

Final

**Facility-wide Groundwater Monitoring Program Plan
RVAAP-66 Facility-wide Groundwater
Addendum for 2020**

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

**Contract No. W912QR-16-D-0003
Delivery Order No. W912QR-18-F-0337**

Prepared for:



**United States Army Corps of Engineers
Louisville District**

Prepared by:



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

June 12, 2020

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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 2020. 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 2020 FWGWMP activities.

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groundwater, monitoring well, sampling and analysis

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Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

July 7, 2020

Mr. Kevin M. Sedlak
Army National Guard
Installation and Environment
Clean-up Branch
IPA Designation
1438 State Route 534 SW
Newton Falls, OH 44444

RE: US Army Ammunition Plt RVAAP
Remediation Response
Project Records
Remedial Response
Portage County
ID # 267000859036

TRANSMITTED ELECTRONICALLY

Subject: Approval of the "Final Facility-wide Groundwater Program Plan, RVAAP-66 Facility-wide Groundwater Addendum for 2020"

Dear Mr. Sedlak:

Ohio EPA has received the "Final Facility-wide Groundwater Program Plan, RVAAP-66 Facility-wide Groundwater Addendum for 2020" at the Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio dated June 12, 2020. This document was received via email at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) on June 12, 2020. The document was prepared for the U.S. Army Corps of Engineers on behalf of the Army National Guard Directorate 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.

If you have any questions, please contact me via email at kevin.palombo@epa.ohio.gov, or call me at (330) 963-1292.

Sincerely,

A handwritten signature in black ink that reads "Kevin M. Palombo".

Kevin M. Palombo
Environmental Specialist
Division of Environmental Response and Revitalization

KP/sc

ec: Katie Tait, OHARNG RTLS, CJAG
Craig Coombs, USACE Louisville
Nathaniel Peters, USACE Louisville
Rebecca Shreffler, Chenega
Bob Princic, Ohio EPA, NEDO, DERR
Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Liam McEvoy, Ohio EPA, NEDO, DERR
Thomas Schneider, Ohio EPA, SWDO, DERR
Carrie Rasik, Ohio EPA, CO, DERR

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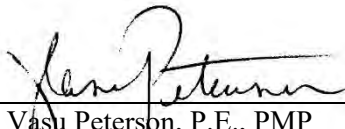
Leidos has completed the Facility-wide Groundwater Monitoring Program Plan, RVAAP-66 Facility-wide Groundwater Addendum for 2020 for the Ravenna Army Ammunition Plant Restoration Program. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of 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 United States Army Corps of Engineers (USACE) policy.



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

June 12, 2020

Date

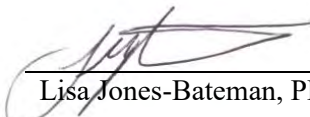


Vasu Peterson, P.E., PMP
Independent Technical Review Team Leader

June 12, 2020

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

June 12, 2020

Date

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Final

**Facility-wide Groundwater Monitoring Program Plan
RVAAP-66 Facility-wide Groundwater
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**Contract No. W912QR-16-D-0003
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Prepared for:

United States Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

Leidos
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

June 12, 2020

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Jay Trumble, USACE – Louisville District	1	1
Administrative Records Manager – Camp James A. Garfield	2	2
Vasu Peterson, Leidos	Email transmittal letter only	
Jed Thomas, Leidos	1	1

ARNG = Army National Guard.
NEDO = Northeast District Office.
OHARNG = Ohio Army National Guard.
Ohio EPA = Ohio Environmental Protection Agency.
SWDO = Southwest District Office.
USACE = U.S. Army Corps of Engineers.

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Appendix A. Ohio EPA Comments

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
COC	Chemical of Concern
COPC	Chemical of Potential Concern
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
MCL	Maximum Contaminant Level
Ohio EPA	Ohio Environmental Protection Agency
P.E.	Professional Engineer
PCB	Polychlorinated Biphenyl
PMP	Project Management Professional
PP	Proposed Plan
PWS	Performance Work Statement
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
REM	Remedial Environmental Manager
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
SAP	Sampling and Analysis Plan
SRC	Site-Related Compound
SVOC	Semi-volatile Organic Compound
USACE	U.S. Army Corps of Engineers
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-16-D-0003, Delivery Order No. W912QR-18-F-0337. 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 2020 Addendum is to satisfy the requirements of Section 15d that 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.”

This Addendum provides an update to the FWGWMP Plan, including the identification of wells to be sampled as part of the semi-annual FWGWMP in 2020.

1.2 OBJECTIVES

The primary objectives of the facility-wide monitoring well network in this 2020 Addendum are to assess potential exit pathways, assess nature and extent data gaps, and monitor contaminant levels related to historical RVAAP activities (e.g., explosives/propellants, volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], pesticides, and polychlorinated biphenyls [PCBs]) at selected source area wells for trend analysis. This 2020 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 on a semi-annual basis (spring and fall 2020) and the chemicals of potential concern (COPCs) that will be evaluated at each selected well.

Results of the 2019 FWGWMP sampling were reviewed to determine the presence of site-related compounds (SRCs) and to evaluate contaminant concentration trends within individual wells. Wells were selected for inclusion in the 2020 semi-annual FWGWMP based on the following criteria:

- **FWGWMP Criterion 1:** Wells representing critical exit pathway monitoring points (generally a carryover from the 2019 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:** Wells with 2018 or 2019 sampling results representing a historical (non-metal) maximum concentration above regulatory screening levels for one or more SRCs in groundwater (based on AOC-specific sampling histories).
- **FWGWMP Criterion 4:** Co-located wells used to establish the vertical distribution of contaminants within the stratigraphic sequence.

Contaminant trend analysis of the 2019 sampling results was conducted by reviewing the well specific sampling histories and time series graphs provided in the *Facility-wide Groundwater Monitoring Program RVAAP-66 Facility-wide Groundwater Annual Report for 2019* (2019 Annual Report) (Leidos 2020). With the exception of Resource Conservation and Recovery Act (RCRA) wells, which will be analyzed for the same parameters as 2019, groundwater monitoring wells sampled in 2019 that do not meet the FWGWMP sampling criteria listed above will not be recommended for sampling in 2020. The 2020 FWGWMP will generally include sampling of wells identified with one or more screening level exceedances in 2019. In addition, the 2020 FWGWMP will include necessary critical migration exit pathway well points and vertical delineation well pairs. The proposed analytical testing suite from 2019 proposed for 2020 are summarized in Section 3.0.

1.3 REPORT ORGANIZATION

The remaining sections of this Annual Report 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. 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 RCRA wells (RQLmw-007, RQLmw-008, RQLmw-009, DETmw-003, and DETmw-004) were incorporated into the FWGWMP after May 2005 and are sampled semi-annually. Beginning in fiscal year 2008, the FWGWMP was expanded to include the characterization of groundwater from 243 existing monitoring wells at the facility.

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 serves as a supplement to the FWGWMP Plan and specifies 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 FWGWMP monitoring well network currently contains 301 permanent wells, 76 of which were sampled in 2019. In addition to these wells, nine permanent wells at RVAAP-69 Building 1048 Fire Station and three 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.

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3.0 SCOPE OF WORK UNDER THE ADDENDUM

The 2020 Addendum is intended to further address AOC-specific nature and extent data gaps in the historical sampling dataset, as indicated by an analysis of results through 2019. Using data and results from the 2019 FWGWMP sampling events, the following subsections provide an assessment of sampling to be conducted in 2020.

To achieve this objective, 47 wells (including 5 RCRA wells) have been selected for sampling during the semi-annual events in 2020. 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 2020 SAMPLING SCHEME

Seventy-six wells were sampled in 2019 under the FWGWMP. This 2020 Addendum recommends 47 wells be sampled in 2020. Some rationale for the difference in number of wells sampled between 2019 and 2020 are presented below:

- The *Background Study for Metals* (Leidos 2019b) was completed and approved by Ohio EPA in 2019. The use of comparison with background concentrations resulted in fewer metals exceedances and fewer wells requiring additional metals analysis.
- The screening criteria and applicable screening levels discussed with the stakeholders during planning meetings for the upcoming RI Report was used to assess chemical concentrations in groundwater. As an example, 13 wells were analyzed in 2019 with the sole purpose of monitoring cyanide. Cyanide was never detected above the maximum contaminant level (MCL) of 0.2 mg/L in any of these wells in 2019, with a maximum 2019 concentration of 0.11 mg/L (EBGmw-125), eliminating the need for further cyanide characterization in a number of wells.
- Historical groundwater concentrations and 2019 groundwater concentrations were assessed to determine if additional data were needed to complete the RI phase of the CERCLA process, resulting in both the addition and elimination of some wells and analytical parameters.
 - Quarterly sampling was completed in August 2019 for the three wells at the Sand Creek Disposal Road Landfill that were installed in October 2018. An evaluation of the quarterly sampling results indicated that additional sampling of these wells was not warranted.
 - Three wells were added to the 2020 sampling scheme to further assess explosives at the Fuze and Booster Quarry Landfill/Ponds. In addition, explosives were added to the 2019 sampling suite for other wells at this site, even if that was not an analyzed chemical group in 2018.
 - Additional chemical analysis is included with LL1mw-087, LL12mw-185, and LL12mw-187 to expand the 2020 scheme and address an RI data gap.
 - LL3mw-238, LL3mw-239, and LL3mw-241 have been added per recent findings during the development of the RI Report.
 - The sampling scheme for LL1mw-064 and SCFmw-004 has been expanded in 2020 to include explosives in these exit pathway wells.

3.2 pH MONITORING WELLS

Selection of existing wells for semi-annual pH monitoring was made based on anomalous pH values outside the typical range of natural groundwater (i.e., 5 to 9 standard units [S.U.s]). Six wells will be tested in 2020 for geochemical parameters, including alkalinity, sulfate/sulfide, and nitrate/nitrite. The six wells in Table 3-1 are included for this assessment in 2020.

Table 3-1. Samples with pH Outside Typical Range in 2019

RVAAP Area	Well	Aquifer	Date Collected	pH
RVAAP-01 Ramsdell Quarry	RQLmw-011	Upper Sharon	5/9/2019	4.07
RVAAP-01 Ramsdell Quarry	RQLmw-011	Upper Sharon	10/7/2019	5.6
RVAAP-01 Ramsdell Quarry	RQLmw-013	Upper Sharon	5/9/2019	3.98
RVAAP-01 Ramsdell Quarry	RQLmw-013	Upper Sharon	10/7/2019	4.37
RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated	10/9/2019	4.35
RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon	5/6/2019	4.44
RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon	10/9/2019	4.4
RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated	5/7/2019	10.44
RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated	10/8/2019	8.17
RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated	5/7/2019	4.75
RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated	10/9/2019	4.99

RVAAP = Ravenna Army Ammunition Plant.

The annual FWGWMP reporting for these wells will include discussion of trends for pH values. An evaluation of secondary geochemical parameters potentially associated with the anomalous pH conditions will be provided in the Annual Report.

The following wells were included for pH evaluation in 2019 but will not be included for pH evaluation in 2020 per the presented rationale (values provided in S.U.):

- FBQmw-171
 - pH of 5.76 in Spring 2019 and 5.7 in Fall 2019.
 - All pH readings since 2011 have been greater than 5.
- FBQmw-174
 - pH of 5.15 in Spring 2019 and 5.38 in Fall 2019.
 - Six of seven pH readings since 2015 have been greater than 5.
- FBQmw-175
 - pH of 5.61 in Spring 2019 and 5.59 in Fall 2019.
 - All pH readings since 2011 have been greater than 5.
- LL1mw-088
 - pH of 7.53 in Spring 2019 and 7.2 in Fall 2019.
 - All previous pH readings have ranged from 7.05 to 7.7.
- LL1mw-084
 - pH of 5.57 in Spring 2019 and 5.34 in Fall 2019.
 - Seventeen of 19 readings since 2009 have been greater than 5.
- RQLmw-012
 - pH of 5.14 in Spring 2019 and 5.13 in Fall 2019.
 - Seven of eight pH readings since 2011 have been greater than 5.

3.3 RCRA WELLS

RCRA wells will be sampled semi-annually as FWGWMP wells. The RCRA wells include the Ramsdell Quarry Landfill wells (RQLmw-007, RQLmw-008, and RQLmw-009) and the Open Demolition Area #2 wells (DEtmw-003 and DEtmw-004). The sampling suite for these wells is consistent with analyses conducted in 2019. Although these wells were designated as RCRA wells, they are being monitored as part of the CERCLA program at CJAG in accordance with the DFFO and will be included in evaluations conducted as part of the pending FWGW RI.

3.4 CERCLA WELLS

Selection of wells for the semi-annual 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 (e.g., RCRA monitoring well locations) or indicated to be potentially increasing or otherwise potentially unstable plume conditions.
 - **Unconsolidated Aquifer:** DEtmw-003, DEtmw-004, FBQmw-168, LL1mw-063, LL1mw-086, LL1mw-089, LL12mw-185, LL12mw-187, FBQmw-176, FBQmw-177, WBGmw-006, WBGmw-009
 - **Homewood Aquifer:** FBQmw-170, FBQmw-171, FBQmw-174, FBQmw-175
 - **Upper Sharon Aquifer:** LL1mw-080, LL1mw-081, LL1mw-083, LL1mw-084, LL2mw-059, LL2mw-267, LL3mw-237, LL3mw-238, LL3mw-239, LL3mw-241, LL10mw-003, RQLmw-007, RQLmw-008, RQLmw-009, RQLmw-011, RQLmw-013
 - **Basal Sharon Conglomerate Aquifer:** None currently proposed.
- **FWGWMP Criterion 3:** Wells with non-metals (including cyanide) historical maximum concentrations from the 2018 and 2019 sampling events. For non-metal chemicals that have exceeded their screening level in any sampling event, Table 3-2 summarizes the maximum concentration that occurred in 2018 and 2019. These wells are planned to be analyzed for the respective chemical group (e.g., explosives) in 2020.
 - **Unconsolidated Aquifer:** LL1mw-063, LL1mw-089
 - **Homewood Aquifer:** FBQmw-174
 - **Upper Sharon Aquifer:** LL1mw-080, LL1mw-083, LL1mw-084, LL2mw-059
 - **Basal Sharon Conglomerate Aquifer:** None.

Table 3-2. Maximum Detected Concentrations (Non-Metal) in 2018/2019

RVAAP Area	Well	Analyte	Maximum Detected Concentration	Units	GW Screening Level (RSL)	Date Collected at Max Detect
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	2,4-Dinitrotoluene	0.67	µg/L	0.24	4/30/2019
RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	RDX	1.2	µg/L	0.97	4/30/2019
RVAAP-08 Load Line 1	LL1mw-063	1,3-Dinitrobenzene	0.41	µg/L	0.2	10/9/2019
RVAAP-08 Load Line 1	LL1mw-080	1,3-Dinitrobenzene	2.4	µg/L	0.2	6/27/2018
RVAAP-08 Load Line 1	LL1mw-083	1,3-Dinitrobenzene	2	µg/L	0.2	5/6/2019
RVAAP-08 Load Line 1	LL1mw-083	2,4-Dinitrotoluene	5.6	µg/L	0.24	10/24/2018
RVAAP-08 Load Line 1	LL1mw-083	RDX	2.1	µg/L	0.97	10/24/2018
RVAAP-08 Load Line 1	LL1mw-084	1,3-Dinitrobenzene	2.5	µg/L	0.2	10/9/2019
RVAAP-08 Load Line 1	LL1mw-084	RDX	5.2	µg/L	0.97	10/24/2018
RVAAP-08 Load Line 1	LL1mw-089	2,4-Dinitrotoluene	0.48	µg/L	0.24	6/27/2018
RVAAP-08 Load Line 1	LL1mw-089	2,6-Dinitrotoluene	0.31	µg/L	0.122	6/27/2018
RVAAP-09 Load Line 2	LL2mw-059	1,3-Dinitrobenzene	0.31	µg/L	0.2	10/2/2019
RVAAP-66 Facility-wide Groundwater	FWGmw-017	Benz(a)anthracene	0.057	µg/L	0.03	10/25/2018

GW = Groundwater.

µg/L = Micrograms per liter.

RSL = Regional screening level.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

RVAAP = Ravenna Army Ammunition Plant.

(Although FWGmw-017 had a maximum concentration of benz[a]anthracene in 2018, it was not recommended for additional sampling per FWGWMP Criterion 3. The estimated concentration of 0.057J µg/L slightly exceeded the Tapwater RSL [0.03 µg/L]. In addition, benz[a]anthracene was not detected during five of six sampling events between 2016 and 2018.)

- **FWGWMP Criterion 4:** 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)
 - *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).

The list of analytes for 2020 reflects the potential chemicals of concern (COCs) within certain areas of the site or immediately downgradient from potential source areas, as appropriate. Table 3-3 provides a comprehensive summary of the proposed wells, 2019 results summary, and rationale for their inclusion in the 2020 FWGWMP sampling scheme. This table summarizes results from the 2019 wells recommended for sampling in 2020, as well as the 2019 wells that do not require additional analysis (highlighted in gray). Figure 3-1 show the wells to be sampled during the semi-annual monitoring events.

The refined analyte list for the semi-annual wells is presented in Table 3-4. The analytical methods for these analytes are provided in Table 3-5. Evaluation of data collected during 2020 will be conducted in accordance with the Final FWGW RIWP, including the supporting SAP and QAPP updates (TEC-Weston 2016).

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Table 3-3. Recommended FWGWMP Wells for 2020

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
1	RVAAP-01 Ramsdell Quarry	RQLmw-007	Upper Sharon	In accordance with the DFFO, analytical parameters for this RCRA well include the same parameters as 2018: VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, phosphorus, and metals.	<ul style="list-style-type: none"> VOCs, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and phosphorus were not detected. Phthalates were detected at low, estimated concentrations during the Fall 2019 sampling event. All metal concentrations were below the screening level or background concentration, with the exceptions of manganese and nickel. Manganese was detected at concentrations of 0.49 mg/L in Spring 2019 and at an estimated concentration of 1.7J mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. Nickel was detected at a concentration of 0.039 mg/L in Fall 2019, meeting the RSL of 0.039 mg/L. 	<ul style="list-style-type: none"> In the absence of VOCs, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and phosphorus, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, phosphorus, and metals. 	2 (RCRA Well)
2	RVAAP-01 Ramsdell Quarry	RQLmw-008	Upper Sharon	In accordance with the DFFO, analytical parameters for this RCRA well include the same parameters as 2018: VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	<ul style="list-style-type: none"> VOCs, phthalates, PAHs, phenols, PCBs, explosives, and pesticides were not detected. Cyanide was detected at an estimated concentration of 0.0053J mg/L, below the MCL of 0.2 mg/L in Spring 2019. Cyanide was not detected in Fall 2019. All metal concentrations were below the screening level or background concentration, with the exceptions of manganese and arsenic. Manganese was detected at concentrations of 0.46 mg/L in Spring 2019 and at an estimated concentration of 0.54J mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. Arsenic was detected at concentrations of 0.011 mg/L in Spring 2019 and 0.031 mg/L in Fall 2019, exceeding the MCL of 0.01 mg/L. 	<ul style="list-style-type: none"> In the absence of VOCs, phthalates, PAHs, phenols, PCBs, explosives, and pesticides, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	2 (RCRA Well)
3	RVAAP-01 Ramsdell Quarry	RQLmw-009	Upper Sharon	In accordance with the DFFO, analytical parameters for this RCRA well include the same parameters as 2018: VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	<ul style="list-style-type: none"> VOCs, phthalates, PAHs, phenols, PCBs, explosives, and pesticides were not detected. Cyanide was detected at an estimated concentration of 0.013J mg/L, below the MCL of 0.2 mg/L in Spring 2019. Cyanide was not detected in Fall 2019. All metal concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at concentrations of 0.3 mg/L in Spring 2019 and at an estimated concentration of 0.65J mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> In the absence of VOCs, phthalates, PAHs, phenols, PCBs, explosives, and pesticides, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	2 (RCRA Well)
4	RVAAP-01 Ramsdell Quarry	RQLmw-011	Upper Sharon	In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity.	<ul style="list-style-type: none"> pH remains low, ranging from 4.07 to 5.6, along with alkalinity ranging from nondetect to 22 mg/L in 2019. Nitrate, nitrite, and sulfide were not detected. 	<ul style="list-style-type: none"> In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity. 	2 (pH Well)
	RVAAP-01 Ramsdell Quarry	RQLmw-012	Upper Sharon	In consideration of the pH anomalies, continue to monitor anions, pH, alkalinity, and cyanide.	<ul style="list-style-type: none"> pH remains low, ranging from 5.13 to 5.14, along with alkalinity ranging from nondetect to 9.9J to 31 mg/L in 2019. Nitrate, nitrite, and sulfide were either not detected or detected at concentrations below the screening level. Cyanide was detected at an estimated concentration of 0.04J mg/L, below the MCL of 0.2 mg/L in Spring 2019. Cyanide was not detected in Fall 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. pH has been greater than 5 S.U. in seven of the last eight samples collected since 2011. The pH was below 5 S.U. at 4.94 S.U. 	NS

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
5	RVAAP-01 Ramsdell Quarry	RQLmw-013	Upper Sharon	In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity.	<ul style="list-style-type: none"> pH remains low, ranging from 3.98 to 4.37 in 2019. Alkalinity, nitrate, and sulfide were not detected. 	<ul style="list-style-type: none"> In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity. 	2 (pH Well)
	RVAAP-01 Ramsdell Quarry	RQLmw-016	Upper Sharon	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected in Spring 2019. Cyanide was detected at an estimated concentration of 0.0069J mg/L in Fall 2019, below the MCL of 0.2 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-02 Erie Burning Grounds	EBGmw-125	Unconsolidated	Continue to monitor cyanide. Analyze for metals to further understand nature and extent of contamination (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> Cyanide was detected at a concentration of 0.011 mg/L in Spring 2019, below the MCL of 0.2 mg/L. Cyanide was not detected in Fall 2019. Metals were analyzed in Fall 2019 only. All metal concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at an estimated concentration of 0.56J mg/L, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-02 Erie Burning Grounds	EBGmw-131	Upper Sharon	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-04 Open Demolition Area #2	DA2mw-115	Upper Sharon	Continue to monitor metals.	<ul style="list-style-type: none"> All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Additional sampling is not recommended 	NS
6	RVAAP-04 Open Demolition Area #2	DEtmw-003	Unconsolidated	In accordance with the DFFO, analytical parameters for this RCRA well include the same parameters as 2018: VOCs, phthalates, nitroaromatics, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	<ul style="list-style-type: none"> Phthalates, nitroaromatics, SVOCs, phenols, PCBs, PAHs, explosives, or pesticides were not detected. Acetone was the only VOC detected. Acetone was detected at an estimated concentration of 2.8J µg/L in Spring 2019, below the Tapwater RSL of 1,400 µg/L. Cyanide was detected at an estimated concentration of 0.005J mg/L in Fall 2019, below the MCL of 0.2 mg/L. All metal concentrations were below the screening level or background concentration, with the exceptions of manganese and arsenic. Manganese was detected at concentrations of 0.24 mg/L in Spring 2019 and 0.23 mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. Arsenic was detected at a concentration of 0.011 mg/L in Fall 2019, exceeding the MCL of 0.01 mg/L. 	<ul style="list-style-type: none"> In the absence of phthalates, nitroaromatics, SVOCs, phenols, PCBs, PAHs, explosives, or pesticides, additional sampling of these parameters is not warranted for the CERCLA investigation. However, in accordance with the DFFO, analytical parameters for this RCRA well in 2020 include VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	2 (RCRA Well)
7	RVAAP-04 Open Demolition Area #2	DEtmw-004	Unconsolidated	In accordance with the DFFO, analytical parameters for this RCRA well include the same parameters as 2018: VOCs, phthalates, nitroaromatics, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals.	<ul style="list-style-type: none"> SVOCs, pesticides, phthalates, nitroaromatics, PAHs, phenols, cyanide, and PCBs were not detected. Acetone was the only VOC detected. Acetone was detected at an estimated concentration of 5.1 µg/L, below the Tapwater RSL in Spring 2019. All metal concentrations were below the screening level or background concentration, with the exception of manganese. Manganese was detected at a concentration of 0.42 mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. No explosives exceeded the screening level with the exception of RDX. RDX was detected at a concentration of 1.4 µg/L in Spring 2019, exceeding the RSL of 0.97 µg/L. 	<ul style="list-style-type: none"> In accordance with the DFFO, analytical parameters for this RCRA well in 2020 include: VOCs, phthalates, PAHs, phenols, PCBs, explosives, pesticides, cyanide, and metals. 	2 (RCRA Well)
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> No explosives exceeded the screening level with the exception of RDX. RDX was detected at concentrations of 11 µg/L in Spring 2019 and 8.2 µg/L in Fall 2019, exceeding the RSL of 0.97 µg/L. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.099 mg/L in Spring 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives. 	2,4

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> No explosives exceeded the screening level with the exception of RDX. RDX was detected at concentrations of 1.6 µg/L in Spring 2019 and 3.5 µg/L in Fall 2019, exceeding the RSL of 0.97 µg/L. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 0.18 mg/L in Spring 2019 and 0.33 mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives. 	2, 4
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 0.22 mg/L in Spring 2019 and 0.3 mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives. 	4
11	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 0.37 mg/L in Spring 2019 and 0.38 mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives. 	4
12	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated	Analyze for explosives and cyanide to address potential data gap (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> This well was sampled in Fall 2019 only. Cyanide was not detected. All explosive concentrations were below the screening level with the exceptions of 1,3-DNB and 4-Amino-2,6-DNT. 1,3-DNB was detected at an estimated concentration of 0.41J µg/L, exceeding the RSL of 0.2 µg/L. 4-Amino-2,6-DNT was detected at a concentration of 5.9 µg/L, exceeding the RSL of 3.9 µg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives. In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity. 	2 (pH Well), 3
13	RVAAP-08 Load Line 1 (east of Load Line 1 fence)	LL1mw-064	Unconsolidated	Continue to monitor metals in this sentinel well.	<ul style="list-style-type: none"> All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.12 mg/L in Spring 2019 and at an estimated concentration of 0.012J mg/L in Fall 2019, above the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals to monitor migration potential. 	1
	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-065	Unconsolidated	Continue to monitor explosives and metals for migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have not had concentrations above screening levels during any sampling event from 1996 to 2019. 	NS
14	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon	Continue to monitor explosives. Analyze for metals to further understand nature and extent of contamination (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> All explosive concentrations were below the screening level or background concentration with the exceptions of 1,3-DNB and RDX. 1,3-DNB was detected at a concentration of 0.62 µg/L in Fall 2019, above the RSL of 0.2 µg/L. RDX was detected at concentrations of 13 µg/L in Spring 2019 and 24 µg/L in Fall 2019, above the RSL of 0.97 µg/L. Metals were only sampled in Fall 2019, and none exceeded the screening level or background concentration. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2, 3
15	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon	Continue to monitor explosives and cyanide.	<ul style="list-style-type: none"> All explosive concentrations were below screening level. Cyanide was not detected. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
16	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon	Continue to monitor explosives, anions, and alkalinity.	<ul style="list-style-type: none"> pH remains low, ranging from 4 to 4.44, along with alkalinity ranging from nondetect to 44 mg/L in 2019. Nitrite and sulfide were not detected, and nitrate was detected at low, estimated concentrations of 0.44J mg/L in Spring and Fall 2019, below the MCL of 10 mg/L. Many explosives exceeded their screening level. Concentrations of 1,3-DNB exceeded the RSL of 0.2 µg/L in Spring and Fall 2019 (2 and 1.7J µg/L, respectively). Concentrations of TNT exceeded the RSL of 0.98 µg/L in Spring and Fall 2019 (1.9 and 2.3 µg/L, respectively). Concentrations of 2,4-DNT exceeded the RSL of 0.24 µg/L in Spring and Fall 2019 both at concentrations of 2.8 µg/L. Concentrations of 2-amino-4,6-DNT exceeded the RSL of 3.9 µg/L in Spring and Fall 2019 (11 and 12 µg/L, respectively). Concentrations of 4-amino-2,6-DNT exceeded the RSL of 3.9 µg/L in Spring and Fall 2019 (14 and 20 µg/L, respectively). 	<ul style="list-style-type: none"> Continue to monitor explosives, anions, and alkalinity. 	2 (pH Well), 3
17	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon	Continue to monitor explosives, anions, alkalinity, and metals.	<ul style="list-style-type: none"> pH ranged from 5.34 to 5.57, along with alkalinity ranging from nondetect to 23 mg/L in 2019. Nitrite was not detected, and nitrate was detected at concentrations below the MCL of 10 mg/L. Many explosives exceeded their screening level. Concentrations of 1,3-DNB exceeded the RSL of 0.2 µg/L in Spring and Fall 2019 (2.4 and 2.5J µg/L, respectively). Concentrations of TNT exceeded the RSL of 0.98 µg/L in Spring and Fall 2019 (3.3 and 3.6 µg/L, respectively). Concentrations of 2,4-DNT exceeded the RSL of 0.24 µg/L in Spring and Fall 2019 (0.87 and 1.4J µg/L, respectively). Concentrations of 2-amino-4,6-DNT exceeded the RSL of 3.9 µg/L in Spring and Fall 2019 (7.9 and 8.9 µg/L, respectively). Concentrations of 4-amino-2,6-DNT exceeded the RSL of 3.9 µg/L in Spring and Fall 2019 (18 and 20 µg/L, respectively). RDX exceeded the RSL of 0.97 µg/L in Spring 2019 at a concentration of 2 µg/L. Concentrations of all metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Continue to monitor explosives. 	2, 3
18	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-086	Unconsolidated	Continue to monitor metals, cyanide, and alkalinity in this sentinel well.	<ul style="list-style-type: none"> pH ranged from 8.17 to 10.44, along with alkalinity ranging from 110 to 190 mg/L in 2019. Cyanide was not detected. All metal concentrations were below the screening level or background concentration with the exceptions of aluminum and manganese. Aluminum was detected at a concentration of 3.1 mg/L in Spring 2019, above the RSL of 2.0 mg/L. Manganese was detected at concentrations of 0.36 mg/L (unfiltered) in Spring 2019 and 0.35 mg/L (filtered) and 0.51 mg/L (unfiltered) in Fall 2019, above the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity. 	1, 2 (pH Well)
19	RVAAP-08 Load Line 1 (southeast of Load Line 1 fence)	LL1mw-087	Unconsolidated	Continue to monitor explosives and metals to monitor migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese in Fall 2019. Manganese was detected at an estimated concentration of 0.28J mg/L, above the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals to monitor migration. Analyze for perchlorate, as this is identified as a potential data gap in the RIWP (TEC-Weston 2016). 	1

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
	RVAAP-08 Load Line 1	LL1mw-088	Unconsolidated	Continue to monitor explosives, alkalinity, and metals in this sentinel well.	<ul style="list-style-type: none"> pH ranged from 7.2 to 7.53, along with alkalinity ranging from 290 to 310 mg/L in 2019. Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of arsenic. Arsenic was detected at a concentration of 0.028 mg/L in Spring 2019 and an estimated concentration of 0.028J mg/L in Fall 2019, exceeding the MCL of 0.01 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have been analyzed in 14 different sampling events since 2014 and only one explosive has been detected (4-nitrotoluene in June 2018). pH has historically ranged from 7.05-7.7 S.U. 	NS
20	RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated	Continue to monitor explosives and re-collect rejected propellant results from 2018.	<ul style="list-style-type: none"> All explosive and propellant concentrations were below their screening level. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. In consideration of the pH anomalies, continue to monitor anions, pH, and alkalinity. 	1, 2 (pH Well), 3
21	RVAAP-09 Load Line 2 South	LL2mw-059	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> The explosive 1,3-DNB exceeded the RSL of 0.2 µg/L in Spring 2019 at estimated concentrations of 0.27J µg/L and an estimated concentration of 0.31J µg/L in Fall 2019. 2,4-DNT exceeded the RSL (0.24 µg/L) in Spring 2019 at a concentration of 0.52 µg/L. All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	1, 2, 3
	RVAAP-09 Load Line 2	LL2mw-264	Upper Sharon	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was detected at an estimated concentration of 0.006J mg/L, below the MCL of 0.2 mg/L in Spring 2019. Cyanide was not detected in Fall 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
22	RVAAP-09 Load Line 2	LL2mw-267	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> All explosive concentrations were below the screening level. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.69 mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives. Although explosives never exceeded their screening levels in 2019, explosive exceedances were in the 2011-2016 datasets. 	2
	RVAAP-09 Load Line 2	LL2mw-272	Upper Sharon	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-10 Load Line 3	LL3mw-234	Upper Sharon	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was detected at an estimated concentration of 0.0087J mg/L, below the MCL of 0.2 mg/L in Spring 2019. Cyanide was not detected in Fall 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
23	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon	Continue to monitor explosives.	<ul style="list-style-type: none"> The explosive 4-amino-2,6-DNT exceeded the RSL of 3.9 µg/L at a concentration of 4 µg/L in Spring 2019. 4-Amino-2,6-DNT did not exceed the screening level in Fall 2019. 	<ul style="list-style-type: none"> Continue to monitor explosives. 	2
	RVAAP-10 Load Line 3	LL3mw-244	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> All explosive concentrations were below the screening level. All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have been analyzed in 17 different sampling events since 2012, and explosive concentrations have never exceeded the screening levels. 	NS
	RVAAP-10 Load Line 3	LL3mw-246	Upper Sharon	Continue to monitor explosives, perchlorate, and metals	<ul style="list-style-type: none"> All explosive concentrations were below the screening level. All metal concentrations were below the screening level or background concentration. Perchlorate was detected at concentrations below the screening level. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have been analyzed in 14 different sampling events since 2014, and explosive concentrations have never exceeded the screening levels. 	NS
24	RVAAP-10 Load Line 3	LL3mw-238	Unconsolidated	Not sampled in 2019.	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Monitor for explosives. Provide supplemental data for the RI regarding explosives at Load Line 3. 	2
25	RVAAP-10 Load Line 3	LL3mw-239	Unconsolidated	Not sampled in 2019.	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Monitor for explosives. Provide supplemental data for the RI regarding explosives at Load Line 3. 	2

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
26	RVAAP-10 Load Line 3	LL3mw-241	Unconsolidated	Not sampled in 2019.	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Monitor for explosives. Provide supplemental data for the RI regarding explosives at Load Line 3. 	2
	RVAAP-11 Load Line 4	LL4mw-200	Unconsolidated	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-12 Load Line 12	LL12mw-183	Unconsolidated	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
27	RVAAP-12 Load Line 12	LL12mw-185	Unconsolidated	Continue to monitor nitrate.	<ul style="list-style-type: none"> Nitrate was detected at concentrations of 92 mg/L in Spring 2019 and 89 mg/L in Fall 2019, exceeding the MCL of 10 mg/L. 	<ul style="list-style-type: none"> Continue to monitor nitrate. Analyze for ammonia to provide supplemental data for the RI. 	2
28	RVAAP-12 Load Line 12	LL12mw-187	Unconsolidated	Continue to monitor nitrate and metals.	<ul style="list-style-type: none"> Nitrate was detected at a concentration of 1,600 mg/L in Spring 2019, exceeding the MCL of 10 mg/L. Nitrate was not detected in Fall 2019. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at concentrations of 2.9 mg/L in Spring 2019 and 2.6 mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor nitrate. Analyze for ammonia to provide supplemental data for the RI. 	2
	RVAAP-12 Load Line 12	LL12mw-242	Unconsolidated	Continue to monitor nitrate and metals.	<ul style="list-style-type: none"> Nitrate was not detected. All metal concentrations were below the screening level or background concentration with the exceptions of arsenic and manganese. Arsenic was detected at concentrations of 0.022 mg/L (unfiltered) and 0.013J mg/L (filtered) in Spring 2019. Arsenic was detected at concentrations of 0.02 mg/L (unfiltered) and 0.018 mg/L (filtered) in Fall 2019, exceeding the MCL of 0.01 mg/L. Manganese was detected at concentrations of 0.15 mg/L (unfiltered) and 0.11 mg/L (filtered) in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Nitrate was analyzed 24 times since 2004. All results were below the MCL of 10 mg/L. Seven of 10 results since 2015 have been nondetect. 	NS
	RVAAP-12 Load Line 12	LL12mw-245	Unconsolidated	Continue to monitor explosives, nitrate, and metals at this exit pathway well.	<ul style="list-style-type: none"> Nitrate was detected at estimated concentrations of 0.12J mg/L in Spring 2019 and 0.23J mg/L in Fall 2019, below the MCL of 10 mg/L. All explosive concentrations were below the screening level, and the only detected explosives were TNT and RDX in Spring 2019 at low, estimated concentrations. All metal concentrations were below the screening level or background concentration, with the exceptions of arsenic and manganese. Arsenic was detected at a concentration of 0.012 mg/L in Spring 2019, exceeding the MCL of 0.01 mg/L. Manganese was detected at a concentration of 0.12 mg/L, exceeding the background concentration of 0.075 mg/L in Fall 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Nitrate was analyzed 24 times since 2004. All results were below the MCL of 10 mg/L. Three of six results since 2017 have been nondetect. 	NS
	RVAAP-12 Load Line 12 (south of Load Line 12 fence)	LL12mw-247	Unconsolidated	Continue to monitor metals and nitrate at this exit pathway well.	<ul style="list-style-type: none"> Nitrate was not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.16 mg/L in Spring 2019 and at an estimated concentration of 0.15J mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Nitrate was analyzed 17 times since 2012. All results were below the MCL of 10 mg/L. Ten of 12 results since 2014 have been nondetect. 	NS
	RVAAP-13 Building 1200	B12mw-012	Upper Sharon	Analyze for metals to further understand nature and extent of contamination (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> This well was sampled in Fall 2019 only. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at an estimated concentration of 0.55J mg/L, which exceeded the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
29	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-168	Unconsolidated	Not sampled in 2019.	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Monitor for explosives. Most recent sample for explosives analysis was October 2016. Historical concentrations are all below screening level. 	2

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
30	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-170	Homewood	Not sampled in 2019.	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Monitor for explosives. Most recent sample for explosives analysis was October 2011. Historical concentrations are all below screening level. 	2
31	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-171	Homewood	Continue to monitor cyanide, anions, and alkalinity.	<ul style="list-style-type: none"> pH ranged from 5.7 to 5.76, along with alkalinity ranging from 41 to 45 mg/L in 2019. Nitrite and sulfide were not detected, and nitrate was detected at concentrations below the MCL of 10 mg/L. Cyanide was not detected. 	<ul style="list-style-type: none"> Monitor for explosives. Most recent sample for explosives analysis was October 2011. Historical concentrations are all below screening level. 	2
	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-172	Homewood	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
32	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood	Continue to monitor explosives, anions, and alkalinity.	<ul style="list-style-type: none"> pH ranged from 5.15 to 5.38, along with alkalinity ranging from 4.8J to 11 mg/L in 2019. Nitrite and sulfide were not detected, and nitrate was detected below the MCL of 10 mg/L. Many explosives exceeded screening criteria in Spring 2019. TNT at a concentration of 10 µg/L exceeded the RSL of 0.98 mg/L. 2,4-DNT at a concentration of 0.67 µg/L exceeded the RSL of 0.24 µg/L. 2-Amino-4,6-DNT at a concentration of 15 µg/L exceeded the RSL of 3.9 µg/L. 4-Amino-2,6-DNT at a concentration of 14 µg/L exceeded the RSL of 3.9 µg/L. RDX at a concentration of 1.2J µg/L exceeded the RSL of 0.97 µg/L. 	<ul style="list-style-type: none"> Continue to monitor for explosives. 	2, 3
33	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood	Continue to monitor anions, alkalinity, and hexavalent chromium.	<ul style="list-style-type: none"> pH ranged from 5.59 to 5.61, along with alkalinity ranging from 8.7J to 13 mg/L in 2019. Nitrate and nitrite were detected at concentrations below their MCL. Hexavalent chromium was not detected. 	<ul style="list-style-type: none"> Monitor for explosives. 	2
34	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-176	Unconsolidated	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Monitor for explosives. 	2
35	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-177	Unconsolidated	Not sampled in 2019.	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> Monitor for explosives. Most recent sample for explosives analysis was October 2011. Historical concentrations are all below screening level. 	2
	RVAAP-34 Sand Creek Disposal Road Landfill	SCLmw-001	Unconsolidated	Continue quarterly monitoring for anions, perchlorate, phosphorus, explosives, PCBs, pesticides, VOCs, SVOCs, PAHs, cyanide, hexavalent chromium, and metals (January/May/August 2019).	<ul style="list-style-type: none"> Explosives, PCBs, pesticides, VOCs, nitrate, nitrite, and sulfide were not detected during any sampling event. The only SVOC detected was naphthalene. Naphthalene was detected in January 2019 at a low, estimated concentration of 0.017 J µg/L, below the RSL of 0.17 µg/L. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese exceeded the background concentration of 0.075 mg/L at concentrations of 0.39 mg/L (January 2019), 0.31 mg/L (May 2019), and 0.26 mg/L (August 2019). Cyanide was detected at an estimated concentration of 0.015 mg/L in May 2019, below the MCL of 0.2 mg/L. Perchlorate was detected at an estimated concentration of 0.012 µg/L in January 2019, below the RSL of 1.4 µg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
	RVAAP-34 Sand Creek Disposal Road Landfill	SCLmw-002	Unconsolidated	Continue quarterly monitoring for anions, perchlorate, phosphorus, explosives, PCBs, pesticides, VOCs, SVOCs, PAHs, cyanide, hexavalent chromium, and metals (January/May/August 2019).	<ul style="list-style-type: none"> PCBs, pesticides, nitrate, nitrite, and sulfide were not detected. All metal concentrations were below the screening criteria or background concentration with the exception of manganese. Manganese exceeded the background concentration of 0.075 mg/L at concentrations of 1.2J mg/L (January 2019), 1.1 mg/L (May 2019), and 0.74 mg/L (August 2019). Cyanide was detected at an estimated concentration of 0.0052J mg/L in the field duplicate sample from May 2019, which is below the MCL of 0.2 mg/L. Perchlorate was detected at a low, estimated concentration of 0.014J µg/L in January 2019. Benzoic acid was the only SVOC detected. It was detected at an estimated concentration of 9.8J µg/L in January 2019, below the RSL of 7,500 µg/L. Acetone and methylene chloride were the only detected VOCs. Acetone was detected at an estimated concentration of 2.1J µg/L in May 2019, below the Tapwater RSL of 1,400 µg/L. Methylene chloride was detected in a field duplicate sample in January 2019 at an estimated concentration of 0.41J µg/L, below the RSL of 11 µg/L. RDX was the only explosive detected. RDX was detected at a concentration of 0.54 µg/L, below the RSL of 0.97 µg/L in August 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-34 Sand Creek Disposal Road Landfill	SCLmw-003	Unconsolidated	Continue quarterly monitoring for anions, perchlorate, phosphorus, explosives, PCBs, pesticides, VOCs, SVOCs, PAHs, cyanide, hexavalent chromium, and metals (January/May/August 2019).	<ul style="list-style-type: none"> Explosives, PCBs, pesticides, phosphorus, cyanide, nitrate, nitrite, and sulfide were not detected. Perchlorate was detected at a low, estimated concentration of 0.0099J µg/L in January 2019. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese exceeded the background concentration of 0.075 mg/L at concentrations of 0.33 mg/L in January 2019, 0.23 mg/L in May 2019, and 0.26 mg/L in August 2019. Benzoic acid was the only SVOC detected. It was detected at an estimated concentration of 11J µg/L in January 2019, below the screening level of 7,500 µg/L. Acetone was the only VOC detected. Acetone was detected at an estimated concentration of 2.1J µg/L in May 2019, below the Tapwater RSL of 1,400 µg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-38 NACA Test Area	NTAmw-119	Unconsolidated	Continue to monitor PAHs, explosives, and metals.	<ul style="list-style-type: none"> PAHs were not detected. The only explosive detected was 4-nitrotoluene in Fall 2019 at an estimated concentration of 0.31J µg/L, below the screening level of 5.01 µg/L. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.33 mg/L in Spring 2019 and at an estimated concentration of 0.29J mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosives have been analyzed in 17 different sampling events since 2012, and explosive concentrations have never exceeded the screening levels. 	NS
	RVAAP-38 NACA Test Area	NTAmw-120	Upper Sharon	Monitor hexachlorocyclopentadiene in spring due to rejected 2018 results.	<ul style="list-style-type: none"> This well was sampled in Spring 2019 only. Hexachlorocyclopentadiene was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-40 Load Line 7	LL7mw-001	Homewood	Continue to sample for metals and cyanide.	<ul style="list-style-type: none"> All metal concentrations were below the screening level or background concentration. Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
	RVAAP-40 Load Line 7	LL7mw-006	Homewood	Continue to monitor explosives.	<ul style="list-style-type: none"> All explosives were below their screening level. 	<ul style="list-style-type: none"> Additional sampling is not recommended. Explosive concentrations have never exceeded the screening level at this well. 	NS
36	RVAAP-43 Load Line 10	LL10mw-003	Homewood	Continue to monitor VOCs.	<ul style="list-style-type: none"> All VOCs were not detected except acetone, carbon tetrachloride, and chloroform, which were below their respective screening levels. 	<ul style="list-style-type: none"> Continue to monitor for carbon tetrachloride to verify recent reduced concentrations. 	2
	RVAAP-43 Load Line 10	LL10mw-005	Homewood	Continue to monitor metals.	<ul style="list-style-type: none"> All metals were below the screening level or background concentration with the exception of manganese. Manganese was not detected in Spring 2019. Manganese was detected at an estimated concentration of 2.2J mg/L in Fall 2019, exceeding the background concentration of 0.56 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-44 Load Line 11	LL11mw-005	Unconsolidated	Continue to monitor cyanide	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-49 Central Burn Pits	CBPmw-008	Unconsolidated	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-49 Central Burn Pits	CBPmw-009	Upper Sharon	Continue to monitor cyanide.	<ul style="list-style-type: none"> Cyanide was not detected. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
	RVAAP-66 Facility-wide Groundwater (north of Smalley Road, Paris-Windham Road intersection)	FWGmw-002	Unconsolidated	Analyze for metals to further understand nature and extent of contamination (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> This well was only sampled in Fall 2019. All metal concentrations were below the screening level or background concentration with the exceptions of aluminum and manganese. Aluminum was detected at a concentration of 2.2 mg/L (unfiltered) in Fall 2019, exceeding the RSL of 2.0 mg/L. Manganese was detected at a concentration of 0.12 mg/L (filtered) and at an estimated concentration of 0.16J mg/L (unfiltered) in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
37	RVAAP-66 Facility-wide Groundwater (southern portion of Administration Area)	FWGmw-004	Unconsolidated	Continue to monitor explosives and metals for migration potential. Analyze for cyanide to address potential data gap (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> Explosives were not detected. All metals were below the screening level or background concentration. Cyanide was detected at an estimated concentration of 0.0095J mg/L in Fall 2019, below the MCL of 0.2 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1
38	RVAAP-66 Facility-wide Groundwater (southwestern portion of facility, south of NACA Test Area)	FWGmw-007	Unconsolidated	Continue to monitor explosives and metals for migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.13 mg/L in Spring 2019 and at an estimated concentration of 0.088J mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1
39	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-011	Unconsolidated	Continue to monitor explosives and metals for migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.29 mg/L in Spring 2019 and at an estimated concentration of 0.24J mg/L in Fall 2019, exceeding the background concentration of 0.075 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1, 4
40	RVAAP-66 Facility-wide Groundwater (near East Classification Yard)	FWGmw-012	Upper Sharon	Continue to monitor explosives and metals for migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals for migration potential. 	1, 4

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
41	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-015	Unconsolidated	Continue to monitor explosives and metals for migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.34 mg/L, exceeding the background concentration of 0.075 mg/L in Fall 2019. Manganese did not exceed the screening level or background concentration in Spring 2019. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1, 4
42	RVAAP-66 Facility-wide Groundwater (southeast of Administration Area)	FWGmw-016	Upper Sharon	Continue to monitor explosives and metals for migration potential.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at a concentration of 0.22 mg/L, which exceeded the background concentration of 0.198 mg/L in Spring 2019. Manganese did not exceed the screening level or background concentration in Fall 2019. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1, 4
43	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-018	Basal Sharon	Continue to monitor VOCs, metals, and cyanide in this exit pathway well.	<ul style="list-style-type: none"> VOCs were not detected. All metal concentrations were below the screening level or background concentration. Cyanide was detected at an estimated concentration of 0.0065J mg/L in Spring 2019, below the MCL of 0.2 mg/L. Cyanide was not detected in Fall 2019. 	<ul style="list-style-type: none"> Continue to monitor VOCs and metals in this exit pathway well. 	1, 4
	RVAAP-66 Facility-wide Groundwater (located between Load Line 10 and Load Line 9)	FWGmw-019	Basal Sharon	Resample for rejected propellant results from 2018.	<ul style="list-style-type: none"> This well was sampled in Spring 2019 as a re-collection of propellants. The propellants nitrocellulose and nitroguanidine were not detected in Spring 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
44	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 12)	FWGmw-020	Upper Sharon	Continue to monitor VOCs, metals, and cyanide in this exit pathway well.	<ul style="list-style-type: none"> VOCs were not detected. All metal concentrations were below the screening level or background concentration with the exception of arsenic. Arsenic was detected at a concentration of 0.023 mg/L in Spring 2019 and at an estimated concentration of 0.031J mg/L in Fall 2019, exceeding the MCL of 0.01 mg/L. Cyanide was detected at a concentration of 0.011 mg/L in Spring 2019, which is below the MCL of 0.2 mg/L. Cyanide was not detected in Fall 2019. 	<ul style="list-style-type: none"> Continue to monitor VOCs and metals in this exit pathway well. 	1, 4
45	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 3)	FWGmw-021	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> All explosive concentrations were below the screening level. All metal concentrations were below the screening level or background concentration with the exception of manganese. Manganese was detected at an estimated concentration of 0.39J mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1
	RVAAP-66 Facility-wide Groundwater (located between Load Line 10 and Load Line 9)	FWGmw-022	Upper Sharon	Resample for rejected propellant results from 2018.	<p>This well was sampled in Spring 2019 as a re-collection of propellants.</p> <ul style="list-style-type: none"> The propellants nitrocellulose and nitroguanidine were not detected in Spring 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS

Table 3-3. Recommended FWGWMP Wells for 2020 (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	2019 FWGWMP Sampling Recommendations	2019 Sampling Results	2020 FWGWMP Sampling Recommendations	FWGWMP Sampling Criterion (See Section 3.4)
	RVAAP-66 Facility-wide Groundwater (located between Load Line 7 and Fuze and Booster Quarry Landfill/Ponds)	FWGmw-023	Upper Sharon	Resample for rejected propellant results from 2018.	This well was sampled in Spring 2019 as a re-collection of propellants. <ul style="list-style-type: none"> The propellants nitrocellulose and nitroguanidine were not detected in Spring 2019. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS
46	RVAAP-66 Facility-wide Groundwater (off-facility, south of State Route 5, south of Load Line 2)	FWGmw-024	Upper Sharon	Continue to monitor explosives and metals.	<ul style="list-style-type: none"> Explosives were not detected. All metal concentrations were below the screening level or background concentration with the exceptions of manganese. Manganese was detected at a concentration of 0.33 mg/L in Spring 2019 and 0.26J mg/L in Fall 2019, exceeding the background concentration of 0.198 mg/L. 	<ul style="list-style-type: none"> Continue to monitor explosives and metals in this exit pathway well. 	1
47	RVAAP-66 Facility-wide Groundwater (southeastern portion of facility)	SCFmw-004	Basal Sharon	Continue to monitor metals.	<ul style="list-style-type: none"> All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Continue to monitor metals and monitor explosives in this exit pathway well. 	1
	RVAAP-66 Facility-wide Groundwater (north of Smalley Road, Paris-Windham Road intersection)	BKGmw-021	Unconsolidated	Analyze for metals to further understand nature and extent of contamination (per FCR LEIDOS_FWGW_009).	<ul style="list-style-type: none"> This well was sampled in Fall 2019 only. All metal concentrations were below the screening level or background concentration. 	<ul style="list-style-type: none"> Additional sampling is not recommended. 	NS


 Denotes wells where additional sampling is not recommended.

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

CERCLA = Community Environmental Response, Compensation, and Liability Act.

DFFO = Director's Final Findings and Orders.

DNB = Dinitrobenzene.

DNT = Dinitrotoluene.

FCR = Field Change Request.

FWGWMP = Facility-Wide Groundwater Monitoring Plan.

MCL = Maximum Contaminant Level.

µg/L = Micrograms per Liter.

mg/L = Milligrams per Liter.

NACA = National Advisory Committee on Aeronautics.

NS = No Sampling Recommended.

PAH = Polycyclic Aromatic Hydrocarbon.

PCB = Polychlorinated Biphenyl.

RCRA = Resource Conservation and Recovery Act.

RDX = Hexahydro-1,3,5-Trinitro-1,3,5-Triazine.

RIWP = Remedial Investigation Work Plan.

RSL = Regional Screening Level.

RVAAP = Ravenna Army Ammunition Plant.

S.U. = Standard Unit.

SVOC = Semi-Volatile Organic Compound.

TNT = 2,4,6-Trinitrotoluene.

VOC = Volatile Organic Compound.

Table 3-4. FWGWMP Wells with Analytical Testing Suite

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	VOCs	SVOCs (1)	PCBs	Pesticides	Cyanide	Nitrate	pH Assessment Suite	Other
1	RVAAP-01 Ramsdell Quarry	RQLmw-007	Upper Sharon	X	X	X	X	X	X	X			Phosphorus
2	RVAAP-01 Ramsdell Quarry	RQLmw-008	Upper Sharon	X	X	X	X	X	X	X			
3	RVAAP-01 Ramsdell Quarry	RQLmw-009	Upper Sharon	X	X	X	X	X	X	X			
4	RVAAP-01 Ramsdell Quarry	RQLmw-011	Upper Sharon									X	
5	RVAAP-01 Ramsdell Quarry	RQLmw-013	Upper Sharon									X	
6	RVAAP-04 Open Demolition Area #2	DETmw-003	Unconsolidated	X	X	X	X	X	X	X			
7	RVAAP-04 Open Demolition Area #2	DETmw-004	Unconsolidated	X	X	X	X	X	X	X			
8	RVAAP-05 Winklepeck Burning Grounds	WBGmw-006	Unconsolidated		X								
9	RVAAP-05 Winklepeck Burning Grounds	WBGmw-009	Unconsolidated		X								
10	RVAAP-05 Winklepeck Burning Grounds	WBGmw-020	Upper Sharon		X								
11	RVAAP-05 Winklepeck Burning Grounds	WBGmw-021	Upper Sharon		X								
12	RVAAP-08 Load Line 1	LL1mw-063	Unconsolidated		X							X	
13	RVAAP-08 Load Line 1	LL1mw-064	Unconsolidated	X	X								
14	RVAAP-08 Load Line 1	LL1mw-080	Upper Sharon		X								
15	RVAAP-08 Load Line 1	LL1mw-081	Upper Sharon		X								
16	RVAAP-08 Load Line 1	LL1mw-083	Upper Sharon		X							X	
17	RVAAP-08 Load Line 1	LL1mw-084	Upper Sharon		X								
18	RVAAP-08 Load Line 1	LL1mw-086	Unconsolidated									X	
19	RVAAP-08 Load Line 1	LL1mw-087	Unconsolidated	X	X								Perchlorate
20	RVAAP-08 Load Line 1	LL1mw-089	Unconsolidated	X	X							X	
21	RVAAP-09 Load Line 2	LL2mw-059	Upper Sharon		X								
22	RVAAP-09 Load Line 2	LL2mw-267	Upper Sharon		X								
23	RVAAP-10 Load Line 3	LL3mw-237	Upper Sharon		X								
24	RVAAP-10 Load Line 3	LL3mw-238	Upper Sharon		X								
25	RVAAP-10 Load Line 3	LL3mw-239	Upper Sharon		X								
26	RVAAP-10 Load Line 3	LL3mw-241	Upper Sharon		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-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-168	Unconsolidated		X								
30	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-170	Homewood		X								
31	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-171	Homewood		X								
32	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-174	Homewood		X								
33	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-175	Homewood		X								
34	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-176	Unconsolidated		X								
35	RVAAP-16 Fuze and Booster Quarry Landfill/Ponds	FBQmw-177	Unconsolidated		X								
36	RVAAP-43 Load Line 10	LL10mw-003	Homewood										Carbon Tetrachloride
37	RVAAP-66 Facility-wide Groundwater	FWGmw-004	Unconsolidated	X	X								
38	RVAAP-66 Facility-wide Groundwater	FWGmw-007	Unconsolidated	X	X								
39	RVAAP-66 Facility-wide Groundwater	FWGmw-011	Unconsolidated	X	X								
40	RVAAP-66 Facility-wide Groundwater	FWGmw-012	Upper Sharon	X	X								
41	RVAAP-66 Facility-wide Groundwater	FWGmw-015	Unconsolidated	X	X								
42	RVAAP-66 Facility-wide Groundwater	FWGmw-016	Upper Sharon	X	X								
43	RVAAP-66 Facility-wide Groundwater	FWGmw-018	Basal Sharon	X		X							
44	RVAAP-66 Facility-wide Groundwater	FWGmw-020	Upper Sharon	X		X							
45	RVAAP-66 Facility-wide Groundwater	FWGmw-021	Upper Sharon	X	X								

Table 3-4. FWGWMP Wells with Analytical Testing Suite (continued)

No.	RVAAP-66 Area	Well Name	Aquifer	Metals	Explosives	VOCs	SVOCs (1)	PCBs	Pesticides	Cyanide	Nitrate	pH Assessment Suite	Other
46	RVAAP-66 Facility-wide Groundwater	FWGmw-024	Upper Sharon	X	X								
47	RVAAP-66 Facility-wide Groundwater	SCFmw-004	Basal Sharon	X	X								

Notes:

X = Indicates well or constituent to be sampled as part of the 2020 FWGWMP. Wells and constituents will be sampled semi-annually unless indicated by footnotes described below.

¹ SVOCs include phthalates, nitroaromatics, polycyclic aromatic hydrocarbons, and phenols.

² pH assessment suite includes: Sulfate/sulfide, nitrate/nitrite, and alkalinity.

FWGWMP = Facility-wide Groundwater Monitoring Program.

PCB = Polychlorinated Biphenyl.

RVAAP = Ravenna Army Ammunition Plant.

SVOC = Semi-volatile Organic Compound.

VOC = Volatile Organic Compound.

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Table 3-5. Analytical Laboratory Test Methods

Constituents	Method¹
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)
Nitroguanidine (Propellant)	Organic Compounds by HPLC (8330 modified)
Nitroaromatics and Nitramines (Explosives)	Explosives by HPLC (8330)
Nitrocellulose (Propellant)	Colorimetric Cadmium Reduction 353.2 ²
Nitrate/Nitrites Sulfate	General Chemistry (9056) General Chemistry (9056A)
Sulfide	General Chemistry (9034)
Total Alkalinity	General Chemistry (SM2320B) ³
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)
Perchlorate	Ion Chromatography/MS (6860)

Notes:

¹ USEPA SW846

² USEPA Methods for Chemical Analysis of Water and Waste

³ 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.

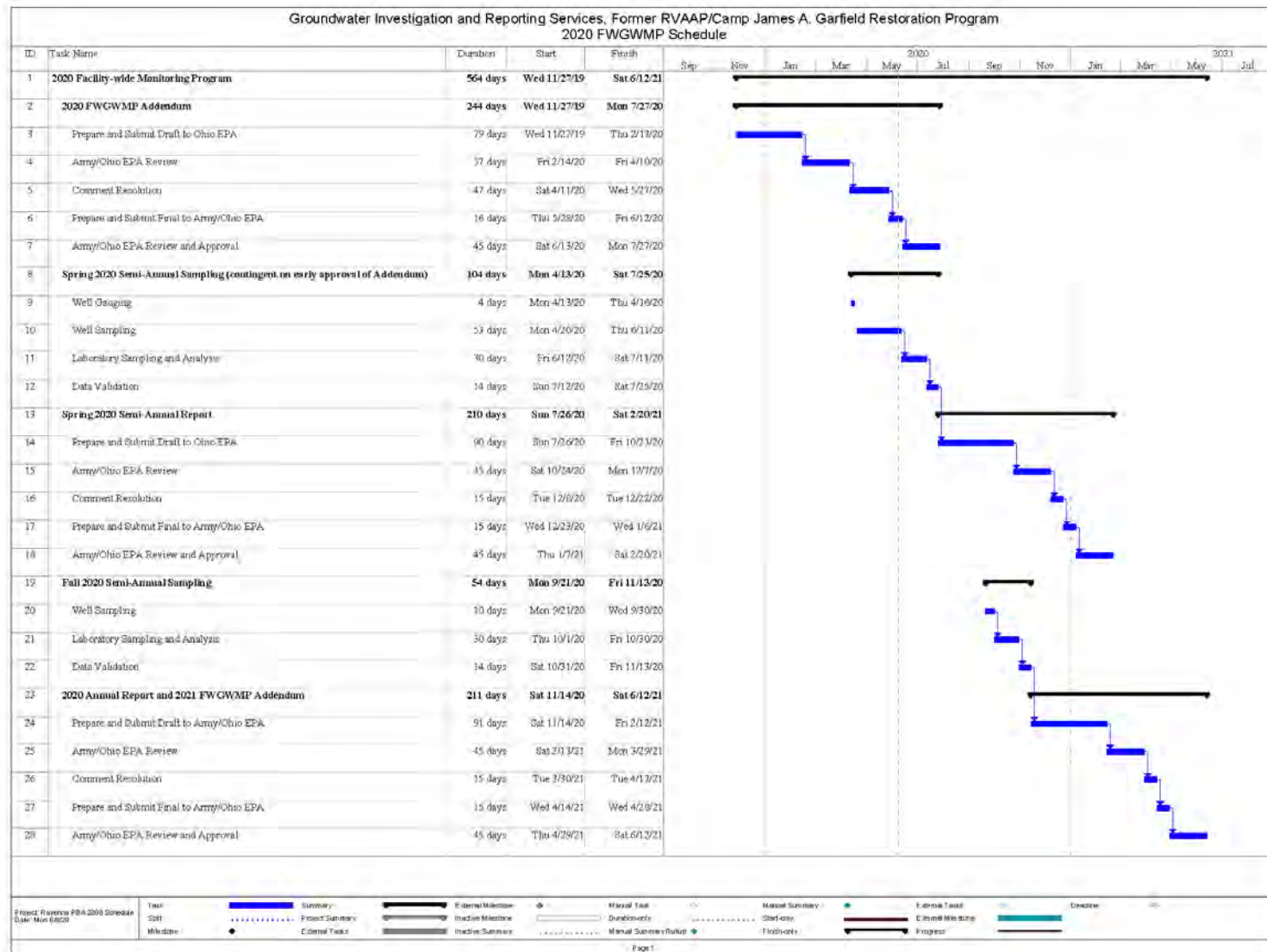
SVOC = Semi-volatile Organic Compound.

USEPA = U.S. Environmental Protection Agency.

VOC = Volatile Organic Compound.

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4.0 SCHEDULE



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5.0 REFERENCES

Leidos 2019a. *Facility-wide Groundwater Monitoring Program Plan Facility-wide Groundwater Addendum for 2019*. January 2019.

Leidos 2019b. *Background Study for Metals for RVAAP-66 Facility-wide Groundwater*. August 2019.

Leidos 2020. *Facility-wide Groundwater Monitoring Program RVAAP-66 Facility-wide Groundwater Annual Report for 2019*. January 2020.

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

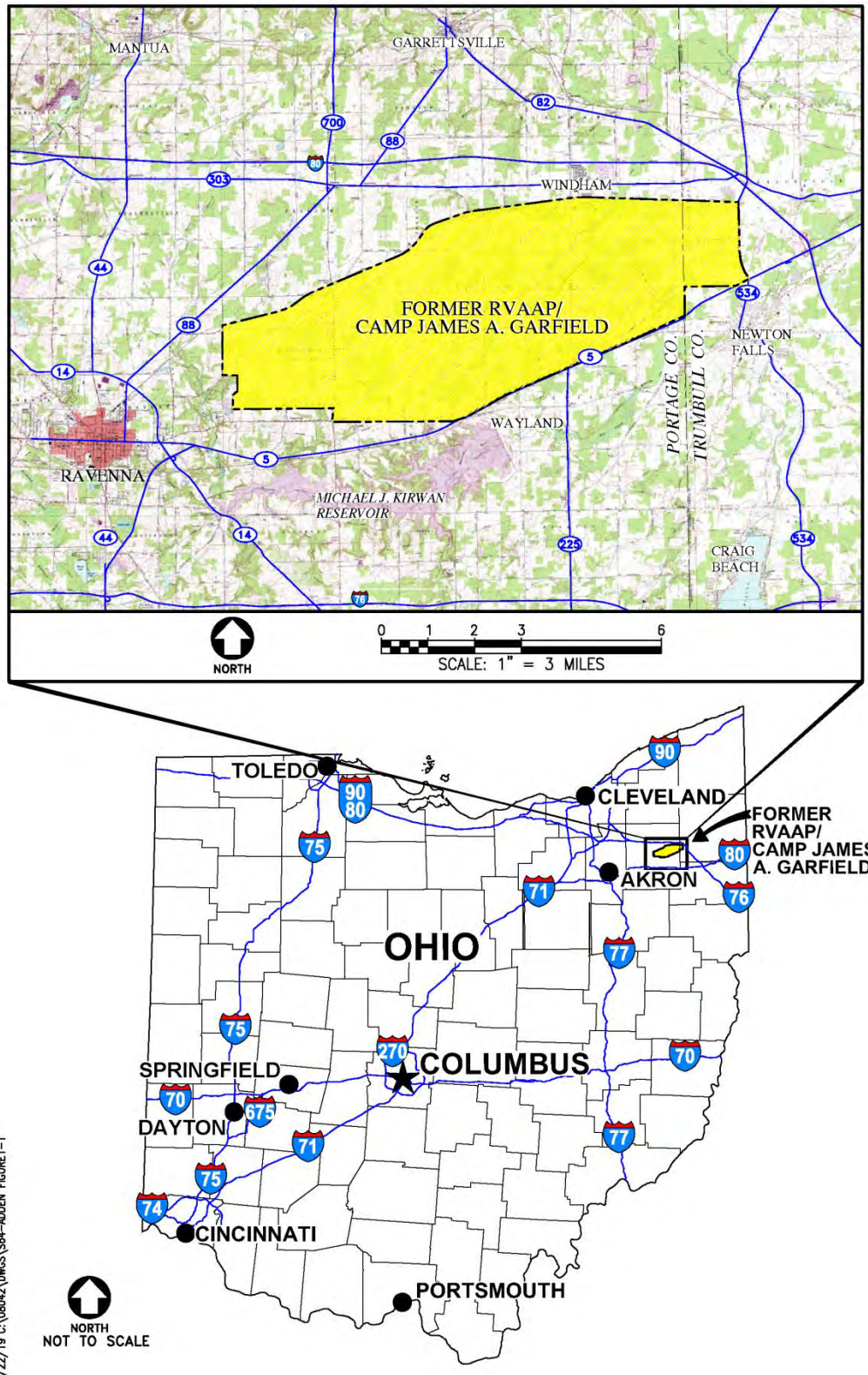
Portage Environmental 2004. *Facility-wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio*. September 2004.

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

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FIGURES

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

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

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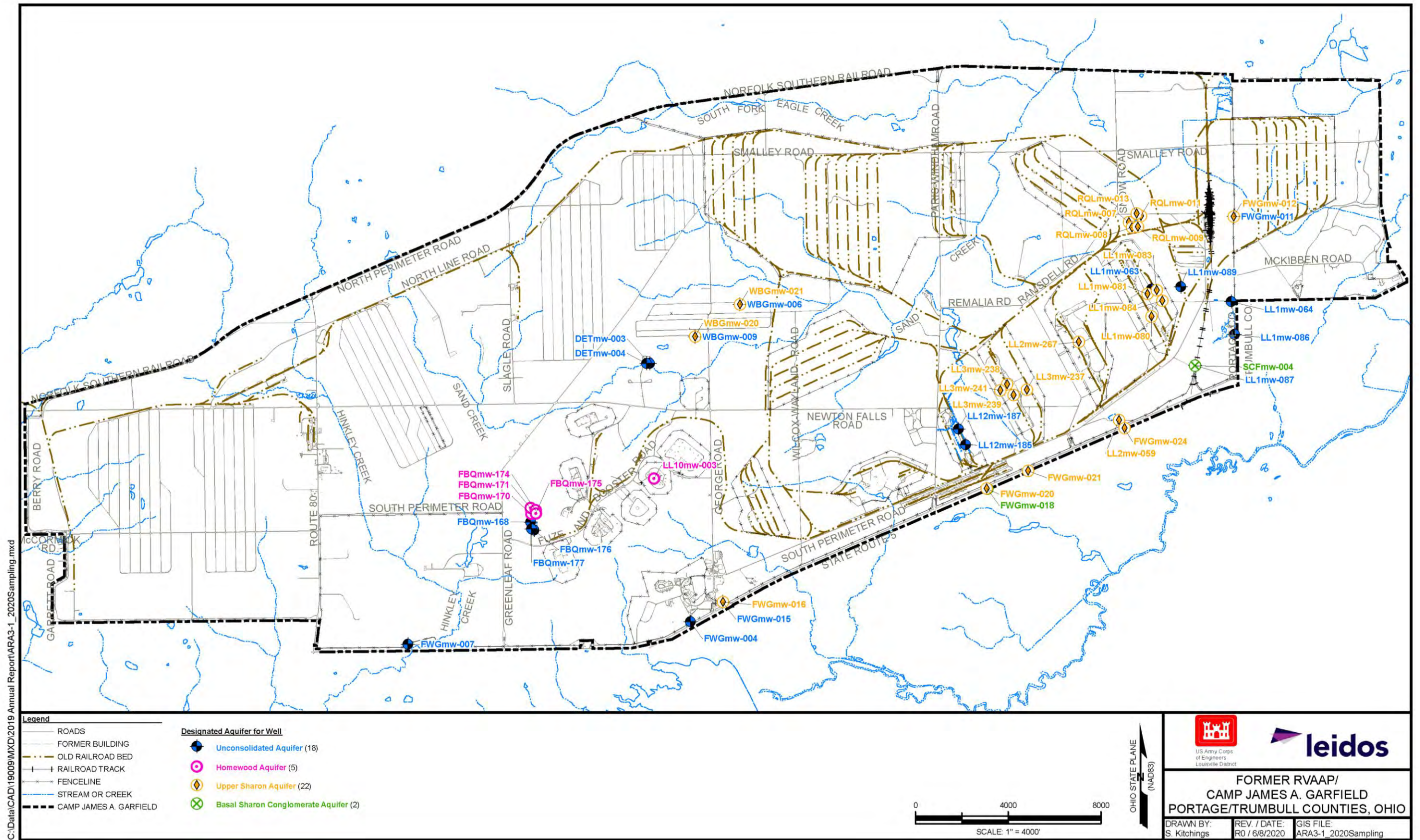


Figure 3-1. 2020 FWGWMP Wells

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APPENDIX A

Ohio EPA Comments

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Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

May 27, 2020

RE: US Army Ammunition Plt RVAAP
Remediation Response
Project Records
Remedial Response
Portage County
ID # 267000859036

Mr. David Connolly
Army National Guard Directorate
Environmental Programs Division
ARNGD-ILE-CR
111 South George Mason Drive
Arlington, VA 22204

TRANSMITTED ELECTRONICALLY

Subject: Response to Ohio EPA Comments on the “Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2020” Dated May 1, 2020

Dear Mr. Connolly:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the Response to Ohio EPA comments on the “Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Sampling Addendum for 2020”. This document was received via email at Ohio EPA’s Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR), on May 6, 2020. The response was prepared for the U.S. Army Corps of Engineers on behalf of the National Guard Bureau by Leidos under Contract Number W912QR-16-D-0003.

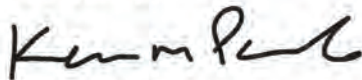
Ohio EPA finds that the comments from Ohio EPA’s April 10, 2020 comment letter have been adequately addressed and are resolved with no further comments warranted. Please finalize the document with the changes agreed to according to this correspondence.

**RECEIVED
MAY 27 2020**

MR. DAVID CONNOLLY
RVAAP-66 FWGW
MAY 27, 2020
PAGE 2 OF 2

If you have questions, please contact me at (330) 963-1292, or by email at kevin.palombo@epa.ohio.gov.

Sincerely,



Kevin M. Palombo
Environmental Specialist
Division of Environmental Response and Revitalization

KP/sc

ec: David Connolly, ARNGD
Katie Tait, OHARNG RTLS
Kevin Sedlak, ARNG
Rebecca Shreffler, Chenega Tri-Services
Craig Coombs, USACE Louisville
Nat Peters, USACE Louisville
Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Thomas Schneider, Ohio EPA, SWDO, DERR
Liam McEvoy, Ohio EPA, NEDO, DERR
Carrie Rasik, Ohio EPA, CO, DERR



NATIONAL GUARD BUREAU

111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

May 1, 2020

Ohio Environmental Protection Agency
DERR-NEDO
Attn: Mr. Kevin Palombo
2110 East Aurora Road
Twinsburg, OH 44087-1924

Subject: Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, RVAAP-66 Facility-Wide Groundwater, Responses to Comments on the Groundwater Monitoring Addendum for 2020 (Work Activity No. 267-000-859-036)

Dear Mr. Palombo:

The Army appreciates your time and comments on the *Draft Facility-Wide Groundwater Monitoring Program Addendum for 2020*. Enclosed for your review are responses to your comments. Upon resolution of these comments, the Army will provide a Final version of the addendum for Ohio EPA concurrence.

This addendum was prepared for the Army in support of the RVAAP restoration program. Please contact the undersigned at (703) 607-7589 or david.m.connolly8.civ@mail.mil if there are issues or concerns with this submission.

Sincerely,

Date: 2020.05.05
15:00:46 -04'00'

David Connolly
RVAAP Restoration Program Manager
Army National Guard Directorate

cc: Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Liam Envoy, Ohio EPA, NEDO, DERR
Thomas Schneider, Ohio EPA, SWDO, DERR
Carrie Rasik, Ohio EPA, CO, DERR
Kevin Sedlak, ARNG, Camp James A. Garfield
Katie Tait, OHARNG, Camp James A. Garfield
Craig Coombs, USACE Louisville
Jay Trumble, USACE Louisville
Vasu Peterson, Leidos
Jed Thomas, Leidos
Jennifer Tierney, Vista Sciences Corporation

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Addendum for 2020 (Work Activity No. 267-000-859-036)

Comments

Ohio EPA Comment 1: Table 3-3 of the Draft FWGWMP Addendum Report for 2020. Table 3-3 indicates that sampling was recommended to be discontinued at 36 wells and that a reduction in contaminant analyses would be conducted at numerous other wells on the table.

The Army should verify that the discontinuation of these 36 wells and subsequent reduced sampling/analysis for the remaining FWGWMP wells for 2020 meet the discontinuation criteria specified in the 2016 remedial investigation work plan (RIWP) (i.e., whether that criteria is statistical trend analysis of historical results, certain number of non-detect results, etc.). Additionally, if these sampling changes would result in the necessity to modify the existing RIWP, then a plan or schedule for such modification procedures should be contemplated and relayed to Ohio EPA for concurrence.

Ohio EPA DERR is in general concurrence with the proposed reduction in monitoring, but also recommends that the Army verify the reduction in well analyses for 2020 will not result in significant data gaps in the vertical or horizontal delineation directions around each affected AOC. Understandably, most of these wells proposed for discontinuation have had non-detects, but if additional delineation or confirmation is required at a later date, these wells may need to be resampled.

Army Response: Clarification. The RI Work Plan does not provide discontinuation criteria for the annual FWGWMP sampling scheme. The purpose of the Addendums are to serve as the annual modification to the FWGWMP sampling scheme; therefore, upon approval of this Addendum, modifications to the RI Work Plan will not be necessary.

The annual Addendums provide rationale for continuation of sampling at certain wells (please reference FWGWMP Criteria 1 to 4, presented in Section 1.2 of the 2020 Addendum). The development of the 2020 Addendum included an evaluation of analytical results against these criteria. Columns are included in Table 3-3 that provides the 2019 sampling results and provides 2020 sampling recommendations. In addition, a column is in Table 3-3 that presents which of the FWGWMP Criterion is rationale for inclusion of a well into the 2020 FWGWMP sampling scheme.

The development of the Draft 2020 Addendum coincided with the development of the Preliminary Draft Remedial Investigation Report (currently under review by the Army). The development of the RI Report included a data gap assessment. As per that assessment, the Army plans to add the following wells to sample and chemicals to analyze in the 2020 Addendum to supplement findings and conclusions in the RI Report.

- LL3mw-238, LL3mw-239, and LL3mw-241 for explosives to assess extent of contamination.
- LL10mw-003 for carbon tetrachloride to verify recent reduced concentrations in this well.
- LL12mw-185 and LL12mw-187 for ammonia to obtain more recent concentrations from these wells. (Note: LL12mw-185 and LL12mw-187 are currently in the 2020 Addendum for analysis of nitrate).

Please also note the RI is intended to inform what will become the final facility groundwater monitoring program as stated in Section 3.7 of the Final RIWP, *a revised configuration of the final FWGMP network (for routine groundwater monitoring purposes) will be established after completion of the FWGW RI to support selection, implementation, and long-term monitoring of the selected FWGW remedy(s).* Interim

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Addendum for 2020 (Work Activity No. 267-000-859-036)

findings of the RI are used to further inform the Addendum with information including identification of data gaps as noted above.

Ohio EPA Comment 2: Sampling for Manganese. Sampling for manganese should continue in 2020 for the following wells to aid in data trend interpretation because at least one detection from the previous four quarters of sampling was above the RSL-based remedial goal (0.43 mg/l). However, if manganese was not identified as a potential leaching chemical of potential concern (COPC) in the AOC's or an upgradient AOC's soil, sediment, and surface water remedial investigations then cessation of 2020 sampling can be made with proper weight of evidence explanation to Ohio EPA.

- EBGmw-125
 - 0.56J mg/l Fall 2019 *first sampling event
- LL1mw-086
 - 0.55 mg/l Fall 2018
 - 0.36 mg/l Spring 2019
 - 0.51 mg/l Fall 2019
- LL2mw-267
 - 0.56 mg/l Fall 2018
 - 0.77 mg/l Summer 2019
 - 0.69 mg/l Fall 2019
- SCLmw-002
 - 0.76 mg/l Fall 2018
- B12mw-012
 - 0.55J mg/l Fall 2019 *first sampling event
- LL10mw-005
 - 0.87 mg/l Summer 2018
 - 0.62 mg/l Fall 2018

Army Response: Clarification. Upon review of these results during development of the 2020 Addendum and Preliminary Draft RI Report, the Army determined it was not necessary to further pursue manganese concentrations in groundwater at these wells.

Within the current data set, wells EBGmw-125, LL1mw-086, LL2mw-267, B12mw-012, and LL10mw-005 have had as few as 11 and as many as 22 samples analyzed for total or dissolved manganese. These wells had a maximum manganese concentration prior to the 2018/2019 timeframe. SCLmw-002 was installed in October 2018 and has adequate manganese concentrations to make risk assessment determinations. These results (and potential contaminant sources and source removals) are discussed and assessed in the RI Report, and manganese was not considered a groundwater COC to go forward in a feasibility study.

If, upon comment resolution of the RI Report, Ohio EPA concludes that additional analyses of manganese at these wells are required for evaluation of nature and extent and risk, the Army will include sampling of manganese in subsequent Addendums.

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Addendum for 2020 (Work Activity No. 267-000-859-036)

Ohio EPA Comment 3: Discontinuance of Sampling for pH. Discontinuance of sampling for pH at five wells is being proposed because “typically ground water pH levels range 5 to 9 Standard Units” (Section 3.2). There is no citation for the pH range provided as acceptable in the addendum. However, the pH detections in these wells do fall near the low end of Ohio EPA’s Division of Drinking and Ground Water (DDAGW) April 2014, “Major Aquifers in Ohio and Associated Ground Water Quality”.

Note: U.S. EPA does not have a regional screening level (RSL) for pH. The U.S. EPA National Secondary Drinking Water Regulations (NSDWRs) for pH is 6.5 to 8.5.

- LL1mw-084, pH ranged from 5.34 to 5.57
- RQLmw-012, pH ranged from 5.13 to 5.14
- FBQmw-171, pH ranged from 5.7 to 5.76
- FBQmw-174, pH ranged from 5.15 to 5.38
- FBQmw-175, pH ranged from 5.59 to 5.61

Army Response: Comment noted. An evaluation of potential impacts from Army activities to the pH in groundwater in these areas is included in the RI Report. In addition, LL1mw-084, FBQmw-171, FBQmw-174, and FBQmw-175 will be sampled during semi-annual events in 2020. The pH will be recorded during collection of these samples.

RQLmw-012 is not scheduled to be sampled in 2020; however, historical information and results from this well was adequate to assess the potential pH impacts at Ramsdell Quarry Landfill. If, upon comment resolution of the RI Report, Ohio EPA concludes that additional analysis of pH at RQLmw-012 is required for evaluation of nature and extent and risk, the Army will include further evaluation in subsequent Addendums.



Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

April 10, 2020

RE: US Army Ammunition Plt RVAAP
Remediation Response
Project Records
Remedial Response
Portage County
ID # 267000859036

Mr. David Connolly
Army National Guard Directorate
Environmental Programs Division
ARNGD-ILE-CR
111 South George Mason Drive
Arlington, VA 22204

TRANSMITTED ELECTRONICALLY

Subject: Ohio EPA Comments on the Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2020 dated February 11, 2020

Dear Mr. Connolly:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the Draft Facility-wide Groundwater Monitoring Program Plan RVAAP-66 Facility-wide Groundwater Addendum for 2020 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) on February 13, 2020.

The report was prepared for the United States Army Corps of Engineers on behalf of the National Guard Bureau by Leidos under Contract Number W912QR-16-D-0003. Comments on the document based on Ohio EPA review are provided below. Please provide responses to the enclosed comments in accordance with the Directors Findings and Orders.

STATEMENT

The Draft Facility-wide Groundwater Monitoring Plan (FWGWMP) Addendum for 2020 summarizes ground water monitoring objectives to be conducted during the 2020 sampling events, including:

- As an update to the FWGWMP Plan for 2019, wells selected for inclusion in the 2020 sampling events will be based on wells representing critical exit pathway monitoring points (generally a carryover from the 2019 program), wells representing primary Area of Concern (AOC)-specific contaminant source area conditions that are potentially increasing or have unstable plume conditions, wells with 2018 or 2019 sampling results representing historical (non-metal) maximum concentrations of one or more site related compounds (SRCs), and wells co-located to establish vertical extent of contaminants within the stratigraphic sequence.

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APR 10 2020

- With the exception of Resource Conservation and Recovery Act (RCRA) wells that will be sampled for the same parameters as 2019, wells sampled in 2019 that do not meet the above criteria will not be recommended for sampling in 2020.
- 2020 FWGWMP sampling will generally include wells found to have one or more screening exceedances during the 2019 sampling events.
- A total of 43 wells (including five RCRA wells) have been selected for sampling during 2020 (this is down from the previous 72 wells including five RCRA wells selected for sampling in 2019). This reduction was based on comparison of 2019 data results with background metals results as presented in the 2019 Background Study for Metals produced by Leidos. The use of calculated metals background levels resulted in fewer metals exceedances and thus fewer wells requiring additional metals analyses.
- Monitoring well sampling and analytical testing is to be completed in accordance with the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) updates provided within the 2016 Remedial Investigation Work Plan (TEC-Weston).
- Table 3-3 provides a summary of the proposed wells to be sampled during 2020, and rationale for inclusion (or removal) from the FWGWMP.
- A total of 36 wells were denoted on Table 3-3 as not being recommended for additional sampling during the 2020 FWGWMP. Numerous other wells were recommended for decreased constituent sampling.
- Table 3-4 presents the proposed analytical testing suites for each well, based on the rationales presented in Table 3-3.

COMMENTS

1. **Table 3-3 of the Draft FWGWMP Addendum Report for 2020:**

Table 3-3 indicates that sampling was recommended to be discontinued at 36 wells and that a reduction in contaminant analyses would be conducted at numerous other wells on the table.

The Army should verify that the discontinuation of these 36 wells and subsequent reduced sampling/analysis for the remaining FWGWMP wells for 2020 meet the discontinuation criteria specified in the 2016 remedial investigation work plan (RIWP) (i.e., whether that criteria is statistical trend analysis of historical results, certain number of non-detect results, etc.). Additionally, if these sampling changes would result in the necessity to modify the existing RIWP, then a plan or schedule for such modification procedures should be contemplated and relayed to Ohio EPA for concurrence.

Ohio EPA DERR is in general concurrence with the proposed reduction in monitoring, but also recommends that the Army verify the reduction in well analyses for 2020 will not result in significant data gaps in the vertical or horizontal delineation directions around each affected AOC. Understandably, most of these wells proposed for discontinuation have had non-detects, but if additional delineation or confirmation is required at a later date, these wells may need to be resampled.

2. Sampling for Manganese:

Sampling for manganese should continue in 2020 for the following wells to aid in data trend interpretation because at least one detection from the previous four quarters of sampling was above the RSL-based remedial goal (0.43 mg/l). However, if manganese was not identified as a potential leaching chemical of potential concern (COPC) in the AOC's or an upgradient AOC's soil, sediment, and surface water remedial investigations then cessation of 2020 sampling can be made with proper weight of evidence explanation to Ohio EPA.

- **EBGmw-125**
 - 0.56J mg/l Fall 2019 *first sampling event

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 - 0.87 mg/l Summer 2018
 - 0.62 mg/l Fall 2018

MR. DAVID CONNOLLY
RVAAP-66 FWGW
APRIL 10, 2020
PAGE 4 OF 4

3. Discontinuance of Sampling for pH

Discontinuance of sampling for pH at five wells is being proposed because “typically ground water pH levels range 5 to 9 Standard Units” (Section 3.2). There is no citation for the pH range provided as acceptable in the addendum. However, the pH detections in these wells do fall near the low end of Ohio EPA’s Division of Drinking and Ground Water (DDAGW) April 2014, “Major Aquifers in Ohio and Associated Ground Water Quality”.

Note: U.S. EPA does not have a regional screening level (RSL) for pH. The U.S. EPA National Secondary Drinking Water Regulations (NSDWRs) for pH is 6.5 to 8.5.

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- -FBGmw-174, pH ranged from 5.15 to 5.38
- -FBQmw-175, pH ranged from 5.59 to 5.61

This document was reviewed by personnel from Ohio EPA. Additional information is necessary to approve the document. If you have questions or would like to set up a meeting to discuss these comments, please call me at (330) 963-1292 or email me at Kevin.Palombo@epa.ohio.gov.

Sincerely,



Kevin M. Palombo
Environmental Specialist
Division of Environmental Response and Revitalization

KP/sc

ec: David Connolly, ARNG Directorate
Katie Tait, OHARNG RTLS
Kevin Sedlak, ARNG
Craig Coombs, USACE Louisville
Nat Peters, USACE Louisville
Rebecca Shreffler, Chenega Tri-Services
Bob Prinic, Ohio EPA, NEDO, DERR
Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Liam McEvoy, Ohio EPA, NEDO, DERR
Thomas Schneider, Ohio EPA, SWDO, DERR
Carrie Rasik, Ohio EPA, CO, DERR