Final
Site Inspection Addendum for CC RVAAP-78 Quarry Pond Surface Dump
Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Prepared for:
National Guard Bureau
Army National Guard
(ARNG-ILE Cleanup)
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September 28, 2018

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14. ABSTRACT

The purpose of the Final Site Inspection Addendum is to identify if chemical contamination is present and if present, is it in great enough concentrations to pose potential risks to human health and the environment in a 30 ft-wide parameter around each of the three Debris Piles and in the Test Pit Area. This SI Addendum was completed after the 2016 SI identified chemical contamination in all three Debris Piles; asbestos containing material (ACM) in Debris Piles A and B and asbestos fibers in subsurface soil from Debris Pile C. No contamination (chemical, ACM, or asbestos fibers) were identified in the 30 ft-wide areas around each of the three Debris Piles. Asbestos containing material was identified in one of the soil borings from the Test Pit Area. Because chemical contamination above Unrestricted (Residential) Land Use was indemnified within Debris Piles in the 2016 SI and asbestos contamination was found at Test Pit 5 in this SI Addendum, additional remedial action is warranted for the AOC. It is recommended that removal action alternatives be evaluated in an EE/CA as the next phase in the CERCLA process

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Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

November 14, 2018

Mr. David Connolly
Army National Guard Directorate
Environmental Programs Division
ARNG-ILE-CR
111 S. George Mason Dr.
Arlington, VA 22204

Re: **US Army Ravenna Ammunition Plt RVAAP**
Remediation Response
Correspondence
Remedial Response
Portage County
267000859156

Subject: Approval of the Final Site Inspection Addendum Report, CC-RVAAP-78 Quarry Pond Surface Dump, September 18, 2018.

Dear Mr. Connolly:

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the Army's Final Site Inspection Addendum for CC RVAAP-78 Quarry Pond Surface Dump, dated September 19, 2018. Ohio EPA approves the document.

A typographical error was noted in the report that failed to delete a sentence that was changed on Page xvii, lines 681-683, as noted in Comment #3 in Ohio EPA's comment letter dated September 18, 2018. The error was resolved on September 28, 2018, when Ohio EPA received a replacement page for the document via e-mail.

If you have any questions or concerns related to this review or would like to schedule a meeting or conference call, please free feel to contact me at (330) 963-1170 or by e-mail at: ed.damato@epa.ohio.gov.

Sincerely,

FOR

Edward J. D'Amato, Project Coordinator
Ohio EPA - Division of Emergency and Remedial Response

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DISCLAIMER STATEMENT

This Site Inspection Addendum report was revised and prepared by the United States Government using a preliminary draft remedial investigation report originally prepared by ECC and AMEC Environment and Infrastructure, Inc. (AMEC). In no event shall either the United States Government, ECC, or AMEC have any responsibility or liability for any consequences of any use, misuse, inability to use, or reliance on the information contained herein, nor does either warrant or otherwise represent in any way the accuracy, adequacy, efficacy, or applicability of the contents hereof.

STATEMENT OF INDEPENDENT TECHNICAL REVIEW

The United States Army Corps of Engineers, Louisville District has completed the *Final Site Inspection Addendum for CC RVAAP-78 Quarry Pond Surface Dump at the Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ravenna, 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 the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of project data quality objectives, technical assumptions, methods, procedures, and materials used. The appropriateness of the data used, level of data obtained, and reasonableness of the results, including whether the product meets the customer's needs, are consistent with law and existing United States Army Corps of Engineers policy.

Angela L. Schmidt

Angela L. Schmidt, MS, CET
Study/Design Team Leader, Main Author

9/26/2018
Date

Nathaniel Peters, II

Nathaniel Peters, II, PhD, PE
Independent Technical Reviewer

9/26/2018
Date

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September 28, 2018

DOCUMENT DISTRIBUTION

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ARNG—Army National Guard
DERR—Division of Environmental Response and Revitalization
NEDO—Northeast District Office
ILE—Installation, Logistics, and Environment
OHARNG—Ohio Army National Guard
RVAAP—Former Ravenna Army Ammunition Plant

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degree Celsius
°F	Degree Fahrenheit
µg/kg	Microgram(s) per kilogram
ACM	Asbestos-containing material
AMEC	AMEC Environment & Infrastructure, Inc.
amsl	Above mean sea level
AOC	Area of concern
atm-m^3/mol	Atmosphere relative to cubic meter per mol
bgs	Below ground surface
BSV	Background Screening Value
C	Carbon or composite sample
CAS	Chemical Abstract Service
CC	Army Environmental Compliance-Related Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter
CPG	Certified Professional Geologist
CrVI	Hexavalent chromium
CSM	Conceptual site model
D	Discrete sample
DDT	Dichlorodiphenyltrichloroethane
DERR	Division of Environmental Response and Revitalization
DNAP	Division of Natural Areas and Preserves
DoD	Department of Defense
DQO	Data quality objective
DU	Decision unit
ECC	Environmental Chemical Corporation
EQM	Environmental Quality Management, Inc.
FD	Field duplicate
FGDC	Federal Geographic Data Committee
ft	Feet(foot)
ft^2	Square feet(foot)
FWCUG	Facility-Wide Cleanup Goal
FWSAP	Facility-Wide Sampling and Analysis Plan
gpm	Gallon per minute
HELP	Hydrologic Evaluations of Landfill Performance
HRR	Historical Records Review
ID	Identification
IDW	Investigation-derived waste
INRMP	Integrated Natural Resources Management Plan
IS	Incremental sample
ISM	Incremental sampling methodology
J	Estimated
km	Kilometer(s)

km^2	Square kilometer(s)
K_{oc}	Water/organic carbon partition coefficient
K_{ow}	Octanol-water partition coefficient
LANL	Los Alamos National Laboratory
L/kg	Liter per kilogram
LOD	Limit of Detection
LOQ	Limit of Quantitation
m	Meter
MCL	Maximum Contaminant Level
MDC	Maximum detected concentration
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
mi	Mile(s)
mi^2	Square mile(s)
MS	Matrix spike
MSD	Matrix spike duplicate
N&E	Nature and extent
NA	Not available
NB	No background
NC	Not calculated
ND	Not detected
NGT	National Guard Trainee
NR	Not reported
NSL	No screening level
ODNR	Ohio Division of Natural Resources
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
P.E.	Professional Engineer
Ph.D.	Doctor of Philosophy
PID	Photoionization detector
PRG	Preliminary Remediation Goal
Prudent	Prudent Technologies, Inc.
QA	Quality assurance
QC	Quality control
QPSD	Quarry Pond Surface Dump
RI	Remedial Investigation
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SB	Subsurface soil boring
SD	Wet sediment
SI	Site Inspection
SOR	Sum of ratio

SpecPro	SpecPro, Inc.
SRC	Site-related chemical
SS	Surface soil
SSL	Soil Screening Level
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TPA	Test Pit Area
T_{RC}	Groundwater travel time to nearest receptor
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile organic compound
WOE	Weight of evidence

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This Site Inspection (SI) Addendum report was completed to document results of the field activities performed for the Compliance Restoration (CR) Site CC (Army Environmental Compliance-Related Cleanup Program) RVAAP-78 Quarry Pond Surface Dump at the former Ravenna Army Ammunition Plant (RVAAP), in Portage and Trumbull counties, Ohio. This work was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This RI Report was originally prepared by Environmental Chemical Corporation (ECC) under the United States Army Corps of Engineers (USACE)–Louisville District's Contract Number (No.) W912QR-04-D-0039, Delivery Order No. 0004, Mod. No. 1.

Planning and performance of all elements of this contract are in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) *Director's Final Findings and Orders for Camp Ravenna* (former RVAAP, the facility), dated June 10, 2004 (Ohio EPA 2004). The Director's Final Findings and Orders requires conformance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) to complete the environmental work at the facility under the Installation Restoration Program, which began in 1989 with 32 environmental areas of concern (AOCs). This RI follows CERCLA/NCP and DFFOs requirements to characterize the AOC. The SI (USACE 2016) concluded that additional remedial actions are warranted at the AOC for the removal of the three Debris Piles. This SI Addendum was completed to evaluate the areas surrounding the Debris Piles to determine if there was contamination in them and if there was contamination in the Test Pit Area. If contamination is identified in the areas around the Debris Piles, then the remedial actions will need to address these areas as well as the piles. The SI already identified that a removal action was warranted to remove the three Debris Piles.

The areas assessed in this SI Addendum were sampled and evaluated to determine if the area around each of the Debris Piles contains chemical contamination and/or asbestos. The SI concluded that the three Debris Piles needed to be removed because of chemical contamination, asbestos fibers in soil, and/or asbestos containing material (ACM) as identified in the SI and this SI Addendum. While the SI made conclusions to move forward to an RI for further evaluation, the sampling completed for the RI, only evaluated the perimeter around and areas between the Debris Piles. The data collected for the preliminary draft RI was extensive and assessed the extent of contamination but only in the Debris Pile perimeters and areas between the Debris Piles. The Preliminary Draft RI did not include an evaluation of the Debris Piles because it was completed assuming that the three Debris Piles would be removed to achieve Unrestricted (Residential) Land Use. Therefore, the data collected for the Preliminary Draft RI was reassessed in this report to form an Addendum to the SI. The approach and sampling completed for the Preliminary Draft RI adequately provided data to evaluate if contamination, asbestos fibers, and/or ACM are present in areas assessed.

This SI Addendum was prepared by USACE to provide environmental investigation information for CC RVAAP-78 (**Figures 1-1 and 1-2**). Environmental investigations at the facility began under the Installation Restoration Program in 1989, at 32 AOCs. The United States Army Center for Health Promotion and Preventive Medicine (now the United States Army Public Health Command - USAPHC) collected samples at each of the AOCs and performed a Relative Risk Site Evaluation, which prioritized each AOC into three groups: low, medium, and high priorities. Restoration work has proceeded primarily by addressing the highest priority sites first. In 1998, the number of AOCs was increased from 32 to 51. The relative risk rankings were performed to prioritize those additional AOCs. Compliance Restoration sites were added as AOCs in 2010. This SI Addendum discusses one of these AOCs, CC RVAAP-78 Quarry Pond Surface Dump (**Figure 1-3**).

ES.2 OBJECTIVES

The following are the CC RVAAP-78 Quarry Pond Surface Dump SI Addendum objectives:

- Conduct a field investigation to collect site-related data to assess contamination (chemical, asbestos fibers in soil, or ACM) within 30- ft. wide perimeters surrounding the Debris Piles (A, B, and C) and the Target Pit Area.

- Provide sufficient quality assurance (QA)/quality control (QC) sampling to evaluate the overall quality of both the field and laboratory sampling procedures.

- Perform AOC-specific evaluation of the data to determine if contamination is present in the study areas by comparing the maximum detected concentrations (MDCs) to Unrestricted (Residential) Land Use criteria.

- Conducting a Weight-of-Evidence (WOE) assessment of chemical concentrations where the MDC exceeds Residential criteria.

- Determine if additional remedial actions are warranted to investigate/ and or characterize the nature and extent of contamination outside the Debris Piles (A, B, and C) or the Test Pit Area if WOE indicates presence of contamination in these areas. If Unrestricted (Residential) Land Use is achieved for these areas, then the next step in the CERCLA process will be to conduct an evaluation of remedial alternatives to remove the Debris Piles in an Engineering Evaluation/Cost Analysis (EE/CA).

ES.3 SCOPE

This SI Addendum conducted for this AOC included a review of previous environmental reports including the information presented in the *Final Historical Records Review Report for 2010 Preliminary Assessment Compliance Restoration Sites CC-RVAAP-78 Quarry Pond Surface Dump & CC-RVAAP-80 Group 2 Propellant Can Tops* (Historical Records Review [HRR]) prepared by Prudent Technologies Inc. (Prudent 2011a); *Final Revised Site Inspection for Compliance Restoration Site CC-RVAAP-78 Quarry Pond Surface Dump* (USACE 2016); and Phase I/Phase II Remedial Investigation of the Fuze and Booster Quarry Landfill/Ponds (RVAAP-16), Volume One – Main Report prepared by (Science Applications International Corporation [SAIC] and SpecPro, Inc. [SpecPro] 2005).

Fieldwork for this SI Addendum consisted of intrusive soil sampling using incremental sampling methodology (ISM), composite sampling methods, discrete sampling methods, and test pit sampling. Following data validation and QA/QC, the dataset was refined and aggregated to identify contamination.

Work described herein was conducted under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). Due to delays in the overall cleanup program at the former RVAAP that were unrelated to ECC' s performance, ECC could not complete this document before the Contract ended and the document was left as a Preliminary Draft. Therefore, USACE has revised and completed this document as needed.

ES.4 SITE BACKGROUND AND HISTORY

The CC RVAAP-78 AOC is located in the south-central portion of the facility, northeast of the intersection between South Patrol Road and Greenleaf Road. The AOC consists of steeply inclined rocky slopes. The former dumping at the bases of the rocky slopes. There are three main dump areas (debris piles) that are located north, northwest, and northeast of the northern-most quarry pond within the adjacent Fuze and Booster Quarry Landfill/Ponds AOC (RVAAP-16). Debris Piles A and B are at the bases of steeply inclined rock slopes of the quarry. The third dump area is called Debris Pile C, is flatter and is adjacent to the northwest end of the northern-most pond within the AOC. Debris Piles consists of construction debris, scrap metal, cultural debris, and ACM (e.g. transite type roofing, sheeting, etc.)

Debris Pile A is approximately 425 feet in length varying in surface width from 18 to 68 feet. A second, smaller debris pile at the base of a steeply inclined rock slope, defined as Debris Pile B, is approximately 296 feet in length and 24 feet wide. Debris Pile C is located along the northwestern corner of the northern-most quarry pond area with the debris area being approximately 120 feet by 45 feet.

In addition to the Debris Piles, a small area where materials appeared to have been burned is located near where a rusted, 55-gallon drum was located within Debris Pile B. This drum was identified as Drum #1 in the SI and was removed and disposed as part of the 2016 Site Inspection (SI). This area was called an "apparent burn area" in the SI although there was no evidence besides charred ground and lack of vegetation to support that it was an actual burn area. The topographic map of this area (**Figure 3-1**), shows the south end of Debris Pile A becoming one continuous slope from Reference Point 9b of Debris Pile A to Reference Point 3 of Debris Pile B. A second rusted 55-gallon drum (Drum #2) was present within Debris Pile C but was removed and disposed of during the SI investigations.

The Historical Records Review (HRR) indicated there was a possible large amount of construction debris located between mainly Debris Pile A and Debris B (referred to herein as the Test Pit Area). It was also noted in the HHR that the construction debris area (Test Pit Area) possibly extended westward to the road along the east side of the northernmost pond on the adjacent AOC (RVAAP-16).

The 2016 SI showed ACM was present in Debris Piles A and B, and one soil sample from Debris Pile C had 2% asbestos. Construction debris and rubble was identified in Debris Pile C but no ACM was noted. The SI soil analytical results showed samples had detections of various chemicals at concentrations greater than the Facility-wide Cleanup Goals (FWCUGs) for Unrestricted (Residential) Land Use as well as the observed presence of substantial amounts of transite and roofing materials that contain approximately 35 percent asbestos. Accordingly, the SI recommended that an RI be completed to further evaluate the Nature and Extent of the chemicals in the Debris Piles and that additional sampling be conducted in the area between Debris Piles A and B and the east side of the northern-most pond to determine if any fill materials are present that contain contamination.

ES.5 INVESTIGATION ACTIVITIES

Based on the findings presented in the SI, additional sampling of the perimeters of Debris Piles A, B, and C as well as the only surface soil and subsurface soil require additional investigation since no surface water or sediment are present on the AOC where the debris occurs. No groundwater samples were collected as part of this RI since groundwater is being addressed under a separate facility-wide groundwater investigation (RVAAP-66 Facility-Wide Groundwater). The sample results in this RI were used primarily to define the nature and extent of contamination in each of the debris piles and to evaluate the fate and transport using soil screening analyses. Additionally, the concentrations of chemicals detected in each DU were further evaluated in the Weight of Evidence (WOE) to ensure that the DU was actually bounding the debris piles or if the sizes of the piles were greater.

Decision Units (DUs) were established to surround each debris pile at a distance of 30 ft in all directions (30-ft perimeter ring around the debris piles) to help establish the extent of the contamination in each pile since the SI already confirmed that chemical contamination was present in all three Debris Piles, ACM in Debris Pile A and Debris Pile B, and asbestos fibers in the subsurface in Debris Pile C. The AOC was divided into three Decision Units (DUs) that surround the three debris piles and at an area between two of the debris piles referred to as the Test Pit Area. For this RI, ISM was used to investigate each DU both vertically and horizontally to 7 ft below ground surface (bgs) to assess potential surface and subsurface contamination in surface and subsurface soil at the AOC. In addition, one vertical composite sample was collected from 7 to 8.5 ft bgs to supplement the HHRA and characterize the soils to 8.5 ft bgs. The target depth of the composite sample was 13 ft bgs for the Unrestricted (Residential) Land Use; however, this depth was not met due to near-surface bedrock and resulting drilling refusal.

Soil samples were collected using incremental sampling methodology (ISM), discrete, and composite methods. All soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and Target Analyte List (TAL) metals, including mercury, polychlorinated biphenyls (PCBs), and propellants. In addition, construction debris was sampled from one test pit for asbestos only.

The work described in this SI Addendum was conducted in accordance with the Final SI/RI Work Plan (ECC 2012) and the Facility-Wide Sampling and Analysis Plan (FWSAP) (Science Applications International Corporation [SAIC] 2011b).

Previous reports were reviewed as part of this RI, including the *Final Historical Records Review Report for 2010 Preliminary Assessment Compliance Restoration Sites CC-RVAAP-78 Quarry Pond Surface Dump & CC-RVAAP-80 Group 2 Propellant Can Tops*, prepared by Prudent Technologies Inc. (Prudent) (2011a). The *Final Revised Site Inspection for Compliance Restoration Site CC-RVAAP-78 Quarry Pond Surface Dump* (USACE 2016) was also reviewed as part of this RI.

Currently, soil and air targets, as described in the Abbreviated Preliminary Assessment Guidance (US EPA, 1999), at CC RVAAP-78 are limited due to low activity levels. However, in the future, the OHARNG plans to use this area for military training. A Feasibility Study (FS), Record of Decision (ROD), Remedial Design (RD), and Remedial Action (RA) for the Fuze and Booster Quarry Landfill/Ponds addressed the larger area surrounding and in the vicinity of CC RVAAP-78. These studies, did not specifically address the contamination and potential asbestos at the CC RVAAP-78 AOC. Use of the data from previous reports and sampling areas is limited to their impact on this AOC. Although the FBQ investigations for the Landfill/Ponds addressed the large areas surrounding the area of CC RVAAP-78, they did not specifically address any potential transite problems or contamination in the Debris Piles which was assessed in the 2016 SI. This SI Addendum is only limited to ensuring that the size of the Debris Piles is adequately known and to identify where if any contamination is present in the Test Pit Area.

ES.6 PATHWAY ANALYSIS

ES.6.1 SOIL EXPOSURE AND AIR PATHWAYS CONCLUSIONS

Following investigation and remediation of the FBQ Landfill/Ponds, three Debris Piles were encountered within this area which required additional consideration. These three Debris Piles constitute the Quarry Pond Surface Dump, CC RVAAP-78, which were assessed in the 2016 SI. Since the SI results indicated chemical contamination and asbestos was in the three Debris Piles in surface soil and in the subsurface soil in Debris Pile C, additional field sampling or analyses of the Debris Piles were not completed for this SI Addendum. The SI indicated that use of the AOC may result in possible exposure to asbestos and chemical contamination if the AOC is used. Potential exposure to friable asbestos fibers from the residual transite and roofing materials at CC RVAAP-78 may occur if the soil is disturbed. The likelihood of asbestos fibers being released into the air is greater if asbestos material is disturbed. Exposure to chemicals in the soil is likely, if the activity disturbs the soil and the receptor contacts the soil. The potential for exposure increases the longer the contact occurs on site.

The intrusive investigation for the SI included surface soil ISM sampling at the apparent Burn Area and Debris Piles A, B, and C; subsurface soil ISM sampling at Debris Pile C; and sampling of the contents of the two rusted drums. Transite was observed in both Debris Piles A and B. The surface soil ISM sampling at the apparent Burn Area and Debris Pile C and the subsurface soil ISM sampling at Debris Pile C, was conducted. Asbestos contents of 30 percent and 40 percent were detected in the transite samples from Debris Piles A and B, respectively, and the roofing sample from Debris Pile B had a level of 35 percent asbestos. All the soil samples were analyzed for asbestos and were non-detect or less than 1 percent asbestos, except for sample C78SB-021M-0001-

SO, one of the subsurface soil vertical ISM samples from Debris Pile C, which had a level of 2 percent asbestos.

The dataset for surface soils consists of ISM samples from the three DUs (one from each DU) and two discrete samples from the Test Pit Area. **Table 5-1** presents the results of the data evaluation of the chemicals included in the chemical analysis. The chemicals that were detected were assessed to determine if they were detected in concentrations great enough to be considered contamination is present in the DUs and the Test Pit Area. No chemicals were retained for further evaluation in the surface soil aggregate (0-1 ft bgs). This indicates that no contamination was found in the surface soil DUs and the Test Pit Area.

The dataset for subsurface soil consists of 23 ISM and 1 composite sample (including investigative and field duplicates) from the DUs surrounding the Debris Piles. Subsurface soil was not evaluated in the Test Pit Area because the soil is very thin in this area and drilling and digging ceased at the top of bedrock, which averaged approximately 1 ft bgs. Depths for each of the subsurface soil borings are provided in the **Table 5-2** presents the results of the data evaluation of the chemicals included in the chemical analysis for the subsurface aggregate data. The minimum concentration detected, and maximum concentration detected for chemical analytes is presented in **Table 5-2**. The established background value for metals in subsurface soils also provided (Table 5-2). The maximum concentration detected was used in the first step of the evaluation process. If the maximum concentration detected was less than the background concentration for metals, then the metal was eliminated as potential contamination. The maximum detected concentration of the remaining metals and all detected chemicals were next compared to the May 2018 USEPA RSL for Residential Land Use for each chemical. If the maximum detected concentration was less than the chemical's USEPA RSL, then the chemical was eliminated as potential contamination. The following six chemicals were further evaluated using a WOE approach for the subsurface soil aggregate (1 ft bgs to various depths depending upon where bedrock was encountered). All the chemicals evaluated in the WOE were semivolatile organics:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Indeno(1,2,3-c,d)pyrene

The maximum concentration detected in the subsurface soils were all from DU01 and from one soil boring (CC78-DU01 SB04, **Table 5-3**). Soil boring logs that provided the depth of the samples are provided in **Appendix B**. This soil boring was only advanced to approximately 2.5 feet bgs because of refusal. Considering the previously collected data from other studies, the area immediately outside of the DU01 where SB04 was taken was shown to not have detectable semivolatile organic compounds (SpecPro 2003, **Figure 5-1**). The five soil borings collectively represent the subsurface soil in each DU around the Debris Piles. Since the single maximum exceeded the USEPA RSL, the next step in the determination of contamination was to evaluate if their concentrations are great enough to represent contamination. **Table 5-3** presents the concentrations for each of the soil borings within each DU. Most of the values for each subsurface sample were non-detect and the value being shown is the LOD. An average concentration was calculated for each chemical and each DU. The average concentration for each of these chemicals per DU was much less than their respective USEPA RSL. This indicates that the concentration of these chemicals does not represent contamination in the subsurface soil. Therefore, no chemical contamination was found in either of the DUs and no chemical contamination was identified in the Test Pit Area. However, one Test Pit (Test Pit 5) sample contained construction debris with suspected ACM. Test Pit 5 is located within the DU03 which surrounds Debris Pile A (**Figure 4-1**). The ACM was analyzed and results indicated it contained 20 percent chrysotile. Because this sample area had construction debris in it and contains asbestos, the small area around Test Pit 5 is recommended for removal when the Debris Piles are removed to address asbestos contamination. Asbestos was not detected in the vertical ISM soil sample from the test pit (0-1.7 ft bgs). The soil exposure pathway was considered incomplete for all areas except Test Pit 5 where asbestos was identified. Therefore, potential exposure at Test Pit 5 is possible.

ES.6.2 GROUNDWATER PATHWAY

ES.6.2.1 Hydrogeologic Setting

As stated previously, CC RVAAP-78 AOC is located within the RVAAP-16 AOC (FBQ Landfill/Ponds). The hydrogeologic setting for RVAAP-16 is contained in Section 2 of the *Phase I/Phase II Remedial Investigation of the Fuze and Booster Quarry Landfill/Ponds (RVAAP-16)*, dated November 2005. Groundwater flow is toward the south and west.

ES.6.2.2 Groundwater Pathways

Groundwater at the AOC is not currently utilized. The OHARNG may utilize groundwater in the future in select areas on the facility. Groundwater wells located in the vicinity of the AOC are being assessed under the facility-wide Groundwater Monitoring Program.

ES.6.2.3 Groundwater Pathway Conclusions

Based on the historical research in Section 3.2 of the HRRR, sample results from groundwater monitoring wells near CC RVAAP-78 should be assessed further as currently being done under the groundwater monitoring program. Considering these results and the AOC's location relative to groundwater bearing units and geologic setting, there is a low likelihood of a release to groundwater from the migration of contaminants through soil and the underlying rock. Groundwater is being addressed under the facility-wide Groundwater Monitoring Program.

ES.6.3 SURFACE WATER PATHWAY

ES.6.3.1 Surface Water Setting

Surface water and sediment are not present on the AOC. Therefore, this is an incomplete pathway and is not evaluated further.

ES.6.3.2 Surface Water Pathway Conclusions

There is no surface water or sediment on the AOC so the surface water and sediment pathway is considered incomplete for this AOC.

ES.7.0 FINDINGS

The Migration Exposure Pathways considered in the SI Addendum were: soil (surface and subsurface), groundwater; and surface water/sediment. Primary pathways for the potential exposure to chemicals and asbestos include airborne inhalation, incidental ingestion, and dermal contact.

Data from groundwater monitoring wells near CC RVAAP-78 should be assessed further as currently being done under the groundwater monitoring program. Considering these results and the AOC's location relative to groundwater bearing units and geologic setting, there is a low likelihood of a release to groundwater from the migration of contaminants through soil and the underlying rock. Groundwater is being addressed under the facility-wide Groundwater Monitoring Program. In addition, no chemical contamination was identified in the three DUs or the Test Pit Area so the groundwater exposure pathway was considered incomplete for this SI Addendum.

Surface soil and subsurface soil were evaluated for a 30-ft wide perimeter around Debris Piles A, B, and C and in the area between Debris Piles known as the Test Pit Area. No chemical contamination, asbestos fibers, or ACM was identified in the surface soil aggregate (0-1 ft bgs) for the DUs or the Test Pit Area. No chemical contamination was found in the subsurface soil for any of the DU subsurface samples or for the Test Pit Area. However, one Test Pit (Test Pit 5) sample contained construction debris with suspected ACM. Test Pit 5 is located within the DU03 which surrounds Debris Pile A (**Figure 4-1**). The suspected ACM was analyzed and results indicated it contained 20 percent chrysotile. The soil exposure pathway was considered incomplete for all areas except Test Pit 5 where asbestos was identified and potential exposure is possible. The soil exposure pathway was considered complete for all areas assessed in this SI Addendum except for Test Pit 5, where exposure is possible.

ES.8 RECOMMENDATIONS

This SI Addendum conducted at CC RVAAP-78 Quarry Pond Surface Dump has adequately identified whether or not there is contamination in surface and subsurface soil contained within the DUs around the three Debris Piles and the Test Pit Area. No further action to address chemical or asbestos contamination is recommended at CC RVAAP-78 Quarry Pond Surface Dump for soil in the three DUs surrounding the Debris Piles. Within the Test Pit Area, one Test Pit (Test Pit 5 – 78 TPA-TP5) sample contained asbestos. Test Pit 5 is located within the DU03 (DU around Debris or asbestos contamination is recommended at CC RVAAP-78 Quarry Pond Surface Dump for soil in the three DUs surrounding the Debris Piles. Within the Test Pit Area, one Test Pit (Test Pit 5 – 78 TPA-TP5) sample contained asbestos. Test Pit 5 is located within the DU03 (DU around Debris Pile A) (Figure 4-1). It is recommended that the area around Test Pit 5 be included with the removal of the three Debris Piles. The 2016 SI recommended that the Debris Piles A, B, and C be removed and disposed of as well as the surface/subsurface soil at Debris Pile C. As documented in the 2016 SI, each of the Debris Piles contain chemical contamination. Debris Piles A and B contain ACM and asbestos fibers were identified in the subsurface soil in Debris Pile C. and ACM. Transite was observed in both Debris Piles A and B. Asbestos contents of 30 percent and 40 percent were detected in the transite samples from Debris Piles A and B, respectively, and the roofing sample from Debris Pile B had a level of 35 percent asbestos. All the soil samples were analyzed for asbestos. All the soil samples were non-detect or less than 1 percent asbestos, except for sample C78SB-021M-0001-SO, one of the subsurface soil vertical ISM samples from Debris Pile C, which had a level of 2 percent asbestos.

Because chemical contamination above Unrestricted (Residential) Land Use was identified within Debris Piles as part of the 2016 SI and asbestos contamination was found at Test Pit 5 in this SI Addendum, additional remedial action is warranted for this AOC. It is recommended that removal action alternatives be evaluated in an EE/CA as the next phase in the CERCLA process.

SECTION 1: PROJECT DESCRIPTION

1.1 INTRODUCTION

This Site Inspection Addendum (SI Addendum) Report was completed to document the results of the field activities performed at the Area of Concern (AOC) CC RVAAP-78 Quarry Pond Surface Dump at the former Ravenna Army Ammunition Plant (RVAAP), in Portage and Trumbull counties, Ohio. Work described herein was conducted under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). This SI Addendum Report was originally drafted by Environmental Chemical Corporation (ECC), under Delivery Order 0004 for Architectural/Engineering Environmental Services at the former RVAAP under the *Indefinite Delivery/Indefinite Quantity Contract No* W912QR-04-D-0039, Delivery Order No. 0004, Mod. No. 1 as a Remedial Investigation (RI). The fieldwork, data collection and sampling were also completed by ECC.

Due to delays in the overall cleanup program at the former RVAAP that were unrelated to ECC's performance, ECC could not complete this document before the contract ended and the report was left as an unfinished Preliminary Draft.

After the Army reviewed the Preliminary Draft RI, it was concluded that an RI was not needed since there was already enough data collected on the Debris Piles and the only additional data needed to complete the removal action was to assess presence/absence of chemical contamination and asbestos in an area (30-ft perimeter) around each of the Debris Piles that was not investigated in the 2016 SI. In addition, the 2016 SI was not completed at that time so final conclusions of the SI were not known to ECC when preparing the preliminary draft report or completing the field work.

The areas assessed in this SI Addendum were sampled and evaluated to determine if the area around each of the Debris Piles contains chemical contamination and/or asbestos. The SI concluded that the three Debris Piles needed to be removed because of chemical contamination, asbestos fibers in soil, and/or asbestos containing material (ACM). While the SI made conclusions to move forward to an RI for further evaluation, the sampling completed, evaluated the perimeter around and areas between the Debris Piles. The data collected for the preliminary draft RI was extensive and assessed if contamination was present but only in the Debris Pile perimeters and areas between the Debris Piles. The Preliminary Draft RI did not include an evaluation of the Debris Piles because it was completed assuming that the three Debris Piles would be removed to achieve Unrestricted (Residential) Land Use. Therefore, the data collected was reassessed in this report to form an Addendum to the SI. The data assessed presence/absence of chemical contamination and asbestos (fibers and ACM) in the area (30-ft perimeter) around each of the Debris Piles that was not investigated in the 2016 SI. In addition, the 2016 SI was not completed at that time so final conclusions of the SI were not known to ECC when preparing the preliminary draft report or completing the field work.

The decision to make the Preliminary Draft RI into an Addendum to the SI does not affect the quality or objectives of the data and no sampling or data errors were committed. Since this is an SI Addendum, no modifications are required to address changes to the human health risk assessment (HHRA) process as required in the *"Final Technical Memorandum: Land Uses and*

Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (Risk Assessment Technical Memo) (RVAAP Installation Restoration Program, Portage/Trumbull Counties, Ohio" (Army National Guard Directorate, 2014).

Planning and performance of all elements of this report were in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders for the former RVAAP, dated June 10, 2004 (Ohio EPA 2004). The Director's Final Findings and Orders requires conformance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan to complete the environmental work at the facility under the IRP, which began in 1989 with 32 environmental AOCs.

The facility, previously known as the RVAAP, consists of 21,683 acres and is located in northeastern Ohio within Portage and Trumbull counties, approximately 4.8 kilometers (km) (3 miles [mi]) east/northeast of the city of Ravenna and approximately 1.6 km (1 mi) northwest of the city of Newton Falls. The facility was formerly used as a load, assemble, and pack facility for munitions production. As of September 2013, administrative accountability for the entire acreage of the facility has been transferred to the United States Property and Fiscal Officer for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site (Camp Ravenna). References in this document to the former RVAAP relate to previous activities at the facility as related to former munitions production activities or to activities being conducted under the restoration/cleanup program. This SI Addendum was conducted at one AOC, CC RVAAP-78 Quarry Pond Surface Dump.

1.2 PURPOSE

This SI Addendum was prepared by USACE to provide environmental investigation information for CC RVAAP-78 (**Figures 1-1 and 1-2**). Environmental investigations at the facility began under the Installation Restoration Program in 1989, at 32 AOCs. The United States Army Center for Health Promotion and Preventive Medicine (now the United States Army Public Health Command - USAPHC) collected samples at each of the AOCs and performed a Relative Risk Site Evaluation, which prioritized each AOC into three groups: low, medium, and high priorities. Restoration work has proceeded primarily by addressing the highest priority sites first. In 1998, the number of AOCs was increased from 32 to 51. The relative risk rankings were performed to prioritize those additional AOCs. Compliance Restoration sites were added as AOCs in 2010. This SI Addendum discusses one of these AOCs, CC RVAAP-78 Quarry Pond Surface Dump (**Figure 1-3**).

The following are the CC RVAAP-78 Quarry Pond Surface Dump SI Addendum objectives:

- Conduct a field investigation to collect site-related data to assess contamination (chemical, asbestos in soil, or ACM) within 30- ft. wide perimeters surrounding the Debris Piles (A, B, and C) and the Target Pit Area.

- Provide sufficient quality assurance (QA)/quality control (QC) sampling to evaluate the overall quality of both the field and laboratory sampling procedures.

- Perform AOC-specific evaluation of the data to determine if contamination is present in the study areas by comparing the maximum detected concentrations (MDCs) to Unrestricted (Residential) Land Use criteria.

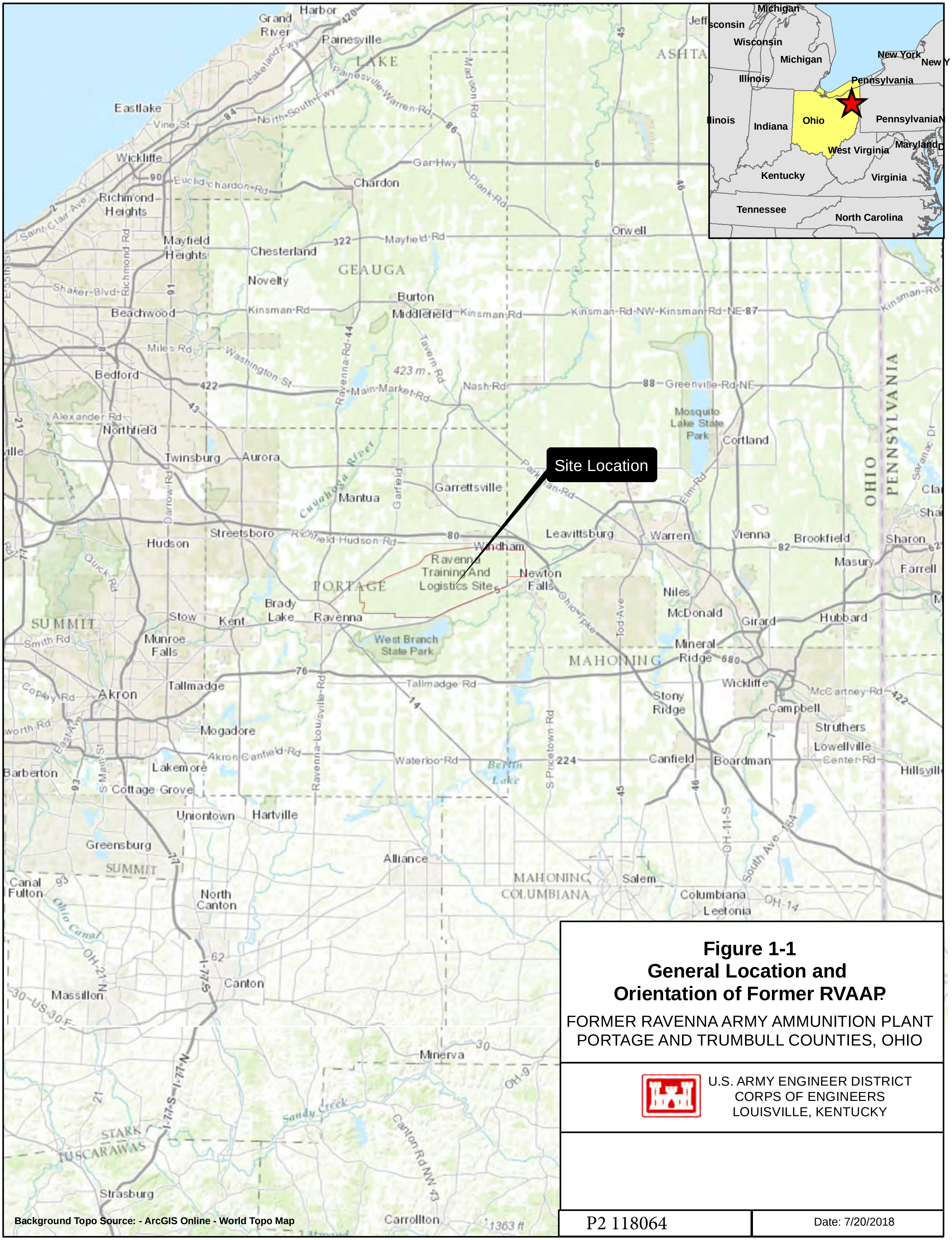
- Conducting a Weight-of-Evidence (WOE) assessment of chemical concentrations where the MDC exceeds Residential criteria.

- Determine if additional remedial actions are warranted to investigate/ and or characterize the nature and extent of contamination outside the Debris Piles (A, B, and C) or the Test Pit Area if WOE indicates presence of contamination in these areas. If Unrestricted (Residential) Land Use is achieved for these areas, then the next step in the CERCLA process will be to conduct an evaluation of remedial alternatives to remove the Debris Piles in an Engineering Evaluation/Cost Analysis (EE/CA).

1.3 SCOPE

This SI Addendum conducted for this AOC included a review of previous environmental reports including the information presented in the *Final Historical Records Review Report for 2010 Preliminary Assessment Compliance Restoration Sites CC-RVAAP-78 Quarry Pond Surface Dump & CC-RVAAP-80 Group 2 Propellant Can Tops* (Historical Records Review [HRR]) prepared by Prudent Technologies Inc. (Prudent 2011a); *Final Revised Site Inspection for Compliance Restoration Site CC-RVAAP-78 Quarry Pond Surface Dump* (USACE 2016); and Phase I/Phase II Remedial Investigation of the Fuze and Booster Quarry Landfill/Ponds (RVAAP-16), Volume One – Main Report prepared by (Science Applications International Corporation [SAIC] and SpecPro, Inc. [SpecPro] 2005).

Fieldwork for this SI Addendum consisted of intrusive soil sampling using incremental sampling methodology (ISM), composite sampling methods, discrete sampling methods, and test pit sampling. Following data validation and QA/QC, the dataset was refined and aggregated to identify contamination.



Background Topo Source: - ArcGIS Online - World Topo Map

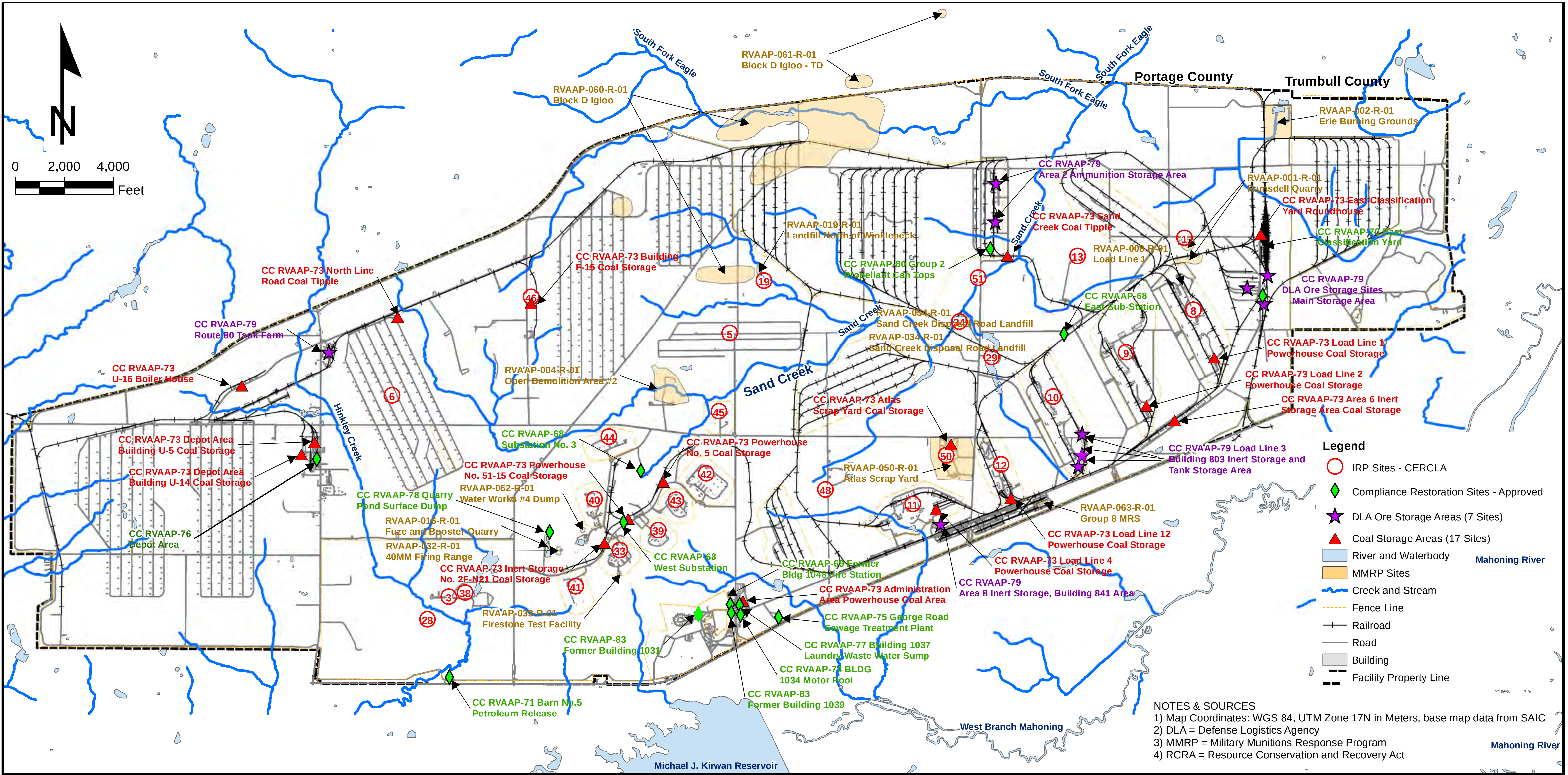
Figure 1-1
General Location and Orientation of Former RVAAP

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

P2 118064

Date: 7/20/2018



NOTES & SOURCES
1) Map Coordinates: WGS 84, UTM Zone 17N in Meters, base map data from SAIC
2) DLA = Defense Logistics Agency
3) MMRP = Military Munitions Response Program
4) RCRA = Resource Conservation and Recovery Act

IRP SITES - CERCLA

1	RVAAP-1	Ramsdell Quarry Landfill
3	RVAAP-3	Open Demolition Area #1
5	RVAAP-5	Winklepeck Burning Grounds
6	RVAAP-6	C Block Quarry
8	RVAAP-8	Load Line 1
9	RVAAP-9	Load Line 2
10	RVAAP-10	Load Line 3
11	RVAAP-11	Load Line 4
12	RVAAP-12	Load Line 12
13	RVAAP-13	Building 1200 - Dilution Settling Pond
19	RVAAP-19	Landfill North of Winklepeck Burning Grounds
28	RVAAP-28	Mustard Agent Burial Site
29	RVAAP-29	Upper and Lower Cobbs Ponds
33	RVAAP-33	Load Line 6
34	RVAAP-34	Sand Creek Disposal Road Landfill
38	RVAAP-38	NACA Test Area
39	RVAAP-39	Load Line 5
40	RVAAP-40	Load Line 7
41	RVAAP-41	Load Line 8
42	RVAAP-42	Load Line 9
43	RVAAP-43	Load Line 10
44	RVAAP-44	Load Line 11
45	RVAAP-45	Wet Storage Area
46	RVAAP-46	Building F-15 and F-16
48	RVAAP-48	Anchor Test Area
50	RVAAP-50	Atlas Scrap Yard
51	RVAAP-51	Dump Along Paris Windham Rd.
	RVAAP-66	Facility-Wide Groundwater
	RVAAP-67	Facility-Wide Sewer

COMPLIANCE RESTORATION SITES(14 SITES)

CC RVAAP-68	Electronic Substations (E, W, No. 3)
CC RVAAP-69	Former Building 1048 Fire Station
CC RVAAP-70	East Classfiication Yard
CC RVAAP-71	Barn No. 5 Petroleum Release
CC RVAAP-72	Facility-Wide UST's (45 Sites)
CC RVAAP-73	Facility-Wide Coal Storage
CC RVAAP-74	Building 1034 Motor Pool Hydraulic Lift
CC RVAAP-75	George Road Sewage Treatment Plant
CC RVAAP-76	Depot Area
CC RVAAP-77	Building 1037 - Laundry Waste Water Sump
CC RVAAP-78	Quarry Pond Surface Dump
CC RVAAP-79	DLA Ore Storage Sites
CC RVAAP-80	Group 2 Propelant Can Tops
CC RVAAP-83	Former Building 1031 and 1039

MMRP SITES (14 SITES)

RVAAP-001-R-01	DLA Ore Storage Sites
RVAAP-002-R-01	Erie Burning Grounds MRS
RVAAP-004-R-01	Open Demolition Area #2 MRS
RVAAP-008-R-01	Load Line 1 MRS
RVAAP-016-R-01	Fuze and Booster Quarry MRS
RVAAP-019-R-01	Landfill North of Winklepeck MRS
RVAAP-032-R-01	40 mm Firing Range MRS
RVAAP-033-R-01	Firestone Test Facility MRS
RVAAP-034-R-01	Sand Creek Dump MRS
RVAAP-050-R-01	Atlas Scrap Yard MRS
RVAAP-060-R-01	Block D Igloo MRS
RVAAP-061-R-01	Block D Igloo - TD MRS
RVAAP-062-R-01	Water Works #4 Dump MRS
RVAAP-063-R-01	Group 8

OTHER REGULATORY - RCRA

CC RVAAP-04 Open Demolition Area #2

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Figure 1-2

Location of the Compliance Restoration Sites

FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

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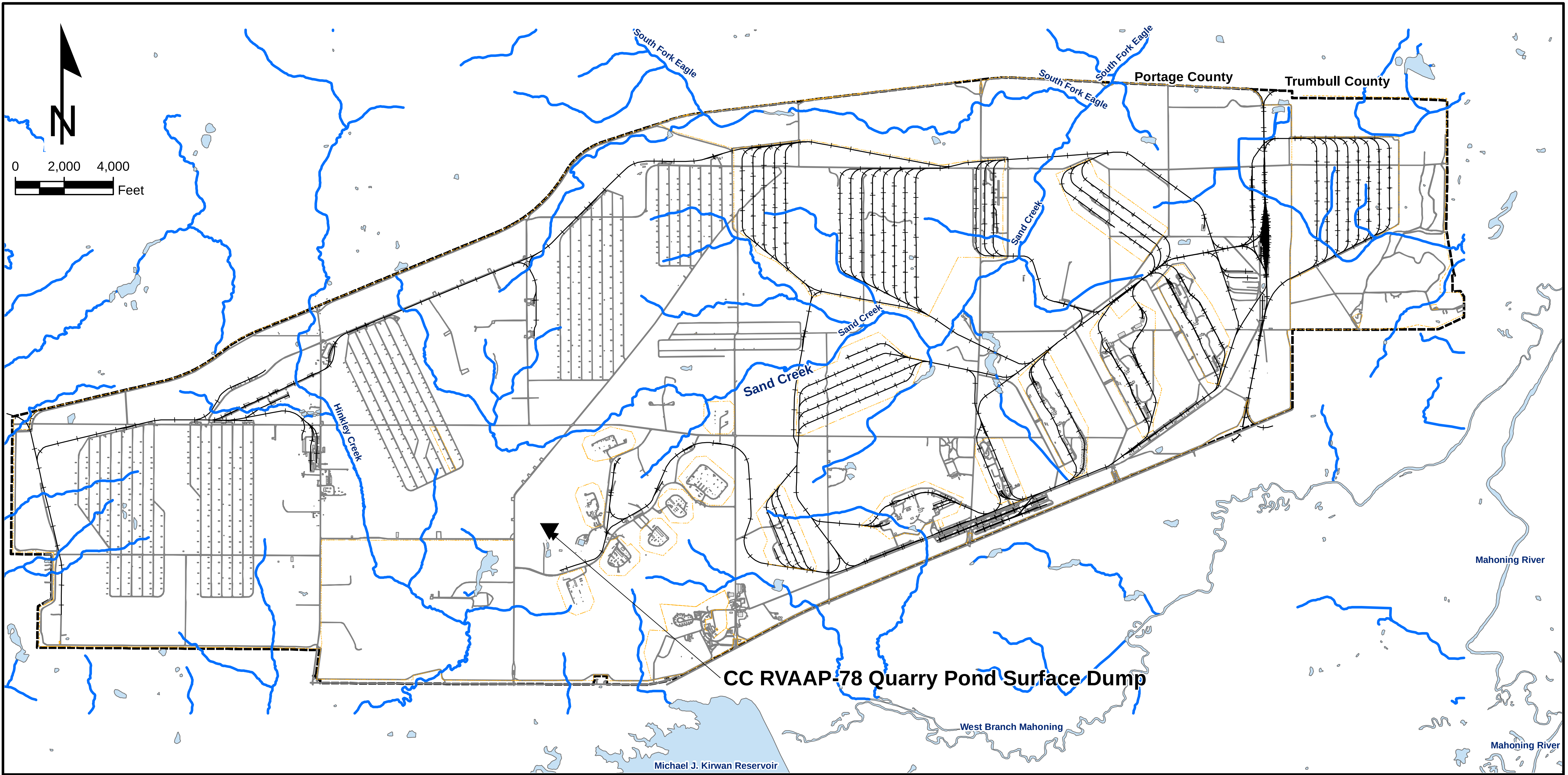

Legend

- ▼ Site Location
- ▭ River and Waterbody
- ~ Creek and Stream
- --- Fence Line
- -+- Railroad
- — Road
- ▭ Building
- ⬚ Facility Property Line

NOTES & SOURCES
1) Map Coordinates: WGS 84, UTM Zone 17N in Meters, base map data from SAIC

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Figure 1-3

Location of CC RVAAP-78 Quarry Pond Surface Dump

FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

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SECTION 2: BACKGROUND

2.1 FACILITY-WIDE BACKGROUND

This section provides a description of the facility. In addition, it summarizes the AOC's operational history, potential sources, potential human health receptors and ecological resources, and co-located or proximate sites.

2.1.1 General Facility Description

The installation, previously known as RVAAP, was formerly used as a load, assemble, and pack facility for munitions production. The former RVAAP received bulk TNT product during operational activities and did not manufacture/produce dinitrotoluene (DNT) or TNT. As of September 2013, administrative accountability for the entire acreage of the facility has been transferred to the U.S. Property and Fiscal Officer (USP& FO) for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site (Camp Ravenna). References in this document to RVAAP relate to previous activities at the facility as related to former munitions production activities or to activities being conducted under the restoration/cleanup program. The facility is located in northeastern Ohio within Portage and Trumbull counties, approximately 4.8 km (3 mi) east/northeast of the city of Ravenna and approximately 1.6 km (1 mi) west of the city of Newton Falls. The facility, consisting of 21,683 acres, is located in northeastern Ohio within Portage and Trumbull counties, approximately 4.8 kilometers (3 miles) east/northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls (**Figure 1-1**).

2.1.2 Demography and Land Use

The 2010 Census reports that the populations of Portage and Trumbull counties are 161,419 and 210,312, respectively. Population centers closest to the facility are Ravenna, with a population of 11,724, and Newton Falls, with a population of 4,795.

The facility is located in a rural area and is not close to any major industrial or developed areas. Approximately 55 percent of Portage County, in which the majority of the facility is located, consists of either woodland or farmland acreage. The closest major recreational area, the Michael J. Kirwan Reservoir (also known as West Branch Reservoir), is south of the facility.

Camp Ravenna is federally owned and is licensed to OHARNG for use as a military training site. Restoration activities at Camp Ravenna are managed by the Army National Guard and OHARNG. Training and related activities at Camp Ravenna include field operations and bivouac training, range firing activities, convoy training, maintaining equipment, C-130 aircraft drop zone operations, helicopter operations, and storing heavy equipment.

2.2 AREA OF CONCERN DESCRIPTION

Figure 1-2 and **Figure 1-3** depict the location of this AOC within the facility. CC RVAAP-78 Quarry Pond Surface Dump is located in the south-central portion of the facility, northeast of the intersection between South Patrol Road and Greenleaf Road and consists of areas of former dumping at the bases of steeply inclined rock slopes. The three surface dumps (debris piles) are located north, northwest, and northeast of the northernmost quarry pond within the adjacent Fuze and Booster Quarry Landfill/Ponds AOC (RVAAP-16).

2.2.1 Operational History

Based on the HRR, CC RVAAP-78 AOC appears to be a possible northern extension of the existing Fuze and Booster Quarry AOC (RVAAP-16), which operated from 1945 through 1993. Prior to 1976, the quarry was reportedly used for open burning and as a landfill. The debris from the burning/landfill was allegedly removed during pond construction during the 1970s. In 1998, the Fuze and Booster Quarry was expanded to include three other settling ponds to the west and two debris piles to the northeast. The CC RVAAP-78 AOC although part of RVAAP-16 was not assessed with RVAAP-16 AOC and thus the three Debris Piles were evaluated separately. The history of use of the CC RVAAP-78 AOC is related to the RVAAP-16 usage and CC RVAAP-78 only represents three Debris Piles that resulted from former DOD activity at RVAAP-16 AOC.

2.2.2 Land Use and Ownership

The CC RVAAP-78 Quarry Pond Surface Dump is on property located within the boundaries of the facility. The facility is federally owned; administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Officer for Ohio, and subsequently licensed to the OHARNG for use as a military training site.

2.2.3 Physical Property Characteristics

The CC RVAAP-78 AOC is located in the south-central portion of the facility, northeast of the intersection between South Patrol Road and Greenleaf Road. The AOC has steeply inclined rocky slopes. The dumping occurred at the bases of the rocky slopes. There are three main dump areas (debris piles) that are located north, northwest, and northeast of the northern-most quarry pond within the adjacent Fuze and Booster Quarry Landfill/Ponds AOC (RVAAP-16). The CC RVAAP-78 Quarry Pond Surface Dump is comprised of three debris piles. Two of the dumping areas at CC RVAAP-78 Quarry Pond Surface Dump (Debris Piles A and B) are at the bases of steeply inclined rock slopes of the quarry. The third area of dumping at this AOC (Debris Pile C) is flatter and is adjacent to the northwest end of the northern-most pond within the RVAAP-16 AOC. Photographs of the debris piles are shown in **Appendix A**. Additional site photographs are provided in the Final SI report for the AOC (USACE 2016). Figures depicting the characteristics of the immediate area are shown in Section 3. The Debris Piles consist of construction debris, scrap metal, cultural debris, and ACM (e.g. transite type roofing, sheeting, etc.). The three Debris Piles and the Test Pit Area were evaluated separately as different Decision Units (DUs) in this SI Addendum. The DUs at the Debris Piles were the 30-ft perimeters around each of the Debris Piles. The DU around the Debris Pile A was designated as DU03. The DU around Debris Pile B was DU02 and the DU around Debris Pile C was DU01. The Test Pit Area was a separate DU.

Debris Pile A is approximately 425 feet in length varying in surface width from 18 to 68 feet. A second, smaller debris pile, defined as Debris Pile B, is approximately 296 feet in length and 24 feet wide. Debris Pile C is located along the northwestern corner of the northern-most quarry pond area with the debris area being approximately 120 feet by 45 feet.

In addition to the Debris Piles, a small area where materials appeared to have been burned is located near where a rusted, 55-gallon drum was located within Debris Pile B. This drum was identified as Drum #1 in the SI and was removed and disposed of as part of the 2016 Site Inspection (SI). The topographic map of this area (**Figure 1-2**), shows the south end of Debris Pile A becoming one continuous slope from Reference Point 9b of Debris Pile A to Reference Point 3 of Debris Pile B (**Figure 1-1**). A second rusted 55-gallon drum (Drum #2) was present within Debris Pile C but was removed and disposed of during the SI.

The Historical Records Review (HRR) indicated there was a possible large amount of construction debris located between mainly Debris Pile A and Debris B (referred to herein as the Test Pit Area). It was also noted in the HHR that the construction debris area (Test Pit Area) possibly extended westward to the road along the east side of the northernmost pond on the adjacent AOC (RVAAP-16).

The 2016 SI showed ACM and chemical contamination in in all three Debris Piles. The two rusted 55-gallon drums were characterized and removed from the site during the SI. The SI soil analytical results showed samples had detections of various chemicals at concentrations greater than the Facility Wide Cleanup Goals (FWCUGs) for Unrestricted (Residential) Land Use as well as the observed presence of substantial amounts of transite and roofing materials that contain approximately 35 percent asbestos. Accordingly, the SI recommended that an RI be completed to further evaluate the Nature and Extent of the contamination in the Debris Piles and that additional sampling to characterize the Test Pit Area to determine if any fill materials are present that contain contamination.

2.2.4 Chronological Property Summary

The adjacent AOC (RVAAP-16 Fuze and Booster Quarry Landfill/Ponds) was used as an explosive-contaminated sawdust burning area for Load Lines 6 and 11 from 1945 to 1949. In 1976, settling ponds were constructed, separated by earthen dams, with flow control gates for treating the spent brine regenerant and sand filtration backwash water from the Water Works 3 treatment plant, which treated groundwater from facility production wells (1976-1993). The debris was removed from the quarry bottom and transferred to either Ramsdell Quarry Landfill or one of the burning grounds in 1976. Historical operational information indicated activity at that fuze and booster assemblies, projectiles, residual ash, and sanitary wastes were burned or dumped in the quarry prior to pond construction. Based on the HRR, aerial photographs from 1952 show CC RVAAP-78 Quarry Pond Surface Dump. Aerial photographs from 1966, 1979, and 1981 show less vegetation in the area than what currently exists. Aerial photographs are provided in **Appendix A** (USACE 2016).

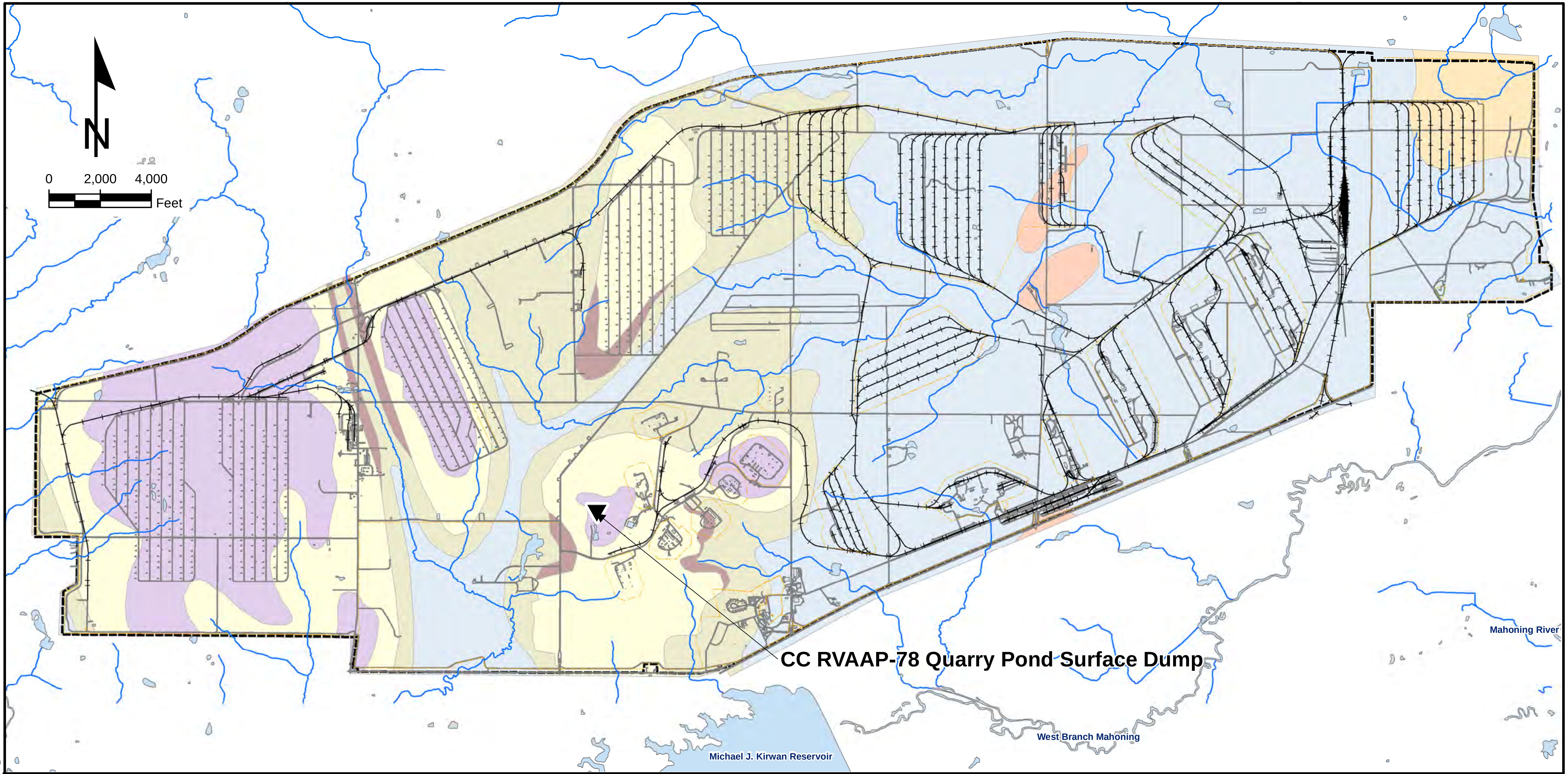
2.2.5 Military Operations

During the historical records review, no documented evidence of military operations being performed at CC RVAAP-78 Quarry Pond Surface Dump were identified.

2.2.6 Previous Investigations

The 2016 SI was completed to identify if there was contamination present in the three Debris Piles and surrounding area including the Test Pit Area. The results of the SI showed ACM and chemical contamination were present in all three Debris Piles. The two rusted 55-gallon drums were characterized and removed from the site and properly disposed of during the SI. The SI soil analytical results showed soil had detections of various chemicals at concentrations greater than the FWCUGs for Unrestricted (Residential) Land Use as well as the observed presence of substantial amounts of transite and roofing materials that contain approximately 35 percent asbestos. Accordingly, the SI recommended that additional work be completed to assess areas between Debris Piles and the Test Pit Area to see if ACM and/or chemical contamination were present.

Besides the 2016 SI and this SI Addendum, no additional investigations specific to CC RVAAP-78 Quarry Pond Surface Dump have been completed. However, multiple investigations have been conducted at the adjacent AOC (RVAAP-16 Fuze and Booster Quarry Landfill/Ponds). Various environmental data for soil and groundwater have been collected at RVAAP-16. Those investigations include sample locations in the vicinity of, and in some cases within, CC RVAAP-78 Quarry Pond Surface Dump (SpecPro 2005).



Legend

🟪 Homewood Sandstone Member of Pottsville Formation
🟨 Mercer Shale Member of Pottsville Formation
🟫 Connoquennissing Sandstone Member of Pottsville Formation
▨ Sharon Shale Member of Pottsville Formation
🟦 Sharon Sandstone Member- Conglomerate Unit of Pottsville Formation
🟧 Berea Sandstone
🟨 Cuyahoga Group
🟥 Area Depicted as All Homewood Sandstone Member by EQM

▼ Site Location
🟦 River and Waterbody
〜 Creek and Stream
---- Fence Line

┼ Railroad
— Road
⬜ Building
⬚ Facility Property Line

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters

Base map data from SAIC including bedrock data

Bedrock data revised from Facility-Wide Groundwater Monitoring Program, July 2012 (Environmental Quality Management, Inc. 2013)

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Figure 2-1

Geologic Bedrock Map and Stratigraphic Description of Units

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

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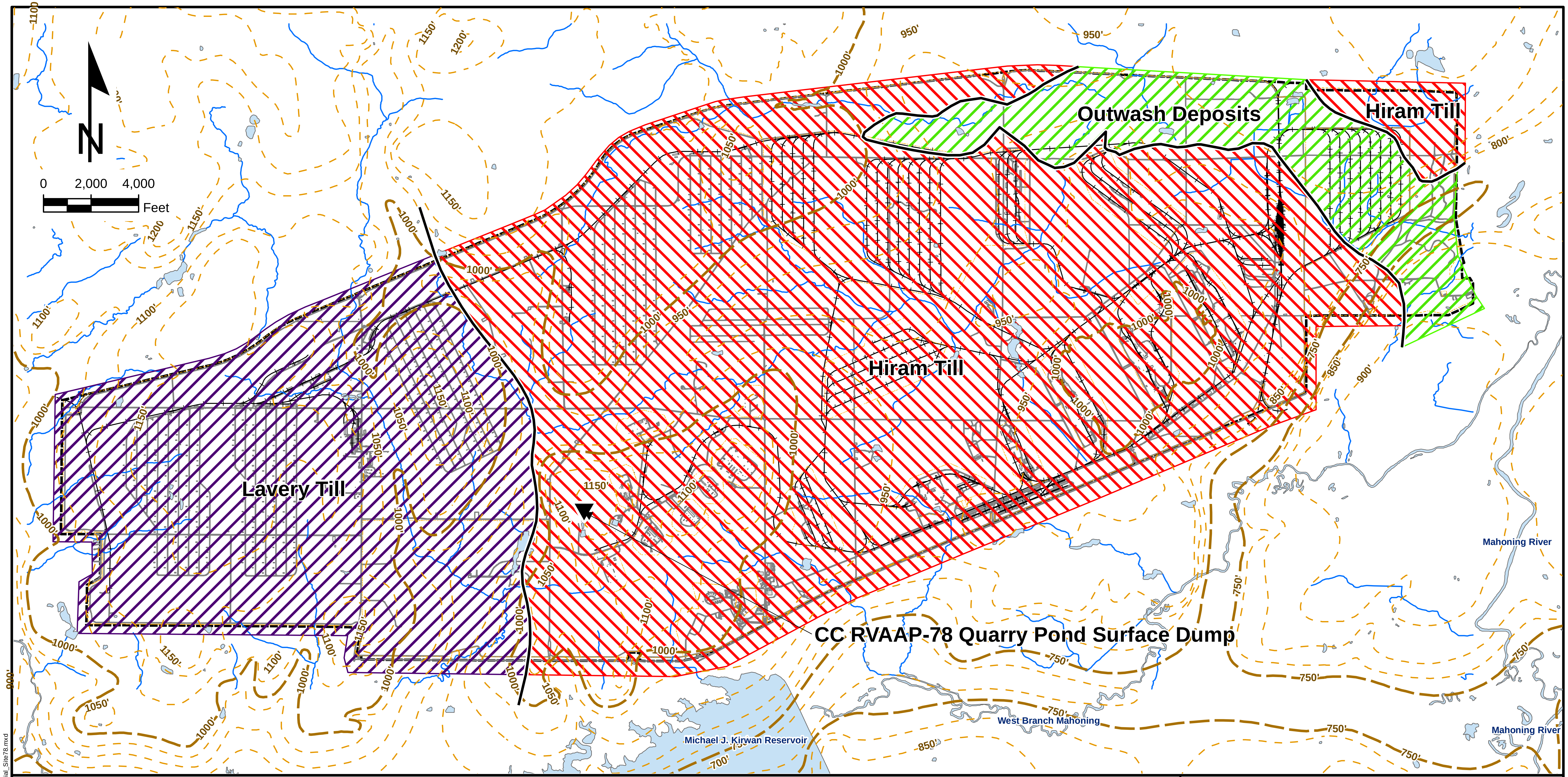

Legend

▼ Site Location

🟦 River and Waterbody

Creek and Stream

Fence Line

Railroad

Road

⬜ Building

Facility Property Line

Bedrock Surface Contour (50 ft interval)

Bedrock Surface Contour (250 ft interval)

Unconsolidated Deposits Approximate Boundary

▨ Lavery Till

▨ Hiram Till

▨ Outwash Deposits

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters
Base map data from SAIC

ft= feet

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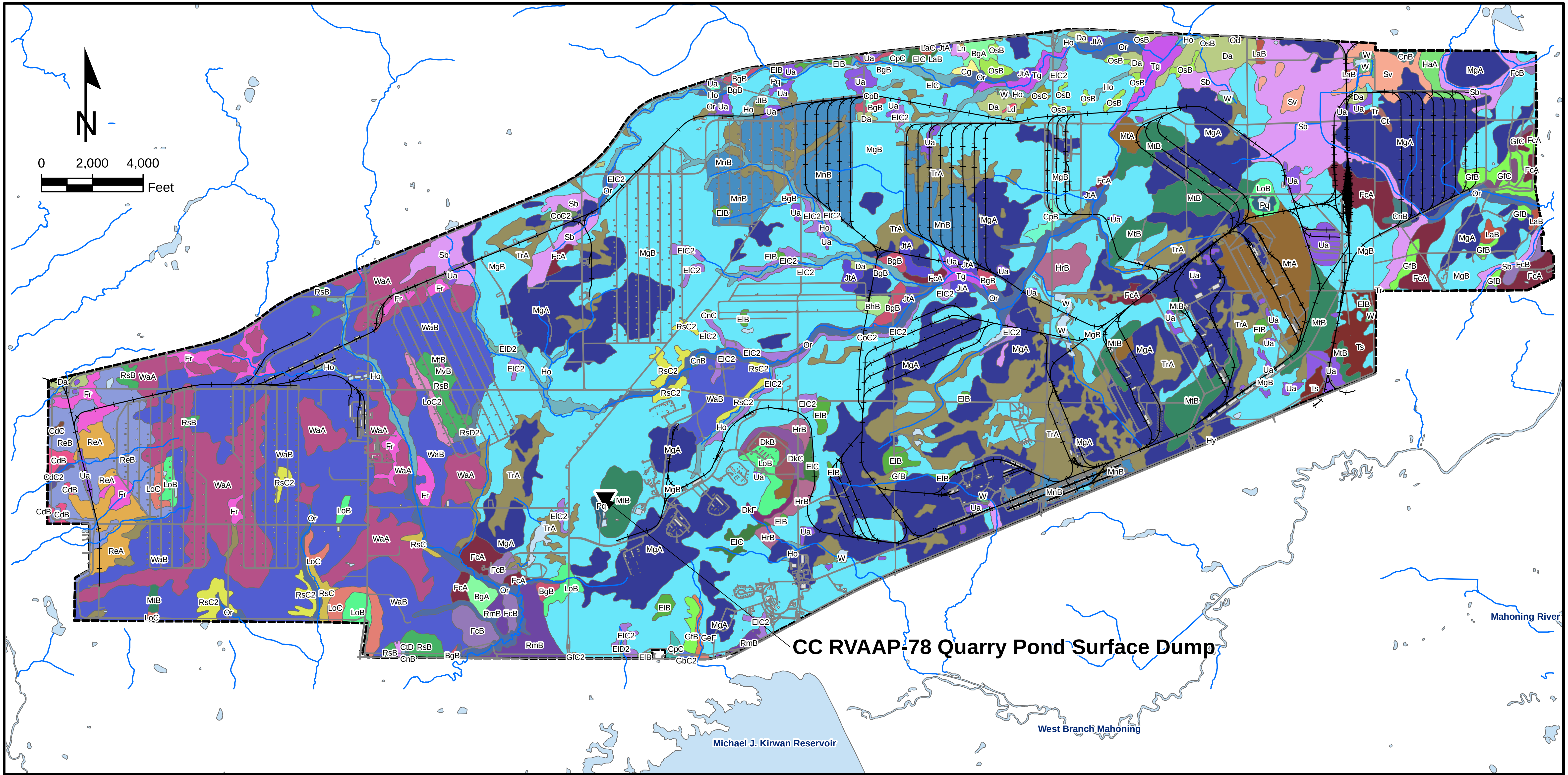
Figure 2-2

Geologic Map of
Unconsolidated Deposits

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 2-2_GeoMap_Glacial_Site78.mxd



Legend

▼ Site Location

Creek and Stream

Railroad

Road

River and Waterbody

Building

Facility Property Line

Soil Mapping Unit

BgA	CoC2	ElB	GfB	LaB	MnB	ReA	Tg
BgB	CpB	ElC	GfC	LaC	MtA	ReB	Tr
BhB	CpC	ElC2	GfC2	Ld	MtB	RmB	TrA
CdB	Ct	ElD2	HaA	Ln	MvB	RsB	Ts
CdC	CtD	FcA	Ho	LoB	Od	RsC	Ua
CdC2	Da	FcB	HrB	LoC	Or	RsC2	W
Cg	DkB	Fr	Hy	LoC2	OsB	RsD2	WaA
CnB	DkC	GbC2	JtA	MgA	OsC	Sb	WaB
CnC	DkF	GeF	JtB	MgB	Pq	Sv	

NOTES & SOURCES

1. Map Coordinates: WGS 84, UTM Zone 17N in Meters.
2. Base map data from SAIC.
3. See Figure 2-3b for soil mapping unit definitions.

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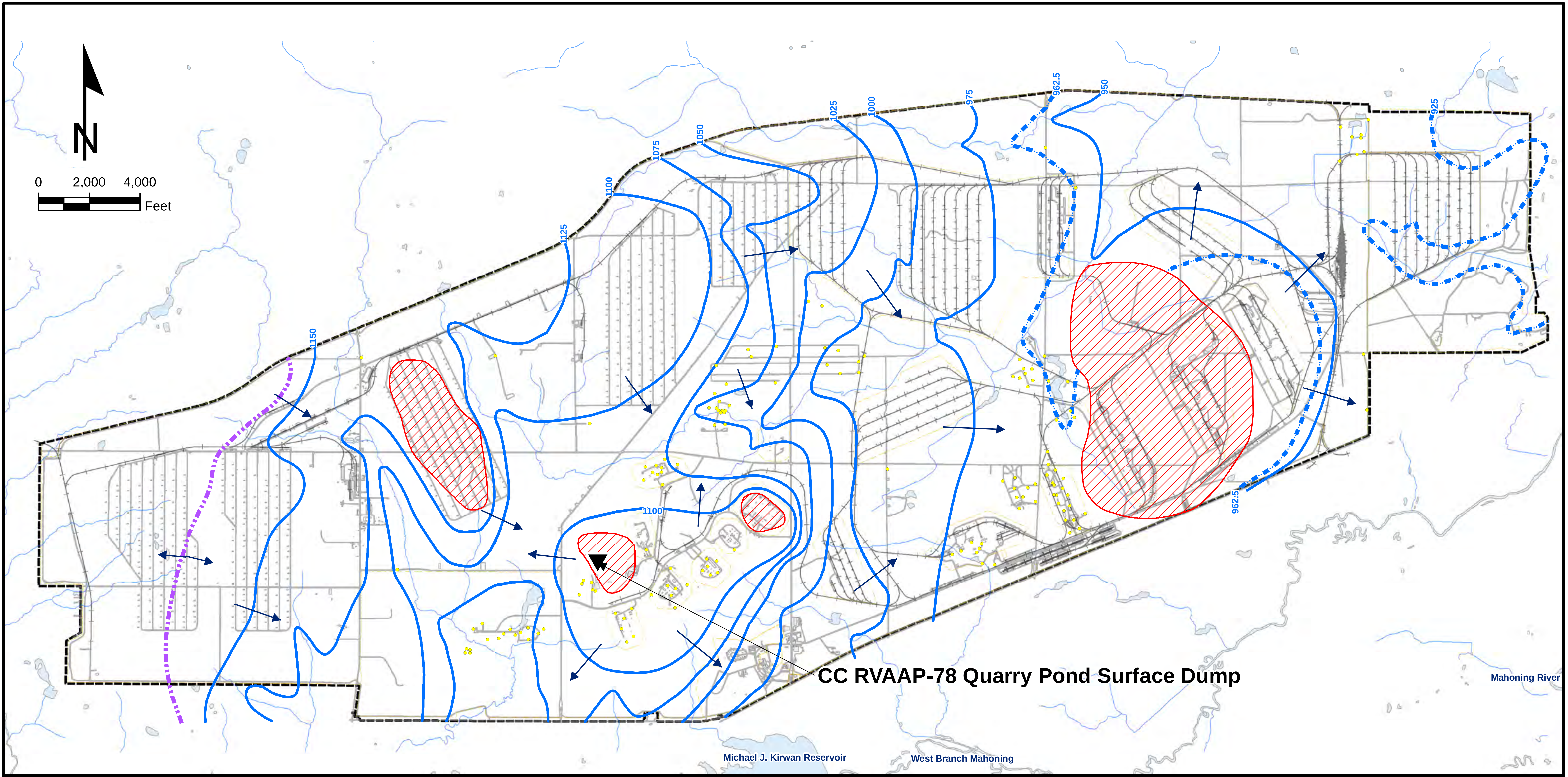
Figure 2-3

Soils Map

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 2-3a_SoilsMap_Site78.mxd



Legend

▼ Site Location

⬚ Facility Property Line

● Unconsolidated Monitoring Well

→ Approximate Flow Direction

— Line of Equal Groundwater Elevation (ft. amsl)

-·- Line of Inferred Groundwater Elevation (ft. amsl)

-·- Inferred Groundwater Divide

▨ Unconsolidated Aquifer Missing

🟦 River and Waterbody

— Creek and Stream

-+- Railroad

⬜ Building

--- Fence Line

— Road

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters
Base map data from SAIC
Groundwater elevation data from Facility-Wide Groundwater Monitoring Program, July 2012 (Environmental Quality Management, Inc. 2013)

ft. amsl is defined as feet above mean sea level

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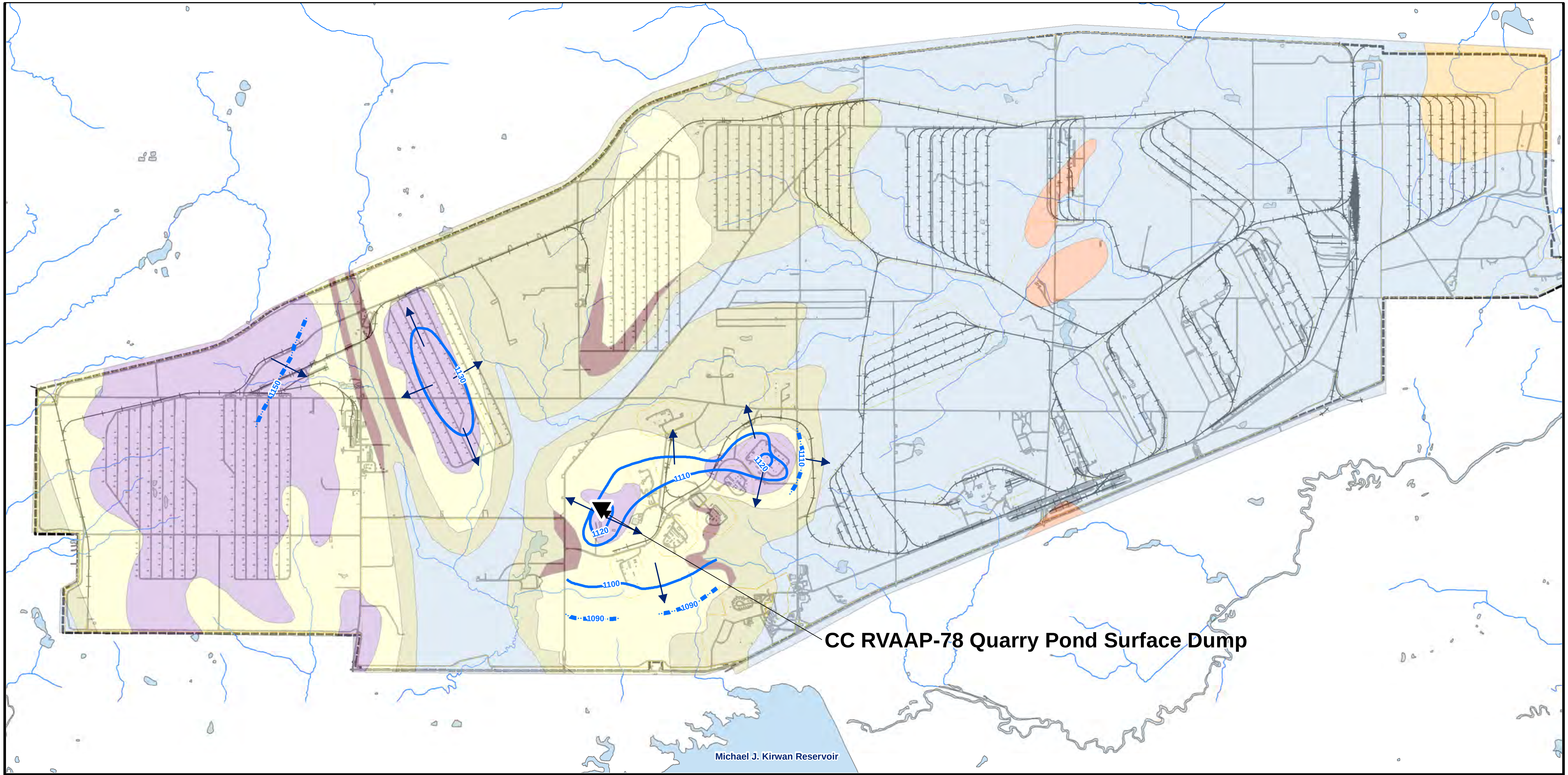
Figure 2-4

Potentiometric Surface of Unconsolidated Aquifer

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 2-4 Unconsolidated Aquifer CC78.mxd



Legend

- 🟪 Homewood Sandstone Member of Pottsville Formation
- 🟨 Mercer Shale Member of Pottsville Formation
- 🟫 Connoquennissing Sandstone Member of Pottsville Formation
- 🟩 Sharon Shale Member of Pottsville Formation
- 🟦 Sharon Sandstone Member- Conglomerate Unit of Pottsville Formation
- 🟧 Berea Sandstone
- 🟨 Cuyahoga Group
- 🟥 Area Depicted as All Homewood Sandstone Member by EQM
- ▼ Site Location
- → Approximate Flow Direction
- — Line of Equal Groundwater Elevation (ft. amsl)
- ‐·‐ Line of Inferred Groundwater Elevation (ft.amsl)
- 🟦 River and Waterbody
- — Creek and Stream
- ┈ Fence Line
- ┼ Railroad
- — Road
- ⬜ Building
- ⬚ Facility Property Line

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters
Base map data from SAIC
Bedrock and Groundwater data from Facility-Wide Groundwater Monitoring Program, July 2012 (Environmental Quality Management, Inc. 2013)

ft. amsl is defined as feet above mean sea level

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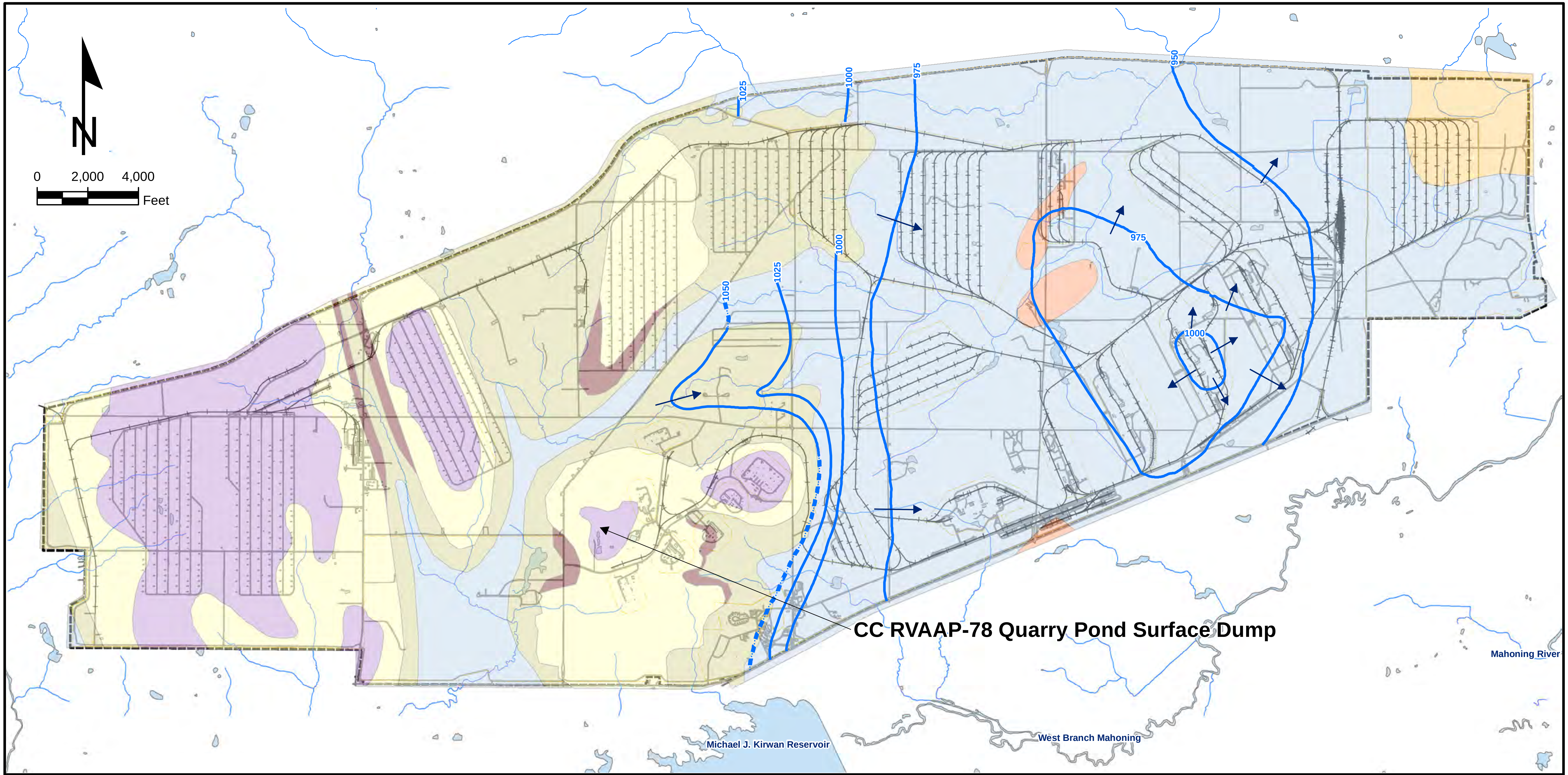
Figure 2-5

Potentiometric Surface of Homewood Aquifer

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 2-5 Potentiometric Surface of Homewood CC78.mxd



Legend

- 🟪 Homewood Sandstone Member of Pottsville Formation
- 🟨 Mercer Shale Member of Pottsville Formation
- 🟫 Connoquennissing Sandstone Member of Pottsville Formation
- ▨ Sharon Shale Member of Pottsville Formation
- 🟦 Sharon Sandstone Member- Conglomerate Unit of Pottsville Formation
- 🟧 Berea Sandstone
- 🟨 Cuyahoga Group
- 🟥 Area Depicted as All Homewood Sandstone Member by EQM
- ▼ Site Location
- → Approximate Flow Direction
- — Line of Equal Groundwater Elevation (ft. amsl)
- ‐ ‐ Line of Inferred Groundwater Elevation (ft. amsl)
- 🟦 River and Waterbody
- — Creek and Stream
- ‐ ‐ Fence Line
- ┼ Railroad
- — Road
- ⬜ Building
- ⬚ Facility Property Line

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters
Base map data from SAIC
Groundwater elevation data from Facility-Wide Groundwater Monitoring Program, July 2012 (Environmental Quality Management, Inc. 2013)

ft. amsl is defined as feet above mean sea level

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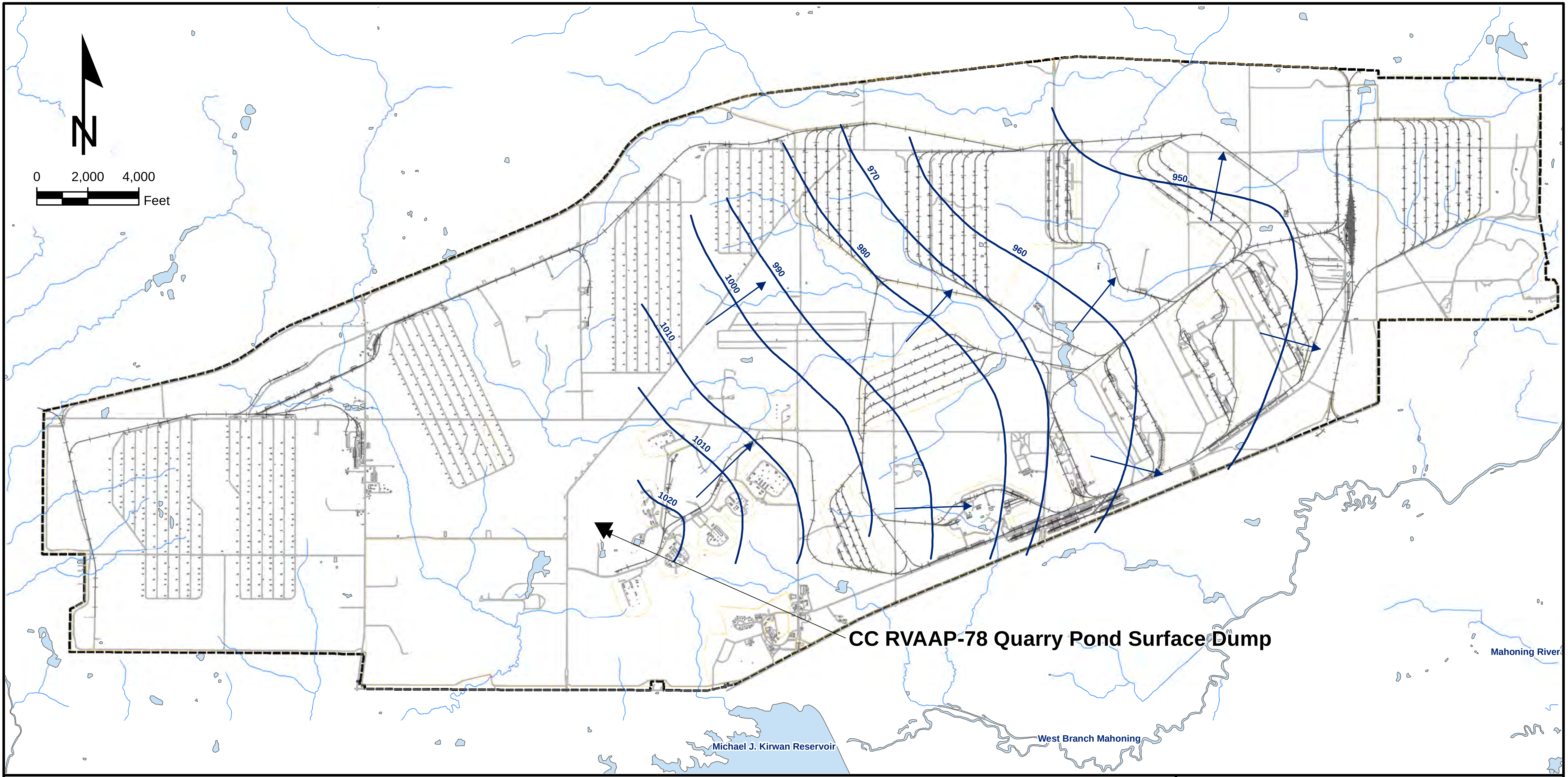
Figure 2-6

Potentiometric Surface of Sharon Sandstone Aquifer

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 2-6_SharonAquifer CC78.mxd



Legend

- ▼ Site Location
- → Approximate Flow Direction
- — Line of Equal Groundwater Elevation (ft. amsl)
- ▭ River and Waterbody
- — Creek and Stream
- ┈ Fence Line
- ┼ Railroad
- — Road
- ▭ Building
- ⬚ Facility Property Line

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters
Base map data from SAIC
Groundwater elevation data from Facility-Wide Groundwater Monitoring Program, July 2012 (Environmental Quality Management, Inc. 2013)

ft. amsl is defined as feet above mean sea level

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Figure 2-7

Potentiometric Surface of Lower Sharon Conglomerate Aquifer

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 2-7_SharonConglomerateAquifer CC78.mxd

SECTION 3: ENVIRONMENTAL SETTING

This chapter describes the physical features of the CC RVAAP-78 Quarry Pond Surface Dump including surface features and topography, geology, and hydrogeology. Potential receptors are also discussed based on the environmental setting.

3.1 PHYSIOGRAPHIC SETTING

Camp Ravenna is located within the southern New York Section of the Appalachian Plateaus physiographic province (USGS 1968). This province is characterized by elevated uplands underlain primarily by Mississippian and Pennsylvanian age bedrock units that are horizontal or gently dipping. The province is characterized by its rolling topography, with incised streams having dendritic drainage patterns. The southern New York Section has been modified by glaciation, which rounded ridges, filled major valleys, and blanketed many areas with glacially-derived unconsolidated deposits (e.g., sand, gravel, and finer-grained outwash deposits). As a result of glacial activity in this section, old stream drainage patterns were disrupted in many locales, and extensive wetland areas developed

3.2 SURFACE FEATURES AND TOPOGRAPHY

The topography of Camp Ravenna is gently undulating, with an overall decrease in ground elevation from a topographic high of approximately 1,220 ft above mean sea level (amsl) in the far western portion of the facility to areas at approximately 930 ft amsl in the far eastern portion of the facility.

The facility topography was mapped in February 1998 using a 2-ft contour interval with an accuracy of 0.02 ft. Additional topographic information based on aerial photographs taken during the spring of 1997 is also available. The USACE survey is the basis for the topographical information illustrated in figures included in this report.

The surface features within CC RVAAP-78 Quarry Pond Surface Dump are mildly undulating topography with steeply inclined rock slopes around the perimeter. The surface elevation of the AOC varies from approximately 1,130 ft amsl to approximately 1,170 ft amsl. **Figure 3-1** shows the area features and topography surrounding the AOC. The AOC surrounds the northernmost quarry pond of the adjacent AOC (RVAAP-16) on the north and east sides. The area around the AOC is forested.

3.3 GEOLOGY AND SOIL

The regional geology at the facility consists of horizontal to gently dipping bedrock strata of Mississippian and Pennsylvanian age overlain by varying thicknesses of unconsolidated glacial deposits. The bedrock and unconsolidated geology at the facility is presented in the following subsections and shown in **Figures 2-1 and 2-2.**

3.3.1 Bedrock Geology

The bedrock geology has been inferred from the data presented in the Environmental Quality Management, Inc. (EQM) Facility-Wide Groundwater Monitoring Annual Report for 2012 (EQM 2013) and shown on **Figure 2-1**. Additional bedrock monitoring wells have been installed at the site since the January 2010 data by SAIC that served as the previous interpretation of site bedrock (SAIC 2011a). Areas that differ significantly are noted on **Figure 2-1**.

The Sharon Sandstone Member of the Pennsylvanian Pottsville Formation is the primary bedrock beneath the facility (**Figure 2-1**). The lower portion of the Sharon Sandstone Member is informally referred to as the Sharon Conglomerate. In the western portion of the facility, the upper members of the Pottsville Formation, including the Sharon Shale, Massillion Sandstone, Mercer Shale, and uppermost Homewood Sandstone, have been found. The regional dip of the Pottsville Formation measured in the western portion of the facility is between 5 and 11.5 ft per mi (1.5-3.5 meter [m] per 1.6 km) to the south. The Sharon Sandstone Member, the lowest unit of the Pottsville Formation, is a highly porous, loosely cemented, permeable, cross-bedded, frequently fractured and weathered, orthoquartzite sandstone, which is locally conglomeratic. Thin shale lenses occur in the upper portion of the unit. The Sharon Shale is a gray to black sandy to micaceous shale containing thin coal, underclay, and sandstone lenses. The Mercer Member of the Pottsville Formation consists of silty to carbonaceous shale with abundant thin, discontinuous sandstone lenses in the upper portion. Regionally, the Mercer Member also has been noted to contain interbeds of coal. The Homewood Sandstone Member is the uppermost unit of the Pottsville Formation. It typically occurs as a caprock on bedrock highs in the subsurface, and ranges from well-sorted, coarse-grained, white quartzose sandstone to a tan, poorly sorted, clay-bonded, micaceous, medium- to fine-grained sandstone. Thin shale layers are prevalent in the Homewood Member as indicated by a darker gray shade of color (Winslow and White 1966).

As shown on **Figure 2-1**, two small areas of Berea Sandstone were identified as the uppermost bedrock present. The Berea sandstone is a medium- to fine-grained clay-bonded quartz sandstone. The upper 20-30 ft of the Berea is thinly-bedded; however, the beds of the lower Berea are more massive with distinctive cross-bedding (USGS 1954).

3.3.2 Soil and Glacial Deposits

Bedrock at the facility is overlain by deposits of the Wisconsin-age Lavery Till in the western portion of the facility and the younger Hiram Till and associated outwash deposits in the eastern two-thirds of the facility (**Figure 2-2**). Unconsolidated glacial deposits vary considerably in their character and thickness across the facility, from 0 ft in some of the eastern portions of the facility to an estimated 150 ft (46 m) in the south-central portion.

Thin coverings of glacial material have been completely removed as a consequence of human activities at locations such as Ramsdell Quarry. Bedrock is present at or near the ground surface in locations such as at Load Line 1 and the Erie Burning Grounds (USACE 2001). Where this glacial material is still present, its distribution and character indicate its origin as ground moraine. These tills consist of laterally discontinuous assemblages of yellow-brown, brown, and gray silty clays to clayey silts, with sand and rock fragments. Lacustrine sediment from bodies of glacial-age standing water has also been encountered in the form of deposits of uniform light gray silt greater than 50 ft thick in some areas (USACE 2001).

Soil at the facility is generally derived from the Wisconsin-age silty clay glacial till. Distributions of soil types are discussed and mapped in the Soil Survey of Portage County, Ohio, which describes soil as nearly level to gently sloping and poor to moderately well drained (United States Department of Agriculture [USDA] 1978, 2010). Much of the native soil at the facility was disturbed during construction activities in former production and operational areas of the facility. Several soil types are present at the facility, as shown on **Figures 2-3a and 2-3b**.

The Sharon Member of the Pennsylvanian Pottsville Formation is the primary bedrock beneath Camp Ravenna. In the western half of the facility, the upper members of the Pottsville Formation, including the Massillon Sandstone, Mercer Shale, and uppermost Homewood Sandstone, have been found. The regional dip of the Pottsville Formation measured in the western portion of Camp Ravenna is between 5 to 11.5 ft per mile to the south.

3.3.3 Soil and Geology at the AOC

The soil and bedrock geology presented in this section has been inferred from the data presented on **Figure 2-1** from the EQM Facility-Wide Groundwater Monitoring Annual Report for 2012 (EQM 2013) and from the RI boring logs (Appendix B). The native soil at CC RVAAP-78 Quarry Pond Surface Dump was mapped by the USDA as pits and quarries (**Figure 3-2**). As indicated on the boring logs, soils are generally described as silty clay and typically extend one to two feet below ground surface. Surface soils in the surrounding area are assumed to be Hiram Till glacial deposits (**Figure 2-2**).

Based on borings at the facility, the shallowest bedrock beneath the AOC is assumed to be Homewood Sandstone (**Figure 2-1**). Multiple borings at CC RVAAP-78 Quarry Pond Surface Dump were advanced to bedrock. Many drilling locations could not be advanced to targeted depth due to encountering the sandstone at approximately 2 ft bgs. Often, the upper few feet of the sandstone bedrock is weathered.

3.4 HYDROGEOLOGY

3.4.1 Regional Hydrogeology

Sand and gravel aquifers are present in the buried-valley and outwash deposits in Portage County, as described in the Phase I RI Report for High-Priority Areas of Concern (USACE 1998). Generally, these saturated zones are too thin and localized to provide sufficient quantities of water for industrial or public water supplies; however, yields are sufficient for residential water supplies. Lateral continuity of these aquifers is unknown. Recharge of these units comes from surface water infiltration of precipitation and surface streams. Specific groundwater recharge and discharge areas at the facility have not been delineated.

The potentiometric surfaces at the facility for unconsolidated deposits and bedrock are based on the facility-wide July 2012 groundwater monitoring event (EQM 2013). The groundwater elevations of the unconsolidated deposits are shown on **Figure 2-4**. The potentiometric surface of the Homewood Sandstone Member (uppermost aquifer of the Pottsville Formation) is presented on **Figure 2-5**, the potentiometric surface of the upper Sharon Sandstone Member (intermediate aquifer of the Pottsville Formation) is presented on **Figure 2-6**, and the potentiometric surface of the lower Sharon Sandstone Member (referred to in this RI as the Sharon Conglomerate; the deepest aquifer of the Pottsville Formation) is presented on **Figure 2-7**.

The groundwater table occurs within the unconsolidated zone in many areas of the facility. The thickness of the unconsolidated interval at the facility ranges from thin to absent in the eastern and northeastern portions of the facility to an estimated 150 ft (46 m) in the central portion of the facility. Because of the heterogeneous nature of the unconsolidated glacial material, groundwater flow patterns are difficult to determine with a high degree of accuracy. Vertical recharge from precipitation likely occurs via infiltration along root zones, desiccation cracks, and partings within the soil column. Laterally, most shallow groundwater flow likely follows topographic contours and stream drainage patterns, with preferential flow along pathways (e.g., sand seams, channel deposits, or other stratigraphic discontinuities) having higher permeabilities than surrounding clay or silt-rich material.

As shown on **Figure 2-4**, groundwater in the unconsolidated aquifer predominantly flows in an eastward direction; however, the unconsolidated zone shows numerous local flow variations influenced by topography and drainage patterns. The local variations in flow direction suggest: (1) groundwater in the unconsolidated deposits is generally in direct hydraulic communication with surface water, and (2) surface water drainage ways may also act as groundwater discharge locations. In addition, topographic ridges between surface water drainage features act as groundwater divides in the unconsolidated deposits, as inferred near the western facility boundary.

Within bedrock units at the facility, the principal water-bearing aquifer is the Sharon Conglomerate of the Pottsville Formation. Depending on the existence and depth of overburden, the Sharon Conglomerate ranges from an unconfined to a leaky artesian aquifer. Water yields from onsite water supply wells completed in the Sharon Conglomerate ranged from 30 to 400 gallons per minute (gpm) (United States Army Toxic and Hazardous Materials Agency 1978). Well yields of 5-200 gpm were reported for onsite bedrock wells completed in the Sharon Conglomerate (Kammer 1982). At the facility, the upper portion of the Sharon Conglomerate (Sharon Sandstone Member) is apparently hydraulically separate from the lower Sharon Conglomerate (EQM 2013).

The Sharon bedrock potentiometric gradient is a more uniform and regional eastward flow direction than the unconsolidated zone and is not as affected by local surface topography. As shown on **Figure 2-6**, the regional groundwater flow direction of the upper Sharon Sandstone is to the east; however, there is a notable mounding of groundwater in the southeastern portion of the facility where groundwater within this aquifer is radial. As shown on **Figure 2-7**, the groundwater flow direction in the lower Sharon Conglomerate is also to the east.

Other local bedrock units capable of producing water include the Homewood Sandstone, which is generally thinner and only capable of well yields less than 10 gpm, and the Connoquenessing Sandstone. Wells completed in the Connoquenessing Sandstone in Portage County have yields ranging from 5 to 100 gpm, but are typically less productive than the Sharon Conglomerate due to lower permeabilities. None of the monitoring wells at the facility are identified as screened in the Connoquenessing (EQM 2013). As shown on **Figure 2-5**, the groundwater flow within the

Homewood Sandstone at the facility is radial due to the sandstone's presence as a localized cap rock.

For much of the eastern half of the facility, bedrock potentiometric elevations are higher than the overlying unconsolidated potentiometric elevations, indicating an upward hydraulic gradient. This evidence suggests there is a confining layer that separates the two aquifers. However, in the far eastern area, the two potentiometric surfaces are at approximately the same elevation, suggesting that hydraulic communication between the two aquifers is occurring. Due to the lack of well data in the western portion of the facility, generalized hydraulic gradients and flow patterns are difficult to discern.

3.4.2 Groundwater Usage and Domestic Water Supply

The installation historically used groundwater for both domestic and industrial supplies. Groundwater utilized at the installation during past operations was obtained from production wells located throughout the installation, with the majority of wells screened in the Sharon Conglomerate. The Army discontinued use of most of the groundwater production wells prior to 1993, when the installation was placed in modified caretaker status. Many of the production wells have been properly closed. In 2010, OHARNG installed two bedrock aquifer production wells for use as a groundwater supply. These two OHARNG groundwater supply wells are installed in the Sharon Conglomerate aquifer and are located near Buildings 1067 and 1068 within the Administration Area. They are considered a private water system and are used for potable use. Municipal water lines have been installed to support water use in this area and buildings will be connected to municipal water in 2019.

The closest population center to the facility, the city of Newton Falls, obtains municipal water supplies from the east branch of the Mahoning River. Currently, the majority of residential groundwater use in the area surrounding the facility is primarily for domestic and livestock supply, with the Sharon Conglomerate acting as the major producing aquifer in the area. The Connoquenessing and Homewood sandstones also provide limited groundwater resources, primarily surrounding the western half of the facility. Unconsolidated deposits can also be an important source of groundwater, as many of the domestic wells and small public water supplies located near the facility obtain sustainable quantities of water from wells completed in unconsolidated deposits. Local groundwater within and surrounding the facility contains proportionately high levels of iron, manganese, and carbonate compounds.

3.4.3 Hydrogeology of the AOC

The hydrogeology for CC RVAAP-78 Quarry Pond Surface Dump is based on data presented in the EQM Facility-Wide Groundwater Monitoring Program 2012 Annual Report (EQM 2013) and the Final SI report for this AOC (USACE 2016).

No groundwater monitoring wells are located within CC RVAAP-78 Quarry Pond Surface Dump. As shown on Figure 2-4, the unconsolidated aquifer is not present below the AOC. As shown on the boring logs (Appendix B), groundwater was not encountered in the shallow soil or the bedrock during drilling (deepest borehole is 10.8 ft bgs).

Monitoring well FBQmw-171 is located approximately 30 ft south of DU01 within the adjacent AOC (RVAAP-16), and monitors the Homewood Sandstone bedrock aquifer from 18 to 28 ft bgs. The depth to groundwater in this monitoring well location was approximately 17 ft bgs during the July 2012 groundwater monitoring event, with a potentiometric elevation of 1,123.27 ft amsl. Monitoring well FBQmw-173 is located approximately 50 ft north of DU03, and is screened from 29.5 to 49.5 ft bgs. The depth to groundwater in this monitoring well location was approximately 39.5 ft bgs during the July 2012 groundwater monitoring event, with a potentiometric elevation of 1,122.87 ft amsl.

Shallow groundwater beneath the AOC likely discharges into the adjacent quarry pond (northernmost quarry pond in RVAAP-16 AOC). The distance to the quarry pond varies from approximately 20 ft from the downgradient edge of DU01 to approximately 200 ft from the downgradient edge of DU03. The depth of the quarry pond is unknown. An outlet pipe from the pond discharges overflow water from the southern pond towards the west, where it eventually flows to the unnamed creek (SpecPro 2005). The unnamed creek is located approximately 1,200 ft west of the quarry ponds.

3.5 SURFACE WATER

3.5.1 Regional Surface Water

The facility resides within the Mahoning River watershed, which is part of the Ohio River basin. The West Branch of the Mahoning River is the main surface stream in the area. The West Branch flows adjacent to the west end of the installation, generally in a north to south direction, before flowing into the Michael J. Kirwan Reservoir, which is located to the south of State Route 5 (**Figure 1-1**). The West Branch flows out of the reservoir and parallels the southern the facility boundary before joining the Mahoning River east of the facility. The western and northern portions of the facility display low hills and a dendritic surface drainage pattern. The eastern and southern portions are characterized by an undulating to moderately level surface, with less dissection of the surface drainage. The facility is marked with marshy areas and flowing and intermittent streams whose headwaters are located in the upland areas of the facility.

As shown on **Figure 1-2**, the three primary watercourses that drain the facility are:

- South fork of Eagle Creek
- Sand Creek
- Hinkley Creek.

All of these watercourses have many associated tributaries. Sand Creek, with a drainage area of 13.9 square mi (mi^2) (36 square km [km^2]), flows generally in a northeast direction to its confluence with the south fork of Eagle Creek. In turn, the south fork of Eagle Creek continues in a northerly direction for 2.7 mi (4.3 km) to its confluence with Eagle Creek. The drainage area of the south fork of Eagle Creek is 26.2 mi^2 (67.8 km^2), including the area drained by Sand Creek. Hinkley Creek originates just southeast of the intersection between State Route 88 and State Route 303 to the north of the facility. Hinkley Creek, with a drainage area of 11.0 mi^2 (28.5 km^2), flows in a southerly direction through the facility, and converges with the west branch of the Mahoning River south of the facility (USACE 2001).

Streams throughout Camp Ravenna are generally dominated by sand, fine gravel, and small cobble substrates. However, bedrock-bottomed pools and riffles and runs of bedrock rubble were also found in South Fork Eagle Creek, Sand Creek, and Hinkley Creek. The larger stream sites typically had the sandy substrates and low gradients, and cobbles and slabs dominated the substrates (ODNR-DNAP, 1999). South Fork Eagle Creek, Sand Creek, and Hinkley Creek are designated as warm-water habitats (WWH) in the Ohio WQS. WWH is defined by the OEPA (1987) as:

"Waters capable of supporting balanced, reproducing populations of warm-water fish, associated vertebrates, invertebrates, and plants on an annual basis. WWH is the Most widely applied of the aquatic life use designations; it is applied to those waters that either demonstrate biological attainment at a sufficient number of sites or provide adequate for supporting the use. A QHEI value that exceeds the ecoregion 25th percentile value demonstrates the capability to support WWH."

South Fork Eagle Creek and its tributaries, including Sand Creek, are also designated by the OEPA as State Resource Waters (SRW). State Resource Waters include water bodies which lie within park systems, wetlands, wildlife areas, and wild, scenic and recreational rivers, and publicly owned lakes, and waters of exceptional recreational or ecological significance. In 1978, the State Resource Water designation was redefined to include four levels of high-quality water: (1) General High-Quality Water, (2) Superior High-Quality Water, (3) State Resource Water, and (4) Outstanding national Resource Water. In 2003 many SRW were re-designated by the Ohio EPA as Superior High Quality Waters (SHQW) and Outstanding State Waters (OSW). South Fork Eagle Creek was re-designated as a SHQW because of the endangered mountain brook lamprey (*Ichthyomyzon greeleyi*) collected there in 1987 and 1999, 2003, and 2010. Mountain brook lamprey were also captured in Sand Creek in 2003 and 2010 (USACE, 2005; USGS, 2002, Hoggarth and Rice 2011) but Sand Creek retained its designation as an SRW and was not re-designated as a SHQW.

Ohio EPA antidegradation rules protect SHQW and OSW from lowering of existing water quality, and permitted pollutant loadings are less than what are permitted for other use designations in Ohio. These waters are protected from any action that would degrade the existing water quality. Actions that degrade the existing water quality in these creeks are closely regulated via standards and rules imposed in Ohio Administrative Code (OAC) Chapter 3745-1. South Fork Eagle Creek, as a SHQW falls under the stricter Ohio EPA antidegradation rules. Sand Creek and Hinkley Creek do not fall under the same antidegradation rules as South Fork Eagle Creek.

Approximately 282 acres of ponds are found on the facility. The major ponds are summarized in Table 5 in the 2014 INRMP, additional information on the historical site usage associated with these ponds can be found in Part II of the Facility-Wide Biological and Water Quality Study 2003 Ravenna Army Ammunition Plant prepared by the USACE in cooperation with the OEPA (USACE, 2005).

Many of the ponds are shallow and in advanced eutrophic states, but 22 or so are deep enough to support a warm water fishery. Most of the ponds were created by beaver (*Castor canadensis*) dams or small man-made dams and embankments. A few of the ponds were originally used as settling ponds during load line production and are undergoing investigation and clean up when determined necessary.

Previous jurisdictional wetland delineations have surveyed approximately 5,680 acres or 26 percent of the Camp Ravenna land. Approximately 715 acres of jurisdictional wetlands have been delineated within the 5,680 acres, which comprises approximately 13 percent of the total surveyed area. In addition to the wetland surveys, previous vegetation community surveys have identified and characterized wetlands at Camp Ravenna. Twelve of the 18 vegetation communities identified by the ODNR - DNAP in 1993 are considered wetland communities (ODNR, 1993). These communities were characterized according to the Anderson's classification system (Anderson, 1982) and include.

- Submergent Marsh
- Floating-leaved Marsh
- Mixed Emergent Marsh
- Cat-tail Marsh
- Sedge-grass Meadow
- Mixed Shrub Swamp
- Button Bush Swamp
- Oak-Maple Swamp Forest
- Mixed Swamp Forest
- Mixed Floodplain Forest
- Wet Fields

3.5.2 Surface Water at the AOC

There are no surface water bodies present within CC RVAAP-78 Quarry Pond Surface Dump AOC. During storm events, surface water generally drains to the quarry pond and provides a recharge area for the Homewood Sandstone aquifer (**Figure 2-5**), described above in Section 3.3. Infiltration of the surface water to groundwater is limited by the sloping surface, presence of silty clay soils, and shallow bedrock. Surface water flow is a primary migration pathway for any potential contamination at CC RVAAP-78 Quarry Pond Surface Dump. **Figure 3-3** shows surface water features and locations of surveyed wetlands within proximity of CC RVAAP-78 Quarry Pond Surface Dump.

3.6 CLIMATE

The general climate of the facility area is continental and is characterized by moderately warm and humid summers, reasonably cold and cloudy winters, and wide variations in precipitation from year to year. Climate data for the facility area presented below were obtained from available National Weather Service records for the 16-year period of record from 1996 to 2012 at the Youngstown Regional Airport, Ohio (http://www.nws.noaa.gov/climate/xmacis.php?wfo=cle). Wind speed data for Youngstown, Ohio, are from the National Climatic Data Center (http://www.ncdc.noaa.gov/data-access/quick-linksa#wind) for the available 53-year period of record from 1950 through 2002.

Average annual rainfall in the facility area is 41.2 inches (104.65 cm), with the highest monthly average occurring in May (4.35 inches or 11.05 cm) and the lowest monthly average occurring in February (2.50 inches or 6.35 cm). For the period of 1971-2000, the average annual snowfall for the Youngstown Area totals approximately 55.0 inches (139.7 cm), with the highest monthly average occurring in January (14.3 inches or 36.32 cm). Due to the influence of lake effect snowfall events associated with Lake Erie (located approximately 35 mi [56.3 km] northwest of the facility), snowfall totals vary widely throughout northeastern Ohio.

The average annual daily temperature in the facility area is 49.6 degrees Fahrenheit (ºF), with an average daily high temperature of 70.7ºF and an average daily low temperature of 26.5ºF. The record high temperature of 103ºF occurred in July 1936, and the record low temperature of -22ºF occurred in January 1994. The prevailing wind direction at the facility is from the west-southwest, with the highest average wind speed occurring in January (12.0 mi [19.31 km] per hour) and the lowest average wind speed occurring in August (7.04 mi [11.27 km] per hour). Thunderstorms occur on approximately 35 days per year and are most abundant from April through August. The facility area is susceptible to tornadoes; minor structural damage to several buildings on facility property occurred as the result of a tornado in 1985.

3.7 TARGET RECEPTORS

Current and future human and ecological receptors are discussed in the following sections.

3.7.1 Human Receptors

The CC RVAAP-78 Quarry Pond Surface Dump was historically used for the dumping of construction debris, ACM, scrap metal, and other materials. Dumping and active use of the AOC has ceased. Projected future Land Use for CC RVAAP-78 Quarry Pond Surface Dump is Military Training. To allow for flexibility and avoid restrictions and limitations associated with the Military Training Land Use (National Guard Trainee), the target receptor evaluated in this SI Addendum is the Resident Receptor for Unrestricted (Residential) Land Use. This receptor was evaluated throughout this report to determine the presence of contamination.

No groundwater receptors have been identified for this AOC. Groundwater in CC RVAAP-78 Quarry Pond Surface Dump is not currently used for potable purposes. The nearest groundwater supply wells utilized by the OHARNG within the facility are located in the Administration Area, which is approximately 1.5 mi southeast of CC RVAAP-78 Quarry Pond Surface Dump (Figure 2-4). Groundwater beneath this AOC is being evaluated separately under RVAAP-66 Facility-Wide Groundwater and will be presented in a separate report.

3.5.2 Biological Resources

Camp Ravenna has a diverse range of vegetation and habitat resources. Habitats present within the facility include large tracts of closed-canopy hardwood forest, scrub/shrub open areas, grasslands, wetlands, open-water ponds and lakes, and semi-improved administration areas (OHARNG 2014). Vegetation at the facility can be grouped into three categories: herb-dominated, shrub-dominated, and tree-dominated. Approximately 60 percent of the facility is covered by forest or tree-dominated vegetation. The facility has seven forest formations, four shrub formations, eight herbaceous formations, and one non-vegetated formation.

An abundance of wildlife is present on the facility: 35 species of land mammals, 214 species of birds, 41 species of fish, and 34 species of amphibians and reptiles have been identified. The ponds support a variety of aquatic animals (e.g., fish, turtles, and frogs) and semi-aquatic wildlife, such as waterfowl (e.g., ducks and geese) and wading birds (e.g., great blue heron).

The northern long-eared bat (*Myotis septentrionalis*; federally threatened) exists at Camp Ravenna. There are no other federally-listed species and no critical habitat occurs on the facility (OHARNG 2014). Ohio state- listed plant and animal species have been identified through confirmed sightings and/or biological inventories at the facility and are presented in Table 2-1. Currently, the AOC is surrounded by forest habitat.

The northern long-eared bat (*Myotis septentrionalis*; federally threatened) exists at Camp Ravenna. There are no other federally listed species and no critical habitat occurs (OHARNG 2014). Ohio state-listed plant and animal species have been identified through confirmed sightings and/or biological inventories at the facility and are presented in Table 3-1. Currently, the AOC is surrounded by forest, grassland, and wetland habitats. Table 3-1 presents the state-listed species that have been identified to be on the facility by biological inventories and confirmed sightings.

A total of thirty-five (35) species of land mammals have been identified at the installation through casual observations and two studies (Schneider, 1993; Carroll, 1999). The most abundant species observed include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), woodchuck (*Marmota monaxv*), and eastern fox squirrel (*Sciurus niger*).

Table 3–1. Federal and State-listed Species List (December 2014).

I. Species confirmed to be on Camp Ravenna property by biological inventories and confirmed sightings.

A. Federal Threatened

1. Northern long-eared bat, *Myotis septentrionalis*

B. State Endangered

1. American bittern, *Botaurus lentiginosus* (migrant)
2. Northern harrier, *Circus cyaneus*
3. Sandhill Crane, *Grus Canadensis* (probable nester)
4. Black bear, *Ursus americanus*
5. Mountain Brook Lamprey, *Ichthyomyzon greeleyi*
6. Brush-tipped emerald, *Somatochlora walshii*
7. Graceful Underwing, *Catocala gracilis*
8. Tufted Moisture-loving Moss, *Philonotis Fontana var. caespitosa*
9. Appalachian quillwort, *Isoetes engelmannii*
10. Handsome sedge, *Carex formosa*
11. Narrow-necked Pohl's Moss, *Pohlia elongata var. elongate*
12. Philadelphia panic-grass, *Panicum philadelphicum*
13. Variegated scouring-rush, *Equisetum variegatum*

C. State Threatened

1. Barn owl, *Tyto alba*
2. Least Bittern, *Ixobrychus exilis*
3. Trumpeter swan, *Cygnus buccinators* (migrant)
4. Bobcat, *Felis rufus*
5. Caddis fly, *Psilotreta indecisa*
6. Northern long-eared bat, *Myotis septentrionalis*
7. Hobblebush, *Viburnum alnifolium*
8. Simple willow-herb, *Epilobium strictum*
9. Lurking leskea, *Plagiothecium latebricola*
10. Strict blue-eyed grass, *Sisyrinchium montanum*

D. State Potentially Threatened Plants

1. Arborvitae, *Thuja occidentalis*
2. False hop sedge, *Carex lupiliformis*
3. Greenwhite sedge, *Carex albolutescens*
4. Long Beech Fern, *Phegopteris connectilis* (*Thelypteris phegopteris*)
5. Pale sedge, *Carex pallescens*
6. Sharp-glumed manna-grass, *Glyceria acutifolia*
7. Straw sedge, *Carex straminea*
8. Water avens, *Geum rivale*
9. Woodland Horsetail, *Equisetum sylvaticum*
10. Shining ladies'-tresses, *Spiranthes lucida*

E. State Species of Concern

1. Big brown bat, *Eptesicus fuscus*
2. Deer mouse, *Peromyscus maniculatus*
3. Eastern red bat, *Lasiurus borealis*
4. Hoary bat, *Lasiurus cinereus*
5. Little brown bat, *Myotis lucifugus*
6. Pygmy shrew, *Sorex hovi*
7. Southern bog lemming, *Svnaptomys cooperi*
8. Star-nosed mole, *Condylura cristata*
9. Tri-colored bat, *Perimyotis subflavus*
10. Woodland jumping mouse, *Napaeozapus insignis*
11. Sharp-shinned hawk, *Accipiter striatus*
12. Marsh wren, *Cistothorus palustris*
13. Henslow's sparrow, *Ammodramus henslowii*
14. Cerulean warbler, *Dendroica cerulean*
15. Prothonotary warbler, *Protonotaria citrea*
16. Bobolink, *Dolichonyx oryzivorus*
17. Northern bobwhite, *Colinus virginianus*
18. Common moorhen, *Gallinula chloropus*
19. Great egret, *Ardea alba* (migrant)
20. Sora, *Porzana carolina*
21. Virginia Rail, *Rallus limicola*
22. Yellow-bellied Sapsucker, *Sphyrapicus varius*
23. Creek heelsplitter, *Lasmigona compressa*
24. Eastern box turtle, *Terrapene carolina*
25. Four-toed Salamander, *Hemidacrylium scutatum*
26. Eastern garter snake, *Thamnophis sirtalis*
27. Smooth green snake, *Opheodrys vernalis*
28. Eastern sand darter, *Ammocrypta pellucida*
29. Mayfly, *Stenonema ithica*
30. Moth, *Apamea mixta*
31. Moth, *Brachylomia algens*
32. Scurfy quaker, *Homorthodes furfurata*
33. Sedge wren, *Cistothorus platensis*

F. State Special Interest

1. American black duck, *Anas rubripes*
2. Canada warbler, *Wilsonia Canadensis*
3. Dark-eyed junco, *Junco hyemalis* (migrant)
4. Hermit thrush, *Catharus guttatus* (migrant)
5. Least flycatcher, *Empidonax minimus*
6. Magnolia warbler, *Dendroica magnolia*
7. Northern waterthrush, *Seiurus noveboracensis*
8. Winter wren, *Troglodytes hiemalis*
9. Back-throated bluewarbler, *Dendroica caerulescens*
10. Brown creeper, *Certhia Americana*
11. Mourning warbler, *Oporornis Philadelphia*
12. Pine siskit, *Carduelis pinus*
13. Purple finch, *Carpodacus purpureus*
14. Red-breasted nuthatch, *Sitta Canadensis*
15. Golden-crowned kinglet, *Regulus satrapa*
16. Blackburnian warbler, *Dendroica fusca*
17. Gadwall, *Anas strepera*
18. Green-winged teal, *Anas crecca*
19. Northern shoveler, *Anas clypeata*
20. Redhead duck, *Aytya Americana*
21. Ruddy duck, *Oxyura jamaicensis*
22. Wilson’s snipe, *Gallinago delicata*
23. Subflava sedge borer, *Capsula subflava*

Note: The Integrated Natural Resources Plan (OHARNG 2014) indicated that no federally listed species are known to reside at Camp Ravenna, and no critical habitat occurs. However, Table 2-1 reflects that the northern long-eared bat exists at Camp Ravenna and is federally threatened (USFWS 2016) and state threatened (ODNR 2016).

The OHARNG commissioned and conducted separate surveys for avian mammals (bats) at Camp Ravenna (Tawse, 1999; Davey Resource Group, 2002; Duffey & Brack, 2005, Tragus 2010).

Eleven species of bats are known to live in Ohio, and eight of these species were identified at Camp Ravenna. Bat species captured included little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), northern long-eared bats (*Myotis septentrionalis*), eastern red bat (*Lasiurus borealis*), silver haired bat (*Lasiurus noctivagans*), evening bat (*Nycticeius humeralis*), tri-colored bat (*Pepistrellus subflavus*), and hoary bat (*Lasiurus cinereus*). Netting efforts provided no evidence of the federally endangered Indiana bat (*Myotis sodalis)*. Most of the roosting habitat with proximity of mist net sites was rated as of moderate value for the Indiana bat, although some high quality summer roosting habitat does exist on the installation. The habitat supports reproduction by all species captured. Reproduction of the little brown and northern long eared bats suggest that many aspects of the habitat are suitable for the Indiana bat.

Beginning in 2012, at least one American black-bear (*Ursus americanus*) has been seen roaming about the grounds at Camp Ravenna. The black-bear is currently listed as state endangered in Ohio and is therefore prohibited from being hunted or trapped. Multiple sightings of the bear were reported by Camp Ravenna staff throughout 2013, however no sightings were reported in 2014. All employees, contractors and visitors on site are briefed about the potential presence of the bear and asked to report to Camp Ravenna Environmental staff where on site and at what time it was spotted and in which direction it was heading. It is Camp Ravenna's policy not to feed or disturb the black bear(s) on site in any way.

The complete taxa list for all mammals identified at Camp Ravenna is included in **Appendix D**.

There is currently an active bald eagle (*Haliaeetus leucocephalus*) nest located in forest management compartment 3. While the bald eagle has been delisted, it is still legally protected under the Federal Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Wildlife studies have not been conducted specifically for CC RVAAP-78 Quarry Pond Surface Dump. However, the herbaceous field, forest, and shrub habitat at CC RVAAP-78 Quarry Pond Surface Dump provides habitat for a variety of wildlife species. The AOC provides foraging habitat for birds as well as habitat for small mammals including, mice and voles, shrews, and moles that would typically occur in these habitats. Larger mammals occurring on the facility including white-tailed deer, raccoons, woodchucks, and eastern fox squirrels may also use CC RVAAP-78 Quarry Pond Surface Dump habitats, but only transiently.

Terrestrial portions of CC RVAAP-78 Quarry Pond Surface Dump have not been surveyed for federal or State-listed species nor have there been any reported sightings of listed species. On the facility, there are no known occurrences of federally listed rare, threatened, and endangered species (AMEC Environment & Infrastructure, Inc. [AMEC] 2008). There are, however, occurrences of State-listed species that have been identified at the facility.

3.6 MIGRATION PATHWAYS

Major pathways of migration for hazardous substances, pollutants, or contaminants (ground water, surface water, soil, or air) and the routes that hazardous substances, pollutants, or contaminants may take to reach these pathways (e.g., flooding, overland flow, vapor migration) are discussed in the following for the AOC. The information specific to the migration pathways for the AOC are summarized below. Primary and secondary contaminant sources at the AOC are presented.

Primary sources are point sources that can be traced back to an operation, discharge point, or other specific location (e.g., debris piles). Secondary sources are contaminated media, such as soil, groundwater, and surface water.

3.6.1 Contaminant Sources

The primary contaminant sources (debris piles) still exist within CC RVAAP-78 Quarry Pond Surface Dump. Secondary sources (contaminated media) identified in previous investigations were further evaluated as part of this effort.

3.6.1.1 Soils

The results of the SI indicated that surface soils in Debris Piles A, B, and C had chemical and ACM contamination. The subsurface soil sampling was conducted during this SI Addendum to identify if there was any contamination outside of the Debris Piles (3 DUs and the Test Pit Areas). Both surface soil and subsurface soil were considered migration pathways.

3.6.1.2 Sediment/Surface Water

Surface water at CC RVAAP-78 Quarry Pond Surface Dump occurs intermittently as stormwater runoff to the quarry pond located on an adjacent AOC (**Figure 3-3**). Since there are no surface water structures or bodies located on the AOC, sediment and surface water sampling was not conducted and this is not a migration pathway.

3.6.1.3 Groundwater

Groundwater at the facility is evaluated on a facility-wide basis, sampled under the Facility-Wide Groundwater Monitoring Program, and will be evaluated through the CERCLA process in a separate report. For this AOC, no groundwater targets (e.g., drinking water wells) have been identified and the migration pathway from groundwater was not considered significant.

3.6.2 Migration Pathways

Contaminants in soil may migrate in the dissolved phase to surface water via groundwater, or as particulates in stormwater run-off following a storm event. Based on topographical elevations (**Figure 3-1**), and proximity of surface water/wetlands (**Figure 3-3**), the northernmost quarry pond likely receives stormwater runoff from CC RVAAP-78 Quarry Pond Surface Dump. Leaching of contaminants in soil or dry sediment to groundwater via vertical migration is also a potential migration pathway, although limited by the sloping ground surface, silty clay soil, and shallow top of bedrock. A full evaluation of Facility-Wide Groundwater will be evaluated under a separate report.

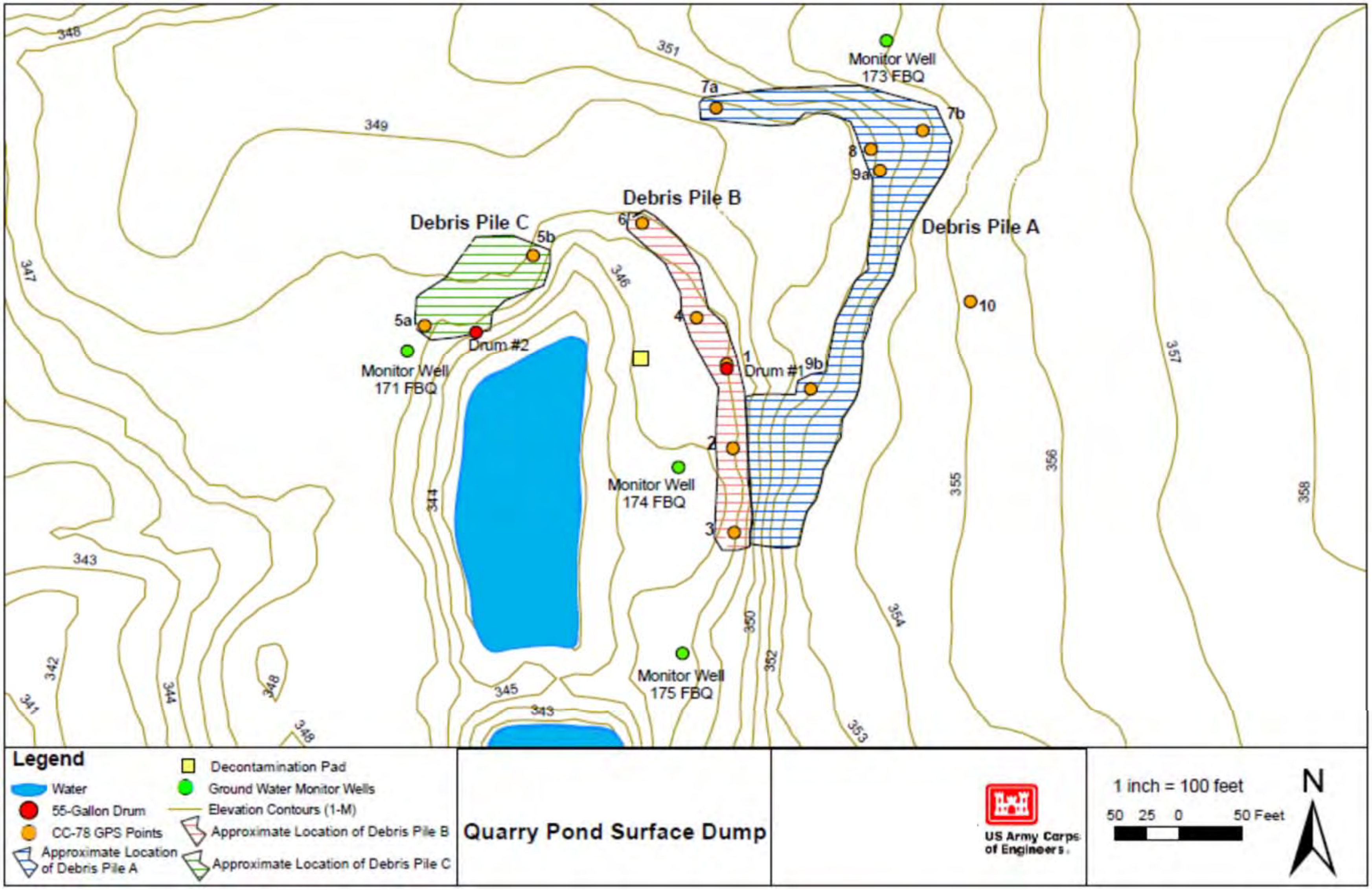

Figure 3-1. Topography at CC RVAAP-78 Quarry Pond Surface Dump.

Legend

▼ Site Location

〰 Creek and Stream

┼ Railroad

— Road

▭ River and Waterbody

▭ Building

▭ Facility Property Line

Soil Mapping Unit

🟩 ElC, Ellsworth silt loam, 6 - 12% slopes	🟩 MtB, Mitiwanga silt loam, 2 - 6% slopes
🟪 ElC2, Ellsworth silt loam, 6 - 12% slopes, moderarely eroded	🟦 Pq, Pits, quarries
🟥 FcA, Fitchville silt loam, 0 - 2% slopes	🟦 RsD2, Rittman silt loam, 12 - 18% slopes, moderately eroded
🟪 FcB, Fitchville silt loam, 2 - 6% slopes	🟫 TrA, Trumbull silt loam, 0 - 2% slopes
🟦 Ho, Holly silt loam	🟩 W, Water
🟦 MgA, Mahoning silt loam, 0 - 2% slopes	🟪 WaA, Wadsworth silt loam, 0 - 2% slopes
🟦 MgB, Mahoning silt loam, 2 - 6% slopes	🟦 WaB, Wadsworth silt loam, 2 - 6% slopes

N

0 200 400
Feet

NOTES & SOURCES

1. Map Coordinates: WGS 84, UTM Zone 17N in Meters.
2. Base map data from SAIC.

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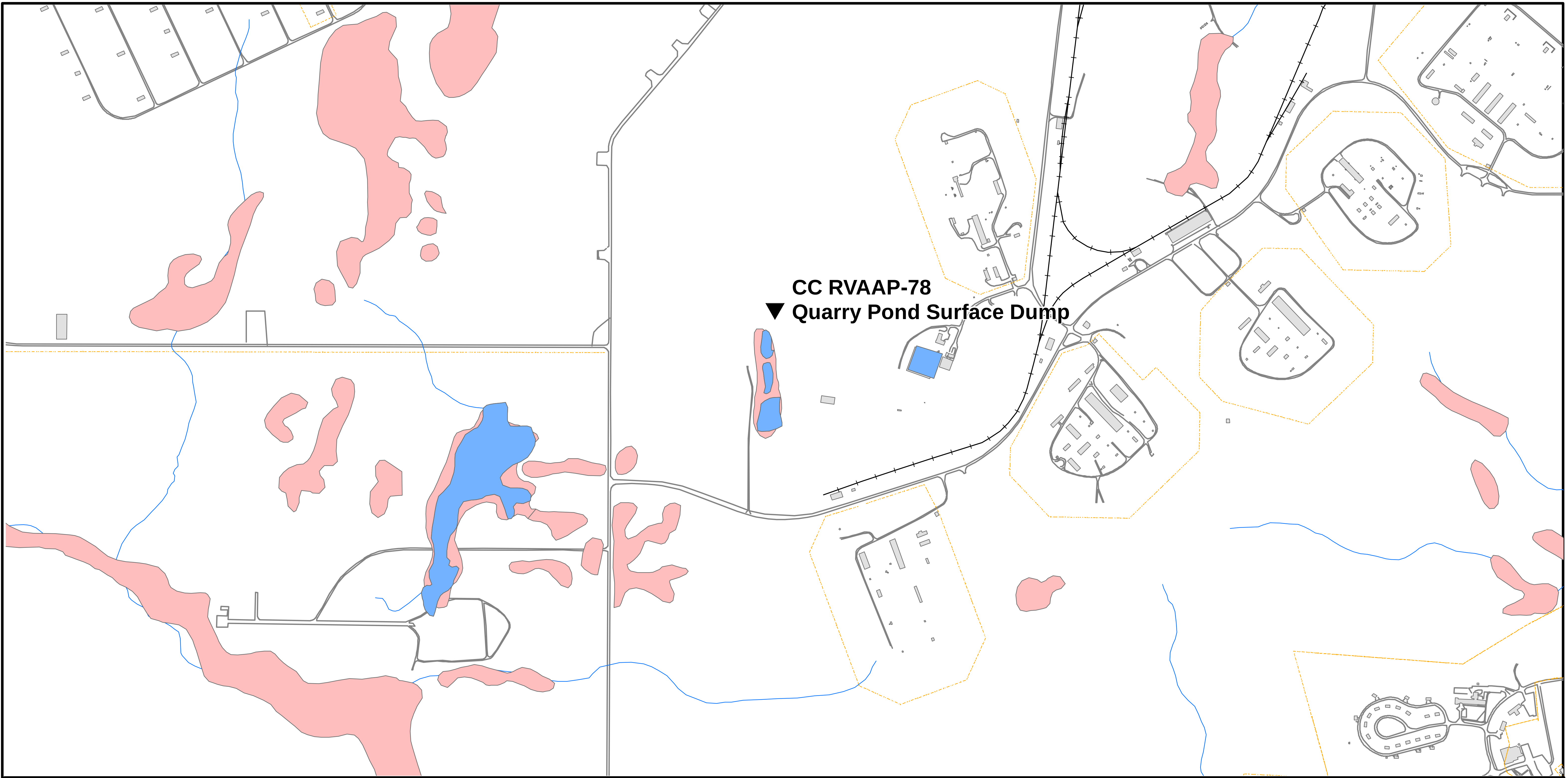
Figure 3-2.

Soils Map
CC RVAAP-78
Quarry Pond Surface Dump
FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 3-2 SoilsMap_Site78 specific.mxd



Legend

▼ Site Location
🟦 Waterbodies
🟥 Wetlands
〰 Creek and Stream
--- Fence Line
┼ Railroad
— Road
▭ Building
▭ Facility Property Line

N

0 1,000 2,000 Feet

NOTES & SOURCES

Map Coordinates: WGS 84, UTM Zone 17N in Meters
Base map data from SAIC

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Figure 3-3.
Surface Water Features and Surveyed Wetlands
CC RVAAP-78
Quarry Pond Surface Dump
FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 3-3 Wetlands_site78.mxd

SECTION 4: FIELD ACTIVITIES

Work conducted for this SI Addendum was performed as specified in the Final SI/RI Work Plan (ECC 2012) and the Facility-Wide Sampling and Analysis Plan (FWSAP) for Environmental Investigations, dated February 24, 2011 (SAIC 2011b), unless specifically noted, herein (Section 4.5). These documents were prepared in accordance with USACE and United States Environmental Protection Agency (USEPA) guidance.

4.1 DATA QUALITY OBJECTIVES

The overall project data quality objective (DQO) is to provide representative, repeatable, high quality data to address the primary project objectives identified in Section 4.2 of the FWSAP. The FWSAP and Final SI/RI Work Plan provide the organization, objectives, intended data uses, and QA/QC activities to perform in order to achieve the desired DQOs for maintaining the defensibility of the data. Project DQOs were established in accordance with USEPA Region 5 guidance. Requirements for sample collection, handling, analysis criteria, target analytes, laboratory criteria, and data verification criteria for this SI Addendum are consistent with USEPA and Department of Defense (DoD) requirements. The DQOs for this project include analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity for the measurement data. **Appendix G presents** the data verification performed in accordance with the project-specific DQOs.

Problem Definition

Work in this SI Addendum was developed and completed considering findings of the HRR and SI and review of previous investigations for adjacent AOCs. The 2016 SI Report recommended that additional investigation of the area between Debris Piles A and B and the road adjacent to the east side of the northern-most pond should be completed as well as additional characterization of contamination within the Debris Piles. Results of the SI for the three Debris Piles indicated that there was ACM and chemical contamination in all three Debris Piles. As stated previously, the SI was not finalized before the work for this SI Addendum was initiated. In the interim, the Army determined that the Debris Piles would be removed so the AOC could meet Unrestricted (Residential) Land Use. Therefore, additional characterization of the Debris Piles was deemed unnecessary since the removal action would include confirmation samples to ensure all of the contamination was removed. The remaining recommendations presented in the SI was to assess if contamination was in the area between Debris Piles A and B (Test Pit Area). Accordingly, the problem to be addressed in this SI Addendum is as follows: *Is there contamination in the areas between the Debris Piles and in the Test Pit Area?*

Determination of what constitutes contamination can vary based on the project, etc. In this SI Addendum, chemical contamination is based on Unrestricted (Residential) Land Use criteria at the target cancer risk of 1×10^{-6} and hazard quotient (HQ) of 0.1. Asbestos in soil or ACM, if present, will require additional evaluation and could be considered as contamination in this SI Addendum. Asbestos-containing material (ACM) is material containing more than one percent asbestos as determined using the methods specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy. The Asbestos NESHAP classifies ACM as either "friable" or "non-friable". Friable ACM is ACM that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. Non-friable ACM is ACM that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure. Non-friable ACM is further classified as either Category I ACM or Category II ACM. Category I ACM and Category II ACM are distinguished from each other by their potential to release fibers when damaged. The applicability of the Asbestos NESHAP to Category I and II ACM depends on: (1) the condition of the material at the time of demolition or renovation, (2) the nature of the operation to which the material will be subjected, (3) the amount of ACM involved.

4.2 SAMPLING RATIONALE AND DESIGN

Discrete, ISM, and composite sampling methods were utilized at CC RVAAP-78 Quarry Pond Surface Dump to investigate surface and subsurface soils to characterize the nature and extent of contamination related to historical activities that once occurred at the site. Decision units (DUs) were established to represent a 30-ft wide area around and between each of the Debris Pile (**Figure 4-1**). Additional soil sampling was conducted within the Test Pit Area located between Debris Piles A and B. A detailed description of the sampling activities conducted at CC RVAAP-78 Quarry Pond Surface Dump is provided in the following section and summarized in **Tables 4-1** and **4-2**.

Decision Unit 01 (DU01) covers an area of approximately 11,749 square feet (ft^2) surrounding Debris Pile C. DU02 covers an area of approximately 21,137 ft^2 surrounding Debris Pile B, and DU03 covers an area of approximately 28,147 ft^2 surrounding Debris Pile A. The Test Pit Area covers an area of approximately 41,082 ft^2 located mostly between Debris Piles A and B.

The ISM sampling of surface and subsurface soils was conducted in DU01 through DU03. In each DU, five soil borings were advanced to a targeted depth of 7 ft bgs using direct-push methods, and the soil was vertically profiled and logged by a field geologist. Surface soil samples were collected using ISM from 0 to 1 ft bgs, and subsurface soils were collected using ISM from the targeted depths of 1-4, 4-7, and 1-7 ft bgs. In several locations, the targeted sample depth could not be achieved due to competent bedrock being encountered at shallow depths causing drilling refusal. One vertical composite soil sample was collected from one deep soil boring in DU03. The targeted depth for the deep soil boring was 7-13 ft bgs; however, bedrock was encountered at 8.5 ft bgs and the sample was collected from 7 to 8.5 ft bgs. Details on the sampling methods are presented in Section 4.4. Figures showing drilling and sampling locations are presented in Chapter 5 on **Figures 5-2** through **5-11**.

The ISM soil samples were analyzed for Target Analyte List (TAL) metals, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and propellants. Within each ISM area a discrete soil sample was collected for VOC analysis. Five subsurface soil samples were also analyzed for the full suite of analytes (organochlorine pesticides, TAL metals, VOCs, SVOCs, PCBs, propellants, and explosives). In addition to the ISM samples, two discrete samples were collected from 4 to 7 ft bgs and analyzed for VOCs only.

In addition to DU sampling, samples were collected in the Test Pit Area. One discrete sample was collected from construction debris present in Test Pit 5 and analyzed for asbestos only. A vertical ISM soil sample was also collected from Test Pit 5 and analyzed for ACM only. Discrete surface soil samples were also collected from Test Pit 6 and Test Pit 7 and analyzed for the full analytical suite.

4.3 PRE-MOBILIZATION ACTIVITIES

Prior to the field investigation, a series of pre-mobilization activities were undertaken to ensure that all applicable requirements were met. These included making any necessary notifications to the Facility Manager, Ohio EPA, the operating contractor, and other stakeholders.

ECC personnel mobilized to the facility on March 18, 2013 to conduct a site walk and pre-mark DUs and direct-push boring locations in CC RVAAP-78 Quarry Pond Surface Dump.

4.4 FIELD SAMPLING

At CC RVAAP-78 Quarry Pond Surface Dump, soil ISM and discrete samples were collected as well as a vertical composite sample. Soil boring logs are provided in **Appendix B**, and field sampling forms are provided in **Appendix D**. Photographs of SI Addendum activities are provided in Appendix A.

Below is a summary regarding the number and assignment of DUs to each area in CC RVAAP-78 Quarry Pond Surface Dump:

- DU01 – Debris Pile C
- DU02 – Debris Pile B
- DU03 – Debris Pile A.

The Test Pit Area of CC RVAAP-78 Quarry Pond Surface Dump is located mostly between DU02 and DU03.

Figure 4-1 depicts the location, size, and layout of each DU and the Test Pit Area. Sampling at the three DUs was conducted on March 26, 2013. Soil sampling in the Test Pit Area and discrete soil sampling within the DUs were completed the following day (March 27, 2013).

Sampling locations, methods, numbers, and analyses were followed as stated in the FWSAP and Final SI/RI Work Plan. **Table 4-1** presents a summary of sample identifications, sample collection methods (type), and the rationale for the sampling activities conducted at each area of CC RVAAP-78 Quarry Pond Surface Dump. **Table 4-2** presents a summary of the media sampled, the number of samples collected, and chemical analyses. Matrix spike (MS)/matrix spike duplicate (MSD) samples were collected at a frequency of 5 percent, and field duplicate samples were collected at a frequency of 10 percent (3 duplicates for subsurface soil).

The VOC soil samples were collected as discrete soil samples using a Terracore sampler. For surface soil DUs, a soil sampling location was selected at the center of the DU for VOC sample collection. For subsurface VOC samples, the sampling liner was cut open and screened with a photoionization detector (PID). The interval with the maximum PID reading was collected as the discrete VOC sample. If no PID readings were recorded, then the discrete VOC sample was collected from the mid-point of the sampling interval.

4.4.1 Surface Soil Incremental Sampling Method

A total of three surface soil ISM samples (one from each DU) were collected from 0 to 1 ft bgs using ISM. Two surface soil samples were also collected from two test pits (Test Pits 6 and 7) using discrete sampling methods. The surface soil ISM samples were collected using the step probe and trowel/spoon method as described in Sections 5.6.2.1.1 and 5.6.2.1.2, respectively, of the FWSAP. The step probe consisted of a hollow stainless-steel rod approximately 0.75 inches in diameter and 4 ft in length with a “T” handle attached to the top. A 12-inch section at the tip of the sampler was cut away to facilitate collecting the sample. The sampler had a foot peg attached 12 inches from the bottom tip, which was used to advance the sampler to 1 ft bgs. The sampler was advanced to 1 ft bgs, and then withdrawn. The soil sample was collected from within the cut away section using a stainless-steel scoopula.

Surface soil ISM samples were created by combining 30 soil aliquots collected over the surface of the DU. If refusal was encountered before 1 ft bgs, the sample location was moved within an approximate 2-ft radius of the original location and sampling was re-attempted. Surface soil sampling was planned to extend from 0 to 1 ft bgs; however, if rock or gravel was encountered at depths less than 1 ft, samples were collected from the accessible portion of the 0- to 1-ft interval. Samples were collected to assess contaminant occurrence in surface soils.

Surface soil samples were analyzed for VOCs, TAL metals (including mercury), SVOCs, PCBs, and propellants. Each ISM sample mass was at least 1 kilogram of soil. All ISM samples were ground and sieved by the laboratory (TestAmerica Laboratories) using a No. 10 sieve (minimum 2 millimeters).

4.4.2 Subsurface Soil Sampling

Each horizontal ISM subsurface soil sample was comprised of two separate intervals, from 1 to 4 ft bgs and from 4 to 7 ft bgs. Soil aliquots were taken from the same interval (1-4 or 4-7 ft bgs) from the five borings in each DU. The aliquots were combined to create the depth-specific horizontal ISM subsurface soil samples. A vertical ISM sample was also collected at each boring location from the 1- to 7-ft interval. As shown in Table 4-1, these target sample depths were not achieved in many borings due to the presence of shallow competent bedrock and resulting drilling refusal.

Subsurface soil samples were collected using a Geoprobe® Model 6620DT direct-push drill rig. The procedures for hydraulic direct-push sampling were performed in accordance with the FWSAP. Samples were collected using 5-ft long stainless-steel sampling rods lined with acetate Microcore® samplers. Each sample was collected using a dedicated liner specific for that interval. The sampler was advanced to the desired depth. The sample was then retrieved from the desired depth and the liner removed. The liner was cut open length-wise and field screened with a 10.6-electrovolt MiniRae PID. Where applicable, a VOC sample was collected using a disposable Terracore® sampler. The soil characteristics for each interval were logged on a soil boring log. All sample containers were labeled and placed in a cooler with ice following collection.

Vertical ISM samples were collected from 1 to 7 ft bgs. The 5-ft stainless steel sampler was advanced twice at each boring location to reach the final depth of 7 ft. A sample was collected by cutting open the acetate liner length-wise and running a stainless-steel scoopula along the length of the sample from 1 to 5 ft and from 5 to 7 ft to collect a representative ISM vertical sample from that boring composed of 30 or more aliquots of soil along the length of the exposed core. Where applicable, VOC samples were collected immediately after the liner was opened and screened with the PID. All samples were labeled and placed in a cooler with ice following collection.

Within each DU and the Test Pit Area, attempts were made to drill (or dig) to the targeted depths shown in Table 4-2; however, competent sandstone bedrock was encountered at various depths ranging from 1 to 8.5 ft in most drilling locations. In those borings where bedrock was encountered, drilling to the targeted depths was prevented.

In DU03, a vertical composite soil sample was attempted from 7 to 13 ft bgs, but could not be collected below 8.5 ft due to refusal. To collect the composite sample, an equal quantity of soil was collected by running a trowel or other disposable sampling device up the collected soil coring and placing soil into a decontaminated or dedicated stainless steel bowl. The soil placed into the bowl was initially split into quarters, and each quarter was mixed thoroughly in the bowl using a stainless steel spoon. All four quarters were then mixed together until the single composite sample had a consistent physical appearance. The sample was then divided in half, and the containers were filled by scooping sample material alternately from each half.

Subsurface soil samples were analyzed for VOCs, TAL metals (including mercury), SVOCs, PCBs, and propellants. Three samples were analyzed for the full suite of analytes. Each ISM soil sample mass weighed at least 1 kilogram. All ISM samples were ground and sieved by the laboratory (TestAmerica Laboratories) using a No. 10 sieve (minimum 2 millimeters).

4.4.3 Asbestos-Containing Material Sampling

Twenty test pits were dug in the locations shown on **Figure 4-1** within and in the vicinity of the Test Pit Area. The Test Pit Area was recommended for investigation in the HRR because the area could potentially contain construction debris with suspected ACM (Prudent 2011). In general, the test pits were approximately 2 ft deep and dug to the top of bedrock. Up to 20 samples were to be collected from the Test Pit Area if building/construction debris indicative of potential ACM was noted during excavation of the test pit. However, construction debris containing suspected ACM was noted in only one test pit (Test Pit 5). One discrete sample was, therefore, collected at Test Pit 5 and submitted for asbestos analysis. In addition, one vertical ISM soil sample was collected from 0 to 1.7 ft bgs from Test Pit 5.

4.4.4 Sediment and Surface Water Sampling

Sediment and surface water sampling was not conducted in CC RVAAP-78 Quarry Pond Surface Dump since they are not present within the AOC.

4.5 DEVIATIONS FROM WORK PLAN

Work performed for this SI Addendum for CC RVAAP-78 Quarry Pond Surface Dump was conducted in accordance with the Final SI/RI Work Plan. The following deviations from the Work Plan were noted:

- For DU01 through DU03, the 1- to 4-ft sampling interval for VOCs is represented by vertical samples rather than horizontal. Two discrete samples were collected from two locations to provide VOC data for the 4- to 7-ft sampling interval because samples were not collected for VOCs during the initial sampling event.

- Targeted sampling intervals could not be achieved in many locations due to drilling refusal at the top of bedrock.

4.6 SURVEYING

Campbell and Associates, Inc. of Cuyahoga Falls, Ohio, was subcontracted by ECC to survey all soil boring and test pit locations within CC RVAAP-78 Quarry Pond Surface Dump. Campbell and Associates, Inc. is a licensed surveyor in the state of Ohio. The survey data were reported in North American Datum 1983 Universal Transverse Mercator Zone 17N datum. Survey coordinates are provided in **Appendix E.**

4.7 INVESTIGATION-DERIVED WASTE

The IDW materials generated in the field were comprised of soil cuttings from subsurface soil sampling, personal protective equipment, empty acetate liners, used TerraCore® samplers, and general non-environmental trash. The soil cuttings were primarily collected in plastic garbage liners placed inside 5-gallon buckets. Additional soil materials were collected on the clear 6-mil-thick plastic sheeting placed on the ground at the end of the cutting table and below the two 5-gallon buckets used for collecting soil cuttings. A large garbage bag was used to contain the used nitrile gloves, the used TerraCore® samplers, and cut up pieces of acetate liners. A long-handled steel lopper was used to cut the acetate liners into 12- to 18-inch-long pieces for ease of disposal. Finally, a large garbage bag was used to collect general non-environmental waste. The buckets for soil cuttings were brought to Building 1036 and placed in appropriately labeled 55-gallon open-headed drums.

4.7.1 Collection and Containerization

All IDW, including soil cuttings, personal protective equipment, disposable sampling equipment, and decontamination fluids, was properly handled, labeled, characterized, and managed in accordance with Section 8.0 of the FWSAP federal and state of Ohio large quantity generator requirements, and the facility's Installation Hazardous Waste Management Plan.

4.7.2 Characterization and Disposal

IDW disposal characterization samples were collected by ECC personnel on April 5, 2013. Samples were comprised of liquid IDW consisting of decontamination fluids, and solid IDW consisting of drill cuttings. IDW analyses included both liquid and solid full Toxicity

Characteristic Leaching Procedure, and Reactivity, Corrosivity and Ignitability analyses by TestAmerica Laboratories (see IDW Letter Report in **Appendix F**). On June 5, 2013, Ohio EPA approved the IDW letter report for the transport and disposal of the accumulated IDW resulting from the field work tasks. The Ohio EPA approval letter for the IDW is provided in Appendix F. On August 15, 2013, the drummed IDW was transported under a non-hazardous waste manifest by Emerald Environmental Services, Inc. for disposal at Vexor Technology in Medina, Ohio.

Table 4-1. Summary of the sample depth, date collected, and type/purpose of each.

Sample Location Identification	Interval (feet below ground surface)	Date	Type	Purpose
078SB-0004M-0001-SO	1-4	3/26/2013	IS	presence/absence
078SB-0005M-0001-SO	4-7	3/26/2013	IS	presence/absence
078SB-0006M-0001-SO	1-7	3/26/2013	IS	presence/absence
078SB-0007M-0001-SO	1-6	3/26/2013	IS	presence/absence
078SB-0008M-0001-SO	1-7	3/26/2013	IS	presence/absence
078SB-0009M-0001-SO	1-7	3/26/2013	IS	QC FD
078SB-0011M-0001-SO	1-2	3/26/2013	IS	presence/absence
078SB-0012M-0001-SO	1-5	3/26/2013	IS	presence/absence
078SB-0013M-0001-SO	1-2	3/26/2013	IS	presence/absence
078SB-0015M-0001-SO	1-2	3/26/2013	IS	presence/absence
078SB-0016M-0001-SO	1-1	3/26/2013	IS	presence/absence
078SB-0017M-0001-SO	1-2	3/26/2013	IS	presence/absence
078SB-0018M-0001-SO	1-2	3/26/2013	IS	QC FD
078SB-0020M-0001-SO	1-2	3/26/2013	IS	presence/absence
078SB-0021M-0001-SO	1-7	3/26/2013	IS	presence/absence
078SB-0023M-0001-SO	1-4	3/26/2013	IS	presence/absence
078SB-0024M-0001-SO	4-7	3/26/2013	IS	presence/absence
078SB-0025M-0001-SO	1-7	3/26/2013	IS	presence/absence
078SB-0026M-0001-SO	1-7	3/26/2013	IS	QC FD
078SB-0028M-0001-SO	1-7	3/26/2013	IS	presence/absence
078SB-0030M-0001-SO	1-6	3/26/2013	IS	presence/absence
078SB-0031M-0001-SO	1-7	3/26/2013	IS	presence/absence
078SB-0032M-0001-SO	1-2	3/26/2013	IS	presence/absence
078SB-0033-0001-SO	7-8.5	3/26/2013	C	presence/absence
078SB-0034-0001-SO	4-7	3/27/2013	D	presence/absence
078SB-0056M-0001-SO	4-7	3/27/2013	D	presence/absence
078SS-0002M-0001-SO	0-1	3/26/2013	IS	presence/absence
078SS-0003M-0001-SO	0-1	3/26/2013	IS	presence/absence
078SS-0210M-0001-SO	0-1	3/26/2013	IS	presence/absence
078TP-0033-0001-TP	1.3	3/27/2013	D	presence/absence
078TP-0033M-0001-TP	0-1.7	3/27/2013	IS	presence/absence
078TP-0034-0001-TP	1.3	3/27/2013	D	QC FD
078TP-0039-0001-TP	0.5	3/27/2013	D	presence/absence
078TP-0040-0001-TP	1	3/27/2013	D	presence/absence
078SB-0010M-0001-SO	1-7	3/26/2013	IS	QA
078SB-0019M-0001-SO	1-2	3/26/2013	IS	QA
078SB-0027M-0001-SO	1-7	3/26/2013	IS	QA

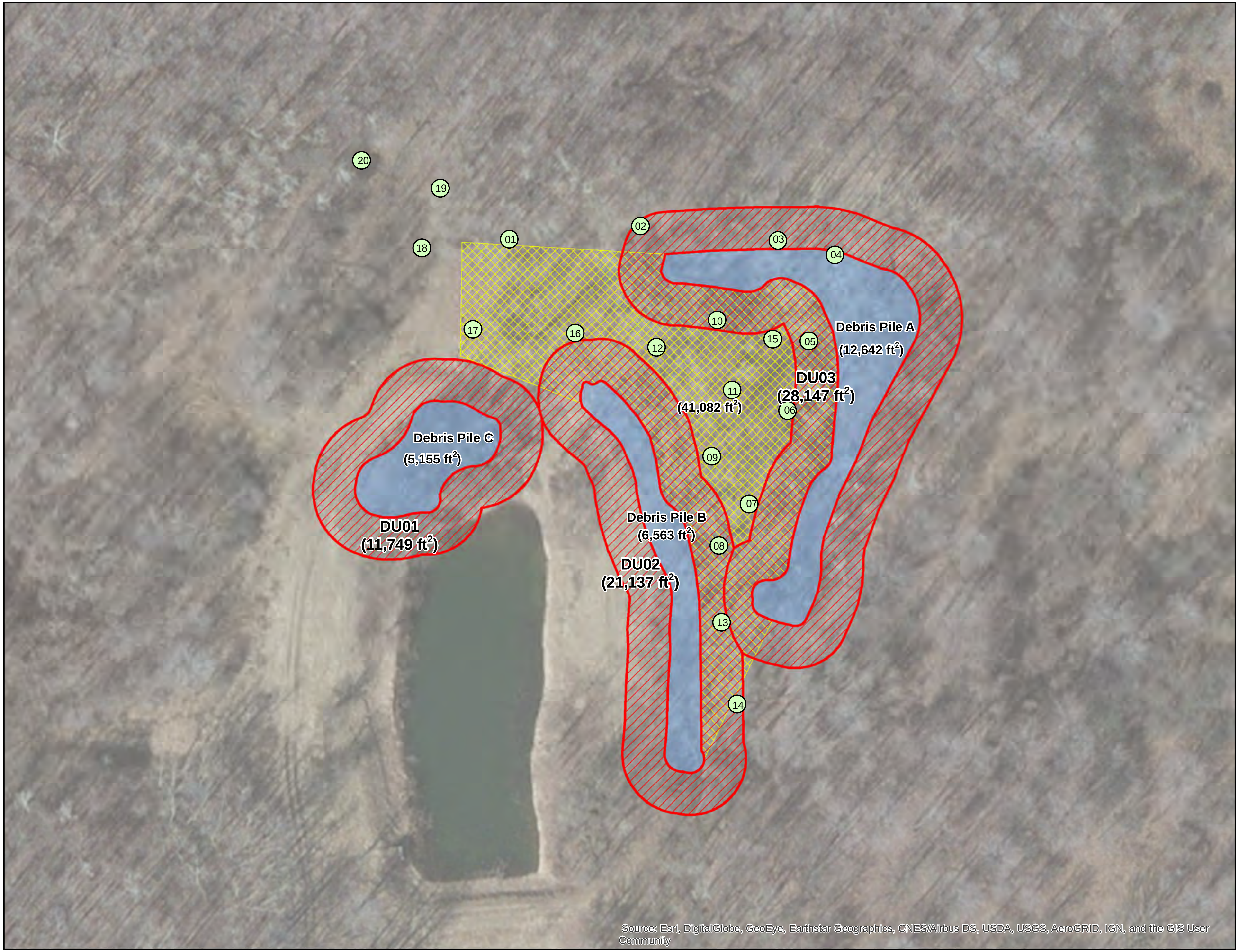
Notes:

C = Composite sample.	D = Discrete sample.
FD = Field duplicate.	IS = Incremental sample.
QA = Quality assurance	QC = Quality control.

Table 4-2. Sample Summary and Analyses.

Sampling Media and Interval		Sample Type			Number of Samples Collected		Analysis							
Media	**Interval* (ft bgs)**	**IS**	**D**	**C**	**Debris Piles**	**Test Pit Area**	**VOCs**	**SVOCs**	**TAL Metals**	**PCBs**	**Propellants**	**Explosives**	**Organochlorine Pesticides**	**ACM**
Subsurface Soil	1-4; 4-7; 1-7	X			20		15	20	20	20	20	3	3	
Subsurface Soil	4-7		X		2		2							
Deep Soil Boring	7-13			X	1		1	1	1	1	1			
Surface Soil	0-1	X			3	2	5	5	5	5	5	2	2	1
Bulk Material/ Construction Debris	0-5	X	X			1								1

Notes:
Sample numbers do not include field duplicates or other quality control samples.
Asterisk (*) indicates targeted depth interval is shown. Actual depths are shown in Table 4-1.
ACM = Asbestos-containing material. One sample was IS and one sample was discrete.
bgs = Below ground surface.
C = Composite sample.
D Discrete sample.
ft = Feet.
IS = Incremental sample.
PCB = Polychlorinated biphenyl.
SVOC = Semivolatile organic compound.
TAL = Target Analyte List.
VOC = Volatile organic compound.



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

○ Test Pit Location

● Test Pit Sample Location

▨ Decision Unit

🟦 Debris Pile

NOTES & SOURCES

Map Source: ESRI World Imagery

TITLE

Figure 4-1. Decision Units and Test Pit Locations at CC RVAAP-78 Quarry Pond Surface Dump

FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
4-1

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 4-1 Decision Units CC78.mxd

SECTION 5: SUMMARY RESULTS, QA/QC, AND FINAL ACTIVITIES

This section presents results for the surface and subsurface soils collected for the SI Addendum. Additionally, the data reduction and comparison process, which describes methods and facility-wide background screening criteria, is presented. Sections 5.2 and 5.3 present the data from surface and subsurface soil and spatial data aggregates established for this SI Addendum. Summary analytical results are presented in tabular formats at the end of this section. Summary analytical results related to QA/QC are presented here in this Section. Analytical results are provided in Appendix G.

5.1 DATA EVALUATION METHOD

The data collected were verified and validated in accordance with the procedures outlined in the FWSAP. The processes used to evaluate the analytical data involved three general steps: (1) defining data aggregates; (2) verifying, reducing, and screening data; and (3) presenting data. The completed Data Verification Report is included in **Appendix C, and the Data Validation Report is provided in Appendix G.** The data reporting convention used is consistent with past data reporting practices to ensure comparability. Non-detect data are reported as not detected at the Limit of Quantitation (LOQ) in Chapter 5 tables and in the Data Verification Report and at the Level of Detection in the Data Validation Report.

5.1.1 Definition of Aggregates

Data aggregates are comprised of all the analytical data for each sampled medium within an AOC (i.e., across all DUs). This process for data aggregates is established to evaluate whether or not contamination is present at each AOC, as explained in Section 5.1.5 below. The data aggregates for CC RVAAP-78 Quarry Pond Surface Dump are as follows:

Surface Soil (0-1 ft bgs)—This medium was evaluated as an aggregate from the three DUs using ISM samples and from the Test Pit Area using discrete sampling methods.

Subsurface Soil (greater than 1 ft bgs)—This medium is evaluated as an aggregate from the three DUs on the same basis as surface soil. Samples collected for the evaluation of subsurface soils were collected in the DUs using horizontal and vertical ISM and vertical composite sampling methods.

5.1.2 Data Validation

Data validation was performed on 3 surface soil samples and 26 subsurface soil samples (all field and field duplicates) collected during the field activities to ensure that the precision and accuracy of the analytical data were adequate for their intended use. The review constituted comprehensive validation of 100 percent of the primary dataset.

Analytical results were reported by the laboratory in electronic format and issued to ECC on compact disc. Data validation was performed to ensure all requested data were received and complete. Data use qualifiers were assigned to each result based on the criteria provided in the DoD Quality Systems Manual for Environmental Laboratories, Version 4.1 (DoD 2009).

Results were qualified as follows:

"U" **–** Analyte was not detected and reported less than the LOQ.

"UJ" **–** Analyte was not detected and the reported limit is estimated.

"J" **–** The reported result was positively identified; however, the associated numerical value is an approximate concentration of the analyte in the sample, or one or more QC criteria failed (e.g., laboratory control sample, surrogate spike recovery, or continued calibration verification). This qualifier is also used to report detections between the LOQ and Detection Limit.

In addition to assigning qualifiers, the verification process also selected the appropriate result to use when re-analyses or dilutions were performed. Where laboratory surrogate recovery data or laboratory QC samples were outside of analytical method specifications, the verification chemist determined whether laboratory re-analysis should be used in place of an original reported result. If the laboratory reported results for both diluted and undiluted samples, diluted sample results were used for those analytes whose concentrations were greater than the calibration range of the undiluted sample. A complete presentation of the verification process results is contained in the Data Verification Report (Appendix C).

5.1.3 Data Validation

Independent, third-party validation of 10 percent of the laboratory data for this Supplemental SI was performed by North Wind Services and MECx in August 2014. The report is provided as Appendix G. For CC RVAAP-78 Quarry Pond Surface Dump, the following samples were validated: 078SB-0008M-0001-SO, which is an ISM subsurface soil sample from 1 to 7 ft bgs that was analyzed for PCBs, SVOCs, VOCs, and TAL metals and 078SB-0016M-0001-SO, which was intended to be an ISM subsurface soil sample from 1 to 4 ft bgs; however, drilling refusal occurred at 1 ft bgs due to competent bedrock, so the sample represents a discrete sample at a depth of 1 ft. The sample was analyzed for the full analytical suite.

The changes to the data based on validation are discussed in Appendix G. In general, the data validation performed for CC RVAAP-78 Quarry Pond Surface Dump indicates that no false negatives or false positives were identified, and the results are usable for their intended purposes.

5.1.4 Data Reduction

Data reduction was not completed for this SI Addendum. Due to the limited number of samples collected, statistical analysis (e.g., frequency of detection) of the data collected at the AOC was not necessary in the data evaluation process for surface soils.

5.1.5 Data Screening

Analytical results comprised the dataset for screening. The dataset did not include QC samples or rejected results. Analytes having at least one detected value were included in the data screening process. Summary statistics calculated for the data aggregate included the minimum, maximum, and average (mean) detected values and the proportion of detected results to the total number of samples collected. For averaging, non-detected results were included by using one-half of the reported LOQ as a surrogate value during calculation of the mean result for each detected compound.

The data were screened to identify the presence or absence of contamination using the processes outlined below.

The steps involved in screening are summarized below:

Data Quality Assessment—Data were produced, reviewed, and reported by the laboratory in accordance with specifications in the FWSAP and in accordance with data verification procedures described above.

Background Screening—The detected concentrations of inorganic chemicals were compared to the facility background screening values (BSVs), where established. If a chemical concentration was greater than the BSV (or detected for those inorganics with no BSV), the respective inorganic chemical was retained to be further evaluated. All detected organic compounds were retained for further screening or evaluation, because BSVs are not established for organic compounds at the facility.

Screening of Essential Human Nutrients—Chemicals that are considered essential nutrients (e.g., calcium, chloride, iodine, iron, magnesium, potassium, phosphorous, and sodium) are an integral part of the human food supply and are often added to foods as supplements. USEPA recommends these chemicals not be evaluated unless they are grossly elevated relative to background concentrations or would exhibit toxicity at the observed concentrations (USEPA 1989; SAIC 2010). The chemicals included in this SI Addendum that are essential nutrients are calcium, iron, magnesium, potassium, and sodium. At CC RVAAP-78 Quarry Pond Surface Dump, these essential nutrients were not detected above BSVs; therefore, essential nutrients were not retained for further evaluation.

Frequency of Detection/WOE Screening—Chemicals that were not detected in a given medium were eliminated and were not assessed further. A WOE approach was used to determine if chemicals with a low detection frequency (i.e., 5 percent or less where a chemical was analyzed in more than 20 samples) were AOC-related and might be contamination. If the detected results for a chemical showed no clustering, concentrations were not substantially elevated relative to the Limit of Detection, and no source was evident, the results were considered spurious, and the chemical was eliminated from further consideration. Frequency-of-detection/WOE screening was applied to the data set by matrix (i.e., surface and subsurface soil), frequency of occurrence, detections, and concentrations of the chemicals reported. This screening was applied to all organic and inorganic chemicals.

5.1.6 Data Presentation

A summary of analytical results for surface and subsurface soil at CC RVAAP-78 Quarry Pond Surface Dump is presented in **Table 5-1** and **Table 5-2**, respectively. The complete laboratory analytical data packages are included in Appendix G as well as laboratory analytical results tables with final qualifiers.

5.1.7 Data Evaluation

The surface and subsurface soil sample data were evaluated and used to perform the AOC-specific screens and data evaluations. Groundwater is currently being investigated under a separate program under RVAAP-66 Facility-Wide Groundwater and was, therefore, not sampled as part of this SI Addendum.

Analytical results of the soil sampling conducted as part of this SI Addendum were initially evaluated to determine whether the chemical should be evaluated further following the AOC-specific screening described above in Section 5.1.5. The results were used to (1) compare the reported concentrations to the background level (where established), (2) determine the frequency of detection and WOE, and (3) determine whether the chemical was an essential nutrient. Analytical data collected during this SI Addendum were also compared to the media-specific (soil) and depth interval-specific (subsurface [greater than 1 ft bgs]) FWCUGs as well as to background levels, if established.

To determine if there is contamination, the concentrations for the detected chemicals were compared to their respective FWCUGs for the Resident Receptor. The Resident Receptor is the most stringent value of either the adult or child criteria. If no FWCUG value has been established for either receptor, detected concentrations were compared to the most current USEPA Regional Screening Levels (RSLs) for residential soil (USEPA 2017). Analytical results were compared to the media-specific (soil) and depth interval-specific (e.g., subsurface) FWCUGs at the 10^{-6} cancer risk level. The cancer risk level is the excess risk of cancer from exposure to a chemical. Results were also compared to the non-carcinogenic risk HQ using the 0.1 risk value.

Detected metals were identified for additional evaluation if the reported concentrations exceeded their established BSVs as well as the FWCUG. For organic compounds, the detected concentrations were only compared to the FWCUGs and were further evaluated if the reported concentration exceeded the FWCUGs. The USEPA Residential RSLs were used for comparison when there are no FWCUGs established for the chemical.

After the analytical results were compared to the FWCUGs (or USEPA RSLs), the chemicals were considered for further evaluation when the following conditions apply:

- The chemical is likely site-related (not background)
- The concentration of the chemical exceeded the FWCUG (equal to 10^{-6} and/or HQ = 0.1) for Resident Receptor.

5.2 ASSESSMENT OF CONTAMINATION

This section includes the evaluation of the analytical results of samples collected at CC RVAAP-78 Quarry Pond Surface Dump. The chemicals retained for each media requiring additional evaluation are listed in **Tables 5-1** and **5-2**. To evaluate the presence of contamination in the horizontal and vertical subsurface, those SRCs identified in surface and subsurface soil were compared with the most recent USEPA RSLs for the Residential Land Use at target risk of 1×10^{-6} and HQ of 0.1. The May 2018 USEPA RSLs were used in the initial comparison since they are more recent than the FWCUGs and the FWCUGs are currently being updated. The analytical results for the surface soil samples are provided in **Appendix G**, along with complete copies of all analytical data packages.

5.2.1 Surface Soils

The dataset for surface soils consists of ISM samples from the three DUs (one from each DU) and two discrete samples from the Test Pit Area. **Table 5-1** presents the results of the data evaluation of the chemicals included in the chemical analysis. The chemicals that were detected were assessed to determine if they were detected in concentrations great enough to be considered contamination is present in the DUs and the Test Pit Area. Chemicals that were not detected were eliminated and were not assessed. The minimum concentration detected, and maximum concentration detected for chemical analytes is presented in Table 5-1. The established background values for metals are also provided (Table 5-1).

The maximum concentration detected was used in the first step of the evaluation process. If the maximum concentration detected was less than the background concentration for metals, then the metal was eliminated as potential contamination. The maximum detected concentration of the remaining metals and all detected chemicals were next compared to the May 2018 USEPA RSL for Residential Land Use for each chemical. If the maximum detected concentration was less than the chemical's USEPA RSL, then the chemical was eliminated as potential contamination.

No chemicals were retained for further evaluation in the surface soil aggregate (0-1 ft bgs) because they were less than criteria (i.e., non-detect, background, USEPA Residential RSLs, etc.). This indicates that no contamination was found in the surface soil of the DUs and the Test Pit Area.

5.2.2 Subsurface Soils

The dataset for subsurface soil consists of 23 ISM and 1 composite sample (including investigative and field duplicates) from the DUs surrounding the Debris Piles. Subsurface soil was not evaluated in the Test Pit Area because the soil is very thin in this area and drilling and digging ceased at the top of bedrock, which averaged approximately 1 ft bgs. **Table 5-2** presents the results of the data evaluation of the chemicals included in the chemical analysis for the subsurface aggregate data. The chemicals that were detected were assessed to determine if they were detected in concentrations great enough to be considered contamination in the DUs around the Debris Piles. Chemicals that were not detected were eliminated and were not assessed. The minimum concentration detected, and maximum concentration detected for chemical analytes is presented in Table 5-2. The established background values for metals in subsurface soils are also provided (Table 5-2).

The maximum concentration detected was used in the first step of the evaluation process. If the maximum concentration detected was less than the background concentration for metals, then the metal was eliminated as potential contamination. The maximum detected concentration of the remaining metals and all detected chemicals were next compared to the May 2018 USEPA RSL for Residential Land Use for each chemical. If the maximum detected concentration was less than the chemical's USEPA RSL, then the chemical was eliminated as potential contamination.

The following six chemicals were retained for further evaluation in the subsurface soil aggregate (0-13 ft bgs) and were all semivolatile organics:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Indeno(1,2,3-c,d)pyrene

The maximum concentration detected in the subsurface soils were from DU01 and from one soil boring (CC78-DU01 SB04). This soil boring was only advanced to approximately 2.5 feet bgs because of refusal. Considering the previously collected data from other studies, the area immediately outside of the DU01 where SB04 was taken was shown to not have detectable semivolatile organic compounds (SpecPro 2003, **Figure 5-1).** The five soil borings collectively represent the subsurface soil in each DU around the Debris Piles. Since the single maximum exceeded the USEPA RSL, the next step in the determination of contamination is to assess these chemicals further to determine if their concentrations are great enough to represent contamination. Table 5-3 presents the concentrations for each of the soil borings within each DU. Most of the values for each subsurface sample were non-detect and the value being shown is the LOD. An average concentration was calculated for each chemical and each DU. The average concentration for each of these chemicals per DU was much less than their respective USEPA RSL. This indicates that the concentration of these chemicals does not represent contamination in the subsurface soil. Therefore, no contamination was found in either of the DUs and no chemical contamination was identified in the Test Pit Area. However, only one Test Pit (Test Pit 5) sample area contained construction debris with suspected ACM. Test Pit 5 is located within the DU03 which surrounds Debris Pile A (**Figure 4-1**). The suspected ACM was analyzed and results indicated it contained 20 percent chrysotile. Because this sample area had construction debris in it and contains confirmed ACM, the small area around Test Pit 5 is recommended for removal when the Debris Piles are removed. Asbestos was not detected in the vertical ISM soil sample from the test pit (0-1.7 ft bgs). The soil exposure pathway was considered incomplete for all areas except Test Pit 5 where asbestos was identified. Therefore, potential exposure is possible at Test Pit 5.

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria(a)	USEPA RSL May 2018	Rationale why Chemical is not Contamination
Metals						
Aluminum	mg/kg	4,200	7,200	17,700		Less than Background
Antimony	mg/kg	0.3	2.9	0.96	3.1	Max detected value less than RSL
Arsenic	mg/kg	0.56	14	15.4		Less than Background
Barium	mg/kg	40	64	88.4		Less than Background
Beryllium	mg/kg	0.3	0.45	0.88		Less than Background
Cadmium	mg/kg	0.27	0.52	0	7.1	Max detected value less than RSL
Calcium	mg/kg	410	2,300	15,800		Less than Background
Chromium	mg/kg	8.5	14	17.4		Less than Background
Cobalt	mg/kg	6.7	8.9	10.4		Less than Background
Copper	mg/kg	9.6	45	17.7	310	Max detected value less than RSL
Iron	mg/kg	9,600	20,000	23,100		Less than Background
Lead	mg/kg	12	430	26.1	400	Max detected value less than RSL
Magnesium	mg/kg	1,000	2,000	3,030		Less than Background
Manganese	mg/kg	300	640	1,450		Less than Background
Nickel	mg/kg	11	19	21.1		Less than Background
Potassium	mg/kg	470	910	927		Less than Background
Selenium	mg/kg	0.19	0.65	1.4		Less than Background
Silver	mg/kg	0.023	0.26	0	580	Exceeds Background
Sodium	mg/kg	22	37	123		Less than Background

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
Thallium	mg/kg	0.082	0.18	0.78 (95%UTL)	1.6	Max detected value less than RSL
Vanadium	mg/kg	7.8	13	31.1		Less than Background
Zinc	mg/kg	59	130	61.8	2,300	Max detected value less than RSL
Mercury	mg/kg	0.041	0.55	0.036	2.3	Max detected value less than RSL
Organochlorine Pesticides						
Aldrin	µg/kg	None	None	NB		Not Detected
alpha-BHC (alpha-Hexachlorocyclohexane)	µg/kg	None	None	NB		Not Detected
alpha-Chlordane	µg/kg	None	None	NB		Not Detected
alpha-Endosulfan	µg/kg	None	None	NB		Not Detected
beta-BHC (beta-Hexachlorocyclohexane)	µg/kg	None	None	NB		Not Detected
beta-Endosulfan	µg/kg	None	None	NB		Not Detected
delta-BHC (delta-Hexachlorocyclohexane)	µg/kg	None	None	NB		Not Detected
Dieldrin	µg/kg	None	None	NB		Not Detected
Endosulfan Sulfate	µg/kg	None	None	NB		Not Detected
Endrin	µg/kg	None	None	NB		Not Detected
Endrin Aldehyde	µg/kg	None	None	NB		Not Detected
Endrin Ketone	µg/kg	None	None	NB		Not Detected

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
gamma-BHC (Lindane)	µg/kg	None	None	NB		Not Detected
gamma-Chlordane	µg/kg	None	None	NB		Not Detected
Heptachlor	µg/kg	None	None	NB		Not Detected
Heptachlor Epoxide	µg/kg	None	None	NB		Not Detected
Methoxychlor	µg/kg	None	None	NB		Not Detected
p,p'-Dichlorodiphenyldichloroethane	µg/kg	None	None	NB		Not Detected
p,p'-Dichlorodiphenyl dichloroethylene	µg/kg	None	None	NB		Not Detected
p,p'-Dichlorodiphenyl trichloroethane	µg/kg	None	None	NB		Not Detected
Toxaphene	µg/kg	None	None	NB		Not Detected
Polychlorinated Biphenyls						
PCB-1016 (Aroclor 1016)	µg/kg	None	None	NB		Not Detected
PCB-1221 (Aroclor 1221)	µg/kg	None	None	NB		Not Detected
PCB-1232 (Aroclor 1232)	µg/kg	None	None	NB		Not Detected
PCB-1242 (Aroclor 1242)	µg/kg	None	None	NB		Not Detected
PCB-1248 (Aroclor 1248)	µg/kg	None	None	NB		Not Detected
PCB-1254 (Aroclor 1254)	µg/kg	43	170	NB	240	Max detected value less than RSL
PCB-1260 (Aroclor 1260)	µg/kg	None	None	NB		Not Detected
Volatile Organic Compounds						
1,1,1-Trichloroethane	µg/kg	None	None	NB		Not Detected
1,1,2,2-Tetrachloroethane	µg/kg	None	None	NB		Not Detected
1,1,2-Trichloroethane	µg/kg	None	None	NB		Not Detected
1,1-Dichloroethane	µg/kg	None	None	NB		Not Detected
1,1-Dichloroethene	µg/kg	None	None	NB		Not Detected
1,2-Dibromoethane (EDB)	µg/kg	None	None	NB		Not Detected

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
1,2-Dichloroethane	µg/kg	None	None	NB		Not Detected
1,2-Dichloroethene	µg/kg	None	None	NB		Not Detected
1,2-Dichloropropane	µg/kg	None	None	NB		Not Detected
2-Butanone (MEK) Methylethyl ketone	µg/kg	4.3	6.5	NB	2,,700,000	Max detected value less than RSL
2-Hexanone	µg/kg	0.98	0.98	NB	20,000	Max detected value less than RSL
4-Methyl-2-pentanone (MIBK)	µg/kg	None	None	NB		Not Detected
Acetone	µg/kg	96	160	NB	6.100,000	Max detected value less than RSL
Benzene	µg/kg	None	None	NB		Not Detected
Bromochloromethane	µg/kg	None	None	NB		Not Detected
Bromodichloromethane	µg/kg	None	None	NB		Not Detected
Bromoform	µg/kg	None	None	NB		Not Detected
Bromomethane	µg/kg	None	None	NB		Not Detected
Carbon Disulfide	µg/kg	None	None	NB		Not Detected
Carbon Tetrachloride	µg/kg	None	None	NB		Not Detected
Chlorobenzene	µg/kg	None	None	NB		Not Detected
Chloroethane	µg/kg	None	None	NB		Not Detected
Chloroform	µg/kg	None	None	NB		Not Detected
Chloromethane	µg/kg	None	None	NB		Not Detected
cis-1,3-Dichloropropene	µg/kg	None	None	NB		Not Detected
Dibromochloromethane	µg/kg	None	None	NB		Not Detected
Ethylbenzene	µg/kg	None	None	NB		Not Detected
Methylene Chloride	µg/kg	None	None	NB		Not Detected
Styrene	µg/kg	None	None	NB		Not Detected
Tetrachloroethene (PCE)	µg/kg	None	None	NB		Not Detected
Toluene	µg/kg	0.27	0.27	NB	490,000	Max detected value less than RSL

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
trans-1,3-Dichloropropene	µg/kg	None	None	NB		Not Detected
Trichloroethene (TCE)	µg/kg	None	None	NB		Not Detected
Vinyl Chloride	µg/kg	None	None	NB		Not Detected
Xylenes, Total	µg/kg	None	None	NB		Not Detected
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	µg/kg	None	None	NB		Not Detected
1,2-Dichlorobenzene	µg/kg	None	None	NB		Not Detected
1,3-Dichlorobenzene	µg/kg	None	None	NB		Not Detected
1,4-Dichlorobenzene	µg/kg	25	25	NB		Not Detected
2,4,5-Trichlorophenol	µg/kg	None	None	NB		Not Detected
2,4,6-Trichlorophenol	µg/kg	None	None	NB		Not Detected
2,4-Dichlorophenol	µg/kg	None	None	NB		Not Detected
2,4-Dimethylphenol	µg/kg	None	None	NB		Not Detected
2,4-Dinitrophenol	µg/kg	None	None	NB		Not Detected
2,4-Dinitrotoluene	µg/kg	79	79	NB	1,700	Max detected value less than RSL
2,6-Dinitrotoluene	µg/kg	None	None	NB		Not Detected
2-Chloronaphthalene	µg/kg	None	None	NB		Not Detected
2-Chlorophenol	µg/kg	None	None	NB		Not Detected
2-Methylnaphthalene	µg/kg	9.1	33	NB	24,000	Max detected value less than RSL
2-Methylphenol (o-Cresol)	µg/kg	None	None	NB		Not Detected
2-Nitroaniline	µg/kg	None	None	NB		Not Detected
2-Nitrophenol	µg/kg	None	None	NB		Not Detected
3,3'-Dichlorobenzidine	µg/kg	None	None	NB		Not Detected
3-Nitroaniline	µg/kg	None	None	NB		Not Detected
4,6-Dinitro-2-Methylphenol	µg/kg	None	None	NB		Not Detected
4-Bromophenyl phenyl ether	µg/kg	None	None	NB		Not Detected

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
4-Chloro-3-Methylphenol	µg/kg	None	None	NB		Not Detected
4-Chloroaniline	µg/kg	None	None	NB		Not Detected
4-Chlorophenyl Phenyl Ether	µg/kg	None	None	NB		Not Detected
4-Nitroaniline	µg/kg	None	None	NB		Not Detected
4-Nitrophenol	µg/kg	None	None	NB		Not Detected
Acenaphthene	µg/kg	9.9	9.9	NB	360,000	Max detected value less than RSL
Acenaphthylene	µg/kg	3.5	34	NB	18,000	Max detected value less than RSL
Anthracene	µg/kg	11	75	NB	1,800,000	Max detected value less than RSL
Benzo(a)anthracene	µg/kg	5	710	NB	1,100	Max detected value less than RSL
Benzo(a)pyrene	µg/kg	5.3	530	NB	1,100	Max detected value less than RSL
Benzo(b)fluoranthene	µg/kg	5.1	820	NB	1,100	Max detected value less than RSL
Benzo(g,h,i)perylene ideno(1,2,3-cd)pyrene	µg/kg	8.9	390	NB	1,100	Max detected value less than RSL
Benzo(k)fluoranthene	µg/kg	7.6	400	NB	1.100	Max detected value less than RSL
Benzoic acid	µg/kg	390	470	NB	25,000,000	Max detected value less than RSL
Benzyl alcohol	µg/kg	33	34	NB	630,000	Max detected value less than RSL
Benzyl butyl phthalate	µg/kg	None	None	NB		Not Detected
bis(2-Chloroethoxy) Methane	µg/kg	None	None	NB		Not Detected

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria$^{(a)}$	USEPA RSL May 2018	Rationale why Chemical is not Contamination
bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	µg/kg	None	None	NB		Not Detected
bis(2-Chloroisopropyl) Ether	µg/kg	None	None	NB		Not Detected
bis(2-Ethylhexyl) Phthalate	µg/kg	19	25	NB	39,000	Max detected value less than RSL
Carbazole diphenylamine	µg/kg	150	150	NB	630,000	Max detected value less than RSL
Chrysene benzo(b)phenanthrene	µg/kg	6.5	740	NB	1,100	Max detected value less than RSL
Cresols, m & p	µg/kg	None	None	NB		Not Detected
Dibenz(a,h)anthracene	µg/kg	12	110	NB	1,100	Max detected value less than RSL
Dibenzofuran	µg/kg	10	16	NB	7,300	Max detected value less than RSL
Diethyl Phthalate	µg/kg	None	None	NB		Not Detected
Dimethyl Phthalate	µg/kg	None	None	NB		Not Detected
Di-n-Butyl Phthalate	µg/kg	None	None	NB		Not Detected
Di-n-Octylphthalate	µg/kg	None	None	NB		Not Detected
Fluoranthene	µg/kg	6.1	1200	NB	240,000	Max detected value less than RSL
Fluorene	µg/kg	5.1	12	NB	240,000	Max detected value less than RSL
Hexachlorobenzene	µg/kg	None	None	NB		Not Detected
Hexachlorobutadiene	µg/kg	None	None	NB		Not Detected
Hexachlorocyclopentadiene	µg/kg	None	None	NB		Not Detected
Hexachloroethane	µg/kg	None	None	NB		Not Detected
Indeno(1,2,3-c,d)pyrene	µg/kg	11	330	NB	1,100	Max detected value less than RSL

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
Isophorone	µg/kg	17	17	NB	570,000	Max detected value less than RSL
Naphthalene	µg/kg	10	31	NB	3,800	Max detected value less than RSL
Nitrobenzene	µg/kg	None	None	NB		Not Detected
n-Nitrosodi-n-propylamine	µg/kg	None	None	NB		Not Detected
n-Nitrosodiphenylamine	µg/kg	None	None	NB		Not Detected
Pentachlorophenol	µg/kg	None	None	NB		Not Detected
Phenanthrene Isomer of anthracene	µg/kg	19	260	NB	1,800,000	Max detected value less than RSL
Phenol	µg/kg	None	None	NB		Not Detected
Pyrene	µg/kg	5.5	960	NB	18,000	Max detected value less than RSL
Explosives						
1,3,5-Trinitrobenzene	mg/kg	0.13	0.13	NB	220,000	Max detected value less than RSL
1,3-Dinitrobenzene	mg/kg	None	None	NB		Not Dectected
2,4,6-Trinitrotoluene	mg/kg	0.88	7.1	NB	36,000	Max detected value less than RSL
2,4-Dinitrotoluene	mg/kg	None	None	NB		Not Detected
2,6-Dinitrotoluene	mg/kg	None	None	NB		Not Detected
2-Amino-4,6-dinitrotoluene	mg/kg	0.11	2.4	NB	800	Max detected value less than RSL
2-Nitrotoluene	mg/kg	None	None	NB		Not Detected
3-Nitrotoluene	mg/kg	None	None	NB		Not Detected
4-Amino-2,6-dinitrotoluene	mg/kg	0.064	2.5	NB	800	Max detected value less than RSL
4-Nitrotoluene	mg/kg	None	None	NB		Not Detected
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	mg/kg	None	None	NB		Not Detected

Table 5-1. Results of chemical analysis for each aggregate in the surface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Site Background Criteria[(a)]	USEPA RSL May 2018	Rationale why Chemical is not Contamination
Nitrobenzene	mg/kg	None	None	NB		Not Detected
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	mg/kg	None	None	NB		Not Detected
Pentaerythritol Tetranitrate	mg/kg	None	None	NB		Not Detected
Tetryl	mg/kg	None	None	NB		Not Detected
Propellents						
Nitrocellulose	mg/kg	1.1	14	NB	190,000,000	Max detected value less than RSL
Nitroglycerin	mg/kg	None	None	NB		Not Detected
Nitroguanidine	mg/kg	None	None	NB		Not Detected

Notes:

a. Background concentrations are published in the Phase II Remedial Investigation Report for Winklepeck Burning Grounds (United States Army Corps of Engineers 2001b).

µg/kg = Micrograms per kilogram.
mg/kg = Milligrams per kilogram.
NB = No background.

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria[(b)]	USEPA RSL 5/2018	Justification
Metals						
Aluminum	mg/kg	400	4,300	19,500		Below Background
Antimony	mg/kg	0.047	4.8	0.96	3.1	Max detected value less than RSL
Arsenic	mg/kg	0.62	6.3	19.8		Below Background
Barium	mg/kg	4.5	190	124		Exceeds Background
Beryllium	mg/kg	0.058	0.45	0.88		Below Background
Cadmium	mg/kg	0.029	2.1	0	7.1	Max detected value less than RSL
Calcium	mg/kg	48	11,000	35,500		Below Background
Chromium	mg/kg	0.87	19	27.2		Below Background
Cobalt	mg/kg	0.85	11	23.2		Below Background
Copper	mg/kg	2.5	140	32.3	310	Max detected value less than RSL
Iron	mg/kg	3,300	17,000	35,200		Below Background
Lead	mg/kg	2.5	260	19.1	400	Max detected value less than RSL
Magnesium	mg/kg	41	2,600	8,790		Below Background
Manganese	mg/kg	32	1,200	3,030		Below Background
Nickel	mg/kg	1.7	14	60.7		Below Background
Potassium	mg/kg	180	660	3,350		Below Background
Selenium	mg/kg	0.062	0.2	1.5		Below Background
Silver	mg/kg	0.011	1.4	0	580	Max detected value less than RSL
Sodium	mg/kg	12	60	145		Below Background
Thallium	mg/kg	0.018	0.12	1	0.165	Below Background
Vanadium	mg/kg	0.82	8.7	37.6		Below Background
Zinc	mg/kg	11	530	93.3	2,300	Max detected value less than RSL
Mercury	mg/kg	0.015	2.5	0.044	2.3	Max detected value less than RSL
Organochlorine Pesticides						

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria[(b)]	USEPA RSL 5/2018	Justification
Aldrin	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
alpha-BHC (alpha-Hexachlorocyclohexane)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
alpha-Chlordane	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
alpha-Endosulfan	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
beta-BHC (beta-Hexachlorocyclohexane)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
beta-Endosulfan	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
delta-BHC (delta-Hexachlorocyclohexane)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Dieldrin	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Endosulfan Sulfate	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Endrin	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Endrin Aldehyde	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Endrin Ketone	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
gamma-BHC (Lindane)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
gamma-Chlordane	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Heptachlor	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Heptachlor Epoxide	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Methoxychlor	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
p,p'-Dichlorodiphenyldichloroethane (DDD)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
p,p'-Dichlorodiphenyldichloroethylene (DDE)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
p,p'-Dichlorodiphenyltrichloroethane (DDT)	**µg/kg**	**1.7**	**1.7**	**NB**	**1,900**	**Max detected value less than RSL**

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria^(b)	USEPA RSL 5/2018	Justification
Toxaphene	µg/kg	None	None	NB		Not Detected
Polychlorinated Biphenyls						
PCB-1016 (Aroclor 1016)	µg/kg	None	None	NB		Not Detected
PCB-1221 (Aroclor 1221)	µg/kg	None	None	NB		Not Detected
PCB-1232 (Aroclor 1232)	µg/kg	None	None	NB		Not Detected
PCB-1242 (Aroclor 1242)	µg/kg	None	None	NB		Not Detected
PCB-1248 (Aroclor 1248)	µg/kg	None	None	NB		Not Detected
PCB-1254 (Aroclor 1254)	µg/kg	50	100	NB	120	Max detected value less than RSL
PCB-1260 (Aroclor 1260)	µg/kg	None	None	NB		Not Detected
Volatile Organic Compounds						
1,1,1-Trichloroethane	µg/kg	None	None	NB		Not Detected
1,1,2,2-Tetrachloroethane	µg/kg	None	None	NB		Not Detected
1,1,2-Trichloroethane	µg/kg	None	None	NB		Not Detected
1,1-Dichloroethane	µg/kg	None	None	NB		Not Detected
1,1-Dichloroethene	µg/kg	None	None	NB		Not Detected
1,2-Dibromoethane (EDB)	µg/kg	None	None	NB		Not Detected
1,2-Dichloroethane	µg/kg	None	None	NB		Not Detected
1,2-Dichloroethene	µg/kg	None	None	NB		Not Detected
1,2-Dichloropropane	µg/kg	None	None	NB		Not Detected
2-Butanone (MEK)	µg/kg	None	None	NB		Not Detected
2-Hexanone	µg/kg	None	None	NB		Not Detected
4-Methyl-2-pentanone (MIBK)	µg/kg	None	None	NB		Not Detected
Acetone	µg/kg	7.4	7.4	NB	6,100,00	Eliminated due to lab contaminant, but maximum detected value is less than RSL
Benzene	µg/kg	None	None	NB		Not Detected
Bromochloromethane	µg/kg	None	None	NB		Not Detected

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria[(b)]	USEPA RSL 5/2018	Justification
Bromodichloromethane	µg/kg	None	None	NB		Not Detected
Bromoform	µg/kg	None	None	NB		Not Detected
Bromomethane	µg/kg	None	None	NB		Not Detected
Carbon Disulfide	µg/kg	3.4	3.6	NB	77,000	Max detected value less than RSL
Carbon Tetrachloride	µg/kg	None	None	NB		Not Detected
Chlorobenzene	µg/kg	None	None	NB		Not Detected
Chloroethane	µg/kg	None	None	NB		Not Detected
Chloroform	µg/kg	None	None	NB		Not Detected
Chloromethane	µg/kg	None	None	NB		Not Detected
cis-1,3-Dichloropropene	µg/kg	None	None	NB		Not Detected
Dibromochloromethane	µg/kg	None	None	NB		Not Detected
Ethylbenzene	µg/kg	None	None	NB		Not Detected
Methylene Chloride	µg/kg	None	None	NB		Not Detected
Styrene	µg/kg	None	None	NB		Not Detected
Tetrachloroethene (PCE)	µg/kg	None	None	NB		Not Detected
Toluene	µg/kg	0.27	0.45	NB	490,000	Max detected value less than RSL
trans-1,3-Dichloropropene	µg/kg	None	None	NB		Not Detected
Trichloroethene (TCE)	µg/kg	None	None	NB		Not Detected
Vinyl Chloride	µg/kg	None	None	NB		Not Detected
Xylenes, Total	µg/kg	None	None	NB		Not Detected
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	µg/kg	None	None	NB		Not Detected
1,2-Dichlorobenzene	µg/kg	None	None	NB		Not Detected
1,3-Dichlorobenzene	µg/kg	None	None	NB		Not Detected
1,4-Dichlorobenzene	µg/kg	None	None	NB		Not Detected
2,4,5-Trichlorophenol	µg/kg	None	None	NB		Not Detected
2,4,6-Trichlorophenol	µg/kg	None	None	NB		Not Detected

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria[(b)]	USEPA RSL 5/2018	Justification
2,4-Dichlorophenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2,4-Dimethylphenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2,4-Dinitrophenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2,4-Dinitrotoluene	**µg/kg**	**39**	**39**	**NB**	**1,700**	**Max detected value less than RSL**
2,6-Dinitrotoluene	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2-Chloronaphthalene	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2-Chlorophenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2-Methylnaphthalene	**µg/kg**	**3.7**	**260**	**NB**	**24,000**	**Max detected value less than RSL**
2-Methylphenol (o-Cresol)	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2-Nitroaniline	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
2-Nitrophenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
3,3'-Dichlorobenzidine	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
3-Nitroaniline	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
4,6-Dinitro-2-Methylphenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
4-Bromophenyl phenyl ether	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
4-Chloro-3-Methylphenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
4-Chloroaniline	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
4-Chlorophenyl Phenyl Ether	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
4-Nitroaniline	µg/kg	None	None	NB		**Not Detected**
4-Nitrophenol	**µg/kg**	**None**	**None**	**NB**		**Not Detected**
Acenaphthene	**µg/kg**	**42**	**820**	**NB**	**360,000**	**Max detected value less than RSL**
Acenaphthylene	**µg/kg**	**11**	**220**	**NB**	**18,000**	**Max detected value less than RSL**
Anthracene	**µg/kg**	**4.6**	**2300**	**NB**	**1,800,000**	**Max detected value less than RSL**
Benzo(a)anthracene	**µg/kg**	**6.3**	**3900**	**NB**	**1,100**	**Weight of Evidence Evaluation – Average per DU less than RSL**
Benzo(a)pyrene	**µg/kg**	**6.8**	**3400**	**NB**	**1,100**	**Weight of Evidence Evaluation – Average per DU less than RSL**

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria$^{(b)}$	USEPA RSL 5/2018	Justification
Benzo(b)fluoranthene	µg/kg	16	4500	NB	1,100	Weight of Evidence Evaluation – Average per DU less than RSL
Benzo(g,h,i)perylene	µg/kg	7.6	1400	NB	1,100	Weight of Evidence Evaluation – Average per DU less than RSL
Benzo(k)fluoranthene	µg/kg	6.9	1700	NB	1,100	Weight of Evidence Evaluation – Average per DU less than RSL
Benzyl alcohol	µg/kg	None	None	NB		Not Detected
Benzyl butyl phthalate	µg/kg	None	None	NB		Not Detected
bis(2-Chloroethoxy) Methane	µg/kg	None	None	NB		Not Detected
bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	µg/kg	None	None	NB		Not Detected
bis(2-Chloroisopropyl) Ether	µg/kg	None	None	NB		Not Detected
bis(2-Ethylhexyl) Phthalate	µg/kg	30	180	NB	39,000	Max detected value less than RSL
Carbazole	µg/kg	78	1100	NB	630,000	Max detected value less than RSL
Chrysene	µg/kg	21	4000	NB	1,100	Max detected value less than RSL
Cresols, m & p	µg/kg	None	None	NB		Max detected value less than RSL
Dibenz(a,h)anthracene	µg/kg	30	310	NB	1,100	Max detected value less than RSL
Dibenzofuran	µg/kg	5.4	670	NB	7,300	Max detected value less than RSL
Diethyl Phthalate	µg/kg	None	None	NB		Not Detected
Dimethyl Phthalate	µg/kg	None	None	NB		Not Detected
Di-n-Butyl Phthalate	µg/kg	16	16	NB	630,000	Max detected value less than RSL
Di-n-Octylphthalate	µg/kg	None	None	NB		Not Detected
Fluoranthene	µg/kg	4.6	10000	NB	240,000	Max detected value less than RSL
Fluorene	µg/kg	58	1100	NB	240,000	Max detected value less than RSL
Hexachlorobenzene	µg/kg	None	None	NB		Not Detected
Hexachlorobutadiene	µg/kg	None	None	NB		Not Detected
Hexachlorocyclopentadiene	µg/kg	None	None	NB		Not Detected
Hexachloroethane	µg/kg	None	None	NB		Not Detected

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

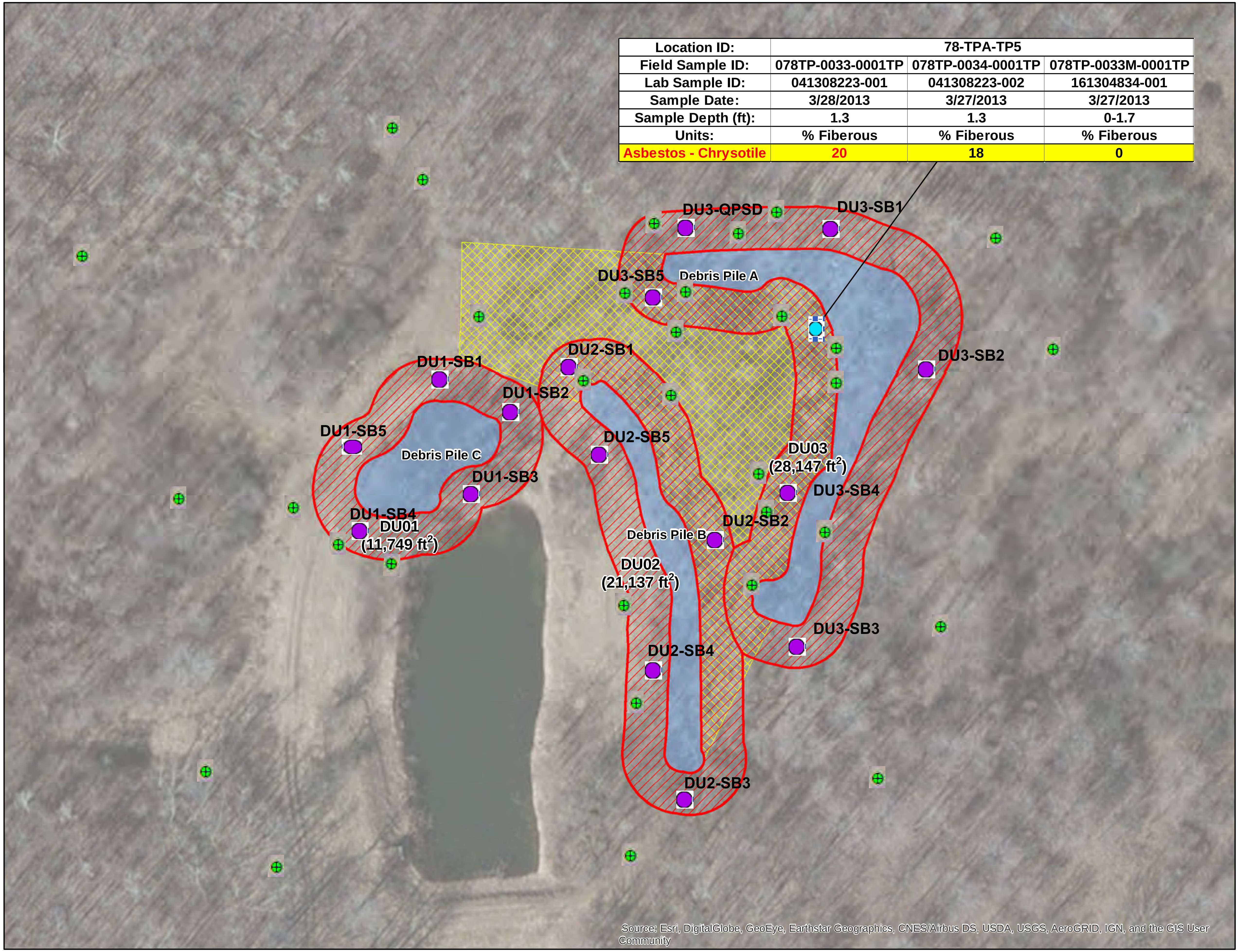
Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria[(b)]	USEPA RSL 5/2018	Justification
Indeno(1,2,3-c,d)pyrene	µg/kg	9.7	1400	NB	1,100	Weight of Evidence Evaluation – Average per DU less than RSL
Isophorone	µg/kg	None	None	NB		Not Detected
Naphthalene	µg/kg	3.9	450	NB	3,800	Max detected value less than RSL
Nitrobenzene	µg/kg	None	None	NB		Not Detected
n-Nitrosodi-n-propylamine	µg/kg	None	None	NB		Not Detected
n-Nitrosodiphenylamine	µg/kg	None	None	NB		Not Detected
Pentachlorophenol	µg/kg	None	None	NB		Not Detected
Phenanthrene	µg/kg	4.9	8400	NB	1,800,000	Max detected value less than RSL
Phenol	µg/kg	None	None	NB		Not Detected
Pyrene	µg/kg	4.2	7700	NB	18,000	Max detected value less than RSL
Explosives						
1,3,5-Trinitrobenzene	mg/kg	None	None	NB		Not Detected
1,3-Dinitrobenzene	mg/kg	None	None	NB		Not Detected
2,4,6-Trinitrotoluene	mg/kg	None	None	NB		Not Detected
2,4-Dinitrotoluene	mg/kg	None	None	NB		Not Detected
2,6-Dinitrotoluene	mg/kg	None	None	NB		Not Detected
2-Amino-4,6-dinitrotoluene	mg/kg	None	None	NB		Not Detected
2-Nitrotoluene	mg/kg	None	None	NB		Not Detected
3-Nitrotoluene	mg/kg	None	None	NB		Not Detected
4-Amino-2,6-dinitrotoluene	mg/kg	None	None	NB		Not Detected
4-Nitrotoluene	mg/kg	None	None	NB		Not Detected
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine (RDX)	mg/kg	None	None	NB		Not Detected
Nitrobenzene	mg/kg	None	None	NB		Not Detected
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	mg/kg	None	None	NB		Not Detected
Pentaerythritol Tetranitrate	mg/kg	None	None	NB		Not Detected

Table 5-2. Results of chemical analysis for each aggregate in the subsurface soil, decision criteria (background and USEPA RSL), and rationale as to whether or not the chemical is at concentrations great enough to be contamination.

Chemical	Units	Minimum Detection	Maximum Detection	Background Criteria[(b)]	USEPA RSL 5/2018	Justification
Tetryl	**mg/kg**	**None**	**None**	**NB**		**Not Detected**
Propellants						
Nitrocellulose	**mg/kg**	**0.87**	**3.4**	**NB**	**190,000,000**	**Max detected value less than RSL**
Nitroglycerin	**mg/kg**	**None**	**None**	**NB**		**Not Detected**
Nitroguanidine	**mg/kg**	**None**	**None**	**NB**		**Not Detected**

Table 5-3. Six chemicals identified in subsurface soil from vertical soil borings within three DUs around the Debris Piles. The concentrations are all in µg/kg.

CHEMICAL	DU01-SB01 0004M	DU01-SB01 0005M	DU01-SB01	DU01-SB02	DU01-SB03 Duplicate	DU01-SB03	DU01-SB04	DU01-SB05	AVERAGE	USEPA RSL	
DU01 – Debris Pile C											
Benzo(a)anthracene	300	6.6	6.8	6.6	6.6	6.6	3900	1300	692	1,100	
Benzo(a)pyrene	290	6.6	6.8	6.6	6.6	6.6	3400	870	574	1,100	
Benzo(b)fluoranthene	450	6.6	6.8	6.6	6.6	6.6	4500	1200	773	1,100	
Benzo(g,h,i)perylene	110	6.6	6.8	6.6	6.6	6.6	1400	370	239	1,100	
Benzo(k)fluoranthene	150	6.6	6.8	6.6	6.6	6.6	1700	480	295	1,100	
Indeno(1,2,3-c,d)pyrene	110	6.6	6.8	6.6	6.6	6.6	1400	360	238	1,100	
DU02– Debris Pile B	**DU02-SB 0013M**	**DU02-SB01**	**DU02-SB02**	**DU02-SB03**	**DU02-SB03 Duplicate**	**DU02-SB04**	**DU02-SB05**		**AVERAGE**	USEPA RSL	
Benzo(a)anthracene	6.3	6.6	6.6	6.7	6.8	6.7	12		7	1,100	
Benzo(a)pyrene	6.7	6.6	7.5	6.7	6.8	6.7	6.8		7	1,100	
Benzo(b)fluoranthene	16	6.6	19	6.7	6.8	6.7	27		13	1,100	
Benzo(g,h,i)perylene	10	6.6	7.6	6.7	6.8	6.7	24		10	1,100	
Benzo(k)fluoranthene	6.7	6.6	6.6	6.7	6.8	6.7	6.9		7	1,100	
Indeno(1,2,3-c,d)pyrene	6.7	6.6	6.6	6.7	6.8	6.7	9.7		7	1,100	
DU03 – Debris Pile A	**DU03-SB 00023M**	**DU03-SB 00024M**	**DU03-SB01 00025M**	**DU03-SB01 Duplicate 0026M**	**DU03-SB01 0033M**	**DU03-SB02**	**DU03-SB03**	**DU03-SB04**	**DU03-SB05**	**AVERAGE**	**USEPA RSL**
Benzo(a)anthracene	68	6.6	33	34	7.3	6.7	6.6	6.7	24	21	
Benzo(a)pyrene	68	6.6	33	34	7.3	6.7	6.6	6.7	22	21	
Benzo(b)fluoranthene	68	6.6	33	34	7.3	6.7	6.6	6.7	29	22	
Benzo(g,h,i)perylene	68	6.6	33	34	7.3	6.7	6.6	6.7	14	20	
Benzo(k)fluoranthene	68	6.6	33	34	7.3	6.7	6.6	6.7	9.7	20	
Indeno(1,2,3-c,d)pyrene	68	6.6	33	34	7.3	6.7	6.6	6.7	11	20	



Location ID:	78-TPA-TP5		
Field Sample ID:	078TP-0033-0001TP	078TP-0034-0001TP	078TP-0033M-0001TP
Lab Sample ID:	041308223-001	041308223-002	161304834-001
Sample Date:	3/28/2013	3/27/2013	3/27/2013
Sample Depth (ft):	1.3	1.3	0-1.7
Units:	% Fiberous	% Fiberous	% Fiberous
Asbestos - Chrysotile	20	18	0

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

● Test Pit Location with Construction Debris

● Approximate Soil Boring Locations within the Decision Units

▨ Decision Unit

🟦 Debris Pile

⊕ Approximate SpecPro 2003 Surface Soil Sample Locations where nochemicals were detected at concentrations greater than screening criteria.

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. ft = feet
4. HQ = hazard quotient
5. % = percent

Locations for Soil borings within the Decision Units, Test Pit Area 05 (asbestos), and approximate locations from SpecPro 2003 without contamination in surface soil.

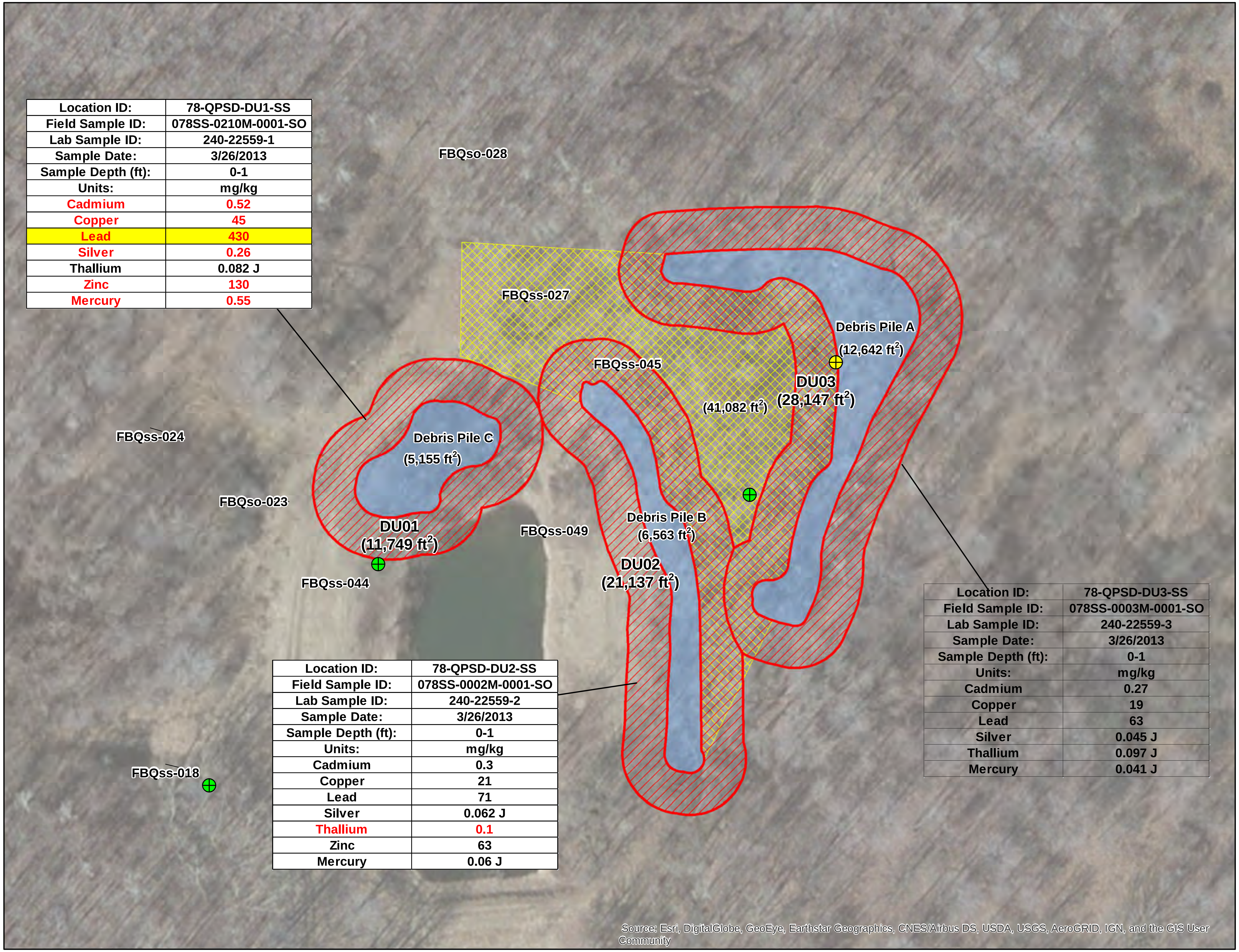
FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-1

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 5-12 cc78 Asbestos surface.mxd



Location ID:	78-QPSD-DU1-SS
Field Sample ID:	078SS-0210M-0001-SO
Lab Sample ID:	240-22559-1
Sample Date:	3/26/2013
Sample Depth (ft):	0-1
Units:	mg/kg
Cadmium	0.52
Copper	45
Lead	430
Silver	0.26
Thallium	0.082 J
Zinc	130
Mercury	0.55

Location ID:	78-QPSD-DU2-SS
Field Sample ID:	078SS-0002M-0001-SO
Lab Sample ID:	240-22559-2
Sample Date:	3/26/2013
Sample Depth (ft):	0-1
Units:	mg/kg
Cadmium	0.3
Copper	21
Lead	71
Silver	0.062 J
Thallium	0.1
Zinc	63
Mercury	0.06 J

Location ID:	78-QPSD-DU3-SS
Field Sample ID:	078SS-0003M-0001-SO
Lab Sample ID:	240-22559-3
Sample Date:	3/26/2013
Sample Depth (ft):	0-1
Units:	mg/kg
Cadmium	0.27
Copper	19
Lead	63
Silver	0.045 J
Thallium	0.097 J
Mercury	0.041 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

⊕	SpecPro 2003 surface soil sample location with lead concentration greater than most stringent FWCUG
⊕	SpecPro 2003 surface soil sample location with lead concentration less than most stringent FWCUG
▨	Decision Unit
🟦	Debris Pile
Analyte	Maximum Concentration Detected
Analyte	SRC
Analyte	Concentration Exceeds Most Stringent FWCUG (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg = milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient

TITLE

Location of Inorganic SRCs in Surface Soil at CC RVAAP-78 Quarry Pond Surface Dump

FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

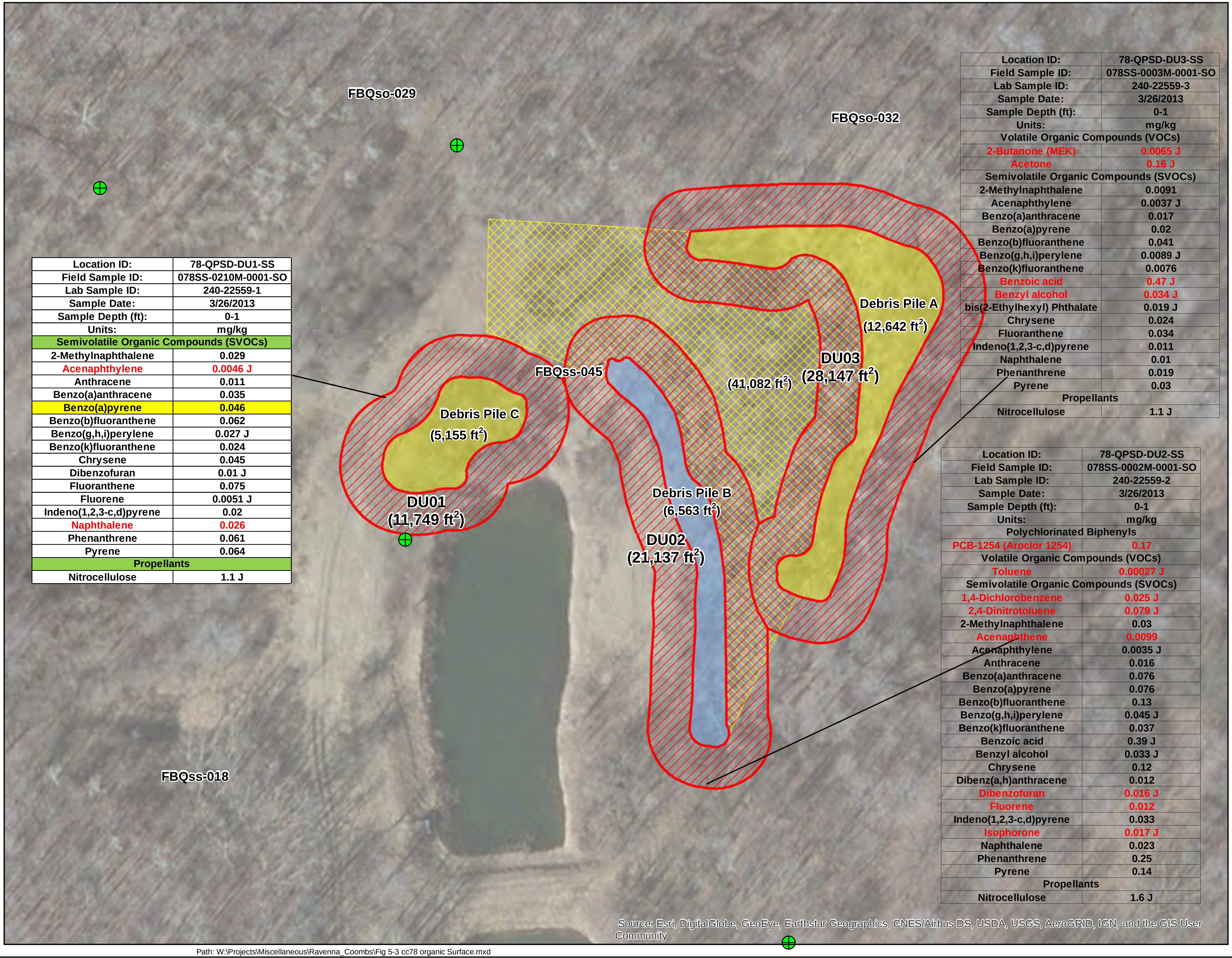
N

AMEC
Novi, Michigan

ECC
Marlborough, Massachusetts

FIGURE
5-2

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 5-2 cc78 Inorganic Surface.mxd



Location ID:	78-QPSD-DU1-SS
Field Sample ID:	078SS-0210M-0001-SO
Lab Sample ID:	240-22559-1
Sample Date:	3/26/2013
Sample Depth (ft):	0-1
Units:	mg/kg
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	0.029
Acenaphthylene	0.0046 J
Anthracene	0.011
Benzo(a)anthracene	0.035
Benzo(a)pyrene	0.046
Benzo(b)fluoranthene	0.062
Benzo(g,h,i)perylene	0.027 J
Benzo(k)fluoranthene	0.024
Chrysene	0.045
Dibenzofuran	0.01 J
Fluoranthene	0.075
Fluorene	0.0051 J
Indeno(1,2,3-c,d)pyrene	0.02
Naphthalene	0.026
Phenanthrene	0.061
Pyrene	0.064
Propellants	
Nitrocellulose	1.1 J

Location ID:	78-QPSD-DU3-SS
Field Sample ID:	078SS-0003M-0001-SO
Lab Sample ID:	240-22559-3
Sample Date:	3/26/2013
Sample Depth (ft):	0-1
Units:	mg/kg
Volatile Organic Compounds (VOCs)	
2-Butanone (MEK)	0.0065 J
Acetone	0.16 J
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	0.0091
Acenaphthylene	0.0037 J
Benzo(a)anthracene	0.017
Benzo(a)pyrene	0.02
Benzo(b)fluoranthene	0.041
Benzo(g,h,i)perylene	0.0089 J
Benzo(k)fluoranthene	0.0076
Benzoic acid	0.47 J
Benzyl alcohol	0.034 J
bis(2-Ethylhexyl) Phthalate	0.019 J
Chrysene	0.024
Fluoranthene	0.034
Indeno(1,2,3-c,d)pyrene	0.011
Naphthalene	0.01
Phenanthrene	0.019
Pyrene	0.03
Propellants	
Nitrocellulose	1.1 J

Location ID:	78-QPSD-DU2-SS
Field Sample ID:	078SS-0002M-0001-SO
Lab Sample ID:	240-22559-2
Sample Date:	3/26/2013
Sample Depth (ft):	0-1
Units:	mg/kg
Polychlorinated Biphenyls	
PCB-1254 (Aroclor 1254)	0.17
Volatile Organic Compounds (VOCs)	
Toluene	0.00027 J
Semivolatile Organic Compounds (SVOCs)	
1,4-Dichlorobenzene	0.025 J
2,4-Dinitrotoluene	0.079 J
2-Methylnaphthalene	0.03
Acenaphthene	0.0099
Acenaphthylene	0.0035 J
Anthracene	0.016
Benzo(a)anthracene	0.076
Benzo(a)pyrene	0.076
Benzo(b)fluoranthene	0.13
Benzo(g,h,i)perylene	0.045 J
Benzo(k)fluoranthene	0.037
Benzoic acid	0.39 J
Benzyl alcohol	0.033 J
Chrysene	0.12
Dibenz(a,h)anthracene	0.012
Dibenzofuran	0.016 J
Fluorene	0.012
Indeno(1,2,3-c,d)pyrene	0.033
Isophorone	0.017 J
Naphthalene	0.023
Phenanthrene	0.25
Pyrene	0.14
Propellants	
Nitrocellulose	1.6 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 5-3 cc78 organic Surface.mxd

LEGEND

⊕	SpecPro 2003 surface soil sample location where Benzo(a)pyrene and PCB-1254 were not detected
🟨	Benzo(a)pyrene in 2011 surface ISM sample of debris pile exceeds most stringent FWCUG (Prudent 2012)
🟦	Debris Pile
▨	Decision Unit
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
Analyte	SRC Concentration Exceeds Most Stringent FWCUG (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg = milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient

TITLE

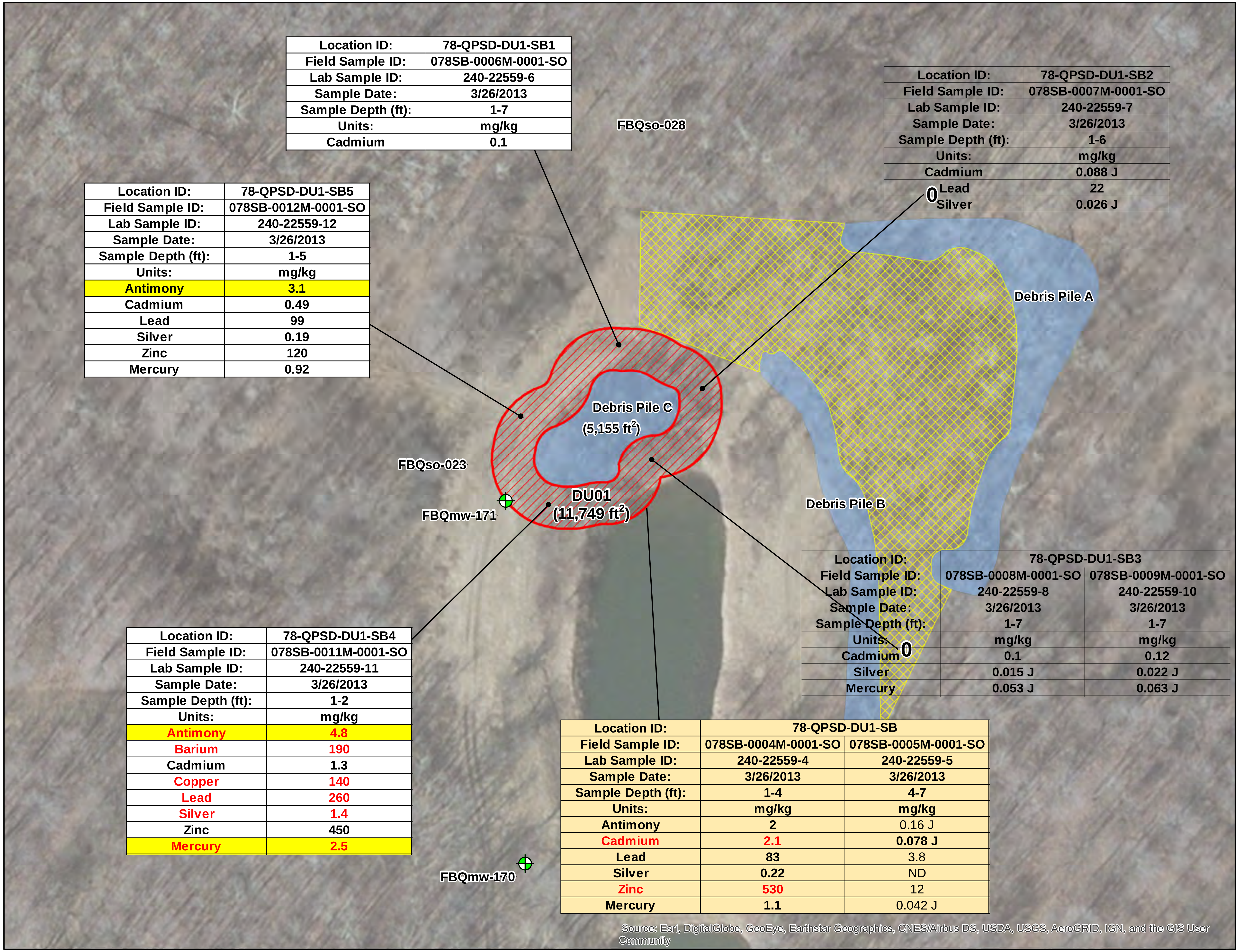
Location of Organic SRCs in Surface Soil at CC RVAAP-78 Quarry Pond Surface Dump

FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-3



Location ID:	78-QPSD-DU1-SB1
Field Sample ID:	078SB-0006M-0001-SO
Lab Sample ID:	240-22559-6
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Cadmium	0.1

Location ID:	78-QPSD-DU1-SB2
Field Sample ID:	078SB-0007M-0001-SO
Lab Sample ID:	240-22559-7
Sample Date:	3/26/2013
Sample Depth (ft):	1-6
Units:	mg/kg
Cadmium	0.088 J
Lead	22
Silver	0.026 J

Location ID:	78-QPSD-DU1-SB5
Field Sample ID:	078SB-0012M-0001-SO
Lab Sample ID:	240-22559-12
Sample Date:	3/26/2013
Sample Depth (ft):	1-5
Units:	mg/kg
Antimony	3.1
Cadmium	0.49
Lead	99
Silver	0.19
Zinc	120
Mercury	0.92

Location ID:	78-QPSD-DU1-SB3	
Field Sample ID:	078SB-0008M-0001-SO	078SB-0009M-0001-SO
Lab Sample ID:	240-22559-8	240-22559-10
Sample Date:	3/26/2013	3/26/2013
Sample Depth (ft):	1-7	1-7
Units:	mg/kg	mg/kg
Cadmium	0.1	0.12
Silver	0.015 J	0.022 J
Mercury	0.053 J	0.063 J

Location ID:	78-QPSD-DU1-SB4
Field Sample ID:	078SB-0011M-0001-SO
Lab Sample ID:	240-22559-11
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Antimony	4.8
Barium	190
Cadmium	1.3
Copper	140
Lead	260
Silver	1.4
Zinc	450
Mercury	2.5

Location ID:	78-QPSD-DU1-SB	
Field Sample ID:	078SB-0004M-0001-SO	078SB-0005M-0001-SO
Lab Sample ID:	240-22559-4	240-22559-5
Sample Date:	3/26/2013	3/26/2013
Sample Depth (ft):	1-4	4-7
Units:	mg/kg	mg/kg
Antimony	2	0.16 J
Cadmium	2.1	0.078 J
Lead	83	3.8
Silver	0.22	ND
Zinc	530	12
Mercury	1.1	0.042 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

⊕	Groundwater sample where antimony and mercury have not been detected since 2003 (Prudent 2012)
⊕	SpecPro 2003 subsurface soil sample (1-3 ft bgs) with antimony and mercury concentrations less than most stringent FWCUG
●	Direct-Push Boring Location
▨	Decision Unit
🟦	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
0.21	Analyte Is Not an SRC at This Depth
🟨	ISM Horizontal Sample for Decision Unit
Analyte	SRC Concentration Exceeds Most Stringent FWCUG (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg = milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient
10. ND = Not Detected
11. bgs = below ground surface

TITLE

Location of Organic SRCs in Subsurface Soil at CC RVAAP-78

Quarry Pond Surface Dump DU01

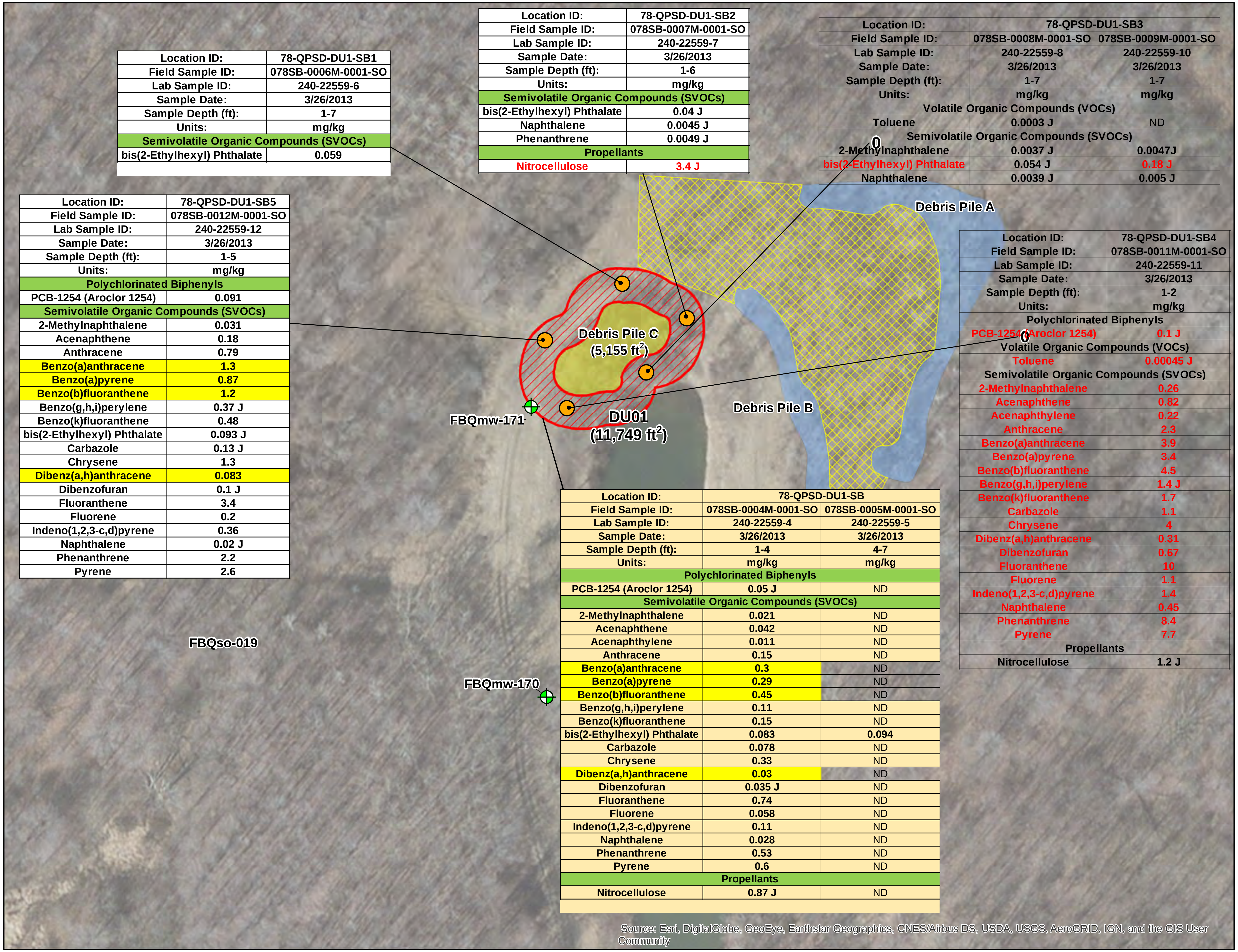
FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-4

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 5-4 cc78 inorganic subsurface du01.mxd



Location ID:	78-QPSD-DU1-SB1
Field Sample ID:	078SB-0006M-0001-SO
Lab Sample ID:	240-22559-6
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	0.059

Location ID:	78-QPSD-DU1-SB2
Field Sample ID:	078SB-0007M-0001-SO
Lab Sample ID:	240-22559-7
Sample Date:	3/26/2013
Sample Depth (ft):	1-6
Units:	mg/kg
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	0.04 J
Naphthalene	0.0045 J
Phenanthrene	0.0049 J
Propellants	
Nitrocellulose	3.4 J

Location ID:	78-QPSD-DU1-SB3	
Field Sample ID:	078SB-0008M-0001-SO	078SB-0009M-0001-SO
Lab Sample ID:	240-22559-8	240-22559-10
Sample Date:	3/26/2013	3/26/2013
Sample Depth (ft):	1-7	1-7
Units:	mg/kg	mg/kg
Volatile Organic Compounds (VOCs)		
Toluene	0.0003 J	ND
Semivolatile Organic Compounds (SVOCs)		
2-Methylnaphthalene	0.0037 J	0.0047J
bis(2-Ethylhexyl) Phthalate	0.054 J	0.18 J
Naphthalene	0.0039 J	0.005 J

Location ID:	78-QPSD-DU1-SB5
Field Sample ID:	078SB-0012M-0001-SO
Lab Sample ID:	240-22559-12
Sample Date:	3/26/2013
Sample Depth (ft):	1-5
Units:	mg/kg
Polychlorinated Biphenyls	
PCB-1254 (Aroclor 1254)	0.091
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	0.031
Acenaphthene	0.18
Anthracene	0.79
Benzo(a)anthracene	1.3
Benzo(a)pyrene	0.87
Benzo(b)fluoranthene	1.2
Benzo(g,h,i)perylene	0.37 J
Benzo(k)fluoranthene	0.48
bis(2-Ethylhexyl) Phthalate	0.093 J
Carbazole	0.13 J
Chrysene	1.3
Dibenz(a,h)anthracene	0.083
Dibenzofuran	0.1 J
Fluoranthene	3.4
Fluorene	0.2
Indeno(1,2,3-c,d)pyrene	0.36
Naphthalene	0.02 J
Phenanthrene	2.2
Pyrene	2.6

Location ID:	78-QPSD-DU1-SB4
Field Sample ID:	078SB-0011M-0001-SO
Lab Sample ID:	240-22559-11
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Polychlorinated Biphenyls	
PCB-1254 (Aroclor 1254)	0.1 J
Volatile Organic Compounds (VOCs)	
Toluene	0.00045 J
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	0.26
Acenaphthene	0.82
Acenaphthylene	0.22
Anthracene	2.3
Benzo(a)anthracene	3.9
Benzo(a)pyrene	3.4
Benzo(b)fluoranthene	4.5
Benzo(g,h,i)perylene	1.4 J
Benzo(k)fluoranthene	1.7
Carbazole	1.1
Chrysene	4
Dibenz(a,h)anthracene	0.31
Dibenzofuran	0.67
Fluoranthene	10
Fluorene	1.1
Indeno(1,2,3-c,d)pyrene	1.4
Naphthalene	0.45
Phenanthrene	8.4
Pyrene	7.7
Propellants	
Nitrocellulose	1.2 J

Location ID:	78-QPSD-DU1-SB	
Field Sample ID:	078SB-0004M-0001-SO	078SB-0005M-0001-SO
Lab Sample ID:	240-22559-4	240-22559-5
Sample Date:	3/26/2013	3/26/2013
Sample Depth (ft):	1-4	4-7
Units:	mg/kg	mg/kg
Polychlorinated Biphenyls		
PCB-1254 (Aroclor 1254)	0.05 J	ND
Semivolatile Organic Compounds (SVOCs)		
2-Methylnaphthalene	0.021	ND
Acenaphthene	0.042	ND
Acenaphthylene	0.011	ND
Anthracene	0.15	ND
Benzo(a)anthracene	0.3	ND
Benzo(a)pyrene	0.29	ND
Benzo(b)fluoranthene	0.45	ND
Benzo(g,h,i)perylene	0.11	ND
Benzo(k)fluoranthene	0.15	ND
bis(2-Ethylhexyl) Phthalate	0.083	0.094
Carbazole	0.078	ND
Chrysene	0.33	ND
Dibenz(a,h)anthracene	0.03	ND
Dibenzofuran	0.035 J	ND
Fluoranthene	0.74	ND
Fluorene	0.058	ND
Indeno(1,2,3-c,d)pyrene	0.11	ND
Naphthalene	0.028	ND
Phenanthrene	0.53	ND
Pyrene	0.6	ND
Propellants		
Nitrocellulose	0.87 J	ND

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

⊕	SpecPro 2003 subsurface soil location (1-3 bgs) where SVOCs* were not detected
⊕	Groundwater sample where highlighted SVOCs* have not been detected since 2003 (Prudent 2012)
●	Direct-Push Boring Location
▨	Decision Unit
🟦	Debris Pile
🟨	Highlighted SVOCs* (except indeno(1,2,3-c,d)pyrene) exceeds most stringent FWCUG in subsurface ISM sample of debris pile (Prudent 2012)
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
ND	Analyte Is Not Detected and Is Not an SRC at This Depth
🟨	ISM Horizontal Sample for Decision Unit
Analyte	SRC Concentration Exceeds Most Stringent FWCUG* (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg = milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient
10. ND = Not Detected
11. bgs = below ground surface

TITLE

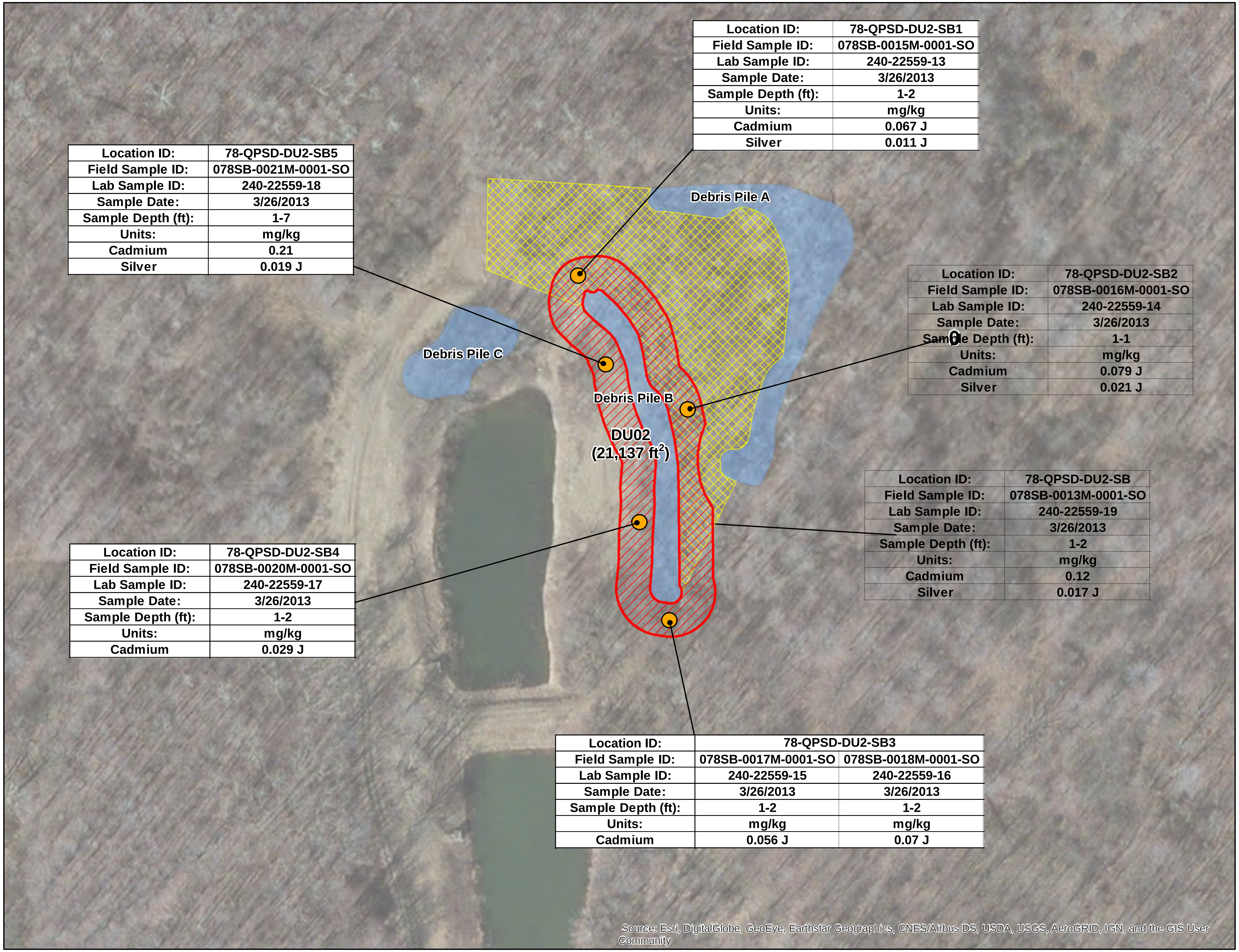
Location of Organic SRCs in Subsurface Soil at CC RVAAP-78 Quarry Pond Surface Dump DU01

FORMER RAVENNA ARMY
AMMUNITION PLANT PORTAGE
AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-5



Location ID:	78-QPSD-DU2-SB1
Field Sample ID:	078SB-0015M-0001-SO
Lab Sample ID:	240-22559-13
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Cadmium	0.067 J
Silver	0.011 J

Location ID:	78-QPSD-DU2-SB5
Field Sample ID:	078SB-0021M-0001-SO
Lab Sample ID:	240-22559-18
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Cadmium	0.21
Silver	0.019 J

Location ID:	78-QPSD-DU2-SB2
Field Sample ID:	078SB-0016M-0001-SO
Lab Sample ID:	240-22559-14
Sample Date:	3/26/2013
Sample Depth (ft):	1-1
Units:	mg/kg
Cadmium	0.079 J
Silver	0.021 J

Location ID:	78-QPSD-DU2-SB
Field Sample ID:	078SB-0013M-0001-SO
Lab Sample ID:	240-22559-19
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Cadmium	0.12
Silver	0.017 J

Location ID:	78-QPSD-DU2-SB4
Field Sample ID:	078SB-0020M-0001-SO
Lab Sample ID:	240-22559-17
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Cadmium	0.029 J

Location ID:	78-QPSD-DU2-SB3	
Field Sample ID:	078SB-0017M-0001-SO	078SB-0018M-0001-SO
Lab Sample ID:	240-22559-15	240-22559-16
Sample Date:	3/26/2013	3/26/2013
Sample Depth (ft):	1-2	1-2
Units:	mg/kg	mg/kg
Cadmium	0.056 J	0.07 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

●	Direct-Push Boring Location
▨	Decision Unit
🟦	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
🟨	ISM Horizontal Sample for Decision Unit

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. Concentrations shown are for SRCs at each sample location
5. mg/kg= milligrams per kilogram
6. J= estimated
7. ft= feet

Location of Inorganic SRCs in Subsurface Soil at CC RVAAP-78 Quarry Pond Surface Dump, DU02

FORMER RAVENNA ARMY
AMMUNITION PLANT
PORTAGE AND TRUMBULL
COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-6

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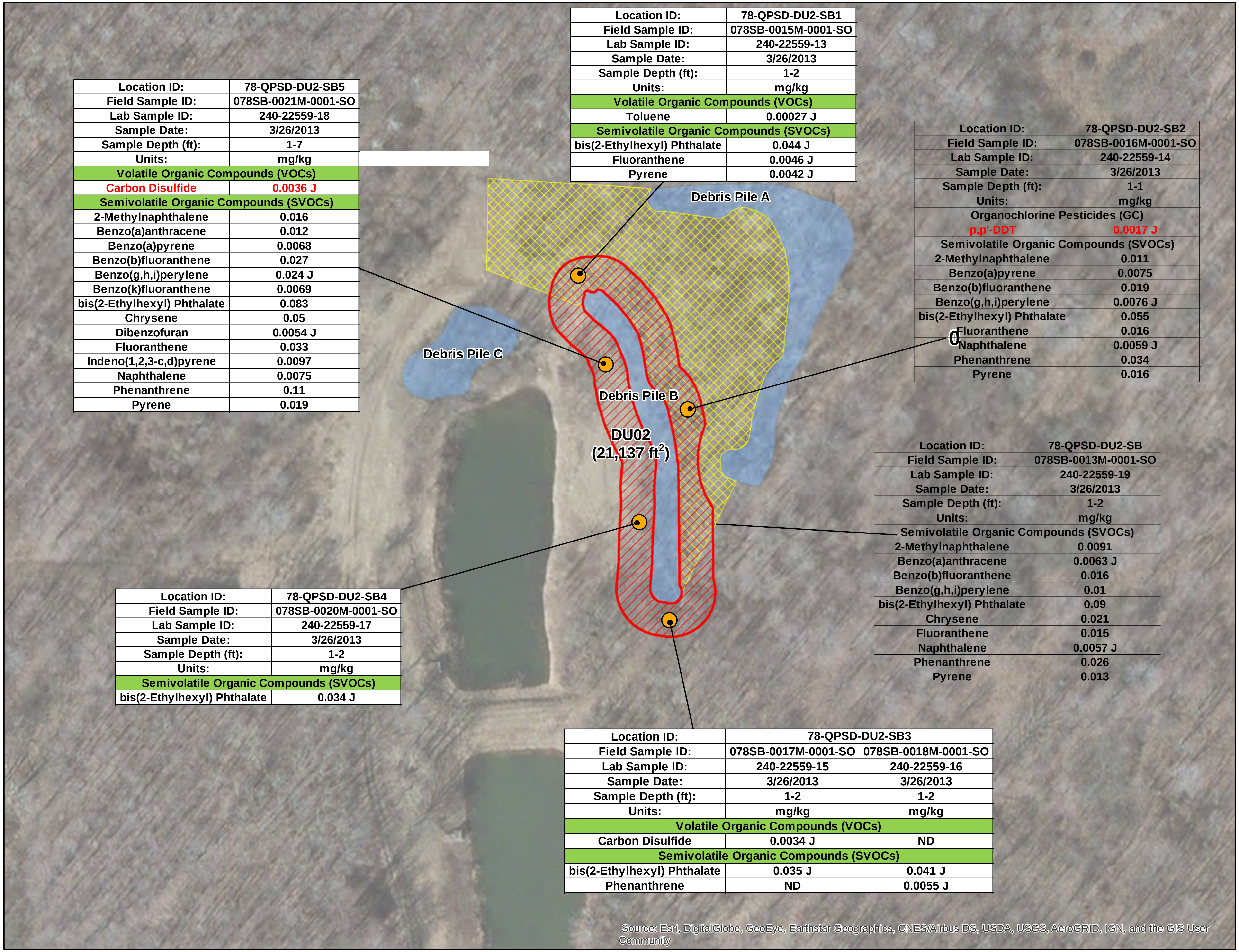

Location ID:	**78-QPSD-DU2-SB5**
Field Sample ID:	**078SB-0021M-0001-SO**
Lab Sample ID:	**240-22559-18**
Sample Date:	**3/26/2013**
Sample Depth (ft):	**1-7**
Units:	**mg/kg**
Volatile Organic Compounds (VOCs)	
Carbon Disulfide	**0.0036 J**
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	**0.016**
Benzo(a)anthracene	**0.012**
Benzo(a)pyrene	**0.0068**
Benzo(b)fluoranthene	**0.027**
Benzo(g,h,i)perylene	**0.024 J**
Benzo(k)fluoranthene	**0.0069**
bis(2-Ethylhexyl) Phthalate	**0.083**
Chrysene	**0.05**
Dibenzofuran	**0.0054 J**
Fluoranthene	**0.033**
Indeno(1,2,3-c,d)pyrene	**0.0097**
Naphthalene	**0.0075**
Phenanthrene	**0.11**
Pyrene	**0.019**

Location ID:	**78-QPSD-DU2-SB1**
Field Sample ID:	**078SB-0015M-0001-SO**
Lab Sample ID:	**240-22559-13**
Sample Date:	**3/26/2013**
Sample Depth (ft):	**1-2**
Units:	**mg/kg**
Volatile Organic Compounds (VOCs)	
Toluene	**0.00027 J**
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	**0.044 J**
Fluoranthene	**0.0046 J**
Pyrene	**0.0042 J**

Location ID:	**78-QPSD-DU2-SB2**
Field Sample ID:	**078SB-0016M-0001-SO**
Lab Sample ID:	**240-22559-14**
Sample Date:	**3/26/2013**
Sample Depth (ft):	**1-1**
Units:	**mg/kg**
Organochlorine Pesticides (GC)	
p,p'-DDT	**0.0017 J**
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	**0.011**
Benzo(a)pyrene	**0.0075**
Benzo(b)fluoranthene	**0.019**
Benzo(g,h,i)perylene	**0.0076 J**
bis(2-Ethylhexyl) Phthalate	**0.055**
Fluoranthene	**0.016**
Naphthalene	**0.0059 J**
Phenanthrene	**0.034**
Pyrene	**0.016**

Location ID:	**78-QPSD-DU2-SB**
Field Sample ID:	**078SB-0013M-0001-SO**
Lab Sample ID:	**240-22559-19**
Sample Date:	**3/26/2013**
Sample Depth (ft):	**1-2**
Units:	**mg/kg**
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	**0.0091**
Benzo(a)anthracene	**0.0063 J**
Benzo(b)fluoranthene	**0.016**
Benzo(g,h,i)perylene	**0.01**
bis(2-Ethylhexyl) Phthalate	**0.09**
Chrysene	**0.021**
Fluoranthene	**0.015**
Naphthalene	**0.0057 J**
Phenanthrene	**0.026**
Pyrene	**0.013**

Location ID:	**78-QPSD-DU2-SB4**
Field Sample ID:	**078SB-0020M-0001-SO**
Lab Sample ID:	**240-22559-17**
Sample Date:	**3/26/2013**
Sample Depth (ft):	**1-2**
Units:	**mg/kg**
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	**0.034 J**

Location ID:	**78-QPSD-DU2-SB3**	
Field Sample ID:	**078SB-0017M-0001-SO**	**078SB-0018M-0001-SO**
Lab Sample ID:	**240-22559-15**	**240-22559-16**
Sample Date:	**3/26/2013**	**3/26/2013**
Sample Depth (ft):	**1-2**	**1-2**
Units:	**mg/kg**	**mg/kg**
Volatile Organic Compounds (VOCs)		
Carbon Disulfide	**0.0034 J**	**ND**
Semivolatile Organic Compounds (SVOCs)		
bis(2-Ethylhexyl) Phthalate	**0.035 J**	**0.041 J**
Phenanthrene	**ND**	**0.0055 J**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

●	Direct-Push Boring Location
▨	Decision Unit
🟦	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
ND	Analyte Is Not Detected and Is Not an SRC at This Depth
🟨	ISM Horizontal Sample for Decision Unit

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. Concentrations shown are for SRCs at each sample location
5. mg/kg= milligrams per kilogram
6. J= estimated
7. ft= feet
8. ND= Not Detected

Location of Organic SRCs in Subsurface Soil at CC RVAAP-78 Quarry Pond Surface Dump, DU02

FORMER RAVENNA ARMY
AMMUNITION PLANT
PORTAGE AND TRUMBULL
COUNTIES, OHIO

0 40 80
Feet

N

AMEC
Novi, Michigan

ECC
Marlborough, Massachusetts

FIGURE
5-7

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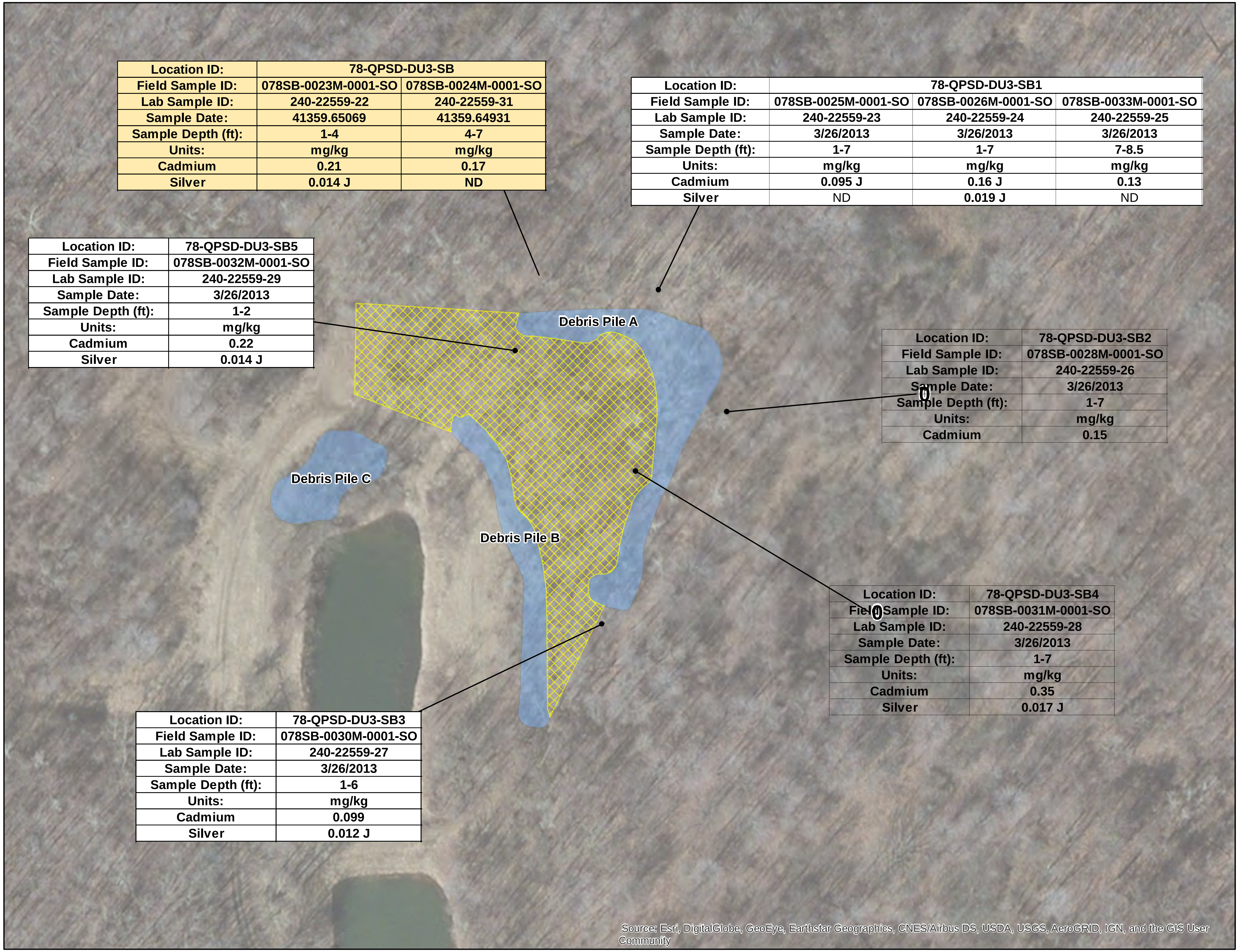

Location ID:	78-QPSD-DU3-SB	
Field Sample ID:	078SB-0023M-0001-SO	078SB-0024M-0001-SO
Lab Sample ID:	240-22559-22	240-22559-31
Sample Date:	41359.65069	41359.64931
Sample Depth (ft):	1-4	4-7
Units:	mg/kg	mg/kg
Cadmium	0.21	0.17
Silver	0.014 J	ND

Location ID:	78-QPSD-DU3-SB1		
Field Sample ID:	078SB-0025M-0001-SO	078SB-0026M-0001-SO	078SB-0033M-0001-SO
Lab Sample ID:	240-22559-23	240-22559-24	240-22559-25
Sample Date:	3/26/2013	3/26/2013	3/26/2013
Sample Depth (ft):	1-7	1-7	7-8.5
Units:	mg/kg	mg/kg	mg/kg
Cadmium	0.095 J	0.16 J	0.13
Silver	ND	0.019 J	ND

Location ID:	78-QPSD-DU3-SB5
Field Sample ID:	078SB-0032M-0001-SO
Lab Sample ID:	240-22559-29
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Cadmium	0.22
Silver	0.014 J

Location ID:	78-QPSD-DU3-SB2
Field Sample ID:	078SB-0028M-0001-SO
Lab Sample ID:	240-22559-26
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Cadmium	0.15

Location ID:	78-QPSD-DU3-SB4
Field Sample ID:	078SB-0031M-0001-SO
Lab Sample ID:	240-22559-28
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Cadmium	0.35
Silver	0.017 J

Location ID:	78-QPSD-DU3-SB3
Field Sample ID:	078SB-0030M-0001-SO
Lab Sample ID:	240-22559-27
Sample Date:	3/26/2013
Sample Depth (ft):	1-6
Units:	mg/kg
Cadmium	0.099
Silver	0.012 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

●	Direct-Push Boring Location
▨	Decision Unit
🟦	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
ND	Analyte Is Not Detected and Is Not an SRC at This Depth
🟨	ISM Horizontal Sample for Decision Unit

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. mg/kg = milligrams per kilogram
5. J = estimated
6. ft = feet
7. ND = Not Detected

TITLE

Location of Inorganic SRCs in Subsurface Soil at CC RVAAP-78 Quarry Pond Surface Dump, DU03

FORMER RAVENNA ARMY
AMMUNITION PLANT
PORTAGE AND TRUMBULL
COUNTIES, OHIO

0 40 80
Feet

N

AMEC
Novi, Michigan

ECC
Marlborough, Massachusetts

FIGURE
5-8

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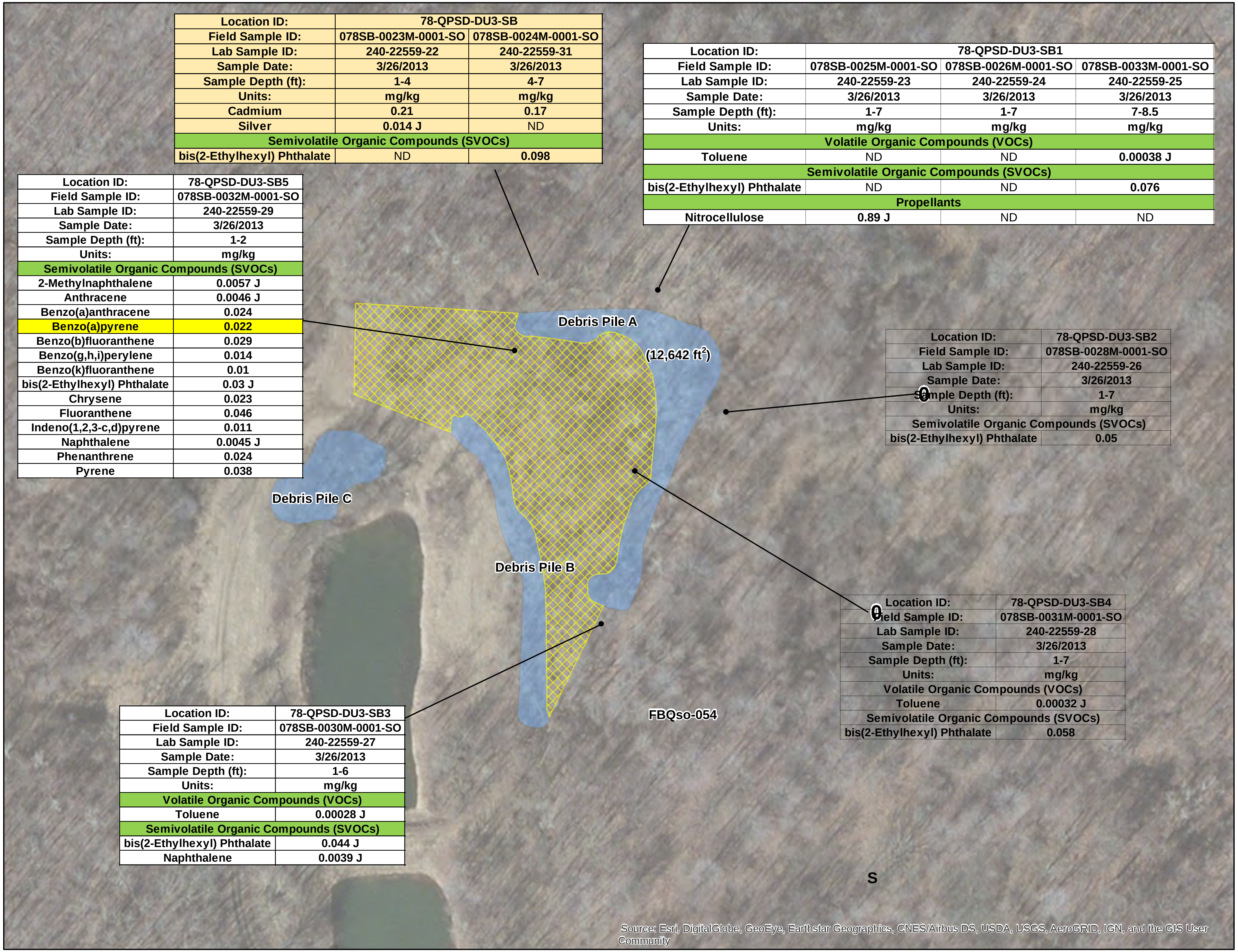

Location ID:	78-QPSD-DU3-SB	
Field Sample ID:	078SB-0023M-0001-SO	078SB-0024M-0001-SO
Lab Sample ID:	240-22559-22	240-22559-31
Sample Date:	3/26/2013	3/26/2013
Sample Depth (ft):	1-4	4-7
Units:	mg/kg	mg/kg
Cadmium	0.21	0.17
Silver	0.014 J	ND
Semivolatile Organic Compounds (SVOCs)		
bis(2-Ethylhexyl) Phthalate	ND	0.098

Location ID:	78-QPSD-DU3-SB1		
Field Sample ID:	078SB-0025M-0001-SO	078SB-0026M-0001-SO	078SB-0033M-0001-SO
Lab Sample ID:	240-22559-23	240-22559-24	240-22559-25
Sample Date:	3/26/2013	3/26/2013	3/26/2013
Sample Depth (ft):	1-7	1-7	7-8.5
Units:	mg/kg	mg/kg	mg/kg
Volatile Organic Compounds (VOCs)			
Toluene	ND	ND	0.00038 J
Semivolatile Organic Compounds (SVOCs)			
bis(2-Ethylhexyl) Phthalate	ND	ND	0.076
Propellants			
Nitrocellulose	0.89 J	ND	ND

Location ID:	78-QPSD-DU3-SB5
Field Sample ID:	078SB-0032M-0001-SO
Lab Sample ID:	240-22559-29
Sample Date:	3/26/2013
Sample Depth (ft):	1-2
Units:	mg/kg
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	0.0057 J
Anthracene	0.0046 J
Benzo(a)anthracene	0.024
Benzo(a)pyrene	0.022
Benzo(b)fluoranthene	0.029
Benzo(g,h,i)perylene	0.014
Benzo(k)fluoranthene	0.01
bis(2-Ethylhexyl) Phthalate	0.03 J
Chrysene	0.023
Fluoranthene	0.046
Indeno(1,2,3-c,d)pyrene	0.011
Naphthalene	0.0045 J
Phenanthrene	0.024
Pyrene	0.038

Location ID:	78-QPSD-DU3-SB2
Field Sample ID:	078SB-0028M-0001-SO
Lab Sample ID:	240-22559-26
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	0.05

Location ID:	78-QPSD-DU3-SB4
Field Sample ID:	078SB-0031M-0001-SO
Lab Sample ID:	240-22559-28
Sample Date:	3/26/2013
Sample Depth (ft):	1-7
Units:	mg/kg
Volatile Organic Compounds (VOCs)	
Toluene	0.00032 J
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	0.058

Location ID:	78-QPSD-DU3-SB3
Field Sample ID:	078SB-0030M-0001-SO
Lab Sample ID:	240-22559-27
Sample Date:	3/26/2013
Sample Depth (ft):	1-6
Units:	mg/kg
Volatile Organic Compounds (VOCs)	
Toluene	0.00028 J
Semivolatile Organic Compounds (SVOCs)	
bis(2-Ethylhexyl) Phthalate	0.044 J
Naphthalene	0.0039 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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LEGEND

●	DU02 boring location with benzo(a)pyrene not detected or less than most stringent FWCUG
⊕	SpecPro 2003 subsurface soil sample location (1-3 ft bgs) where benzo(a)pyrene was not detected
●	Direct-Push Boring Location
▨	Decision Unit
■	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
ND	Analyte Is Not Detected and Is Not an SRC at This Depth
▭	ISM Horizontal Sample for Decision Unit
Analyte	SRC Concentration Exceeds Most Stringent FWCUG (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft² = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg= milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient
10. ND = Not Detected
11. bgs = below ground surface

TITLE

Location of Organic SRCs in Subsurface Soil at CC RVAAP-78 Quarry Pond Surface Dump, DU03

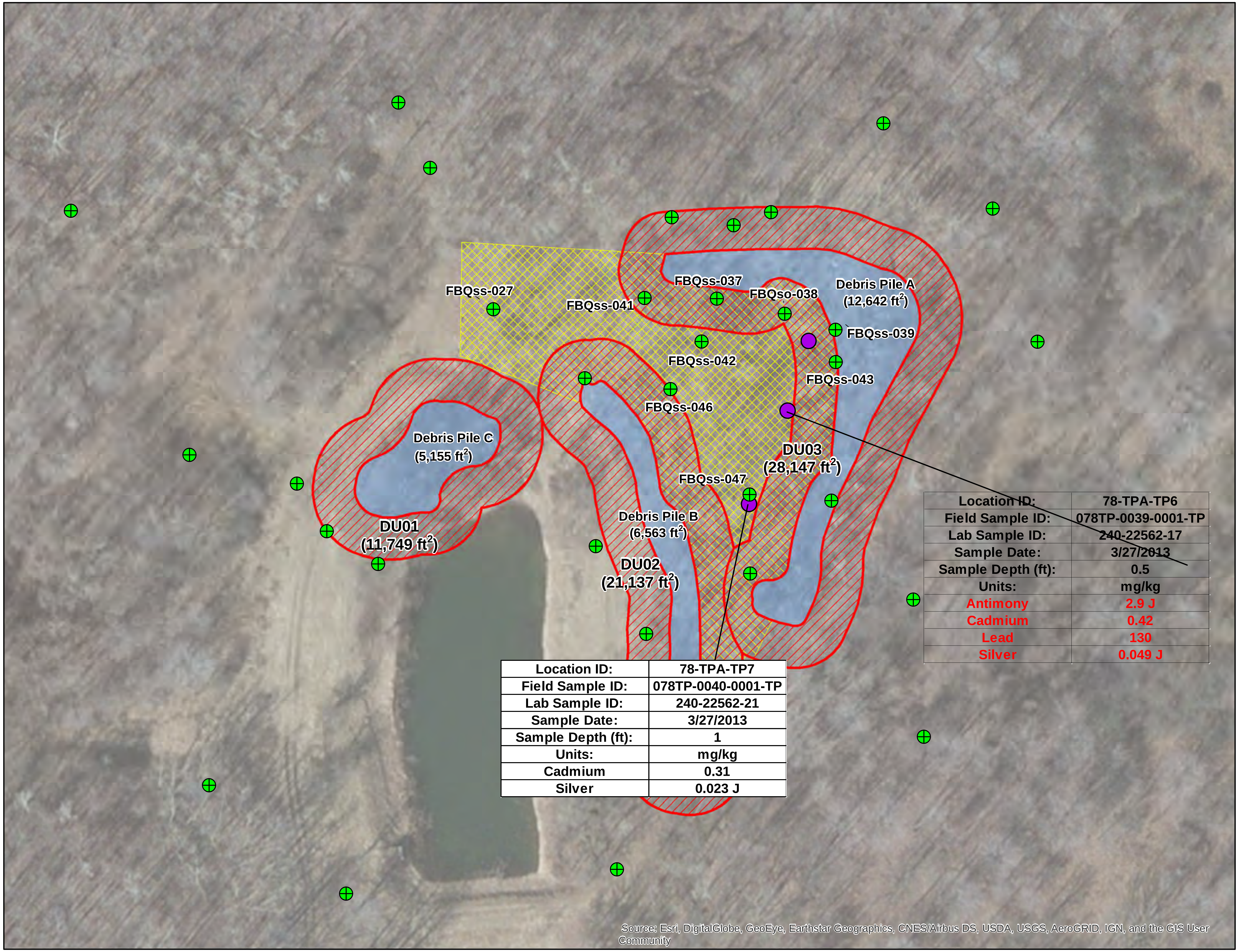
FORMER RAVENNA ARMY
AMMUNITION PLANT
PORTAGE AND TRUMBULL
COUNTIES, OHIO

0 40 80
Feet

N

FIGURE

5-9



Location ID:	**78-TPA-TP6**
Field Sample ID:	**078TP-0039-0001-TP**
Lab Sample ID:	**240-22562-17**
Sample Date:	**3/27/2013**
Sample Depth (ft):	**0.5**
Units:	**mg/kg**
Antimony	**2.9 J**
Cadmium	**0.42**
Lead	**130**
Silver	**0.049 J**

Location ID:	**78-TPA-TP7**
Field Sample ID:	**078TP-0040-0001-TP**
Lab Sample ID:	**240-22562-21**
Sample Date:	**3/27/2013**
Sample Depth (ft):	**1**
Units:	**mg/kg**
Cadmium	**0.31**
Silver	**0.023 J**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

⊕	SpecPro 2003 surface soil sample location with antimony concentration less than most stringent FWCUG
●	Test Pit Location
▨	Decision Unit
■	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
Analyte	SRC Concentration Exceeds Most Stringent FWCUG (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg = milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient
10. % = percent

TITLE

Location of Inorganic SRCs in Surface Soil in Test Pit Area at CC RVAAP-78 Quarry Pond Surface Dump.

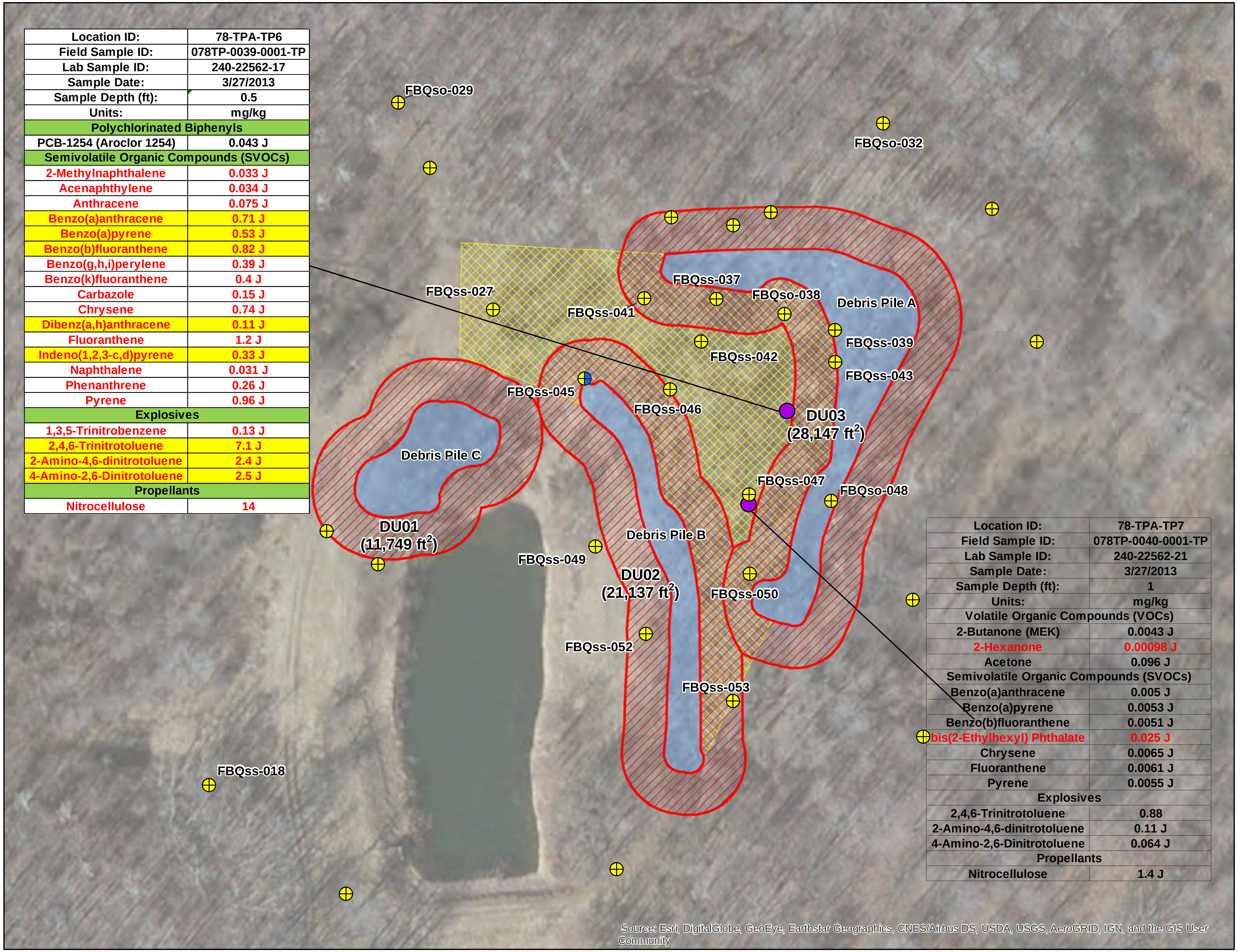
FORMER RAVENNA ARMY
AMMUNITION PLANT
PORTAGE AND TRUMBULL
COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-10

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 5-10 cc78 Test Pit SB Inorganic.mxd



Location ID:	78-TPA-TP6
Field Sample ID:	078TP-0039-0001-TP
Lab Sample ID:	240-22562-17
Sample Date:	3/27/2013
Sample Depth (ft):	0.5
Units:	mg/kg
Polychlorinated Biphenyls	
PCB-1254 (Aroclor 1254)	0.043 J
Semivolatile Organic Compounds (SVOCs)	
2-Methylnaphthalene	0.033 J
Acenaphthylene	0.034 J
Anthracene	0.075 J
Benzo(a)anthracene	0.71 J
Benzo(a)pyrene	0.53 J
Benzo(b)fluoranthene	0.82 J
Benzo(g,h,i)perylene	0.39 J
Benzo(k)fluoranthene	0.4 J
Carbazole	0.15 J
Chrysene	0.74 J
Dibenz(a,h)anthracene	0.11 J
Fluoranthene	1.2 J
Indeno(1,2,3-c,d)pyrene	0.33 J
Naphthalene	0.031 J
Phenanthrene	0.26 J
Pyrene	0.96 J
Explosives	
1,3,5-Trinitrobenzene	0.13 J
2,4,6-Trinitrotoluene	7.1 J
2-Amino-4,6-dinitrotoluene	2.4 J
4-Amino-2,6-Dinitrotoluene	2.5 J
Propellants	
Nitrocellulose	14

Location ID:	78-TPA-TP7
Field Sample ID:	078TP-0040-0001-TP
Lab Sample ID:	240-22562-21
Sample Date:	3/27/2013
Sample Depth (ft):	1
Units:	mg/kg
Volatile Organic Compounds (VOCs)	
2-Butanone (MEK)	0.0043 J
2-Hexanone	0.00098 J
Acetone	0.096 J
Semivolatile Organic Compounds (SVOCs)	
Benzo(a)anthracene	0.005 J
Benzo(a)pyrene	0.0053 J
Benzo(b)fluoranthene	0.0051 J
bis(2-Ethylhexyl) Phthalate	0.025 J
Chrysene	0.0065 J
Fluoranthene	0.0061 J
Pyrene	0.0055 J
Explosives	
2,4,6-Trinitrotoluene	0.88
2-Amino-4,6-dinitrotoluene	0.11 J
4-Amino-2,6-Dinitrotoluene	0.064 J
Propellants	
Nitrocellulose	1.4 J

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

⊕	SpecPro 2003 surface soil sample location with highlighted explosives* at concentrations greater than the most stringent FWCUG
⊕	SpecPro 2003 surface soil sample location with highlighted explosives* at concentrations less than the most stringent FWCUG
⊕	SpecPro 2003 surface soil sample location where highlighted SVOCs* were not detected
●	Test Pit Location
▨	Decision Unit
■	Debris Pile
Analyte	SRC and Maximum Concentration Detected
Analyte	SRC
Analyte	*SRC Concentration Exceeds Most Stringent FWCUG (HQ=0.1/Target Cancer Risk =10^{-6})

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. SRC = Site-Related Chemical
4. FWCUG = Facility-Wide Cleanup Goal
5. Concentrations shown are for SRCs at each sample location.
6. mg/kg = milligrams per kilogram
7. J = estimated
8. ft = feet
9. HQ = hazard quotient

Location of Organic SRCs in Surface Soil at Test Pit Area at CC RVAAP-78 Quarry Pond Dump.

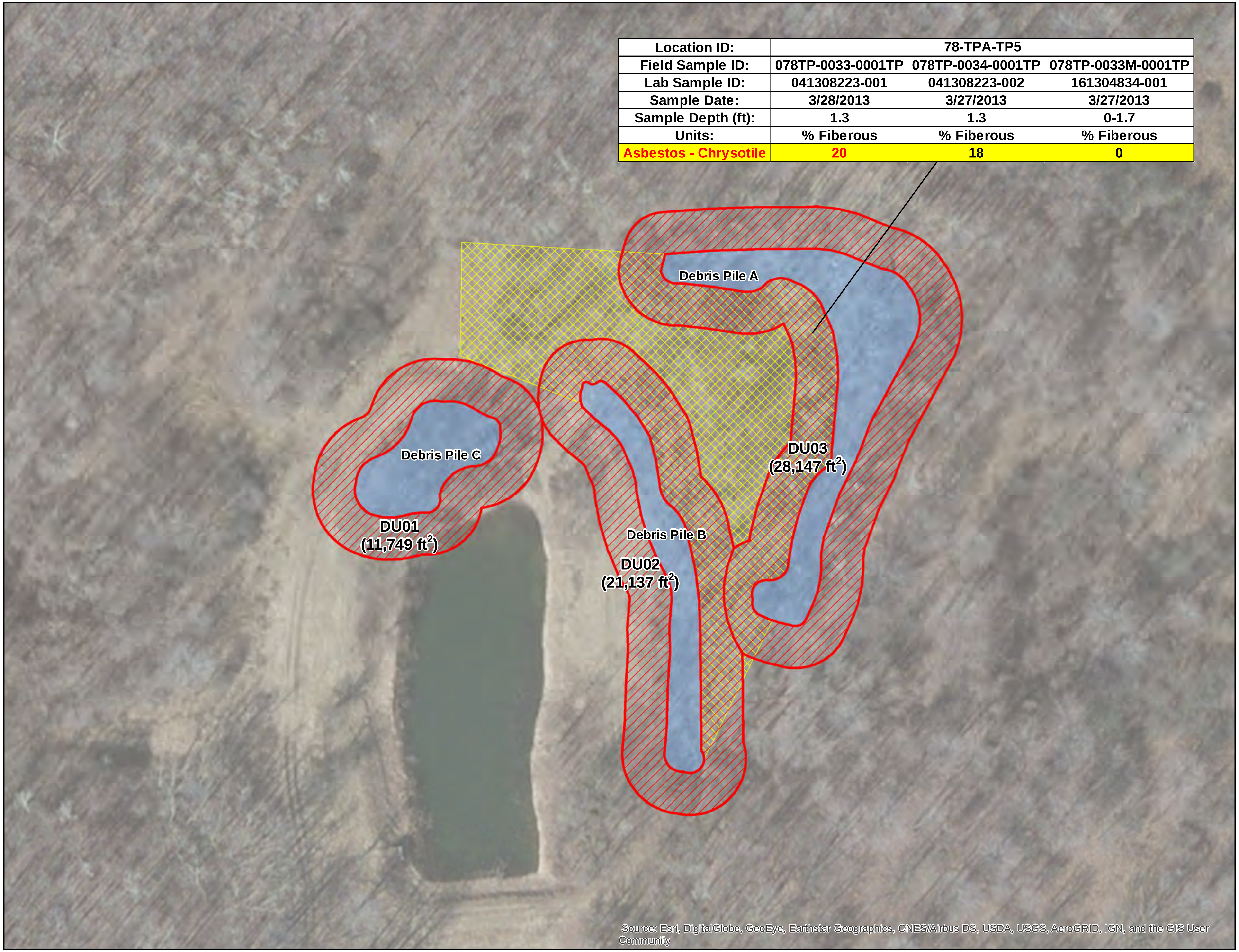
FORMER RAVENNA ARMY
AMMUNITION PLANT
PORTAGE AND TRUMBULL
COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-11

Path: W:\Projects\Miscellaneous\Ravenna_Coombs\Fig 5-11 cc78 Test Pit SB Organic.mxd



Location ID:	78-TPA-TP5		
Field Sample ID:	078TP-0033-0001TP	078TP-0034-0001TP	078TP-0033M-0001TP
Lab Sample ID:	041308223-001	041308223-002	161304834-001
Sample Date:	3/28/2013	3/27/2013	3/27/2013
Sample Depth (ft):	1.3	1.3	0-1.7
Units:	% Fiberous	% Fiberous	% Fiberous
Asbestos - Chrysotile	20	18	0

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

● Test Pit Location with Construction Debris

● Test Pit Location without Construction Debris

▨ Decision Unit

🟦 Debris Pile

Asbestos Maximum Concentration Detected

Asbestos Concentration

Asbestos Concentration Exceeds Facility Cleanup goal of greater than 1% asbestos

NOTES & SOURCES

1. Map Coordinates: NAD 83, UTM Zone 17N, 2009 Orthoimagery from USGS.
2. ft^2 = square feet
3. ft = feet
4. HQ = hazard quotient
5. % = percent

TITLE

Location of Asbestos in Surface Soil at Test Pit Area CC RVAAP-78 Quarry Pond Surface Dump

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

0 40 80
Feet

N

FIGURE
5-12

SECTION 6: EXPOSURE PATHWAYS

6.1 SOIL EXPOSURE AND AIR PATHWAYS

Primary pathways for the potential exposure to chemicals and asbestos include airborne inhalation, incidental ingestion, and dermal contact.

6.1.1 Physical Conditions

The previous environmental work at the RVAAP-16 AOC provided information about the soils adjacent to the debris pile areas. See Section 2 of the 2016 SI for more details. The *U.S. Department of Agriculture Portage County Soil Survey* indicates that the soil within CC RVAAP-78 is defined as “pit, quarries” with possibly Mitiwanga Silt Loam in the eastern portion of Debris Pile A. Chemical contamination, fill materials, including transite, are present at the base of the steeply inclined rock slopes in Debris Piles A and B and in Debris Pile C.

6.1.2 Potential Soil and Air Pathways

Currently, soil and air targets, as described in the Abbreviated Preliminary Assessment Guidance (US EPA, 1999), at CC RVAAP-78 are limited due to low activity levels. However, in the future, the OHARNG plans to use this area for military training. A Feasibility Study (FS), Record of Decision (ROD), Remedial Design (RD), and Remedial Action (RA) for the Fuze and Booster Quarry Landfill/Ponds addressed the larger area surrounding and in the vicinity of CC RVAAP-78. These studies, did not specifically address the contamination and potential asbestos at the CC RVAAP-78 AOC. Use of the data from previous reports and sampling areas is limited to their impact on this AOC. Although the FBQ investigations for the Landfill/Ponds addressed the large areas surrounding the area of CC RVAAP-78, they did not specifically address any potential transite problems or contamination in the Debris Piles which was assessed in the 2016 SI. This SI Addendum is only limited to ensuring that the size of the Debris Piles is adequately known and to identify where if any contamination is present in the Test Pit Area.

6.1.3 Soil Exposure and Air Pathways Conclusion

Following investigation and remediation of the FBQ Landfill/Ponds, three Debris Piles were encountered within this area which required additional consideration. These three Debris Piles constitute the Quarry Pond Surface Dump, CC RVAAP-78, which were assessed in the 2016 SI. Since the SI results indicated chemical contamination and asbestos was in the three Debris Piles in surface soil and in the subsurface soil in Debris Pile C, additional field sampling or analyses of the Debris Piles were not completed for this SI Addendum. The SI indicated that use of the AOC may result in possible exposure to asbestos and chemical contamination if the AOC is used. Potential exposure to friable asbestos fibers from the residual transite and roofing materials at CC RVAAP-78 may occur if the soil is disturbed. The likelihood of asbestos fibers being released into the air is greater if asbestos material is disturbed. Exposure to chemicals in the soil is likely, if the activity disturbs the soil and the receptor contacts the soil. The potential for exposure increases the longer the contact occurs on site.

The intrusive investigation for the SI included surface soil ISM sampling at the apparent Burn Area and Debris Piles A, B, and C; subsurface soil ISM sampling at Debris Pile C; and sampling of the contents of the two rusted drums. Transite was observed in both Debris Piles A and B. The surface soil ISM sampling at the apparent Burn Area and Debris Pile C and the subsurface soil ISM sampling at Debris Pile C, was conducted. Asbestos contents of 30 percent and 40 percent were detected in the transite samples from Debris Piles A and B, respectively, and the roofing sample from Debris Pile B had a level of 35 percent asbestos. All the soil samples were analyzed for asbestos. and were non-detect or less than 1 percent asbestos, except for sample C78SB-021M-0001-SO, one of the subsurface soil vertical ISM samples from Debris Pile C, which had a level of 2 percent asbestos.

The dataset for surface soils consists of ISM samples from the three DUs (one from each DU) and two discrete samples from the Test Pit Area. **Table 5-1** presents the results of the data evaluation of the chemicals included in the chemical analysis. The chemicals that were detected were assessed to determine if they were detected in concentrations great enough to be considered contamination is present in the DUs and the Test Pit Area. No chemicals were retained for further evaluation in the surface soil aggregate (0-1 ft bgs). This indicates that no contamination was found in the surface soil DUs and the Test Pit Area.

The dataset for subsurface soil consists of 23 ISM and 1 composite sample (including investigative and field duplicates) from the DUs surrounding the Debris Piles. Subsurface soil was not evaluated in the Test Pit Area because the soil is very thin in this area and drilling and digging ceased at the top of bedrock, which averaged approximately 1 ft bgs. Depths for each of the subsurface soil borings are provided in the **Table 5-2** presents the results of the data evaluation of the chemicals included in the chemical analysis for the subsurface aggregate data. The minimum concentration detected, and maximum concentration detected for chemical analytes is presented in **Table 5-2**. The established background value for metals in subsurface soils also provided (Table 5-2). The maximum concentration detected was used in the first step of the evaluation process. If the maximum concentration detected was less than the background concentration for metals, then the metal was eliminated as potential contamination. The maximum detected concentration of the remaining metals and all detected chemicals were next compared to the May 2018 USEPA RSL for Residential Land Use for each chemical. If the maximum detected concentration was less than the chemical's USEPA RSL, then the chemical was eliminated as potential contamination. The following six chemicals were further evaluated using a WOE approach for the subsurface soil aggregate (1 ft bgs to various depths depending upon where bedrock was encountered). All the chemicals evaluated in the WOE were semivolatile organics:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Indeno(1,2,3-c,d)pyrene

The maximum concentration detected in the subsurface soils were all from DU01 and from one soil boring (CC78-DU01 SB04, **Table 5-3**). Soil boring logs that provided the depth of the samples are provided in **Appendix B**. This soil boring was only advance to approximately 2.5 feet bgs because of refusal. Considering the previously collected data from other studies, the area immediately outside of the DU01 where SB04 was taken was shown to not have detectable semivolatile organic compounds (SpecPro 2003, **Figure 5-1**). The five soil borings collectively represent the subsurface soil in each DU around the Debris Piles. Since the single maximum exceeded the USEPA RSL, the next step in the determination of contamination was to evaluate if their concentrations are great enough to represent contamination. **Table 5-3** presents the concentrations for each of the soil borings within each DU. Most of the values for each subsurface sample were non-detect and the value being shown is the LOD. An average concentration was calculated for each chemical and each DU. The average concentration for each of these chemicals per DU was much less than their respective USEPA RSL. This indicates that the concentration of these chemicals does not represent contamination in the subsurface soil. Therefore, no chemical contamination was found in either of the DUs and no chemical contamination was identified in the Test Pit Area. However, one Test Pit (Test Pit 5) sample contained construction debris with suspected ACM. Test Pit 5 is located within the DU03 which surrounds Debris Pile A (**Figure 4-1**). The ACM was analyzed and results indicated it contained 20 percent chrysotile. Because this sample area had construction debris in it and contains asbestos, the small area around Test Pit 5 is recommended for removal when the Debris Piles are removed to address asbestos contamination. Asbestos was not detected in the vertical ISM soil sample from the test pit (0-1.7 ft bgs). The soil exposure pathway was considered incomplete for all areas except Test Pit 5 where asbestos was identified and potential exposure is possible.

6.2 GROUNDWATER PATHWAY

6.2.1 Hydrogeologic Setting

As stated previously, CC RVAAP-78 AOC is located within the RVAAP-16 AOC (FBQ Landfill/Ponds). The hydrogeologic setting for RVAAP-16 is contained in Section 2 of the *Phase I/Phase II Remedial Investigation of the Fuze and Booster Quarry Landfill/Ponds (RVAAP-16),* dated November 2005. Groundwater flow is toward the south and west.

6.2.2 Groundwater Pathways

Groundwater at the AOC is not currently utilized. The OHARNG may utilize groundwater in the future in select areas on the facility. Groundwater wells located in the vicinity of the AOC are being assessed under the facility-wide Groundwater Monitoring Program.

6.2.3 Groundwater Pathway Conclusions

Groundwater is not currently used at the AOC. Groundwater will be evaluated during the Remedial Investigation of RVAAP-66 Facility-Wide Groundwater and as part of the Facility-Wide Groundwater Monitoring Program (FWGWMP). The AOC's location relative to groundwater bearing units and geologic setting indicates that there is a low likelihood of a release to groundwater from the migration of contaminants through soil and the underlying rock.

6.3 SURFACE WATER PATHWAY

6.3.1 Surface Water Setting

Surface water and sediment are not present on the AOC. Therefore, this is an incomplete pathway and is not evaluated further.

6.3.2 Surface Water Pathway Conclusions

There is no surface water or sediment on the AOC so the surface water and sediment pathway is considered incomplete for this AOC.

SECTION 7: FINDINGS AND RECOMMENDATIONS

7.1 FINDINGS

The Migration Exposure Pathways considered in the SI Addendum were: soil (surface and subsurface), groundwater; and surface water/sediment. Primary pathways for the potential exposure to chemicals and asbestos include airborne inhalation, incidental ingestion, and dermal contact.

Data from groundwater monitoring wells near CC RVAAP-78 should be assessed further as currently being done under the groundwater monitoring program. Considering these results and the AOC's location relative to groundwater bearing units and geologic setting, there is a low likelihood of a release to groundwater from the migration of contaminants through soil and the underlying rock. Groundwater is being addressed under the facility-wide Groundwater Monitoring Program. In addition, no chemical contamination was identified in the three DUs or the Test Pit Area so the groundwater exposure pathway was considered incomplete for this SI Addendum.

There is no surface water or sediment on the AOC so the surface water and sediment pathways were considered incomplete for this AOC.

Surface soil and subsurface soil were evaluated for a 30-ft wide perimeter around Debris Piles A, B, and C and in the area between Debris Piles known as the Test Pit Area. No chemical contamination, asbestos fibers in soil, or ACM was identified in the surface soil aggregate (0-1 ft bgs) for the DUs or the Test Pit Area. No chemical contamination was found in the subsurface soil for any of the DU subsurface samples or for the Test Pit Area. However, one Test Pit (Test Pit 5) sample contained construction debris with suspected ACM. Test Pit 5 is located within the DU03 which surrounds Debris Pile A (**Figure 4-1**). The suspected ACM was analyzed and results indicated it contained 20 percent chrysotile asbestos. The soil exposure pathway was considered incomplete for all areas except Test Pit 5 where asbestos was identified and potential exposure is possible.

7.2 RECOMMENDATIONS

This SI Addendum conducted at CC RVAAP-78 Quarry Pond Surface Dump has adequately identified whether or not there is contamination in surface and subsurface soil contained within the DUs around the three Debris Piles and the Test Pit Area. No further action to address chemical or asbestos contamination is recommended at CC RVAAP-78 Quarry Pond Surface Dump for soil in the three DUs surrounding the Debris Piles. Within the Test Pit Area, one Test Pit (Test Pit 5 – 78 TPA-TP5) sample contained asbestos. Test Pit 5 is located within the DU03 (DU around Debris Pile A) (**Figure 4-1**). It is recommended that the area around Test Pit 5 be included with the removal of the three Debris Piles. The 2016 SI recommended that the Debris Piles A, B, and C be removed and disposed of as well as the surface/subsurface soil at Debris Pile C. As documented in the 2016 SI, each of the Debris Piles contain chemical contamination. Debris Piles A and B had ACM and Debris Pile C soil was shown to have asbestos (2%) in in one subsurface soil sample. Transite was observed in both Debris Piles A and B. Asbestos contents of 30 percent and 40 percent were detected in the transite samples from Debris Piles A and B, respectively, and the roofing sample from Debris Pile B had a level of 35 percent asbestos. All the soil samples were analyzed for asbestos. All the soil samples were non-detect or less than 1 percent asbestos, except for sample C78SB-021M-0001-SO, one of the subsurface soil vertical ISM samples from Debris Pile C, which had a level of 2 percent asbestos.

Because chemical contamination above Unrestricted (Residential) Land Use was identified within Debris Piles as part of the 2016 SI and asbestos contamination was found at Test Pit 5 in this SI Addendum, additional remedial action is warranted for this AOC. It is recommended that removal action alternatives be evaluated in an EE/CA as the next phase in the CERCLA process.

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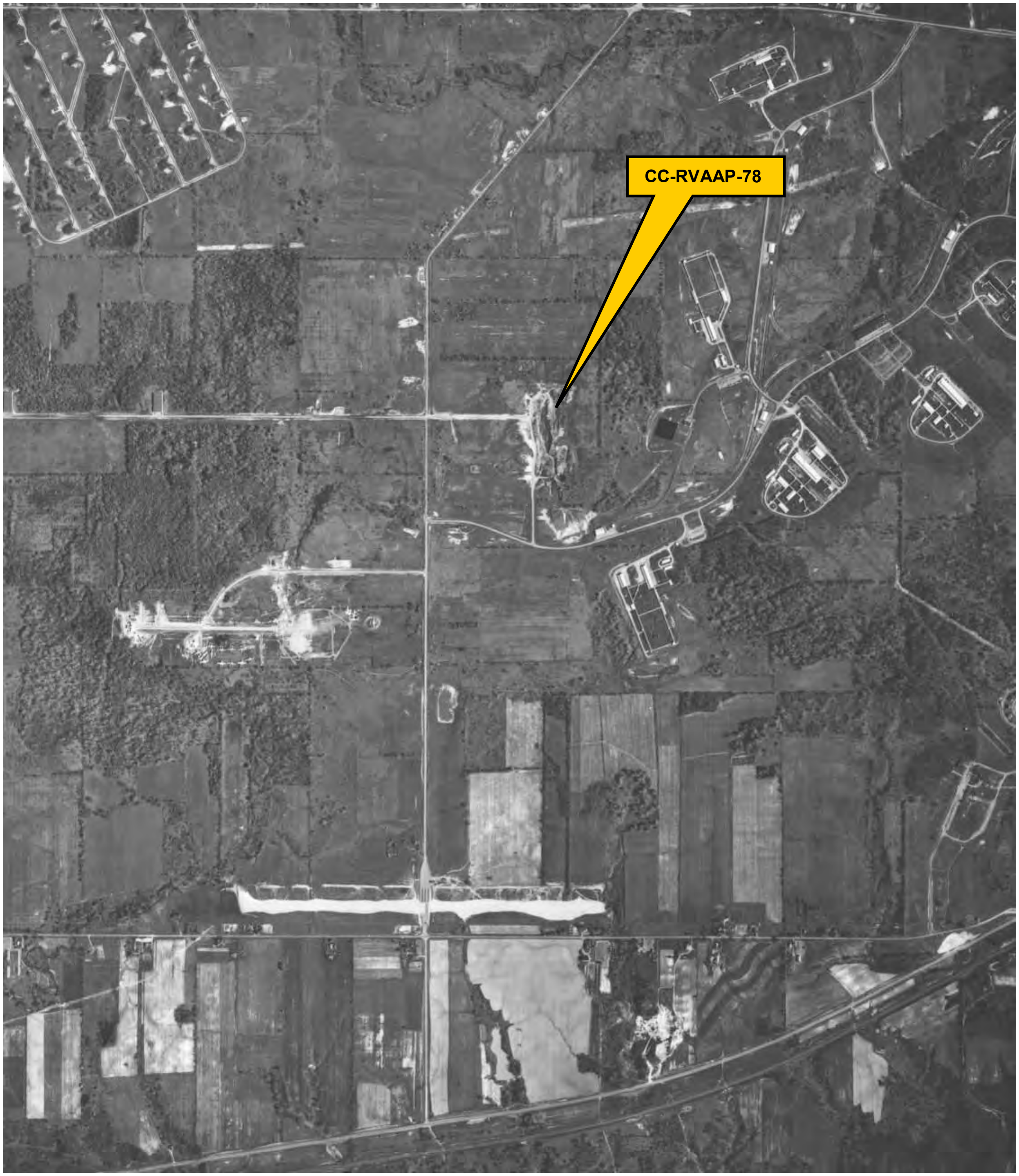
APPENDIX A:
Site Photographs and Historical Aerial Photographs



1951 AERIAL

FIGURE 1

N↑

CC-RVAAP-78
Aerial Photograph, May 2, 1951
Quarry Pond Surface Dump

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

1952 AERIAL

FIGURE 2

N↑

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

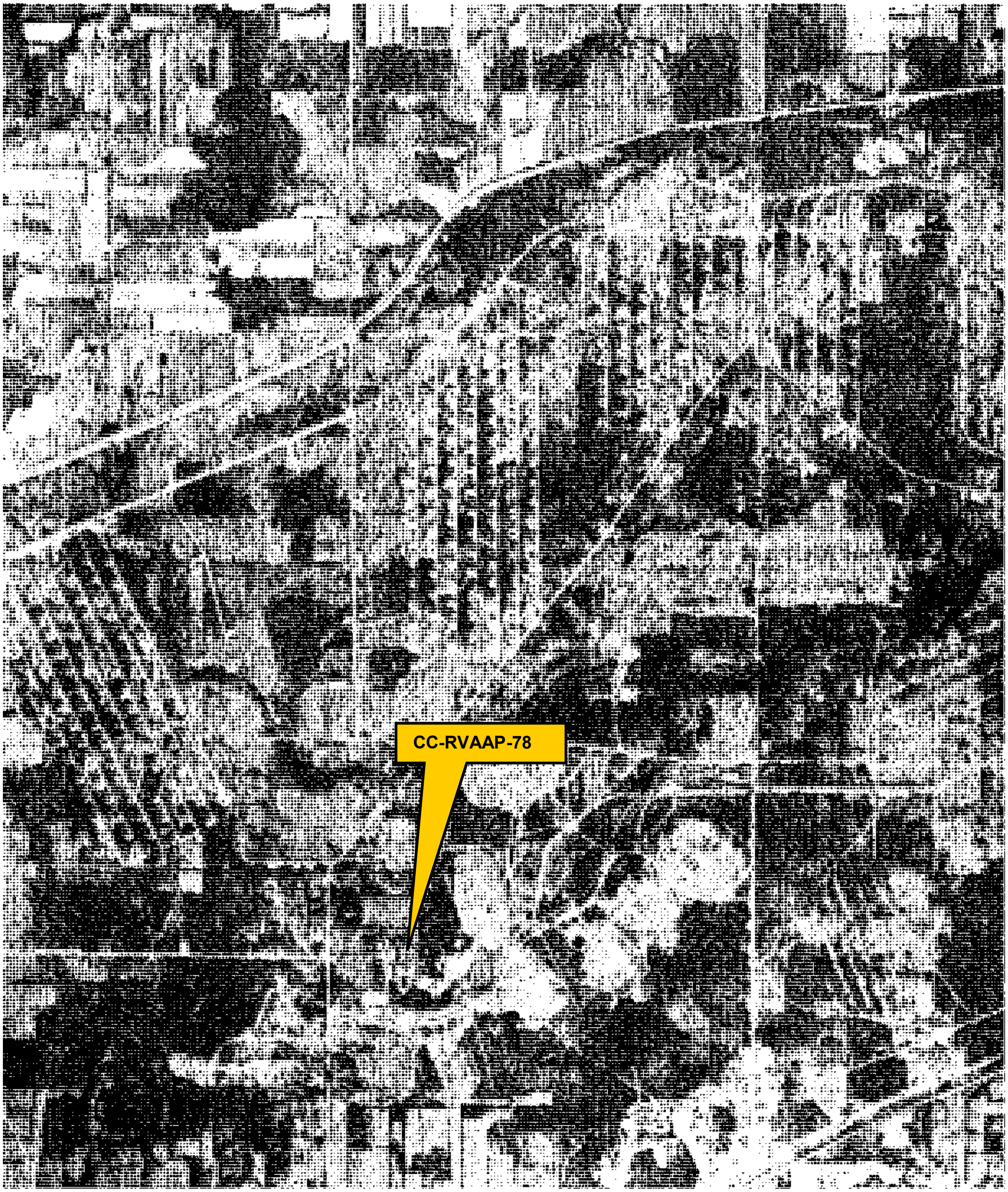
CC-RVAAP-78
Aerial Photograph, April 6, 1952
Quarry Pond Surface Dump

1966 AERIAL

FIGURE 3

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

CC-RVAAP-78
Aerial Photograph, June 17, 1966
Quarry Pond Surface Dump



1979 AERIAL

FIGURE 4

N↑

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

CC-RVAAP-78
Aerial Photograph, September 17, 1979
Quarry Pond Surface Dump

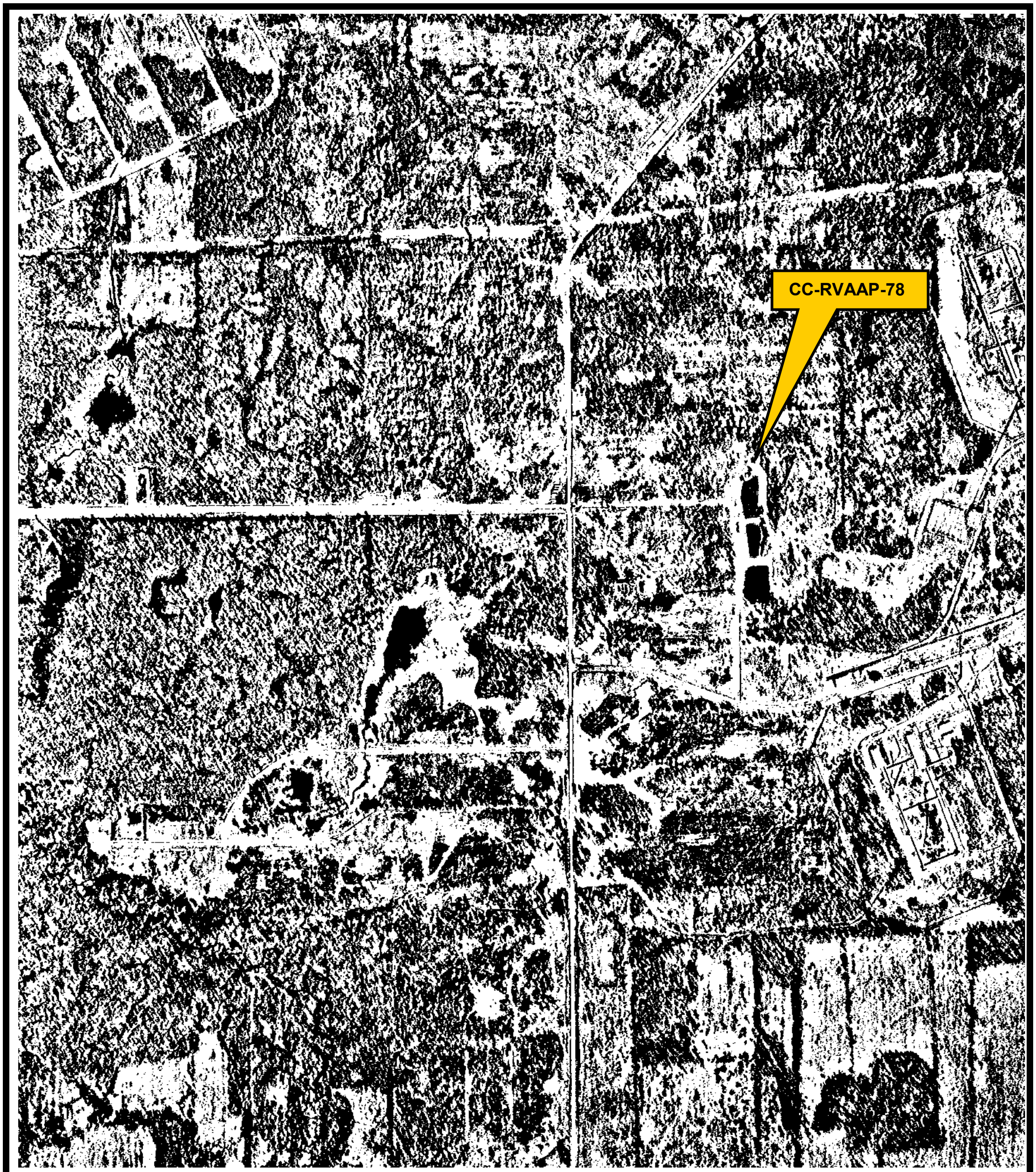
1981 AERIAL

FIGURE 5

N ←

CC-RVAAP-78
Aerial Photograph, November 10, 1981
Quarry Pond Surface Dump

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.



1985 AERIAL

FIGURE 6

N ←

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

CC-RVAAP-78
Aerial Photograph, March 26, 1985
Quarry Pond Surface Dump

APPENDIX B:
Boring Logs

HTW DRILLING LOG

HOLE NO. SB1

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC78, Quarry Ponds, DU1

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU-1 SB-1

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 7'

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	T. SCOTT

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil, dark brown	0.0				
SM	~~5~~ 1	Silty Sand, Strong brown hard, loose.	0.0 0.0				
	~~10~~ 2						
	~~15~~ 3						
SM	~~20~~ 4	Grading to hard, dense	0.0				
	~~25~~ 5						
	~~30~~ 6						
	~~35~~ 7						TD=7'
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. SB2

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 **OF** **SHEETS**

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Ponds

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU-1, SB2

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 6

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS SEE SAMPLE SUMMARY SHEET

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
—	—	—		

21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
BENTONITE	—	—

23. SIGNATURE OF INSPECTOR J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil; dark brown, (10 YR 3/3); Soft, dense, moist	0.0				
	~~5~~ 1						
SM		Silty Sand Strong brown (7.5 YR 5/8); hard, loose, weathered					displace Per- UXO force
	~~10~~ 2						
	~~15~~ 3						
		Grading w/ Yellowish Red (5 YR 5/8)	0.0				
	~~20~~ 4						
	~~25~~ 5	Grading to dark yellowish brown (10 YR 4/4) hard, dense, dry	0.0				
	~~30~~ 6						Refusal
	~~35~~ 7						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. SB3

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78 Quarry Ponds

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU-1, SB3

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 10.8

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil; 10YR 3/3 dark brown, soft, dense, Moist	0.0				Refusal on 1st attempt @ 16"
	1 ~~5~~	Sandstone, 7.5 YR 5/8 strong Brown; hard, dry, weathered					?
	2 ~~10~~	Interbedded w/ highly weathered,					
	3 ~~15~~						low Recovery 4-7'
SM		Sand, strong brown to yellowish red (5YR 5/8)	0.0				
	4 ~~20~~						
	5 ~~25~~						
	6 ~~30~~	Grading to dark yellowish brown (10YR 4/4), hard, loose, faint moist.					
	7 ~~35~~		0.0				
	10 ~~40~~	grading to very pale brown, (10YR 7/3) hard, loose					Refusal 10.8'
	45						

MRK FORM JUN 90 55

PROJECT RVAAP

HOLE NO.

HTW DRILLING LOG

HOLE NO. SB4

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1
OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78 Quarry Ponds, DU1 SB4

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU1 -SB4

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

15. DEPTH GROUNDWATER ENCOUNTERED NA

13. DEPTH DRILLED INTO ROCK NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

14. TOTAL DEPTH OF HOLE 2.5

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS SEE SAMPLE SUMMARY SHEET

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
—	—	—	—	

21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
BENTONITE	—	—

23. SIGNATURE OF INSPECTOR J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil	0.0				
	~~5~~ 1						
SM		Silty Sand	0.0				
	~~10~~ 2	SS					
	15						
	20						
	25						
	30						
	35						
	40						
	45						

MRK FORM JUN 86 55

PROJECT RVAAP

HOLE NO.

HTW DRILLING LOG

HOLE NO. SB5

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC-78, Quarry Ponds, DU1

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU1 SB5

9. SURFACE ELEVATION NA

10. DATE STARTED

11. DATE COMPLETED

12. OVERBURDEN THICKNESS NA

15. DEPTH GROUNDWATER ENCOUNTERED NA

13. DEPTH DRILLED INTO ROCK NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

14. TOTAL DEPTH OF HOLE 5'

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA | DISTURBED | UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES —

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—		J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CC		Silty Clay Soil	0.0				
	~~5~~ 1						
SM		Silty Sand	0.0				
	~~10~~ 2						
	~~15~~ 3						
	~~20~~ 4						
	~~25~~ 5	SS, Very Pale brown hard, dense, dry	0.0				TD=5'
	~~30~~ 6						
	~~35~~ 7						
	40						
	45						

MRK FORM JUN 00 55

PROJECT RVAAP

HOLE NO.

HTW DRILLING LOG

HOLE NO. Du2 ; SB1

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 **OF** **SHEETS**

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Ponds

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU2, SB1

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 2

15. DEPTH GROUNDWATER ENCOUNTERED NO

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES —

20. SAMPLES FOR CHEMICAL ANALYSIS SEE SAMPLE SUMMARY SHEET

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
—	—	—		

21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
BENTONITE	—	—

23. SIGNATURE OF INSPECTOR J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil dark brown	0.0				
SM		Silty Sand ~~Ite~~					
	~~5~~ 1						
	~~10~~ 2	Sandstone					TD=2' Refusal@2'
	~~15~~ 3						
	~~20~~ 4						
	~~25~~ 5						
	~~30~~ 6						
	~~35~~ 7						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 80 55

HTW DRILLING LOG

HOLE NO. SB2

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 **OF** **SHEETS**

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Roads DU 2

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU 2 - SB 2

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 1'

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS SEE SAMPLE SUMMARY SHEET

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
—	—	—	—	

21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
BENTONITE	—	—

23. SIGNATURE OF INSPECTOR J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CC		Silty Clay Soil	0.0				
SM		Silty Sand; Yellowish Red	0.0				TD = 1'
	~~5~~ 1	Sandstone, faintly weathered					Refusal @ 1'
	~~10~~ 2						
	~~15~~ 3						
	~~20~~ 4						
	~~25~~ 5						
	30						
	35						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 90 55

HTW DRILLING LOG

HOLE NO. SB3

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 **OF** **SHEETS**

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC-78, Quarry Ponds DU2

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU2-SB3

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

15. DEPTH GROUNDWATER ENCOUNTERED NO

13. DEPTH DRILLED INTO ROCK NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

14. TOTAL DEPTH OF HOLE 2'

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
18. GEOTECHNICAL SAMPLES NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SEE SAMPLE SUMMARY SHEET	—	—	-	—		%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	J. Scott

~~ELEV.~~ a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil, dark brown	0.0				
SM	1 ~~5~~	Silty Sand; Yellowish Red	0.0				
	2 ~~10~~	Sand Stone					Refusal e 2'
	15						
	20						
	25						
	30						
	35						
	40						
	45						

MRK FORM JUN 89 55

PROJECT RVAAP

HOLE NO.

HTW DRILLING LOG

HOLE NO. SB4

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Ponds

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU 2, SB4

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 2

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
	BENTONITE	—	—

23. SIGNATURE OF INSPECTOR J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil	0.0				
SM		Silty Sand	0.0				
	~~5~~ 1						
	~~10~~ 2	Sandstone					TD=2' Refusal@2'
	~~15~~ 3						
	~~20~~ 4						
	25						
	30						
	35						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. DU2-SB5

1. COMPANY NAME ECC
2. DRILLING SUBCONTRACTOR Frontz
SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant
4. LOCATION CC 78: Quarry Ponds

5. NAME OF DRILLER Joe Teter
6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5 FT SS SAMPLER
MACROCORE
8. HOLE LOCATION QU2-SB5
9. SURFACE ELEVATION NA
10. DATE STARTED 3/26/13
11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA
15. DEPTH GROUNDWATER ENCOUNTERED NA

13. DEPTH DRILLED INTO ROCK NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

14. TOTAL DEPTH OF HOLE 7'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil, dark brown, soft, loose, wet	0.0				
SM	~~5~~ 1	Silty Sand; strong brown, hard, loose, damp					
	~~10~~ 2						
	~~15~~ 3	Grading to dark yellowish brown, hard, dense, moist	0.0				
SM	~~20~~ 4						
	~~25~~ 5	Grading to yellowish red SS, highly weathered, hard, dense, dry	0.0				
	~~30~~ 6						Very low Recovery 4-7
	~~35~~ 7						TD=7' Refusal @ 7'
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. SB01

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Ponds, Pile A

5. NAME OF DRILLER Joe Teter

6 MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU 3, SB01

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

15. DEPTH GROUNDWATER ENCOUNTERED NA

13. DEPTH DRILLED INTO ROCK NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

14. TOTAL DEPTH OF HOLE 8.5'

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CC		Silty Clay Soil; dark brown	0.0				
SM SW	1 ~~5~~	Weathered Sandstone; brown (7.5 YR 5/3)					
	2 ~~10~~						
	3 ~~15~~						
SW	4 ~~20~~	Grading to Sand, yellowish red, soft, loose, dry	0.0				
	5 ~~25~~						
	6 ~~30~~						
	7 ~~35~~						
	8 ~~40~~						
		← Sandstone -					TD=8.5
	9 ~~45~~						Refusal

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. SB-2

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78 DU3 SB-2

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION CC 78 DU3 SB-2

9. SURFACE ELEVATION NA

10. DATE STARTED 3-26-13

11. DATE COMPLETED 3-26-13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 7'

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS SEE SAMPLE SUMMARY SHEET

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
—	—	—	—		

22. DISPOSITION OF HOLE

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
BENTONITE	—	—

23. SIGNATURE OF INSPECTOR T. Hernandez

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
PT		0 - 1 3" BLK veg.					
SM		LT BRN SILTY/SAND					
	5	1 - 4'					
		4 - 7 SS Refusal@6.8'					
	10						
		TD 7'					
	15						
	20						
	25						
	30						
	35						
	40						
	45						

MRK FORM JUN 89 55

PROJECT RVAAP

HOLE NO.

HTW DRILLING LOG

HOLE NO.

1. COMPANY NAME ECC
2. DRILLING SUBCONTRACTOR Frontz

SHEET 1
OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant
4. LOCATION CC78, Quarry Ponds
5. NAME OF DRILLER Joe Teter
6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5 FT SS SAMPLER
MACROCORE
8. HOLE LOCATION DU3 SB-3, Pile A
9. SURFACE ELEVATION NA
10. DATE STARTED 3/26/~~12~~13
11. DATE COMPLETED 3/26/13
12. OVERBURDEN THICKNESS NA
13. DEPTH DRILLED INTO ROCK NA
14. TOTAL DEPTH OF HOLE 6'
15. DEPTH GROUNDWATER ENCOUNTERED NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA
18. GEOTECHNICAL SAMPLES NA

DISTURBED	UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS SEE SAMPLE SUMMARY SHEET

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
—	—	—	—	

21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
BENTONITE	—	—

23. SIGNATURE OF INSPECTOR J. Scott

~~ELEV.~~ a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
cc		Silty Clay, Brown (10YR 4/3) Soft, dense, dry	0.0				
	~~5~~ 1						
	~~10~~ 2	grading to soft wet					
	~~15~~ 3						
		weathered Sandstone and Sand, Yellowish brown, (10YR 5/4)	0.0				
fm	~~20~~ 4						
	~~25~~ 5	grading to moderately weathered	0.0				
	~~30~~ 6						TD=6' Refusal
	35						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. SB-~~2~~4

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Ponds DU-3

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT
5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU3, SB-~~2~~4, Pile A

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 7'

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA

	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
18. GEOTECHNICAL SAMPLES NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CL		Silty Clay Soil, loose, Soft wet	0.0				
	~~5~~ 1						
SM		Sand with Silt, Brown (7.5-YR 5/3), Soft, loose					
	~~10~~ 2						
	~~15~~ 3						
		Grading to Yellowish Red dense, firm	0.0				
SM	~~20~~ 4						
	~~25~~ 5						
	~~30~~ 6						
		Grading to weathered SS	0.0				
	~~35~~ 7						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

HTW DRILLING LOG

HOLE NO. DU3-SB5

1. COMPANY NAME ECC

2. DRILLING SUBCONTRACTOR Frontz

SHEET 1 OF SHEETS

3. PROJECT Ravenna Army Ammunition Plant

4. LOCATION CC 78, Quarry Ponds

5. NAME OF DRILLER Joe Teter

6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 5 FT SS SAMPLER
MACROCORE

8. HOLE LOCATION DU3-SB5

9. SURFACE ELEVATION NA

10. DATE STARTED 3/26/13

11. DATE COMPLETED 3/26/13

12. OVERBURDEN THICKNESS NA

13. DEPTH DRILLED INTO ROCK NA

14. TOTAL DEPTH OF HOLE 2'

15. DEPTH GROUNDWATER ENCOUNTERED NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES NA	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
SEE SAMPLE SUMMARY SHEET	—	—	—	—		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	BENTONITE	—	—	J. Scott

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
CC		Silty Clay Soil	0.0				
SM	1~~5~~	Sand w/ Silt; Brown	0.0				
	2~~10~~	Sand Stone					TD=2' Refusd
	15						
	20						
	25						
	30						
	35						
	40						
	45						

PROJECT RVAAP

HOLE NO.

MRK FORM JUN 89 55

APPENDIX C:
Laboratory Analytical Results, Laboratory Data, and Chain of Custody Forms

APPENDIX D:
Field Activity Forms

APPENDIX D

Field Activity Forms

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APPENDIX D.1

Surface Soil Sampling Summary Forms

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FIELD LOG FORM

SURFACE SOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** QUARRY POND SURFACE DUMP

Decision Unit: DU01 **Building No.** —

Sample Date: 3/26/13 **Time:** 0940 **Weather:** CLOUDY, 30's

Sample ID: 078SS-0210M-0001-SO

Duplicate Sample ID: —

Field Sampler: FR, MK

Depth of Sample: 0-1'

Material: soil

Remarks:

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☐ TPH GRO/DRO ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: (Signature) **DATE:** 3/26/13

FIELD LOG FORM

SURFACE SOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** QUARRY POND SURFACE DUMP

Decision Unit: DU02 **Building No.** —

Sample Date: 3/26/13 **Time:** 1251 **Weather:** CLOUDY -30's

Sample ID: 078SS-0002M-0001-SO

Duplicate Sample ID: —

Field Sampler: FR, MG

Depth of Sample: 0-1'

Material: SOIL

Remarks:

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☐ TPH GRO/DRO ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: (Signature) **DATE:** 3/26/13

FIELD LOG FORM

SURFACE SOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** QUARRY POND SURFACE DUMP

Decision Unit: DU03 **Building No.** —

Sample Date: 3/26/13 **Time:** 1335 **Weather:** CLEAR, 30'S

Sample ID: 078SS-0003M-0001-SO

Duplicate Sample ID: —

Field Sampler: FM, MC

Depth of Sample: 0-1'

Material: SOIL

Remarks:

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☐ TPH GRO/DRO ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: Jeff Dunn **DATE:** 3/26/13
(Signature)

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APPENDIX D.2

Test Pit Sampling Summary Forms

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FIELD LOG FORM

TEST PIT SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** QUARRY POND

Decision Unit: DU03 **~~Building No.~~** TEST PIT TP05

Sample Date: 3/27/13 **Time:** 1000 **Weather:** DRY, CLOUDY, 30'S

Sample ID: 078TP-0033-0001-TP

Duplicate Sample ID: 078TP-0034-0001-TP

Field Sampler: KIETH BIEKEL

Depth of Sample: 1 FT 3"

Material: ACM

Remarks:

Laboratory Analysis:

☐ VOC ☐ TAL METALS ☐ SVOCs ☐ EXPLOSIVES ☐ TPH GRO/DRO ☐ PCBs ☐ PROPELLANTS ☒ ACM

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

RECORDED BY: (Signature) **DATE:** 3/27/13

FIELD LOG FORM

TEST PIT SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** QUARRY POND

Decision Unit: DU 03 **Building No.** — TEST PIT TP06

Sample Date: 3/27/13 **Time:** 1211 **Weather:** PTLY. CLOUDY, 30°F

Sample ID: 078TP-0039-0001-TP

Duplicate Sample ID: —

Field Sampler: MG

Depth of Sample: 6"

Material: SOIL

Remarks:

Laboratory Analysis:

☐ VOC ☐ TAL METALS ☐ SVOCs ☐ EXPLOSIVES ☐ TPH GRO/DRO ☐ PCBs ☐ PROPELLANTS

☒ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

RECORDED BY: (Signature) **DATE:** 3/27/13

FIELD LOG FORM

TEST PIT SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** QUARRY POND

Decision Unit: DU 03 **~~Building~~ No.** TEST PIT TP07

Sample Date: 3/27/13 **Time:** 1332 **Weather:** PTLY CLOUDY, 30's

Sample ID: 078TP-0040-0001-TP

Duplicate Sample ID: —

Field Sampler: MG.

Depth of Sample: 1 FT

Material: SOIL

Remarks:

Laboratory Analysis:

☐ VOC ☐ TAL METALS ☐ SVOCs ☐ EXPLOSIVES ☐ TPH GRO/DRO ☐ PCBs ☐ PROPELLANTS

☒ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

RECORDED BY: (Signature) **DATE:** 3/27/13

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APPENDIX D.3

Subsurface Soil Sampling Summary Forms

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FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** Quarry Ponds

Decision Unit: DU 01 **Building No.** Pile C **VerticalGeoprobe No.** SB-1

Sample Date: 3/26/13 **Time:** 1105 **Weather:** 38°, Ovcst, Calm

VERTICAL 078SB-0006M-0001-SO 1105

Subsurface Horizontal Sample ID: 1-4' 078SB-0004M-0001-SO 1156
4-7' 078SB-0005M-0001-SO 1159

Duplicate Sample ID: —

Field Samplers: AW, FA

Tube A **Time** 1048 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 30"

Tube B **Time** 1055 **Interval Drilled (ftbgs) :** 4-7 **Recovery (ft/in):** 24"

Tube C **Time** ______ **Interval Drilled (ftbgs) :** ______ **Recovery (ft/in):** ______

Subcontractor (Name/Company): FRONTZ

Remarks: VOC's NOT COLL. FOR 078SB-0004M-0001-SO OR -0005M

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☒ MS/MSD Sample Collected 078SB-0006M-0002-SO 1105

☐ QA Sample Collected

RECORDED BY: ______ **DATE:** 3/26/13
(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU01 **Building No.** Pile C **VerticalGeoprobe No.** SB2

Sample Date: 3/26/13 **Time:** 1020 **Weather:** 33°, Ovcst, Calm

Subsurface ~~Horizontal~~ VERTICAL Sample ID: 078SB-0007M-0001-SO 1049

Duplicate Sample ID: —

Field Samplers: FR, RW

Tube A **Time** 1020 **Interval Drilled (ftbgs) :** 1-2 **Recovery (ft/in):** 24" displace for UXO

Tube B **Time** 1029 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" displace for UXO

Tube C **Time** 1033 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24"

D 1035 4-7 8" Refusal

Subcontractor (Name/Company):

Remarks: Refusal @ 6'

Laboratory Analysis:

☐VOC ☐ TAL METALS ☐ SVOCs ☐EXPLOSIVES ☐ PCBs ☐ PROPELLANTS

☒ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: Jeff D **DATE:** 3/26/13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU01 **Building No.** Pile C **VerticalGeoprobe No.** SB3

Sample Date: 3/26/13 **Time:** 0947 **Weather:** Ovcst, 33°, Calm

Subsurface ~~Horizontal~~ VERTICAL Sample ID: 078SB-0008M-0001-SO 1006

Duplicate Sample ID: 078SB- ~~0010M~~ 0009M -0001-SO 1006

Field Samplers: FR, RW,

Tube A **Time** 947 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 18" Refusal

Tube B **Time** 0951 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 38"

Tube C **Time** 1000 **Interval Drilled (ftbgs) :** 4-7 **Recovery (ft/in):** 21"

Tube D 1005 7-10 31"

Tube E 1007 10-13 10"

Subcontractor (Name/Company): FRONTZ

Remarks: Refusal again @ 10.8', significant lateral displacement for UXO
COLL DISCRETE VOC SAMPLE 4-7' on 3/27/13 078SB-0056M-0001SO

Laboratory Analysis:

☒VOC ☒TAL METALS ☒SVOCs ☐EXPLOSIVES ☒PCBs ☒PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☒ QA Sample Collected METALS ONLY – 078SB-0010M-0001SO 1006

RECORDED BY: **DATE:** 3/26/13
(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU01 **Building No.** Pile C **VerticalGeoprobe No.** SB-4

Sample Date: 3/26/13 **Time:** 1201 **Weather:** 34°, Ovcst, Calm

Subsurface ~~Horizontal~~ VERTICAL **Sample ID:** 078SB-0011M-0001-SO 1201

Duplicate Sample ID: —

Field Samplers: FR, RW, JS

Tube A **Time** 1150 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" Refusal @ 2.5'

Tube B **Time** 1157 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 20" Refusal @ 2'

Tube C **Time** ____ **Interval Drilled (ftbgs) :** ____ **Recovery (ft/in):** ____

Subcontractor (Name/Company): FRONTZ

Remarks: Refusal @ 2'

Laboratory Analysis:

☒VOC ☒TAL METALS ☒SVOCs ☐EXPLOSIVES ☒PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: ________ **DATE:** 3/26/13
(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: SB01 **Building No.** Pit C **VerticalGeoprobe No.** SB5

Sample Date: 3/26/13 **Time:** 1147 **Weather:** 33°, Ovcst, Calm

Subsurface ~~Horizontal~~ VERTICAL Sample ID: 078SB-0012M-0001-SO

Duplicate Sample ID: —

Field Samplers: FA, AW, JS

Tube A Time 1119 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" Relocate for UXO

Tube B Time 1123 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" Refusal @3.5'

Tube C Time 1135 **Interval Drilled (ftbgs) :** 4-7 **Recovery (ft/in):** 12" Refusal@ 5'

Subcontractor (Name/Company): FRONTZ

Remarks: Refusal @ 5', 1 Relocate for UXO

Laboratory Analysis:

☒VOC ☒TAL METALS ☒SVOCs ☐EXPLOSIVES ☒PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: ____________ **DATE:** 3/26/13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** Quarry Ponds

Decision Unit: DU2 **Building No.** Pile B **VerticalGeoprobe No.** SB-01

Sample Date: 3/26/13 **Time:** 1702 **Weather:** 34°, Overcast, Calm

VERTICAL 078SB-0015M-0001-SO

Subsurface Horizontal Sample ID: 1-4' 078SB-0013M-0001-SO 1702

4-7' -COULD NOT COLL - REFUSAL AT ~~4~~' 2

Duplicate Sample ID: —

Field Samplers: FA, RLW

Tube A **Time** 1557 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 25" Refusal@ 2'

Tube B **Time** 1601 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" Refusal@ 2'

Tube C **Time** 1605 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" Refusal@ 2'

Subcontractor (Name/Company): FRANTZ

Remarks: REFUSAL AT ~~4~~' 2' -COULD NOT COLL 4-7' SAMPLE

NO VOC COLL. AT 078SB-0013M-0001-SO

Laboratory Analysis:

~~☐VOC~~ ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☒ MS/MSD Sample Collected 078SB-0015M-0002-SO 1613

☐ QA Sample Collected

RECORDED BY: ____________ **DATE:** 3/26/13

(Signature)

FIELD LOG FORM

SUBSURFACE SOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU2 **Building No.** Pile B **Vertical Geoprobe No.** SB 2

Sample Date: 3/26/13 **Time:** 1626 **Weather:** 34°, Ovcst; Calm

Subsurface VERTICAL **~~Horizontal~~ Sample ID:** 078SB-0016M-0001-SO

Duplicate Sample ID: —

Field Samplers: FN, RW

Tube A **Time** 1617 **Interval Drilled (ft bgs) :** 1-4' **Recovery (ft/in):** 12" Refusal @ 1'

Tube B **Time** 1614 **Interval Drilled (ft bgs) :** 1-4' **Recovery (ft/in):** 12" Refusal @ 1'

Tube C **Time** 1623 **Interval Drilled (ft bgs) :** 1-4' **Recovery (ft/in):**

Subcontractor (Name/Company): FRONTZ

Remarks:

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☐ SVOCs ☐ EXPLOSIVES ☐ PCBs ☐ PROPELLANTS

☒ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: (Signature) **DATE:** 3/26/13

FIELD LOG FORM

SUBSURFACE SOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** Quarry Ponds

Decision Unit: DU 2 **Building No.** Pile B **Vertical Geoprobe No.** SB-3

Sample Date: 3/26/13 **Time:** 1656 **Weather:** 34°, Ovcst, Calm

Subsurface ~~Horizontal~~ VERTICAL **Sample ID:** 078SB-0017M-0001-SO

Duplicate Sample ID: 078SB-0018M-0001-SO 1656

Field Samplers: FR, RW

Tube A Time 1637 **Interval Drilled (ft bgs) :** 1-4 **Recovery (ft/in):** 22"

Tube B Time 1642 **Interval Drilled (ft bgs) :** 1-4 **Recovery (ft/in):** 24"

Tube C Time 1649 **Interval Drilled (ft bgs) :** 1-4 **Recovery (ft/in):**

Subcontractor (Name/Company): FRONTZ

Remarks: Refusal @ 2'

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☒ QA Sample Collected 078SB-0019M-0001-SO 1656 METALS ONLY

RECORDED BY: (Signature) **DATE:** 3/26/13

FIELD LOG FORM

SUBSURFACE SOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** Quarry Ponds

Decision Unit: DU 2 **Building No.** Pile B **Vertical Geoprobe No.** SB-4

Sample Date: 3/26/13 **Time:** 1710 **Weather:** 34°, Ovcst Calm

Subsurface VERTICAL ~~**Horizontal**~~ **Sample ID:** 078SO-0020M-0001-SO

Duplicate Sample ID: —

Field Samplers: FR, RW

Tube A Time 1656 **Interval Drilled (ft bgs) :** 1-4 **Recovery (ft/in):** 22"

Tube B Time 1658 **Interval Drilled (ft bgs) :** 1-4 **Recovery (ft/in):** 22"

Tube C Time ____ **Interval Drilled (ft bgs) :** ____ **Recovery (ft/in):** ____

Subcontractor (Name/Company): FRONTZ

Remarks: Refusal @ 2', 2 attempts

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: ____ **DATE:** 3/26/13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** Quarry Ponds

Decision Unit: DU 2 **Building No.** Pile B **VerticalGeoprobe No.** SB-5

Sample Date: 3/26/13 **Time:** 1553 **Weather:** 34°, Overcast, Calm - 5

Subsurface ~~Horizontal~~ VERTICAL Sample ID: 078SB-002IM-0001-SO

Duplicate Sample ID: —

Field Samplers: FA, RW

Tube A **Time** 1539 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 33"

Tube B **Time** 1545 **Interval Drilled (ftbgs) :** 4-7 **Recovery (ft/in):** 18" Refusal @ 7'

Tube C **Time** ______ **Interval Drilled (ftbgs) :** ______ **Recovery (ft/in):** ______

Subcontractor (Name/Company): FRONTZ

Remarks:

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: ______ **DATE:** 3/26/13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU 3 **Building No.** D-1a A **VerticalGeoprobe No.** SB01

Sample Date: 5/26/13 **Time:** 1238 **Weather:** 54°, Ovcst, Calm

VERTICAL 078SB-0025M-0001-SO 1238

Subsurface Horizontal Sample ID: 1-4' 078SB-0023M-0001-SO 1537

*4-7' 078SB-0024M-0001-SO 1535

Duplicate Sample ID: 078SB-0026M-0001-SO 1238

DSB 7-13' 078SB-0033-0001-SO 1242

Field Samplers: EA, RW

Tube A **Time** 1212 **Interval Drilled (ftbgs) :** 1-4' **Recovery (ft/in):** 36"

Tube B **Time** 1214 **Interval Drilled (ftbgs) :** 4-7' **Recovery (ft/in):** 18"

Tube C **Time** 1225 **Interval Drilled (ftbgs) :** 7-13' **Recovery (ft/in):** 18" Refusal @ 8.5'

Subcontractor (Name/Company): FRONTZ

Remarks: low Recovery 4-8' - NO VOC COLL. FOR 078SB-0023M-0001-SO

*MISSED COLL. VOC FROM 4-7' 078SB-0024M-0001-SO

WENT BACK ON 3-27-13 AND COLL. VOC FROM 4-7'

SAMPLE I.D = 078SB-0034-0001-SO

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☒ QA Sample Collected 078SB-0027M-0001-SO 1238

RECORDED BY: ______________________ **DATE:** 3-26-13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU3 **Building No.** Pile A **VerticalGeoprobe No.** SB-2

Sample Date: 3/26/13 **Time:** 12.45 **Weather:** 34° Ovcst, Calm w/flurries

Subsurface ~~Horizontal~~ VERTICAL **Sample ID:** 078SB-0028M-0001-SO

Duplicate Sample ID: —

Field Samplers: FR, RW

Tube A **Time** 13:02 **Interval Drilled (ftbgs) :** 1-4' **Recovery (ft/in):** 38"

Tube B **Time** 13:09 **Interval Drilled (ftbgs) :** 4-7' **Recovery (ft/in):** 36"

Tube C **Time** ______ **Interval Drilled (ftbgs) :** ______ **Recovery (ft/in):** ______

Subcontractor (Name/Company): FRONTZ

Remarks: SS

Laboratory Analysis:

☐VOC ☐ TAL METALS ☐ SVOCs ☐EXPLOSIVES ☐ PCBs ☐ PROPELLANTS

☒ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☑ QA Sample Collected 078SB-0029M-0001-SO

RECORDED BY: ______________ **DATE:** 3-26-13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP-78 **CR Site Name:** Quarry Pond

Decision Unit: DU3 **Building No.** Pug A **VerticalGeoprobe No.** SB-3

Sample Date: 3 26 13 **Time:** 1440 **Weather:** 34° F P/C

Subsurface ~~Horizontal~~ VERTICAL Sample ID: 078SB-0030M-0001-SO

Duplicate Sample ID: —

Field Samplers: FR, RW

Tube A **Time** 1415 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 43"

Tube B **Time** 1425 **Interval Drilled (ftbgs) :** 4-7' **Recovery (ft/in):** 18"

Tube C **Time** ______ **Interval Drilled (ftbgs) :** ______ **Recovery (ft/in):** ______

Subcontractor (Name/Company): FRONTZ

Remarks: Refusal @ 6'

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: ______________ **DATE:** 3-26-13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU3 **Building No.** Pile A **VerticalGeoprobe No.** ~~DU-2~~ SB-4

Sample Date: 3/26/13 **Time:** 1437 **Weather:** 34°, Ovcst, Flurries, W 0-3

Subsurface Horizontal Sample ID: 078SB-0031M-0001-SO 1505

Duplicate Sample ID: —

Field Samplers: FR, RW

Tube A **Time** 1440 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 38"

Tube B **Time** 1450 **Interval Drilled (ftbgs) :** 4-7 **Recovery (ft/in):** 56"

Tube C **Time** ____ **Interval Drilled (ftbgs) :** ____ **Recovery (ft/in):** ____

Subcontractor (Name/Company): Frontz

Remarks:

Laboratory Analysis:

☒VOC ☒ TAL METALS ☒SVOCs ☐EXPLOSIVES ☒PCBs ☒PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: **DATE:** 3/26/13

(Signature)

FIELD LOG FORM

SUBSURFACESOIL ISM SAMPLING

2011 PBA ENVIRONMENTAL INVESTIGATION AND REMEDIATION AT 14 CR SITES

USACE Contract No. W91QR-04-D-0039

Ravenna Army Ammunition Plant, Ravenna, Ohio

CR Site No. CC-RVAAP- 78 **CR Site Name:** Quarry Ponds

Decision Unit: DU 3 **Building No.** Pile A **VerticalGeoprobe No.** SB-5

Sample Date: 3/26/13 **Time:** 1538 **Weather:** Ovcst, 35°, Calm

Subsurface ~~Horizontal~~ VERTICAL Sample ID: 078SB-0032M-0001-SO

Duplicate Sample ID: —

Field Samplers: FM, AW

Tube A **Time** 1522 **Interval Drilled (ftbgs) :** 1-4 **Recovery (ft/in):** 24" Refusal @2'

Tube B **Time** ______ **Interval Drilled (ftbgs) :** ________ **Recovery (ft/in):** ________

Tube C **Time** ______ **Interval Drilled (ftbgs) :** ________ **Recovery (ft/in):** ________

Subcontractor (Name/Company): Frontz

Remarks: Refusal @ 2', 2 attempts

Laboratory Analysis:

☒ VOC ☒ TAL METALS ☒ SVOCs ☐ EXPLOSIVES ☒ PCBs ☒ PROPELLANTS

☐ FULL SUITE (VOCs, SVOCs, TAL Metals, Explosives, Propellants, PCBs, Pesticides)

☐ MS/MSD Sample Collected

☐ QA Sample Collected

RECORDED BY: ____________________ **DATE:** 3/26/13

(Signature)

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APPENDIX D.4

Daily Health and Safety Forms

Vision Integrity Results	**ECC**	**DAILY SAFETY MEETING SIGN-IN SHEET**

Date: 3-26-13
Company: ECC
Project Name/Location: Ravenna AAP, Ravenna, OH
Person Conducting Briefing: Jeff Donovan

1. AWARENESS (e.g., special EHS concerns, pollution prevention, recent incidents, etc.):

Vehicle Awareness – Speed Limit on Base
Lifting Coolers, sampling equipment, lift with your legs
Level D PPE unless upgraded due to site conditions
Use caution when working around drill rig

2. OTHER ISSUES (HASP changes, new AHAs, attendee comments, etc.):

POSSIBLE CONTACT W/ ACM - IF SUSPECTED ACM OBSERVED, CALL KEITH BICKEL (ACM INSPECTOR) TO CHECK MATERIAL

3. DISCUSSION OF DAILY ACTIVITIES/TASKS AND SAFETY MEASURES TO BE USED:

WILL CONDUCT SS + SUBSURFACE ISM SAMPLING AT CC 78 QUARRY POND SURFACE DUMP.

4. ATTENDEES (Print Name):

1. Jeff Donovan	2. Joe Teter
3. Henry Millard JR	4. Fred Riehle
5. Rich Mendenhall	6. Tomas Hernandez
7. KEITH BICKEL	8. Mike Greene
9. Jason Scott	10. Roxann Williams.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.
21.	22.
23.	24.
25.	26.
27.	28.
29.	30.

Vision
Integrity
Results

ECC

DAILY SAFETY MEETING SIGN-IN SHEET

Date: 3-27-13
Company: ECC
Project Name/Location: Ravenna AAP, Ravenna, OH
Person Conducting Briefing: Jeff Donovan

1. AWARENESS (e.g., special EHS concerns, pollution prevention, recent incidents, etc.):

Vehicle Awareness – Speed Limit on Base
Lifting Coolers, sampling equipment, lift with your legs
Level D PPE unless upgraded due to site conditions
Use caution when working around drill rig

2. OTHER ISSUES (HASP changes, new AHAs, attendee comments, etc.):

SMALL EXCAVATOR TO BE ONSITE AT CC78, KEEP AWAY FROM SWING AREA, MAINTAIN EYE CONTACT W/ OPERATOR WHEN IN AREA OF MACHINE

3. DISCUSSION OF DAILY ACTIVITIES/TASKS AND SAFETY MEASURES TO BE USED:

CONT. SAMPLING AT CC78, CONDUCT TEST PITTING AT CC78, MOVE TO RT 80 TANK FARM WHEN FINISHED

4. ATTENDEES (Print Name):

1. Jeff Donovan	2. Roxann Williams
3. Fred Roche	4. Tomas Hammarock
5. KEITH BICKEL	6. Mike Greene
7. Jason Scott	8. Rich Mendenhall
9. Henry Millard JR	10. Joe Teter
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.
21.	22.
23.	24.
25.	26.
27.	28.
29.	30.

APPENDIX D.5

Field Notes

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⑪ 3-25-13 Monday SNOW 3"

9:30 AM	DU3 SB-2 7' GRAVEL BLK 8"
9:40 AM	DU5 SB-2 5' SS REFUSAL
10:08 AM	DU5 SB-3 5'
10:24 AM	DU5 SB-5 5' SS REFUSAL
11:00 AM	DU5 SB-4 6.5' SS " "
11:21 AM	DU8 SB-3 6.5 SS REFUSAL
11:35 AM	DU8 SB-4 4.5 SS REFUSAL SAME
11:53 AM	DU8 SB-5 4.5 SS REFUSAL
12:20 P	LUNCH
1:20 P	RETURN FROM LUNCH
2:00 P	DU8 SB-2
2:30 P	DU8 SB-1
2:57 P	DU7 SB-5

JASON LOG/SAMPLED

17:43	FINISHED DU5, 8, 7, & 6
18:23	LEFT SITE

TM

3-26-13 Tuesday P/C TOM HERNANDEZ PG

7:28 AM	AT SITE 15:30 PM LEFT
8:30 AM	CC78
9:45 AM	DU1

---

⑫ 3-27-13 WED P/C COLD

7:25 AM	ON SITE
8:30 AM	CC78 - WENT TO GET VOCs @ DU1 & DU3 4-7'
9:55 AM	CC79 RT. 80 TANK FARM
10:17 AM	CC79 DU2 SB-5 - DSB 13'
10:42 AM	DU2 SB-4 7'
10:55 AM	DU2 SB-3 7'
11:08 AM	DU2 SB-2 7'
11:38 AM	DU2 SB-1 7'
11:52 AM	DU1 SB-1 7'
12:02 PM	DU1 SB-2 7'
12:08	DU1 SB-3 7'
12:16	DU1 SB-4 7'
12:27	DU1 SB-5 7'
12:45	LUNCH
13:45	CC73 NORTH COAL TIPPLE
13:55	DU1 SB-1 14' DSB*
14:27	DU1 SB 2 7'
14:45	DU1 SB-5 13' DSB*
15:10	DU1 SB-4 7'
15:22	DU1 SB 3 7'
15:34	PACKING UP
16:00	AT CC73 SANDY CREEK
17:32	LEFT FACILITY

TM

Mike Greene Staff Geologist

cc-78

- TP01

Depth: 3ft
Width: 2.5ft
Sample: NO ACM
Time: 10:12, 3-27-13
Remarks: Bedrock encountered at 3ft Bgs,
Soil Mixed, with cobbles

- TP02

Depth: 2Ft
Width: 2.5Ft
Sample: No ACM
Time: 10:30 3-27-13
Remarks: Sand Stone Bed rock encoutered at 2ft Bgs
Soil Mixed with cobbles

TP03
Depth: 8in
Width: 2.5 Ft
Sample: No ACM
Time: 10:57 3-27-13
Remarks Sandstone bedrock encountered at 8in bgs
Soil Mixed with cobbles

TP04
Depth: 1 Ft
Width: 2.5 Ft
Sample: No ACM
Time: 11:08 3-27-13
remarks: very little overborden (4in) with Bed rock
at 4-8in Comp Sandston ecountered 1 Ft bgs

TP10
Depth: 1.5
Width 2.5
Sample No AcM
Time: 11:18
remarks: standstone encountered at 1.5 Ft bgs
laminated weathered standstone Mixed in top 5-10in

TP05

Depth 1.8 Ft

Width 2.5ft Length 3 ft

Sample Yes, ACM at 3 in, 1 ft

Time : 11:29 , 3-27-13

remarks: Constrution Debris at 6 in (Mason Blocks); Sandstone Bedrock encountered at 1.8 ft

TP15

Depth 1.5

Width 2.5 length 3

Sample NO ACM

Time: 11:57 , 3-27-13

remarks sandstone bed rock encountered at 1.5 ft bgs
Weather bedrock at 8 in bgs

TP06

Depth 1.5 ft

Width 2.5 length 3

Sample: Yes full suite, NO

Time 12:11

remarks: Construstion Debris (slate roofing) ecountered 6 in bgs
bedrock encountered at 7 in

TP11

Depth 1 Ft

Width 2.5 length 6 ft

Sample: No ACM

Time 13:05 3-27-13

Remarks: Weather sandstone encountered at 4 in bgs, comp. sandstone at 1 ft bgs

TP09

Depth 1.5 ft

Width 2.5 length 5.5

Sample: No ACM

Time 13:16 3-27-13

remarks: Soil Top 6in, weathered sandston comp. bedrock at 1.5 ft bgs

TP07

Depth: 1.5

Width: 2.5 length 5 ft

Sample: Yes Full Suite

Time: 1332

remarks: Almost No over burden/ soil, weathered sandstone 1.5 bgs some clay Mixed in

TP08

Depth 2.5ft

Width 2.5ft length 5ft

Sample NO ACM

Time 13:56 3-27-13

remarks. Tie Metal Plates found in Top 6inchs, Bedrock encountered at 2.5 bgs

TP12

Depth 2.5 ft

Width 2.5 length 5ft

Sample NO ACM

Time 14:10 3-27-13

remarks; 6in of soil then large slap of sandston at 1ft hit comp. shale bedrock at 2.5 bgs

TP16

Depth 2ft

Width 2.5ft length 5ft

Sample NO ACM

Time 1435

remarks: Top 1ft soil. Weather sandstone from 1-2 ft. comp. Bedrock 2ft bgs.

TP17

Depth: 1.8 ft

Width 2.5 ft length 6 ft

Sample NO ACM

Time 1446 3-27-13

remarks. sandstone encountered at 1.8 ft bgs.

TP18

Depth 10 in

Width 2.5 length 5 ft

Sample No ACM

Time 1505 3-27-13

remarks. soils and organics top 8 inches. Comp sandstone
bedrock at 10 in bgs

TP19

Depth 1.5 ft

Width 2.5 ft length 5 ft

Sample NO ACM

Time 1520 3-27-13

remarks. very wet soil. bedrock at 1.5 bgs

TP20

Depth 4ft

Width2.5ft length 5ft

Sample NO ACM

Time: 1538 3-27-13

remarks Top 4ft Brown silty clay, stiff. Comp.
sandstone at 4ft bgs

TP13

Depth 1ft

Width2.5ft length 5ft

Sample NO ACM

Time 1601 3-27-13

remarks soil sandy clay and Brownish tan. comp sandstone
bedrock at 1ft bgs.

TP14

Depth 4.2 ft

Width2.5 length 5ft

Sample NO ACM

Time 16:20

remarks Tan clay silt top 3.2 ft. Comp. sandstone at
4.2 ft bgs

Mike Green

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APPENDIX D.6

Photoionization Detector Calibration Forms

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INSTRUMENT CALIBRATION LOG

Project/Site Name Ravenna, Ohio **Calibrated By** David Comeau

Instrument/Serial Number		Pre-calibration Reading	Post-calibration Reading	Calibration Gas/Concentration	Date
MiniRae ~~3000~~ PID 2000	06087	0.8 / 102	0.3/99.8	Isobutylene / 100ppm	3-18-13
MiniRae ~~3000~~ PID 2000	3443	0.4 / 107	1.0/101	Isobutylene / 100ppm	3-18-13
MiniRae ~~3000~~ PID 2000	3443	0.7/ 101	0.5/98.7	Isobutylene / 100ppm	3-19-13
MiniRae ~~3000~~ PID 2000	3443	0.2/104	1.2/103	Isobutylene / 100ppm	3-20-13
MiniRae ~~3000~~ PID 2000	3443	0.4/101	0.9/99.8	Isobutylene / 100ppm	3-21-13
MiniRae 3000 PID	3443	0.8/102	1.1/98.9	Isobutylene / 100ppm	3-22-13
MiniRae 3000 PID	3443	0.5/99.8	1.2/101.3	Isobutylene / 100ppm	3-23-13
MiniRae 3000 PID	3443	0.2/101	0.8/98.7	Isobutylene / 100ppm	3-25-13
MiniRae 3000 PID	3443	0.4/98.8	0.4/100.2	Isobutylene / 100ppm	3-26-13
MiniRae 3000 PID	3443	1.1/101.2	0.3/99.2	Isobutylene / 100ppm	3-27-13
MiniRae 3000 PID	3443	0.7/98.9	0.6/100.7	Isobutylene / 100ppm	3-28-13
MiniRae 3000 PID	3443	0.8/99.7	0.2/101.1	Isobutylene / 100ppm	3-29-13

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APPENDIX E:
Survey Data

CAMPBELL & ASSOCIATES, INC.
Land Surveyors
3485 Fortuna Drive, Suite 100
Akron, OH 44312
330.945.4117
FAX 330.945.4140
800-233-4117

August 20, 2013

Dear Mr. Easterday,

Please find the enclosed survey data for the following AOCs located at Camp Ravenna OH:

CC-RVAAP-68
CC-RVAAP-69
CC-RVAAP-70
CC-RVAAP-71
CC-RVAAP-72
CC-RVAAP-73
CC-RVAAP-74
CC-RVAAP-75
CC-RVAAP-76
CC-RVAAP-77
CC-RVAAP-78
CC-RVAAP-79
CC-RVAAP-83

If you have any questions please feel free to contact me.

Sincerely,

James P. Yurkschatt,
Ohio Surveyor License No. 7809
Vice President
Campbell and Associates, Inc.

CC78 UTM Zone 17 NAD 83 - 8/13/13

Easting (X)	Northing (Y)	Elev. Meters	Description	Ft Msl
490458.094	4558694.632	347.482	BORE cc78-quarry-du1-sb3	1140.019
490478.963	4558717.929	347.994	BORE cc78-quarry-du1-sb2	1141.699
490488.651	4558728.426	348.015	BORE cc78-quarry-du1-sb1	1141.768
490498.815	4558706.717	343.517	BORE cc78-quarry-du1-sb5	1127.011
490490.78	4558702.658	343.172	BORE cc78-quarry-du1-sb4	1125.879
490508.521	4558742.327	347.531	BORE cc78-quarry-du2-sb1	1140.180
490498.884	4558736.779	348.137	BORE tp17	1142.168
490498.88	4558736.956	347.699	cc78-quarry-tp17	1140.731
490487.755	4558754.708	349.209	cc78-quarry-tp18	1145.685
490523.837	4558706.187	346.782	BORE cc78-quarry-du2-sb2	1137.722
490527.845	4558669.451	346.351	BORE cc78-quarry-du2-sb3	1136.308
490519.477	4558669.507	346.042	Trav. Pt/mag	1135.295
490519.208	4558692.377	346.499	Trav. Pt/mag	1136.794
490521.127	4558736.12	347.043	cc78-quarry-tp16	1138.579
490506.761	4558756.579	347.579	cc78-quarry-tp1	1140.337
490483.22	4558751.945	349.249	Trav. Pt/mag	1145.816
490476.346	4558734.796	348.841	Trav. Pt/mag	1144.478
490474.62	4558773.769	350.184	cc78-quarry-tp20	1148.884
490491.767	4558767.716	349.503	cc78-quarry-tp19	1146.649
490535.285	4558759.446	349.472	cc78-quarry-tp2	1146.548
490537.512	4558758.997	349.803	BORE cc78-quarry-du3-sb1	1147.634
490525.361	4558777.133	351.95	Trav. Pt/mag	1154.678
490568.034	4558770.496	354.082	BORE cc78-quarry-du3-sb2	1161.672
490569.428	4558770.017	354.218	Trav. Pt/mag	1162.118
490577.636	4558753.134	350.58	cc78-quarry-tp4	1150.183
490565.273	4558756.357	349.943	cc78-quarry-tp3	1148.093
490571.945	4558734.432	350.783	cc78-quarry-tp5	1150.849
490564.113	4558734.83	350.415	cc78-quarry-tp15	1149.642
490569.045	4558720.008	350.939	BORE cc78-quarry-du3-sb5	1151.361
490567.368	4558719.259	350.792	cc78-quarry-tp6	1150.878
490552.034	4558739.004	349.76	cc78-quarry-tp10	1147.493
490586.739	4558733.472	354.78	BORE cc78-quarry-du3-sb3	1163.962
490538.824	4558733.102	348.893	cc78-quarry-tp12	1144.648
490568.045	4558736.188	350.216	Trav. Pt/mag	1148.989
490555.307	4558723.741	349.85	cc78-quarry-tp11	1147.788
490550.851	4558709.278	350.196	cc78-quarry-tp9	1148.923
490549.146	4558708.512	350.113	BORE cc78-quarry-du2-sb5	1148.651
490558.935	4558698.936	350.376	cc78-quarry-tp7	1149.514
490552.359	4558689.831	350.004	cc78-quarry-tp8	1148.293
490553.953	4558680.389	351.868	Trav. Pt/mag	1154.409
490557.773	4558679.524	352.036	BORE cc78-quarry-du3-sb4	1154.960
490552.992	4558673.162	351.606	cc78-quarry-tp13	1153.549
490556.4	4558655.353	353.252	cc78-quarry-tp14	1158.949
490530.215	4558645.836	346.1	BORE cc78-quarry-du2-sb4	1135.485

APPENDIX F:
Investigation-Derived Waste Disposal Letter Report

APPENDIX F

IDW Disposal Letter Report

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Regional Office
33 Boston Post Rd West
Suite 420
Marlborough, MA 01752

Phone: 508.229.2270
Fax: 508.229.7737

Corporate Office
1240 Bayshore Highway
Burlingame, CA 94010

Phone: (650) 347-1555

Fax: (650) 347-8789

www.ecc.net

May 22, 2013

Mr. Eric Cheng, P.E.
Technical Manager
U.S. Army Corps of Engineers, Louisville District
600 Martin Luther King Jr. Place
Louisville, Kentucky 40202-0059

Subject: Investigation-Derived Waste Letter Report
2011 Performance-Based Acquisition
Environmental Investigation and Remediation
14 Compliance Restoration Sites
Ravenna Army Ammunition Plant, Ravenna, Ohio
Contract No. W912QR-04-D-0039
Delivery Order No. 0004
Project No. 5161.004

Dear Mr. Cheng:

Investigation activities in accordance with the Site Inspection and Remedial Investigation Work Plan (October 2012) were conducted from 18 March 2013 through 5 April 2013. These activities resulted in the generation of Investigation-Derived Waste (IDW) consisting of soil cuttings from direct push borings and equipment decontamination fluids. The purpose of this letter report is to characterize and classify IDW for disposal and to propose methods for disposing of the IDW.

This letter report includes a summary of IDW generated, the origin of the IDW (Table 1), as well as proposed classification and recommendations for disposal of the IDW (Table 2). This letter report follows guidance established by the following:

1.) The Facility-Wide Sampling and Analysis Plan (SAIC 2011), and
2.) Final Site Inspection and Remedial Investigation (SI/RI) Work Plan (ECC 2012).

Three distinct IDW streams were sampled as part of the SI/RI Work Plan field activities. Each waste stream was composited and sampled per requirements outlined in Section 7.0 of the Facility-Wide Sampling and Analysis Plan (FWSAP) and SI/RI Work Plan. IDW streams generated are:

- One (1) 55-gallon drum containing equipment decontamination fluids (Liquinox, distilled water (DI), and HCL/nitric acid), sampled on 5 April 2013
- One (1) 55-gallon drum containing soils from RI sampling activities conducted at CC RVAAP-68 Electrical Substations East, West, and No. 3, sampled on 3 April 2013. This drum was sampled separately due to possible poly chlorinated byphynel (PCB) contamination
- Three (3) 55-gallon drums containing soils from RI sampling activities, sampled on 5 April 2013.

Per Section 7.0 of the Facility-Wide SAP, three composite samples were collected for Toxicity Characteristic Leaching Procedure (TCLP) parameters, flashpoint, reactivity, and corrosivity and submitted for laboratory analysis to characterize the following waste streams for disposal:

- Liquid IDW

The first sample (068SB-0063-0001-IDW) characterized one drum of decontamination fluid containing 2% hydrochloric acid (HCL)/10% nitric acid, deionized (DI) water, and Liquinox). This sample was analyzed for full TCLP plus poly chlorinated biphenyls (PCBs), flashpoint, reactivity, and corrosivity. Sampling equipment used at CC RVAAP-68 Electrical Substations East, West, and No. 3 were decontaminated following standard protocol. Liquid decontamination fluids generated during sampling at CC RVAAP-68 were containerized in the same drum as non-PCB sites. PCB's were a possible site chemical of concern (COC) at the Electrical Substations East, West, and No. 3 due to the former presence of transformers at these sites.

- Solid IDW

The second sample (068SB-0062-0001-IDW) was composited from three, 55-gallon drums containing soil cuttings.

- Solid IDW with possible PCBs

The third sample (078SB-0059-0001-IDW) was composited from one, 55-gallon drum containing soil cuttings. This drum was sampled separately as the soils may have been impacted with PCBs. These soils originated from drill cuttings collected at CC RVAAP-68 Electrical Substations East, West, and No. 3.

Table 1 summarizes the IDW samples collected.

Table 1 – Summary of Site Inspection/Remedial Investigation Investigation-Derived Waste

Container Type and Size	Contents	Generation Dates	Sample ID
55- Gallon Closed Top Drum	De-con Fluids from sampling equipment decontamination	18 March 2013 through 4 April 2013	068SB-0063-0001-IDW
55- Gallon Closed Top Drum	Soil Cuttings	18 March 2013 through 4 April 2013	068SB-0062-0001-IDW
55- Gallon Closed Top Drum	Soil Cuttings	18 March 2013 through 4 April 2013	068SB-0062-0001-IDW
55- Gallon Closed Top Drum	Soil Cuttings	18 March 2013 through 4 April 2013	068SB-0062-0001-IDW
55-Gallon Closed Top Drum	Soil Cuttings	29 March 2013 through 4 April 2013	078SB-0059-0001-IDW

Per Section 8.0 of the FWSAP, non-indigenous IDW is characterized for disposal on the basis of composite samples collected and submitted for laboratory analysis to characterize the waste stream for disposal. Upon receipt of analytical results from the laboratory, the analytical data was reviewed to determine if the waste was potentially hazardous. This review consisted of a comparison of the analytical results against the TCLP criteria presented in Table 8-1 and 8-2, Maximum Concentration of Contaminants for the Toxicity Characteristic (40 Code of Federal Regulation (CFR) 261.24), presented in the FWSAP. The results of this review are summarized below.

IDW –FLUIDS

One liquid composite sample (068SB-0063-0001-IDW) was collected. **Attachment 1** presents the analytical laboratory data for TCLP flashpoint, reactivity, and corrosivity analyses for IDW fluids generated during the 18 March through 5 April field activities. All analytical results were below regulatory levels as presented in Tables 8-1 and 8-2 in the FWSAP.

IDW –SOLIDS

Two solid composite samples (078SB-0059-0001-IDW, and 068SB-0062-0001-IDW) were collected. **Attachment 2** presents the analytical laboratory data for TCLP, flashpoint, reactivity, and corrosivity analyses for IDW solids generated during the 18 March through 5 April 2013 field activities. All analytical results were below regulatory levels as presented in Tables 8-1 and 8-2 in the FWSAP.

Please note the IDW addressed in this letter report has been characterized under provisions of the FWSAP using TCLP analysis and process knowledge. Unless RVAAP has additional information that would result in the IDW meeting, or containing materials that meet, the definition of a listed hazardous waste as defined in 40 CFR Part 261 Subpart D, it is recommended that the IDW, as presently characterized, be disposed as summarized in Table 2.

Table 2 - Summary of Final Waste Classification and Recommended Options

Medium	Waste Criterion	Disposal Recommendation
Water	Inorganics, Organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility
Soils	Inorganics, Organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility
Soils	Inorganics, Organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility

Since RVAAP, under RCRA, is the generator of this material, ECC requests concurrence or direction in the waste classification prior to disposal to ensure materials are properly disposed. Following your direction and immediate approval, ECC will proceed with appropriate waste disposal.

Should you have any questions or wish to discuss the proposed activities further, please do not hesitate to contact the undersigned at (508) 229-2270, ext. 22109, or via email.

Regards,
ECC

Alexander Easterday

Alexander Easterday
Senior Project Manager

Copy:	Ann Wood, ARNG
	Katie Tait, OHARNG
	Mark Patterson, RVAAP Facility Manager
	Eileen Mohr, Ohio EPA
	Ed D’Amato, Ohio EPA

ATTACHMENTS

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Attachment 1 – IDW Analytical Results - Fluids

Analysis Type	Chemical	Units	Reporting Limit	TCLP Criteria	Results
					068SB-0063-0001-IDW
TCLP Semi-Volatile Organics	1,4-Dichlorobenzene	mg/L	0.00080	7.50	0.00080 U
TCLP Semi-Volatile Organics	2,4,5-Trichlorophenol	mg/L	0.00080	400.00	0.00080 U
TCLP Semi-Volatile Organics	2,4,6-Trichlorophenol	mg/L	0.00080	2.00	0.00080 U
TCLP Semi-Volatile Organics	2,4-Dinitrotoluene	mg/L	0.00080	0.13	0.00080 U
TCLP Semi-Volatile Organics	Hexachlorobenzene	mg/L	0.00010	0.13	0.00010 U
TCLP Semi-Volatile Organics	Hexachlorobutadiene	mg/L	0.00080	0.50	0.00080 U
TCLP Semi-Volatile Organics	Hexachloroethane	mg/L	0.00080	3.00	0.00080 U
TCLP Semi-Volatile Organics	3 &4 Methylphenol	mg/L	0.00080	200	0.00080 U
TCLP Semi-Volatile Organics	2-Methylphenol	mg/L	0.00080	200	0.00080 U
TCLP Semi-Volatile Organics	Nitrobenzene	mg/L	0.00010	2.00	0.00010 U
TCLP Semi-Volatile Organics	Pentachlorophenol	mg/L	00024	100.00	0.0024 U
TCLP Semi-Volatile Organics	Pyidine	mg/L	0.00080	5.00	0.00080 U
TCLP Metals	Arsenic	mg/L	0.010	5.00	0.010 U
TCLP Metals	Barium	mg/L	0.0050	100.00	0.20 J
TCLP Metals	Cadmium	mg/L	0.0010	1.00	0.00057 J
TCLP Metals	Chromium	mg/L	0.0040	5.00	0.0040 U
TCLP Metals	Lead	mg/L	0.0050	5.00	0.0050 U
TCLP Metals	Mercury	mg/L	0.00020	0.20	0.00020 U
TCLP Metals	Selenium	mg/L	0.010	1.00	0.010 U
TCLP Metals	Silver	mg/L	0.0050	5.00	0.0050 U
TCLP Herbicides	2,4,5-TP (Silvex)	mg/L	0.00010	1.00	0.00010 U
TCLP Herbicides	2,4-D	mg/L	0.00025	10.00	0.00025 U
TCLP Pesticides	Chlordane	mg/L	0.000079	0.03	0.000079 U
TCLP Pesticides	Endrin	mg/L	0.000026	0.02	0.000026 U
TCLP Pesticides	Gamma-BHC (Lindane)	mg/L	0.000024	0.40	0.000024 U
TCLP Pesticides	Heptachlor	mg/L	0.000024	0.01	0.000024 U
TCLP Pesticides	Heptachlor Epoxide	mg/L	0.000024	0.01	0.000024 U
TCLP Pesticides	Methoxychlor	mg/L	0.000077	10.00	0.000077 U
TCLP Pesticides	Toxaphene	mg/L	0.0012	0.50	0.0012 U
TCLP Volatile Organics	1,1-Dichloroethene	mg/L	0.013	0.70	0.013 U
TCLP Volatile Organics	1,2-Dichloroethane	mg/L	0.013	0.50	0.013 U
TCLP Volatile Organics	2-Butanone	mg/L	0.025	200	0.030 J
TCLP Volatile Organics	Benzene	mg/L	0.013	0.50	0.013 U
TCLP Volatile Organics	Carbon Tetrachloride	mg/L	0.013	0.50	0.013 U
TCLP Volatile Organics	Chlorobenzene	mg/L	0.013	100.00	0.013 U
TCLP Volatile Organics	Chloroform	mg/L	0.025	6.00	0.013 U
TCLP Volatile Organics	Tetrachloroethylene	mg/L	0.025	0.70	0.025 U
TCLP Volatile Organics	Trichloroethene	mg/L	0.013	0.50	0.013 U
TCLP Volatile Organics	Vinyl Chloride	mg/L	0.013	0.20	0.013 U
PCBs	Aroclor – 1221	µg/L	1.1	-	1.1 U
PCBs	Aroclor – 1016	µg/L	1.1	-	1.1 U
PCBs	Aroclor – 1232	µg/L	2.2	-	1.1 U
PCBs	Aroclor – 1242	µg/L	1.1	-	2.2 U
PCBs	Aroclor – 1248	µg/L	1.1	-	1.1 U
PCBs	Aroclor – 1254	µg/L	1.1	-	1.1 U
PCBs	Aroclor – 1260	µg/L	1.1	-	1.1 U
Flashpoint	Flashpoint	°F	1.0	-	>180 °F
Reactivity	Cyanide, total	mg/L	0.010	-	0.010 U
Reactivity	Sulfide	mg/L	2.5	-	2.5 U
Corrosivity	Corrosivity	SU	0.100	-	7.87

Notes:
J – Estimated value
U – Undetected above laboratory reporting limit
mg/L – milligrams per liter
µg/L – mircograms per liter
SU – Standard units
°F – degrees Fahrenheit

Attachment 2 – IDW Analytical Results - Solids

Analysis Type	Chemical	Units	Reporting Limit	TCLP Criteria	Results	
					068SB-0062-0001-IDW	078SB-0059-0001-IDW
TCLP Semi-Volatile Organics	1,4-Dichlorobenzene	mg/L	0.00080	7.50	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	2,4,5-Trichlorophenol	mg/L	0.00080	400.00	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	2,4,6-Trichlorophenol	mg/L	0.00080	2.00	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	2,4-Dinitrotoluene	mg/L	0.00080	0.13	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	Hexachlorobenzene	mg/L	0.00010	0.13	0.00010 U	0.00010 U
TCLP Semi-Volatile Organics	Hexachlorobutadiene	mg/L	0.00080	0.50	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	Hexachloroethane	mg/L	0.00080	3.00	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	3 & 4 Methylphenol	mg/L	0.00080	200	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	2-Methylphenol	mg/L	0.00080	200	0.00080 U	0.00080 U
TCLP Semi-Volatile Organics	Nitrobenzene	mg/L	0.00010	2.00	0.00010 U	0.00010 U
TCLP Semi-Volatile Organics	Pentachlorophenol	mg/L	00024	100.00	0.0024 U	0.0024 U
TCLP Semi-Volatile Organics	Pyidine	mg/L	0.00080	5.00	0.00080 U	0.00080 U
TCLP Metals	Arsenic	mg/L	0.010	5.00	0.0045 J	0.0042 J
TCLP Metals	Barium	mg/L	0.0050	100.00	0.60 J	0.46 J
TCLP Metals	Cadmium	mg/L	0.0010	1.00	0.0023 J	0.00043 J
TCLP Metals	Chromium	mg/L	0.0040	5.00	0.0027 J	0.0018 J
TCLP Metals	Lead	mg/L	0.0050	5.00	0.0050 U	0.0050 U
TCLP Metals	Mercury	mg/L	0.00020	0.20	0.00020 U	0.00020 U
TCLP Metals	Selenium	mg/L	0.010	1.00	0.0051 J	0.0042 J
TCLP Metals	Silver	mg/L	0.0050	5.00	0.0050 U	0.0050 U
TCLP Herbicides	2,4,5-TP (Silvex)	mg/L	0.00010	1.00	0.00010 U	0.00010 U
TCLP Herbicides	2,4-D	mg/L	0.00025	10.00	0.00033 J	0.00025 U
TCLP Pesticides	Chlordane	mg/L	0.000079	0.03	0.000079 U	0.000079 U
TCLP Pesticides	Endrin	mg/L	0.000026	0.02	0.000026 U	0.000026 U
TCLP Pesticides	Gamma-BHC (Lindane)	mg/L	0.000024	0.40	0.000024 U	0.000024 U
TCLP Pesticides	Heptachlor	mg/L	0.000024	0.01	0.000024 U	0.000024 U
TCLP Pesticides	Heptachlor Epoxide	mg/L	0.000024	0.01	0.000024 U	0.000024 U
TCLP Pesticides	Methoxychlor	mg/L	0.000077	10.00	0.000077 U	0.000077 U
TCLP Pesticides	Toxaphene	mg/L	0.0012	0.50	0.0012 U	0.0012 U
TCLP Volatile Organics	1,1-Dichloroethene	mg/L	0.013	0.70	0.013 U	0.013 U
TCLP Volatile Organics	1,2-Dichloroethane	mg/L	0.013	0.50	0.013 U	0.013 U
TCLP Volatile Organics	2-Butanone	mg/L	0.025	200	0.025 U	0.025 U
TCLP Volatile Organics	Benzene	mg/L	0.013	0.50	0.013 U	0.013 U
TCLP Volatile Organics	Carbon Tetrachloride	mg/L	0.013	0.50	0.013 U	0.013 U
TCLP Volatile Organics	Chlorobenzene	mg/L	0.013	100.00	0.013 U	0.013 U
TCLP Volatile Organics	Chloroform	mg/L	0.025	6.00	0.013 U	0.013 U
TCLP Volatile Organics	Tetrachloroethylene	mg/L	0.025	0.70	0.025 U	0.025 U
TCLP Volatile Organics	Trichloroethene	mg/L	0.013	0.50	0.013 U	0.013 U
TCLP Volatile Organics	Vinyl Chloride	mg/L	0.013	0.20	0.013 U	0.013 U
PCBs	Aroclor – 1221	µg/Kg	1.1	-	NA	29 U
PCBs	Aroclor – 1016	µg/Kg	1.1	-	NA	29 U
PCBs	Aroclor – 1232	µg/Kg	2.2	-	NA	29 U
PCBs	Aroclor – 1242	µg/Kg	1.1	-	NA	29 U
PCBs	Aroclor – 1248	µg/Kg	1.1	-	NA	29 U
PCBs	Aroclor – 1254	µg/Kg	1.1	-	NA	29 U
PCBs	Aroclor – 1260	µg/Kg	1.1	-	NA	29 U
Flashpoint	Flashpoint	°F	1.0	-	>180 °F	>180 °F
Reactivity	Cyanide, total	mg/Kg	0.010	-	0.03 U	0.038
Reactivity	Sulfide	mg/Kg	2.5	-	32 U	89
Corrosivity	Corrosivity	SU	0.100	-	7.22	8.20

Notes:
J – Estimated value
U – Undetected above laboratory reporting limit
mg/L – milligrams per liter
µg/Kg – mircograms per kilogram
SU – Standard units for pH
°F – degrees Fahrenheit

Ohio EPA
40 years and moving forward

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

June 5, 2013

RE: RAVENNA ARMY AMMUNITION PLANT
PORTAGE/TRUMBULL COUNTIES
CC SITES IDW
OHIO EPA ID # 67000859155

CERTIFIED LETTER 70101060000000898534

Mr. Mark Patterson
Environmental Program Manager
Ravenna Army Ammunition Plant
Building 1037
8451 State Route 5
Ravenna, OH 44266-9297

Dear Mr. Patterson:

The Ohio Environmental Protection Agency (Ohio EPA), Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) has received and reviewed the document entitled: *"Investigation-Derived Waste Letter Report, 2011 Performance–Based Acquisition, Environmental Investigation and Remediation, 14 Compliance Restoration Sites, Ravenna Army Ammunition Plant, Ravenna, Ohio."* This letter report, dated May 22, 2013 and received at Ohio EPA on June 04, 2013, was prepared for the U.S. Army Corps of Engineers (USACE) – Louisville District by ECC under Contract Number W912QR-04-D-0039.

Based upon the presented results, the Ohio EPA is in agreement that the liquid Investigation Derived Wastes (IDW) should be disposed of at a permitted wastewater treatment facility and the soils at a permitted solid waste facility. As generator of the material, it is the responsibility to ensure that all wastes are disposed of in accordance with applicable state, federal, and local rules, laws and regulations; and that analytical testing is also conducted in accordance with the accepting facility's requirements.

If you have any questions concerning this correspondence, please do not hesitate to contact me at 330-963-1221.

Sincerely,

Eileen T. Mohr
Project Manager
Division of Environmental Response and Revitalization

EM:ds

pc: Katie Tait, OHARNG
Ann Wood, ARNGD
Cullen Grasty, USACE Louisville

ec: Justin Burke, Ohio EPA, DERR, CO
Nancy Zikmanis, Ohio EPA, DERR, NEDO
Todd Fisher, Ohio EPA, DERR, NEDO
Ed D'Amato, Ohio EPA, DERR, NEDO

E-MAILED
6-7-2013 GH

Scanned
By: GH
Date: 6-7-2013

Northeast District Office • 2110 East Aurora Road • Twinsburg, OH 44087-1924
www.epa.ohio.gov • (330) 963-1200 • (330) 487-0769 (fax)

RECEIVED
6-7-2013
GH

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

OhioEPA
Northeast District Office
2110 E. Aurora Road
Twinsburg, Ohio 44087

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

MR. MARK PATTERSON
ENVIRONMENTAL PROGRAM MANAGER
RVAAP BLDG 1037
8451 STATE ROUTE 5
RAVENNA, OH 44266-9297

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Gail Harr ☒ Agent ☐ Addressee

B. Received by (*Printed Name*)
Gail Harris

C. Date of Delivery
6-7-2013

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (*Extra Fee*) ☐ Yes

2. Article Number
(*Transfer from service label*)
70101060000000898534 EM:ds 6 5 13

PS Form **3811**, February 2004 Domestic Return Receipt 102595-02-M-1540

COPY

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: OH5 210 020 736

2. Page 1 of 1

3. Emergency Response Phone: 330-677-0785

4. Waste Tracking Number: 08513

5. Generator's Name and Mailing Address

Ravenna Army Ammunition Plant
8451 State Route 5
Ravenna Ohio 44266

Generator's Site Address (if different than mailing address): Same

Generator's Phone: 330-358-2920

6. Transporter 1 Company Name: Emerald Environmental Services, Inc — U.S. EPA ID Number: OHR 000 102 053

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address

Vexor Technology
955 West Smith Road
Medina, Ohio 44256

U.S. EPA ID Number: OHD 077 772 895

Facility's Phone: 330-721-9773

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non DOT Regulated, Non Hazardous Material ~~(Purge Water)~~ (SOIL CUTTINGS)	4	DM	1400	P
2. Non DOT Regulated, Non Hazardous Material (PURGE WATER) (DECON FLUID)	1	DM	59	G
3.				
4.				

13. Special Handling Instructions and Additional Information

9.1.) Approval # VEX 25094
9.2.) Approval # VEX 25095

Job Number: 13-0081EES

14. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: Mark Patterson — Signature: Mark Patterson — Month Day Year: 8 15 13

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Darrin Bowers — Signature: Darin Bowers — Month Day Year: 8 15 13

Transporter 2 Printed/Typed Name: — Signature: — Month Day Year:

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number:

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Tim O'Brien — Signature: — Month Day Year: 08 15 13

169-BLC-O 5 11977 (Rev. 8/06)

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APPENDIX G:
Data Validation Report