arden Hills
NPL	- National Priorities List
OU	- Operable Unit
PCBs	- Polychlorinated Biphenyls
QAPP	- Quality Assurance Project Plan
ROD	- Record of Decision
TCAAP	- Twin Cities Army Ammunition Plant
USEPA	- United States Environmental Protection Agency

1.0 Site Chronology

The following is a summary of the key events for the New Brighton/Arden Hills (NB/AH) Superfund Site. For this site, the United States Environmental Protection Agency's (USEPA) Operable Unit designation differs from the Army's designation. To avoid confusion, only the Army designation is referred to throughout this report; however, a crosswalk (Table A-1) is included as a guide when accessing NB/AH information through the USEPA's repository.

1942	Twin Cities Army Ammunition Plant (TCAAP) began producing ammunition
1978 - 1982	Contamination of the regional aquifer first discovered
Sept. 1983	NB/AH Superfund Site was placed on the National Priorities List (NPL)
Aug. 1987	Federal Facility Agreement (FFA) signed
June 1989	Record of Decision (ROD) on Interim Removal Action for Polychlorinated biphenyls (PCB) contaminated Soils near Site D
Sept. 1992	OU3 ROD (Amendment #1 in 2006)
Sept. 1993	OU1 ROD (Amendment #1 in 2006)
May 1994	Public Health Assessment for NB/AH Superfund Site finalized by Agency for Toxic Substances and Disease Registry
Oct. 1997	OU2 ROD (Amendment #1 in 2007, Amendment #2 and #3 in 2009, Amendment #4 in 2012)
Feb. 1999	Action Memorandum for Outdoor Firing Range Removal Action
Feb. 1999	Action Memorandum for Grenade Range Removal Action
Sept. 1999	First Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Five-Year Review Report signed
Sept. 2004	Second CERCLA Five-Year Review Report signed
Oct. 2008	Action Memorandum for Building 102 Groundwater

Oct. 2008	Action Memorandum for Site K
Mar. 2009	Action Memorandum for 535 Primer/Tracer Area
Aug. 2009	Third CERCLA Five-Year Review Report signed

The following sites were in progress at the end of fiscal year (FY) 2012. These sites are not included in the scope of this five-year review because the sites are either still under investigation or not part of the OU2 ROD:

Soil Areas of Concern

135 Primer/Tracer Area

The 135 Primer/Tracer Area consists of Building 135 and associated structures and utilities that were used for the production of component primers and tracing compounds associated with TCAAP small caliber ammunition production. The Preliminary Assessment report for this site received regulatory approval in FY 2002. The 135 Primer/Tracer Area Site Inspection Work Plan received regulatory approval and site investigation fieldwork was completed in FY 2002. The Site Investigation Summary Report was approved in FY 2005 and recommended that an engineering evaluation / cost analysis (EE/CA) be performed. This site is on a parcel of property proposed to be transferred out of federal ownership. The Army is anticipating transfer of the western portion of the 135 Primer/Tracer Area 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 Primer Tracer Area in early FY 2012. A Phase II Environmental Site Assessment report documenting this work was submitted to the Minnesota Pollution Control Agency (MPCA) (Volunteer Investigation

and Cleanup Program) in December 2011. Final USEPA and MPCA approval of the Quality Assurance Project Plan (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 the 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.

National Guard Environmental Baseline Survey

Soil samples collected in June 1999 as part of Minnesota Army National Guard environmental baseline survey 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.

Site A

Soil samples collected in December 2009 as part of Minnesota Army National Guard environmental baseline survey 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.

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, was approved by the MPCA and USEPA in December 2004. In June 2005, the Army submitted a draft feasibility study 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 feasibility study, it was agreed to conduct additional sampling of Marsden Lake and Pond G, which was completed in 2008. A revised feasibility study was submitted in January 2009. Based on comments received and resolution thereof, the Army then submitted a revised (redlined) feasibility study 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 feasibility study 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, the Minnesota Department of Natural Resources, the Fish and Wildlife Service, and the TCAAP Restoration Advisory Board 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 feasibility study, 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 feasibility study. With USEPA and MPCA agreement, the Army initiated a strategy to revise the feasibility study 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 feasibility study 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. The need for a remedy has yet to be determined.

2.0 Background

2.1 PHYSICAL CHARACTERISTICS

The Twin Cities Army Ammunition Plant (TCAAP) is a government-owned facility located 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 A-1). For purposes of the U.S. Army's restoration program for the New Brighton/Arden Hills Superfund Site, TCAAP formerly occupied an approximately four square mile area east of U.S. Interstate Highway 35W and north of Ramsey County Highway 96 (i.e., this was the original TCAAP boundary as shown on Figure A-2).

Remedial investigations performed at TCAAP and the surrounding areas have identified four geologic units of importance on and around TCAAP (Figure A-3 illustrates the geologic units conceptually). Unit 1 is an unconsolidated unit with intermixed beds of sand and clay found on the surface at many locations at TCAAP. Unit 1 contains groundwater, but the aquifer yield is low and the water is not used as a municipal water supply source by any of the surrounding communities. Sites A, C, I, and K are nominally referred to as "shallow groundwater sites", since the groundwater contamination at these sites is located in Unit 1. Unit 2 lies beneath Unit 1 and is a glacial till deposit that behaves as an aquitard at TCAAP and as an upper confining layer off-TCAAP to the southwest. Unit 3, the Hillside Sand and the Arsenal Sand, lies beneath Unit 2 but is exposed at the surface in some areas of TCAAP. Unit 3 is a water-bearing formation with high water yield. Groundwater from Unit 3 has historically been utilized as a potable water supply. Unit 4 (located directly below Unit 3) is a major aquifer for the Twin Cities area, including the communities surrounding TCAAP. It consists of two bedrock units: the Prairie du Chien group (referred to as Upper Unit 4), which overlies the Jordan sandstone (referred to as Lower Unit 4). Groundwater contamination that exists below TCAAP in Unit 3

and 4, and that exists in Unit 3 and 4 to the southwest of TCAAP, is nominally referred to as "deep groundwater" contamination, since the groundwater is located in these deeper geologic units. Figures A-4 and A-5 present a geologic cross section through TCAAP, along a line parallel to the direction of groundwater flow in the Unit 3 and 4 aquifer. The line of this section is labeled as A-A' on plume maps discussed in Section 4, such as Figure A-4. In addition to the geologic units, the cross section shows the vertical distribution of trichloroethene concentrations. Since Unit 3 is relatively thick, monitoring wells constructed within this unit are designated as "upper" (U), "middle" (M), or "lower" (L) to represent their relative depth. This labeling convention is used on various figures in this report.

2.2 LAND AND RESOURCE USE

TCAAP was constructed beginning in 1941 with a primary mission to produce small-caliber ammunition and related materials. Production levels varied over time and ceased in 2005. TCAAP was constructed on federally-owned land controlled by the U.S. Army. The size of TCAAP has periodically shrunk as a result of property ownership transfers and reassignment of control. Since placement on the NPL, control for over 1500 acres has been reassigned to the National Guard Bureau and U.S. Army Reserve. This property is still federally-owned and controlled by the U.S. Army, but is no longer controlled by TCAAP or considered part of TCAAP. Also, more than 270 acres have transferred out of federal ownership to state, county, and municipal governments. The remaining 585 acres of TCAAP have been determined to be surplus to the needs of the federal government and are in the process of being transferred out of federal ownership. These 585 acres are currently controlled by the Base Realignment And Closure (BRAC) Division of the U.S. Army, the organization to which TCAAP presently reports. Over time, property ownership and/or control have changed, and what is considered TCAAP has changed, but the area defined as OU2 of the New Brighton/Arden Hills Superfund Site has not changed.

The Minnesota National Guard uses the land held by the National Guard Bureau for military training purposes. For the remaining 585 acres of TCAAP proposed for transfer, the future property use is not known at this time, but will potentially be a mixture of recreational, residential, commercial, and industrial uses. Because OU2 soil has been remediated to site-specific cleanup levels based on industrial use, if the future land use should change, the cleanup levels and associated risks should be reevaluated.

Groundwater beneath the original TCAAP boundary is not being used for potable water supply or other commercial/industrial uses. Groundwater flowing away from TCAAP is utilized for residential, commercial, industrial, and municipal water supply. The Prairie du Chien-Jordan aquifer is a major source for municipal water supplies, such as for the Cities of New Brighton and Saint Anthony.

2.3 HISTORY OF CONTAMINATION

During the years of ammunition production, TCAAP generated industrial wastes that were disposed of using the accepted practices of the times, which included on-site dumping, burial, and open-burning. Between 1978 and 1982, contamination of the regional aquifer was discovered beyond the original TCAAP boundary, and later, 14 different areas were identified at TCAAP as potential sources for groundwater contamination, soil contamination, or both. The contaminants included VOCs, especially those commonly used as industrial solvents or degreasers (like trichloroethene), polychlorinated biphenyls (PCBs), and ammunition-related heavy metals. The drinking water supply of local communities, with a total population of approximately 33,000, was directly impacted by VOCs.

2.4 INITIAL RESPONSE

Based upon the information gathered between 1978 and 1982, TCAAP was placed on the National Priorities List (NPL) in September 1983 and was designated as the New Brighton/Arden Hills (NB/AH) Superfund Site. The Site consists of contaminated areas within the original TCAAP boundary and those areas outside of the plant that are affected by groundwater contamination from the plant. The NB/AH Site has been divided into three operable units, principally due to the nature and extent of the contaminated groundwater plume on and off TCAAP. The plume is approximately 2-miles wide and 6-miles long.

The three operable units are depicted on Figure A-6 (as related to the original TCAAP boundary) and are defined as follows:

- OU1 consists of the deep groundwater "North Plume" of off-TCAAP contaminated groundwater.

- OU2 consists of on-TCAAP soil and groundwater contamination, including 14 suspected source areas designated as Sites A, B, C, D, E, F, G, H, I, J, K, 129-3, 129-5, and 129-15 (see Figure A-7). OU2 also includes the area of the Site A shallow groundwater contamination that extends off the north end of TCAAP Remediation of Sites F and J was completed prior to the 1997 OU2 ROD with no further action required. The Grenade Range and Outdoor Firing Range were added to OU2 as part of the 2009 OU2 ROD Amendment #3. In addition, Building 102 groundwaer, the Site K soils, the 535 Primer/Tracer Area, and the aquatic sites (Rice Creek, Sunfish Lake, Marsden Lake North, Marsden Lake South, and Pond G) were added to OU2 as part of the 2012 ROD Amendment #4.

- OU3 consists of the deep groundwater "South Plume" of off-TCAAP contaminated groundwater.

A number of actions were taken at this Site prior to signing of the RODs, as discussed below:

OU1

A temporary, followed by a permanent, granular activated carbon (GAC) treatment system was constructed for the City of New Brighton to treat the municipal water supply. The permanent system was completed in June 1990.

A temporary, followed by a permanent, GAC treatment system was constructed for the Village of St. Anthony to treat the municipal water supply. The permanent system is a remedial action pursuant to an interim action ROD signed in September 1986, and was completed in April 1991.

The Army provided municipal water supply hookup for the Lowry Grove Trailer Park and Arden Manor Trailer Park.

OU2

Interim Remedial Actions (IRAs) at Sites D and G, implemented in January 1986 and February 1986, respectively, included the installation of soil vapor extraction (SVE) systems at both sites to remove VOCs from the soils, effectively reducing VOC migration to the groundwater. During their period of operation, the SVE systems at Sites D and G removed more than 220,000 pounds of VOCs from the soil.

PCB-contaminated soil east of Building 502 was excavated in 1986. These soils were stored in a storage building built as part of the PCB IRA at Site I. During August and September 1996, these soils were removed and disposed of at a Toxic Substances Control Act (TSCA) landfill, with approval of the USEPA and MPCA.

In September 1989, the thermal treatment of 1,400 cubic yards of PCB-contaminated soil from Site D was completed. As part of this Site D work, the remedy allowed for soils with less than 50 milligrams per kilogram (mg/kg) of PCBs to be “secured in-place”, in

that they were backfilled into the lower part of the PCB excavation area, with approximately 4 to 6 feet of clean soils placed over the contaminated soil. A protective soil cover with a minimum thickness of two feet is maintained over the soils that were "secured in-place", to prevent exposure to these soils.

In 1995, the cleanup of Site F was completed under the Resource Conservation and Recovery Act (RCRA). More than 25,000 tons of metal-contaminated soils were treated over a period of three years. The Site F Closure Report (1999) was approved by the MPCA (since the State has the lead for RCRA actions) and documented that this site was available for unlimited use and unrestricted exposure.

Site J is a portion of TCAAP's underground sanitary sewer that was cleaned out. Soils and groundwater along the sewer location were investigated and no contamination was found. The Final Site J Closure Report (1994) was approved by the MPCA and USEPA, and documented the absence of contaminants above background levels and recommended no further action.

Many actions have also been undertaken to clean up the contaminated groundwater. In 1986, groundwater extraction treatment systems were installed at Sites I and K as IRAs. In October 1987, the installation constructed the Boundary Groundwater Recovery System (BGRS) to contain and treat VOC-contaminated groundwater at the TCAAP's southwest boundary. In January 1989, the system was modified and expanded and became the TCAAP Groundwater Recovery System (TGRS).

In September 1988, the installation conducted an IRA at Site A to recover shallow VOC-contaminated groundwater via a single extraction well located near the source area. In 1994, the installation replaced the Site A IRA remedy with a boundary plume containment system designed to prevent the off-TCAAP migration of VOCs in shallow groundwater.

OU3

There were no interim actions taken prior to signing of the OU3 ROD.

2.5 BASIS FOR TAKING ACTION

The contaminants of concern (COCs) present at each site, and specific to each media of concern, are summarized in Table A-2.

A human health risk assessment for TCAAP was completed by the USEPA in April 1991. For groundwater contamination, potential receptors included TCAAP workers and local residents who rely on private or municipal wells that extract contaminated groundwater for water supply. The risk assessment evaluated the carcinogenic and non-carcinogenic risks associated with exposure to contaminated groundwater through exposure pathways of ingestion, inhalation during showering, and absorption through the skin during showering or bathing. Estimated increases in carcinogenic and/or non-carcinogenic risks that would result from exposure to contaminated groundwater exceeded acceptable levels as defined by the USEPA and MPCA.

For contaminated soils, the exposure pathways that were evaluated were based on an industrial use scenario, with potential receptors being TCAAP workers or occupants. Incidental ingestion and dermal contact were assumed to be the only significant routes for receptors to be exposed to contaminants in surface soils at the site (it was also noted that, during excavation activities, workers could also be exposed to contaminants by inhaling vapors or dust, as well as through incidental ingestion and dermal contact). The health risk assessment found that carcinogenic and non-carcinogenic risks exceeded acceptable levels at most soil sites in OU2.

The Army conducted an ecological risk assessment for terrestrial habitats at the original TCAAP (U.S. Army Environmental Hygiene Agency, October 1991, final report approved by USEPA

and MPCA). The risk assessment addressed on-TCAAP risks to plants and animals, and concluded that no significant risks exist. The Army also conducted an ecological risk assessment for 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 in FY 2005. The Tier II report evaluated and characterized the potential ecological risks associated with six aquatic sites; however, it stopped short of recommending risk management decisions and the Army, USEPA, and MPCA agreed that a feasibility study would be more appropriate for documenting recommended decisions. In January 2011, regulators approved the feasibility study prepared for the aquatic sites to address potential ecological risks from surface waters and sediment identified in the Tier II ERA. Note that earlier iterations of the document had also included Round Lake; however, this lake was separated from this feasibility study in order to allow completion of additional sediment investigation work in Round Lake. No action was recommended for Rice Creek, Sunfish Lake, Marsden Lake North, and Marsden Lake South. For Pond G, surface water sampling results presented in the Tier II ERA included exceedances of state water quality standards for lead and aluminum. Additional Pond G surface water results for aluminum and lead, documented in the feasibility study, showed that the mean aluminum concentration was below the state water quality standard, while the mean lead concentration exceeded the standard (Minnesota surface water quality standards promulgated in Minnesota Rule 7050.0222). Although the Tier II ERA did not identify a plausible risk, the exceedance of the state water quality standard for lead suggested that the water quality of Pond G may not be protective of the entire aquatic ecosystem. Lead was identified as the only COC for Pond G surface water.

Table A-1
Crosswalk, Operable Unit (OU) Designations
New Brighton /Arden Hills Superfund Site

EPA OU #	Description	Date	EPA Remarks	TCAAP OU #
1	St. Anthony Water Pipeline ROD	08/02/1984	interim action ROD	
2	RI/FS (Sewer line/Round Lake) ROD	08/12/1987	interim action ROD	
3	St. Anthony Alternate Water Supply ROD	03/31/1987	interim action ROD	
4	Off-Base RI	03/31/1991	MPCA performed	
5	New Brighton Well #7 ROD	06/30/1986	ROD was amended 09/30/1989, rescinding construction of Well #7	
6	BGRS ROD	09/25/1987	interim action ROD	
7	On-TCAAP RI	07/02/1993	NBCGRS (TCAAP OU1) and On-TCAAP Cleanup (OU2), and all of their amendments, are tracked under this OU	1,2
	NBCGRS ROD	09/30/1993	(OU7 is where the 'final remedy' designation for the Site has been tracked)	
	On-TCAAP Cleanup ROD	12/11/1997		
	Site A, 135 Primer/Tracer Area, EBS Sites	?	OU7 ROD Amendment #5	
8	PCB Burn	08/11/1989	interim action ROD	
9	PGRS ROD	09/30/1992	(TCAAP OU3)	3
10	Round Lake ROD	?		

Table A-2
Chemicals of Concern (COCs) and Selected Cleanup Levels
New Brighton/Arden Hills Superfund Site

		Soil COC	Cleanup Level (mg/kg)	Groundwater COC	Cleanup Level (µg/l) and Basis [1]	Surface Water COC	Cleanup Level (µg/l) and Basis [1]
OU1							
	Deep Groundwater	*None*		1,1-Dichloroethane	70 (RAL)	*None*	
				1,1-Dichloroethene	6 (HRL)		
				cis-1,2-Dichloroethene	70 (MCL,RAL)		
				1,1,1-Trichloroethane	200 (MCL)		
				1,1,2-Trichloroethane	3 (HRL)		
				Trichloroethene	5 (MCL)		
OU2							
	A	Antimony	33.6	Antimony	6 (HRL)	*None*	
		Barium	21,745	1,1-Dichloroethene	6 (HRL)		
		Copper	19,593	1,2-Dichloroethane	4 (HRL)		
		Lead	1200	Benzene	10 (HRL)		
		Tetrachloroethene	0.5[2]	Chloroform	60 (HRL)		
		Trichloroethene	1.44[2]	cis- 1,2-Dichloroethene	70 (HRL)		
				Tetrachloroethene	7 (HRL)		
				Trichloroethene	30 (HRL)		
	C	Antimony	67.2	Lead	15 (NPDWR)	*None*	
		Arsenic	10				
		Beryllium	0.7				
		Lead	1200				
		Manganese	2503				
		Thallium	11.8				
	D	Trichloroethene	0.416[2]	*Refer to OU2 Deep Groundwater*		*None*	
		PCBs	10				
		Antimony	67.2				
		Lead	1200				
		Nitroglycerine	61.2				
	E	Antimony	22.4	*None*		*None*	
		Barium	21,745				
		Copper	13,062				
		Lead	1200				
		Manganese	834				
	G	Trichloroethene	36.1[2]	*Refer to OU2 Deep Groundwater*		*None*	
	H	Antimony	33.6	*None*		*None*	
		Arsenic	10				
		Copper	19,593				
		Lead	1200				
		Manganese	2503				
	I	*None*		1,2-Dichloroethene (cis and trans)	70 (HRL)	*None*	
				Trichloroethene	30 (HRL)		
				Vinyl Chloride	0.2 (HRL)		
	K	*None*		1,2-Dichloroethene (cis and trans)	70 (HRL)		
				Trichlorothene	30 (HRL)		
	129-3	Antimony	22.4	*None*		*None*	
		Lead	1200				
		Manganese	834				
		Nitroglycerine	61.2				
		Trichloroethene	4.43[2]				
	129-5	Antimony	67.2	*None*		*None*	
		Barium	21,745				
		Lead	1200				
	129-15	Benzo(a)anthracene	0.215	*None*		*None*	
		Benzo(a)pyrene	0.021				
		Lead	1200				
	Grenade Range	Antimony	33	*None*		*None*	
		Cadmium					
		0-1 ft above GW*	1.4[2]				
		1-2 ft above GW	2.3[2]				
		2-3 ft above GW	7[2]				
		> 3 ft above GW	50				
		Lead					
		0-1 ft above GW	270[2]				
		> 1 ft above GW	1200				

Table A-2
Chemicals of Concern (COCs) and Selected Cleanup Levels
New Brighton/Arden Hills Superfund Site

	Soil COC	Cleanup Level (mg/kg)	Groundwater COC	Cleanup Level (µg/l) and Basis [1]	Surface Water COC	Cleanup Level (µg/l) and Basis [1]
OU2 (cont'd)						
Outdoor Firing Range	Antimony	22.4	*None*		*None*	
	Copper	13,067				
	Lead	1200				
	Benzo(a)anthracene	0.645				
	Benzo(a)pyrene	0.0645				
	Indeno(1,2,3-cd) -pyrene	0.645				
Building 535 Primer Tracer Area						
Building 535 Area	cPAHs (BAP Equivalent)	3	*None*		*None*	
	Fluoranthene	295				
	Pyrene	272				
Building 535 Primer Tracer Area						
Building 535 Storm Sewer Outfall	Lead	525	*None*		*None*	
Building 102 Groundwater	*None*		Trichloroethene	5 (HRL)	*None*	
			cis-1,2-Dichloroethene	70 (HRL)		
			1,1-Dichloroethene	6 (HRL)		
			Vinyl Chloride	0.18 (C2)[4]		
Pond G	*None*		*None*		Lead	calculated[3] (C2)
Deep Groundwater	*None*		1,1,1-Trichloroethane	200 (MCL)	*None*	
			1,1-Dichloroethane	70 (HRL)		
			1,1-Dichloroethene	6 (HRL)		
			1,2-Dichloroethane	4 (HRL)		
			cis-1,2-Dichloroethene	70 (MCL)		
			Tetrachloroethene	5 (MCL)		
			Trichloroethene	5 (MCL)		
OU3						
Deep Groundwater	*None*		1,1-Dichloroethane	70 (RAL)	*None*	
			1,1-Dichloroethene	6 (RAL)		
			cis-1,2-Dichloroethene	70 (MCL,RAL)		
			1,1,1-Trichloroethane	200 (MCL)		
			1,1,2-Trichloroethane	3 (RAL)		
			Trichloroethene	5 (MCL)		

* GW = groundwater table

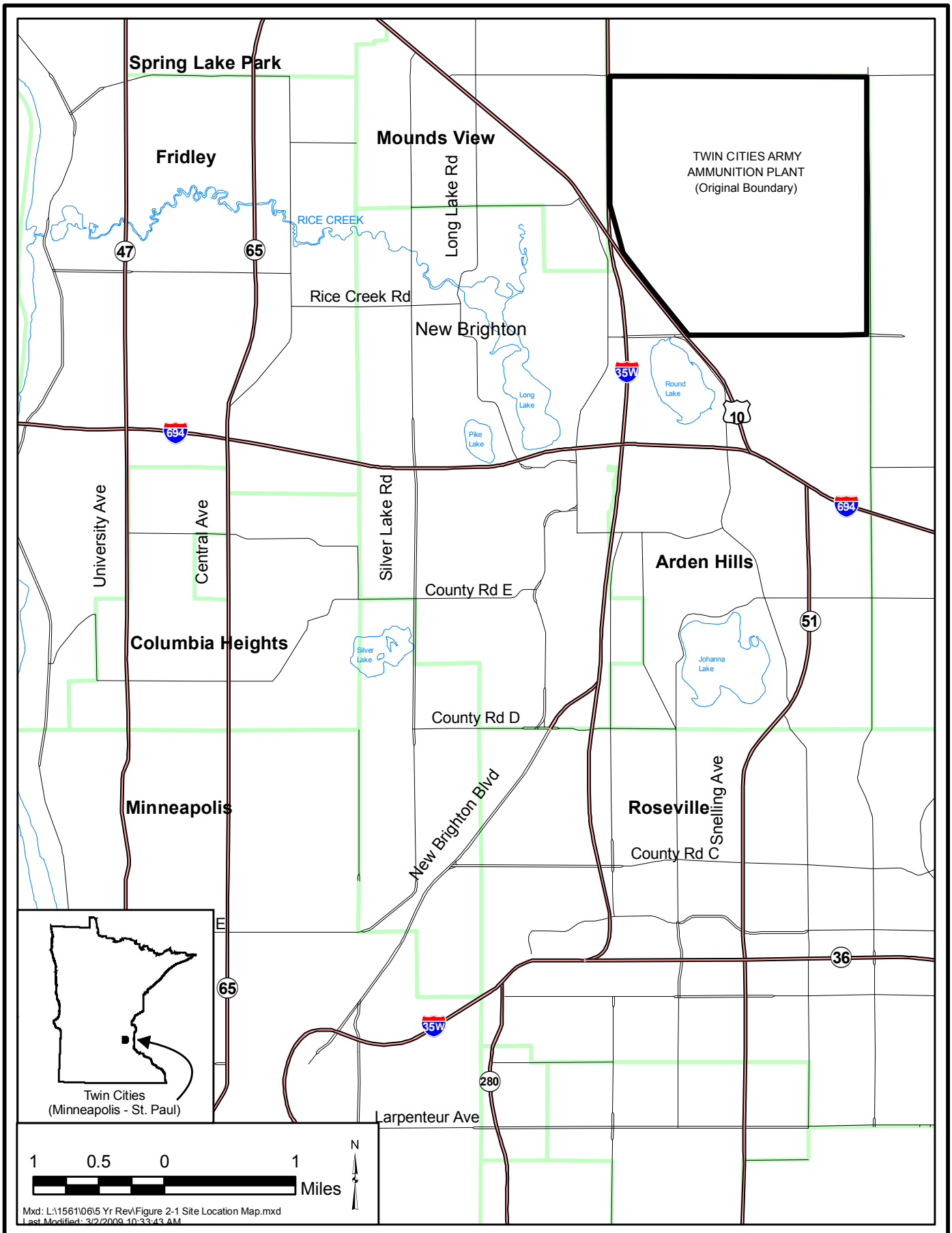
Note 1: The basis for each cleanup level as presented in the respective RODs. For OU1, OU2, and OU3 deep groundwater, the lowest ARAR value was selected. For Sites A, I, and K, preference was given to the HRLs because this aquifer is not used for community water supplies (MCLs do not apply).

RAL = State of Minnesota Recommended Allowable Limit (subsequently superceded by the HRLs).
HRL = State of Minnesota Health Risk Limit.
MCL = Federal Maximum Contaminant Level.
NPDWR = National Primary Drinking Water Regulations (action level at the tap).
C2 = Minnesota Rule 7050.0222, Water Quality Standards for Class 2 Waters

Note 2: Indicates a cleanup level that was derived based on the leaching pathway (versus a direct exposure).

Note 3: The surface water standard for lead is dependant on the hardness of the water body and is calculated using the calculation specified in MN Rule 7050.0222 (Class 2Bd Chronic Standard).

Note 4: Given that Building 102 shallow groundwater discharges to Rice Creek, COCs are the HRLs unless the surface water standard (C2) for for Rice Creek is lower thatn the HRL.



TWIN CITIES ARMY AMMUNITION PLANT

Site Location Map

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

AUG 2009

Figure A-1

TWIN CITIES ARMY AMMUNITION PLANT

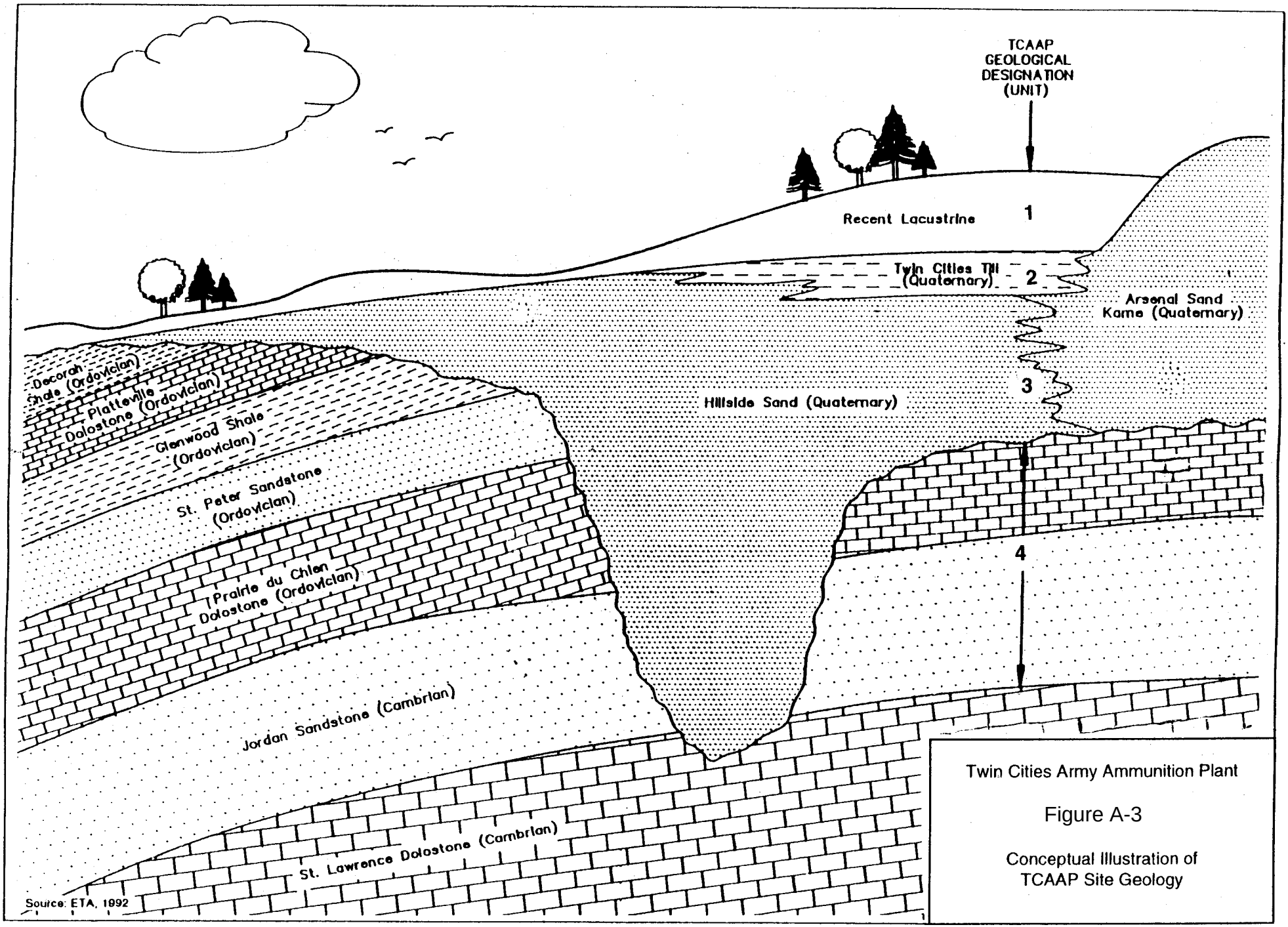
Original TCAAP Boundary

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

AUG 2009

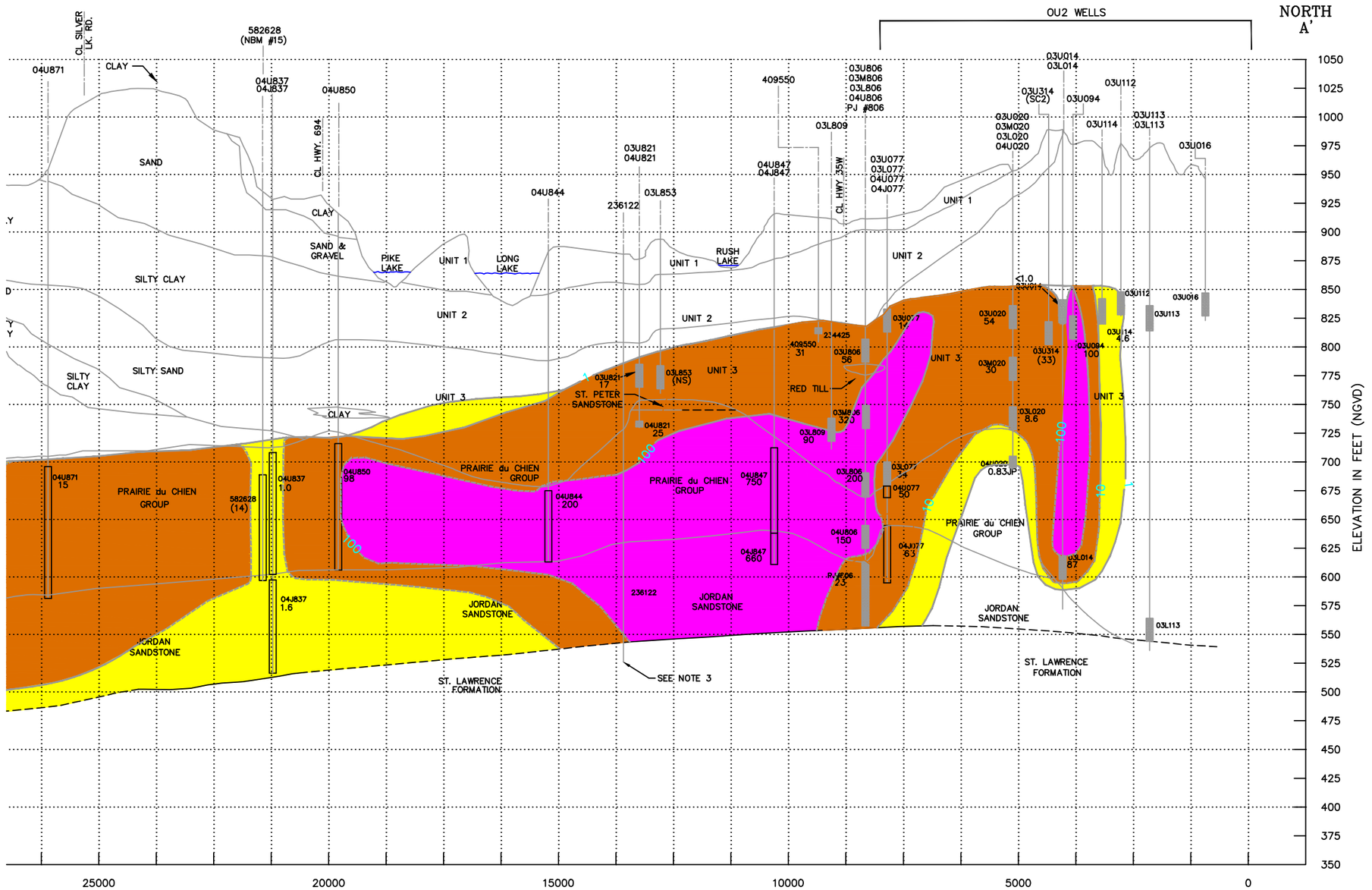
Figure A-2



Twin Cities Army Ammunition Plant

Figure A-3

Conceptual Illustration of
TCAAP Site Geology



NOTES

(1) CROSS SECTION: TOPOGRAPHY CONSTRUCTED WITH DATA FROM U.S.G.S. NEW BRIGHTON 7.5 MINUTE SERIES QUAD MAP DATED 1967 (PHOTOREVISED 1972, AND 1980); WELL LOCATIONS AND THE "LINE" OF SECTION ARE SHOWN ON FIGURES 3-3 THROUGH 3-5.

(2) WELL NESTS, CONSISTING OF INDIVIDUAL WELLS IN THE SAME PROXIMITY, ARE REPRESENTED ON THE CROSS SECTION BY A SINGLE LINE WITH MULTIPLE WELL SCREENS

(3) WELL 236122 HAS BEEN SEALED, BUT IS SHOWN SINCE IT WAS USED TO PREPARE THE CROSS SECTION

LEGEND

- GEOLOGIC CONTACT
- INFERRED GEOLOGIC CONTACT
- SCREENED INTERVAL OF WELL
- OPEN HOLE INTERVAL OF WELL
- 04U806 2500.00 / 04U847 790.00 — TRICHLOROETHENE CONCENTRATION (µg/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)
- 10 — ISOCONCENTRATION CONTOUR µg/l)
- 10 — ESTIMATED ISOCONCENTRATION CONTOUR (µg/l)
- 04U852 (JP 0.48) — THE VALUE IS ESTIMATED BECAUSE THE VALUE IS BELOW THE REPORTING LIMIT, BUT ABOVE THE METHOD DETECTION LEVEL.
- (NS) — NOT SAMPLED

M: /1561/2011/SUMMER 2011.DWG

ANNUAL PERFORMANCE REPORT

OU2/OU1 TRICHLOROETHENE CROSS-SECTION A-A' (NORTH HALF), SUMMER 2011

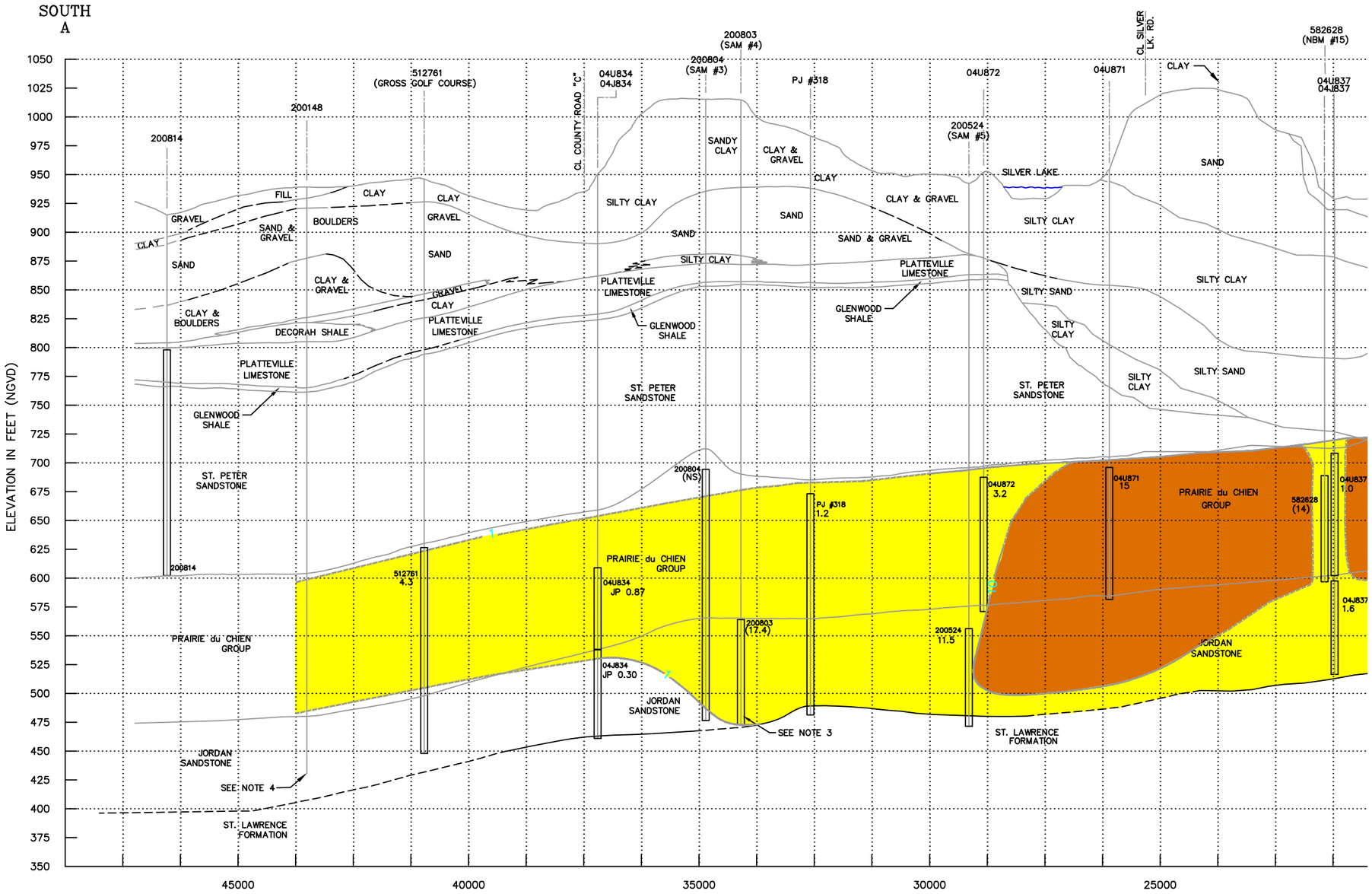
Wenck Associates, Inc.
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55339

FY 2011

Figure A-4

SOUTH

A



DISTANCE IN FEET

NOTES

(1) CROSS SECTION: TOPOGRAPHY CONSTRUCTED WITH DATA FROM U.S.G.S. NEW BRIGHTON 7.5 MINUTE SERIES QUAD MAP DATED 1967 (PHOTOREVISED 1972, AND 1980); WELL LOCATIONS AND THE "LINE" OF SECTION ARE SHOWN ON FIGURES 3-3 THROUGH 3-5.

(2) WELL NESTS, CONSISTING OF INDIVIDUAL WELLS IN THE SAME PROXIMITY, ARE REPRESENTED ON THE CROSS SECTION BY A SINGLE LINE WITH MULTIPLE WELL SCREENS

(3) NO INFORMATION WAS PROVIDED ON THE WELL LOG FOR 200803 (SAM #4) CONCERNING WELL CONSTRUCTION DETAILS, ESPECIALLY THE OPEN HOLE INTERVAL. AS THIS IS REFERRED TO AS A JORDAN WELL, THE OPEN HOLE WAS ASSUMED TO EXTEND FROM THE TOP OF THE JORDAN TO THE BOTTOM OF THE BOREHOLE.

(4) WELL 200148 HAS BEEN SEALED, BUT IS SHOWN SINCE IT WAS USED TO PREPARE THE CROSS SECTION

LEGEND

- GEOLOGIC CONTACT
- INFERRED GEOLOGIC CONTACT
- SCREENED INTERVAL OF WELL
- OPEN HOLE INTERVAL OF WELL
- 04U806 2500.00 / 04U847 790.00 — TRICHLOROETHENE CONCENTRATION (µg/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)
- 10 — ISOCONCENTRATION CONTOUR µg/l)
- 10 — ESTIMATED ISOCONCENTRATION CONTOUR (µg/l)
- 04U852 (JP 0.48) — THE VALUE IS ESTIMATED BECAUSE THE VALUE IS BELOW THE REPORTING LIMIT, BUT ABOVE THE METHOD DETECTION LEVEL.
- (NS) — NOT SAMPLED

M: /1561/2011/SUMMER 2011.DWG

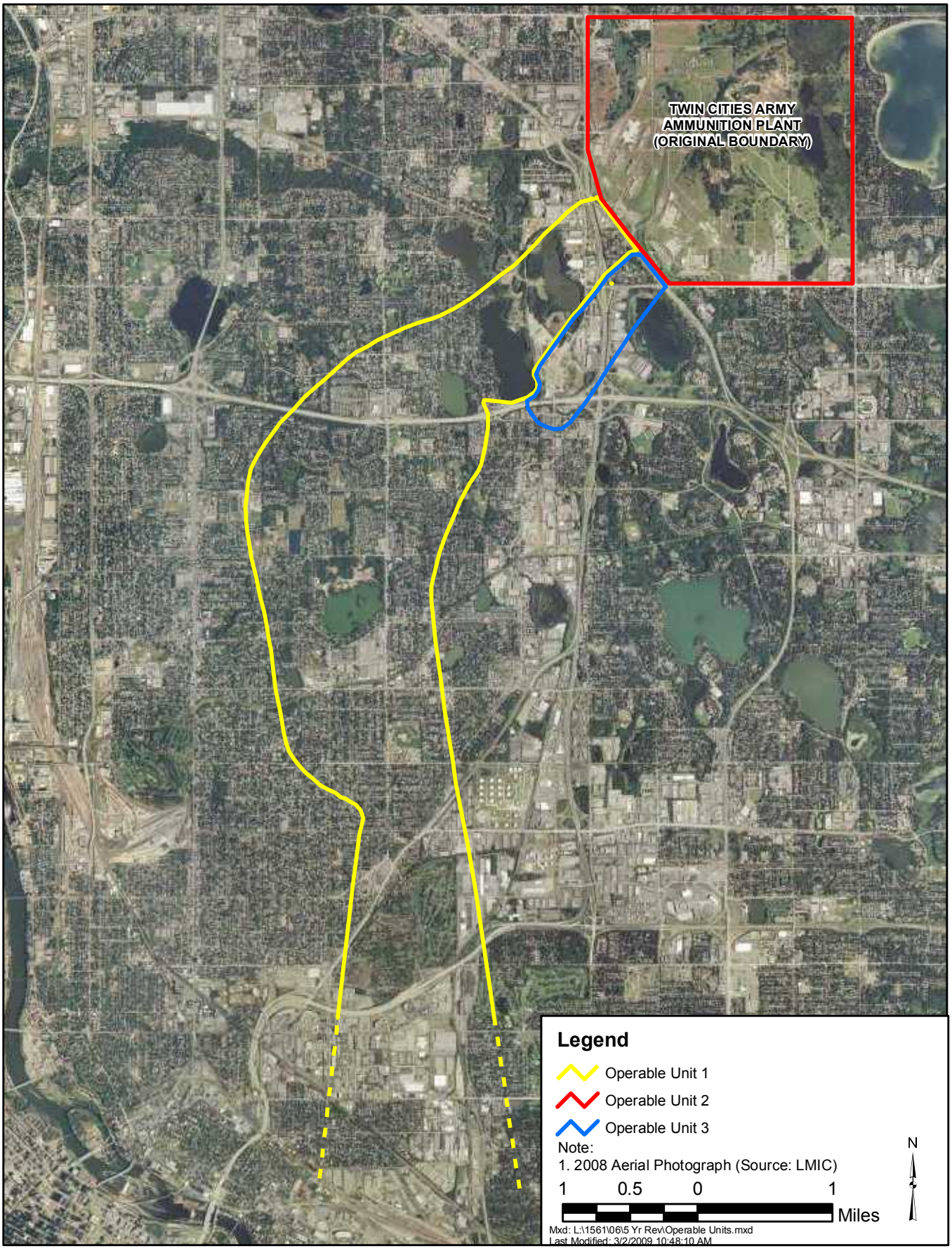
ANNUAL PERFORMANCE REPORT

OU1 TRICHLOROETHENE CROSS-SECTION A-A' (SOUTH HALF), SUMMER 2011

Wenck Associates, Inc.
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55339

FY 2011

Figure A-5



TWIN CITIES ARMY AMMUNITION PLANT

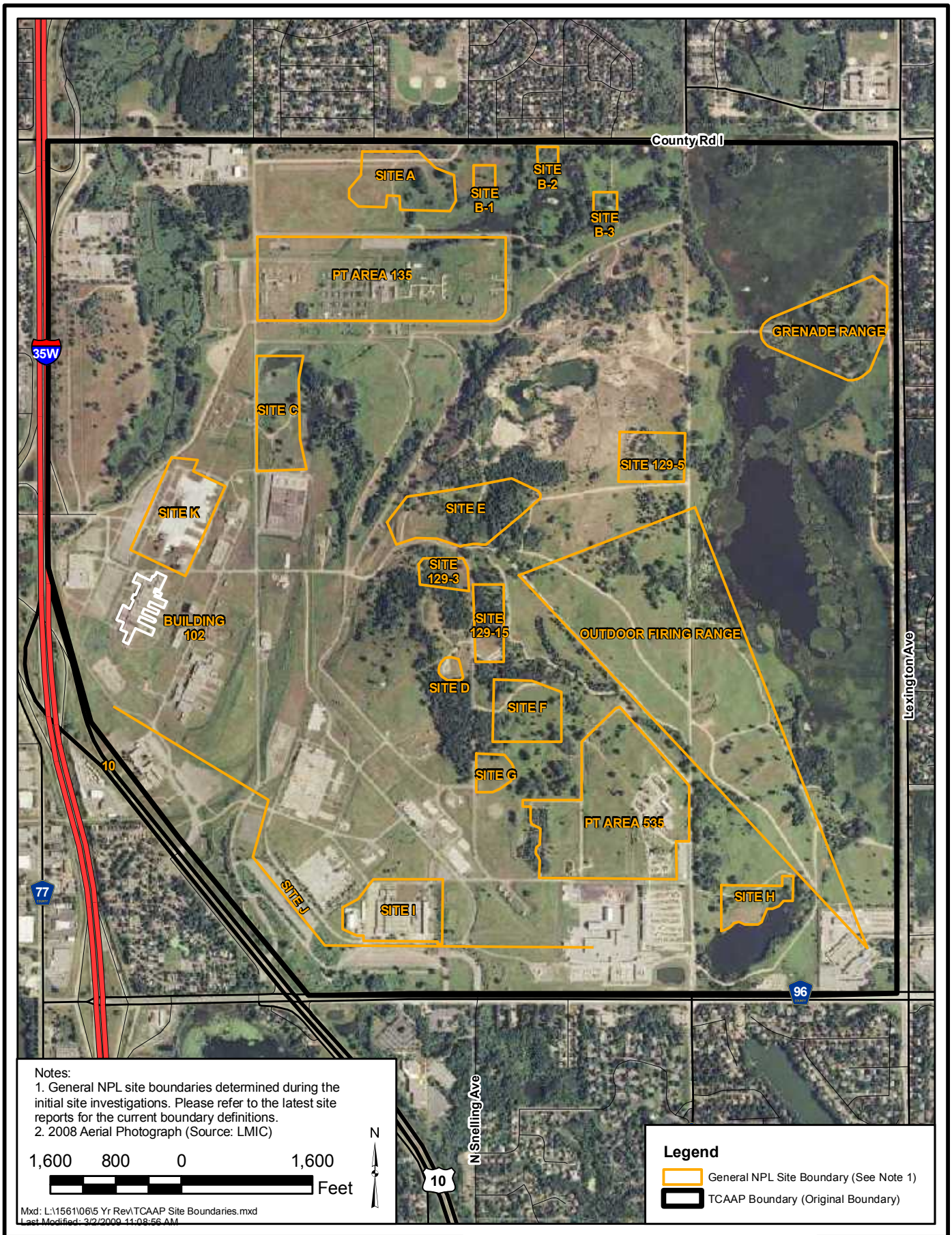
Conceptual Illustration of
TCAAP Operable Units

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

AUG 2009

Figure A-6



TWIN CITIES ARMY AMMUNTION PLANT

TCAAP Site Boundaries

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

AUG 2009

Figure A-7

Appendix B

Site Inspection Checklists

B.1 Operable Unit 1

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***Operable Unit 1 New Brighton/Arden Hills Superfund Site***	Date of inspection: ***This site was not visited, as agreed to by the USEPA/MPCA***
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U.S. Army***	Weather/temperature:

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Land use controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager ***Dave Olson, City of N.B.*** (Name) ***Public Works Superintendent*** (Title) ***N/A*** (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(651) 638-2113***
   Problems, suggestions; ☐ Report attached _____

2. O&M staff ***Kris Fluegel, City of N.B.*** (Name) ***Treatment Plant Operator*** (Title) ***N/A*** (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(651) 638-2065***
   Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Waste disposal, POTW ☐ Readily available ☐ Up to date ☐ N/A
   ☒ Other permits (see remarks) ☒ Readily available ☒ Up to date ☐ N/A
   Remarks
   1) A MDNR permit exists for groundwater appropriation.
   2) A RCRA Hazardous Waste Generator permit exists for the spent granular activated carbon. Spent carbon is returned to the original, clean carbon supplier for regeneration.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2011Annual Performance Report. The next major sampling event is upcoming in FY 2013. Recommendations for this next major sampling events are in the TCAAP FY2012 Annual Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Water (effluent) ☐ Readily available ☐ Up to date ☐ N/A
   Remarks

10. **Daily Access/Security Logs**
    ☒ Readily available ☐ Up to date ☐ N/A
    Remarks ***Daily Access is not logged but security alarms are operable.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house ☐ Contractor for State
   - ☐ PRP in-house ☐ Contractor for PRP
   - ☐ Federal Facility in-house ☐ Contractor for Federal Facility
   - ☒ Other ***City of New Brighton***

2. **O&M Cost Records**
   - ☐ Readily available ☒ Up to date
   - ☒ Funding mechanism/agreement in place
   - Original O&M cost estimate ***$705,000 (OU1 ROD, 1993 dollars)*** ☐ Breakdown attached

   Total annual cost by year for review period if available

From	***1/1/09***	To	***12/31/09***	***$1,908,492***	☒ Breakdown attached
	Date		Date	Total cost	
From	***1/1/10***	To	***12/31/10***	***$2,308,588***	☒ Breakdown attached
	Date		Date	Total cost	
From	***1/1/11***	To	***12/31/11***	***$2,060,887***	☒ Breakdown attached
	Date		Date	Total cost	
From	***1/1/12***	To	***12/31/12***	***$2,564,189***	☒ Breakdown attached
	Date		Date	Total cost	
From	***1/1/13***	To	***06/31/13***	***$1,290,695***	☒ Breakdown attached
	Date		Date	Total cost	

Note: Since the OU1 was not reviewed, there is no more data on the latest total cost by year since FY 2008

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons:

   Since FY 1993, the O&M costs have been higher than the original estimate; however, carbon changes are now occurring at 6 month intervals rather than the 12 month interval in the original estimate. The original estimate is now approximately 19 years old, which also accounts for some of the disparity.
   Annual O&M costs ranged from $1.9 million in FY2009 to $2.5 million in FY2012. These costs are in line with the amount budgeted for FY2012 of $2.4 million.

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***When not attended, treatment building is locked and also has security alarms.***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

   LUCs: 1) Maintain the Minnesota Department of Health (MDH) Special Well Construction Area (SWCA).

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***Self-reporting (through the Annual Performance Report, the Army reports on the status of the MDH SWCA)***
   Frequency ***Annual***
   Responsible party/agency ***Army***
   Contact ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***(651) 294-4930*** (Phone no.)

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***The MDH continues to administer the SWCA to prohibit construction of new wells into the contaminated portion of the aquifer. At the end of FY 2012, there were no known wells that were a potential exposure route to groundwater contaminants at unacceptable levels (i.e., all wells with potential exposure have been abandoned and/or provided with an alternate water supply, or have been considered in an MDH Health Consultation and found not to pose a health hazard.)***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A
   Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines
☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☒ Carbon adsorbers
   - ☐ Filters ☐ Others
   - ☐ Additive (*e.g.*, chelation agent, flocculent)
   - ☒ Good condition ☐ Needs maintenance
   - ☒ Sampling ports properly marked and functional
   - ☒ Sampling/maintenance log displayed and-up to date ***(not displayed)***
   - ☒ Equipment properly identified
   - ☒ Quantity of groundwater treated annually ***Target Volume- 1.15 Billion gallons/year***
   - ☐ Quantity of surface water treated annually ***N/A***

   Remarks ***Treatment system is referred to as the Permanent Granular Activated Carbon System or "PGAC".***

   Sampling and maintenance information is maintained in a computer database that is accessible via the computers in the PGAC treatment system office.

2. **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A
   - ☒ Good condition ☐ Needs maintenance

   Remarks

3. **Tanks, Vaults, Storage Vessels** ☐ N/A
   - ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance

   Remarks

4. **Discharge Structure and Appurtenances** ☐ N/A
   - ☒ Good condition ☐ Needs maintenance

   Remarks

5. **Treatment Building(s)** ☐ N/A
   - ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☒ Chemicals and equipment properly stored

   Remarks

6. **Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked
   - ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located
   - ☐ Needs maintenance ☐ N/A

   Remarks

D. Monitoring Data

1. **Monitoring data**
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring data suggest**
   - ☒ Contaminant concentrations are declining
   - ☒ Groundwater plume is effectively contained ***(see Section 004 for further discussion)***

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) ☒ N/A
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs maintenance

   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy components below.)***

A. Alternative Water Supply/Well Abandonment

1. **Well Inventory Records** ☒ Readily available ☒ Up-to-Date
   Remarks _____

2. **O&M Organization**
   - ☐ State in-house
   - ☐ PRP in-house
   - ☐ Federal Facility in-house
   - ☐ Other _____
   - ☐ Contractor for State
   - ☐ Contractor for PRP
   - ☒ Contractor for Federal Facility

3. **Program Status**
   a. Number of well owners previously connected to an alternate water supply: ***2***
   b. Number of well owners currently scheduled to receive alternate water supply: ***0***
   c. Number of wells previously abandoned: ***11***
   d. Number of wells currently scheduled to be abandoned: ***0***
   e. Number of well owners yet to be contacted to be offered an alternate water supply/well abandonment: ***0***

4. **Groundwater Monitoring Network**
   a. Adequacy to detect plume size increase, if it occurred ☒ Adequate ☐ Not adequate
   Remarks _____

B. Drilling Advisory

1. **MDH Special Well Construction Area (SWCA)**
   a. MDH SWCA currently in place ☒ yes ☐ no
   b. MDH SWCA encompasses entire plume ☒ yes ☐ no

   Remarks: ***The MDH revised the SWCA boundary in 1999 to more closely match the area of concern.***

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The 2006 ROD Amendment documented the change to using statistical analysis of groundwater quality to show aquifer restoration, in lieu of showing containment in the vicinity of County Road E. The NBCGRS is still operated at groundwater extraction rates that are consistent with the long-term operating history, as required by the 2006 ROD Amendment. The statistical analysis of groundwater quality for the most recent major OU1 sampling event (FY 2011) indicated that, overall, there has been continuing improvement in the OU1 plume through FY 2012. The Alternate Water Supply and Well Abandonment Program, along with the MDH SWCA, continue to mitigate risks associated with private wells. The treatment system (GAC) has provided reliable treatment of the water to drinking water standards prior to its discharge into the City of New Brighton municipal water distribution system. The PGAC treated 1.41 billion gallons of water and removed 528 pounds of VOCs during FY 2012. Approx. 22,619 pounds of VOCs have been removed since system startup.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M procedures are adequate to ensure the short- and long-term protectiveness of the remedy. The PGAC system has operated without significant problems and in a manner that has provided reliable treatment of the water to drinking water standards.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None.

ANNUAL FINANCIAL SUMMARIES
WATER TREATMENT PLANT #1, FUND 206
3001 5th Street N.W.

		2006 Actual	2007 Actual	2008 Actual	2009 Actual	2010 Actual	2011 Actual	2012 Budget	2012 Actual	2013 Budget	2013 Actual through June	2014 Budget
MATERIALS AND SUPPLIES												
General Materials	2170	$18,672	$8,722	$23,534	$38,385	$49,984	$22,210	**$36,300**	$48,640	**$38,000**	$8,711	**$50,000**
Chemicals	2175	$51,856	$50,423	$49,758	$61,748	$50,998	$57,230	**$76,420**	$73,706	**$77,000**	$25,583	**$84,000**
Small Equipment	2280	$0	$0	$0	$0	$0	$770	**$2,000**	$2,104	**$2,000**	$0	**$2,400**
TOTAL		$70,529	$59,145	$73,292	$100,133	$100,982	$80,210	**$114,720**	$124,451	**$117,000**	$34,295	**$140,000**
CONTRACTUAL SERVICES												
Professional Services	3300	$0	$0	$0	$0	$924	$1,157	**$1,000**	$826	**$1,500**	$1,736	**$1,500**
Telephone	3310	$7,436	$7,444	$8,446	$8,333	$8,778	$8,411	**$9,100**	$8,838	**$9,400**	$4,356	**$9,400**
Utility Charges	3320	$228,034	$225,380	$205,437	$224,968	$199,553	$232,387	**$260,000**	$240,347	**$280,000**	$78,751	**$300,000**
Printing/Publishing/Postage	3330/3340	$1,811	$396	$765	$2,390	$3,104	$2,901	**$3,000**	$3,282	**$3,500**	$1,365	**$3,700**
Cleaning	3350	$0	$0	$0	$0	$0	$930	**$200**	$994	**$1,000**	$270	**$1,000**
Memberships	3360	$0	$0	$0	$0	$0	$0	**$300**	$0	**$300**	$0	**$300**
Training	3370	$219	$225	$255	$0	$0	$0	**$300**	$0	**$300**	$0	**$300**
Travel	3380	$0	$0	$0	$0	$0	$0	**$100**	$0	**$100**	$0	**$100**
Maint. of Buildings & Equipment	3510	$179,297	$156,057	$182,625	$133,921	$307,186	$184,598	**$320,000**	$221,654	**$310,000**	$174,206	**$312,000**
Administration	3551	$131,070	$133,174	$136,570	$141,830	$141,120	$143,695	**$146,000**	$148,858	**$149,000**	$0	**$155,000**
Insurance	3563	$11,200	$12,900	$17,600	$18,900	$19,800	$18,600	**$22,200**	$22,100	**$23,000**	$11,550	**$24,000**
Other Services	3590	$11,272	$12,701	$27,218	$0	$21,994	$0	**$14,400**	$25,727	**$30,000**	$0	**$27,000**
DNR App. Fee		$700	$750	$825	$2,542	$0	$2,046	**$3,000**	$695	**$3,000**	$725	**$800**
MCES Ind. Chg.		$0	$0	$0	$0	$0	$0	**$0**	$0	**$0**	$7,260	**$0**
SAC		$8,715	$11,538	$32,531	$9,609	$16,544	$25,948	**$27,500**	$24,492	**$30,000**	$9,108	**$26,500**
Sanitary Sewer		$520	$0	$0	$945	$25	$25	**$1,000**	$25	**$1,000**	$25	**$25**
RC/MPCA Fee		$585	$615	$615	$675	$675	$0	**$700**	$0	**$650**	$0	**$0**
Chemtrek		$252	$110	$335	$4,064	$632	$20	**$5,000**	$20	**$5,000**	$0	**$100**
Miscellaneous		$835	$768	$3,016	$835	$23,494	$903	**$2,000**	$890	**$2,000**	$902	**$1,500**
Auditing Services	3701	$35,918	$51,703	$41,432	$93,910	$215,862	$54,679	**$180,000**	$541,344	**$250,000**	$380,270	**$1,000,000**
Legal Cost	3703	$291,917	$365,178	$383,943	$436,236	$463,084	$401,022	**$500,000**	$401,458	**$500,000**	$201,958	**$425,000**
City Services - Operations	3803	$182,506	$216,443	$235,350	$348,190	$193,055	$182,596	**$340,000**	$246,315	**$353,000**	$128,893	**$325,000**
Engineering	3803	$263,293	$340,734	$358,583	$387,033	$439,505	$469,668	**$490,000**	$504,019	**$500,000**	$255,063	**$510,000**
Carbon Contracts	6751					$34,135	$11,909		$5,095			
Transfer to Other Funds	9992		$678	$2,063	($6,022)	($1,993)	($1,748)		($4,669)		($38)	
Corrections		$1,355,578	$1,536,793	$1,637,609	$1,808,359	$2,087,477	$1,739,747	**$2,325,800**	$2,392,310	**$2,452,750**	$1,256,400	**$3,120,000**
TOTAL												
TOTAL		$1,426,106	$1,595,939	$1,710,901	$1,908,492	$2,188,459	$1,819,957	**$2,440,520**	$2,516,760	**$2,569,750**	$1,290,695	**$3,260,000**
Radium Removal Project (2007 - 2008)			$312,697	$249,091								
WTP #1 Roof Replacement Project (2010)						$120,129						
WTP #1 Controls Upgrades (2011)							$240,930		$47,429			
GRAND TOTAL		$1,426,106	$1,908,636	$1,959,992	$1,908,492	$2,308,588	$2,060,887	**$2,440,520**	$2,564,189	**$2,569,750**	$1,290,695	**$3,260,000**

B.2 Operable Unit 2, Shallow Soil Sites

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***Operable Unit 2, Shallow Soil Sites (Sites A, C, E, H, 129-3, 129-5, Dump Site 129-15, Grenade Range, and Outdoor Firing Range) New Brighton/Arden Hills Superfund Site***	Date of inspection: ***September 11, 2013***
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U.S. Army***	Weather/temperature:

Remedy Includes: (Check all that apply) ***(The items checked below apply to all sites, except as noted)***

- ☒ Landfill cover/containment ***(Sites C, E, H, 129-15, and Outdoor Firing Range only)***
- ☒ Access controls
- ☒ Land use controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other ***Soil excavation, on-site treatment, and off-site disposal (all sites except Dump Site 129-15).***

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. Site Managers

Protective Soil Cover O&M (Site C):

a. O&M site manager ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***Sept 10, 2013*** (Date)
Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(651) 294-4930***
Problems, suggestions; ☐ Report attached

Protective Soil Cover O&M (Sites E, H, 129-15, and Outdoor Firing Range)

b. O&M site manager ***Mary Lee, Nat'l Guard*** (Name) ***AHATS Coordinator*** (Title) (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(651) 282-4420***
Problems, suggestions; ☐ Report attached

Soil Remediation and Protective Cover Construction (Outdoor Firing Range):

c. O&M site manager ***Jim Persoon, Alliant Techsystem*** (Name) ***Project Manager*** (Title) (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(763) 744-5690***
Problems, suggestions; ☐ Report attached

Soil Remediation and Protective Soil Cover Construction (Sites C, E, H, and 129-15):

d. Site manager ***Kathleen Romalia, Shaw Group*** (Name) ***Project Manager*** (Title) ***N/A*** (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(720) 554-8207***
Problems, suggestions; ☐ Report attached

2. O&M staff ***N/A*** (Name) (Title) (Date)

Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ***(Note 1)*** ☒ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***1) Refer to Section V.C.1 regarding implementation of O&M procedures for land use controls.***

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Other permits ***(Note 1)*** ☐ Readily available ☒ Up to date ☐ N/A
   Remarks
   1) Excavated soils that have been treated (stabilized) have been sent to permitted landfills for disposal.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks: ***Groundwater monitoring results for "5-Year Monitoring" that has been continued at Sites A,C,I, K and Building 102 is documented in the TCAAP Fiscal Year 2011 Annual Performance Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***The affected sites are on property controlled by the Army (either TCAAP or AHATS). Both are secured facilities with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house ☐ Contractor for State
   - ☐ PRP in-house ☐ Contractor for PRP
   - ☒ Federal Facility in-house ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date ☒ N/A ***(Review of costs for cover O&M was not deemed necessary due to the minimal nature of the O&M costs)***
   - ☒ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: ***N/A***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks The affected sites are on property controlled by the Army (either ***TCAAP or AHATS). Both are secured facilities with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***See above comments on fencing. Also, protective soil covers have been constructed at Sites C, E, H, 129-15, and the Outdoor Firing Range to restrict access to contaminants. The Army has installed signs around the perimeter of soil covers at Sites C, E, H, 129-1, and the Outdoor Firing Range that caution against disturbance of the cover areas.***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**
   In 2007, US Army and regulatory agency signed and issued a ROD Amendment #1 for OU2 that amended the soil remedy at Site C-2 (south) to include soil cover and use land use control (LUC) for contaminated soil & sediment.
   In 2009, US Army and regulatory agency signed and issued an OU2 ROD Amendment #3 for OU2 and two Explanations of Significant Differences (ESD) that implemented LUC as part of the final remedy for OU2 areas with soil contamination – Sites A, C-1 (the northern portion of Site C), D, E, G, H, Dump Site 129-15, 129-3, 129-5, Grenade Range, and the Outdoor Firing Range.
   In Sep 2010, the USEPA and MPCA provided consistency approval of OU2 LUCRD and it is being implemented by the Army. In 2011, USEPA and MPCA approved Revision 2 of the LUCRD but this does not affect LUCs for shallow soils.
   The Army, National Guard, and Wenck have continued to maintain appropriate LUCs for OU2 Sites and have conducted annual inspections of the OU2 sites with LUCs, including Sites A, C, E, H, 129-3, 129-5, Dump Site 129-15, the Grenade Range, and the Outdoor Firing Range.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***Inspection***
   Frequency ***Annual***
   Responsible party/agency ***Army and National Guard***

	Name	Title	Phone no.
Contact	***Mike Fix, Army***	***Commander's Representative***	***(651) 294-4930***
Contact	***Mary Lee, Nat'l Guard***	***AHATS Coordinator***	***(651) 282-4420***

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***LUCs implementation will be indefinitely unless further action is taken that would allow for unlimited use and unrestricted exposure.***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks _____
2. **Land use changes onsite** ☒ N/A Remarks _____
3. **Land use changes offsite** ☒ N/A Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

(Sites C, E, H, 129-15, and the Outdoor Firing Range have protective soil covers over portions of the site)

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent _____ Depth _____
   Remarks _____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
   Lengths _____ Widths _____ Depths _____
   Remarks _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent _____ Depth _____
   Remarks _____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
   Areal extent _____ Depth _____
   Remarks _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks ***The rip rap at Sites H and 129-15 is in good condition.***

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
   Areal extent _____ Height _____
   Remarks _____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent _____
   ☐ Ponding ☐ Location shown on site map Areal extent _____
   ☐ Seeps ☐ Location shown on site map Areal extent _____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent _____
   Remarks _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
   Areal extent _____
   Remarks _____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descends down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☒ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
   ☐ Routinely sampled ☐ Good condition ☐ Needs Maintenance
   ☐ Evidence of leakage at penetration
   Remarks _____

2. **Gas Monitoring Probes** ☒ N/A ☐ Properly secured/locked ☐ Functioning
   ☐ Routinely sampled ☐ Good condition ☐ Needs Maintenance
   ☐ Evidence of leakage at penetration
   Remarks _____

3. **Monitoring Wells** (within surface area of landfill) ☐ N/A ☒ Properly secured/locked
   ☒ Functioning ☒ Routinely sampled ☒ Good condition ☐ Needs Maintenance
   ☐ Evidence of leakage at penetration
   Remarks _____

4. **Leachate Extraction Wells** ☒ N/A ☐ Properly secured/locked ☐ Functioning
   ☐ Routinely sampled ☐ Good condition ☐ Needs Maintenance
   ☐ Evidence of leakage at penetration
   Remarks _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
   Remarks _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy components below.)***

A. Soil Remediation

What is the current status of soil remediation:

Site A ***Remediation is complete. 16,226 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility (refer to the OU2, Site A Shallow Groundwater Site Inspection for information on VOC-contaminated soil). The Final Closeout Report for Site A (metals-contaminated soils) was approved and finalized in FY 2001.***

Site C ***Remediation is complete. 21,450 cubic yards of metals- and VOC-contaminated soil have been excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Also, a protective soil cover was constructed over a portion of Site C where metals-contaminated soils (and sediment from the former surface water ditches) remain in-place. Final Remedial Action Completion and Shallow Soils Close Out Report, Site C Activities was finalized in FY 2009.***

Site E ***Remediation is complete. 21,097 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Also, a protective soil cover was constructed over a portion of Site E (Area E1-2 west dump) where debris with asbestos-containing material (ACM) remains in-place. Testing did not show any metals-contaminated soil in the area under this cover. The Final Remedial Action Completion and Shallow Soil Closeout Report for Site was approved and finalized in FY 2002.***

Site H ***Remediation is complete. 8,615 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Also, a protective soil cover was constructed over a portion of Site H (Area H1-3 dump) where debris with ACM remains in-place. Testing did not show any metals-contaminated soil in the area under this cover. Final Remedial Action Completion and Shallow Soils Close Out Report, Site H Activities was approved and finalized in FY 2002.***

Site 129-3 ***Remediation is complete. 3,460 tons of metals-, nitroglycerine-, and VOC-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Final Remedial Action Completion and Shallow Soils Close Out Report, Site 129-3 Activities was approved and finalized in FY 2002.***

Site 129-5 ***Remediation is complete. 100 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. Final Remedial Action Completion and Shallow Soils Close Out Report, Site 129-5 Activities was approved and finalized in FY 2001.***

Grenade Range ***Remediation is complete. 2,179 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Closeout Report for the Grenade Range received final consistency on Oct 25, 2010.***

Outdoor Firing Range ***Remediation is complete. 990 cubic yards of metals-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. A protective 2-foot soil cover was constructed (2003-4)over a portion of the Outdoor Firing Range (at the 1900 Yard Range) where PAH-contaminated soils will remain in-place. The Closeout Report for the Outdoor Firing Range received final consistency on Oct 25, 2010.***

What is the status of the TCAAP Corrective Action Management Unit (CAMU):

The discovery of asbestos at shallow soil sites in FY 1999 rendered further use of the CAMU impractical. The CAMU was removed in FY 2002/2003. The CAMU Closeout Report received consistency in FY 2004, which states that there were no adverse impacts to soil or groundwater due to CAMU operations and that no LUCs are required for this area.

B. Groundwater Monitoring (5-Year Groundwater Monitoring at Shallow Soil Sites)

Data are routinely submitted on time	☒ Yes	☐ No	☐ N/A
Data are of acceptable quality	☒ Yes	☐ No	☐ N/A
Data suggest that no impacts to groundwater have occurred	☒ Yes	☐ No	☐ N/A

Remarks ***Monitoring was conducted from FY 2009 through FY 2013, and this remedy component has been deemed complete for all shallow soil sites.***

C. Characterization of Dump Site 129-15

Describe the status of dump characterization: ***Characterization work was completed in FY 1999.***

If characterization is complete, describe the remedy that will be implemented and its status:

☐ No further action

☒ Other ***Characterization revealed that a protective soil cover was required due to lead and polycyclic aromatic hydrocarbon (PAH) contamination. The cover was constructed in FY 2002. OU2 ROD Amend #3 and ESD specified implementation of the LUC as an additional remdy component for shallow soil and dumps Sites A, E, H, and Dump Site 129-15.***

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

For the shallow soil sites (exclusive of Dump Site 129-15), the remedy that has been selected is intended to remove soils that are contaminated above the cleanup goals specified in the OU2 ROD, restoring the site's availability for industrial use. The soil excavation, treatment, and off-site disposal remedy has effectively accomplished this objective. Remediation has been completed at Sites A, C, E, H, 129-3, 129-5, the Grenade Range, and the Outdoor Firing Range. Due to high groundwater levels, a protective soil cover was constructed over portions of Site C as a means of preventing access to the metals-contaminated soils (and sediments from the former surface water ditches). Due to the discovery of debris with ACM, protective soil covers were constructed over portions of the dumps at Sites E and H as a means of preventing access to the ACM. The protective soil cover at the 1900 Yard Range of the Outdoor Firing Range was constructed to prevent access to PAH-contaminated soils. The protective soil covers, in conjunction with land use controls, effectively accomplish these added objectives. Site A also contained VOC-contamination (source area soils), which are discussed in the OU2, Site A Shallow Groundwater Site Inspection.

For Dump Site 129-15, the selected remedy was to first characterize the dump, determine if any further remedial actions were required, and then implement them. Based on the characterization work, further action was required, and the selected remedy was to construct a protective soil cover over the site as a means of preventing access to the contaminants. The protective soil cover, in conjunction with land use controls, effectively accomplishes this objective. The investigation of the dump at Site 129-15 has been completed, the selected remedy (protective soil cover) has been constructed, and an amendment to the OU2 ROD documenting remedy selection has been completed.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M procedures are limited to maintaining the cautionary signs around the perimeter of the protective soil covers. These signs are in place at Sites C, E, H, 129-15, and the Outdoor Firing Range. These signs help ensure the short- and long-term protectiveness of the remedy by helping to prevent disturbance of the protective soil cover. O&M would also include repair of any damage that compromises the thickness requirements for the protective soil cover; however, no such damage occurred during the period of this five-year review.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. ***None.***

B.3 Operable Unit 2, Deep Soil Sites (D and G)

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***Operable Unit 2, Deep Soil Sites (D and G) New Brighton/Arden Hills Superfund Site***	Date of inspection: ***September 11, 2013***
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U.S. Army***	Weather/temperature:

Remedy Includes (Check all that apply) ***(The items checked below apply to both sites, except as noted)***

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Land use controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other ***Soil vapor extraction (systems have been removed).***
- ☒ Other ***Soil excavation, on-site treatment, and off-site disposal (remediation has been completed). (Applies to Site D only)***

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. Site Managers

Protective Soil Cover O&M:

a. O&M site manager ***Mary Lee, Nat'l Guard*** (Name) ***AHATS Coordinator*** (Title) _____ (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(651) 282-4420***
Problems, suggestions; ☐ Report attached _____

Site D Shallow Soil Remediation and Site G Cover Improvement:

b. Site manager ***Kathleen Romalia, Shaw Group*** (Name) ***Project Manager*** (Title) ***N/A*** (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(720) 554-8207***
Problems, suggestions; ☐ Report attached _____

2. O&M staff ***N/A*** (Name) _____ (Title) _____ (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ***(Note 1)*** ☐ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☐ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***1) Refer to Section V.C.1 regarding implementation of O&M procedures for land use controls.***

2. **Site Specific Health and Safety Plan** ☐ Readily available ☒ Up to date ☐ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☐ Readily available ☒ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Other permits ***(Note 1)*** ☐ Readily available ☒ Up to date ☐ N/A
   Remarks
   1) Excavated soils that have been treated (stabilized) have been sent to permitted landfills for disposal.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☐ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2011Annual Performance Report. No major sampling was performed during FY 2012***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***These two sites are on property controlled by the Army (AHATS). AHATS is a secured facility with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ PRP in-house
   - ☒ Federal Facility in-house
   - ☐ Other _____
   - ☐ Contractor for State
   - ☐ Contractor for PRP
   - ☐ Contractor for Federal Facility

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date ☒ N/A ***(Review of costs for cover O&M was not deemed necessary due to the minimal nature of the O&M costs)***
   - ☒ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached
From	_____ Date	To _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   - Describe costs and reasons: ***N/A***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks ***These two sites are on property controlled by the Army (AHATS). AHATS is a secured facility with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***See above comments on fencing. Also, protective soil covers are present which restrict access to contaminants. The Army has installed signs around the perimeter of the soil covers at both sites that caution against disturbance of the cover areas***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

   The deep soil requirements of the OU2 ROD have been completed. There are ongoing LUCs requirements for the shallow soil at site D and dump at Site G. OU2 ROD Amend #3 specified LUCs as an additional component for shallow soil at Site D and dump site G.
   The USEPA and MPCA provided consistency approval for the OU2 LUC remedial Design (RD)in Sep 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 LUCs for shallow soil sites. Annual LUCs site inspections has been conducted by the Army, National Guard, and Wrenck.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***Inspection***
   Frequency50Tr review
   Annual
   Responsible party/agency ***National Guard***
   Contact ***Mary Lee, Nat'l Guard*** ***AHATS Coordinator*** ***(651) 282-4420***
   Name Title Phone no.

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***Annual LUCs site inspections have been conducted by the Army, National Guard, and Wrenck.***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A
   Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent _____ Depth _____
   Remarks _____
2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
   Lengths _____ Widths _____ Depths _____
   Remarks _____
3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent _____ Depth _____
   Remarks _____
4. **Holes** ☐ Location shown on site map ☒ Holes not evident
   Areal extent _____ Depth _____
   Remarks _____
5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks _____
6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
   Remarks _____
7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
   Areal extent _____ Height _____
   Remarks _____
8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent _____
   ☐ Ponding ☐ Location shown on site map Areal extent _____
   ☐ Seeps ☐ Location shown on site map Areal extent _____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent _____
   Remarks _____
9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
   Areal extent _____
   Remarks _____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descends down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

D. Cover Penetrations ☐ Applicable ☒ N/A

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy components below.)***

A. SVE System

What is the current status of the SVE systems:
Site investigations conducted in FY 2000 showed that all Site D soils (shallow and deep) were below the Site D VOC cleanup levels, and that all Site G soils (shallow and deep) were below the subsequently developed, higher Site G VOC cleanup levels
Site D and G SVE systems were shut down in FY 1998 and were subsequently removed in FY 2001, this completed the Remedy components#2-#6 related to deep soil. The Site D Closeout Report (VOC-contaminated soils) received consistency in FY 2002.
In 2009, OU2 ROD Amendment #3 amended the remedy for Site D to declare that the past removal actions and PCB soil cover are part of the final remedy for the site, and included the use of long-term LUCs as part of the remedy. Deep soil requirements have been completed, but there are ongoing LUCs requirements for the shallow soil at Site D and dump at Site G. Groundwater Monitoring still on-going in the vicinity of both sites, as part of OU2 deep groundwater monitoring.
The Site G (VOC) Closeout Report has received final consistency.

B. Characterize Site D Shallow Soils and Site G Dump

Describe the status of characterization:

Site D: ***Characterization of shallow soils was completed in FY 2002.***

Site G: ***A technical memorandum, which concluded that no further characterization of the dump was needed, received regulatory was approved in FY 2003.***

If characterization is complete, describe the remedy that will be implemented and its status:

Site D:

☐ No further action

☒ Other ***Characterization revealed that soil remediation was required due to metals and nitroglycerine contamination. Remediation is complete. 1,381 cubic yards of metals- and nitroglycerine-contaminated soil were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Closeout Report for Site D shallow soils has received final consistency.***

The Site D closeout report recommended that Site D be added to the list of shallow soil sites where 5-year groundwater monitoring is performed, to evaluate whether soil remediation work caused any impacts to groundwater (see Item C below).

Site G:

☐ No further action

☒ Other ***The technical memorandum regarding characterization (mentioned above) also recommended improvements to the Site G cover (which received regulatory approval in FY 2003). Cover construction has been completed. The Closeout Report for Site G has received final consistency.***

C. Groundwater Monitoring (5-Year Groundwater Monitoring at Shallow Soil Sites)

Data are routinely submitted on time	☐ Yes	☐ No	☒ N/A
Data are of acceptable quality	☐ Yes	☐ No	☒ N/A
Data suggest that no impacts to groundwater have occurred	☐ Yes	☐ No	☒ N/A

Remarks ***This remedy component has been deemed complete for Site D. Monitoring did not show any evidence of impacts to groundwater.***

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The SVE systems at Sites D & G were installed to remove VOCs from soil in the unsaturated zone. The systems were very effective, removing over 220,000 pounds of VOCs from startup in 1986 through shutdown in FY 1998. The SVE systems reduced the VOC concentrations in both shallow and deep soils at both sites to below cleanup levels. Having completed their objective, the SVE systems have been dismantled.

For the Site D shallow soils, the remedy that has been selected is intended to remove soils that are contaminated above the cleanup goals, restoring the site's availability for industrial use. The soil excavation, treatment, and off-site disposal remedy has effectively accomplished this objective, with remediation now complete at Site D.

The protective soil cover at Site D is intended to prevent access to PCBs that were left in-place. The protective soil cover, in conjunction with land use controls, effectively accomplishes this objective. The protective soil cover at Site G is intended to prevent access to dump materials and also reduces infiltration of precipitation, minimizing leaching of any remaining VOCs. The protective soil cover, in conjunction with land use controls, effectively accomplishes this objective.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M procedures are limited to two items. The first is maintaining the cautionary signs around the perimeter of each protective soil cover. These signs help ensure the short- and long-term protectiveness of the remedy by helping to prevent disturbance of protective soil covers. The second item is to annually remove any woody vegetation (greater than 2-inch diameter) to prevent deep rooting into the cover. This O&M procedure helps maintain the integrity of the cover, thereby minimizing infiltration of precipitation and helping to ensure the short- and long-term protectiveness of the remedy. O&M would also include repair of any damage to a protective soil cover; however, no such damage occurred during the period of this Five-Year Review.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None.

B.4 Operable Unit 2, Site A Shallow Groundwater

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***OU2, Site A Shallow Groundwater New Brighton/Arden Hills Superfund Site***	Date of inspection: ***September 11, 2013***
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U.S. Army***	Weather/temperature:

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Land Use controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☒ Groundwater containment ***(see Note 1)***
- ☐ Vertical barrier walls
- ☒ Other ***Soil excavation, on-site treatment, and off-site disposal***

Note 1: The need to operate the groundwater extraction system to achieve groundwater containment and mass removal (remedy component #2) is currently being evaluated. In FY 2008, the Army prepared (and the USEPA and MPCA approved) an evaluation report of the remedy for Site A shallow groundwater, which recommended that the four operating extraction wells be shut off and that monitored natural attenuation (MNA) be implemented. Following USEPA and MPCA approval of a monitoring and contingency plan, the four operating extraction wells were shut off on September 24, 2008, and were placed in standby. The end of FY 2012 was the end of the fourth year since extraction wells were shut off. The length of the trial MNA period was originally anticipated to be three to five years.

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. Site Managers

Protective Soil Cover O&M

a. O&M site manager ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***Sept 10, 2013*** (Date)
Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(651) 294-4930***
Problems, suggestions; ☐ Report attached

Soil Remediation (Former 1945 Trench excavation):

b. Site manager ***Kathleen Romalia, Shaw Group*** (Name) ***Project Manager*** (Title) ***N/A*** (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(720) 554-8207***
Problems, suggestions; ☐ Report attached

2.
a. O&M staff ***Matt Bowers, Wenck, PE*** (Name) (Title) (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(763) 479-4230***
Problems, suggestions; ☐ Report attached

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Waste disposal, POTW ***(Note 1)*** ☒ Readily available ☒ Up to date ☐ N/A
   ☐ Other permits ***(Note 2)*** ☐ Readily available ☒ Up to date ☐ N/A
   Remarks ***1) If operating, the recovered groundwater is pumped into the sanitary sewer and is ultimately treated at the Metropolitan Council Environmental Services (MCES) Treatment Plant located at 2400 Childs Road in Saint Paul, Minnesota. Discharge is authorized under Industrial Permit Number 2194 from the MCES.***

   2) Excavated soils that have been treated (stabilized) have been sent to permitted landfills for disposal.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2012 Annual Performance Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Water (effluent) ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***The area of the plume exceeding cleanup levels is on property controlled by the Army (AHATS). AHATS is a secured facility with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☒ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available
   - ☒ Up to date
   - ☒ Funding mechanism/agreement in place

   Original O&M cost estimate **$192,200 (OU2 ROD, 1997 dollars)** ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   Since the system is now shut down, the prior annual O&M costs are not comparable to the O&M costs for MNA going forward. The O&M costs for operating the groundwater extraction system were approximately $100,000 per year, and the estimated O&M costs for the MNA remedy are approximately $30,000 per year for the first two years (due to more frequent monitoring), and less than $20,000 per year thereafter, based on an assumed reduction in monitoring frequency after two years.

3. **Unanticipated or Unusually High O&M Costs During Review Period**

   Describe costs and reasons: ***None.***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks ***The area of the plume exceeding cleanup levels is on property controlled by the Army (AHATS). AHATS is a secured facility with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***(see above comments on fencing)***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

   In 2009, US Army and regulatory agency signed and issued two Explanations of Significant Difference (ESD) for the OU2 ROD. ESD #1 for OU2 ROD amended the shallow groundwater at Site A to include the use of LUCS. ESD #2 for OU2 ROD amended the soil remedy at Site A to include the use of long-term LUCs for the metals-contaminated soil.
   The Army has continued to maintain appropriate LUCs for OU2) and has conducted annual inspections of the OU2 Site A.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***1) Self-reporting (through the Annual Performance Report, the Army reports on the status of the MDH SWCA); and 2) Inspections by the National Guard for other interim LUC components***
   Frequency ***Annual***
   Responsible party/agency ***Item 1 above: Army Item 2 above: National Guard***
   Contact ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***(651) 294-4930*** (Phone no.)
   Contact ***Mary Lee, Nat'l Guard*** (Name) ***AHATS Coordinator*** (Title) ***(651) 282-4420*** (Phone no.)

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***LUCs implementation will be indefinitely unless further action is taken that would allow for unlimited use and unrestricted exposure. In 2009, OU2 ROD ESD#1 amended the GW Remedy to include the use of LUCs and the OU2 ROD ESD#2 amended the soil remedy to include LUCs for metals-contaminated soils for Site A.***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
(applicable based on maintaining the groundwater extraction system in standby mode until MNA is evaluated)

A. Groundwater Extraction Wells, Pumps, and Pipelines
☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply) ***Currently shut down, it was not inspected***.
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ☐ Filters
   - ☐ Additive (*e.g.*, chelation agent, flocculent)
   - ☒ Others ***Direct discharge to sanitary sewer, if operating.***
   - ☒ Good condition ☐ Needs maintenance
   - ☒ Sampling ports properly marked and functional
   - ☒ Sampling/maintenance log displayed and up to date ***(not kept on-site)***
   - ☐ Equipment properly identified
   - ☒ Quantity of groundwater treated annually ***Approx. 8 million gallons, if operating***
   - ☐ Quantity of surface water treated annually ***N/A***
   - Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A
   - ☐ Good condition ☐ Needs maintenance
   - Remarks

3. **Tanks, Vaults, Storage Vessels** ☒ N/A
   - ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance
   - Remarks

4. **Discharge Structure and Appurtenances** ☐ N/A
   - ☐ Good condition ☐ Needs maintenance
   - Remarks

5. **Treatment Building(s)** ☐ N/A
   - ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored
   - Remarks

6. **Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked
   - ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located
   - ☐ Needs maintenance ☐ N/A
   - Remarks

D. Monitoring Data

1. **Monitoring data**
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring data suggest**
   - ☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining
   - ***(Groundwater containment is currently being evaluated for MNA to be considered as a remedy, as noted previously.)***

E. Monitored Natural Attenuation (*refer to Item C.6 above)*

1. **Monitoring Wells** (natural attenuation remedy) ☒ N/A
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs maintenance
   - Remarks ***Refer to Item C.6 above***

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy components below.)***

A. Alternative Water Supply/Well Abandonment

The OU1 Alternative Water Supply and Well Abandonment Program was expanded to cover the area affected by the OU2 Site A shallow groundwater plume. (See OU1 Site Inspection for discussion of this remedy component.)

B. Source Characterization

Describe the status of source characterization:
The source characterization investigation report was completed in FY 1998. The source of Site A shallow groundwater VOC contamination was identified as the Former 1945 Trench (disposal trench).

If characterization is complete, describe the remedy that will be implemented and its status:
o No further action
☒Other ***Remediation of VOC-contaminated soils is complete. In November 2002, approx. 688 cubic yards of VOC-contaminated soil (non-hazardous soil) were excavated, treated (stabilized), and transported to a permitted off-site disposal facility. The Closeout Report for Site A Former 1945 Trench received consistency in FY 2004. Note that remediation of metals-contaminated soils is also complete (refer to Site Inspection for OU2, Shallow Soil Sites for additional information). Currently the soil area is under a long-term LUC for the metals-contaminated soils(as required by 2009 ESD #2 for OU2)***

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
As stated previously, the need to operate the groundwater extraction system to achieve groundwater containment and mass removal (remedy component #2) is currently being evaluated. In FY 2008, the Army prepared (and the USEPA and MPCA approved) an evaluation report of the remedy for Site A shallow groundwater, which recommended that the four operating extraction wells be shut off and that monitored natural attenuation (MNA) be implemented. Following USEPA and MPCA approval of a monitoring and contingency plan, the four operating extraction wells were shut off on September 24, 2008, and were placed in standby. If ongoing monitoring shows that MNA is not adequately controlling plume migration, then the extraction well(s) will be turned back on. Otherwise, when the Army, USEPA, and MPCA are satisfied that MNA is effective, a ROD modification will be prepared to formally document the change (anticipated to be in 2 to 3 years). The end of FY 2012 was the end of the fourth year since the extraction wells were shut off.

For the VOC source area soils (Former 1945 Trench), the remedy that was implemented was intended to remove soils that were contaminated above the cleanup goals specified in the OU2 ROD, restoring the site's availability for industrial use. The soil excavation, treatment, and off-site disposal remedy has effectively accomplished this objective and, in fact, based on post-excavation verification sampling, soil remediation at the Former 1945 Trench area of Site A has restored this area's availability for unrestricted use (except for groundwater use restrictions that still apply to groundwater below this area).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

When operating, the O&M procedures for the groundwater recovery system were effective for providing short- and long-term protectiveness. The procedures have resulted in system operation that provided adequate containment of the plume and restoration of the groundwater. Under the MNA evaluation that is currently being implemented, there are no O&M procedures that need to be implemented.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

As noted previously, MNA is under evaluation. If the change to an MNA remedy is ultimately approved by the USEPA and MPCA, a substantial savings in O&M costs will occur (an approximate reduction in annual costs from $100,000 to less than $20,000).

B.5 Operable Unit 2, Site C Shallow Groundwater

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION

Site name: ***OU2, Site C Shallow Groundwater New Brighton/Arden Hills Superfund Site(under BRAC Division)***	Date of inspection: ***September 11, 2013***
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U.S. Army***	Weather/temperature:

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Land use controls
- ☒ Groundwater pump and treatment
- ☒ Surface water collection and treatment ***(only as a contingency action, but has never occurred)***
- ☐ Monitored natural attenuation
- ☒ Groundwater containment ***(see Note 1)***
- ☐ Vertical barrier walls
- ☐ Other _____

Note 1: On Nov 2008, the groundwater extraction system was shut off with USEPA/MPCA approval given that the extraction wells had all been below the groundwater lead cleanup level since March 2008 (as recommended by Site C GW Extraction System Evaluation report). However, the GW System remains in place in the event that one or more extraction wells need to be restarted. If it is proven that extraction system operation is no longer necessary, the remedy could be formally changed through either an ESD or 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.

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. Site Managers

Groundwater Extraction System O&M:

a. O&M site manager ***Matt Bowers, Wenck*** (Name) ***Project Manager*** (Title) _____ (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(763) 479-4230***
Problems, suggestions; ☐ Report attached _____

2. O&M staff _____ (Name) _____ (Title) _____ (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. __
Problems, suggestions; ☐ Report attached _____

2. Site Manager - O&M

a. O&M site manager ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***Sept 10, 2013*** (Date)
Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(651) 294-4930***
Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

2. **Site Specific Health and Safety Plan** ☐ Readily available ☒ Up to date ☐ N/A
   Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☐ Readily available ☒ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Waste disposal, POTW ***(Note 1)*** ☐ Readily available ☒ Up to date ☐ N/A
   ☐ Other permits ☐ Readily available ☒ Up to date ☐ N/A
   Remarks ***1) The recovered groundwater is pumped into the sanitary sewer and is ultimately treated at the Metropolitan Council Environmental Services (MCES) Treatment Plant located at 2400 Childs Road in Saint Paul, Minnesota. Discharge is authorized under Industrial Permit Number 2260 from the MCES. However, the groundwater extraction system has been shut down since November 13, 2008.***

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2012Annual Performance Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Water (effluent) ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***The Site C shallow groundwater plume is on property controlled by the Army (TCAAP). TCAAP is a secured facility with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☒ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date
   - ☒ Funding mechanism/agreement in place
   - Original O&M cost estimate **$180,524 (2007 OU2 ROD Amendment)** ☐ Breakdown attached

   Total annual cost by year for review period if available

From	Date	To Date	Total cost	☐ Breakdown attached
From	Date	To Date	Total cost	☐ Breakdown attached
From	Date	To Date	Total cost	☐ Breakdown attached
From	Date	To Date	Total cost	☐ Breakdown attached
From	Date	To Date	Total cost	☐ Breakdown attached

   The O&M costs were approximately $200,000 per year based on FY 2007 and FY 2008; however, since the groundwater extraction system shut down, a substantial reduction in O&M costs has occurred. O&M costs have been reduced to less than $20,000 per year.

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: ***None.***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks ***The Site C shallow groundwater plume is on property controlled by the Army (TCAAP). TCAAP is a secured facility with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***(see above comments on fencing)***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**
   In 2007, US Army and regulatory agency signed and issued a ROD Amendment #1 for OU2 that amended the soil remedy at Site C-2 (southern portion) to include soil cover and land use land control (LUC) for contaminated soil & sediment.
   In 2009, an Explanation of Significant Difference (ESD) #2 for OU2 ROD implemented LUC as part of the final remedy for Site C-1 (the northern portion of Site C) to use long-term LUCs for soil.
   In 2010, The USEPA and MPCA provided consistency approval of OU2 LUCRD and it is being implemented by the Army. In 2011, USEPA and MPCA approved Revision 2 of the LUCRD but this does not affect LUCs for shallow soils.

   The Army, National Guard, and Wenck have continued to maintain appropriate LUCs for OU2 and have conducted annual inspections of the OU2 Site C.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***Inspection***
   Frequency ***Annual***
   Responsible party/agency ***Army***
   Contact ***Mike Fix, Army*** ***Commander's Representative*** ***(651) 294-4930***
   Name Title Phone no.

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***LUCs implementation will be indefinitely unless further action is taken that would allow for unlimited use and unrestricted exposure. .***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A
   Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines
☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ☐ Filters
   - ☐ Additive (*e.g.*, chelation agent, flocculent)
   - ☒ Others ***Direct discharge to sanitary sewer***
   - ☒ Good condition ☐ Needs maintenance
   - ☒ Sampling ports properly marked and functional
   - ☒ Sampling/maintenance log displayed and up to date ***(not kept on-site)***
   - ☐ Equipment properly identified
   - ☒ Quantity of groundwater treated annually ***Approx. 400,000 gallons***
   - ☐ Quantity of surface water treated annually ***N/A***

   Remarks ***The 2007 OU2 ROD Amendment #1 added the existing groundwater extraction system as the final remedy. The groundwater extraction system was shut down on November 13, 2008. The groundwater system remains in Stand-by-mode in the event that one or more extraction wells need to be restarted.***

2. **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A
   - ☐ Good condition ☐ Needs maintenance

   Remarks

3. **Tanks, Vaults, Storage Vessels** ☒ N/A
   - ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

   Remarks

4. **Discharge Structure and Appurtenances** ☐ N/A
   - ☐ Good condition ☐ Needs maintenance

   Remarks

5. **Treatment Building(s)** ☐ N/A
   - ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored

   Remarks

6. **Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked
   - ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located
   - ☐ Needs maintenance ☐ N/A

   Remarks

D. Monitoring Data

GW and surface water monitoring at Site C will follow the monitoring plan of FY 2012 (approved in the FY 2010 APR), monitoring locations and annual monitoring frequencies are to remain unchanged during FY 2013. Only one monitoring well located near the source area exceeded the groundwater cleanup level for lead in FY 2012. None of the GW or surface water contingency locations exceeded the approver trigger levels in FY 2012. Contingency actions have been specified if a trigger level were to be exceeded.

1. **Monitoring data**
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring data suggest**
   - ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

   (Plume has receded upgradient from extraction wells and all extraction wells are below cleanup level.)

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) ☒ N/A
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs maintenance

Remarks _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy components below.)***

A. Surface Water Monitoring and Contingency Action

The 1997 OU2 ROD Amendment for Site C-2 requires that surface water be monitored and, if the Minnesota chronic surface water standard for lead is exceeded, requires that such surface water be contained and treated. Throughout the period of this Five-Year Review, the surface water monitoring results have shown compliance with the surface water standard for lead, and the contingency trigger for containing and treating surface water has never been reached.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

As stated previously, at the end of FY 2008, Site C Extraction System Evaluation Report was approved by regulatory review, and this report recommended that the extraction system be shut off (Nov 2008), given that the extraction wells had all been below the groundwater cleanup level since March 2008. The plume has now attenuated to a degree in which the area of concern for Site C groundwater no longer extends to the extraction wells and continues to recede towards the source area (only one monitoring well exceed the lead cleanup level). However, the decreasing lead concentration trends in two of the MWs, near the source area, continue to suggest that overall this site is trending toward meeting the clean up levels..

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures for the groundwater recovery system were effective for providing short- and long-term protectiveness. The procedures have resulted in system operation that provided adequate containment of the plume and restoration of the groundwater, though continued operation is no longer required for containment (see previous item).

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Based on the extraction system shut down, a substantial reduction in O&M costs have occurred (annual costs were reduced to less than $20,000).

B.6 Operable Unit 2, Site I Shallow Groundwater

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***OU2, Site I Shallow Groundwater (Bldg 502), New Brighton/Arden Hills Superfund Site***	Date of inspection: ***September11, 2013***
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U. S. Army***	Weather/temperature:

Remedy Includes (Check all that apply) ***Note: Shallow Groundwater Contamination- Unit 1***

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Land use controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other ***Pilot testing of a dual-phase extraction system determined that the technology was not feasible due to low permeability of the soils. Amendment#2 to the OU2 ROD changed the Preferred remedy from groundwater pump and treat to groundwater monitoring, & LUCs based remedy.***

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager ***Karie Mars, Alliant Techsystem*** ***Project Manager*** _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(952) 351-5511***
   Problems, suggestions; ☐ Report attached _____

2. O&M staff ***Alan Gorski, Stantec*** ***Project Manager*** _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ***(651) 653-9112***
   Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☐ Readily available ☐ Up to date ☒ N/A
   As-built drawings ☐ Readily available ☐ Up to date ☒ N/A
   Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***No system will be constructed.***

2. **Site Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***No system will be constructed.***

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***No system will be constructed.***

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Other permits _____ ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***No system will be constructed.***

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2012 Annual Performance Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
   Remarks ***No system will be constructed.***

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***The Site I shallow groundwater plume is on property controlled by the Army (TCAAP). TCAAP is a secured facility with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house ☐ Contractor for State
   - ☐ PRP in-house ☐ Contractor for PRP
   - ☐ Federal Facility in-house ☐ Contractor for Federal Facility
   - ☐ Other ***N/A. No system will be constructed.***

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date ☒ N/A ***(No system will be constructed)***
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: ***N/A. No system will be constructed.***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks ***The Site I shallow groundwater plume is on property controlled by the Army (TCAAP). TCAAP is a secured facility with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***(see above comments on fencing)***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

   In 2009, US Army and regulatory agency signed and issued a ROD Amendment #2 for OU2 for Site I Groundwater). Amend #2 OU2 ROD amended the shallow GW remedy to include the use of long-term LUCs for the GW.
   USEPA and MPCA provided consistency approval from the Revision #2, OU2 LUCRD in June 2011and it is being implemented by the Army.

   The Army has continued to maintain appropriate LUCs for OU2) and has conducted annual inspections of the OU2 Site I. The FY 2012-and the FY 2013 Annual inspections identified no follow up actions needed to maintain the protectiveness of the LUCs.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***Inspection***
   Frequency ***Annual***
   Responsible party/agency ***Army***
   Contact ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***(651) 294-4930*** (Phone no.)

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***Implementation of the OU2 LUCRD will continue until such time that the groundwater concentrations are below the clean up levels.***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A
   Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

(No system will be constructed)

A. Groundwater Extraction Wells, Pumps, and Pipelines
☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

3. Spare Parts and Equipment
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks _____

C. Treatment System ☐ Applicable ☒ N/A ***(No system will be constructed)***

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ☐ Filters _____ ☐ Others _____
   - ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   - ☐ Good condition ☐ Needs maintenance
   - ☐ Sampling ports properly marked and functional
   - ☐ Sampling/maintenance log displayed and up to date
   - ☐ Equipment properly identified
   - ☐ Quantity of groundwater treated annually _____
   - ☐ Quantity of surface water treated annually _____

   Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional) ☒ N/A
   - ☐ Good condition ☐ Needs maintenance

   Remarks _____

3. **Tanks, Vaults, Storage Vessels** ☒ N/A
   - ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

   Remarks _____

4. **Discharge Structure and Appurtenances** ☒ N/A
   - ☐ Good condition ☐ Needs maintenance

   Remarks _____

5. **Treatment Building(s)** ☒ N/A
   - ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored

   Remarks _____

6. **Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked
   - ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located
   - ☐ Needs maintenance ☐ N/A

   Remarks _____

D. Monitoring Data

1. **Monitoring data**
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring data suggest**
   - ☒ Contaminant concentrations are declining
   - ☐ Groundwater plume is effectively contained ***(No containment system will be constructed. The Unit 1 plume is not migrating offsite; rather, the Unit 1 contaminants leak downward into Unit 3, which is hydraulically contained by the TCAAP Groundwater Recovery System (TGRS). The TGRS then extracts this groundwater and treats it prior to discharge of the water to the Arsenal Sand and Gravel Pit.)***

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) ☒ N/A
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs maintenance

   Remarks _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy component below.)***

A. Additional Investigation

Describe the status of additional investigation

Additional investigation work is completed. Results led to proposing a dual-phase extraction remedy (combining groundwater extraction and soil vapor extraction), is further discussed in the next section.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Pilot testing of a dual-phase extraction system determined that the technology was not feasible due to low permeability of the soils. The May 2009 Amendment #2 - OU2 ROD changed the preferred remedy from groundwater pump and treat to groundwater monitoring based remedy. The concentration of vinyl chloride in one well, 01U 064 has decreased overtime, but still above clean up levels.

Monitoring based remedy is appropriate since the Unit 1 plume is not migrating offsite; rather, the Unit 1 contaminants leak downward into Unit 3, which is hydraulically contained by the TGRS.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A (No system will be constructed)

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A (No system will be constructed)

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None.

B.7 Operable Unit 2, Site K Shallow Groundwater

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***OU2, Site K Shallow Groundwater New Brighton/Arden Hills Superfund Site(BRAC Div)***	Date of inspection: ***September 11, 2013***
Location and region: ***Arden Hills, MN, Region 5***	EPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U. S. Army***	Weather/temperature:

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Land use controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager ***Karie Mars, Alliant Techsystems*** ***Project Manager*** ***Sept 10, 2013***
   Name Title Date
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(952) 351-5511***
   Problems, suggestions; ☐ Report attached _____

2. O&M staff ***Alan Gorski, Stantec*** ***Project Manager*** _____
   Name Title Date
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(651) 653-9112***
   Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   As-built Drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***The current month's maintenance logs are stored onsite; older logs are stored off-site.***

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A ***(Note 1)***
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Other permits ☐ Readily available ☐ Up to date ☒ N/A
   Remarks
   1) An air emissions permit is not required.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2012 Annual Performance Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Water (effluent) ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***The Site K shallow groundwater plume is on property controlled by the Army (TCAAP). TCAAP is a secured facility with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☒ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available
   - ☒ Up to date ***(Costs are proprietary.)***
   - ☒ Funding mechanism/agreement in place

   Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

   Describe costs and reasons: ***None.***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks ***The Site K shallow groundwater plume is on property controlled by the Army (TCAAP). TCAAP is a secured facility with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***(see above comments on fencing)***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

   In 2009, US Army and regulatory agency signed and issued a ROD Explanations of Significant Difference-Changes for GW Sites (ESD #1) for OU2 which modified Site K remedy to implement land use control (LUC) for groundwater and to prevent human exposure to contaminated soils remaining beneath the floor at Former Building 103.
   In June 2011, the USEPA and MPCA provided consistency approval for the Revision 2, of OU2 LUC Remedial Design (RD) for Site K and it is being implemented by the Army.
   Implementation of the LUC will continue until such time that the groundwater concentrations are below the clean up levels.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) ***Inspection***
   Frequency ***Annual***
   Responsible party/agency ***Army***
   Contact ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***(651) 294-4930*** (Phone no.)

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***Based on the FY 2012 annual LUCs inspection conducted by the Army, National Guard, and Wenck, this Site meets the LUCs requirements. Subsequent FY 2013 inspection conducted by the Army findings agreed with previous inspection, the LUCs implementation is protective of the site.***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A
   Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines
☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☒ Air stripping ☐ Carbon adsorbers
   - ☐ Filters ☐ Others
   - ☐ Additive (*e.g.*, chelation agent, flocculent)
   - ☐ Good condition ☐ Needs maintenance
   - ☒ Sampling ports properly marked and functional
   - ☒ Sampling/maintenance log displayed and up to date ***(not displayed on-site)***
   - ☐ Equipment properly identified
   - ☒ Quantity of groundwater treated annually ***Approx. 4 million gallons***
   - ☐ Quantity of surface water treated annually ***N/A***

   Remarks ***Treatment System consist of a Pack Tower Air Stripper, built in 1998, with a capacity of 0 to 30 gpm. It treats an influent TCE concentration of 200-300 ppb down to less than <1 ppb. The treatment system captured and treated 4,669,250 gallons of water, about 14.5 pounds of VOCs removed from the aquifer in FY 2012. This is a cumulative mass removal is 298.9 pounds of VOCs.***

2. **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A
   - ☒ Good condition ☐ Needs maintenance

   Remarks

3. **Tanks, Vaults, Storage Vessels** ☒ N/A
   - ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

   Remarks

4. **Discharge Structure and Appurtenances** ☐ N/A
   - ☒ Good condition ☐ Needs maintenance

   Remarks

5. **Treatment Building(s)** ☐ N/A
   - ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored ***(N/A)***

   Remarks

6. **Monitoring Wells** (***pump and treatment remedy***) ☒ Properly secured/locked
   - ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located
   - ☐ Needs maintenance ☐ N/A

   Remarks

D. Monitoring Data

1. **Monitoring data**
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring data suggest**
   - ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) ☒ N/A
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs maintenance

   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy component below.)***

A. Additional Investigation

Describe the status of additional investigation

Additional investigation work is complete. The investigation defined the location of VOC-contaminated soils located beneath the former Building 103 slab and refined the location of the source area.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is intended to provide containment of the groundwater plume and to restore the groundwater to the cleanup levels specified in the OU2 ROD. The groundwater recovery and treatment system is effective since it is containing the plume and since treated water is in compliance with the discharge requirements. The additional investigation further defined the source area. Pilot studies of two groundwater remediation technologies were conducted: Hydrogen Release Compound (HRC) and direct hydrogen injection with gas-permeable membranes. The use of HRC was not effective. The direct hydrogen injection yielded promising results but further technological advancement is required to make a full-scale operation feasible.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M procedures are deemed adequate to ensure short- and long-term protectiveness of the remedy. Containment is being achieved and discharge requirements are consistently met. Treatment system is monitored with quarterly influent and effluent sampling. FY 2012 data from the Influent and Effluent analytical results indicated the discharge treated water have met all the treatment requirements. Based on FY 12 Annual inspection data, the treatment system was functioned and operational 98% of the time.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None.

B.8 Operable Unit 2, Deep Groundwater

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable".)

I. SITE INFORMATION	
Site name: ***OU2 Deep Groundwater New Brighton/Arden Hills Superfund Site***	Date of inspection: September 11, 2013
Location and region: ***Arden Hills, MN, Region 5***	USEPA ID: ***MN 7213820908***
Agency, office or company leading the Five-Year Review: ***U. S. Army***	Weather/temperature:

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Land use controls
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Groundwater pump and treatment ***(TCAAP Groundwater Recovery System, or TGRS)***
- ☐ Surface water collection and treatment
- ☐ Other _____

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager ***Karie Mars, Alliant Techsystems*** ***Project Manager*** ***Sept 10, 2013***
   Name Title Date
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(952) 351-5511***
   Problems, suggestions; ☐ Report attached _____

2. O&M staff ***Shawn Horn, CRA*** ***Project Manager*** ***Sept 10, 2013***
   Name Title Date
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ***(651) 639-0913***
   Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ***N/A***
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☐ Report attached.

N/A

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Other permits ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Groundwater monitoring results are documented in the TCAAP Fiscal Year 2012 Annual Performance Report.***

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☒ Water (effluent) ☒ Readily available ☒ Up to date ☐ N/A
   Remarks ***Discharge monitoring results are documented in the TCAAP Fiscal Year 2012 Annual Performance Report.***

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
    Remarks ***The OU2 deep groundwater plume is on property controlled by the Army (either TCAAP or AHATS). Both are secured facilities with restricted access.***

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☒ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☒ Readily available
   - ☒ Up to date
   - ☒ Funding mechanism/agreement in place

   Original O&M cost estimate **$732,700 (OU2 ROD, 1997 dollars)** ☐ Breakdown attached

   Total annual cost by year for review period if available

   \+

   \-

From	***Dec 2008***	To	***Nov 2008***	***$741,239***	☐ Breakdown attached
	Date		Date	Total cost	
From	***Dec 2009***	To	***Nov 2009***	***$822,265***	☐ Breakdown attached
	Date		Date	Total cost	
From	***Dec 2010***	To	***Nov 2010***	***$642,123***	☐ Breakdown attached
	Date		Date	Total cost	
From	***Dec 2011***	To	***Nov 2011***	***$563,324***	☐ Breakdown attached
	Date		Date	Total cost	
From	***Dec 2012***	To	***Nov 2012***	***$618,878***	☐ Breakdown attached
	Date		Date	Total cost	

The Army's annual O&M costs have been very consistent in the most recent three years, ranging from approximately $563,324 to $642,000.

3. **Unanticipated or Unusually High O&M Costs During Review Period**

   Describe costs and reasons: ***None.***

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
   Remarks ***The OU2 deep groundwater plume is on property controlled by the Army (either TCAAP or AHATS). Both are secured facilities with restricted access. Fences and locked gates are in good condition.***

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
   Remarks ***(see above comments on fencing)***

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

   The OU2 land use control (LUC) required for deep groundwater are the Institutional Controls (ICs) as part of the remedy component. The ICs were implemented at OU2 Deep Groundwater. At this site, 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 only.

   Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
   Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

   Type of monitoring (*e.g*., self-reporting, drive by) ***Inspection***
   Frequency ***Annual***
   Responsible party/agency ***Army and National Guard***
   Contact ***Mike Fix, Army*** (Name) ***Commander's Representative*** (Title) ***(651) 294-4930*** (Phone no.)
   Contact ***Dave Hamernick, Nat'l Guard*** (Name) ***AHATS Coordinator*** (Title) ***(651) 775-5017*** (Phone no.)

   Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

   Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
   Have there been violations ☐ Yes ☒ No ☐ N/A

   Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
   Remarks ***Implementation of the OU2 LUCRD is an ongoing requirement.***

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
   Remarks

2. **Land use changes onsite** ☒ N/A
   Remarks

3. **Land use changes offsite** ☒ N/A
   Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
   Remarks _____

B. Other Site Conditions

Remarks ***None***

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines
☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A
   Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs maintenance
   Remarks _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☒ Air stripping ☐ Carbon adsorbers
   - ☐ Filters _____ ☐ Others _____
   - ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   - ☒ Good condition ☐ Needs maintenance
   - ☐ Sampling ports properly marked and functional
   - ☒ Sampling/maintenance log displayed and up to date
   - ☒ Equipment properly identified
   - ☒ Quantity of groundwater treated annually ***Approximately one billion gallons***
   - ☐ Quantity of surface water treated annually ***N/A***
   - Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A
   - ☒ Good condition ☐ Needs maintenance
   - Remarks _____

3. **Tanks, Vaults, Storage Vessels** ☐ N/A
   - ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance
   - Remarks _____

4. **Discharge Structure and Appurtenances** ☐ N/A
   - ☒ Good condition ☐ Needs maintenance
   - Remarks _____

5. **Treatment Building(s)** ☐ N/A
   - ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☒ Chemicals and equipment properly stored
   - Remarks _____

6. **Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked
   - ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located
   - ☐ Needs maintenance ☐ N/A
   - Remarks _____

D. Monitoring Data

1. **Monitoring data**
   - ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring data suggest**
   - ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) ☒ N/A
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs maintenance
   - Remarks _____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. ***(See additional remedy component below.)***

A. Review of New Technologies

Are reviews conducted ☒ Yes ☐ No

Remarks ***As a remedy component (#5), the Army reports annually on the status of any reviews of emerging technologies. MPCA and USEPA have been reviewing Natural attenuation processes as an alternative(2004 Microcosm Study by MPCA and USEPA was published. Up to now, the Army has not identify any new or emerging technology that have the potential to cost-effectively accelerate the timeframe for aquifer restoration..***

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The TCAAP Groundwater Recovery System (TGRS) provides containment of the VOC plume (to the cleanup goals) and provides contaminant removal from the highest groundwater contamination areas (source areas). The system is shrinking the size of the plume. The system has been effective at mass removal. In FY 2012, the TGRS extracted and treated approximately 964,996,900 gallons of water. Since system start-up in 1987, the TGRS has removed 207,180 pounds of VOCs. In FY 2012, the TGRS removed 1,801 pounds of VOCs. The annual mass removal has generally been declining since FY 1992, but continues to remove a relatively large mass of VOCs each year. The treatment component (air stripping) is effective, since discharge requirements are consistently met.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M procedures are providing short- and long-term protectiveness of the remedy. The system has run without significant problems and in a manner that provides the desired containment and level of treatment prior to discharge. On March 2010, the TGRS was modified and since then the groundwater has been effectively treated by two air stripping towers (3 and 4) 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 ppb TCE. The TGRS maintain constant operation of all extraction wells and air stripping towers above the operating minimum.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None.

Appendix C

Community Notices

ECM Publishers, Inc.

-Receipt-

NOV 20 [illegible]
Email

Date:	11/20/13
Account #:	437504
Company Name:	USACE~
Contact:	STACEY HEMPEL
Address:	1616 CAPITAL AVENUE OMAHA
Telephone:	(402) 995-2268
Fax:	

Publications:
SF Moundsview/New Brighton

Ad ID:	53800
Run Dates:	11/21/13 to 11/27/13
# of Inserts:	8
Columns wide:	1
Total # of Lines:	42
Total Depth:	4.278
Total Cost:	$49.05
Ad Class:	155
Account Rep:	Lisa Smith
Phone #	(952) 392-6829
Email:	lisa.smith@ecm-inc.com

Payments:	Method	Card Type	Name on Card	Last 4 Digits	Expire Date	Check Number	Amount Paid
	CC	VISA		8778			$49.05

Gross:	**$49.05**
Paid Amount:	**- $49.05**
Amount Due:	**$0.00**

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Enlarged

Public Notice

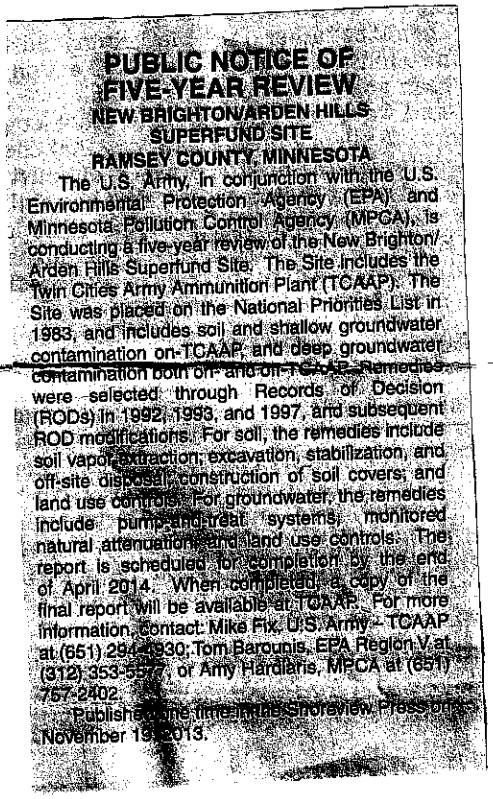
(Official Publication)

Public Notice of
Five-Year Review
New Brighton/Arden
Hills Superfund Site
Ramsey County, Minnesota

The U.S. Army, in conjunction with the U.S. Environmental Protection Agency (EPA) and Minnesota Pollution Control Agency (MPCA), is conducting a five-year review of the New Brighton/Arden Hills Superfund Site. The Site includes the Twin Cities Army Ammunition Plant (TCAAP). The Site was placed on the National Priorities List in 1983, and includes soil and shallow groundwater contamination on-TCAAP, and deep groundwater contamination both on- and off-TCAAP. Remedies were selected through Records of Decision (RODs) in 1992, 1993, and 1997, and subsequent ROD modifications. For soil, the remedies include soil vapor extraction; excavation, stabilization, and off-site disposal; construction of soil covers; and land use controls. For groundwater, the remedies include pump-and-treat systems, monitored natural attenuation, and land use controls. The report is scheduled for completion by the end of April 2014. When completed, a copy of the final report will be available at TCAAP. For more information, contact: Mike Fix, U.S. Army – TCAAP at (651) 294-4930; Tom Barounis, EPA Region V at (312) 353-5577, or Amy Hardiaris, MPCA at (651) 757-2402.

11/21/13, F3, Arden Hills Superfund Site, 53800

PRINTER'S AFFIDAVIT OF PUBLICATION



PUBLIC NOTICE OF FIVE-YEAR REVIEW
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE
RAMSEY COUNTY, MINNESOTA

The U.S. Army, in conjunction with the U.S. Environmental Protection Agency (EPA) and Minnesota Pollution Control Agency (MPCA), is conducting a five-year review of the New Brighton/ Arden Hills Superfund Site. The Site includes the Twin Cities Army Ammunition Plant (TCAAP). The Site was placed on the National Priorities List in 1983, and includes soil and shallow groundwater contamination on-TCAAP, and deep groundwater contamination both on- and off-TCAAP. Remedies were selected through Records of Decision (RODs) in 1992, 1993, and 1997, and subsequent ROD modifications. For soil, the remedies include soil vapor extraction, excavation, stabilization, and off-site disposal; construction of soil covers; and land use controls. For groundwater, the remedies include pump-and-treat systems, monitored natural attenuation, and land use controls. The report is scheduled for completion by the end of April 2014. When completed, a copy of the final report will be available at TCAAP. For more information, contact: Mike Fix, U.S. Army - TCAAP at (651) 294-4930; Tom Barounis, EPA Region V at (312) 353-5577; or Amy Hardiaris, MPCA at (651) 757-2402.

Published one time in the Shoreview Press on November 19, 2013.

AFFIDAVIT OF PUBLICATION

STATE OF MINNESOTA)
County of Ramsey)

I, the publisher, or the publisher's designated agent, being duly sworn, on oath state that I am the publisher, or the publisher's designated agent and an employee of the newspaper known as the ***SHOREVIEW PRESS***, and that I have full knowledge of the facts which are stated below:

(A) The newspaper has complied with all of the requirements constituting qualification as a qualified newspaper, as provided by Minnesota Statute 331A.02, 331A.07, and other applicable laws, and amended.

(B) The printed: **PUBLIC NOTICE OF FIVE-YEAR REVIEW**
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE
RAMSEY COUNTY, MINNESOTA

which is attached was cut from the columns of said newspaper and was printed and published for one week on **TUESDAY,** the **19TH** day of **NOVEMBER, 2013**. Printed below is a copy of the lower case alphabet from A to Z, both inclusive, which is hereby acknowledged as being the size and kind of type used in the composition and publication of the notice:

abcdefghijklmnopqrstuvwxyz

BY:
TITLE: Publisher

Subscribed and sworn to before me on this **19TH** day of **NOVEMBER, 2013.**

MYRNA L. PRESS
NOTARY PUBLIC - MINNESOTA
MY COMMISSION
EXPIRES JAN. 31, 2015

Myrna L. Press
Notary Public, Minnesota

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(1) Lowest classified rate paid by commercial users for comparable space. $_____ (Line, word or inch rate)

(2) Maximum rate allowed by law for the above matter. $_____ (Line, word or inch rate)

(3) Rate actually charged for the above matter. $ **35.50 FLAT RATE**

StarTribune
Minneapolis | St. Paul
425 Portland Avenue
Minneapolis, MN 55488

STATE OF MINNESOTA)
COUNTY OF HENNEPIN)

Karen Greenhoe, being duly sworn, on oath says she is and during all times herein stated has been an employee of Star Tribune Media Company LLC, a Delaware limited liability company with offices at 425 Portland Avenue, Minneapolis, Minnesota 55488, publisher and printer of the *Star Tribune* newspaper (the "Newspaper"), published 7 days a week, and has full knowledge of the facts herein stated as follows:

1. The Newspaper meets the following qualifications:
   (a) The Newspaper is printed in the English language in newspaper format and in column and sheet form equivalent in printed space to at least 1,000 square inches;
   (b) The Newspaper is printed daily and distributed at least five days each week;
   (c) In at least half of its issues each year, the Newspaper has no more than 75 percent of its printed space comprised of advertising material and paid public notices. In all of its issues each year, the Newspaper has not less than 25 percent of its news columns devoted to news of local interest to the community that it purports to serve. Not more than 25 percent of the Newspaper's non-advertising column inches in any issue duplicates any other publication;
   (d) The Newspaper is circulated in the local public corporation which it purports to serve, and has at least 500 copies regularly delivered to paying subscribers;
   (e) The Newspaper has its known office of issue established in either the county in which it lies, in whole or in part, the local public corporation which the Newspaper purports to serve, or in an adjoining county;
   (f) The Newspaper files a copy of each issue immediately with the state historical society;
   (g) The Newspaper is made available at single or subscription prices to any person, corporation, partnership, or other unincorporated association requesting the Newspaper and making the applicable payment;
   (h) The Newspaper has complied with all the foregoing conditions for at least one year immediately preceding the date of the notice publication which is the subject of the Affidavit; and
   (i) Between September 1 and December 31 of each year, the Newspaper publishes and submits to the secretary of state, along with a filing fee of $25, a sworn United States Post Office periodical class statement of ownership and circulation.
2. The printed copy of the matter attached hereto (the "Notice") was copied from the columns of the Newspaper and was printed and published in the English language on the following days and dates: **Wednesday, November 20, 2013.**
3. Except as otherwise directed by a particular statute requiring publication of a public notice, the Notice was printed in a typeface no smaller than six point with a lowercase alphabet of 90 point.
4. The Newspaper's lowest classified rate paid by commercial users for space comparable to the space in which the Notice was published is **$220.35.**

Karen Greenhoe

Subscribed and sworn to before me on November 20, 2013

Jolene K. Howard

Jolene K. Howard
NOTARY PUBLIC
STATE OF MINNESOTA
My Commission Expires 1-31-2018

Ad Number:	13944052	Advertiser:	US Army Corp of Engineers
Insertion Number:	N/A	Agency:	N/A
Size:	1 Col x 3.435 in	Section-Page-Zone(s):	K-1-Southwest
Color Ty	0	Description:	

StarTribune

Wednesday, November 20, 2013

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Appendix D

Annual Site Inspection Checklist
For OU2 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)

Appendix E

Site Inspection Photographs

TCAAP Groundwater Recovery System

TCAAP Groundwater Recovery System inlet Piping(OU2)

TCAAP Groundwater Recovery System Discharge side

Relief Well B-6, Pump House

Relief Well B-6, Well and Pump

Relief Well B-6, Control Panel

Relief Well B-6, Lock. Secure upon arrival

Relief Well B-6, Pump House

TCAAP Perimeter Fence, adjacent to Relief Well B-6 Pump House

Monitoring Well 04J714 or 04U714

Monitoring Well 04J714 or 04U714. Not able to distinguish Well 04J714J from 04U714 from the markings on the well casing

Monitoring Well 643881

Site C, Land Use Control Signage

Site C, Example of well vegetated cover

Site C, Example of well vegetated cover

Site C, Example of well vegetated cover

Site E, Land Use Control Signage

Site E, Example of well vegetated cover

Site E, Example of well vegetated cover

Site D, Land Use Control Signage

Site D, Example of well vegetated cover

Site D, Example of well vegetated cover

Site 129-15, Rip rap for mitigation of run-off from upper road

Site 129-15, Land Use Control Signage

Site 129-15, Example of well vegetated cover

Site 129-15, Example of well vegetated cover

Site 129-15, Monitoring Well. Uncertain of well ID.

Site 129-15, Monitoring Well. Uncertain of well ID. Well may need to be abandoned.

Site G, Land Use Control Signage

Site G, Example of well vegetated cap

Site G, Example of well vegetated cap

Site G, Trees near the edge of the cap

Site G, Trees near the edge of the cap

Site G, Trees near the edge of the cap

Site G, Trees near the edge of the cap

Site G, Trees near the edge of the cap

Site G, Monitoring Well 03U094 (uncertain of well ID – ID is worn).
Well may need to be abandoned.

Outdoor Firing Range, Land Use Control Signage

Outdoor Firing Range, Example of well vegetated cover

Site H, Land Use Control Signage

Site H, Example of well vegetated cover

Site H, Example of well vegetated cover

Site H, Example of well vegetated cover

Site H, Example of well vegetated cover

Site H, Example of well vegetated cover

Site K, Monitoring Well 03U621. Good condition and well marked.

Site H, Example of well vegetated cover

Site K, Monitoring Well 03U621. Good condition and well marked

Site 102, Monitoring Well 01U582 and 01L582. Good condition and well marked.

Site 102, Monitoring Well 01U582. Good condition and well marked.

Site 102, Monitoring Well 01L582. Good condition and well marked.

Site 102, SVE Treatment System

Site 102, SVE Treatment System

Site 102, SVE Treatment System

Site 102, SVE Treatment System

Site 102, SVE Treatment System

Site 102, SVE Treatment System

Site 102, Collection Trench

Site A, Example of Perimeter Fence

Site A, Monitoring Well 01U355. Good condition and well marked.

Site A, Monitoring Well 01U356. Cover broken and well not secure.

Site A, Overall site

Appendix F

MDH Special Well Construction Area Information

Minnesota Department of Health
Well Management
Twin Cities Army Ammunition Plant
Special Well and Boring Construction Area

In 1996, the Minnesota Department of Health (MDH) designated a Special Well and Boring Construction Area (Well Advisory) incorporating the Cities of New Brighton, St. Anthony and portions of Arden Hills, Columbia Heights, Falcon Heights, Fridley, Lauderdale, Minneapolis, Roseville, and Shoreview, which are located in Anoka, Hennepin, and Ramsey Counties. The Special Well and Boring Construction Area incorporated two areas of groundwater contamination related to volatile organic chemicals (VOCs) contamination at, and around the Twin Cities Army Ammunition Plant (TCAAP) in Arden Hills. The largest area of contamination extends several miles to the south and west of TCAAP, to depths of several hundred feet. Portions of the buried sand aquifer (Hillside Sand formation) and the Prairie du Chien dolomite and Jordan sandstone bedrock formations have been contaminated with VOCs, principally trichloroethene (TCE). A second, much smaller area of VOC contamination exists in the surficial sand deposits (Fridley formation) north and west of TCAAP to depths of approximately 45 feet.

In June 1999, the Minnesota Pollution Control Agency requested that the MDH extend the Special Well and Boring Construction Area boundary for the larger contamination plume farther to the southwest to the Mississippi River in Minneapolis, and Marshall Avenue in St. Paul. The eastern boundary of the extension area is Cleveland Avenue, between Larpenteur Avenue on the north and Marshall Avenue on the south. The western boundary of the extension area is a continuation of Central Avenue to the Mississippi River. The boundaries of the original area north of Larpenteur Avenue and Hennepin Avenue remain unchanged. The revised boundaries of the Special Well and Boring Construction Area are shown on the accompanying map (PDF: 106KB/1 page).

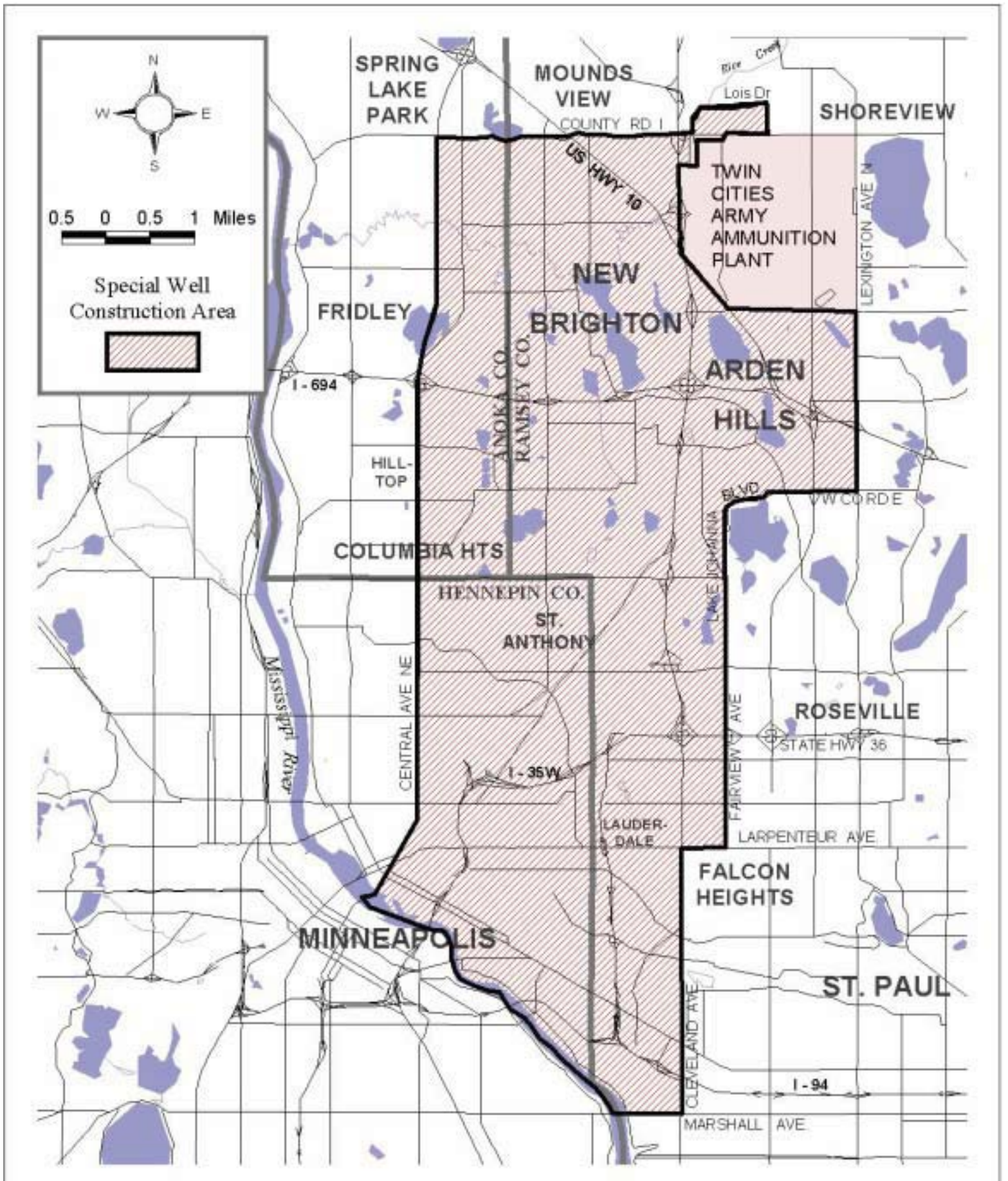
Wells within the Special Well and Boring Construction Area may not be constructed or modified until after the MDH has reviewed and approved plans for the proposed activity. Wells completed in or below the Prairie du Chien dolomite may not be sealed until after the MDH has reviewed and approved plans. Plans for well construction, well reconstruction, or well sealing may be submitted to Patrick Sarafolean, 651-201-3962, at our metro district office in St. Paul.

Questions?
Contact the **MDH Well Management Section**
651-201-4600 or 800-383-9808
health.wells@state.mn.us

Minnesota Department of Health
651-201-5000 Phone
888-345-0823 Toll-free

Information on this website is available in alternative formats upon request.

Special Well Constructon Area
Twin Cities Army Ammunition Plant



Updated Monday, 19-Aug-2013 09:29:44 CDT

Appendix G

Interviews

From:	Worthington, Heather
To:	Grimm, Jennifer J NWO
Cc:	Kubler, Rick
Subject:	[EXTERNAL] RE: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)
Date:	Monday, December 02, 2013 9:55:24 AM
Attachments:	GPDOCS1-#3545525-v2-Five-Year_Review_Interview_Record (2).docx TCAAP Deed - Exhibit C - Groundwater.pdf

---

Jennifer:

Please see my attached reply, along with an exhibit that explains the County's ownership.

Please call or e-mail if you have any questions.

Thanks!
HW

Heather Worthington
Deputy County Manager
15 W. Kellogg Blvd., Rm. 250
St. Paul, MN 55102
651.266.8010 (office)
651.262.9896 (mobile)
www.co.ramsey.mn.us
Working with You to Enhance our Quality of Life

-----Original Message-----
From: Grimm, Jennifer J NWO [mailto:Jennifer.J.Grimm@usace.army.mil]
Sent: Friday, November 15, 2013 11:00 AM
To: Worthington, Heather
Subject: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Ms. Worthington-

On behalf of the U.S. Army, The U.S. Army Corps of Engineers is conducting the 4th Five-Year Review of remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH site) which includes the Twin Cities Army Ammunition Plant (TCAAP). The purpose of the Five-Year Review is to determine whether the remedy at a site is/remains protective of human health and the environment and to evaluate the implementation and performance of the selected remedy. For the NB/AH site, remedies have been selected for Operable Unit (OU) 1, OU2, and OU3. OU1 consists of the large north plume of contaminated groundwater outside the boundaries of the TCAAP facility. OU2 consists of affected soil, sediment, surface water, and groundwater within the boundaries of the TCAAP facility. OU3 consists of the south plume of groundwater contamination outside the boundaries of the TCAAP facility. Implementation of the remedies selected for these OUs comprises the final remedy for the NB/AH site.

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Below is a list of questions being asked to all individuals participating in the Five-Year Review Interviews. If you are willing to participate, please take some time to consider each question and provide answers. Your answers can be provided in two ways:

1) respond in writing to each question by replying directly to this email, or

2) contact me by email or phone and schedule a time to conduct a telephone interview.

Please contact me if you'd rather not participate, and I will take you off the distribution list.

Thank you for considering this request,

Jennifer Grimm

Geologist
U.S. Army Corps of Engineers, Omaha District
Phone: 402.619.6502
Email: Jennifer.j.grimm@usace.army.mil

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME:
TITLE:
ORGANIZATION:
STREET ADDRESS:
CITY, STATE, ZIP:
DATE:

1. What is your overall impression of the project?

2. What effects have site operations had on the surrounding community?

3. Are you aware of any community concerns regarding the site?

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency response from local authorities?

5. Do you feel well informed about the site's activities and progress?

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME: Heather Worthington
TITLE: Deputy County Manager
ORGANIZATION: Ramsey County
STREET ADDRESS: 15 W. Kellogg Blvd., Rm. 250
CITY, STATE, ZIP: St. Paul, MN 55102
DATE: November 19, 2013

1. What is your overall impression of the project?

In April 2013, the County purchased 397 acres of the former TCAAP property from the federal government for which the Army had made a Finding of Suitability for Transfer. The County also leased an additional 30 acres of TCAAP from the federal government and will complete the soil cleanup necessary to satisfy the Army's obligations under the Federal Facility Agreement (FFA) and Operable Unit 2 Record of Decision (OU-2 ROD) for that portion of the property. The County will take title to the 30 leased acres once the cleanup of that property is complete. The Army retained responsibility for all TCAAP groundwater remediation. A figure showing the boundaries of the 427 acre parcel (both County's property and the leased property) is attached. The County's responses to your questions will focus primarily on the County's ongoing activities on those 427 acres (site).

The County has a fixed price contract with Carl Bolander & Sons Co. (Bolander) to complete demolition of all buildings and other site improvements, hazardous material abatement (e.g., asbestos, petroleum, lead paint, etc.), utility removals, and remediate the soil to meet Minnesota Tier I Residential Soil Reference Values. As part of that contract, Bolander will complete the Army's soil cleanup obligations under the FFA and OU-2 ROD on the leased property. At present, Bolander has completed all hazardous material abatement and demolition for all buildings but one (Building 502) and is in the process of completing the remaining utility removals. Soil remediation work has also commenced under a Quality Assurance Project Plan (QAPP) approved by the Minnesota Pollution Control Agency (MPCA) and U.S. Environmental Protection Agency (EPA), and an MPCA-approved Response Action Plan/Development Response Action (RAP). We anticipate that all soil cleanup activity will be completed across the entire 427 acre parcel by October 2015.

2. What effects have site operations had on the surrounding community?

Thus far, the work being performed by Bolander under the fixed-fee contract has not likely affected the surrounding community, as it has been restricted to the 427 acres we purchased/leased from the federal government. The County is not altering the groundwater treatment system. The extraction wells, piping and treatment facility are still in place and owned by the Army, and the Army remains responsible for operation and maintenance of that system. Truck traffic for removals is limited to the north gate at County Road H. Work is only being performed during daylight hours.

3. Are you aware of any community concerns regarding the site?

There is a long-standing Remediation Advisory Board (RAB) that has been active up until recently; some of those members have attended community meetings, and expressed their satisfaction with the County's remediation efforts and scope of work. Other than that, we have not had concerns related to the pollution and its remediation.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency response from local authorities?

Prior to April 2013, the site security was very "porous". There were many breaks in the fencing around the site, and it was obvious that the site was subject to constant trespass, often for the purpose of removing copper and other scrap metal. Since the County has occupied the site and Bolander began its work, trespass has declined significantly. In addition, building demolition seems to have eliminated the "attractive nuisance" nature of the site that was drawing people to trespass. We likely still have some trespass, but evidence is minimal.

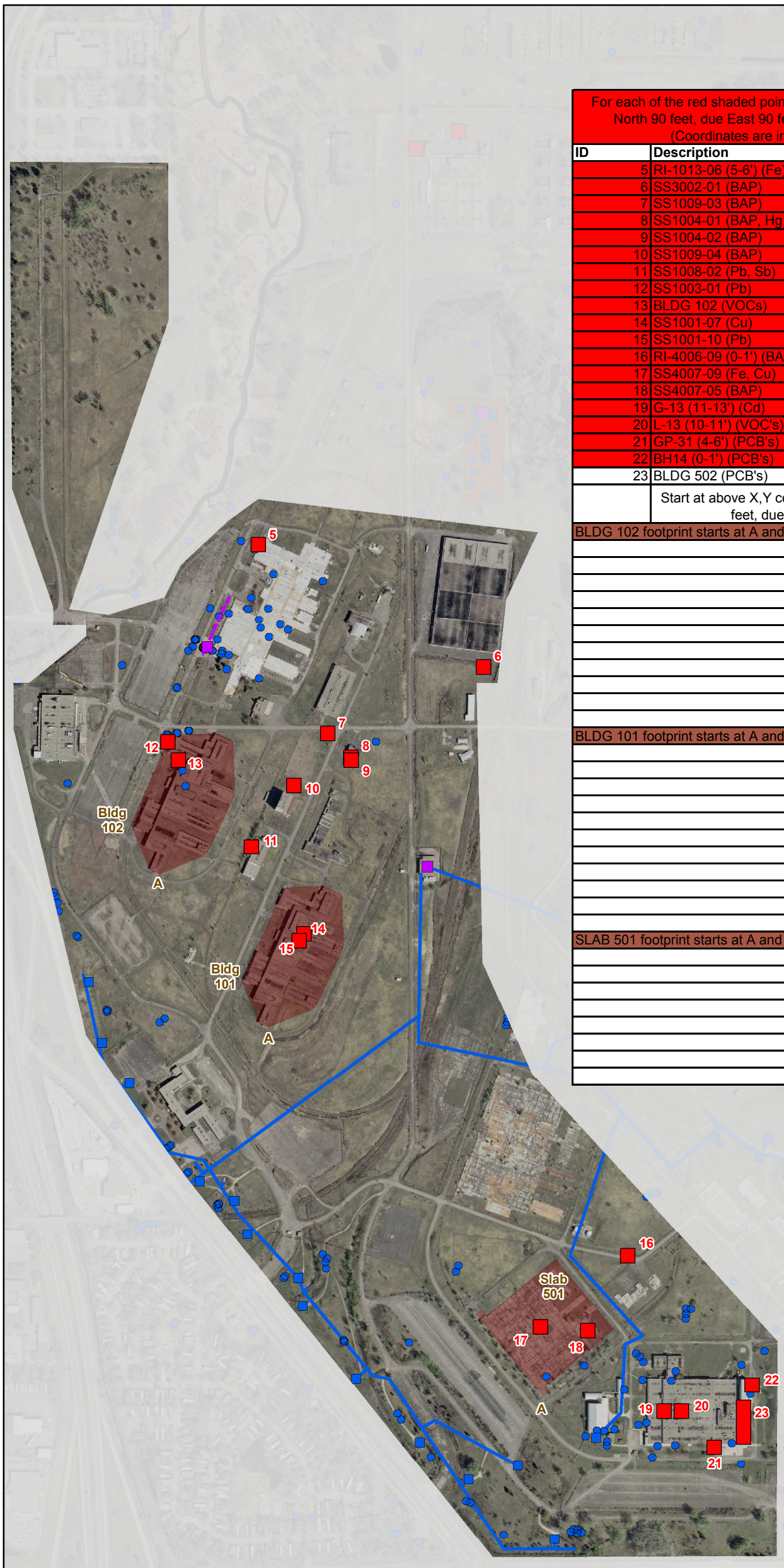
5. Do you feel well informed about the site's activities and progress?

I am the overall project manager for the site remediation and redevelopment project. As such, I oversee the remediation of the site and act as the County's staff representative in the Joint Development Authority (JDA) between the City of Arden Hills and Ramsey County. I am involved, with City staff, in all aspects of the master planning effort. I feel that I am well informed in the nature of the site and the specifics of this project.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

In terms of the site, we are actively seeking a "Commissioner's Certificate of Completion" from the MPCA for all soil pollution, as we expect to clean the site to meet MPCA Tier I SRVs. Receipt of this Certificate will help ensure that the public understands the site cleanup was properly completed and that land is safe to occupy. We will also seek modification by the MPCA, EPA and Army of the TCAAP Land Use Control Remedial Design (LUCRD) to allow future residential redevelopment over as much of the site as possible.

However, we understand that significant groundwater contamination will remain after Bolander's cleanup is complete. A municipality adjacent to TCAAP, the City of New Brighton, has had a long-standing agreement with the federal government to provide resources for remediating that water through the City's water treatment facility. As we understand it, that agreement seems to be in jeopardy at this time. It is in our interest, as well as the City of New Brighton's interest, that this agreement be renewed, and a future commitment made to the City to provide funding for the treatment of that water. We welcome the opportunity to comment further on this, and how we believe the public perceives the treatment of that water and the value it provides not only to New Brighton, but also to the greater TCAAP area encompassing the communities of Shoreview, Arden Hills and Mounds View.



For each of the red shaded points below, start at the X,Y coordinate, thence due North 90 feet, due East 90 feet, due South 90 feet and due West 90 feet. (Coordinates are in UTM, Zone 15N, NAD 83, Meters)

ID	Description	X	Y
5	RI-1013-06 (5-6') (Fe)	485,680.55	4,993,690.12
6	SS3002-01 (BAP)	486,106.38	4,993,459.45
7	SS1009-03 (BAP)	485,812.04	4,993,333.29
8	SS1004-01 (BAP, Hg)	485,855.32	4,993,288.44
9	SS1004-02 (BAP)	485,856.32	4,993,282.90
10	SS1009-04 (BAP)	485,747.81	4,993,234.87
11	SS1008-02 (Pb, Sb)	485,668.17	4,993,118.97
12	SS1003-01 (Pb)	485,510.23	4,993,317.70
13	BLDG 102 (VOCs)	485,529.82	4,993,310.61
14	SS1001-07 (Cu)	485,766.67	4,992,954.20
15	SS1001-10 (Pb)	485,757.96	4,992,941.43
16	RI-4006-09 (0-1') (BAP)	486,378.63	4,992,346.13
17	SS4007-09 (Fe, Cu)	486,213.30	4,992,211.82
18	SS4007-05 (BAP)	486,303.17	4,992,205.24
19	G-13 (11-13') (Cd)	486,446.60	4,992,052.41
20	L-13 (10-11') (VOC's)	486,479.61	4,992,052.71
21	GP-31 (4-6') (PCB's)	486,541.72	4,991,985.31
22	BH14 (0-1') (PCB's)	486,612.97	4,992,102.64
23	BLDG 502 (PCB's)	486,596.96	4,992,004.85

Start at above X,Y coordinate, thence due North 270 feet, due East 90 feet, due South 270 feet and due West 90 feet.

BLDG 102 footprint starts at A and goes clockwise.		
A	485,505.37	4,993,079.81
B	485,496.37	4,993,083.69
C	485,487.94	4,993,090.81
D	485,455.46	4,993,169.40
E	485,533.39	4,993,345.11
F	485,611.67	4,993,347.94
G	485,647.55	4,993,332.30
H	485,650.31	4,993,239.84
I	485,648.97	4,993,228.85
J	485,599.67	4,993,123.58
K	485,592.92	4,993,115.81
BLDG 101 footprint starts at A and goes clockwise.		
A	485,592.92	4,993,115.81
B	485,701.22	4,992,794.37
C	485,693.70	4,992,801.45
D	485,663.65	4,992,879.59
E	485,742.30	4,993,055.76
F	485,817.74	4,993,058.98
G	485,852.69	4,993,042.88
H	485,855.45	4,992,950.88
I	485,854.71	4,992,941.14
J	485,805.15	4,992,833.79
K	485,798.42	4,992,825.77
SLAB 501 footprint starts at A and goes clockwise.		
A	486,231.70	4,992,093.97
B	486,104.29	4,992,249.90
C	486,115.33	4,992,258.64
D	486,125.91	4,992,247.14
E	486,255.62	4,992,354.87
F	486,366.01	4,992,222.30
G	486,236.30	4,992,112.37
H	486,243.66	4,992,103.17

NORTHERN POINTE

Environmental Condition

Wenck
Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2011

From:	Skoglund, Martin J NFG NG MNARNG (US)
To:	Grimm, Jennifer J NWO
Subject:	[EXTERNAL] RE: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)
Date:	Thursday, December 19, 2013 10:59:22 AM

Classification: UNCLASSIFIED
Caveats: NONE

Jennifer,
I have limited input relative to the entire site since MN National Guard has responsibility for the eastern portion of TCAAP (known as the Arden Hills Army Training Site (AHATS) totaling about 1500 of the 2300 acres. Regardless here is what I have to offer:

1. What is your overall impression of the project?
The MNARNG has prepared and updates annually an Integrated Natural Resources Management Plan (INRMP) for AHATS. While MNARNG has the lead in crafting the INRMP it is done in coordination with MNDNR and USFWS. The INRMP provides the basis for maintaining and improving the natural resources for AHATS.

2. What effects have site operations had on the surrounding community?
The INRMP offers the community and MNARNG's partners an opportunity to understand MNARNG's commitment to good stewardship of AHATS.

3. Are you aware of any community concerns regarding the site?
I do know that the community would like to access the site more freely but the LUCRD limits access due to a concern with lead contamination via MPCA directive. Currently only MNARNG Soldiers and individuals 18 years old or older allowed to access the site. Regardless, MNARNG would only provide controlled public access to AHATS similar to that which is done for Camp Ripley. This is necessary to ensure safety and to avoid conflict with MNARNG's training mission.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency response from local authorities?
I am aware that for a number of years thieves were freely accessing the site without permission and were salvaging copper from the old buildings. Law enforcement was an issue given jurisdiction on the federal property status. This is an issue that is being worked on between MNARNG and Ramsey County particularly as it relates to enforcement on AHATS. Ramsey County now owns the balance of land that used to be TCAAP to the west.

5. Do you feel well informed about the site's activities and progress?
Yes compliments to Army representatives.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
Regardless how things play out the key take home message is AHATS is intended to train MNARNG Soldiers first and foremost. The community mission is secondary yet very important.

Marty Skoglund
Environmental Program Manager

Minnesota Army National Guard
Facilities Management Office
15000 Hwy 115
Little Falls, MN 56345
(320) 616-2618
(320) 412-6103 (Cell)
Email: martin.j.skoglund.nfg@mail.mil

-----Original Message-----
From: Grimm, Jennifer J NWO [mailto:Jennifer.J.Grimm@usace.army.mil]
Sent: Friday, November 15, 2013 10:45 AM
To: Skoglund, Martin J NFG NG MNARNG (US)
Subject: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Mr. Skoglund-

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Thank you for considering this request,

Jennifer Grimm

Geologist
U.S. Army Corps of Engineers, Omaha District
Phone: 402.619.6502
Email: Jennifer.j.grimm@usace.army.mil

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME:
TITLE:
ORGANIZATION:
STREET ADDRESS:
CITY, STATE, ZIP:
DATE:

1. What is your overall impression of the project?

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Classification: UNCLASSIFIED
Caveats: NONE

Classification: UNCLASSIFIED
Caveats: NONE

From:	LRSalmela@aol.com
To:	Grimm, Jennifer J NWO
Cc:	mike.fix@us.army.mil
Subject:	[EXTERNAL] Re: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UN...
Date:	Friday, November 15, 2013 1:05:59 PM
Attachments:	TCAAP PLANNING7.docx TCAAPMASTERPLANDESIGNGUIDELINES020309.doc

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Jennifer Grimm

Name: Lyle R. Salmela REM
Title: TCAAP RAB Community Co-Chair
Organization: Arden Hills Resident
Street Address: 1480 Arden Vista Court
City: Arden Hills, MN, 55112
Date: 11/15/2013

1. Overall impression of the project?

All citizens want the project cleaned up from the eye-sore that it was to a productive self contained tax-paying community. Now that Ramsey County and the City are cleaning the purchased 427 acres we can see progress. The Army has done a good job of removing the contaminants and the development will be cleaned to residential standards before development can proceed. The MN National Guard is doing a nice job to developing the AHATS site and managing the remaining 1500 acres. I feel the Army and National Guard should become key partners to sharing the 1500 acres and development of the 427 sold acres with the surrounding communities. This is a PR opportunity for future recruitment. There may need to be some revision to the Land Use Controls for more public involvement and access to the 1500 acres.

2. Community concerns regarding the site.

I have been involved with the Army RAB, City and County for over 10 years for remediation and development of the site. See 2 attachments.

3. Community concerns regarding the site.

See question 2 and attachments.

4. Events, incidents or activities at the site.

Vandals have removed large amounts of copper wire and other property. The fence has kept out most trespassers except wildlife.

5. Do you feel well informed?

As RAB Co-Chair I have stayed involved even through the Round Lake restoration regulatory process, which is the last RAB involvement with the TCAAP site.

6. Do you have comments, suggestions or recommendations regarding the sites management or operation?

I have not heard progress on Round Lake for over the past year since I spoke to the Regulatory Agencies and Army about my concerns about over regulation of the restoration operations. In my over 40 years in the environmental regulatory compliance field I feel that we have to be more aware of what nature can do to resolve our contamination problems than spending millions of dollars that we don't have.

I feel that a water tower with an observation deck should be located on the Kame(hill) 200 feet higher than the development area. This is the highest point in Ramsey County and an observation deck would have an elevation of 350 feet and an observation point over the whole twin city area. This could be a

tourist attraction and accessed by a sky ride from the development area if the Land Use Controls don't allow the public to set foot on the AHATS property.

Ramsey County would also like to utilize the Kame (hill on AHATS property) area during the winter for cross-country skiing. My relatives who have been involved with the U.S. Olympic cross-country and biathlon teams (a military sport) have also expressed interest along with the world cross-country ski federation. My nephew will announce the play-by-play of all cross-county events on NBC at this winters Olympics.

If you would like to discuss these comments further, please give me a call at 651-636-6461.

Lyle R. Salmela, REM

In a message dated 11/15/2013 10:51:41 A.M. Central Standard Time, Jennifer.J.Grimm@usace.army.mil writes:

Classification: UNCLASSIFIED
Caveats: NONE

Mr. Salmela-

On behalf of the U.S. Army, The U.S. Army Corps of Engineers is conducting the 4th Five-Year Review of remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH site) which includes the Twin Cities Army Ammunition Plant (TCAAP). The purpose of the Five-Year Review is to determine whether the remedy at a site is/remains protective of human health and the environment and to evaluate the implementation and performance of the selected remedy. For the NB/AH site, remedies have been selected for Operable Unit (OU) 1, OU2, and OU3. OU1 consists of the large north plume of contaminated groundwater outside the boundaries of the TCAAP facility. OU2 consists of affected soil, sediment, surface water, and groundwater within the boundaries of the TCAAP facility. OU3 consists of the south plume of groundwater contamination outside the boundaries of the TCAAP facility. Implementation of the remedies selected for these OUs comprises the final remedy for the NB/AH site.

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Thank you for considering this request,

Jennifer Grimm

Geologist
U.S. Army Corps of Engineers, Omaha District
Phone: 402.619.6502
Email: Jennifer.j.grimm@usace.army.mil

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME:
TITLE:
ORGANIZATION:
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DATE:

1. What is your overall impression of the project?

2. What effects have site operations had on the surrounding community?

3. Are you aware of any community concerns regarding the site?

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency response from local authorities?

5. Do you feel well informed about the site's activities and progress?

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

From: Fix, Michael R CIV (US)
To: Grimm, Jennifer J NWO
Subject: [EXTERNAL] RE: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)
Date: Wednesday, November 27, 2013 10:09:13 AM

Responses are inserted below.

_____
From: Grimm, Jennifer J NWO [Jennifer.J.Grimm@usace.army.mil]
Sent: Friday, November 15, 2013 11:03 AM
To: Fix, Michael R CIV (US)
Subject: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Mr. Fix-

On behalf of the U.S. Army, The U.S. Army Corps of Engineers is conducting the 4th Five-Year Review of remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH site) which includes the Twin Cities Army Ammunition Plant (TCAAP). The purpose of the Five-Year Review is to determine whether the remedy at a site is/remains protective of human health and the environment and to evaluate the implementation and performance of the selected remedy. For the NB/AH site, remedies have been selected for Operable Unit (OU) 1, OU2, and OU3. OU1 consists of the large north plume of contaminated groundwater outside the boundaries of the TCAAP facility. OU2 consists of affected soil, sediment, surface water, and groundwater within the boundaries of the TCAAP facility. OU3 consists of the south plume of groundwater contamination outside the boundaries of the TCAAP facility. Implementation of the remedies selected for these OUs comprises the final remedy for the NB/AH site.

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Jennifer Grimm

Geologist
U.S. Army Corps of Engineers, Omaha District
Phone: 402.619.6502
Email: Jennifer.j.grimm@usace.army.mil

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME: Michael Fix
TITLE: Remedial Project Manager/ Commander's Representative
ORGANIZATION: US Army Base Realignment and Closure Division
STREET ADDRESS: 470 W Hwy 96, Suite 100
CITY, STATE, ZIP: Shoreview, MN 55126
DATE: 27 Nov 2013

1. What is your overall impression of the project?
As the Army's project manager for the New Brighton/Arden Hills Site I consider the project to be very mature and protective of human health and the environment.

2. What effects have site operations had on the surrounding community?
Historically operations impacted surrounding groundwater, but recently activities are limited to restoration which has been positive.

3. Are you aware of any community concerns regarding the site?
No specific restoration concerns.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency response from local authorities?
Yes, there has been vandalism and trespassing and emergency responses, but little to no impact on restoration activities.

5. Do you feel well informed about the site's activities and progress?
Yes.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
N/A.

Classification: UNCLASSIFIED
Caveats: NONE

From:	Blomquist (Mars), Karie
To:	Grimm, Jennifer J NWO
Subject:	[EXTERNAL] Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)
Date:	Monday, November 18, 2013 1:44:33 PM

Please see my responses in red below. Let me know if you need anything else. Thanks!

Karie

-----Original Message-----
From: Grimm, Jennifer J NWO [mailto:Jennifer.J.Grimm@usace.army.mil]
Sent: Friday, November 15, 2013 11:02 AM
To: Blomquist (Mars), Karie
Subject: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)

Classification: UNCLASSIFIED

Caveats: NONE

Ms. Blomquist-

On behalf of the U.S. Army, The U.S. Army Corps of Engineers is conducting the 4th Five-Year Review of remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH site) which includes the Twin Cities Army Ammunition Plant (TCAAP). The purpose of the Five-Year Review is to determine whether the remedy at a site is/remains protective of human health and the environment and to evaluate the implementation and performance of the selected remedy. For the NB/AH site, remedies have been selected for Operable Unit (OU) 1, OU2, and OU3. OU1 consists of the large north plume of contaminated groundwater outside the boundaries of the TCAAP facility. OU2 consists of affected soil, sediment, surface water, and groundwater within the boundaries of the TCAAP facility. OU3 consists of the south plume of groundwater contamination outside the boundaries of the TCAAP facility. Implementation of the remedies selected for these OUs comprises the final remedy for the NB/AH site.

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Jennifer Grimm

Geologist

U.S. Army Corps of Engineers, Omaha District

Phone: 402.619.6502

Email: Jennifer.j.grimm@usace.army.mil <mailto:Jennifer.j.grimm@usace.army.mil>

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME: Karie Blomquist

TITLE: Remediation Project Manager

ORGANIZATION: ATK

STREET ADDRESS: 7480 Flying Cloud Dr

CITY, STATE, ZIP: Eden Prairie, MN 55344

DATE: 11/18/13

1. What is your overall impression of the project? The environmental impacts at this site are well understood and are being addressed in such a way to as to ensure protection of human health and the environment.

2. What effects have site operations had on the surrounding community? From an environmental impact standpoint, historic operations at the site have led to restrictions in groundwater use and the need for treatment of VOCs at the municipal water supply.

3. Are you aware of any community concerns regarding the site? The TCAAP Restoration Advisory Board (RAB) has been in place for a number of years and gives community members a platform to voice their concerns and provide input in the cleanup process. Currently, I am not aware of any specific community concerns with respect to environmental impacts. At the moment, the community is primarily focused on redevelopment of the site.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency response from local authorities? Yes, there has been significant vandalism at the site since Army operations ceased. Vandals have been trespassing primarily to steal copper and other scrap metal from the site. Now that the county has purchased the site and is in the process of redevelopment, I believe there has been less vandalism.

5. Do you feel well informed about the site's activities and progress? Yes, I am well informed on the sites I manage for ATK (OU2 and OU3).

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? In general, the site cleanup has been well managed and has consistently been in compliance with State and Federal regulations.

Classification: UNCLASSIFIED

Caveats: NONE

Karie Blomquist, P.E.

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From:	Barounis, Thomas
To:	Grimm, Jennifer J NWO
Cc:	Hadiaris, Amy (MPCA)
Subject:	[EXTERNAL] RE: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)
Date:	Tuesday, November 26, 2013 12:46:20 PM

Hello, Jennifer.

As you may know, I am the USEPA Remedial Project Manager for the NB/AH/TCAAP Site. As such, and because USEPA ultimately has to make the FYR protectiveness determination, I don't think that I actually need to be interviewed for it. The Army did not include interviews with EPA or MPCA staff during the previous FYRs. That being said, I can give you some general answers to the questions.

1. The Army has generally been doing a good job of maintaining the remedies.

2. Probably the greatest impact to the surrounding communities has been the need to address the large groundwater plume through the various groundwater remedies, including the New Brighton Contaminated Groundwater Recovery System and the St. Anthony water treatment facility.

3. The communities around the Twin Cities Army Ammunition Plant expressed concerns about the impact of the site at various times over the years. Active community involvement in the site has been expressed through the TCAAP Restoration Advisory Board, initiated around 1996. Additional community input and involvement with the Site has taken place as a result of the transfer of portions of the TCAAP property for various uses.

4. Although incidents such as described in the question have happened, they have been rare. The Army has promptly informed the regulators when those incidents have occurred and addressed them in a timely manner.

5. As the longstanding EPA RPM for the site, yes.

6. No comments, suggestions or recommendations at this time. EPA will thoroughly review the FYR and make any necessary recommendations at that time.

Please let me know if you have any questions

Tom Barounis, RPM
U.S.EPA Region 5
77 W. Jackson Boulevard
Chicago, IL 60604
312-353-5577

-----Original Message-----
From: Grimm, Jennifer J NWO [mailto:Jennifer.J.Grimm@usace.army.mil]
Sent: Friday, November 15, 2013 11:09 AM
To: Barounis, Thomas
Subject: Five-Year Review, New Brighton/Arden Hills Superfund Site - Interview (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Mr. Barounis-

On behalf of the U.S. Army, The U.S. Army Corps of Engineers is conducting the 4th Five-Year Review

of remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH site) which includes the Twin Cities Army Ammunition Plant (TCAAP). The purpose of the Five-Year Review is to determine whether the remedy at a site is/remains protective of human health and the environment and to evaluate the implementation and performance of the selected remedy. For the NB/AH site, remedies have been selected for Operable Unit (OU) 1, OU2, and OU3. OU1 consists of the large north plume of contaminated groundwater outside the boundaries of the TCAAP facility. OU2 consists of affected soil, sediment, surface water, and groundwater within the boundaries of the TCAAP facility. OU3 consists of the south plume of groundwater contamination outside the boundaries of the TCAAP facility. Implementation of the remedies selected for these OUs comprises the final remedy for the NB/AH site.

You have been identified as an individual who may be key to better understanding site status. As such, your participation in the Five-Year Review Interview process is requested.

Below is a list of questions being asked to all individuals participating in the Five-Year Review Interviews. If you are willing to participate, please take some time to consider each question and provide answers. Your answers can be provided in two ways:

1) respond in writing to each question by replying directly to this email, or

2) contact me by email or phone and schedule a time to conduct a telephone interview.

Please contact me if you'd rather not participate, and I will take you off the distribution list.

Thank you for considering this request,

Jennifer Grimm

Geologist
U.S. Army Corps of Engineers, Omaha District
Phone: 402.619.6502
Email: Jennifer.j.grimm@usace.army.mil

Five-Year Review Interview Record

Please include your name, title, organization, and address.

NAME:
TITLE:
ORGANIZATION:
STREET ADDRESS:
CITY, STATE, ZIP:
DATE:

1. What is your overall impression of the project?

2. What effects have site operations had on the surrounding community?

3. Are you aware of any community concerns regarding the site?

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or

emergency response from local authorities?

5. Do you feel well informed about the site's activities and progress?

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Classification: UNCLASSIFIED
Caveats: NONE