Final

Facility-wide Groundwater Monitoring Program
RVAAP-66 Facility-wide Groundwater
Annual Report for 2023

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-21-D-0016
Delivery Order No. W912QR22F0186

Prepared for:

U.S. Army Corps of Engineers
Louisville District

Prepared by:

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8866 Commons Boulevard, Suite 201
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November 1, 2024

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REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
01-11-2024	Technical	Sep 2004- Nov 2024

4. TITLE AND SUBTITLE
Final
Facility-wide Groundwater Monitoring Program
Annual Report for 2023
Groundwater Investigation and Reporting Services
Ravenna Army Ammunition Plant Restoration Program
Portage and Trumbull Counties, Ohio

5a. CONTRACT NUMBER
W912QR-21-D-0016, DO W912QR22F0186

5b. GRANT NUMBER
NA

5c. PROGRAM ELEMENT NUMBER
NA

6. AUTHOR(S)
Laurich, Ryan M.

5d. PROJECT NUMBER
NA

5e. TASK NUMBER
NA

5f. WORK UNIT NUMBER
NA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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8. PERFORMING ORGANIZATION REPORT NUMBER
NA

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
USACE - Louisville District
U.S. Army Corps of Engineers
600 Martin Luther King Jr., Place
Louisville, Kentucky 40202-2232

10. SPONSOR/MONITOR'S ACRONYM(S)
USACE

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
NA

12. DISTRIBUTION/AVAILABILITY STATEMENT
Reference distribution page.

13. SUPPLEMENTARY NOTES
None.

14. ABSTRACT
This Annual Report summarizes activities conducted in 2023 as part of the Facility-wide Groundwater Monitoring Program (FWGWMP) in support of the Ravenna Army Ammunition Plant Restoration Program. This report provides a description of field activities performed, presents field and analytical results, updates potentiometric surfaces, analyzes chemical data collected to date, and provides conclusions of the 2023 activities and recommendations for the 2024 FWGWMP activities.

15. SUBJECT TERMS
groundwater, monitoring well, statistics, hydraulic gradient, trend lines

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON / 19b. TELEPHONE NUMBER *(Include area code)*
U	U	U	U	2118	Jay Trumble / 502.315.6349

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January 15, 2025

Received January 16, 2025

TRANSMITTED ELECTRONICALLY

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Approval
Project Records
Remedial Response
Portage County
ID#267000859036

Sent via email to: Kevin.m.sedlak.ctr@army.mil

Subject: Former Ravenna Army Ammunition Plant
Receipt of Final Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-wide Groundwater Annual Report for 2023 (Work Activity No. 267000859036)
Ohio EPA – Approval of Final Report

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has received the Final Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-Wide Groundwater Annual Report for 2023 (Work Activity No. 267000859036) for the Former Ravenna Army Ammunition Plant (RVAAP)[1], Portage and Trumbull Counties, Ohio dated November 1, 2024. This document was received via email by Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) on November 5, 2024. The report was prepared for the United States Army Corps of Engineers on behalf of the National Guard Bureau by Leidos.

The final document was reviewed by personnel from Ohio EPA's DERR. Pursuant to the Director's Findings and Orders paragraph 39 (b), Ohio EPA considers the document final and approved.

[1] http://edocpub.epa.ohio.gov/publicportal/ViewDocument.aspx?docid=3296204

This letter is an official response from Ohio EPA that will be maintained as a public record. If you have questions or would like to set up a meeting to discuss these comments, you can contact me at liam.mcevoy@epa.ohio.gov or call me at (330) 963-1181.

Sincerely,

Liam P. McEvoy, PG
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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Company Name: Leidos

Contract and Delivery Order Number: Contract No. W912QR-21-D-0016, Delivery Order No. W912QR22F0186

Document Name: Facility-wide Groundwater Monitoring Program, Annual Report for 2023, RVAAP-66 Facility-wide Groundwater, Ravenna Army Ammunition Plant Restoration Program, Camp James A. Garfield Joint Military Training Center, Portage and Trumbull Counties, Ohio

Notice is hereby given that an independent technical review, that is appropriate to the level of risk and complexity inherent in the project, has been conducted. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level obtained; and reasonableness of the result, including whether the product meets the customer's needs consistent with law and existing Corps policy. All concerns and comments resulting from these independent technical reviews have been resolved.

Ryan Laurich Deputy Program Manager	11/1/2024 Date

Charles Spurr, PG Field Manager Independent Technical Review Team Leader	11/1/2024 Date

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from the independent technical review of the document have been fully resolved.

Lisa Jones-Bateman, REM, PMP Senior Program Manager	11/1/2024 Date

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for the
Final
Facility-wide Groundwater Monitoring Program
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Annual Report for 2023
Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

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ACRONYMS AND ABBREVIATIONS

amsl	Above Mean Sea Level
AOC	Area of Concern
Army	U.S. Department of the Army
bgs	Below Ground Surface
BTOC	Below Top of Casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CJAG	Camp James A. Garfield
COC	Chemical of Concern
CSM	Conceptual Site Model
DFFO	Director’s Final Findings and Orders
DNB	Dinitrobenzene
DNT	Dinitrotoluene
FCR	Field Change Request
FS	Feasibility Study
FWCUG	Facility-wide Cleanup Goal
FWGW	Facility-wide Groundwater
FWGWMP	Facility-wide Groundwater Monitoring Program
FWSAP	Facility-wide Sampling and Analysis Plan
gpm	Gallons per Minute
IDW	Investigation-Derived Waste
MCL	Maximum Contaminant Level
NACA	National Advisory Committee for Aeronautics
NTU	Nephelometric Turbidity Unit
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PCB	Polychlorinated Biphenyl
PP	Proposed Plan
PWS	Performance Work Statement
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
ROD	Record of Decision
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
S.U.	Standard Unit
SI	Site Inspection
SVOC	Semivolatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TNT	2,4,6-Trinitrotoluene

ACRONYMS AND ABBREVIATIONS (Continued)

USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USP&FO	U.S. Property and Fiscal Officer
VOC	Volatile Organic Compound

1.0 INTRODUCTION

Leidos has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to execute the performance work statement (PWS) titled "Groundwater Investigation and Reporting Services, Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Camp James A. Garfield (CJAG) Joint Military Training Center, Portage and Trumbull Counties, Ohio." This work is being performed under a firm-fixed price basis in accordance with USACE, Louisville District Contract No. W912QR-21-D-0016, Delivery Order No. W912QR22F0186.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation and cleanup for groundwater within the former RVAAP are being conducted under the U.S. Department of Defense Installation Restoration Program. Activities include monitoring an extensive network of groundwater monitoring wells to determine the nature and extent of groundwater impacts, providing additional information to support hydrogeologic and fate and transport models, evaluating potential exit pathways, and evaluating vertical contaminant distribution and/or particle inflow/outflow through the facility.

The former RVAAP is now known as CJAG Joint Military Training Center. The former RVAAP/CJAG is in Portage and Trumbull Counties, Ohio.

1.1 PURPOSE

The Director's Final Findings and Orders (DFFO) were issued to the U.S. Department of the Army (Army) on June 10, 2004 (Ohio EPA 2014). The purpose of the DFFO is for the Army to develop and implement:

- A Remedial Investigation (RI)/Feasibility Study (FS), Proposed Plan (PP), Record of Decision (ROD), or other appropriate document and remedy for each area of concern (AOC) or appropriate group of AOCs at the former RVAAP
- A facility-wide groundwater (FWGW) investigation, monitoring, and remediation program at the former RVAAP.

Section 15 of the DFFO outlines the requirements of the Facility-wide Groundwater Monitoring Program (FWGWMP). This 2023 Annual Report has been prepared to satisfy the requirements of Section 15d, which specifies the FWGWMP Plan will "utilize an iterative process, with an annual review and revision cycle to accommodate the addition or deletion of wells from the groundwater monitoring network."

1.2 OBJECTIVES

The primary objectives of this 2023 Annual Report are to describe the FWGWMP sampling events that occurred in Spring and Fall 2023, as specified in the *Facility-wide Groundwater Monitoring Addendum for 2023* (Leidos 2023a, herein referred to as the 2023 Addendum), monitoring well installation and sampling activities, as specified in the *Feasibility Study Monitoring Well Installation Plan for RVAAP-66 Facility-Wide Groundwater* (Leidos 2022a, herein referred to as the FS Monitoring Well Installation Plan), and applicable field change requests (FCRs). This report provides groundwater elevations from the April 2023 facility-wide well gauging event and the analytical results, discussion, conclusions, and recommendations as to how the FWGWMP should proceed. This report also discusses changes to the FWGWMP in 2023.

1.3 REPORT ORGANIZATION

The remaining sections of this 2023 Annual Report are organized as follows:

- Section 2.0 Background
- Section 3.0 Facility Description
- Section 4.0 2023 Monitoring Program
- Section 5.0 Groundwater Elevations
- Section 6.0 2023 Results and Discussion
- Section 7.0 Time-Trend Graphs
- Section 8.0 Conclusions and Recommendations
- Section 9.0 References.

2.0 BACKGROUND

In 2004, the Army and Ohio Environmental Protection Agency (Ohio EPA) finalized the *Facility-wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (Portage Environmental 2004) for the former RVAAP, now known as CJAG Joint Military Training Center. The FWGWMP was initiated in April 2005 with quarterly sampling of 36 FWGWMP monitoring wells. Fourteen of these wells were identified as "background wells," and the remaining wells were located at various AOCs at CJAG.

Five wells historically known as Resource Conservation and Recovery Act (RCRA) wells (RQLmw-007, RQLmw-008, RQLmw-009, DETmw-003, and DETmw-004) were incorporated into the FWGWMP after May 2005. As of 2021, these wells are no longer identified as RCRA wells. Sampling groundwater from these wells will be based on decisions made under the CERCLA program.

The FWGWMP monitoring well network currently contains 313 permanent wells. Twelve permanent monitoring wells (LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, LL12mw-248, LL12mw-249, FBQmw-178, FBQmw-179, FBQmw-180, and FBQmw-181) and one temporary well (071tw-001) were installed in 2023 as part of the FS Monitoring Well Installation Plan (Leidos 2022a). Sixty-one wells were sampled in Spring 2023 under the FWGWMP (48 wells from the 2023 Addendum, 12 FS wells, and 1 temporary well). Fifty-eight wells were sampled in Fall 2023 under the FWGWMP (47 from the 2023 Addendum [LL1mw-063 was dry] and 11 FS wells [LL12mw-248 was dry]).

In addition to these wells, 14 permanent wells at RVAAP-69 Building 1048 Fire Station and 3 permanent wells at RVAAP-74 Building 1034 Motor Pool Hydraulic Lift are not currently incorporated into the FWGWMP monitoring well network because they were installed and sampled to support their current site-specific investigations.

Under the FWGWMP, four of the permanent wells (FWGmw-018, FWGmw-020, FWGmw-021, and FWGmw-024) have historically been referenced as "Offsite Wells." This term has been used to define wells that are adjacent to State Route 5, outside the perimeter fence of CJAG. However, all four wells are on federally owned property at CJAG.

Since 2005, the results have been summarized in an annual report. In 2016, the *Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater* (TEC-Weston 2016) (herein referred to as the Remedial Investigation Work Plan [RIWP]) was developed. This RIWP served as a supplement to the FWGWMP Plan and specified aspects of the RI with the goal of adequately characterizing pertinent physical and chemical groundwater conditions in the multi-aquifer hydrostratigraphic units variably present across CJAG, so that potential current and future risks to potential human and environmental receptors can be ascertained, effectively managed, and mitigated as needed. The *Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater* (Leidos 2022b), herein referred to as the FWGW RI Report, was approved by Ohio EPA in April 2022.

2.1 CERCLA PROCESS

CERCLA, commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party could be identified.

The law authorizes two kinds of response actions:

- Short-term removals, where actions may be taken to address releases or threatened releases requiring prompt response; and
- Long-term remedial response actions that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious but not immediately life threatening.

Although the former RVAAP is not on the National Priorities List, the objective of the DFFO was for the Army and Ohio EPA to:

> "Contribute to the protection of public health, safety, and welfare and the environment from the disposal, discharge, or release of contaminants at or from the site, through implementation of a CERCLA-based environmental remediation program. This program will include the development by respondent of an RI/FS for each AOC or appropriate group of AOCs at the site, and upon completion and publication of a PP and ROD or other appropriate document for each AOC or appropriate group of AOCs, the design, construction, operation, and maintenance of the selected remedy as set forth in the ROD or other appropriate document for each AOC or appropriate group of AOCs."

The basic stages of the CERCLA process are as follows:

- Preliminary Assessment/Site Inspection (SI) – An initial evaluation of a site to determine if further investigations or responses are necessary.
- RI/FS – A detailed investigation to determine the nature and extent of contamination at a site, test whether certain technologies are capable of treating the contamination, and evaluate the cost and performance of technologies that could be used to clean up the site.
- PP – A plan presented to the public that summarizes the findings of the RI/FS phase, highlighting the key factors that led to identifying a preferred alternative. The PP is made available for public comment.
- ROD – A decision document presenting the remedial action plan for a site that 1) certifies that the remedy selection process was carried out in accordance with CERCLA; 2) describes the technical parameters of the remedy, specifying the methods selected to protect human health and the environment, including treatment, engineering, and institutional control components,

as well as cleanup levels; and 3) provides the public with a consolidated summary of information about the site and the chosen remedy, including the rationale behind the selection.

- Remedial Design/Remedial Action – The engineering phase during which additional technical information and data identified are incorporated into technical drawings and specifications developed for the subsequent remedial action and the implementation phase of site cleanup.

The FWGW AOC at the former RVAAP is currently in the RI/FS phase of the CERCLA process.

2.2 GROUNDWATER MODELING

A groundwater flow model used in the RIWP (TEC-Weston 2016) was evaluated and revised, as needed, to conduct the groundwater flow modeling required to support the RI and is summarized in the FWGW RI Report. The groundwater flow model, combined with transport models, is an effective tool for understanding of the groundwater flow system at CJAG and thereby support making more appropriate groundwater management decisions. This model will be again evaluated and revised, as needed, to support the future FS, remedial design, remedial action, and other decision-making process.

2.3 ASSESSMENT OF GROUNDWATER REMEDIAL ACTION EFFECTIVENESS

Groundwater remedial actions have not been conducted at CJAG. Contaminant source removals through soil excavations have been implemented to reduce groundwater impacts. Following the completion of the FWGW FS, a determination will be made as to whether remedial actions are warranted for groundwater.

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3.0 FACILITY DESCRIPTION

This section provides a brief description of CJAG, describes the site geology and hydrogeology that is pertinent in understanding and evaluating FWGW, and presents the conceptual site model (CSM) for the FWGW AOC.

3.1 FACILITY DESCRIPTION

The former RVAAP, now known as CJAG, located in northeastern Ohio within Portage and Trumbull Counties, is approximately 3 miles east/northeast of the city of Ravenna and 1 mile north/northwest of the city of Newton Falls (Figure 3-1). The facility is approximately 11 miles long and 3.5 miles wide. The facility is bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad to the south; Garrett, McCormick, and Berry Roads to the west; the Norfolk Southern Railroad to the north; and State Route 534 to the east. In addition, the facility is surrounded by the communities of Windham, Garrettsville, Charlestown, and Wayland. The facility is Federal property, which has had multiple accountability transfers among multiple Army agencies, making the property ownership and transfer history complex. The last administrative accountability transfer occurred in September 2013 when the remaining acreage (not previously transferred) was transferred to the U.S. Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site (Camp James A. Garfield).

3.2 SITE GEOLOGY

Surface geology at CJAG generally consists of glacial till deposits from the Wisconsinan glacial advance, with occasional outcrops of bedrock of the Pottsville formation. North-south trending pre-glacial valleys in the central and western portions of CJAG were generally deepened by scouring and subsequently buried during two minor glacial advances and retreats. The Wisconsinan glacial advances first deposited the Lavery Till and later deposited the Hiram Till. Figure 3-2 depicts the unconsolidated deposits at CJAG.

The uppermost bedrock underlying CJAG consists of several units of the Pennsylvanian-age Pottsville formation, as shown in Figure 3-3. Figure 3-4 is a cross-section location map, and Figures 3-5 and 3 6, adapted from the *Facility-wide Groundwater Monitoring Program RVAAP-66 Facility-wide Groundwater Annual Report for 2017* (TEC-Weston 2018), present cross-sections trending east-west and north-south, respectively, which illustrate the geology underlying CJAG. The Pottsville formation varies significantly in composition both vertically and laterally, ranging from coarse, permeable sandstones to impermeable shales.

Due to the variation in composition, the Pottsville formation is subdivided into the members and units discussed below. The base unit of the Pottsville formation is sandstone, which is locally conglomeratic and underlain by Mississippian-age shale of the Cuyahoga formation (Winslow and White 1966).

3.2.1 Unconsolidated

The surface of the eastern two-thirds of the CJAG property is composed of the clay-rich and relatively impermeable Hiram Till and associated outwash plain deposits. The western third of CJAG is covered by the Lavery Till, a silty, sandy deposit with occasional cobbles and sporadic boulders (Winslow and White 1966). The first Wisconsinan glacial advance deposited the Lavery Till with a thickness ranging from 20 to 40 feet. The second advance covered only the eastern two-thirds of CJAG, depositing the Hiram Till (Kammer 1982). The Hiram Till consists of 12 percent sand, 41 percent silt, and 47 percent illite and chlorite clay minerals, and ranges in depth from 5 to 15 feet below ground surface (bgs). In the far northeastern corner of CJAG, the Hiram Till overlies thin beds of sandy outwash material. Across CJAG, the thickness of unconsolidated deposits ranges from less than 3 feet to approximately 45 feet (Author unknown 1998; as cited in the *Integrated Natural Resources Management Plan at the Camp Ravenna Joint Military Training Center* [OHARNG 2014]).

3.2.2 Homewood Sandstone

The Homewood Sandstone Member is the uppermost Member of the Pottsville formation, and it is present in the western portion of CJAG. The Homewood Member consists of a range of well-sorted, coarse-grained, white quartzose sandstone to a tan, poorly sorted, clay-bonded, micaceous, medium- to fine-grained sandstone. Thin shale layers are prevalent in the Homewood Member, as indicated by a darker gray. The Homewood Sandstone Member lies unconformably upon the Mercer Member of the Pottsville formation and often forms a caprock (Winslow and White 1966).

3.2.3 Mercer Shale

The Mercer Shale Member consists of silty to carbonaceous shale, thin coal, underclay, and limestone layers with abundant thin, discontinuous sandstone lenses in the upper portion. This member occurs in the western portion of CJAG along eroded/incised slopes; however, it is not well documented at CJAG. The Mercer Member is underlain by the Massillon Sandstone Member (Winslow and White 1966).

3.2.4 Massillon Sandstone

The Massillon Sandstone Member consists of coarse- to medium-grained micaceous sandstone beds, which are commonly cross-bedded and often separated by shale beds. The separating silty sandy shale beds can be up to 50 feet thick and contain plant fragments. The sandstone beds contain rounded granules and quartz pebbles in some locations but do not create thick conglomerate beds. The Massillon Sandstone unconformably overlies the Shale unit of the Sharon Member of the Pottsville formation (Winslow and White 1966).

3.2.5 Sharon Shale

The Sharon Member of the Pottsville formation contains two distinct units: the Upper Sharon and the Basal Sharon Conglomerate. The Upper Sharon is composed of thin gray to black sandy to micaceous shale lenses, containing thin coal, underclay, and sandstone lenses. This unit is present in the western portion of CJAG but was eroded from the eastern portion of the property before the Massillon Sandstone was deposited. The Sharon Shale unit overlies the Sharon Sandstone/Conglomerate unit (Winslow and White 1966).

3.2.6 Basal Sharon Conglomerate

The Basal Sharon Conglomerate unit is the basal portion of the Pottsville formation and is a highly porous, loosely cemented, permeable, cross-bedded, frequently fractured, and weathered sandstone. The conglomerate portion consists of well-rounded quartz pebbles and granules with little sand-sized matrix or cement. The conglomerate typically occurs within the lower (deeper) portions of the unit, which lies unconformably upon the Mississippian-age shale of the Cuyahoga formation (Winslow and White 1966).

3.2.7 Cuyahoga Shale

The Meadville Shale is the uppermost unit of the Mississippian-age Cuyahoga Group. It consists of micaceous, blue-gray sandy shale with flagstone and clay-ironstone layers. The Meadville Shale overlies the Sharpsville Sandstone of the Cuyahoga Group, which overlies the Orangeville Shale of the Cuyahoga Group (Winslow and White 1966). While previously mapped in limited extent on the eastern portion of CJAG (Portage Environmental 2004), subsequent studies (TEC-Weston 2016) indicate the mapped unit is the Sharon Member.

3.3 SITE HYDROGEOLOGY

Throughout CJAG, depth to groundwater ranges from 0 feet bgs (four wells were artesian during the April 2023 gauging event) to more than 136 feet bgs, with static water elevations occurring from approximately 929 to 1,178 feet above mean sea level (amsl). Table 3-1 provides the aquifer depths relative to ground surface and sea level. Observed gradients indicate groundwater flows from bedrock highs in the western portion of the property toward stream valleys in the eastern portion.

Table 3-1. Aquifer Depths Relative to Ground Surface and Sea Level

Aquifer	Aquifer Depths			
	Below Ground Surface		Elevation	
	Minimum Depth (ft bgs)	Maximum Depth (ft bgs)	Upper Elevation (ft amsl)	Lower Elevation (ft amsl)
Unconsolidated[a]	0.00	99.08	929.81	1,153.41
Homewood[b]	0.00	57.19	943.62	1,143.75
Upper Sharon[c]	0.00	136.44	939.82	1,178.82
Basal Sharon Conglomerate	1.57	41.58	939.28	1,105.98

[a]LL1mw-092 and CPmw-002 were artesian during the April 2023 gauging event.
[b]SCFmw-004 was artesian during the April 2023 gauging event.
[c]LL1mw-093 was artesian during the April 2023 gauging event.
amsl = Above Mean Sea Level
bgs = Below Ground Surface
ft = Feet

The majority of CJAG is composed of clay-rich glacial tills with low permeability and underlying bedrock formations with extremely variable, but relatively low, permeability. Typical yields from wells were reported in the 1982 study as penetrating the Sharon Conglomerate range from 5 to 200 gallons per minute (gpm); yields from the overlying unconsolidated deposits are usually considerably lower. In addition, the thickness and permeability of the bedrock water-bearing formations at CJAG vary considerably and have a strong effect on well yields, transmissivity, and hydraulic conductivity (Kammer 1982).

3.3.1 Unconsolidated

Groundwater occurs within the unconsolidated deposits in many areas of the facility. The thickness of the unconsolidated deposits at the facility ranges from thin to absent in the eastern and northeastern portions of the facility to an estimated 150 feet in pre-glacial valleys near the central portion of the facility. Because of the heterogeneous nature of the unconsolidated glacial material, groundwater flow paths likely exhibit local variations, which are difficult to determine.

The hydraulic gradient in the Unconsolidated aquifer predominantly trends in an eastward direction; however, the unconsolidated zone shows numerous local flow variations influenced by topography and stream drainage patterns, with localized flow along preferential pathways (e.g., sand seams, channel deposits, or other stratigraphic discontinuities) having higher permeabilities than surrounding clay or silt-rich material. The local variations in flow direction suggest 1) groundwater in the unconsolidated deposits is generally in direct hydraulic communication with surface water, and 2) surface water drainageways may also act as groundwater discharge locations. In addition, topographic ridges between surface water drainage features act as groundwater divides in the unconsolidated deposits.

At CJAG and the surrounding regions, groundwater recharge occurs via surface infiltration of precipitation along root zones, desiccation cracks, partings within the soil column, and general percolation through sand and gravel within buried valleys. Two large, buried valleys occur southwest and northwest of the facility; wells in the Unconsolidated aquifers in these valleys can yield up to 1,600 gpm. Monitoring wells that currently exist in unconsolidated material on the CJAG property range from 14 to 130 feet bgs. The potentiometric surface of groundwater in the Unconsolidated aquifer is discussed further in Section 5.

3.3.2 Homewood Sandstone

The uppermost bedrock aquifer at CJAG is the Homewood Sandstone, which is reportedly only capable of well yields less than 10 gpm (Kammer 1982). The Homewood aquifer is present in the central and western portions of the property. It is usually bound above by unconsolidated glacial till and below by the Mercer Member. Existing monitoring wells screened within the Homewood Sandstone Member range from 19 to 50 feet bgs. The potentiometric surface of groundwater in the Homewood Sandstone is discussed further in Section 5.

Review of regional geology maps (Winslow and White 1996) and historical monitored formation interval designations at CJAG during preparation of the RIWP (TEC-Weston 2016) indicated certain groundwater monitoring wells near Fuze and Booster Quarry, including Load Lines 5 through 10, known as Fuze and Booster Hill, were likely incorrectly identified to be installed within the Homewood Sandstone formation.

3.3.3 Upper Sharon

The principal water-bearing aquifer at CJAG is the Sharon Sandstone/Conglomerate unit of the Pottsville formation. Depending on the existence and depth of overburden, the Sharon Sandstone/Conglomerate unit ranges from an unconfined to a leaky artesian (semi-confined) aquifer. The Sharon Shale is a confining unit to the Upper Sharon (or Sharon Sandstone) aquifer where present in the western portion of the property. Water yields from area wells completed in the Sharon Sandstone/Conglomerate unit range from 30 to 400 gpm (USATHAMA 1978). Well yields of 5 to 200 gpm were reported for onsite bedrock wells completed in the Sharon Sandstone/Conglomerate unit (Kammer 1982). Existing monitoring wells screened within the Upper Sharon unit, including those in the Sharon Shale, range from 12.6 to 236.5 feet bgs.

The potentiometric surface of groundwater in the Upper Sharon aquifer is discussed further in Section 5. This bedrock potentiometric map shows a more uniform and regional eastward flow direction that is less affected by local surface topography than unconsolidated material and Homewood Sandstone groundwater.

3.3.4 Basal Sharon Conglomerate

The Sharon Sandstone/Conglomerate unit is the most productive unit of the Pottsville formation and is the major bedrock aquifer in northeastern Ohio. A 1982 study reported that of the 71 groundwater wells that had been installed at the installation, 57 were completed in the Sharon Conglomerate, differing from the Basal Sharon Conglomerate aquifer currently described for CJAG. Data from the 1982 study indicated that the thickness of the Sharon Conglomerate ranges from 44 to 177 feet (Kammer 1982). Existing monitoring wells screened within the Sharon Conglomerate range from 90 to 277 feet bgs.

The potentiometric surface of groundwater in the Basal Sharon Conglomerate aquifer is discussed further in Section 5. The bedrock potentiometric map shows a more uniform and regional eastward flow direction that is less affected by local surface topography than the overlying aquifers.

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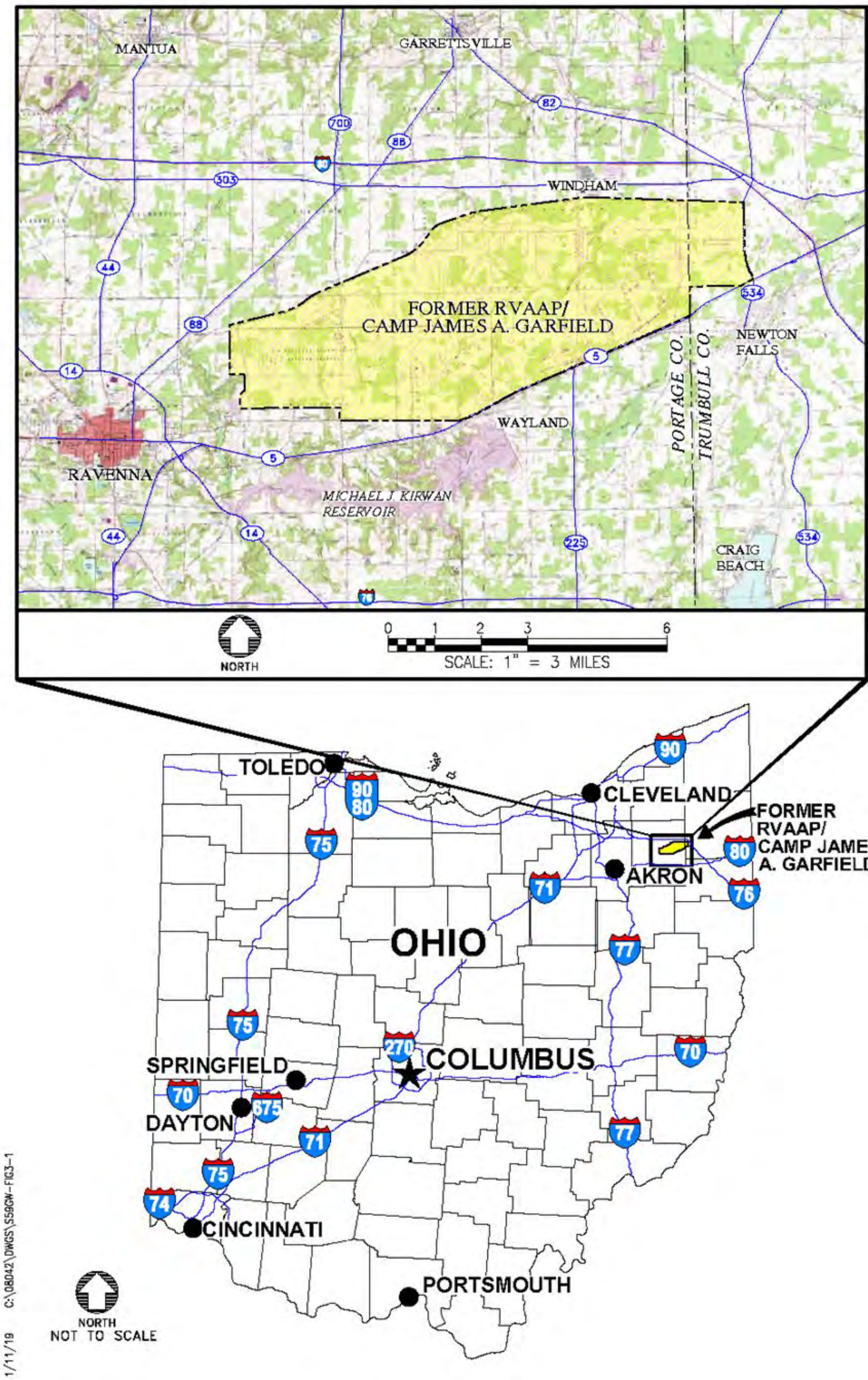

Figure 3-1. General Location and Orientation of Camp James A. Garfield

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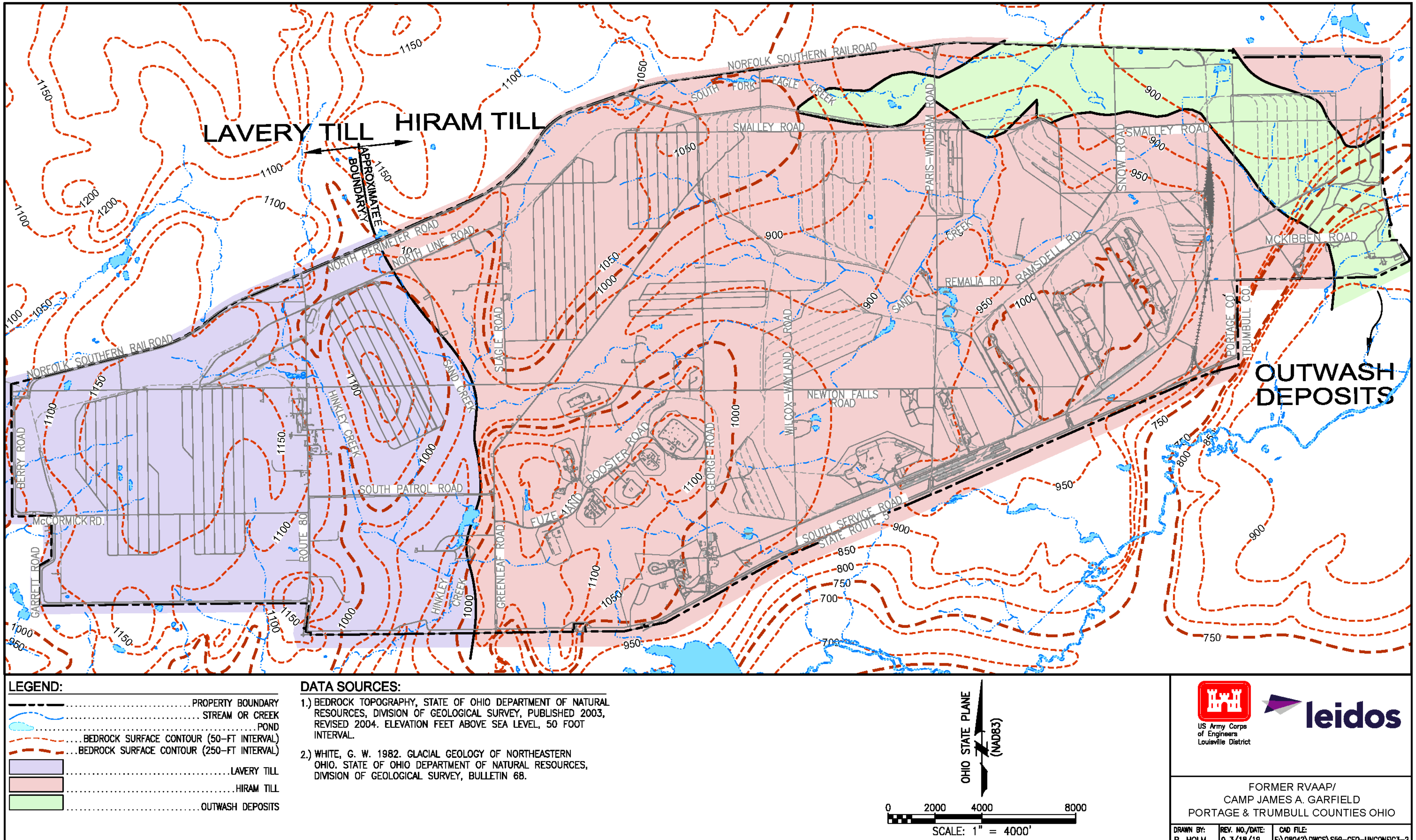

Figure 3-2. Geologic Map of Unconsolidated Deposits at Camp James A. Garfield

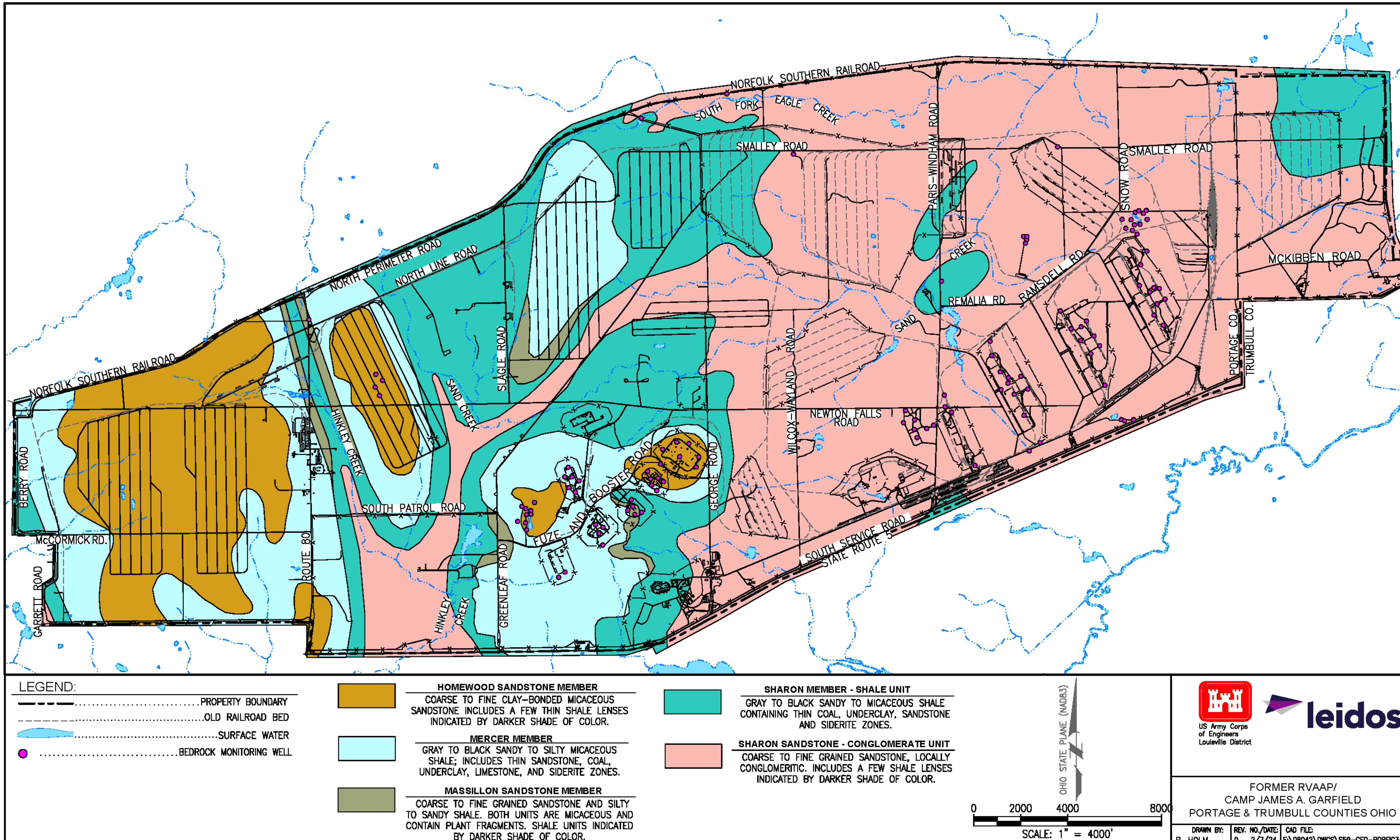

Figure 3-3. Geologic Bedrock Map and Stratigraphic Description of Units at Camp James A. Garfield

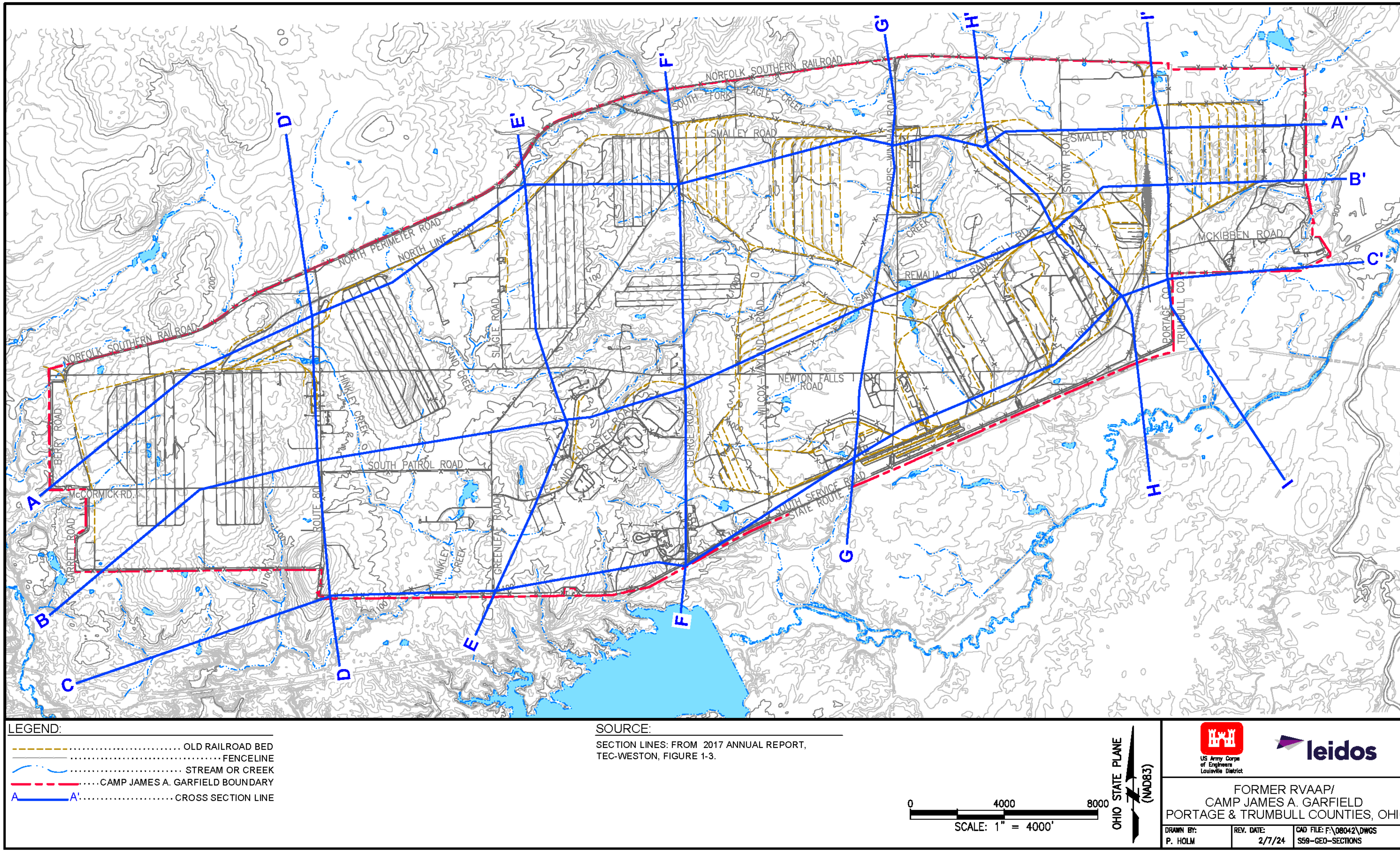

Figure 3-4. Line of Section Map

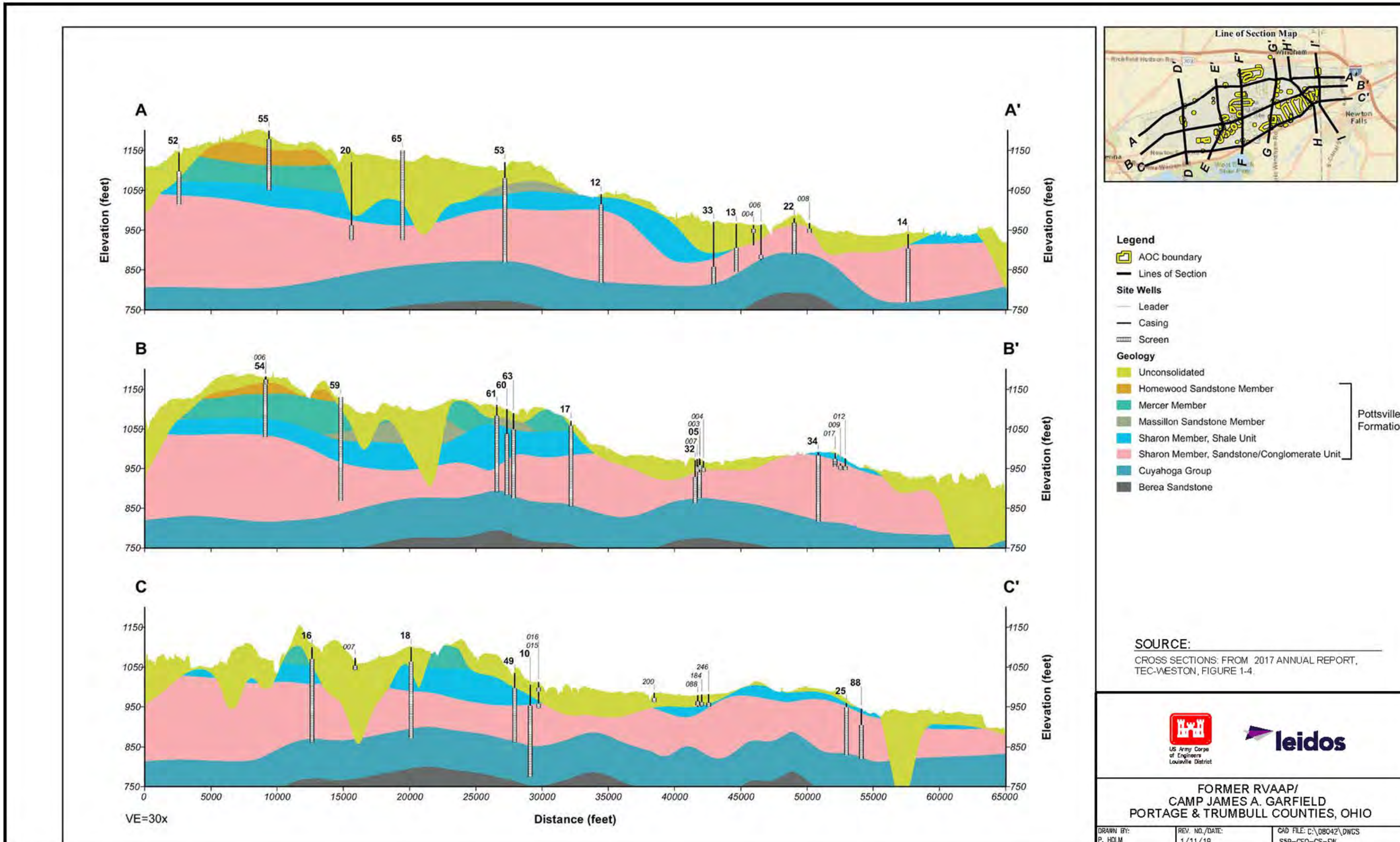

Figure 3-5. East-West Cross-Sections (A-C)

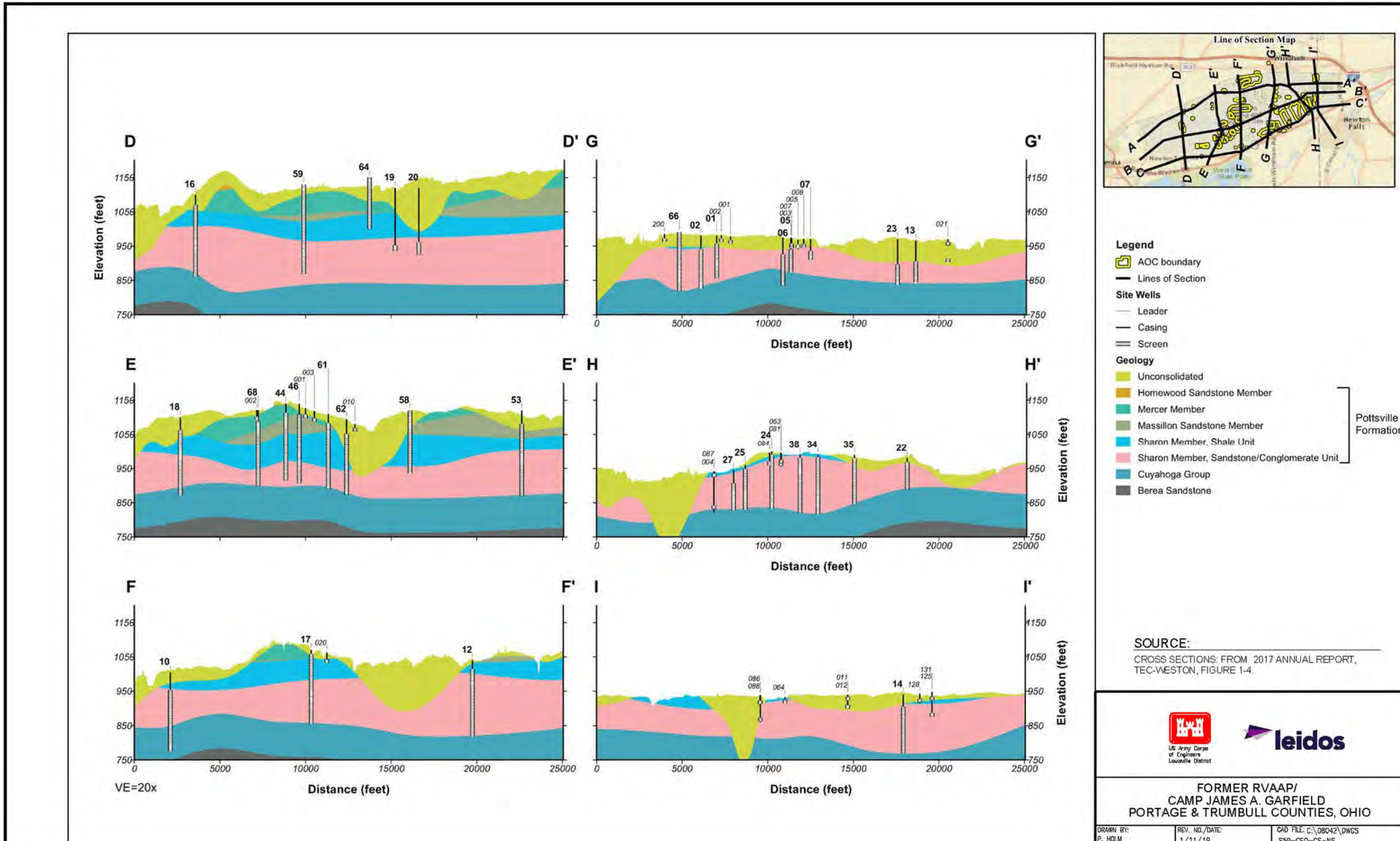

Figure 3-6. North-South Cross-Sections (D-I)

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4.0 2023 MONITORING PROGRAM

This section summarizes activities conducted during implementation of the 2023 monitoring program. Monitoring well construction details are presented in Appendix A.

4.1 MONITORING WELL GAUGING AND INSPECTIONS

From April 24 to April 28, 2023, Leidos conducted the annual groundwater elevation monitoring event (discussed in Section 5.1). During this event, permanent monitoring wells within the FWGWMP monitoring well network were inspected, the condition of each well was documented, and the groundwater water elevations were recorded. The groundwater elevations for DA2mw-106, DA2mw-112, DA2mw-113, DETmw-001B, and DETmw-002 could not be recorded due to the presence of wasp nests. The groundwater elevation for WBGmw-010 could not be recorded due to a puncture in the well skirt, which was allowing surface water to penetrate the vault at a rate greater than it could be evacuated. The groundwater elevation for WBGmw-017 could not be recorded because surface water submerged the flush mount well. The groundwater elevation for LL1mw-085 could not be recorded due to the presence of a submersible pump stuck in the well casing. Well construction was not complete at the time of the April 2023 gauging event for eight of the newly installed FS wells (LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, LL12mw-248, and LL12mw-249). Well LL11mw-012 was inadvertently missed during the April 2023 gauging event. The groundwater elevation for FWGmw-002 could not be recorded due to an obstruction in the well casing.

The 2023 monitoring well inspection report was provided to the Army and contained the well inspection field forms and photographs. The groundwater monitoring well conditions, repair recommendations, and repairs conducted in 2023 are summarized in Appendix B.

4.2 MONITORING WELL INSTALLATION

The FWGW RI Report (Leidos 2022b) identified five areas within CJAG that require further evaluation in an FS. Accordingly, 12 permanent were installed under the FS Monitoring Well Installation Plan (Leidos 2022a). The data collected under the FS well installation plan will be used to refine the CSM and supplement the FS. In addition, one temporary well was installed at the CC RVAAP-71 Barn No. 5 Petroleum Release AOC. Appendix C contains daily activity logs (C.3.1 through C.3.6), boring/well installation logs (C.3.7), well development logs (C.3.8), groundwater sampling logs (C.3.9) chains of custody (C.3.10), calibration logs (C.3.11), and daily quality control reports (C.3.12) associated with the FS monitoring well installation activities.

4.2.1 RVAAP-08 Load Line 1

The FWGW RI Report identified four chemicals of concern (COCs) (1,3-dinitrobenzene, 2,4-dinitrotoluene [DNT], 2,6-DNT, and hexahydro-1,3,5-trinito-1,3,5-triazine [RDX]) in the Upper Sharon aquifer of Load Line 1 as chemicals requiring further evaluation in an FS for potential remediation. No COCs in the Unconsolidated aquifer were identified as requiring evaluation in the FS. Two nested well pairs were installed to provide lateral and vertical migration potential in the localized direction of groundwater flow of the Unconsolidated and Upper Sharon aquifers (toward Criggy's

Pond). One well pair (LL1mw-090 [Unconsolidated], and LL1mw-091 [Upper Sharon]) was installed along South Service Road, east of the center of Load Line 1, and one well pair (LL1mw-092 [Unconsolidated], and LL1mw-093 [Upper Sharon]) was installed west of Criggy's Pond, southeast of the center of Load Line 1.

4.2.2 RVAAP-10 Load Line 3

The FWGW RI Report identified four COCs (2,4,6-trinitotoluene [TNT], 2,6-DNT, 4-amino-2,6-DNT, and RDX) at Load Line 3 in the Upper Sharon aquifer as requiring evaluation in an FS for potential remediation. No COCs in the Unconsolidated aquifer were identified as requiring evaluation in the FS. One monitoring well (LL3mw-247 [Upper Sharon]) was installed west and one monitoring well (LL3mw-248 [Upper Sharon]) was installed southwest of the cluster of four wells (LL3mw-237, LL3mw-238, LL3mw-239, and LL3mw-241) at the center of Load Line 3.

4.2.3 RVAAP-12 Load Line 12

The FWGW RI Report recommended that the area around LL12mw-185 and LLmw-187 proceed to an FS for further evaluation to address the nitrate and ammonia contamination within the Unconsolidated aquifer. In addition, the FWGW RI Report recommended installing new wells to support this evaluation. One monitoring well (LL12mw-248 [Unconsolidated]) was installed east of LL12mw-187. A second monitoring well (LL12mw-249 [Unconsolidated]) was installed east of LL12mw-185. Both monitoring wells were installed along the perimeter of Load Line 12 and will provide data used to identify localized groundwater flow and lateral migration potential of nitrate to the east.

4.2.4 RVAAP-16 Fuze and Booster Quarry

The FWGW RI Report identified four COCs (2,4-DNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and TNT) detected in FBQmw-174 within the Homewood aquifer as requiring evaluation in an FS for potential remediation. No COCs in the Unconsolidated aquifer were identified as requiring evaluation in the FS.

Two nested well pairs (Pair 1: FBQmw-178 [Homewood] and FBQmw-179 [Upper Sharon], and Pair 2: FBQmw-180 [Homewood] and FBQmw-181 [Upper Sharon]) were installed to provide lateral and vertical migration potential in the localized direction of groundwater flow in both the Homewood and Upper Sharon aquifers. The first pair of wells (FBQmw-178 and FBQmw-179) was installed approximately 900 feet east of FBQmw-174. The second pair of wells (FBQmw-180 and FBQmw-181) was installed approximately 500 feet southeast of FBQmw-174.

4.2.5 CC RVAAP-71 Barn No. 5 Petroleum Release

The CC RVAAP-71 Barn No. 5 Petroleum Release AOC is approximately 0.6 acres, including the footprint of Barn No. 5 and the land between the barn and fence line in the western portion of the facility (south of the National Advisory Committee for Aeronautics [NACA] Test Area and Open Demolition Area #1). The site was identified based on a historical gasoline release documented in a 1964 letter written by a former RVAAP Security Manager. The 1964 pipeline break caused a consequent release of an estimated 20 barrels of gasoline at the AOC. An SI was conducted in 2013 that included the sampling of subsurface soil to 13 feet bgs. The results of the SI indicated that no further action was required at this site. Although there is no documented evidence of impact from former and/or current military operations at this site, the Army and Ohio EPA agreed to install a temporary well (071tw-001) south of the location of the former pipeline. The temporary well was installed in the Unconsolidated aquifer. This AOC is not part of the FWGW FS.

4.3 MONITORING WELL SAMPLING EVENTS

The following subsections summarize the two semi-annual sampling events that were conducted in 2023 per the 2023 Addendum (Leidos 2023a). Tables 4-1 and 4-2 summarize wells sampled in 2023 and the associated chemical groups that were analyzed. Figure 4-1 presents the locations of all wells sampled in 2023. Appendix C contains the Ohio EPA 15-day notifications (C.1.1 and C.2.1), daily reports and activity logs (C.1.2 and C.2.2), well purge forms (C.1.3 and C.2.3), well redevelopment forms (C.1.4), chain of custody (C.1.5 and C.2.4), calibration logs (C.1.6 and C.2.5), and daily quality control reports (C.1.7 and C.2.6) associated with 2023 field events, and Appendix D presents the laboratory analytical results (D.1 [Metals], D.2 [Explosives], D.3 [Semivolatile Organic Compounds {SVOCs}], D.4 [Volatile Organic Compounds {VOCs}], D.5 [Polychlorinated Biphenyls {PCBs}], D.6 [Pesticides], and D.7 [Miscellaneous]).

4.3.1 Spring 2023 Sampling Event

The Spring 2023 sampling event was conducted from May 1 to May 23, 2023. In accordance with the 2023 Addendum (Leidos 2023a), 48 monitoring wells were sampled during the first semi-annual event of 2023. Thirteen monitoring wells (LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, LL12mw-248, LL12mw-249, FBQmw-178, FBQmw-179, FBQmw-180, FBQmw-181, and 071tw-001[temporary well]) installed under the FS Monitoring Well Installation Plan (Leidos 2022a) were sampled concurrently during the Spring 2023 sampling event. The overall results of the Spring 2023 sampling event are discussed further in Section 6.0.

4.3.2 Fall 2023 Sampling Event

The Fall 2023 sampling event was conducted from September 25 to October 10, 2023. Forty-seven of the 48 wells specified in the 2023 Addendum (Leidos 2023a) were sampled. Eleven of the 13 monitoring wells (LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, LL12mw-249, FBQmw-178, FBQmw-179, FBQmw-180, and FBQmw-181) installed under the FS Monitoring Well Installation Plan (Leidos 2022a) were sampled concurrently during the Fall 2023 sampling event. Monitoring wells LL1mw-082 and LL1mw-087 could not sustain low-flow purging and were purged dry. Another attempt at sample collection was made at both wells within 24 hours, and sufficient volume was produced for the sample; however, water quality parameters for stabilization could not be collected. The following addresses the three wells that were not sampled:

- LL1mw-063 was purged dry while attempting to attain stability. Another attempt at collection was made within 24 hours; however, no water could be produced for the sample.
- LL12mw-248 was purged dry while attempting to attain stability. Another attempt at collection was made within 24 hours; however, no water could be produced for the sample.

- Temporary well 071tw-001 installed under the FS Monitoring Well Installation Plan (Leidos 2022a) was only recommended to be sampled one time.

The overall results of the Fall 2023 sampling event are discussed further in Section 6.0.

4.4 SEDIMENTATION AND TURBIDITY

The following subsections describe the wells that were redeveloped in 2023, summarize the turbidity readings at the time of sample collection in 2023, and provide recommendations of wells to be redeveloped in the future.

4.4.1 Well Redevelopment Activities

Section 8.2.1 of the 2022 Annual Report (Leidos 2023b) recommended that monitoring wells LL1mw-086, LL1mw-089, and LL12mw-244 would be considered for redevelopment during the Spring 2023 FWGWMP sampling event. During the Spring 2023 FWGWMP sampling event, the permanent pumps at these wells were removed and the total depth of each well was gauged. If more than 20 percent of the well screen was occluded by sediment, the monitoring well would be redeveloped prior to sampling. The following summarizes the assessment for redevelopment at each of the previously noted monitoring wells:

- LL1mw-086
  - According to the well construction log, the total depth of the well is at 75 feet bgs. A 10-foot screen is set from 75 to 65 feet bgs.
  - On April 24, 2023, the depth to the bottom was gauged at 73.93 feet bgs (76.98 feet below top of casing [BTOC]).
  - Gauging data indicate a difference of 1.07 feet between, suggesting that 11 percent of the screen is occluded by sediment.
  - Well redevelopment was not completed because sediment accumulation fell below the 20 percent threshold.
- LL1mw-089
  - According to the well construction log, the total depth of the well is at 35 feet bgs. A 10-foot screen is set from 37 to 27 feet bgs.
  - On April 27, 2023, the depth to bottom was gauged at 35.95 feet bgs (38.70 feet BTOC).
  - Gauging data indicated a difference of 1.05 feet, suggesting that 10.5 percent of the screen is occluded by sediment.
  - Well redevelopment was not completed because sediment accumulation fell below the 20 percent threshold.
- LL12mw-244
  - According to the well construction log, the total depth of the well is at 29.5 feet bgs. A 10-foot screen is set from 29.5 to 19.5 feet bgs.
  - On April 28, 2023, the depth to bottom was gauged at 24.21 feet bgs (26.76 feet BTOC).
  - Gauging data indicated a difference of 5.29 feet, suggesting that 52.9 percent of the screen is occluded by sediment.

- Well redevelopment was completed at this location from April 15 through 18, 2023. Well LL12mw-244 could not be redeveloped continuously because it went dry multiple times due to low recharge rates. Sediments blocking the screen likely decreased the recharge rate at this location. In addition, water quality parameters did not stabilize during redevelopment. Five well volumes (64 gallons) were removed from the well upon completion of redevelopment. Depth to bottom at LL12mw-244 was gauged at 25.38 feet bgs (27.93 feet BTOC) following redevelopment. Redevelopment removed approximately 1.17 feet of sediment accumulation at the bottom of the well. The well redevelopment log for LL12mw-244 is provided in Appendix E.

4.4.2 Turbidity Results

Historically, elevated turbidity readings have been measured in many of the RVAAP restoration program monitoring wells. Mitigation efforts to reduce elevated turbidity in groundwater samples were implemented in 2016. The primary approach to reduce turbidity was to install permanent bladder pumps in the monitoring wells that are to be regularly sampled. The permanent pumps eliminate the need to lower and raise equipment in the well, which disturbs the sediment at the bottom of the well.

Wells sampled in 2023 used previously installed bladder pumps, with the exceptions noted below:

- Non-dedicated pumps were set in WBGmw-016, WBGmw-017, WBGmw-018, LL1mw-082, LL3mw-245, LL12mw-246, LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, LL12mw-248, LL12mw-249, FBQmw-178, FBQmw-179, FBQmw-180, FBQmw-181, and 071tw-001 for a minimum of 48 hours prior to sampling during the Spring 2023 sampling event.
- Prior to the Fall 2023 sampling event, dedicated pumps were set in the 12 wells installed under the FS Monitoring Well Installation Plan (Leidos 2022a). A dedicated pump was not set at temporary well 071tw-001 because it was only recommended for one-time sampling. The dedicated pumps were installed a minimum of 48 hours prior to sampling during the Fall 2023 sampling event.
- Non-dedicated pumps were set in WBGmw-016, WBGmw-017, WBGmw-018, LL1mw-082, LL3mw-245, LL12mw-246, LL1mw-087, LL1mw-090, and FBQmw-174 for a minimum of 48 hours prior to sampling during the Fall 2023 sampling event. Non-dedicated pumps were required to collect samples at LL1mw-087, LL1mw-090, and FBQmw-174 because groundwater was below the intake of the previously installed dedicated pumps.
- Monitoring well SCFmw-004 is known to become artesian; therefore, a well packer is used to inhibit groundwater from perpetually flooding the well casing. The well was only artesian during the Spring 2023 sampling event. A minimum of 48 hours prior to sampling, the well packer was removed, and a bladder pump was installed.

Turbidity was measured during groundwater sampling using Aqua TROLL 600 Multiparameter Sondes during the Spring and Fall 2023 sampling events. In accordance with turbidity stabilization requirements for sampling procedures at the facility, turbidity was considered stable when readings less than or equal to 10 nephelometric turbidity units (NTUs) were achieved or the turbidity was less than 50 NTUs after 2 hours of purging the well.

The Spring 2023 sampling event included collecting groundwater samples from 61 monitoring wells. Forty-two of the 61 wells had turbidity readings between 0 and 10 NTUs, 5 of the wells had turbidity readings between 10 and 50 NTUs, and 14 of the wells (LL1mw-086, LL1mw-090, LL1mw-091, LL2mw-059, LL3mw-237, LL3mw-247, LL3mw-248, LL12mw-187, LL12mw-244, LL12mw-246, LL12mw-248, LL12mw-249, FWGmw-011, and FWGmw-021) had turbidity readings greater than 50 NTUs. Metals analysis was not required for any of the 14 wells in which turbidity readings exceeded 50 NTU; therefore, filtered samples were not collected at these wells during the Spring 2023 sampling event. Table 4-3 presents the final turbidity readings from the Spring 2023 sampling event.

The Fall 2023 sampling event included collecting groundwater samples from 58 monitoring wells. Forty-three of the 58 wells had turbidity readings between 0 and 10 NTUs, 5 of the wells had turbidity readings between 10 and 50 NTUs, and 9 of the wells (LL1mw-081, LL1mw-082, LL1mw-086, LL1mw-093, LL12mw-244, LL3mw-238, LL3mw-239, FBQmw-175, and FBQmw-179) had final turbidity readings greater than 50 NTUs. One of the wells (LL1mw-087) was sampled over the course of 2 days due to the well continually going dry, although field notes indicate that the water was clear. Metals analysis was not required at any of these nine wells; therefore, filtered samples were not collected at these wells during the Fall 2023 sampling event. Table 4-4 presents the final turbidity readings from the Fall 2023 sampling event.

4.4.3 Well Redevelopment Recommendations

As part of the ongoing FWGWMP, wells will be selected for redevelopment to remove accumulated sediment and fines from the filter packs. Redevelopment of monitoring wells, as stated in the RIWP (TEC-Weston 2016), will occur if one of the following criteria is met:

- Monitoring wells have turbidity levels between 10 and 20 NTUs, if there is greater than 0.5 feet of sedimentation in the bottom of the well, all previous rounds showed exceedingly high NTUs, and the well is a non-producer (i.e., low yield).
- Turbidity levels were greater than 20 NTUs, unless turbidity levels were less than 10 NTUs in the three previous rounds and unless the well is within a naturally high-turbidity water-bearing zone/aquifer.

An additional consideration of target analytes also will be made when addressing if a well requires redevelopment. For example, if a monitoring well is not going to be sampled and analyzed for metals, it may be determined that well redevelopment is unnecessary.

Wells that had turbidity readings greater than 10 NTUs in 2023 are summarized below and recommendations, if necessary, are provided:

- WBGmw-016
  - Turbidity was 0.59 NTUs in Spring 2023 and 31.36 NTUs in Fall 2023. One of the two previous samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well is recommended for redevelopment in 2024.
- WBGmw-017
  - Turbidity was 47.43 NTUs in Spring 2023 and 13.28 NTUs in Fall 2023. The two previous samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well is recommended for redevelopment in 2024.

- LL1mw-063
    - Turbidity was 25.56 in Spring 2023 and could not be measured in Fall 2023 because the well was dry. Turbidity could only be measured once during the three previous events prior to 2023 and was less than 10 NTUs.
    - This well is recommended for redevelopment prior to sampling in 2024 if sufficient water is available.
- LL1mw-081
    - Turbidity was 38.80 NTUs in Spring 2023 and 104.19 NTUs in Fall 2023. The three previous samples prior to 2023 had a turbidity less than 10 NTUs.
    - This well is recommended for redevelopment prior to sampling in 2024.
- LL1mw-082
    - Turbidity was 3.59 NTUs in Spring 2023 and 4862.50 NTUs in Fall 2023. One of the three previous samples prior to 2023 had a turbidity greater than 10 NTUs.
    - This well is recommended for redevelopment prior to sampling in 2024.
- LL1mw-086
    - Turbidity was 128.62 NTUs in Spring 2023 and 450.68 NTUs in Fall 2023. The three previous samples prior to 2023 had a turbidity greater than 10 NTUs.
    - This well is recommended for redevelopment prior to sampling in 2024.
- LL1mw-090
    - Turbidity was 263.59 NTUs in Spring 2023 and 4.07 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events.
    - This well is not recommended for redevelopment in 2024.
- LL1mw-091
    - Turbidity was 137.38 NTUs in Spring 2023 and 14.54 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events.
    - This well is not recommended for redevelopment in 2024.
- LL1mw-092
    - Turbidity was 8.12 NTUs in Spring 2023 and 17.81 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events. In addition, this well is artesian.
    - This well is not recommended for redevelopment in 2024.
- LL1mw-093
    - Turbidity was 2.00 NTUs in Spring 2023 and 281.91 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events. In addition, this well is artesian.
    - This well is not recommended for redevelopment in 2024.
- LL2mw-059
    - Turbidity was 138.65 NTUs in Spring 2023 and 12.28 NTUs in Fall 2023. One of the previous three samples prior to 2023 had a turbidity greater than 10 NTUs.
    - This well is recommended for redevelopment in 2024.
- LL3mw-237
    - Turbidity was 54.14 NTUs in Spring 2023 and 0.00 NTUs in Fall 2023. The previous three samples prior to 2023 had a turbidity of less than 10 NTUs.
    - This well is not recommended for redevelopment in 2024.

- LL3mw-238
  - Turbidity was 15.26 NTUs in Spring 2023 and 147.03 NTUs in Fall 2023. The previous three samples prior to 2023 had a turbidity less than 10 NTUs.
  - This well is recommended for redevelopment prior to sampling in 2024.
- LL3mw-239
  - Turbidity was 5.33 NTUs in Spring 2023 and 201.24 NTUs in Fall 2023. One of the three previous samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well is recommended for redevelopment prior to sampling in 2024.
- LL3mw-247
  - Turbidity was 312.44 NTUs in Spring 2023 and 7.97 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events.
  - This well is not recommended for redevelopment in 2024.
- LL3mw-248
  - Turbidity was 182.68 NTUs in Spring 2023 and 5.89 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events.
  - This well is not recommended for redevelopment in 2024.
- LL12mw-187
  - Turbidity was 279.58 NTUs in Spring 2023 and 2.89 NTUs in Fall 2023. One of the previous three samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well is recommended for redevelopment in 2024.
- LL12mw-244
  - Turbidity was 2,537.70 NTUs in Spring 2023 and 3,658.4 NTUs in Fall 2023. Two of the previous three samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well was redeveloped on May 18, 2023, prior to both the Spring and Fall 2023 sampling events. This well was also redeveloped on April 21, 2021, during 2021 FWGWMP activities.
  - Per comments provided in the Ohio EPA letter dated January 12, 2024, to the *Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Semi-Annual Report for Spring 2023 Sampling Event*, LL12mw-244 is recommended for redevelopment using a Waterra pump (or equivalent).
- LL12mw-246
  - Turbidity was 268.95 NTUs in Spring 2023 and 5.80 NTUs in Fall 2023. One of the previous three samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well was redeveloped on April 22, 2021, during 2021 FWGWMP activities.
  - This well is recommended for redevelopment in 2024.
- LL12mw-248
  - Turbidity was 546.4 NTUs in Spring 2023 and was not sampled in Fall 2023 because it was dry. This well was installed in 2023, and there is only one recorded sampling event.
  - This well is not recommended for redevelopment in 2024.
- LL12mw-249
  - Turbidity was 163.80 NTUs in Spring 2023 and 6.69 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events.
  - This well is not recommended for redevelopment in 2024.

- FWGmw-011
  - Turbidity was 64.28 NTUs in Spring 2023 and 8.09 NTUs in Fall 2023. The three previous samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well is recommended for redevelopment in 2024.
- FWGmw-021
  - Turbidity was 50.01 NTUs in Spring 2023 and 8.10 NTUs in Fall 2023. One of the three previous samples prior to 2023 had a turbidity greater than 10 NTUs.
  - This well is recommended for redevelopment in 2024.
- FBQmw-175
  - Turbidity was 3.88 NTUs in Spring 2023 and 133.18 NTUs in Fall 2023. The three previous samples prior to 2023 had a turbidity less than 10 NTUs.
  - This well is not recommended for redevelopment in 2024.
- FBQmw-179
  - Turbidity was 9.87 NTUs in Spring 2023 and 57.50 NTUs in Fall 2023. This well was installed in 2023, and there are only two recorded sampling events.
  - This well is not recommended for redevelopment in 2024.
- 071tw-001
  - Turbidity was 12.00 NTUs in Spring 2023 and was not sampled in Fall 2023. This temporary well was only recommended for a one-time sampling event.
  - This well is not recommended for redevelopment in 2024.

4.5 pH MONITORING

As part of each sampling event, field parameter readings of pH are collected during the purging and well stabilization process, as presented in Tables 4-4 and 4-5 for Spring and Fall 2023, respectively. The typical pH range for groundwater in the vicinity of the facility is approximately 5 to 9 standard units (S.U.). One Homewood Sandstone aquifer well sampled in 2023 (FBQmw-174) had a pH level out of the normal range during the Spring 2023 sampling event. The pH for this well was 4.70 S.U. during the Spring 2023 sampling event and 5.99 S.U. during the Fall 2023 sampling event. One Upper Sharon aquifer well (LL1mw-083) had a pH of 4.44 S.U. during the Spring 2023 sampling event and a pH of 4.47 S.U. during the Fall 2023 sampling event.

The FWGW RI Report (Leidos 2022b) evaluated pH at the facility. It was determined that groundwater at Fuze and Booster Quarry was not impacted by historical activities, as a significant reduction in pH did not occur. For Load Line 1, the composition of this highly heterogeneous rock may cause some phenomena to occur at a certain location that is producing a significant amount of carbon dioxide, thereby decreasing the groundwater pH in this location. The observed sulfate and chloride ions were evaluated at the specific wells, and based on this evaluation, no indication was found that the groundwater in this area is contaminated by stronger acids that would reduce the pH.

4.6 LABORATORY ANALYSIS

For the FWGWMP samples collected in 2023, White Water Associates in Amasa, Michigan, and their subcontracted partner, Eurofins in Denver, Colorado, conducted the sample analyses. Appendix D (D.1 [Metals], D.2 [Explosives], D.3 [SVOCs], D.4 [VOCs], D.5 [PCBs], D.6 [Pesticides], and D.7 [Miscellaneous]) contains the laboratory data associated with the Spring and Fall 2023 sampling events.

4.7 DATA QUALITY ASSESSMENTS

Appendix F (F.1 [Spring 2023 Data Packages], F.2 [Fall 2023 Data Packages], F.3 [Spring 2023 FWGWMP Data Quality Assessment Report], F.4 [Spring 2023 FS Data Quality Assessment Report], and F.5 [Fall 2023 Data Quality Assessment Report]) contains the laboratory data packages and data quality assessment reports associated with the Spring and Fall 2023 FWGWMP sampling events and Spring 2023 monitoring well installation sampling event. The results from the Spring 2023 monitoring well sampling event had a separate data quality assessment report, as that one event was in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).

The overall quality of the Spring 2023 FWGWMP, Spring 2023 monitoring well installation, and Fall 2023 FWGWMP sampling events met their respective established project objectives. Through implementation of the project data verification, validation, and assessment process, project information has been determined to be acceptable for use. Samples were successfully collected and produced usable results for 100 percent of the sample analyses performed during each of the sampling events.

4.8 GROUNDWATER ANALYTICAL RESULTS

The groundwater analytical results for the Spring and Fall 2023 sampling events are presented in Appendix D. The tables in this appendix present the groundwater results by analyte group (e.g., VOCs, SVOCs) and indicate the AOC and aquifer associated with each monitoring well, as applicable. The tables also include the appropriate screening level and identify data that are equal to or exceed the screening level. Table 4-6 presents summary statistics of field parameters and chemical analysis by aquifer from the samples collected in 2023.

4.9 INVESTIGATION-DERIVED WASTE

The following subsections summarize the investigation-derived waste (IDW) generated and disposed of in 2023 specific to the FWGWMP sampling and the FS monitoring well installation. Appendix G contains the IDW Waste Characterization and Disposal Reports with waste profiles and supporting laboratory data (G.1 [Spring 2023 FWGWMP Characterization and Disposal Plan], G.3 [Spring 2023 FS Characterization and Disposal Plan], and G.5 [Fall 2023 Characterization and Disposal Plan]), and final bills of lading (G.2, G.4. and G.6).

4.9.1 FWGWMP Sampling

During the Spring and Fall 2023 FWGWMP sampling events, eight 55-gallon drums of liquid IDW were generated. IDW was classified as non-hazardous waste based on generator knowledge and analytical results from IDW samples collected during Spring 2022 FWGWMP activities. The Spring 2023 liquid IDW stream was generated from the same sampling activities as the Spring 2022 sampling activities.

The IDW generated in 2023 consisted of the following:

- Purge water collected from monitoring wells during low-flow sampling activities. Minimal purge water IDW volume was generated during sampling because of the use of dedicated sampling equipment.

- Decontamination fluids used to decontaminate instruments and equipment before and after purging and sampling at each monitoring well.

Purge water and decontamination fluids were transferred to staged drums within Building 1036 by the end of each day. All drums were properly labeled and inspected.

During the Spring 2023 sampling event, five 55-gallon drums of liquid IDW were generated. This IDW was classified as non-hazardous waste using generator knowledge (based on prior analytical results). On August 1, 2023, the five IDW drums were properly transported and disposed of as non-hazardous waste at a permitted wastewater treatment plant. Appendix G (G.1 and G.2) contains the IDW Waste Characterization and Disposal Report, waste profiles, final bill of lading, and supporting laboratory data.

During the Fall 2023 well sampling event, three 55-gallon drums of liquid IDW were generated. This IDW was classified as non-hazardous based on analytical results. On December 14, 2023, the three IDW drums were properly transported and disposed of as non-hazardous waste at a permitted wastewater treatment plant. Appendix G (G.5 and G.6) contains the IDW Waste Characterization and Disposal Report, waste profiles, final bill of lading, and supporting laboratory data.

4.9.2 FS Monitoring Well Installation

IDW was generated during the FS well installation, well development, and groundwater sampling activities. Thirty-two 55-gallon drums of soil and rock cuttings were generated during the installation of the 12 FS monitoring wells and temporary well. One 20,000-gallon frac tank was used to containerize the estimated 13,217 gallons of liquid IDW generated during well installation, well development, and groundwater sampling activities.

On May 30, 2023, composite liquid and solid IDW samples were collected and analyzed for toxicity characteristic leaching procedure (TCLP) VOCs, TCLP SVOCs, TCLP pesticides, TCLP herbicides, TCLP metals, total sulfide, total cyanide, pH, ignitability, nitrate/nitrite, and PCBs. The solid IDW profile (CH2503039) was approved by the OHARNG Environmental Specialist on July 26, 2023. A liquid IDW profile was not generated because the liquid was approved by the Army and Ohio EPA to be land applied onsite.

On July 24, 2023, Leidos submitted characterization results and a plan for the liquid IDW. The plan recommended that the liquid IDW be characterized as non-hazardous and for the liquid to be applied onsite via land application. OHARNG approved the plan on July 27, 2023, and subsequently submitted the plan to Ohio EPA for their review and approval of the land application. Ohio EPA provided approval for the land application of the liquid IDW on August 11, 2023. Land application of the liquid IDW was completed from August 22 through August 23, 2023. Land application was completed by purging the liquid from the frac tank using a submersible pump. A 100-micron filter bag was placed at the end of the discharge line to catch sediment and restrict flow. Straw bales were placed at the discharge area to reduce erosion. Land application was continuously monitored, and erosion was not observed. Appendix G (G.3 and G.4) provides the IDW report, laboratory analytical report, IDW container log, and Ohio EPA approval letter for the onsite land application of the liquid IDW.

On July 24, 2023, Leidos submitted a characterization and disposal plan to recommend characterization and classification of the solid IDW and to propose methods for disposal. The plan recommended that the solid IDW be characterized as non-hazardous based on sample results and be disposed of at a permitted treatment or waste facility. OHARNG approved the characterization and disposal plan on July 27, 2023. Clean Harbors picked up the 32 soil drums for disposal on August 11, 2023. Disposal was completed at the Spring Grove Resource Recovery, Inc. facility in Cincinnati, Ohio, on August 14, 2023.

4.10 FIELD CHANGE REQUESTS

All applicable FCRs related to the 2023 FWGWMP sampling events are summarized below and presented in Appendix H:

- LEIDOS_FWGW_001 – Specifies that total depths of wells will not be measured during the facility-wide comprehensive water level measurements due to the permanent bladder pumps.
- LEIDOS_FWGW_004 – Specifies the field quality control sampling frequency.
- LEIDOS_FWGW_006 – Documents the micro-purge procedure to be implemented during groundwater sampling collected by micro-purging with dedicated bladder pumps.
- LEIDOS_FWGW_010 – Specifies that post-sample water quality parameters may not be an accurate characterization of groundwater, and water quality parameters recorded at the time of stabilization (before sampling) are the parameters used for evaluation.
- LEIDOS_FWGW_013 – Addresses recent guidance that a municipal water source is required for drilling source water. This FCR documents the use of the city of Newton Falls water as the approved municipal water source.
- LEIDOS_FWGW_014 – Recommends updated drilling methods to those presented in Sections 4.3.2.1 and 4.3.2.2 of the RIWP (TEC-Weston 2016).

Table 4-1. Wells Sampled and Chemical Groups Analyzed in Spring 2023

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Expanded Explosives[a]	VOCs	SVOCs[b]	PCBs	Pesticides	Cyanide	Nitrate	MNA Suite[c]	Other
1	RVAAP-04 Open Demolition Area #2	DETmw-003	Unconsolidated	X	X		X	X	X	X	X			
2	RVAAP-04 Open Demolition Area #2	DETmw-004	Unconsolidated	X	X		X	X	X	X	X			
3	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated		X	X							X	
4	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated		X	X							X	
5	RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	Unconsolidated		X	X								
6	RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	Unconsolidated		X	X								
7	RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	Unconsolidated		X	X								
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	Unconsolidated		X	X							X	
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon		X	X								
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon		X	X								
11	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated		X	X								
13	RVAAP-08 Load Line 1	LL1mw-064	Unconsolidated		X	X								
12	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon		X	X							X	
14	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon		X									
15	RVAAP-08 Load Line 1	LL1mw-082	Upper Sharon		X	X								
16	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon		X	X							X	
17	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon		X	X							X	
18	RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated		X	X								
19	RVAAP-08 Load Line 1	LL1mw-087	Unconsolidated		X	X								
20	RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated		X	X								
21	RVAAP-08 Load Line 1	LL1mw-090[d]	Unconsolidated		X									
22	RVAAP-08 Load Line 1	LL1mw-091[d]	Upper Sharon		X									
23	RVAAP-08 Load Line 1	LL1mw-092[d]	Unconsolidated		X									
24	RVAAP-08 Load Line 1	LL1mw-093[d]	Upper Sharon		X									
25	RVAAP-09 Load Line 2	LL2mw-059	Upper Sharon		X	X							X	
26	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon		X	X								
27	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon		X	X							X	
28	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon		X	X							X	
29	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon		X	X								
30	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon		X	X								
31	RVAAP-10 Load Line 3	LL3mw-247[d]	Upper Sharon			X								
32	RVAAP-10 Load Line 3	LL3mw-248[d]	Upper Sharon			X								
33	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated									X		Ammonia
34	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated									X		Ammonia
35	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated									X		Ammonia
36	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated									X		Ammonia
37	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated									X		Ammonia
38	RVAAP-12 Load Line 12	LL12mw-248[d]	Unconsolidated									X		Ammonia
39	RVAAP-12 Load Line 12	LL12mw-249[d]	Unconsolidated									X		
40	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	Homewood		X	X							X	
41	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood		X	X							X	
42	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood		X	X								
43	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-178[d]	Homewood			X								
44	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-179[d]	Upper Sharon			X								
45	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-180[d]	Homewood			X								
46	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-181[d]	Upper Sharon			X								
47	RVAAP-43 Load Line 10	LL10mw-003	Homewood											Carbon tetrachloride
48	RVAAP-66 Facility-wide Groundwater	FWGmw-004	Unconsolidated		X									
49	RVAAP-66 Facility-wide Groundwater	FWGmw-007	Unconsolidated		X									
50	RVAAP-66 Facility-wide Groundwater	FWGmw-010	Unconsolidated		X	X								

Table 4-1. Wells Sampled and Chemical Groups Analyzed in Spring 2023 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Expanded Explosives[a]	VOCs	SVOCs[c]	PCBs	Pesticides	Cyanide	Nitrate	MNA Suite[c]	Other
51	RVAAP-66 Facility-wide Groundwater	FWGmw-011	Unconsolidated		X									
52	RVAAP-66 Facility-wide Groundwater	FWGmw-012	Upper Sharon		X									
53	RVAAP-66 Facility-wide Groundwater	FWGmw-015	Unconsolidated		X									
54	RVAAP-66 Facility-wide Groundwater	FWGmw-016	Upper Sharon		X									
55	RVAAP-66 Facility-wide Groundwater	FWGmw-018	Basal Sharon									X		
56	RVAAP-66 Facility-wide Groundwater	FWGmw-020	Upper Sharon									X		
57	RVAAP-66 Facility-wide Groundwater	FWGmw-021	Upper Sharon		X									
58	RVAAP-66 Facility-wide Groundwater	FWGmw-023	Upper Sharon		X	X								
59	RVAAP-66 Facility-wide Groundwater	FWGmw-024	Upper Sharon		X									
60	RVAAP-66 Facility-wide Groundwater	SCFmw-004	Unconsolidated		X									
61	RVAAP-66 Facility-wide Groundwater	071tw-001	Unconsolidated	X			X	X						DRO, GRO

X = Indicates well or constituent to be sampled as part of the 2023 FWGWMP.

[a]Expanded explosives list includes 3,5-dinitroanaline, hexahydro-1,3,5-trinitroso-1,3,5-triazine, hexahydro-1,3-dinitroso-5-dinitro-1,3,5-triazine, hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine, 2,4-diamino-6-nitrotoluene, and 2,6-diamino-4-nitrotoluene.
[b]SVOCs include phthalates, nitroaromatics, PAHs, and phenols.
[c]MNA suite includes anions, total organic carbon, alkalinity, pH, and water quality parameters.
[d]Monitoring well installed as part of the in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).

DRO = Diesel Range Organics
FS = Feasibility Study
FWGWMP = Facility-wide Groundwater Monitoring Program
GRO = Gasoline Range Organics
MNA = Monitored Natural Attenuation
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
RVAAP = Ravenna Army Ammunition Plant
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Table 4-2. Wells Sampled and Chemical Groups Analyzed in Fall 2023

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Expanded Explosives[a]	VOCs	SVOCs[b]	PCBs	Pesticides	Cyanide	Nitrate	MNA Suite[c]	Other
1	RVAAP-04 Open Demolition Area #2	DETmw-003	Unconsolidated	X	X		X	X	X	X	X			
2	RVAAP-04 Open Demolition Area #2	DETmw-004	Unconsolidated	X	X		X	X	X	X	X			
3	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated		X	X							X	
4	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated		X	X							X	
5	RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	Unconsolidated		X	X								
6	RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	Unconsolidated		X	X								
7	RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	Unconsolidated		X	X								
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	Unconsolidated		X	X							X	
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon		X	X								
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon		X	X								
11	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated		X	X								
13	RVAAP-08 Load Line 1	LL1mw-064	Unconsolidated		X	X								
12	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon		X	X							X	
14	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon		X									
15	RVAAP-08 Load Line 1	LL1mw-082	Upper Sharon		X	X								
16	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon		X	X							X	
17	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon		X	X							X	
18	RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated		X	X								
19	RVAAP-08 Load Line 1	LL1mw-087	Unconsolidated		X	X								
20	RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated		X	X								
21	RVAAP-08 Load Line 1	LL1mw-090[d]	Unconsolidated		X									
22	RVAAP-08 Load Line 1	LL1mw-091[d]	Upper Sharon		X									
23	RVAAP-08 Load Line 1	LL1mw-092[d]	Unconsolidated		X									
24	RVAAP-08 Load Line 1	LL1mw-093[d]	Upper Sharon		X									
25	RVAAP-09 Load Line 2	LL2mw-059	Upper Sharon		X	X							X	
26	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon		X	X								
27	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon		X	X							X	
28	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon		X	X							X	
29	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon		X	X								
30	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon		X	X								
31	RVAAP-10 Load Line 3	LL3mw-247[d]	Upper Sharon			X								
32	RVAAP-10 Load Line 3	LL3mw-248[d]	Upper Sharon			X								
33	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated									X		Ammonia
34	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated									X		Ammonia
35	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated									X		Ammonia
36	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated									X		Ammonia
37	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated									X		Ammonia
38	RVAAP-12 Load Line 12	LL12mw-248[d]	Unconsolidated									X		Ammonia
39	RVAAP-12 Load Line 12	LL12mw-249[d]	Unconsolidated									X		
40	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	Homewood		X	X							X	
41	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood		X	X							X	
42	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood		X	X								
43	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-178[d]	Homewood			X								
44	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-179[d]	Upper Sharon			X								
45	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-180[d]	Homewood			X								
46	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-181[d]	Upper Sharon			X								
47	RVAAP-43 Load Line 10	LL10mw-003	Homewood											Carbon tetrachloride
48	RVAAP-66 Facility-wide Groundwater	FWGmw-004	Unconsolidated		X									
49	RVAAP-66 Facility-wide Groundwater	FWGmw-007	Unconsolidated		X									
50	RVAAP-66 Facility-wide Groundwater	FWGmw-010	Unconsolidated		X	X								

Table 4-2. Wells Sampled and Chemical Groups Analyzed in Fall 2023 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Expanded Explosives[a]	VOCs	SVOCs[b]	PCBs	Pesticides	Cyanide	Nitrate	MNA Suite[c]	Other
51	RVAAP-66 Facility-wide Groundwater	FWGmw-011	Unconsolidated		X									
52	RVAAP-66 Facility-wide Groundwater	FWGmw-012	Upper Sharon		X									
53	RVAAP-66 Facility-wide Groundwater	FWGmw-015	Unconsolidated		X									
54	RVAAP-66 Facility-wide Groundwater	FWGmw-016	Upper Sharon		X									
55	RVAAP-66 Facility-wide Groundwater	FWGmw-018	Basal Sharon									X		
56	RVAAP-66 Facility-wide Groundwater	FWGmw-020	Upper Sharon									X		
57	RVAAP-66 Facility-wide Groundwater	FWGmw-021	Upper Sharon		X									
58	RVAAP-66 Facility-wide Groundwater	FWGmw-023	Upper Sharon		X	X								
59	RVAAP-66 Facility-wide Groundwater	FWGmw-024	Upper Sharon		X									
60	RVAAP-66 Facility-wide Groundwater	SCFmw-004	Unconsolidated		X									

Monitoring wells LL1mw-063 and LL12mw-248 were both dry and could not be sampled during the Fall 2023 FWGWMP Event.

X = Indicates well or constituent to be sampled as part of the 2023 FWGWMP.

[a]Expanded explosives list includes 3,5-dinitroanaline, hexahydro-1,3,5-trinitroso-1,3,5-triazine, hexahydro-1,3-dinitroso-5-dinitro-1,3,5-triazine, hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine, 2,4-diamino-6-nitrotoluene, and 2,6-diamino-4-nitrotoluene.
[b]SVOCs include phthalates, nitroaromatics, PAHs, and phenols.
[c]MNA suite includes anions, total organic carbon, alkalinity, pH, and water quality parameters.
[d]Monitoring well installed in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).

FS = Feasibility Study
FWGWMP = Facility-wide Groundwater Monitoring Program
MNA = Monitored Natural Attenuation
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
RVAAP = Ravenna Army Ammunition Plant
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Table 4-3. Field Parameter Readings – Spring 2023 Sampling Event

RVAAP Area	Well ID	Date Sampled	Water Temperature (°C)	Conductivity (ms/cm)	pH (S.U.)	Turbidity (NTU)	Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Depth to Water (ft BTOC)
RVAAP-04 Open Demolition Area #2	DETmw-004	5/11/2023	14.30	0.68	6.71	0.00	1.52	218.4	N/A
RVAAP-04 Open Demolition Area #2	DETmw-003	5/11/2023	9.31	0.73	6.86	0.00	0.06	-164.7	9.28
RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	5/16/2023	12.16	0.32	6.27	1.18	0.21	111.7	11.92
RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	5/16/2023	10.98	0.51	7.15	0.00	0.04	44.1	4.08
RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	5/16/2023	10.46	0.49	6.94	6.99	0.16	-5.8	12.10
RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	5/16/2023	11.03	0.42	6.41	0.59	7.50	168.5	13.64
RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	5/16/2023	11.10	0.51	7.36	47.43	2.89	-141.0	4.62
RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	5/16/2023	8.87	0.11	5.52	0.00	5.82	197.1	13.20
RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	5/16/2023	11.49	0.46	7.12	9.31	0.08	-27.2	7.77
RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	5/16/2023	11.73	0.24	6.94	9.39	0.10	-76.9	10.77
RVAAP-08 Load Line 1	LL1mw-063	5/4/2023	11.34	0.16	5.73	25.56	9.30	6.0	N/A
RVAAP-08 Load Line 1	LL1mw-064	5/2/2023	10.38	0.39	7.43	9.28	0.00	-100.5	0.06
RVAAP-08 Load Line 1	LL1mw-087	5/3/2023	11.18	0.33	6.65	4.33	0.76	208.0	4.56
RVAAP-08 Load Line 1	LL1mw-080	5/3/2023	9.10	0.20	6.53	0.00	8.72	243.2	11.40
RVAAP-08 Load Line 1	LL1mw-086	5/4/2023	10.44	0.54	7.36	128.62	0.24	-87.6	6.85
RVAAP-08 Load Line 1	LL1mw-081	5/3/2023	8.35	0.46	6.55	38.80	0.17	-97.6	30.62
RVAAP-08 Load Line 1	LL1mw-082	5/10/2023	11.91	0.34	6.37	3.59	0.72	-106.0	32.20
RVAAP-08 Load Line 1	LL1mw-083	5/3/2023	10.21	0.34	4.44	0.90	5.78	308.8	35.21
RVAAP-08 Load Line 1	LL1mw-089	5/4/2023	10.54	0.08	5.26	7.45	1.34	222.6	26.60
RVAAP-08 Load Line 1	LL1mw-084	5/3/2023	8.63	0.31	5.84	7.89	5.40	265.0	30.20
RVAAP-08 Load Line 1	LL1mw-090	5/9/2023	11.48	0.28	6.77	263.59	0.01	-254.7	7.35
RVAAP-08 Load Line 1	LL1mw-091	5/9/2023	12.67	0.22	6.39	137.38	0.36	-148.3	7.15
RVAAP-08 Load Line 1	LL1mw-092	5/16/2023	11.37	0.37	7.09	8.12	0.00	-113.2	0.00
RVAAP-08 Load Line 1	LL1mw-093	5/16/2023	10.94	0.41	6.72	2.00	1.04	-30.0	0.00
RVAAP-09 Load Line 2	LL2mw-059	5/10/2023	12.09	0.27	6.13	138.65	0.20	69.6	13.44
RVAAP-10 Load Line 3	LL3mw-238	5/15/2023	15.66	0.40	6.72	15.26	2.98	70.0	16.30
RVAAP-10 Load Line 3	LL3mw-237	5/4/2023	9.95	0.29	6.42	54.14	2.31	99.0	15.93
RVAAP-10 Load Line 3	LL3mw-239	5/15/2023	14.22	0.21	5.94	5.33	0.26	72.1	25.76
RVAAP-10 Load Line 3	LL3mw-241	5/17/2023	10.98	0.15	6.01	6.01	3.87	231.3	10.30
RVAAP-10 Load Line 3	LL3mw-245	5/9/2023	11.37	0.80	7.15	6.60	0.00	-75.9	13.42
RVAAP-10 Load Line 3	LL3mw-247	5/15/2023	11.82	0.21	6.20	312.44	0.03	18.2	17.50
RVAAP-10 Load Line 3	LL3mw-248	5/15/2023	10.65	0.12	6.14	182.68	0.00	-20.1	15.91
RVAAP-43 Load Line 10	LL10mw-003	5/11/2023	12.89	0.49	6.46	0.00	5.85	67.4	17.83
RVAAP-12 Load Line 12	LL12mw-187	5/17/2023	11.69	13.64	6.25	279.58	0.20	272.4	10.47
RVAAP-12 Load Line 12	LL12mw-185	5/17/2023	13.40	4.15	6.60	7.41	2.59	247.4	9.69
RVAAP-12 Load Line 12	LL12mw-244	5/22/2023	17.52	0.31	7.22	2537.70	0.63	-117.3	12.35
RVAAP-12 Load Line 12	LL12mw-245	5/17/2023	17.18	1.32	6.92	0.00	1.74	-71.7	13.65
RVAAP-12 Load Line 12	LL12mw-246	5/9/2023	11.85	0.90	7.06	268.95	0.02	-69.8	18.21
RVAAP-12 Load Line 12	LL12mw-248	5/8/2023	16.90	0.43	7.49	546.40	1.01	44.6	12.51
RVAAP-12 Load Line 12	LL12mw-249	5/8/2023	11.99	0.76	7.21	163.80	0.58	188.7	14.36
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	5/17/2023	11.26	0.15	5.43	0.00	5.18	131.0	44.45
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	5/11/2023	12.07	0.19	4.70	0.00	8.58	221.6	N/A
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	5/17/2023	9.61	0.08	5.09	3.88	10.47	200.8	17.64
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-178	5/16/2023	12.36	0.15	5.76	6.15	0.37	-27.7	57.45
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-179	5/22/2023	12.87	0.51	6.68	9.87	0.00	-56.7	136.88
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-180	5/17/2023	11.06	0.20	5.69	3.42	0.01	123.7	47.65
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-181	5/22/2023	13.25	0.91	6.73	8.43	0.00	-59.7	130.33

Table 4-3. Field Parameter Readings – Spring 2023 Sampling Event (Continued)

RVAAP Area	Well ID	Date Sampled	Water Temperature (°C)	Conductivity (ms/cm)	pH (S.U.)	Turbidity (NTU)	Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Depth to Water (ft BTOC)
RVAAP-66 Facility-wide Groundwater	SCFmw-004	5/4/2023	11.21	1.16	6.87	0.66	1.82	-211.7	0.00
RVAAP-66 Facility-wide Groundwater	FWGmw-007	5/18/2023	10.72	1.12	6.85	8.94	1.32	154.0	24.67
RVAAP-66 Facility-wide Groundwater	FWGmw-020	5/10/2023	11.10	0.83	6.95	2.56	2.40	-165.0	22.36
RVAAP-66 Facility-wide Groundwater	FWGmw-016	5/2/2023	11.27	0.73	7.14	0.00	0.53	-54.2	16.43
RVAAP-66 Facility-wide Groundwater	FWGmw-015	5/17/2023	18.71	2.63	6.94	5.59	1.32	160.8	7.15
RVAAP-66 Facility-wide Groundwater	FWGmw-004	5/18/2023	11.01	0.75	7.04	0.00	0.46	157.7	13.52
RVAAP-66 Facility-wide Groundwater	FWGmw-018	5/10/2023	10.98	0.63	7.19	0.00	0.08	-111.8	22.41
RVAAP-66 Facility-wide Groundwater	FWGmw-023	5/2/2023	10.31	0.65	7.04	0.00	0.39	-108.0	116.38
RVAAP-66 Facility-wide Groundwater	FWGmw-024	5/10/2023	13.02	0.47	6.99	9.86	0.15	-44.5	13.47
RVAAP-66 Facility-wide Groundwater	FWGmw-010	5/2/2023	9.22	0.08	5.40	3.98	7.19	222.6	11.65
RVAAP-66 Facility-wide Groundwater	FWGmw-012	5/2/2023	9.59	0.17	6.30	8.81	0.33	-10.2	0.93
RVAAP-66 Facility-wide Groundwater	FWGmw-011	5/2/2023	8.75	0.33	7.07	64.28	1.06	-136.8	1.65
RVAAP-66 Facility-wide Groundwater	FWGmw-021	5/10/2023	11.14	0.17	6.05	50.01	1.81	113.1	20.45
RVAAP-71 Barn No. 5	071tw-001	3/28/2023	10.19	0.73	7.23	12.00	0.94	2.0	21.88

°C = Degrees Celsius
BTOC = Below Top of Casing
ft = Foot
mg/L = Milligrams per Liter
mS/cm MilliSiemens per Centimeter
mV = Millivolt
ID = Identifier
N/A = Not Applicable (depth to water was below top of submersible pump)
NTU = Nephelometric Turbidity Unit
RVAAP = Ravenna Army Ammunition Plant
S.U. = Standard Unit

Table 4-4. Field Parameter Readings – Fall 2023 Sampling Event

RVAAP Area	Well ID	Date Sampled	Water Temperature (°C)	Conductivity (mS/cm)	pH (S.U.)	Turbidity (NTU)	Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Depth to Water (ft BTOC)
RVAAP-04 Open Demolition Area #2	DETmw-004	10/3/2023	15.14	0.77	6.50	9.04	2.65	148.9	N/A
RVAAP-04 Open Demolition Area #2	DETmw-003	10/3/2023	13.82	0.50	7.32	0.78	0.01	-40.3	9.46
RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	10/4/2023	15.56	0.68	6.77	0.00	1.24	203.9	13.85
RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	10/4/2023	14.40	0.55	7.47	0.74	0.16	25.5	7.32
RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	10/4/2023	12.74	0.45	7.42	8.15	0.07	194.8	14.45
RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	10/4/2023	13.91	0.54	7.23	31.36	1.28	35.1	16.15
RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	10/4/2023	13.88	0.53	7.16	13.28	0.03	-80.2	12.27
RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	10/4/2023	14.49	0.12	6.78	0.89	6.44	138.7	20.79
RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	10/4/2023	17.48	0.50	7.19	9.13	0.57	-48.2	10.75
RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	10/4/2023	13.06	0.25	6.96	9.65	0.17	-66.9	13.82
RVAAP-08 Load Line 1	LL1mw-063	NS	NS	NS	NS	NS	NS	NS	NS
RVAAP-08 Load Line 1	LL1mw-064	9/25/2023	14.09	0.39	7.35	9.73	0.16	-45.2	3.86
RVAAP-08 Load Line 1	LL1mw-087[a]	10/5/2023	-	-	-	-	-	-	17.35
RVAAP-08 Load Line 1	LL1mw-080	9/28/2023	15.12	1.06	6.66	2.30	4.62	185.4	18.17
RVAAP-08 Load Line 1	LL1mw-086	9/27/2023	13.64	0.52	7.70	450.68	0.58	-77.3	10.95
RVAAP-08 Load Line 1	LL1mw-081[b]	9/26/2023	14.27	0.43	6.38	104.19	1.61	39.0	35.44
RVAAP-08 Load Line 1	LL1mw-082	10/3/2023	23.87	0.40	6.79	4862.50	5.29	93.7	38.49
RVAAP-08 Load Line 1	LL1mw-083	9/28/2023	11.65	0.36	4.47	5.92	10.40	359.5	36.46
RVAAP-08 Load Line 1	LL1mw-089	9/25/2023	13.24	0.08	5.72	3.34	1.10	124.7	27.97
RVAAP-08 Load Line 1	LL1mw-084	9/28/2023	13.12	0.31	5.70	0.49	4.40	278.6	33.32
RVAAP-08 Load Line 1	LL1mw-090	10/10/2023	13.00	0.16	6.08	4.07	0.38	-20.9	10.11
RVAAP-08 Load Line 1	LL1mw-091	10/2/2023	14.59	0.22	6.75	14.54	1.93	-10.6	9.89
RVAAP-08 Load Line 1	LL1mw-092	10/2/2023	15.01	0.31	7.21	17.81	6.80	-63.6	N/A
RVAAP-08 Load Line 1	LL1mw-093	10/2/2023	17.11	0.35	7.21	281.91	6.46	-85.9	N/A
RVAAP-09 Load Line 2	LL2mw-059	9/27/2023	13.93	0.24	6.24	12.28	0.58	104.6	15.60
RVAAP-10 Load Line 3	LL3mw-238	9/27/2023	15.52	0.40	6.27	147.03	4.65	208.9	19.98
RVAAP-10 Load Line 3	LL3mw-237	10/2/2023	15.82	0.32	6.28	0.00	1.38	213.2	21.88
RVAAP-10 Load Line 3	LL3mw-239	9/27/2023	16.92	0.20	6.31	201.24	0.68	176.3	29.51
RVAAP-10 Load Line 3	LL3mw-241	10/2/2023	14.34	0.20	6.50	0.46	1.32	153.6	16.80
RVAAP-10 Load Line 3	LL3mw-245	9/28/2023	11.31	0.84	7.06	2.99	0.05	-37.4	16.58
RVAAP-10 Load Line 3	LL3mw-247	10/2/2023	12.65	0.22	6.49	7.97	0.12	18.3	20.96
RVAAP-10 Load Line 3	LL3mw-248	10/2/2023	14.18	0.14	6.18	5.89	2.76	14.6	19.60
RVAAP-43 Load Line 10	LL10mw-003	9/28/2023	12.93	0.40	6.83	3.68	1.50	73.2	21.90
RVAAP-12 Load Line 12	LL12mw-187	10/3/2023	14.58	13.95	6.55	2.89	0.21	185.9	15.60
RVAAP-12 Load Line 12	LL12mw-185	10/2/2023	22.40	4.31	6.66	4.92	0.46	137.6	10.10
RVAAP-12 Load Line 12	LL12mw-244	10/3/2023	17.76	0.63	7.17	3658.40	0.05	-45.8	18.01
RVAAP-12 Load Line 12	LL12mw-245	10/3/2023	21.10	1.39	6.98	3.06	1.95	-12.7	16.05
RVAAP-12 Load Line 12	LL12mw-246	9/28/2023	12.83	0.94	7.09	5.80	0.28	-35.7	21.22
RVAAP-12 Load Line 12	LL12mw-248	NS	NS	NS	NS	NS	NS	NS	NS
RVAAP-12 Load Line 12	LL12mw-249	10/3/2023	14.37	0.76	7.13	6.69	1.67	160.4	18.78
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	10/5/2023	11.66	0.11	5.69	0.36	0.27	200.3	47.70
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	10/10/2023	13.22	0.13	5.99	9.58	10.70	127.1	21.15
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	10/4/2023	15.70	0.08	5.93	133.18	8.41	189.5	N/A
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-178	10/5/2023	11.62	0.13	5.95	3.59	0.20	53.4	60.15
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-179	10/5/2023	12.83	0.63	7.24	57.50	0.50	-145.1	138.10
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-180	10/5/2023	12.23	0.14	6.11	6.62	0.18	64.3	50.50
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-181	10/5/2023	12.07	1.00	7.10	8.75	2.26	-130.7	131.08

Table 4-4. Field Parameter Readings – Fall 2023 Sampling Event (Continued)

RVAAP Area	Well ID	Date Sampled	Water Temperature (°C)	Conductivity (mS/cm)	pH (S.U.)	Turbidity (NTU)	Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Depth to Water (ft BTOC)
RVAAP-66 Facility-wide Groundwater	SCFmw-004	10/2/2023	12.66	1.21	7.02	1.52	0.07	-156.9	2.41
RVAAP-66 Facility-wide Groundwater	FWGmw-007	9/26/2023	13.66	1.21	6.87	7.70	0.47	40.7	25.70
RVAAP-66 Facility-wide Groundwater	FWGmw-020	9/28/2023	12.15	0.76	7.07	7.59	1.49	-23.6	24.74
RVAAP-66 Facility-wide Groundwater	FWGmw-016	9/25/2023	15.20	0.74	7.38	0.70	1.51	-26.2	19.19
RVAAP-66 Facility-wide Groundwater	FWGmw-015	9/27/2023	19.72	1.97	7.20	4.47	2.08	56.6	12.52
RVAAP-66 Facility-wide Groundwater	FWGmw-004	10/3/2023	17.86	0.63	7.04	2.68	0.51	102.0	17.02
RVAAP-66 Facility-wide Groundwater	FWGmw-018	9/28/2023	11.48	0.64	7.03	0.08	0.07	-64.0	23.70
RVAAP-66 Facility-wide Groundwater	FWGmw-023	9/28/2023	11.35	0.64	7.32	0.36	0.56	-45.1	118.60
RVAAP-66 Facility-wide Groundwater	FWGmw-024	9/28/2023	12.11	0.49	7.22	8.82	0.07	-30.5	15.60
RVAAP-66 Facility-wide Groundwater	FWGmw-010	9/25/2023	15.74	0.08	5.76	9.15	6.63	193.3	14.98
RVAAP-66 Facility-wide Groundwater	FWGmw-012	9/25/2023	12.16	0.20	5.95	9.26	0.07	85.6	3.83
RVAAP-66 Facility-wide Groundwater	FWGmw-011	9/25/2023	13.90	0.35	7.06	8.09	0.43	-82.9	4.78
RVAAP-66 Facility-wide Groundwater	FWGmw-021	9/28/2023	11.05	0.18	6.33	8.10	0.75	27.5	14.50

[a]Well could not sustain low-flow purge; purged dry with sample being collected within 24 hours. Water quality parameters could not be recorded.
[b]Well could not sustain low-flow purge; purged dry with sample being collected within 24 hours. Water quality parameters collected prior to sampling but do not indicate stabilization during low flow.

°C = Degrees Celsius
BTOC = Below Top of Casing
ft = Feet
ID = Identifier
mg/L = Milligrams per Liter
mS/cm = Millisiemens per Centimeter
mV = Millivolt
N/A = Not Applicable (depth to water was below top of submersible pump)
NS = No Sample (well was dry and no sample could be collected)
NTU = Nephelometric Turbidity Unit
RVAAP = Ravenna Army Ammunition Plant
S.U. = Standard Unit

Table 4-5. 2023 Summary Statistics of Field Parameters and Chemical Analysis

Location	Analysis Type	Analyte	Units	CAS Number	Results >Detection Limit	Minimum Detect	Maximum Detect	Average Result	Groundwater Screening Level	Groundwater Screening Level Source	Number Exceeding Groundwater Screening Level	Station at Max Detect	Date Collected at Max Detect
Basal Sharon Conglomerate	Field Measurements	Conductivity	mS/cm	N237	4/4	0.63	1.21	0.91			0	SCFmw-004	10/02/23
Basal Sharon Conglomerate	Field Measurements	Depth to Water	ft BTOC	WDEPTH	4/4	0	23.7	12.1			0	FWGmw-018	09/28/23
Basal Sharon Conglomerate	Field Measurements	ORP	mV	ORP	4/4	-211.7	-64	-136			0	FWGmw-018	09/28/23
Basal Sharon Conglomerate	Field Measurements	Oxygen	mg/L	17778-80-2	4/4	0.07	1.82	0.51			0	SCFmw-004	05/04/23
Basal Sharon Conglomerate	Field Measurements	Turbidity	NTU	TURBID	4/4	0	1.52	0.565			0	SCFmw-004	10/02/23
Basal Sharon Conglomerate	Field Measurements	Water Temperature	°C	WTEMP	4/4	10.98	12.66	11.6			0	SCFmw-004	10/02/23
Basal Sharon Conglomerate	Field Measurements	pH	units	N704	4/4	6.87	7.19	7.03			0	FWGmw-018	05/10/23
Homewood	Field Measurements	Conductivity	mS/cm	N237	10/10	0.08	0.4	0.157			0	LL10mw-003	09/28/23
Homewood	Field Measurements	Depth to Water	ft BTOC	WDEPTH	9/9	17.64	60.15	41			0	FBQmw-178	10/05/23
Homewood	Field Measurements	ORP	mV	ORP	10/10	-27.7	200.8	114			0	FBQmw-175	05/17/23
Homewood	Field Measurements	Oxygen	mg/L	17778-80-2	10/10	0.01	10.7	3.73			0	FBQmw-174	10/10/23
Homewood	Field Measurements	Turbidity	NTU	TURBID	10/10	0	133.18	17			0	FBQmw-175	10/04/23
Homewood	Field Measurements	Water Temperature	°C	WTEMP	10/10	9.61	15.7	12.2			0	FBQmw-175	10/04/23
Homewood	Field Measurements	pH	units	N704	10/10	5.09	6.83	5.85			0	LL10mw-003	09/28/23
Homewood	Anions	Nitrate	mg/L	14797-55-8	3/4	0.21	0.89	0.54	10	MCL	0	FBQmw-174	05/11/23
Homewood	Anions	Sulfate	mg/L	14808-79-8	4/4	33	64	44.3			0	FBQmw-174	05/11/23
Homewood	Miscellaneous	Alkalinity	mg/L	N33	4/4	8.3	26	18.8			0	FBQmw-174	10/10/23
Homewood	Miscellaneous	TOC	mg/L	N997	4/4	0.57	1.7	1.21			0	FBQmw-174	05/11/23
Homewood	Explosives/Propellants	TNT	µg/L	118-96-7	3/10	0.11	4.4	2.6	0.98	RSL	2	FBQmw-174	10/10/23
Homewood	Explosives/Propellants	2,4-DNT	µg/L	121-14-2	1/10	0.49	0.49	0.49	0.24	RSL	1	FBQmw-174	05/11/23
Homewood	Explosives/Propellants	2-Amino-4,6-DNT	µg/L	35572-78-2	3/10	1.2	7	4.47	0.209	RC	3	FBQmw-174	05/11/23
Homewood	Explosives/Propellants	2-Nitrotoluene	µg/L	88-72-2	1/10	0.22	0.22	0.22	0.37	RA	0	FBQmw-180	05/17/23
Homewood	Explosives/Propellants	3,5-Dinitroaniline	µg/L	618-87-1	3/6	0.15	0.74	0.513	0.77	RSL	0	FBQmw-174	05/11/23
Homewood	Explosives/Propellants	4-Amino-2,6-DNT	µg/L	19406-51-0	3/10	1.5	25	12.8	0.209	RC	3	FBQmw-174	10/10/23
Homewood	Explosives/Propellants	RDX	µg/L	121-82-4	2/10	1.1	2.7	1.9	0.97	RSL	2	FBQmw-178	05/16/23
Homewood	VOCs	Carbon Tetrachloride	µg/L	56-23-5	1/2	1.8	1.8	1.8	5	MCL	0	LL10mw-003	09/28/23
Unconsolidated	Field Measurements	Conductivity	mS/cm	N237	50/50	0.08	13.95	1.27			0	LL12mw-187	10/03/23
Unconsolidated	Field Measurements	Depth to Water	ft BTOC	WDEPTH	48/48	0	27.97	12.8			0	LL1mw-089	09/25/23
Unconsolidated	Field Measurements	ORP	mV	ORP	50/50	-254.7	272.4	51.1			0	LL12mw-187	05/17/23
Unconsolidated	Field Measurements	Oxygen	mg/L	17778-80-2	50/50	0	9.3	1.66			0	LL1mw-063	05/04/23
Unconsolidated	Field Measurements	Turbidity	NTU	TURBID	50/50	0	3658.4	173			0	LL12mw-244	10/03/23
Unconsolidated	Field Measurements	Water Temperature	°C	WTEMP	50/50	8.75	22.4	13.5			0	LL12mw-185	10/02/23
Unconsolidated	Field Measurements	pH	units	N704	50/50	5.26	7.7	6.83			0	LL1mw-086	09/27/23
Unconsolidated	Metals, Total	Aluminum	mg/L	7429-90-5	2/4	0.022	0.029	0.0255	2	RSL	0	DETmw-004	05/11/23
Unconsolidated	Metals, Total	Arsenic	mg/L	7440-38-2	2/4	0.0096	0.012	0.0108	0.01	MCL	1	DETmw-003	10/03/23
Unconsolidated	Metals, Total	Barium	mg/L	7440-39-3	4/4	0.047	0.064	0.0535	2	MCL	0	DETmw-004	10/03/23
Unconsolidated	Metals, Total	Cadmium	mg/L	7440-43-9	1/4	0.00025	0.00025	0.00025	0.005	MCL	0	DETmw-004	10/03/23
Unconsolidated	Metals, Total	Calcium	mg/L	7440-70-2	4/4	95	130	111			0	DETmw-004	10/03/23
Unconsolidated	Metals, Total	Cobalt	mg/L	7440-48-4	2/4	0.00039	0.00041	0.0004	0.0208	RC	0	DETmw-003	10/03/23
Unconsolidated	Metals, Total	Copper	mg/L	7440-50-8	2/4	0.001	0.0012	0.0011	1.3	MCL	0	DETmw-004	05/11/23
Unconsolidated	Metals, Total	Iron	mg/L	7439-89-6	2/4	2	2.1	2.05	1.91	BKG	2	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Lead	mg/L	7439-92-1	1/5	0.00083	0.00083	0.00083	0.015	MCL	0	071tw-001	03/28/23
Unconsolidated	Metals, Total	Magnesium	mg/L	7439-95-4	4/4	25	37	30.5			0	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Manganese	mg/L	7439-96-5	4/4	0.0068	0.26	0.174	0.075	BKG	3	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Potassium	mg/L	7440-09-7	4/4	0.73	2.1	1.53			0	DETmw-003	10/03/23
Unconsolidated	Metals, Total	Sodium	mg/L	7440-23-5	4/4	1.9	13	8.1			0	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Zinc	mg/L	7440-66-6	2/4	0.009	0.032	0.0205	0.6	RSL	0	DETmw-004	10/03/23
Unconsolidated	Anions	Nitrate	mg/L	14797-55-8	10/19	0.091	1700	333	10	MCL	4	LL12mw-187	10/03/23
Unconsolidated	Anions	Sulfate	mg/L	14808-79-8	6/6	9.6	27	18.3			0	WBGmw-006	10/04/23

Table 4-5. 2023 Summary Statistics of Field Parameters and Chemical Analysis (Continued)

Location	Analysis Type	Analyte	Units	CAS Number	Results >Detection Limit	Minimum Detect	Maximum Detect	Average Result	Groundwater Screening Level	Groundwater Screening Level Source	Number Exceeding Groundwater Screening Level	Station at Max Detect	Date Collected at Max Detect
Unconsolidated	Miscellaneous	Alkalinity	mg/L	N33	6/6	49	340	195			0	WBGmw-009	10/04/23
Unconsolidated	Miscellaneous	Ammonia	mg/L	7664-41-7	7/13	0.11	730	209			0	LL12mw-187	10/03/23
Unconsolidated	Miscellaneous	TPH – Gasoline Range Organics	mg/L	NS834	1/1	0.074	0.074	0.074			0	071tw-001	03/28/23
Unconsolidated	Miscellaneous	TOC	mg/L	N997	3/6	0.91	2	1.34			0	WBGmw-006	05/16/23
Unconsolidated	Explosives/Propellants	2-Amino-4,6-DNT	µg/L	35572-78-2	1/39	0.13	0.13	0.13	0.209	RC	0	LL1mw-063	05/04/23
Unconsolidated	Explosives/Propellants	4-Amino-2,6-DNT	µg/L	19406-51-0	1/39	0.32	0.32	0.32	0.209	RC	1	LL1mw-063	05/04/23
Unconsolidated	Explosives/Propellants	HMX	µg/L	2691-41-0	8/39	0.11	3.2	1.46	100	RSL	0	WBGmw-006	10/04/23
Unconsolidated	Explosives/Propellants	MNX	µg/L	5755-27-1	1/23	0.43	0.43	0.43			0	WBGmw-006	05/16/23
Unconsolidated	Explosives/Propellants	RDX	µg/L	121-82-4	7/39	1	7.8	3.34	0.97	RSL	7	WBGmw-006	05/16/23
Unconsolidated	SVOCs	1-Methylnaphthalene	µg/L	90-12-0	1/3	0.033	0.033	0.033	1.1	RSL	0	071tw-001	03/28/23
Unconsolidated	SVOCs	2-Methylnaphthalene	µg/L	91-57-6	2/5	0.037	0.23	0.134	3.6	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Acenaphthylene	µg/L	208-96-8	1/5	0.091	0.091	0.091	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Anthracene	µg/L	120-12-7	2/5	0.095	0.17	0.133	180	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benz(a)anthracene	µg/L	56-55-3	2/5	0.091	0.18	0.136	0.03	RSL	2	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(a)pyrene	µg/L	50-32-8	2/5	0.065	0.15	0.108	0.2	MCL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(b)fluoranthene	µg/L	205-99-2	2/5	0.083	0.17	0.127	0.25	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(g,h,i)perylene	µg/L	191-24-2	2/5	0.073	0.14	0.107	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(k)fluoranthene	µg/L	207-08-9	2/5	0.077	0.16	0.119	2.5	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Chrysene	µg/L	218-01-9	2/5	0.093	0.18	0.137	25	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Di-n-Butyl Phthalate	µg/L	84-74-2	2/5	5.8	7.8	6.8	90	RSL	0	DETmw-004	10/03/23
Unconsolidated	SVOCs	Dibenz(a,h)anthracene	µg/L	53-70-3	2/5	0.069	0.13	0.0995	0.025	RSL	2	DETmw-003	10/03/23
Unconsolidated	SVOCs	Fluoranthene	µg/L	206-44-0	2/5	0.11	0.2	0.155	80	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Fluorene	µg/L	86-73-7	1/5	0.13	0.13	0.13	29	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Indeno(1,2,3-c,d)pyrene	µg/L	193-39-5	2/5	0.076	0.15	0.113	0.25	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Naphthalene	µg/L	91-20-3	1/5	0.11	0.11	0.11	0.12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Phenanthrene	µg/L	85-01-8	3/5	0.057	0.19	0.119	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Pyrene	µg/L	129-00-0	2/5	0.098	0.18	0.139	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	VOCs	Acetone	µg/L	67-64-1	1/5	21	21	21	1800	RSL	0	DETmw-004	10/03/23
Unconsolidated	VOCs	Benzene	µg/L	71-43-2	1/5	0.35	0.35	0.35	5	MCL	0	071tw-001	03/28/23
Upper Sharon	Field Measurements	Conductivity	mS/cm	N237	50/50	0.12	1.06	0.419			0	LL1mw-080	09/28/23
Upper Sharon	Field Measurements	Depth to Water	ft BTOC	WDEPTH	49/49	0	138.1	32.1			0	FBQmw-179	10/05/23
Upper Sharon	Field Measurements	ORP	mV	ORP	50/50	-165	359.5	34.4			0	LL1mw-083	09/28/23
Upper Sharon	Field Measurements	Oxygen	mg/L	17778-80-2	50/50	0	10.4	1.84			0	LL1mw-083	09/28/23
Upper Sharon	Field Measurements	Turbidity	NTU	TURBID	50/50	0	4862.5	136			0	LL1mw-082	10/03/23
Upper Sharon	Field Measurements	Water Temperature	°C	WTEMP	50/50	8.35	23.87	12.8			0	LL1mw-082	10/03/23
Upper Sharon	Field Measurements	pH	units	N704	50/50	4.44	7.38	6.53			0	FWGmw-016	09/25/23
Unconsolidated	Metals, Total	Copper	mg/L	7440-50-8	2/4	0.001	0.0012	0.0011	1.3	MCL	0	DETmw-004	05/11/23
Unconsolidated	Metals, Total	Iron	mg/L	7439-89-6	2/4	2	2.1	2.05	1.91	BKG	2	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Lead	mg/L	7439-92-1	1/5	0.00083	0.00083	0.00083	0.015	MCL	0	071tw-001	03/28/23
Unconsolidated	Metals, Total	Magnesium	mg/L	7439-95-4	4/4	25	37	30.5			0	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Manganese	mg/L	7439-96-5	4/4	0.0068	0.26	0.174	0.075	BKG	3	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Potassium	mg/L	7440-09-7	4/4	0.73	2.1	1.53			0	DETmw-003	10/03/23
Unconsolidated	Metals, Total	Sodium	mg/L	7440-23-5	4/4	1.9	13	8.1			0	DETmw-003	05/11/23
Unconsolidated	Metals, Total	Zinc	mg/L	7440-66-6	2/4	0.009	0.032	0.0205	0.6	RSL	0	DETmw-004	10/03/23
Unconsolidated	Anions	Nitrate	mg/L	14797-55-8	10/19	0.091	1700	333	10	MCL	4	LL12mw-187	10/03/23
Unconsolidated	Anions	Sulfate	mg/L	14808-79-8	6/6	9.6	27	18.3			0	WBGmw-006	10/04/23
Unconsolidated	Miscellaneous	Alkalinity	mg/L	N33	6/6	49	340	195			0	WBGmw-009	10/04/23
Unconsolidated	Miscellaneous	Ammonia	mg/L	7664-41-7	7/13	0.11	730	209			0	LL12mw-187	10/03/23
Unconsolidated	Miscellaneous	TPH – Gasoline Range Organics	mg/L	NS834	1/1	0.074	0.074	0.074			0	071tw-001	03/28/23

Table 4-5. 2023 Summary Statistics of Field Parameters and Chemical Analysis (Continued)

Location	Analysis Type	Analyte	Units	CAS Number	Results >Detection Limit	Minimum Detect	Maximum Detect	Average Result	Groundwater Screening Level	Groundwater Screening Level Source	Number Exceeding Groundwater Screening Level	Station at Max Detect	Date Collected at Max Detect
Unconsolidated	Miscellaneous	TOC	mg/L	N997	3/6	0.91	2	1.34			0	WBGmw-006	05/16/23
Unconsolidated	Explosives/Propellants	2-Amino-4,6-DNT	µg/L	35572-78-2	1/39	0.13	0.13	0.13	0.209	RC	0	LL1mw-063	05/04/23
Unconsolidated	Explosives/Propellants	4-Amino-2,6-DNT	µg/L	19406-51-0	1/39	0.32	0.32	0.32	0.209	RC	1	LL1mw-063	05/04/23
Unconsolidated	Explosives/Propellants	HMX	µg/L	2691-41-0	8/39	0.11	3.2	1.46	100	RSL	0	WBGmw-006	10/04/23
Unconsolidated	Explosives/Propellants	MNX	µg/L	5755-27-1	1/23	0.43	0.43	0.43			0	WBGmw-006	05/16/23
Unconsolidated	Explosives/Propellants	RDX	µg/L	121-82-4	7/39	1	7.8	3.34	0.97	RSL	7	WBGmw-006	05/16/23
Unconsolidated	SVOCs	1-Methylnaphthalene	µg/L	90-12-0	1/3	0.033	0.033	0.033	1.1	RSL	0	071tw-001	03/28/23
Unconsolidated	SVOCs	2-Methylnaphthalene	µg/L	91-57-6	2/5	0.037	0.23	0.134	3.6	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Acenaphthylene	µg/L	208-96-8	1/5	0.091	0.091	0.091	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Anthracene	µg/L	120-12-7	2/5	0.095	0.17	0.133	180	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benz(a)anthracene	µg/L	56-55-3	2/5	0.091	0.18	0.136	0.03	RSL	2	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(a)pyrene	µg/L	50-32-8	2/5	0.065	0.15	0.108	0.2	MCL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(b)fluoranthene	µg/L	205-99-2	2/5	0.083	0.17	0.127	0.25	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(g,h,i)perylene	µg/L	191-24-2	2/5	0.073	0.14	0.107	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Benzo(k)fluoranthene	µg/L	207-08-9	2/5	0.077	0.16	0.119	2.5	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Chrysene	µg/L	218-01-9	2/5	0.093	0.18	0.137	25	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Di-n-butyl phthalate	µg/L	84-74-2	2/5	5.8	7.8	6.8	90	RSL	0	DETmw-004	10/03/23
Unconsolidated	SVOCs	Dibenz(a,h)anthracene	µg/L	53-70-3	2/5	0.069	0.13	0.0995	0.025	RSL	2	DETmw-003	10/03/23
Unconsolidated	SVOCs	Fluoranthene	µg/L	206-44-0	2/5	0.11	0.2	0.155	80	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Fluorene	µg/L	86-73-7	1/5	0.13	0.13	0.13	29	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Indeno(1,2,3-c,d)pyrene	µg/L	193-39-5	2/5	0.076	0.15	0.113	0.25	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Naphthalene	µg/L	91-20-3	1/5	0.11	0.11	0.11	0.12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Phenanthrene	µg/L	85-01-8	3/5	0.057	0.19	0.119	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	SVOCs	Pyrene	µg/L	129-00-0	2/5	0.098	0.18	0.139	12	RSL	0	DETmw-003	10/03/23
Unconsolidated	VOCs	Acetone	µg/L	67-64-1	1/5	21	21	21	1800	RSL	0	DETmw-004	10/03/23
Unconsolidated	VOCs	Benzene	µg/L	71-43-2	1/5	0.35	0.35	0.35	5	MCL	0	071tw-001	03/28/23
Upper Sharon	Field Measurements	Conductivity	mS/cm	N237	50/50	0.12	1.06	0.419			0	LL1mw-080	09/28/23
Upper Sharon	Field Measurements	Depth to Water	ft BTOC	WDEPTH	49/49	0	138.1	32.1			0	FBQmw-179	10/05/23
Upper Sharon	Field Measurements	ORP	mV	ORP	50/50	-165	359.5	34.4			0	LL1mw-083	09/28/23
Upper Sharon	Field Measurements	Oxygen	mg/L	17778-80-2	50/50	0	10.4	1.84			0	LL1mw-083	09/28/23
Upper Sharon	Field Measurements	Turbidity	NTU	TURBID	50/50	0	4862.5	136			0	LL1mw-082	10/03/23
Upper Sharon	Field Measurements	Water Temperature	°C	WTEMP	50/50	8.35	23.87	12.8			0	LL1mw-082	10/03/23
Upper Sharon	Field Measurements	pH	units	N704	50/50	4.44	7.38	6.53			0	FWGmw-016	09/25/23
Upper Sharon	Anions	Nitrate	mg/L	14797-55-8	12/14	0.09	0.9	0.414	10	MCL	0	LL3mw-239	05/15/23
Upper Sharon	Anions	Sulfate	mg/L	14808-79-8	12/12	16	500	98.9			0	LL1mw-080	09/28/23
Upper Sharon	Anions	Sulfide	mg/L	18496-25-8	1/12	1.6	1.6	1.6			0	LL2mw-059	09/27/23
Upper Sharon	Miscellaneous	Alkalinity	mg/L	N33	10/12	29	140	90.7			0	LL1mw-080	09/28/23
Upper Sharon	Miscellaneous	TOC	mg/L	N997	12/12	0.9	2.6	1.43			0	LL3mw-238	05/15/23
Upper Sharon	Explosives/Propellants	1,3,5-TNB	µg/L	99-35-4	8/48	1	11	4.3	59	RSL	0	LL3mw-238	05/15/23
Upper Sharon	Explosives/Propellants	1,3-DNB	µg/L	99-65-0	2/48	1.1	1.6	1.35	0.2	RSL	2	LL1mw-084	05/03/23
Upper Sharon	Explosives/Propellants	TNT	µg/L	118-96-7	12/48	0.088	28	5.77	0.98	RSL	9	LL3mw-238	05/15/23
Upper Sharon	Explosives/Propellants	2,4-Diamino-6-Nitrotoluene	µg/L	6629-29-4	1/26	0.73	0.73	0.73			0	LL1mw-084	05/03/23
Upper Sharon	Explosives/Propellants	2,4-DNT	µg/L	121-14-2	9/48	0.044	2.9	1.02	0.24	RSL	6	LL1mw-083	09/26/23
Upper Sharon	Explosives/Propellants	2,6-DNT	µg/L	606-20-2	2/48	0.8	1.6	1.2	0.122	RA	2	LL1mw-083	09/26/23
Upper Sharon	Explosives/Propellants	2-Amino-4,6-DNT	µg/L	35572-78-2	14/48	0.11	8.7	2.95	0.209	RC	12	LL1mw-083	05/03/23
Upper Sharon	Explosives/Propellants	2-Nitrotoluene	µg/L	88-72-2	4/48	0.13	0.28	0.208	0.37	RA	0	FBQmw-179	05/22/23
Upper Sharon	Explosives/Propellants	3,5-Dinitroaniline	µg/L	618-87-1	13/26	0.14	2.7	1.05	0.77	RSL	7	LL1mw-083	05/03/23
Upper Sharon	Explosives/Propellants	4-Amino-2,6-DNT	µg/L	19406-51-0	16/48	0.19	21	6.83	0.209	RC	15	LL3mw-238	09/27/23
Upper Sharon	Explosives/Propellants	HMX	µg/L	2691-41-0	8/48	0.11	1.6	0.865	100	RSL	0	LL1mw-080	05/03/23

Table 4-5. 2023 Summary Statistics of Field Parameters and Chemical Analysis (Continued)

Location	Analysis Type	Analyte	Units	CAS Number	Results >Detection Limit	Minimum Detect	Maximum Detect	Average Result	Groundwater Screening Level	Groundwater Screening Level Source	Number Exceeding Groundwater Screening Level	Station at Max Detect	Date Collected at Max Detect
Upper Sharon	Explosives/Propellants	MNX	µg/L	5755-27-1	2/26	0.94	1.1	1.02			0	LL1mw-084	05/03/23
Upper Sharon	Explosives/Propellants	RDX	µg/L	121-82-4	22/48	0.25	13	2.4	0.97	RSL	12	LL3mw-238	09/27/23
Upper Sharon	Explosives/Propellants	TNX	µg/L	13980-04-6	1/26	0.11	0.11	0.11			0	LL1mw-084	05/03/23

µg/L = Micrograms per Liter
BKG = Background Screening Level
BTOC = Below Top of Casing
°C = Degrees Celsius
CAS = Chemical Abstracts Service
DNB = Dinitrobenzene
DNT = Dinitrotoluene
ft = feet
HMX = Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
MNX = Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine
mS/cm = Millisiemens per Centimeter
mV = Millivolt
NTU = Nephelometric Turbidity Unit
ORP = Oxidation-Reduction Potential
RA = Resident Adult
RC = Resident Child
RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RSL = Regional Screening Level
SVOC = Semivolatile Organic Compound
TPH = Total Petroleum Hydrocarbon
TNB = Trinitrobenzene
TNT = 2,4,6-Trinitrotoluene
TNX = Hexahydro-1,3,5-Trinitroso-1,3,5-Triazine
TOC = Total Organic Carbon
VOC = Volatile Organic Compound

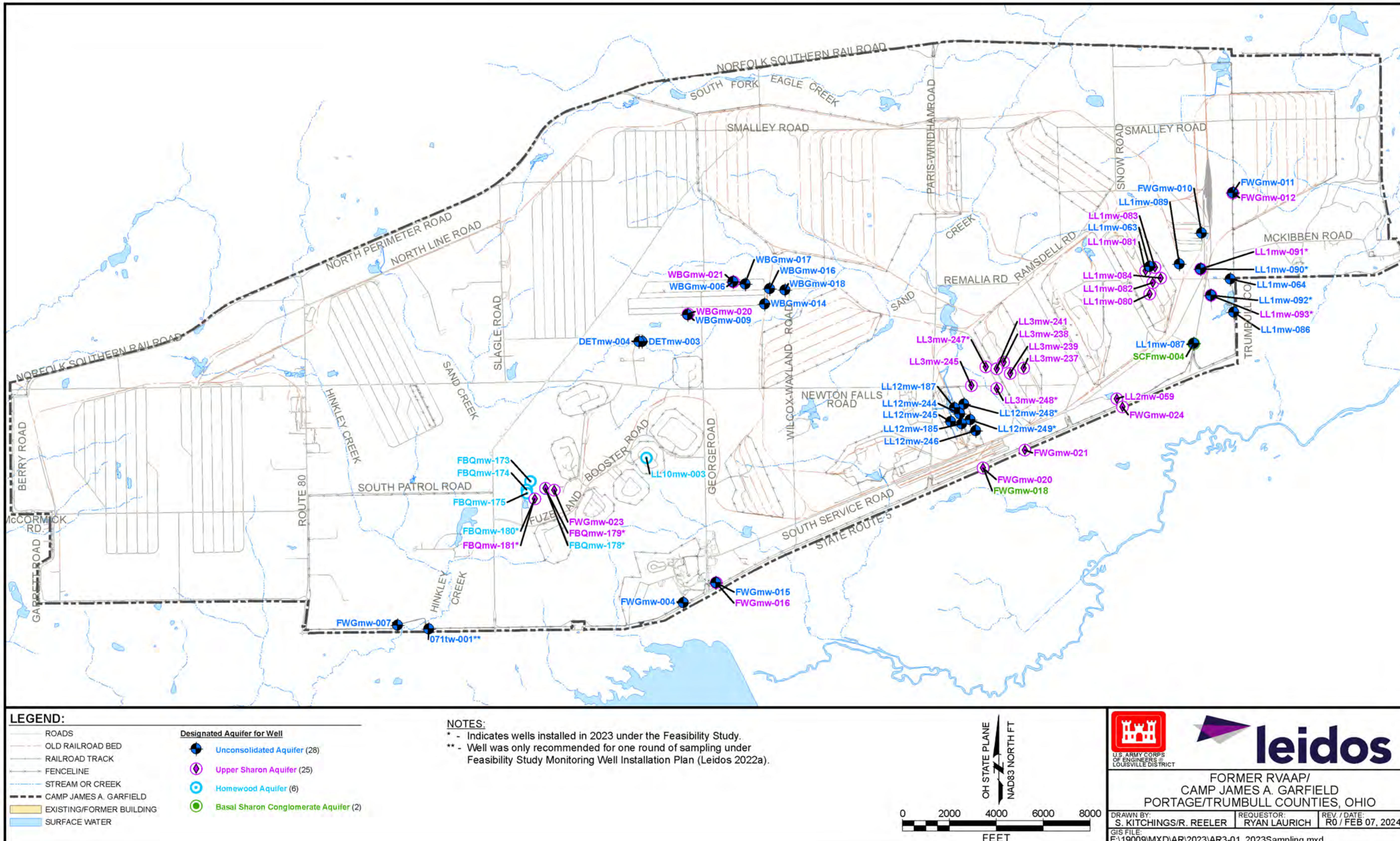

Figure 4-1. FWGWMP Wells Sampled in 2023

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5.0 GROUNDWATER ELEVATIONS

This section discusses the process for obtaining groundwater elevations in 2023, presents updated potentiometric surfaces for the four aquifers at CJAG, and compares and contrasts the current potentiometric surfaces with previous surfaces.

5.1 GROUNDWATER ELEVATION MONITORING

Annual water level measurements were collected in April 2023 in accordance with procedures in Section 5.4.3.1 of the Facility-wide Sampling and Analysis Plan (FWSAP) (SAIC 2011) and the RIWP (TEC-Weston 2016). Table 5-1 presents the water level measurements at each well.

During the field activities, groundwater level measurements could not be obtained from 18 wells. Wasp nests at DA2mw-106, DA2mw-112, DA2mw-113, DETmw-001B, and DETmw-002 prevented field personnel from gauging these wells. A puncture in the well skirt at WBGmw-010 was allowing surface water to penetrate the well vault at a rate greater than it could be evacuated from the vault. Surface water at WBGmw-017 submerged the flush mount well and it could not be gauged. The presence of a stuck pump at LL1mw-085 prevented field personnel from gauging this well. Well construction was not complete at the time of the April 2023 gauging event for eight of the newly installed FS wells (LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, LL12mw-248, and LL12mw-249). LL11mw-012 was inadvertently missed during the April 2023 gauging event. An obstruction in the well casing prevented field personnel from gauging FWGmw-002.Therefore, groundwater elevations from 312 FWGWMP monitoring wells were used to generate the potentiometric surfaces presented in Figures 5-1 through 5-4. These figures show potentiometric surfaces for the Unconsolidated, Homewood Sandstone, Upper Sharon Sandstone, and Basal Sharon Conglomerate aquifers. These depictions include topographic and groundwater elevations to infer potentiometric surfaces near surface water features; however, staff gauges in surface water bodies are not available. Therefore, the interpretations represent estimates based on available information. The remainder of this section discusses the hydraulic gradients and inferred groundwater flow directions in each of the aquifers, vertical and horizontal gradients, and potential offsite migration pathways.

5.2 HORIZONTAL GRADIENTS AND FLOW VELOCITIES

5.2.1 Unconsolidated Aquifer

Figure 5-1 illustrates the potentiometric surface of the Unconsolidated aquifer. Where the Unconsolidated aquifer is absent due to erosion or insufficient thickness, the Homewood formation or Sharon Sandstone is the uppermost aquifer, as shown with a hatched pattern in Figure 5-1. The Homewood formation and Sharon Sandstone are in direct hydraulic communication with the Unconsolidated aquifer, where present.

The site-wide hydraulic gradient in the Unconsolidated aquifer generally includes a strong easterly component with variable northerly or southerly components depending upon the location within the facility. A localized variation is present in the southwestern portion of the facility where the gradient displays a southwesterly trend. Variations in gradient direction are assumed to be caused by variations in topography, the presence streams and waterbodies, land use, subsurface heterogeneity, and the presence/absence of unconsolidated materials. In many portions of the site, streams likely serve as discharge locations for the Unconsolidated aquifer.

Horizontal hydraulic gradients, ranging from 0.008 to 0.015 ft/ft, were calculated for the Unconsolidated aquifer at the three locations shown in Figure 5-1. The average linear groundwater velocity (seepage velocity) was calculated using the three gradients, average porosity values (EQM 2012) from previous Shelby tube samples, and average hydraulic conductivity values derived from rising head/falling head tests conducted on 10 wells in November 2012 (TEC-Weston 2018). The calculated velocities (0.035, 0.044, and 0.066 ft/day) correspond to approximately 13, 16, and 24 ft/yr. Table 5-2 summarizes the horizontal hydraulic gradient and average linear groundwater velocity data for the various aquifers using the April 2023 groundwater elevation measurement data.

5.2.2 Homewood Sandstone Aquifer

Figure 5-2 illustrates the potentiometric surface of the Homewood formation. Note that the Homewood formation is not continuous across CJAG and that there are insufficient wells to accurately determine the potentiometric surface across the aquifer system. As such, contours are inferred based on available wells, topography, and surface water features. The hydraulic gradient within the Homewood formation varies across CJAG. The gradient near C Block Quarry is likely to exhibit radial flow from topographic high points toward local surface water features; however, limited wells are present to accurately determine the hydraulic gradient and potentiometric surface. The gradient near Fuze and Booster Quarry is also inferred to exhibit radial flow from topographic high points toward local surface water features. Along the eastern portion of Fuze and Booster Quarry where several wells are present, the gradient is inferred to trend generally eastward toward local surface water features. The gradient near Load Lines 9 and 10 forms a radial pattern around a topographic high point and trends toward local surface water features.

Horizontal hydraulic gradients were calculated for the Homewood Sandstone aquifer at the four locations shown in Figure 5-2. The gradients are 0.007 ft/ft. Seepage velocities were calculated using the four gradients, average porosity values from previous core samples (EQM 2012), and average hydraulic conductivity values derived from hydraulic testing (slug testing) conducted on two Homewood Sandstone aquifer wells (TEC-Weston 2018). The calculated seepage velocities (0.401 ft/day) correspond to velocities of 146 ft/yr, as shown in Table 5-2.

5.2.3 Upper Sharon Aquifer

Figure 5-3 presents the potentiometric surface of the Upper Sharon aquifer. The site-wide hydraulic gradient in the Upper Sharon generally has an easterly component, but local variations include radial, northerly, and/or southerly flow components. Notable features of the potentiometric surface include a radial pattern associated with the topographic high point near Load Line 2.

As stated above, the Upper Sharon is in direct hydraulic communication with the Unconsolidated aquifer for much of its extent in the central and eastern portions of CJAG. It is inferred that where streams have eroded the unconsolidated deposits, the Upper Sharon is in direct hydraulic communication with the local stream system. Portions of these streams likely receive groundwater discharge from the Upper Sharon.

Horizontal hydraulic gradients were calculated for the Sharon Sandstone aquifer at the three locations shown in Figure 5-3. The gradients range from 0.013 to 0.023 ft/ft. Seepage velocities were calculated using the three gradients, average porosity values from previous core samples (EQM 2012), and average hydraulic conductivity values derived from hydraulic testing (slug testing) conducted on two Sharon Sandstone aquifer wells (TEC-Weston 2018). The calculated seepage velocities (1.5655, 1,926, and 2.769 ft/day) correspond to approximately or 571, 703, and 1,011 ft/yr, as listed in Table 5-2.

5.2.4 Basal Sharon Conglomerate Aquifer

The deepest aquifer zone monitored at CJAG is the Basal Sharon Conglomerate, which occurs within the lower portions of the Sandstone/Conglomerate unit of the Sharon Member. The hydraulic gradient in the Basal Sharon Conglomerate is generally eastward with local trends to the northeast and southeast, as illustrated in Figure 5-4.

Horizontal hydraulic gradients were calculated for the Basal Sharon Conglomerate at the two locations shown in Figure 5-4. The gradients range from 0.0018 to 0.006 ft/ft. Seepage velocities were calculated using the three gradients, porosity values obtained from previous cores in the Upper Sharon (EQM 2012), and hydraulic conductivity value obtained from literary sources for sandstone formations (Bear 1972). The calculated seepage velocities (0.005 and 0.016 ft/day) correspond to approximately 2 and 6 ft/yr, as listed in Table 5-2.

5.3 VERTICAL GRADIENTS

Groundwater elevations at 13 clustered well pairs were compared to calculate vertical gradients between CJAG aquifers. For this evaluation, a well cluster is defined as two wells located within 20 feet of one another and screened in different aquifers. Figure 5-5 presents locations of the well clusters within CJAG.

Table 5-3 lists the well clusters evaluated along with the April 2023 groundwater elevations, midpoint elevation of each well screen interval, and calculated vertical hydraulic gradients. The vertical gradient at a well cluster was calculated as the quotient of the change in groundwater elevations (head) and vertical distance between screen midpoints. A negative vertical gradient indicates an upward gradient, and a positive vertical gradient indicates a downward gradient.

5.3.1 Unconsolidated and Homewood Aquifers

A well cluster screened in the Unconsolidated and Homewood Sharon aquifers was evaluated to determine the vertical hydraulic gradient between the aquifers. The well cluster (LL6mw-008 and LL6mw-009) displayed a downward vertical gradient of 0.004 ft/ft from the Unconsolidated aquifer to the Homewood aquifer. The magnitude of this vertical gradient is minor, and it may be inferred that the aquifers are hydraulically connected with minimal confinement.

5.3.2 Unconsolidated and Upper Sharon Aquifers

Seven well clusters screened in the Unconsolidated and Upper Sharon aquifers were evaluated to determine the vertical hydraulic gradient between the aquifers. Two of the seven well clusters (EBGmw-125/EBGmw-131 and LL4mw-199/LL4mw-201) displayed an upward vertical gradient of -0.047 and -0.165 ft/ft, respectively, from the Upper Sharon to the Unconsolidated aquifer. The observed vertical gradient indicates the Upper Sharon aquifer may be under confined or semi-confined conditions in these areas.

The five remaining well clusters exhibited a downward vertical gradient from the Unconsolidated aquifer toward the Upper Sharon aquifer. The downward gradients ranged from 0.113 to 0.299 ft/ft. At the two well clusters (FWGmw-015/FWGmw-016 and NTAmw-113/NTAmw-120) with the largest vertical gradient, a shale layer is present between the Unconsolidated aquifer and the Upper Sharon Sandstone, as evidenced in the boring logs. The gradient observed at these locations is likely attributable to the shale acting as an aquitard; however, the shale is limited in areal extent. At the remaining three locations, the downward gradient has a lower magnitude but still likely indicates the presence of a low permeable layer between the two aquifers.

5.3.3 Unconsolidated and Basal Sharon Conglomerate Aquifers

Groundwater elevations in two well clusters (LL1mw-087/SCFmw-004 and LL12mw-247/SCFmw-002) were evaluated to estimate the vertical hydraulic gradient between the Unconsolidated and Basal Sharon Conglomerate aquifers. As listed in Table 5-3, the LL1mw-087/SCFmw-004 cluster exhibits an upward gradient of approximately -0.043 ft/ft, while the LL12mw-247/SCFmw-002 cluster exhibits a downward gradient of approximately 0.116 ft/ft.

The LL1mw-087/SCFmw-004 cluster is in the eastern portion of CJAG, close to the southern property boundary. The upward gradient observed in this cluster is corroborated by artesian conditions observed during historical gauging activities. Southwest of LL1mw-087/SCFmw-004, well cluster LL12mw-247/SCFmw-002 exhibits a downward gradient, potentially indicating an area of recharge for the Basal Sharon Conglomerate.

In the south-central portion of CJAG, near Load Lines 5 and 9, the groundwater elevation at SCFmw-001 and FWGmw-019 is approximately 80 to 90 feet lower than the groundwater elevation encountered in the Unconsolidated aquifer. Geologic mapping (Winslow and White 1966) indicates the Mercer Member (shale), Massillon Sandstone, and Sharon Member are present in this area. Shales within the Mercer Member and the Sharon Member-Shale unit likely act as aquitards, locally inhibiting flow between the Unconsolidated and Homewood aquifers to the Basal Sharon Conglomerate. A vertical gradient was not calculated for this area because suitable well pairs (i.e., located within 20 feet of each other) are not present.

To the east of SCFmw-001, where the Homewood, Massillon Sandstone, and Mercer Member have been eroded, the difference in groundwater elevations and the vertical gradient between the Basal Sharon Conglomerate and overlying aquifers decreases rapidly.

5.3.4 Upper Sharon and Basal Sharon Conglomerate Aquifers

Three well clusters screened in the Upper Sharon Sandstone and Basal Sharon Conglomerate were evaluated to estimate the vertical hydraulic gradient between these aquifers. The BKGmw-018/BKGmw-024 cluster indicated an upward gradient of -0.045. At Load Line 12, well cluster FWGmw-018/ FWGmw-020 exhibited an upward gradient of -0.006. At Load Line 10, well cluster FWGmw-019/FWGmw-022 exhibited an upward gradient of -0.008. The gradients calculated between the Upper Sharon and Basal Sharon Conglomerate were relatively minor, indicating the two aquifers are hydraulically connected with minimal confining layers.

5.4 VARIANCES FROM RECENT POTENTIOMETRIC SURFACES

This section and its associated subsections compare and contrast the April 2023 potentiometric surface maps with the October 2022 potentiometric surface maps. The following subsections discuss variances between the 2022 and 2023 potentiometric surfaces for each of the four aquifers.

5.4.1 Unconsolidated Aquifer

A total of 191 wells were used to develop the potentiometric surface map in 2023 (the same number of wells used in 2022). In general, the groundwater elevations observed in the Unconsolidated aquifer during the April 2023 gauging event were similar to those observed during the October 2022 event. On average, the April 2023 groundwater elevations were approximately 3.12 feet higher than in October 2022 (note that the area receives on average 3.98 inches of precipitation in April versus 3.35 inches in October, which comes at the end of the dryer portion of the year). The overall gradients show the primary gradient toward the east, with localized variances toward the north and south, as well as localized radial flow.

5.4.2 Homewood Sandstone Aquifer

Thirty-five wells were used to develop the potentiometric surface maps in 2023. In 2022, 33 wells were used to develop the potentiometric surface. In general, the groundwater elevations observed in the Homewood aquifer during the April 2023 gauging event were similar to those observed during the October 2022 event. The overall gradients indicated by the two events show the primary gradient toward the east/southeast, with a localized radial pattern near Load Line 9. On average, the April 2023 groundwater elevations were approximately 3.70 feet higher than in October 2022 (note that the area receives on average 3.98 inches of precipitation in April versus 3.35 inches in October, which comes at the end of the dryer portion of the year).

5.4.3 Upper Sharon Aquifer

Seventy-two wells were used to develop the 2023 potentiometric map. In 2022, 79 wells were used to develop the potentiometric surface. In general, the groundwater elevations observed in the Upper Sharon aquifer during the April 2023 gauging event were similar to those observed during the October 2022 event. The overall gradients indicated by the two events show the primary gradient toward the east/southeast/northeast with a localized radial pattern near Load Line 2. On average, groundwater elevations in April 2023 were approximately 3.56 feet higher than in October 2022 (note that the area receives on average 3.98 inches of precipitation in April versus 3.35 inches in October, which comes at the end of the dryer portion of the year).

5.4.4 Basal Sharon Conglomerate Aquifer

Eleven wells were used to develop the 2023 potentiometric map (the same number of wells used in 2022). In general, the groundwater elevations observed in the Basal Sharon Conglomerate aquifer during the April 2023 gauging event were similar to those observed during the October 2022 event. In general, the overall gradients indicated by the two events show the primary gradient directed toward the east, with a northeasterly trend in the northeastern portion of CJAG. On average, April 2023 groundwater elevations were approximately 3.10 feet higher than in October 2022 (note that the area receives on average 3.98 inches of precipitation in April versus 3.35 inches in October, which comes at the end of the dryer portion of the year).

Table 5-1. Groundwater Elevations – Spring 2023

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-006	4/24/2023	36.44	958.95
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-007	4/25/2023	6.43	959.48
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-008	4/25/2023	6.98	959.10
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-009	4/25/2023	5.48	959.10
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-010	4/25/2023	26.10	956.04
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-011	4/25/2023	22.41	954.16
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-012	4/25/2023	22.62	955.03
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-013	4/25/2023	25.49	955.22
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-014	4/25/2023	20.21	953.28
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-015	4/24/2023	33.04	958.22
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-016	4/24/2023	37.38	959.22
RVAAP-01 Ramsdell Quarry Landfill	RQLmw-017	4/24/2023	31.72	959.51
RVAAP-02 Erie Burning Grounds	EBGmw-123	4/24/2023	9.57	937.71
RVAAP-02 Erie Burning Grounds	EBGmw-124	4/24/2023	3.21	937.64
RVAAP-02 Erie Burning Grounds	EBGmw-125	4/24/2023	11.05	938.30
RVAAP-02 Erie Burning Grounds	EBGmw-126	4/24/2023	1.74	938.33
RVAAP-02 Erie Burning Grounds	EBGmw-127	4/24/2023	5.82	936.71
RVAAP-02 Erie Burning Grounds	EBGmw-128	4/24/2023	7.21	937.38
RVAAP-02 Erie Burning Grounds	EBGmw-129	4/24/2023	4.86	938.96
RVAAP-02 Erie Burning Grounds	EBGmw-130	4/24/2023	6.61	936.85
RVAAP-02 Erie Burning Grounds	EBGmw-131	4/24/2023	9.06	940.48
RVAAP-04 Open Demolition Area #2	DA2mw-104	4/26/2023	21.96	1051.93
RVAAP-04 Open Demolition Area #2	DA2mw-105	4/26/2023	3.07	1042.27
RVAAP-04 Open Demolition Area #2	DA2mw-106	N/A	NG[a]	N/A
RVAAP-04 Open Demolition Area #2	DA2mw-107	4/26/2023	6.61	1035.02
RVAAP-04 Open Demolition Area #2	DA2mw-108	4/27/2023	5.70	1026.66
RVAAP-04 Open Demolition Area #2	DA2mw-109	4/26/2023	11.91	1059.38
RVAAP-04 Open Demolition Area #2	DA2mw-110	4/26/2023	6.01	1057.77
RVAAP-04 Open Demolition Area #2	DA2mw-111	4/26/2023	7.52	1034.60
RVAAP-04 Open Demolition Area #2	DA2mw-112	N/A	NG[a]	N/A
RVAAP-04 Open Demolition Area #2	DA2mw-113	N/A	NG[a]	N/A
RVAAP-04 Open Demolition Area #2	DA2mw-114	4/27/2023	4.76	1026.60
RVAAP-04 Open Demolition Area #2	DA2mw-115	4/26/2023	5.81	1031.73
RVAAP-04 Open Demolition Area #2	DETmw-001B	N/A	NG[a]	N/A
RVAAP-04 Open Demolition Area #2	DETmw-002	N/A	NG[a]	N/A
RVAAP-04 Open Demolition Area #2	DETmw-003	4/26/2023	9.00	1027.81
RVAAP-04 Open Demolition Area #2	DETmw-004	4/26/2023	10.50	1028.18
RVAAP-05 Winklepeck Burning Grounds	WBGmw-005	4/25/2023	1.33	1050.87
RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	4/25/2023	3.10	1009.06
RVAAP-05 Winklepeck Burning Grounds	WBGmw-007	4/25/2023	13.45	984.64
RVAAP-05 Winklepeck Burning Grounds	WBGmw-008	4/25/2023	11.01	994.70
RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	4/25/2023	9.17	1035.86
RVAAP-05 Winklepeck Burning Grounds	WBGmw-010	N/A	NG[b]	N/A
RVAAP-05 Winklepeck Burning Grounds	WBGmw-011	4/25/2023	7.10	1065.28
RVAAP-05 Winklepeck Burning Grounds	WBGmw-012	4/25/2023	22.78	1056.33
RVAAP-05 Winklepeck Burning Grounds	WBGmw-013	4/26/2023	11.34	1060.36
RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	4/25/2023	11.84	984.94
RVAAP-05 Winklepeck Burning Grounds	WBGmw-015	4/25/2023	7.82	1003.78
RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	4/25/2023	13.52	983.51
RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	N/A	NG[c]	N/A

Table 5-1. Groundwater Elevations – Spring 2023 (Continued)

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	4/25/2023	12.59	978.32
RVAAP-05 Winklepeck Burning Grounds	WBGmw-019	4/25/2023	15.42	974.29
RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	4/25/2023	10.31	1033.46
RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	4/25/2023	7.12	1003.26
RVAAP-06 C Block Quarry	CBLmw-001	4/26/2023	42.94	1138.14
RVAAP-06 C Block Quarry	CBLmw-002	4/26/2023	31.49	1143.75
RVAAP-06 C Block Quarry	CBLmw-003	4/26/2023	34.67	1140.39
RVAAP-06 C Block Quarry	CBLmw-004	4/26/2023	35.37	1139.47
RVAAP-06 C Block Quarry	CBLmw-005	4/26/2023	24.68	1132.88
RVAAP-08 Load Line 1	LL1mw-063	4/24/2023	29.04	965.26
RVAAP-08 Load Line 1	LL1mw-064	4/24/2023	4.75	929.81
RVAAP-08 Load Line 1	LL1mw-065	4/24/2023	10.87	932.99
RVAAP-08 Load Line 1	LL1mw-067	4/24/2023	20.62	959.20
RVAAP-08 Load Line 1	LL1mw-078	4/24/2023	34.68	961.16
RVAAP-08 Load Line 1	LL1mw-079	4/24/2023	34.39	963.48
RVAAP-08 Load Line 1	LL1mw-080	4/24/2023	10.92	985.35
RVAAP-08 Load Line 1	LL1mw-081	4/24/2023	30.32	968.60
RVAAP-08 Load Line 1	LL1mw-082	4/24/2023	30.15	976.30
RVAAP-08 Load Line 1	LL1mw-083	4/24/2023	35.51	959.69
RVAAP-08 Load Line 1	LL1mw-084	4/24/2023	29.85	968.88
RVAAP-08 Load Line 1	LL1mw-085	N/A	NG[d]	N/A
RVAAP-08 Load Line 1	LL1mw-086	4/24/2023	7.36	932.73
RVAAP-08 Load Line 1	LL1mw-087	4/24/2023	4.12	939.66
RVAAP-08 Load Line 1	LL1mw-088	4/27/2023	5.04	933.05
RVAAP-08 Load Line 1	LL1mw-089	4/27/2023	26.81	953.48
RVAAP-08 Load Line 1	LL1mw-090	N/A	NG[e]	N/A
RVAAP-08 Load Line 1	LL1mw-091	N/A	NG[e]	N/A
RVAAP-08 Load Line 1	LL1mw-092	N/A	NG[e]	N/A
RVAAP-08 Load Line 1	LL1mw-093	N/A	NG[e]	N/A
RVAAP-09 Load Line 2	LL2mw-059	4/24/2023	13.31	952.82
RVAAP-09 Load Line 2	LL2mw-060	4/24/2023	6.19	954.84
RVAAP-09 Load Line 2	LL2mw-261	4/24/2023	6.45	1004.95
RVAAP-09 Load Line 2	LL2mw-262	4/24/2023	8.28	1004.34
RVAAP-09 Load Line 2	LL2mw-263	4/24/2023	8.49	1002.98
RVAAP-09 Load Line 2	LL2mw-264	4/24/2023	6.36	1005.52
RVAAP-09 Load Line 2	LL2mw-265	4/24/2023	9.54	951.70
RVAAP-09 Load Line 2	LL2mw-266	4/24/2023	10.76	1005.52
RVAAP-09 Load Line 2	LL2mw-267	4/24/2023	6.01	1008.80
RVAAP-09 Load Line 2	LL2mw-268	4/24/2023	14.17	1003.11
RVAAP-09 Load Line 2	LL2mw-269	4/24/2023	16.36	995.26
RVAAP-09 Load Line 2	LL2mw-270	4/24/2023	6.63	1003.55
RVAAP-09 Load Line 2	LL2mw-271	4/27/2023	10.38	950.27
RVAAP-09 Load Line 2	LL2mw-272	4/24/2023	7.88	1009.92
RVAAP-10 Load Line 3	LL3mw-232	4/25/2023	18.58	981.83
RVAAP-10 Load Line 3	LL3mw-233	4/25/2023	26.03	978.33
RVAAP-10 Load Line 3	LL3mw-234	4/25/2023	9.10	997.46
RVAAP-10 Load Line 3	LL3mw-235	4/25/2023	17.90	992.04
RVAAP-10 Load Line 3	LL3mw-236	4/25/2023	17.17	994.53
RVAAP-10 Load Line 3	LL3mw-237	4/25/2023	14.60	990.97
RVAAP-10 Load Line 3	LL3mw-238	4/25/2023	15.56	991.35

Table 5-1. Groundwater Elevations – Spring 2023 (Continued)

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-10 Load Line 3	LL3mw-239	4/25/2023	24.17	979.33
RVAAP-10 Load Line 3	LL3mw-240	4/25/2023	25.15	982.37
RVAAP-10 Load Line 3	LL3mw-241	4/25/2023	8.09	986.56
RVAAP-10 Load Line 3	LL3mw-242	4/25/2023	13.17	986.15
RVAAP-10 Load Line 3	LL3mw-243	4/25/2023	9.03	982.13
RVAAP-10 Load Line 3	LL3mw-244	4/25/2023	7.25	980.99
RVAAP-10 Load Line 3	LL3mw-245	4/25/2023	13.43	967.27
RVAAP-10 Load Line 3	LL3mw-246	4/27/2023	19.56	968.74
RVAAP-10 Load Line 3	LL3mw-247	N/A	NG[e]	N/A
RVAAP-10 Load Line 3	LL3mw-248	N/A	NG[e]	N/A
RVAAP-11 Load Line 4	LL4mw-193	4/25/2023	15.63	967.29
RVAAP-11 Load Line 4	LL4mw-194	4/25/2023	6.62	977.14
RVAAP-11 Load Line 4	LL4mw-195	4/25/2023	10.01	972.58
RVAAP-11 Load Line 4	LL4mw-196	4/25/2023	12.92	971.63
RVAAP-11 Load Line 4	LL4mw-197	4/25/2023	14.09	971.37
RVAAP-11 Load Line 4	LL4mw-198	4/25/2023	6.58	976.84
RVAAP-11 Load Line 4	LL4mw-199	4/25/2023	17.43	959.85
RVAAP-11 Load Line 4	LL4mw-200	4/25/2023	18.53	969.40
RVAAP-11 Load Line 4	LL4mw-201	4/25/2023	10.05	967.43
RVAAP-12 Load Line 12	LL12mw-088	4/25/2023	7.05	974.01
RVAAP-12 Load Line 12	LL12mw-107	4/25/2023	10.26	969.89
RVAAP-12 Load Line 12	LL12mw-113	4/25/2023	5.83	974.35
RVAAP-12 Load Line 12	LL12mw-128	4/25/2023	10.10	968.14
RVAAP-12 Load Line 12	LL12mw-153	4/25/2023	6.62	971.23
RVAAP-12 Load Line 12	LL12mw-154	4/25/2023	9.63	969.43
RVAAP-12 Load Line 12	LL12mw-182	4/25/2023	8.92	975.50
RVAAP-12 Load Line 12	LL12mw-182ss	4/25/2023	9.39	975.09
RVAAP-12 Load Line 12	LL12mw-183	4/25/2023	12.33	970.65
RVAAP-12 Load Line 12	LL12mw-184	4/25/2023	12.71	970.45
RVAAP-12 Load Line 12	LL12mw-185	4/25/2023	7.72	973.59
RVAAP-12 Load Line 12	LL12mw-186	4/25/2023	5.93	972.38
RVAAP-12 Load Line 12	LL12mw-187	4/25/2023	9.92	970.02
RVAAP-12 Load Line 12	LL12mw-188	4/25/2023	4.56	976.07
RVAAP-12 Load Line 12	LL12mw-189	4/25/2023	3.63	974.41
RVAAP-12 Load Line 12	LL12mw-242	4/25/2023	6.12	975.08
RVAAP-12 Load Line 12	LL12mw-243	4/25/2023	10.09	970.70
RVAAP-12 Load Line 12	LL12mw-244	4/25/2023	12.66	967.99
RVAAP-12 Load Line 12	LL12mw-245	4/25/2023	8.93	971.11
RVAAP-12 Load Line 12	LL12mw-246	4/25/2023	17.46	967.37
RVAAP-12 Load Line 12	LL12mw-247	4/25/2023	4.94	978.77
RVAAP-12 Load Line 12	LL12mw-248	N/A	NG[e]	N/A
RVAAP-12 Load Line 12	LL12mw-249	N/A	NG[e]	N/A
RVAAP-13 Building 1200	B12mw-010	4/24/2023	16.17	989.75
RVAAP-13 Building 1200	B12mw-011	4/24/2023	19.17	987.53
RVAAP-13 Building 1200	B12mw-012	4/24/2023	19.42	986.90
RVAAP-13 Building 1200	B12mw-013	4/24/2023	22.02	981.92
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-166	4/24/2023	4.95	1103.91
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-167	4/24/2023	3.92	1111.98
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-168	4/24/2023	9.93	1123.98
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-169	4/24/2023	5.53	1115.05

Table 5-1. Groundwater Elevations – Spring 2023 (Continued)

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-170	4/24/2023	17.96	1124.30
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-171	4/24/2023	16.90	1126.65
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-172	4/24/2023	25.05	1125.04
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	4/24/2023	44.37	1121.57
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	4/24/2023	16.60	1123.37
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	4/24/2023	17.50	1123.23
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-176	4/24/2023	7.71	1124.20
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-177	4/24/2023	11.48	1117.09
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-178	4/27/2023	57.19	1117.92
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-179	4/27/2023	136.44	1038.71
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-180	4/28/2023	47.43	1123.49
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-181	4/28/2023	129.26	1041.67
RVAAP-19 Landfill North of Winklepeck Burning Grounds	LNWmw-024	4/25/2023	10.75	1027.25
RVAAP-19 Landfill North of Winklepeck Burning Grounds	LNWmw-025	4/25/2023	4.37	1024.76
RVAAP-19 Landfill North of Winklepeck Burning Grounds	LNWmw-026	4/25/2023	3.62	1024.18
RVAAP-19 Landfill North of Winklepeck Burning Grounds	LNWmw-027	4/25/2023	5.46	1021.67
RVAAP-28 Suspected Mustard Agent Burial Site	MBSmw-001	4/26/2023	16.99	1065.21
RVAAP-28 Suspected Mustard Agent Burial Site	MBSmw-002	4/26/2023	17.71	1065.51
RVAAP-28 Suspected Mustard Agent Burial Site	MBSmw-003	4/26/2023	18.12	1066.33
RVAAP-28 Suspected Mustard Agent Burial Site	MBSmw-004	4/26/2023	16.51	1065.29
RVAAP-28 Suspected Mustard Agent Burial Site	MBSmw-005	4/26/2023	17.29	1065.13
RVAAP-28 Suspected Mustard Agent Burial Site	MBSmw-006	4/26/2023	16.79	1065.04
RVAAP-29 Upper and Lower Cobbs Ponds	CPmw-001	4/24/2023	0.80	974.46
RVAAP-29 Upper and Lower Cobbs Ponds	CPmw-002	4/24/2023	0.00	972.31
RVAAP-29 Upper and Lower Cobbs Ponds	CPmw-003	4/24/2023	0.50	972.42
RVAAP-29 Upper and Lower Cobbs Ponds	CPmw-004	4/24/2023	9.67	971.53
RVAAP-29 Upper and Lower Cobbs Ponds	CPmw-005	4/24/2023	11.02	962.56
RVAAP-29 Upper and Lower Cobbs Ponds	CPmw-006	4/24/2023	8.01	957.12
RVAAP-33 Load Line 6	LL6mw-001	4/26/2023	16.81	1107.35
RVAAP-33 Load Line 6	LL6mw-002	4/26/2023	19.13	1110.23
RVAAP-33 Load Line 6	LL6mw-003	4/26/2023	15.11	1110.27
RVAAP-33 Load Line 6	LL6mw-004	4/26/2023	15.92	1109.47
RVAAP-33 Load Line 6	LL6mw-005	4/26/2023	11.68	1108.79
RVAAP-33 Load Line 6	LL6mw-006	4/26/2023	13.38	1110.99
RVAAP-33 Load Line 6	LL6mw-007	4/26/2023	3.86	1111.76
RVAAP-33 Load Line 6	LL6mw-008	4/26/2023	13.79	1109.82
RVAAP-33 Load Line 6	LL6mw-009	4/26/2023	13.48	1109.73
RVAAP-34 Sand Creek Disposal Road Landfill	SCLmw-001	4/24/2023	3.01	948.36
RVAAP-34 Sand Creek Disposal Road Landfill	SCLmw-002	4/24/2023	2.84	948.87
RVAAP-34 Sand Creek Disposal Road Landfill	SCLmw-003	4/24/2023	16.66	955.54
RVAAP-38 NACA Test Area	NTAmw-107	4/26/2023	12.55	1067.75
RVAAP-38 NACA Test Area	NTAmw-108	4/26/2023	17.34	1068.28
RVAAP-38 NACA Test Area	NTAmw-109	4/26/2023	11.57	1068.27
RVAAP-38 NACA Test Area	NTAmw-110	4/26/2023	13.63	1068.99
RVAAP-38 NACA Test Area	NTAmw-111	4/26/2023	3.59	1077.35
RVAAP-38 NACA Test Area	NTAmw-112	4/26/2023	8.47	1069.86

Table 5-1. Groundwater Elevations – Spring 2023 (Continued)

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-38 NACA Test Area	NTAmw-113	4/26/2023	6.37	1069.31
RVAAP-38 NACA Test Area	NTAmw-114	4/26/2023	5.61	1073.10
RVAAP-38 NACA Test Area	NTAmw-115	4/26/2023	10.69	1078.96
RVAAP-38 NACA Test Area	NTAmw-116	4/26/2023	4.83	1089.50
RVAAP-38 NACA Test Area	NTAmw-117	4/26/2023	12.98	1081.56
RVAAP-38 NACA Test Area	NTAmw-118	4/26/2023	8.38	1073.06
RVAAP-38 NACA Test Area	NTAmw-119	4/26/2023	12.21	1067.32
RVAAP-38 NACA Test Area	NTAmw-120	4/26/2023	33.49	1041.71
RVAAP-39 Load Line 5	LL5mw-001	4/26/2023	18.99	1108.93
RVAAP-39 Load Line 5	LL5mw-002	4/26/2023	19.61	1109.07
RVAAP-39 Load Line 5	LL5mw-003	4/26/2023	18.28	1109.42
RVAAP-39 Load Line 5	LL5mw-004	4/26/2023	16.81	1109.00
RVAAP-39 Load Line 5	LL5mw-005	4/26/2023	20.52	1108.90
RVAAP-39 Load Line 5	LL5mw-006	4/26/2023	19.15	1108.85
RVAAP-40 Load Line 7	LL7mw-001	4/26/2023	18.58	1111.06
RVAAP-40 Load Line 7	LL7mw-002	4/26/2023	14.75	1114.80
RVAAP-40 Load Line 7	LL7mw-003	4/26/2023	10.49	1110.35
RVAAP-40 Load Line 7	LL7mw-004	4/26/2023	14.13	1112.19
RVAAP-40 Load Line 7	LL7mw-005	4/26/2023	12.05	1123.82
RVAAP-40 Load Line 7	LL7mw-006	4/26/2023	6.98	1116.58
RVAAP-41 Load Line 8	LL8mw-001	4/26/2023	10.53	1110.93
RVAAP-41 Load Line 8	LL8mw-002	4/26/2023	17.02	1107.49
RVAAP-41 Load Line 8	LL8mw-003	4/26/2023	11.85	1107.20
RVAAP-41 Load Line 8	LL8mw-004	4/26/2023	10.09	1105.66
RVAAP-41 Load Line 8	LL8mw-005	4/26/2023	11.45	1104.28
RVAAP-41 Load Line 8	LL8mw-006	4/26/2023	19.45	1097.70
RVAAP-42 Load Line 9	LL9mw-001	4/25/2023	13.11	1121.51
RVAAP-42 Load Line 9	LL9mw-002	4/25/2023	7.61	1119.69
RVAAP-42 Load Line 9	LL9mw-003	4/25/2023	10.66	1125.10
RVAAP-42 Load Line 9	LL9mw-004	4/25/2023	18.83	1113.00
RVAAP-42 Load Line 9	LL9mw-005	4/25/2023	14.02	1116.91
RVAAP-42 Load Line 9	LL9mw-006	4/25/2023	18.69	1111.19
RVAAP-42 Load Line 9	LL9mw-007	4/25/2023	17.44	1102.55
RVAAP-43 Load Line 10	LL10mw-001	4/26/2023	22.49	1110.28
RVAAP-43 Load Line 10	LL10mw-002	4/26/2023	15.12	1112.01
RVAAP-43 Load Line 10	LL10mw-003	4/26/2023	18.14	1112.14
RVAAP-43 Load Line 10	LL10mw-004	4/26/2023	11.21	1111.18
RVAAP-43 Load Line 10	LL10mw-005	4/26/2023	15.35	1110.32
RVAAP-43 Load Line 10	LL10mw-006	4/26/2023	9.98	1113.85
RVAAP-44 Load Line 11	LL11mw-001	4/26/2023	5.05	1095.11
RVAAP-44 Load Line 11	LL11mw-002	4/26/2023	1.03	1078.97
RVAAP-44 Load Line 11	LL11mw-003	4/26/2023	0.70	1087.79
RVAAP-44 Load Line 11	LL11mw-004	4/26/2023	0.20	1084.53
RVAAP-44 Load Line 11	LL11mw-005	4/26/2023	5.34	1074.07
RVAAP-44 Load Line 11	LL11mw-006	4/26/2023	2.28	1084.22
RVAAP-44 Load Line 11	LL11mw-007	4/26/2023	13.48	1068.52
RVAAP-44 Load Line 11	LL11mw-008	4/26/2023	0.40	1087.34
RVAAP-44 Load Line 11	LL11mw-009	4/26/2023	1.70	1089.84
RVAAP-44 Load Line 11	LL11mw-010	4/26/2023	3.27	1079.41
RVAAP-44 Load Line 11	LL11mw-011	4/24/2023	8.01	1071.65

Table 5-1. Groundwater Elevations – Spring 2023 (Continued)

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-44 Load Line 11	LL11mw-012	N/A	NG[f]	N/A
RVAAP-49 Central Burn Pits	CBPmw-001	4/25/2023	13.31	962.53
RVAAP-49 Central Burn Pits	CBPmw-002	4/25/2023	9.38	960.66
RVAAP-49 Central Burn Pits	CBPmw-003	4/25/2023	11.72	962.95
RVAAP-49 Central Burn Pits	CBPmw-004	4/25/2023	10.58	960.55
RVAAP-49 Central Burn Pits	CBPmw-005	4/25/2023	11.85	959.74
RVAAP-49 Central Burn Pits	CBPmw-006	4/25/2023	7.68	959.96
RVAAP-49 Central Burn Pits	CBPmw-007	4/25/2023	15.02	961.35
RVAAP-49 Central Burn Pits	CBPmw-008	4/25/2023	15.65	957.54
RVAAP-49 Central Burn Pits	CBPmw-009	4/25/2023	10.12	961.82
RVAAP-50 Atlas Scrap Yard	ASYmw-001	4/25/2023	11.46	969.67
RVAAP-50 Atlas Scrap Yard	ASYmw-002	4/25/2023	12.63	972.61
RVAAP-50 Atlas Scrap Yard	ASYmw-003	4/25/2023	12.51	969.70
RVAAP-50 Atlas Scrap Yard	ASYmw-004	4/25/2023	9.63	970.03
RVAAP-50 Atlas Scrap Yard	ASYmw-005	4/25/2023	8.12	971.68
RVAAP-50 Atlas Scrap Yard	ASYmw-006	4/25/2023	14.21	968.80
RVAAP-50 Atlas Scrap Yard	ASYmw-007	4/25/2023	15.62	968.54
RVAAP-50 Atlas Scrap Yard	ASYmw-008	4/25/2023	5.65	973.20
RVAAP-50 Atlas Scrap Yard	ASYmw-009	4/25/2023	12.01	970.69
RVAAP-50 Atlas Scrap Yard	ASYmw-010	4/25/2023	12.66	968.39
RVAAP-66 Facility-wide Groundwater	FWGmw-001	4/24/2023	8.08	948.00
RVAAP-66 Facility-wide Groundwater	FWGmw-002	N/A	NG[g]	N/A
RVAAP-66 Facility-wide Groundwater	FWGmw-003	4/26/2023	4.98	1126.44
RVAAP-66 Facility-wide Groundwater	FWGmw-004	4/26/2023	11.93	1024.68
RVAAP-66 Facility-wide Groundwater	FWGmw-005	4/26/2023	21.24	1148.32
RVAAP-66 Facility-wide Groundwater	FWGmw-006	4/26/2023	4.97	1178.82
RVAAP-66 Facility-wide Groundwater	FWGmw-007	4/26/2023	24.44	1050.43
RVAAP-66 Facility-wide Groundwater	FWGmw-008	4/26/2023	5.09	1105.98
RVAAP-66 Facility-wide Groundwater	FWGmw-009	4/26/2023	1.77	1099.83
RVAAP-66 Facility-wide Groundwater	FWGmw-010	4/27/2023	11.80	949.81
RVAAP-66 Facility-wide Groundwater	FWGmw-011	4/24/2023	1.68	939.39
RVAAP-66 Facility-wide Groundwater	FWGmw-012	4/24/2023	1.57	939.28
RVAAP-66 Facility-wide Groundwater	FWGmw-013	4/25/2023	19.21	1039.76
RVAAP-66 Facility-wide Groundwater	FWGmw-014	4/26/2023	3.41	1133.62
RVAAP-66 Facility-wide Groundwater	FWGmw-015	4/26/2023	4.92	1009.05
RVAAP-66 Facility-wide Groundwater	FWGmw-016	4/26/2023	16.68	997.17
RVAAP-66 Facility-wide Groundwater	FWGmw-018	4/27/2023	21.14	962.89
RVAAP-66 Facility-wide Groundwater	FWGmw-019	4/26/2023	98.42	1033.81
RVAAP-66 Facility-wide Groundwater	FWGmw-020	4/27/2023	21.89	962.69
RVAAP-66 Facility-wide Groundwater	FWGmw-021	4/27/2023	19.39	968.58
RVAAP-66 Facility-wide Groundwater	FWGmw-022	4/26/2023	99.08	1033.23
RVAAP-66 Facility-wide Groundwater	FWGmw-023	4/27/2023	116.79	1035.58
RVAAP-66 Facility-wide Groundwater	FWGmw-024	4/27/2023	13.56	949.60
RVAAP-66 Facility-wide Groundwater	SCFmw-001	4/26/2023	89.03	1031.14
RVAAP-66 Facility-wide Groundwater	SCFmw-002	4/25/2023	19.83	964.19
RVAAP-66 Facility-wide Groundwater	SCFmw-003	4/24/2023	7.93	949.99
RVAAP-66 Facility-wide Groundwater	SCFmw-004	4/24/2023	0.00	943.62
RVAAP-66 Facility-wide Groundwater	SCFmw-005	4/27/2023	10.41	949.85
RVAAP-66 Facility-wide Groundwater	SCFmw-006	4/24/2023	17.62	947.76
RVAAP-66 Facility-wide Groundwater	BKGmw-004	4/24/2023	13.42	951.74

Table 5-1. Groundwater Elevations – Spring 2023 (Continued)

RVAAP Area	Well ID	Date Gauged	Water Level Depth (feet)	Groundwater Elevation
RVAAP-66 Facility-wide Groundwater	BKGmw-005	4/26/2023	10.63	1138.81
RVAAP-66 Facility-wide Groundwater	BKGmw-006	4/25/2023	24.21	1002.17
RVAAP-66 Facility-wide Groundwater	BKGmw-008	4/24/2023	17.45	952.95
RVAAP-66 Facility-wide Groundwater	BKGmw-010	4/24/2023	14.66	991.63
RVAAP-66 Facility-wide Groundwater	BKGmw-012	4/24/2023	8.41	989.16
RVAAP-66 Facility-wide Groundwater	BKGmw-013	4/27/2023	10.04	976.55
RVAAP-66 Facility-wide Groundwater	BKGmw-015	4/25/2023	49.97	987.93
RVAAP-66 Facility-wide Groundwater	BKGmw-016	4/26/2023	5.91	1092.51
RVAAP-66 Facility-wide Groundwater	BKGmw-017	4/26/2023	17.79	1115.01
RVAAP-66 Facility-wide Groundwater	BKGmw-018	4/25/2023	15.82	1027.24
RVAAP-66 Facility-wide Groundwater	BKGmw-019	4/27/2023	21.61	1086.63
RVAAP-66 Facility-wide Groundwater	BKGmw-020	4/25/2023	7.48	1057.52
RVAAP-66 Facility-wide Groundwater	BKGmw-021	4/24/2023	22.92	949.24
RVAAP-66 Facility-wide Groundwater	BKGmw-022	4/26/2023	13.91	1153.41
RVAAP-66 Facility-wide Groundwater	BKGmw-023	4/26/2023	4.84	1178.78
RVAAP-66 Facility-wide Groundwater	BKGmw-024	4/25/2023	10.67	1033.11
RVAAP-66 Facility-wide Groundwater	BKGmw-025	4/26/2023	41.58	1069.02
RVAAP-69 Building 1048 Fire Station	069mw-001	4/26/2023	5.46	1021.79
RVAAP-69 Building 1048 Fire Station	069mw-002	4/26/2023	5.58	1022.70
RVAAP-69 Building 1048 Fire Station	069mw-003	4/26/2023	9.52	1017.76
RVAAP-69 Building 1048 Fire Station	069mw-004	4/26/2023	9.25	1014.94
RVAAP-69 Building 1048 Fire Station	069mw-005	4/26/2023	8.40	1014.78
RVAAP-69 Building 1048 Fire Station	069mw-006	4/26/2023	8.45	1019.94
RVAAP-69 Building 1048 Fire Station	069mw-007	4/26/2023	10.12	1019.23
RVAAP-69 Building 1048 Fire Station	069mw-008	4/26/2023	8.02	1015.85
RVAAP-69 Building 1048 Fire Station	069mw-009	4/26/2023	9.41	1014.13
RVAAP-69 Building 1048 Fire Station	069mw-010	4/26/2023	7.21	1016.88
RVAAP-69 Building 1048 Fire Station	069mw-011	4/26/2023	9.03	1014.16
RVAAP-69 Building 1048 Fire Station	069mw-012	4/26/2023	9.68	1013.18
RVAAP-69 Building 1048 Fire Station	069mw-013	4/26/2023	9.76	1022.80
RVAAP-69 Building 1048 Fire Station	069mw-014	4/26/2023	6.72	1021.05
RVAAP-74 Building 1034 Motor Pool Hydraulic Lift	074mw-001	4/27/2023	10.98	1011.03
RVAAP-74 Building 1034 Motor Pool Hydraulic Lift	074mw-002	4/27/2023	11.26	1010.38
RVAAP-74 Building 1034 Motor Pool Hydraulic Lift	074mw-003	4/26/2023	11.92	1008.89

[a]Well not gauged due to presence of wasp nest.
[b]Well not gauged due to hole in well skirt allowing surface water into well vault at a rate higher than it could be evacuated.
[c]Flush mount well submerged by surface water and could not be gauged.
[d]Pump stuck in well above groundwater and could not be gauged.
[e]FS well that could not be gauged, construction was incomplete at time of gauging event.
[f]Well inadvertently not gauged during April 2023 gauging event.
[g]Well could not be gauged due to obstruction above groundwater.

FS = Feasibility Study
ID = Identifier
N/A = Not Applicable
N/G = Not Gauged
NACA = National Advisory Committee for Aeronautics
RVAAP = Ravenna Army Ammunition Plant

Table 5-2. Hydraulic Gradient and Groundwater Flow Velocity

Formation	Hydraulic Gradient	General Gradient	Porosity	Hydraulic Conductivity		Seepage Velocity	
			%	cm/sec	ft/day	ft/day	ft/yr
Unconsolidated	0.008	East	27.40	4.27E-04	1.21	0.035	13
Unconsolidated	0.010	Southwest	27.40	4.27E-04	1.21	0.044	16
Unconsolidated	0.015	East	27.40	4.27E-04	1.21	0.066	24
Homewood Sandstone	0.007	Southeast	13.90	2.81E-03	7.97	0.401	146
Homewood Sandstone	0.007	Southeast	13.90	2.81E-03	7.97	0.401	146
Homewood Sandstone	0.007	East-Northeast	13.90	2.81E-03	7.97	0.401	146
Homewood Sandstone	0.007	East	13.90	2.81E-03	7.97	0.401	146
Upper Sharon	0.016	East-Northeast	10.50	4.46E-03	12.64	1.926	703
Upper Sharon	0.013	East-Northeast	10.50	4.46E-03	12.64	1.565	571
Upper Sharon	0.023	Southeast	10.50	4.46E-03	12.64	2.769	1011
Basal Sharon Conglomerate	0.0018	East	10.50	1.00E-04	0.28	0.005	2
Basal Sharon Conglomerate	0.006	East	10.50	1.00E-04	0.28	0.016	6

cm/sec = Centimeters per Second
ft/day = Feet per Day
ft/yr = Feet per Year

Table 5-3. Vertical Gradient Calculations

RVAAP Area	Well ID	Monitored Zone/Aquifer	TOC Elevation (ft amsl)	Groundwater Elevation (ft amsl)	Screen Midpoint Elevation (ft amsl)	Vertical Hydraulic Gradient (ft/ft)	Vertical Gradient Direction	Comments
Unconsolidated and Homewood Aquifers								
Load Line 6	LL6mw-008	Unconsolidated	1123.61	1109.82	1108.60	0.004	Down	Downward gradient from Unconsolidated aquifer toward Homewood aquifer
Load Line 6	LL6mw-009	Homewood Sandstone	1123.21	1109.73	1086.90			
Unconsolidated and Upper Sharon Aquifers								
Erie Burning Grounds	EBGmw-125	Unconsolidated	949.35	938.30	928.01	-0.047	Up	Upward gradient from Upper Sharon aquifer toward Unconsolidated aquifer
Erie Burning Grounds	EBGmw-131	Upper Sharon	949.54	940.48	881.50			
Facility-wide Groundwater	FWGmw-015	Unconsolidated	1013.97	1009.05	993.10	0.286	Down	Downward gradient from Unconsolidated aquifer toward Upper Sharon aquifer
Facility-wide Groundwater	FWGmw-016	Upper Sharon	1013.85	997.17	951.60			
Load Line 4	LL4mw-199	Unconsolidated	977.28	959.85	959.90	-0.165	Up	Upward gradient from Unconsolidated aquifer toward Upper Sharon aquifer
Load Line 4	LL4mw-201	Upper Sharon	977.48	967.43	913.90			
NACA Test Area	NTAmw-113	Unconsolidated	1075.68	1069.31	1050.61	0.299	Down	Downward gradient from Unconsolidated aquifer toward Upper Sharon aquifer
NACA Test Area	NTAmw-120	Upper Sharon	1075.20	1041.71	958.17			
Winklepeck Burning Grounds	WBGmw-009	Unconsolidated	1045.03	1035.86	1026.32	0.113	Down	Downward gradient from Unconsolidated aquifer toward Upper Sharon aquifer
Winklepeck Burning Grounds	WBGmw-020	Upper Sharon	1043.77	1033.46	1005.00			
Winklepeck Burning Grounds	WBGmw-018	Unconsolidated	990.91	978.32	971.50	0.148	Down	Downward gradient from Unconsolidated aquifer toward Upper Sharon aquifer
Winklepeck Burning Grounds	WBGmw-019	Upper Sharon	989.71	974.29	944.20			

Table 5-3. Vertical Gradient Calculations (Continued)

RVAAP Area	Well ID	Monitored Zone/Aquifer	TOC Elevation (ft amsl)	Groundwater Elevation (ft amsl)	Screen Midpoint Elevation (ft amsl)	Vertical Hydraulic Gradient (ft/ft)	Vertical Gradient Direction	Comments
Winklepeck Burning Grounds	WBGmw-006	Unconsolidated	1012.16	1009.06	997.33	0.234	Down	Downward gradient from Unconsolidated aquifer toward Upper Sharon aquifer
Winklepeck Burning Grounds	WBGmw-021	Upper Sharon	1010.38	1003.26	972.50			
Unconsolidated and Basal Sharon Conglomerate Aquifers								
Load Line 1	LL1mw-087	Unconsolidated	943.78	939.66	929.3	-0.043	Up	Upward gradient from Basal Sharon Conglomerate toward Unconsolidated aquifer
Basal Sharon Conglomerate	SCFmw-004	Basal Sharon Conglomerate	943.62	943.62	836.32			
Load Line 12	LL12mw-247	Unconsolidated	983.71	978.77	965.8	0.116	Down	Downward gradient from Unconsolidated aquifer toward Basal Sharon Conglomerate aquifer
Basal Sharon Conglomerate	SCFmw-002	Basal Sharon Conglomerate	984.02	964.19	839.74			
Upper Sharon and Basal Sharon Conglomerate Aquifers								
Background	BKGmw-018	Upper Sharon	1043.06	1027.24	1021.32	-0.045	Up	Upward gradient from Basal Sharon aquifer toward Upper Sharon aquifer
Background	BKGmw-024	Basal Sharon Conglomerate	1043.78	1033.11	889.89			
Load Line 10	FWGmw-022	Upper Sharon	1132.31	1033.23	970.81	-0.008	Up	Upward gradient from Upper Sharon aquifer toward Basal Sharon Conglomerate aquifer
Load Line 10	FWGmw-019	Basal Sharon Conglomerate	1132.23	1033.81	900.08			
Load Line 12	FWGmw-020	Upper Sharon	984.58	962.29	942.03	-0.006	Up	Minor upward gradient from Basal Sharon aquifer toward Upper Sharon aquifer
Load Line 12	FWGmw-018	Basal Sharon Conglomerate	984.03	962.89	839.92			

amsl = Above Mean Sea Level
ID = Identifier
ft = Feet
ft/ft = Feet per Foot
NACA = National Advisory Committee for Aeronautics
RVAAP = Ravenna Army Ammunition Plant
TOC = Total Organic Carbon

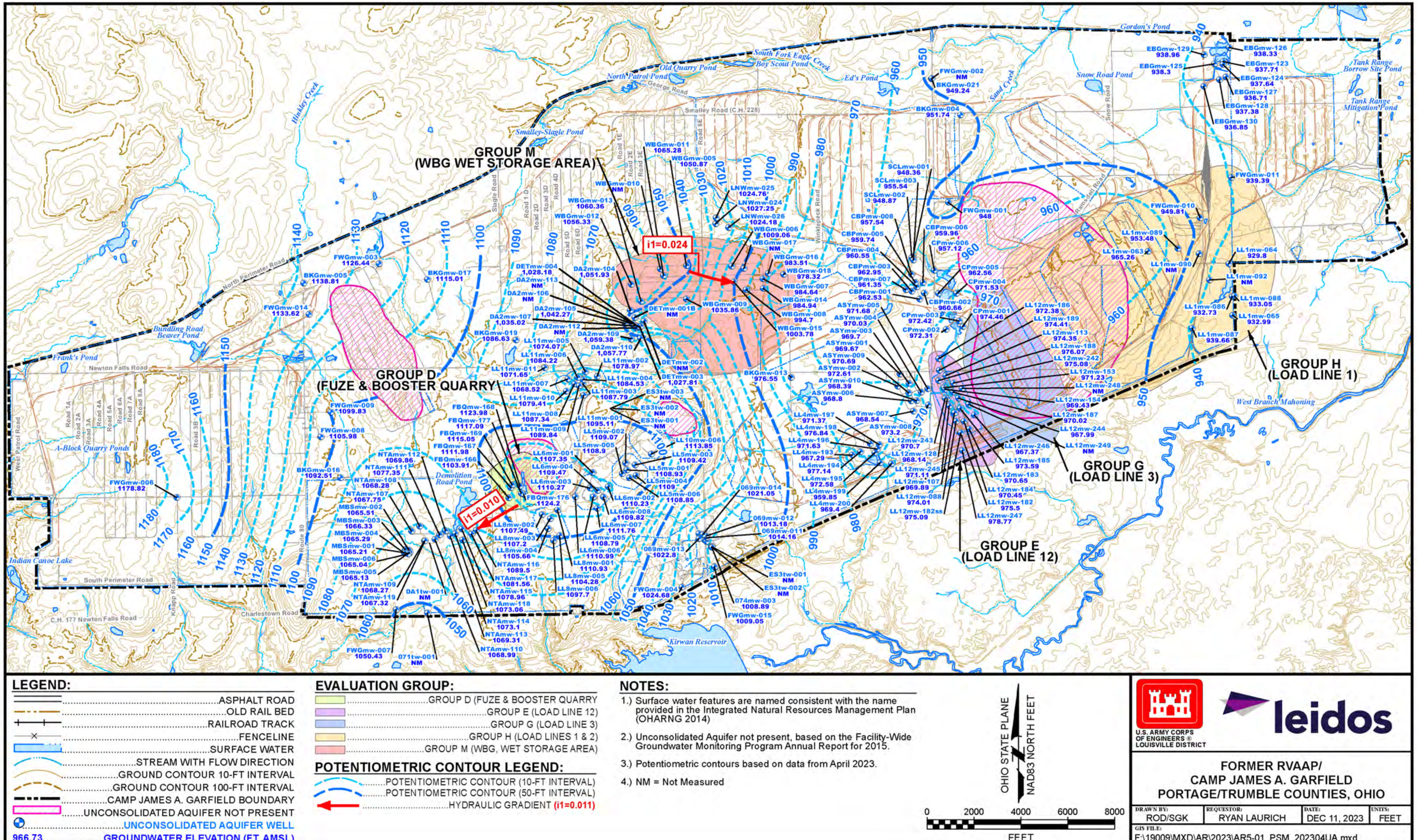

Figure 5-1. Potentiometric Surface Map, April 2023 – Unconsolidated Aquifer

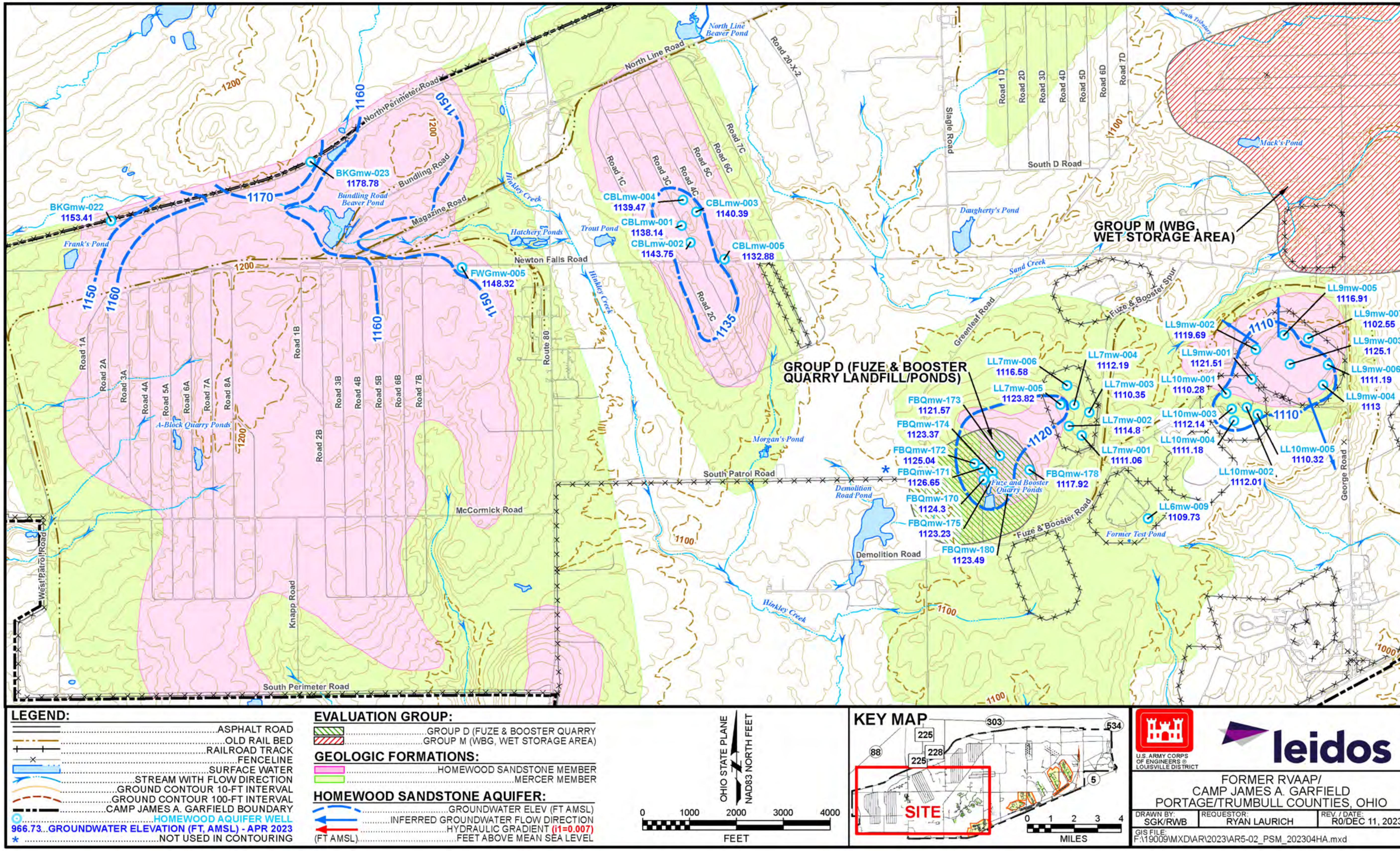

Figure 5-2. Potentiometric Surface Map, April 2023 – Homewood Sandstone Aquifer

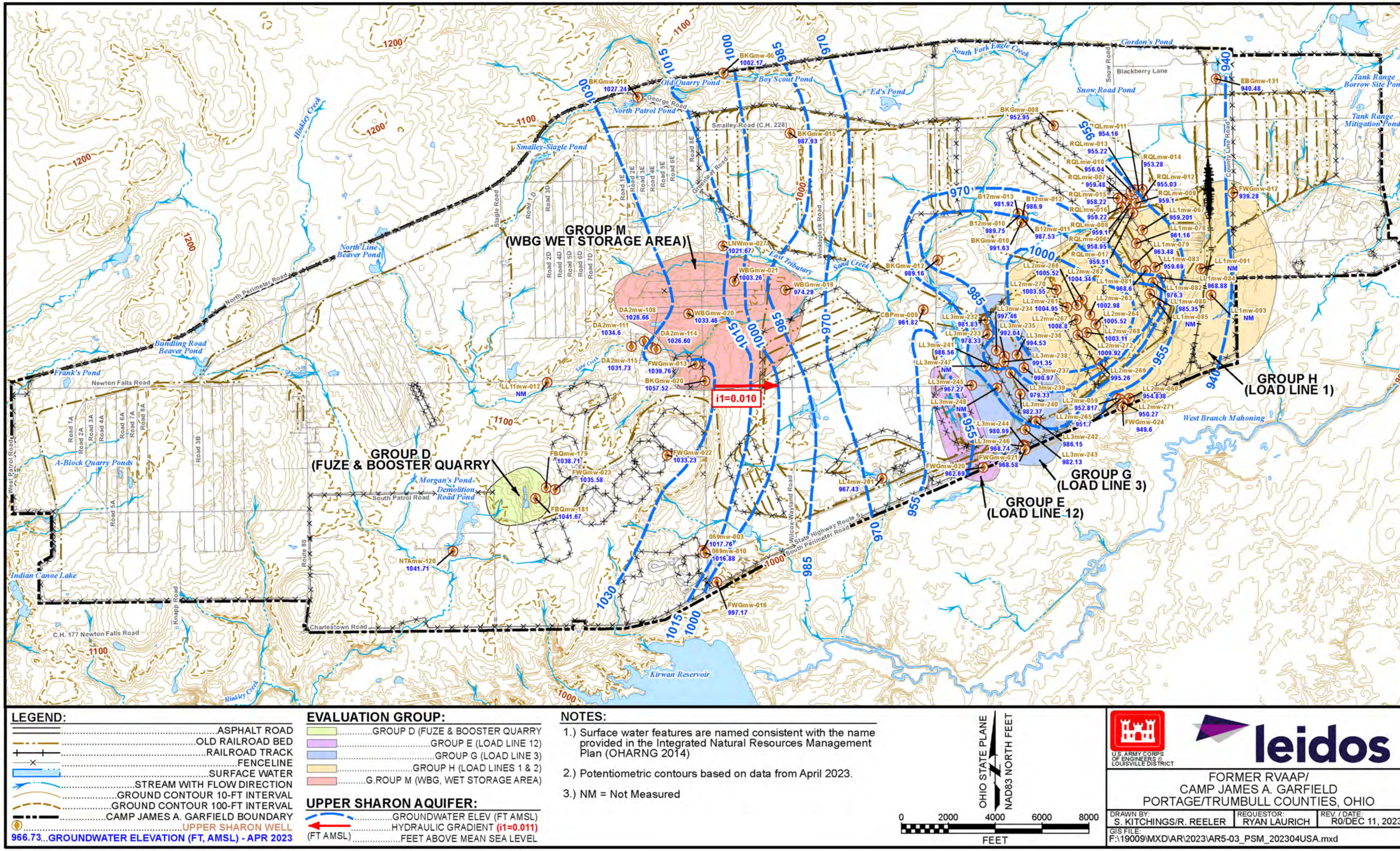

Figure 5-3. Potentiometric Surface Map, April 2023 – Upper Sharon Sandstone Aquifer

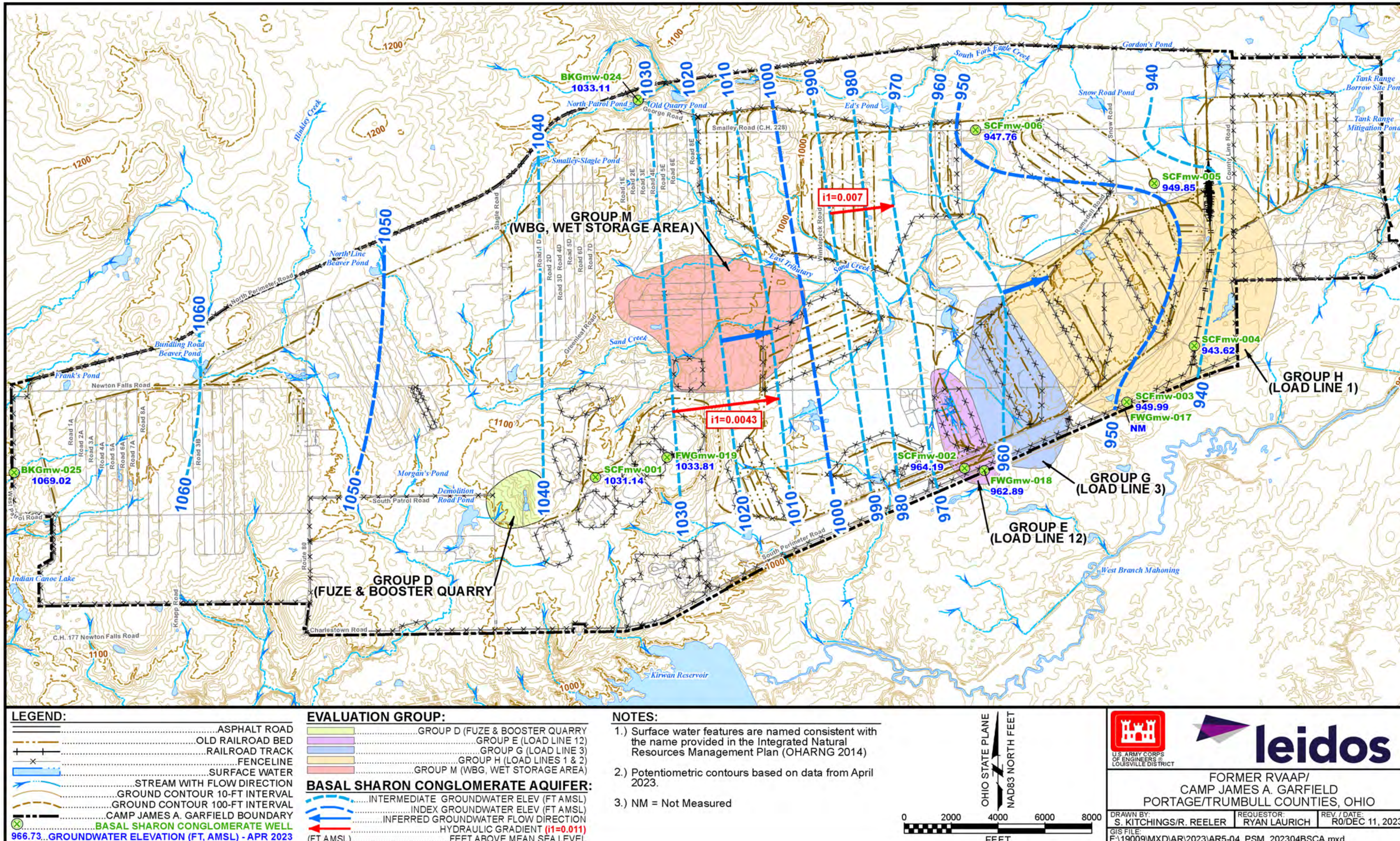

Figure 5-4. Potentiometric Surface Map, April 2023 – Basal Sharon Conglomerate Aquifer

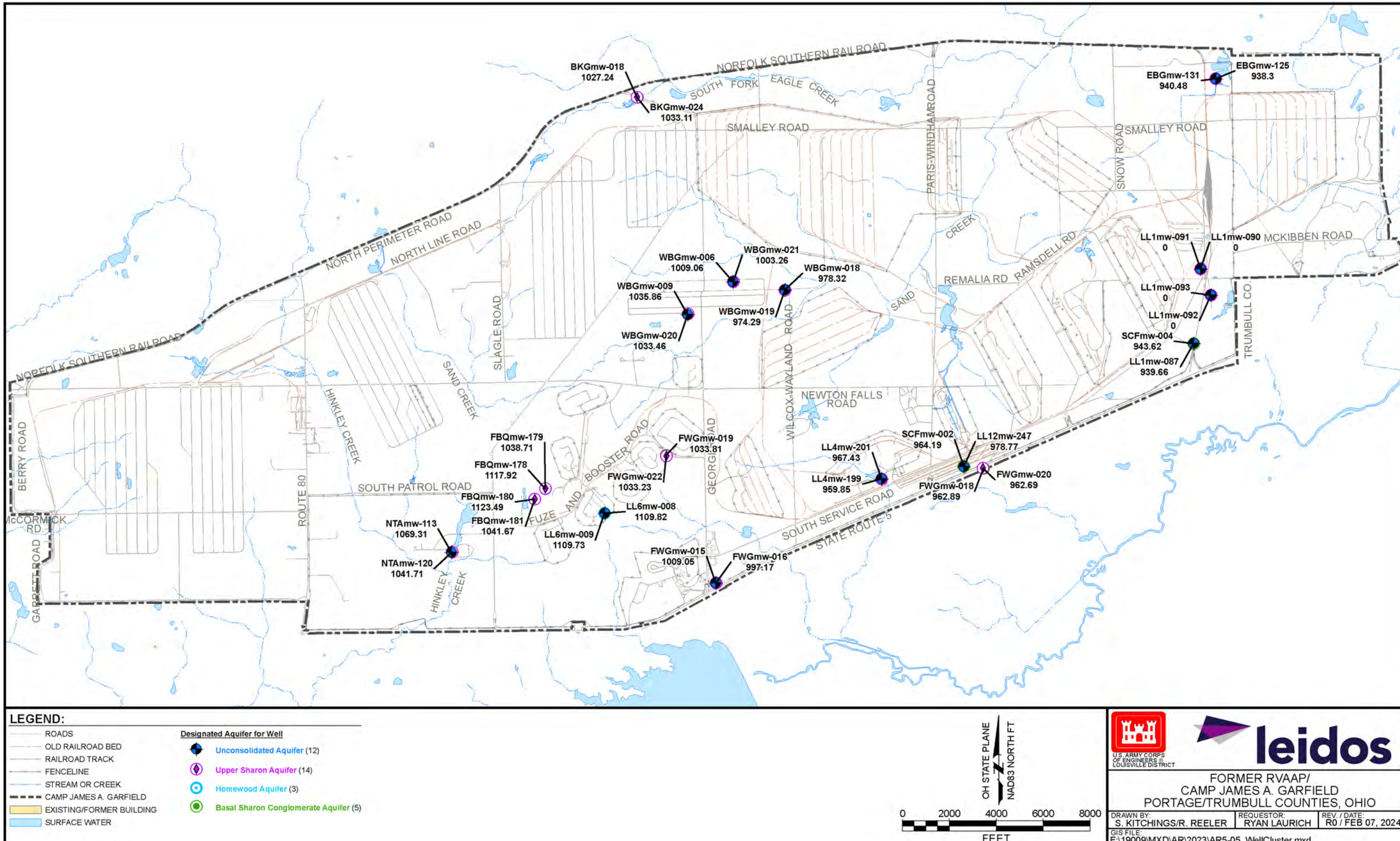

Figure 5-5. Monitoring Well Clusters within Camp James A. Garfield

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6.0 2023 RESULTS AND DISCUSSION

This section provides a discussion of the 2023 results for each analyzed chemical group for the four aquifers at CJAG. In addition, this section explains the screening level used to assess the reported chemical concentrations and provides figures depicting exceedances of the screening levels.

6.1 SCREENING LEVELS

Screening levels have been established for a basis of comparison against actual results. The chemical-specific screening level is the highest concentration among the maximum contaminant level (MCL), Resident Adult/Child facility-wide cleanup goal (FWCUG), or U.S. Environmental Protection Agency (USEPA) Residential tap water regional screening level (RSL) updated as of November 2023. For metals, if the aquifer-specific background concentration is greater than the previously mentioned criteria, that background concentration is used as the screening level. The concentrations are compared to the applicable screening criteria for each chemical.

For this evaluation, updated background concentrations per the *Background Study for Metals for RVAAP-66 Facility-wide Groundwater* (Leidos 2019) are used. The FWCUGs are listed in Tables 5-8 through 5-10 in the *Facility-wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (SAIC 2010). If a chemical does not have one of these values, a cleanup goal may need to be developed in coordination with Ohio EPA.

Chemicals that are considered essential nutrients (e.g., calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium) are an integral part of the human food supply and often are added to food as supplements. These essential nutrients are provided in the tables presenting exceedances of screening level; however, to streamline the narrative section, the essential nutrients are not discussed in the text provided in the following subsections.

The applicable screening level used in this report for each chemical are presented in Table 6-1. The cleanup goal or regulatory limit chosen for screening purposes also is presented in this table. Table 6-2 presents the exceedances during the Spring 2023 sampling event, and Table 6-3 presents the exceedances during the Fall 2023 sampling event. Table 6-4 presents the pH levels in 2023 that were outside a typical pH range of 5 to 9 S.U.

6.2 UNCONSOLIDATED

Twenty-eight wells screened in the Unconsolidated aquifer were sampled in 2023. Temporary well 071tw-001 was only sampled during the Spring 2023 sampling event, as specified in the FS Monitoring Well Installation Plan (Leidos 2022a). Monitoring wells LL12mw-248 and LL1mw-063 were dry and could not be sampled during the Fall 2023 sampling event. The following subsections summarize chemicals exceeding the screening level by chemical group.

6.2.1 Metals

Two wells (DETmw-003 and DETmw-004) screened in the Unconsolidated aquifer were sampled for total metals during the Spring and Fall 2023 sampling events. Only arsenic, iron, and manganese exceeded their screening level in groundwater at DETmw-003, and only manganese exceeded its screening level in groundwater at DETmw-004. These chemicals are discussed below and presented in Figure 6-1.

Arsenic – Arsenic exceeded the MCL of 0.01 mg/L in the parent sample at DETmw-003 collected during the Fall 2023 sampling event. Arsenic exceeded the MCL at DETmw-003 during the Fall 2023 sampling event at a concentration of 0.012 mg/L for the parent sample. Arsenic did not exceed the screening level in the Fall 2023 duplicate or Spring 2023 samples.

Manganese – Manganese exceeded the background screening level of 0.075 mg/L in the parent and duplicate samples collected during the Spring and Fall 2023 sampling events. Monitoring well DETmw-003 exceeded the screening criteria in Spring 2023 at a concentration of 0.25 J mg/L for the parent sample and 0.26 mg/L for the duplicate sample. Manganese exceeded screening criteria at DETmw-003 during the Fall 2023 sampling event at a concentration of 0.25 J mg/L for the parent sample. Manganese only exceeded screening criteria at DETmw-004 during the Fall 2023 sampling event at a concentration of 0.18 mg/L.

Iron **–** Iron exceeded the background screening level of 1.91 mg/L in the parent and duplicate samples collected during the Spring and Fall 2023 sampling events. Iron exceeded the screening criteria at DETmw-003 during the Spring 2023 sampling event at a concentration of 2.1 mg/L for the duplicate sample. Iron exceeded the screening criteria at DETmw-003 during the Fall 2023 sampling event at a concentration of 2 mg/L for the parent sample. Iron did not exceed the screening level at DETmw-004 in the Fall or Spring 2023 samples.

6.2.2 Explosives and Propellants

Twenty wells screened in the Unconsolidated aquifer were sampled for explosives during the Spring and Fall 2023 sampling events. RDX exceeded its screening level in four wells (DETmw-004, WBGmw-006, WBGmw-009, and LL1mw-092), and 4-amino-2,6- DNT exceeded its screening level in one well (LL1mw-063). Results are presented in Figure 6-2.

RDX **–** Samples collected from the following wells exceeded the RSL of 0.97 µg/L for RDX during the Spring and Fall 2023 sampling events: WBGmw-006 (7.8 and 6.6 µg/L), WBGmw-009 (1.8 and 3.2 µg/L), and LL1mw-092 (1 and 1 µg/L). Groundwater in DETmw-004 only exceeded the RSL for RDX during the Spring 2023 sampling event at a concentration of 2 µg/L.

4-Amino-2,6-DNT – 4-Amino-2,6-DNT exceeded the Resident Adult FWCUG goal of 0.209 µg/L in one sample collected during the Spring 2023 sampling event. 4-Amino-2,6-DNT exceeded the Resident Adult FWCUG at LL1mw-063 during the Spring 2023 sampling event at a concentration of 0.32 µg/L. Monitoring well LL1mw-063 was dry during the Fall 2023 sampling event and could not be sampled.

6.2.3 Semivolatile Organic Compounds

Three wells (DETmw-003, DETmw-004, and 071tw-001) screened in the Unconsolidated aquifer were sampled for SVOCs in 2023. Benz(a)anthracene and dibenz(a,h)anthracene exceeded their respective screening levels in two wells (DETmw-003 and DETmw-004). Results are presented in Figure 6-3.

Benz(a)anthracene – Benz(a)anthracene exceeded the RSL of 0.03 µg/L during the Spring and Fall 2023 sampling events. Benz(a)anthracene exceeded the RSL at DETmw-003 during the Fall 2023 sampling event at a concentration of 0.18 µg/L in the duplicate sample. Benz(a)anthracene was not detected in the Spring 2023 samples and the Fall 2023 parent sample. Benz(a)anthracene exceeded the RSL at DETmw-004 during the Spring 2023 sampling event at a concentration of 0.091 J µg/L and was not detected during the Fall 2023 sampling event.

Dibenz(a,h)anthracene – Dibenz(a,h)anthracene exceeded the RSL of 0.025 µg/L during the Spring and Fall 2023 sampling events. Dibenz(a,h)anthracene exceeded the RSL at DETmw-003 during the Fall 2023 sampling event at a concentration of 0.13 µg/L in the duplicate sample. Dibenz(a,h)anthracene was not detected in the Spring 2023 samples and the Fall 2023 parent sample. Dibenz(a,h)anthracene exceeded the RSL at DETmw-004 during the Spring 2023 sampling event at a concentration of 0.069 J mg/L and was not detected during the Fall 2023 sampling event.

6.2.4 Volatile Organic Compounds

Three wells (DETmw-003, DETmw-004, and 071tw-001) screened in the Unconsolidated aquifer were sampled for VOCs in 2023. VOC concentrations were below their respective screening level.

6.2.5 Pesticides and Polychlorinated Biphenyls

Two wells (DETmw-003 and DETmw-004) screened in the Unconsolidated aquifer were sampled for pesticides and PCBs in 2023. Pesticides and PCBs were not detected in any of the samples.

6.2.6 Cyanide

Two wells (DETmw-003 and DETmw-004) screened in the Unconsolidated aquifer were sampled for cyanide in 2023. Cyanide was not detected in any of the samples.

6.2.7 Nitrate

Ten wells screened in the Unconsolidated aquifer were sampled for nitrate in 2023. The results compared to the MCL of 10 mg/L are summarized below:

- Nitrate in LL12mw-244, LL12mw-245, LL12mw-246, LL12mw-248, LL12mw-249 WBGmw-006, WBGmw-009, and WBGmw-018 did not exceed the MCL.
- Nitrate in LL12mw-185 exceeded the MCL in both the primary and duplicate samples with estimated concentrations of 67 and 74 mg/L during the Spring 2023 sampling event and 56 and 54 mg/L during the Fall 2023 sampling event.
- Nitrate in LL12mw-187 exceeded the MCL during the Spring 2023 sampling event at a concentration of 1,500 J mg/L and during the Fall 2023 sampling event at a concentration of 1,700 J mg/L.

These results are presented in Figure 6-4.

6.2.8 pH

The typical pH range for naturally occurring groundwater is approximately 5 to 9 S.U. All pH levels were within the standard pH range of 5 to 9 S.U. for wells in the Unconsolidated aquifer.

6.2.9 Sulfate

Three wells (WBGmw-006, WBGmw-009, and WBG-018) screened in the unconsolidated aquifer were sampled for sulfate during the Spring and Fall 2023 sampling events. Sulfate was detected in all wells during the Spring and Fall sampling events. Sulfate does not have a screening level.

6.2.10 Sulfide

Three wells (WBGmw-006, WBGmw-009, and WBG-018) screened in the unconsolidated aquifer were sampled for sulfide during the Spring and Fall 2023 sampling events. Sulfide was not detected in any of the samples.

6.3 HOMEWOOD SANDSTONE

Six wells screened in the Homewood Sandstone aquifer were sampled in 2023. The following subsections summarize chemicals exceeding the screening level by chemical group.

6.3.1 Metals

No wells screened in the Homewood Sandstone aquifer were sampled for total or dissolved metals in 2023.

6.3.2 Explosives and Propellants

Five wells (FBQmw-173, FBQmw-174, FBQmw-175, FBQmw-178, and FBQmw-180) screened in the Homewood Sandstone aquifer were sampled for explosives and propellants in 2023. Concentrations were not detected above screening levels at FBQmw-175 during the Spring or Fall 2023 sampling events.

The following explosive/propellant concentrations exceeded screening levels at FBQmw-173:

- 2-Amino-4,6-DNT exceeded the Resident Adult FWCUG of 0.209 µg/L during the Spring 2023 sampling event at a concentration of 1.2 µg/L; concentrations did not exceed the Resident Adult FWCUG during the Fall 2023 sampling event.
- 4-Amino-2,6-DNT exceeded the Resident Adult FWCUG 0.209 µg/L during the Spring 2023 sampling event at a concentration of 1.5 µg/L; concentrations did not exceed the Resident Adult FWCUG during the Fall 2023 sampling event.

The following explosive/propellant concentrations exceeded screening levels at FBQmw-174:

- TNT concentrations exceeded the RSL of 0.98 µg/L during the Spring 2023 sampling event at a concentration of 3.3 µg/L and Fall 2023 sampling event at a concentration of 4.4 µg/L.

- 2,4-DNT only exceeded the RSL of 0.24 µg/L during the Spring 2023 sampling event at a concentration of 0.49 J µg/L.
- 2-Amino-4,6-DNT concentrations exceeded the Resident Adult FWCUG 0.209 µg/L during the Spring 2023 sampling event at a concentration of 7 µg/L and Fall 2023 sampling event at a concentration of 5.2 µg/L.
- 4-Amino-2,6-DNT concentrations exceeded the Resident Adult FWCUG 0.209 µg/L during the Spring 2023 sampling event at a concentration of 12 µg/L and Fall 2023 sampling event at a concentration of 25 µg/L.

The following explosive/propellant concentrations exceeded screening levels at FBQmw-178:

- RDX concentrations exceeded the RSL 0.97 µg/L in the Spring 2023 parent and duplicate samples (2.7 J and 2.6 J µg/L) and was not detected during the Fall 2023 sampling event.

The following explosive/propellant concentrations exceeded screening levels at FBQmw-180:

- RDX concentrations exceeded the RSL 0.97 µg/L in the Spring 2023 sample (1.1 J µg/L) and was not detected during the Fall 2023 sampling event.

These results are presented in Figure 6-5.

6.3.3 Volatile Organic Compounds

One well (LL10mw-003) screened in the Homewood Sandstone aquifer was sampled for the VOC carbon tetrachloride. Carbon tetrachloride was not detected during the Spring 2023 sampling event and did not exceed the screening level during the Fall 2023 sampling event.

6.3.4 pH

The typical pH range for naturally occurring groundwater is approximately 5 to 9 S.U. One Homewood Sandstone aquifer well sampled in 2023 (FBQmw-174) had a pH level out of the normal range during the Spring 2023 sampling event. The pH for this well was 4.70 S.U. during the Spring 2023 sampling event and 5.99 during the Fall 2023 sampling event.

6.3.5 Sulfate

Two wells (FBQmw-173 and FBQmw-174) screened in the Homewood Sandstone aquifer were sampled for sulfate during the Spring and Fall 2023 sampling events. Sulfate was detected in both wells during the Spring and Fall sampling events. Sulfate does not have a screening level.

6.3.6 Sulfide

Two wells (FBQmw-173 and FBQmw-174) screened in the Homewood Sandstone aquifer were sampled for sulfide during the Spring and Fall 2023 sampling events. Sulfide was not detected in any of the samples.

6.4 UPPER SHARON

Twenty-five wells screened in the Upper Sharon were sampled in 2023. Although they were screened within the Upper Sharon, FWGmw-020, FWGmw-021, and FWGmw-024 will be addressed separately as offsite wells in Section 6.6 and are not discussed with the other Upper Sharon wells. The following subsections summarize chemicals exceeding the screening level by chemical group.

6.4.1 Explosives and Propellants

Twenty-two wells screened in the Upper Sharon aquifer were sampled for explosives in 2023. The explosives that exceeded their respective screening level were 1,3-dinitrobenzene (DNB), TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, and RDX. These results are discussed below and presented in Figure 6-6.

1,3-DNB – The sample collected at LL1mw-083 (1.1 J µg/L) during the Spring 2023 sampling event exceeded the RSL of 0.2 µg/L and was undetected during the Fall 2023 sampling event. The parent and duplicate samples collected at LL1mw-084 (1.4 J and 1.6 µg/L) during the Spring 2023 sampling event exceeded the RSL and was undetected during the Fall 2023 sampling event.

TNT – Samples collected from LL1mw-083 (1.8 and 1.4 J µg/L) exceeded the RSL of 0.98 µg/L during the Spring and Fall 2023 sampling events. Samples collected from LL1mw-084 during the Spring 2023 sampling event (parent sample 2.1 µg/L and duplicate sample 2.4 µg/L) and Fall 2023 sampling event (parent sample 2.1 J µg/L and duplicate sample 2.2 J µg/L) exceeded the RSL. Samples collected from LL3mw-238 (28 J and 25 J µg/L) exceeded the RSL during the Spring and Fall 2023 sampling events. Samples collected from LL3mw-239 (3.3 and 2.1 J µg/L) exceeded the RSL during the Spring and Fall 2023 sampling events. The sample collected at LL3mw-241 (2 µg/L) during the Spring 2023 sampling event exceeded the RSL. The detected concentrations in the Fall 2023 parent and duplicate samples were below the RSL.

2,4-DNT – Samples collected from LL1mw-083 (2.9 and 2.9 J µg/L) exceeded the RSL of 0.24 µg/L during the Spring and Fall 2023 sampling events. The samples from LL1mw-084 exceeded the RSL during the Spring 2023 sampling event in the duplicate sample (0.97 µg/L) and in both the Fall 2023 parent (1.5 J µg/L) and duplicate (1.4 J µg/L) samples. The samples from LL2mw-059 (0.3 and 0.29 J µg/L) exceeded the RSL during the Spring and Fall 2023 sampling events.

2,6-DNT – The sample collected from LL1mw-083 exceeded the Resident Adult FWCUG of 0.122 µg/L at a concentration of 1.6 J µg/L during the Fall 2023 sampling event and was not detected during the Spring 2023 sampling event. The parent sample (0.8 J µg/L) collected at LL1mw-084 during the Fall 2023 sampling event exceeded the Resident Adult FWCUG. 2,6-DNT was not detected in the Spring 2023 parent and duplicate samples or the Fall 2023 duplicate sample.

2-Amino-4,6-DNT – Samples collected from LL1mw-080 exceeded the Resident Adult FWCUG of 0.209 µg/L in Spring and Fall 2023 at concentrations of 0.84 and 0.3 J µg/L respectively. The sample collected from LL1mw-081 (0.3 J µg/L) in Spring 2023 exceeded the Resident Adult FWCUG and was not detected in Fall 2023. The samples collected from LL1mw-083 exceeded the Resident Adult FWCUG in Spring and Fall 2023 at concentrations of 8.7 µg/L and 7.9 J µg/L respectively. Samples collected from LL1mw-084 exceeded the Resident Adult FWCUG in Spring (parent sample 6.2 µg/L and duplicate sample 6.8 µg/L) and Fall (parent sample 5.3 J µg/L and duplicate sample 5.2 J µg/L) 2023. The sample collected from LL3mw-237 (1 µg/L) during the Spring 2023 sampling event exceeded the Resident Adult FWCUG and was not detected during the Fall 2023 sampling event. The sample collected from LL3mw-238 (7 µg/L) during the Spring 2023 sampling event exceeded the Resident Adult FWCUG and was not detected during the Fall 2023 sampling event. The samples collected from LL3mw-239 exceeded the Resident Adult FWCUG during the Spring and Fall 2023 sampling events at concentrations of 1.1 and 0.62 J µg/L, respectively. The duplicate sample collected at LL3mw-241 (1.1 µg/L) exceeded the Resident Adult FWCUG during the Fall 2023 sampling event and was not detected in both the Spring 2023 sample and the Fall 2023 parent sample.

3,5-Dinitroaniline – Samples collected from LL1mw-083 exceeded the RSL of 0.77 µg/L during the Spring and Fall 2023 sampling events at concentrations of 2.7 and 1.7 J µg/L, respectively. Samples collected from LL1mw-084 exceeded the RSL during the Spring 2023 sampling event (parent sample 0.99 µg/L and duplicate sample 1.2 µg/L) and Fall 2023 sampling event (parent and duplicate sample 1.6 J µg/L). Samples collected from LL2mw-59 exceeded the RSL during the Spring and Fall 2023 sampling events at concentrations of 1.9 and 1.8 J µg/L, respectively. The Spring 2023 sample (0.92 µg/L) collected at LL3mw-238 exceeded the RSL and was below the RSL during the Fall 2023 sampling event.

4-Amino-2,6-DNT – Samples collected from LL1mw-080 exceeded the Resident Adult FWCUG of 0.209 µg/L during the Spring and Fall 2023 sampling events at concentrations of 2.1 and 0.61 J µg/L, respectively. Samples collected from LL1mw-083 exceeded the Resident Adult FWCUG during the Spring and Fall 2023 sampling events at concentrations of 13 and 11 J µg/L, respectively. Samples collected from LL1mw-084 exceeded the Resident Adult FWCUG during the Spring 2023 sampling event (parent sample 16 µg/L and duplicate sample 18 µg/L) and Fall 2023 sampling event (parent and duplicate sample 13 J µg/L). Samples collected from LL2mw-059 exceeded the Resident Adult FWCUG during the Spring and Fall 2023 sampling events at concentrations of 0.54 and 0.57 J µg/L, respectively. The Spring 2023 sample (2.2 µg/L) collected at LL3mw-237 exceeded the Resident Adult FWCUG and was below the Resident FWCUG during the Fall 2023 sampling event. Samples collected from LL3mw-238 exceeded the Resident Adult FWCUG during the Spring and Fall 2023 sampling events at concentrations of 21 and 21 J µg/L, respectively. Samples collected from LL3mw-239 exceeded the Resident Adult FWCUG during the Spring and Fall 2023 sampling events at concentrations of 1.9 and 1.3 J µg/L, respectively. Samples collected from LL3mw-241 exceeded the Resident Adult FWCUG during the Spring 2023 sampling event at a concentration of 1.7 µg/L and during the Fall 2023 sampling event at concentrations of 1.1 J and 0.86 J µg/L, respectively (parent and duplicate).

RDX – Samples collected from the following wells exceeded the RSL of 0.97 µg/L during the Spring or Fall 2023 sampling event. RDX exceeded the RSL at LL1mw-080 during the Spring 2023 sampling event at a concentration of 12 µg/L and during the Fall 2023 sampling event at a concentration at 1.9 J µg/L. RDX only exceeded the RSL at LL1mw-081 during the Spring 2023 sampling event at a concentration of 1.2 µg/L. RDX only exceeded the RSL at LL1mw-082 during the Spring 2023 sampling event at a concentration of 0.98 J µg/L. RDX only exceeded the RSL at LL1mw-091 during the Spring 2023 sampling event at a concentration of 2 J µg/L. RDX exceeded the RSL at LL3mw-238 during the Spring 2023 sampling event at a concentration of 7.5 µg/L and during the Fall 2023 sampling event at a concentration at 13 J µg/L. RDX only exceeded the RSL at LL3mw-239 during the Spring

2023 sampling event at a concentration of 1.1 µg/L. RDX only exceeded the RSL at LL3mw-241 during the Spring 2023 sampling event at a concentration of 1 J µg/L. RDX exceeded the RSL at LL3mw-247 during the Spring 2023 sampling event at a concentration of 1.7 J µg/L and during the Fall 2023 sampling event at a concentration at 1.9 µg/L. RDX only exceeded the RSL at LL3mw-248 during the Spring 2023 sampling event at a concentration of 2 J µg/L.

6.4.2 Volatile Organic Compounds

No wells screened in the Upper Sharon aquifer were sampled and analyzed for VOCs in 2023.

6.4.3 Nitrate

Six wells (LL1mw-080, LL1mw-083, LL1mw-084, LL2mw-059, LL3mw-238, and LL3mw-239) screened in the Upper Sharon aquifer were sampled for nitrate during the Spring and Fall 2023 sampling events. Nitrate was detected in groundwater from each well, but all concentrations were below the MCL of 10 µg/L.

6.4.4 Nitrite

Six wells (LL1mw-080, LL1mw-083, LL1mw-084, LL2mw-059, LL3mw-238, and LL3mw-239) screened in the Upper Sharon aquifer were sampled for nitrite during the Spring and Fall 2023 sampling events. Nitrite was not detected in any sample.

6.4.5 Sulfate

Six wells (LL1mw-080, LL1mw-083, LL1mw-084, LL2mw-059, LL3mw-238, and LL3mw-239) screened in the Upper Sharon aquifer were sampled for sulfate during the Spring and Fall 2023 sampling events. Sulfate was detected in all wells during the Spring and Fall sampling events. Sulfate does not have a screening level.

6.4.6 Sulfide

Six wells (LL1mw-080, LL1mw-083, LL1mw-084, LL2mw-059, LL3mw-238, and LL3mw-239) screened in the Upper Sharon aquifer were sampled for sulfide during the Spring and Fall 2023 events. Sulfide was only detected during the Fall 2023 sampling event at LL2mw-059. Sulfide does not have a screening level.

6.4.7 pH

The typical pH range for naturally occurring groundwater is approximately 5 to 9 S.U. Groundwater at LL1mw-083 had a pH of 4.44 S.U. during the Spring 2023 sampling event and a pH 4.47 S.U. during the Fall 2023 sampling event.

6.5 BASAL SHARON CONGLOMERATE

Two wells (FWGmw-018 and SCFmw-004) screened in the Basal Sharon Conglomerate were sampled during the Spring and Fall 2023 sampling events. Although FWGmw-018 is screened within the Basal Sharon Conglomerate, it will be summarized separately as an offsite well in Section 6.6.

The following subsections summarize chemicals exceeding the screening level by chemical group.

6.5.1 Explosives and Propellants

Explosives or propellants were not detected during the Spring or Fall 2023 sampling event.

6.5.2 pH

All pH levels were within the standard pH range of 5 to 9 S.U. for wells in the Basal Sharon Conglomerate aquifer.

6.6 OFFSITE WELLS

Four offsite wells, located along State Route 5 and bordering the southern edge of the property, were sampled during the Spring and Fall 2023 sampling events. Three wells were screened in the Upper Sharon (FWGmw-020, FWGmw-021, and FWGmw-024), and one well was screened in the Basal Sharon Conglomerate (FWGmw-018). The following subsections summarize chemicals exceeding the screening level by chemical group.

6.6.1 Explosives and Propellants

Two offsite wells (FWGmw-021 and FWGmw-024) were sampled for explosives and propellants. The only explosives and propellants detected were 2-amino-4,6-DNT and RDX in FWGmw-021 at concentrations below screening levels.

6.6.2 Nitrate

Two offsite wells (FWGmw-018 and FWGmw-020) were sampled for nitrate. Nitrate was only detected in FWGmw-020 during the Spring 2023 sampling event.

6.6.3 pH

All offsite wells had pH levels within the standard range of 5 to 9 S.U.

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Table 6-1. Groundwater Screening Levels

Zone	Analysis Type	Chemical	Units	CAS No	NGT CUG	Resident CUG	MCL	Tap Water RSL	Background	Groundwater Screening Level	Groundwater Screening Level Source
Same for all zones	Anions	Nitrate	mg/L	14797-55-8	52.283	1.666	10	3.2	N/A	10	MCL
Same for all zones	Anions	Nitrite	mg/L	14797-65-0			1	0.2	N/A	1	MCL
Same for all zones	Anions	Sulfate	mg/L	14808-79-8					N/A		
Same for all zones	Anions	Sulfide	mg/L	18496-25-8					N/A		
Same for all zones	Explosives/Propellants	1,3,5-TNB	µg/L	99-35-4				59	N/A	59	RSL
Same for all zones	Explosives/Propellants	1,3-DNB	µg/L	99-65-0	3.28	0.104		0.2	N/A	0.2	RSL
Same for all zones	Explosives/Propellants	TNT	µg/L	118-96-7	16.4	0.521		0.98	N/A	0.98	RSL
Same for all zones	Explosives/Propellants	2,4-Diamino-6-nitrotoluene	µg/L	6629-29-4					N/A		
Same for all zones	Explosives/Propellants	2,4-DNT	µg/L	121-14-2	1.29	0.12		0.24	N/A	0.24	RSL
Same for all zones	Explosives/Propellants	2,6-Diamino-4-nitrotoluene	µg/L	59229-75-3					N/A		
Same for all zones	Explosives/Propellants	2,6-DNT	µg/L	606-20-2	1.31	0.122		0.049	N/A	0.122	RA
Same for all zones	Explosives/Propellants	2-Amino-4,6-DNT	µg/L	35572-78-2	6.55	0.209		0.19	N/A	0.209	RC
Same for all zones	Explosives/Propellants	2-Nitrotoluene	µg/L	88-72-2	3.99	0.37		0.31	N/A	0.37	RA
Same for all zones	Explosives/Propellants	3,5-Dinitroaniline	µg/L	618-87-1				0.77	N/A	0.77	RSL
Same for all zones	Explosives/Propellants	3-Nitrotoluene	µg/L	99-08-1				0.17	N/A	0.17	RSL
Same for all zones	Explosives/Propellants	4-Amino-2,6-DNT	µg/L	19406-51-0	6.55	0.209		0.19	N/A	0.209	RC
Same for all zones	Explosives/Propellants	4-Nitrotoluene	µg/L	99-99-0	54	5.01		4.3	N/A	5.01	RA
Same for all zones	Explosives/Propellants	DNX	µg/L	80251-29-2					N/A		
Same for all zones	Explosives/Propellants	HMX	µg/L	2691-41-0				100	N/A	100	RSL
Same for all zones	Explosives/Propellants	MNX	µg/L	5755-27-1					N/A		
Same for all zones	Explosives/Propellants	Nitrobenzene	µg/L	98-95-3	16.4	0.521		0.14	N/A	0.521	RC
Same for all zones	Explosives/Propellants	Nitroglycerin	µg/L	55-63-0	54	5.01		0.2	N/A	5.01	RA
Same for all zones	Explosives/Propellants	PETN	µg/L	78-11-5				17	N/A	17	RSL
Same for all zones	Explosives/Propellants	RDX	µg/L	121-82-4	8.34	0.774		0.97	N/A	0.97	RSL
Same for all zones	Explosives/Propellants	TNX	µg/L	13980-04-6					N/A		
Same for all zones	Explosives/Propellants	Tetryl	µg/L	479-45-8				3.9	N/A	3.9	RSL
Same for all zones	Miscellaneous	Alkalinity	mg/L	N33					N/A		
Same for all zones	Miscellaneous	Ammonia	mg/L	7664-41-7					N/A		
Same for all zones	Miscellaneous	Cyanide	mg/L	57-12-5			0.2	0.00015	N/A	0.2	MCL
Same for all zones	Miscellaneous	TPH – Diesel Range Organics	mg/L	NS791					N/A		
Same for all zones	Miscellaneous	TPH – Gasoline Range Organics	mg/L	NS834					N/A		
Same for all zones	Miscellaneous	TOC	mg/L	N997					N/A		
Same for all zones	PCBs	PCB-1016	µg/L	12674-11-2				0.14	N/A	0.14	RSL
Same for all zones	PCBs	PCB-1221	µg/L	11104-28-2				0.0047	N/A	0.0047	RSL
Same for all zones	PCBs	PCB-1232	µg/L	11141-16-5				0.0047	N/A	0.0047	RSL
Same for all zones	PCBs	PCB-1242	µg/L	53469-21-9	2.29	0.213		0.0078	N/A	0.213	RA
Same for all zones	PCBs	PCB-1248	µg/L	12672-29-6				0.0078	N/A	0.0078	RSL
Same for all zones	PCBs	PCB-1254	µg/L	11097-69-1	0.655	0.021		0.0078	N/A	0.021	RC
Same for all zones	PCBs	PCB-1260	µg/L	11096-82-5	2.29	0.213		0.0078	N/A	0.213	RA
Same for all zones	Pesticides	4,4'-DDD	µg/L	72-54-8	0.639	0.059		0.032	N/A	0.059	RA
Same for all zones	Pesticides	4,4'-DDE	µg/L	72-55-9	0.503	0.047		0.046	N/A	0.047	RA
Same for all zones	Pesticides	4,4'-DDT	µg/L	50-29-3	0.294	0.027		0.23	N/A	0.23	RSL
Same for all zones	Pesticides	Aldrin	µg/L	309-00-2	0.051	0.005		0.00092	N/A	0.005	RA
Same for all zones	Pesticides	Dieldrin	µg/L	60-57-1	0.038	0.004		0.0018	N/A	0.004	RA
Same for all zones	Pesticides	Endosulfan I	µg/L	959-98-8				10	N/A	10	RSL
Same for all zones	Pesticides	Endosulfan II	µg/L	33213-65-9				10	N/A	10	RSL
Same for all zones	Pesticides	Endosulfan sulfate	µg/L	1031-07-8				10	N/A	10	RSL
Same for all zones	Pesticides	Endosulfan sulfate	µg/L	1031-07-8				11	N/A	11	RSL
Same for all zones	Pesticides	Endrin	µg/L	72-20-8			2	0.23	N/A	2	MCL
Same for all zones	Pesticides	Endrin aldehyde	µg/L	7421-93-4				0.23	N/A	0.23	RSL
Same for all zones	Pesticides	Endrin ketone	µg/L	53494-70-5				0.23	N/A	0.23	RSL
Same for all zones	Pesticides	Heptachlor	µg/L	76-44-8	0.153	0.014	0.4	0.0014	N/A	0.4	MCL

Table 6-1. Groundwater Screening Levels (Continued)

Zone	Analysis Type	Chemical	Units	CAS No	NGT CUG	Resident CUG	MCL	Tap Water RSL	Background	Groundwater Screening Level	Groundwater Screening Level Source
Same for all zones	Pesticides	Heptachlor epoxide	µg/L	1024-57-3	0.101	0.009	0.2	0.0014	N/A	0.2	MCL
Same for all zones	Pesticides	Lindane	µg/L	58-89-9	0.55	0.051	0.2	0.042	N/A	0.2	MCL
Same for all zones	Pesticides	Methoxychlor	µg/L	72-43-5			40	3.7	N/A	40	MCL
Same for all zones	Pesticides	Toxaphene	µg/L	8001-35-2	0.518	0.048	3	0.071	N/A	3	MCL
Same for all zones	Pesticides	alpha-BHC	µg/L	319-84-6	0.146	0.014		0.0072	N/A	0.014	RA
Same for all zones	Pesticides	alpha-Chlordane	µg/L	5103-71-9				0.36	N/A	0.36	RSL
Same for all zones	Pesticides	alpha-Chlordane	µg/L	5103-71-9				0.02	N/A	0.02	RSL
Same for all zones	Pesticides	beta-BHC	µg/L	319-85-7	0.51	0.047		0.025	N/A	0.047	RA
Same for all zones	Pesticides	delta-BHC	µg/L	319-86-8					N/A		
Same for all zones	Pesticides	gamma-Chlordane	µg/L	5103-74-2				1	N/A	1	RSL
Same for all zones	Pesticides	gamma-Chlordane	µg/L	5103-74-2				0.02	N/A	0.02	RSL
Same for all zones	SVOCs	1,2,4-Trichlorobenzene	µg/L	120-82-1			70	0.4	N/A	70	MCL
Same for all zones	SVOCs	1,2-Dichlorobenzene	µg/L	95-50-1			600	30	N/A	600	MCL
Same for all zones	SVOCs	1,3-Dichlorobenzene	µg/L	541-73-1					N/A		
Same for all zones	SVOCs	1,4-Dichlorobenzene	µg/L	106-46-7			75	0.48	N/A	75	MCL
Same for all zones	SVOCs	1-Methylnaphthalene	µg/L	90-12-0				1.1	N/A	1.1	RSL
Same for all zones	SVOCs	2,4,5-Trichlorophenol	µg/L	95-95-4				120	N/A	120	RSL
Same for all zones	SVOCs	2,4,6-Trichlorophenol	µg/L	88-06-2				1.2	N/A	1.2	RSL
Same for all zones	SVOCs	2,4-Dichlorophenol	µg/L	120-83-2				4.6	N/A	4.6	RSL
Same for all zones	SVOCs	2,4-Dimethylphenol	µg/L	105-67-9				36	N/A	36	RSL
Same for all zones	SVOCs	2,4-Dinitrophenol	µg/L	51-28-5				3.9	N/A	3.9	RSL
Same for all zones	SVOCs	2,4-DNT	µg/L	121-14-2	1.29	0.12		0.24	N/A	0.24	RSL
Same for all zones	SVOCs	2,6-DNT	µg/L	606-20-2	1.31	0.122		0.049	N/A	0.122	RA
Same for all zones	SVOCs	2-Chloronaphthalene	µg/L	91-58-7				75	N/A	75	RSL
Same for all zones	SVOCs	2-Chlorophenol	µg/L	95-57-8				9.1	N/A	9.1	RSL
Same for all zones	SVOCs	2-Methyl-4,6-dinitrophenol	µg/L	534-52-1				0.15	N/A	0.15	RSL
Same for all zones	SVOCs	2-Methylnaphthalene	µg/L	91-57-6				3.6	N/A	3.6	RSL
Same for all zones	SVOCs	2-Methylphenol	µg/L	95-48-7				93	N/A	93	RSL
Same for all zones	SVOCs	2-Nitrobenzenamine	µg/L	88-74-4				19	N/A	19	RSL
Same for all zones	SVOCs	2-Nitrophenol	µg/L	88-75-5					N/A		
Same for all zones	SVOCs	3,3'-Dichlorobenzidine	µg/L	91-94-1				0.13	N/A	0.13	RSL
Same for all zones	SVOCs	3-Nitrobenzenamine	µg/L	99-09-2					N/A		
Same for all zones	SVOCs	4-Bromophenyl phenyl ether	µg/L	101-55-3					N/A		
Same for all zones	SVOCs	4-Chloro-3-methylphenol	µg/L	59-50-7				140	N/A	140	RSL
Same for all zones	SVOCs	4-Chlorobenzenamine	µg/L	106-47-8				0.37	N/A	0.37	RSL
Same for all zones	SVOCs	4-Chlorophenyl phenyl ether	µg/L	7005-72-3					N/A		
Same for all zones	SVOCs	4-Nitrobenzenamine	µg/L	100-01-6	43.7	3.13		3.8	N/A	3.8	RSL
Same for all zones	SVOCs	4-Nitrophenol	µg/L	100-02-7					N/A		
Same for all zones	SVOCs	Acenaphthene	µg/L	83-32-9				53	N/A	53	RSL
Same for all zones	SVOCs	Acenaphthylene	µg/L	208-96-8				12	N/A	12	RSL
Same for all zones	SVOCs	Anthracene	µg/L	120-12-7				180	N/A	180	RSL
Same for all zones	SVOCs	Benz(a)anthracene	µg/L	56-55-3	0.042	0.004		0.03	N/A	0.03	RSL
Same for all zones	SVOCs	Benzenemethanol	µg/L	100-51-6				200	N/A	200	RSL
Same for all zones	SVOCs	Benzo(a)pyrene	µg/L	50-32-8	0.002	0.00023	0.2	0.025	N/A	0.2	MCL
Same for all zones	SVOCs	Benzo(b)fluoranthene	µg/L	205-99-2	0.024	0.002		0.25	N/A	0.25	RSL
Same for all zones	SVOCs	Benzo(g,h,i)perylene	µg/L	191-24-2				12	N/A	12	RSL
Same for all zones	SVOCs	Benzo(k)fluoranthene	µg/L	207-08-9				2.5	N/A	2.5	RSL
Same for all zones	SVOCs	Benzoic acid	µg/L	65-85-0				7500	N/A	7500	RSL
Same for all zones	SVOCs	Bis(2-chloroethoxy)methane	µg/L	111-91-1				5.9	N/A	5.9	RSL
Same for all zones	SVOCs	Bis(2-chloroethyl) ether	µg/L	111-44-4				0.014	N/A	0.014	RSL
Same for all zones	SVOCs	Bis(2-chloroisopropyl) ether	µg/L	108-60-1				71	N/A	71	RSL
Same for all zones	SVOCs	Bis(2-ethylhexyl)phthalate	µg/L	117-81-7	9.7	0.9	6	5.6	N/A	6	MCL

Table 6-1. Groundwater Screening Levels (Continued)

Zone	Analysis Type	Chemical	Units	CAS No	NGT CUG	Resident CUG	MCL	Tap Water RSL	Background	Groundwater Screening Level	Groundwater Screening Level Source
Same for all zones	SVOCs	Butyl benzyl phthalate	µg/L	85-68-7				16	N/A	16	RSL
Same for all zones	SVOCs	Carbazole	µg/L	86-74-8					N/A		
Same for all zones	SVOCs	Chrysene	µg/L	218-01-9				25	N/A	25	RSL
Same for all zones	SVOCs	Di-n-butyl phthalate	µg/L	84-74-2				90	N/A	90	RSL
Same for all zones	SVOCs	Di-n-octylphthalate	µg/L	117-84-0				20	N/A	20	RSL
Same for all zones	SVOCs	Dibenz(a,h)anthracene	µg/L	53-70-3	0.002	0.00015		0.025	N/A	0.025	RSL
Same for all zones	SVOCs	Dibenzofuran	µg/L	132-64-9				0.79	N/A	0.79	RSL
Same for all zones	SVOCs	Diethyl phthalate	µg/L	84-66-2				1500	N/A	1500	RSL
Same for all zones	SVOCs	Dimethyl phthalate	µg/L	131-11-3					N/A		
Same for all zones	SVOCs	Fluoranthene	µg/L	206-44-0				80	N/A	80	RSL
Same for all zones	SVOCs	Fluorene	µg/L	86-73-7				29	N/A	29	RSL
Same for all zones	SVOCs	Hexachlorobenzene	µg/L	118-74-1			1	0.0098	N/A	1	MCL
Same for all zones	SVOCs	Hexachlorobutadiene	µg/L	87-68-3				0.14	N/A	0.14	RSL
Same for all zones	SVOCs	Hexachlorocyclopentadiene	µg/L	77-47-4			50	0.041	N/A	50	MCL
Same for all zones	SVOCs	Hexachloroethane	µg/L	67-72-1				0.33	N/A	0.33	RSL
Same for all zones	SVOCs	Indeno(1,2,3-c,d)pyrene	µg/L	193-39-5	0.024	0.002		0.25	N/A	0.25	RSL
Same for all zones	SVOCs	Isophorone	µg/L	78-59-1				78	N/A	78	RSL
Same for all zones	SVOCs	N-Nitroso-di-n-propylamine	µg/L	621-64-7				0.011	N/A	0.011	RSL
Same for all zones	SVOCs	N-Nitrosodiphenylamine	µg/L	86-30-6				12	N/A	12	RSL
Same for all zones	SVOCs	Naphthalene	µg/L	91-20-3				0.12	N/A	0.12	RSL
Same for all zones	SVOCs	Nitrobenzene	µg/L	98-95-3	16.4	0.521		0.14	N/A	0.521	RC
Same for all zones	SVOCs	Pentachlorophenol	µg/L	87-86-5	0.797	0.074	1	0.041	N/A	1	MCL
Same for all zones	SVOCs	Phenanthrene	µg/L	85-01-8				12	N/A	12	RSL
Same for all zones	SVOCs	Phenol	µg/L	108-95-2				580	N/A	580	RSL
Same for all zones	SVOCs	Pyrene	µg/L	129-00-0				12	N/A	12	RSL
Same for all zones	SVOCs	Total Cresols	µg/L	1319-77-3				150	N/A	150	RSL
Same for all zones	VOCs	1,1,1-Trichloroethane	µg/L	71-55-6			200	800	N/A	200	MCL
Same for all zones	VOCs	1,1,2,2-Tetrachloroethane	µg/L	79-34-5	0.744	0.069		0.076	N/A	0.076	RSL
Same for all zones	VOCs	1,1,2-Trichloroethane	µg/L	79-00-5			5	0.041	N/A	5	MCL
Same for all zones	VOCs	1,1-Dichloroethane	µg/L	75-34-3				2.8	N/A	2.8	RSL
Same for all zones	VOCs	1,1-Dichloroethene	µg/L	75-35-4			7	28	N/A	7	MCL
Same for all zones	VOCs	1,2-Dibromoethane	µg/L	106-93-4			0.05	0.0075	N/A	0.05	MCL
Same for all zones	VOCs	1,2-Dichloroethane	µg/L	107-06-2	1.67	0.155	5	0.17	N/A	5	MCL
Same for all zones	VOCs	1,2-Dichloroethene	µg/L	540-59-0			70	2.5	N/A	70	MCL
Same for all zones	VOCs	1,2-Dichloropropane	µg/L	78-87-5			5	0.82	N/A	5	MCL
Same for all zones	VOCs	2-Butanone	µg/L	78-93-3				560	N/A	560	RSL
Same for all zones	VOCs	2-Hexanone	µg/L	591-78-6				3.8	N/A	3.8	RSL
Same for all zones	VOCs	4-Methyl-2-pentanone	µg/L	108-10-1				630	N/A	630	RSL
Same for all zones	VOCs	Acetone	µg/L	67-64-1				1800	N/A	1800	RSL
Same for all zones	VOCs	Benzene	µg/L	71-43-2	4.64	0.431	5	0.46	N/A	5	MCL
Same for all zones	VOCs	Bromobenzene	µg/L	108-86-1				6.2	N/A	6.2	RSL
Same for all zones	VOCs	Bromochloromethane	µg/L	74-97-5				8.3	N/A	8.3	RSL
Same for all zones	VOCs	Bromodichloromethane	µg/L	75-27-4				0.13	N/A	0.13	RSL
Same for all zones	VOCs	Bromoform	µg/L	75-25-2				3.3	N/A	3.3	RSL
Same for all zones	VOCs	Bromomethane	µg/L	74-83-9				0.75	N/A	0.75	RSL
Same for all zones	VOCs	Carbon disulfide	µg/L	75-15-0				81	N/A	81	RSL
Same for all zones	VOCs	Carbon tetrachloride	µg/L	56-23-5	2.2	0.204	5	0.46	N/A	5	MCL
Same for all zones	VOCs	Chlorobenzene	µg/L	108-90-7			100	7.8	N/A	100	MCL
Same for all zones	VOCs	Chloroethane	µg/L	75-00-3				830	N/A	830	RSL
Same for all zones	VOCs	Chloroform	µg/L	67-66-3	2.23	0.207	80	0.22	N/A	80	MCL
Same for all zones	VOCs	Chloromethane	µg/L	74-87-3				19	N/A	19	RSL
Same for all zones	VOCs	Dibromochloromethane	µg/L	124-48-1				0.87	N/A	0.87	RSL

Table 6-1. Groundwater Screening Levels (Continued)

Zone	Analysis Type	Chemical	Units	CAS No	NGT CUG	Resident CUG	MCL	Tap Water RSL	Background	Groundwater Screening Level	Groundwater Screening Level Source
Same for all zones	VOCs	Ethylbenzene	µg/L	100-41-4			700	1.5	N/A	700	MCL
Same for all zones	VOCs	Methylene chloride	µg/L	75-09-2	57.5	5.34	5	11	N/A	5	MCL
Same for all zones	VOCs	Styrene	µg/L	100-42-5			100	120	N/A	100	MCL
Same for all zones	VOCs	Tetrachloroethene	µg/L	127-18-4	1.05	0.098	5	4.1	N/A	5	MCL
Same for all zones	VOCs	Toluene	µg/L	108-88-3			1000	110	N/A	1000	MCL
Same for all zones	VOCs	Trichloroethene	µg/L	79-01-6	0.336	0.031	5	0.28	N/A	5	MCL
Same for all zones	VOCs	Vinyl chloride	µg/L	75-01-4			2	0.019	N/A	2	MCL
Same for all zones	VOCs	Xylenes, total	µg/L	1330-20-7			10000	19	N/A	10000	MCL
Same for all zones	VOCs	cis-1,3-Dichloropropene	µg/L	10061-01-5				0.47	N/A	0.47	RSL
Same for all zones	VOCs	trans-1,3-Dichloropropene	µg/L	10061-02-6				0.47	N/A	0.47	RSL
Unconsolidated	Metals, Total/Filtered	Aluminum	mg/L	7429-90-5	31.981	1.028		2	0.386	2	RSL
Unconsolidated	Metals, Total/Filtered	Antimony	mg/L	7440-36-0	0.0117	0.000389	0.006	0.00078	0	0.006	MCL
Unconsolidated	Metals, Total/Filtered	Arsenic	mg/L	7440-38-2	0.000608	0.000056	0.01	0.000052	0.003	0.01	MCL
Unconsolidated	Metals, Total/Filtered	Barium	mg/L	7440-39-3	6.332	0.204	2	0.38	0.034	2	MCL
Unconsolidated	Metals, Total/Filtered	Beryllium	mg/L	7440-41-7			0.004	0.0025	0	0.004	MCL
Unconsolidated	Metals, Total/Filtered	Cadmium	mg/L	7440-43-9	0.0132	0.000456	0.005	0.00018	0	0.005	MCL
Unconsolidated	Metals, Total/Filtered	Calcium	mg/L	7440-70-2					107		
Unconsolidated	Metals, Total/Filtered	Chromium	mg/L	7440-47-3	33.087	1.214	0.1	2.2	0.002	0.1	MCL
Unconsolidated	Metals, Total/Filtered	Cobalt	mg/L	7440-48-4	0.654	0.0208		0.0006	0.00083	0.0208	RC
Unconsolidated	Metals, Total/Filtered	Copper	mg/L	7440-50-8			1.3	0.08	0.005	1.3	MCL
Unconsolidated	Metals, Total/Filtered	Iron	mg/L	7439-89-6	9.671	0.31		1.4	1.91	1.91	BKG
Unconsolidated	Metals, Total/Filtered	Lead	mg/L	7439-92-1			0.015	0.015	0.00099	0.015	MCL
Unconsolidated	Metals, Total/Filtered	Magnesium	mg/L	7439-95-4					55.3		
Unconsolidated	Metals, Total/Filtered	Manganese	mg/L	7439-96-5	1.421	0.0463		0.043	0.075	0.075	BKG
Unconsolidated	Metals, Total/Filtered	Mercury	mg/L	7439-97-6			0.002	0.000063	0	0.002	MCL
Unconsolidated	Metals, Total/Filtered	Nickel	mg/L	7440-02-0	0.654	0.0208		0.039	0.002	0.039	RSL
Unconsolidated	Metals, Total/Filtered	Potassium	mg/L	7440-09-7					4.84		
Unconsolidated	Metals, Total/Filtered	Selenium	mg/L	7782-49-2			0.05	0.01	0.00099	0.05	MCL
Unconsolidated	Metals, Total/Filtered	Silver	mg/L	7440-22-4				0.0094	0	0.0094	RSL
Unconsolidated	Metals, Total/Filtered	Sodium	mg/L	7440-23-5					18.2		
Unconsolidated	Metals, Total/Filtered	Thallium	mg/L	7440-28-0	0.00261	0.000083	0.002	0.00002	0	0.002	MCL
Unconsolidated	Metals, Total/Filtered	Vanadium	mg/L	7440-62-2	0.185	0.00638		0.0086	0.0005	0.0086	RSL
Unconsolidated	Metals, Total/Filtered	Zinc	mg/L	7440-66-6	9.756	0.312		0.6	0.005	0.6	RSL

µg/L = Micrograms per Liter
BHC = Hexachlorocyclohexane
BKG = Background
CAS = Chemical Abstracts Service
CUG = Cleanup Goal
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
DNB = Dinitrobenzene
DNT = Dinitrotoluene
DNX = Hexahydro-1,3-Dinitroso-5-Dinitro-1,3,5-Triazine
HMX = Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
MNX = Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine
N/A = Not Applicable
PETN = Pentaerythritol Tetranitrate
RA = Resident Adult Facility-wide Cleanup Goal
RC = Resident Child Facility-wide Cleanup Goal
RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RSL = Regional Screening Level
SVOC = Semivolatile Organic Compound
TNB = Trinitrobenzene
TNT = Trinitrotoluene
TNX = Hexahydro-1,3,5-Trinitroso-1,3,5-Triazine
TOC = Total Organic Carbon
TPH = Total Petroleum Hydrocarbon
TOC = Total Organic Carbon
VOC = Volatile Organic Compound
NGT = National Guard Trainee
PCB = Polychlorinated Biphenyl

Table 6-2. Screening Level Exceedances – Spring 2023 Sampling Event

Zone	Well	Date Collected	Sample ID	Sample Type	Analysis Type	Chemical	Result	Units	Validation Qualifier	Background Criteria	Groundwater Screening Level	Groundwater Screening Criteria Source
Homewood	FBQmw-173	5/17/2023	FBQmw-173-230401-GW-R	Grab	Explosives/Propellants	2-Amino-4,6-DNT	1.2	µg/L			0.209	RC
Homewood	FBQmw-173	5/17/2023	FBQmw-173-230401-GW-R	Grab	Explosives/Propellants	4-Amino-2,6-DNT	1.5	µg/L			0.209	RC
Homewood	FBQmw-174	5/11/2023	FBQmw-174-230401-GW-R	Grab	Explosives/Propellants	TNT	3.3	µg/L			0.98	RSL
Homewood	FBQmw-174	5/11/2023	FBQmw-174-230401-GW-R	Grab	Explosives/Propellants	2,4-DNT	0.49	µg/L	J		0.24	RSL
Homewood	FBQmw-174	5/11/2023	FBQmw-174-230401-GW-R	Grab	Explosives/Propellants	2-Amino-4,6-DNT	7	µg/L			0.209	RC
Homewood	FBQmw-174	5/11/2023	FBQmw-174-230401-GW-R	Grab	Explosives/Propellants	4-Amino-2,6-DNT	12	µg/L			0.209	RC
Homewood	FBQmw-178	5/16/2023	FBQmw-178-230302-GW	Field Duplicate	Explosives/Propellants	RDX	2.6	µg/L	J		0.97	RSL
Homewood	FBQmw-178	5/16/2023	FBQmw-178-230301-GW	Grab	Explosives/Propellants	RDX	2.7	µg/L	J		0.97	RSL
Homewood	FBQmw-180	5/17/2023	FBQmw-180-230301-GW	Grab	Explosives/Propellants	RDX	1.1	µg/L	J		0.97	RSL
Unconsolidated	DETmw-003	5/11/2023	DET-003-230402-GW	Field Duplicate	Metals, Total	Iron	2.1	mg/L		1.91	1.91	BKG
Unconsolidated	DETmw-003	5/11/2023	DET-003-230401-GW	Grab	Metals, Total	Manganese	0.25	mg/L	J	0.075	0.075	BKG
Unconsolidated	DETmw-003	5/11/2023	DET-003-230402-GW	Field Duplicate	Metals, Total	Manganese	0.26	mg/L		0.075	0.075	BKG
Unconsolidated	DETmw-004	5/11/2023	DET-004-230401-GW	Grab	Explosives/Propellants	RDX	2	µg/L			0.97	RSL
Unconsolidated	DETmw-004	5/11/2023	DET-004-230401-GW	Grab	SVOCs	Benz(a)anthracene	0.091	µg/L	J		0.03	RSL
Unconsolidated	DETmw-004	5/11/2023	DET-004-230401-GW	Grab	SVOCs	Dibenz(a,h)anthracene	0.069	µg/L	J		0.025	RSL
Unconsolidated	WBGmw-006	5/16/2023	WBGmw-006-230401-GW	Grab	Explosives/Propellants	RDX	7.8	µg/L			0.97	RSL
Unconsolidated	WBGmw-009	5/16/2023	WBGmw-009-230401-GW	Grab	Explosives/Propellants	RDX	1.8	µg/L			0.97	RSL
Unconsolidated	LL1mw-063	5/4/2023	LL1mw-063-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	0.32	µg/L			0.209	RC
Unconsolidated	LL1mw-092	5/16/2023	LL1mw-092-230301-GW	Grab	Explosives/Propellants	RDX	1	µg/L	J		0.97	RSL
Unconsolidated	LL12mw-185	5/17/2023	LL12mw-185-230401-GW	Grab	Anions	Nitrate	67	mg/L			10	MCL
Unconsolidated	LL12mw-185	5/17/2023	LL12mw-185-230402-GW	Field Duplicate	Anions	Nitrate	74	mg/L			10	MCL
Unconsolidated	LL12mw-187	5/17/2023	LL12mw-187-230401-GW	Grab	Anions	Nitrate	1500	mg/L	J		10	MCL
Upper Sharon	LL1mw-080	5/3/2023	LL1mw-080-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	0.84	µg/L			0.209	RC
Upper Sharon	LL1mw-080	5/3/2023	LL1mw-080-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	2.1	µg/L			0.209	RC
Upper Sharon	LL1mw-080	5/3/2023	LL1mw-080-230401-GW	Grab	Explosives/Propellants	RDX	12	µg/L			0.97	RSL
Upper Sharon	LL1mw-081	5/3/2023	LL1mw-081-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	0.3	µg/L	J		0.209	RC
Upper Sharon	LL1mw-081	5/3/2023	LL1mw-081-230401-GW	Grab	Explosives/Propellants	RDX	1.2	µg/L			0.97	RSL
Upper Sharon	LL1mw-082	5/10/2023	LL1mw-082-230401-GW	Grab	Explosives/Propellants	RDX	0.98	µg/L	J		0.97	RSL
Upper Sharon	LL1mw-083	5/3/2023	LL1mw-083-230401-GW	Grab	Explosives/Propellants	1,3-DNB	1.1	µg/L	J		0.2	RSL
Upper Sharon	LL1mw-083	5/3/2023	LL1mw-083-230401-GW	Grab	Explosives/Propellants	TNT	1.8	µg/L			0.98	RSL
Upper Sharon	LL1mw-083	5/3/2023	LL1mw-083-230401-GW	Grab	Explosives/Propellants	2,4-DNT	2.9	µg/L			0.24	RSL
Upper Sharon	LL1mw-083	5/3/2023	LL1mw-083-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	8.7	µg/L			0.209	RC
Upper Sharon	LL1mw-083	5/3/2023	LL1mw-083-230401-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	2.7	µg/L			0.77	RSL
Upper Sharon	LL1mw-083	5/3/2023	LL1mw-083-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	13	µg/L			0.209	RC
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230401-GW	Grab	Explosives/Propellants	1,3-DNB	1.4	µg/L	J		0.2	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230402-GW	Field Duplicate	Explosives/Propellants	1,3-DNB	1.6	µg/L			0.2	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230401-GW	Grab	Explosives/Propellants	TNT	2.1	µg/L			0.98	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230402-GW	Field Duplicate	Explosives/Propellants	TNT	2.4	µg/L			0.98	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230402-GW	Field Duplicate	Explosives/Propellants	2,4-DNT	0.97	µg/L			0.24	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	6.2	µg/L			0.209	RC
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230402-GW	Field Duplicate	Explosives/Propellants	2-Amino-4,6-DNT	6.8	µg/L			0.209	RC
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230401-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	0.99	µg/L			0.77	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230402-GW	Field Duplicate	Explosives/Propellants	3,5-Dinitroaniline	1.2	µg/L			0.77	RSL
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	16	µg/L			0.209	RC
Upper Sharon	LL1mw-084	5/3/2023	LL1mw-084-230402-GW	Field Duplicate	Explosives/Propellants	4-Amino-2,6-DNT	18	µg/L			0.209	RC
Upper Sharon	LL1mw-091	5/9/2023	LL1mw-091-230301-GW	Grab	Explosives/Propellants	RDX	2	µg/L	J		0.97	RSL
Upper Sharon	LL2mw-059	5/10/2023	LL2mw-059-230401-GW	Grab	Explosives/Propellants	2,4-DNT	0.3	µg/L			0.24	RSL
Upper Sharon	LL2mw-059	5/10/2023	LL2mw-059-230401-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	1.9	µg/L			0.77	RSL
Upper Sharon	LL2mw-059	5/10/2023	LL2mw-059-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	0.54	µg/L			0.209	RC
Upper Sharon	LL3mw-237	5/4/2023	LL3mw-237-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	1	µg/L			0.209	RC
Upper Sharon	LL3mw-237	5/4/2023	LL3mw-237-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	2.2	µg/L			0.209	RC
Upper Sharon	LL3mw-238	5/15/2023	LL3mw-238-230401-GW	Grab	Explosives/Propellants	TNT	28	µg/L	J		0.98	RSL

Table 6-2. Screening Level Exceedances – Spring 2023 Sampling Event (Continued)

Zone	Well	Date Collected	Sample ID	Sample Type	Analysis Type	Chemical	Result	Units	Validation Qualifier	Background Criteria	Groundwater Screening Level	Groundwater Screening Criteria Source
Upper Sharon	LL3mw-238	5/15/2023	LL3mw-238-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	7	µg/L			0.209	RC
Upper Sharon	LL3mw-238	5/15/2023	LL3mw-238-230401-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	0.92	µg/L			0.77	RSL
Upper Sharon	LL3mw-238	5/15/2023	LL3mw-238-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	21	µg/L			0.209	RC
Upper Sharon	LL3mw-238	5/15/2023	LL3mw-238-230401-GW	Grab	Explosives/Propellants	RDX	7.5	µg/L			0.97	RSL
Upper Sharon	LL3mw-239	5/15/2023	LL3mw-239-230401-GW	Grab	Explosives/Propellants	TNT	3.3	µg/L			0.98	RSL
Upper Sharon	LL3mw-239	5/15/2023	LL3mw-239-230401-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	1.1	µg/L			0.209	RC
Upper Sharon	LL3mw-239	5/15/2023	LL3mw-239-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	1.9	µg/L			0.209	RC
Upper Sharon	LL3mw-239	5/15/2023	LL3mw-239-230401-GW	Grab	Explosives/Propellants	RDX	1.1	µg/L			0.97	RSL
Upper Sharon	LL3mw-241	5/17/2023	LL3mw-241-230401-GW	Grab	Explosives/Propellants	TNT	2	µg/L			0.98	RSL
Upper Sharon	LL3mw-241	5/17/2023	LL3mw-241-230401-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	1.7	µg/L			0.209	RC
Upper Sharon	LL3mw-241	5/17/2023	LL3mw-241-230401-GW	Grab	Explosives/Propellants	RDX	1	µg/L	J		0.97	RSL
Upper Sharon	LL3mw-247	5/15/2023	LL3mw-247-230301-GW	Grab	Explosives/Propellants	RDX	1.7	µg/L	J		0.97	RSL
Upper Sharon	LL3mw-248	5/15/2023	LL3mw-248-230301-GW	Grab	Explosives/Propellants	RDX	2	µg/L	J		0.97	RSL

µg/L = Micrograms per Liter
BKG = Background
DNB = Dinitrobenzene
DNT = Dinitrotoluene
ID = Identifier
J = Result is estimated
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
RC = Resident Child Facility-wide Cleanup Goal
RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RSL = Regional Screening Level
SVOC = Semivolatile Organic Compound
TNT = 2,4,6-Trinitrotoluene

Table 6-3. Screening Level Exceedances – Fall 2023 Sampling Event

Zone	Well	Date Collected	Sample ID	Sample Type	Analysis Type	Chemical	Result	Units	Validation Qualifier	Background Criteria	Groundwater Screening Level	Groundwater Screening Criteria Source
Homewood	FBQmw-174	10/10/2023	FBQmw-174-230901-GW	Grab	Explosives/Propellants	TNT	4.4	µg/L			0.98	RSL
Homewood	FBQmw-174	10/10/2023	FBQmw-174-230901-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	5.2	µg/L			0.209	RC
Homewood	FBQmw-174	10/10/2023	FBQmw-174-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	25	µg/L			0.209	RC
Unconsolidated	DETmw-003	10/3/2023	DET-003-230901-GW	Grab	Metals, Total	Arsenic	0.012	mg/L		0.003	0.01	MCL
Unconsolidated	DETmw-003	10/3/2023	DET-003-230901-GW	Grab	Metals, Total	Iron	2	mg/L		1.91	1.91	BKG
Unconsolidated	DETmw-003	10/3/2023	DET-003-230901-GW	Grab	Metals, Total	Manganese	0.25	mg/L	J	0.075	0.075	BKG
Unconsolidated	DETmw-003	10/3/2023	DET-003-230902-GW	Field Duplicate	SVOCs	Benz(a)anthracene	0.18	µg/L			0.03	RSL
Unconsolidated	DETmw-003	10/3/2023	DET-003-230902-GW	Field Duplicate	SVOCs	Dibenz(a,h)anthracene	0.13	µg/L			0.025	RSL
Unconsolidated	DETmw-004	10/3/2023	DET-004-230901-GW	Grab	Metals, Total	Manganese	0.18	mg/L		0.075	0.075	BKG
Unconsolidated	WBGmw-006	10/4/2023	WBGmw-006-230901-GW	Grab	Explosives/Propellants	RDX	6.6	µg/L			0.97	RSL
Unconsolidated	WBGmw-009	10/4/2023	WBGmw-009-230901-GW	Grab	Explosives/Propellants	RDX	3.2	µg/L			0.97	RSL
Unconsolidated	LL1mw-092	10/2/2023	LL1mw-092-230901-GW	Grab	Explosives/Propellants	RDX	1	µg/L	J		0.97	RSL
Unconsolidated	LL12mw-185	10/2/2023	LL12mw-185-230902-GW	Field Duplicate	Anions	Nitrate	54	mg/L			10	MCL
Unconsolidated	LL12mw-185	10/2/2023	LL12mw-185-230901-GW	Grab	Anions	Nitrate	56	mg/L			10	MCL
Unconsolidated	LL12mw-187	10/3/2023	LL12mw-187-230901-GW	Grab	Anions	Nitrate	1700	mg/L	J		10	MCL
Upper Sharon	LL1mw-080	9/26/2023	LL1mw-080-230901-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	0.3	µg/L	J		0.209	RC
Upper Sharon	LL1mw-080	9/26/2023	LL1mw-080-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	0.61	µg/L	J		0.209	RC
Upper Sharon	LL1mw-080	9/26/2023	LL1mw-080-230901-GW	Grab	Explosives/Propellants	RDX	1.9	µg/L	J		0.97	RSL
Upper Sharon	LL1mw-083	9/26/2023	LL1mw-083-230901-GW	Grab	Explosives/Propellants	TNT	1.4	µg/L	J		0.98	RSL
Upper Sharon	LL1mw-083	9/26/2023	LL1mw-083-230901-GW	Grab	Explosives/Propellants	2,4-DNT	2.9	µg/L	J		0.24	RSL
Upper Sharon	LL1mw-083	9/26/2023	LL1mw-083-230901-GW	Grab	Explosives/Propellants	2,6-DNT	1.6	µg/L	J		0.122	RA
Upper Sharon	LL1mw-083	9/26/2023	LL1mw-083-230901-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	7.9	µg/L	J		0.209	RC
Upper Sharon	LL1mw-083	9/26/2023	LL1mw-083-230901-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	1.7	µg/L	J		0.77	RSL
Upper Sharon	LL1mw-083	9/26/2023	LL1mw-083-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	11	µg/L	J		0.209	RC
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230902-GW	Field Duplicate	Explosives/Propellants	TNT	2.1	µg/L	J		0.98	RSL
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230901-GW	Grab	Explosives/Propellants	TNT	2.2	µg/L	J		0.98	RSL
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230902-GW	Field Duplicate	Explosives/Propellants	2,4-DNT	1.4	µg/L	J		0.24	RSL
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230901-GW	Grab	Explosives/Propellants	2,4-DNT	1.5	µg/L	J		0.24	RSL
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230902-GW	Field Duplicate	Explosives/Propellants	2,6-DNT	0.8	µg/L	J		0.122	RA
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230902-GW	Field Duplicate	Explosives/Propellants	2-Amino-4,6-DNT	5.2	µg/L	J		0.209	RC
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230901-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	5.3	µg/L	J		0.209	RC
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230902-GW	Field Duplicate	Explosives/Propellants	3,5-Dinitroaniline	1.6	µg/L	J		0.77	RSL
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230901-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	1.6	µg/L	J		0.77	RSL
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230902-GW	Field Duplicate	Explosives/Propellants	4-Amino-2,6-DNT	13	µg/L	J		0.209	RC
Upper Sharon	LL1mw-084	9/26/2023	LL1mw-084-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	13	µg/L	J		0.209	RC
Upper Sharon	LL2mw-059	9/27/2023	LL2mw-059-230901-GW	Grab	Explosives/Propellants	2,4-DNT	0.29	µg/L	J		0.24	RSL
Upper Sharon	LL2mw-059	9/27/2023	LL2mw-059-230901-GW	Grab	Explosives/Propellants	3,5-Dinitroaniline	1.8	µg/L	J		0.77	RSL
Upper Sharon	LL2mw-059	9/27/2023	LL2mw-059-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	0.57	µg/L	J		0.209	RC
Upper Sharon	LL3mw-238	9/27/2023	LL3mw-238-230901-GW	Grab	Explosives/Propellants	TNT	25	µg/L	J		0.98	RSL
Upper Sharon	LL3mw-238	9/27/2023	LL3mw-238-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	21	µg/L	J		0.209	RC
Upper Sharon	LL3mw-238	9/27/2023	LL3mw-238-230901-GW	Grab	Explosives/Propellants	RDX	13	µg/L	J		0.97	RSL
Upper Sharon	LL3mw-239	9/27/2023	LL3mw-239-230901-GW	Grab	Explosives/Propellants	TNT	2.1	µg/L	J		0.98	RSL
Upper Sharon	LL3mw-239	9/27/2023	LL3mw-239-230901-GW	Grab	Explosives/Propellants	2-Amino-4,6-DNT	0.62	µg/L	J		0.209	RC
Upper Sharon	LL3mw-239	9/27/2023	LL3mw-239-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	1.3	µg/L	J		0.209	RC
Upper Sharon	LL3mw-241	10/2/2023	LL3mw-241-230902-GW	Field Duplicate	Explosives/Propellants	2-Amino-4,6-DNT	1.1	µg/L			0.209	RC
Upper Sharon	LL3mw-241	10/2/2023	LL3mw-241-230902-GW	Field Duplicate	Explosives/Propellants	4-Amino-2,6-DNT	0.86	µg/L	J		0.209	RC
Upper Sharon	LL3mw-241	10/2/2023	LL3mw-241-230901-GW	Grab	Explosives/Propellants	4-Amino-2,6-DNT	1.1	µg/L	J		0.209	RC
Upper Sharon	LL3mw-247	10/2/2023	LL3mw-247-230901-GW	Grab	Explosives/Propellants	RDX	1.9	µg/L			0.97	RSL

µg/L = Micrograms per Liter
BKG = Background
DNT = Dinitrotoluene
ID = Identifier
J = Result is estimated
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
RA = Resident Adult
RC = Resident Child Facility-wide Cleanup Goal
RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RSL = Regional Screening Level
TNT = 2,4,6-Trinitrotoluene

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Table 6-4. pH Levels Outside the Normal Range in 2023

Aquifer	Well ID	Spring 2023		Fall 2023	
		Date Sampled	pH	Date Sampled	pH
Homewood	FBQmw-174	5/11/2023	4.70	10/10/2023	5.99
Upper Sharon	LL1mw-083	5/3/2023	4.44	9/28/2022	4.47

ID = Identifier

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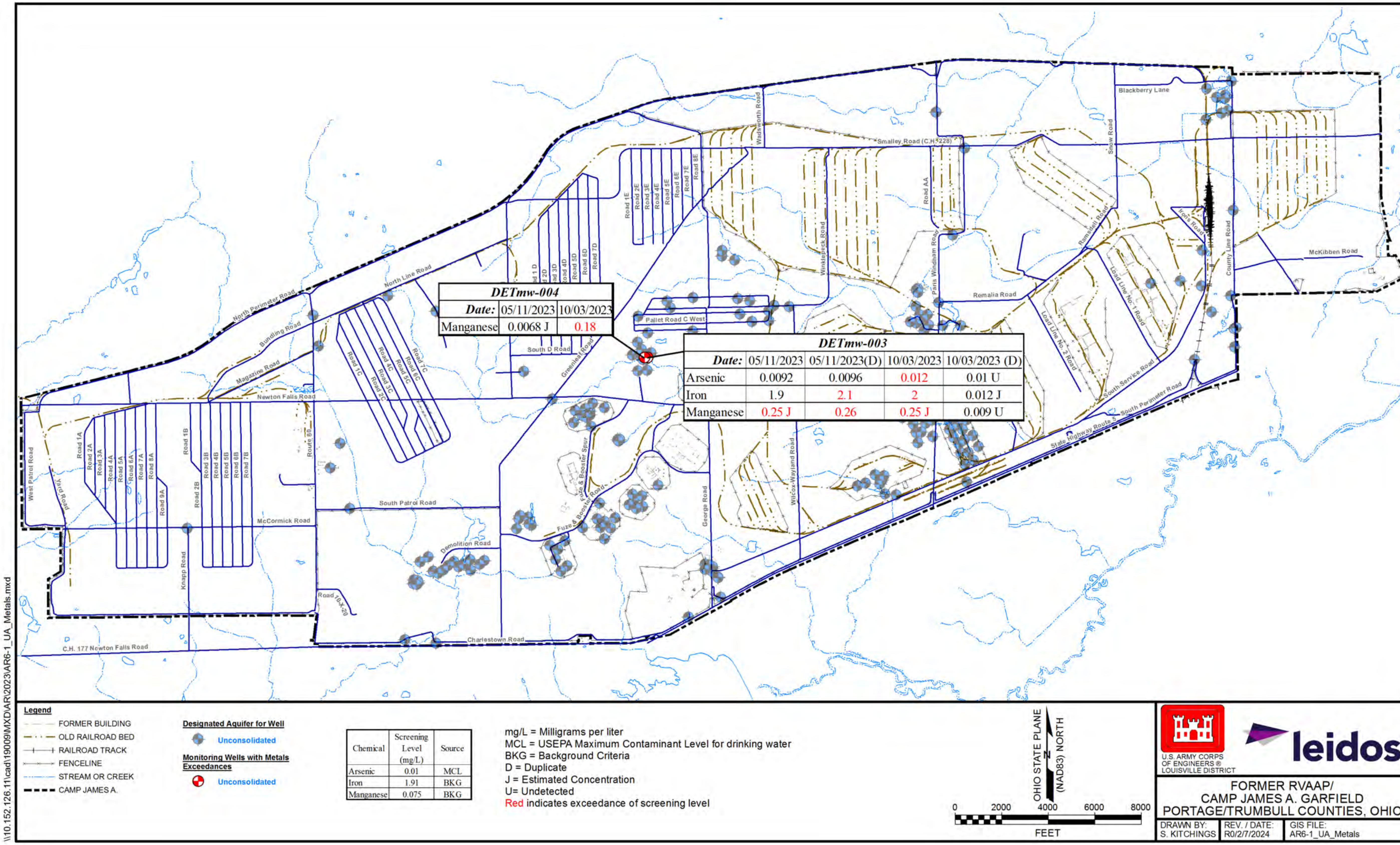


Figure 6-1. Inorganic Exceedances in the Unconsolidated Aquifer

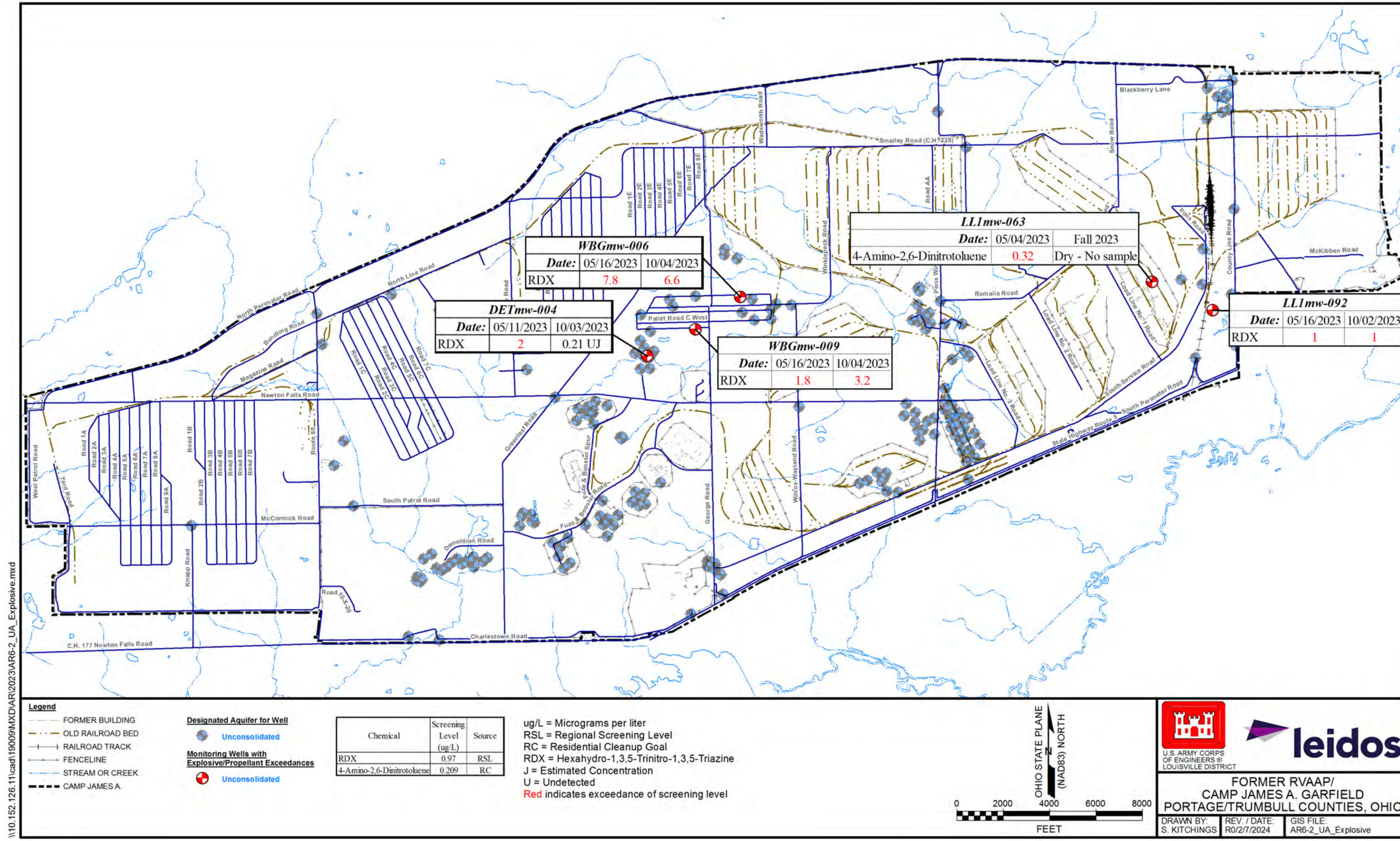
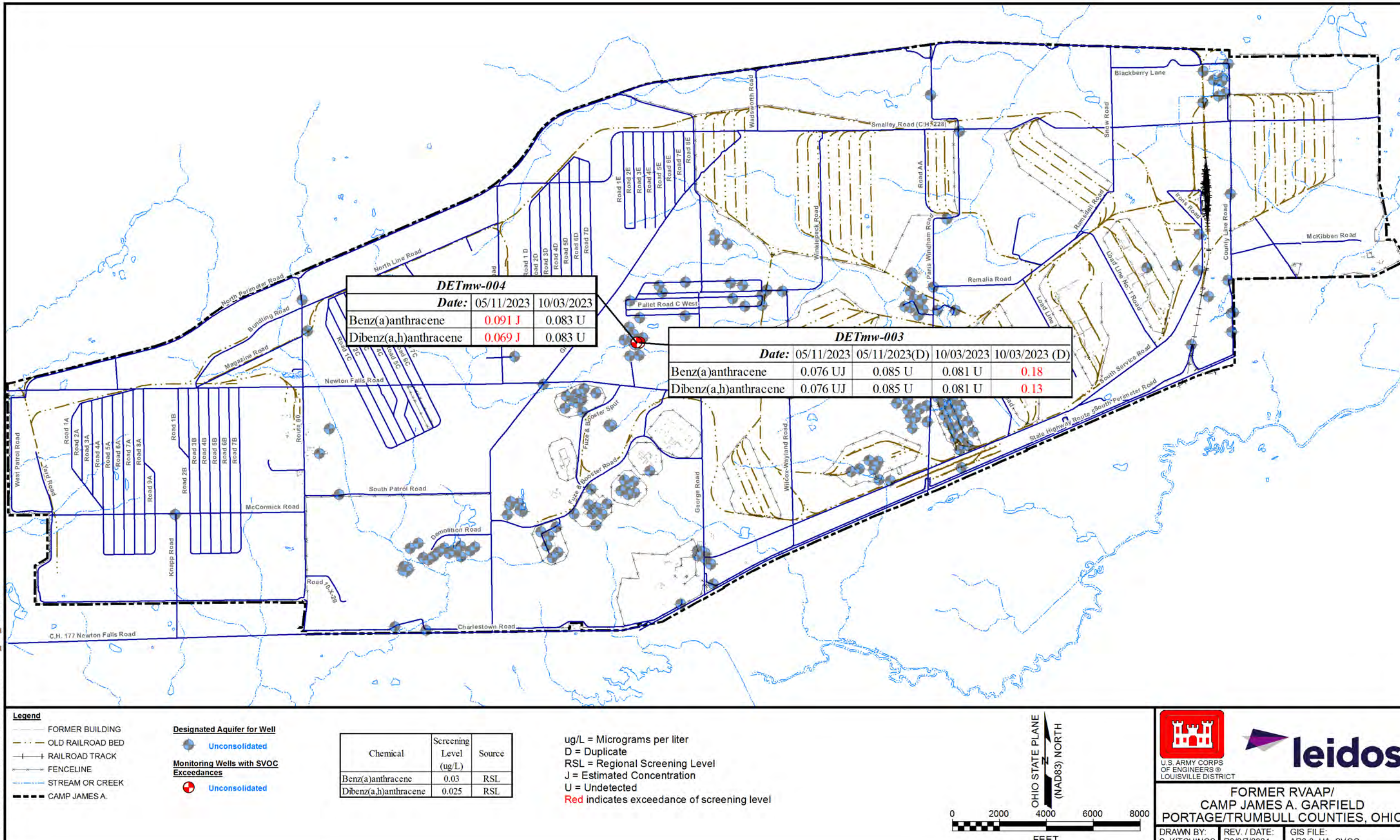


Figure 6-2. Explosive/Propellant Exceedances in the Unconsolidated Aquifer



DETmw-004

Date:	05/11/2023	10/03/2023
Benz(a)anthracene	0.091 J	0.083 U
Dibenz(a,h)anthracene	0.069 J	0.083 U

DETmw-003

Date:	05/11/2023	05/11/2023(D)	10/03/2023	10/03/2023 (D)
Benz(a)anthracene	0.076 UJ	0.085 U	0.081 U	0.18
Dibenz(a,h)anthracene	0.076 UJ	0.085 U	0.081 U	0.13

Chemical	Screening Level (ug/L)	Source
Benz(a)anthracene	0.03	RSL
Dibenz(a,h)anthracene	0.025	RSL

Figure 6-3. SVOC Exceedances in the Unconsolidated Aquifer

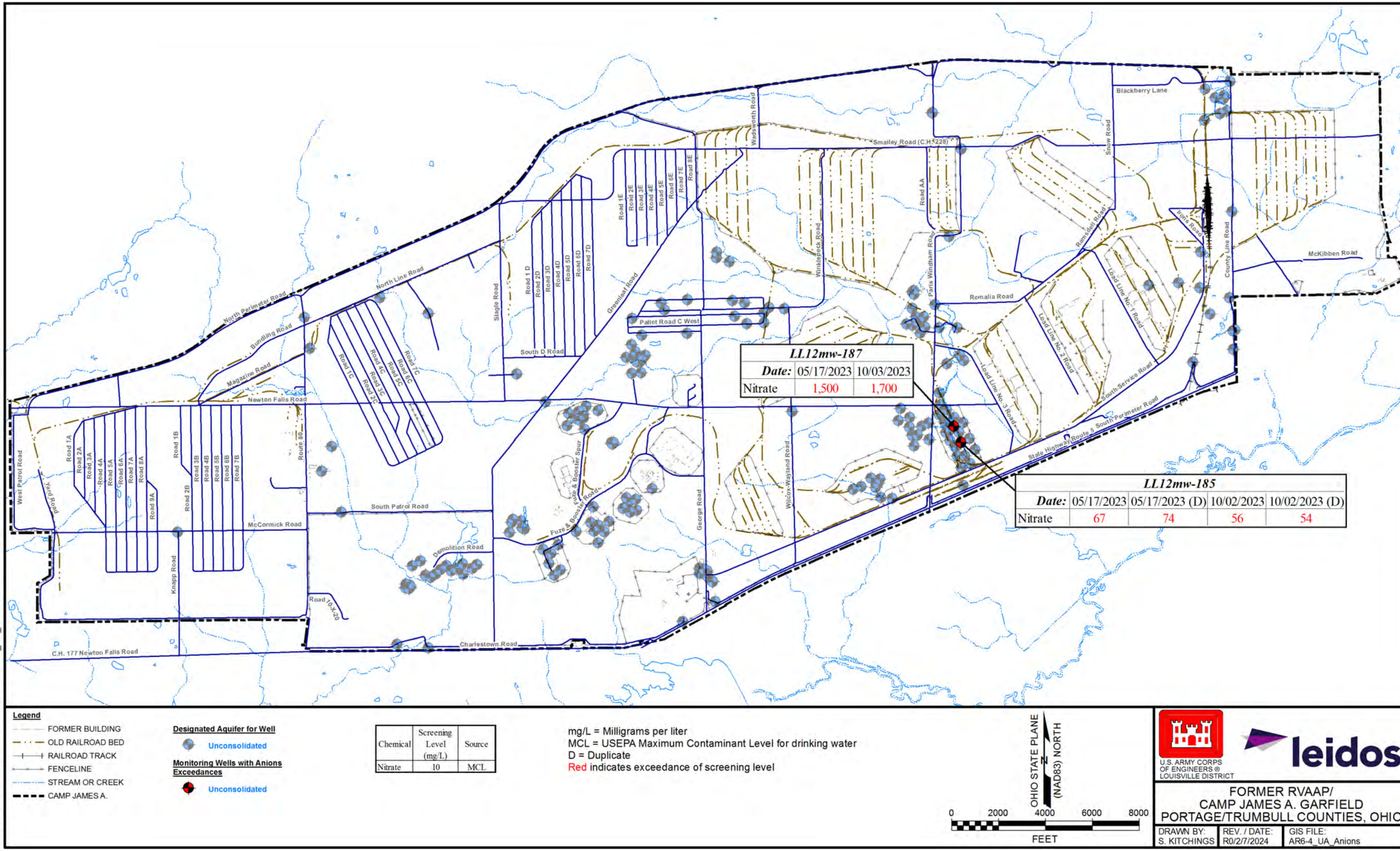
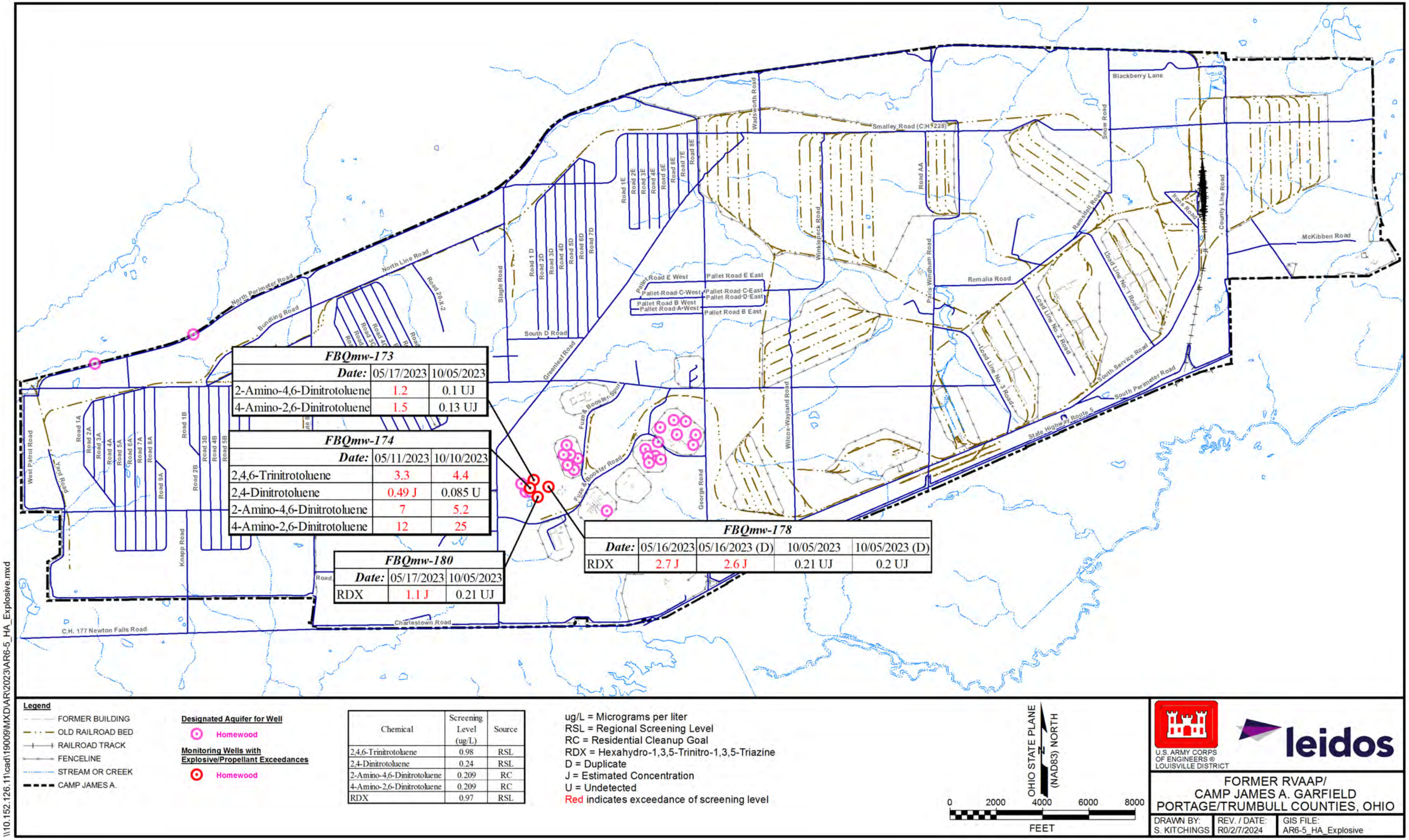


Figure 6-4. Anion Exceedances in the Unconsolidated Aquifer



FBQmw-173		
Date:	05/17/2023	10/05/2023
2-Amino-4,6-Dinitrotoluene	1.2	0.1 UJ
4-Amino-2,6-Dinitrotoluene	1.5	0.13 UJ

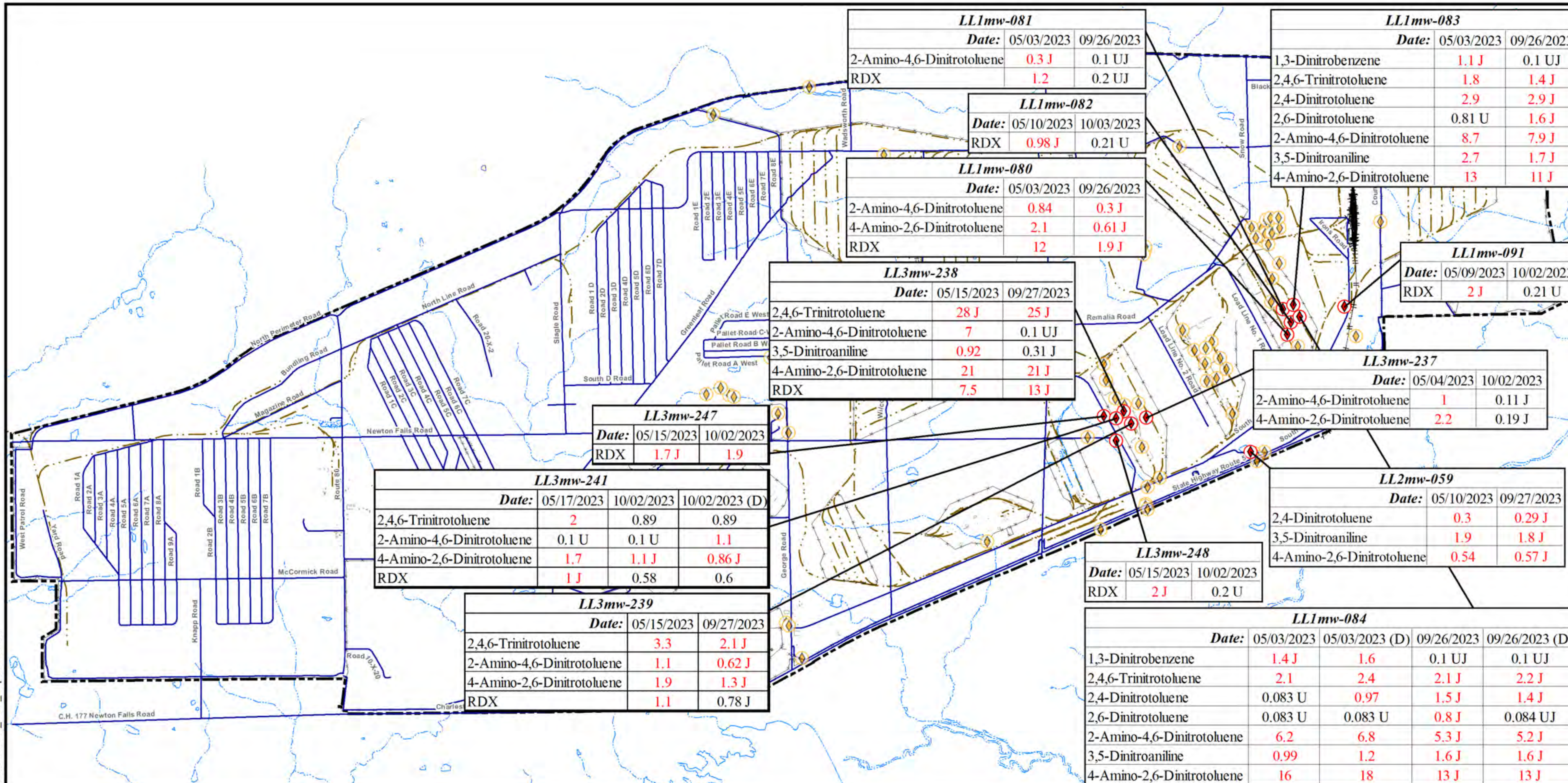
FBQmw-174		
Date:	05/11/2023	10/10/2023
2,4,6-Trinitrotoluene	3.3	4.4
2,4-Dinitrotoluene	0.49 J	0.085 U
2-Amino-4,6-Dinitrotoluene	7	5.2
4-Amino-2,6-Dinitrotoluene	12	25

FBQmw-180		
Date:	05/17/2023	10/05/2023
RDX	1.1 J	0.21 UJ

FBQmw-178				
Date:	05/16/2023	05/16/2023 (D)	10/05/2023	10/05/2023 (D)
RDX	2.7 J	2.6 J	0.21 UJ	0.2 UJ

Chemical	Screening Level (ug/L)	Source
2,4,6-Trinitrotoluene	0.98	RSL
2,4-Dinitrotoluene	0.24	RSL
2-Amino-4,6-Dinitrotoluene	0.209	RC
4-Amino-2,6-Dinitrotoluene	0.209	RC
RDX	0.97	RSL

Figure 6-5. Explosive/Propellant Exceedances in the Homewood Aquifer



LL1mw-081		
Date:	05/03/2023	09/26/2023
2-Amino-4,6-Dinitrotoluene	0.3 J	0.1 UJ
RDX	1.2	0.2 UJ

LL1mw-082		
Date:	05/10/2023	10/03/2023
RDX	0.98 J	0.21 U

LL1mw-080		
Date:	05/03/2023	09/26/2023
2-Amino-4,6-Dinitrotoluene	0.84	0.3 J
4-Amino-2,6-Dinitrotoluene	2.1	0.61 J
RDX	12	1.9 J

LL1mw-083		
Date:	05/03/2023	09/26/2023
1,3-Dinitrobenzene	1.1 J	0.1 UJ
2,4,6-Trinitrotoluene	1.8	1.4 J
2,4-Dinitrotoluene	2.9	2.9 J
2,6-Dinitrotoluene	0.81 U	1.6 J
2-Amino-4,6-Dinitrotoluene	8.7	7.9 J
3,5-Dinitroaniline	2.7	1.7 J
4-Amino-2,6-Dinitrotoluene	13	11 J

LL1mw-091		
Date:	05/09/2023	10/02/2023
RDX	2 J	0.21 U

LL3mw-238		
Date:	05/15/2023	09/27/2023
2,4,6-Trinitrotoluene	28 J	25 J
2-Amino-4,6-Dinitrotoluene	7	0.1 UJ
3,5-Dinitroaniline	0.92	0.31 J
4-Amino-2,6-Dinitrotoluene	21	21 J
RDX	7.5	13 J

LL3mw-237		
Date:	05/04/2023	10/02/2023
2-Amino-4,6-Dinitrotoluene	1	0.11 J
4-Amino-2,6-Dinitrotoluene	2.2	0.19 J

LL3mw-247		
Date:	05/15/2023	10/02/2023
RDX	1.7 J	1.9

LL3mw-241			
Date:	05/17/2023	10/02/2023	10/02/2023 (D)
2,4,6-Trinitrotoluene	2	0.89	0.89
2-Amino-4,6-Dinitrotoluene	0.1 U	0.1 U	1.1
4-Amino-2,6-Dinitrotoluene	1.7	1.1 J	0.86 J
RDX	1 J	0.58	0.6

LL2mw-059		
Date:	05/10/2023	09/27/2023
2,4-Dinitrotoluene	0.3	0.29 J
3,5-Dinitroaniline	1.9	1.8 J
4-Amino-2,6-Dinitrotoluene	0.54	0.57 J

LL3mw-248		
Date:	05/15/2023	10/02/2023
RDX	2 J	0.2 U

LL3mw-239		
Date:	05/15/2023	09/27/2023
2,4,6-Trinitrotoluene	3.3	2.1 J
2-Amino-4,6-Dinitrotoluene	1.1	0.62 J
4-Amino-2,6-Dinitrotoluene	1.9	1.3 J
RDX	1.1	0.78 J

LL1mw-084				
Date:	05/03/2023	05/03/2023 (D)	09/26/2023	09/26/2023 (D)
1,3-Dinitrobenzene	1.4 J	1.6	0.1 UJ	0.1 UJ
2,4,6-Trinitrotoluene	2.1	2.4	2.1 J	2.2 J
2,4-Dinitrotoluene	0.083 U	0.97	1.5 J	1.4 J
2,6-Dinitrotoluene	0.083 U	0.083 U	0.8 J	0.084 UJ
2-Amino-4,6-Dinitrotoluene	6.2	6.8	5.3 J	5.2 J
3,5-Dinitroaniline	0.99	1.2	1.6 J	1.6 J
4-Amino-2,6-Dinitrotoluene	16	18	13 J	13 J

Legend

- FORMER BUILDING
- OLD RAILROAD BED
- RAILROAD TRACK
- FENCELINE
- STREAM OR CREEK
- CAMP JAMES A.

Designated Aquifer for Well

- Upper Sharon

Monitoring Wells with Explosive/Propellant Exceedances

- Upper Sharon

Chemical	Screening Level (ug/L)	Source
1,3-Dinitrobenzene	0.2	RSL
2,4,6-Trinitrotoluene	0.98	RSL
2,4-Dinitrotoluene	0.24	RSL
2,6-Dinitrotoluene	0.122	RC
2-Amino-4,6-Dinitrotoluene	0.209	RC
3,5-Dinitroaniline	0.77	RSL
4-Amino-2,6-Dinitrotoluene	0.209	RC
RDX	0.97	RSL

ug/L = Micrograms per liter
RSL = Regional Screening Level
RC = Residential Cleanup Goal
RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
D = Duplicate
J = Estimated Concentration
U = Undetected
Red indicates exceedance of screening level

OHIO STATE PLANE (NAD83) NORTH

0 2000 4000 6000 8000
FEET

U.S. ARMY CORPS OF ENGINEERS ® LOUISVILLE DISTRICT

leidos

FORMER RVAAP/
CAMP JAMES A. GARFIELD
PORTAGE/TRUMBULL COUNTIES, OHIO

DRAWN BY:	REV. / DATE:	GIS FILE:
S. KITCHINGS	R0/2/7/2024	AR6-6_USA_Explosive

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Figure 6-6. Explosive/Propellant Exceedances in the Upper Sharon Aquifer

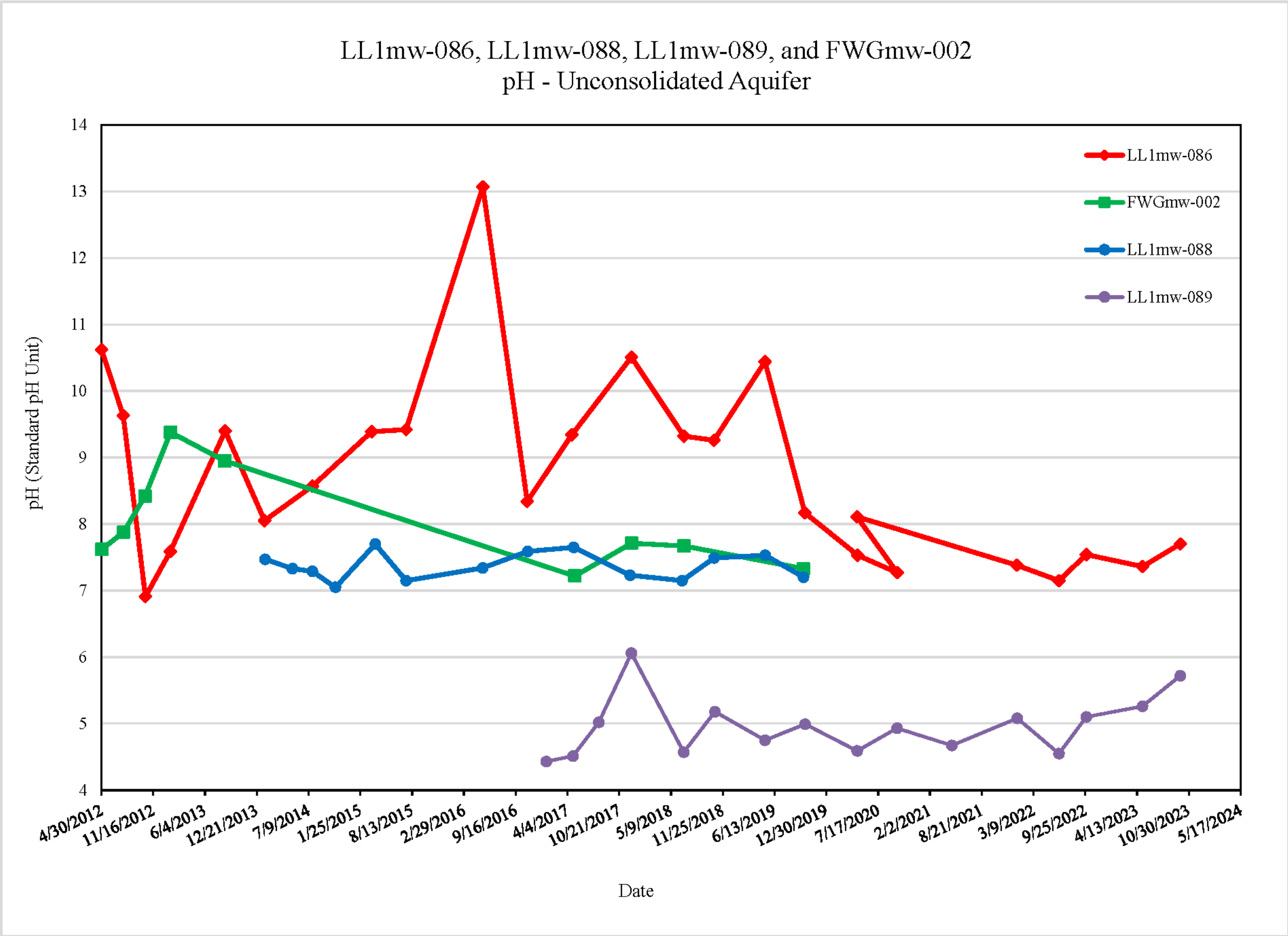

Figure 6-7. FWGmw-002, LL1mw-086, LL1mw-088, and LL1mw-089 pH – Unconsolidated Aquifer

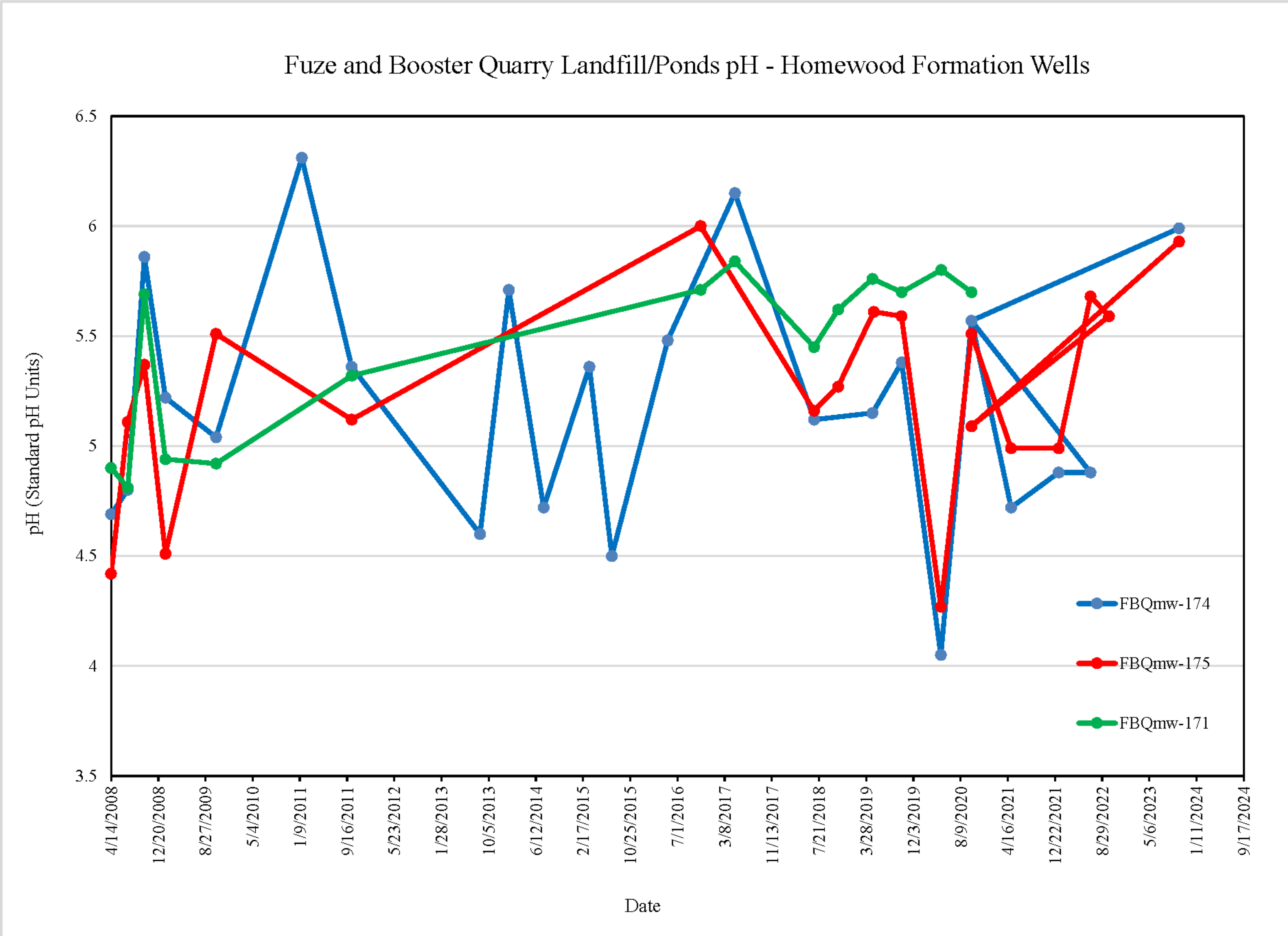

Figure 6-8. Fuze and Booster Quarry Landfill/Ponds pH – Homewood Aquifer

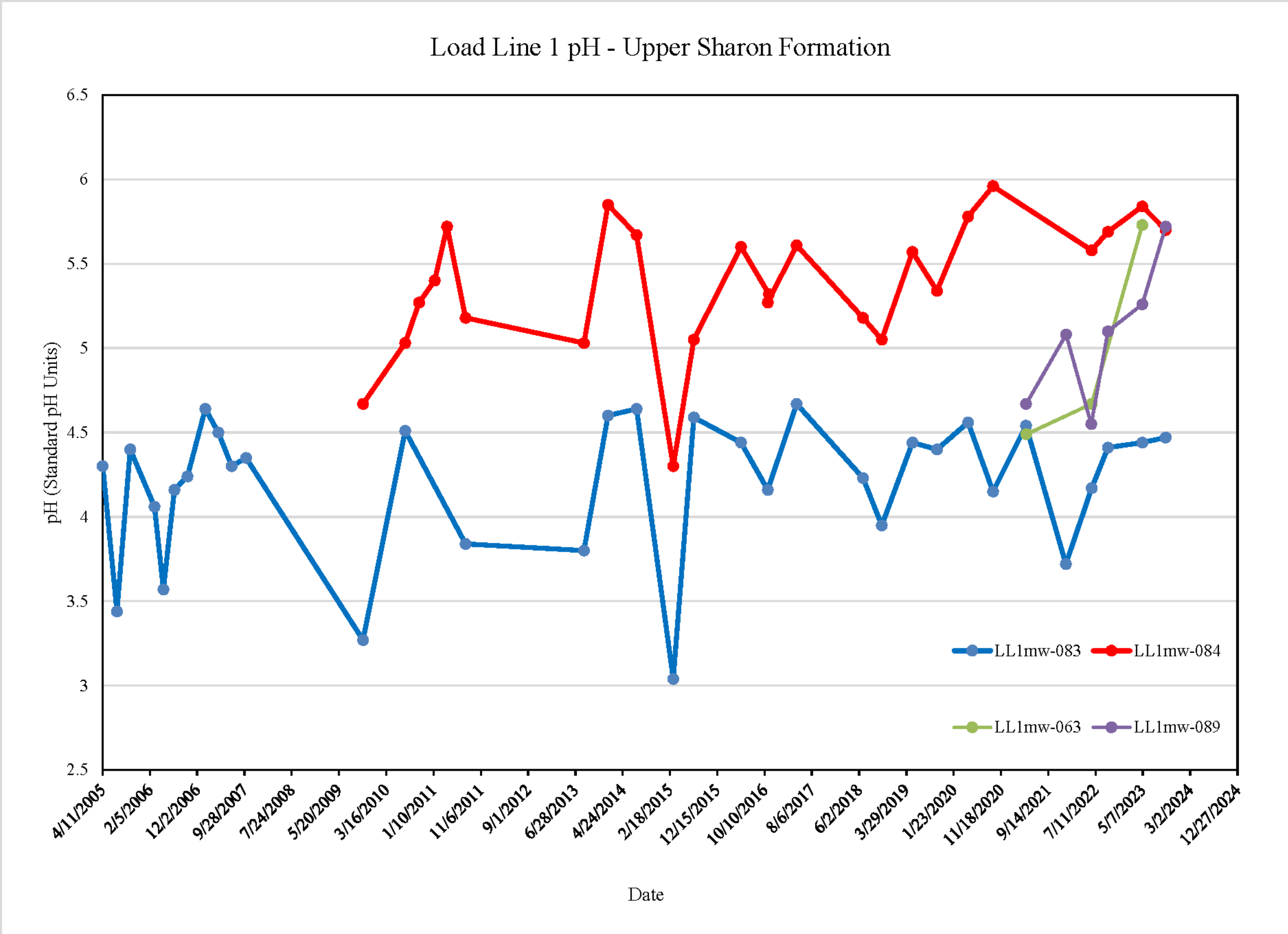

Figure 6-9. Load Line 1 pH – Upper Sharon Aquifer

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7.0 TIME-TREND GRAPHS

Time-trend graphs presented in the FWGW RI Report (Leidos 2022b) are updated in this report to present 2023 data. Concentrations of the constituents were graphed by monitoring well and chemical. The graphs include linear trendlines for each chemical. Non-detect results are included in the graphs and are plotted as the reporting limit. Appendix I includes the graphs. The following subsections summarize the findings of the graphs.

7.1 EXPLOSIVES AND PROPELLANTS

Explosives or propellants were detected in 29 of 50 wells sampled for explosives in 2023 and only exceeded the screening level in 22 wells. The time-trend graphs in Appendix I indicate that in most of the monitoring wells where exceedances were detected in 2023, the concentration is decreasing or remaining the same. Monitoring wells (LL1mw-090, LL1mw-091, LL1mw-092, LL1mw-093, LL3mw-247, LL3mw-248, FBQmw-178, FBQmw-179, FBQmw-180, and FBQmw-181) installed under the FS Monitoring Well Installation Plan (Leidos 2022a) have only been sampled twice in 2023. Consequently, trend analysis and graphs are not provided for these wells. The trendlines for all other FWGWMP wells are provided in Appendix I and summarized below:

- FBQmw-174
  - 2,4-DNT – The slightly upward trendline is a result of the May 2017 sample, which was considered non-detect but was reported at a concentration of 2.2 µg/L. Without this data point, the trendline is downward. 2,4-DNT concentrations after the May 2017 concentration are significantly less than 2.2 µg/L. 2,4-DNT was below the detection limit of 0.085 µg/L during the Fall 2023 sampling event (Figure I-1).
  - 2-Amino-4,6-DNT and 4-amino-2,6-DNT – The trendlines show decreasing groundwater concentrations. 2-Amino-4,6-DNT and 4-amino-2,6-DNT were detected at concentrations that exceeded screening criteria in the most recent samples from the Fall 2023 sampling event, above the non-detect sample concentrations from the Fall 2019 sampling event (Figures I-2 and I 3).
  - TNT – The trendline shows decreasing groundwater concentrations. The Fall 2023 sample exceeded the screening criteria at a concentration of 4.4 µg/L (Figure I-4).
- LL1mw-080
  - 2-Amino-4,6-DNT and 4-amino-2,6-DNT – The trendlines for groundwater concentration have been continuously decreasing but continue to exceed the screening criteria since the Fall 2020 sampling event. (Figures I-5 and I-6).
  - RDX – Based on the trendline, groundwater concentrations have been decreasing. However, concentrations remain above the screening level except for in the most recent sample collected during the Fall 2022 sampling event, which was below the detection limit (Figure I-7).
- LL1mw-083
  - 1,3-DNB – The trendline shows slightly increased groundwater concentrations due to the high concentrations detected in 2019 through Spring 2023, above the screening level of 0.2 µg/L. Samples from 2020 through 2023 are below the concentration of the Spring 2019

sample but are still above the screening level except for the Spring 2021, Spring 2022, Fall 2022, and Fall 2023 samples. Since 2010, 8 of 22 samples have been below the screening level of 0.2 µg/L (Figure I-8).

    - All other explosive (2-amino-4,6-DNT, 4-amino-2,6-DNT, TNT, 2,4-DNT, and 2,6-DNT) trendlines for LL1mw 083 show decreasing groundwater concentrations, even with the most recent sampling events showing concentrations above the respective screening levels (Figures I-9 to I-13).

- LL1mw-084
    - 1,3-DNB – The trendline shows slightly decreasing groundwater concentrations. The highest concentration was detected during the Fall 2019 sampling event. The most recent Fall 2023 sample is below the detection level at 0.1 U µg/L (Figure I-14).
    - RDX – The overall trendline shows slightly decreasing groundwater concentrations. RDX was detected at the highest concentration of 5.2 µg/L during the October 2018 sampling event. The concentration of RDX was below the detection level in the Fall 2023 sample at 0.21 U µg/L (Figure I-15).
    - 2,6-DNT – The trendline has been historically above the screening level of 0.122 µg/L. However, since the Fall 2020 sampling event, concentrations have been below the screening level. The Fall 2023 detected concentration of 0.8 µg/L is the only exceedance since the Fall 202 sampling event (Figure I-16).
    - The trendlines for all other explosives (2-amino-4,6-DNT, 4-amino-2,6-DNT, TNT, and 2,4-DNT) show decreasing groundwater concentrations. 2,4-DNT concentrations remain above the respective screening levels except for the concentration of 0.086 U µg/L detected in the Spring 2022 sample (Figures I-16 to I-20).
- LL2mw-059
    - 1,3-DNB – The trendline shows slightly decreasing groundwater concentrations, with 30 of 41 reported concentrations below the screening level. The most recent concentrations from the Spring and Fall 2023 sampling events are below the screening level (Figure I-21).
    - 2,4-DNT – The trendline shows increasing groundwater concentrations. The samples collected during the Spring and Fall 2023 sampling events were detected at concentrations exceeding the screening level (Figure I-22).
- LL3mw-237
    - 2-Amino-4,6-DNT – The trendline shows decreasing concentrations in groundwater. However, the sample collected during the Spring 2022 sampling event was detected at a concentration of 6.9 µg/L, which is the highest concentration since semi-annual monitoring began in 2016. The most recent sample collected during the Fall 2023 sampling event was below the screening level (Figure I-23).
    - 4-Amino-2,6-DNT – The trendline shows decreasing concentrations in groundwater. The sample collected during the Spring 2022 sampling event was detected at a concentration of 27 µg/L, which is the highest concentration since monitoring began in 2001. The most recent sample collected during the Fall 2023 sampling event was below the screening level (Figure I-24).

- LL3mw-238
  - All trendlines for explosives (2-amino-4,6-DNT, 4-amino-2,6-DNT, TNT, 2,6-DNT, and RDX) show decreasing groundwater concentrations. TNT, 4-amino-2,6-DNT, and RDX concentrations remain above the respective screening levels except for non-detects during the Spring 2022 sampling events (Figures I-25 to I-29).
- LL3mw-239
  - RDX – The trendline shows decreasing groundwater concentrations. The most recent sample collected during the Fall 2023 sampling event is below the screening level (Figure I-30).
- LL3mw-241
  - TNT and RDX – The trendlines show decreasing groundwater concentrations. The most recent samples collected during the Fall 2023 sampling event are below screening levels (Figures I-31 and I-32).
- WBGmw-006
  - RDX – The trendline shows decreasing groundwater concentrations, but concentrations remain above the screening level (Figure I-33).
- WBGmw-009
  - RDX – The trendline shows decreasing groundwater concentrations, but concentrations remain above the screening level (Figure I-34).

7.2 SEMIVOLATILE ORGANIC COMPOUNDS

SVOCs were detected in all three wells sampled for SVOCs in 2023 and only exceeded the screening level in two wells. The only previous detection of benz(a)anthracene at DETmw-003 was in August 2013, and there have not been any detections at DETmw-004. Dibenz(a,h)anthracene has not been historically detected at either DETmw-003 or DETmw-004. Historical data are not available for 071tw-001. Consequently, time-trend graphs are not available for these wells.

- DETmw-003
  - Benz(a)anthracene – Detected at a concentration of 0.18 µg/L in the Fall 2023 duplicate sample, which exceeded the RSL of 0.03 µg/L. Benz(a)anthracene was not detected in the Spring 2023 parent sample, the Spring 2023 duplicate, or the Fall 2023 parent sample.
  - Dibenz(a,h)anthracene – Detected at a concentration of 0.13 µg/L in the Fall 2023 duplicate sample, which exceeded the RSL of 0.025 µg/L. Dibenz(a,h)anthracene was not detected in the Spring 2023 parent sample, the Spring 2023 duplicate, or the Fall 2023 parent sample.
  - All other detected SVOCs were below their respective screening levels.
- DETmw-004
  - Benz(a)anthracene – Detected at a concentration of 0.091 J µg/L in Spring 2023, which exceeded the RSL of 0.03 µg/L. Benz(a)anthracene was not detected during the Fall 2023 sampling event.

    - Dibenz(a,h)anthracene – Detected at a concentration of 0.069 J µg/L in Spring 2023, which exceeded the RSL of 0.025 µg/L. Dibenz(a,h)anthracene was not detected during the Fall 2023 sampling event.
    - All other detected SVOCs were below their respective screening levels.
- 071tw-001
    - 1-Methylnaphthalene – Detected below the RSL of 1.1 µg/L in the Spring 2023 parent and duplicate sample.
    - 2-Methylnaphthalene – Detected below the RSL of 3.6 µg/L in the Spring 2023 parent and duplicate sample.

7.3 VOLATILE ORGANIC COMPOUNDS

VOCs were detected in three (LL10mw-003, DETmw-004, and 071tw-001) of the four wells sampled for VOCs during the Spring and Fall 2023 sampling events. VOCs did not exceed the screening criteria in either sampling event of 2023.

Carbon tetrachloride was only detected in the Fall 2023 sample collected at LL10mw-003; however, the detected concentration was below the MCL of 5 µg/L. A trend analysis is provided in Figure I-35 showing carbon tetrachloride concentrations at the Load Line 10 monitoring wells. In addition, a Mann-Kendall Trend test was completed for carbon tetrachloride data dating back to 2005. A description of the statistical software, the methodology used, and the analytical results are presented in Appendix J. The statistical analysis confirmed that the concentration of carbon tetrachloride in LL10mw-003 does not have a statistically significant trend.

Benzene was detected in the Spring 2023 sample collected at 071tw-001; however, the detected concentration was below the MCL of 5 µg/L. Per the FS Monitoring Well Installation Plan (Leidos 2022a), the temporary well 071tw-001 was only proposed for one round of sampling.

Acetone was only detected in the Fall 2023 sample collected at DETmw-004; however, the detected concentration was below the RSL of 1,800 µg/L.

7.4 PESTICIDES AND POLYCHLORINATED BIPHENYLS

No pesticides or PCBs were detected in any of the six groundwater samples (four parent and two duplicate) collected in 2023. Consequently, trend analysis and graphs are not provided for pesticides or PCBs.

7.5 CYANIDE

No cyanide was detected in either of the two groundwater samples collected in 2023. Consequently, trend analysis and graphs are not provided for cyanide.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the work completed and the pertinent findings from the 2023 FWGWMP monitoring events conducted at CJAG. The recommendations indicate future activities to be performed regarding groundwater monitoring.

8.1 CONCLUSIONS

FWGWMP sampling events were conducted in Spring and Fall 2023. These sampling events were conducted in accordance with the objectives specified in the 2023 Addendum (Leidos 2023a) and applicable FCRs. Table 8-1 presents the wells and rationale list, which is provided in Table 3-3 of the 2023 Addendum (Leidos 2023a) and includes a column that presents the results and findings from the analyses conducted at each well.

The annual water level measurements were collected in April 2023. Groundwater elevations from 312 monitoring wells were used to generate the potentiometric surfaces for the Unconsolidated, Homewood Sandstone, Upper Sharon Sandstone, and Basal Sharon Conglomerate aquifers.

In general, the groundwater elevations observed during the April 2023 gauging event were similar to those observed during the October 2022 event. The primary gradient for the Unconsolidated aquifer was toward the east, with localized variances toward the north and south, as well as localized radial flow. The primary gradient for the Homewood aquifer was toward the east/southeast, with a localized radial pattern near Load Line 9 and Fuze and Booster Quarry. The primary gradient of the Upper Sharon aquifer was toward the east/southeast/northeast, with a localized radial pattern near Load Line 2. The primary gradient for the Basal Sharon Conglomerate aquifer was directed toward the east, with a northeasterly trend in the northeastern portion of CJAG.

8.2 RECOMMENDATIONS

The following subsections present recommendations of activities to be performed during the FWGWMP.

8.2.1 Well Redevelopment

As part of the ongoing FWGW monitoring, wells will be considered for redevelopment to remove accumulated sediment and fines from the filter packs. Wells to be considered for redevelopment prior to sampling are WBGmw-016, WBGmw-017, LL1mw-063, LL1mw-081, LL1mw-082, LL1mw-086, LL2mw-059, LL3mw-238, LL3mw-239, LL12mw-187, LL12mw-246, FWGmw-011, and FWGmw-021.

8.2.2 2024 FWGWMP Sampling

The proposed FWGWMP groundwater sampling for 2024 is provided in the *Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2024* (Leidos 2024).

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Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
1	RVAAP-04 Open Demolition Area #2	DETmw-003	Unconsolidated	In accordance with the DFFO, analytical parameters for this well in 2023 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	• Explosives, cyanide, VOCs, PCBs, and pesticides were not detected in the parent or duplicate samples in Spring or Fall 2023. • Seventeen SVOCs, including 2-methylnaphthalene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, di-n-butyl phthalate, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene, and pyrene were detected in groundwater during 2023. All SVOC concentrations were below screening levels, with the exception of benz(a)anthracene and dibenz(a,h)anthracene. Benz(a)anthracene was only detected in the Fall 2023 duplicate sample at a concentration of 0.00018 mg/L, which exceeded the RSL of 0.00003 mg/L. Dibenz(a,h)anthracene was only detected in the Fall 2023 duplicate sample at a concentration of 0.00013 mg/L, which exceeded the RSL of 0.000025 mg/L. • All detected metals concentrations were below the screening level or background concentration, except for arsenic, iron, and manganese. The arsenic concentration detected in the Fall 2023 parent sample at 0.012 mg/L exceeded the MCL of 0.01 mg/L. All other arsenic detections were below the MCL concentration of 0.01 mg/L. The iron concentration detected in the Spring 2023 duplicate sample at 2.1 mg/L and in the Fall 2023 parent sample at 2 mg/L exceeded the background concentration of 1.91 mg/L. All other iron detections were below the background concentration of 1.91 mg/L. The manganese concentration detected in the Spring 2023 parent sample at 0.25 J mg/L, the Spring 2023 duplicate sample at 0.26 mg/L, and the Fall 2023 parent sample at 0.25 J mg/L exceeded the background concentration of 0.075 mg/L. Manganese was not detected in the Fall 2023 duplicate sample. • pH was 6.86 S.U. in Spring 2023 and 7.32 S.U. in Fall 2023.
2	RVAAP-04 Open Demolition Area #2	DETmw-004	Unconsolidated	In accordance with the DFFO, analytical parameters for this well in 2023 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	• Pesticides, cyanide, and PCBs were not detected in Spring and Fall 2023. • HMX and RDX were detected in groundwater during 2023. HMX detections during Fall and Spring 2023 did not exceed the RSL concentration of 0.1 mg/L. The RDX concentration detected in Spring 2023 at 0.002 mg/L exceeded the RSL of 0.00097 mg/L. RDX was not detected during Fall 2023. • Thirteen SVOCs, including anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, di-n-butyl phthalate, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, and pyrene were detected in groundwater during 2023. All SVOC concentrations were below screening levels, with the exception of benz(a)anthracene and dibenz(a,h)anthracene. Benz(a)anthracene was only detected in Spring 2023 at a concentration of 0.000091 J mg/L, which exceeded the RSL of 0.00003 mg/L. Dibenz(a,h)anthracene was only detected in Spring 2023 at a concentration of 0.000069 J mg/L, which exceeded the RSL of 0.000025 mg/L. • Acetone was only detected in Fall 2023 at a concentration below the RSL of 1.8 mg/L. • All metal concentrations were below the screening level or background concentration with the exceptions of manganese. Manganese was detected at a concentration of 0.18 mg/L in Fall 2023, which exceeds the background concentration of 0.075 mg/L. Manganese was detected below the background concentration of 0.075 mg/L in Spring 2023. • pH was 6.71 S.U. in Spring 2023 and 6.50 S.U. in Fall 2023.
3	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• HMX, MNX, and RDX were the only explosives detected. RDX was detected at a concentration of 0.0078 mg/L in Spring 2023 and 0.0066 mg/L in Fall 2023, both of which exceed the RSL of 0.00097 mg/L. HMX was detected in both Spring and Fall 2023 at concentrations below the RSL of 0.1 mg/L. MNX was only detected in Spring 2023 at a concentration of 0.00043 mg/L. • Sulfide, nitrate, and nitrite were not detected in Spring or Fall 2023. • Sulfate was detected at 24 mg/L in Spring 2023 and 27 mg/L in Fall 2023. • Alkalinity was detected at 270 mg/L in Spring 2023 and 280 mg/L in Fall 2023. • TOC was detected at 2 mg/L in Spring 2023 and 1.1 mg/L in Fall 2023. • pH was 7.15 S.U. in Spring 2023 and 7.47 S.U. in Fall 2023.

Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum (Continued)

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
4	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• HMX and RDX were the only explosives detected. RDX was detected at 0.0018 mg/L in Spring 2023 and 0.0032 mg/L in Fall 2023; both concentrations exceed the RSL of 0.00097 mg/L. HMX was detected at 0.00073 mg/L in Spring 2023 and 0.0016 mg/L in Fall 2023; both concentrations were below the RSL of 0.1 mg/L. • Nitrite and sulfide were not detected. • Nitrate was detected at 0.35 mg/L in Spring 2023 and 0.091 mg/L in Fall 2023. • Sulfate was detected at 15 mg/L in Spring 2023 and 22 mg/L in Fall 2023. • Alkalinity was detected at 180 mg/L in Spring 2023 and 340 mg/L in Fall 2023. • TOC was not detected in Spring 2023 and was detected at 0.91 J mg/L in Fall 2023. • pH was 6.27 S.U. in Spring 2023 and 6.77 S.U. in Fall 2023.
5	RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	Unconsolidated	Monitor for explosives to support the FS.	• Explosives were not detected in Spring or Fall 2023. • pH was 6.94 S.U. in Spring 2023 and 7.42 S.U. in Fall 2023.
6	RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	Unconsolidated	Monitor for explosives to support the FS.	• Explosives were not detected in Spring or Fall 2023. • pH was 6.41 S.U. in Spring 2023 and 7.23 S.U. in Fall 2023.
7	RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	Unconsolidated	Monitor for explosives to support the FS.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.36 S.U. in Spring 2023 and 7.16 S.U. in Fall 2023.
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	Unconsolidated	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• HMX was the only explosive detected. HMX was not detected in Spring 2023. HMX was detected at 0.00011 J mg/L in Fall 2023, which was below the RSL of 0.1 mg/L. • Nitrite and sulfide were not detected in Spring or Fall 2023. • Nitrate was detected at a concentration of 0.45 J mg/L in Spring 2023 and 0.43 J mg/L in Fall 2023. • Sulfate was detected at 9.6 mg/L in Spring 2023 and 12 J mg/L in Fall 2023. • Alkalinity was detected at 49 mg/L in Spring 2023 and 50 mg/L in Fall 2023. • TOC was not detected in Spring or Fall 2023. • pH was 5.52 S.U. in Spring 2023 and 6.78 S.U. in Fall 2023.
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon	Continue to monitor for explosives.	• 2-Nitrotoluene was the only explosive detected. 2-Nitrotoluene was detected at a concentration of 0.00021 J mg/L in Spring 2023, which was below the RC of 0.00037 mg/L. 2-Nitrotoluene was not detected in Fall 2023. • pH was 6.94 S.U. in Spring 2023 and 6.96 S.U. in Fall 2023.
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon	Continue to monitor for explosives.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.12 S.U. in Spring 2023 and 7.19 S.U. in Fall 2023.
11	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated	Continue to monitor for explosives.	• LL1mw-063 was dry in Fall 2023 and only sampled in Spring 2023. • 2-Amino-4,6-DNT, 4-amino-2,6-DNT, and HMX were the only explosives detected. The detected concentration of 2-amino-4,6-DNT in Spring 2023 was below the RC of 0.000209 mg/L. The detected concentration of HMX in Spring 2023 was below the RSL of 0.1 mg/L. 4-amino-2,6-DNT was detected at a concentration of 0.00032 mg/L in Spring 2023, which exceeded the RC of 0.000209 mg/L. • pH was 5.73 S.U. in Spring 2023.
12	RVAAP-08 Load Line 1 (east of Load Line 1 fence)	LL1mw-064	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.43 S.U. in Spring 2023 and 7.35 S.U. in Fall 2023.
13	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• TNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, HMX, and RDX were detected; however, only 2-amino-4,6-DNT, 4-amino-2,6-DNT, and RDX exceeded screening criteria. • The detected concentration of 2-amino-4,6-DNT at 0.00084 mg/L in Spring 2023 and 0.0003 J mg/L in Fall 2023 exceeded the RC of 0.000209 mg/L. The detected concentration of 4-amino-2,6-DNT at 0.0021 mg/L in Spring 2023 and 0.00061 J mg/L in Fall 2023 exceeded the RC of 0.000209 mg/L. The detected concentration of RDX at 0.012 mg/L in Spring 2023 and 0.0019 mg/L in Fall 2023 exceeded the RSL of 0.00097 mg/L. • Nitrite and sulfide were not detected in Spring or Fall 2023. • Nitrate was not detected in Spring 2023 but was detected at 0.09 J mg/L in Fall 2023. • Sulfate was detected at 26 mg/L in Spring 2023 and 500 mg/L in Fall 2023. • Alkalinity was detected at 85 mg/L in Spring 2023 and 140 mg/L in Fall 2023. • TOC was detected at 1.2 mg/L in Spring 2023 and an estimated concentration of 1.7 mg/L in Fall 2023. • pH was 6.53 S.U. in Spring 2023 and 6.66 S.U. in Fall 2023.
14	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon	Continue to monitor for explosives.	• 2-Amino-4,6-DNT and RDX were the only explosives detected. 2-amino-4,6-DNT was only detected in Spring 2023 at a concentration of 0.0003 J mg/L, which exceeded the RC of 0.000209 mg/L. RDX was only detected in Spring 2023 at a concentration of 0.0012 mg/L, which exceeded the RSL of 0.00097 mg/L. • pH was 6.55 S.U. in Spring 2023 and 6.38 S.U. in Fall 2023.

Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum (Continued)

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
15	RVAAP-08 Load Line 1	LL1mw-082	Upper Sharon	Monitor for explosives to support the FS.	• RDX was the only explosives detected. RDX was only detected in Spring 2023 at a concentration of 0.00098 J mg/L, which exceeded the RSL of 0.00097 mg/L. • pH was 6.37 S.U. in Spring 2023 and 6.79 S.U. in Fall 2023.
16	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• 1,3,5-TNB,1,3-DNB, TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3,5-dinitroaniline, 4-amino-2,6-DNT, HMX, and RDX were the only explosives detected. The explosives 1,3,5-TNB, 2-nitrotoluene, HMX, and RDX did not exceed screening levels. 1,3-DNB was only detected in Spring 2023 at a concentration of 0.0011 J mg/L, which exceeded the RSL of 0.0002 mg/L. The detected concentration of TNT in Spring 2023 at 0.0018 mg/L in Fall 2023 at 0.0014 J mg/L both exceeded the RSL of 0.00098 mg/L. The detected concentration of 2,4-DNT in Spring 2023 at 0.0029 mg/L and Fall 2023 at 0.0029 J mg/L both exceeded the RSL of 0.00024 mg/L. 2,6-DNT was only detected in Fall 2023 at a concentration of 0.0016 J mg/L, which exceeds the RC of 0.000122 mg/L. The detected concentration of 2-amino-4,6-DNT in Spring 2023 at 0.0087 mg/L and Fall 2023 at 0.0079 J mg/L both exceeded the RC of 0.000209 mg/L. The detected concentration of 3,5-dinitroaniline in Spring 2023 at 0.0027 mg/L and Fall 2023 at 0.0017 J mg/L both exceeded the RSL of 0.00077 mg/L. The detected concentration of 4-amino-2,6-DNT in Spring 2023 at 0.013 mg/L and Fall 2023 at 0.011 J mg/L both exceeded the RC of 0.000209 mg/L. • Alkalinity, nitrite, and sulfide were not detected in Spring or Fall 2023. • Nitrate was detected at a concentration of 0.18 J mg/L in both Spring and Fall 2023. • Sulfate was detected at 23 J mg/L in Spring 2023 and 180 mg/L in Fall 2023. • TOC was detected at 0.93 J mg/L in Spring 2023 and at 0.9 J mg/L in Fall 2023. • pH was 4.44 S.U. in Spring 2023 and 4.47 S.U. in Fall 2023.
17	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• 1,3,5-TNB,1,3-DNB, TNT, 2,4-diamino-6-nitrotoluene, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3,5-dinitroaniline, 4-amino-2,6-DNT, HMX, MNX, RDX, and TNX were the only explosives detected. The explosives 1,3,5-TNB, 2,4-diamino-6-nitrotoluene, 2-nitrotoluene, HMX, MNX, RDX, and TNX did not exceed screening levels.1,3-Dinitrobenzene was only detected in the Spring 2023 parent and duplicate samples at concentrations of 0.0014 J mg/L and 0.0016 mg/L, respectively, both of which exceeded the RSL of 0.0002 mg/L. Detected concentrations of TNT in both the Spring 2023 and Fall 2023 parent and duplicate samples exceeded the RSL of 0.00098 mg/L. The detected concentration of TNT in the Spring 2023 parent sample was 0.0021 mg/L, while the duplicate was 0.0024 mg/L. The detected concentration of TNT in the Fall 2023 parent sample was 0.0021 J mg/L, while the duplicate was 0.0022 J mg/L. Detected concentrations of 2,4-DNT in the Spring 2023 duplicate sample and the Fall 2023 parent and duplicate samples exceeded the RSL of 0.00024 mg/L. The detected concentration of 2,4-DNT in the Spring 2023 duplicate sample was 0.00097 mg/L, while the parent sample was non-detect. The detected concentration of 2,4-DNT was 0.0015 J mg/L in the Fall 2023 parent sample and 0.0014 J mg/L in the duplicate. 2,6-DNT was only detected in the Fall 2023 duplicate sample at a concentration of 0.0008 mg/L, which exceeds the RC of 0.000122 mg/L. Detected concentrations of 2-amino-4,6-DNT in both the Spring and Fall 2023 parent and duplicate samples exceeded the RC of 0.000209 mg/L. The detected concentration of 2-amino-4,6-DNT in the Spring 2023 parent sample was 0.0062 mg/L, while the duplicate was 0.0068 mg/L. The detected concentration of 2-amino-4,6-DNT in the Fall 2023 parent sample was 0.0053 J mg/L, while the duplicate was 0.0052 J mg/L. Detected concentrations of 3,5-dinitroaniline in both the Spring and Fall 2023 parent and duplicate samples exceeded the RSL of 0.00077 mg/L. The detected concentration of 3,5-dinitroaniline in the Spring 2023 parent sample was 0.00099 mg/L, while the duplicate was 0.0012 mg/L. The detected concentration of 3,5-dinitroaniline in the Fall 2023 parent and duplicate sample was 0.0016 J mg/L. Detected concentrations of 4-amino-2,6-DNT in both the Spring 2023 and Fall 2023 parent and duplicate samples exceeded the RC of 0.000209 mg/L. The detected concentration of 4-amino-2,6-DNT in the Spring 2023 parent sample was 0.016 mg/L, while the duplicate was 0.018 mg/L. The detected concentration of 4-amino-2,6-DNT in the Fall 2023 parent and duplicate sample was 0.013 J mg/L. • Nitrite and sulfide were not detected in the parent or duplicate sample in Spring or Fall 2023. • Nitrate was detected at 0.67 and 0.66 mg/L in the parent and duplicate samples, respectively, in Spring 2023. Nitrate was detected at 0.4 J and 0.39 J mg/L in the parent and duplicate samples, respectively, in Fall 2023. • Sulfate was only detected in the Spring 2023 parent sample at 110 mg/L, and at 120 mg/L in the parent and duplicate samples in Fall 2023. • Alkalinity was detected at 48 and 50 mg/L in the parent and duplicate samples, respectively, in Spring 2023. Alkalinity was detected at 29 mg/L in the parent and duplicate samples in Fall 2023. • TOC was detected at 1.5 mg/L in Spring 2023 and at 1.3 mg/L in Fall 2023. • pH was 5.84 S.U. in Spring 2023 and 5.7 S.U. in Fall 2023.

Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum (Continued)

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
18	RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated	Monitor for explosives in this exit pathway well. Although no historical exceedances of screening levels have been detected, ongoing sampling for explosives is recommended in support of the FS.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.36 S.U. in Spring 2023 and 7.7 S.U. in Fall 2023.
19	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-087	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in the parent or duplicate samples in Spring or Fall 2023. • pH was 6.65 S.U. in Spring 2023. The well could not sustain low-flow purging in Fall 2023. The well was purged dry, allowed to recharge, and sampled within 24 hours (water quality parameters could not be recorded).
20	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-089	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 5.26 S.U. in Spring 2023 and 5.72 S.U. in Fall 2023.
21	RVAAP-08 Load Line 1	LL1mw-090	Unconsolidated	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• Explosives were not detected in Spring or Fall 2023. • pH was 6.77 S.U. in Spring 2023 and 6.08 S.U. in Fall 2023.
22	RVAAP-08 Load Line 1	LL1mw-091	Upper Sharon	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.002 mg/L, which exceeded the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.39 S.U. in Spring 2023 and 6.75 S.U. in Fall 2023.
23	RVAAP-08 Load Line 1	LL1mw-092	Unconsolidated	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring and Fall 2023 at 0.001 J mg/L, which exceeded the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 7.09 S.U. in Spring 2023 and 7.21 S.U. in Fall 2023.
24	RVAAP-08 Load Line 1	LL1mw-093	Upper Sharon	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.00067 J mg/L and Fall 2023 at 0.00082 J mg/L; both detections were below the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.72 S.U. in Spring 2023 and 7.21 S.U. in Fall 2023.
25	RVAAP-09 Load Line 2 South	LL2mw-059	Upper Sharon	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• 1,3,5-TNB, 2,4-DNT, 3,5-dinitroaniline, and 4-amino-2,6-DNT were the only explosives detected in 2023. Detected concentrations of 1,3,5-TNB in Spring 2023 did not exceed screening levels. The detected concentrations of 2,4-DNT in Spring 2023 at 0.0003 mg/L and Fall 2023 at 0.00029 J mg/L both exceeded the RSL 0.00024 mg/L. The detected concentrations of 3,5-dinitroaniline in Spring 2023 at 0.0019 mg/L and Fall 2023 at 0.0018 J mg/L exceeded the RSL of 0.00077 mg/L. The detected concentrations of 4-amino-2,6-DNT in Spring 2023 at 0.00054 mg/L and Fall 2023 at 0.00057 J mg/L exceeded the RC of 0.000209 mg/L. • Nitrite was not detected in Spring or Fall 2023. • Nitrate was detected at 0.39 J mg/L in Spring 2023 and 0.42 J mg/L in Fall 2023. • Sulfate was detected at 16 mg/L in Spring 2023 and 20 mg/L in Fall 2023. • Sulfide was only detected in Fall 2023 at 1.6 J mg/L. • Alkalinity was detected at 110 mg/L in Spring 2023 and 100 mg/L in Fall 2023. • TOC was detected at 1.2 mg/L in Spring 2023 and 1.3 mg/L in Fall 2023. • pH was 6.13 S.U. in Spring 2023 and 6.24 S.U. in Fall 2023.
26	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon	Continue to monitor for explosives.	• The explosives TNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT were detected; however, only, 2-amino-4,6-DNT and 4-amino-2,6-DNT exceeded screening levels in Spring 2023. The detected concentration of 2-amino-4,6-DNT in Spring 2023 at 0.001 exceeded the RC of 0.000209 mg/L. The detected concentration of 4-amino-2,6-DNT in Spring 2023 at 0.0022 mg/L exceeded the RC of 0.000209 mg/L. • pH was 6.42 S.U. in Spring 2023 and 6.28 S.U. in Fall 2023.
27	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• 1,3,5-TNB, TNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, HMX, and RDX were the only explosives detected. Detected concentrations of the explosives 1,3,5-TNB and HMX did not exceed screening levels. The detected concentrations of TNT in Spring 2023 at 0.028 J mg/L and Fall 2023 at 0.025 J mg/L exceeded the RSL of 0.00098 mg/L. 2-Amino-4,6-DNT was only detected in Spring 2023 at a concentration of 0.007 mg/L, which exceeds the RC of 0.000209 mg/L. The detected concentration of 3,5-dinitroaniline in Spring 2023 at 0.00092 mg/L exceeded the RSL of 0.00077 mg/L; the detected concentration in Fall 2023 did not exceed the RSL. The detected concentrations of 4-amino-2,6-DNT in Spring 2023 at 0.021 mg/L and Fall 2023 at 0.021 J mg/L exceeded the RC of 0.000209 mg/L. The detected concentrations of RDX in Spring 2023 at 0.0075 mg/L and Fall 2023 at 0.013 J mg/L exceeded the RSL of 0.00097 mg/L. • Nitrite and sulfide were not detected in Spring or Fall 2023. • Nitrate was detected 0.59 mg/L in Spring 2023 and at 0.54 mg/L in Fall 2023. • Sulfate was detected at 53 mg/L in Spring 2023 and 60 mg/L in Fall 2023. • Alkalinity was detected at 140 mg/L in Spring and Fall 2023. • TOC was detected at 2.6 mg/L in Spring 2023 and 2.2 mg/L in Fall 2023. • pH was 6.72 S.U. in Spring 2023 and 6.27 S.U. in Fall 2023.

Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum (Continued)

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
28	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• TNT, 2,4-DNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, and RDX were the only explosives detected. Detected concentrations of 2,4-DNT and 3,5-dinitroaniline were below screening levels. The detected concentrations of TNT in Spring 2023 at 0.0033 mg/L and Fall 2023 at 0.0021 J mg/L exceeded the RSL of 0.00098 mg/L. The detected concentrations of 2-amino-4,6-DNT in Spring 2023 at 0.0011 mg/L and Fall 2023 at 0.00062 J mg/L exceeded the RC of 0.000209 mg/L. The detected concentrations of 4-amino-2,6-DNT in Spring 2023 at 0.0019 mg/L and Fall 2023 at 0.0013 J mg/L exceeded the RC of 0.000209 mg/L. Only the detected concentration of RDX in Spring 2023 at 0.0011 mg/L exceeded the RSL of 0.00097 mg/L. • Nitrite and sulfide were not detected in Spring or Fall 2023. • Nitrate was detected at 0.9 mg/L in Spring 2023 and at 0.48 J mg/L in Fall 2023. • Sulfate was detected at 38 mg/L in Spring 2023 and 41 mg/L in Fall 2023. • Alkalinity was detected at 53 mg/L in Spring 2023 and 60 mg/L in Fall 2023. • TOC was detected at 1.4 mg/L in Spring 2023 and 0.96 J mg/L in Fall 2023. • pH was 5.94 S.U. in Spring 2023 and 6.31 S.U. in Fall 2023.
29	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon	Continue to monitor for explosives.	• 1,3,5-TNB, TNT, 2,4-DNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, HMX, and RDX were the only explosives detected. The explosives 1,3,5-TNB, 2,4-DNT, 3,5-dinitroaniline, and HMX were detected at concentrations below screening levels. Detected concentrations of TNT in the Spring 2023 parent sample at 0.0002 mg/L and the Fall 2023 parent and duplicate sample at 0.00089 mg/L exceeded the RSL of 0.00098 mg/L. The only detected concentration of 2-amino-4,6-DNT was in the Fall 2023 duplicate sample at 0.0011 mg/L, which exceeded the RC of 0.000209 mg/L. The detected concentration of 4-amino-2,6-DNT in the Spring 2023 parent sample was 0.0017 mg/L, in the Fall 2023 parent sample was 0.0011 J mg/L, and in the Fall 2023 duplicate sample was 0.00086 J mg/L. All three detections of 4-amino-2,6-DNT exceeded the RC of 0.000209 mg/L. 4-Amino-2,6-DNT was not detected in the Spring 2023 duplicate sample. The detected concentration of RDX in the Spring 2023 sample of 0.001 J mg/L exceeded the RSL of 0.00097 mg/L. Detected concentrations of RDX in the Fall 2023 parent and duplicate samples did not exceed the RSL. • pH was 6.01 S.U. in Spring 2023 and 6.5 S.U. in Fall 2023.
30	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon	Monitor for explosives to support the FS.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.15 S.U. in Spring 2023 and 7.06 S.U. in Fall 2023.
31	RVAAP-10 Load Line 3	LL3mw-247	Upper Sharon	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.0017 J mg/L and in Fall 2023 at 0.0019 mg/L; both detections exceeded the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.2 S.U. in Spring 2023 and 6.49 S.U. in Fall 2023.
32	RVAAP-10 Load Line 3	LL3mw-248	Upper Sharon	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.002 J mg/L, which exceeded the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.14 S.U. in Spring 2023 and 6.18 S.U. in Fall 2023.
33	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated	Continue to monitor for nitrate and ammonia.	• Nitrate was detected at 67 mg/L (parent) and 74 mg/L (duplicate) in Spring 2023 and 56 mg/L (parent) and 54 mg/L (duplicate) in Fall 2023, which exceeded the MCL of 10 mg/L. • Ammonia was not detected in Spring 2023; however, it was detected at 0.097 J mg/L (parent) and 0.11 mg/L (duplicate) in Fall 2023. • pH was 6.6 S.U. in Spring 2023 and 6.66 S.U. in Fall 2023.
34	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated	Continue to monitor for nitrate and ammonia.	• Nitrate was detected at 1,500 J mg/L in Spring 2023 and at 1,700 J mg/L in Fall 2023, which exceeded the MCL of 10 mg/L and the RSL of 3.2 mg/L. • Ammonia has no screening level but was detected at 730 mg/L in Spring and Fall 2023. • pH was 6.25 S.U. in Spring 2023 and 6.55 S.U. in Fall 2023.
35	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated	Monitor for nitrate and ammonia to support the FS.	• Nitrate was not detected in 2023. • Ammonia has no screening level but was detected at 0.22 mg/L in Spring 2023 and 0.35 mg/L in Fall 2023. • pH was 7.22 S.U. in Spring 2023 and 7.17 S.U. in Fall 2023.
36	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated	Monitor for nitrate and ammonia to support the FS.	• Nitrate was not detected in Spring 2023 but was detected in Fall 2023 at 0.16 J mg/L, which is below the screening level. • Ammonia was not detected in 2023. • pH was 6.92 S.U. in Spring 2023 and 6.98 S.U. in Fall 2023.
37	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated	Monitor for nitrate and ammonia to support the FS.	• Nitrate was not detected in 2023. • Ammonia has no screening level but was detected at 0.14 mg/L in Spring 2023 and was not detected in Fall 2023. • pH was 7.06 S.U. in Spring 2023 and 7.09 S.U. in Fall 2023.

Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum (Continued)

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
38	RVAAP-12 Load Line 12	LL12mw-248	Unconsolidated	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• Nitrate and ammonia were not detected in Spring 2023. Well LL12mw-248 was dry and could not be sampled in Fall 2023. • pH was 7.49 S.U. in Spring 2023.
39	RVAAP-12 Load Line 12	LL12mw-249	Unconsolidated	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• Nitrate was not detected in Spring 2023. Nitrate was detected in Fall 2023 at 0.15 J mg/L (duplicate), which is below the MCL of 10 mg/L. • Ammonia was detected in Spring 2023 at 0.18 mg/L (duplicate) and was not detected in Fall 2023. • pH was 7.21 S.U. in Spring 2023 and 7.13 S.U. in Fall 2023.
40	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	Homewood	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• TNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, and 4-amino-2,6-DNT were the only explosives detected. Detected concentrations of TNT and 3,5-dinitroaniline were below screening levels. The detected concentration of 2-amino-4,6-DNT in the Spring 2023 parent sample at 0.0012 mg/L exceeded the RC of 0.000209 mg/L and was not detected in Fall 2023. The detected concentration of 4-amino-2,6-DNT in the Spring 2023 parent sample at 0.0015 mg/L exceeded the RC of 0.000209 mg/L and was not detected in Fall 2023. • Nitrite and sulfide were not detected in Spring or Fall 2023. • Nitrate was detected in the Spring 2023 parent sample at 0.2 mg/L and in the duplicate at 0.21 mg/L, both below the MCL of 10 mg/L. Nitrate was not detected in Fall 2023. • Sulfate was detected at 42 mg/L in the parent sample and 45 mg/L in the duplicate sample in Spring 2023. Sulfate was detected at 33 J mg/L in the parent and duplicate sample in Fall 2023. • Alkalinity was detected at 18 mg/L in the parent sample and duplicate sample in Spring 2023 and at 23 mg/L in the parent sample and 21 mg/L in the duplicate sample in Fall 2023. • TOC was detected at a concentration of 0.85 J mg/L in Spring 2023 and 0.57 J mg/L in Fall 2023. • pH was 5.43 S.U. in Spring 2023 and 5.69 S.U. in Fall 2023.
41	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood	Continue to monitor for explosives and assess effectiveness of MNA (anions, TOC, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option.	• TNT, 2,4-DNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, and 4-amino-2,6-DNT were the only explosives detected. Detected concentrations of 3,5-dinitroaniline were below screening levels. The detected concentrations of TNT in Spring 2023 at 0.0033 mg/L and Fall 2023 at 0.0044 mg/L both exceeded the RSL of 0.00098 mg/L. 2,4-DNT was only detected in Spring 2023 at 0.00049 J mg/L, which exceeded the RSL of 0.00024 mg/L. The detected concentrations of 2-amino-4,6-DNT in Spring 2023 at 0.007 mg/L and Fall 2023 at 0.0052 mg/L both exceeded the RC of 0.000209 mg/L. The detected concentrations of 4-amino-2,6-DNT in Spring 2023 at 0.012 mg/L and Fall 2023 at 0.025 mg/L both exceeded the RC of 0.000209 mg/L. • Sulfide and nitrite were not detected in Spring or Fall 2023. • Nitrate was detected at 0.89 mg/L in Spring 2023 and at 0.52 mg/L in Fall 2023. • Sulfate was detected at 64 mg/L in Spring 2023 and at 35 mg/L in Fall 2023. • Alkalinity was detected at 8.3 J mg/L in Spring 2023 and at 26 mg/L in Fall 2023. • TOC was detected at 1.7 mg/L in Spring and Fall 2023. • pH was 4.7 S.U. in Spring 2023 and 5.99 S.U. in Fall 2023.
42	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood	Continue to monitor for explosives.	• Explosives were not detected in Spring or Fall 2023. • pH was 5.09 S.U. in Spring 2023 and 5.93 S.U. in Fall 2023.
43	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-178	Homewood	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected at 0.0027 J mg/L in the Spring 2023 parent sample and at 0.0026 J mg/L in the Spring 2023 duplicate sample; both detections exceeded the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 5.76 S.U. in Spring 2023 and 5.95 in Fall 2023.
44	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-179	Upper Sharon	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.00077 J mg/L, which is below the RSL of 0.00097 mg/L. 2-nitrotoluene was detected in Spring 2023 at 0.00028 J mg/L, which is below the RC of 0.00037 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.68 S.U. in Spring 2023 and 7.24 S.U. in Fall 2023.
45	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-180	Homewood	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.011 J mg/L, which exceeded the RSL of 0.00097 mg/L. 2-nitrotoluene was detected in Spring 2023 at 0.00022 J mg/L, which is below the RC of 0.00037 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 5.69 S.U. in Spring 2023 and 6.11 S.U. in Fall 2023.
46	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-181	Upper Sharon	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a).	• RDX was detected in Spring 2023 at 0.00096 J mg/L, which is below the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.73 S.U. in Spring 2023 and 7.1 S.U. in Fall 2023.

Table 8-1. Summary of 2023 FWGWMP Wells, Rationale, and Results Recommended in 2023 Addendum (Continued)

No	RVAAP-66 Area	Well Name	Aquifer	2023 FWGWMP Sampling Recommendations	2023 Sampling Results
47	RVAAP-43 Load Line 10	LL10mw-003	Homewood	Continue to monitor for carbon tetrachloride to verify recent reduced concentrations.	• Carbon tetrachloride was not detected Spring 2023 and was detected at 0.0018 mg/L in Fall 2023, below the MCL of 0.005 mg/L. • pH was 6.46 S.U. in Spring 2023 and 6.83 S.U. in Fall 2023.
48	RVAAP-66 Facility-wide Groundwater (southern portion of Administration Area)	FWGmw-004	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in the parent or duplicate sample in Spring or Fall 2023. • pH was 7.04 S.U. in Spring and Fall 2023.
49	RVAAP-66 Facility-wide Groundwater (southwestern portion of facility, south of NACA Test Area)	FWGmw-007	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 6.85 S.U. in Spring 2023 and 6.87 S.U. in Fall 2023.
50	RVAAP-66 Facility-wide Groundwater (in DLA Main Ore Storage Area)	FWGmw-010	Unconsolidated	Monitor for explosives to support the FS.	• Explosives were not detected in Spring or Fall 2023 • pH was 5.4 S.U. in Spring 2023 and 5.76 S.U. in Fall 2023.
51	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-011	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.07 S.U. in Spring 2023 and 7.06 S.U. in Fall 2023.
52	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-012	Upper Sharon	Continue to monitor for explosives in this exit pathway well.	• RDX was detected at 0.00031 J mg/L in Spring 2023, which is below the RSL of 0.00097 mg/L. No other explosives were detected in Spring or Fall 2023. • pH was 6.3 S.U. in Spring 2023 and 5.95 S.U. in Fall 2023.
53	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-015	Unconsolidated	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 6.94 S.U. in Spring 2023 and 7.2 S.U. in Fall 2023.
54	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-016	Upper Sharon	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.14 S.U. in Spring 2023 and 7.38 S.U. in Fall 2023.
55	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-018	Basal Sharon	Continue to monitor for nitrates to support the FS. Discontinue sampling for VOCs, as VOCs have not been detected in well since 2018.	• Nitrate was not detected in Spring or Fall 2023. • pH was 7.19 S.U. in Spring 2023 and 7.03 S.U. in Fall 2023.
56	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-020	Upper Sharon	Continue to monitor for nitrates to support the FS. Discontinue sampling for VOCs, as VOCs have not been detected in well since 2018.	• Nitrate was detected in Spring 2023 at 0.13 J mg/L, below the MCL of 10 mg/L. Nitrate was not detected in Fall 2023. • pH was 6.95 S.U. in Spring 2023 and 7.07 S.U. in Fall 2023.
57	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 3)	FWGmw-021	Upper Sharon	Continue to monitor for explosives in this exit pathway well.	• 2-Amino-4,6-DNT was detected in Spring 2023 and RDX was detected in Fall 2023, both concentrations were below screening levels. No other explosives were detected in Spring or Fall 2023. • pH was 6.05 S.U. in Spring 2023 and 6.33 S.U. in Fall 2023.
58	RVAAP-66 Facility-wide Groundwater (downgradient from Fuze and Booster Quarry Landfill/Ponds)	FWGmw-023	Upper Sharon	Monitor for explosives to support the FS.	• Explosives were not detected in Spring or Fall 2023. • pH was 7.04 S.U. in Spring 2023 and 7.32 S.U. in Fall 2023.
59	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 2)	FWGmw-024	Upper Sharon	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 6.99 S.U. in Spring 2023 and 7.22 in Fall 2023.
60	RVAAP-66 Facility-wide Groundwater (southeastern portion of facility)	SCFmw-004	Basal Sharon	Continue to monitor for explosives in this exit pathway well.	• Explosives were not detected in Spring or Fall 2023. • pH was 6.87 S.U. in Spring 2023 and 7.02 S.U. in Fall 2023.
61	CC RVAAP-71 Barn No. 5 Petroleum Release	071tw-001	Unconsolidated	Not included in the 2023 Addendum. The monitoring well was installed and sampled in accordance with the FS Monitoring Well Installation Plan (Leidos 2022a). Only proposed for one round of sampling, completed in Spring 2023. Temporary well has been abandoned.	• Lead was detected in the parent sample at 0.00083 J mg/L and at 0.00081 J mg/L in the duplicate, both detections are below the MCL of 0.015 mg/L. • 1-Methylnaphthalene was detected in the parent sample at 0.000033 J mg/L and at 0.000031 J mg/L in the duplicate, both detections are below the RSL of 0.0011 mg/L. 2-Methylnaphthalene was detected in the parent sample at 0.000036 J mg/L and at 0.000037 J mg/L in the duplicate, both detections are below the RSL of 0.0036 mg/L. • Benzene was only detected in the duplicate sample at 0.00035 mg/L, which is below the MCL of 0.005 mg/L. • TPH GRO was detected in the parent and duplicate sample at 0.074 mg/L, screening levels do not exist for TPH GRO. • pH was 7.23 S.U.

This table does not include a discussion of essential nutrients (calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium).

DFFO = Director's Final Findings and Orders
DNB = Dinitrobenzene
DNT = Dinitrotoluene
FS = Feasibility Study
FWGWMP = Facility-wide Groundwater Monitoring Plan
HMX = Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
MNA = Monitored Natural Attenuation
MNX = Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine
NACA = National Advisory Committee on Aeronautics
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
RC = Residential Cleanup Goal
RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RSL = Regional Screening Level
RVAAP = Ravenna Army Ammunition Plant
S.U. = Standard Unit
SVOC = Semivolatile Organic Compound
TNB = Trinitrobenzene
TNT = 2,4,6-Trinitrotoluene
TNX = Hexahydro-1,3,5-Trinitroso-1,3,5-Triazine
TOC = Total Organic Carbon
VOC = Volatile Organic Compound

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