Final Action Memorandum:
RVAAP-34 Sand Creek Disposal Road Landfill at Former Ravenna Army Ammunition Plant Camp James A. Garfield Joint Military Training Center

Portage and Trumbull Counties, Ohio

September 2019

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Final Action Memorandum
Excavation and Offsite Disposal for the
RVAAP-34 Sand Creek Disposal Road Landfill
Camp James A. Garfield Joint Military Training Center/
Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

This Action Memorandum presents the selected alternative (Alternative 2 - *Excavation and Off-site Disposal for Soil Containing Arsenic and Ex-situ Thermal Treatment for Soil with PAHS (benzo(a)pyrene and benzo(b)fluoranthene*) as recommended in the Engineering Evaluation and Cost Analysis (EE/CA) (USACE, 2019) for the RVAAP-34 Sand Creek Disposal Road Landfill area of concern (AOC) at the Camp James A. Garfield (CJAG) (formerly the Ravenna Army Ammunition Plant - RVAAP) in Portage and Trumbull counties, Ohio. The US Army is the lead agency under the Defense Environmental Restoration Program (DERP) at the Ravenna Army Ammunition Plant, and developed this Action Memorandum consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, and consistent with the National Oil and Hazardous Substances Contingency Plan (NCP). This decision document will be incorporated into the larger Administrative Record file for the former Ravenna Army Ammunition Plant, which is available for public view at 1438 State Route 534 SW, Newton Falls, Ohio 44444.

This document, presenting a selected Alternative 2 Excavation and Offsite Disposal with a present worth cost estimate of $142,400 is approved by the undersigned, pursuant to:

- Memorandum, DAIM-ZA, 9 Sept 2003, subject: Policies for Staffing and Approving Decision Documents (DDs);

- Memorandum, 18 Jan 2017, subject: Department of the Army Decision Document Policy; and

- Memorandum, Assistant Chief of Staff for Installation Management (ACISM), DAIM-ZB, 16 Apr 08, subject: Army Environmental Compliance-related Cleanup Policy Guidance.

APPROVED:

HAMMETT.ANTHONY.SCOTT.1116575562 Digitally signed by HAMMETT.ANTHONY.SCOTT.1116575562 Date: 2020.07.21 23:44:24 -04'00'

Anthony Hammett
Colonel, U.S. Army
Chief, G9
Army National Guard

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ACRONYMS AND ABBREVIATIONS

95% UCL	Upper Confidence Limits
ACM	Asbestos Containing Material
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
ARNG	Army National Guard
bgs	Below Ground Surface
BSV	Background Screening Value
C&DD	Construction and Demolition Debris
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPECs	Chemicals of Potential Ecological Concern
CJAG	Camp James A. Garfield Joint Military Training Center
DD	Decision Document
DERP	Defense Environmental Restoration Program
DERR	Division of Environmental Response and Revitalization
DFFO	Director's Final Findings and Orders
DGM	digital geophysical mapping
DOD	Department of Defense
DU	Decision Units
EE/CA	Engineering Evaluation/Cost Analysis
EQM	Environmental Quality Management, Inc.
EU	Exposure Unit
FS	Feasibility Study
ft	feet
FWBWQS	Facility Wide Biological Water Quality Study
HHRA	Human Health Risk Assessment
HHRAM	Human Health Risk Assessment Manual
IRP	Installation Restoration Program
ISM	Incremental Sampling Methodology
LUCs	Land Use Controls
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
NCP	National Contingency Plan
NGT	National Guard Trainee

NPL	National Priorities List
NTCRA	Non-Time Critical Removal Action
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OWQS	Ohio Water Quality Standards
PA	Preliminary Assessment
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PRGs	Preliminary Remediation Goal
RA	Removal Action
RAO	Remedial Action Objective
RD/RA	Remedial Design/Removal Action
RI	Remedial Investigation
RmAO	Removal Action Objectives
RRSE	Relative Risk Site Evaluation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation (now Leidos)
Shaw	Shaw Environmental & Infrastructure, Inc. (now CB&I)
SI	Site Inspection (Phase I RI)
SLERA	Screening Level Ecological Risk Assessment
SOR	Sum of Ratios
sq ft	square feet
SVOCs	Semivolatile Organic Compounds
TAL	Target Analyte List
USACE	United States Army Corps of Engineers
USACHPPM	United States Army Center for Health Promotion and Preventative Medicine (now known as Army Public Health Center)
USAEC	United States Army Environmental Command
USAESC	United States Army Engineering and Support Center
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

SECTION 1: INTRODUCTION

1.1 PURPOSE

The United States Army Corps of Engineers, Louisville District (USACE) prepared this Action Memorandum to document approval for the selection of Alternative 2 - *Excavation and Off-site Disposal for Soil Containing Arsenic and Ex-situ Thermal Treatment for Soil with PAHS (benzo(a)pyrene and benzo(b)fluoranthene)* as recommended in the Engineering Evaluation and Cost Analysis (EE/CA) (USACE, 2019). The EE/CA was completed for the RVAAP-34 Sand Creek Disposal Road Landfill area of concern (AOC) at the Camp James A. Garfield Joint Military Training Center (CJAG) (formerly the Ravenna Army Ammunition Plant - RVAAP) in Portage and Trumbull counties, Ohio. This is a non-critical time removal action (NTCRA) (DOE, 1998 and USEPA, 2000). The chemicals of concern (COCs) in soil for human health are arsenic and two polycyclic aromatic hydrocarbons (benzo(a)pyrene and benzo(b)fluoranthene. No COCs were identified in surface water or sediment. No chemicals of ecological concern were identified for the AOC.

The U.S. Army is the lead agency under the Defense Environmental Restoration Program (DERP) at the Ravenna Army Ammunition Plant, and developed this Action Memorandum consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, and consistent with the National Oil and Hazardous Substances Contingency Plan (NCP). This decision document will be incorporated into the larger Administrative Record file for the former Ravenna Army Ammunition Plant, which is available for public view at CJAG, 1438 State Route 534 SW, Newton Falls, Ohio 44444.

In addition, an Information Repository of current information and final documents is available to any interested reader at the following libraries:

Reed Memorial Library
167 East Main Street
Ravenna, Ohio 44266

Newton Falls Public Library
204 South Canal Street
Newton Falls, Ohio 44444-1694

The RVAAP Restoration Program has an online resource for restoration news and information. This website can be viewed at www.rvaap.org.

1.2 GENERAL FACILITY DESCRIPTION

The former RVAAP (Federal Facility Identification [ID] No. OH5210020736) is federally owned and is located in northeastern Ohio within Portage County and Trumbull County, approximately 3 miles east-northeast of the city of Ravenna (**Figure 1-1**). The Installation is approximately 11 miles long and 3.5 miles wide. It is bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garrett, McCormick, and Berry Roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (**Figure 1-2**). The Installation is surrounded by several communities: Windham on the north, Garrettsville 6 miles to the northwest, Newton Falls 1 mile to the southeast, Charlestown to the southwest, and Wayland 3 miles to the south.

As of September 2013, administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and the property subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site, Camp James A. Garfield. The restoration program at the former RVAAP involves cleanup of former production/operational areas throughout the facility related to activities that were conducted there.

1.3 FORMER RVAAP OPERATIONAL HISTORY AND MISSION

Constructed in 1940, production at the former RVAAP began in December 1941, with the primary missions of depot storage and ammunition loading. The Installation was divided into two separate units: the Portage Ordnance Depot and the Ravenna Ordnance Plant. The depot's primary mission was storage of munitions and components, while the mission of the ordnance plant was loading and packing major caliber artillery ammunition and the assembly of munitions-initiating components that included fuzes, boosters, and percussion elements. In August 1943, the Installation was re-designated as the Ravenna Ordnance Center, and in November 1945, it was re-designated as the Ravenna Arsenal.

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Other load lines were used to manufacture fuzes, primers, and boosters. From 1946 to 1949, one facility (Load Line 12) was used to produce ammonium nitrate for explosives and fertilizers. Demilitarization activities were also conducted at RVAAP that included disassembly of hot water or steam melt extraction of explosive compounds from varied-sized military projectiles. Periodic demilitarization of various munitions continued through 1992.

Other areas at RVAAP were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consisted of large parcels of open space or abandoned quarries. A landfill also exists at the former RVAAP. Principal contaminants include explosives, propellants, metals, and semivolatile organics.

The plant was placed in standby status in 1950 and reactivated during the Korean Conflict to load and pack major caliber shells and components. All production ended in August 1957, and in October 1957 the Installation again was placed in a standby condition. In October 1960 the ammonium nitrate line was renovated for demilitarization operations, which involved melting explosives out of bomb casings for subsequent recycling. These operations began in January 1961. In July 1961, the plant was deactivated again. In November 1961, the Installation was divided into the Ravenna Ordnance Plant and an industrial section, with the entire Installation designated as the former RVAAP.

In May 1968, loading, assembling, and packing munitions began on three load lines and two component lines to support the Southeast Asia conflict. These facilities were deactivated in

August 1972. The destruction of M71A1 90-millimeter (mm) projectiles extended from June 1973 until March 1974. Demilitarization of various munitions was conducted from October 1982 through 1992.

Until 1993, the former RVAAP maintained the capability to load, assemble, and pack military ammunition. As part of the former RVAAP mission, the U.S. Army maintained inactive facilities in a standby status by keeping equipment in a condition to allow resuming production within prescribed limitations. In September 1993, the U.S. Army placed the former RVAAP in inactive caretaker status, which subsequently changed to modified caretaker status. The load lines and associated real estate were determined to be excess by the U.S. Army.

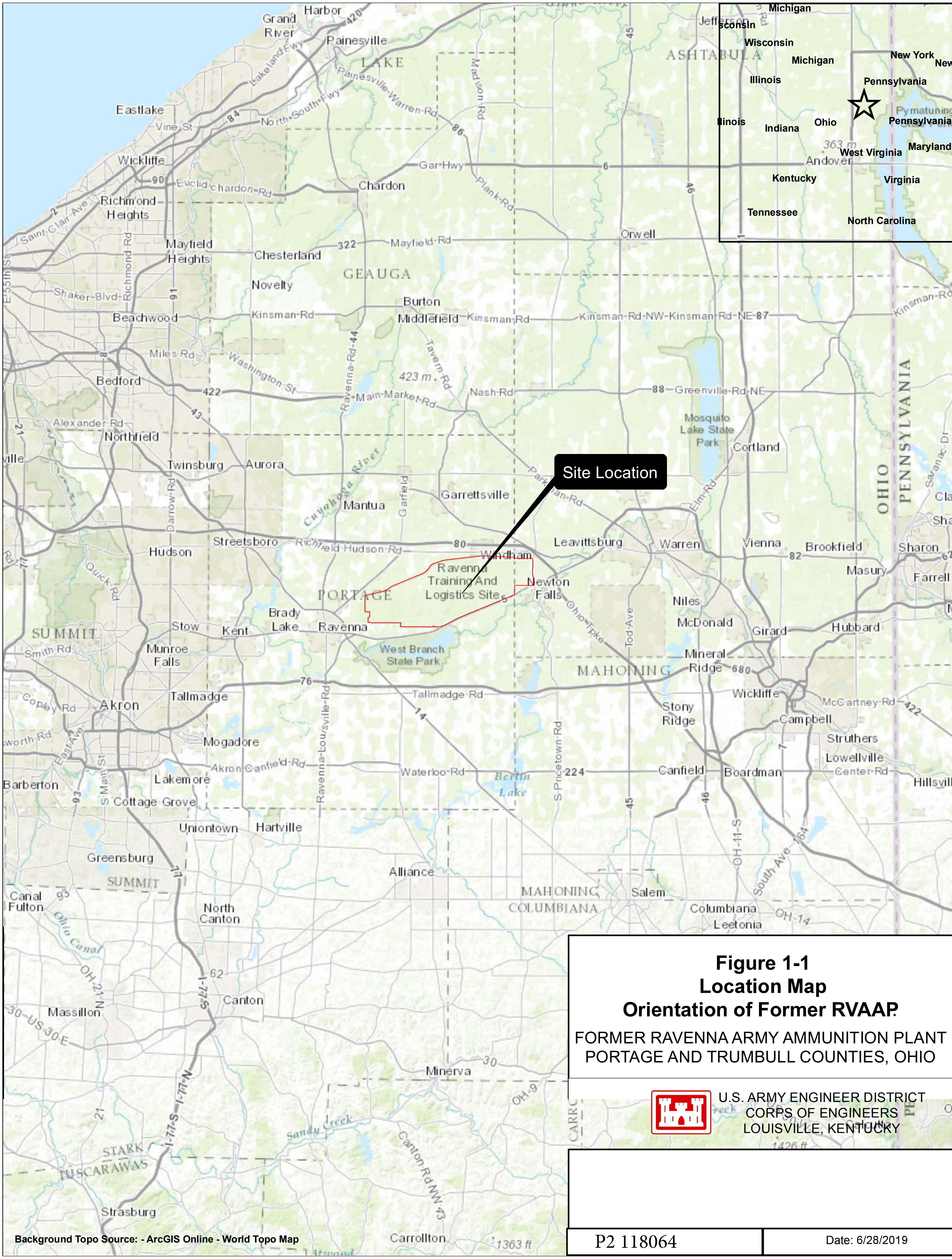

Figure 1-1
Location Map
Orientation of Former RVAAP

FORMER RAVENNA ARMY AMMUNITION PLANT
PORTAGE AND TRUMBULL COUNTIES, OHIO

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

P2 118064

Date: 6/28/2019

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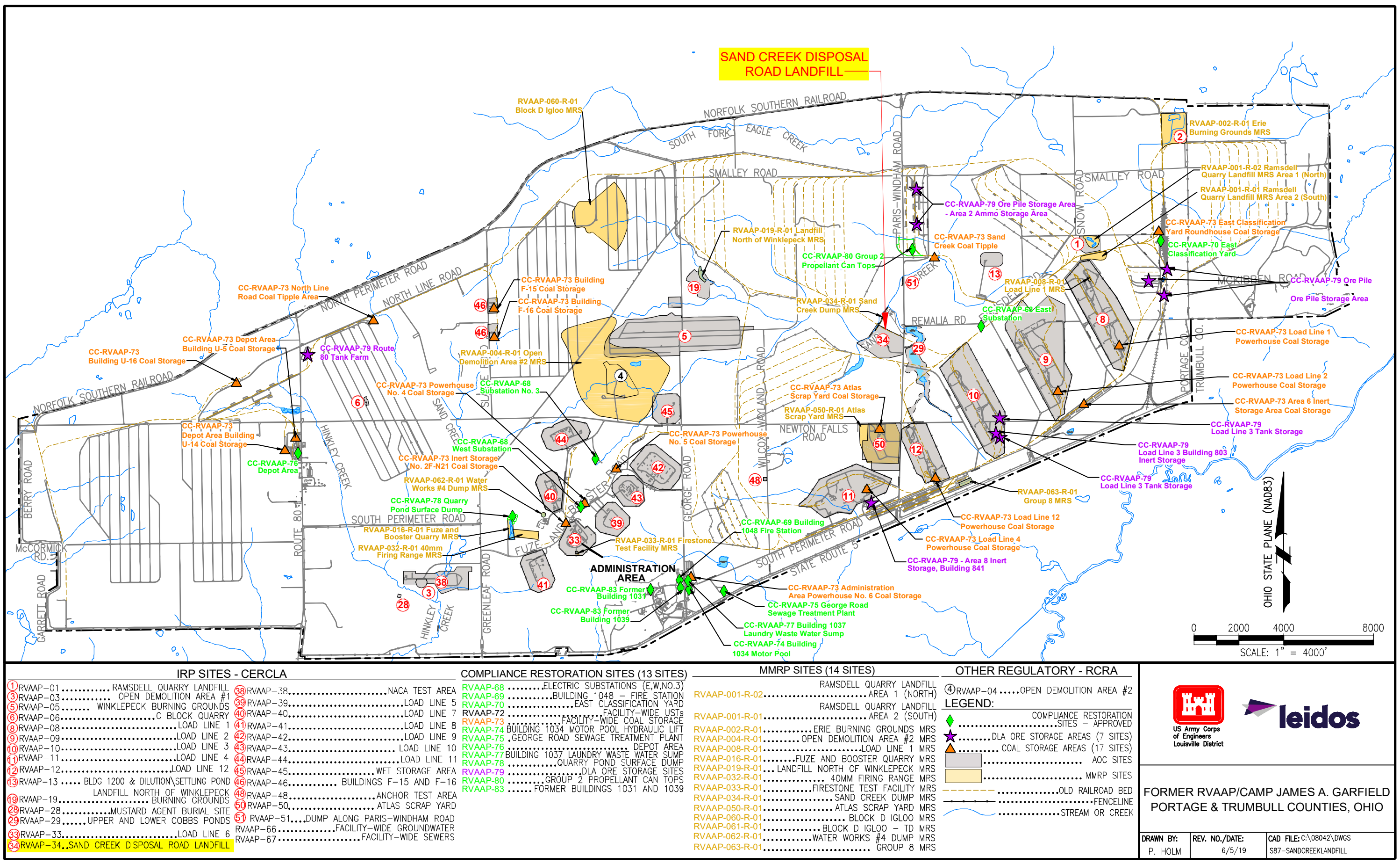


FIGURE 1-2. RVAAP-34 Sand Creek Disposal Road Landfill and Camp James A. Garfield Map.

SECTION 2: SITE DESCRIPTION AND HISTORY

2.1 RVAAP-34 SITE DESCRIPTION

The Sand Creek Disposal Road Landfill is located in the central eastern portion of the former RVAAP and was used as an open dump area (**Figure 2-1**). The operational history of disposal activities at the site is incomplete. Construction and demolition debris (C&DD) type material were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek. The dump site extended along the embankment for approximately 1,200 feet and varied in width from 20 to 40 feet from the top of the bank to the bottom (**Figure 2-1**).

The size of the defined AOC is approximately 1 acre. The bank slopes from east to west towards Sand Creek at 40 to 60 degrees from the horizontal. There are no records indicating the quantities or materials dumped at the site and the dates of operation for the landfill are unknown. Several buildings associated with the former Sand Creek Sewage Treatment Plant are located northeast of the site. Surface water runoff follows the topography of the site and flows in a westerly direction where it enters Sand Creek. A very narrow floodplain occupies the land between the bottom of the embankment and Sand Creek. A former railroad bed bisects the AOC (MKM, 2004).

During the preliminary site assessment work on the Sand Creek AOC, the site was very overgrown with mature trees and ground level vegetation. The entire site was littered with C&DD materials with large piles of debris concentrated mostly in the southern portion of the AOC. Some of the types of C&DD materials identified during the preliminary site assessment included the following:

- Asbestos-containing material (ACM) (i.e., large piles of corrugated transite roofing and flat transite siding)
- Rubble (i.e., concrete, brick, and masonry fragments)
- Drywall and plaster
- Glass bottles, fluorescent light tubes, and broken glass
- Scrap metal items including wire fencing
- Wooden debris.

2.2 PREVIOUS INVESTIGATIONS

Several investigations and other activities have been conducted at the Sand Creek Site which included a preliminary assessment (PA), RA, confirmatory sampling, a Facility wide Baseline Water Quality Study, a Digital Geophysical Mapping (DGM) survey, a Phase I (Site Inspection), and a Phase II RI. A discussion of these activities and the results/recommendations is presented further in this Section.

2.2.1 Preliminary Assessment (1996)

In 1996, SAIC was contracted by the USACE to conduct a Preliminary Assessment (PA) at various AOCs at the former RVAAP. The purpose of the PA was to collect information concerning conditions at the former RVAAP. The information was to be sufficient to assess the potential threat posed to human health and the environment and to determine the need for additional characterization at areas identified as containing potentially hazardous materials from former munitions assembly and demilitarization operations at the installation. The scope of the PA included review of available information, interviews with former employees, and field visits to review and identify potential sites. The PA reported that the site contained concrete, wood, several tons of asbestos and spent fluorescent light bulbs. The waste was characterized as containing asbestos and heavy metals (mercury), although no characterization data were available (SAIC, 1996).

2.2.2 Relative Risk Site Evaluation (1996)/Phase I Remedial Investigation (Site Inspection) (1998)

The U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) (now known as US Army Public Health Center) conducted a relative risk site evaluation (RRSE) for previously uninvestigated sites at the former RVAAP in 1996. From the 19 sites that were evaluated, 4 were classified as “high” priority AOCs and the others were classified as “low” or ”medium.” The four high-priority AOCs included the Sand Creek Disposal Road Landfill.

The 1998 USACHPPM Report identified surface soil and sediments to be potential media for contaminant migration at the Sand Creek Site due to the lack of any physical barriers/fence around the site and its proximity to Sand Creek. Three shallow soil samples and one sediment sample were collected from the site during the RRSE. The study identified arsenic as exceeding RRSE screening values for sediments and identified the potential for arsenic to migrate into Sand Creek. The RRSE for this AOC was scored “high” since it is the habitat for state-endangered species (Mountain Brook Lamprey and the River Otter). Under the CERCLA process, a site which registers a RRSE rating of “high” requires further investigation and/or removal (USACHPPM, 1996).

The USACE completed an additional Phase I Remedial Investigation in1998 which served as a Site Inspection (SI) (USACE, 1998). Site evaluations following the USACHPPM sampling event showed that the area used for dumping at the Sand Creek Site was larger than originally defined. In addition, observations identified multiple potential sources of chemical contamination, such as solvent drums, gas cylinders, open canisters, broken lab bottles, and construction debris.

Additional surface soil samples were taken to further characterize the dump site. Samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs or polycyclic aromatic hydrocarbons (PAHs)), metals, cyanide, pesticides, polychlorinated biphenyls (PCBs), explosives, and nitroguanidine. Results indicated metals and SVOCs were present and should be evaluated further.

Results from these samples indicated that contaminants had migrated to the sediment of Sand Creek. Other contamination in soils beneath the sediment along the Sand Creek was a concern. However, unexploded ordnance concerns prevented additional sampling before debris removal. A Removal Action (RA) was the selected alternative for the Sand Creek Disposal Road Landfill as detailed in the *Final Remedial Design and Removal Action Plan for RVAAP-34 Sand Creek Disposal Road Landfill at Ravenna Army Ammunition Plant* (MKM, 2004).

2.2.3 Removal Action (2003) (RA)

A removal action (RA) at the Sand Creek Site was conducted by MKM between August and September 2003. The removal effort at the site consisted of removing all existing unconsolidated surface debris, the limited removal of subsurface debris, transportation and disposal of debris and restoration activities. Due to the presence of transite, all debris was disposed of as ACM special waste. Approximately 1,118 tons (~799 cubic yards) of ACM, including the subsurface transite, glass, and miscellaneous debris were removed from the AOC (MKM, 2004). The areas that had the debris are presented on **Figure 2-3**.

The 2003 RA event included the collection of discrete surface soil (0 to 1 foot), sediment samples (0 to 6 inches) and surface water samples. The results and conclusions of the confirmatory sampling were evaluated and presented in the Remedial Design/Removal Action (RD/RA) Report (MKM, 2004). At the time the report was issued, the confirmatory results were compared to the former RVAAP background screening levels (BSVs) for inorganics and the U.S. Environmental Protection Agency (USEPA) Preliminary Remediation Goals (PRGs), which are based on risk-based screening concentrations adjusted to account for additive effects between chemicals and routes of exposure.

The analysis of the confirmatory soil samples showed elevated concentrations (i.e., greater than the former RVAAP BSVs and/or the PRGs) of heavy metals in the northern third of the site with lower concentrations of heavy metals, SVOCs, explosives, and propellants dispersed over the remainder of the site. The confirmation sediment samples collected from the neighboring floodplain and Sand Creek had results with arsenic levels greater than the EPA PRG level.

2.2.4 After-Action Sample Collection (2003)

Confirmatory soil, surface water, and sediment samples were collected in and around the site by MKM following the removal efforts to evaluate the success of the RA and characterize potential impact to Sand Creek and the neighboring floodplain (**Figure 2-3**). Prior to sampling, the dump area was divided into 30 sampling grids to facilitate collection of the discrete soil samples. One shallow soil sample (0 to 1 foot), not including duplicates and quality control (QC) samples, was collected from each grid (30 total) measuring approximately 40 feet by 40 feet. Surface water was collected at 3 locations, and sediment samples were collected at 12 locations within the Sand Creek and neighboring floodplains, respectively, to characterize potential impact associated with surface water runoff from the site.

A summary of results for the samples collected during the RA is as follows:

Surface Soil—Multiple inorganics were detected in the 2003 RA confirmatory surface soil samples in excess of the facility-wide BSVs. Although sporadic, numerous SVOCs consisting of PAHs, three explosives (2,4-trintrotoluene, 2,4-dinitrotoluene, and 2,6-dinitrotoluene), one propellant (nitrocellulose), and one VOC concentration (chloroethane) were detected at two surface soil sample locations.

Sediment—Multiple inorganics were detected in the RA confirmatory sediment samples in excess of the facility-wide BSVs), and one VOC (acetone) was detected at two sample locations. No SVOCs were detected.

Surface Water—No VOCs, SVOCs, explosives, or propellants were detected in surface water during the 2003 RA. All detected metals were either essential nutrients (calcium, iron, magnesium, potassium, and sodium), or the maximum detected concentration (MDC) was less than the RVAAP surface water BSVs (arsenic, aluminum, barium, copper, manganese, and zinc).

Results indicated that there could be some impact to environmental media at the AOC as a result of historical activities, in particular surface soil. During confirmation sampling following the RA, two 75-mm projectile shells (i.e. munitions debris [MD]) were discovered at the northern portion of the site.

2.2.5 Facility-Wide Biological and Water Quality Study (2003)

In 2003, the USACE performed surface water and sediment sampling and biological monitoring at 26 stream sites at the former RVAAP that included sample location (S-7) at the intersection of the Sand Creek and the former railroad that transects the site (**Figure 2-2**). Biological monitoring included fish and macroinvertebrate community assessments. Two surface water samples from each location at different collection dates during the summer of 2003 (June and September) were analyzed for target analyte list (TAL) metals, pesticides, PCBs, explosive compounds, SVOCs, and several nutrient parameters. One sediment sample was collected using the Incremental Sampling Methodology (ISM) at the collocated biological sampling sites. Sediments were analyzed for TAL metals, SVOCs, pesticides, PCBs, explosive compounds, percent solids, and cyanide as well as several nutrient parameters. The collection of the aforementioned data provided (1) aquatic life use attainment status of streams regarding the Warm Water Habitat or other applicable aquatic life use designation codified in the Ohio Water Quality Standards (OWQS), (2) an assessment if chemical contamination within the streams was adversely affecting the biological communities, and (3) an ecological assessment report summarizing the sediment, surface water, and aquatic biological results. The results of the surface water and sediment results collected at sample location S-7 is presented in the 2003 FWBWQS (USACE, 2005a). A summary of the results are as follows:

Sediment—Cadmium and antimony were the only inorganics in the sediment sample that exceeded the former RVAAP background screening value (BSV) since the BSV is 0. A low SVOC concentration of di-n-butyl phthalate was also detected. No PCBs, pesticides, cyanide, or explosives compounds were detected in the sediment sample.

Surface Water—The only detected metal that exceeded an RVAAP-calculated BSV samples from the September 2003 sampling event was arsenic. Concentrations of chromium, cobalt, silver, and vanadium were detected between the two sampling events and exceeded the BSV of 0. All other detected metals were either essential nutrients (calcium, iron, magnesium, potassium, and sodium), or the maximum detected concentration (MDC) was less than the former RVAAP surface water BSV (aluminum, barium, copper, manganese, and zinc). A low concentration of bis(2-ethylhexyl) phthalate was detected in surface water during the first round of sampling, and di-n-butyl phthalate was detected in the second round of sampling. No PCBs, pesticides, or explosive concentrations were detected in the surface water samples.

A comparison of the results at sample location S-7 indicates that historical activities at the Sand Creek Site have not impacted surface water or sediment quality within the portion of the Sand Creek that is adjacent to the AOC. Furthermore, evaluation of the surface water and sediment data at the nearest downstream sample location (S-9 located approximately 1000 feet downstream of the site) provides support that historical activities at the Sand Creek Site have not impacted downstream conditions. In general, the FWBWQS 2003 Report (USACE, 2005a) concluded that surface water quality throughout the installation was generally good to excellent with very few exceedances of Ohio aquatic life water quality criteria. Sediment samples generally reflected non-contaminated conditions and stream habitat was good at most sites.

2.2.6 Digital Geophysical Mapping (DGM) Survey (2011)/Prove Out Report (2010b)

Between April and May 2010, Shaw conducted a Digital Geophysical Mapping (DGM) survey at and in the immediate vicinity of the Sand Creek Site where historical dumping activities occurred. Work was completed as described in the 2010 Work Plan prepared by Shaw (Shaw 2010a). The primary purpose of the survey was determining the horizontal extent of potential munitions and explosives of concern (MEC) contamination and other suspected buried anomalies without performing intrusive activities at the site. The secondary objective was to evaluate the data to characterize the anomaly density at the site. Geophysical data were collected south and north of the access road adjacent to the stream, along the steep slopes of the embankment in the central portion of the Sand Creek Site and east of the steep embankment in the open area. During this effort, data were acquired in accessible areas void of thick vegetation and fallen trees and where the embankments and other localized slopes were navigable by the field crew (Shaw, 2011). The areas at and adjacent to the Sand Creek Site that the DGM survey covered are presented in **Figure 2-4**.

The DGM data collected at the Sand Creek Site were able to determine the broader limits of metallic waste materials as well as to define more localized regions within and outside the AOC footprint that contain relatively higher metal content. The survey data indicated that the largest portion of the metal debris at the site is present northeast of the former railroad bed. Several areas characterized by relatively higher density of anomalies are located between the stream and the edge of the eastern plateau. The large oval-shaped area that trends southwest-northeast in the northeastern portion of the survey area (contiguous pink colors on **Figure 2-4**) is approximately 0.8 acres in size. Areas characterized by relatively lower density of anomalies are present throughout the southern portion of the survey area. During the survey of the area, the field crew noticed several relatively large areas where concrete rubble was present along and at the bottom of the embankment at the northern portion of the site.

2.2.7 Remedial Investigation (2017)

An RI Report was completed to document the results of the field activities performed for RVAAP-34 Sand Creek Site. As part of the RI, a human health risk assessment (HHRA) was performed to evaluate whether site conditions may pose a risk to current or future human receptors and to identify which, if any site conditions need to be addressed in the Feasibility Study (FS). The data sets used for the risk assessment process were primarily from the RI and included the ISM surface soil and sediment samples and subsurface samples (**Figures 2-5 and 2-6)**. A cross section of the AOC is provided in **Figure 2-7**. The surface water samples from the 2003 RA and the 2003 FWBWQS were also used.

At the time the RI was completed, the AOC was not being used for military training activities but did receive periodic foot traffic during maintenance, restoration, and security activities. The AOC is now considered to be part of the range complex so the most likely future land use for the AOC is the Military Training. The Representative Receptor for this Land Use is the National Guard Trainee (NGT) per the *USACE's Facility-Wide Human Health Risk Assessment Manual* (HHRAM - USACE, 2005b) and the Risk Assessment Technical Memorandum (NGB, 2014). This anticipated future Land Use, in conjunction with the evaluation of Unrestricted (Residential) Land Use, were the basis for identifying COCs in the RI. Unrestricted (Residential) Land Use was included to evaluate COCs for Unrestricted (Residential) Land Use at the AOC, as required by the CERCLA process and as outlined in the HHRAM (USACE, 2005b).

A third Land Use was also included in the RI. The Commercial/Industrial Land Use was identified in the Risk Assessment Technical Memorandum (NGB, 2014) as a means to evaluate the site to determine if it is suitable for full-time, permanent employees. According to the Risk Assessment Technical Memorandum(NGB, 2014), if the criteria for the Commercial/Industrial Land Use are met, then no additional remedial actions are required except for the development of Land Use Controls through the CERCLA process (FS, Proposed Plan, Record of Decision, etc.). The Military Training Land Use is the primary Land Use and is protective of all activities that the OHARNG may conduct on the site except for full-time, permanent-occupational use.

The Sand Creek AOC was considered as a single Exposure Unit (EU) based on the future land use. Although the site was evaluated as a single EU, soil data collected within and adjacent to the AOC were aggregated by depth intervals to address future use receptors with different depths of potential exposure. The RI included analyses to assess potential risks at various depths to assess whether the most likely receptor to deep surface soil and subsurface soil, the National Guard Trainee (NGT), could be allowed to dig. The soil intervals for Unrestricted (Residential) Land Use and Commercial/Industrial Land Use were also assessed. Sediment samples collected for the RI and previously collected surface water samples were evaluated in the same manner for the identified receptors. The purpose of evaluating the receptors in this manner was to provide information for further evaluation in the FS and to determine the best remedial action to meet the evaluation criteria.

Since the OHARNG want to use the AOC without restrictions on their training, the Unrestricted (Residential) Land Use was determined to be what is required. Therefore, only the COCs identified for the Resident Receptor for the Unrestricted (Residential) Land Use are discussed and evaluated in this Action Memorandum.

The chemicals of potential concern (COPCs) were first identified for the following data sets:

- Resident Receptor (Adult and Child)—Surface soil (0–1 foot bgs)
- Resident Receptor (Adult/Child)—Subsurface soil (1–13 feet bgs)
- Resident Receptor (Adult and Child—Sediment and
- Resident Receptor (Adult and Child—Surface water.

The COCs were identified through additional screening of the COPCs by comparing site concentrations to specific Facility Wide Cleanup Goals (FWCUGs) and using a "sum of ratios" (SOR) approach to account for cumulative effects for carcinogens and non-carcinogens acting on the same critical effect.

COCs in Surface Soil and Deep Surface Soil

Surface soil for Unrestricted (Residential) Land Use is defined as the 0- to 1-foot interval. . The COC determination for each receptor was determined separately for non-cancer (by target organ/critical effect) and for cancer risks

COCs Unrestricted (Residential) Land Use in Surface Soil

Only arsenic was identified as a COC based on non-cancerous effects for the child Resident Receptor for the Unrestricted (Residential) Land Uses in surface soil (**Table 2-1**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC for the Unrestricted (Residential) Land Use.

COCs Unrestricted (Residential) Land Use in Subsurface Soil

Based on the results of this HHRA, there are several COCs identified in the subsurface soil for the Unrestricted (Residential) Land Use. These were identified using the 95% UCL or the MDC (if it was larger than the 95% UCL) for each COPCs regardless of location. No COCs based on non-cancer effects were identified for the Unrestricted (Residential) Land Use receptors in subsurface soil. The results from ISM Decision Unit (DU) from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet is presented in (**Table 2-1**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC.

COCs in Sediment Summary

No COCs were identified for Unrestricted (Residential) Land Use in the sediment at the AOC. This media does not require further evaluation in an FS. A "No further Action" (NFA) determination is obtained for sediment at the Sand Creek Site.

Surface Water Summary

No COCs were identified for Unrestricted (Residential) Land Use. This media does not require further evaluation in an FS. An NFA determination is obtained for surface water at the Sand Creek Site.

Conclusions

Results of the HHRA indicated the presence of several COCs in surface soil and subsurface soil for the Unrestricted (Residential) Land Use. Arsenic and benzo(a)pyrene were the COCs. These COCs were recommended to be further evaluated in an FS to determine the appropriate remedial actions for soil at this AOC.

A screening level ecological risk assessment (SLERA) was conducted as part of the RI to evaluate the potential for adverse effects to ecological receptors from SRCs at the Sand Creek Site and to determine if any ecological receptors need to be recommended for further evaluation in the FS.

The RI recommended that the CERCLA process at the AOC should proceed to the FS phase. The FS should include a Risk Management Evaluation to fully assess each COCs before proceeding to the alternative analysis for human health. Since no Chemicals of Potential Ecological Concern (COPECs) in soil were identified in the SLERA, no additional remedial actions are warranted at the AOC from an ecological perspective. No COCs or COPECs were identified in sediment or surface water; therefore, an FS was not warranted for sediment or surface water at the Sand Creek Site.

TABLE 2-1. Summary of COCs identified for Unrestricted (Residential) Land Use, for each Exposure Media from the 2017 RI but before re-evaluation in the EE/CA.

<table>
<tr><th>Receptor per Land Use and Exposure Point</th><th colspan="2">COPCs Identified[a]</th><th>COCs Identified[b]</th></tr>
<tr><td colspan="4">SURFACE SOIL</td></tr>
<tr><td colspan="4">Surface Soil (0 to 1 foot bgs)</td></tr>
<tr><td rowspan="9">Unrestricted (Residential) Land Use
-Based on MDC</td><td>Antimony</td><td>Benzo(a)anthracene</td><td rowspan="9">Arsenic
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Dibenzo(a,h)anthracene
All carcinogenic. Arsenic was also identified for non-carcinogenic effects</td></tr>
<tr><td>Arsenic</td><td>Benzo(a)pyrene</td></tr>
<tr><td>Cadmium</td><td>Benzo(b)fluoranthene</td></tr>
<tr><td>Copper</td><td>Dibenzo(a,h)anthracene</td></tr>
<tr><td>Mercury</td><td>Indeno(1,2,3-cd)pyrene</td></tr>
<tr><td>Silver</td><td>Thallium</td></tr>
<tr><td>Barium</td><td>Benzo(b)fluoranthene</td></tr>
<tr><td>Cadmium</td><td>Dibenzo(a,h)anthracene</td></tr>
<tr><td>Cobalt</td><td></td></tr>
<tr><td colspan="4">SUBSURFACE SOIL</td></tr>
<tr><td colspan="4">Subsurface Soil (1 to 13 foot bgs)</td></tr>
<tr><td rowspan="7">Unrestricted (Residential) Land Use
(1 to 13 feet bgs)
Based on site-wide results and 95% UCL for Discrete samples</td><td>Antimony</td><td>Benzo(a)anthracene</td><td rowspan="7">Arsenic
Benzo(a)pyrene
All carcinogenic based</td></tr>
<tr><td>Arsenic</td><td>Benzo(a)pyrene</td></tr>
<tr><td>Copper</td><td>Benzo(b)fluoranthene</td></tr>
<tr><td>Thallium</td><td>Dibenzo(a,h)anthracene</td></tr>
<tr><td>Vanadium</td><td></td></tr>
<tr><td>Thallium</td><td>Benzo(a)pyrene</td></tr>
<tr><td></td><td>Dibenzo(a,h)anthracene</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="2">Unrestricted (Residential) Land Use</td><td>Antimony</td><td>Thallium</td><td rowspan="2">None</td></tr>
<tr><td>Silver</td><td>Benzo(a)pyrene</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Unrestricted (Residential) Land Use,</td><td colspan="2">Arsenic</td><td>None</td></tr>
</table>

[a] denotes COPCs identified by screening.
[b] denotes COCs identified by screening.
COC denotes chemical of concern. COPC denotes chemical of potential concern.
bgs denotes below ground surface.
mg/kg denotes milligrams per kilogram.

2.2.8 Engineering Evaluation/Cost Analysis (2019)

The 2017 Remedial Investigation (RI) prepared by USACE, recommended that the path forward was to proceed to the FS phase of the CERCLA process. The FS was deemed necessary to evaluate remedial alternatives to address the COCs identified in surface and subsurface soil. Instead of completing an FS and going through the detailed Alternatives analysis and remedy selection, the Army decided the most efficient and cost-effective way to complete the removal action was through the EE/CA process.

As included in an FS, the EE/CA included a Risk Management Evaluation to fully assess each COC to identify the areas where COCs should be removed and which COCs must be addressed in the removal action to meet the Land Use requirements for human health. The COCs presented in Table 2-1 were re-evaluated to determine if they were true COCs and needed to be addressed via a remdiela action. Of the COCs listed in Table 2-1, only benzo(a)pyrene, benzo(b)fluoranthene, and arsenic were identified in the soil as COCs that needed to be further evaluated.

No COPECs in soil were identified in the RI; therefore, additional remedial actions are not warranted at the AOC from an ecological perspective. No COCs or COPECs were identified in sediment or surface water; therefore, removal actions are not warranted for sediment or surface water at the Sand Creek Site.

The RI also recommended that further analysis of the groundwater should be conducted for this AOC. Contaminant Migration Chemicals of Potential Concern (CMCPOCs) were identified in the RI. The presence of these CMCPOCs may be indicative that leaching from soil to groundwater may occur. Evaluation of groundwater at the AOC will be conducted as part of the Facility Wide Groundwater Investigation (RVAAP-66).

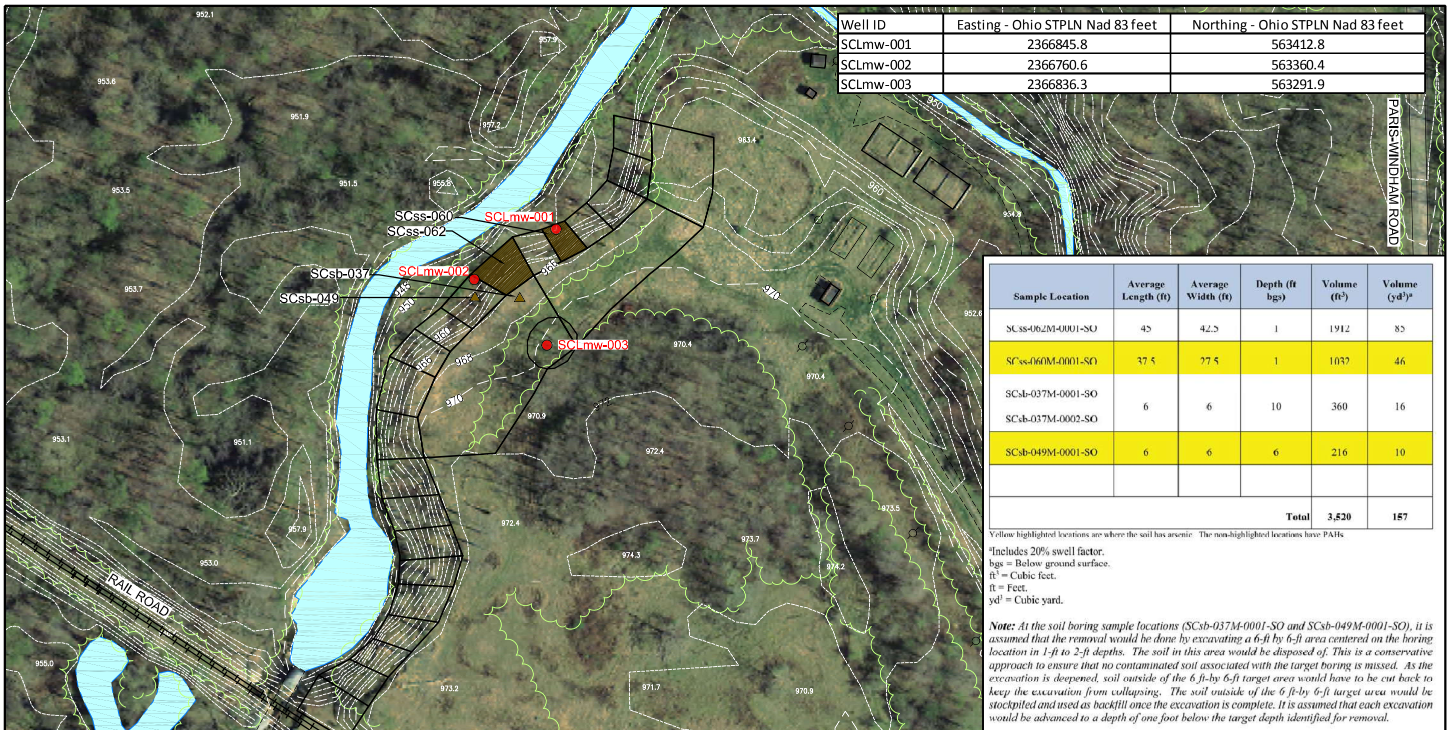
The EE/CA streamlined the CERCLA process for the Sand Creek AOC, given the limited number of COCs distributed at only a few locations. The EE/CA identified removal action objectives (RmAOs), potential removal action alternatives, and evaluated alternatives against criteria identified in U. S. Environmental Protection Agency (USEPA) Guidance for Conducting Non-Time Critical Removal Actions under CERLCA (USEPA, 1993). The two Alternatives considered in the EE/CA were:

- Alternative 1 – No Action
- Alternative 2 – Excavation with Off-site Disposal for Soil with Arsenic (and Ex-situ Thermal Treatment for Soil with PAHs and to attain Unrestricted (Residential) Land Use.

These alternatives are discussed in detail later in this Action Memorandum.

2.3 CURRENT STATUS AND STATE / LOCAL AUTHORITIES ROLES

The OHARNG currently uses Camp James A. Garfield as a military training site. The RVAAP Restoration Program encompasses investigation and cleanup of past activities over the 21,683-acre facility. The Ohio Environmental Protection Agency (Ohio EPA) is the lead regulatory agency for the investigation and remediation conducted by the U.S. Army under the Department of Defense (DOD) Installation Restoration Program (IRP). Additionally, the U.S. Army is required to follow CERCLA/NCP processes, etc. for the RVAAP Restoration Program per the Ohio EPA Director's Final Findings and Orders (DFFOs) dated June 10, 2004 (Ohio EPA, 2004).



Well ID	Easting - Ohio STPLN Nad 83 feet	Northing - Ohio STPLN Nad 83 feet
SCLmw-001	2366845.8	563412.8
SCLmw-002	2366760.6	563360.4
SCLmw-003	2366836.3	563291.9

Sample Location	Average Length (ft)	Average Width (ft)	Depth (ft bgs)	Volume (ft³)	Volume (yd³)[a]
SCss-062M-0001-SO	45	42.5	1	1912	85
SCss-060M-0001-SO	37.5	27.5	1	1032	46
SCsb-037M-0001-SO SCsb-037M-0002-SO	6	6	10	360	16
SCsb-049M-0001-SO	6	6	6	216	10
			Total	**3,520**	**157**

Yellow highlighted locations are where the soil has arsenic. The non-highlighted locations have PAHs.

[a]Includes 20% swell factor.
bgs = Below ground surface.
ft³ = Cubic feet.
ft = Feet.
yd³ = Cubic yard.

Note: *At the soil boring sample locations (SCsb-037M-0001-SO and SCsb-049M-0001-SO), it is assumed that the removal would be done by excavating a 6-ft by 6-ft area centered on the boring location in 1-ft to 2-ft depths. The soil in this area would be disposed of. This is a conservative approach to ensure that no contaminated soil associated with the target boring is missed. As the excavation is deepened, soil outside of the 6 ft-by 6-ft target area would have to be cut back to keep the excavation from collapsing. The soil outside of the 6 ft-by 6-ft target area would be stockpiled and used as backfill once the excavation is complete. It is assumed that each excavation would be advanced to a depth of one foot below the target depth identified for removal.*

LEGEND:
SAND CREEK DUMP SAMPLE GRIDS
SCsb-049 ... AREAS RECOMMENDED FOR REMEDIATION/REMOVAL IN DRAFT EE/CA
SCLmw-001 ... GROUNDWATER MONITORING WELLS TO BE SAMPLED IN OCTOBER 2018

NOTE:
PER REVISED FINAL RIR, THERE ARE CURRENTLY NO POTENTIOMETRIC DATA FOR THE SAND CREEK SITE SINCE NO MONITORING WELLS HAVE BEEN INSTALLED AT THE AOC.

0 50 100 200
SCALE: 1" = 100'
OHIO STATE PLANE (NAD 83)

leidos
SAND CREEK DUMP
FORMER RVAAP/CAMP RAVENNA

DRAWN BY:	REV. NO./DATE:	CAD FILE: C:\08042\DWGS
P. HOLM	R0/ 9/28/18	S36-SAND CREEK DUMP-FIGURE 2

Sand Creek Dump

FIGURE 2-1. Map RVAAP-34 Sand Creek Disposal Road Landfill.

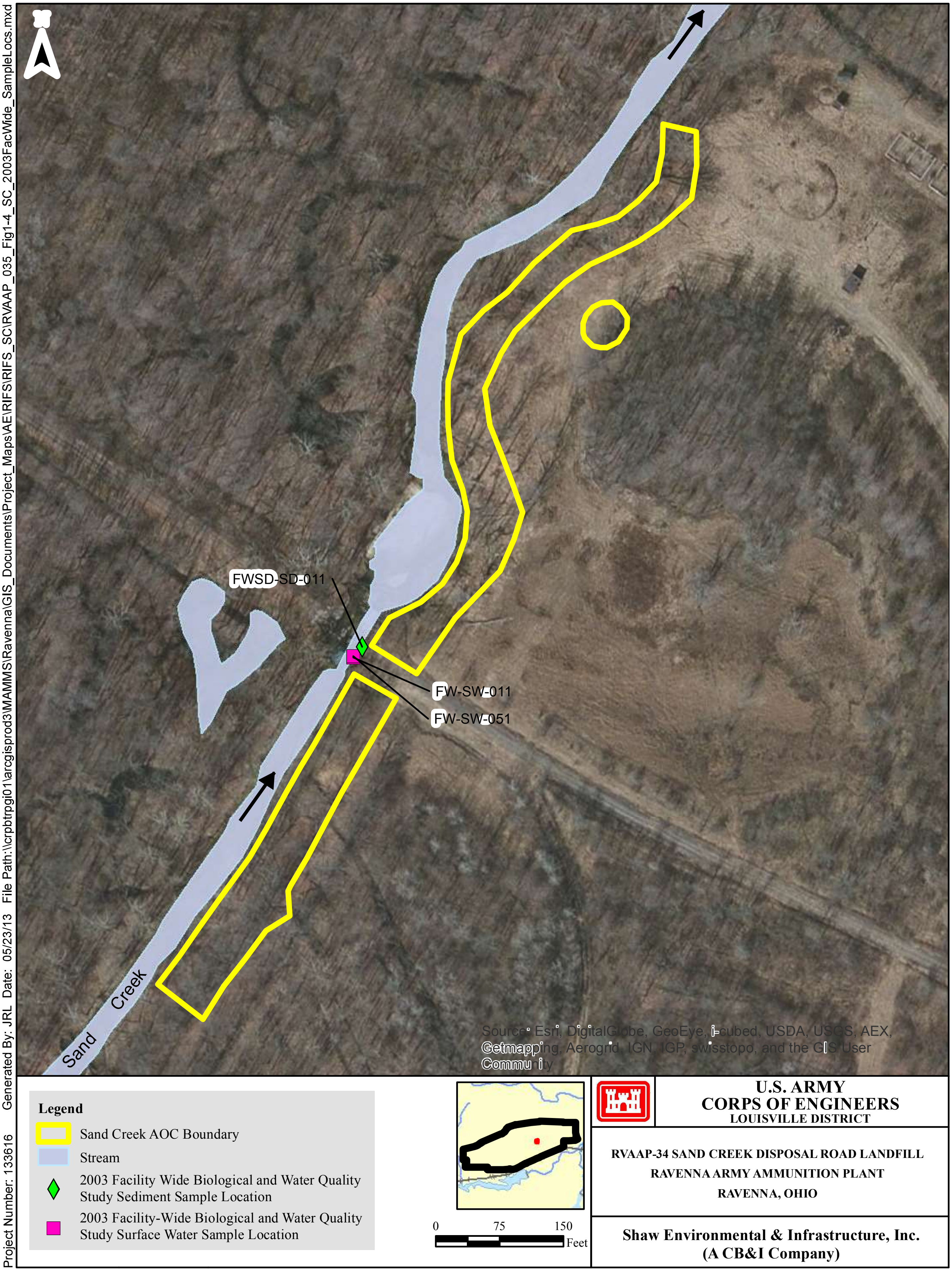


Figure 2-2. 2003 Facility-Wide Biological and Water Quality Study Sample Locations.

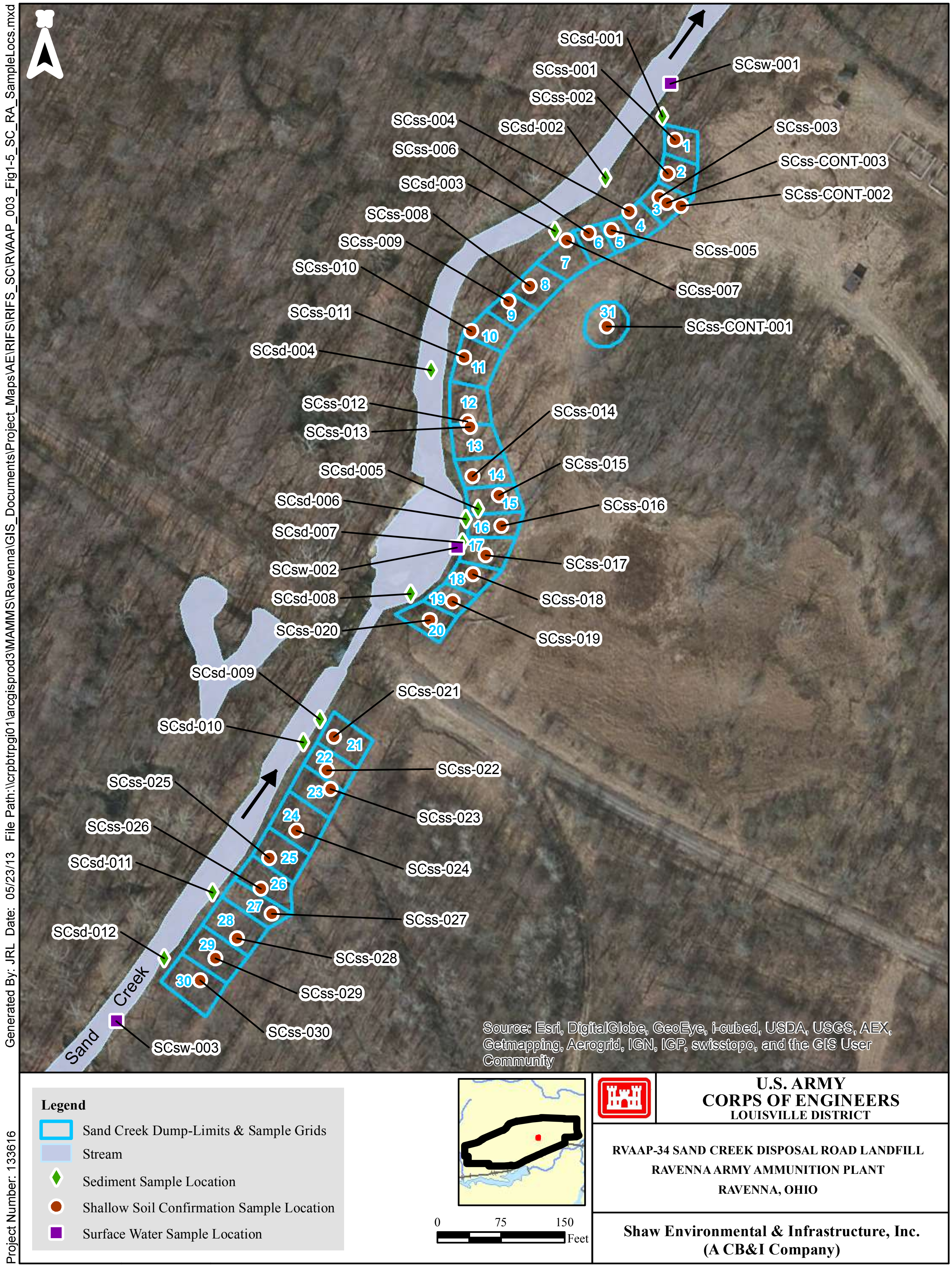
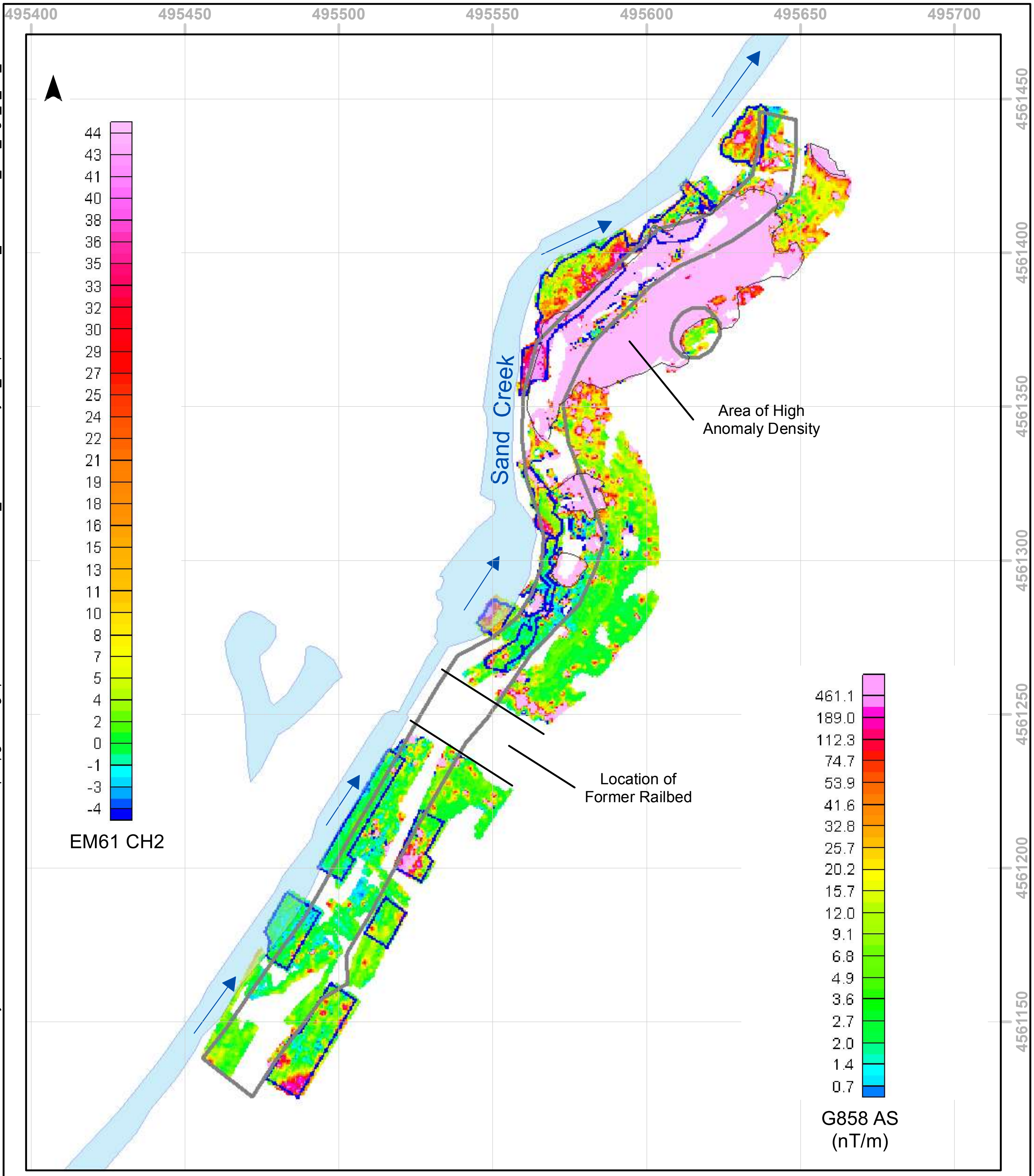


Figure 2-3. 2003 Removal Action Sample Locations.



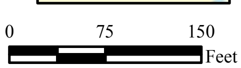
Generated By: JRL Date: 05/23/13 File Path:\\crpbtrpgi01\arcgisprod3\MAMMS\Ravenna\GIS_Documents\Project_Maps\AE\RIFS\RIFS_SC\RVAAP_004_Fig1_6_SC_DGM.mxd

Legend

- Sand Creek Disposal Road Landfill Area of Concern Boundary
- Sand Creek
- Direction of Flow

NOTES:

1) Outlined areas indicate larger contniguous area of increased anomaly density.
2) Dark blue outlined areas indicate areas that were investigated using the Geometrics G-858G cesium vapor magnetometer instrument.



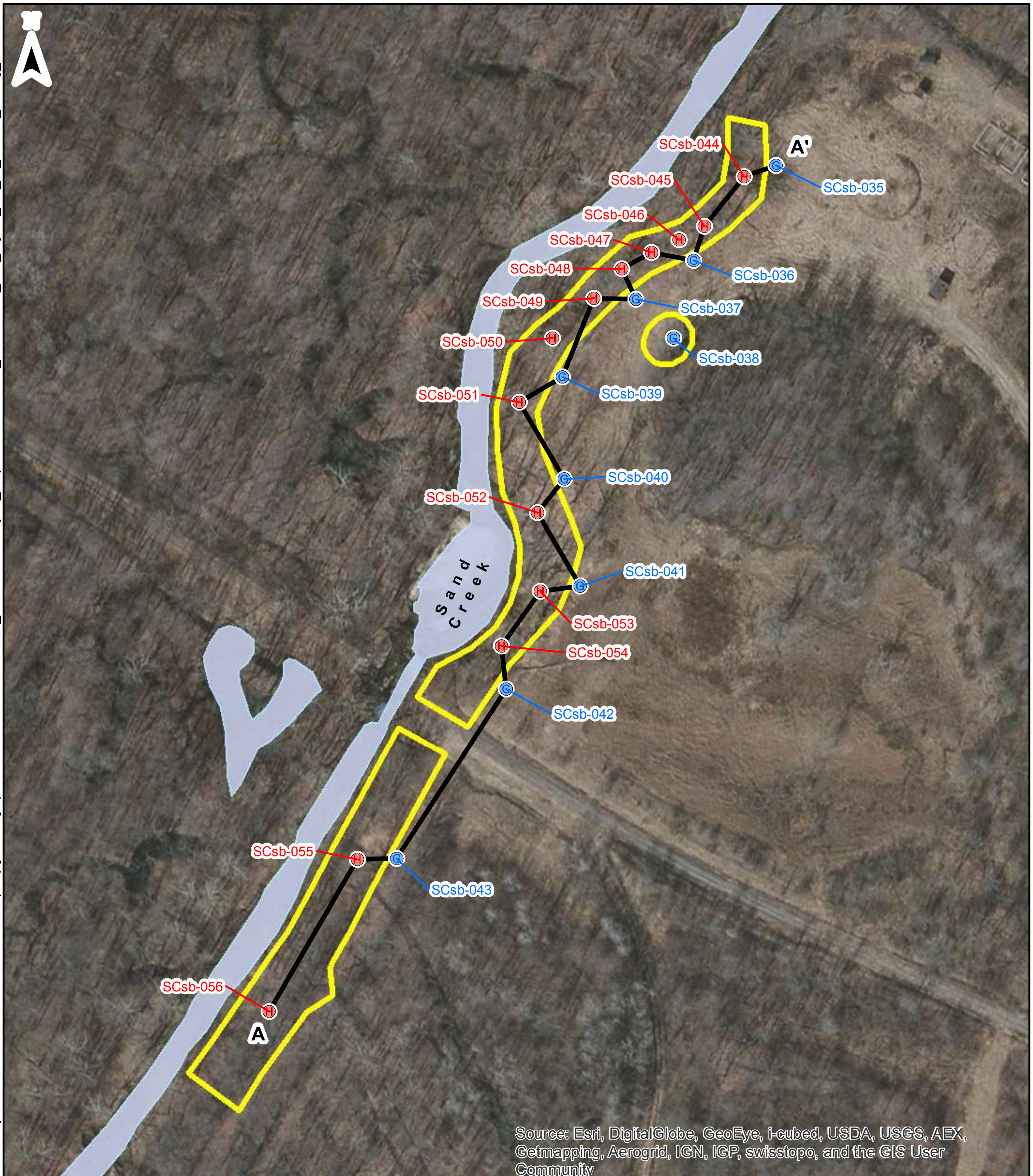
U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

RVAAP-34 SAND CREEK DISPOSAL ROAD LANDFILL
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

133616

Figure 2-4.. Geophysical Investigation Boundary



Generated By: JRL Date: 05/28/13 File Path:\\crpbtrpgi01\arcgisprod3\MAMMS\Ravenna\GIS_Documents\Project_Maps\AE\RIFS\RIFS_SC\RVAAP_037_Fig2-4_SC_RI_PhaseI_Boring_Locs.mxd

Project Number: 133616

Legend

- Sand Creek AOC Boundary
- Stream
- A-A' Cross Section as Shown on Figure 2-6
- Geoprobe Sample Location (9)
- Hand-Auger Sample Location (13)

0 75 150 Feet

U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

RVAAP-34 SAND CREEK DISPOSAL ROAD LANDFILL
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc. (A CB&I Company)

Figure 2-5. Phase I Remedial Investigation Boring Locations.

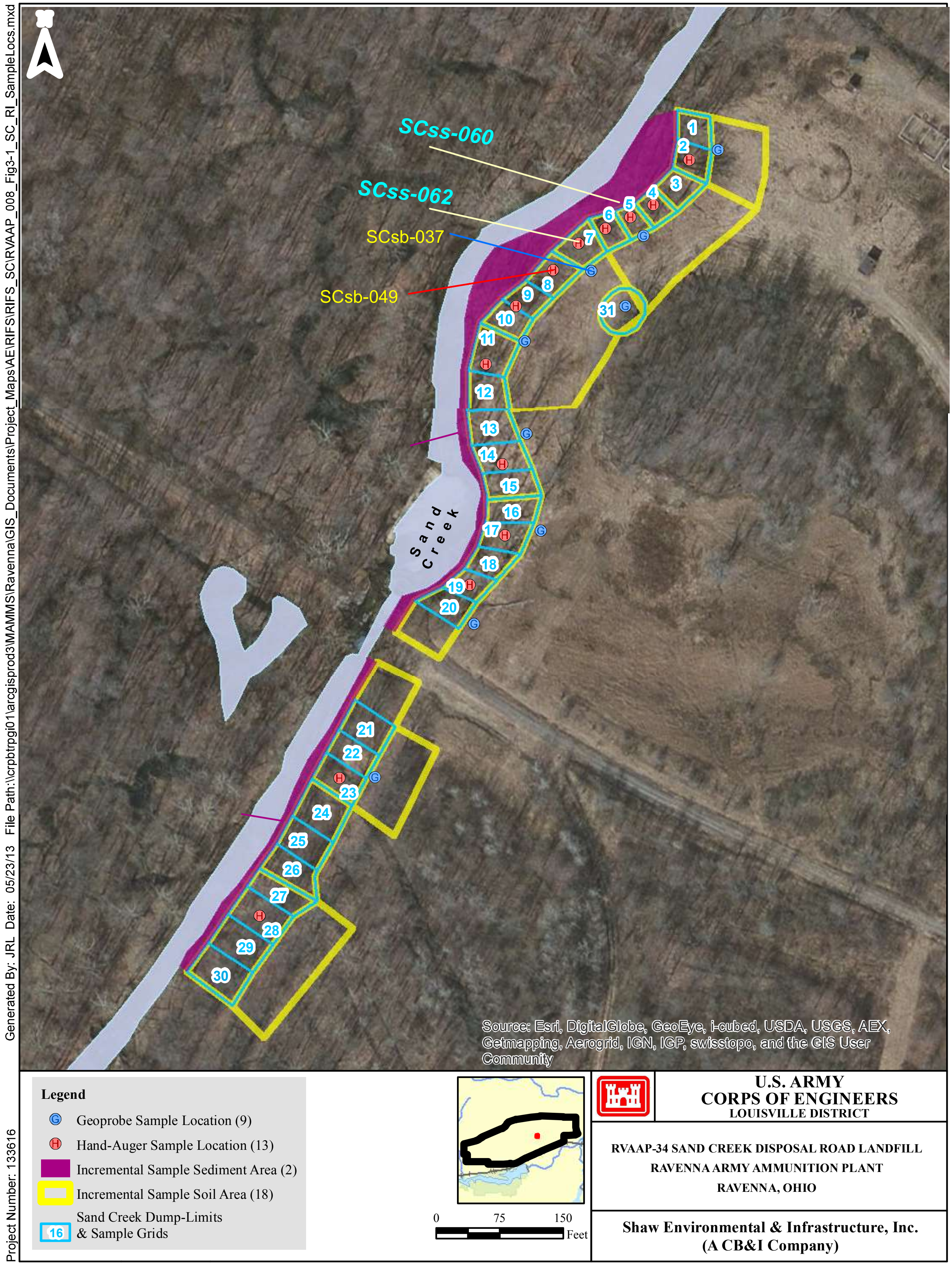


Figure 2-6. Sample Locations from the 2017 Remedial Investigation (2017 Phase II RI).

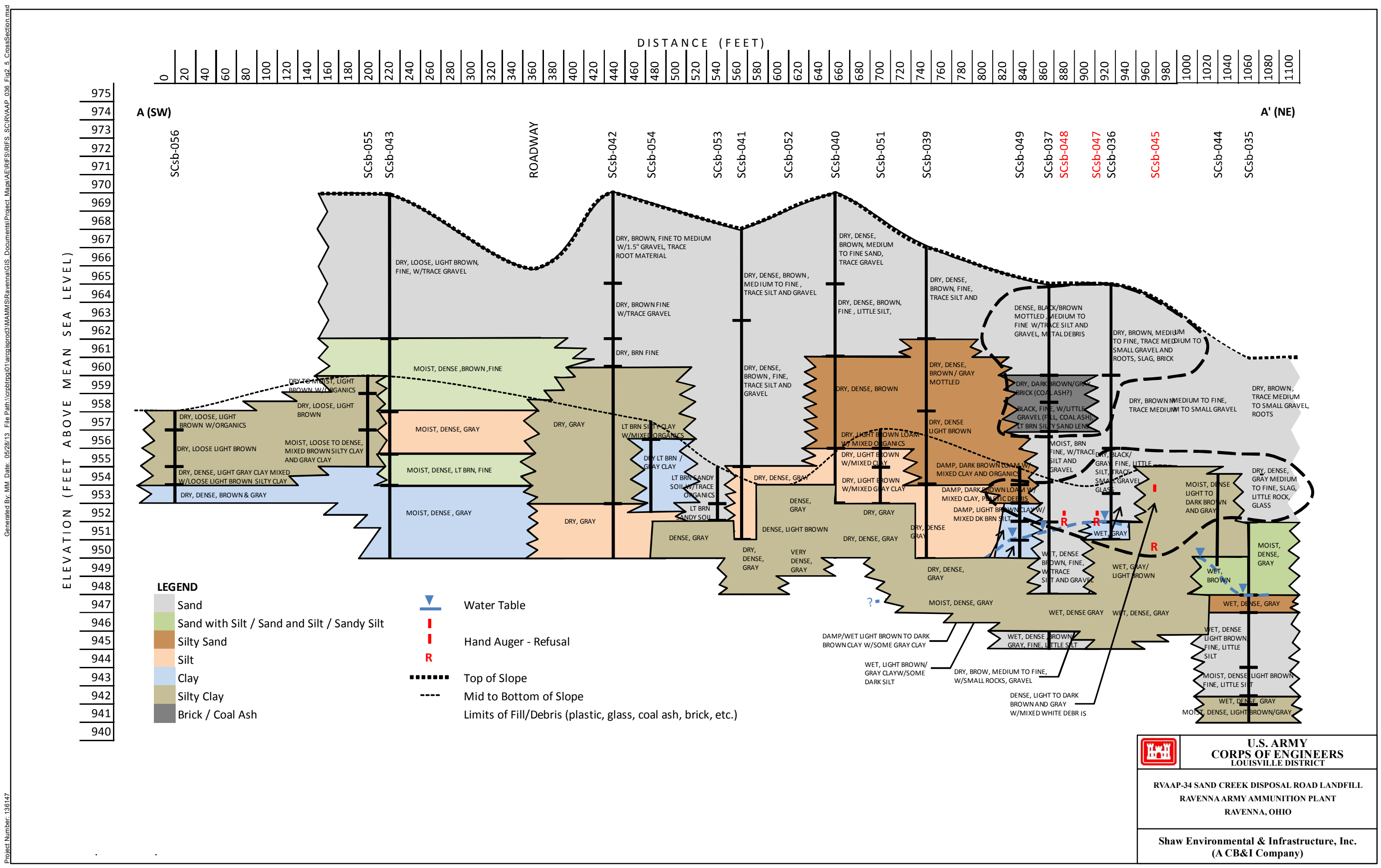


Figure 2-7 Cross Section of the AOC

SECTION 3: STATEMENT OF BASIS AND JUSTIFICATION

The U.S. Army determined that the best Alternative was one without land use restrictions or controls to accommodate future military use. Therefore, the Unrestricted (Residential) Land Use was selected since this would not require any additional monitoring, restrictions, or Five Year Reviews.

Results from the 2017 RI indicated that there are several different COCs for the three Land Uses evaluated: Unrestricted (Residential) Land Use, Military Training Land Use, and Commercial/Industrial Land Use. These COCs were re-evaluated in the EE/CA in a Risk Management Evaluation to determine which specific COCs and at which locations needed to be removed to achieve Unrestricted (Residential) Land Use and to prevent the COCs as acting as a source to the environment.

The re-evaluation of the COCs in the EE/CA indicated that the following locations and COCs in surface soil and subsurface soil were identified for Unrestricted (Residential) Land Use.

- Soil excavation and off-site disposal (SCss-062M-0001-SO (0 to 1 ft bgs) and discrete locations SCsb-037M-0001-SO from the 1 to 5 feet bgs interval and SCsb-037M-0002-SO from the 5 to 9 interval in the subsurface soil (for arsenic).

- Soil treatment (thermal) (SCss-060M-0001-SO (for PAHs - benzo(a)pyrene, and benzo(b)fluoranthene) in the surface soil (0 to 1 feet bgs) and discrete location SCsb-049M-0001-SO from the 1 to 5 feet bgs (PAHs - benzo(a)pyrene).

The removal of arsenic and the thermal treatment of benzo(a)pyrene, and benzo(b)fluoranthene) at the specific surface and subsurface soil locations would eliminate the potential risks to future users of the site.

SECTION 4: THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT AND STATURORY AND REGULATORY AUTHORITIES

As required by§ 300.415(b)(2)(i) of the NCP, actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances or pollutants or contaminants in soil at the Sand Creek AOC are discussed below.

No ecological risks were identified for the AOC in the 2017 RI. Therefore, no potential threat to the environment from an ecological perspective is present. Additionally, no risks were identified for surface water or sediment for the Resident Receptor (Unrestricted (Residential) Land Use) in the RI.

The three COCs (arsenic, benzo(a)pyrene, and benzo(b)fluoranthene), were identified for the surface and subsurface soil for Unrestricted (Residential) Land Use. The re-evaluation indicated that the following locations and COCs in surface soil and subsurface soil for Unrestricted (Residential) Land Use. Arsenic was identified at one discrete sample location for surface soil and one discrete sample location at concentrations that pose potential risks to Residential Receptors for Unrestricted (Residential) Land Use. Benzo(a)pyrene, and benzo(b)fluoranthene) were found at concentrations in the surface soil and one discrete location that pose potential risks to the Residential Receptor for the Unrestricted (Residential) Land Use. These COCs, have the potential to affect human receptors. All three chemicals in soil may contact the receptors mainly through ingestion and inhalation if they are exposed.

The following information was obtained from the Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles. All three COCs are considered to be carcinogens. Exposure to these COCs may be hazardous to human health.

4.1 ARSENIC

How arsenic affects the human body varies based on the different forms of arsenic. Inorganic arsenic compounds are more toxic than organoarsenicals are, and trivalent arsenite is more toxic than pentavalent arsenate is. The major arsenical in most species is arsenobetaine, which human cannot metabolize and is considered to have negligible toxicity. However, arsenic was confirmed as a carcinogenic agent in humans associated with skin and lung cancers. Arsenic affects nearly all organ systems because it targets widely dispersed enzyme reactions.

The most sensitive endpoint from arsenic exposure is dermal effects. While several studies may identify effects on other endpoints at the same exposure level that produces dermal effects, the database for dermal effects is stronger than for effects on other endpoints. Arsenic is absorbed primarily through inhalation or oral consumption and is rarely absorbed through the skin. During oral consumption, the absorption rate of arsenic in the gastrointestinal tract is 90%, which is greater than that of other heavy metals. Absorbed arsenic binds to red blood cells, and deposits in the liver, kidneys, muscle, bone, hair, skin, and nails, but is expelled mainly through the urine. Inorganic arsenic compounds suppress the activities of various enzymes involved in cellular respiration, glutathione metabolism, and DNA synthesis, and may pass through the placenta affecting the development of the fetal nervous system. Arsenic metabolism is a complex process that involves more than five metabolites, and begins with the methylation of inorganic arsenic compounds. In the body, the inorganic arsenic compound pentavalent arsenate is converted into trivalent arsenite. The majority of trivalent arsenite is metabolized into MMA, and then into DMA, before being excreted in the urine.

The major metabolic pathway of arsenic is methylation. Trivalent arsenite is methylated to the major metabolites MMA and DMA before it is expelled through the urine. Methylation was once thought to detoxify arsenic; however, recent studies have reported increased toxicity because of methylation in some metabolites containing trivalent arsenite.

Key physiologic effects from arsenic exposure are as follows:

- Patchy skin hyperpigmentation, small focal keratoses, and other skin lesions are common effects of heavy chronic exposure.
- It is difficult to establish strong associations between arsenic exposure and disease, as the prevalence and spectrum of diseases linked to chronic arsenic exposure differ not only between countries, but even within countries.
- Arsenic can cause lung and skin cancers and may cause other cancers.
- The association between chronic arsenic exposure and cancer is strongest for skin, lung, and bladder cancer. Liver (angiosarcoma), kidney, and other cancers have limited strength of association.

4.2 BENZO(A)PYRENE AND BENZO(B)FLUORANTHENE

Benzo(a)pyrene, and benzo(b)fluoranthene belong to a group of chemicals called polycyclic aromatic hydrocarbons (PAHS) and are discussed in herein collectively as PAHS. Most PAHs generally have a low degree of acute toxicity to humans. Some studies have shown noncarcinogenic effects that are based on PAH exposure dose. It is not clear that PAHs cause short-term health effects. Other compounds commonly found with PAHs may be the cause of short-term symptoms such as eye irritation, nausea, vomiting, diarrhea, and confusion. Long-term health effects of exposure to PAHs may include cataracts, kidney and liver damage, and jaundice. After chronic exposure, the non-carcinogenic effects of PAHs involve primarily the pulmonary, gastrointestinal, renal, and dermatologic systems.

Long-term exposure to low levels of some PAHs have caused cancer in laboratory animals. Benzo(a)pyrene is the most common PAH to cause cancer in animals. Studies of workers exposed to mixtures of PAHs and other compounds have noted an increased risk of skin, lung, bladder, and gastrointestinal cancers. The information provided by these studies is limited because the workers were exposed to other potential cancer-causing chemicals besides PAHs. Although animal studies have shown adverse reproductive and developmental effects from PAH exposure, these effects have generally not been seen in humans.

The carcinogenicity of certain PAHs is well established in laboratory animals. Researchers have reported increased incidences of skin, lung, bladder, liver, and stomach cancers, as well as injection-site sarcomas, in animals. Animal studies show that certain PAHs also can affect the hematopoietic and immune systems and can produce reproductive, neurologic, and developmental effects.

It is difficult to ascribe observed health effects in epidemiological studies to specific PAHs because most exposures are to PAH mixtures.

Increased incidences of lung, skin, and bladder cancers are associated with occupational exposure to PAHs. Epidemiologic reports of PAH-exposed workers have noted increased incidences of skin, lung, bladder, and gastrointestinal cancers. These reports, however, provide only qualitative evidence of the carcinogenic potential of PAHs in humans because of the presence of multiple PAH compounds and other suspected carcinogens. Some of these reports also indicate the lack of quantitative monitoring.

The earliest human PAH-related epidemiologic study was reported in 1936 by investigators in Japan and England who studied lung cancer mortality among workers in coal carbonization and gasification processes. Subsequent U.S. studies among coke oven workers confirmed an excess of lung cancer mortality, with the suggestion of excessive genitourinary system cancer mortality. Later experimental studies showed that PAHs in soot were probably responsible for the increased incidence of scrotal cancer noted by Percival Pott among London chimney sweeps in his 1775 treatise.

SECTION 5: ENDANGERMENT DETERMINATION

Based on the results of the EE/CA, there are several locations where removal actions are required to address actual or threatened releases of contaminants from this AOC that present an imminent and substantial endangerment to public health, or welfare, or the environment. The EE/CA showed that to eliminate contaminants in soil at the AOC to prevent any threat or endangerment to public health, or welfare, or the environment several locations where the contaminants were found need to be removed. These locations were identified in the Risk Management Evaluation (**Section 3** of the EE/CA) so the Sand Creek AOC meets the Unrestricted (Residential) Land Use requirements. The danger or risk may occur when human receptors contact the soil on the AOC if the removal action does not occur.

The removal action (excavation and disposal and thermal treatment) will prevent Resident Receptors from contacting unsafe concentrations of arsenic at SCss-062M-0001-SO in the surface soil; and soil treatment PAHs (benzo(a)pyrene and benzo(b)fluoranthene) at location SCss-060M-0001-SO in the surface soil; arsenic at location SCsb-037M-0001-SO from the 1 to 5 feet bgs interval and the 5 to 9 in subsurface soil; and benzo(a)pyrene at location SCsb-049M-0001-SO from the 1 to 5 feet bgs interval in subsurface soil.

The removal action selected in the EE/CA was considered protective because this action would remove all locations of soil where the contaminants were at concentrations great enough to pose a risk to the Residential Receptor. Once the removal action is fully implemented, there will be no remaining threats.

SECTION 6: ALTERNATIVES CONSIDERED

This section describes the removal action Alternatives developed for the Sand Creek AOC and the individual analysis of each.

6.1 INTRODUCTION

Remedial Action Alternatives should assure adequate protection of human health and the environment, achieve RAOs, meet ARARs, and if applicable, permanently and significantly reduce the volume, toxicity, and/or mobility of contaminants.

The two Alternatives considered in this EE/CA are:

- Alternative 1 – No Action
- Alternative 2 – Excavation with Off-site Disposal for Soil with Arsenic and Ex-situ Thermal Treatment for Soil with PAHs and to attain Unrestricted (Residential) Land Use.

6.2 ALTERNATIVE 1: NO ACTION

The No Action Alternative is required for evaluation under the NCP. This Alternative is the baseline to which other Alternatives are compared. This Alternative assumes all current actions (e.g., access restrictions and environmental monitoring) are discontinued and assumes no future actions will take place to protect human receptors or the environment. Impacted media at the AOC would not be removed or treated. This Alternative was considered but eliminated since it does not achieve the RAOs or allow the AOC to be used as planned.

6.3 ALTERNATIVE 2: EXCAVATION AND OFF-SITE DISPOSAL FOR SOIL CONTAINING ARSENIC AND EX-SITU THERMAL TREATMENT FOR SOIL WITH PAHS (BENZO(A)PYRENE AND BENZO(B)FLUORANTHENE)

Alternative 2 involves two remedial technologies: Excavation and off-site disposal and thermal treatment. Excavation and off-site disposal would be used for the soil at SCss-062M-0001-SO (0 to 1 ft bgs) and discrete locations SCsb-037M-0001-SO from the 1 to 5 feet bgs interval and SCsb-037M-0002-SO from the 5 to 9 interval in the subsurface soil (for arsenic). Ex-situ thermal treatment, such as the Vapor Energy Generator (VEG©) treatment, would be used for soil at sample locations SCss-060M-0001-SO (for benzo(a)pyrene, and benzo(b)fluoranthene) in the surface soil (0 to 1 feet bgs) and discrete location SCsb-049M-0001-SO from the 1 to 5 feet bgs (benzo(a)pyrene). Implementing these remedial technologies would achieve Unrestricted (Residential) Land Use. The evaluation of this Alternative assumes that a mobile thermal treatment system is already on site and readily available for use. An Alternative to mobilize a treatment system on site solely for treating the soil volume specified in this EE/CA may not be feasible. If not feasible or available, excavation and off-site disposal of PAH-contaminated soil could also be used.

This remedial alternative requires coordinating remediation activities with Ohio EPA, OHARNG, and the Army. Coordinating with stakeholders during implementation of the excavation will minimize health and safety risks to on-site personnel and potential disruptions of CJAG activities. The time period to complete this remedial action is relatively short and will not include an O&M period, as an Unrestricted (Residential) Land Use scenario will be achieved. Components of this remedial alternative include:

- Delineation/pre-excavation confirmation sampling,
- Waste characterization sampling,
- Remedial Design (RD)/Work Plan development,
- Soil excavation and off-site disposal (SCss-062M-0001-SO (0 to 1 ft bgs) and discrete locations SCsb-037M-0001-SO from the 1 to 5 feet bgs interval and SCsb-037M-0002-SO from the 5 to 9 interval in the subsurface soil (for arsenic)).
- Soil treatment (SCss-060M-0001-SO) (for PAHs - benzo(a)pyrene, and benzo(b)fluoranthene) in the surface soil (0 to 1 feet bgs) and discrete location SCsb-049M-0001-SO from the 1 to 5 feet bgs (PAHs - benzo(a)pyrene), and
- Site Restoration.

By excavating specific locations and then completing thermal treatment in the surface soil and subsurface soil where the concentrations of COCs were identified in the Risk Management Evaluation (Section 3 of the EE/CA), will allow the Sand Creek AOC to meet Unrestricted (Residential) Land Use. These locations assessed in the 2017 RI were from ISM sample locations for surface soil and discrete sample locations in the subsurface soil (**Figure 2-5**).

The arsenic contaminated soil at the AOC will be removed from the former RVAAP facility, hauled to a licensed and permitted disposal facility, and appropriately disposed. The soil locations with PAH contamination, will be excavated and then undergo thermal treatment. The soil will be put back in place. The arsenic removal areas will be restored with clean fill material.

No long-term monitoring or five-year reviews would be required under CERCLA since Unrestricted (Residential) Land Use will be obtained. However, residual solid waste will be managed under the solid waste management plan and any solid waste identified during excavation will be removed and properly disposed. Approximately 101 yds^3 of contaminated soil will be removed from the AOC for off-site disposal and 56 yds^3 will be excavated, undergo thermal treatment, and then put back in place. This removal will be conducted as an NTCRA and will achieve quick, protective results at the AOC and was determined to be cost effective (estimated $142,400 for removal and thermal treatment). **Figure 6-1** provides the locations of the areas that require removal. **Attachment 1** of this Action Memorandum presents **Appendix C** of the EE/CA which includes a breakdown of the costs and other information used to calculate this estimate.

6.4 CONTRIBUTION TO REMEDIAL PERFORMANCE

No further action is required under CERCLA since Unrestricted (Residential) Land Use will be obtained after the removal action and soil treatment are completed.

6.5 COSTS – EE/CA

The present value cost to complete Alternative 2 is approximately $142,400 (in base year 2018 dollars). Costs include implementing the removal, off-site disposal, thermal treatment, and site restoration. See Attachment 1 (**Appendix C** of the EE/CA) for a detailed description of Alternative 2 costs.

6.6 OUTCOME

Alternative 2 would be an effective method of removing and disposing of contaminated soil at the Sand Creek AOC for arsenic contaminated soil. Excavation and off-site disposal are conventional technologies which can be readily implemented. This Alternative would also be effective for eliminating PAHs in soil using thermal treatment. This Alternative would reduce risks and once implemented, the Sand Creek AOC would meet Unrestricted (Residential) Land Use. Under this Alternative, soils undergoing the thermal treatment will be effectively treated and will meet Unrestricted (Residential) Land Use after treatment.

6.7 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

6.7.1 Potential Chemical-Specific ARARS

A review of the regulations indicated there are no chemical-specific ARARs for any of the alternatives being considered in this EE/CA for the media and COCs. No regulations were identified that included specific chemical concentrations or requirements that would be a potential ARAR to drive the remedial action process. However, there are chemical –specific cleanup values that will be used as cleanup standards (acceptable concentrations of the COCs - arsenic, PAHs - benzo(a)pyrene, and benzo(b)fluoranthene) that will be used for the removal action of the surface soil or subsurface soil at the locations specified herein at the Sand Creek AOC. The values that will be used will be the most current version of the US EPA's Residential Regional Screening Levels (RSLs) for benzo(a)pyrene, and benzo(b)fluoranthene (using the lower of the 1 X 10^{-5} target cancer risk or the Hazard Quotient of 1) and the approved RVAAP-specific soil background value for arsenic. The current US EPA RSL for benzo(a)pyrene is 1.1 mg/kg and the RSL for benzo(b)fluoranthene is 11.1 mg/kg. The RVAAP-specific background value for arsenic is 19.8 mg/kg for soil.

6.7.2 Potential Action-Specific ARARS

Implementing an excavation and disposal alternative triggers potential ARARs associated with land disturbance and emission controls. The OAC 3745-15-07 requires that nuisance air pollution emissions be controlled. This includes controlling potential fugitive dust from excavation activities associated with the potential removal of the pipes/inlets/manholes. In addition, any construction (i.e., soil disturbance activities that would encompass over 1 acre) would trigger the storm water requirements found at 40 CFR Part 450. These requirements mandate that erosion and sedimentation control measures be designed and implemented to control erosion and sediment runoff.

Because excavation would include generating and managing contaminated media, RCRA requirements would be considered potential ARARs for this activity. The RCRA requirements mandate that a generator must determine whether a material is (or contains in the case of environmental media) hazardous waste under OAC 3745-52-11. If a material is determined to be or contain a listed hazardous waste, or exhibits a hazardous waste characteristic, additional management requirements under RCRA must be followed as an ARAR under CERCLA.

These requirements include how hazardous waste is stored, treated, transported, and disposed. The RCRA requirements are generally not considered to be chemical-specific ARARs because they do not relate directly to the degree of cleanup or to specific chemicals. In addition to the substantive requirements associated with managing and storing material that is also RCRA hazardous waste (or found to contain such waste), some RCRA requirements prescribe standards for disposing hazardous material, including LDRs prohibiting disposal of specific chemicals until they are treated to a specified level or by a specific treatment technology and minimum technical requirements for land disposal units.

Shipments of contaminated soils will comply with federal, state, and local rules, laws and regulations. In addition to the identified ARARs for the selected action, the Army will comply with requirements applicable to off-site actions, such as Resource Conservation and Recovery Act (RCRA) hazardous waste transportation requirements under OAC 3745-52-20 to OAC 3745-52-33, and off-site treatment prior to land disposal as required by RCRA's land disposal restrictions (LDRs) under OAC 3745-270, including alternative LDR treatment standards for contaminated soil under OAC 3745-270-49.

The USEPA cautions that LDRs should not be used to determine site-specific cleanup levels (USEPA, 2002). All LDRs require appropriate treatment of RCRA hazardous waste that is to be disposed to minimize short- and long-term threats to human health or the environment, based on available technology. Performing treatment to meet LDR standards is different from the CERCLA approach to remediation, which analyzes risk and then develops cleanup standards based on the risk present; this may result in cleanup levels that are different from those of a risk-based approach. Nevertheless, if RCRA hazardous waste is generated from the CERCLA action and is disposed on site, the material must meet the established LDR.

In order for LDRs to be triggered as potential ARARs, RCRA hazardous waste must be present. This requires: (1) the waste material must contain contaminants that derive from RCRA-listed waste or exhibit a characteristic of RCRA hazardous waste, and (2) the waste material is managed in a way that "generates" hazardous waste. Several methods of waste material management that do not "generate" hazardous waste, and so do not trigger LDRs, are available for use. These methods include using the AOC approach, using a staging pile, using a storage or treatment corrective action management unit (CAMU), or using a temporary unit.

If waste material (soil) is managed in a manner that generates hazardous waste, such as removing it to an aboveground container and then re-depositing the material within the land unit for disposal, then LDRs become potential ARARs. Land Disposal Restrictions are assigned to the waste when it is removed from the unit under an AOC approach or when the waste material is excavated and lifted out of the unit. Potential LDR ARARs in Ohio are variances from treatment standards in OAC Section 3745-270-44, LDR standards for contaminated debris in OAC Section 3745-270-45, Universal Treatment Standards (UTS) in OAC Section 3745-270-48, and Alternative LDR Treatment Standards for Contaminated Soil in OAC Section 3745-270-49.

Ohio has adopted the alternative soil treatment standards promulgated by USEPA in its Phase IV LDR rule, effective August 1998. The rules provide that if RCRA hazardous waste is present, the material must meet one of two sets of LDRs before being disposed of in a land unit: (1) the UTS, or (2) the contaminated soil (technology-based treatment) standards promulgated in Phase IV of the LDRs, whichever is greater. Or, if a generator so chooses, they may use the generic treatment standards in OAC Section 3745-270-40 which apply to all hazardous waste. Only the alternative soil treatment standards are explained in this document.

Under the alternative soil treatment standards, all soil subject to treatment must be treated as follows:

1. For non-metals, treatment must achieve a 90% reduction in total constituent concentration (i.e., the primary constituent for which the waste is characteristically hazardous as well as for any organic or inorganic chemical underlying hazardous constituent), subject to item three below.

2. For contaminants in soil (e.g., inorganic chemicals, carbon disulfide, cyclohexanone, and methanol), treatment must achieve a 90% reduction in constituent concentrations as measured in leachate from the treated media [tested according to the toxicity characteristic leaching procedure (TCLP)] or a 90% reduction in total constituent concentrations (when an inorganic chemical removal treatment technology is used), subject to item three below.

3. When treating any constituent subject to treatment to a 90% reduction standard would result in a concentration less than 10 times the UTS for that constituent, treatment to achieve constituent concentrations less than 10 times the UTS is not required. This is commonly referred to as "90% capped by 10 x UTS."

4. USEPA and Ohio EPA have established a site-specific variance from the soil treatment standards, which can be used when treatment to concentrations of hazardous constituents higher than those specified in the soil treatment standards minimizes short- and long-term threats to human health and the environment. In this way, on a case-by-case basis, risk-based LDR treatment standards approved through a variance process could supersede the soil treatment standards. Any variance granted cannot rely on capping, containment, or other physical or institutional controls.

If CAMUs are used as disposal units at the AOC, the design and treatment standards established in OAC Section 3745-57-72 will be potentially relevant and appropriate to the response action. Only CAMU-eligible waste can be disposed in a CAMU. CAMU-eligible waste includes hazardous and non-hazardous wastes that are managed for implementing cleanup, depending on the Ohio EPA Director's approval or prohibition of specific waste or waste streams. Using a CAMU for disposal does not trigger LDRs or MTRs as long as the standards specified in the rule are observed. The Director will incorporate design and treatment standards into a permit or order. Design standards include a composite liner and a leachate collection system designed and constructed to maintain less than 30 cm of leachate over the liner. A composite liner entails a system consisting of two components which each have detailed specifications and installation requirements. The Director may approve alternate requirements if he can make the findings adhere to the requirements specified in the rule. Treatment standards are similar to LDR standards for contaminated soil, although alternative and adjusted standards may be approved or required by the Director as long as the adjusted standard is protective of human health and the environment.

Treatment standards are similar to LDR standards for contaminated soil, although alternative and adjusted standards may be approved or required by the Ohio EPA Director, as long as the adjusted standard is protective of human health and the environment.

In the event solid waste material is found to be contaminated but not a RCRA hazardous waste, management and disposal of this material would be subject to the requirements associated with managing and disposing solid waste within the state of Ohio. The OAC Section 3745-27-05 requirements would be potential ARARs for disposing non-hazardous contaminated waste material generated during excavation and subsequent disposal at an off-site location.

A permit-by-rule (PBR) is a specific permit exemption in the OAC that applies to certain types of low-emitting air pollution sources. Soil vapor emissions from a thermal treatment system would require exemption under OAC 3745-31-03 (PBR). The PBR contains qualifying criteria, emission limitations, conditions for operation, and requirements for record keeping and reporting which must be followed. Potential action-specific ARARs for the Sand Creek AOC are provided in **Appendix B** of the EE/CA.

6.7.3 Potential Location-Specific ARARS

Location-specific requirements include those established for potential remedial activities conducted within wetlands, within a floodplain area, or with respect to threatened and endangered species. Generally, for wetlands and floodplains, rules require alternatives to remedial activity within the sensitive area be pursued; if that is not feasible, adverse effects from any actions taken within the sensitive area must be mitigated to the extent possible. These requirements do not relate to specific chemicals nor do they further change the degree of cleanup in the sense of protecting human health or the environment from the effects of harmful substances. Rather, their purpose is to protect the sensitive areas (i.e., ecological areas or areas that include cultural resources and/or sites of historical/archeological significance) to the extent possible. Under CERCLA Section 121(d), relevance and appropriateness are related to the circumstances presented by the release of hazardous substances, with the goal of attaining a degree of cleanup and control of further release that ensures protection of human health and the environment.

Potential location-specific ARARs for the Sand Creek AOC are provided in **Appendix B** of the EE/CA.

In addition to the requirements identified as ARARs, any action taken by the federal government must be conducted in accordance with requirements established under the National Environmental Policy Act, Endangered Species Act, National Historic Preservation Act, and federal and state wetlands and floodplains construction and placement of material considerations, even though these laws and rules do not establish standards, requirements, limitations, or criteria relating to the degree of cleanup for chemicals remaining on site at the close of the response actions.

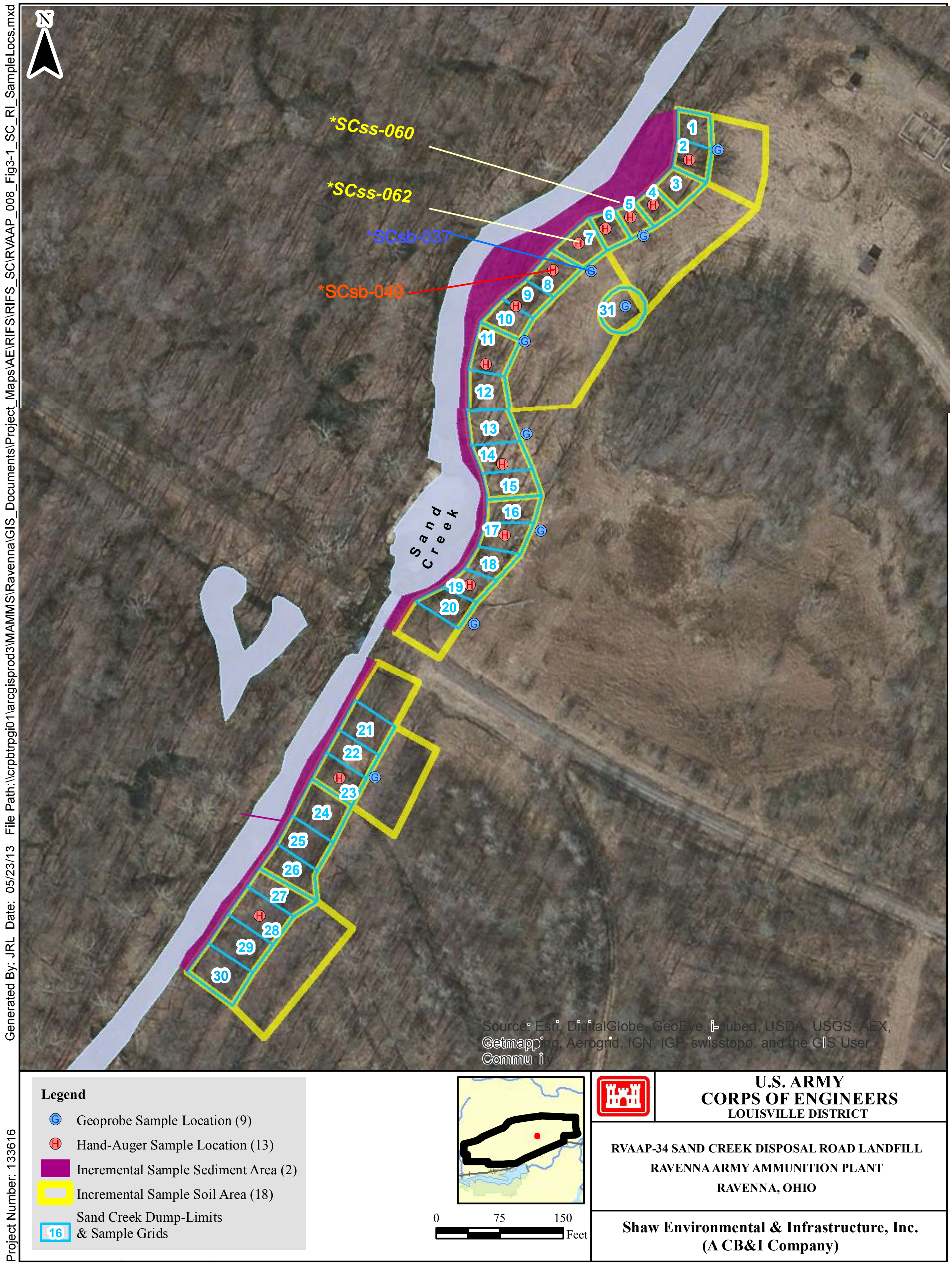


Figure 6-1. Four Locations Identified as Requiring a Removal Action.

SECTION 7: AGENCY COORDINATION AND PUBLIC INVOLVEMENT

The Ohio EPA is the lead regulatory agency for the restoration activities at the former RVAAP. The Army coordinated the preparation of the EE/CA as required under the DFFOs. The Ohio EPA approved the Final EE/CA (dated January 14, 2019) along with the Alternative 2 on February 12, 2019. The Final (approved) EE/CA was published for public review and comment as described in the following.

Community involvement is a necessary part of the CERCLA process and the DFFOs. The NCP requires that a public notice describing the EE/CA and announcing a public comment period be published in a major local newspaper. In May 2019, the Army notified several local newspapers to announce the availability of the Final EE/CA for public review. The public review period began on May 21 and ended June 21, 2019. The public comment period provided appropriate opportunity for the public to be involved in site-related decisions. No specific comments were received on the EE/CA from the public during the review period.

In addition to providing the EE/CA to the public for comment, CERCLA 42 U.S.C. 9617(a) requires that an Administrative Record be established "at or near the facility at issue." Relevant documents regarding the RVAAP Restoration Program have been made available to the public. The Administrative Record for this project is available at the following location:

Camp James A. Garfield Joint Military Training Center (CJAG)
Environmental Office
1438 State Route 534 SW
Newton Falls Ohio 44444
(614) 336-6136

Note: Access is controlled to Camp James A. Garfield, but the file can be obtained or viewed with prior notice.

An Information Repository of current information and final documents is also available to any interested reader at the following libraries:

Reed Memorial Library
167 East Main Street
Ravenna, Ohio 44266

Newton Falls Public Library
204 South Canal Street
Newton Falls, Ohio 44444-1694

The RVAAP Restoration Program has an online resource for documents, restoration news and information. This website can be viewed at www.rvaap.org.

SECTION 8: RESPONSIVENESS SUMMARY

No specific comments were received on the EE/CA from the public during the review period (May 21, 2019 to June 21, 2019).

SECTION 9: PROPOSED ACTIONS AND ESTIMATED COSTS

9.1 DESCRIPTION

Alternative 2 (Excavation and Offsite Disposal and Thermal Treatment for Soil) is the recommended action for the RVAAP-34 Sand Creek Disposal Road Landfill AOC. This recommendation is based on results from the EE/CA including the Risk Management Evaluation of the RI conducted at the AOC. There is evidence that several locations at the AOC must be remediated for the AOC to achieve Unrestricted (Residential) Land Use.

Alternative 2 involves two remedial technologies: Excavation and off-site disposal and thermal treatment. The remedial action includes excavation and off-site disposal for the soil at SCss-062M-0001-SO (0 to 1 ft bgs) and discrete locations SCsb-037M-0001-SO from the 1 to 5 feet bgs interval and SCsb-037M-0002-SO from the 5 to 9 interval in the subsurface soil (for arsenic). Ex-situ thermal treatment, such as the Vapor Energy Generator (VEG©) treatment, will be used for soil at sample locations SCss-060M-0001-SO (for benzo(a)pyrene, and benzo(b)fluoranthene) in the surface soil (0 to 1 feet bgs) and discrete location SCsb-049M-0001-SO from the 1 to 5 feet bgs (benzo(a)pyrene). **Table 9-1** provides the estimated volumes of soil to be excavated, disposed off-site, and treated.

Implementing these remedial technologies will meet the criteria for Unrestricted (Residential) Land Use. The evaluation of this Alternative assumes that a mobile thermal treatment system is already on site and readily available for use. An Alternative to mobilize a treatment system on site solely for treating the soil volume specified in this EE/CA may not be feasible. If not feasible or available, excavation and off-site disposal of PAH-contaminated soil could also be used.

This remedial alternative requires coordinating remediation activities with Ohio EPA, OHARNG, and the Army. Coordinating with stakeholders during implementation of the excavation will minimize health and safety risks to on-site personnel and potential disruptions of CJAG activities. The time period to complete this remedial action is relatively short and will not include an O&M period, as an Unrestricted (Residential) Land Use scenario will be achieved. Components of this remedial alternative include:

- Delineation/pre-excavation confirmation sampling,
- Waste characterization sampling,
- Remedial Design (RD)/Work Plan,
- Soil excavation and off-site disposal of SCss-062M-0001-SO (0 to 1 ft bgs) and discrete locations SCsb-037M-0001-SO from the 1 to 5 feet bgs interval and SCsb-037M-0002-SO from the 5 to 9 interval in the subsurface soil (for arsenic).
- Soil treatment for SCss-060M-0001-SO (for PAHs - benzo(a)pyrene, and benzo(b)fluoranthene) in the surface soil (0 to 1 feet bgs) and discrete location SCsb-049M-0001-SO from the 1 to 5 feet bgs (PAHs - benzo(a)pyrene), and
- Site Restoration.

TABLE 9-1. Estimated Volumes of Surface Soil and Subsurface Requiring Removal at Sand Creek AOC.

Sample Location	Average Length (ft)	Average Width (ft)	Depth (ft bgs)	Volume (ft^3)	Volume (yd^3)[a]
SCss-062M-0001-SO	45	42.5	1	1912	85
SCss-060M-0001-SO	37.5	27.5	1	1032	46
SCsb-037M-0001-SO SCsb-037M-0002-SO	6	6	10	360	16
SCsb-049M-0001-SO	6	6	6	216	10
			Total	**3,520**	**157**

Yellow highlighted locations are where the soil has PAH contamination. Non-highlighted locations have arsenic contamination.

[a]Includes 20% swell factor.
bgs = Below ground surface.
ft^3 = Cubic feet.
ft = Feet.
yd^3 = Cubic yard.

Note: *At the soil boring sample locations (SCsb-037M-0001-SO and SCsb-049M-0001-SO), it is assumed that the removal would be done by excavating a 6-ft by 6-ft area centered on the boring location in 1-ft to 2-ft depths. The soil in this area would be disposed of. This is a conservative approach to ensure that no contaminated soil associated with the target boring is missed. As the excavation is deepened, soil outside of the 6 ft-by 6-ft target area would have to be cut back to keep the excavation from collapsing. The soil outside of the 6 ft-by 6-ft target area would be stockpiled and used as backfill once the excavation is complete. It is assumed that each excavation would be advanced to a depth of one foot below the target depth identified for removal.*

9.2 COSTS

The present value cost to complete Alternative 2 is $142,400. There is no capital cost associated with No Action Alternative. Any costs relative to the continued use and management of the AOC per the Contingency Plan and Army regulations are not a function of CERCLA or of the EE/CA and are not considered further.

Excavation of specific locations along with completion of thermal treatment in the surface soil and subsurface soil where the concentrations of COCs were identified in Section 3 of the EE/CA, will allow the Sand Creek AOC to meet Unrestricted (Residential) Land Use. These locations assessed in the 2017 RI were from ISM sample locations for surface soil and discrete sample locations in the subsurface soil (**Figure 6-1**).

9.3 SOIL EXCAVATION

Soil removal is accomplished using conventional construction equipment such as backhoes, bulldozers, front-end loaders, and scrapers. Oversize debris will be crushed or otherwise processed to meet disposal facility requirements.

Soil will be hauled by truck to a licensed and permitted disposal facility. All trucks will be inspected prior to exiting the Sand Creek AOC. Appropriate waste manifests will accompany each waste shipment. Only regulated and licensed transporters and vehicles will be used. All trucks will travel pre-designated routes within CJAG.

Residual solid waste will be managed under the solid waste management plan which and any solid waste identified during excavation will be removed and properly disposed. Excavated soil will be disposed at an existing off-site facility licensed and permitted to accept the characterized waste stream. The selection of an appropriate facility considers the type of waste, location, transportation options, and cost. Waste streams with different constituents and/or characteristics may be generated. Disposal cost savings can be made possible by utilizing specific disposal facilities for different waste streams but all excavated soil that does not undergo thermal treatment is assumed to be contaminated with arsenic.

9.4 SOIL TREATMENT

Prior to any ground disturbance, the excavation area will be surveyed and demarcated by stakes. Erosion control material such as silt fences and straw bales will be installed to minimize sediment runoff. Dust generation will be minimized during excavation activities by keeping equipment movement areas and excavation areas misted with water. The health and safety of remediation workers, on-site CJAG employees, and the general public will be covered in a site-specific health and safety plan.

To achieve Unrestricted (Residential) Land Use at SCss-060M-0001-SO (for benzo(a)pyrene, and benzo(b)fluoranthene) in the surface soil (0 to 1 feet bgs) and discrete location SCsb-049M-0001-SO from the 1 to 5 feet bgs (benzo(a)pyrene) the contaminated soil will undergo ex-situ thermal treatment. The treatment system will be pre-heated to the optimal treatment temperature based on results of past bench- and pilot-scale tests previously conducted at the former RVAAP. While the system is being heated, soil will be excavated using conventional construction equipment such as backhoes, bulldozers, front-end loaders, and scrapers and will be stockpiled immediately adjacent to the treatment system into approximately 50 yd^3 piles.

Once the treatment system is at the optimal treatment temperature, contaminated soil will be fed directly into the fully enclosed, preheated chamber by being placed onto a conveyor. Steam at a temperature of 1300°F will be fed into the renewal/treatment chamber, where it serves as the heat source for thermally treating soils. As the soil moves through the system via a rotational auger, the soil contaminants will be desorbed at specified temperatures and residence times and passed as vapors into the box head space within the enclosed chamber.

The PAH vapors will then be subject to a patented filter/scrubber system to remove the acidic gases [i.e., nitrous oxides, sulfur oxides, and hydrogen chloride] and CO2 components, using an engineered mixture of sodium hydroxide, lime, zero valent iron, steam, and water within a slender packed column. Induced vapors from the contaminated soils will be routed through this filtration system, allowing for full treatment of acidic gases, SVOC vapors, and conversion of any remaining vapors into a synthetic gas. This synthetic gas will be used as a renewable source of fuel to replace the propane used initially to generate steam and to continue operating the VEG© or other similar treatment system.

Relying on this fully-enclosed looping system, there will be no emissions to the atmosphere, and the limited CO2 generated through the process may be further reduced (by some 90% to levels below background) using the water-lime component of the patented filtration process. After treatment, the soil will be stockpiled into approximately 50 yd^3 stockpiles on tarp and covered with plastic sheeting.

Soil samples will be collected from the individual stockpiles, and soil will be analyzed for COCs using USEPA Method 8270. The laboratory results will be compared to Removal Action Cleanup Goals. Once the laboratory analysis determines COCs are less than the Cleanup Goals, the treated soil will be used for backfill and site restoration. Should confirmation samples indicate that any contaminants are not sufficiently treated, then those soils will be rerun through the VEG© system, or similar treatment system likely at a higher temperature, until the target post-treatment levels are reached.

9.5 RESTORATION

Upon completing the excavation, confirmation samples will be taken to verify the removal action was successful and all contamination was removed. The disturbed areas will be backfilled with overburden from the excavation and clean fill (from an approved and tested source) will be used if needed to assist in grading to neighboring contours. After the area is backfilled and graded, workers will apply a seed mixture (as approved by OHARNG) and mulch. Restored areas will be inspected and monitored consistent with best management practices.

SECTION 10: EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

If Alternative 2 is not implemented, negative impacts to the current usability of the AOC for training purposes will occur. Alternative 2 as presented in the EE/CA, allows the OHARNG to remove the restrictions and use the AOC for training as needed or for Unrestricted (Residential) Land Use. Additionally, no more actions such as Five-Year Reviews would be required if the removal action is implemented.

This Alternative allows the AOC to be removed from the CERCLA process and used as needed. If this Alternative is not implemented the AOC would remain in the CERCLA process and would require implementation of Land Use Controls, Five-Year Reviews, maintenance and implementation of them, as well as making the AOC unsuitable for the mission-planned use.

SECTION 11: OUTSTANDING POLICY ISSUES AND ENFORCEMENT

11.1 OUTSTANDING POLICY ISSUES

There are no outstanding policy issues.

11.2 ENFORCEMENT

Camp James A. Garfield (inclusive of the RVAAP-34 AOC) is a federal facility that is licensed to the OHARNG for use as a military training site. The ARNG/OHARNG are responsible for continuing the management of the site per applicable Army Regulations, policies and CERCLA until the removal action is completed.

The Ohio EPA is the lead regulatory agency that will oversee the NTCRA. Additional oversight and enforcement considerations from the Ohio EPA were addressed during preparation of the EE/CA. The EE/CA was prepared in consultation with Ohio EPA. Ohio EPA provided input during the ongoing investigation and report development process to ensure the removal action ultimately selected meets the needs of the state of Ohio and fulfills the requirements of the DFFO (Ohio EPA 2004).

Because the AOC is located within CJAG, no additional enforcement components are needed. Once the removal action is completed, the AOC will meet requirements for Unrestricted (Residential) Land Use, so enforcement components will not be required.

SECTION 12: RECOMMENDATIONS

This Action Memorandum (Decision Document) represents the selected removal action for the Sand Creek AOC on CJAG. Alternative 2: Excavation with Off-site Disposal For Soil with Arsenic and Ex-situ Thermal Treatment for Soil with PAHs to attain Unrestricted (Residential) Land Use is the recommended action for the Sand Creek AOC. The arsenic contaminated soil at the AOC will be removed from the former RVAAP facility, hauled to a licensed and permitted disposal facility, and appropriately disposed. The soil locations with PAH contamination, will be excavated and then undergo thermal treatment. The soil will be put back in place. The arsenic removal areas will be restored with clean backfill material.

No long-term monitoring or five-year reviews would be required under CERCLA since Unrestricted (Residential) Land Use will be obtained. However, residual solid waste will be managed under the solid waste management plan and any solid waste identified during excavation will be removed and properly disposed.

Approximately 101 yds^3 of contaminated soil will be removed from the AOC for off-site disposal and 56 yds^3 will be excavated, undergo thermal treatment, and then put back in place. This removal will be conducted as an NTCRA and will achieve quick, protective results at the AOC and was determined to be cost effective (estimated $142,400 for removal and thermal treatment). **Figure 5-1** provides the locations of the areas that required removal. **Appendix C** of the EE/CA includes breakdown of the costs and other information used to make this estimate and is included as **Attachment 1** of this Action Memorandum.

SECTION 13: REFERENCES

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ATTACHMENT 1: ESTIMATED COSTS DETAILS FROM APPENDIX C OF THE 2019 EE/CA

EE/CA Study for Sand Creek Disposal Road Landfill, Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio
Summary of Alternatives

RVAAP Sand Creek Disposal Road Landfill		Duration	Cost Based on 2018 Data		
			Soil		
			Capital Cost	O&M Cost	Total
1	**Alternative -1: No Action**	0	$0	$0	$0
2	**Alternative 2:** Alternative 2 – Excavation with Off-site Disposal For Soil with Arsenic (and Ex-situ Thermal Treatment for Soil with PAHs to attain Unrestricted (Residential) Land Use.	<1 yr	$142,400	$0	$142,400

Notes:

1. Costs were estimated for comparison purposes only and are believed to be accurate within a range of -30% to +50%. Use of these costs for other purposes, such as, budgeting or construction cost estimating is not appropriate.
2. Estimated Capital Costs include preparation of the Remedial Design, award of a contract, contract cost, and oversight of the contract.

Engineering Evaluation/Cost Analysis (EE/CA) for RVAAP Sand Creek Disposal Road Landfill Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio
Summary of Removal Volumes

EE/CA Estimated Soil Removal at Sand Creek Disposal Road Landfill.

Media	Sample Numbers	In-situ volume (yd^3)	Volume for disposal (yd^3)
Soil with Arsenic as COC	SCss-062M-0001-SO	71	85
Soil with Arsenic as COC	SCsb-037M-0001-SO	12.3	16
Soil with PAHs as COC	SCss-060M-0001-SO	38	46
Soil with PAHs as COC	SCsb-049M-0001-SO	3.7	10
			157

[a]Includes 20% swell factor.
yd^3 = Cubic yard.

*101 cu.yds. Excavation and off-site disposal

*56 cu.yds for Thermal treatment

Note: Disposal Volume was estimated by using a factor of 1.2 to account for swelling

Note: At the soil boring sample locations (SCsb-037M-0001-SO and SCsb-049M-0001-SO), it is assumed that the removal would be done by excavating a 6-ft by 6-ft area centered on the boring location in 1-ft to 2-ft depths. The soil in this area would be disposed of. This is a conservative approach to ensure that no contaminated soil associated with the target boring is missed. As the excavation is deepened, soil outside of the 6 ft-by 6-ft target area would have to be cut back to keep the excavation from collapsing. The soil outside of the 6 ft-by 6-ft target area would be stockpiled and used as backfill once the excavation is complete. It is assumed that each excavation would be advanced to a depth of one foot below the target depth identified for removal.