Final
ENGINEERING EVALUATION/COST ANALYSIS for Central Burn Pits

(RVAAP-49)

Ravenna Army Ammunition Plant
Ravenna, Ohio

January 2007

US Army Corps of Engineers®
Louisville District

Contract No. GS-10F-0076J
Delivery Order No. W912QR-05-F-0033

Prepared for:
U.S. Army Corps of Engineers
Louisville, Kentucky

SAIC® From Science to Solutions

Prepared by:
Science Applications International Corporation
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

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LIST OF ACRONYMS

ALM	Adult Lead Model
AOC	Area of Concern
ARAR	Applicable and Relevant or Appropriate Requirements
BGS	below ground surface
BRAC	Base Realignment and Closure
CBP	Central Burn Pits
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	constituent of concern
COEC	constituent of ecological concern
COPEC	constituent of potential ecological concern
DFFO	Director's Final Findings and Orders
DOT	Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
EPC	exposure point concentration
ERA	ecological risk assessment
GSA	U. S. General Services Administration
HHRA	human health risk assessment
HQ	hazard quotient
IRP	Installation Restoration Program
LDR	land disposal requirement
MEC	munitions and explosives of concern
MI	multi-increment
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
NCP	National Contingency Plan
NGB	National Guard Bureau
NPL	National Priorities List
O&M	operation and maintenance
OAC	Ohio Administrative Code
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PBC	Performance Based Contract
PPE	personal protective equipment
PRG	preliminary remediation goal
PWS	Performance Work Statement
RAB	Restoration Advisory Board

LIST OF ACRONYMS (continued)

RCRA	Resource Conservation and Recovery Act
RGO	remedial goal option
RI	Remedial Investigation
RmAO	Removal Action Objective
RRSE	Relative Risk Site Evaluation
RTLS	Ravenna Training and Logistics
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
TCLP	toxicity characteristic leaching procedure
TCRA	time critical removal action
TERP	transportation and emergency response plan
TNT	2,4,6-trinitrotoluene
USACE	U. S. Army Corps of Engineers
USACHPPM	U. S. Army Center for Health Promotion and Prevention Medicine
USC	U. S. Code
USEPA	U. S. Environmental Protection Agency

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ES.0 EXECUTIVE SUMMARY

Science Applications International Corporation (SAIC) has been contracted by the U. S. Army Corps of Engineers (USACE) Louisville District to provide environmental services to achieve remedy for (or cleanup of) soils and dry sediments at the Central Burn Pits (CBP) area of concern (AOC) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio by September 30, 2007. This work is being performed under a firm-fixed price basis in accordance with U. S. General Services Administration (GSA) Environmental Advisory Services Contract GS-10-F-0076J under a Performance Based Contract (PBC) as specified in the Performance Work Statement (PWS) issued by the Army on February 10, 2005 (USACE 2005a). In addition, planning and performance of all elements of this work will be in accordance with the requirements of the Director's Final Findings and Orders (DFFO) dated June 10, 2004 [Ohio Environmental Protection Agency (Ohio EPA) 2004].

ES.1 SCOPE

This Engineering Evaluation/Cost Analysis (EE/CA) is developed following guidelines of *Use of Non-Time Critical Removal Authority in Superfund Response Actions* (U. S. Environmental Protection Agency [USEPA] 2000). As stated in the guidelines, USEPA has urged Superfund decision makers to broadly use the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal authority to achieve quick, protective results at Superfund sites, consistent with legal requirements, including public participation.

Although RVAAP is not a National Priorities List (NPL) site, Ohio EPA, the Army, and the Ohio Army National Guard (OHARNG) have agreed to proceed with a non-Time Critical Removal Action (TCRA) for Piles M and N at CBP. Debris piles M and N contain residues and materials with elevated levels of lead and hexavalent chromium that have a high likelihood to disperse and migrate. Further, Pile M lead levels also exceed toxicity characteristic leaching procedure (TCLP) criteria indicating the materials in the pile are characteristically hazardous. The piles are not considered viable exposure units because (1) process knowledge and visual characteristics indicate that these piles contain a substantial percentage of burning residues and, on this basis, are considered as a waste material rather than conventional environmental media (i.e., not soil); and (2) due to their small size a receptor would be expected to spend a very small portion of his time at CBP at the piles. However, due to the elevated levels of lead and hexavalent chromium, a removal action is required to provide protection to human health and the environment and minimize the potential for contaminant dispersal from the materials.

ES.2 SUMMARY OF REMOVAL ACTION OBJECTIVES

The potential exists for dispersal of contaminants from materials in Piles M and N to adjacent soil by wind and water erosion. Future land use of CBP includes dismounted training by the OHARNG. Future land use will also include the development of small arms ranges. This land use may include

activities and vehicle traffic that could physically disperse contaminants should trainees inadvertently disturb the materials. These factors provide sufficient justification to warrant a removal action.

The following removal action objective (RmAO) for impacted piles at CBP was developed consistent with the intended future land use at CBP:

- Remove Piles M and N to prevent dispersal of contaminants and ensure underlying soil meets the lowest risk-based cleanup goals for the exposure scenarios evaluated in the RI.

Information obtained during the RI shows that soil and dry sediment at CBP already meets cleanup goals for restricted land use (National Guard Trainee) and residential land use. Considering these data, it is cost effective to establish removal action cleanup goals consistent with all exposure scenarios evaluated for the COCs, so that land use controls are not required for any small area of residual contamination in soil beneath Piles M and N following the removal action. Preliminary cleanup goals for this removal action are; therefore, selected based on the lowest cleanup number for the exposure scenarios evaluated in the RI. The lowest risk-based preliminary cleanup goal for lead among the receptors evaluated is residential land use (400mg/kg, U.S. EPA residential play areas hazard level – 40 *CFR* 745). The lowest cleanup goal for hexavalent chromium among the receptors evaluated is for the National Guard Trainee (16 mg/kg), based on combined exposure through ingestion, inhalation of fugitive dust, and dermal contact with soil. The hexavalent chromium cleanup goal is consistent with the previously approved preliminary cleanup goal in the Final Proposed Remedial Goal Options for Soils at Load Lines 1, 2, 3, and 4 at the Ravenna Army Ammunition Plant (Shaw 2004).

ES.2.1 Extent and Volume Calculations

Estimated volumes of material in Piles M and N are summarized in Table ES-1. These volumes are estimated based on field measurements taken during the Supplemental Phase II Remedial Investigation (RI) field investigation.

Table ES-1. Estimated Volume of Impacted Piles

Surface Features	Approximate Dimensions	Shape	Estimated Volume
Pile M	Height = 3 ft, Radius = 19 ft	Pile	1,700 cu feet 63 cu yards
Pile N	Height = 4.5 ft, Radius = 10 ft	Pile	710 cu feet 26 cu yards

ES.3 DEVELOPMENT OF REMOVAL ACTION ALTERNATIVES

Removal action alternatives assembled for Piles M and N at CBP are presented in Table ES-2. Removal action alternatives should ensure adequate protection of human health and the environment, achieve the RmAO, meet applicable and relevant or appropriate requirements, and permanently and significantly reduce the volume, toxicity, and/or mobility of constituents.

Table ES-2. Summary of Removal Action Alternatives

Alternative 1 – No Action This removal action alternative provides no further action and is included as a baseline for comparison with other removal action alternatives. Any current access restrictions and environmental monitoring would be discontinued. The AOC and facility will no longer have legal, physical, or administrative mechanisms to restrict access. Additional actions regarding land use controls, monitoring, or access restrictions will not be implemented. Five-year reviews would not be conducted in accordance with CERCLA 121(c).
Alternative 2 – Excavation of Waste Piles with Off-Site Treatment and Disposal This removal action alternative involves the removal, transportation, treatment, and disposal of debris at Piles M and N. Waste materials would be excavated and transported to an off-site disposal facility licensed and permitted to accept these wastes. If necessary, the disposal facility would treat the waste to ensure is meets the land disposal restriction and then will dispose of the soils. Once the piles are removed, confirmation sampling would be conducted to ensure preliminary cleanup goals have been achieved. Areas successfully excavated may not need backfilling, for the AOC may be level to the surrounding ground surface. Alternative 2 does not include operation and maintenance or long-term monitoring because the piles are removed from the AOC.

AOC = area of concern
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

ES.4 RECOMMENDED ALTERNATIVE

Alternative 2 (Removal of Waste Piles with Off-site Treatment and Disposal) is the recommended alternative for CBP. Pile M had a lead concentration result of 8,560 mg/kg. TCLP sample results indicate the soil in Pile M would have to be disposed of as characteristically hazardous waste. Pile N had a hexavalent chromium soil sample result of 25 mg/kg, which is much higher than surrounding soil and exceeds a previously agreed upon preliminary cleanup goal of 16 mg/kg (Shaw 2005). Both piles appear to be a product of former burning activities at CBP. This removal will be conducted as a non-TCRA and will achieve quick and protective results at the AOC and was determined to be cost effective (estimated $91,366 for removal).

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1.0 INTRODUCTION

Science Applications International Corporation (SAIC) has been contracted by the U. S. Army Corps of Engineers (USACE) Louisville District to provide environmental services to achieve remedy for (or cleanup of) soils and dry sediments at the Central Burn Pits (CBP) area of concern (AOC) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio by September 30, 2007. This work is being performed under a firm-fixed price basis in accordance with U. S. General Services Administration (GSA) Environmental Advisory Services Contract GS-10-F-0076J under a Performance Based Contract (PBC) as specified in the Performance Work Statement (PWS) issued by the Army on February 10, 2005 (USACE 2005c). In addition, planning and performance of all elements of this work will be in accordance with the requirements of the Director's Final Findings and Orders (DFFO) dated June 10, 2004 [Ohio Environmental Protection Agency (Ohio EPA) 2004].

1.1 PURPOSE AND ORGANIZATION OF REPORT

This Engineering Evaluation/Cost Analysis (EE/CA) evaluates alternatives for remediation of chemical contamination in two debris piles (Piles M and N) at CBP. These debris piles were identified and characterized during Supplemental Phase II Remedial Investigation (RI) field activities conducted in the Fall of 2005. Characterization data for the two piles indicated the need to manage the materials and perform a removal action to minimize the potential for contaminant dispersal. Removal of the piles will be performed as a non-Time Critical Removal Action (non-TCRA). This report was prepared in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERLCA) (42 U. S. Code 9601 et seq.) requirements to develop and evaluate removal action alternatives. Following CERLCA guidance, this EE/CA identifies removal action objectives (RmAOs), identifies potential removal action alternatives, and evaluates alternatives against criteria identified in U. S. Environmental Protection Agency (USEPA) Guidance for *Conducting Non-Time Critical Removal Actions under CERLCA* (USEPA 1993).

Ohio Army National Guard (OHARNG) has established future land uses for CBP based on anticipated training mission and utilization of the Ravenna Training and Logistics (RTLS) (USACE 2005e). These anticipated future land uses form the basis for identifying and evaluating removal action alternatives in this EE/CA. This removal action will achieve preliminary cleanup goals established for OHARNG land use at CBP.

This report is organized as follows:

- Chapter 2 summarizes the removal action objectives.
- Chapter 3 presents the removal action alternatives.
- Chapter 4 analyzes the alternatives.
- Chapter 5 summarizes partnering and public involvement activities.
- Chapter 6 states the recommended removal action alternative.
- Chapter 7 presents the schedule for implementation.

- Chapter 8 presents the references.
- The appendix provides detailed cost estimates.

1.2 FACILITY DESCRIPTION

When the RVAAP Installation Restoration Program (IRP) began in 1989, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by OHARNG over a 2-year period (2002 and 2003) and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP have been transferred to the National Guard Bureau (NGB) and subsequently licensed to OHARNG for use as a military training site. The current RVAAP consists of 1,280 acres scattered throughout the OHARNG RTLS.

The RTLS is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 km (3 miles) east-northeast of the city of Ravenna and approximately 1.6 km (1 mile) northwest of the city of Newton Falls. The RVAAP portions of the property are solely located within Portage County. The RTLS/RVAAP is a parcel of property approximately 17.7 km (11 miles) long and 5.6 km (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 1-1 and 1-2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 9.6 km (6 miles) to the northwest; Newton Falls 1.6 km (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 km (3 miles) to the south.

When the RVAAP was operational, the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and, therefore, references to RVAAP in this document are considered to be inclusive of the historical extent of RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. The liquid, containing TNT and Composition B, was known as "pink water" for its characteristic color. Pink water was collected in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to its use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In

addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other AOCs at RVAAP were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, waste oils, and sanitary waste. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

The U. S. Census Bureau population estimates for 2001 indicate that the populations of Portage and Trumbull counties are 152,743 and 223,982, respectively. Population centers closest to RVAAP are Ravenna, with a population of 12,100, and Newton Falls, with a population of 4,866. The RVAAP facility is located in a rural area and is not close to any major industrial or developed areas. Approximately 55% of Portage County, in which the majority of RVAAP is located, consists of either woodland or farmland acreage. The closest major recreational area, the Michael J. Kirwan Reservoir (also known as West Branch Reservoir), is located adjacent to the western half of RVAAP south of State Route 5.

RVAAP is operated by the Base Realignment and Closure (BRAC) Division. The BRAC Division controls environmental AOCs at RVAAP. NGB controls non-AOC areas and has licensed these areas to OHARNG for training purposes. Training and related activities at RTLS include field operations and bivouac training, convoy training, equipment maintenance, and storage of heavy equipment. As environmental AOCs are investigated and addressed or remediated, if needed, transfer of these AOCs from the BRAC Division to NGB will be conducted.

OHARNG has prepared a comprehensive Environmental Assessment and an Integrated Natural Resources Management Plan to address future use of RTLS property (OHARNG 2001). The perimeter of RVAAP is currently fenced and the perimeter is patrolled intermittently by the facility caretaker contractor. Access to RVAAP is strictly controlled and any contractors, consultants, or visitors who wish to gain access to the facility must follow procedures established by RVAAP, OHARNG, and the facility caretaker contractor.

The physiographic, geologic, hydrogeologic, and ecologic settings for RVAAP are presented in detail in the Phase II RI Report for CBP (USACE 2005b).

1.3 CBP HISTORY

CBP is located in the east-central area at the intersection of Paris-Windham Road and Lumber Yard Road, and covers approximately 20 acres (Figure 1-3). The AOC is bordered by old railroad beds to the north (Track 39) and south (Track 33), and Sand Creek to the west-northwest. The AOC was originally used as a lumber and building materials storage area, and later used for open burning of non-explosive

wastes, electrical components, wooden boxes, and scrap and the disposal of other non-hazardous waste material. Operation of the burn pits is believed to have started shortly after RVAAP began operations and continued into the mid-1970s, although actual dates are unknown. The burn pits are comprised of bare mounds of slag and debris, and there are approximately 15 located within the AOC. Three burn areas, characterized by debris, scrap materials, and distressed vegetation, were identified in the eastern portion of the AOC near Lumber Yard Road.

The topography across the majority of CBP is relatively flat due to historical grading and fill activities. Undisturbed topography is characterized by gently undulating contours. Sand Creek forms the western AOC boundary. Elevations vary from 292 to 298 meters (960 to 980 ft) (Figure 1-3). Structural features include former rail lines Track 39 and Track 33. Other features include debris piles and berms in the central area and burn areas in the eastern area. These debris piles and berms are placed materials, dumped over a period of time from other areas of RVAAP, and not conventional environmental media. Visual observations of the debris piles and berms show they consist of primarily of gravel and excess fill dirt. Some of the piles and berms contain minor miscellaneous general construction debris (scrap metal, aluminum door frames, glass). Two piles, further discussed below, contain primarily burning residues. Miscellaneous materials including glass, ceramics, and rail road ties have been noted scattered within the AOC. Several berms and piles are seen in Photograph 1-1. There are no buildings at CBP.

Photograph 1-1. Berms/Piles at CBP, April 2005

Soils within CBP consist primarily of Mahoning silt loams, Trumbull silt loams, and Ellsworth silt loams. The Ellsworth silt loam is found near the southwestern boundary of the AOC. The Trumbull silt loam is found in the eastern portion of the AOC. The Mahoning silt loam covers the remainder of CBP (western and extreme eastern boundary). Subsurface lithology at CBP consists mostly of clay to sand-rich silt tills with interbedded sands scattered throughout. These deposits are generally firm, moderately plastic, and tend to hold water where encountered.

A topographic high is located near the southwestern portion of the site, which decreases towards the north. Sand Creek is located adjacent to the northwestern boundary of CBP. Surface water intermittently flows in several drainage ditches located on site. The drainage ditches generate flow mainly from surface water runoff and precipitation events following the topography of the AOC. Eventually, the majority of surface water drains to Sand Creek. The ditches tend to hold water for extended periods due to the low permeability of most soil at CBP.

Although bedrock was not encountered during the RI monitoring well installation, it is assumed bedrock is the Sharon Conglomerate bedrock based on available historical geologic and environmental surveys of the area.

1.4 PREVIOUS INVESTIGATIONS AND REMOVAL ACTIONS

Previous investigations at CBP include a Relative Risk Site Evaluation (RRSE), a Phase I RI, and a supplemental Phase II RI. No previous removal actions have been conducted at CBP.

1.4.1 RRSE and Phase I RI

Previous investigations at CBP include the following:

- The "Relative Risk Evaluation for Newly Added Sites at the RVAAP, Ravenna, Ohio, Hazardous and Medical Waste Study No. 37-EF-5360-99, 19-23 October 1998," by the U. S. Army Center for Health Promotion and Prevention Medicine (USACHPPM) evaluated 13 new sites, resulting in CBP being classified as a high-priority AOC.

- The Phase I RI (USACE 2005a) sampled soil (0 to 3 ft below ground surface [BGS]) and subsurface soil (3 to 30 ft BGS), sediment, surface water, and groundwater in order to characterize contamination at the AOC.

1.4.2 Supplemental Phase II RI

Supplemental Phase II RI field activities were conducted to further define nature and extent of soil contamination at CBP and collect additional data from the debris piles and berms to assess disposition requirements and options. The sampling strategy is presented in the *Supplemental Phase II Remedial Investigation of Central Burn Pits, Fuze and Booster Quarry Landfill/Ponds, and Open Demolition Area*

#2 at Ravenna Army Ammunition Plant in Ravenna, Ohio (USACE 2005b). The full results from the Supplemental Phase II RI will be published in a future Phase II RI Report.

Additional surface (0 to 1 ft BGS) and subsurface (1 to 3 ft BGS) discrete soil sampling was performed to delineate contamination identified during the Phase I RI. Debris piles and berms (Figure 1-4) identified at CBP during the Phase I RI and subsequent visits were not evaluated in the Phase I RI. During a field reconnaissance in September 2005, field measurements of the approximate dimensions of these piles and berms were collected. The dimensions and estimated volumes are summarized in Table 1-1.

Table 1-1. CBP Debris Piles and Berms

Surface Features	Approximate Dimensions	Shape	Estimated Volume
Berm A[1]	Length = 570 ft, Width = 19 ft Height = 3 ft	Rectangular	32,500 cu feet 1,200 cu yards
Pile B	Height = 8 ft, Radius = 10 ft	Pile	1,260 cu feet 47 cu yards
Pile C	Height = 8 ft, Radius = 10 ft	Pile	1,260 cu feet 47 cu yards
Berm D[2]	Length = 340 ft, Width = 15 ft Height = 3 ft	Rectangular	15,300 cu feet 570 cu yards
Pile E	Length = 12 ft, Width = 8 ft Height = 4 ft	Rectangular	380 cu feet 14 cu yards
Pad F	Length = 6 ft, Width = 6 ft	Rectangular	NA
Berm H	Length = 245 ft, Width = 13 ft Height = 4 ft	Rectangular	12,740 cu feet 470 cu yards
Pile I[3]	Length = 304 ft, Width = 12 ft Height = 4 ft	Rectangular	14,600 cu feet 540 cu yards
Berm K	Length = 120 ft, Width = 9 ft Height = 1.5 ft	Rectangular	1,620 cu feet 60 cu yards
Pile L	Height = 8 ft, Radius = 5 ft	Pile	310 cu feet 11 cu yards
Pile M	Height = 3 ft, Radius = 19 ft	Pile	1,700 cu feet 63 cu yards
Pile N	Height = 4.5 ft, Radius = 10 ft	Pile	710 cu feet 26 cu yards
Pile P[4]	Height = 8 ft, Radius = 10 ft	Pile	1,260 cu feet 47 cu yards

[1] Berm A was re-surveyed after the Supplemental Phase II Remedial Investigation (RI) sampling and length was adjusted.
[2] Berm D encompasses Berm D and Berm G from the Supplemental Phase II RI Sampling and Analysis Plan.
[3] Pile I was re-surveyed after the Supplemental Phase II RI sampling and length was adjusted.
[4] Pile P identified during walkover with Ohio Environmental Protection Agency November 14, 2005.

Soil samples of berm and pile materials at CBP were collected using multi-increment (MI) sampling techniques. MI samples are composite samples collected from multiple, stratified random points within each of the designated MI sampling areas. Results of the MI sampling of piles and berms are shown in Table 1-2. The MI sample results from piles M and N indicate they contain inorganic contaminants at much higher levels than surrounding soil. Process knowledge and visual characteristics indicate that piles M and N contain a substantial percentage of residues from previous burning activities and, on this basis,

are considered as a waste material rather than conventional environmental media. Supplemental Phase II sampling indicated that Pile M has a lead MI concentration of 8,560 mg/kg and also a lead toxicity characteristic leaching procedure (TCLP) result of 15.4 mg/L. This TCLP result exceeds the maximum concentration of lead (5.0 mg/L) for toxicity characteristics and the debris pile material potentially classifies as a characteristically hazardous waste. Also, the MI sample for Pile N had a detected value of 25 mg/kg of hexavalent chromium, which, although not characteristically hazardous, is highly elevated compared to the surrounding soil.

Table 1-2. Inorganics Detected in Multi-Increment Samples of Debris Piles and Berms at CBP

Analyte (mg/kg)	Pile or Berm												
	Back-ground	Berm A	Pile B	Pile C	Berm D	Pile E	Berm H	Pile I	Berm K	Pile L	Pile M	Pile N	Pile P
Chromium, hexavalent	--	0.42 U	0.47 U	0.4 U	0.48 U	0.43 U	0.53 U	0.42 U	0.49 U	1.2 =	0.42 U	25 =	0.49 U
Aluminum	17700	14500 =	15900 =	6960 =	18100 =#	12400 =	16900 =	12500 =	32600 =#	22300 =#	12700 =	10200 =	6190 =
Antimony	0.96	0.47 J	0.88 J	0.93 J	0.4 UJ	0.96 J	0.69 J	0.34 U	0.37 UJ	0.51 J	39.3 =#	6.5 =#	0.46 J
Arsenic	15.4	10 =	14.6 =	21.3/=#	8.8 =	15.6 =#	9.9 =	11.3 =	5.4 =	10.8 =	12 =	40.1 =#	15 =
Barium	88.4	121 J#	135 J#	87 J	329 J#	132 J#	222 J#	76.8 =	465 J#	264 =#	1560 =#	317 =#	73.1 J
Beryllium	0.88	1.1 =#	1.3 =#	0.67=	2.4 =#	1.2 =#	2.1 =#	0.6 =	3.6 =#	2.2 =#	1.6 U	1.1 =#	0.37 =
Cadmium	0	0.35 =#	0.68 =#	0.92 =#	0.69 =#	0.27 =#	0.79 =#	0.36 =#	0.38 =#	0.27 =#	14.1 =#	6.2 =#	0.43 =#
Chromium	17.4	51.6 J#	27.9 J#	19.2 J#	28.9 =#	28.3 =#	20.5 J#	18.8 =#	40.8 J#	27.8 =#	23.1 =#	105 =#	13.8 J
Copper	17.7	13.9 =	28.5 =#	113 =#	13.2 =	38.7 J#	16.4 =	15.7 =	14.8 =	18 =#	12800 =#	380 =#	9.9 =
Lead	26.1	20.7 =	75.1 =#	62.1 =#	57.9 =#	85.3 =#	56.1 =#	37.3 =#	15.4 =	21.6 =	8560 =#	348 =#	29.8 =#
Manganese	1450	1540 =#	1320 =	1050 =	2790 =#	3130 =#	1880 =#	733 =	5290 =#	2630 =#	668 =	745 =	690 =
Mercury	0.036	0.04 =#	0.05 =#	0.06 =#	0.04 =#	0.04 =#	0.06 =#	0.06 =#	0.04 =#	0.13 =#	0.04 =#	28 =#	0.06 =#
Nickel	21.1	24.6 =#	20.6 =	19.5=	17.1 =	24.9 =#	18.1 =	16.5 =	9 =	13.9 =	26.3 =#	30.7 =#	15.4 =
Selenium	1.4	1.8 J#	1.6 =#	1.4 J	1.6 J#	0.5 J	1 J	0.73 =	3.6 J#	2.3 J#	3.9 =#	2.7 =#	0.91 =
Silver	0	0.21 U	0.08 U	0.11 J#	0.24/U	0.04 U	0.22 U	0.04 U	0.9 J#	0.2 U	0.73 =#	98.2 =#	0.05 U
Thallium	0	1.4 U	0.54 U	0.57 U	1.6 U	2.4 U	1.5 U	0.27 U	2.9 U	1.3 U	0.84 J#	0.41 J#	0.3 U
Zinc	61.8	58.1 =	131 =#	151 =#	65.5 =#	151 =#	75.1 =#	127 =#	34.3 =	72.9 =#	8780 =#	490 =#	67.2 =#

J - estimated value less than reporting limits.
U - Not detected
= - analyte present and concentration accurate
- value above Facility-Wide background

1.5 STREAMLINED RISK EVALUATION

1.5.1 Summary of Human Health Risk Assessment

A baseline Human Health Risk Assessment (HHRA) was performed in the Phase I RI (USACE 2005b) to assess the potential current and future risks associated with human exposure to site-related contaminants found at CBP. Future land use scenarios include ownership by the NGB for training purposes; use by recreational hunters and fishermen; and use as a residential farm. Risks were evaluated for a National Guard trainee and a National Guard resident/trainer; a hunter/trapper; security maintenance worker; and a resident farmer (adult and child). Constituents of concern (COCs) were selected and toxicological and exposure factors were applied to evaluate risk. HHRA results are summarized in Table 1-3. Subsequent to this baseline HHRA, the RVAAP Facility Wide Risk Assessor Manual (USACE 2005e) was updated to include a trespasser scenario. Based on the exposure parameters, risks to a trespasser would be less than those predicted for the National Guard Trainee and Security Guard/Maintenance Worker.

Table 1-3. Summary of HHRA Risk Results for Direct Contact with Soil at the Central Burn Pits

Receptor	Total HI	Total ILCR	Potential COCs	Notes
National Guard Trainee (Representative Receptor)				
Deep Surface Soil[a]	4.1	1.6E-05	As, Cr, Mn	EPCs for As and Mn are ≤ background. Total Cr results evaluated as hexavalent chromium. Supplemental Phase II RI data confirm the majority of the chromium in deep surface soil is not hexavalent chromium.
Security Guard/Maintenance Worker				
Shallow Surface Soil[a]	0.10	8.1E-06	As, B(*a*)P	Total risk exceeds USEPA *deminimis* risk level of 1E-06, but is below Ohio EPA target risk level of 1E-05. EPC for As is ≤ background.
Hunter				
Shallow Surface Soil[a]	0.0010	8.9E-08	None	Total risk and hazard below USEPA and Ohio EPA target risk values.
National Guard Resident				
Shallow Surface Soil[a]	0.20	1.3E-05	As, B(*a*)P	EPC for As is ≤ subsurface background in a highly disturbed area. Risk from B(*a*)P is below Ohio EPA target risk level.
Subsurface Soil[a]	0.13	1.0E-05	As	EPC for As is ≤ background.
Resident Subsistence Farmer[b]				
Shallow Surface Soil[a]	1.7	6.0E-05	As, B(*a*)P	EPC for As is ≤ subsurface background in a highly disturbed area. Risk from B(*a*)P is below Ohio EPA target risk level.
Subsurface Soil[a]	1.2	4.8E-05	As	EPC for As is ≤ background.

As = arsenic
B(*a*)P = benzo(*a*)pyrene
COC = constituent of concern.
Cr = chromium (evaluated as hexavalent chromium)
EPC = exposure point concentration
HI = hazard index.
ILCR = incremental lifetime cancer risk.
Mn = manganese
Ohio EPA = Ohio Environmental Protection Agency
RI = remedial investigation
USEPA = U. S. Environmental Protection Agency

[a]Shallow surface soil includes samples from 0-1 ft below ground surface (BGS); Deep surface soil includes samples from 0-4 ft BGS; ubsurface soil includes samples from 1-30 ft BGS.
[b]Noncancer risks were calculated separately for Adult and Child Resident Subsistence Farmer scenarios. The maximum HI (for the child) are presented here. Cancer risks were calculated for a combined adult and child "Lifelong" Resident Subsistence Farmer scenario.

As part of Phase II supplemental RI activities, discrete soil samples were collected from surface (0 to 1 ft BGS) and subsurface (1 to 3 ft BGS) soil at CBP to complete the analysis of nature and extent of contamination (USACE 2006a). Evaluation of the supplemental soil data shows that, with the exception of chromium, these new data do not change the conclusions of the HHRA at CBP for shallow (0 to 1 ft BGS) surface soil or subsurface (1 to 30 ft BGS) soil. The supplemental data confirm the majority of the chromium in deep surface soil (0 to 4 ft BGS) is not hexavalent chromium; therefore, chromium is not a risk driver for the National Guard Trainee.

Calculated exposure point concentrations (EPCs) of the two potential inorganic COCs (arsenic and manganese) are below background concentrations of these metals. The calculated risk from benzo(a)pyrene is below the Ohio EPA target risk level of 1E-05; therefore, no COCs are identified for soil/dry sediment for evaluation of remedial alternatives for National Guard or residential land use at CBP. A complete presentation of risk assessment results will be presented in a future Supplemental Phase II RI Report.

Characterization of debris piles, which are placed materials and not conventional environmental media, was performed, using MI samples, during the supplemental Phase II RI to assess disposition requirements/options and are not included in the HHRA. The multi-increment sample results from Piles M and N indicate they contain inorganic contaminants at much higher levels than surrounding soil. These piles are not viable exposure units for risk characterization because (1) process knowledge and visual characteristics indicate that these piles contain a substantial percentage of burning residues and, on this basis, are considered as a waste material rather than conventional environmental media (i.e., they are not soil); and (2) due to their small size a receptor would be expected to spend a very small portion of his time at CBP at the piles.

1.5.2 Summary of Ecological Risk Assessment

The ecological risk assessment (ERA) performed for CBP is available in the Phase I RI Report (USACE 2005a). The ERA in the Phase I RI Report identifies a variety of ecological receptor populations that could be at risk and identifies constituents of ecological concern (COECs) that could contribute to potential risks from exposure to contaminated media. The ERA for CBP also reported the ecological field work conducted at the site, including ecological reconnaissance of existing vegetation and animal life. The ERA showed soil hazard quotients (HQs) exceed 1 for some chemicals, but are generally not highly elevated and metal concentrations are similar to background for all COECs. The field efforts indicated there are currently few observable adverse ecological effects, and there is ample nearby habitat to maintain ecological communities at CBP and elsewhere on RVAAP. Further, there was evidence that the nearby Sand Creek and by implication terrestrial habitats yet further away have not received migrating contaminants from CBP because those areas showed no negative ecological effects anywhere according to the Facility-wide Biological and Surface Water Study (USACE 2005d). All the studies document the presence of healthy and functioning terrestrial and aquatic ecosystems. The Supplemental Phase II RI Report, to be prepared as a future document will present a full ecological weight-of-evidence assessment pertaining to ecological cleanup goals for soil/dry sediment at CBP.

1.5.3 Preliminary Cleanup Goals

This section documents the proposed land use and corresponding preliminary cleanup goals to support the removal action alternative selection process for lead and hexavalent chromium at Piles M and N at CBP. Preliminary cleanup goals are the chemical-specific numeric cleanup goals used to meet the RmAOs for protection of human health. Piles M and N are not viable terrestrial ecological habitat; therefore, ecological cleanup goals are not applicable for this removal action. The Phase I RI indicated there are currently few observable adverse ecological effects at CBP and this removal action will reduce the potential for contaminant migration that could increase ecological HQs in adjacent soil/dry sediment. Preliminary human health and ecological cleanup goals for soil/dry sediment at CBP will be fully addressed in the Supplemental Phase II RI.

Characterization of debris piles indicates Pile M has a lead concentration of 8,560 mg/kg and also a lead TCLP result of 15.4 mg/L. This TCLP result exceeds the maximum concentration of lead (5.0 mg/L) for toxicity characteristics and the debris pile material potentially classifies as a characteristically hazardous waste. Also, Pile N had a detected value of 25 mg/kg of hexavalent chromium, which, although not characteristically hazardous, is highly elevated compared to the surrounding soil. Therefore; preliminary cleanup goals are identified for lead and hexavalent chromium. These cleanup goals will be applied to soil underlying the debris piles in order to ensure contamination that may have migrated from the pile materials is addressed.

Information obtained during the RI shows that soil and dry sediment at CBP already meets cleanup goals for restricted (National Guard Trainee), as well as residential land use. Considering these data, it is cost effective to establish removal action cleanup goals consistent with all exposure scenarios evaluated for the COCs, so that land use controls are not required for any small area of residual contamination in soil beneath Piles M and N following the removal action. Preliminary cleanup goals for this removal action are; therefore, selected based on the lowest cleanup number for the exposure scenarios evaluated in the RI. The lowest risk-based preliminary cleanup goal for lead among the receptors evaluated is residential land use (400mg/kg, U.S. EPA residential play areas hazard level – 40 CFR 745). The lowest cleanup goal for hexavalent chromium among the receptors evaluated is for the National Guard Trainee (16 mg/kg), based on combined exposure through ingestion, inhalation of fugitive dust, and dermal contact with soil. The hexavalent chromium cleanup goal is consistent with the previously approved preliminary cleanup goal in the Final Proposed Remedial Goal Options for Soils at Load Lines 1, 2, 3, and 4 at the Ravenna Army Ammunition Plant (Shaw 2004).

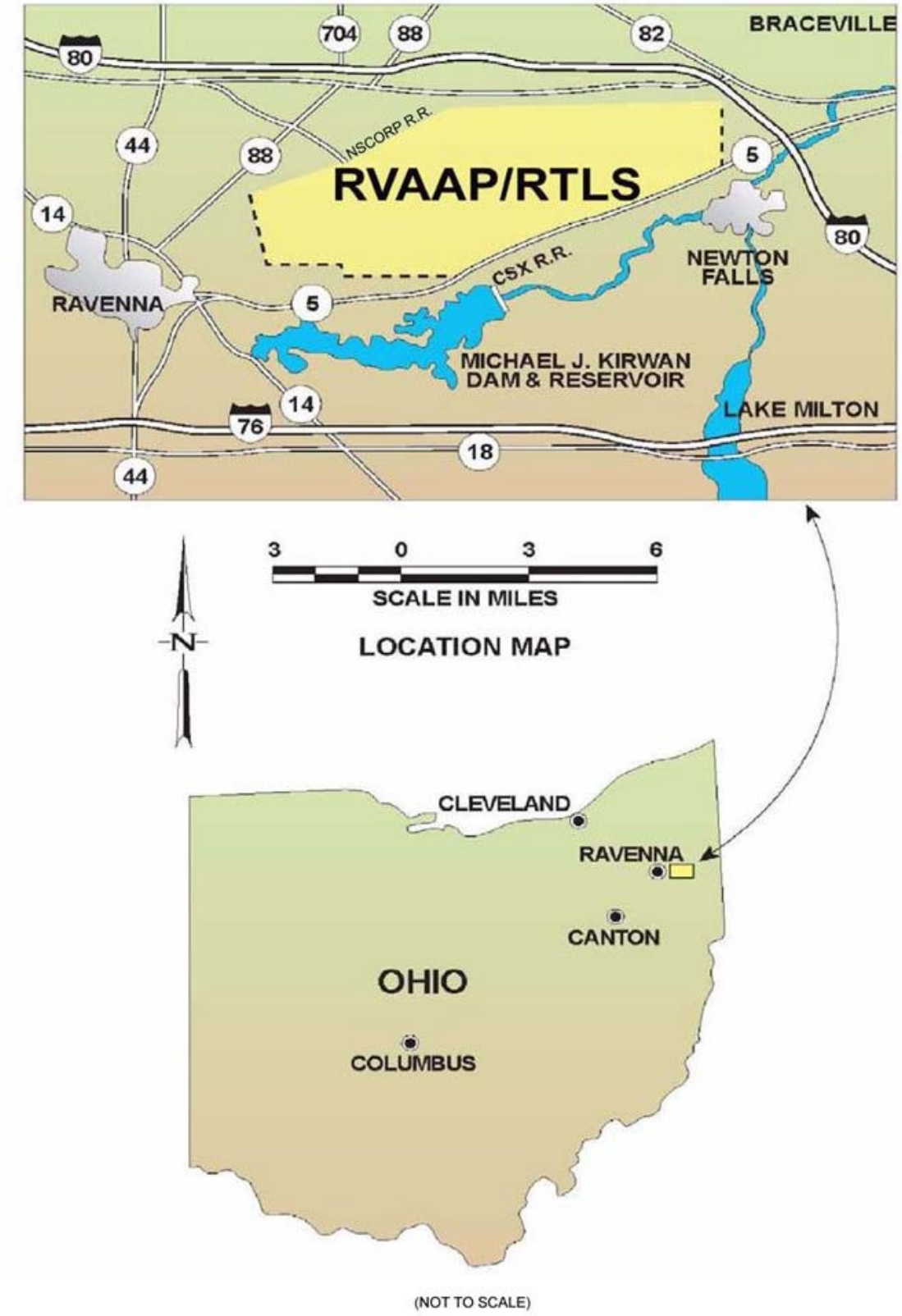

Figure 1-1. General Location and Orientation of RTLS/RVAAP

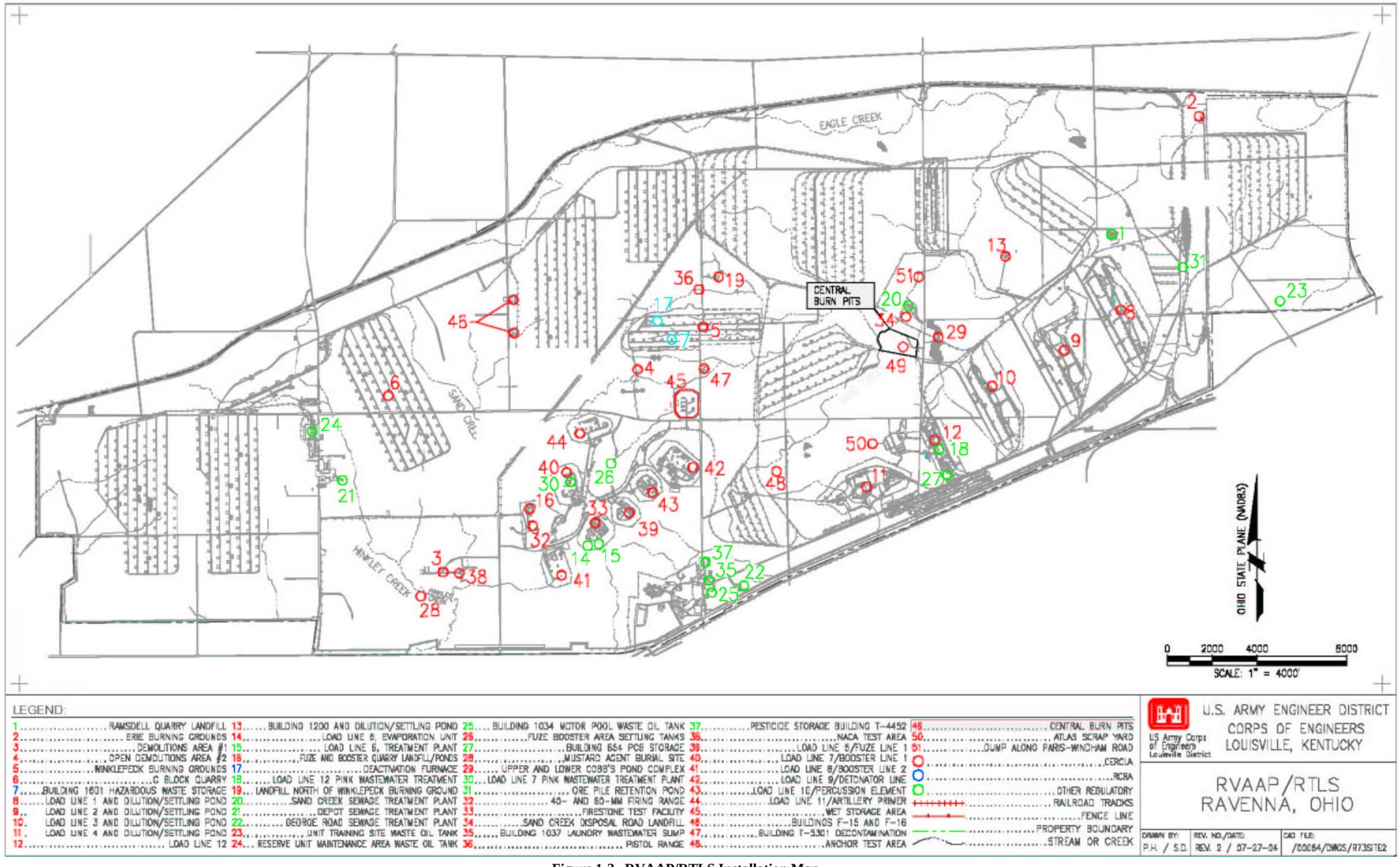

Figure 1-2. RVAAP/RTLS Installation Map

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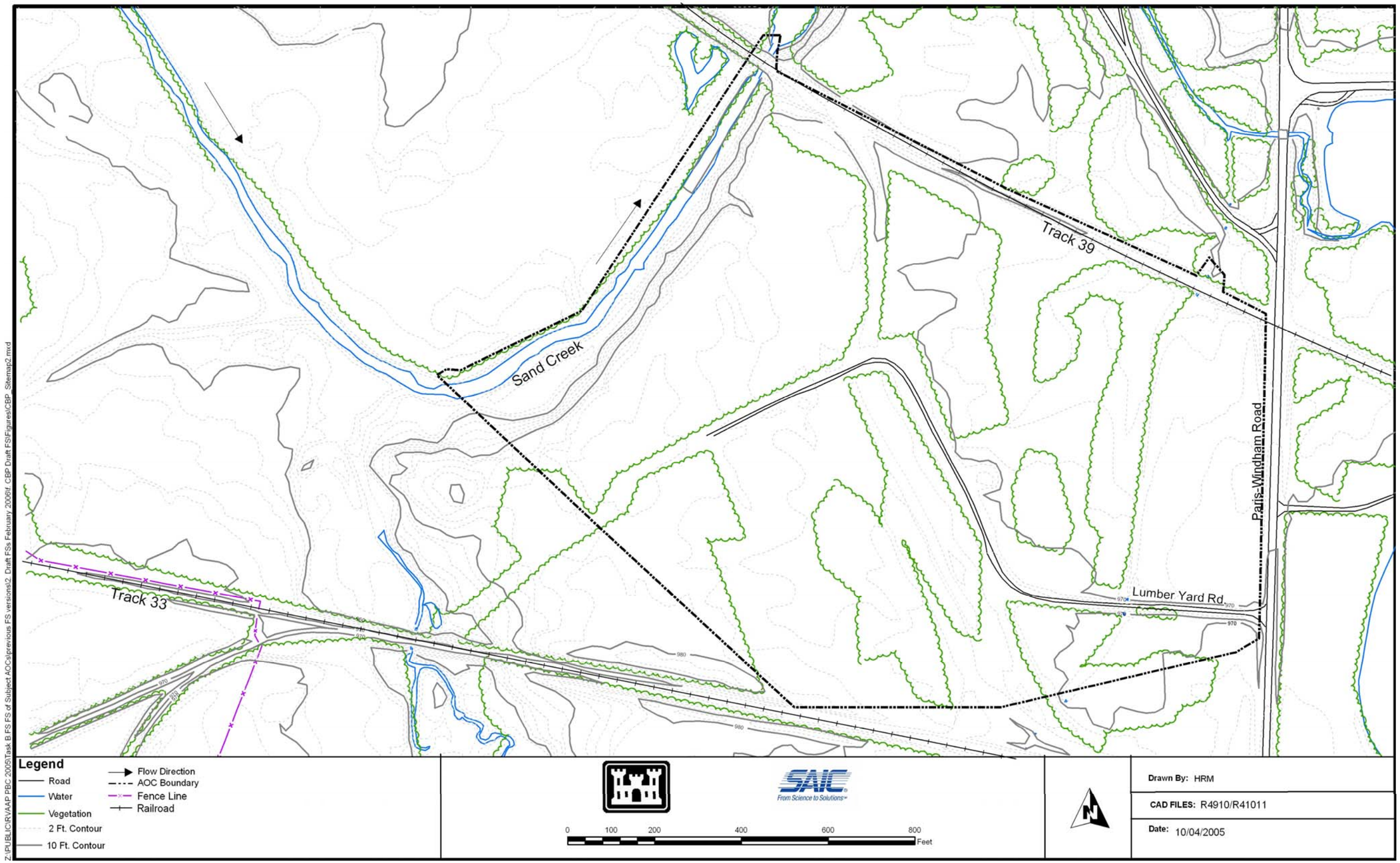

Figure 1-3. Features of CBP

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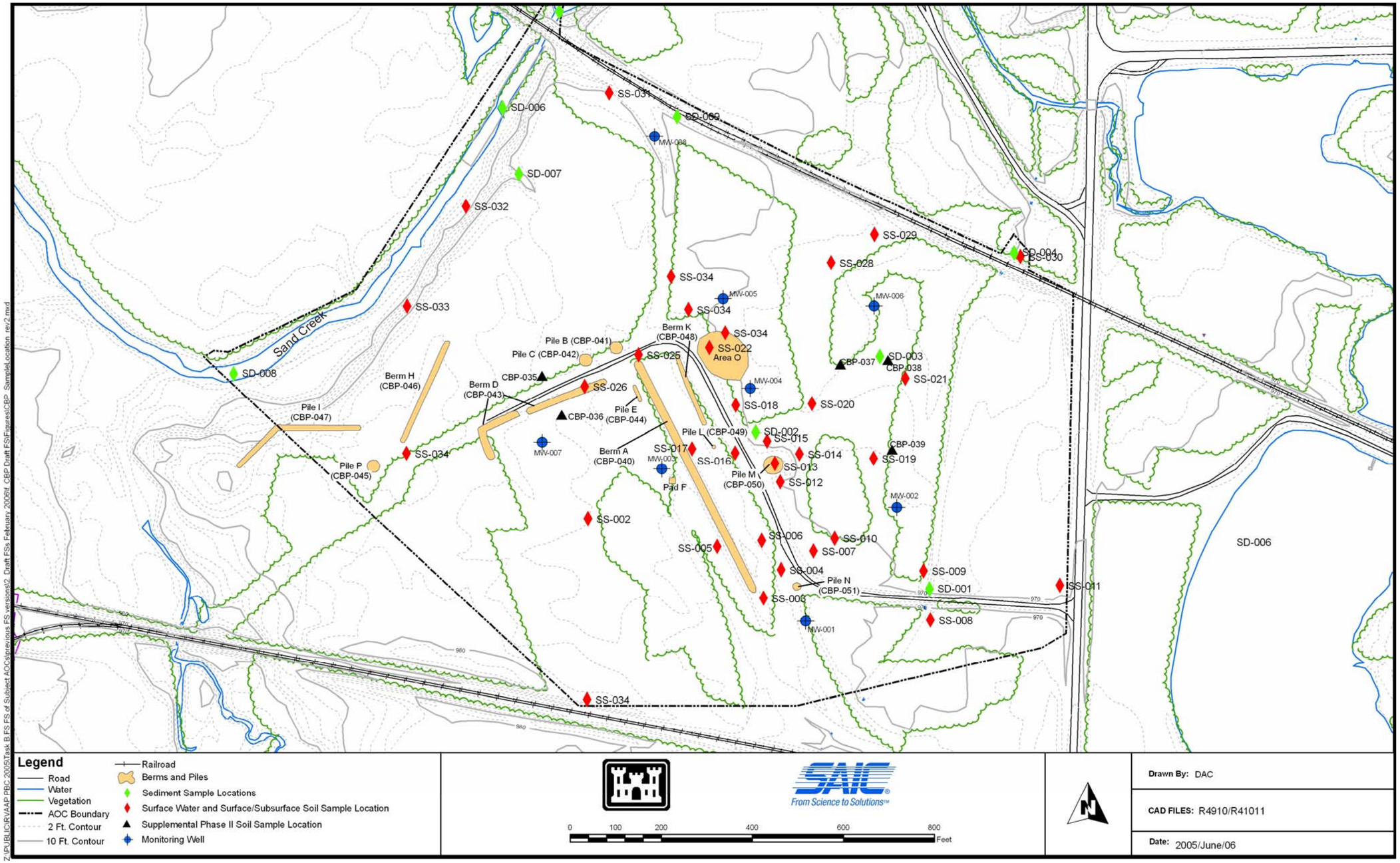

Figure 1-4. Sample Locations, Monitoring Well Locations, and Piles and Berms at CBP

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2.0 REMOVAL ACTION OBJECTIVES

This chapter of the EE/CA describes the RmAOs, justification for the proposed action, and identifies applicable or relevant and appropriate requirements. RmAOs specify the requirements that removal action must fulfill in order to protect human health and the environment from contaminants and provide the basis for identifying removal action alternatives in Chapter 3.

2.1 SCOPE AND PURPOSE

As noted in Chapter 1, debris piles M and N at CBP contain residues and materials with elevated levels of lead and hexavalent chromium that have a high likelihood to disperse and migrate. Further, Pile M lead levels exceed TCLP criteria indicating the materials in the pile are characteristically hazardous. The piles are not considered viable exposure units and are not soil media; however, due to the elevated levels of lead and hexavalent chromium, a removal action is indicated in order to provide protection to human health and the environment and minimize the potential for contaminant dispersal from the materials.

OHARNG has prepared a comprehensive Environmental Assessment and an Integrated Natural Resources Management Plan to address future use of RTLS property (OHARNG 2001). OHARNG has established future land use for CBP as Dismounted Training, No Digging based on anticipated training, mission, and utilization of the RTLS (USACE 2005e). Future land use will also include the development of small arms ranges. The CBP is not included as a Military Munitions Response Program (MMRP) Munitions Response Site (MRS) at RVAAP based on available historical and operational information; therefore, no removal actions or land use controls are currently planned with respect munitions and explosives of concern (MEC).

This EE/CA is developed following guidelines of *Use of Non-Time Critical Removal Authority in Superfund Response Actions* (USEPA 2000). As stated in the guidelines, USEPA has urged Superfund decision makers to broadly use the CERCLA removal authority to achieve quick, protective results at Superfund sites, consistent with legal requirements, including public participation. Although RVAAP is not a National Priorities List (NPL) listed site, Ohio EPA, the Army, and OHARNG have agreed to proceed with a non-TCRA for Piles M and N. This EE/CA develops RmAOs consistent with the intended future land use at CBP. The following RmAO is for impacted piles at CBP was developed consistent with the intended future land use at CBP:

- Remove Piles M and N to prevent dispersal of contaminants and ensure underlying soil meets the lowest risk-based cleanup goals for the exposure scenarios evaluated in the RI.

2.2 JUSTIFICATION FOR THE PROPOSED ACTION

The MI sample results for piles M and N indicate they contain inorganic contaminants at much higher levels than surrounding soil. Future land use of CBP includes dismounted training, which includes activities and vehicle traffic that also could physically disperse contaminants should trainees inadvertently

disturb the materials. The potential exists for dispersal of contaminants from materials in Piles M and N to adjacent soil by wind and water erosion. These factors provide sufficient justification to warrant a removal action.

2.3 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with the National Contingency Plan (NCP) [40 *Code of Federal Regulations (CFR)* 300.415(j)] on-site removal actions conducted under CERCLA are required to meet ARARs "to the extent practicable, considering the exigencies of the situation." Shipments of contaminated soils and dry sediments will comply with Federal, State, and local rules, laws and regulations. In addition to the identified applicable and relevant or appropriate requirements (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 Ohio Administrative Code (OAC) 3745-52-20 to OAC 3745-52-33, and offsite treatment prior to land disposal as required by RCRA's land disposal restrictions under OAC 3745-270, including alternative land disposal restriction treatment standards for contaminated soil under OAC 3745-270-49. Table 2-1 presents the ARARs that are applicable to removing Piles M and N at CBP.

Table 2-1. ARARs for Disposal of RCRA Hazardous Waste

General Construction Standards – Site Preparation and Excavation			
Activities Resulting in the Emission of Particulate Matter, Dusts, Fumes, Gas, Mists, Smoke, etc. From a Hazardous Waste Facility	No owner/operator of a hazardous waste facility shall cause or allow the emission of any particulate matter, dusts, gas, fumes, mists, smoke, vapor, or odorous substances that interferes with the enjoyment of life or property by persons living or working in the vicinity of the facility. Any such action is considered a public nuisance.	Applicable to soil excavation activities at CBP	ORC 3734.02(I) OAC 3745-15-07(A)
Activities Causing Fugitive Dust Emissions	Persons engaged in construction activities shall take reasonable precautions to prevent particulate matter from becoming airborne; reasonable precautions include, but are not limited to, the following: ▪ the use of water or chemicals for control of dust during construction operations or clearing of land; and ▪ the application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces, which can create airborne dusts. No person shall cause, or allow, fugitive dust to be emitted in such a manner that visible emissions are produced beyond the property line.	Applicable to pre-construction clearing activities and excavation activities.	OAC 3745-17-08(B)

Table 2-1. ARARs for Disposal of RCRA Hazardous Waste

Removal of Contaminated Soils			
Waste Generation, Characterization, Segregation, and Storage-Excavated Soils and Buried Wastes, Sludge, Surface Features, Debris, and Secondary Waste			
Generation and Characterization of Solid Waste *(all primary and secondary wastes)*	The generator must determine if the material is a solid waste, as defined in 40 *CFR* 261.2 and 40 *CFR* 261.4(a). If the material is a solid waste, the generator must determine if the solid waste is a hazardous waste by: ▪ determining if the waste is listed under 40 *CFR* Part 261; or ▪ determining if the waste exhibits characteristics by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used; and ▪ determining if the waste is excluded under 40 *CFR* Parts 261, 262, 266, 268, and 273.	Applicable to generation of a solid waste as defined in 40 *CFR* 261.2 and that is not excluded under 40 *CFR* 261.4(a). Applicable to the generation and characterization of hazardous-contaminated soil and hazardous debris resulting from excavation. Applicable to the generation and characterization of hazardous-contaminated soil and hazardous debris resulting from excavation. Applicable to generation of decontamination wastewater.	40 CFR 262.11(a)(b)(c) OAC 3745-52-11(A)(B)(C)(D) 40 CFR 262.11(a)(b)(c) OAC 3745-52-11(A)(B)(C)(D) 40 CFR 262.II(a)(b)(c) OAC 3745-52-11(A)(B)(C)(D)
	The generator must determine if the waste is restricted from land disposal under 40 *CFR* 268 *et seq.* by testing in accordance with prescribed methods or use of generator knowledge of waste.	Applicable to the generation and characterization of hazardous-contaminated soil and hazardous debris resulting from excavation. Applicable to generation of decontamination wastewater.	40 CFR 268.7 OAC 3745-270-07
	The generator must determine each USEPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under 40 CFR 268.40, Subpart D.	Applicable to the generation and characterization of hazardous-contaminated soil and hazardous debris resulting from excavation. Applicable to generation of decontamination wastewater.	40 CFR 268.9(a) OAC 3745-270-07 OAC 3745-270-09

Table 2-1. ARARs for Disposal of RCRA Hazardous Waste

	The generator must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the waste.	Applicable to the generation and characterization of RCRA characteristic hazardous waste (except D00I non-wastewaters treated by combustion, recovery of organics, or polymerization. See 268.42, Table I) and to hazardous-contaminated soils for their subsequent storage, treatment, or disposal.	40 CFR 268.9(a) OAC 3745-270-09
Accumulation of Hazardous Debris from Excavation and Screening. It is Assumed that any Debris Resulting from Excavation and Screening will be Accumulated for < 90 Days	A generator may accumulate for up to 90 days or conduct treatment of hazardous wastes in containers without an Ohio EPA permit. Generators that accumulate for 90 days or conduct on-site treatment of hazardous waste in containers must comply with the personnel training, preparedness and prevention requirements, and contingency plan requirements of 40 *CFR* 265.16; 40 *CFR* 265, Subpart C; and 40 *CFR* 265, Subpart D, respectively. Personal training and contingency plan requirements would appear to be administrative in nature. Arguably some of the components/goals of the contingency plan such as: (1) to minimize the hazards to human health or environment from fire, explosion or sudden release of hazardous waste or hazardous constituents, or (2) presence of an emergency coordinator on site, could be viewed as substantive. If determined to be substantive, these provisions should be cited as ARAR; however, the plans, details or implementation steps should be included in the CERCLA documentation for the site (i.e., remedial design documents).	Applicable to 90-day accumulation of debris from excavation and screening if such debris contains listed wastes or exhibits a characteristic.	40 CFR 262.34(a)(4) OAC 3745-52-34(A)(4) OAC 3745-66-70 to 66-77

Table 2-1. ARARs for Disposal of RCRA Hazardous Waste

	Containers must be marked with the date upon which period of accumulation began and with the words "Hazardous Waste."	Applicable to 90-day accumulation of debris from excavation and screening if such debris contains listed wastes or exhibits a characteristic.	40 CFR 262.34 (a)(2)(3) OAC 3745-52-34 (A)(2)(3)
	Containers holding hazardous wastes must be kept closed except to add or remove wastes and must not be managed in a manner that would cause them to leak.	Applicable to 90-day accumulation of debris from excavation and screening if such debris contains listed wastes or exhibits a characteristic.	40 CFR 264.171 40 CFR 264.172 40 CFR 264.173 40 CFR 264.176 40 CFR 264.17 OAC 3745-52-34(A)(1)
	Containers of hazardous waste must be maintained in good condition and comparable with the waste stored therein. Containers holding ignitable or reactive wastes must be separated from potential ignition sources and located 50 feet from the property boundary.		
Placement of hazardous contaminated soil in a staging pile	In 1998, USEPA created a new unit for the temporary management of remediation wastes known as the staging pile. The staging pile is an accumulation of solid, non-flowing remediation wastes that may be used for storage of those wastes for two years. The requirements for staging piles include the performance criteria of 40 CFR 264.554(d). These standards require that: ▪ the staging pile must be designed to prevent or minimize releases of hazardous waste or hazardous constituents into the environment,	Applicable to storage of hazardous contaminated soils in staging piles. Potentially relevant and appropriate if excavated soils are determined to not contain listed wastes or exhibit the TC soils.	40 CFR 264.554 OAC 3745-57-74

Table 2-1. ARARs for Disposal of RCRA Hazardous Waste

	▪ the staging pile must be designed to minimize cross-media transfer as necessary to protect human health and the environment (by using liners, run-off/run-on controls as appropriate) The staging pile requirements also contain closure requirements (separate provisions for staging piles located in previously contaminated areas and those located in previously uncontaminated areas)		

ARAR = applicable and relevant or appropriate requirements.
CBP = Central Burn Pits
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
OAC = Ohio Administrative Code
Ohio EPA = Ohio Environmental Protection Agency
ORC = Ohio Revised Code
RCRA = Resource Conservation and Recovery Act
USEPA = U. S. Environmental Protection Agency

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3.0 DEVELOPMENT OF ALTERNATIVES

3.1 DEVELOPMENT OF REMOVAL ACTION ALTERNATIVES

This section describes the removal action alternatives assembled for impacted Piles M and N at CBP. Removal action alternatives should assure adequate protection of human health and the environment, achieve RmAOs, meet ARARs, and permanently and significantly reduce the volume, toxicity, and/or mobility of contaminants.

The removal action alternatives presented herein address Piles M and N and encompass a range of potential removal actions:

- Alternative 1: No Action; and
- Alternative 2: Excavation of Waste Piles with Off-site Treatment and Disposal.

Alternative 1 is the no action response required under the NCP. Alternative 2 addresses impacts through removal and treatment of impacted media via chemical fixation prior to disposal at an off-site facility. Disposal without treatment is not evaluated as a separate alternative because debris pile materials containing contaminants at levels greater than RCRA land disposal requirement (LDR) standards will require treatment to achieve less than LDR standards prior to disposal. A summary can be seen in Table 3-1.

3.1.1 Alternative 1: No Action

Under Alternative 1, current access restrictions and monitoring programs at CBP will discontinue and no additional actions regarding access or land use controls will be implemented. Alternative 1 provides no additional protection to human health and the environment over current conditions. This alternative is required under the NCP as a no action baseline against which other alternatives can be compared.

3.1.2 Alternative 2: Excavation Of Waste Piles with Off-site Treatment And Disposal

Alternative 2 consists of excavating Piles M and N, off-site disposal, and treatment of the materials. This removal action alternative would require coordination of removal and monitoring activities with OHARNG and the Army. Such coordination will minimize health and safety risks to on-site personnel and minimize disruption to their activities consistent with a safe and effective removal. The timeframe to complete the alternative is relatively short. The amount of time to complete this removal action includes the time to develop a Removal Action Work Plan, implement the plan, and conduct the confirmatory sampling. No operation and maintenance (O&M) period is included.

Removal Action Work Plan. This plan would detail preparation activities, the extent of the excavation, implementation and sequence of construction and treatment activities, decontamination, and segregation, transportation, and disposal of various waste streams. Short term land use controls will be necessary

during the active construction period to ensure a safe removal. If required for land disposal restrictions, the disposal facility may have to treat the waste piles.

Excavation. Piles M and N would be excavated and transported to a staging area for loading trucks. The volume of Pile M is estimated to be 63 yd^3 and Pile N is estimated to be 26 yd^3. Pile removal would be accomplished using standard construction equipment such as excavators, bulldozers, front-end loaders, and scrapers. Excavation would be guided using a limited quantity of analytical samples. Oversize debris would be crushed or otherwise processed to meet disposal facility requirements. Movement of pile materials would be performed using dump trucks and conventional construction equipment. Erosion control materials such as silt fences and straw bales would be installed to minimize erosion. Impacted materials would be kept moist or covered with tarps to minimize dust generation. Excavation would take place in stages to limit impacts to current activities. The safety of workers, on-site employees, and the general public would be covered in a site-specific health and safety plan. The health and safety plan would address potential exposures and monitoring requirements to ensure protection.

Waste pile materials would be hauled to a disposal facility by trucks lined with polyethylene sheeting (inter-model containers similarly lined also could be used) and covered with specially designed tarps or hard covers. All trucks would be inspected prior to ingressing and egressing the facility. The appropriate bill-of-lading [in accordance with Department of Transportation (DOT) regulations for shipment of treated materials on public roads] would accompany the waste shipment. Only regulated and licensed transporters and vehicles would be used. The transport vehicles would travel pre-designated routes and an emergency response plan would be developed in the event of a vehicle accident.

Transportation activities would be performed in accordance with a site-specific transportation and emergency response plan (TERP) developed in the removal design work plan. The TERP would evaluate the vehicles to be used for transport of treated materials; the safest transportation routes (e.g., minimizing use of high traffic roads, public facilities, or secondary roads unsuited for trucks), and emergency response procedures for responding to a vehicle accident.

Off-site disposal. Waste pile materials would be disposed of at an off-site facility licensed and permitted to accept the characterized waste stream. The selection of an appropriate facility will consider the types of wastes, location, transportation options, and cost. Utilizing specific disposal facilities for different waste streams may reduce disposal costs.

Confirmatory sampling. Sampling would be conducted after excavation of each area. The sampling would confirm preliminary cleanup goals have been achieved for the soil underlying the debris piles.

Restoration. Excavated areas should not need to be backfilled with clean soil (removal of the piles should leave the impacted area at the surrounding ground surface). In the event that fill is needed, it would be tested prior to placement to ensure compliance with acceptance criteria established in the design work plan. The excavated area will also be re-vegetated.

Table 3-1. Summary of Removal Action Alternatives

Alternative 1 – No Action This removal action alternative provides no further removal actions and is included as a baseline for comparison with other removal action alternatives. Any current access restrictions and environmental monitoring would be discontinued. The AOC and facility will no longer have legal, physical, or administrative mechanisms to restrict access. Additional actions regarding land use controls, monitoring, or access restrictions will not be implemented. Five-year reviews would not be conducted in accordance with CERCLA 121(c).
Alternative 2 – Excavation of Waste Piles with Off-Site Treatment and Disposal This removal action alternative involves the removal, transportation, treatment, and disposal of debris at Piles M and N. Waste materials would be excavated and transported to an off-site disposal facility licensed and permitted to accept these wastes. If necessary, the disposal facility would treat the waste to ensure it meets the land disposal restriction and then dispose of the soils. Once the piles are removed, confirmation sampling would be conducted to ensure preliminary cleanup goals have been achieved. Areas successfully excavated may not need backfilling, for the AOC may be level to the surrounding ground surface. Alternative 2 does not include operation and maintenance or long-term monitoring because the piles are removed from the AOC.

AOC = area of concern
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

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4.0 ANALYSIS OF ALTERNATIVES

4.1 INTRODUCTION

This section presents a detailed analysis of the two removal action alternatives formulated for further evaluation. From this set of alternatives, one will ultimately be chosen as the remedy for contaminated debris piles at CBP. Consistent with the *Guidance for Conducting Non-Time Critical Removal Actions Under CERCLA* EPA/540-R-93-057 (USEPA 1993), the proposed alternatives are judged by three criteria: effectiveness, implementability, and cost. This section contains a detailed analysis of the two alternatives against the evaluation criteria. The detailed analysis includes further definition of each alternative, and if necessary, compares the alternatives against one another and presents considerations common to alternatives.

4.1.1 Effectiveness

USEPA defines effectiveness as the ability to meet the objectives of the removal action. The criteria that determines the level of effectiveness is the overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; and short-term effectiveness.

4.1.1.1 Overall Protection of Human Health and the Environment

Each alternative must be evaluated to determine how it achieves and maintains protection of human health and the environment.

4.1.1.2 Compliance with ARARs

Section 121(d)(1) of CERCLA, 42 U. S. Code (USC) § 9621(d)(1), requires that on-site removal actions attain federal standards, requirements, criteria, limitations or more stringent state standards determined to be legally applicable or relevant and appropriate to the circumstances at a given site. For removal actions, compliance with ARARs is required to the extent possible based on the urgency of the situation and the scope of the action contemplated. 40 *CFR* §16 300.415(j). Each alternative must be evaluated against the ARARs presented in Section 2.3. On-site response actions must comply with the substantive requirements that may be an ARAR, where practical.

4.1.1.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence is an evaluation of the magnitude of residual risk (risk remaining after implementation of the alternative) and the adequacy and reliability of controls used to manage the remaining waste (untreated waste and treatment residuals) over the long term. Alternatives that provide the highest degree of long-term effectiveness and permanence leave little or no untreated

waste at the AOC, make long-term maintenance and monitoring unnecessary, and minimize the need for land use controls.

4.1.1.4 Reduction of Toxicity, Mobility, or Volume

Reduction of toxicity, mobility, or volume through treatment is an evaluation of the ability of the alternative to reduce the toxicity, mobility, or volume of the waste. The evaluation involves an assessment of the amount of hazardous material destroyed or treated, the degree of reduction in toxicity, mobility, or volume, and the type and quantities of residuals remaining after treatment. The irreversibility of the treatment process and the type and quantity of residuals remaining after treatment also are assessed.

4.1.1.5 Short-term Effectiveness

Short-term effectiveness addresses the protection of workers and the community during the removal action, the environmental effects of implementing the action, and the time required to achieve media-specific preliminary cleanup goals. This criterion accounts for potential threats to workers (e.g., fugitive dust and transportation of hazardous materials), the environment (e.g., potential spills and releases) and reliability of mitigation measures.

4.1.2 Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative, the availability of various services and materials required during implementation, and the state and community acceptance.

4.1.2.1 Technical Feasibility

Technical feasibility assesses the reliability of the technology and operational difficulties and the environmental conditions of construction/removal implemnation. It assesses the ability to perform the removal in the allotted amount of time. Technical feasibility also takes into consideration the potential need and ease of future removal actions.

4.1.2.2 Administrative Feasibility

The administrative feasibility criterion assesses the coordination of all aspects involved with the removal action, addressing concerns from regulatory agencies, and adherence to non-environmental laws.

4.1.2.3 Availability of Services and Materials

The availability of services and materials to implement the removal actions is evaluated. The evaluation includes an assessment of availability of prospective treatments, availability of materials, availability of contractors and specialists, and the availability of off-site treatment, storage, and disposal of excavated material.

4.1.2.4 State and Community Acceptance

State Acceptance considers comments received from agencies of the State of Ohio. The primary state agency supporting this investigation is the Ohio EPA. Community Acceptance considers comments made by the community, including stakeholders, on the alternatives being considered during the public comment period. Comments will be accepted from the community on the EE/CA and the preferred remedy presented in an Action Memo.

4.1.3 Cost

Cost analyses provide an estimate of the dollar cost of each alternative. This analysis includes an estimate of the capital cost in dollars, annual O&M cost (if applicable), and indicates the period of time to complete the proposed action. Costs estimates in this EE/CA are reported in base year 2005 dollars, or present value (future costs are converted to base year 2005 dollars using a 3.1 percent discount factor). Details and assumptions used in developing cost estimates for each of the alternatives are provided in Appendix A.

4.2 INDIVIDUAL ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The two removal action alternatives evaluated for CBP are described in Section 3.0. These removal action alternatives are as follows:

- Alternative 1: No Action (i.e., no removal actions or controls conducted on-site); and
- Alternative 2: Excavation of Waste Piles with Off-Site Treatment and Disposal.

The following sections provide an analysis of each removal action alternative using the criteria described in Section 4.1. This analysis will provide a basis of the advantages and disadvantages of each alternative.

4.2.1 Alternative 1: No Action

4.2.1.1 Effectiveness

Under this alternative, impacted Piles M and N would remain in place at CBP. With these piles in place the potential exists for future contaminant dispersal from the piles to the adjacent soils and; therefore, would not provide for overall protection of human health and the environment. Removal goals would not be achieved and this alternative provides for no long-term effectiveness and permanence. This alternative has no removal or treatment; therefore, there is no reduction in toxicity, mobility, or volume.

There would be no mitigation of potential risks to ecological receptors from constituents of potential ecological concern (COPECs) in soil under this alternative.

4.2.1.2 Implementability

No actions are proposed under this alternative. The no action alternative is implementable and no services or materials would be required for implementation. However, it is not likely that the state and community would accept no action to occur on piles that are characteristically hazardous and have concentrations of hexavalent chromium that far exceed neighboring soils.

4.2.1.3 Cost

The present value cost to complete Alternative 1 is zero. There are also no capital costs associated with this alternative.

4.2.1.4 Outcome

The No Action Alternative will not be further evaluated or considered because it fails the effectiveness and implementability criteria.

4.2.2 Alternative 2. Excavation of Waste Piles with Off-Site Treatment and Disposal

4.2.2.1 Effectiveness

Pile M has high levels of lead, for which it failed TCLP analysis and Pile N has high levels of hexavalent chromium. Alternative 2 will result in removal of these two contaminated piles, thus further reducing risk at CBP. Ecological functions and sustainability are expected to continue during implementation and following the removal because of the small size of the piles. Alternative 2 will reduce the mobility and toxicity of the contaminants through off-site treatment. The excavation and removal of impacted pile materials would result in a permanent reduction in risks at CBP. Piles M and N would be removed and placed in a permanent disposal facility after treatment, subsequently no long-term management and no CERCLA 5-year reviews would be required. During implementation, risks will be mitigated through use of proper controls such as:

- requiring workers to follow a health and safety plan and wear appropriate personal protective equipment (PPE) to minimize exposures;
- implementing mitigation measures such as erosion and dust control during construction;
- inspecting vehicles transporting soils before and after use; and
- limiting the distance waste is transported in vehicles.

4.2.2.2 Implementability

The alternative is implementable. Coordination would be required between removal action planners and OHARNG to minimize disruptions and/or impacts to OHARNG operations. Excavation and truck transport of soil are conventional construction activities. Resources such as standard excavation and construction equipment would be used and are readily available. Borrow sites have not been selected, but

are anticipated to be locally available if needed. Alternative 2's overall implementability would be affected by the administrative requirements for transport and disposal. The DOT regulates the transport of most materials. The state has been receptive to the idea of removing piles M and N from CBP. It is anticipated that the community would also accept this alternative.

4.2.2.3 Cost

The present value cost to complete Alternative 2 is approximately $91,366 (in base year 2005 dollars with a 3.1 percent discount factor). Costs include implementation of the removal, disposal, treatment, and confirmation sampling. For costing purposes, it is assumed stabilization/solidification was chosen as the ex situ physical/chemical treatment technology. See Appendix A for a detailed description of Alternative 2 costs.

4.2.2.4 Outcome

Alternative 2 would be an effective method of removing and disposing Piles M and N from CBP. The excavation and off-site treatment are conventional technologies. Thus, this alternative will be further considered.

4.3 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The No Action Alternative was eliminated during the individual analysis due to the lack of effectiveness and implementability. As Alternative 2 is the only remaining alternative for addressing Piles M and N at CBP, it is the Recommended Removal Action Alternative. The contaminated soils in Piles M and N will be removed from the RVAAP facility, hauled to a disposal facility, treated until the soil meets LDRs, and appropriately disposed. The removal areas will undergo confirmation sampling to ensure all cleanup goals are achieved. The AOC will not require any long-term monitoring with respect to the removal of Piles M and N.

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5.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

The Army is the lead agency under the Defense Environmental Restoration Program responsible for achieving remedy of soils and dry sediments at CBP. This chapter reviews actions that have been conducted and that are planned in the future to ensure regulatory agencies and the public have been provided with appropriate opportunities to stay informed of the progress of CBP removal actions and to provide meaningful input on the planning effort as well as the final selection of a remedy.

5.1 STATE ACCEPTANCE

State Acceptance considers comments received from agencies of the State of Ohio on the actions being considered. For the process of achieving remedy of soils and dry sediment at CBP, Ohio EPA is the lead regulatory agency and this EE/CA has been prepared in consultation with Ohio EPA. Ohio EPA has provided input during the ongoing investigation and report development process to ensure the action ultimately selected meets the needs of the State of Ohio and fulfills the requirements of the DFFO (Ohio EPA 2004). Comments will be solicited from Ohio EPA on the EE/CA and an Action Memo. The Army will obtain Ohio EPA concurrence prior to the final selection of the remedy for Piles M and N at CBP.

5.2 COMMUNITY ACCEPTANCE

Community acceptance considers comments provided by the community on the actions being considered. CERCLA 42 U.S.C. 9617(a) emphasizes early, constant, and responsive community relations. The Army has prepared a Community Relations Plan (USACE 2003) for this project to ensure the public has convenient access to information regarding project progress. The community relations program interacts with the public through news releases, public meetings, public workshops, and Restoration Advisory Board (RAB) meetings with local officials, interest groups, and the general public. The public also is provided the opportunity during a thirty day public comment period to comment on the Final EE/CA

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 have been made available to the public for review and comment. The ***Administrative Record*** for this project is available at the following location:

Ravenna Army Ammunition Plant
Building 1037 Conference Room
8451 St. Route 5
Ravenna, Ohio 44266-9297

Access to RVAAP is restricted but can be obtained by contacting facility management at (330) 358-7311. 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 Canals
Newton Falls, Ohio 44444-1694

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

Similar to state agencies, comments will be received from the community upon issuance of this EE/CA. The Army will request public comments on the Final EE/CA, as required by the CERCLA regulatory process and the RVAAP Community Relations Plan. These comments will be considered in the final selection of a remedy for Piles M and N at CBP.

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Alternative 2 (Removal of Waste Piles with Off-site Treatment and Disposal) is the recommended removal action alternative for CBP. Pile M had a lead concentration result of 8,560 mg/kg. TCLP sample results indicate the soil in Pile M would have to be disposed of as characteristically hazardous waste. Pile N had a hexavalent chromium soil sample result of 25 mg/kg, which is much higher than surrounding soil and exceeds a previously agreed upon remedial goal option concentration of 16 mg/kg (Shaw 2005). Both piles appear to be a product of former burning activities at CBP. This removal will be conducted as a non-TCRA and will achieve quick and protective results at the AOC and was determined to be cost effective (estimated $91,366 for removal).

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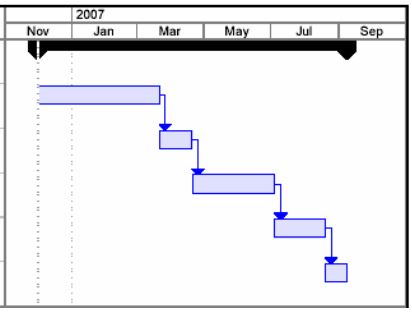
7.0 SCHEDULE

The schedule of tasks leading up to the removal of Piles M and N at CBP is presented in Table 7-1.

Table 7-1. Project Schedule for the Removal of Piles M and N at CBP

ID	Task Name	Start	Finish
1	**Removal Action of CBP Piles M and N**	**Fri 12/1/06**	**Sat 9/8/07**
2	Development and Ohio EPA Approval of Engineering Evaluation/Cost Analysis	Fri 12/1/06	Wed 3/21/07
3	Public Comment Period	Thu 3/22/07	Fri 4/20/07
4	Development and Ohio EPA Approval of Action Memo	Sat 4/21/07	Wed 7/4/07
5	Development and Ohio EPA Approval of Removal Action Work Plan	Thu 7/5/07	Sun 8/19/07
6	Implementation of Removal Action Work Plan	Mon 8/20/07	Sat 9/8/07



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8.0 REFERENCES

OHARNG 2001. *Integrated Natural Resources Management Plan and Environmental Assessment for the Ravenna Training and Logistics and the Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio*, Prepared by AMEC Earth & Environmental, Louisville, KY.

Ohio EPA 2004. Director's Final Findings and Orders in the matter of U. S. Department of the Army, Ravenna Army Ammunitions Plant. June 2004.

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Shaw 2005. *Final Focused Feasibility Study for the Remediation of Soil at Load Lines 1 through 4 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. May 2005.

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USACE 2005a. *Performance Work Statement for Performance Based Contract of Six High Priority RVAAP AOCs*. February 10, 2005.

USACE 2005b. *RVAAP Facility Wide Human Health Risk Assessor Manual.* January 2005.

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USACHPPM 1998. *Relative Risk Evaluation for Newly Added Sites at the RVAAP, Ravenna, Ohio, Hazardous and Medical Waste Study No. 37-EF-5360-99, 19-23.* October 1998.

USEPA 1993. *Conducting Non-Time-Critical Removal Actions Under CERCLA.* December 1993.

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Appendix A
Cost Estimate

Engineering Evaluation/Cost Analysis (EE/CA)
Central Burn Pits - Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio
Summary of Alternatives

Central Burn Pits Alternatives		Duration	Non Discounted Cost		
			Soils and Sediment		
			Capital Cost	O&M Cost	Total
1	No Action	0	$0	$0	$0
2	Excavation of Waste Piles, and Offsite Treatment and Disposal	<1 mo	$91,366	$0	$91,366

Central Burn Pits Alternatives		Duration	Discounted Cost (3.1%)		
			Soils and Sediment		
			Capital Cost	O&M Cost	Total
1	No Action	0	$0	$0	$0
2	Excavation of Waste Piles, and Offsite Treatment and Disposal	<1 mo	$91,366	$0	$91,366

Notes:

1. The base year of comparison and cost data will be CY2005. The "real" discounted rates used to calculate present values will be based on OMB Circular No. A-94 memorandum dated January 31, 2005.

2. 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, including but not limited to, budgetary or construction cost estimating is not appropriate.

Engineering Evaluation/Cost Analysis (EE/CA)
Central Burn Pits - Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio
Summary of AOC Areas and Volumes

SITE/SCENARIO	Surface Area (sq ft)	*In situ* Volume (cubic ft)	*In situ* Volume (cubic yards)	*In situ with Constructability* [a] Volume (cubic ft)	*In situ with Constructability* [a] Volume (cubic yards)	*Ex situ* [a,b] Volume (cubic ft)	*Ex situ* [a,b] Volume (cubic yards)
Central Burn Pits Soil							
Pile M[c]	1,134	1,700	63	2,125	79	2,550	95
Pile N[d]	314	710	26	888	33	1,065	39
Total Central Burn Pits Soil	1,448	2,410	89	3,013	111	3,615	134

[a] Includes 25% constructability factor

[b] Includes 20% swell factor

[c] Includes a 19-ft radius pile with a 3-ft height. Pile shaped as paraboloid.

[d] Includes a 10-ft radius pile with a 4.5-ft height. Pile shaped as paraboloid.

Central Burn Pits Soil Piles
Alternative 2 - Excavation of Waste Piles, and Offsite Treatment and Disposal
Key Parameters and Assumptions

Key Parameters and Assumptions:

Item	Unit	Value	Notes
Capital Cost			
Additional Site Characterization			Piles have been characterized. Assume existing data is adequate for the disposal facility waste acceptance profile forms. Assume no additional characterization is required.
Site Work			
Site Area	sf	1,448	
Civil Survey	day	0.5	Survey AOC for as-built drawings. RSMeans 01107 700 1200.
Civil Survey	$/day	885	
As Built Drawings	hours	4	Develop as-built drawings.
As Built Drawings	$/hr	60	
Clearing	acre	0.00	Assume trees/brush cleared, chipped, and left onsite.
Clearing	$/acre	4,025	RSMeans 022302000200. Clear and chip medium trees to 12" dia.
Soil Excavation			Includes excavation of AOC areas based on the areas and heights presented in the summary table. In situ volume includes a 25% constructability factor.
Soil Excavation Volume (In situ)	cy	111	
Soil Excavation Volume (Ex situ)	cy	134	Includes soil to be treated and disposed off site. Ex situ volume includes a 25% constructability factor and 20% swell factor.
Soil Excavation Mass	tons	150	Includes soil mass to be treated and disposed off site.
Soil Excavation Surface Area	sf	1,448	
Volume to Weight Conversion	tons/cy	1.35	Insitu soil conversion.
Mobilization/Demobilization	ls	5,000	Includes mob/demob of excavation equipment and preparing submittals.
Excavate Soils	days	1.00	Includes 3/4 cy excavator, 1 O.E., 1 L.S. spotter, 2 L.S. to prep trucks/and miscellaneous activities. Assume small excavations take one day for excavation crew. RSMeans Crew B12-F.
	$/day	2,396.00	
Transport and Offsite Disposal			
Transport and Offsite Disposal	tons	150	Based on vendor quote to stabilize and dispose waste at similar site. Assumes 22 ton/trip @ 400 mi RT.
Transport and Offsite Disposal	$/ton	210.00	
Confirmational Sampling & Analysis			
Confirmation Samples	ea	6	Assume average of 1 sample per 2000 sf and 4 sidewall samples. Includes 10% duplicate and 5% rinsate.
Sampling Labor	hrs	20	Includes confirmation sampling. Assumes 1 sampling technician at 10 hours/day for 2 days.
Sampling Labor	$/hr	60	
Per Diem	$/event	230	1 person x $115/day
Truck Rental / Gas	$/event	280	1 truck x $90/day. Add $100 for gas.
Confirmation Sample Materials	ea	6	Reference ECHOS 33 02 0401/0402 for disposable sampling and decontamination materials.
Confirmation Sample Materials	$/ea	21	
Sample Analysis	$/ea	600	Analyze samples for metals (6 @ $100). Includes 10% duplicate and 5% rinsate.
Data Management	hrs	3	Data validation
Data Management	$/hr	60	

Central Burn Pits Soil Piles
Alternative 2 - Excavation of Waste Piles, and Offsite Treatment and Disposal
Key Parameters and Assumptions

Key Parameters and Assumptions:

Item	Unit	Value	Notes
Restoration			Includes native soil backfill. Assume productivity has been reduced by 25% to account for security and safety requirements. Add 20% premium for small job.
Native Soil Backfill	cy	134	ECHOS 17030422, Unclassified Fill, 6" Lifts, Onsite Source, Includes Delivery, Spreading, and Compaction.
Native Soil Backfill	$/cy	10.76	
Seeding, Vegetative Cover	MSF	11	
Seeding, Vegetative Cover	$/MSF	69.75	RSMeans 029203200200. Seeding with mulch and fertilizer. Assume 0.25 acre is revegetated for excavation areas and equipment damage.
Plans and Reports			
Corrective Action Completion Report	hrs	120	Includes Construction QC data and preparing report.
Technical Labor	$/hr	70	

Central Burn Pits Soil Piles
Alternative 2 - Excavation of Waste Piles, and Offsite Treatment and Disposal
Cost Estimate

CAPITAL COST **$91,366**

Activity (unit)	Quantity	Unit Cost	Total
Site Work			
Civil Survey (day)	0.5	$885.00	$443
As Built Drawings (hrs)	4	$60.00	$240
Clearing (acre)	0.0	$4,025.00	$0
Soil Excavation			
Mobilization/Demobilization (ls)	1	$5,000.00	$5,000
Excavate Soils (days)	1	$2,396.00	$2,396
Transport and Offsite Disposal			
Transport and Offsite Disposal (tons)	150	$210.00	$31,539
Confirmational Sampling & Analysis			
Sampling Labor (hrs)	20	$60.00	$1,200
Per Diem (event)	1	$230.00	$230
Truck Rental / Gas (event)	1	$280.00	$280
Confirmation Sample Materials (ea)	6	$21.00	$126
Sample Analysis	1	$600.00	$600
Data Management (hrs)	3	$60.00	$180
Restoration			
Native Soil Backfill (cy)	134	$10.76	$1,436
Seeding, Vegetative Cover (MSF)	11	$69.75	$767
Plans and Reports			
Corrective Action Completion Report (ea)	120	$70.00	$8,400
Subtotal			$52,837
Design		12%	$6,340
Office Overhead		5%	$2,642
Field Overhead		15%	$7,926
Subtotal			$69,745
Profit		6%	$4,185
Contingency		25%	$17,436
Total			$91,366