Final

Work Plan Addendum
Additional Sampling for
CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation,
Ore Storage Pond Sub-Area,
Ravenna Army Ammunition Plant Restoration Program,
Portage and Trumbull Counties, Ohio

March 22, 2021

Contract No.: W912QR-12-D-0002
Delivery Order: 0003

Prepared for:

U.S. Army Corps of Engineers,
Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202-2267

Prepared by:

PARSONS
401 Diamond Drive NW
Huntsville, AL 35806
256-837-5200

This Page Intentionally Left Blank

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
22-03-2021	Work Plan	March 2021

4. TITLE AND SUBTITLE

Final
Work Plan Addendum Additional Sampling
for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation,
Ore Storage Pond Sub-Area
Ravenna Army Ammunition Plant Restoration Program
Portage and Trumbull Counties, Ohio

5a. CONTRACT NUMBER W912QR-12-D-0002

5b. GRANT NUMBER N/A

5c. PROGRAM ELEMENT NUMBER N/A

6. AUTHOR(S)

Heyse, Edward
Hinger, Jessica
Fields, Karen
Bartscherer, Janelle

5d. PROJECT NUMBER Delivery Order 0003

5e. TASK NUMBER 2

5f. WORK UNIT NUMBER N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Parsons Government Services Inc.
401 Diamond Drive NW
Huntsville, Alabama 35806

8. PERFORMING ORGANIZATION REPORT NUMBER NA

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Corps of Engineers--Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202-0059

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

11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A

12. DISTRIBUTION/AVAILABILITY STATEMENT

Please reference distribution page.

13. SUPPLEMENTARY NOTES

None.

14. ABSTRACT

This Work Plan Addendum summarizes previous investigations at Area of Concern (AOC) CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area and presents a sediment sampling approach to complete the Remedial Investigation (RI) at the Ore Storage Pond sub-area. Ohio EPA requires additional sampling of sediment from the Ore Storage Pond sub-area to characterize the nature of contaminants including: a bioassay study and pond characteristics data.

15. SUBJECT TERMS

Compliance Restoration Site; Addendum; DLA Ore Storage; Ore Storage Pond; Remedial Investigation; sediment; bioassay

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON / 19b. TELEPHONE NUMBER *(Include area code)*
U	U	U	N/A	78	Edward Heyse / (256) 217-2573

Reset

This Page Intentionally Left Blank

Ohio Environmental Protection Agency

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

April 12, 2021

TRANSMITTED ELECTRONICALLY

Mr. Kevin M. Sedlak
Army National Guard
Installations & Environment
Cleanup Branch IPA Designation
1438 State Route 534 SW
Newton Falls, OH 44444

RE: US Army Ravenna Ammunition Plt RVAAP
Remediation Response
Project Records
Remedial Response
Portage County
ID # 267000859258

Subject: Review of Final Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the Final Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, dated March 24, 2021. Ohio EPA approves the document.

As a precautionary response to COVID-19, Ohio EPA is currently operating with most staff working remotely. During this time, we will not be issuing hard-copy mail. This letter is an official response from Ohio EPA that will be maintained as a public record. If you have any questions concerning this letter, please contact me at (330) 963-1170 or via email at ed.damato@epa.ohio.gov.

Sincerely,

Edward J D'Amato

Edward D'Amato
Site Coordinator
Division of Environmental Response and Revitalization

ED/sc

ec: Nat Peters, USACE
Steven Kvaal, USACE
Katie Tait, OHARNG RTLS
Rebecca Shreffler, Chenega
Mark Leeper, ARNG
Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Megan Oravec, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Susan Netzly-Watkins, Ohio EPA, DERR, NEDO
Tom Schneider, Ohio EPA, DERR, SWDO
Brian Tucker, Ohio EPA, DERR, CO

RECEIVED
APR 13 2021

This Page Intentionally Left Blank

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Parsons has completed the Final Work Plan Addendum Additional Sampling for Area of Concern CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, at the former Ravenna Army Ammunition Plant, Portage and Trumbull counties, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in this 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 the level of data obtained; and the reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing U.S. Corps of Engineers policy.

Independent Technical Reviewer:
Dan Griffiths, PG, CPG ______________________ 6 November 2020

Parsons (Signature) (Date)

Technical Director

Plan Preparer:

Edward Heyse, Ph.D., P.E. ______________________ 22 March 2021

Parsons (Signature) (Date)

Project Manager

This Page Intentionally Left Blank

Final

Work Plan Addendum
Additional Sampling for
CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation,
Ore Storage Pond Sub-Area,
Ravenna Army Ammunition Plant Restoration Program,
Portage and Trumbull Counties, Ohio

March 22, 2021

Contract No.: W912QR-12-D-0002
Delivery Order: 0003

Prepared for:

U.S. Army Corps of Engineers, Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202-2267

Prepared by:

PARSONS
401 Diamond Drive NW
Huntsville, AL 35806
256-837-5200

This Page Intentionally Left Blank

DOCUMENT DISTRIBUTION

for the
Final
Work Plan Addendum
Additional Sampling for
CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation,
Ore Storage Pond Sub-Area

Ravenna Army Ammunition Plant Restoration Program
Portage and Trumbull Counties, Ohio

Name/Organization	Number of Printed Copies	Number of Electronic Copies
Ed D’Amato, Ohio EPA DERR-NEDO	0	1
Tom Schneider, Ohio EPA-SWDO	Email Transmittal Letter Only	
Bob Princic, Ohio EPA DERR-NEDO	Email Transmittal Letter Only	
Natalie Oryshkewych, Ohio EPA DERR-NEDO	Email Transmittal Letter Only	
Megan Oravec, Ohio EPA DERR-NEDO	Email Transmittal Letter Only	
Mark Leeper, ARNG	0	1
Kevin Sedlak, ARNG	0	1
Katie Tait, OHARNG	0	1
Jennifer Tierney, Administrative Record Manager	1	1
Pat Ryan, REIMS	Email Transmittal Letter Only	
Steven Kvaal, USACE – Louisville District	Email Transmittal Letter Only	
Kevin Mieczkowski, USACE – Louisville District	2	1

ARNG = Army National Guard
DERR = Division of Environmental Response and Revitalization
NEDO = Northeast District Office
OHARNG = Ohio Army National Guard
Ohio EPA = Ohio Environmental Protection Agency
REIMS = Ravenna Environmental Information Management System
SWDO = Southwest District Office
USACE = U.S. Army Corps of Engineers

This Page Intentionally Left Blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
AOCs	Areas of Concern
ARNG	Army National Guard
bgs	below ground surface
CJAG	Camp James A. Garfield Joint Military Training Center
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
COCs	chemicals of concern
COPCs	chemicals of potential concern
COPECs	chemicals of potential ecological concern
DFFOs	Director's Final Findings and Orders
DLA	Defense Logistics Agency
DQOs	Data Quality Objectives
DUs	decision units
ECC	Environmental Chemical Corporation
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FWCUG	Facility-Wide Cleanup Goal
FWSAP	Facility-Wide Sampling and Analysis Plan
GPS	global positioning system
HQ	hazard quotient
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
NPDES	National Pollutant Discharge Elimination System
NGT	National Guard Trainee
OAC	Ohio Administrative Code
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
REIMS	Ravenna Environmental Information Management System
RI	Remedial Investigation
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SRCs	Site-Related Chemicals
SSHP	Site Safety and Health Plan
SVOCs	semi-volatile organic compound
TAL	target analyte list
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
WPA	Work Plan Addendum

1.0 PROJECT DESCRIPTION

1.1 Introduction

This Work Plan Addendum (WPA) is submitted to the U.S. Army in accordance with Section 3 the Performance Work Statement for environmental services at Areas of Concern (AOCs) under the Ravenna Army Ammunition Plant (RVAAP) Restoration Program at Camp James A. Garfield Joint Military Training Center (CJAG), Ohio. The task order was originally issued by the U.S. Army Corps of Engineers (USACE), Louisville District on 27 July 2016, and the *Final Work Plan, Additional Sampling for CC RVAAP-69 Building 1048 Fire Station, CC RVAAP-70 East Classification Yard, and CC RVAAP-74 Building 1034-Motor Pool Hydraulic Lift, Ravenna Army Ammunition Plant Restoration Program, Camp Ravenna, Portage and Trumbull Counties, Ohio* (Parsons, 2017) was approved and issued final on 30 November 2017.

The majority of field work for the Remedial Investigation (RI) for CC RVAAP-79 Defense Logistics Agency (DLA) Ore Storage Sites (Parsons, 2020) was conducted by Environmental Chemical Corporation (ECC). Parsons was contracted by the USACE-Louisville District to complete the RI documentation under Contract No. W912QR-12-D-0002, Delivery Order No. 0003. The field work was conducted in accordance with the *Final Site Inspection and Remedial Investigation Work Plan at Compliance Restoration Sites (Revision 0), Ravenna Army Ammunition Plant, Ravenna, Ohio* (ECC, 2012), *CC RVAAP-79 DLA Ore Storage Sites, USACE In-House Sampling, Group 2 Ore Storage Area Work Plan* (USACE, 2010), and the Facility-Wide Sampling and Analysis Plan (FWSAP) (SAIC, 2011a).

The RI Report (Parsons, 2020) concluded that additional assessment of the sediment at the 0.36 acre Ore Storage Pond is required to complete characterization of this sub-area. Arsenic concentrations in sediment samples from the Ore Storage Pond exceed the sediment reference values; therefore, the Ohio Environmental Protection Agency (Ohio EPA) requires additional sediment sampling at the Ore Storage Pond sub-area within CC RVAAP-79 in accordance with Ohio Administrative Code (OAC) 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA, 2018). Additional sampling includes: a bioassay study to determine whether remedial alternatives should be evaluated, or no further action is appropriate, and pond characteristics data collection to support the remedial alternative evaluation if required. Following the collection of additional samples and bioassay, an amendment to the RI Report (Parsons, 2020) will be prepared to address the Ore Storage Pond sub-area. The task order was modified (modification 08) on 29 September 2020 for additional field work required by Ohio EPA and Army National Guard (ARNG) to complete the RI at CC RVAAP-79, Ore Storage Pond sub-area.

This WPA amends the *Final Work Plan, Additional Sampling for CC RVAAP-69 Building 1048 Fire Station, CC RVAAP-70 East Classification Yard, and CC RVAAP-74 Building 1034-Motor Pool Hydraulic Lift* (Parsons, 2017) to incorporate additional sampling at CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area to complete the RI.

This WPA was prepared in accordance with Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) guidance and regulations, Ohio EPA Director's Final Findings and Orders (DFFOs) (Ohio EPA, 2004), and the National Oil and Hazardous Substances Contingency Plan. The former RVAAP is not on the U.S. Environmental Protection Agency (USEPA) National Priorities List, although it is in the USEPA Superfund Enterprise Management System database. The Ohio EPA is the environmental regulator for the RVAAP restoration program. The DFFOs form the basis for the implementation of a CERCLA-based environmental remediation program at the installation.

1.2 Project Scope and Objectives

The objective of this WPA is to provide methods and details for additional sampling to complete the RI for AOC CC RVAAP-79 Ore Storage Sites, Ore Storage Pond sub-area, specifically, to characterize and assess potential ecological risk posed by metals in sediment. The scope of this WPA includes:

- Provide a summary of information and conclusions in previous reports through the RI for the CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area (see Section 2.0 of this WPA);
- Establish Remedial Investigation objectives for the Ore Storage Pond sub-area sediment (see Section 3.0 of this WPA);
- Design a sampling approach to complete the RI objectives (see Sections 4.0 and 5.0 of this WPA); and
- Establish decision criteria consistent with OAC 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA, 2018) to determine, based on the results of the bioassays to be conducted on Ore Storage Pond sub-area sediment, whether the sub-area needs to proceed to evaluation of remediation alternatives, or is appropriate for no further action (Section 9.0).

Existing sediment data from the RI investigation will be compiled with new data collected under this WPA to complete an RI Report addendum to address the sediment in the Ore Storage Pond sub-area.

This WPA is a supplement to the *Final Work Plan Additional Sampling for CC RVAAP-69 Building 1048 Fire Station, CC RVAAP-70 East Classification Yard, and CC RVAAP-74 Building 1034-Motor Pool Hydraulic Lift Ravenna Army Ammunition Plant Restoration Program Camp Ravenna, Portage and Trumbull Counties, Ohio* (Parsons, 2017). The Work Plan (Parsons, 2017) presented sampling protocol and sample locations to address data gaps, health and safety specifications to minimize the potential for personnel injury or illness, and quality assurance (QA) and quality control (QC) requirements to ensure data are usable and defensible. The Field Sampling Plan, Appendix A in the Final Work Plan, was an addendum to the FWSAP (SAIC, 2011a). The Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP), Appendix B in the Final Work Plan, was written in accordance with *Office of Solid Waste Emergency Response Directive 9272.0-17 Implementation of the Uniform Federal Policy for Quality Assurance Project Plans at Federal Facility Hazardous Waste Sites* (USEPA, 2005). The Accident Prevention Plan, Appendix C in the Final Work Plan, was developed using the minimum basic outline provided in Appendix A of the *USACE Engineering Manual 358-1-1, Safety and Health Requirements Manual* (USACE, 2014). The Site Safety and Health Plan (SSHP), Appendix C-1 in the Final Work Plan, was an addendum to the RVAAP Facility-Wide Safety and Health Plan (SAIC 2011b). The Waste Management Plan, Appendix D in the Final Work Plan, was prepared in accordance with CERCLA guidance and regulations and the Ohio Army National Guard (OHARNG) Waste Management Guidelines (OHARNG, 2016).

This WPA incorporates the Work Plan (Parsons, 2017) as necessary to describe the bioassays to assess potential toxicity of sediment to biota from arsenic within the Ore Storage Pond sub-area at CC RVAAP-79 DLA Ore Storage Sites. Data Quality Objectives (DQOs) are presented in Section 3.

1.3 Work Plan Organization

This WPA provides the technical approaches and field activities to be completed in order to complete the RI at the Ore Storage Pond sub-area. This WPA has the following contents:

- Section 1—Project Description
- Section 2—Operational History and Previous Investigations
- Section 3—Remedial Investigation Objectives
- Section 4—Proposed Sampling Strategy
- Section 5—Project Activities
- Section 6—Environmental Protection Plan
- Section 7—Project Documentation and Sample Quality Assurance/Quality Control
- Section 8—Disposition of Investigation-Derived Waste
- Section 9—Data Screening Process
- Section 10—Deliverables
- Section 11— References

This WPA consists of two appendices:

- Appendix A—Field Forms
- Appendix B— Regulatory Correspondence Letters and Response to Comments (included in Final WPA)

1.4 Facility Description and History

The facility description and history of the former RVAAP, now known as CJAG, is provided in Section 1.4 of the Work Plan (Parsons, 2017).

1.5 Area of Concern Description

CC RVAAP-79 DLA Ore Storage Sites include the following nine sub-areas:

- Main Storage Area
- Area West of Railroad
- East Transportation Yard
- Concrete Pad Storage Area
- Ore Storage Pond
- Route 80 Tank Farm
- Area 2 Ammunition Storage Area
- Load Line 3 Building 803 Inert Storage and Tank Storage Area
- Area 8 Inert Storage, Building 841

The nine separate ore storage sub-areas comprising CC RVAAP-79 DLA Ore Storage Sites are all located within CJAG (Figure 1-1). The RI for eight of the nine areas is complete and documented in the *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (Parsons, 2020). This WPA only addresses additional sampling for the Ore Storage Pond sub-area.

Five of the sub-areas are contiguous and are located in the eastern portion of CJAG near the intersection of South Service Road and Irons Road (Figure 1-2; Main Storage Area, Area West of Railroad, East Transportation Yard, Concrete Pad Storage Area, and Ore Storage Pond). All five areas comprising these contiguous sub-areas cover approximately 63 acres. The portion of the sub-areas that stored ore is approximately 53 acres, the other 10 acres were added to the sub-areas as delineation decision units (DUs). The DLA stored strategic and critical materials, including chrome ore, ferrochrome ore, and metallurgical manganese ore at these subareas starting in the late 1940's. All ore was removed by 2012. The Ore Storage Pond was reportedly constructed in the mid-1950s to prevent potentially contaminated surface water runoff from nearby manganese and chrome stockpiles from entering surface water. Because the pond has not been maintained, the pond has filled in significantly since it was originally constructed and now functions as a palustrine, emergent, intermittently exposed wetland as mapped by the National Wetland Inventory (U.S. Fish and Wildlife Service, 2018). No buildings or associated infrastructure (e.g., utility lines) are believed to have been located in or near these sub-areas; however, railroad spurs were located in portions of the Main Storage Area and the Concrete Pad Storage Area. The Area West of Railroad, East Transportation Yard, and the Ore Storage Pond are located immediately adjacent to railroad spurs.

1.6 Environmental Setting

A general description of the physical features, topography, geology, hydrogeology, and environmental characteristics of CJAG is included in Section 1.5 of the Work Plan (Parsons, 2017). The environmental setting specific to CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area is included in this Section.

1.6.1 Topography

The surface features present at CC RVAAP-79 DLA Ore Storage Sites are generally similar to the rest of CJAG, with mildly undulating topography. Figure 1-2 shows the site features and topography of the five contiguous sub-areas of the AOC, including the Ore Storage Pond sub-area. These sub-areas are mostly devoid of large or tall vegetation and are surrounded by wooded areas. Railroad spurs formerly either traversed or were located immediately adjacent to each sub-area.

Topographical elevations of the contiguous sub-areas (including the Ore Storage Pond) are between approximately 980 feet above mean sea level (amsl) on the western side and 940 feet amsl on the eastern side (Figure 1-2). Based on area topography, the ground surface slopes to the east across these contiguous sub-areas.

1.6.2 Geology and Soil

The regional geology at CJAG consists of horizontal to gently dipping bedrock strata of Mississippian and Pennsylvanian age overlain by varying thicknesses of unconsolidated glacial deposits. Soils were observed and logged during the RI conducted at the CC RVAAP-79 DLA Ore Storage Sites (Parsons, 2020).

The soil type present at the contiguous sub-areas (including the Ore Storage Pond) consists of disturbed soils that are lacking any original depositional structures or features called Udorthents. No pertinent information regarding Udorthents is available as these soils have been disturbed to a degree that the original soil type at these locations can no longer be identified. Mahoning silt loam (2 to 6 percent slopes) is present in the area surrounding the Ore Storage Pond. Mahoning silt loam is a somewhat poorly drained soil with variable surface runoff and low permeability. The deeper soils observed and documented during the previous RI sampling events are assumed to be Hiram Till glacial deposits or fill material from site construction.

Bedrock was encountered during drilling at depths ranging from 2 to 9 feet in the contiguous sub-areas (including the Ore Storage Pond). In general, the top of bedrock was within four feet of the surface in the Area West of Railroad sub-area (west side of contiguous sub-areas) and from four to nine feet below ground surface (bgs) in the East Transportation Yard sub-area (east side of the contiguous sub-areas). The bedrock is described on boring logs as sandstone and varies in depth of weathering. This sandstone is likely the Sharon Sandstone (Conglomerate) Member of the Pottsville Formation.

1.6.3 Hydrogeology

The potentiometric surface for CJAG aquifers is mapped annually from groundwater elevation measurements in monitoring wells, most recently in the *Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-Wide Groundwater Annual Report for 2019* (Leidos, 2020). One monitoring well, FWGmw-010, is located within the Main Storage Area. This well is completed in unconsolidated deposits and screened from 6 to 16 feet bgs. During the April 2019 groundwater monitoring event, the groundwater in this well was measured at approximately 11.40 feet bgs (Leidos, 2020). The groundwater flow direction within the unconsolidated aquifer beneath the contiguous sub-areas (including the Ore Storage Pond) is to the east.

The nearest bedrock monitoring well is FWGmw-012, located approximately 1,300 ft to the northeast of the contiguous sub-areas (including the Ore Storage Pond), and is screened in the Sharon Shale from 29.5 to 39.5 feet bgs. During the April 2019 groundwater monitoring event, the groundwater in this well was measured at approximately 0.25 feet bgs (Leidos, 2020). The Sharon Shale is not a regional aquifer. It is assumed that the regional bedrock aquifer beneath the vicinity of the contiguous sub-areas (including the Ore Storage Pond) is the Sharon Sandstone. The regional groundwater flow direction in the vicinity of the contiguous sub-areas (including the Ore Storage Pond) within the Sharon Sandstone Aquifer is towards the east- northeast.

1.6.4 Surface Water

Surface water at the contiguous sub-areas occurs intermittently as storm water runoff within ditches or conveyances and toward a wetland area within these contiguous sub-areas (i.e., the Ore Storage Pond). The Ore Storage Pond is approximately 0.36 acres in size and was constructed to control potentially contaminated surface water runoff from the adjacent manganese and chrome stockpiles from leaving the site. The exact depth of the pond when constructed is unknown; however, given that the depth to bedrock in the area is between 2 and 9 feet deep, it is unlikely that the pond was constructed deeper than depth to bedrock. The pond has not been maintained and therefore has been subject to continuous sedimentation and now is classified as an intermittently exposed, palustrine, emergent wetland versus a small open-water pond. The nearest wetland area downgradient of the contiguous sub-areas is approximately 2,100 to the feet east.

This Page Intentionally Left Blank

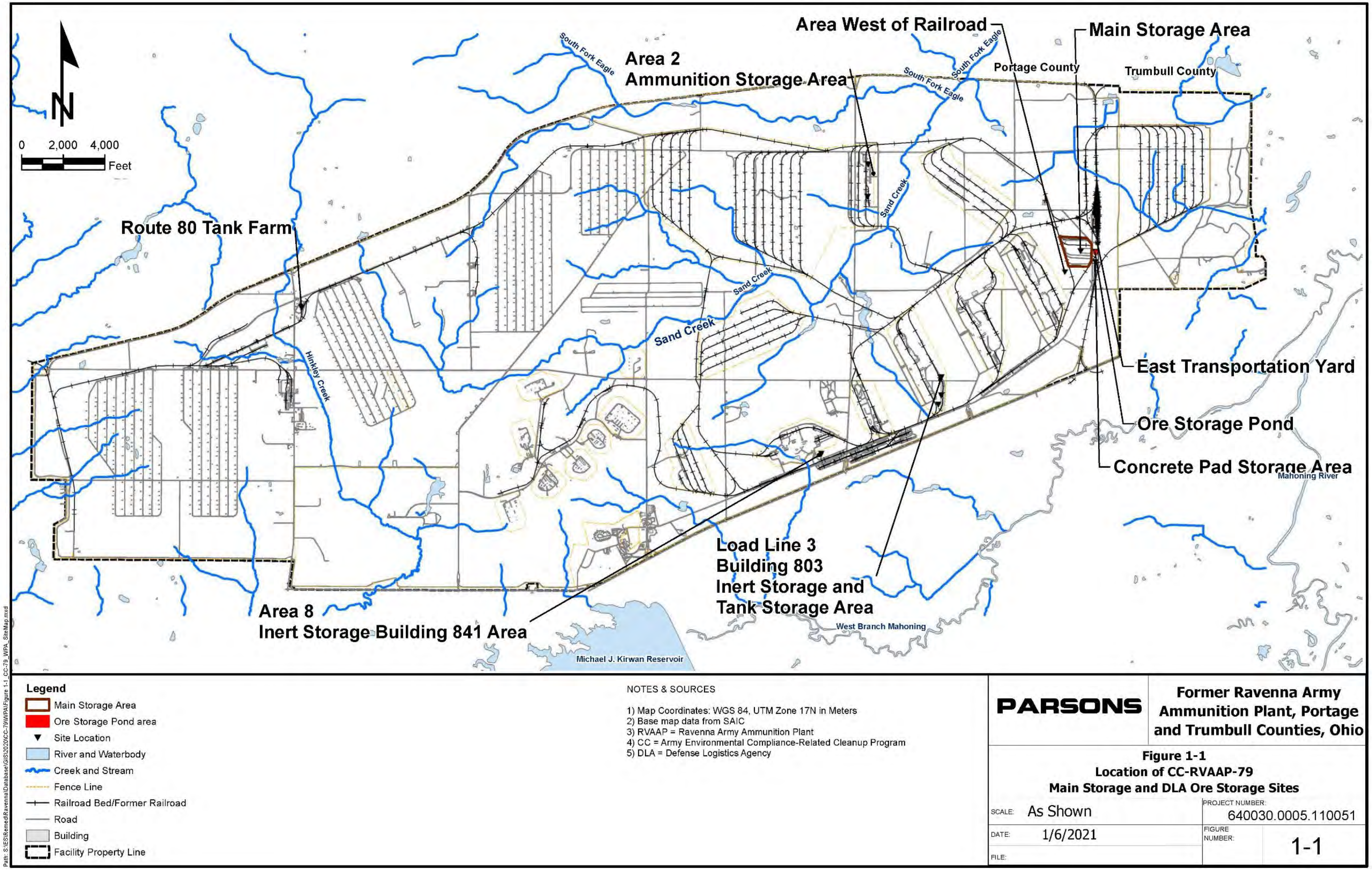


Figure 1-1: Location of CC RVAAP-79 DLA Ore Storage Sites

This page intentionally left blank

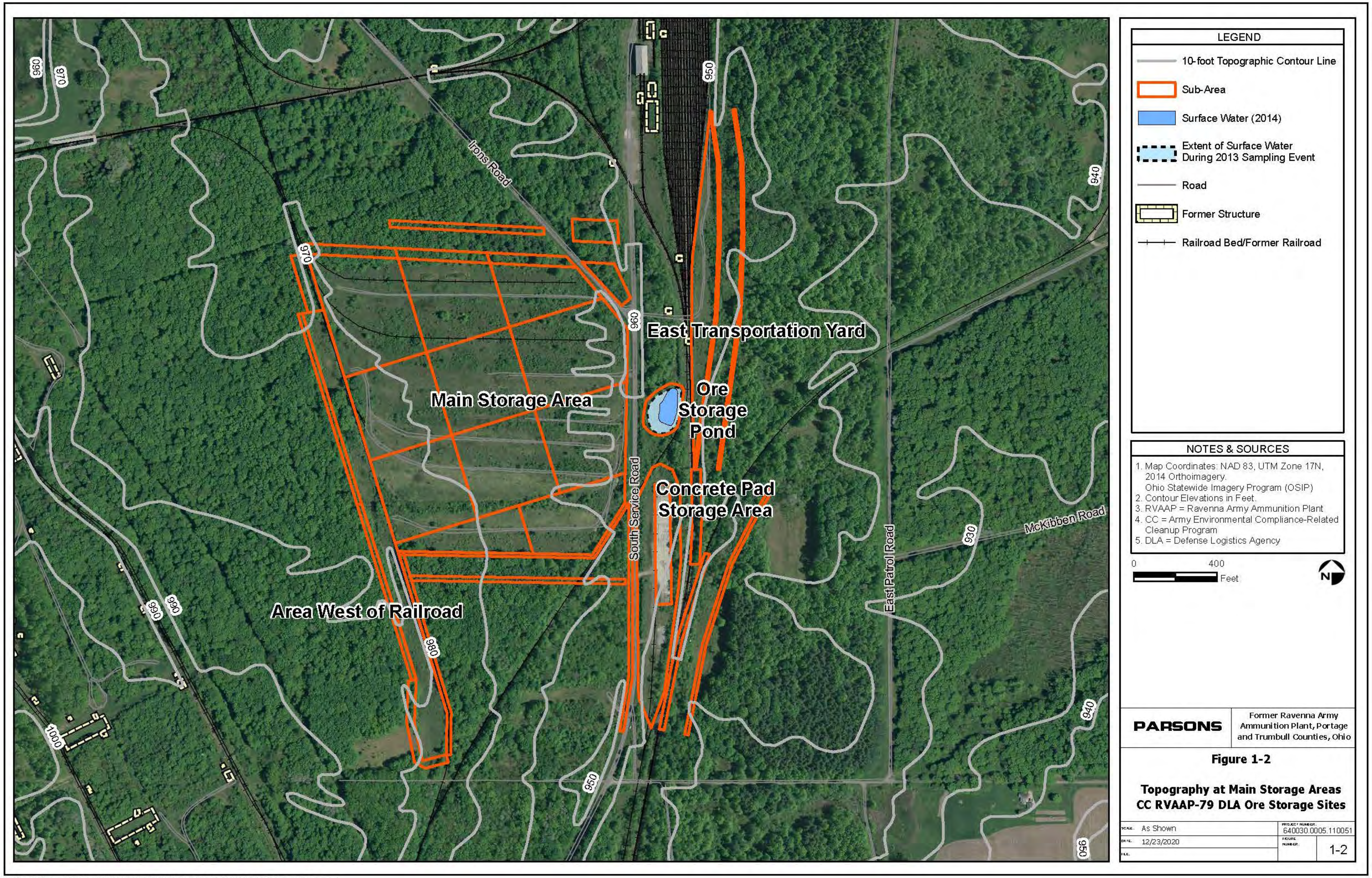


Figure 1-2: Sub-Areas and Topography of CC RVAAP-79 DLA Ore Storage Sites near Ore Storage Pond

This page intentionally left blank

2.0 OPERATIONAL HISTORY AND PREVIOUS INVESTIGATIONS

This section provides a summary of historical information and findings of previous investigations at CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area.

2.1 Operational History/Description

Based on the *Final Report for the Assessment of Potential Contamination at the Defense Logistics Agency Outdoor Storage Areas, Ravenna Army Ammunition Plant, Ravenna, Ohio* (SpecPro, 2003), historical operations conducted at the facility included handling and storage of strategic and critical materials, including various types of ore, for the General Services Administration (GSA). The DLA Defense National Stockpile Center leased space at the facility for the storage of the ore materials on the ground and in above-ground storage tanks since the late 1940's. The following GSA materials were stockpiled on the ground surface in the sub-areas surrounding the Ore Storage Pond: chrome ore, ferrochrome ore, and metallurgical manganese ore (SpecPro, 2003). Ore stockpiles were being removed during the 2003 SpecPro investigation and were completely removed from the AOC when RI investigations began in 2012.

The Historical Records Review report (SAIC, 2011c) suggested that coal storage may have occurred within the Concrete Pad Storage Area (DU05). If coal was stored within the Concrete Pad Storage Area, it was likely removed by 1979, which is the approximate date that coal piles were removed from the other coal storage areas (CC RVAAP-73 Facility-Wide Coal Storage). No ore or coal was present at the Concrete Pad Storage Area during RI sampling.

2.2 Previous Investigations Summary

Timeline for investigations and related documents at CC RVAAP-79 DLA Ore Storage Sites:

- 2003 – Final Report for the Assessment of Potential Contamination at the DLA Outdoor Storage Areas (SpecPro, 2003)
- November 2010 – Initial Assessment of CC RVAAP-79 DLA Group 2 Ammunition Storage Area (USACE, 2011)
- October 2012 – Site Inspection/RI Work Plan finalized (ECC, 2012)
- October 2012 and March 2013 – RI sampling performed at CC RVAAP-79 DLA Ore Storage Sites
- April 2015 – Additional RI sampling performed at CC RVAAP-79 DLA Ore Storage Sites (except for the Ore Storage Pond and Area 2 Ammunition Storage Area)
- February 2019 – Draft RI Report submitted to Ohio EPA
- April 2019 to February 2020 – Series of comments on Draft RI from Ohio EPA requesting additional sediment sampling and bioassays for the Ore Storage Pond.
- October 2020 – Final RI Report (Parsons, 2020) recommending additional sediment sampling and bioassays at the Ore Storage Pond sub-area.

2.2.1 Previous Investigations at the Main Storage Area, Area West of the Railroad, East Transportation Yard, Concrete Pad Storage Area, and Ore Storage Pond

A soil and sediment survey conducted in 1982 by The Mogul Corporation included the collection of 7 soil and 1 pond sediment sample points in the DLA ore pile area (The Mogul Corporation, 1982). The samples were analyzed for 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, and selected inorganics. Sampling for pollutants in storm water discharges was conducted on a monthly basis upstream (National Pollutant Discharge Elimination System [NPDES] Outfall #800) and downstream (NPDES Outfall #900) from the site in a surface drainage pathway adjacent to the chromium ore piles from November 1992 through February 1997. Available results from this investigation are available in the *Assessment of Potential Contamination at the DLA Outdoor Storage Areas* (SpecPro, 2003).

SpecPro conducted an assessment of DLA outdoor storage areas, including documenting the operational history of ore storage at these contiguous sub-areas, Route 80 Tank Farm, and Load Line 3 DLA Tank Storage Area, summarizing previous investigations, and conducting sampling in 2003 (SpecPro, 2003). During the 2003 investigation, 86 discrete surface soil samples (0-1 foot bgs) were collected from the Ore Storage Areas, as well as 14 sediment and 2 surface water samples (SpecPro, 2003). For soil characterizations purposes, most samples were analyzed for Resource Conservation and Recovery Act (RCRA) 8 metals. A portion of those samples were further characterized using the complete Target Analyte List (TAL) metals list. Detected contaminant concentrations were compared against facility-wide background values developed as part of the Phase II RI for the Winklepeck Burning Grounds (SAIC, 2001).

Three inorganics (arsenic, chromium, and lead) were detected at concentrations greater than background levels in the surface water samples collected from the Ore Storage Pond. Five inorganics were detected at concentrations greater than background levels in the sediment samples. Arsenic and chromium were detected in most sediment samples (71% and 93% of the time, respectively). In general, the occurrence of inorganics in sediment at concentrations greater than background criteria was limited to areas nearest to the chromium piles at the storage area. Inorganics were detected at concentrations greater than the background criterion in 83 out of 86 surface soil samples. Arsenic, barium, and chromium represented most contaminants detected at concentrations greater than background levels in the ore pile storage area; however, the concentrations of inorganics were spatially variable. In general, the occurrence of inorganics at concentrations greater than background criteria in surface soil was limited only to the DLA Ore Pile Storage Area and not the area surrounding the main storage location. Subsurface soil samples were not collected because target analyte Toxicity Characteristic Leaching Procedure maximum contaminant levels were not exceeded in surface soil samples (SpecPro, 2003). SpecPro concluded that surface soil “does not appear to be significantly impacted by storage-related activities”. SpecPro further concluded that “many of the inorganics found at the DLA Storage Areas may be attributable to sources that have already been removed or are in the process of being removed.” Results from this 2003 investigation are available in the *Assessment of Potential Contamination at the DLA Outdoor Storage Areas* (SpecPro, 2003).

2.2.2 Remedial Investigation Activities at the Ore Storage Pond

The following paragraphs summarize the results documented in the *Final Remedial Investigation Report CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (Parsons, 2020).

RI field work at the Ore Storage Pond was conducted in March and April 2013. Field work was conducted in accordance with *Final Site Inspection and Remedial Investigation Work Plan at Compliance Restoration Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (ECC, 2012). DUs were designed to represent the operational areas where storage or staging activities could have caused residual contamination in surrounding media. The Ore Storage Pond was designated DU03.

Five discrete collocated sediment and surface water samples (4 primary samples and 1 field duplicate) were collected from 4 sampling locations at the Ore Storage Pond (Figures 2-1). The sediment samples were collected from 0-1 foot below the bottom of the pond. All the samples were analyzed for TAL metals, including mercury. The sediment sample from 79-OSP-DU3-SD3 and surface water sample from 79-OSP-DU3-SW1 were also analyzed for full-suite (including volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], organochlorine pesticides, polychlorinated biphenyls, and explosives/propellants).

Data generated during the CC RVAAP-79 DLA Ore Storage Sites RI for the Ore Storage Pond were screened to identify Site-Related Chemicals (SRCs). A chemical detected at a concentration greater than the established Background Screening Value, that is not an essential nutrient, and has not been screened out through a frequency of detection evaluation is identified as an SRC. An SRC may, or may not be, related to the former operations at the AOC. Ten inorganics, eleven SVOCs, and three VOCs were identified as SRCs in sediment at the Ore Storage Pond. Five inorganics and one VOC were identified as SRCs in surface water at the Ore Storage Pond.

2.2.2.1 Receptors and Land Use

The OHARNG-projected future land use for the AOC is Military Training Land Use. The representative receptor for these areas is the National Guard Trainee (NGT) Receptor. Additionally, the Industrial Receptor is representative for the full-time worker at CJAG. Unrestricted (Residential) Land Use is evaluated using the Resident Receptor. The Ore Storage Pond is a small (0.36 acre) former man-made pond and has no permanent inlet. There is an overflow outlet ditch from Ore Storage Pond to the ditch along the railroad to east of the pond. The Ore Storage Pond represents only a small fraction of the total habitat available at CJAG, it does not contain any unique habitats, and it may contain habitat of lower quality than the less developed portions of CJAG property (Parsons, 2020).

2.2.2.2 Human Health Risk Assessment

Chemicals of potential concern (COPCs) that were carried through the risk assessment were identified by comparing the maximum detected concentration (MDC) of each SRC at each sub-area to the most stringent Resident Receptor Facility-Wide Cleanup Goal (FWCUG) (SAIC, 2010) (or USEPA Residential Receptor Regional Screening Level [RSL] if no FWCUG is established) at a target cancer risk level of 10^{-6} and non-carcinogenic target hazard quotient (HQ) of 0.1. Discrete samples were used to identify COPCs in sediment at the Ore Storage Pond. Grab samples were used to identify COPCs in surface water.

The COPCs in sediment (arsenic and cobalt) and surface water (arsenic) were further evaluated to identify chemicals of concern (COCs). COCs were determined by comparing the exposure point concentrations (EPCs) to FWCUGs or, where not developed, RSLs corresponding to a target cancer risk of 10^{-5} or target HQ of 1. The HHRA performed for CC RVAAP-79 DLA Ore Storage Sites evaluated Unrestricted (Residential) Land Use (Resident Receptor), which is protective of all receptors. The RI Report (Parsons 2020) concluded that there are no COCs identified in any media the Ore Storage Pond sub-area.

2.2.2.3 Ecological Risk Assessment

The RI Report (Parsons 2020) included a Phase I and Phase II ecological risk assessment (ERA) for all DUs including sediment and surface water at the Ore Storage Pond sub-area. The process included selection of EPCs for all SRCs, and comparison of EPC concentration to Ohio EPA sediment reference values (SRV) and ecological screening values (ESVs) to identify and refine chemicals of potential ecological concern (COPECs).

There were no COPECs identified for surface water in the Level II ERA, therefore the RI Report (Parsons, 2020) concluded that no further investigation (e.g., Level III Baseline ERA) for surface water is considered necessary for the protection of ecological receptors at the Ore Storage Pond.

The maximum concentration of arsenic in sediment (300 mg/kg) exceeded the Ohio EPA sediment reference value (25 mg/kg) and ecological screening value (9.79 mg/kg).

The Level II ERA identified arsenic as a COPEC in sediment at the Ore Storage Pond (Table 2-1 and Figure 2-1). Although the weight of evidence in the ERA showed arsenic was unlikely to cause any ecological impact, the arsenic concentration in sediment exceeded the Ohio EPA sediment reference values. Therefore, in accordance with OAC 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA, 2018), Ohio EPA indicated that only two options were available for Ore Storage Pond sediment: assess ecotoxicity with bioassays or remediate.

2.2.2.4 Remedial Investigation Report Recommendations

The Final RI report (Parsons, 2020), consistent with OAC 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA, 2018), recommended additional assessment for sediment at the Ore Storage Pond. Specifically, the report recommended that six sediment samples should be collected across the pond. Two bioassays should be performed on composite samples consisting of portions from three of the six sediment samples:

- *Hyalella azteca* 10-day bioassay, and
- *Chironomus dilutus (*formerly *tentans)* 10-day bioassay.

Bioassays should follow *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (USEPA, 2000). Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed. The decision of whether sediment should be evaluated for remedial alternatives or is appropriate for no further action would be based on the results of the bioassays.

In addition, the six sediment samples would be analyzed for standard sediment parameters (total organic carbon, pH, and grain size analysis) and the TAL metals. The results of these analyses would be used to support the evaluation of remedial alternatives, should evaluation be necessary. The results may also be helpful in interpreting the results of the bioassays.

This WPA describes the approach for additional sampling and bioassays for Ohio EPA for review and approval. An amendment to the Final RI Report will be prepared to document the results of bioassays and samples from the Ore Storage Pond sub-area.

No further investigation or removal action was recommended for surface water.

Table 2-1: COPECs for Sediment at Ore Storage Pond - Using Average Concentration

SRC	CAS Number	Number of Detections	Number of Samples	Max Detect Concentration	Average Concentration	ESV [(a)]	ESV Source	COPEC?-Yes/No	COPEC Justification	Hazard Quotient [(b)]
TAL Metals (mg/kg)										
Arsenic	**7440-38-2**	**5**	**5**	**300**	**200**	**9.79**	**TEC**	**Yes**	**Avg > ESV**	**20**
Beryllium	7440-41-5	5	5	1.3	0.78	NA	-	No	Average is 0.78 mg/kg, all other detected concentrations are below BSV & SRV.	NC
Lead	7439-92-1	5	5	51	33	35.8	TEC	No	Avg < ESV	1
Volatile Organic Compounds (mg/kg)										
Acetone	67-64-1	1	1	0.054 J	0.054 J	0.0099	Region 5	No	MDC is less than LANL no-effect ESV.	5

Notes:
Average concentration calculated by using 1/2 the detection limit for non-detects.

a. ESVs are selected from a hierarchy using these sources in the order presented:
   Consensus-based Threshold Effects Concentrations (TEC) (MacDonald, et al., 2000).
   Region 5 Ecological Screening Levels (USEPA, 2003)
b. Hazard Quotient calculated by dividing the MDC by the ESV.

Yellow indicates COPEC.
BSV = Background Screening Value
COPEC = Chemical of Potential Ecological Concern
ESV = Ecological Screening Value
HQ = Hazard Quotient
ID = identification
J = Analyte detected, estimated concentration.
MDC = maximum detected concentration
mg/kg = milligrams per kilogram
SRC = Site-related chemical
SRV = sediment reference value

This page intentionally left blank

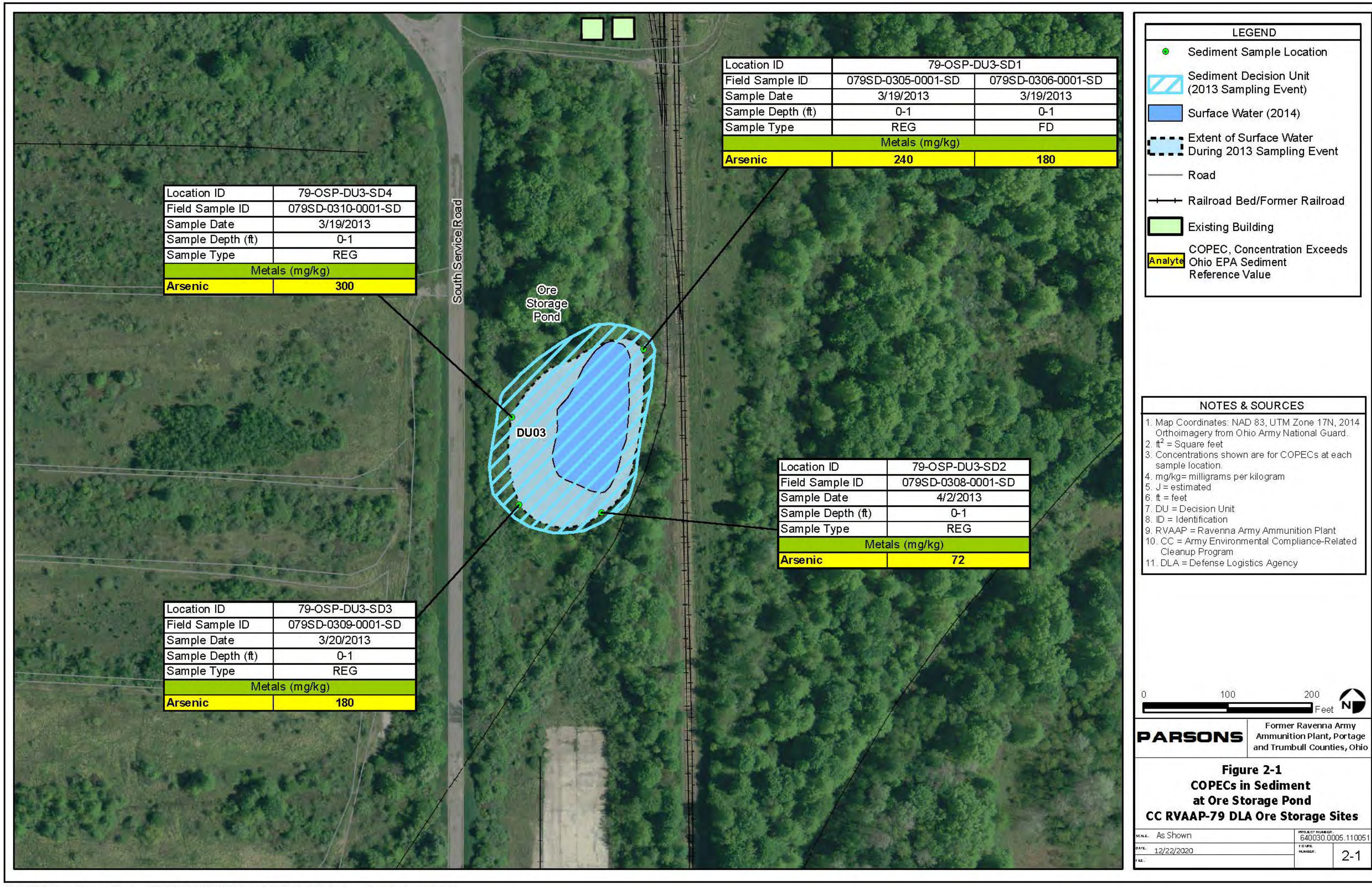


Figure 2-1: COPECs in Sediment at Ore Storage Pond CC RVAAP-79 DLA Ore Storage Sites

This page intentionally left blank

3.0 REMEDIAL INVESTIGATION OBJECTIVES

This section presents objectives for additional sampling to complete the RI for the Ore Storage Pond sub-area.

Arsenic concentrations in sediment exceeded its sediment reference value (SRV) (Ohio EPA, 2018). OAC 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA, 2018) require that further evaluation using bioassay or remediation of the sediment be performed if contaminant concentrations in sediment in lentic water bodies exceeds the SRV.

The depth of the pond, and thickness of sediment within the pond (i.e., volume of sediment within the pond), and concentrations of metals in sediment from the middle of the pond are unknown. This information may be necessary if it is determined that remedial alternatives need to be evaluated for sediment.

The following objectives have been identified to complete the RI for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area:

- Characterize sediment ecotoxicity using bioassays to determine if remedial alternatives should be evaluated for sediment, or if sediment is appropriate for no further action. Perform two bioassays on composite sediment samples:
    - *Hyalella azteca* 10-day bioassay, and
    - *Chironomus dilutus (tentans)* 10-day bioassay.

  Bioassays should follow *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (USEPA, 2000). Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed.

- Collect additional information about the Ore Storage Pond to be used to facilitate an evaluation of remedial alternatives if evaluation is required. Collect six sediment samples across the pond, including from the middle of the pond. Analyze samples for TAL metals and standard sediment parameters (total organic carbon, pH, and grain size analysis). Measure depth of water above each sediment sample location and thickness of sediment at each sediment sample location using the corer or a polyvinyl chloride pipe. Delineate wetlands boundary in the vicinity of the Ore Storage Pond in accordance with state and federal criteria (Ohio EPA, 2001 and USACE, 2012).

As part of the facility-wide approach to environmental investigation activities at the former RVAAP, facility-wide DQOs have been developed consistent with the USEPA DQO process. The overall project DQO is to provide representative, repeatable, high quality data in order to complete a RI Report at the Ore Storage Pond sub-area at CC RVAAP-79. DQOs specific to the Ore Storage Pond sub-area are presented in Table 3-1.

This Page Intentionally Left Blank

Table 3-1 Data Quality Objectives

State the Problem	Identify Goals of the Study	Identify Information Inputs	Define the Boundaries of the Study	Develop the Analytic Approach	Specify Performance or Acceptance Criteria	Develop the Detailed Plan for Obtaining Data
CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area						
Concentrations of metals were detected in the sediment samples from the Ore Storage Pond that were greater than Ohio EPA Sediment Reference Values. Although the Army showed there were unlikely to be unacceptable risks to ecological receptors that use the pond using standard ERA tools; the Ohio EPA per their regulations, stated that there were only two options: test the sediment by completing two bioassays or remediate the sediment.	Is the sediment toxic as measured by *Hyalella azteca* 10 day bioassay and /or *Chironomus dilutus* (*tentans*) 10 day bioassay? If bioassays indicate toxicity, report results and close the RI phase, then proceed to evaluation of remedial alternatives. If not toxic, report and close the RI phase with conclusion that no further action is required.	Sediment toxicity is evaluated by survival and growth of in 10-day bioassays. Survival is measured by counting living (moving) organisms at the end of the 10-day test. Growth is measured by average dry weight (for *H. azteca*) or ash-free dry weight (for *C. dilutus*) of surviving organisms. Acceptable tests meet the following criteria in the controls: • *H. azteca* Test Acceptability Criteria (TAC): 80% survival and measurable growth in the control • *C. dilutus* TAC: 70% survival and a mean ash-free dry weight of 0.48 mg/organism in the control The survival and growth results from the Ore Pond sediment will be compared to those of the control or reference sediment to determine toxicity using statistical methods in accordance with *US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*, EPA 617 600/R-99/064, March 2000. If the data are normally distributed, then a t-Test will be performed to detect statistically significant (p = 0.05) differences between test sediments and the control sediment. If the data distribution is non-normal, then a Wilcoxon Two-Sample Test will be used to compare the group means. Shapiro-Wilk's Test will be used to determine if the data are normally distributed, and the F-Test will be used to test for homogeneity of variance. Should the test results indicate a high degree of statistical strength due to low variability in the data or if the data is highly variable, an indication of biological significance of >20% difference from the control, is sufficient to indicate that a sample may have a substantial impact.	Sediment from within the submerged portions of Ore Storage Pond. The pond is small (0.36 acres). Because the pond has not been maintained, the pond has filled in significantly since it was originally constructed. The size of the pond changes seasonally and with rain events.	Analytic approach is in accordance with *US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*, EPA 617 600/R-99/064, March 2000.	All sampling and analysis will be performed in accordance with the procedures outlined in the UFP-QAPP and the *Work Plan Addendum, Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio.*	Collect six sediment samples across the pond. Prepare field composite samples that each contain portions from three of the six sediment samples) and perform the two bioassays: • *Hyalella azteca* 10 day bioassay and • *Chironomus dilutus (tentans)* 10 day bioassay Bioassays should follow *US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, Second Edition, EPA 600/R-99/064, March 2000. Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed. Refer to Section 4.0 for further details.

This Page Intentionally Left Blank

4.0 PROPOSED SAMPLING STRATEGY

Proposed additional sampling for the CC RVAAP-79 DLA Ore Storage Sites RI to address the Ore Storage Pond is presented in this section. Samples will be collected in accordance with USEPA and Ohio EPA guidance (USEPA, 2000 and Ohio EPA, 2012). Proposed sample locations are illustrated on Figure 4-1. A complete listing of proposed samples, sample identifiers, sample type (including sample depth intervals), and sample analyses are presented in Table 4-1. The sample IDs were approved by the RVAAP Environmental Information Management System (REIMS) administrator.

Based on the size of the pond, current conditions, and historical sampling results, each of the six locations will be sampled along two transects that transverse the width the pond (from west to east). A portion of three samples will be composited in the field for a total of two composite samples (one composite sample consisting of even-numbered samples, and the other composite sample consisting of odd-numbered samples) for biological analysis. In addition, each of the six discrete sediment samples will be submitted for chemical analyses.

4.1 Sediment Sampling

Six discrete primary sediment samples will be collected from the transects across the width of the pond. QC samples (including a field duplicate and matrix spike/matrix spike duplicate and an equipment rinsate blank will also be collected. A portion of the sediment will be composited from a minimum of three deployments of the sampler at each station to obtain the volume needed for the required bioassays. All samples will be collected from submerged portions of the pond. If the pond is smaller than indicated on Figure 4-1, the sample locations will be adjusted and recorded. If conditions such as a rocky substrate or dry location preclude sample collection at a particular station, the station may be relocated using best professional judgement. A sample will be collected as close as possible to the originally proposed sample location, within a 4-meter radius where possible. Any station relocation will be documented on the field sampling log. Information recorded on the log will include information such as station number, global positioning system (GPS) coordinates, depth to bottom, sediment depth (i.e., sampler penetration depth), sediment depth stratum sampled, physical sediment characteristics, date and time of sample collection, and photo details (Appendix A Field Forms). In addition, field measurements for temperature, pH, and dissolved oxygen will be collected from the water column within one meter of the sediment prior to sediment sample collection. Photographs will also be taken of each sample station.

All sediment samples will be collected from a depth of 0 to 0.5 feet (0 to 15 centimeters) below the sediment surface using equipment that causes minimal disturbance to the sediment surface during collection, such as a Wildco hand-coring device. An extension rod may be attached to the hand corer and used to lower the device through the body of water to the sample point. Care will be taken to extract sediment from the most undisturbed center portion of each grab sample. The sediment will be placed in a plastic container using a plastic or wooden spoon because chemical analyses include TAL metals. When sufficient sediment for all analyses has been collected, the sediment in the container will be thoroughly homogenized. After this process, the sediment will be divided and transferred to appropriate containers provided by the laboratories. All sample containers will be stored in insulated, ice-filled coolers while in the field prior to shipment.

The hand corer and extension rod (if used) will be decontaminated between sampling stations by scrubbing with a brush and ambient pond water, followed by a thorough in situ rinsing. A separate bowl and spoon (or spatula) will be dedicated to each composite sample, so this equipment will not need to be decontaminated between samples.

4.2 Bioassay

Six sediment samples will be collected using two transects across the pond and composited into two samples (three samples for each composite). Sediment will be homogenized and split into laboratory containers in the field as described above. Headspace in the bioassay test sample containers will be minimized.

A bioassay will be performed by EA Engineering Science and Technology, Inc. PBC in Hunt Valley, Maryland on each composited sample:

- *Hyalella azteca* (amphipod) 10-day bioassay and
- *Chironomus dilutus* (midge, formerly tentans) 10-day bioassay.

Bioassays will follow *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (USEPA, 2000). Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed.

The 10-day bioassay tests will evaluate survival and growth as endpoints for each test organism and a laboratory control sample will be included with the tests. The bioassay samples will be performed with a holding time of 14 days or less. Water overlying the test organisms will also be field tested for temperature, pH, dissolved oxygen, and conductivity/salinity. The laboratory will provide a final report specifying methods, materials, results, statistical determination of toxic concentrations, and unforeseen protocol deviations with an evaluation of the resulting impact.

4.3 Chemical Analyses

Sediment from each of the six discrete sample locations will be analyzed for TAL metals and standard sediment parameters (total organic carbon, pH, and grain size analysis). Sediment chemistry test sample containers will be supplied by the laboratory. Typical chain of custody documentation will accompany each sample shipment to the laboratory. All chemical analyses will be performed by EMAX in Torrance, CA.

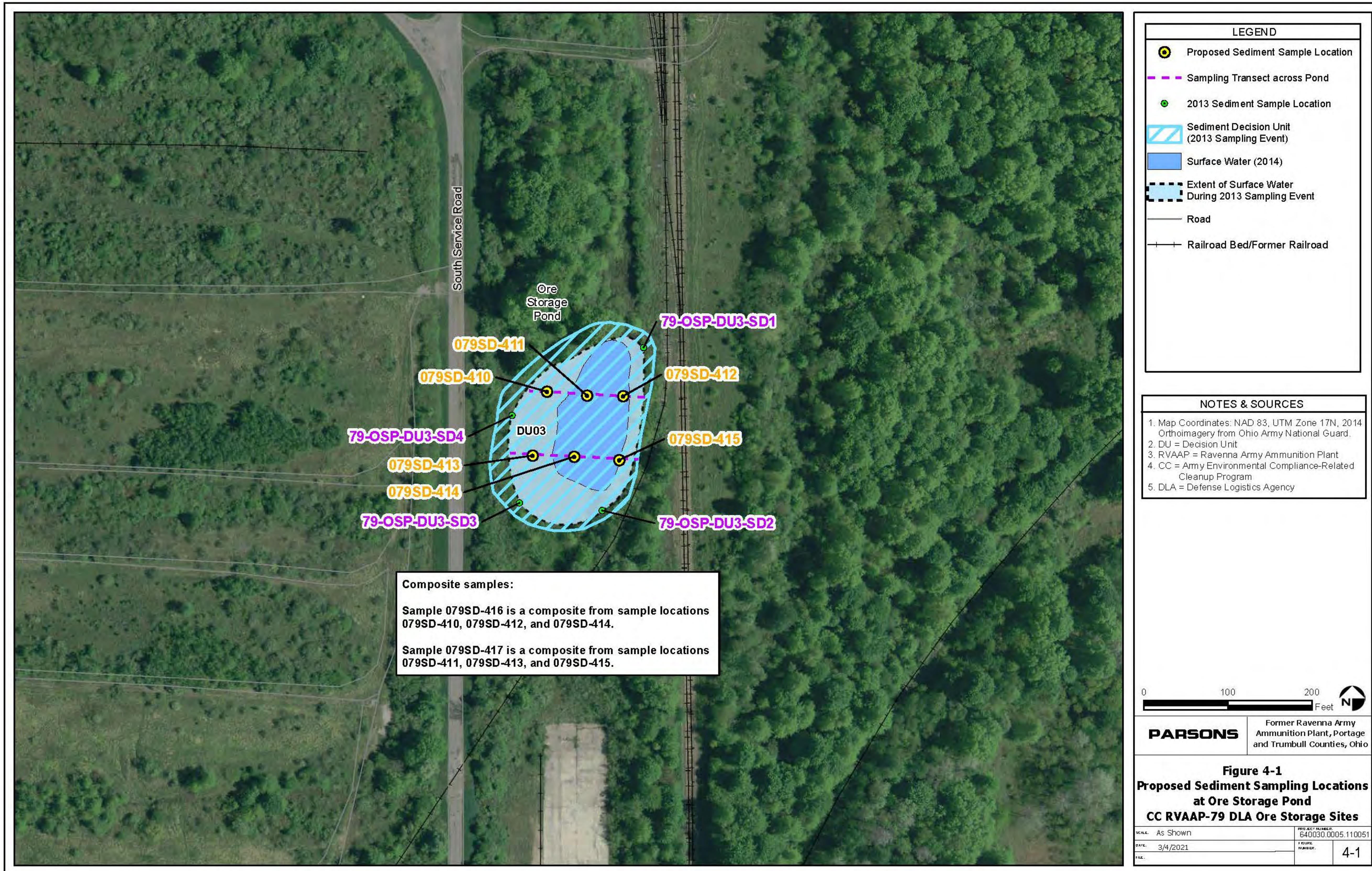
4.4 Wetlands Delineation

The Ore Storage pond has filled in significantly since it was originally constructed and is currently mapped as a palustrine, emergent, intermittently exposed wetland by the National Wetland Inventory (USFWS, 2018). To confirm this designation and the precise boundary of the wetland, a delineation will be conducted in conjunction with the sediment sampling activities. The wetland boundary will be delineated in accordance with state and federal criteria for delineating wetlands (Ohio EPA, 2001 and USACE, 2012). As such, data on vegetation, soils, and hydrology will be collected in plots along the wetland boundary. Plot data will be recorded on wetland determination data forms (Appendix A) designed to follow the requirements in USACE (2012). Representative photographs of each plot and each wetland area will be taken. Each wetland boundary flag will be labeled with a letter identifier of the wetland and numbered consecutively and surveyed. Wetlands boundaries will be used during evaluation of remedial alternatives, if that evaluation is necessary.

Table 4-1 Sampling Locations and Methods at CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond

Location ID	Sample ID	Depth (feet)	Matrix	Sample Type		Analysis	
079SD-410	079SD-410-0001-SD	0-15cm	sediment	Discrete	N	TAL metals, Standard physical and chemical parameters (TOC, pH, grain size)	Western most end of north transect. True sediment is submerged year around >1 ft underwater
	079SD-410-9001-SD	0-15cm	sediment	Discrete	FD		
	079SD-410-0001-SD-MS	0-15cm	sediment	Discrete	MS		
	079SD-410-0001-SD-MSD	0-15cm	sediment	Discrete	MSD		
079SD-411	079SD-411-0001-SD	0-15cm	sediment	Discrete	N		
079SD-412	079SD-412-0001-SD	0-15cm	sediment	Discrete	N		Eastern most end of north transect.
079SD-413	079SD-413-0001-SD	0-15cm	sediment	Discrete	N		Western most end of south transect
079SD-414	079SD-414-0001-SD	0-15cm	sediment	Discrete	N		
079SD-415	079SD-415-0001-SD	0-15cm	sediment	Discrete	N		Eastern most end of south transect
079SD-416M	079SD-416M-0001-SD	0-15cm	sediment	composite	N	*Hyalella azteca* 10 day bioassay	Composite sediment from SD-410, SD-412, and SD-414
079SD-417M	079SD-417M-0001-SD	0-15cm	sediment	composite	N	*Chironomus dilutus (tentans)* 10 day bioassay	Composite sediment from SD-411, SD-413, and SD-415
-	079EB-MMDDYY-01	-	water	discrete	N	TAL metals	Collect rinsate sample as an equipment blank from sediment tool

This Page Intentionally Left Blank



Path: S:\ES\Remed\Ravenna\Database\GIS\2020\CC-79\WPA\Figure 4-1_CC-79_WPA_MOS_ProposedSampLOC.mxd

Figure 4-1: Proposed Sediment Sample Locations at Ore Storage Pond CC RVAAP-79 DLA Ore Storage Sites

This page intentionally left blank

5.0 PROJECT ACTIVITIES

This WPA includes descriptions of all project activities.

5.1 Premobilization

Premobilization activities will be conducted in accordance with the Work Plan (Parsons, 2017).

5.1.1 Utility Clearance

There are no active utilities in the vicinity of the Ore Storage Pond based on prior investigations.

5.1.2 Pre-Field Work Meetings

Premobilization meetings will be conducted in accordance with the Work Plan (Parsons, 2017).

5.2 Mobilization and Site Preparation

Mobilization shall include all activities required to transport, assemble, and set up on site all equipment, personnel, and other services necessary to perform the work. Transportation and assembly of equipment necessary to perform the work during the project are also included in the mobilization item.

5.2.1 Temporary Facilities

Sanitary facilities and hand wash stations will be placed at locations coordinated with the OHARNG. No other temporary facilities on site are anticipated.

5.2.2 Site Access and Security

Site Access and Security procedures will be followed as described in the Work Plan (Parsons, 2017).

5.2.3 Decontamination

The hand corer used for sediment sampling will be decontaminated between sampling stations by scrubbing with a brush and ambient pond water, followed by a thorough in situ rinsing.

5.3 Investigation Field Work

The sequencing of the field work at CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond is as follows:

1) Launch small boat in the pond. Establish two transects across the pond marked with a rope.
2) Collect sediment samples along the transects using a hand coring device (Figure 4-1). Record water depth and thickness of the sediment at each location. Include field measurements of the surface water overlying the sediment for pH, temperature, dissolved oxygen, and conductivity/salinity. Prepare individual discrete samples for TAL metals and standard physical parameter analyses as specified in Section 4.3. Prepare two composite samples consisting of three sediment samples each for 10-day bioassay tests for amphipod and midge testing as specified in Section 4.2.
3) Delineate wetlands boundary around the Ore Storage Pond in accordance with state and federal criteria for delineating wetlands (Ohio EPA, 2001 and USACE, 2012).

5.4 Schedule

Sampling will be conducted once the WPA is approved, estimated in early 2021. Sampling described in this WPA will not be initiated until the Final WPA is approved. Field activities will then be scheduled and coordinated with ARNG/OHARNG/USACE.

5.5 Analytical Work

A summary of all proposed samples is provided in Table 4-1.

Two ten-day bioassays will be performed on sediment composited from three samples each, one bioassay will use *Hyalella azteca* (amphipod) and the second bioassay will use *Chironomus dilutus* (midge, formerly *tentans*). Sediment from each of the six sample locations from the Ore Storage Pond will be analyzed for TAL metals and standard sediment parameters (total organic carbon, pH, and grain size analysis).

The FWSAP (SAIC, 2011a) indicates that typically 10 percent of all samples are submitted for full suite analysis while the remaining 90 percent will have targeted analyses based on the investigation-specific goals. Full suite analyses were performed during the earlier (2012 through 2015) RI investigations and accomplished the goal of identifying any additional (unanticipated) potential contaminants at the AOCs. Because this investigation is targeted at specific, previously identified potential contaminants, further full suite analyses are not necessary and only targeted analyses based on investigation specific goals are proposed.

5.6 Data Management / Data Validation

The data validation and usability processes are detailed in the UFP-QAPP (Parsons, 2017, Appendix B, Worksheets 36 and 37). Parsons will meet the data validation requirements outlined in Section 10.0 of the FWSAP (SAIC, 2011a) as described in the Work Plan (Parsons, 2017). Data will be managed, evaluated, processed, and presented in accordance with the Work Plan (Parsons, 2017).

5.7 Surveying and Mapping

The location of sediment sampling stations will be recorded using hand-held GPS locating device (e.g., a Trimble).

5.8 Reporting

An RI addendum will be prepared for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area sediment for U.S. Army review. This report will incorporate previous RI sediment data from the Ore Storage Pond (Parsons, 2020) and will also incorporate RI data collected in accordance with this WPA. Upon acceptance of the RI addendum report by the USACE Contracting Officer Representative, a Draft RI addendum report for the Ore Storage Pond sub-area sediment will be prepared for Ohio EPA review. Once the Draft is accepted, a Final RI addendum report will be prepared and submitted to the Ohio EPA.

5.9 Project Resources

Building 1036 will be available for equipment storage and sample processing.

6.0 ENVIRONMENTAL PROTECTION PLAN

The environmental protection plan from the Work Plan (Parsons, 2017) will be followed for this WPA.

This Page Intentionally Left Blank

7.0 PROJECT DOCUMENTATION AND SAMPLE QUALITY ASSURANCE/QUALITY CONTROL

Procedures for project documentation, sample handling and tracking, field activities coordination, and field and laboratory QA/QC described in the Work Plan (Parsons, 2017) will be followed for this WPA.

This Page Intentionally Left Blank

8.0 DISPOSITION OF INVESTIGATION-DERIVED WASTE

Sampling at the Ore Storage Pond is not anticipated to generate any investigation-derived waste.

This Page Intentionally Left Blank

9.0 DATA SCREENING PROCESS

The results of the bioassays will determine if no further action or remediation is required for the Ore Storage Pond. Sediment toxicity is evaluated by survival and growth of in 10-day bioassays. Survival is measured by counting living (moving) organisms at the end of the 10-day test. Growth is measured by average dry weight (for *H. azteca*) or ash-free dry weight (for *C. dilutus*) of surviving organisms.

A bioassay test is considered acceptable according to the following criteria:

- *Hyalella azteca* Test Acceptability Criteria (TAC): 80% Survival in the control and measurable growth.
- *Chironomus dilutus* TAC: 70% survival and a mean ash-free dry weight of 0.48 mg/organism in the control.

The survival and growth results from the Ore Pond sediment will be compared to those of the control or reference sediment to determine toxicity using statistical methods in accordance with USEPA guidance (USEPA, 2000). If the data are normally distributed, then a t-Test will be performed to detect statistically significant ($p = 0.05$) differences between test sediments and the control sediment. If the data distribution is non-normal, then a Wilcoxon Two-Sample Test will be used to compare the group means. Shapiro-Wilk's Test will be used to determine if the data are normally distributed, and the F-Test will be used to test for homogeneity of variance.

Should the test results indicate a high degree of statistical strength due to low variability in the data or if the data are highly variable, an indication of biological significance of >20% difference from the control, is sufficient to indicate that a sample may have a substantial impact.

If both of the bioassays pass, then no further action will be necessary at the Ore Storage Pond. However, if one or both of the bioassays exhibit toxicity (fail), remedial alternatives will be evaluated for the Ore Storage Pond sediment.

The results of additional sediment characterization (pond depth, sediment thickness, extent of wetlands, and sediment analytical results for TAL metals and standard sediment parameters) may be used to evaluate remediation alternatives. Results of additional sediment characterization data will only be used if bioassays indicate that remedial alternatives must be evaluated. Data will be used to estimate the volume of sediment to be remediated. Sediment analytical results will be compared to Ohio EPA sediment reference values (Ohio EPA, 2018) to evaluate if concentrations are within background conditions and to disposal criteria (e.g., RCRA toxicity characteristic values) to evaluate disposal options.

This Page Intentionally Left Blank

10.0 DELIVERABLES

Deliverables for this WPA will be produced in accordance with the Work Plan (Parsons, 2017). The results of the additional sampling will be documented in an RI addendum report. If remedial alternatives need to be evaluated for Ore Storage Pond sediment, that evaluation will be documented in a Feasibility Study or Engineering Evaluation/Cost Analysis report.

This Page Intentionally Left Blank

11.0 REFERENCES

Environmental Chemical Corporation (ECC), 2012. *Final Site Inspection and Remedial Investigation Work Plan at Compliance Restoration Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio*. October 3.

Leidos, 2020. *Final Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-Wide Groundwater Annual Report for 2019, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio*. June 12.

MacDonald, D., Ingersoll, C. & Berger, T (MacDonald, et. al.), 2000. *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*. July.

Ohio Army National Guard (OHARNG), 2014. *Integrated Natural Resources Management Plan and Environmental Assessment for the Ravenna Training and Logistics Site, Portage and Trumbull Counties, Ohio*. December 2014.

OHARNG, 2016. Ohio Army National Guard Waste Management Guidelines.

Ohio Environmental Protection Agency (Ohio EPA), 2001. *Ohio Rapid Assessment Method (ORAM) for Wetlands v. 5.0*. Ohio EPA Technical Report WET/2001-1, February 1, 2001.

Ohio EPA, 2004. *Director's Final Findings and Orders (DFFOs) for RVAAP*. June 10.

Ohio EPA, 2012. *Sediment Sampling Guide and Methodologies*. 3rd Edition. Division of Surface Water. March 1.

Ohio EPA, 2018. *Ecological Risk Assessment Guidance Document*. Division of Environmental Response and Revitalization, Assessment, Remediation and Corrective Action Section. July.

Parsons, 2017. *Final Work Plan Additional Sampling for CC RVAAP-69 Building 1048 Fire Station, CC RVAAP-70 East Classification Yard, and CC RVAAP-74 Building 1034-Motor Pool Hydraulic Lift Ravenna Army Ammunition Plant Restoration Program Camp Ravenna, Portage and Trumbull Counties, Ohio*. November 17.

Parsons, 2020. *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio.* October 16.

Science Applications International Corporation (SAIC), 2001. *Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. April.

SAIC, 2010. *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio*. March 23.

SAIC, 2011a. *Facility-Wide Sample and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 24.

SAIC, 2011b. *Facility-Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 24.

SAIC, 2011c. *Historical Records Review Report for the 2010 Phase I Remedial Investigation Services at Compliance Restoration Sites (9 Areas of Concern), Ravenna Army Ammunition Plant, Ravenna, Ohio.* 22 December.

SpecPro, 2003. *Final Report for Assessment of Potential Contamination at the DLA Outdoor Storage Areas, Ravenna Army Ammunition Plant, Ravenna, Ohio*. Prepared for U.S. Army Joint Munitions Command. August.

The Mogul Corporation, 1982. *Soil and Sediment Analyses Performed for Ravenna Arsenal*, Ravenna, Ohio, 1982.

U.S. Army Corps of Engineers (USACE), 2005. *Ravenna Army Ammunition Plant Facility-Wide Human Health Risk Assessors Manual – Amendment 1*. December.

USACE, 2010. *CC RVAAP-79 DLA Ore Storage Sites, USACE In-House Sampling, Group 2 Ore Storage Area Work Plan.* U.S. Army Corps of Engineers. February 2010.

USACE, 2014. USACE Engineering Manual 358-1-1, Safety and Health Requirements Manual. November.

USACE, 2011. Letter to Base Realignment and Closure Division; Ravenna Army Ammunition Plant, regarding Results for Initial Assessment of CC-RVAAP-79 DLA Group 2 Ammunition Storage Area, 22 November.

USACE. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)*, ed. J.S. Wakeley, R.W. Lichvar, C.V. Noble, and J.F. Berkowitz. ERDC/EL TR-12-1. U.S. Army Engineer Research and Development Center, Vicksburg, MS. January.

U.S. Environmental Protection Agency (USEPA), 2000. *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*.

USEPA, 2003. *U.S. EPA Region 5 RCRA Ecological Screening Levels*, Website version last updated August 22, 2003: http//www.epa.gov/reg5rcra/ca/edql.htm.

USEPA, 2005. *Office of Solid Waste Emergency Response Directive 9272.0-17 Implementation of the Uniform Federal Policy for Quality Assurance Project Plans at Federal Facility Hazardous Waste Sites.* June.

USEPA, 2018. USEPA Regional Screening Level (RSL). November.

U.S. Fish and Wildlife Service, 2018. Wetlands Mapper, accessed 12/21/2018. www.fws.gov/wetlands/data/mapper.html

APPENDICES

This Page Intentionally Left Blank

Appendix A: Field Forms

This Page Intentionally Left Blank

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By:________________

Weather:________________

Sample Location Description:

Water Body Name:________________ Latitude/Longitude:________________

Sample Site Description (color, odor, appearance):________________

Ambient Water Conditions:

Water Temp. (ºC)	pH (SU)	Electrical Conductivity (μS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)

Sediment Collection Information:

Water Depth Above Sample (feet):________

Sediment Sample Depth:________ Sediment Depth to Refusal:________

Collection Method (circle one): Scoop Eckman Dredge Hand Corer Other:________

Sample Type (circle one): Grab Composite

Sediment Sample Information:

Station ID:________________

Sample ID:____________ Date Sampled:____________ Time Sampled:____________

Duplicate Sample ID____________ Duplicate Time (+5min):____________ MS/MSD collected? Yes / No

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance):________________

Photos: ________________

Sample Preservation: Ice,________________

Comments: ________________

Laboratory Analytical Methods:

_____ TAL Metals/Mercury by SW6010C/SW7471B

_____% TOC by Walkley Black Method

_____ pH by SW9045D

_____ Grain Size by ASTM D 422-63

_____ Bioassay Hyalella azteca 10 day

_____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

This Page Intentionally Left Blank.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: ____________________ City/County: ____________________ Sampling Date: __________

Applicant/Owner: ____________________ State: ______ Sampling Point: __________

Investigator(s): ____________________ Section, Township, Range: ____________________

Landform (hillslope, terrace, etc.): ______________ Local relief (concave, convex, none): ______________ Slope (%): ______

Subregion (LRR or MLRA): __________ Lat: ______________ Long: ______________ Datum: __________

Soil Map Unit Name: ____________________ NWI classification: ______________

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ______ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ______ No Hydric Soil Present? Yes ______ No Wetland Hydrology Present? Yes ______ No	**Is the Sampled Area within a Wetland? Yes ______ No** If yes, optional Wetland Site ID: ______________
Remarks: (Explain alternative procedures here or in a separate report.)	

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches):

Water Table Present? Yes _____ No _____ Depth (inches):

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches):

Wetland Hydrology Present? Yes ______ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: ____________

Tree Stratum (Plot size: ______________)	Absolute % Cover	Dominant Species?	Indicator Status
1.______			
2.______			
3.______			
4.______			
5.______			
6.______			
7.______			
	______ = Total Cover		
Sapling/Shrub Stratum (Plot size:______________)			
1.______			
2.______			
3.______			
4.______			
5.______			
6.______			
7.______			
	______ = Total Cover		
Herb Stratum (Plot size: ______________)			
1.______			
2.______			
3.______			
4.______			
5.______			
6.______			
7.______			
8.______			
9.______			
10.______			
11.______			
12.______			
	______ = Total Cover		
Woody Vine Stratum (Plot size: ______________)			
1.______			
2.______			
3.______			
4.______			
	______ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____________ (A)

Total Number of Dominant Species Across All Strata: ____________ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____________ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	________	x 1 = ________
FACW species	________	x 2 = ________
FAC species	________	x 3 = ________
FACU species	________	x 4 = ________
UPL species	________	x 5 = ________
Column Totals:	________ (A)	________ (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ______ **No**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: ______

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L, M**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ______

Remarks:

This Page Intentionally Left Blank.

Appendix B: Regulatory Correspondence Letters and Response to Comments

This Page Intentionally Left Blank

Ohio Environmental Protection Agency

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

March 19, 2021

TRANSMITTED ELECTRONICALLY

Mr. Kevin M. Sedlak
Army National Guard
Installations & Environment
Cleanup Branch IPA Designation
1438 State Route 534 SW
Newton Falls, OH 44444

RE: US Army Ravenna Ammunition Plt RVAAP
Remediation Response
Project Records
Remedial Response
Portage County
ID # 267000859258

Subject: Review of Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area

Dear Mr. Sedlak:

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the Army's March 5, 2021 response to Ohio EPA's February 26, 2021 comment letter on the Draft Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area.

Ohio EPA finds the Army's responses to be acceptable. Please submit the document in final form.

As a precautionary response to COVID-19, Ohio EPA is currently operating with most staff working remotely. During this time, we will not be issuing hard-copy mail. This letter is an official response from Ohio EPA that will be maintained as a public record. If you have any questions concerning this letter, please contact me at (330) 963-1170, or by email at ed.damato@epa.ohio.gov.

Sincerely,

Edward J. D'Amato

Edward D'Amato
Site Coordinator
Division of Environmental Response and Revitalization

ED/sc

ec: Katie Tait, OHARNG RTLS
Nat Peters, USACE
Steven Kvaal, USACE
Rebecca Shreffler, Chenega
Mark Leeper, ARNG
Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Megan Oravec, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Susan Netzly-Watkins, Ohio EPA, NEDO, DERR
Tom Schneider, Ohio EPA, SWDO, DERR
Brian Tucker, Ohio EPA, CO, DERR

RECEIVED
MAR 19 2021

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

March 05, 2021

Ohio Environmental Protection Agency
DERR-NEDO
Attn: Edward J. D'Amato, Site Coordinator
2110 East Aurora Road
Twinsburg, Ohio 44087-1924

Subject: Responses to Comments (dated February 26, 2021) on the *Draft Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area* dated January 14, 2021, for the Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage and Trumbull Counties, Ohio. Ohio EPA ID# 267-000859-258

Dear Mr. D'Amato:

The Army appreciates your time and comments (dated February 26, 2021) on the *Draft Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Ravenna Army Ammunition Plant Restoration Program, Ravenna, Ohio*, dated January 14, 2021. Enclosed for your review are responses to your comments.

Please contact the undersigned at (614) 336-6000 Ex 2053 or kevin.m.sedlak.ctr@mail.mil if there are issues or concerns with this submission.

Sincerely,

SEDLAK.KEVIN.MICHAEL.1254440171 Digitally signed by SEDLAK.KEVIN.MICHAEL.1254440171 Date: 2021.03.05 08:46:02 -05'00'

Mr. Kevin Sedlak
RVAAP Restoration Program Manager

cc. Tom Schneider, Ohio EPA, SWDO
Natalie Oryshkewych, Ohio EPA, NEDO, DERR
Megan Oravec, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Katie Tait, OHARNG, CJAG
Kevin Mieczkowski, USACE Louisville
Steven Kvaal, USACE
Mark Leeper, ARNG
Jennifer Tierney, Vista Sciences
Becky Shreffler, Chenega Tri-Services, LLC
Patrick Ryan, Leidos
Ed Heyse, Parsons

Draft Work Plan Addendum:
Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites,
Ore Storage Pond Sub-Area
***Ravenna Army Ammunition Plant (RVAAP) Restoration Program*, January 14, 2021.**
Ohio EPA ID# 267-000859-258

General Comments

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the Work Plan Addendum: Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, received on January 14, 2021. Ohio EPA has the following comments. Please note that all citations are to U.S. EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 617 600/R-99/064 (U.S. EPA 2000).

1.) Table 3-1, Data Quality Objectives: Table 3-1 in the draft Work Plan Addendum (WPA) states in part: "(d)etermine the toxicity of the sediment via bioassays. A bioassay test is considered acceptable (i.e. passing) if there is at least 70 percent survival and a mean ash-free dry weight of 0.48 mg/organism in the control. Toxicity is indicated if one or both bioassays fail." This criterion is a description of the acceptability of the tests and not an indication of toxicity.

Failure (i.e., considered toxic) of bioassay results generally will be considered as a 20% difference when compared to the control using the appropriate statistics/power. However, other methods (e.g., comparing mean values) may be appropriate given the variability of the results of the bioassays. Section 16 of the U.S. EPA 2000 bioassay manual should be reviewed and the failure criteria in the WPA is to be consistent with the above.

Both mortality and growth are to be assessed in the bioassays. Per U.S. EPA 2000, the endpoints in the 10-day toxicity test with *H. azteca* and *C. tentans* are survival and growth. Information was provided in the draft WPA that indicate only mortality was to be assessed. However, the standard 10-day bioassay provides information on both mortality and growth. Revise text to clarify both endpoints will be assessed. Also, it is recommended that the project be discussed with the contracted laboratory doing the bioassays, prior to revising the WPA as many of the comments could be easily addressed with their assistance.

***Response:* Agree.** *We coordinated with the laboratory (EA Science and Technology) and revised Table 3-1 in the work plan to clarify that both survival and growth will be used to assess toxicity. A revised Table 3-1 is attached to this response.*

Survival is measured by counting living (moving) organisms at the end of the 10-day test. Growth is measured by average dry weight (for H. azteca) or ash-free dry weight (for C. dilutus) of surviving organisms.

Acceptable tests meet the following criteria in the controls:

- *Hyalella azteca Test Acceptability Criteria (TAC): 80% survival and measurable growth in the control*
- *Chironomus dilutus TAC: 70% survival and a mean ash-free dry weight of 0.48 mg/organism in the control*

The survival and growth results from the Ore Pond sediment will be compared to those of the control or reference sediment to determine toxicity using statistical methods in accordance with U.S. EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 617 600/R-99/064 (U.S. EPA 2000). If the data are normally distributed, then a t-Test will be performed to detect statistically significant (p = 0.05) differences between test sediments and the control sediment. If the data distribution is non-normal, then a Wilcoxon Two-Sample Test will be used to compare the group means. Shapiro-Wilk's Test will be used to determine if the data are normally distributed, and the F-Test will be used to test for homogeneity of variance.

Should the test results indicate a high degree of statistical strength due to low variability in the data or if the data is highly variable, an indication of biological significance of >20% difference from the control, is sufficient to indicate that a sample may have a substantial impact.

2.) Section 4.1: Sediment Sampling: The current WPA is suggesting a single transect that runs through the area of the pond with largest area of open water. Ohio EPA recommends two transects running perpendicular to and instead of the current line, one crossing approximately between samples 411 and 412, and one approximately between 413 and 414 (Figure 4-1 draft WPA). A total of six samples as proposed in the draft WPA is sufficient, with three from each suggested transect. Wetland sediment/soil should also be included but only within the historical boundary of the ore storage pond. The proposed single transect in the draft WPA avoids the sediment sample with the maximum concentration of arsenic. The two-transect approach should provide representative sediment samples for the bioassay work.

***Response**: **Agree**. Please see attached revised Figure 4-1 for new sample transects and locations.*

3.) Section 4.1 Sediment Sampling: The draft WPA indicates that sediment samples will be collected from the zero to 0.5-foot depth. It is recommended that samples of zero to one-foot depth be collected for two reasons: a) six samples from a zero to 0.5-foot interval may not provide enough sediment mass for the required bioassay replicates and metal analysis, and b) the zero to one-foot interval will provide a slightly more historical sediment sample and represent the biologically active zones of the sediment and fringe wetland sediment/soil environments.

***Response**: **Clarification**. The 0.5-foot sampling depth for sediment is based on the July 2018 Ohio EPA Ecological Risk Assessment Guidance Document. Because the purpose of the sampling is to determine toxicity to aquatic macroinvertebrates inhabiting the sediments of the Ore Storage Pond, the Ohio EPA recommended sampling depth of 0.5-foot was utilized, which is based on the depth of macroinvertebrate activities in sediment. This 0.5-foot depth is also in accordance with USEPA recommended sampling depths for sampling the bioactive zone/burrowing depths of oligochaetes in freshwater sediment (USEPA, 2000). To ensure that enough sample material is collected to provide the mass for the required bioassay replicates and metal analyses, additional co-located cores will be collected until sufficient sample volume is achieved. Thus, the sediment sampling depth was not changed.*

4.) Section 4.2: Bioassay: Composite sediment samples used for bioassay/replicates should also be analyzed for Target Analyte List (TAL) metals. One approach would be to equally split (using incremental sampling methodology (ISM) sample preparation methods) the composite of three sediment samples (odd and even as proposed) into 10 equal amounts, one for metal analysis and eight for bioassay replicates with one remaining for a replacement, if needed.

***Response*: Clarification.** *The purpose of collecting the TAL metals is to use those results as part of the remedy evaluation if the bioassay toxicity tests fail; not for site investigation purposes. Thus, no change will be made to the collection of TAL metals. The laboratory will create the eight bioassay replicates at the laboratory from the composite samples that are delivered to them.*

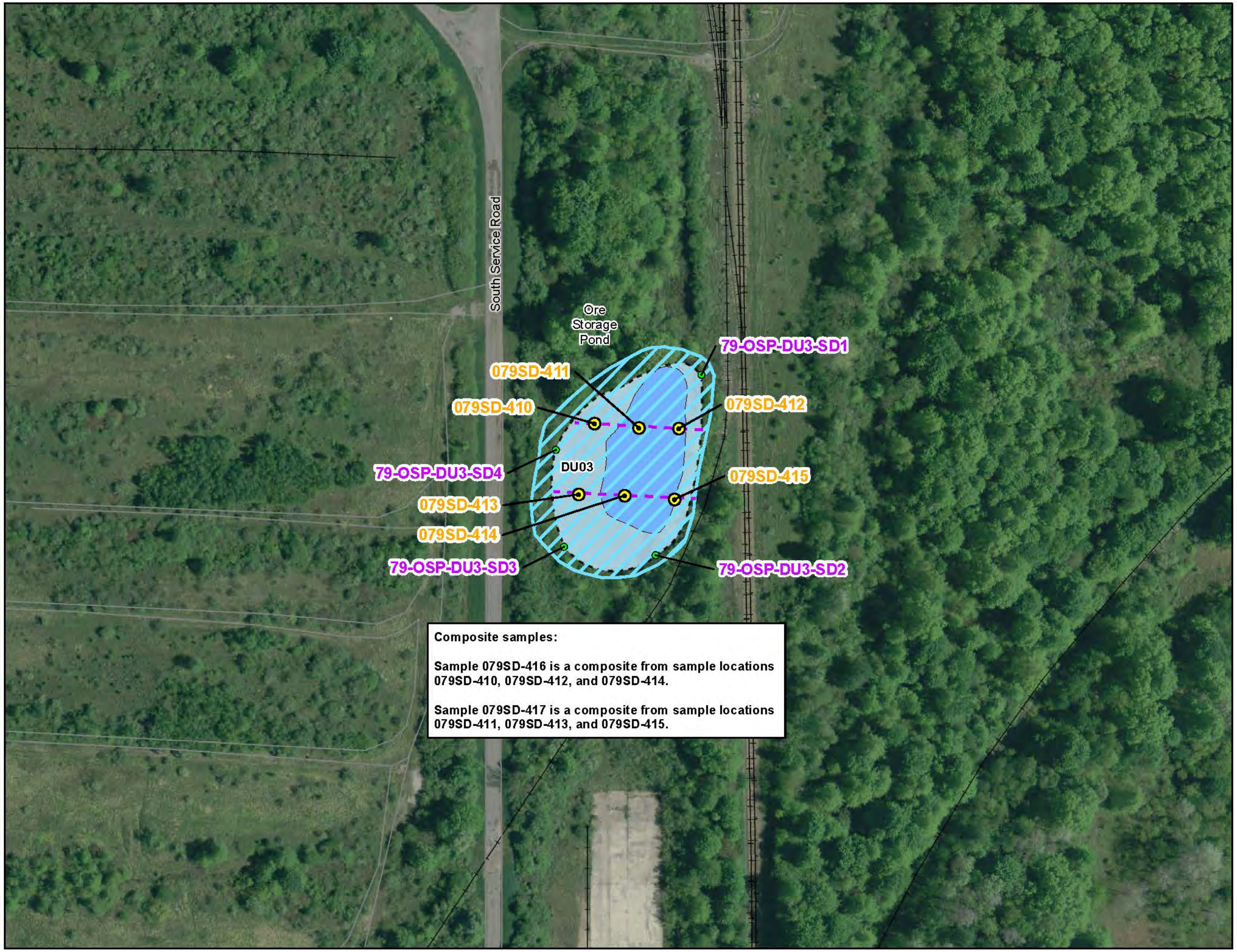
Please revise the document accordingly and re-submit it.

***Response*:** *Upon resolution of comments, we will prepare and submit the Final Work Plan Addendum for Ohio EPA approval.*

This Page Intentionally Left Blank.

Table 3-1 Data Quality Objectives

State the Problem	Identify Goals of the Study	Identify Information Inputs	Define the Boundaries of the Study	Develop the Analytic Approach	Specify Performance or Acceptance Criteria	Develop the Detailed Plan for Obtaining Data
CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area						
Concentrations of metals were detected in the sediment samples from the Ore Storage Pond that were greater than Ohio EPA Sediment Reference Values. Although the Army showed there were unlikely to be unacceptable risks to ecological receptors that use the pond using standard ERA tools, the Ohio EPA per their regulations, stated that there were only two options: test the sediment by completing two bioassays or remediate the sediment.	Is the sediment toxic as measured by *Hyalella azteca* 10 day bioassay and /or *Chironomus dilutus (tentans)* 10 day bioassay? If bioassays indicate toxicity, report results and close the RI phase, then proceed to evaluation of remedial alternatives. If not toxic, report and close the RI phase with conclusion that no further action is required.	Sediment toxicity is evaluated by survival and growth of in 10-day bioassays. Survival is measured by counting living (moving) organisms at the end of the 10-day test. Growth is measured by average dry weight (for *H. azteca*) or ash-free dry weight (for *C. dilutus*) of surviving organisms. Acceptable tests meet the following criteria in the controls: • *H. azteca* Test Acceptability Criteria (TAC): 80% survival and measurable growth in the control • *C. dilutus* TAC: 70% survival and a mean ash-free dry weight of 0.48 mg/organism in the control The survival and growth results from the Ore Pond sediment will be compared to those of the control or reference sediment to determine toxicity using statistical methods in accordance with *US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*, EPA 617 600/R-99/064, March 2000. If the data are normally distributed, then a t-Test will be performed to detect statistically significant ($p = 0.05$) differences between test sediments and the control sediment. If the data distribution is non-normal, then a Wilcoxon Two-Sample Test will be used to compare the group means. Shapiro-Wilk's Test will be used to determine if the data are normally distributed, and the F-Test will be used to test for homogeneity of variance. Should the test results indicate a high degree of statistical strength due to low variability in the data or if the data is highly variable, an indication of biological significance of >20% difference from the control, is sufficient to indicate that a sample may have a substantial impact.	Sediment from within the submerged portions of Ore Storage Pond. The pond is small (0.36 acres). Because the pond has not been maintained, the pond has filled in significantly since it was originally constructed. The size of the pond changes seasonally and with rain events.	Analytic approach is in accordance with *US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*, EPA 617 600/R-99/064, March 2000.	All sampling and analysis will be performed in accordance with the procedures outlined in the UFP-QAPP and the *Work Plan Addendum, Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio.*	Collect six sediment samples across the pond. Prepare field composite samples that each contain portions from three of the six sediment samples) and perform the two bioassays: • *Hyalella azteca* 10 day bioassay and • *Chironomus dilutus (tentans)* 10 day bioassay Bioassays should follow *US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, Second Edition, EPA 600/R-99/064, March 2000. Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed. Refer to Section 4.0 for further details.



LEGEND

- Proposed Sediment Sample Location
- Sampling Transect across Pond
- 2013 Sediment Sample Location
- Sediment Decision Unit (2013 Sampling Event)
- Surface Water (2014)
- Extent of Surface Water During 2013 Sampling Event
- Road
- Railroad Bed/Former Railroad

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2014 Orthoimagery from Ohio Army National Guard.
2. DU = Decision Unit
3. RVAAP = Ravenna Army Ammunition Plant
4. CC = Army Environmental Compliance-Related Cleanup Program
5. DLA = Defense Logistics Agency

0 100 200 Feet

N

PARSONS

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

Figure 4-1
Proposed Sediment Sampling Locations at Ore Storage Pond
CC RVAAP-79 DLA Ore Storage Sites

SCALE:	As Shown	PROJECT NUMBER:	640030.0005.110051
DATE:	3/4/2021	FIGURE NUMBER:	4-1
FILE:			

Path: S:\ES\Remed\Ravenna\Database\GIS\2020\CC-79\WPA\Figure 4-1_CC-79_WPA_MOS_ProposedSampLOC.mxd