Final
Feasibility Study for
RVAAP-002-R-01 Erie Burning Grounds MRS
Version 1.0

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912DR-15-D-0016
Delivery Order No. 0001

Prepared for:

US Army Corps
of Engineers

North Atlantic Division, Baltimore District
2 Hopkins Plaza
Baltimore, MD 21201

Prepared by:

HydroGeoLogic, Inc.
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August 2018

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14. ABSTRACT

This Final Feasibility Study for RVAAP-002-R-01 Erie Burning Grounds Munitions Response Site (MRS) Version 1.0 is submitted in support of the Multiple Award Military Munitions Services (MAMMS) Contract No. W912DR-15-D-0016, Task Order 0001. The objective of this FS is to develop, evaluate, and compare remedial action alternatives that will meet the remedial action objectives for the MRS so that the Department of Defense can select and propose an appropriate remedy. This FS used the information obtained during the Remedial Investigation to determine appropriate remedial actions based on the current and anticipated future land uses of the MRS.

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Ohio Environmental Protection Agency

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

August 28, 2018

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

Re: US Army Ravenna Ammunition Plt RVAAP
Remediation Response
Correspondence
Remedial Response
Portage County
267000859197

Subject: Receipt and Review of the "Final Feasibility Study for RVAAP-002-R-01 Erie Burning Grounds MRS, Version 1.0" Dated August 17, 2018 (Work Activity No. 267-0008590-197)

Dear Mr. Connolly:

The Ohio Environmental Protection Agency (Ohio EPA), Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) has received and reviewed the document entitled, "Final Feasibility Study for RVAAP-002-R-01 Erie Burning Grounds MRS, Version 1.0" dated August 17, 2018. This document, received by Ohio EPA, NEDO on August 17, 2018, was prepared for the U.S. Army Corps of Engineers (USACE) Baltimore District, by HydroGeoLogic, Inc. in response to Ohio EPA's request for the final document sent August 10, 2018.

This document was reviewed by personnel from Ohio EPA's DERR, pursuant to the Director's Findings and Orders paragraph 39 (b), and we concur with the feasibility study in its final format.

If you have any questions or concerns, please do not hesitate to contact me at (330) 963-1235.

Sincerely,

Nicholas Roope
Site Coordinator
Division of Environmental Response and Revitalization

NCR/nvp

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CONTRACTOR'S STATEMENT OF INDEPENDENT TECHNICAL REVIEW

HydroGeoLogic, Inc. has completed this *Final Feasibility Study for RVAAP-002-R-01 Erie Burning Grounds Munitions Response Site, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, Version 1.0.* Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives, technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets customer's needs consistent with law and existing USACE policy.

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August 2018

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RVAAP-002-R-01 Erie Burning Grounds MRS

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ARNG – Army National Guard
COR – Contracting Officer's Representative
IED – Installation and Environmental Division
OHARNG – Ohio Army National Guard
RVAAP – Former Ravenna Army Ammunition Plant
USACE – United States Army Corps of Engineers

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AEDB-R	Army Environmental Database - Restoration Module
ARAR	applicable or relevant and appropriate requirements
ARNG	Army National Guard
bgs	below ground surface
Camp Ravenna	Camp Ravenna Joint Military Training Center
CB&I	CB&I Federal Services, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHE	Chemical Warfare Materiel Hazard Evaluation
COR	Contracting Officer's Representative
CSM	conceptual site model
DERP	Defense Environmental Response Program
DoD	U.S. Department of Defense
EHE	Explosive Hazard Evaluation
FS	Feasibility Study
HGL	HydroGeoLogic, Inc.
IED	Installation and Environmental Division
HHE	Health Hazard Evaluation
lbs	pounds
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
MRSPP	Munitions Response Site Prioritization Protocol
NCP	National Oil and Hazardous Substances Contingency Plan
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
RAO	remedial action objective
RI	Remedial Investigation
ROD	Record of Decision
RVAAP	Former Ravenna Army Ammunition Plant
SRC	site-related chemical
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USP&FO	U.S. Property and Fiscal Officer

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EXECUTIVE SUMMARY

Introduction

HydroGeoLogic, Inc. (HGL) has been contracted by the U.S. Army Corps of Engineers (USACE), North Atlantic Division, Baltimore District, to complete a Feasibility Study (FS) for the Erie Burning Grounds Munitions Response Site (MRS) (RVAAP-002-R-01) at the former Ravenna Army Ammunition Plant (RVAAP) in Portage and Trumbull Counties, Ohio. This FS is being prepared under Delivery Order No. 0001 of *Multiple Award Military Munitions Services Performance-Based Acquisition* Contract No. W912DR-15-D-0016. USACE, Baltimore District, issued the delivery order on August 26, 2016.

No explosive hazards or unacceptable risks associated with munitions-constituents (MC)-related contamination are present on the MRS. Therefore, this FS evaluates the No Action alternative for the Erie Burning Grounds MRS to support No Action at the MRS.

Erie Burning Grounds MRS History and Background

The Erie Burning Grounds MRS is a 33.93-acre parcel in the northeastern portion of the Camp Ravenna Joint Military Training Center (Camp Ravenna) within Portage County. The MRS was a former burning ground that operated between 1941 and 1951 located south of North Perimeter Road at Camp Ravenna. The Erie Burning Grounds received bulk, obsolete, and off-specification propellants; conventional explosives; rags, and large, explosive-contaminated items (railcars) to be thermally treated (by open burning). Open burn activities occurred in four areas: Burn Area A, Burn Area B, Burn Area C, and Burn Area D. Bomb flashing and open burn activities deposited ash that remained at the MRS after use of the burning ground was discontinued in 1951 (CB&I, 2014).

After use of the burning ground ended, the MRS was inundated with water because the stream that drains the MRS became clogged due to sedimentation, vegetation growth, and beaver dams. As a result, the MRS is now occupied by high quality wetlands with surface water depth ranging from 3 feet to 5 feet depending on the season and amount of precipitation. Four distinct water basins of varying size lie within the MRS: North Surface Water Basin, West Surface Water Basin, East Surface Water Basin, and South Surface Water Basin. The North Surface Water Basin is the largest, extending beyond the MRS boundaries to the north. The wetlands are surrounded by hardwood forest, scrub/shrub open areas, grasslands, gravel access roads, former rail beds, and main-made ditches that traverse or bound the MRS. Remnants of Track 49 still exist on the MRS including railroad ties and miscellaneous metal debris such as rail spikes and plates (CB&I, 2014). The railroad ties and miscellaneous debris will be managed under the Solid Waste Management Plan for Camp Ravenna (currently being produced).

USACE completed a Remedial Investigation (RI) at the Erie Burning Grounds MRS in December 2011 and May 2012 as documented in *Final Remedial Investigation Report for RVAAP-002-R-01 Erie Burning Grounds MRS, Version 1.0* (CB&I, 2014). USACE encountered no U.S. Department of Defense (DoD) military munitions confirmed to be munitions and explosives of concern (MEC) during the RI field work; however, material potentially presenting an explosive hazard (MPPEH) were found. The MPPEH were evaluated, determined as safe, and classified as munitions debris (MD). The MD items were solid and/or inert and did not pose an explosive safety hazard.

The Munitions Response Site Prioritization Protocol (MRSPP) evaluates three types of hazards (Explosive, Chemical Warfare Materiel, and Health) and assigns an MRS a priority ranking between 1 (highest priority) and 8 (lowest priority), with alternative ratings of Evaluation Pending, No Known or Suspected Hazards, or No Longer Required. During the RI, the MRS was assigned a MRSPP priority of 7. The MRSPP tables were updated during the RI in accordance with the *Munitions Response Site Prioritization Protocol Primer* (DoD, 2007) and the revised MRSPP priority is "No Longer Required". Section 3.3 describes the MRSPP inputs and scoring in further detail.

Current activities will continue at the Erie Burning Grounds MRS including maintenance, natural resource management activities (beaver dam removal) and sampling. The future land use for the MRS includes fire suppression activities and military training. These activities are preferably assessed using the Commercial/Industrial Land Use Exposure Scenario and the Industrial Receptor as the Representative Receptor (Army National Guard, 2014). No Further Action is protective of other potential future human receptors (such as residential receptors); however, there are no current plans for the MRS to change from an industrial land use to a residential land use. The MRS is currently considered an "Authorized Access" area within Camp Ravenna (CB&I, 2014). There are interim controls (signage and Siebert Stakes) in place. Ohio Army National Guard (OHARNG) will remove these interim controls after the Final Record of Decision for No Further Action is approved.

The ecological risk assessment conducted as part of the RI determined that contaminants of potential ecological concern in surface water (copper and iron) and sediment (antimony, barium, cadmium, copper, iron, lead, mercury, nitrocellulose, Arclor-1254, and dibenzofuran) have minimal impact on upper trophic-level receptors. Therefore, no adverse effect on these receptors is expected. Iron in wet sediment was identified as a contaminant of concern that may pose a risk to current or future human receptors; however, elevated iron concentration in a single sample is most likely associated with background conditions and does not pose a hazard. The detected site-related chemicals (SRCs) that were evaluated as MC in surface water, sediment and subsurface soil do not pose potential risks to human or ecological receptors at the MRS. Therefore, the risk assessment concluded that no unacceptable risks to human or ecological receptors due to MC-related contamination exists at the MRS.

Problem Identification

During the RI, no MEC was found and no unacceptable risks due to MC-related contamination were identified at the MRS. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as applied to Military Munitions Response Program (MMRP), if no explosive hazard or unacceptable risk due to MC-related contamination is found, there is no basis for a remedial action. As there is no exposure to potential hazards present at the MRS, no remedial action is necessary to ensure protection of human health and the environment.

Remedial Action Objectives

As established during the RI, no MEC was found and no unacceptable risks due to MC-related contamination were identified at the MRS. Therefore, the development of remedial action objectives is unnecessary.

Evaluation of the No Action Alternative

A detailed analysis was completed for the No Action alternative using the nine evaluation criteria defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Section 300.430[e][9]).

The No Action alternative is technically and administratively implementable and has no costs. There are no explosive hazards or unacceptable risks due to MC-related contamination at the MRS and the No Action alternative is protective of human health and the environment. The No Action alternative triggers no applicable or relevant and appropriate requirements. Therefore, the No Action alternative meets the threshold criteria in accordance with the NCP (Section 300.430[f]).

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1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) has been contracted by the U. S. Army Corps of Engineers (USACE), North Atlantic Division, Baltimore District, to complete a Feasibility Study (FS) for the Erie Burning Grounds Munitions Response Site (MRS) at the Former Ravenna Army Ammunition Plant (RVAAP) in Portage and Trumbull Counties, Ohio. This FS is being prepared under Delivery Order No. 0001 of *Multiple Award Military Munitions Services Performance-Based Acquisition* Contract No. W912DR-15-D-0016. The USACE, Baltimore District issued the delivery order on August 26, 2016.

1.1 Regulatory Framework and Authorization

Pursuant to the U.S. Department of Defense (DoD) Manual 4715.20, *Defense Environmental Response Program* (*DERP) Management* (DoD, 2012), USACE is conducting Military Munitions Response Program (MMRP) activities in accordance with the DERP statute (10 United States Code [USC] 2701 et seq.), the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) (42 USC § 9620), Executive Orders 12580 and 13016, and the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 Code of Federal Regulations [CFR] Part 300).

1.2 Purpose

The purpose of an FS is to develop, evaluate, and perform a detailed analysis of potential remedial alternatives for the MRS that will meet remedial action objectives (RAOs) and allow the DoD to select and propose an appropriate remedy. This FS used the information obtained during the Remedial Investigation (RI) to perform a systematic analysis of the No Action alternative based on the current and anticipated future land uses of the Erie Burning Grounds MRS. This FS was developed in accordance with the U.S. Army's *Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009) and with U.S. Environmental Protection Agency's (USEPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988).

1.3 MRS Description

The Erie Burning Grounds MRS was used to thermally treat bulk, obsolete, and off-specification propellants; conventional explosives; rags, and large, explosive-contaminated items such as railcars. The MRS is composed of four burning areas: Burn Area A, Burn Area B, Burn Area C, and Burn Area D. The grounds at the end of Track 49 were used from 1941 until 1951 as an open burn area where items were dumped out of railcars and thermally treated. The ash that resulted from open burn activities remained at the MRS after activities were completed. Bomb bodies were also transported to the MRS for flashing after they were cleaned out. Bomb flashing activities occurred within the former borrow area located in the western portion of the MRS (CB&I, 2014).

During planning for the RI field work, the visual survey data collected during the Site Inspection was used to determine where open burning activities may have occurred. The 8.55-acre RI investigation area included the suspected burn areas. During the RI field work, munitions debris (MD) was encountered in the subsurface between 0- and 6-inches at point-source locations and between 12- and 48-inches at trench locations. All material potentially presenting an explosive hazard (MPPEH) was verified to be MD. MD totaling 1,295

pounds (lbs) and 2,720-lbs of other debris were recovered (CB&I, 2014). The MRS area is shown in Figure 1-3a and Figure 1-3b.

The configuration of the MRS has changed significantly since 1951 when use halted. The MRS became inundated because the small stream that drains the MRS became clogged due to sedimentation, vegetation growth, and beaver dams. As a result, the lowland areas within the MRS are now surface water areas. The surface water in these wetlands is approximately 3 to 5 feet below the surrounding grade. Water depths of the ponds fluctuate with the seasons and with variations in precipitation. Wetland areas extend beyond the MRS boundary to the north and east. Water is typically present in the basin north of Track 49; however, the basin may drain during very dry periods. The wetlands are surrounded by hardwood forest, scrub/shrub open areas, grasslands, gravel access roads, former rail beds, and man-made ditches that traverse or bound the MRS. Remnants of Track 49 still exist and include railroad ties and miscellaneous metal debris such as rail spikes and plates (CB&I, 2014). The railroad ties and miscellaneous debris will be managed under a Solid Waste Management Plan which is currently in preparation.

1.3.1 Physical Setting and Administrative Control

RVAAP (Federal Facility ID No. OH213820736), now known as the Camp Ravenna Joint Military Training Center (Camp Ravenna), is in northeastern Ohio within Portage and Trumbull Counties, approximately 3 miles east-northeast of the city of Ravenna. The 21,683-acre facility is approximately 11 miles long and 3.5 miles wide. The facility is bounded by the Norfolk Southern Railroad to the north; State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad to the south; State Route 534 to the east; and Garret, McCormick, and Beery Roads to the west. Camp Ravenna is surrounded by the communities of Windham, Garrettsville, Newton Falls, Charlestown, and Wayland (Figure 1-1).

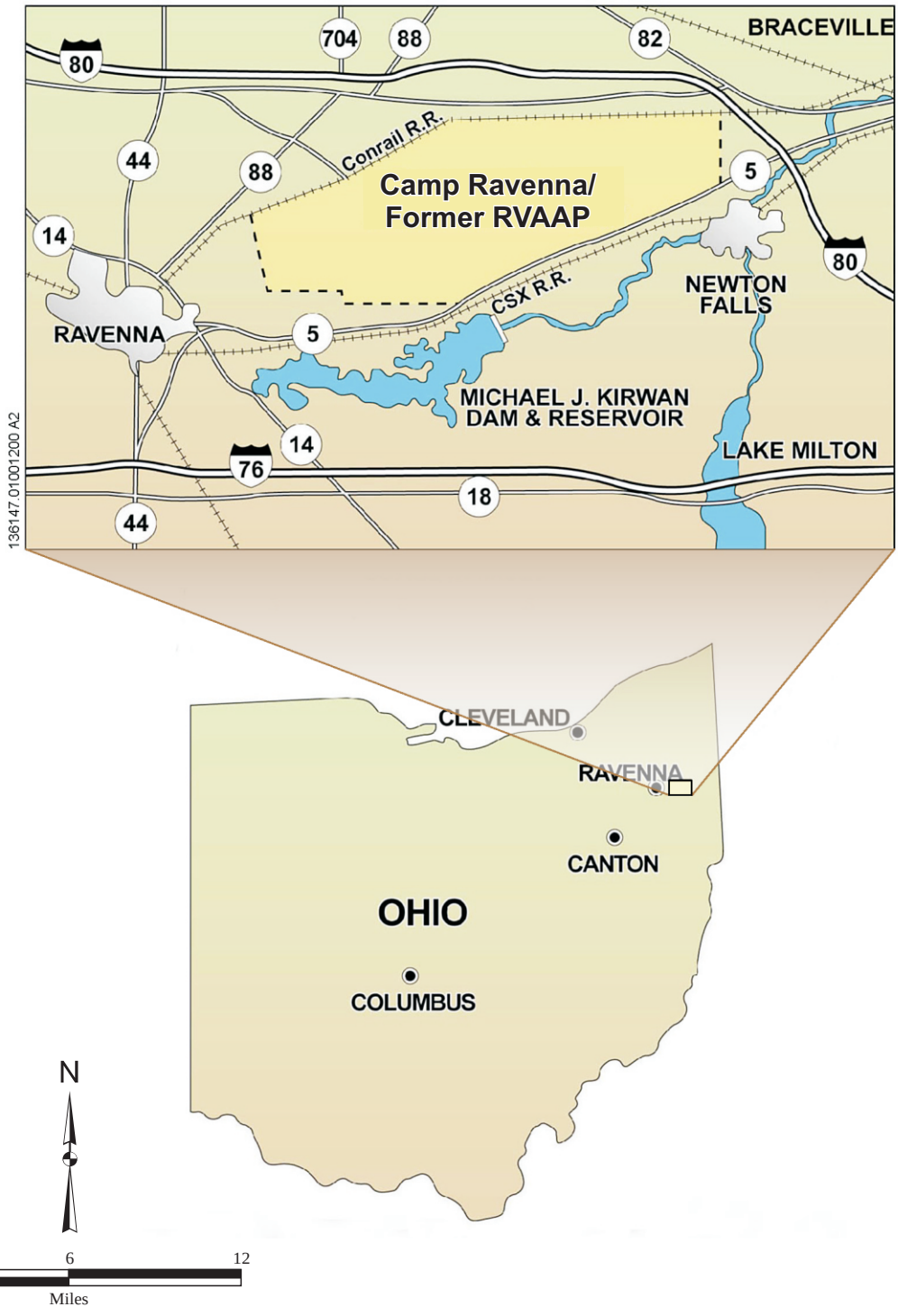
Administrative control of the facility was transferred to the U.S. Property and Fiscal Officer (USP&FO) for Ohio and was subsequently licensed to the OHARNG for use as a training site, Camp Ravenna. The restoration program involves cleanup of areas associated with operations at RVAAP located across the facility.

The Erie Burning Grounds MRS covers 33.93 acres located in the northeastern portion of the installation south of North Perimeter Road at Camp Ravenna. (Figure 1-2). The MRS is located on federal property, with administrative accountability assigned to the USP&FO for Ohio. The MRS is jointly managed by the Army National Guard (ARNG) and OHARNG. Table 1-1 provides an administrative summary of the MRS.

Table 1-1. Administrative Summary of the Erie Burning Grounds MRS

Investigation Area	AEDB-R MRS Number	Area (Acres)	Property Owner	MRS Management Responsibility
Erie Burning Grounds MRS	RVAAP-002-R-01	33.93	USP&FO	ARNG/OHARNG

ARNG = Army National Guard.
AEDB-R = Army Environmental Database Restoration Module.
MRS = Munitions Response Site.
OHARNG = Ohio Army National Guard.
USP&FO = U.S. Property and Fiscal Officer.



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Legend

Camp Ravenna/Former RVAAP

Figure 1-1
Location Map
Camp Ravenna/
Former RVAAP
Portage and Trumbull
Counties, Ohio

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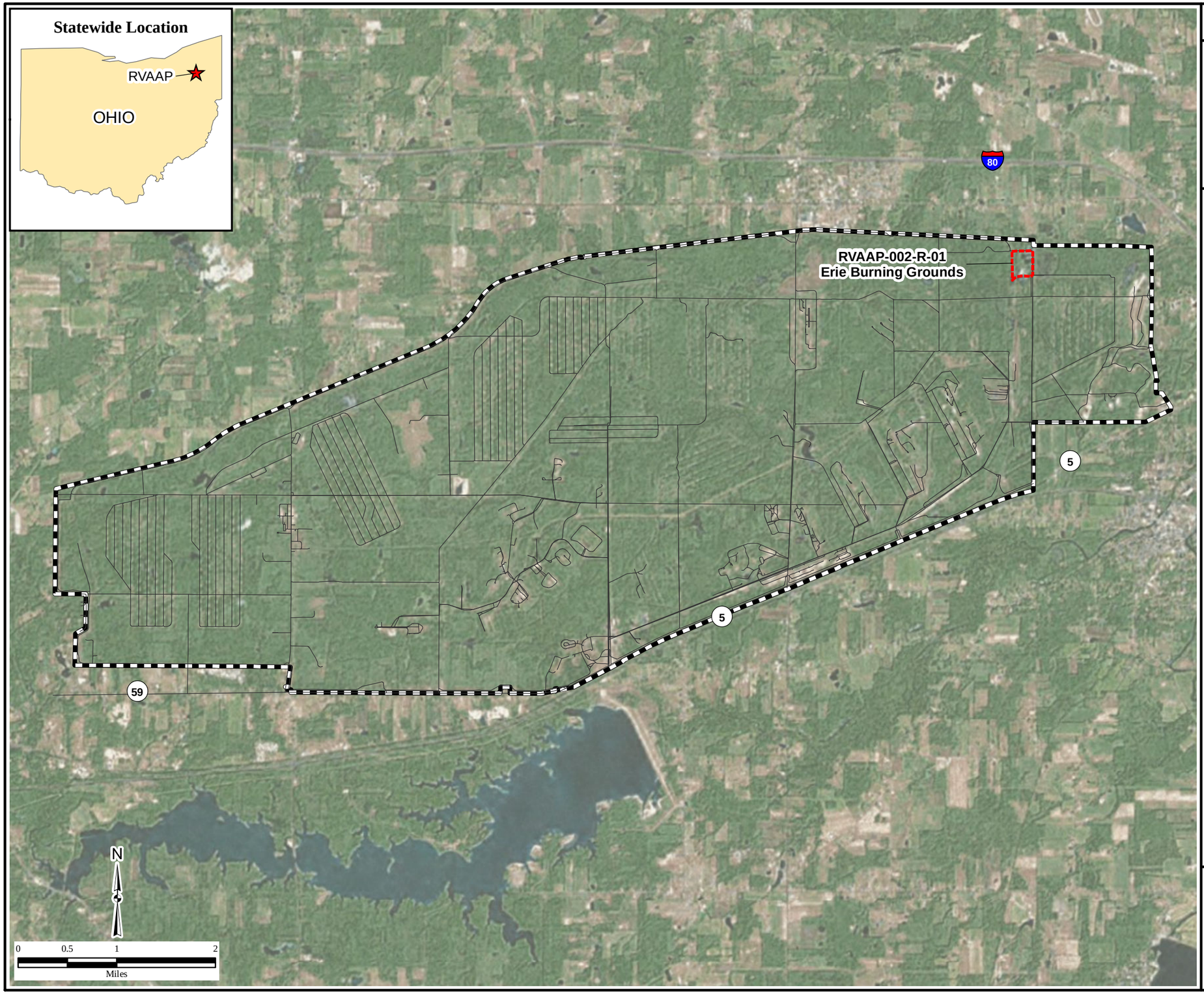

HGL—Feasibility Study—Former RVAAP, Ohio

Figure 1-2
MRS Location
Erie Burning Grounds
Former RVAAP
Portage and Trumbull Counties, Ohio

Legend

- Road
- MRS
- Installation Boundary

Notes:
MRS=munitions response site
RVAAP=Ravenna Army Ammuntion Plant

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ArcGIS Online Imagery

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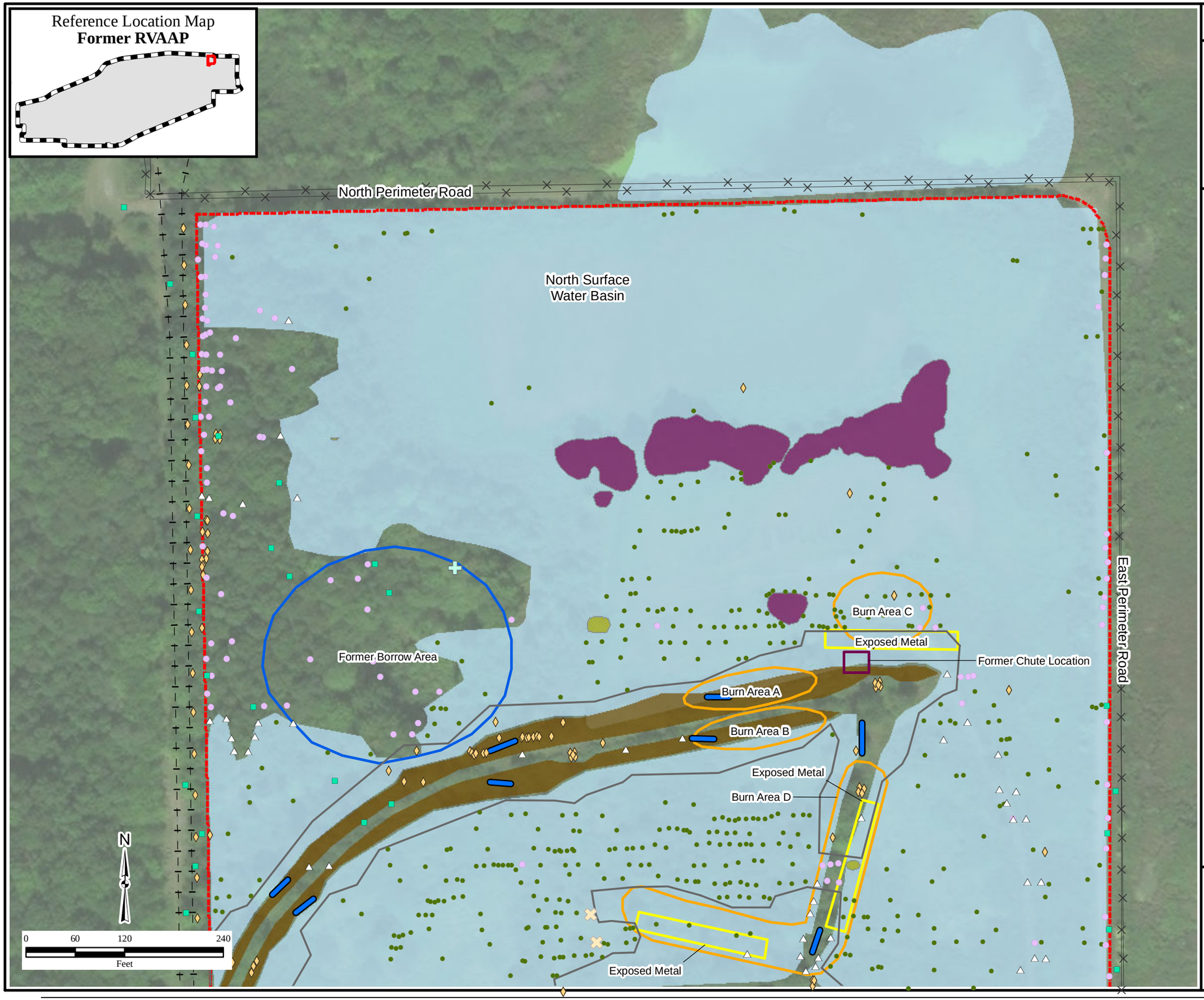

HGL—Feasibility Study—Former RVAAP, Ohio

Figure 1-3a
2014 Remedial Investigation
Intrusive Investigation Results
North Section
Erie Burning Grounds
Former RVAAP
Portage and Trumbull Counties, Ohio

Legend

Intrusive Investigation MD Items Identified

- Bomb, 500 lb, General Purpose, AN-M64A1
- Other Debris Identified
- Anomaly Type Unknown Item Present, Buried Under Sediment
- Cultural Feature
- Metal Feature
- Quality Control Position (Nail)

Visual Survey MD Items Identified

- Bomb, 500 lb, General Purpose, AN-M64A1
- Trench (No MEC or Munitions Debris)
- Fence
- Former Railroad
- Former Burn Area
- Exposed Metal (Historical)
- Former Borrow Area
- Former Chute
- High Anomaly Density Area
- Vegetation Area
- Island
- Steep Slope
- Surface Water
- MRS
- Installation Boundary

Notes:
MD=munition debris
MEC=munitions and explosives of concern
MRS=munitions response site
RVAAP=Ravenna Army Ammuntion Plant

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Source: HGL,CB&I, USACE, e²M ArcGIS Online Imagery

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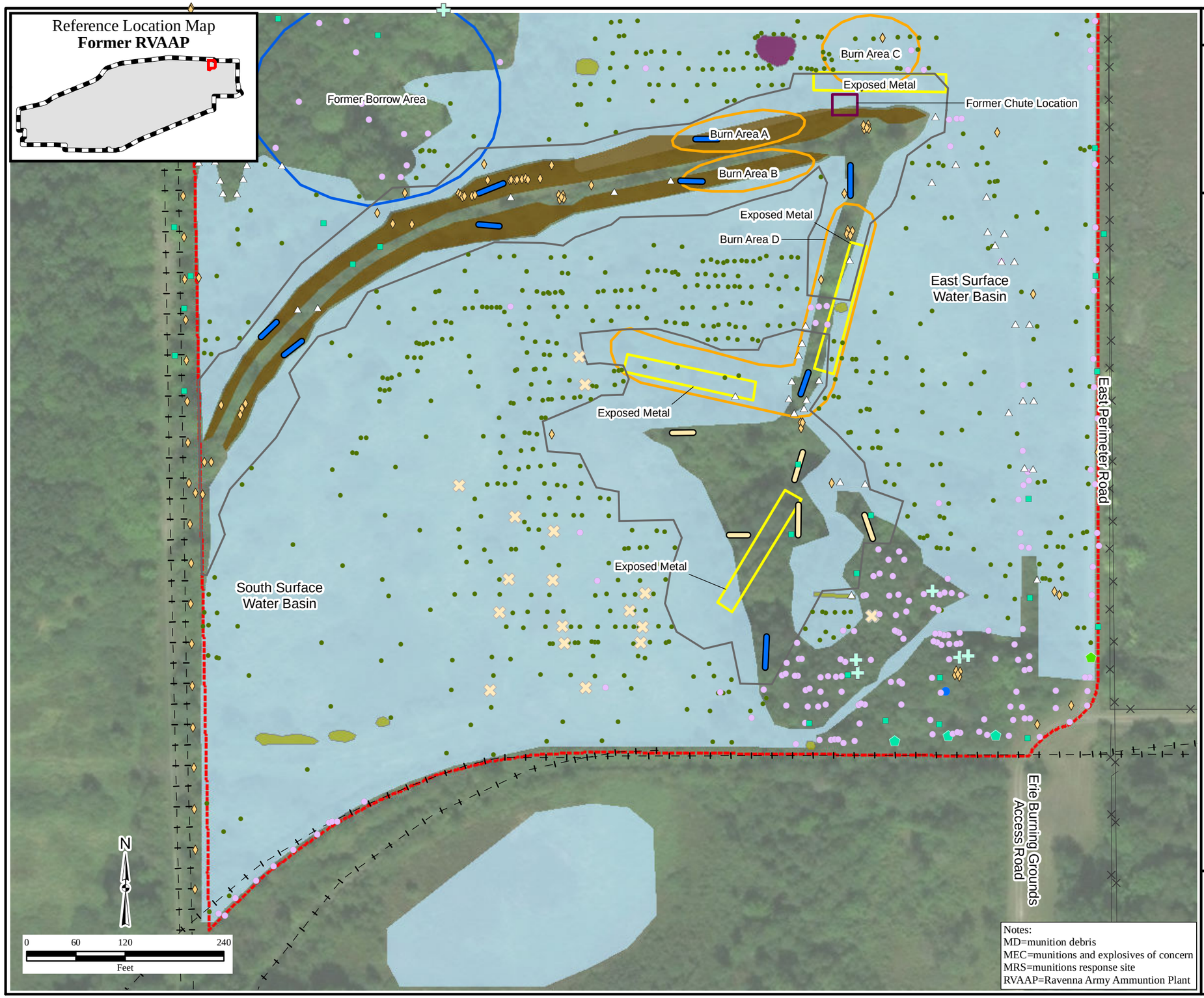

HGL—Feasibility Study—Former RVAAP, Ohio

Figure 1-3b
2014 Remedial Investigation
Intrusive Investigation Results
South Section
Erie Burning Grounds
Former RVAAP
Portage and Trumbull Counties, Ohio

Legend

Intrusive Investigation MD Items Identified

- Bomb, 500 lb, General Purpose, AN-M64A1
- Projectile, 75mm, HE, M309
- Projectile, 75mm, HE, M48
- Other Debris Identified
- Anomaly Type Unknown
- Item Present, Buried Under Sediment
- Cultural Feature
- Metal Feature
- Quality Control Position (Nail)

Visual Survey MD Items Identified

- Ordnance Components
- Bomb, 500 lb, General Purpose, AN-M64A1

- Trench (Munitions Debris Identified)
- Trench (No MEC or Munitions Debris)
- Fence
- Former Railroad
- Former Burn Area
- Exposed Metal (Historical)
- Former Borrow Area
- Former Chute
- High Anomaly Density Area
- Vegetation Area
- Island
- Steep Slope
- Surface Water
- MRS
- Installation Boundary

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Source: HGL,CB&I, USACE, e²M ArcGIS Online Imagery

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1.4 Current and Projected Land Use

The human health risk assessment conducted as part of the RI was completed prior to the issue of the "Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the RVAAP Installation Restoration Program, Portage/Trumbull Counties, Ohio" (Risk Assessment Technical Memo) (ARNG, 2014). The Risk Assessment Technical Memo defined three Categorical Land Uses and Representative Receptors to be considered during the RI phase of the CERCLA process. These three land uses, and Representative Receptors are summarized below.

1.) Unrestricted (Residential) Land Use – Resident Receptor (Adult and Child) (formerly called Resident Farmer);

2.) Military Training Land Use – National Guard Trainee; and

3.) Commercial/Industrial Land Use – Industrial Receptor (USEPA Composite Worker).

The Risk Assessment Technical Memo allowed for exceptions to evaluating these three land uses, depending upon the stage of RI completion. Because the RI was complete by the time the Risk Assessment Technical Memo was finalized, the three land uses were not fully evaluated in the RI.

The Erie Burning Grounds MRS is within a larger area designated for military training. The MRS is currently considered an "Authorized Access" area with interim controls (signage and Siebert Stakes) in place (CB&I, 2014). The current land uses within the MRS include maintenance, natural resource management (beaver dam removal), and sampling activities. The future land use will remain the same as current land use except that fire suppression activities and military training will be added.

The representative receptors identified in the Final RI Report (CB&I, 2014) for the current and future land uses at the MRS were the Security Guard and the Maintenance Worker. Therefore, the Industrial Receptor is representative of the receptors identified in the Final RI Report (CB&I, 2014) for the current and future land use at the MRS.

The exposure scenario for the Industrial Receptor (USEPA's Composite Worker) does not include subsurface exposure. Since the National Guard Trainee's exposure scenario does include subsurface exposure to 4 feet below ground surface (bgs), this value was used to represent the subsurface depth for the Industrial Receptor in this FS. The RVAAP's Facility-Wide Human Health Risk Assessor Manual (USACE, 2005) has detailed descriptions of the exposure scenario and exposure parameters for the National Guard Trainee. The USEPA Regional Screening Levels webpage contains the exposure scenario and parameters for the Industrial Receptor.

1.5 Report Organization

The organization of this FS includes the specific sequence of steps used to develop, screen, and analyze remedial alternatives, as follows:

- Section 1.0 – Introduction: This section discusses the regulatory framework for and purpose of this FS, describes the MRS property, provides background information, and summarizes previous investigations.

- Section 2.0 – Project Objectives: This section presents the conceptual site model (CSM), applicable or relevant and appropriate requirements (ARARs), and RAOs for the MRS.
- Section 3.0 – Detailed Analysis of the Alternative: This section presents a detailed evaluation of the No Action alternative. The evaluation is based on the nine criteria in the NCP: protection to human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; state acceptance; and community acceptance.
- Section 4.0 – References: This section lists pertinent documents cited in this FS report.

2.0 PROJECT OBJECTIVES

This section presents a summary of the CSM for the Erie Burning Grounds MRS. Based on the results of the RI, no explosive hazards or unacceptable risks due to munitions constituent (MC)-related contamination are present at the MRS. Section 2.1 describes the current CSM and discusses any changes made to the CSM following the RI. Section 2.2 summarizes the basis for no remedial action at the MRS.

2.1 Conceptual Site Model

The information collected during the RI and the conclusions reached were used to update the CSM and identify actual, potentially complete, or incomplete source-receptor interactions for the MRS for both current and reasonably anticipated future land uses. The CSMs (Figure 2-1a and 2-1b and Table 2-1) have three sections: Potential Sources, Receptors, and Interactions for munitions and explosives of concern (MEC) and MC-related contamination, with complete or incomplete exposure pathways identified for each receptor. Each section is discussed below:

- Sources: Sources are areas where MEC or MC-related contamination has entered (or may enter) the physical system. A source is also where MEC or MC-related contamination is situated or expected to be found.
- Receptors: A receptor is an organism (human or ecological) that contacts a chemical or physical agent. The pathway evaluation must consider both current and reasonably anticipated future land use, as receptors are determined on that basis.
- Interactions: Hazards from MEC and MC-related contamination arise from direct contact as a result of human activity. Interactions describe how receptors come into contact with a source.

The applicable receptors presented in the RI report CSMs have been revised in the FS CSMs as discussed in Section 1.4. The RI CSMs presented the National Guard Trainee and Biota as the applicable receptors. The FS CSMs (Figure 2-1a and Figure 2-1b) include the Industrial Receptor.

Table 2-1. Erie Burning Grounds CSM

Description	CSM Finding
Location Profile	
Boundaries	33.93 acres mostly inundated with surface water with thick vegetation and ground cover in the land areas.
Structures	No structures and no paved roads are located within the MRS.
Utilities	No utilities are located within the MRS.
Security	Access to Camp Ravenna is controlled; however, access to the MRS is unrestricted. Interim controls currently in place include siebert stakes and signage.
Land Use and Receptors	
Current Land Use	maintenance, natural resource management (beaver dam removal), and sampling
Potential Future Land Use	maintenance, natural resource management (beaver dam removal), sampling, fire suppression, and military training.
Human Receptors	Industrial Receptor
Wetlands	The MRS contains high-quality wetlands with areas of surface water that have been broken into four basins that have been identified through planning-level surveys; however, a jurisdictional delineation has not been conducted at the MRS.
Ecological Receptors	Biota such as terrestrial invertebrates (earthworms), voles, shrews, common bird species (owls, hawks, robins and waterfowl), common large mammals (white-tailed deer, raccoon, and woodchuck), small mammals (muskrat, mink) and aquatic biota.
Cultural Resources	A cultural resources survey has not been conducted at the MRS; however, all activities need to adhere to the Inadvertent Discovery Policy for Cultural or Archeological Resources.

2.1.1 MEC Exposure Pathway Analysis

An exposure pathway is the course a chemical or physical agent takes from a source to a receptor. Each potential MEC pathway includes a source, an interaction (access and activity), and a receptor. A pathway is considered complete when a source is known to exist and when receptors have access to the MRS while engaging in an activity that results in contact with the source. A pathway is considered potentially complete when a source has not been confirmed, but is suspected to exist, and when receptors have access to the MRS while engaging in an activity that results in contact with the source. Lastly, a pathway is considered incomplete when one of the four components (source, activity, access, or receptor) is missing from the MRS. As summarized on Figures 2-1a and 2-1b, there are incomplete pathways for MEC and MC-related contamination for the Erie Burning Grounds MRS in the surface and subsurface.

2.1.1.1 Sources

A RI was completed at the Erie Burning Grounds MRS in December 2011 and May 2012 to determine the nature and extent of DoD military munitions and MC-related contamination and to identify the associated hazards and risks posed to likely human and ecological receptors. No MEC was discovered during the RI. Approximately 910 pounds of MD were encountered at 5 of the 14 trenches at a maximum depth of 48 inches bgs. The majority of MD was recovered from Trenches 6 and 8, both located in the southern portion of the MRS. Approximately 385 pounds of MD were encountered no deeper than 6 inches bgs at 29 point-source anomaly locations located in terrestrial and underwater areas. MD was recovered on the ground surface at

19 of the 29 point-source anomaly locations. Figures 1-3a and 1-3b present the findings of the RI intrusive investigation. MD was identified at isolated locations along slopes on the western sides of the ponds. MD included parts from the following munitions:

- GP Bomb, 500 lbs, AN-M64A1 series (trench and point-source locations)
- Projectile, 75 millimeter (mm), High Explosive, M48 series (point-source locations)
- Projectile, 75mm, High Explosive, M309 series (point-source locations)

During the terrestrial and underwater point-source anomaly investigations, 1,052 targets were chosen for reacquisitions and intrusive investigation. Three locations with low initial detection responses could not be reacquired. Of the 1,049 targets that were reacquired, 350 were intrusively investigated. Most of these anomalies were buried in sediment more than 10 inches bgs and were not investigated because of poor underwater visibility conditions that posed safety concerns to the unexploded ordnance technicians.

No DoD military munitions confirmed to be MEC were identified at the Erie Burning Grounds MRS during the RI field activities. The MPPEH encountered on the ground surface and in subsurface soils during the RI were evaluated, determined to be safe, and classified as MD.

2.1.1.2 Receptors

A receptor for the CSM is any human who comes into physical contact with a potential explosive hazard. The future land use for the Erie Burning Grounds MRS is Commercial/Industrial Land Use, and the Industrial Receptor is the human receptor with the greatest opportunity for exposure. As established in Section 1.4, the Industrial Receptor represents a full-time occupational receptor at the MRS. Commercial/Industrial Land Use includes activities consistent with full-time employees or career military personnel who are expected to work daily at Camp Ravenna. The maximum exposure depth for the Industrial Receptor is 4 feet bgs, which is equal to the maximum depth of MD found during the RI field work (48 inches bgs). Section 1.4 provides details on current and projected future land uses for the MRS.

2.1.1.3 Interactions

Interaction describes how receptors come into contact with a source, including both access and activity. Activity describes how receptors come into contact with a source. Access describes the degree to which MEC is available to potential receptors. A receptor may contact MEC on the surface by walking through the MRS and treading on MEC unintentionally or in the subsurface when performing intrusive activities.

Current activities at the Erie Burning Grounds MRS include maintenance, natural resource management (beaver dam removal), and sampling. Fire suppression activities and military training may be conducted at the MRS in the future. Current activities conducted at the MRS primarily involve foot traffic only; however, periodic beaver dam removal has the potential to be intrusive to a depth of 2 feet bgs. The Industrial Receptor (see Section 1.4) representing receptor activities at the MRS has an anticipated intrusive depth of 4 feet bgs (CB&I, 2014). The surface water and saturated areas at the MRS are either forested wetlands or wet fields with shallow water depths (i.e., 3 to 5 feet deep). The maximum exposure depth in subsurface soil for the Industrial Receptor is 4 feet bgs, which is equal to the maximum depth of MD found during the RI field work (48 inches bgs). No construction projects requiring intrusive activities are currently scheduled for the MRS. As stated in Section 1.4, the Industrial Receptor is the Representative Receptor for this MRS, with a subsurface exposure depth defined as 4 feet bgs.

2.1.1.4 MEC Exposure Conclusions

Based on the findings of the RI, no explosive hazards are present at the MRS. No DoD military munitions confirmed to be MEC were found during RI intrusive investigations and only MD were found. Therefore, the surface and the subsurface pathways for MEC are considered incomplete for the Industrial Receptor.

2.1.2 MC-Related Contamination Exposure Pathway Analysis

The RI determined that no known or suspected unacceptable risk due to MC-related contamination exists at the MRS. Therefore, no complete MC-related contamination exposure pathway exists for any terrestrial or aquatic biota receptor. The MC-related contamination CSM is presented in Figure 2-1b and Table 2-1.

2.2 Problem Identification

No explosive hazard is present at the MRS based on the findings of the RI. No DoD military munitions confirmed to be MEC were found at the MRS and only MD was found. No unacceptable risks are present on the MRS due to MC-related contamination as determined by the risk assessment presented in the RI. Therefore, under CERCLA, there is no basis for a remedial action at the MRS. This FS evaluates No Action for the Erie Burning Grounds MRS to support No Action at the MRS.

*2.3 Preliminary Identification of Applicable or Relevant and Appropriate **Requirements and "To Be Considered" Information***

Remedial actions must meet a level and standard of control that attain standards, requirements, limitation, or criteria that are "applicable or relevant and appropriate" (ARAR) under the Section 121 (d)(2)(A) of CERCLA. Because no unacceptable risk due to MC-related contamination are presented on the MRS, no chemical-specific ARARs are identified. Because no actions will be implemented under the No Action alternative, no location- or action-specific ARARs are identified.

2.4 Remedial Action Objectives

As established in the RI, no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS. Therefore, development of RAOs for the MRS is unnecessary.

FIGURE 2-1a MEC CONCEPTUAL SITE MODEL
RVAAP-002-R-01 ERIE BURNING GROUNDS MRS

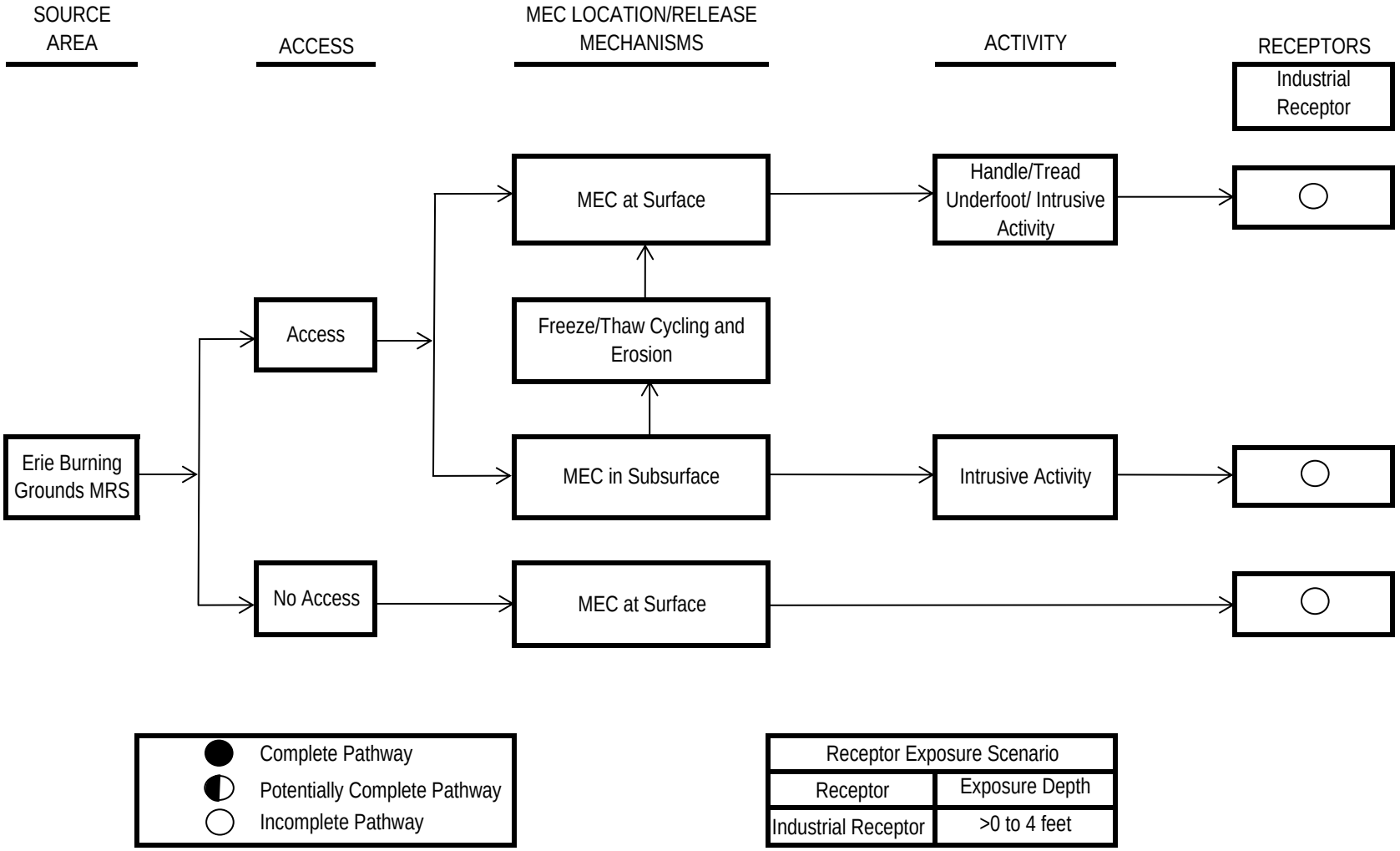

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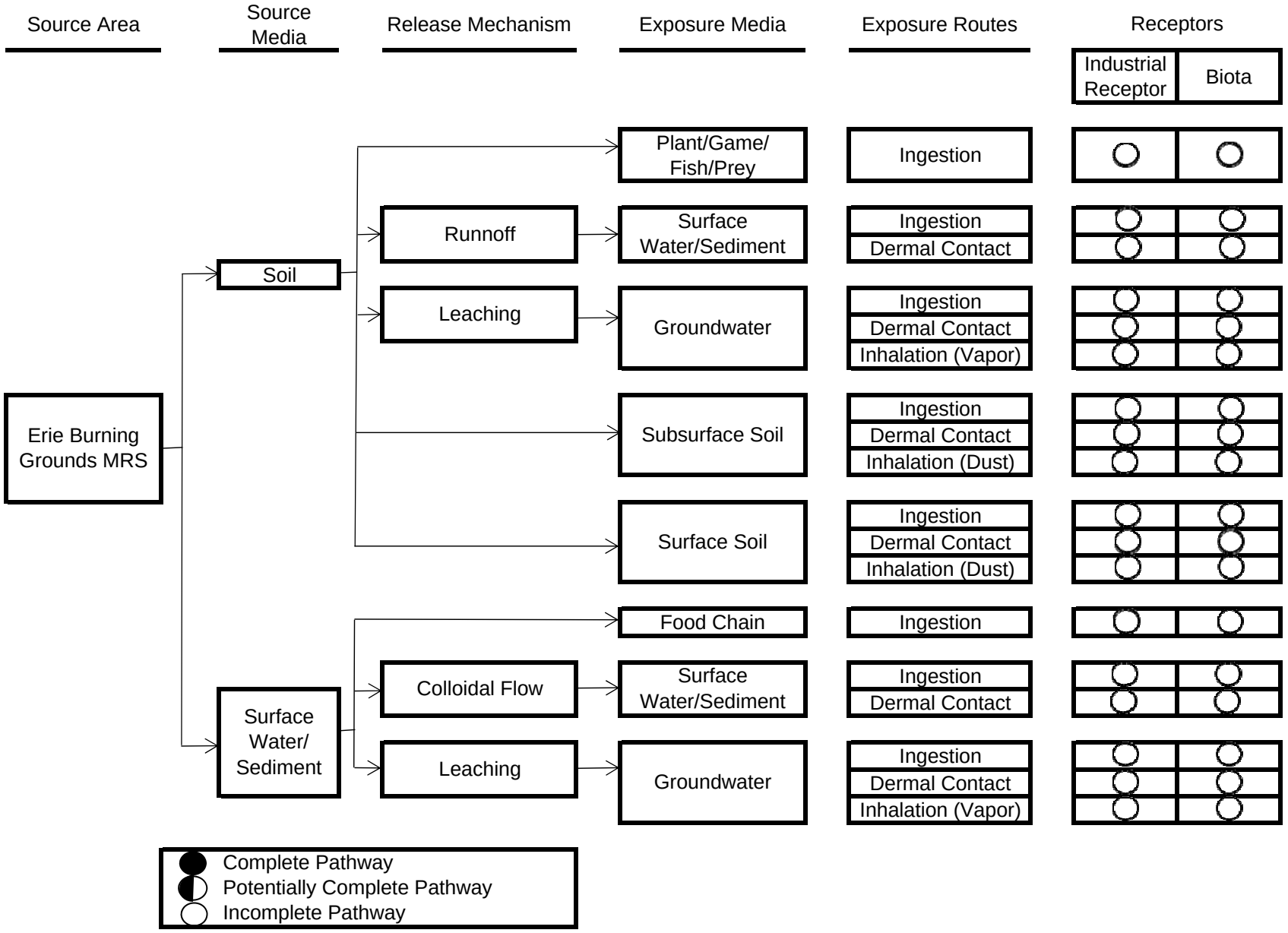
FIGURE 2-1b MC CONCEPTUAL SITE MODEL
RVAAP-002-R-01 ERIE BURNING GROUNDS MRS



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3.0 DETAILED ANALYSIS OF THE NO ACTION ALTERNATIVE

This section presents a detailed analysis of the No Action alternative using the nine criteria listed in the NCP. The purpose of this detailed analysis is to support No Action at the MRS.

3.1 Overview of Evaluation

Section 300.430(e) of the NCP lists nine CERCLA criteria against which each remedial alternative must be assessed. The NCP (Section 300.430(f)) states that the first two criteria, protection of human health and the environment and compliance with ARARs, are "threshold criteria" that must be met by the selected remedial action unless a waiver is granted under Section 121(d)(4) of CERCLA. The next five criteria are "primary balancing criteria," and the trade-offs within this group must be balanced. The final two criteria, state and community acceptance, are "modifying criteria" that are evaluated after comment periods on the FS report and the Proposed Plan are completed.

3.2 Individual Analysis of the No Action Alternative

The following sections provide a detailed analysis of the No Action alternative according to the nine NCP criteria.

3.2.1 Threshold Criteria

Overall Protection of Human Health and the Environment – The selected remedy presented in the Record of Decision (ROD) must meet this threshold criterion. The threshold criterion will be met if the risks associated with human exposures are eliminated, reduced, or controlled, and if the remedial action is protective of the environment. No explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS. Therefore, the No Action alternative is protective of human health and the environment and meets this criterion.

Compliance with ARARs – Compliance with ARARs is a threshold criterion that must be met by the remedial action. There are no chemical-specific, location-specific, or action-specific ARARs identified for this alternative. Therefore, the No Action alternative meets this criterion.

3.2.2 Balancing Criteria

Long-Term Effectiveness and Permanence – The level of risk associated with DoD military munitions and MC-related contamination after implementation of the remedial alternative is evaluated by this criterion. No explosive hazard or unacceptable risk due to MC-related contamination is present at this MRS. Therefore, the No Action alternative will be effective in the long term and no residual hazards or risks will remain at the MRS.

Reduction of Toxicity, Mobility, or Volume Through Treatment – The statutory preference for remedial technologies that significantly and permanently reduce the toxicity, mobility, or volume of the waste is addressed by this criterion. The No Action alternative includes no treatment because no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS.

Short-Term Effectiveness – The effect of the remedial alternative from the beginning of construction and implementation to the completion of the remedial alternative is addressed under this criterion. Because no active remediation activities are conducted, no additional hazards are posed to current receptors or the future Industrial Receptor as a result of implementing the No Action alternative. The No Action alternative will not result in any adverse short-term effects on the environment.

Implementability – The technical and administrative feasibility of implementing the remedial action is addressed by this criterion. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete. Administrative feasibility refers to the ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services; and the requirements for, and availability of, specific equipment and technical specialists. The No Action alternative does not involve active remediation. Therefore, technical feasibility is not a consideration. No services or equipment are necessary to implement No Action. OHARNG will remove existing interim controls after the Final Record of Decision for No Further Action is approved. This alternative will not interfere with any planned remedial action in the future. The No Action alternative is administratively feasible to OHARNG/Camp Ravenna because no explosive hazard or unacceptable risk due to MC-related contamination is present on the MRS. The No Action alternative is expected to receive Ohio Environmental Protection Agency (Ohio EPA) concurrence because no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS.

Cost – Capital and long-term management costs are estimated under this criterion. The No Action alternative has no capital or long-term management costs associated with it.

3.2.3 Modifying Criteria

State Acceptance – This criterion will be evaluated during incorporation of regulatory review comments into this FS, and during the future submittals of the Proposed Plan and ROD.

Community Acceptance – This criterion will be evaluated when the Proposed Plan is presented to the public for review and comment.

3.2.4 Overall Evaluation

The No Action alternative is technically and administratively implementable and has no costs. The No Action alternative is protective of human health and the environment because no explosive hazard or unacceptable risk due to MC-related contamination is present at the MRS. The NFA determination is protective of other potential future human receptors (such as residential receptors). Though there are no current plans for the MRS to change from an industrial land use to a residential land use, there are no unacceptable risks to a potential future residential receptor from explosive hazards.

3.3 Munitions Response Site Prioritization Protocol

In response to a 2002 National Defense Authorization Act requirement, DoD proposed the Munitions Response Site Prioritization Protocol (MRSPP) as the methodology for prioritizing MRSs for response actions. In 2005, the Final Rule for the MRSPP was issued and codified at 32 CFR Part 179. The MRSPP provided in the RI was revised for this FS in accordance with the *Munitions Response Site Prioritization Protocol Primer* (DoD, 2007). The MRSPP consists of the following three modules to evaluate the unique characteristics of each hazard type at an MRS: Explosive Hazard Evaluation (EHE), Chemical Warfare

Materiel Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE). The composite rating of the three modules is used to assign a priority ranking to the MRS ranging from 1 (highest priority) to 8 (lowest priority), with alternative ratings of Evaluation Pending, No Known or Suspected Hazard, or No Longer Required. The revised MRSPP for the Erie Burning Grounds MRS is included in Appendix A. The revised composite MRSPP priority is “No Longer Required”.

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4.0 REFERENCES

Army National Guard (ARNG), 2014. *Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program*, Portage/Trumbull Counties, Ohio, February.

CB&I Federal Services LLC (CB&I), 2014. *Final Remedial Investigation Report for RVAAP-002-R-01 Erie Burning Grounds MRS, Version 1.0*. August.

Department of Defense (DoD), 2007. *Munitions Response Site Prioritization Protocol Primer,* April.

DoD, 2012. Manual 4715.20: *Defense Environmental Restoration Program (DERP) Management*. March.

U.S. Army, 2009. *Final United States Army Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance.* November.

U.S. Army Corps of Engineers (USACE), 2005. *RVAAP's Facility-Wide Human Health Risk Assessor Manual, Amendment 1*. December.

U.S. Environmental Protection Agency (USEPA), 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. October.

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Appendix A

Revised Munitions Response Site Prioritization Protocol Worksheets

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Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

Munitions Response Site (MRS) Name:	**Erie Burning Grounds (RVAAP-004-R-01)**
Component:	US Army
Installation/Property Name:	**Ravenna Army Ammunition Plant**
Location (City, County, State):	Ravenna, Portage and Trumbull Counties, Ohio
UTM Coordinates (NAD83):	X = 495533.228229 Y = 4559646.312867
Site Name (RMIS ID):	OH213820736
Project Name (Project No.):	Ravenna Army Ammunition Plant/Contract No. W912DR-09D-0005/0002
Date Information Entered/Updated:	31-Oct-2017
Point of Contact (Name/Phone):	Craig Coombs, USACE Louisville District/(502)315-6324

Project Phase ("X" only one):										
	PA		**SI**		**RI**	**X**	**FS**		**RD**
	RA-C		**RIP**		**RA-O**		**RC**		**LTM**

Media Evaluated ("X" all that apply):				
	Groundwater (human receptor)	**X**	**Sediment (human receptor)**
	Surface soil (human receptor)	**X**	**Surface water (ecological receptor)**
X	**Sediment (ecological receptor)**	**X**	**Surface water (human receptor)**

MRS Summary

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present):

The Erie Burning Grounds is a 33.93 acre munitions response site (MRS) that is co-located with an Installation Restoration Program (IRP) Area of Concern (Army Environmental Database Restoration Module # RVAAP-02) (RI Report [2014], Section 1.3.1). The MRS was used to thermally treat bulk, obsolete, off-spec propellants, conventional explosives, rags, and large explosive contaminated items (e.g., railcars) by open burning (OB) on the ground surface. (RI Report, Section 1.2). Since activities ceased, the areas where the OB activities occurred have become inundated with water due to seasonal flooding and beaver dam activity. No MEC was found during the intrusive investigations; however, numerous munitions debris (MD) items were identified. The MD items were solid and/or inert, and posed no explosives safety hazard (RI Report, Section 9.1.1). Site-related chemicals (SRCs) were detected in the media sampled during the RI field activities (surface water, sediment, and subsurface soils) but were determined not to pose risks to likely receptors (RI Report, Section 4.3). Given the extent of environmental media coverage achieved for the sampling activities for the RI and the results for the MC characterization, it is unlikely that SRCs will leach from any MD.

Description of Pathways for Human and Ecological Receptors:

Based on the results of the RI field investigations, the use or introduction of munitions at the MRS is confirmed. Because no direct evidence of an explosive hazard exists, the pathways for MEC are considered incomplete (RI Report, Sections 9.1.5). No risks associated with potential MC were identified during the RI or the previous IRP investigations and given the extent of environmental media coverage achieved for the sampling activities for the RI and the results for the MC characterization, it is unlikely that SRCs will leach from any MD that may remain at the MRS. The CSM for MC has been updated to reflect incomplete pathways for all receptors in the terrestrial and aquatic environments (RI Report, Section 9.2).

Description of Receptors (Human and Ecological):

A receptor is an organism (human or ecological) that comes into physical contact with MEC. Human receptors identified for the Erie Burning Grounds MRS include both current and anticipated future land users. Ecological receptors (biota) are based on animal species that are likely to occur in the terrestrial habitats at the MRS. The primary MRS-specific biota identified for the MRS include terrestrial invertebrates (earthworms), voles, shrews, robins, foxes, barn owls, hawks, muskrat, mink, mallards, great blue heron, benthic invertebrates, and aquatic biota (USACE, 2003c).

Current activities at the Erie Burning Grounds MRS include maintenance and natural resource management activities. Most of these activities involve foot traffic only; however, periodic beaver dam removal as part of maintenance at the MRS may require in intrusive activities. The future land use at Erie Burning Grounds MRS is anticipated to remain the same as current activities; however, the MRS may also be used for hunting/trapping and fire suppression activities.The current human receptors identified at the Erie Burning Grounds MRS include RVAAP personnel, contract workers, regulatory personnel, hunters and trespassers (e2M, 2008). The Security Guard/Maintenance Worker, Hunter/Trapper, and Fire/Dust Suppression Worker have been identified as the potential receptors based on the future land use (USACE, 2005).

Table 1
EHE Module: Munitions Type Data Element Table

Directions: Below are eleven classifications of munitions and their descriptions. Annotate the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions*, *small arms*, *physical evidence*, and *historical evidence* are defined in Appendix C of the MRSPP Primer (Draft, Dec 2005).

Classification	Description	Possible Score	Score
Sensitive	All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorous (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions].	30	
	All hand grenades containing energetic filler.		
	Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.		
High explosive (used or damaged)	All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive."	25	
	All DMM containing a high-explosive filler that have been damaged by burning or detonation, or deteriorated to the point of instability		
Pyrotechnic (used or damaged)	All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades).	20	
	All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have been damaged by burning or detonation, or deteriorated to the point of instability.		
High explosive (unused)	All DMM containing a high-explosive filler that have not been damaged by burning or detonation, or are not deteriorated to the point of instability.	15	
Propellant	All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor).	15	
	All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are damaged by burning or detonation, or deteriorated to the point of instability		
Bulk secondary high explosives, pyrotechnics, or propellant	All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated	10	
	Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.		
Pyrotechnic (not used or damaged)	All DMM containing a pyrotechnic filler (i.e. red phosphorous), other than white phosphorous filler, that have not been damaged by burning or detonation, or are not deteriorated to the point of instability	10	
Practice	All UXO that are practice munitions that are not associated with a sensitive fuze.	5	
	All DMM that are practice munitions that are not associated with a sensitive fuze and that have not been damaged by burning or detonation, or are not deteriorated to the point of instability.		
Riot control	All UXO or DMM containing a riot control agent filler (e.g., tear gas).	3	
Small arms	All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2	
Evidence of no munitions	Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).		**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space below.

During the RI field activities at the Erie Burning Grounds MRS, numerous MD items were found on the ground surface, in subsurface soil to maximum depth of 4 feet bgs, and at the submerged areas of the MRS. MD items identified at the MRS included pieces and fragments associated with the AN-M64A1 series 500-pound (lb) general purpose (GP) bomb, the M309 series 75 millimeter (mm) projectile, and the M48 series 75mm projectile (all HE) (RI Report, Section 10.1). The recovered MD items were solid and/or inert and posed no explosives safety hazard. Tables 2 – 9 are intentionally omitted according to Army Guidance.

Tables 2 – 9 are intentionally omitted according to Army Guidance.

Table 10

Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 01 - 09, record the data element scores in the **Score** boxes to the right.

2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.

3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.

4. Identify the appropriate range for the **EHE Module Total** at right.

5. Identify the **EHE Module Rating** that corresponds to the range selected and record this rating in the **EHE Module Rating** box at the lower right corner of this table.

NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 01	0	0
Source of Hazard	Table 02	0	
Accessibility Factor Data Elements			
Location of Munitions	Table 03	0	0
Ease of Access	Table 04	0	
Status of Property	Table 05	0	
Receptor Factor Data Elements			
Population Density	Table 06	0	0
Population Near Hazard	Table 07	0	
Types of Activities/Structures	Table 08	0	
Ecological and/or Cultural Resources	Table 09	0	
EHE MODULE TOTAL			**0**

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	**No Known or Suspected Explosive Hazard**

Table 11

CHE Module: CWM Configuration Data Element Table

Directions: Below are seven classifications of CWM configuration and their descriptions. Annotate the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO*, *CWM/DMM*, *physical evidence*, and *historical evidence* are defined in Appendix C of the MRSPP Primer (Draft, Dec 2005).

Classification	Description	Possible Score	Score
CWM, explosive configuration either UXO or damaged DMM	The CWM known or suspected of being present at the MRS is (a) explosively configured CWM that are UXO (i.e. CWM/UXO), or (b) explosively configured CWM that are DMM (i.e. CWM/DMM) that have been damaged.	30	
CWM mixed with UXO	The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO.	25	
CWM, explosive configuration that are undamaged DMM	The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20	
CWM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is (a) nonexplosively configured CWM/DMM, or (b) bulk CWM/DMM (e.g., ton container).	15	
CAIS K941 and CAIS K942	The CWM/DMM known or suspected of being present at the MRS is CAIS K941(toxic gas set M-1) or CAIS K942 (toxic gas set M-2/E11).	12	
CAIS (chemical agent identification sets)	Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10	
Evidence of no CWM	Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).		**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space below.

The RVAAP is listed on the Non-Stockpile CWM List as a site with known or possible buried CWM; however, there is no known historical or physical evidence of CWM being produced, stored, or used at the MRS. As such, Tables 12-19 are not applicable and have intentionally been omitted according to active Army Guidance.

Tables 12 – 19 are intentionally omitted according to Army Guidance.

Table 20

Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11 - 19, record the data element scores in the **Score** boxes to the right.

2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.

3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11	0	0
Sources of CWM	Table 12	0	
Accessibility Factor Data Elements			
Location of CWM	Table 13	0	0
Ease of Access	Table 14	0	
Status of Property	Table 15	0	
Receptor Factor Data Elements			
Population Density	Table 16	0	0
Population Near Hazard	Table 17	0	
Types of Activities/Structures	Table 18	0	
Ecological and/or Cultural Resources	Table 19	0	
CHE MODULE TOTAL			**0**

4. Identify the appropriate range for the **CHE Module Total** at right.

5. Identify the **CHE Module Rating** that corresponds to the range selected and record this rating in the **CHE Module Rating** box at the lower right corner of this table.

NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	**No Known or Suspected CWM Hazard**

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant [CAS No.]	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
No samples have been collected at the MRS under the MMRP			
(RI Report)			
		Total from Table 27	
		Sum the Ratios	

CHF Scale	CHF Value
CHF > 100	H (High)
100 > CHF >2	M (Medium)
2 > CHF	L (Low)

CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

Directions: Annotate the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Place an "X" in the box to the right if there is no known or suspected Groundwater MC Hazard	

Table 22

HHE Module: Surface Water - Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant [CAS No.]	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
See list of detected SRCs in surface water in Table 27 (Human Health Risks)			
None of the detected SRCs exceeded the RVAAP screening criteria,			
therefore, there is no known or suspected MC hazard in surface water			
(RI Report, Sections 7.0 and 8.0).			
		Total from Table 27	0
		Sum the Ratios	0

CHF Scale	CHF Value	
CHF > 100	H (High)	
100 > CHF >2	M (Medium)	
2 > CHF	L (Low)	

CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	**L**

Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Place an "X" in the box to the right if there is no known or suspected Surface Water (Human Endpoint) MC Hazard	**X**

Table 23

HHE Module: Sediment - Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the site's sediment and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Note: N/A

Contaminant [CAS No.]	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
See list of detected SRCs in sediment in Table 27 (Human Health Risks).			
None of the detected SRCs exceeded the RVAAP screening criteria,			
therefore, there is no known or suspected MC hazard in sediment			
(RI Report, Sections 7.0 and 8.0).			
		Total from Table 27	3
		Sum the Ratios	3

CHF Scale	CHF Value
CHF > 100	**H (High)**
100 > CHF >2	**M (Medium)**
2 > CHF	**L (Low)**

CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	**M**

Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	
Place an "X" in the box to the right if there is no known or suspected Sediment (Human Endpoint) MC Hazard		**X**

Table 24

HHE Module: Surface Water - Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Note: Use either dissolved or total metals analyses.

Contaminant [CAS No.]	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
See list of detected SRCs in surface water in Table 27 (Eco Health Risks).			
None of the detected SRCs exceeded the RVAAP screening criteria,			
therefore, there is no known or suspected MC hazard in surface water			
(RI Report, Sections 7.0 and 8.0).			
		Total from Table 27	0
		Sum the Ratios	0

CHF Scale	CHF Value	
CHF > 100	H (High)	
100 > CHF >2	M (Medium)	
2 > CHF	L (Low)	

CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	**L**

Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Place an "X" in the box to the right if there is no known or suspected Surface Water (Ecological Endpoint) MC Hazard	**X**

Table 25

HHE Module: Sediment - Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

Note: N/A

Contaminant [CAS No.]	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
See list of detected SRCs in sediment in Table 27 (Eco Health Risks).			
None of the detected SRCs exceeded the RVAAP screening criteria,			
therefore, there is no known or suspected MC hazard in sediment			
(RI Report, Sections 7.0 and 8.0).			
		Total from Table 27	51
		Sum the Ratios	51

CHF Scale	CHF Value	
CHF > 100	H (High)	
100 > CHF >2	M (Medium)	
2 > CHF	L (Low)	CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	**M**

Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Place an "X" in the box to the right if there is no known or suspected Sediment (Ecological Endpoint) MC Hazard	**X**

Table 26

HHE Module: Surface Soil - Data Element Table

Contaminant Hazard Factor (CHF)

Directions: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Note: N/A

Contaminant [CAS No.]	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
No samples have been collected at the MRS under the MMRP (RI Report)			
		Total from Table 27	

CHF Scale	CHF Value	Sum the Ratios	
CHF > 100	H (High)	CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])	
100 > CHF >2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

Directions: Annotate the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

Directions: Annotate the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	
Place an "X" in the box to the right if there is no known or suspected Surface Soil MC Hazard		

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

Directions: **Only use this table if there are more than five contaminants present at the MRS.** This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - Revised) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: For human exposures to groundwater and surface water, use dissolved, rather than total, metals analyses when both are available. Remember not to add ratios from different media.

Media	Contaminant [CAS No.]	Maximum Concentration	Units	Comparison Value	Units	Ratios
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
				SUBTOTAL FOR SURFACE SOIL		0
Sediment	Aluminum [7429-90-5]	37,300.00	mg/kg	76,000.00	mg/kg	0
Sediment	Antimony [7440-36-0]	6.50	mg/kg	31.00	mg/kg	0
Sediment	Barium [7440-39-3]	418.00	mg/kg	16,000.00	mg/kg	0
Sediment	Cadmium [7440-43-9]	2.50	mg/kg	39.00	mg/kg	0
Sediment	Hexavalent Chromium [18540-29-9]	22.00	mg/kg	230.00	mg/kg	0
Sediment	Chromium (as Cr+3) [16065-83-1]	20.20	mg/kg	100,000.00	mg/kg	0
Sediment	Copper [7440-50-6]	301.00	mg/kg	3,100.00	mg/kg	0
Sediment	Iron [7439-89-6]	33,000.00	mg/kg	23,000.00	mg/kg	1
Sediment	Lead [7439-92-1]	72.00	mg/kg	400.00	mg/kg	0
Sediment	Mercury [7439-97-6]	0.09	mg/kg	23.00	mg/kg	0
Sediment	Strontium [7440-24-6]	29.60	mg/kg	470,000.00	mg/kg	0
Sediment	2,4,6-Trinitrotoluene [118-96-7]	0.63	mg/kg	31.00	mg/kg	0
Sediment	PCB-1254 [11097-69-1]	0.05	mg/kg	22.00	mg/kg	0
				SUBTOTAL FOR SEDIMENT		3
Surface water	Barium [7440-39-3]	0.05	µg/L	7,300.00	µg/L	0
Surface water	Chromium (as Cr+3) [16065-83-1]	0.00	µg/L	5.50E+04	µg/L	0
Surface water	Copper [7440-50-6]	0.02	µg/L	1,500.00	µg/L	0
Surface water	Iron [7439-89-6]	8.69	µg/L	11,000.00	µg/L	0
Surface water	Lead [7439-92-1]	0.06	µg/L	15.00	µg/L	0
Surface water	Strontium [7440-24-6]	0.08	µg/L	22,000.00	µg/L	0
Surface water	Zinc [7440-36-0]	0.04	µg/L	11,000.00	µg/L	0
Surface water			µg/L		µg/L	
Surface water			µg/L		µg/L	
Surface water			µg/L		µg/L	
Surface water			µg/L		µg/L	
Surface water			µg/L		µg/L	
Surface water			µg/L		µg/L	
				SUBTOTAL FOR SURFACE WATER		0
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
Groundwater			µg/L		µg/L	
				SUBTOTAL FOR GROUNDWATER		0

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

Directions: **only use this table if there are more than five contaminants present at the MRS.**This is a supplemental table designed to hold information about contaminants that do not fit in previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations**and their **comparison values** (from Appendix B, Relative Risk Site Evaluation (RRSE) Primer, Summer 1997 - REvised) in table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration**by the **comparison value**. Determine the **CHF** for each medium ont he appropriate media-specific tables.

Note: For human exposures to groundwater and surface water, use dissolved, rather than total, metals analyses when both are available. Remember not to add ratios from different media.

Media	Contaminant [CAS No.]	Maximum Concentration	Units	Comparison Value	Units	Ratios
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
Surface soil					mg/kg	
				SUBTOTAL FOR SURFACE SOIL		**0**
Sediment	Aluminum [7429-90-5]	37300	mg/kg	14,000.00	mg/kg	3
Sediment	Antimony [7440-36-0]	6.5	mg/kg	2.00	mg/kg	3
Sediment	Barium [7440-39-3]	418	mg/kg	20.00	mg/kg	21
Sediment	Cadmium [7440-43-9]	2.5	mg/kg	0.99	mg/kg	3
Sediment	Copper [7440-50-6]	301	mg/kg	31.60	mg/kg	10
Sediment	Iron [7439-89-6]	33000	mg/kg	20,000.00	mg/kg	2
Sediment	Lead [7439-92-1]	72	mg/kg	35.80	mg/kg	2
Sediment	Mercury [7439-97-6]	0.09	mg/kg	0.18	mg/kg	1
Sediment	2,4,6-Trinitrotoluene [118-96-7]	0.63	mg/kg	0.09	mg/kg	7
Sediment	PCB-1254 [11097-69-1]	0.05	mg/kg	0.06	mg/kg	1
Sediment	Chrysene [218-01-9]	0.039	mg/kg	0.17	mg/kg	0
Sediment	Pyrene [129-00-0]	0.042	mg/kg	0.20	mg/kg	0
				SUBTOTAL FOR SEDIMENT		**51**
Surface water	Barium [7440-39-3]	0.05	ug/L	4.00E+00	µg/L	0
Surface water	Chromium (as Cr+3) [16065-83-1]	0	ug/L	1.20E+02	µg/L	0
Surface water	Copper [7440-50-6]	0.02	ug/L	9	µg/L	0
Surface water	Iron [7439-89-6]	8.69	ug/L	1000	µg/L	0
Surface water	Lead [7439-92-1]	0.01	ug/L	2.5	µg/L	0
Surface water	Zinc [7440-36-0]	0.04	ug/L	120	µg/L	0
Surface water			ug/L		µg/L	
Surface water					µg/L	
Surface water					µg/L	
Surface water					µg/L	
Surface water					µg/L	
Surface water					µg/L	
Surface water					µg/L	
Surface water					µg/L	
				SUBTOTAL FOR SURFACE WATER		**0**
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
Groundwater					µg/L	
				SUBTOTAL FOR GROUNDWATER		**0**

Table 28

Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard**, **Migration Pathway**, and **Receptor Factors** for the media (from Tables 21 - 26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter-Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the reference provided below, determine each medium's rating (A - G) and record the letter in the corresponding **Media Rating** box below.

Medium (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A - G)
Table 21 - Groundwater					
Table 22 - Surface Water (Human Endpoint)	L	L	L	MML	
Table 23 - Sediment (Human Endpoint)	M			MLL	
Table 24 - Surface Water (Ecological Endpoint)	L	L	L	MML	
Table 25 - Sediment (Ecological Endpoint)	M	L	L	MMM	
Table 26 - Surface Soil					
			HHE MODULE RATING		**No Known or Suspected MC Hazard**

DIRECTIONS (Continued):

4. Select the single highest **Media Rating** (A is the highest; G is the lowest) and enter the letter in the **HHE Module Rating** box below.

HHE Ratings (for reference only)	
HHH	A
HHM	B
HHL	C
HMM	
HML	D
MMM	
HLL	E
MML	
MLL	F
LLL	G

NOTE: An alternative module rating may be assigned when a module letter rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

Alternative Module Ratings	
	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29

MRS Priority

DIRECTIONS: In the chart below, enter the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Enter the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the **MRS or Alternative Priority** box at the bottom of the table.

NOTE: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		No Known or Suspected CWM Hazard		No Known or Suspected MC Hazard	

Reference Table 10:		Reference Table 20:		Reference Table 28:	
EHE Module Rating	**Priority**	**CHE Module Rating**	**Priority**	**HHE Module Rating**	**Priority**
No Known or Suspected Explosive Hazard	No Known or Suspected Explosive Hazard	No Known or Suspected CWM Hazard	No Known or Suspected CWM Hazard	No Known or Suspected MC Hazard	No Known or Suspected MC Hazard

MRS or Alternative Priority	No Longer Required

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