

Final

**Facility-wide Groundwater Monitoring Program Plan
RVAAP-66 Facility-wide Groundwater
Addendum for 2022**

**Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio**

**Contract No. W912QR-21-D-0016
Delivery Order No. W912QR22F0014**

Prepared for:



**U.S. Army Corps of Engineers
Louisville District**

Prepared by:



**Leidos
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087**

April 28, 2022

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**Facility-wide Groundwater Monitoring Program Plan
RVAAP-66 Facility-wide Groundwater
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REPORT DOCUMENTATION PAGE

*Form Approved
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1. REPORT DATE (DD-MM-YYYY) 28-04-2022	2. REPORT TYPE Technical	3. DATES COVERED (From - To) Sep 2004-Apr 2022
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4. TITLE AND SUBTITLE Final Facility-wide Groundwater Monitoring Program Addendum for 2022 Groundwater Investigation and Reporting Services Ravenna Army Ammunition Plant Restoration Program Portage and Trumbull Counties, Ohio	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>5a. CONTRACT NUMBER</td> <td>W912QR-21-D-0016, DO W912QR22F0014</td> </tr> <tr> <td>5b. GRANT NUMBER</td> <td>NA</td> </tr> <tr> <td>5c. PROGRAM ELEMENT NUMBER</td> <td>NA</td> </tr> </table>	5a. CONTRACT NUMBER	W912QR-21-D-0016, DO W912QR22F0014	5b. GRANT NUMBER	NA	5c. PROGRAM ELEMENT NUMBER	NA
5a. CONTRACT NUMBER	W912QR-21-D-0016, DO W912QR22F0014						
5b. GRANT NUMBER	NA						
5c. PROGRAM ELEMENT NUMBER	NA						

6. AUTHOR(S) Thomas, Jed, H.	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>5d. PROJECT NUMBER</td> <td>NA</td> </tr> <tr> <td>5e. TASK NUMBER</td> <td>NA</td> </tr> <tr> <td>5f. WORK UNIT NUMBER</td> <td>NA</td> </tr> </table>	5d. PROJECT NUMBER	NA	5e. TASK NUMBER	NA	5f. WORK UNIT NUMBER	NA
5d. PROJECT NUMBER	NA						
5e. TASK NUMBER	NA						
5f. WORK UNIT NUMBER	NA						

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Leidos 8866 Commons Boulevard, Suite 201 Twinsburg, Ohio 44087	8. PERFORMING ORGANIZATION REPORT NUMBER NA
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) USACE - Louisville District U.S. Army Corps of Engineers 600 Martin Luther King Jr., Place PO Box 59 Louisville, Kentucky 40202-0059	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>10. SPONSOR/MONITOR'S ACRONYM(S)</td> <td>USACE</td> </tr> <tr> <td>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</td> <td>NA</td> </tr> </table>	10. SPONSOR/MONITOR'S ACRONYM(S)	USACE	11. SPONSOR/MONITOR'S REPORT NUMBER(S)	NA
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 Addendum provides the sampling and analytical approach to continue the Facility-wide Groundwater Monitoring Program (FWGWMP) in support of the Ravenna Army Ammunition Plant Restoration Program into 2022. This report provides a summary of data collected to date, a matrix to decide if and where additional samples should be collected, and summarizes wells and parameters to be collected for the 2022 FWGWMP activities.

15. SUBJECT TERMS
groundwater, monitoring well, sampling and analysis

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT	b. ABSTRACT	c. THIS PAGE			Jay Trumble	
U	U	U	U	44	19b. TELEPHONE NUMBER (Include area code) 502.315.6349	

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Mike DeWine, Governor
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Received 24 June 2022

June 24, 2022

TRANSMITTED ELECTRONICALLY

Mr. Kevin Sedlak
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1438 State Route 534 SW
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RE: **US Army Ammunition Plt RVAAP
Remediation Response
Approval
Remedial Response
Portage County
ID#267000859036**

Subject: Approval of the "Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Final Facility-wide Groundwater 2022 Addendum" dated April 28, 2022

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the "Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Final Facility-wide Groundwater 2022 Addendum" at the Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio (Camp James A. Garfield). This document was received at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) via email on April 28, 2022. The document was prepared for the United States Army Corps of Engineers (USACE) on behalf of the National Guard Bureau by Leidos under Contract Number W912QR-16-D-0003.

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.

At this time, we will not be issuing hard-copy mail. This letter is an official response from Ohio EPA that will be maintained as a public record. If you have questions regarding this letter, please contact me at kevin.palombo@epa.ohio.gov or at (330) 963-1292.

Sincerely,

Kevin M. Palombo
Site Coordinator
Division of Environmental Response and Revitalization

KP/cm

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Leidos has completed the Facility-wide Groundwater Monitoring Program Plan, RVAAP-66 Facility-wide Groundwater Addendum for 2022 for the Ravenna Army Ammunition Plant Restoration Program. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing U.S. Army Corps of Engineers (USACE) policy.



Jed Thomas, P.E., PMP
Study/Design Team Leader

April 28, 2022

Date

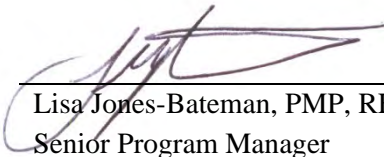


Vasu Peterson, P.E., PMP
Independent Technical Review Team Leader

April 28, 2022

Date

Significant concerns and the explanation of the resolution are documented within the project file. As noted above, all concerns resulting from independent technical review of the project have been considered.



Lisa Jones-Bateman, PMP, REM
Senior Program Manager

April 28, 2022

Date

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**Facility-wide Groundwater Monitoring Program Plan
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Prepared for:

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Prepared by:

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April 28, 2022

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NEDO = Northeast District Office
OHARNG = Ohio Army National Guard
Ohio EPA = Ohio Environmental Protection Agency
SAFE = Secure Access File Exchange
SWDO = Southwest District Office
USACE = U.S. Army Corps of Engineers

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
Army	U.S. Department of the Army
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CJAG	Camp James A. Garfield
CSM	Conceptual Site Model
DFFO	Director's Final Findings and Orders
DoD	U.S. Department of Defense
FS	Feasibility Study
FWGW	Facility-wide Groundwater
FWGWMP	Facility-wide Groundwater Monitoring Program
IRP	Installation Restoration Program
MNA	Monitored Natural Attenuation
Ohio EPA	Ohio Environmental Protection Agency
P.E.	Professional Engineer
PMP	Project Management Professional
PP	Proposed Plan
PWS	Performance Work Statement
QAPP	Quality Assurance Project Plan
REM	Remedial Environmental Manager
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
ROD	Record of Decision
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
USACE	U.S. Army Corps of Engineers

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. W912QR22F0014. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation and cleanup are being conducted under the U.S. Department of Defense (DoD) Installation Restoration Program (IRP). Activities include monitoring an extensive network of groundwater monitoring wells to determine nature and extent of groundwater impacts, provide additional information in support of hydrogeologic and fate and transport models, evaluate potential exit pathways, and evaluate vertical contaminant distribution and/or particle inflow/outflow through the facility.

1.1 PURPOSE

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

- A Remedial Investigation/Feasibility Study (RI/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; and
- 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). The purpose of this 2022 Addendum is to satisfy the requirements of Section 15d that specify 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.” This Addendum provides an update to the FWGWMP Plan, including the identification of wells to be sampled as part of the FWGWMP in 2022.

1.2 OBJECTIVES

The primary objectives of the facility-wide monitoring well network in this 2022 Addendum are to assess potential exit pathways, monitor contaminant concentrations related to historical RVAAP activities (e.g., explosives/propellants) at selected source area wells for trend analysis, and sample wells to refine the conceptual site model (CSM) or contaminant distribution associated with the areas recommended for evaluation within the FS.

This 2022 Addendum is a supplement to the FWGWMP Plan and discusses the subset of currently existing monitoring wells at the former RVAAP that will be monitored in 2022, the frequency of samples to be collected, and the chemicals that will be evaluated at each selected well. Contaminant trend analysis, including the Spring 2021 FWGMWP sampling event sampling and historical results, was conducted by reviewing the well-specific sampling histories and time series graphs. In addition, the recommendations of the *Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater* (Leidos 2022) were considered and data collection to support the FS has been incorporated into the 2021 FWGWMP.

Wells were selected for inclusion in the 2022 FWGWMP based on the following criteria:

- **FWGWMP Criterion 1:** Wells representing critical exit pathway monitoring points (generally a carryover from the 2021 program).
- **FWGWMP Criterion 2:** Wells representing primary AOC-specific contaminant source area conditions indicated to be potentially increasing or otherwise potentially unstable plume conditions.
- **FWGWMP Criterion 3:** Co-located wells used to establish the vertical distribution of contaminants within the stratigraphic sequence.
- **FWGWMP Criterion 4:** Wells refining the CSM or contaminant distribution associated with the areas recommended for evaluation within the FS.

1.3 REPORT ORGANIZATION

The remaining sections of this Addendum are organized as follows:

- Section 2.0. Background,
- Section 3.0. Scope of Work Under the Addendum,
- Section 4.0. Schedule, and
- Section 5.0. 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. Figure 2-1 presents the general location of CJAG.

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. The FWGWMP monitoring well network currently contains 301 permanent wells, 53 of which were sampled in 2021. 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 as they were installed and sampled to support their current site-specific investigations.

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* (herein referred to as the RIWP; TEC-Weston 2016) 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 RI Report (Leidos 2022) was submitted to Ohio EPA in February 2022 upon resolution of all regulatory comments.

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3.0 SCOPE OF WORK UNDER THE ADDENDUM

The 2022 Addendum presents information to support the continued monitoring of AOC-specific contaminant concentrations, as indicated by an analysis of results through 2021. Using data and results from the Spring 2021 FWGWMP sampling event and findings of the RI Report (Leidos 2022), the following sections provide an assessment of sampling to be conducted in 2022.

To achieve this objective, 48 wells have been selected for sampling in 2022. Monitoring well sampling and analytical testing will be conducted in accordance with the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) updates provided with the RIWP (TEC-Weston 2016).

3.1 REVISIONS TO 2021 SAMPLING SCHEME

Fifty-three wells were sampled in spring 2021 under the FWGWMP. This 2022 Addendum recommends that 48 wells be sampled in 2022. The rationale for notable differences in the number of wells sampled and the analyte list between 2021 and 2022 is presented below:

- Historically, pH and related anions were analyzed for in monitoring wells with pH outside typical background ranges. An evaluation of historical DoD operational impacts on groundwater pH is included in the RI Report (Leidos 2022). To support the FS, pH data will continue to be collected as a water quality parameter along with monitored natural attenuation (MNA) data during sample collection.
- The RI Report (Leidos 2022) recommended five AOCs to be evaluated in the FS. Wells located in these AOCs will be analyzed to refine the CSM or contaminant distribution for evaluation within the FS. In addition, the sampling suite for some wells in these AOCs includes parameters to determine the effectiveness of MNA (anions, total organic carbon, alkalinity, pH, and expanded explosives, which include explosive daughter products) as a remedial option. These wells will be sampled during the 2022 sampling events.

3.2 CERCLA WELLS

Selection of wells for the 2022 FWGWMP was made based on consideration of the following criteria:

- **FWGWMP Criterion 1:** Wells representing critical exit pathway monitoring points (i.e., located along the CJAG boundary or downgradient from AOC concentration areas).
 - **Unconsolidated Aquifer:** LL1mw-064, LL1mw-086, LL1mw-087, LL1mw-089, FWGmw-004, FWGmw-007, FWGmw-011, FWGmw-015
 - **Upper Sharon Aquifer:** LL2mw-059, FWGmw-012, FWGmw-016, FWGmw-020, FWGmw-021, FWGmw-024
 - **Basal Sharon Conglomerate Aquifer:** SCFmw-004, FWGmw-018.

- **FWGWMP Criterion 2:** Wells representing primary AOC-specific contaminant source area conditions routinely monitored or indicated to be potentially increasing or otherwise potentially unstable plume conditions.
 - *Unconsolidated Aquifer:* DETmw-003, DETmw-004, LL1mw-063, LL1mw-089, LL12mw-185, LL12mw-187, WBGmw-006, WBGmw-009
 - *Homewood Aquifer:* FBQmw-174, FBQmw-175, LL10m-003
 - *Upper Sharon Aquifer:* LL1mw-080, LL1mw-081, LL1mw-083, LL1mw-084, LL3mw-237, LL3mw-238, LL3mw-239, LL3mw-241
 - *Basal Sharon Conglomerate Aquifer:* None currently proposed.
- **FWGWMP Criterion 3:** Co-located wells used to evaluate the vertical distribution of contaminants within the stratigraphic sequence (includes all wells installed to date).
 - *East of Ramsdell Quarry Landfill:* FWGmw-011 (Unconsolidated Aquifer), FWGmw-012 (Upper Sharon Aquifer)
 - *Southeast of Load Line 1:* LL1mw-087 (Unconsolidated Aquifer), SCFmw-004 (Basal Sharon Conglomerate Aquifer)
 - *Post Boundary at Load Line 12:* FWGmw-020 (Upper Sharon Aquifer), FWGmw-018 (Basal Sharon Conglomerate Aquifer)
 - *Winklepeck Burning Grounds:* WBGmw-009 (Unconsolidated Aquifer), WBGmw-020 (Upper Sharon Aquifer)
 - *Winklepeck Burning Grounds:* WBGmw-006 (Unconsolidated Aquifer), WBGmw-021 (Upper Sharon Aquifer)
 - *Post Boundary South of the CJAG Main Cantonment Area:* FWGmw-015 (Unconsolidated Aquifer), FWGmw-016 (Upper Sharon Aquifer).
- **FWGWMP Criterion 4:** Wells refining the CSM or contaminant distribution associated with the areas recommended for evaluation within the FS.
 - *Winklepeck Burning Grounds:* WBGmw-014, WBGmw-016, WBGmw-017, WBGmw-018
 - *Load Line 1:* LL1mw-080, LL1mw-082, LL1mw-083, LL1mw-084, LL1mw-086, FWGmw-010
 - *Load Line 2:* LL2mw-059
 - *Load Line 3:* LL3mw-245
 - *Load Line 12:* LL12mw-244, LL12mw-245, LL12mw-246, FWGmw-018, FWGmw-020
 - *Fuze and Booster Quarry:* FBQmw-173, FWGmw-023.

The list of analytes for 2022 reflects the potential chemicals of concern within certain areas or immediately downgradient from potential source areas, as appropriate. Table 3-1 provides a comprehensive summary of the proposed wells, Spring 2021 results summary, and rationale for their inclusion in the 2022 FWGWMP sampling scheme. This table also presents results from wells sampled in 2021 that do not require additional analysis in 2022 (highlighted in gray). Figure 3-1 show the wells to be sampled during the 2022 FWGWMP.

The refined analyte list is presented in Table 3-2. The analytical methods for these analytes are provided in Table 3-3. Evaluation of data collected during 2022 will be conducted in accordance with the Final FWGW RIWP, including the supporting SAP and QAPP updates (TEC-Weston 2016).

Table 3-1. Recommended FWGWMP Wells for 2022

No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
1	RVAAP-04 Open Demolition Area #2	DETMw-003	Unconsolidated	<ul style="list-style-type: none"> In accordance with the DFFO, analytical parameters for this well in 2021 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	<ul style="list-style-type: none"> Phthalates, phenol, cyanide, nitroaromatics, SVOCs, PCBs, explosives, or pesticides were not detected. The VOCs benzene and ethylbenzene were detected at low, estimated concentrations below screening criteria. All metal concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at a concentration of 0.23 mg/L, exceeding the background concentration of 0.075 mg/L in the primary and duplicate sample. 	<ul style="list-style-type: none"> In accordance with the DFFO, analytical parameters for this well in 2021 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	2
2	RVAAP-04 Open Demolition Area #2	DETMw-004	Unconsolidated	<ul style="list-style-type: none"> In accordance with the DFFO, analytical parameters for this well in 2021 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	<ul style="list-style-type: none"> VOCs, SVOCs, pesticides, phthalates, phenol nitroaromatics, cyanide, PAHs, and PCBs were not detected. All metal and explosive concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> In accordance with the DFFO, analytical parameters for this well in 2021 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	2
3	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> No explosives were detected with the exception of HMX, DNX, MNX, and RDX. The RDX concentration of 0.0081 mg/L exceeded the RSL of 0.00097 mg/L. Nitrate and nitrite were not detected. Sulfate was detected at an estimated concentration of 27J mg/L. Sulfide was detected at an estimated concentration of 0.8J mg/L. Alkalinity was detected at a concentration of 270 mg/L. TOC was detected at an estimated concentration of 0.83J mg/L. pH was 7.05 S.U. 	<ul style="list-style-type: none"> Continue to monitor for explosives and MNA parameters. 	2, 3
	RVAAP-05 Winklepeck Burning Grounds	WBGmw-007	Unconsolidated	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected in sampling events conducted in 2016 and 2021. 	NS
	RVAAP-05 Winklepeck Burning Grounds	WBGmw-008	Unconsolidated	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected in sampling events conducted in 2016 and 2021. 	NS
4	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> No explosives were detected with the exception of HMX and RDX. The RDX concentration of 0.0016 mg/L exceeded the RSL of 0.00097 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives and add MNA parameters. 	2, 3
5	RVAAP-05 Winklepeck Burning Grounds	WBGmw-014	Unconsolidated	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
6	RVAAP-05 Winklepeck Burning Grounds	WBGmw-016	Unconsolidated	<ul style="list-style-type: none"> Not sampled in 2021. 	<ul style="list-style-type: none"> Not sampled in 2021. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
7	RVAAP-05 Winklepeck Burning Grounds	WBGmw-017	Unconsolidated	<ul style="list-style-type: none"> Not sampled in 2021. 	<ul style="list-style-type: none"> Not sampled in 2021. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-018	Unconsolidated	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Explosives and nitrite were not detected. Nitrate was detected at an estimated concentration of 0.3J mg/L. Sulfate was detected at an estimated concentration of 8.9J mg/L. Sulfide was detected at an estimated concentration of 0.8J mg/L. Alkalinity was detected at a concentration of 38 mg/L. TOC was detected at a concentration of 1.7 mg/L. pH was 5.62 S.U. 	<ul style="list-style-type: none"> Monitor for explosives and MNA parameters to support the FS. 	4

Table 3-1. Recommended FWGWMP Wells for 2022 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
	RVAAP-05 Winklepeck Burning Grounds	WBGmw-019	Upper Sharon	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected in sampling events conducted in 2016 and 2021. 	NS
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	3
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	3
11	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> No explosives were detected with the exception of HMX, 2-amino-4,6-DNT, and 4-amino-2,6-DNT. No detection exceeded screening criteria. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2
12	RVAAP-08 Load Line 1 (east of Load Line 1 fence)	LL1mw-064	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1
	RVAAP-08 Load Line 1	LL1mw-079	Upper Sharon	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> No explosives were detected with the exception of HMX, RDX, 2-amino-4,6-DNT, and 4-amino-2,6-DNT. No concentration exceeded screening criteria. Nitrite and sulfide were not detected. Nitrate was detected at an estimated concentration of 0.11J mg/L. Sulfate was detected at a concentration of 82 mg/L. Alkalinity was detected at a concentration of 72 mg/L. TOC was detected at an estimated concentration of 0.56J mg/L. pH was 6.16 S.U. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected at concentrations exceeding screening criteria in sampling events conducted in 2011 and 2021. 	NS
13	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> The explosives 1,3,5-TNB, TNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, HMX, MNX, and RDX were detected; however, only RDX exceeded the RSL of 0.00097 mg/L at a concentration of 0.023 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives and add MNA. 	2,4
14	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> No explosives were detected with the exception of 2,4-diamino-6-nitrotoluene, 2,6-diamino-4-nitrotoluene, 2-amino-4,6-DNT, 3,5-dinitroaniline, and TNX. No concentration exceeded screening criteria in Spring 2021. The estimated RDX concentration of 0.0011J mg/L exceeded the RSL of 0.00097 mg/L in Winter 2021. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2
15	RVAAP-08 Load Line 1	LL1mw-082	Upper Sharon	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> No explosives were detected with the exception of MNX and RDX. The estimated RDX concentration of 0.0012J mg/L exceeded the RSL of 0.00097 mg/L. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
16	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> The explosives TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT were detected at concentrations above screening criteria. TNT exceeded the RSL of 0.00098 mg/L at an estimated concentration of 0.0015J mg/L. 2,4-DNT exceeded the RSL of 0.00024 mg/L at an estimated concentration of 0.002J mg/L. 2,6-DNT exceeded the RA of 0.000122 mg/L at an estimated concentration of 0.00097J mg/L. 2-Amino-4,6-DNT exceeded the RSL of 0.0039 mg/L at a concentration of 0.0066 mg/L. 4-Amino-2,6-DNT exceeded the RSL of 0.0039 mg/L at an estimated concentration of 0.013J mg/L. All other explosives were detected at concentrations below screening criteria. All other explosives were detected at concentrations below screening criteria. 	<ul style="list-style-type: none"> Continue to monitor for explosives and add MNA parameters. 	2,4

Table 3-1. Recommended FWGWMP Wells for 2022 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
17	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> The explosives 1,3-DNB, TNT, 2,4-DNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT were detected at concentrations above screening criteria. 1,3-DNB exceeded the RSL of 0.0002 mg/L in the primary and duplicate samples at concentrations of 0.00064 and 0.00076 mg/L, respectively. TNT exceeded the RSL of 0.00098 mg/L in the primary and duplicate samples at concentrations of 0.0023 and 0.003 mg/L, respectively. 2,4-DNT exceeded the RSL of 0.00024mg/L in the primary sample at a concentration of 0.00077 mg/L, 2,4-DNT was not detected in the duplicate sample. 2-Amino-4,6-DNT exceeded the RSL of 0.0039 mg/L in the primary and duplicate samples at concentrations of 0.0058 and 0.0076 mg/L, respectively. 4-Amino-2,6-DNT exceeded the RSL of 0.0039 mg/L in the primary and field duplicate samples at concentrations of 0.017 and 0.019 mg/L, respectively. All other explosives were detected at concentrations below screening criteria. Nitrite was not detected in the primary or duplicate sample. Nitrate was detected at estimated concentrations of 0.44J and 0.046J mg/L in the primary and duplicate samples, respectively. Sulfate was detected at a concentration of 130 mg/L in the primary and duplicate samples. Sulfide was detected at estimated concentrations of 1.6J and 0.8J mg/L in the primary and duplicate samples, respectively. Alkalinity was detected at concentrations of 39 and 38 mg/L in the primary and duplicate samples, respectively. TOC was detected at a concentration of 1.4 mg/L. pH was 5.57 S.U. 	<ul style="list-style-type: none"> Continue to monitor for explosives and MNA parameters. 	2,4
18	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-086	Unconsolidated	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> 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. 	1, 4
19	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-087	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 3
20	RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 2
21	RVAAP-09 Load Line 2 South	LL2mw-059	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> No explosives were detected with the exception of 1,3,5-TNB, 2,4-DNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT; however, only the 2,4-DNT concentration of 0.00038 mg/L exceeded the RSL of 0.00024 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives and add MNA parameters. 	1, 4
22	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> No explosives were detected with the exception of TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and 3,5-dinitroaniline; however, only the 4-amino-2,6-DNT concentration of 0.0061 mg/L exceeded the RSL of 0.0039 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2

Table 3-1. Recommended FWGWMP Wells for 2022 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
23	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> The explosives TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and RDX were detected at concentrations above the screening criteria. TNT exceeded the RSL of 0.00098 mg/L at an estimated concentration of 0.03J mg/L. 2-Amino-4,6-DNT exceeded the RSL of 0.0039 mg/L at a concentration of 0.0067 mg/L. 4-Amino-2,6-DNT exceeded the RSL of 0.0039 mg/L at a concentration of 0.017 mg/L. RDX exceeded the RSL of 0.00097 mg/L at a concentration of 0.0019 mg/L. All other concentrations were below the screening criteria. Nitrite and sulfide were not detected. Nitrate was detected at an estimated concentration of 0.46J mg/L. Sulfate was detected at an estimated concentration of 45J mg/L. Alkalinity was detected at a concentration of 140 mg/L. TOC was detected at a concentration of 2.2 mg/L. pH was 6.71 S.U. 	<ul style="list-style-type: none"> Continue to monitor for explosives and MNA parameters. 	2
24	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> The explosives TNT, 2,4-DNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, and RDX were detected; however, only RDX exceeded the RSL of 0.00097 mg/L at a concentration of 0.0012 mg/L. Nitrite and sulfide were not detected. Nitrate was detected at an estimated concentration of 0.74J mg/L. Sulfate was detected at an estimated concentration of 40J mg/L. Alkalinity was detected at a concentration of 55 mg/L. TOC was detected at an estimated concentration of 0.78J mg/L. pH was 6.02 S.U. 	<ul style="list-style-type: none"> Continue to monitor for explosives and MNA parameters. 	2
25	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> The explosives 1,3,5-TNB, TNT, 2-amino-4,6-DNT, 3,5-dinitroaniline, 4-amino-2,6-DNT, and RDX were detected; however, only TNT exceeded the RSL of 0.00098 mg/L at a concentration of 0.001 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2
26	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
27	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for nitrate and ammonia. 	<ul style="list-style-type: none"> Nitrate was detected at estimated concentrations of 63J and 64J mg/L in the primary and duplicate samples, exceeding the MCL of 10 mg/L. Ammonia was not detected. 	<ul style="list-style-type: none"> Continue to monitor for nitrate and ammonia. 	2
28	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for nitrate and ammonia. 	<ul style="list-style-type: none"> Nitrate was detected at an estimated concentration of 1,500J mg/L, exceeding the MCL of 10 mg/L. Ammonia has no screening level, but was detected at a concentration of 780 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for nitrate and ammonia. 	2
29	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated	<ul style="list-style-type: none"> Monitor for nitrate and ammonia to support the FS. 	<ul style="list-style-type: none"> Nitrate was not detected. Ammonia has no screening level, but was detected at an estimated concentration of 0.023J mg/L. 	<ul style="list-style-type: none"> Monitor for nitrate and ammonia to support the FS. 	4
30	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated	<ul style="list-style-type: none"> Monitor for nitrate and ammonia to support the FS. 	<ul style="list-style-type: none"> Nitrate was detected at an estimated concentration of 0.11J mg/L, below the screening criteria. Ammonia was not detected. 	<ul style="list-style-type: none"> Monitor for nitrate and ammonia to support the FS. 	4
31	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated	<ul style="list-style-type: none"> Monitor for nitrate and ammonia to support the FS. 	<ul style="list-style-type: none"> Nitrate was not detected. Ammonia has no screening level, but was detected at an estimated concentration of 0.088J mg/L. 	<ul style="list-style-type: none"> Monitor for nitrate and ammonia to support the FS. 	4

Table 3-1. Recommended FWGWMP Wells for 2022 (Continued)


No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-170	Homewood	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected in continuous sampling events since 2017. 	NS
	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-171	Homewood	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected in continuous sampling events since 2017. 	NS
	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-172	Homewood	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not been detected in sampling events conducted in 2016 and 2021. 	NS
32	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	Homewood	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> No explosives were detected with the exception of 2-amino-4,6-DNT; the concentration did not exceed screening criteria. Nitrate, nitrite, and sulfide were not detected. Sulfate was detected at a concentration of 32 mg/L. Alkalinity was detected at a concentration of 13 mg/L. TOC was detected at a concentration of 0.53 mg/L. pH was 4.93 S.U. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS and MNA parameters. 	4
33	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> The explosives TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and 2,4-DNT were detected at concentrations above screening criteria. TNT exceeded the RSL of 0.00098 mg/L at a concentration of 0.0017 mg/L. 2,4-DNT exceeded the RSL of 0.00024 mg/L at a concentration of 0.00037 mg/L. 2-Amino-4,6-DNT exceeded the RSL of 0.0039 mg/L at a concentration of 0.0086 mg/L. 4-Amino-2,6-DNT exceeded the RSL of 0.0039 at a concentration of 0.011 mg/L. All other concentrations were below screening criteria. Sulfide was not detected. Nitrate was detected at a concentration of 3.4 mg/L. Nitrite was detected at an estimated concentration of 0.049J mg/L. Sulfate was detected at a concentration of 60 mg/L. Alkalinity was detected at an estimated concentration of 8.3J mg/L. TOC was detected at a concentration of 1.9 mg/L. pH was 4.72 S.U. 	<ul style="list-style-type: none"> Continue to monitor for explosives and MNA parameters. 	2
34	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood	<ul style="list-style-type: none"> Continue to monitor for explosives. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2
35	RVAAP-43 Load Line 10	LL10mw-003	Homewood	<ul style="list-style-type: none"> Continue to monitor for carbon tetrachloride to verify recent reduced concentrations. 	<ul style="list-style-type: none"> Carbon tetrachloride was detected at a concentration of 2.4 µg/L, below the MCL of 5 µg/L. 	<ul style="list-style-type: none"> Continue to monitor for carbon tetrachloride to verify recent reduced concentrations. 	2
36	RVAAP-66 Facility-wide Groundwater (southern portion of Administration Area)	FWGmw-004	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1

Table 3-1. Recommended FWGWMP Wells for 2022 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
37	RVAAP-66 Facility-wide Groundwater (southwestern portion of facility, south of NACA Test Area)	FWGmw-007	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1
38	RVAAP-66 Facility-wide Groundwater (in DLA Main Ore Storage Area)	FWGmw-010	Unconsolidated	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
39	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-011	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 3
40	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-012	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 3
41	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-015	Unconsolidated	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 3
42	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-016	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 3
43	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-018	Basal Sharon	<ul style="list-style-type: none"> Continue to monitor for VOCs in this exit pathway well. Monitor for nitrates to support the FS. 	<ul style="list-style-type: none"> Nitrate and VOCs were not detected. 	<ul style="list-style-type: none"> Continue to monitor for nitrates to support the FS. Discontinue sampling for VOCs, as VOCs have not been detected in well since 2018. 	1, 3, 4

Table 3-1. Recommended FWGWMP Wells for 2022 (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2021 FWGWMP Sampling Recommendations	Spring 2021 Sampling Results	2022 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.2)
44	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-020	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for VOCs in this exit pathway well. Monitor for nitrates to support the FS. 	<ul style="list-style-type: none"> Nitrate and VOCs were not detected. 	<ul style="list-style-type: none"> Continue to monitor for nitrates to support the FS. Discontinue sampling for VOCs, as VOCs have not been detected in well since 2018. 	1, 3, 4
45	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 3)	FWGmw-021	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> No explosives were detected with the exception of 2-amino-4,6-DNT and RDX. Concentrations were below screening criteria. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1
46	RVAAP-66 Facility-wide Groundwater (downgradient from Fuze and Booster Quarry Landfill/Ponds)	FWGmw-023	Upper Sharon	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Monitor for explosives to support the FS. 	4
47	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 2)	FWGmw-024	Upper Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1
48	RVAAP-66 Facility-wide Groundwater (southeastern portion of facility)	SCFmw-004	Basal Sharon	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	<ul style="list-style-type: none"> Explosives were not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives in this exit pathway well. 	1, 3

 Denotes wells where additional sampling is not recommended.


 Denotes wells that were not sampled in 2021.

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
 DLA = Defense Logistics Agency
 DNB = Dinitrobenzene
 DNT = Dinitrotoluene
 DNX = Hexahydro-1,3-dinitroso-5-dinitro-1,3,5-triazine
 FS = Feasibility Study
 FWGWMP = Facility-wide Groundwater Monitoring Plan
 HMX = Cyclotetramethylene-tetranitramine
 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
 NS = No Sampling Recommended
 PAH = Polycyclic Aromatic Hydrocarbon
 PCB = Polychlorinated Biphenyl
 RA = Resident Adult Facility-wide 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 = Tinitrobenzene
 TNT = 2,4,6-Trinitrotoluene
 TNX = Hexahydro-1,3,5-trinitroso-1,3,5-triazine
 TOC = Total Organic Carbon
 VOC = Volatile Organic Compound
 µg/L = Micrograms per Liter

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Table 3-2. FWGWMP Wells with Analytical Testing Suite

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Expanded Explosives (1)	VOCs	SVOCs (2)	PCBs	Pesticides	Cyanide	Nitrate	MNA Suite (3)	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								
12	RVAAP-08 Load Line 1	LL1mw-064	Unconsolidated		X	X								
13	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-09 Load Line 2	LL2mw-059	Upper Sharon		X	X							X	
22	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon		X	X								
23	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon		X	X							X	
24	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon		X	X							X	
25	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon		X	X								
26	RVAAP-10 Load Line 3	LL3mw-245	Upper Sharon		X	X								
27	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated									X		Ammonia
28	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated									X		Ammonia
29	RVAAP-12 Load Line 12	LL12mw-244	Unconsolidated									X		Ammonia
30	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated									X		Ammonia
31	RVAAP-12 Load Line 12	LL12mw-246	Unconsolidated									X		Ammonia
32	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-173	Homewood		X	X							X	
33	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood		X	X							X	
34	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood		X	X								
35	RVAAP-43 Load Line 10	LL10mw-003	Homewood											Carbon Tetrachloride
36	RVAAP-66 Facility-wide Groundwater	FWGmw-004	Unconsolidated		X									
37	RVAAP-66 Facility-wide Groundwater	FWGmw-007	Unconsolidated		X									
38	RVAAP-66 Facility-wide Groundwater	FWGmw-010	Unconsolidated		X	X								
39	RVAAP-66 Facility-wide Groundwater	FWGmw-011	Unconsolidated		X									
40	RVAAP-66 Facility-wide Groundwater	FWGmw-012	Upper Sharon		X									
41	RVAAP-66 Facility-wide Groundwater	FWGmw-015	Unconsolidated		X									
42	RVAAP-66 Facility-wide Groundwater	FWGmw-016	Upper Sharon		X									
43	RVAAP-66 Facility-wide Groundwater	FWGmw-018	Basal Sharon									X		
44	RVAAP-66 Facility-wide Groundwater	FWGmw-020	Upper Sharon									X		

Table 3-2. FWGWMP Wells with Analytical Testing Suite (Continued)

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	Expanded Explosives (1)	VOCs	SVOCs (2)	PCBs	Pesticides	Cyanide	Nitrate	MNA Suite (3)	Other
45	RVAAP-66 Facility-wide Groundwater	FWGmw-021	Upper Sharon		X									
46	RVAAP-66 Facility-wide Groundwater	FWGmw-023	Upper Sharon		X	X								
47	RVAAP-66 Facility-wide Groundwater	FWGmw-024	Upper Sharon		X									
48	RVAAP-66 Facility-wide Groundwater	SCFmw-004	Basal Sharon		X									

X = Indicates well or constituent to be sampled as part of the 2021 FWGWMP. Wells and constituents will be sampled semi-annually unless indicated by footnotes described below.

(1) Expanded Explosives list include 3,5-dinitroaniline (3,5-DNA); hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX); hexahydro-1,3-dinitroso-5-dinitro-1,3,5-triazine (DNX); hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX); 2,4-diamino-6-nitrotoluene (2,4-DANT); and 2,6-diamino-4-nitrotoluene (2,6-DANT).

(2) SVOCs include phthalates, nitroaromatics, polycyclic aromatic hydrocarbons, and phenols.

(3) MNA suite includes anions, total organic carbon, alkalinity, pH, and water quality parameters.

FWGWMP = Facility-wide Groundwater Monitoring Program

MNA = Monitored Natural Attenuation

PCB = Polychlorinated Biphenyl

RVAAP = Ravenna Army Ammunition Plant

SVOC = Semivolatile Organic Compound

VOC = Volatile Organic Compound

Table 3-3. Analytical Laboratory Test Methods

Constituents	Method^a
PCBs	GC – SVOCs (8082A)
Pesticides	GC Semivolatile Organics (8081B)
SVOCs Including Phthalates, Phenols, or Nitroaromatics	GC/MS Semivolatile Organics (8270D)
PAHs	GC/MS 8270D SIM
VOCs	GC/MS Volatile Organics (8260B)
Nitroaromatics and Nitramines (Explosives)	Explosives by HPLC (8330)
Nitrate/Nitrites	General Chemistry (9056)
Sulfate	General Chemistry (9056A)
Sulfide	General Chemistry (9034)
Total Organic Compound	General Chemistry (9060)
Total Alkalinity	General Chemistry (SM2320B) ^b
Cyanide (Total)	General Chemistry (9012B)
Metals (Aluminum, Iron, Magnesium, Potassium, Sodium, Phosphorus, Calcium)	Inductively Coupled Plasma (6010C)
Metals (Antimony, Beryllium, Thallium, Zinc, Cadmium, Manganese, Barium, Nickel, Silver, Vanadium, Chromium, Cobalt, Copper, Arsenic, Lead, Selenium)	Inductively Coupled Plasma/Mass Spectrometry (6020A)
Hexavalent Chromium	General Chemistry (7196A)
Mercury	Liquid Waste Cold Vapor Technique (7470A)

^a USEPA SW846

^b Standard Methods for the Examination of Water and Wastewater

GC = Gas Chromatography

HPLC = High-Performance Liquid Chromatography

MS = Mass Spectrometry

PAH = Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

SIM = Selective Ion Monitoring

SVOC = Semi-volatile Organic Compound

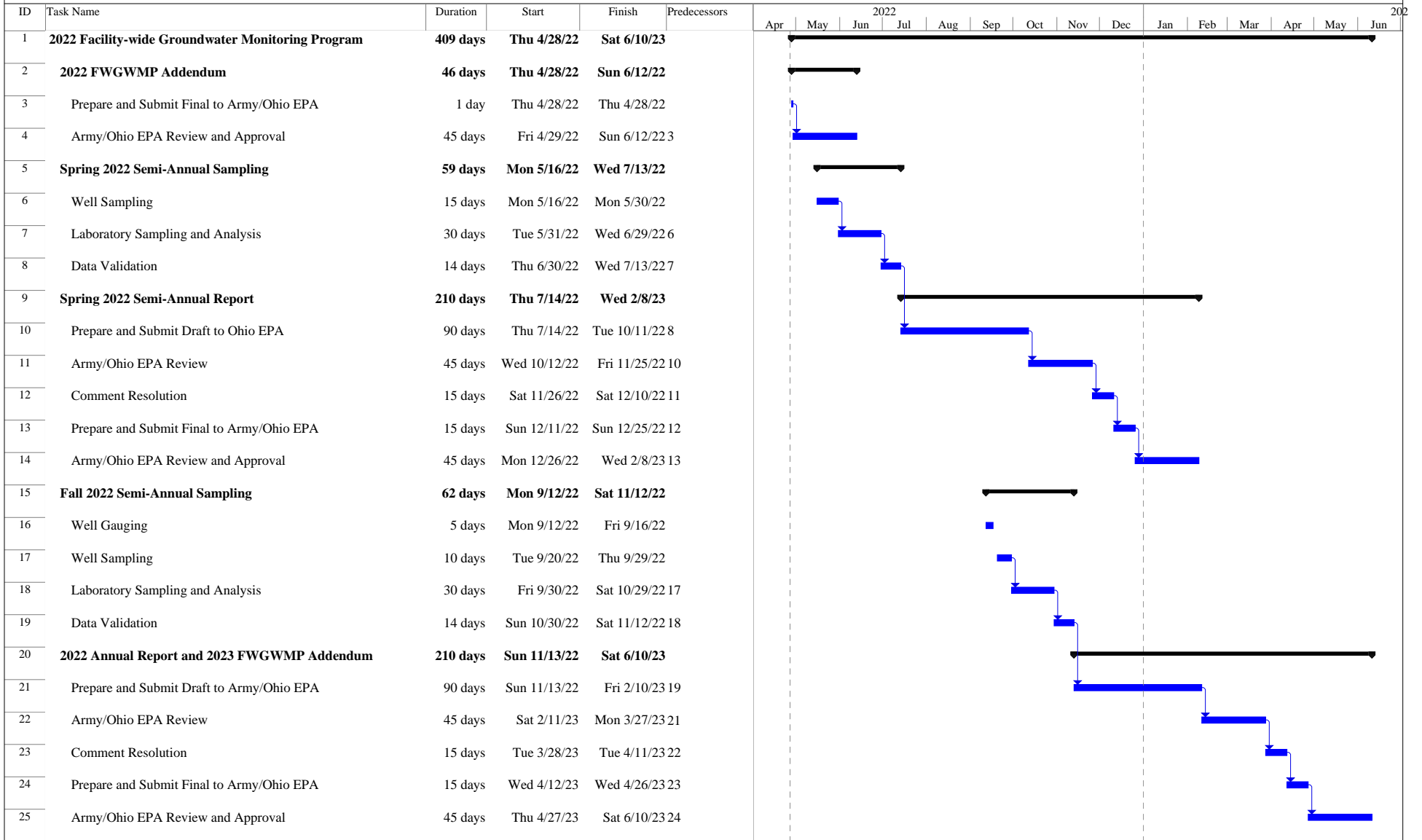
USEPA = U.S. Environmental Protection Agency

VOC = Volatile Organic Compound

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4.0 SCHEDULE

Groundwater Investigation and Reporting Services, Former RVAAP/Camp James A. Garfield Restoration Program 2022 FWGWMP Schedule



Project: Ravenna PBA 2008 Schedule
Date: Wed 4/27/22

Task	Summary	External Milestone	Manual Task	Manual Summary	External Tasks	Deadline
Split	Project Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	
Milestone	External Tasks	Inactive Summary	Manual Summary Rollup	Finish-only	Progress	

Page 1

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5.0 REFERENCES

Leidos 2022. *Remedial Investigation Report for RVAAP-66 Facility-wide Groundwater*. February.

Ohio EPA (Ohio Environmental Protection Agency) 2004. *Director's Final Findings and Orders for the Ravenna Army Ammunition Plant*. June.

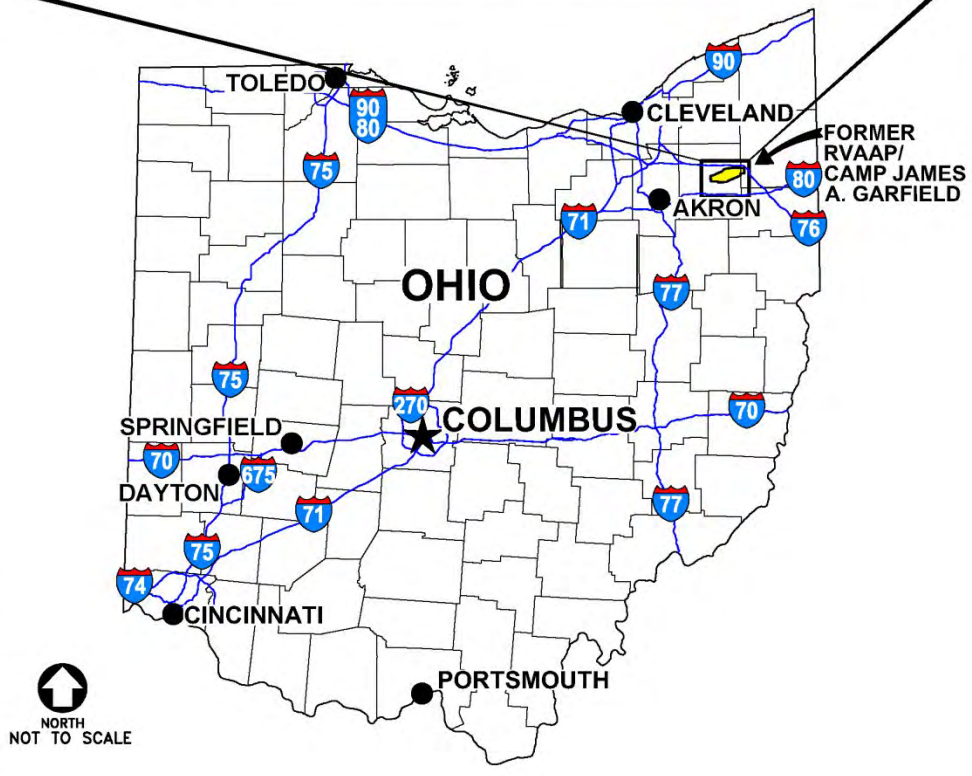
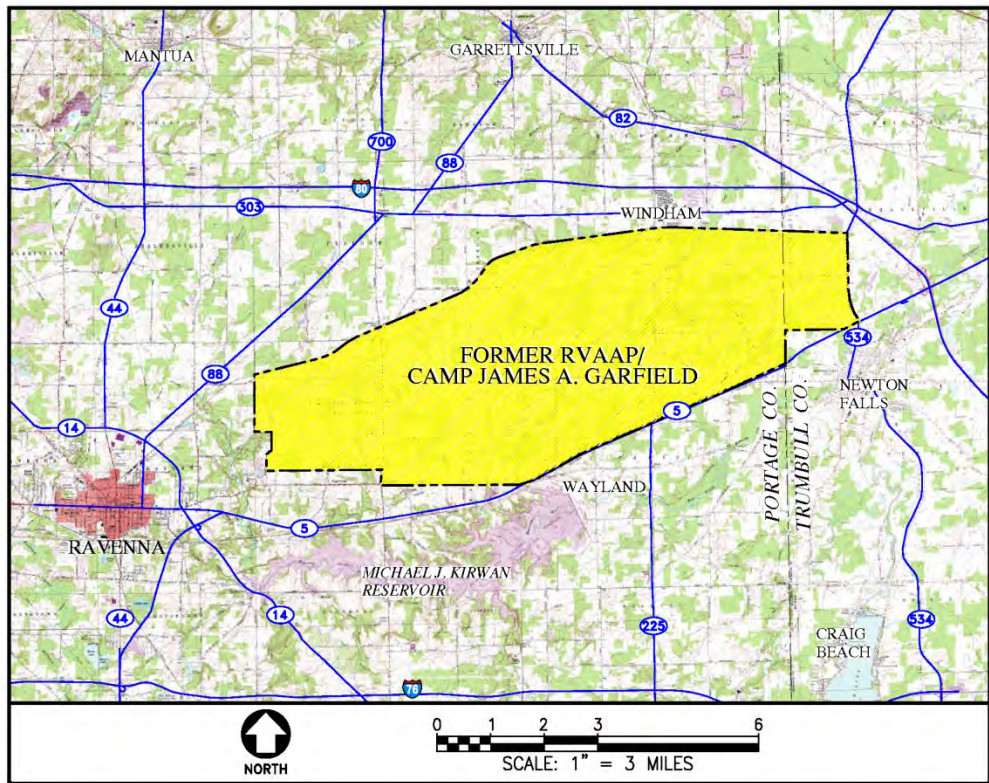
Portage Environmental 2004. *Facility-wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio*. September.

TEC-Weston 2016. *Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater*. December.

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FIGURES

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1/22/19 C:\08042\DWGS\564-HDDEN FIGURE1-1

Figure 2-1. General Location and Orientation of the Former RVAAP/CJAG

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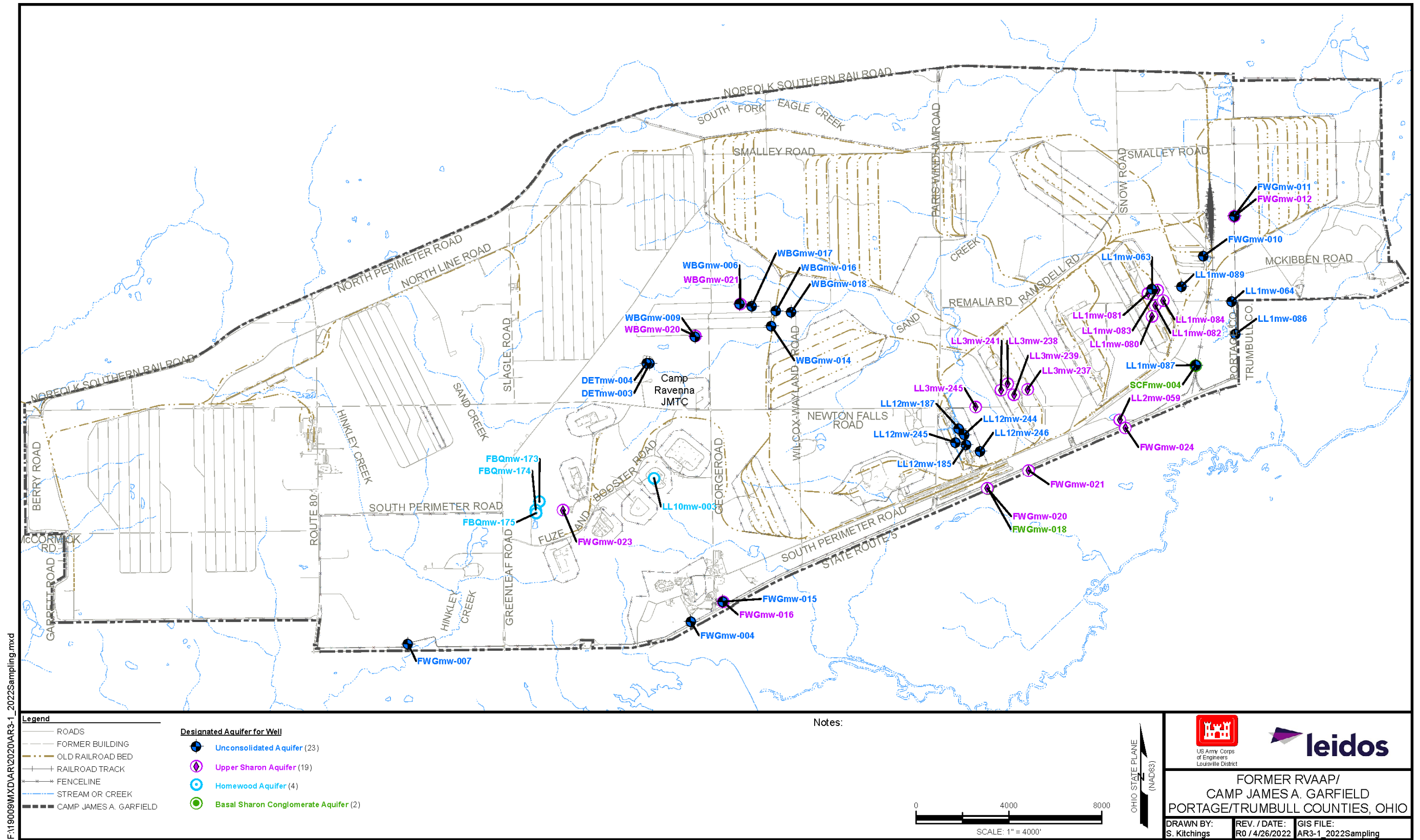


Figure 3-1. 2022 FWGWMP Wells

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