



U.S. ARMY



**U.S. ARMY
ENVIRONMENTAL
COMMAND**

Status of Cleanup at Twin Cities Army Ammunition Plant (TCAAP)

RAB Meeting

02-17-2026

- Old Business
- Cleanup Status Update
 - Round Lake
 - Groundwater Remediation
 - Per- and poly-fluoroalkyl substances (PFAS)
 - U.S. Geological Survey (USGS) Groundwater Model
- New Business
- Next Meeting Agenda
- Public Comments



- Vote to accept the minutes from previous meeting.
- Army held groundwater stakeholder and Round Lake Technical Working Group meeting on 17 February 2026.



Round Lake Remedial Design / Remedial Action Update

Twin Cities Army Ammunition Plant: Round Lake

Arden Hills, Minnesota

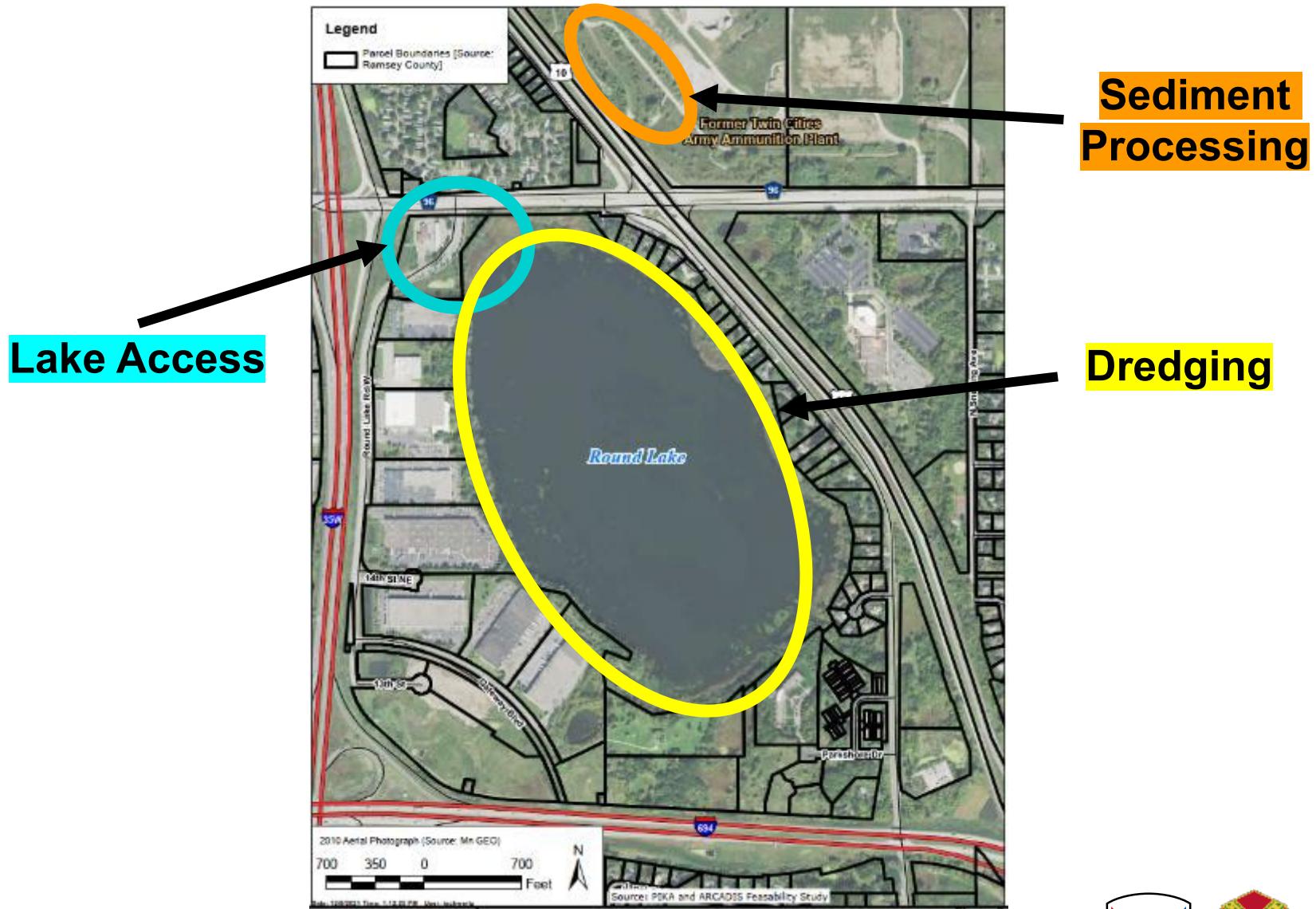
Contract No. W9128F22D0002



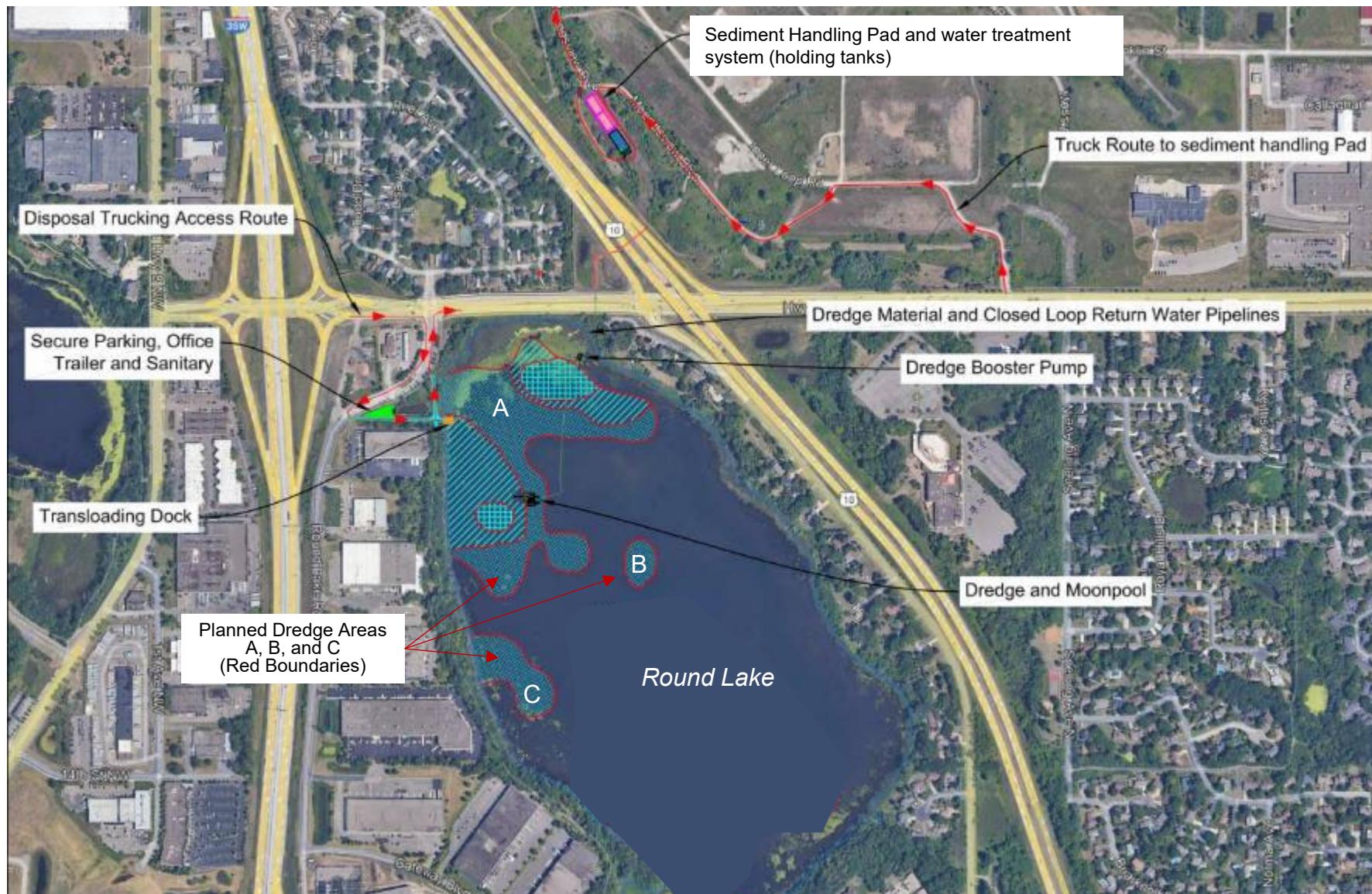
- Round Lake Remedial Action Overview
- MOD for Dredging Areas, Design, and Schedule
- Project Schedule



Round Lake Remedial Action

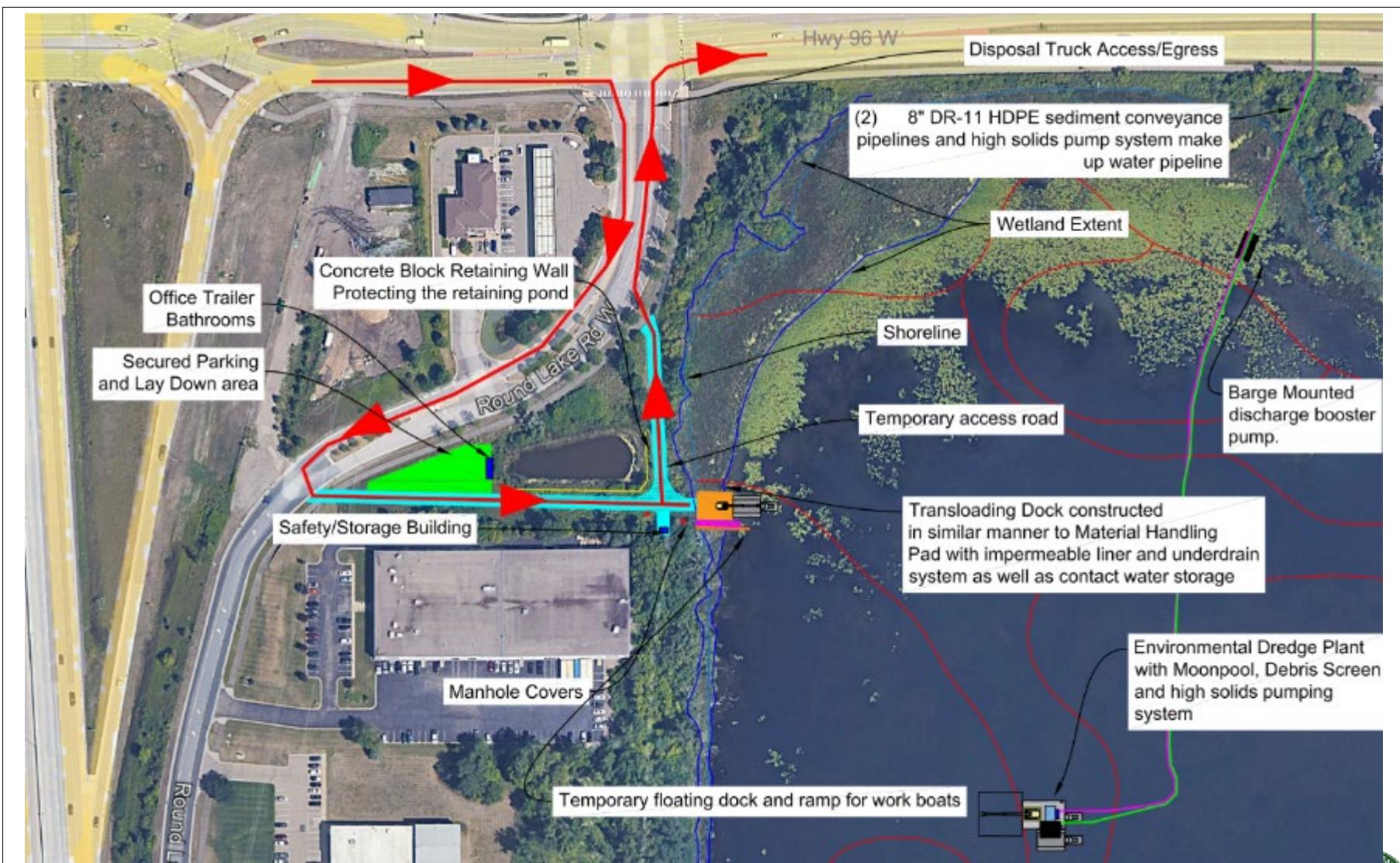


Round Lake Remedial Action



Round Lake Cleanup

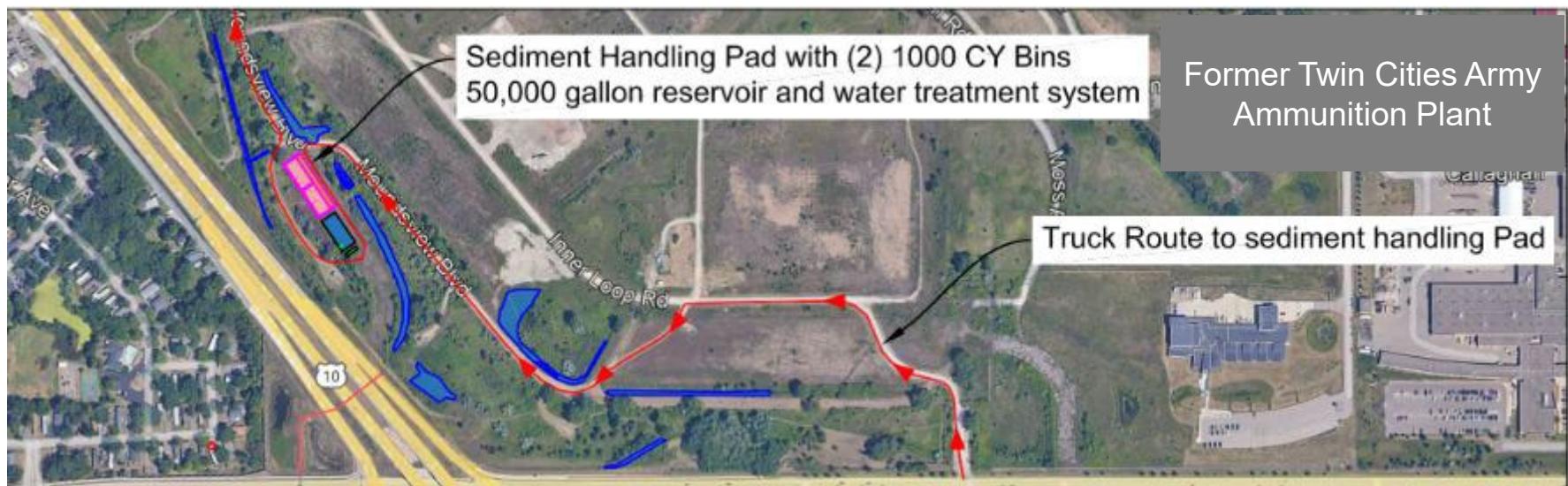
Lake Access



Dredged sediments will be transported to the TCAAP property via pipelines routed through the storm sewer



Round Lake Cleanup Sediment Processing and Potential Truck Route

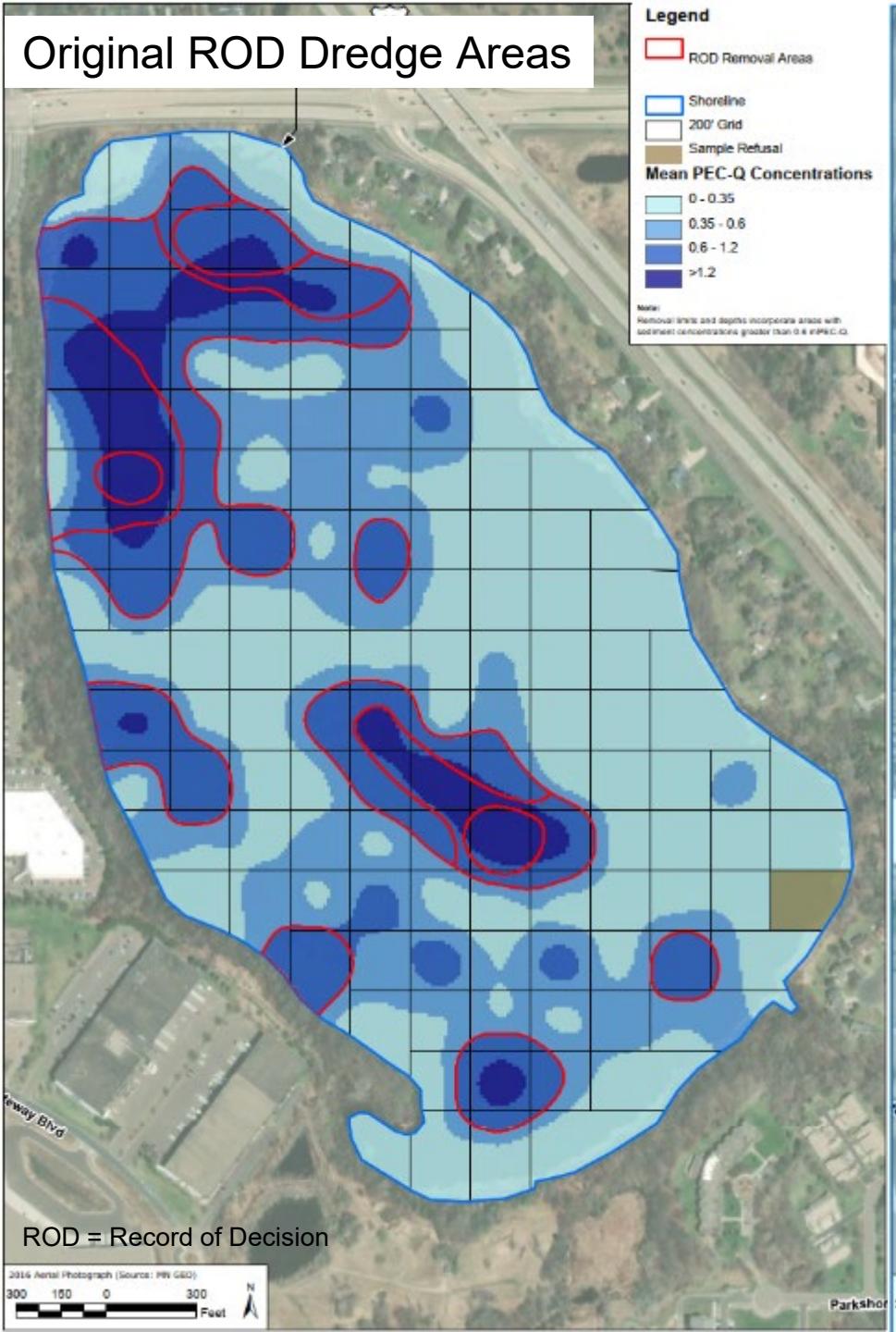


Contract Modification

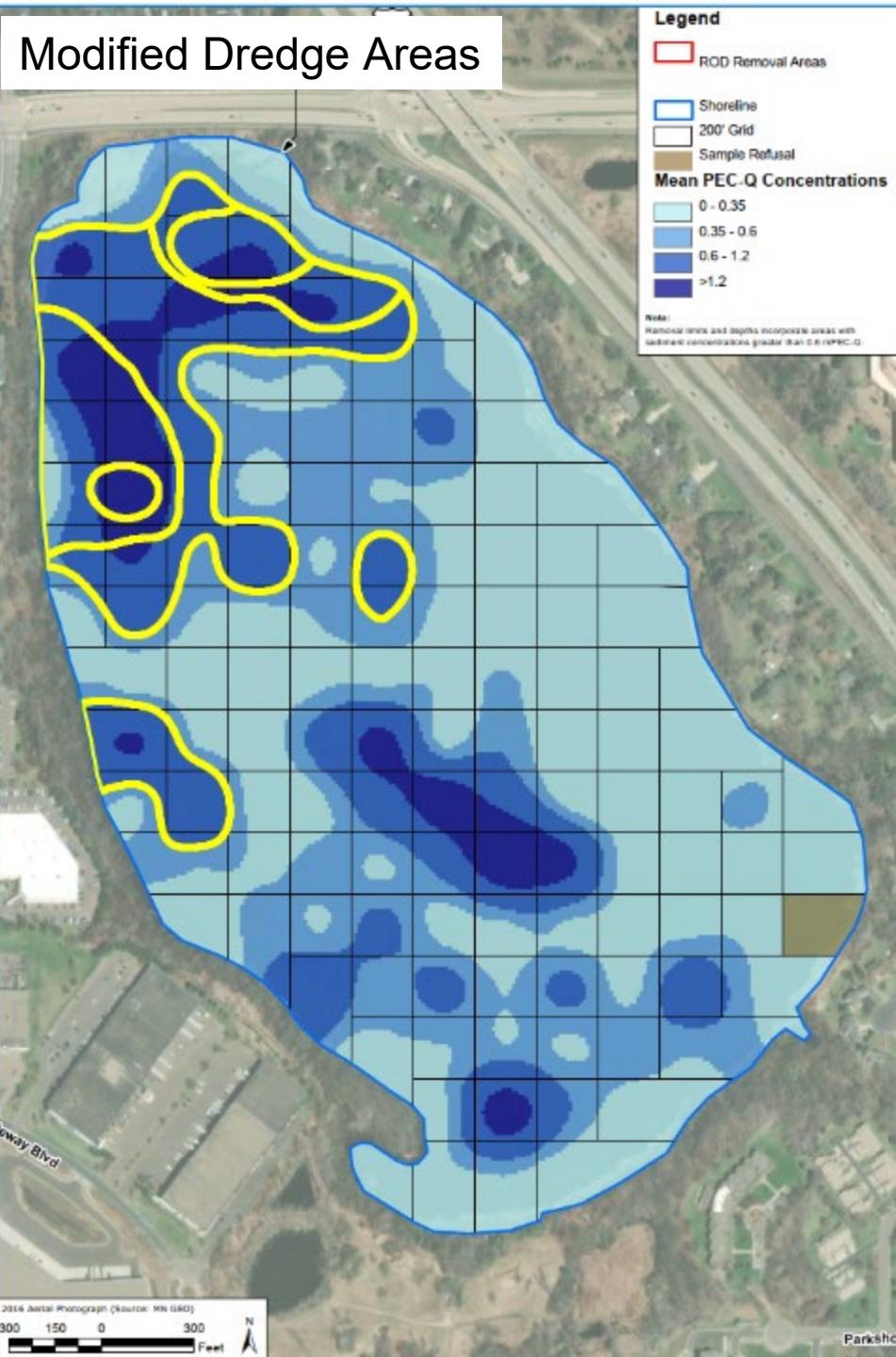
- The Record of Decision (ROD) identified 82,000 cy of sediment within the footprint that exceeds the targeted cleanup level, further investigation showed that the actual volume in the footprint is 156,000 Cubic Yards (cy), this is 74,000 cy more than what was specified in the ROD and what this contract was originally scoped and funded for.
- After several discussions with the TWG, it was decided the best course of action was to dredge as much of the originally scoped 82,000 cy and targeting the rest in a future contract.
- Due to the cost associated with modifying the contract and no additional funding being available, the dredge volume was reduced from 82,000 cy to 76,000 cy to fund the modification.
- The Army identified three selected dredge areas that total closest to the contracted removal volume. The TWG approved the selection.



Original ROD Dredge Areas



Modified Dredge Areas



Impacts of Government Shutdown

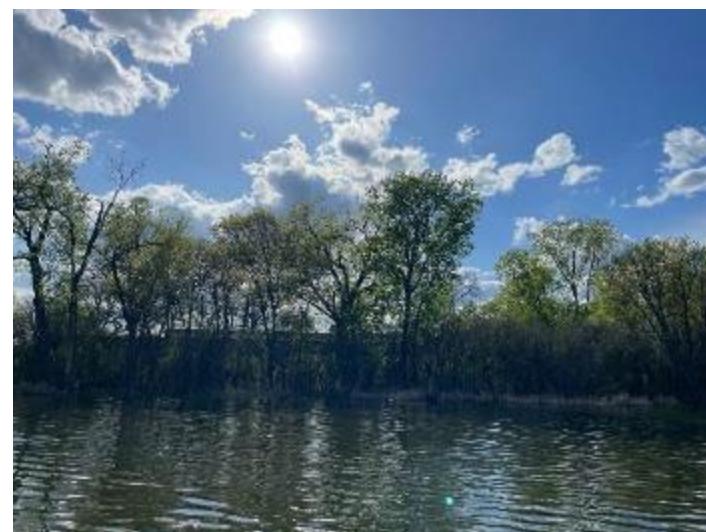
- Due to a lapse in federal appropriations between October 1 and November 12, and further delay in USACE funding through January 20, there was a significant delay in document review and project milestones.
 - Stakeholders are looking for ways to expedite the project timeline to makeup as much time as possible to allow for mobilization in Spring 2026.
 - The remediation will be conducted over two construction seasons (2026 – 2027) starting in July 2026.



Round Lake Cleanup Schedule

Recent Activity

- Remedial Design Report
 - Draft 60% Design submitted October 2025
 - Regulatory comments on 60% Draft received January 2026
 - Army comments on 60% Draft received February 2026
- Quality Assurance Project Plan
 - Regulatory comments on Draft received late 2025
 - Response to comments in progress
 - Army to review response to comments in March 2026
- Technical Meetings
 - February 2026 Stakeholder and RAB Meetings



Round Lake Cleanup Schedule

Upcoming Activities

- Remedial Design
 - Quality Assurance Project Plan: June 2026
 - Final Remedial Design: July 2026
- Remedial Action
 - Vegetation Clearing: March 2026
 - Preparation of Sediment Processing and Access Areas: April – July 2026
 - Sediment Removal Activities
 - Season 1: July – December 2026
 - Season 2: April – December 2027
- Technical Meetings
 - March 2026 Technical Workgroup Meeting (60% Remedial Design)



- Draft Final FY23 Annual Performance Report (APR) in regulatory review. Draft Final FY24 APR in regulatory review. FY25 APR is being written concurrently and will incorporate working comments from current version.
- TGRS Operating Strategy Revision in process
- FY25 Annual groundwater sampling and land use control inspections completed.
- Sixth Five-Year Review signed off by regulators, with final concurrence given by EPA on 26 September 2025.



TCAAP Cleanup Status Update



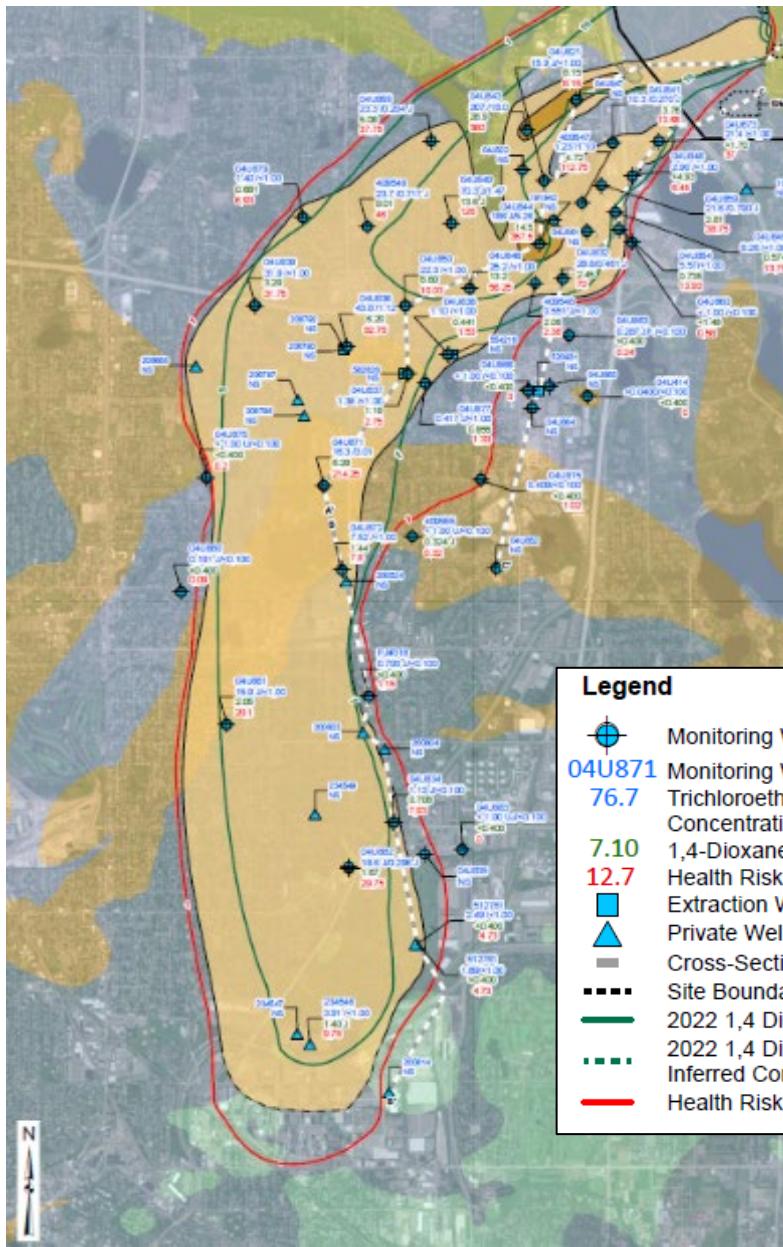
LEGEND:

- Operable Unit 1 (North Plume)
- 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.)
- Operable Unit 3 (South Plume)
- Municipal Boundaries

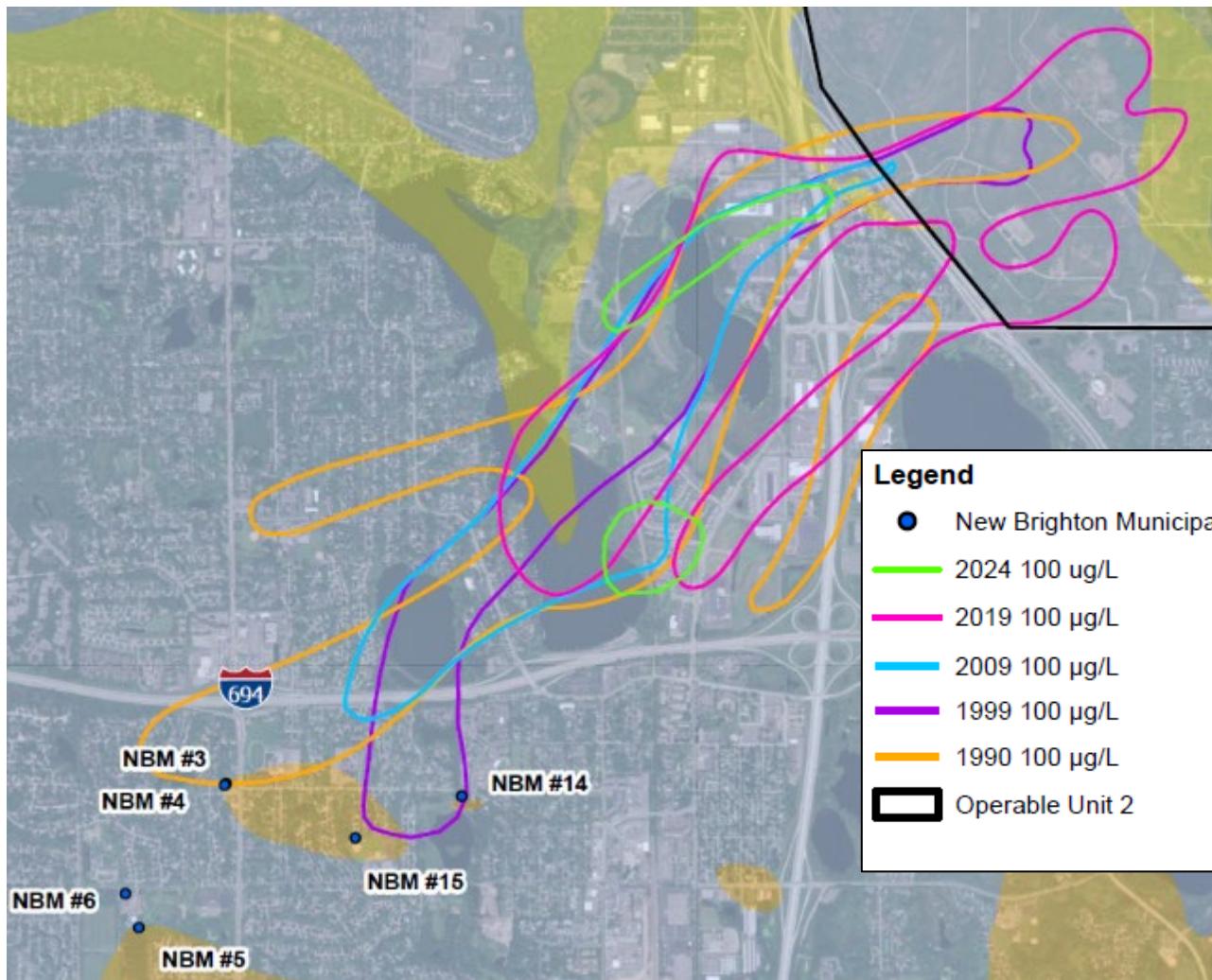
- Draft Final FY23 and FY24 APRs under regulatory review. Comments will be incorporated and Final reports distributed as soon as possible. FY25 APR is being written concurrently and will incorporate working comments from current version once finalized. FY25 APR submission will be delayed because of this.
- Completed annual groundwater sampling (minor year) of OU1 monitoring wells in Summer 2025.
- Groundwater data will be validated and will be incorporated into the Draft Final FY25 APR.
- Annual plume maps are available in the respective APRs, most recently updated in the Draft Final FY24 APR. Final revisions underway and will be reflected in Final FY24 and subsequent Draft FY25 APR.
- Statistical evaluation of monitoring well network currently in progress. Results expected FY26.
- Groundwater sampling allows the Army to monitor the plumes, assess remedy performance, and update the maps.



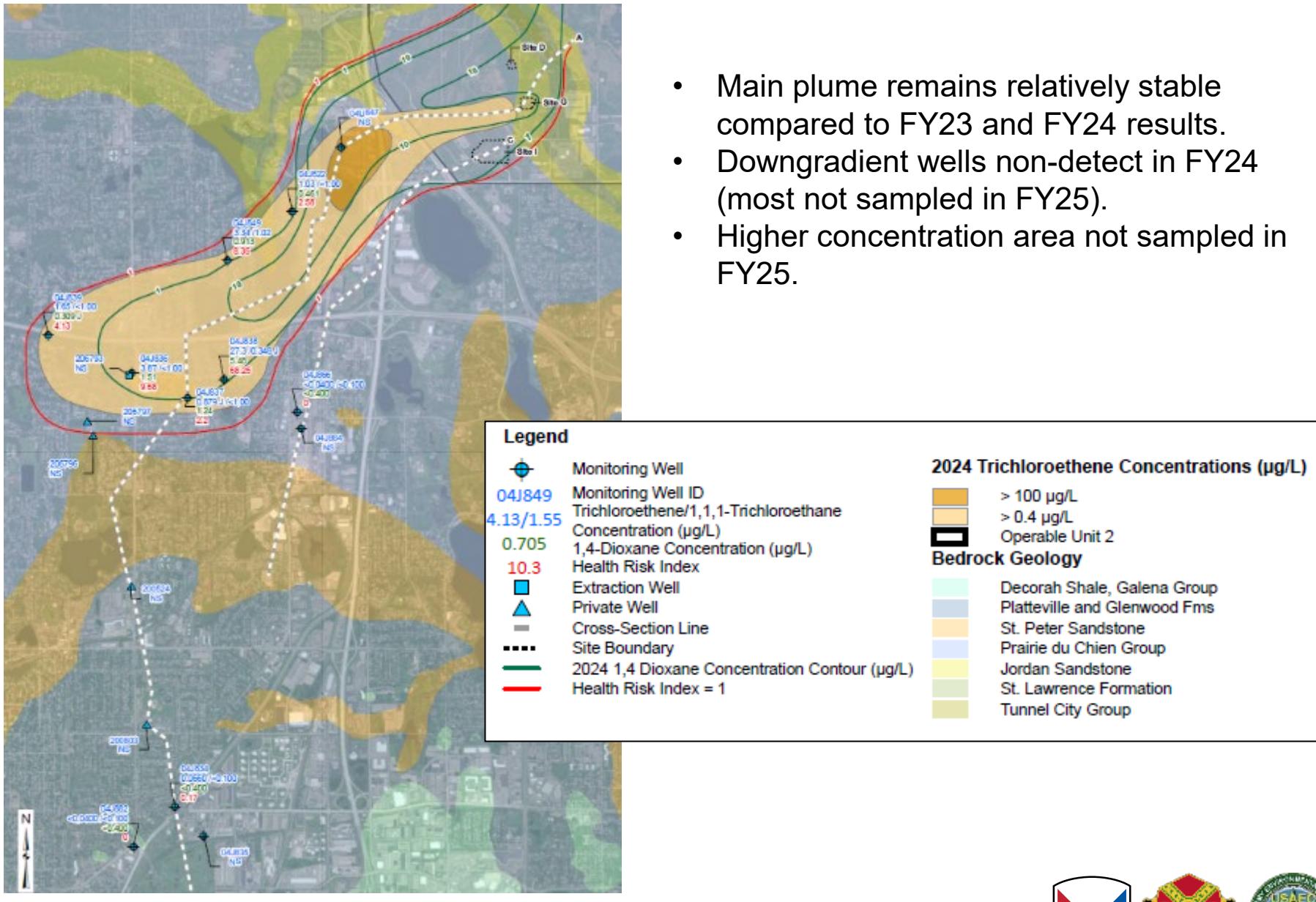
FY24 – Prairie du Chien Plume Map



- FY24 Plume (major year) remained relatively stable compared to FY23. FY25 results (minor year) continued to remain stable.
- Some minor fluctuations (both increases and decreases) spread throughout the plume.
- Higher concentration area ($>100\text{ug/L}$) remains as two distinct lobes (shown on next slide), consistent with FY24 results.



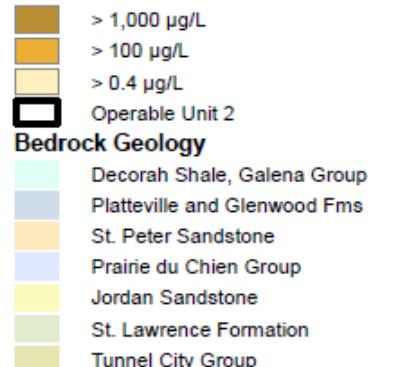
FY24 – Jordan Plume Map



Legend

- Monitoring Well
- 04U871 Monitoring Well ID
- 76.7 Trichloroethene/1,1,1-Trichloroethane Concentration (µg/L)
- 7.10 1,4-Dioxane Concentration (µg/L)
- 12.7 Health Risk Index
- Cross-Section Line
- Site Boundary
- 2024 1,4 Dioxane Concentration Contour (µg/L)
- Health Risk Index = 1

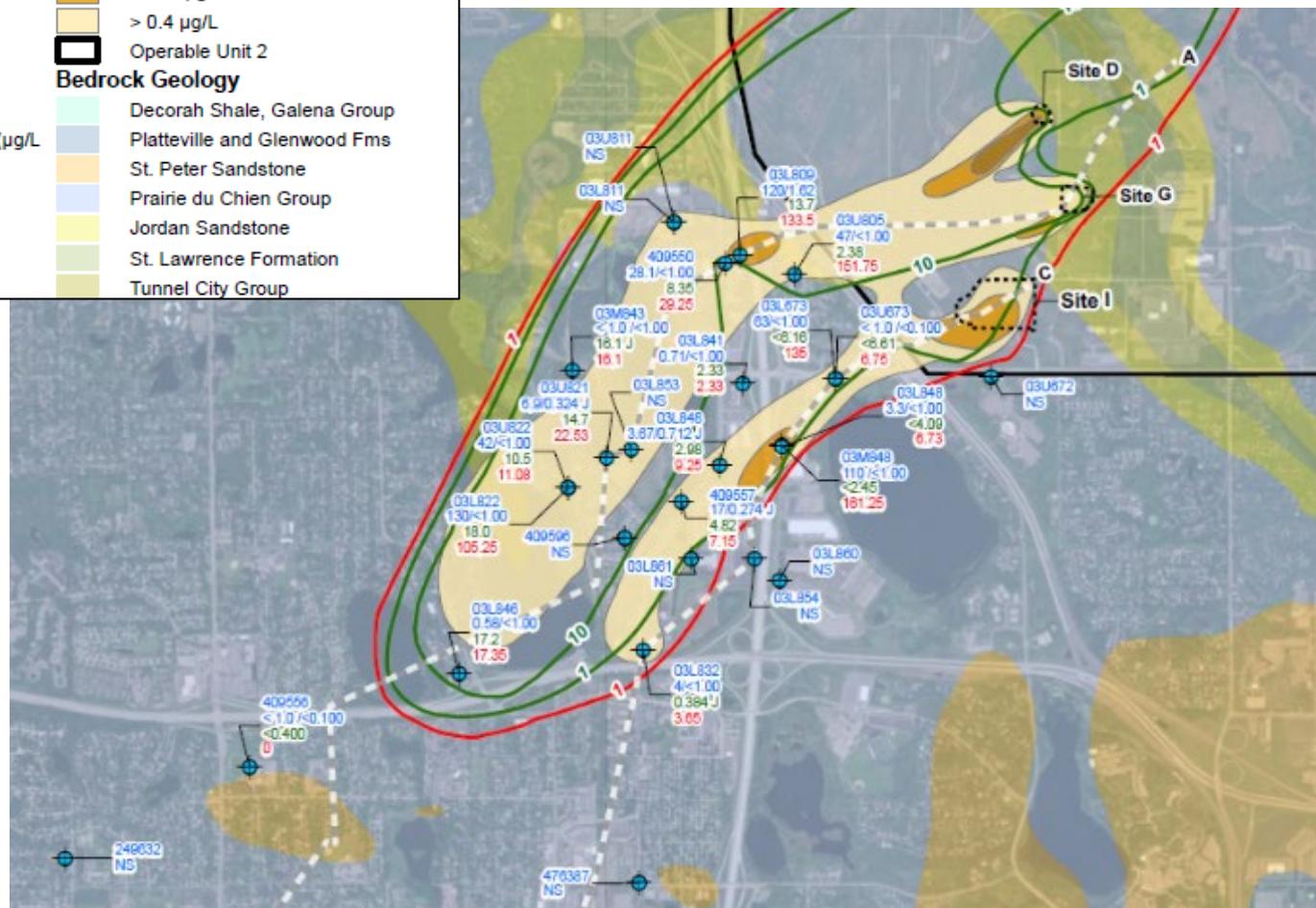
2024 Trichloroethene Concentrations



Bedrock Geology

- Decorah Shale, Galena Group
- Platteville and Glenwood Fms
- St. Peter Sandstone
- Prairie du Chien Group
- Jordan Sandstone
- St. Lawrence Formation
- Tunnel City Group

- Plume remains relatively stable compared to FY23 and FY24 results. Appears mid-concentration ($>100\text{ug/L}$) area has split and migrated slightly.
- Higher concentration area ($>1,000\text{ug/L}$) consistent with FY23 and FY24 results.



Twin Cities Army Ammunition Plant Cleanup

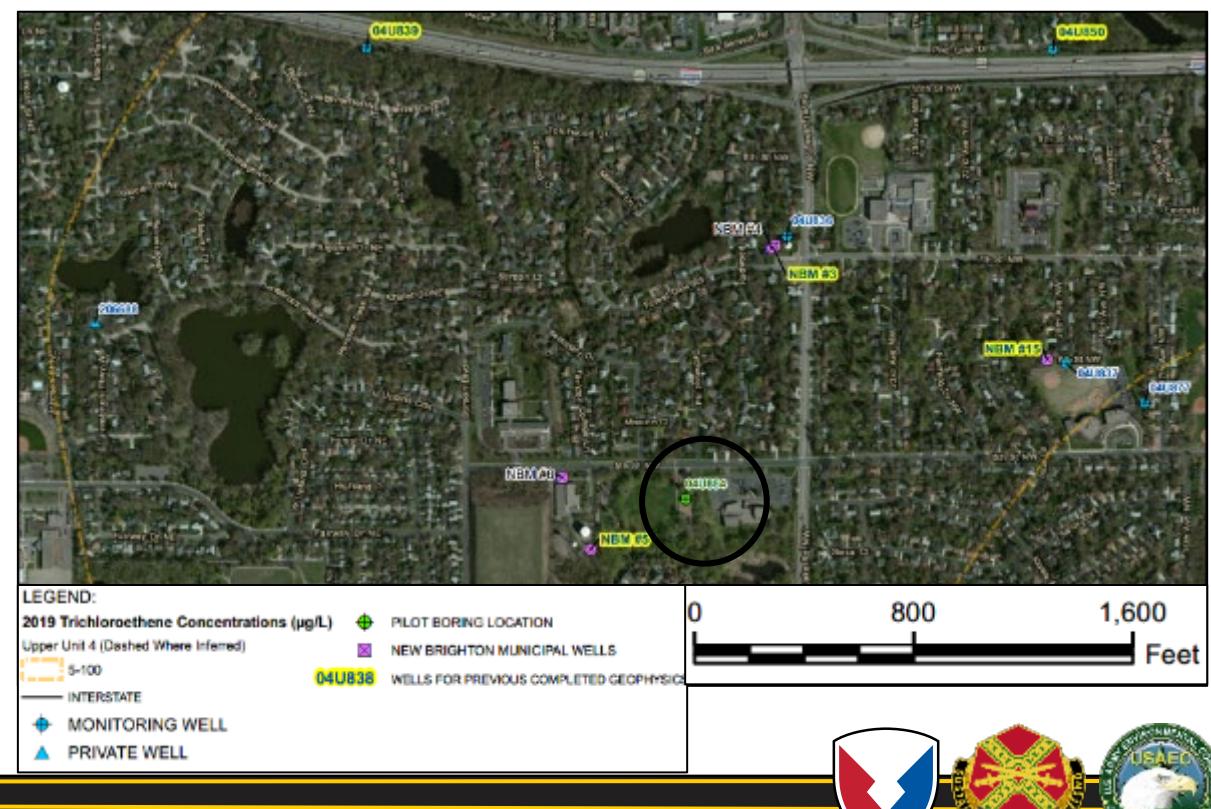


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- Operable Unit 2 of the New Brighton/Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)
- Operable Unit 3 (South Plume)
- Municipal Boundaries

OU1 Optimization Objectives

- Generate data to support siting and design of a potential New Brighton (NB) recovery well:
 - Optimize plume control and mass recovery.
 - Meet NB requirements for production volume and integration with existing drinking water system.
- Identify potential refinements to NB operation to optimize plume control and mass recovery.
- City has awarded a contract to Traut to install new well, drilling planned for Spring 2026, expected to be operational by end of 2026.



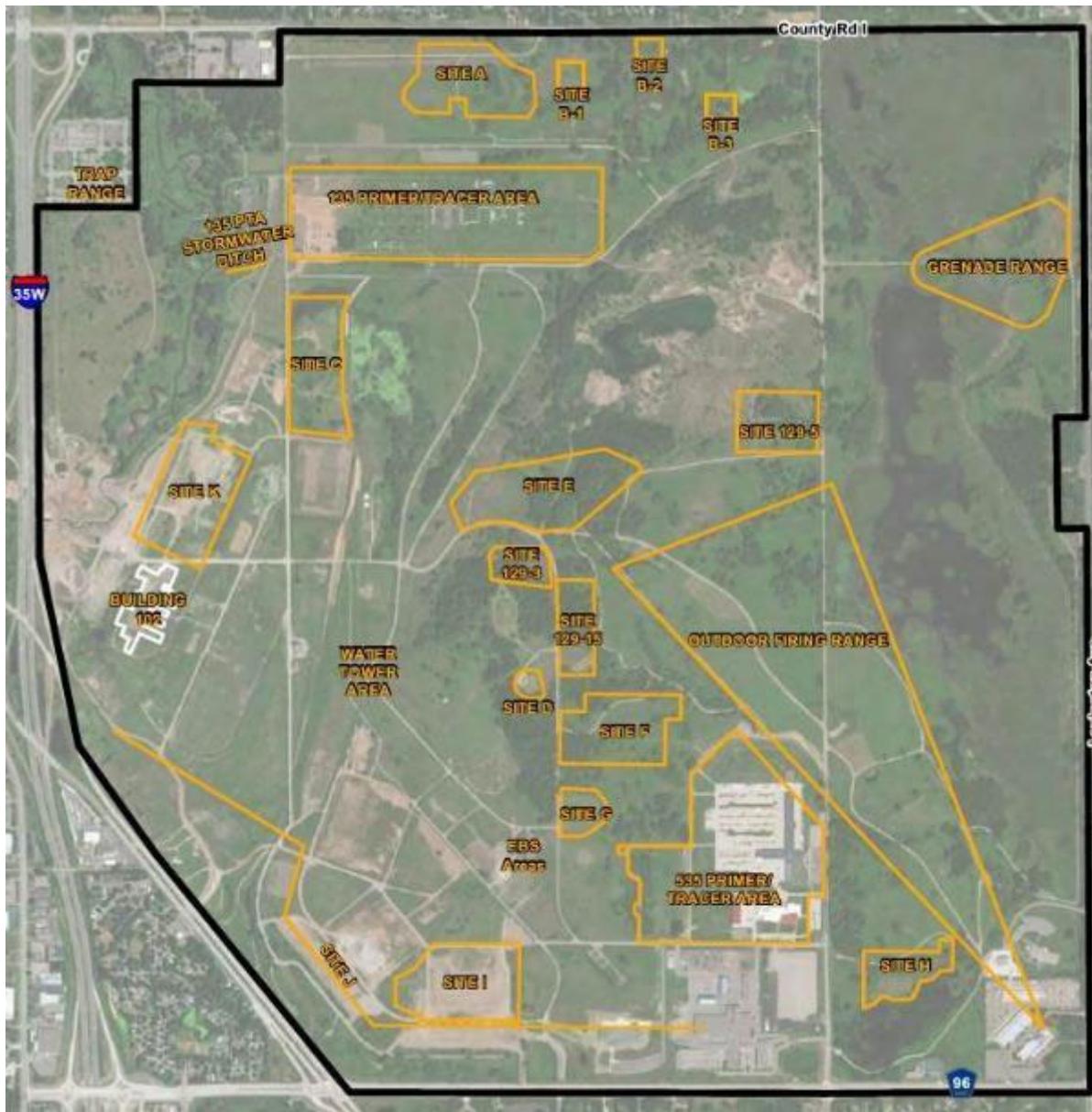
Twin Cities Army Ammunition Plant Cleanup



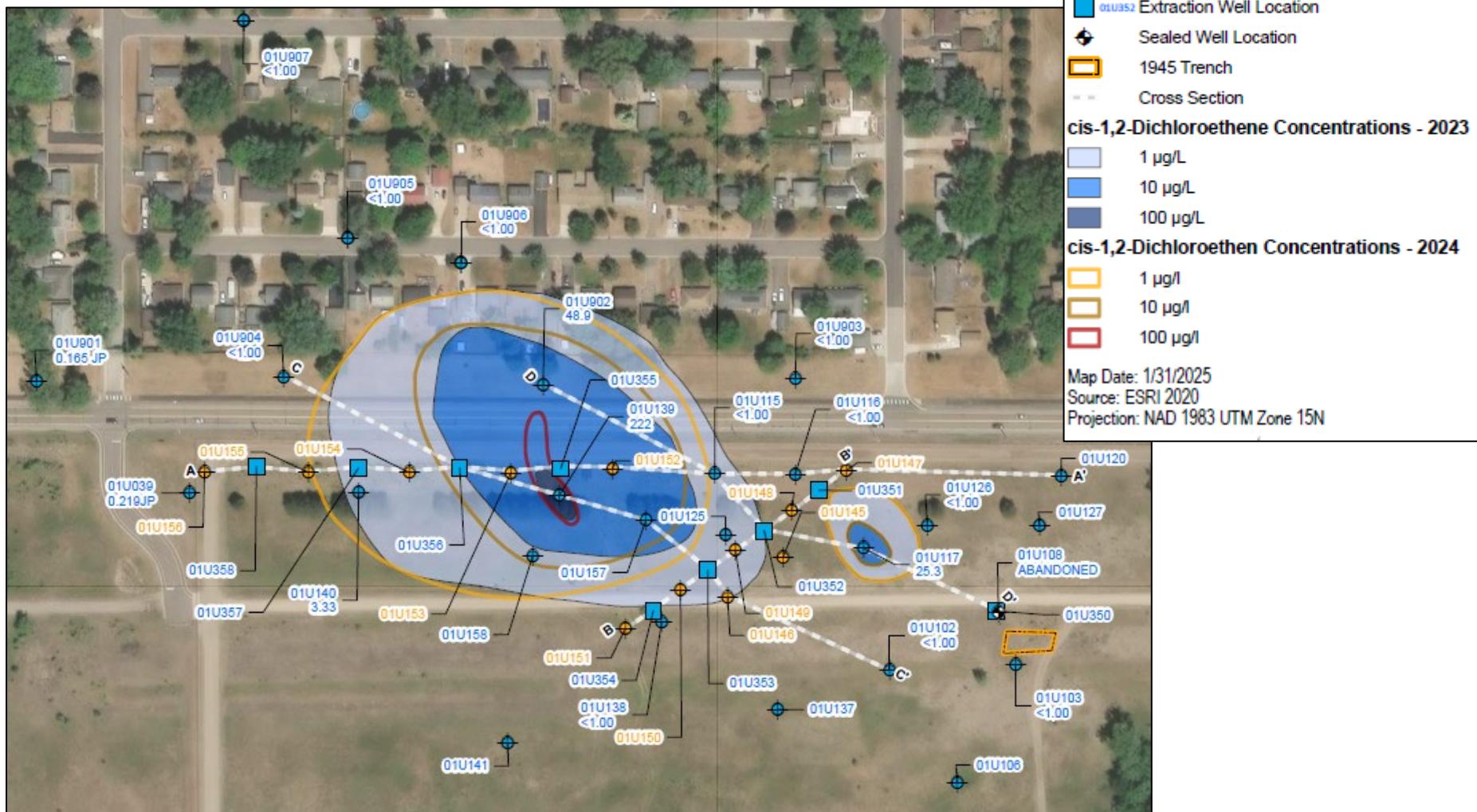
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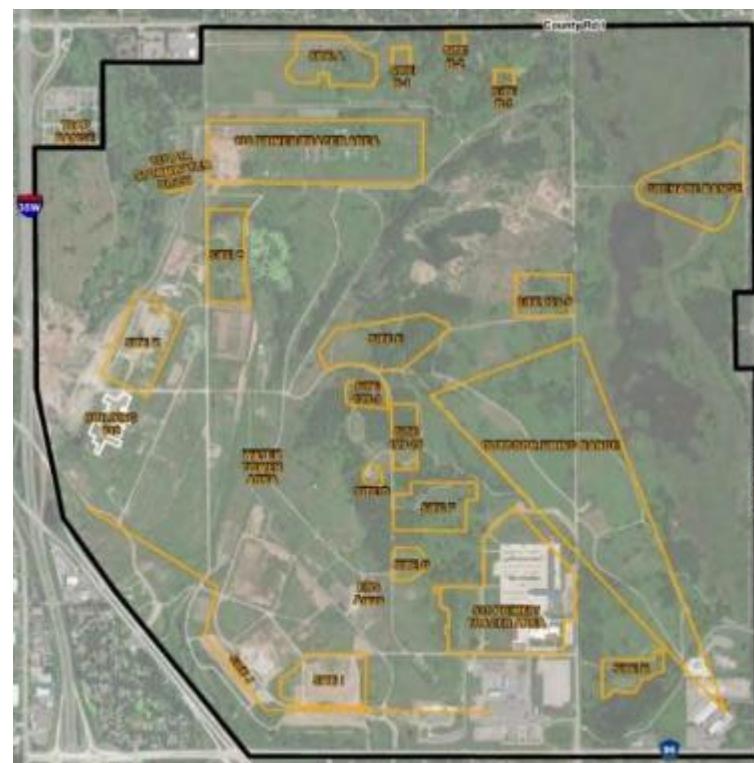
OU2 – Site A Monitored Natural Attenuation



- Main plume (FY24) relatively stable compared to FY23. FY25 results remain consistent.
- Plume continues to remain relatively stationary; no evidence of migration to the northern residential area.



- Two locations exceed cleanup level in FY25 compared to one location in FY24. Exceedances have been previously observed at these locations.
- Plume remains relatively stable.
- Continue monitored natural attenuation.



OU2 – Site C Monitored Natural Attenuation



Legend

- Monitoring Well Location
- Sealed Well Location
- Surface Water Sampling Locations
- Annual Monitoring Locations
- Ditch
- Location of Plot for Phytoremediation Demonstration

■ Approximate Boundary of Wetland Constructed in 2007

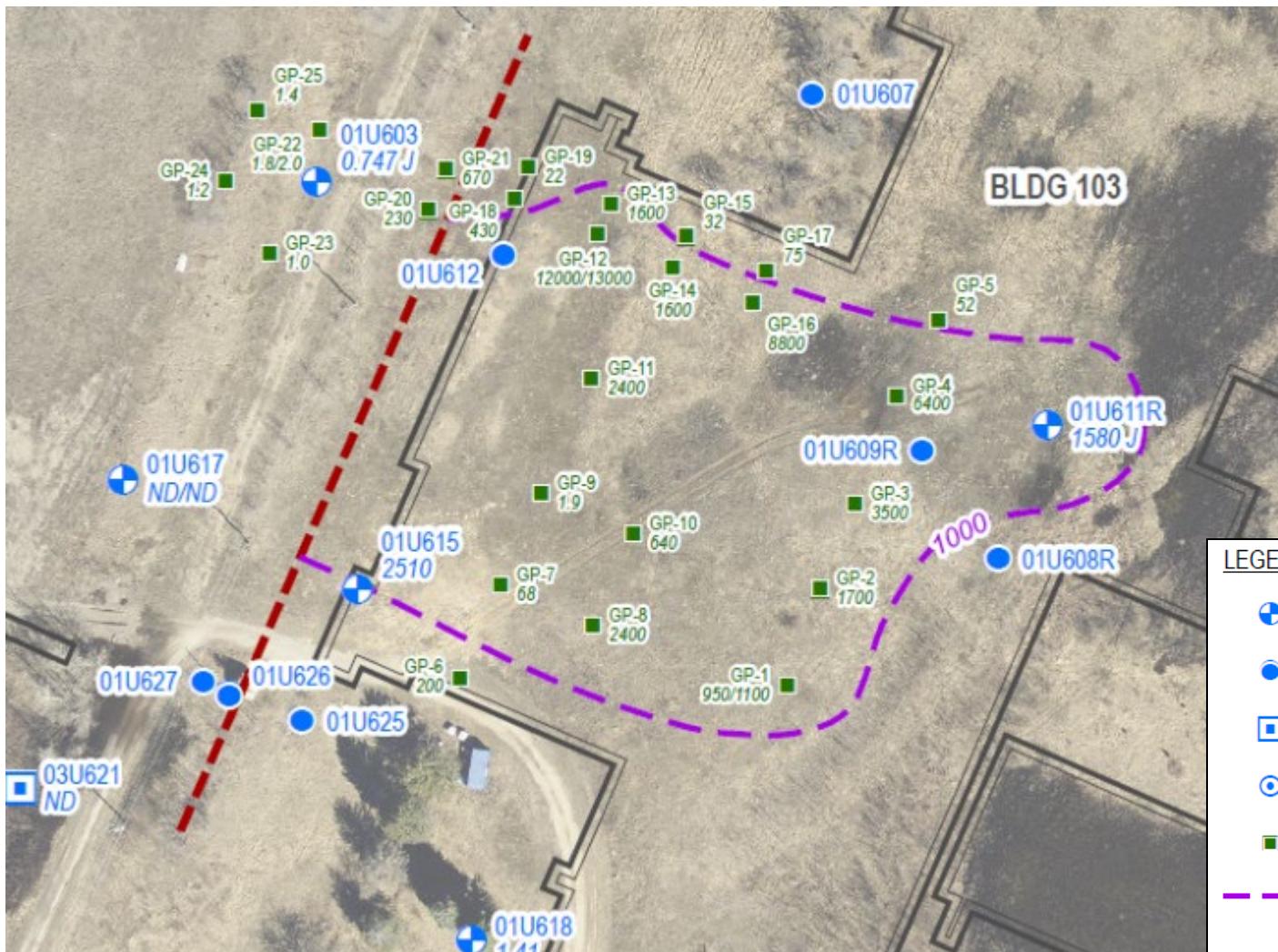
— Cross Section

■ 15 µg/L Lead Contour (2024)

- Groundwater collection system continues to provide containment of the horizontal and vertical extent of the TCE plume.
- Annual groundwater sampling for FY25 completed in June 2025.
- June 2025 groundwater sample results confirmed trend of stable or decreasing TCE over 20+ years.
- FY25 & FY26 quarterly treatment system samples collected to date met applicable discharge limits.



OU2 – Site K Pump and Treat



LEGEND

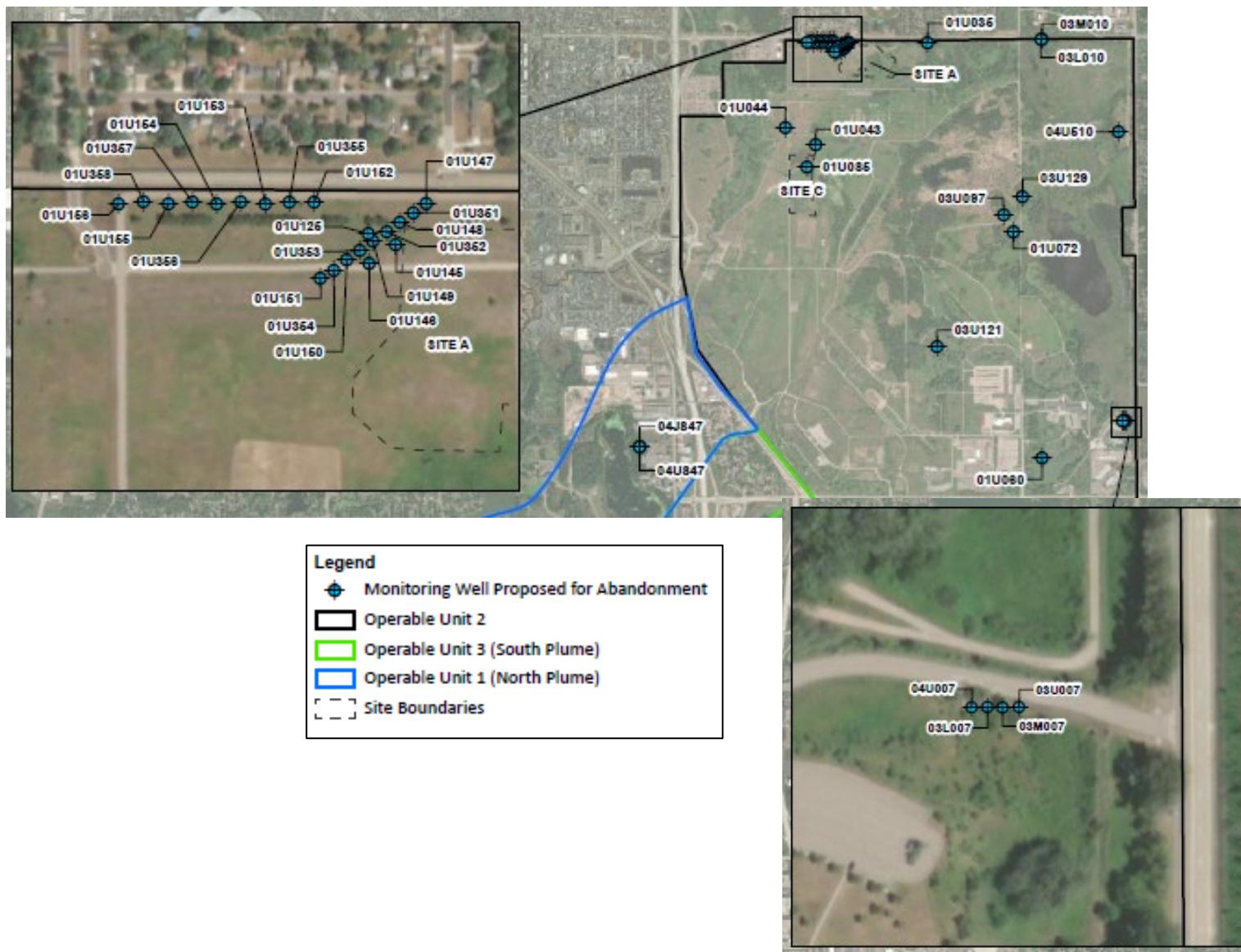
- ANNUAL UNIT 1 WATER QUALITY MONITORING WELL LOCATION
- ANNUAL UNIT 1 WATER LEVEL MONITORING WELL LOCATION
- UNIT 3 SENTINEL WELL LOCATION
- BUILDING 102 MONITORING WELL (SAMPLED IN MAY 2024)
- GEOPROBE BORING LOCATION FROM 2014 INVESTIGATION
- 1000 µg/L TCE PLUME LIMIT (ESTIMATED BASED ON 2014 DATA)
- SITE K COLLECTION TRENCH LOCATION
-  HISTORICAL BUILDING / STRUCTURE



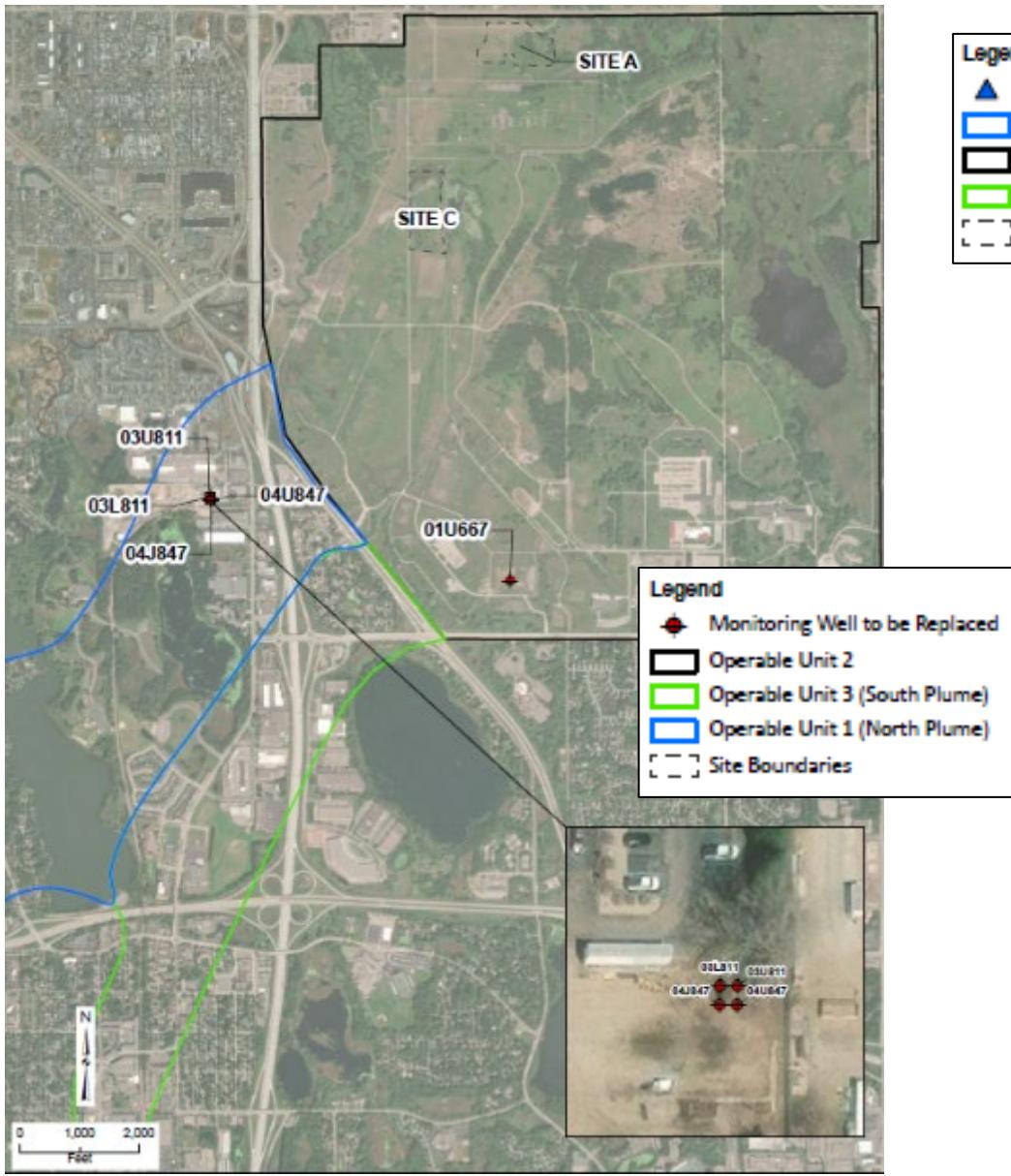
- Abandonment of three industrial wells in OU1 and 42 monitoring wells in OU2.
- Reinstallation of four monitoring wells in OU1 and one monitoring well in OU2.
- Monitoring well reinstallation in OU1 pending successful right-of-entry negotiations.
- All activities planned for FY26.



OU1/OU2 Well Abandonment and Reinstalation

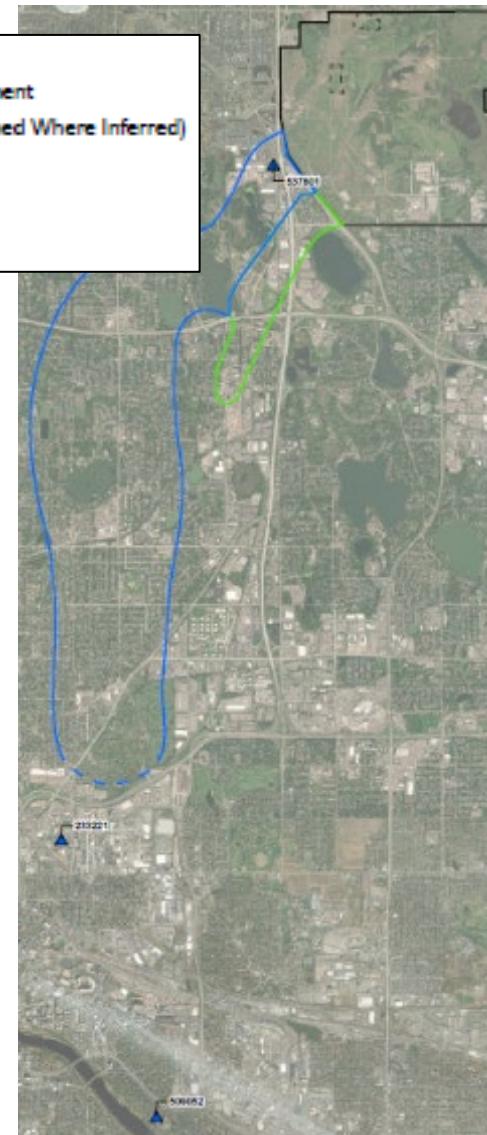


OU1/OU2 Well Abandonment and Reinstallation



Legend

- ▲ Private Well Proposed for Abandonment
- Operable Unit 1 (North Plume) (Dashed Where Inferred)
- Operable Unit 2
- Operable Unit 3 (South Plume)
- [- -] Site Boundaries



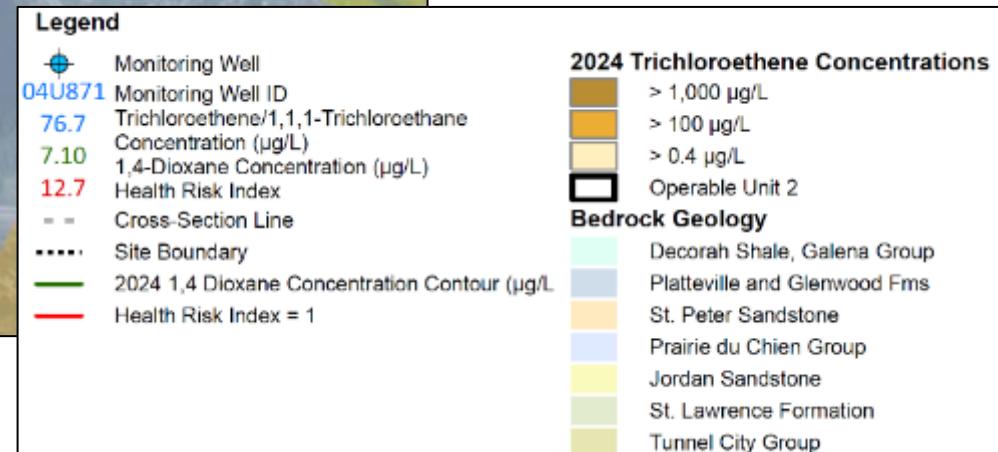
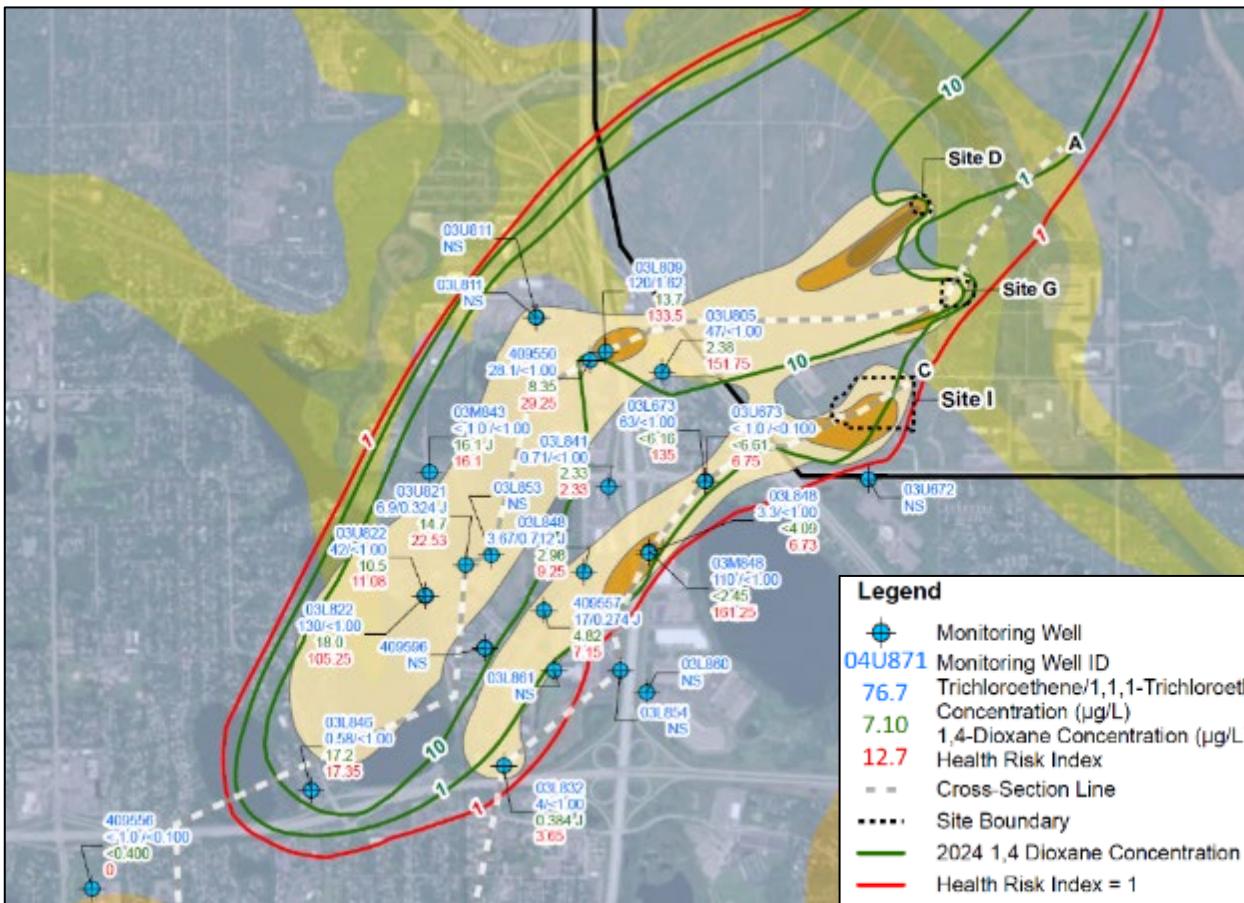
Twin Cities Army Ammunition Plant Cleanup



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- Municipal Boundaries

- OU3 plume remains relatively stable – FY25 results were consistent with FY24.
- Continued monitored natural attenuation.
- Annual groundwater sampling completed in Summer 2025.



Update on the Deep Groundwater TCAAP Groundwater Recovery System (TGRS)



OU2 Optimization – TGRS Layout

Boundary Groundwater Recovery System (BGRS)

Source Area Groundwater Recovery System (SGRS)

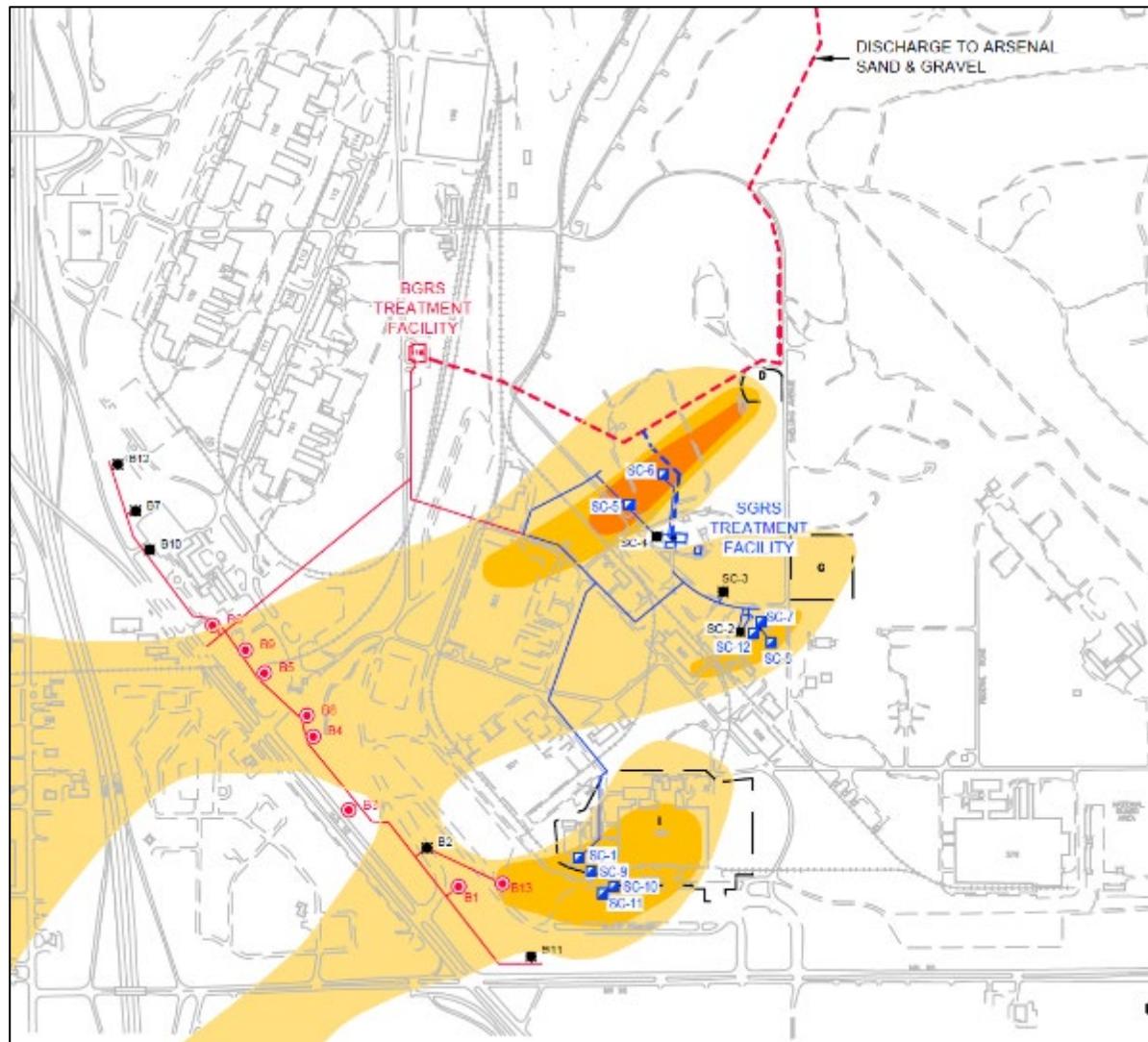
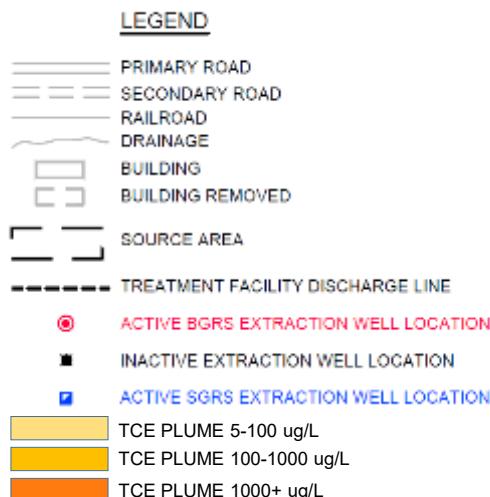
**BGRS + SGRS =
TGRS**



Boundary Groundwater Recovery System (BGRS)

Source Area Groundwater Recovery System (SGRS)

**BGRS + SGRS =
TGRS**



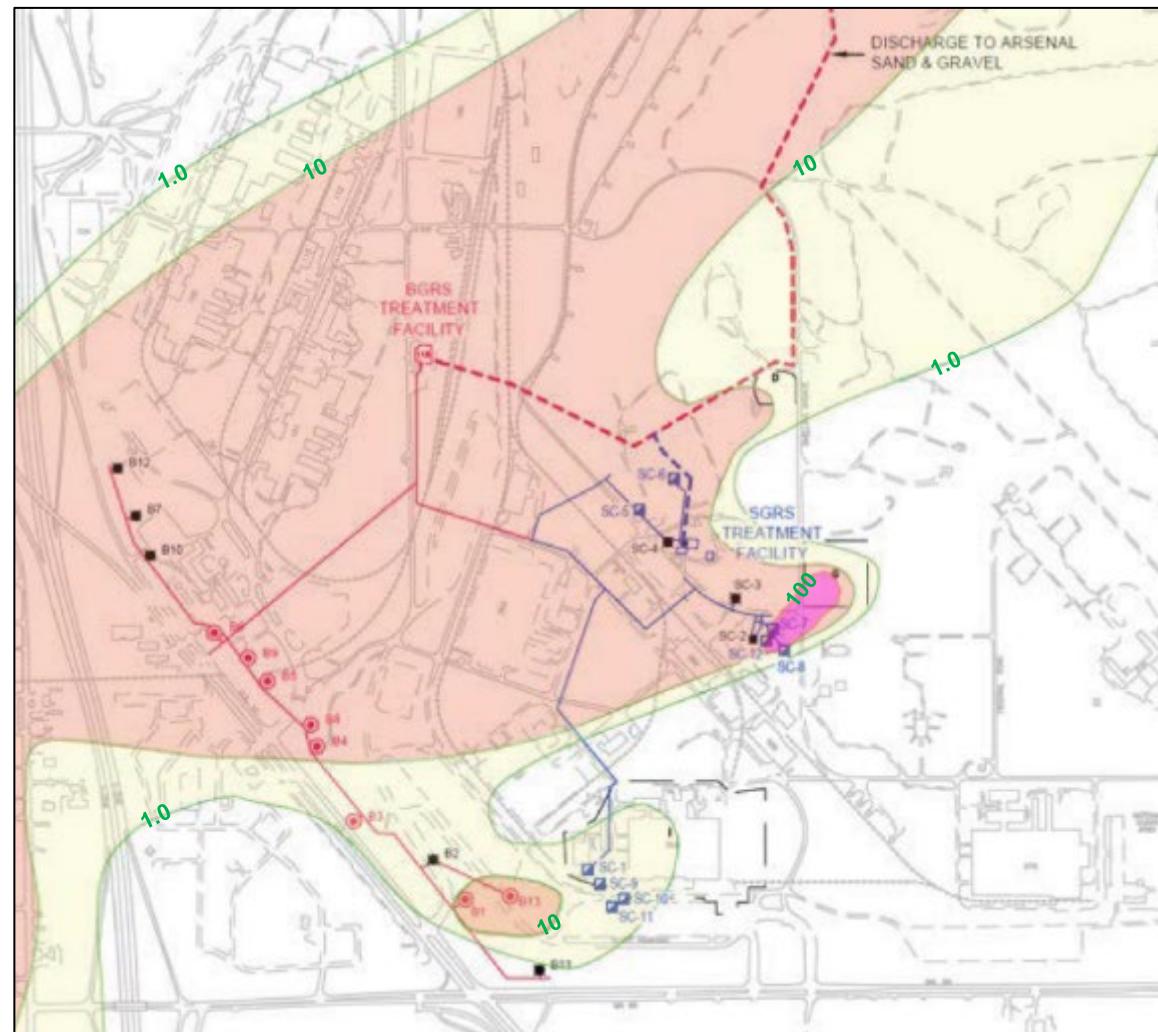
Boundary Groundwater Recovery System (BGRS)

Source Area Groundwater Recovery System (SGRS)

BGRS + SGRS = TGRS

LEGEND

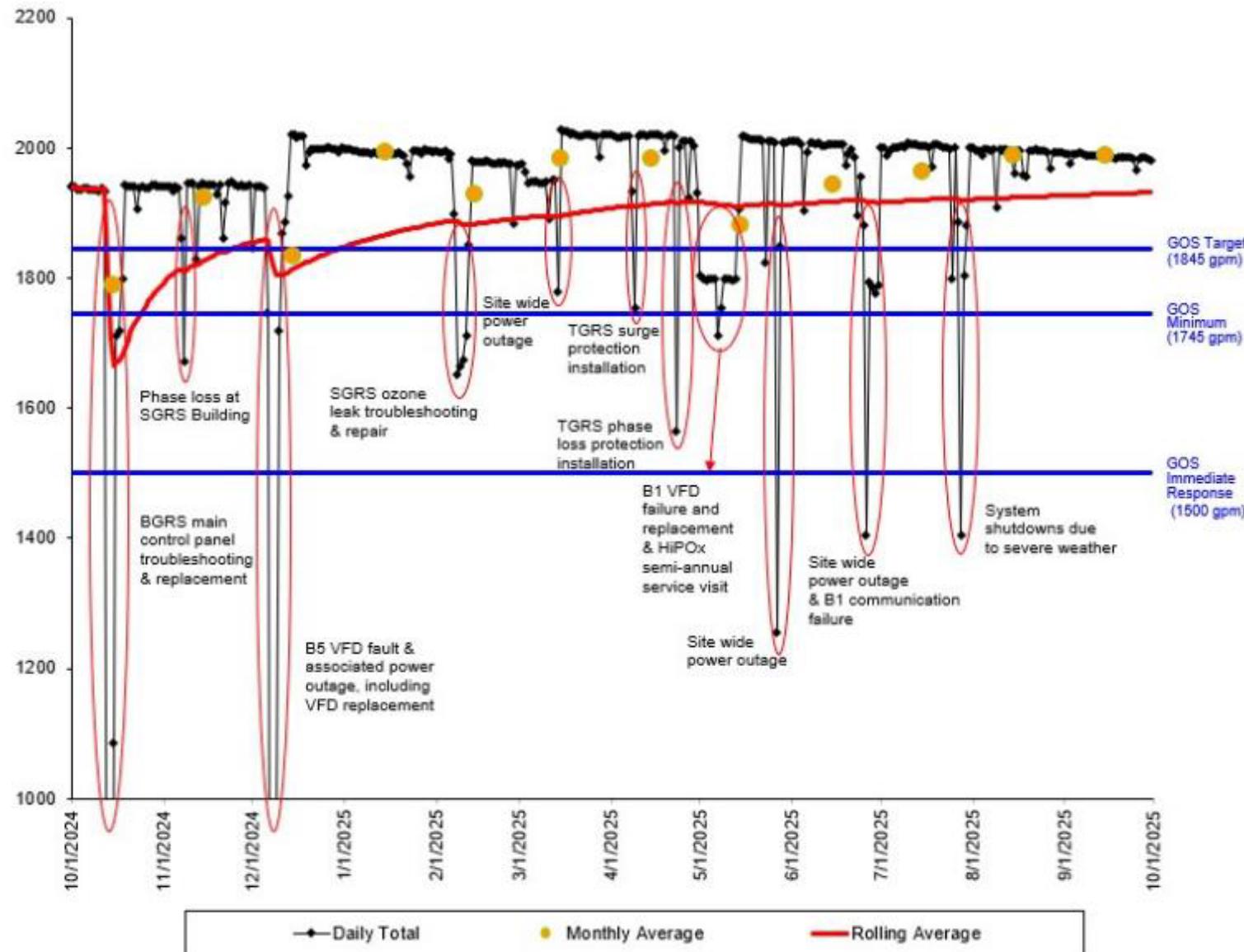
- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- TREATMENT FACILITY DISCHARGE LINE
- ACTIVE BGRS EXTRACTION WELL LOCATION
- INACTIVE EXTRACTION WELL LOCATION
- ACTIVE SGRS EXTRACTION WELL LOCATION
- 1,4-DIOXANE CONTOUR



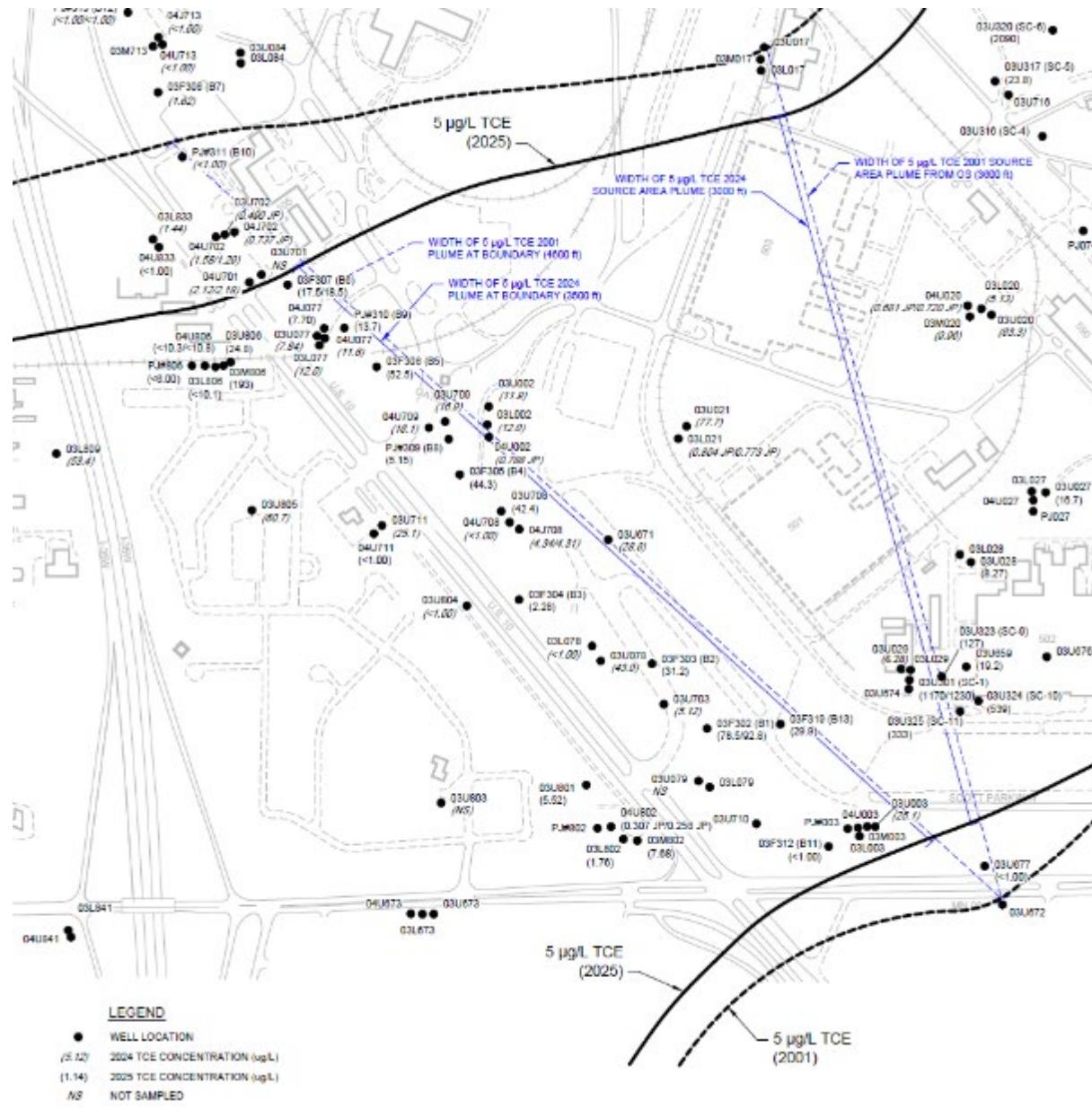
- The FY25 annual average extraction rate (BGRS + SGRS) was approximately 1,931 gal per minute (gpm), **well above** the Global Operating Strategy (GOS) Operational Minimum of 1,745 gpm.
- GOS is based on the 2001 TCE plume concentrations
- FY25 TCE plume width is ~17% narrower than the FY01 plume. TCE contained by TGRS during FY25.
- In FY25, the BGRS has pumped 836,163,680 gallons and removed 280 lbs of VOCs; and the SGRS has pumped 178,975,332 gallons and removed 1,280 lbs of VOCs.
- TGRS Operating Strategy Revision is being prepared to optimize contaminant removal & more efficiently sustain hydraulic containment of the source areas.



FY25 Daily Flow Rates



FY25 TCE Plume (3,000 feet wide)



SGRS (Source Area) System Operation – AO + Air Stripper

- System is operating and meeting all 1997 OU2 ROD and 2020 ESD #3 discharge criteria in monthly sampling since start up, including:

SGRS Discharge Criteria	
1,4-Dioxane	1.0 µg/L
TCE	5 µg/L
1,1,1-TCA	200 µg/L
Bromate	10 µg/L

- Full treatment to criteria of 1,4-dioxane and TCE in AO reactor; air stripper only needed for chlorinated alkanes
- Since the SGRS began operation, influent TCE and 1,4-Dioxane concentrations decreased by over 65% through January 2026. TCE and 1,4-Dioxane concentrations in the individual SGRS extraction wells also decreasing.



SGRS startup sampling results:

- Measured contaminants were much less than those assumed-modeled in April 2021
 - No detectable ozone within the SGRS Building (previously assumed @ 0.18 lb/hr),
 - TCE into air stripper less than 5 ug/L (vs. assumed @ 32 ug/L)
- Confirmed through MPCA screening model that SGRS air emissions are below State of Minnesota inhalation risks levels for acute, subchronic, chronic, and cancer exposures for at National Guard fence line.



BGRS (Boundary) System Operation – Air Stripper

- System is operating and BGRS Effluent samples met all 1997 OU2 ROD discharge criteria in monthly sampling completed during FY25.
 - TCE all less than 5 µg/L limit
 - All other contaminants of concern were non-detect (<1.0 µg/L)

BGRS VOC influent concentrations decreased from FY24 to FY25:

Averaging ~40 µg/L



- Development activity has not begun in this area and there are currently no receptors. Modeling and sampling completed in 2020.
- 80% reduction in TCE influent concentrations at BGRS since SC-5 and SC-1 were rerouted from BGRS to SGRS. Influent TCE reduced from 201 µg/L in 2020 to ~30 µg/L *through January 2026*.
- TCE emission rate *through January 2026* = 0.0034 g/s (2020 modeled emission rate = 0.005 g/s).
- Additional air sampling and modeling will be completed for BGRS emissions *prior to permanent non-worker (residential) receptors being on site near the BGRS related to Ramsey County development activities*.

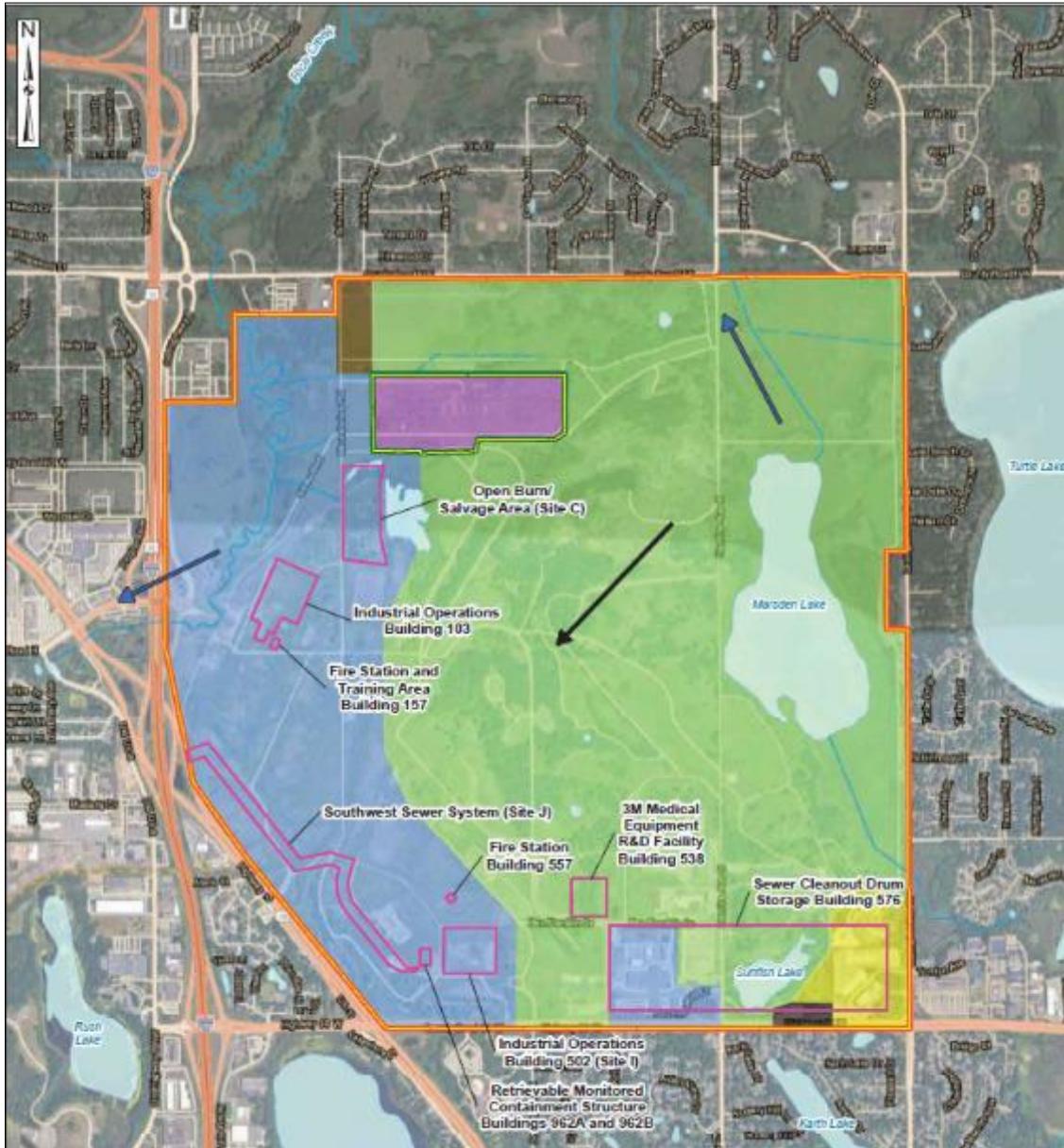


- A Preliminary Assessment and Site Inspection (PA/SI) was finalized in September of 2023.
- In July of 2024, the Army received a joint letter from EPA and MPCA disagreeing with the number of Areas of Potential Interest (AOPIs) moving forward to a Remedial Investigation and Feasibility Study (RI/FS).
- In November of 2024, a discussion between USAEC and EPA was held to discuss a path forwards, this includes a supplemental screening and sampling event to identify sites potentially missed during the PA/SI. This effort will be combined with the RI/FS contract.
- In January 2025, the Department of Defense adopted new screening levels for PFAS. Due to this two additional AOPIs have been added to the RI, the Southwest Sewer System (Site J) and the Open Burn Area/Salvage Area (Site C).
- A RI/FS contract is currently on hold, and some work may be sequenced differently due to FY26 resource adjustments.



- Because of the timeline of the DoD PFAS investigation, Ramsey County is voluntarily performing PFAS screening activities of soils on the Rice Creek Commons parcel.
- Ramsey County has sampled soils for PFAS on the Army identified AOPIs as well as three additional AOPIs in coordination with FFA stakeholders.
 - Validated results expected Spring 2026.
- Next steps
 - FFA stakeholders will coordinate with the county to determine the best route for remediation of these areas.





Current PFAS AOPIs

- Building 103
- Building 157
- Building 502
- Building 576
- Site C
- Site J

Additional AOPIs are under consideration on the Rice Creek Commons parcel.



- USGS Site K Treatability Test



OU2- Site K: USGS Bioremediation Treatability Test

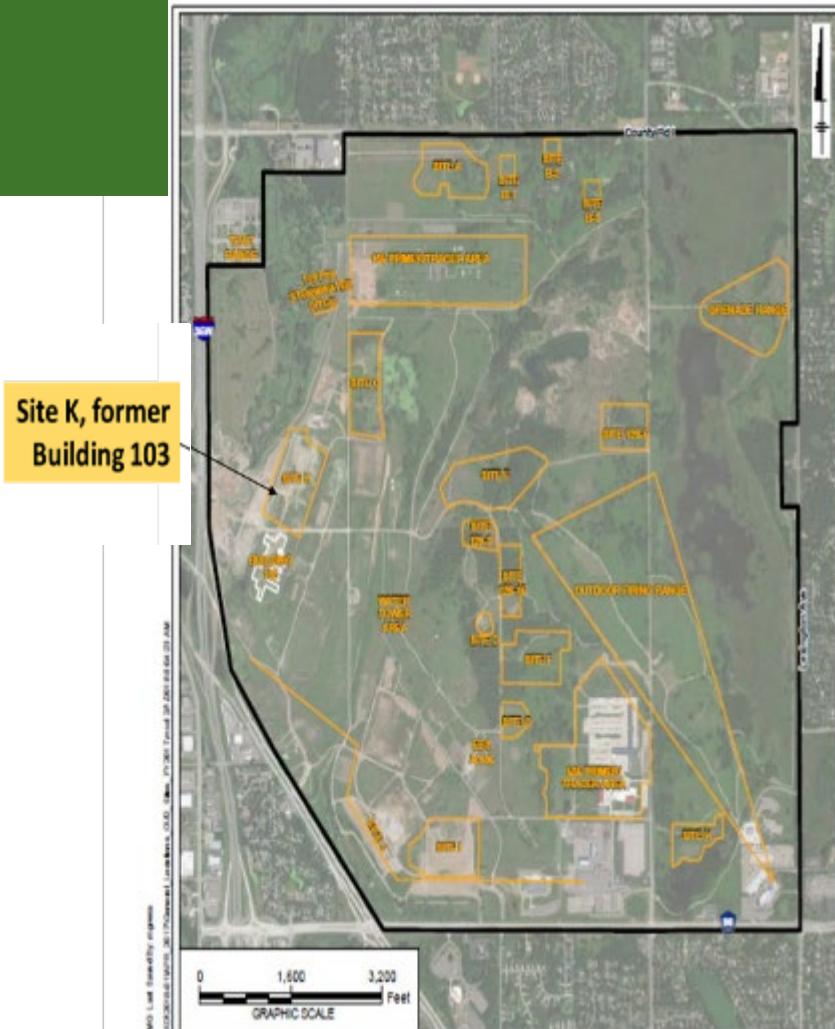


Dr. Michelle M. Lorah
Research Hydrologist
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Restoration Advisory Board Meeting,
TCAAP, MN, February 17, 2026



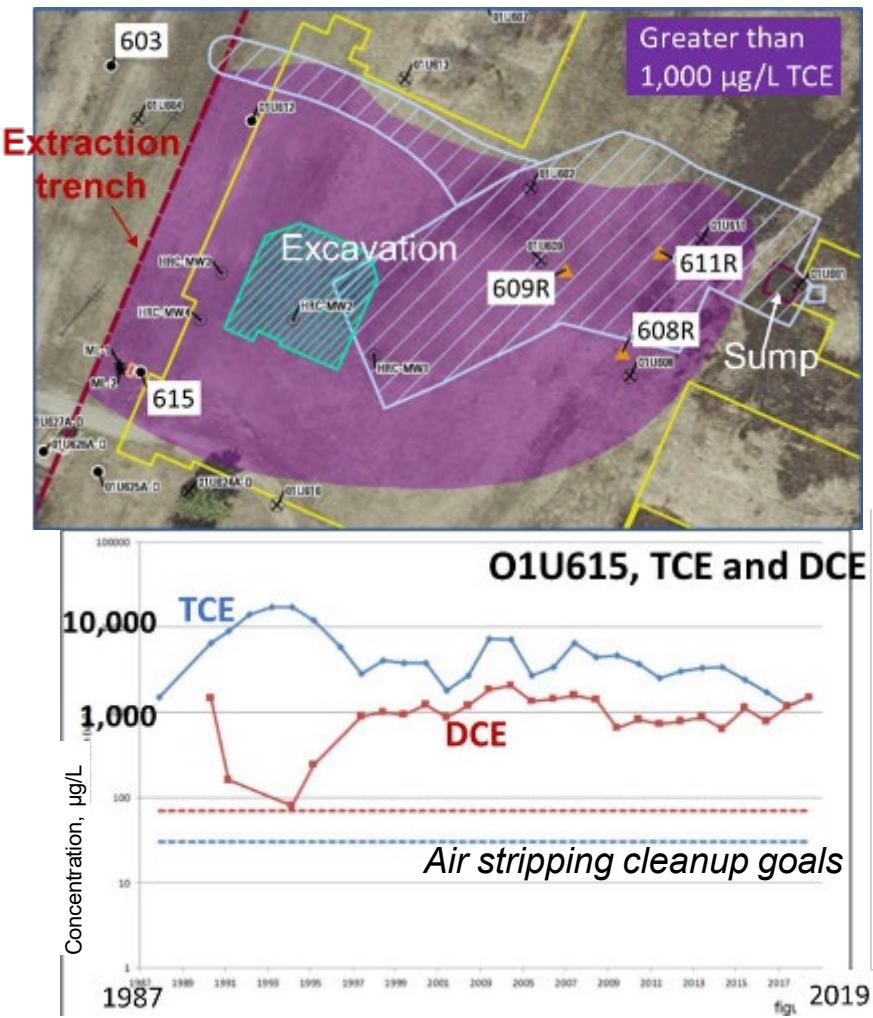
This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.



Purpose

Groundwater extraction and air stripping controlling plume but not decreasing concentrations.

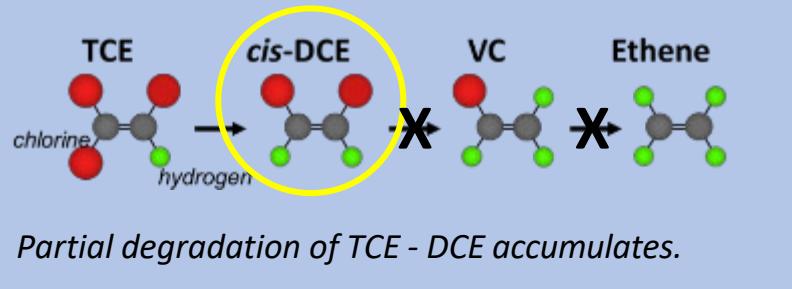
- Improve remediation of trichloroethylene (TCE) and dichloroethylene (DCE) using bioremediation in shallow groundwater.
- Potential complicating factors:
 - Fluctuating water table and flow directions in shallow groundwater
 - Residual sorbed or separate solvent phase at base of groundwater unit



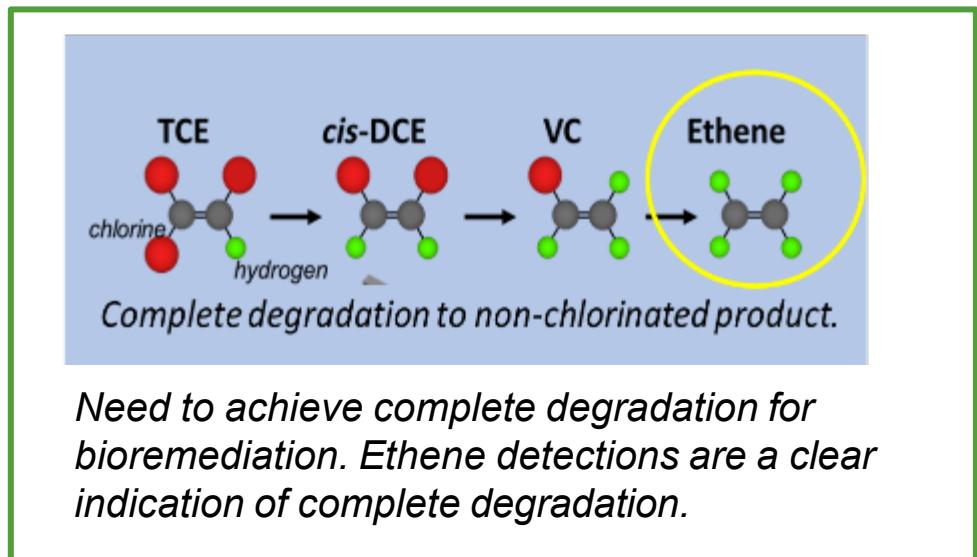
From FY 2019 Annual Performance Report, PIKA ARCADIS U.S., INC.

Biodegradation by reductive dechlorination

Site K Untreated Groundwater



- Native bacteria capable of complete biodegradation may not be present or have low population density.
- Dissolution/desorption of DNAPL can cause daughter product accumulation and inhibit complete degradation.



Bioremediation

Biostimulation: add donor (carbon) and nutrients to enhance native microbial population

Bioaugmentation: add microbes known to degrade contaminants, along with donor and nutrients

Site Evaluation

- Site history evaluation; pre-design drilling, sampling
- Site microbial community and matrices for lab tests

Natural Degradation

- Natural biotic and abiotic rates

Lab Treatability Tests

- Evaluate biostimulation and bioaugmentation
- Select effective electron donor

Field Treatability Test – Year One

- Installation of injection and monitoring wells
- Biostimulation and bioaugmentation injections
- Baseline and performance monitoring

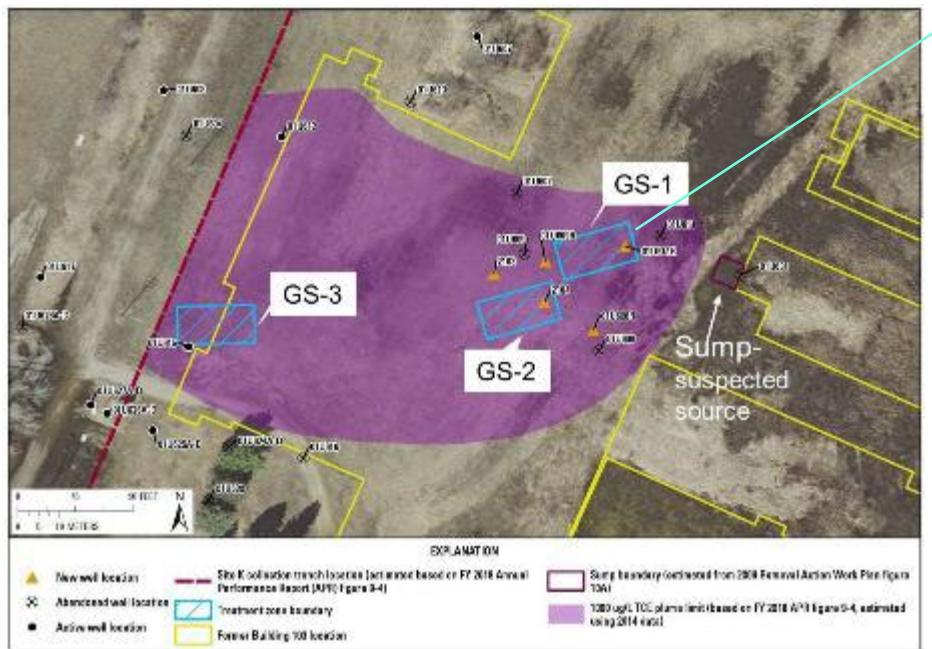
Field Treatability Test – Year Two

- Second biostimulation injection in one plot
- Baseline and performance monitoring in three plots

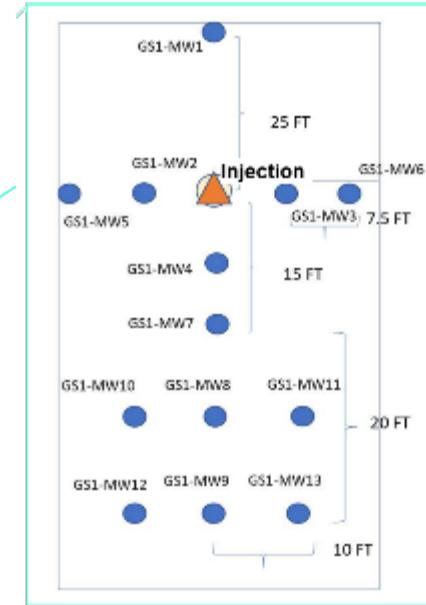
- Initial site evaluation, lab tests, injections, and Year One and Year Two monitoring of the field test completed between October 2020 to July 2024.
- On-line publication of data report through Year One monitoring.
- On-line publication of final interpretative report through Year One monitoring in February 2026.
- Data report for Year Two monitoring in review; draft interpretative report to be completed March 2026.



Year One Field Test



Three treatment plots, two in suspected source area (GS-1, GS-2) and one downgradient near trench (GS-3).



Treatment Plot Design

Each plot ~ 30 x 60 ft
1 injection well
13 monitoring wells

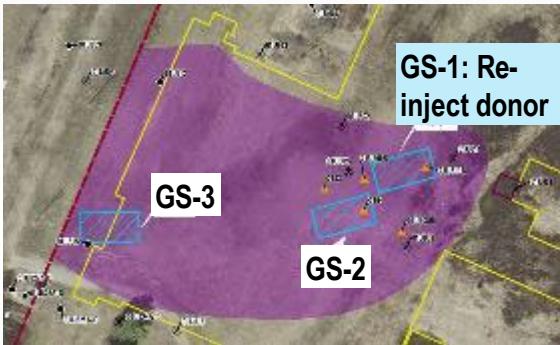
Biostimulation (October 18–20, 2021)

- SRS®-SD EVO (Terra Systems)— combination of lactate and emulsified vegetable oil.
- Mixed with Site K treatment effluent (1:5).

Bioaugmentation (November 29–30, 2021)

- Injected known dechlorinating culture, WBC-2.





Re-inject carbon donor in one plot (GS-1) in the spring. No additional WBC-2.

Analyze soil cores in GS-1 for VOCs before and after second injection.

Monitor GS-2 and GS-3 wells, along with GS-1, for another year.

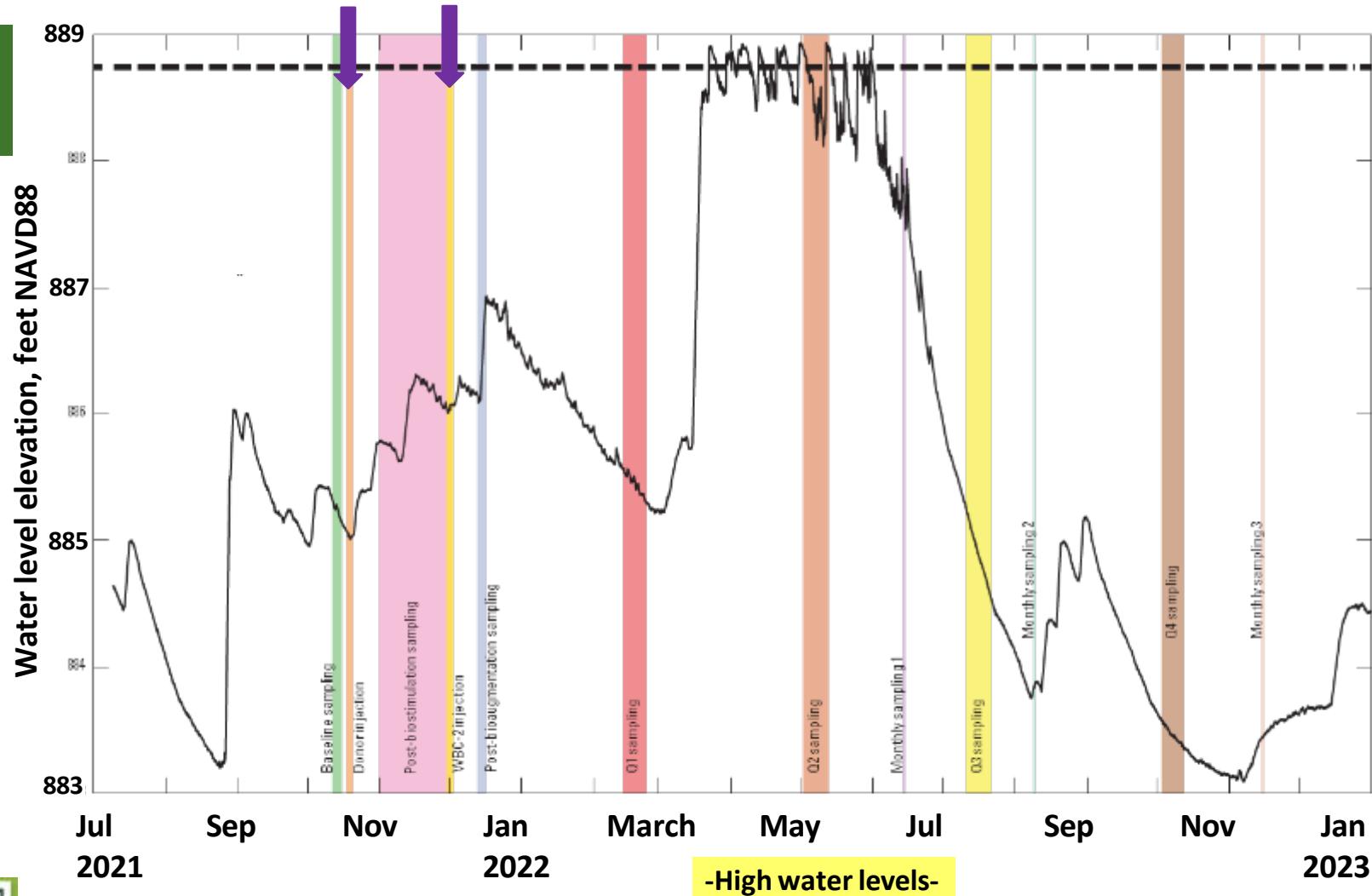
Expanded Pilot Treatability Test

Efficiency of bioremediation ultimately depends on **how often injections are needed and the ability to remove mass of residual solvent** sorbed to the soil in the aquifer.

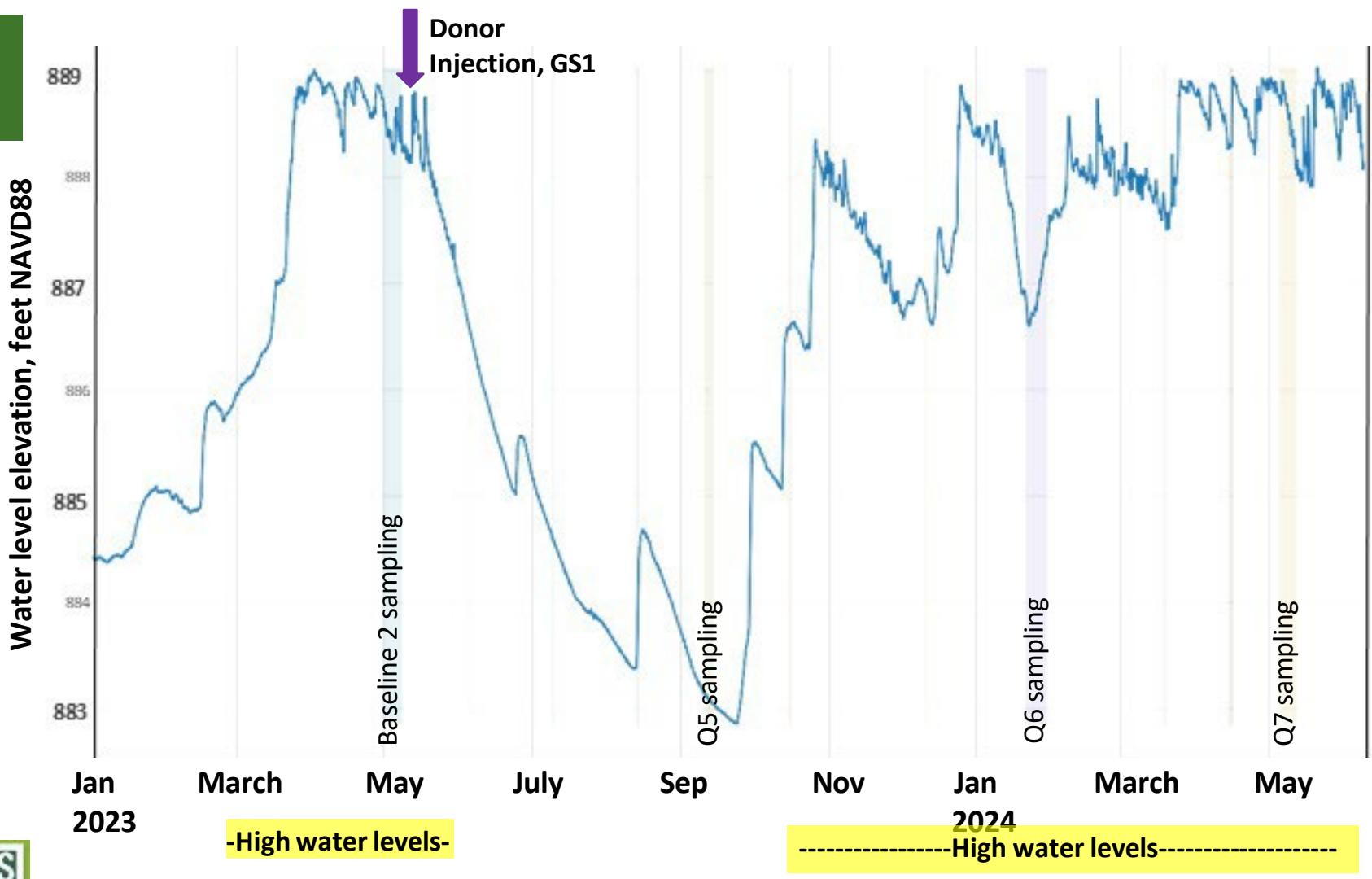
- How long does the initial donor amendment continue to enhance degradation without re-injection?
- Does donor injection when water levels are high result in faster distribution of amendments and improved degradation?
- Does the culture need to be re-injected to maintain efficient degradation rates?
- Does the complete biodegradation of TCE to ethene observed in the groundwater measurably reduce the sorbed or residual solvent in the soil?



Year One

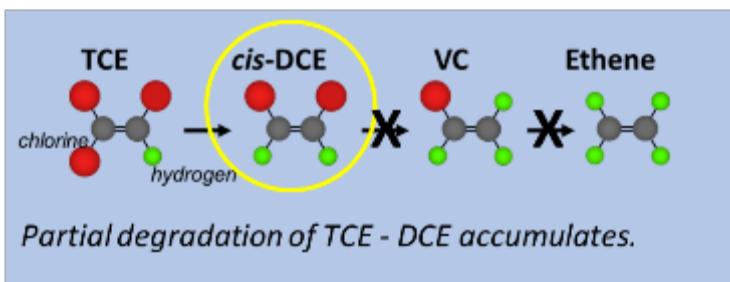
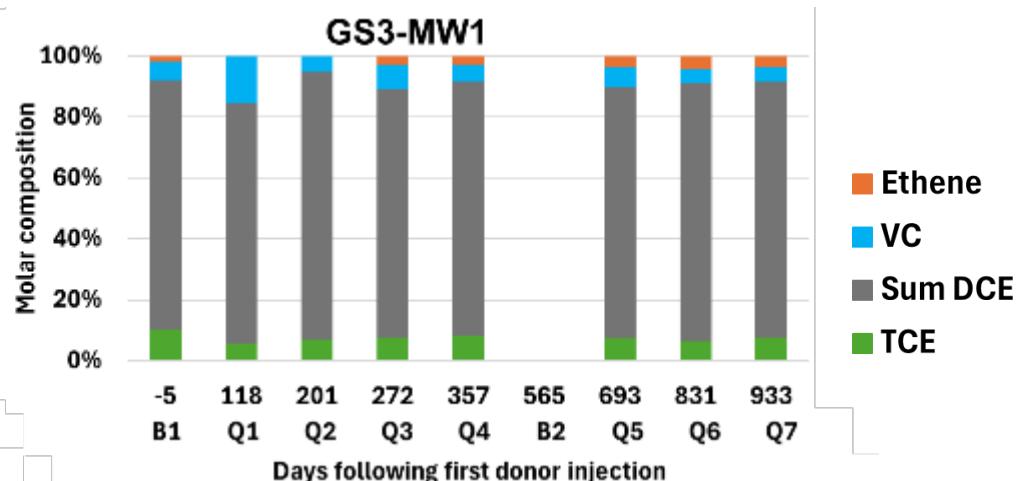
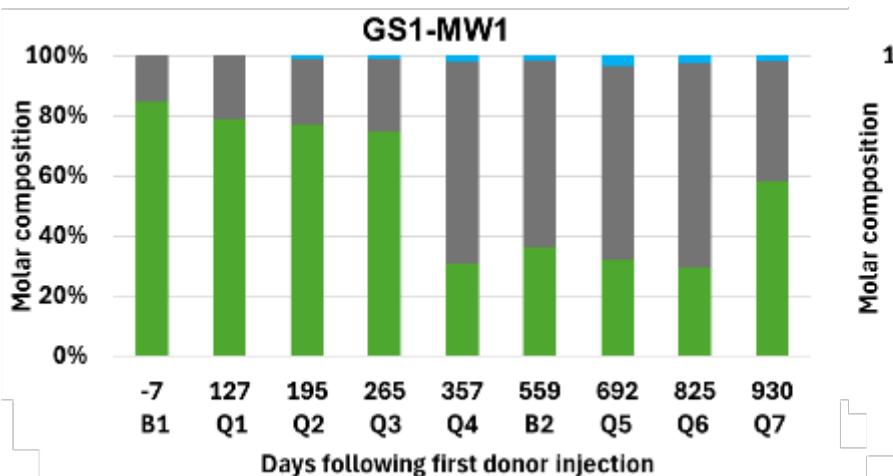


Year Two



GS1 and GS3 Upgradient Wells, October 2021—May 2024

Upgradient -25 feet from injection well

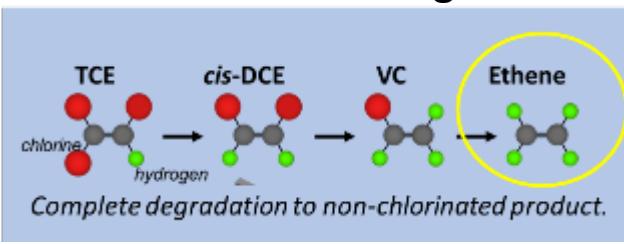


- VOC composition indicates minimal enhancement of **degradation of TCE in the upgradient wells** for each plot following injections.

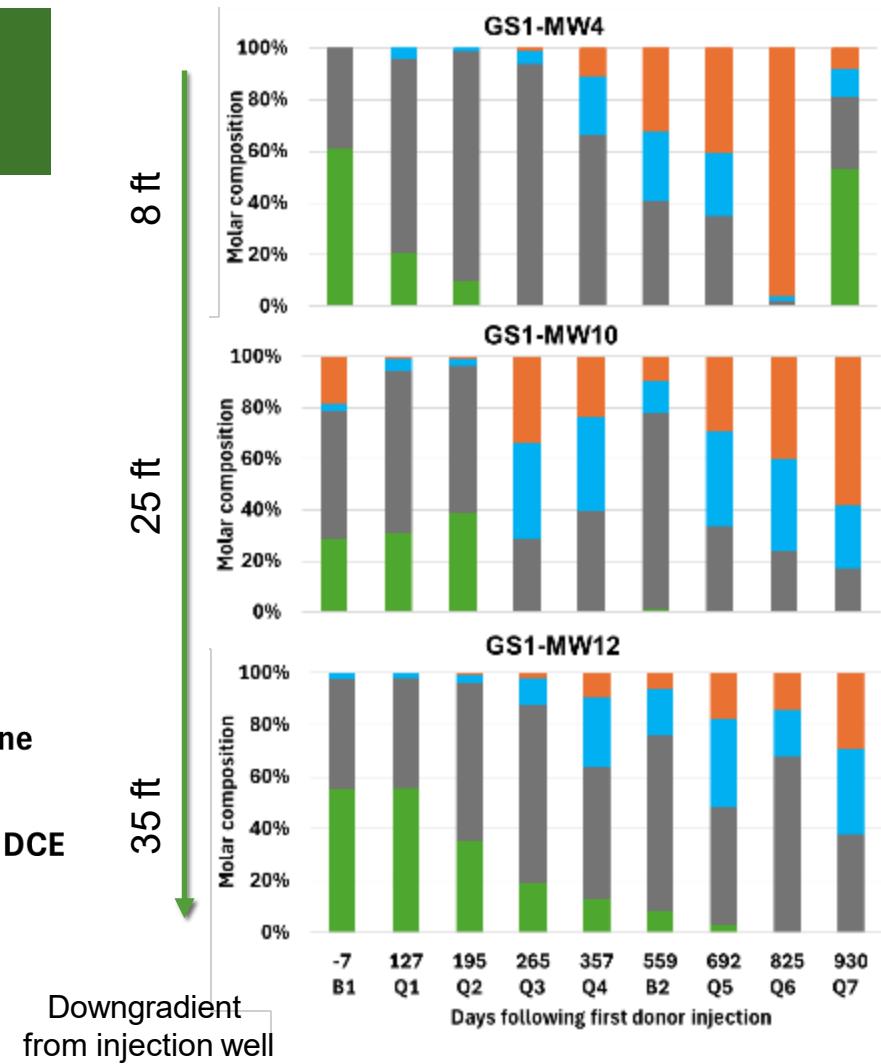


GS1, Downgradient Wells, October 2021—May 2024

- VOC composition indicates that **degradation of TCE was enhanced in downgradient wells** following both donor injections.
- Second donor injection resulted in **nearly complete degradation of TCE to ethene** close to injection well.
- Degradation was enhanced in all downgradient GS1 monitoring wells.



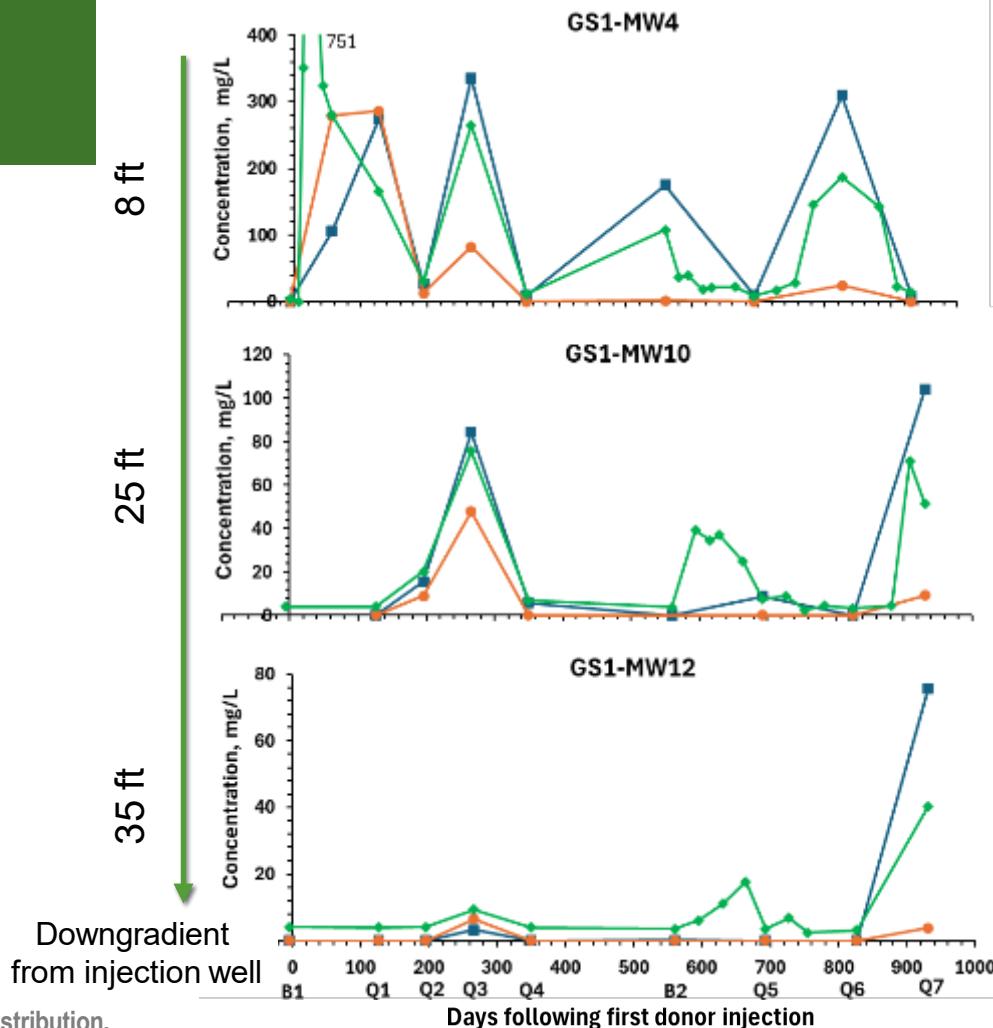
■ Ethene
■ VC
■ Sum DCE
■ TCE



GS1, Downgradient Wells, October 2021—May 2024

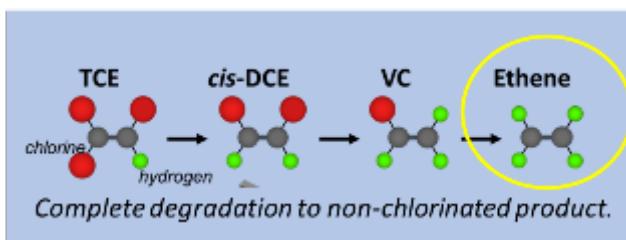
- Increases in **ethene production (molar percent)** reflect increases in **TOC/DOC concentrations** with downgradient movement of donor.
- **Ethene production was maintained** during periods of relatively low TOC/DOC.
- Second donor injection during high water levels resulted in **lower initial TOC/DOC concentrations but greater distribution** throughout GS1 area.

■ Acetate
■ Propionate
■ TOC/NVDOC

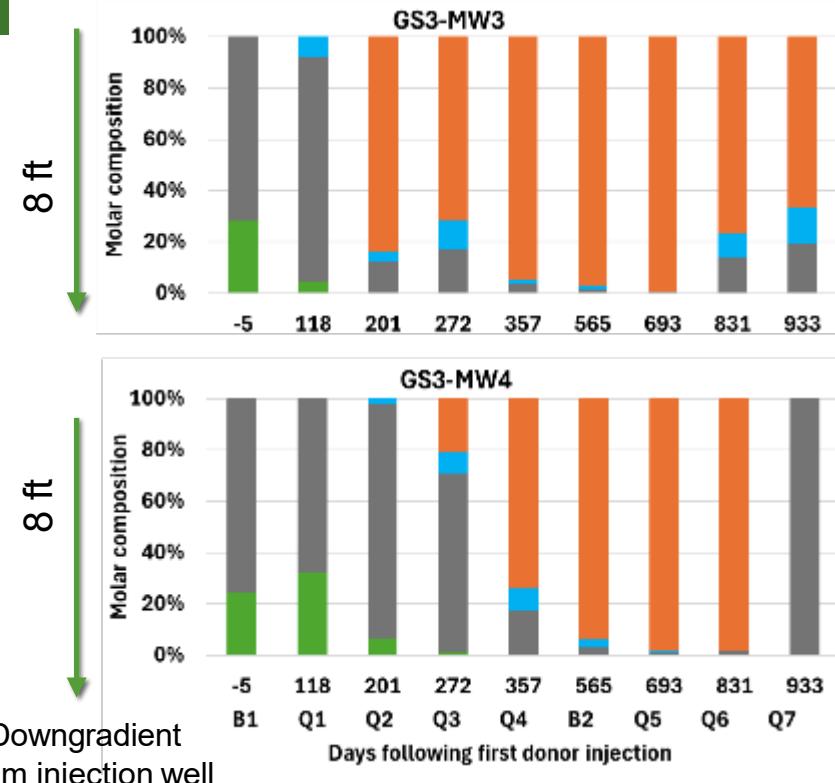


GS3, Downgradient Wells, October 2021—May 2024

- VOC composition indicates that **degradation of TCE was enhanced radially downgradient**.
- Biodegradation **continued without a second donor injection**.
- Biodegradation resulted in **nearly complete removal of TCE to ethene**, and VOC concentrations decreased substantially in all GS3 wells.



■ Ethene
■ VC
■ Sum DCE
■ TCE



Field Treatability Test – Soil Core Collection

- Soil core samples were collected at one location in the source area during well installation in 2021 before first injection.
- Soil core samples in or near the GS1 plot were collected at 5 locations in April 2023 before second donor injection and in

Determining the effect of enhanced biodegradation on DNAPL/sorbed VOC concentrations in the soil is complicated by heterogeneity and limited number of samples in the same location and depth.



Soil core collection, GS-1, April 2023



Key Points from Treatability Test

- Enhanced biodegradation was effective at complete degradation of TCE and chlorinated daughter compounds, even in the DNAPL source area.
- Enhanced biodegradation was most effective in areas of more homogeneous flow, including in the source area where previous soil excavation was done.
- A second donor injection increased the area where enhanced biodegradation occurred and was effective without a second culture amendment.
- Complete biodegradation to ethene continued without a second donor injection where DNAPL was not present (treatment plot GS3).
- A passive biowall near the trench could capture downgradient contamination and decrease the need for longterm pump and treat.
- Enhanced dissolution of residual DNAPL coupled to biodegradation was evident, but estimation of the mass of remaining DNAPL in the source area is difficult.



Planned tasks and schedule

- Finalize online publication of first interpretive report (through Year One pilot test) in February 2026.
- Complete online publication of second data report, currently in review.
- Complete draft final interpretive report for expanded pilot treatability test in March 2026 and complete review process by September 2026.

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- OU1
 - New Brighton new well drilling and installation.
 - Begin industrial well abandonment (3 wells).
 - Begin installation of 4 monitoring wells.
- OU2
 - Begin abandonment of 42 monitoring wells.
 - Begin installation of 1 monitoring well including optimization of the monitoring well network.
 - Begin Risk Assessment for unrestricted land use.
 - 135 Primer Tracer Area – sold.
- OU3
 - Continue groundwater monitoring.
- Round Lake
 - Continue remedial design.
- Administrative Record/Information Repository
 - Army working with Arden Hills Army Training Site (AHATS) to enlarge space.



- Recommend next RAB meeting 15 September 2026.
- Topics for future RAB meetings?
- Additional administrative requirements for RAB?
- Suggestions for improvement of RAB?



- Review/Approve minutes of last meeting
- Old Business
- Cleanup Status Update
- New Business
- Next Meeting Agenda
- Public Comments



- You can ask questions now or at anytime using the email listed on the website.

