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14. ABSTRACT

This Remedial Investigation (RI) Report presents the findings and conclusions of the RI field activities conducted at the RVAAP-050-R-01 Atlas Scrap Yard Munitions Response Site (MRS) between June and October 2011 at the Ravenna Army Ammunition Plant. The purpose of the RI is to determine whether the Atlas Scrap Yard MRS warrants further response action pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and the National Oil and Hazardous Substances Pollution Control Plan. More specifically, the RI is intended to determine the nature and extent of munitions and explosives of concern (MEC) and munitions constituents (MC) and subsequently determine the likely hazards and risks posed to human and environmental receptors by MEC and MC. This RI Report also presents additional data to support the identification and evaluation of alternatives in the Feasibility Study (FS), if required. This RI Report was prepared in accordance with the Army's Final Military Munitions Response Program Munitions Response RI/FS Guidance dated November 2009.

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CB&I Federal Services LLC has completed the *Final Remedial Investigation Report for RVAAP-050-R-01 Atlas Scrap Yard MRS, Version 2.0*, at the former Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy, principles, and procedures, utilizing justified and valid assumptions, was verified. This included review of 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 United States Army Corps of Engineers policy.

Reviewed/Approved by:  Date: August 25, 2014

David Crispo, P.E.
Project Manager

Prepared/Approved by:  Date: March 12, 2014

Laura O'Donnell
Project Engineer

Final Remedial Investigation Report for RVAAP-050-R-01 Atlas Scrap Yard MRS Version 2.0

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912DR-09-D-0005
Delivery Order 0002

Prepared for:

US Army Corps of Engineers®

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Baltimore District
10 S. Howard Street, Room 7000
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Prepared by:

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ARNG—Army National Guard
CB&I—CB&I Federal Services LLC
Ohio EPA—Ohio Environmental Protection Agency
RVAAP—former Ravenna Army Ammunition Plant
USACE—U.S. Army Corps of Engineers

Table of Contents

Table of Contents (continued)

List of Figures

List of Tables

List of Appendices

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AEDB-R	Army Environmental Data Base Restoration Module
AMEC	AMEC Earth and Environmental, Inc.
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
ARNG	Army National Guard
ASR	*Final Archives Search Report*
bgs	below ground surface
Camp Ravenna	Camp Ravenna Joint Military Training Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
CSM	conceptual site model
CTT	Closed, Transferring, and Transferred
DERP	Defense Environmental Response Program
DGM	digital geophysical mapping
DID	Data Item Description
DoD	Department of Defense
DQO	data quality objective
e^2M	engineering-environmental Management, Inc.
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
FS	Feasibility Study
FWSAP	*Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the RVAAP*
GPS	global positioning system
HA	hazard assessment
HHRA	human health risk assessment
HRR	*Final Historical Records Review*
IVS	instrument verification strip
IRP	Installation Restoration Program
lb	pound
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
MKM	MKM Engineers, Inc.
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
MRSPP	*Munitions Response Site Prioritization Protocol*
mV	millivolt(s)

Acronyms and Abbreviations (continued)

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PRG	Preliminary Remediation Goal
QC	quality control
RI	Remedial Investigation
RTK	real-time kinematic
RVAAP	former Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
Shaw	Shaw Environmental & Infrastructure, Inc.
SI	site inspection
SI Report	*Final Site Inspection Report*
SRC	site-related chemical
SVOC	semivolatile organic compound
TBC	to be considered
U.S.	United States
USACE	U.S. Army Corps of Engineers
USP&FO	U.S. Property and Fiscal Officer
UXO	unexploded ordnance
Work Plan	*Final Work Plan for MMRP Remedial Investigation Environmental Services*

EXECUTIVE SUMMARY

This Remedial Investigation (RI) Report documents the findings and conclusions of the RI field activities for the Atlas Scrap Yard (RVAAP-050-R-01) Munitions Response Site (MRS) located at the former Ravenna Army Ammunition Plant (RVAAP) in Portage and Trumbull Counties, Ohio. This RI Report was prepared by CB&I Federal Services LLC under Delivery Order 0002 for Military Munitions Response Program environmental services at the facility under the *Multiple Award Military Munitions Services Performance-Based Acquisition* Contract No. W912DR-09-D-0005. The Delivery Order was issued by the United States (U.S.) Army Corps of Engineers (USACE), Baltimore District on May 27, 2009.

The purpose of the RI was to determine whether the Atlas Scrap Yard MRS warrants further response action pursuant to the *Comprehensive Environmental Responsibility, Compensation, and Liability Act* (CERCLA) of 1980 and the *National Oil and Hazardous Substances Pollution Contingency Plan*. More specifically, the RI was intended to determine the nature and extent of munitions and explosives of concern (MEC) and munitions constituents (MC) and to subsequently determine the potential hazards and risks posed to likely human and ecological receptors by MEC and MC.

ES.1 MRS Description

Whenever possible, existing information and data were incorporated into this RI Report. Background information related to the MRS was taken from the *Final Archival Search Report* (USACE, 2004), the *Final Historical Records Review* (engineering-environmental Management Inc. [e^2M], 2007), and the *Final Site Inspection Report* (e^2M, 2008). Previous data collected at the MRS under the Installation Restoration Program (IRP) were also reviewed, but were not considered applicable as no MEC was identified during the RI field effort and no MC sampling was conducted for the RI. Additionally, chemicals of concern identified during previous investigations under the IRP at the Atlas Scrap Yard MRS continue to be addressed under the IRP.

The Atlas Scrap Yard MRS encompasses 66 acres of mostly open land that contains a network of former roads. The MRS was originally used as a construction camp beginning in 1940. After the conclusion of World War II, the construction camp facilities were demolished and, in 1969, became a storage area/scrap yard for nonexplosive scrap material; however, the MRS may have also been used to store munitions. Debris piles comprised of construction debris, dunnage, and metal are still apparent at the MRS. Following the 2007 site inspection (SI), information was provided to e^2M indicating that a 40-millimeter (mm) fragmentation shell burial area was located in the central portion of the Atlas Scrap Yard MRS (e^2M, 2008).

Any munitions made or stored at the facility, including small arms, explosives, pyrotechnics, propellants, mortars, medium and large caliber munitions, landmines, hand grenades, flares, bombs, detonators, and fuzes, may have been disposed at the MRS (e^2M, 2008). Although the munitions disposal activities could not be verified, photographic evidence indicates that many of these items were stockpiled by the sides of the roads running through the MRS (Ohio Environmental Protection Agency, 2013). These items were reportedly removed in 2003; however, there are no available records documenting the removal action (e^2M, 2008).

Current activities at the Atlas Scrap Yard MRS include storage of construction materials, maintenance activities, natural resource management activities, and environmental sampling under the IRP. The future land use at the Atlas Scrap Yard MRS will be military training.

ES.2 Summary of Remedial Investigation Activities

The preliminary MEC and MC conceptual site models (CSMs) were developed during the SI (e^2M, 2008) phase of the CERCLA process and were used to identify data needs and data quality objectives (DQOs) as outlined in the *Final Work Plan for Military Munitions Response Program Remedial Investigation Environmental Services* (Shaw Environmental & Infrastructure, Inc. [Shaw], 2011), hereafter referred to as the Work Plan. The data needs and DQOs were determined at the planning stage of the RI activities and included characterization of the nature and extent of MEC and MC associated with former activities at the MRS. The DQOs were developed to ensure the reliability of field sampling, chemical analyses, and physical analyses; the collection of sufficient data; the acceptable quality of data generated for its intended use; and the inference of valid assumptions from the data. The DQOs for the Atlas Scrap Yard MRS identified the following decision rules that were implemented in evaluating the MRS:

- Perform a geophysical investigation to identify if buried MEC or munitions debris (MD) was present.
- Perform an intrusive investigation of anomalies identified during the geophysical investigation to evaluate if MEC/MD was present.
- Collect incremental and/or discrete soil samples (surface and subsurface) in areas with concentrated MEC/MD, if any, to evaluate for MC.
- Process the information to evaluate whether there are unacceptable risks to human health and the environment associated with MEC and/or MC and make a determination if further investigation was required under the CERCLA process.

Based on the potential storage and burial activities associated with the MRS, it was determined in the SI reporting stage that there was a potential for MEC and/or MD on the

ground surface and subsurface at the MRS. The initial step in evaluating for buried MEC at the Atlas Scrap Yard MRS consisted of performing a geophysical investigation. Visual surveys of surface conditions were performed in conjunction with the geophysical investigation.

Geophysical Investigation

In June and July of 2011, Shaw performed a digital geophysical mapping (DGM) investigation to identify potential areas of buried MEC and/or MD at the Atlas Scrap Yard MRS. One-dimensional transect survey methodology was employed to collect uniform geophysical data. The DGM data were collected in all accessible areas within the MRS. Spatial coverage was calculated to be 6.1 acres, which represents site coverage of 9.2 percent and exceeds the coverage requirements specified in the Work Plan (Shaw, 2011). The 6.1 acres equate to a total transect distance of 16.7 miles where each transect width covered was 1 meter wide.

Anomaly Selection

Evaluation of the data collected during the DGM survey identified 3,621 single point anomalies, high density areas within and adjacent to the suspected 40 mm burial area, and 14 additional high density areas within remainder of the MRS. Four contiguous areas of high anomaly density were observed within the suspected 40 mm burial area. Two areas of high anomaly density were identified adjacent to the southeast portion of the suspected 40 mm burial area and are at least partially associated with debris piles observed on the ground surface at the suspected burial area. In the remainder of the MRS, 14 additional regions were characterized by high anomaly densities, defined shapes, and elevated EM61-MK2 signal intensity where trench investigations were considered more appropriate. Distinct subsurface linear features appeared to be related to cultural features such as former utility lines and/or possible burial debris. The corners of the MRS were characterized by significantly lower anomaly densities.

Intrusive Investigations

Following the completion of the DGM survey, between August and October 2011, an intrusive investigation was conducted for the locations identified as potentially containing subsurface MEC and/or MD based on an analysis of the DGM survey data. A total of 3,185 single point source anomaly locations (of the 3,621 total identified) and the high density regions of the MRS were identified for reacquisition and intrusive investigation.

The high density areas were investigated by six trenches within and adjacent to the suspected 40 mm burial area and 27 trenches at the remaining 14 high density anomaly areas. Each trench was approximately 20 to 25 feet in length and approximately 3 feet in width. All trenches were mechanically excavated and no MEC or MD was identified in any of the 33

trenches. A total of 12,851 pounds of "Other Debris" items were identified within the 33 trenches. "Other Debris" can represent any form of debris determined not to be munitions related, including scrap metal, hot rocks (i.e., slag), nails, pipe, and construction debris.

During the reacquisition process for the single point source anomalies, 60 of the single point source anomalies were determined to have the source item on the ground surface rather than buried below the surface; therefore, they did not require intrusive investigation to resolve. An additional 34 single point anomalies were not intrusively investigated due to not finding the peak during reacquisition. A total of 3,090 single point anomalies were successfully intrusively investigated by hand following reacquisition. No MEC or MD was identified, while a total of 58,008 pounds of "Other Debris" was identified from the 3,090 individual source anomalies.

The "Other Debris" quantities for both the mechanical trench excavation and manually excavated single point source anomalies were determined by the Unexploded Ordnance (UXO) teams in the field. All debris was left in place.

MC Sampling

The DQOs stated that incremental samples and discrete samples (surface and subsurface soil) would be collected in areas with concentrated MEC or MD. As no source of MEC or MD was identified at the Atlas Scrap Yard MRS, sampling for MC was not warranted in accordance with the Work Plan (Shaw, 2011).

ES.3 MEC Hazard Assessment

The *Interim Munitions of Concern Hazard Assessment (MEC HA) Methodology* (U.S. Environmental Protection Agency [EPA], 2008) addresses human health and safety concerns associated with potential exposure to MEC at a MRS under a variety of site conditions, including various cleanup scenarios and land use assumptions. If an explosive hazard is identified for this RI, the MEC hazard assessment (HA) evaluation will include the information available for the MRS up to and including the RI field activities and provide a scoring summary for the current and future land use activities. If no explosive hazard is found at the MRS, then there is no need to calculate a MEC HA score since there are no human health safety concerns. No MEC or MD items were identified at the MRS during either the 2007 SI or 2011 RI field activities, which indicate that no MEC source or explosive safety hazard is present at the MRS. Therefore, calculation of a MEC HA score was not warranted for the Atlas Scrap Yard MRS.

ES.4 Conceptual Site Model

The information collected during the RI field activities was used to update the MEC CSM and determine if the development of a CSM for MC was required. The CSM identifies all complete, potentially complete, or incomplete source-receptor interactions for current and future land use activities at the MRS. An exposure pathway is the course a MEC item or MC takes from a source to a receptor. Each pathway includes a source, activity, access, and receptor.

MEC Exposure Analysis

A receptor is an organism (human or ecological) that comes into physical contact with MEC or MC. The National Guard Trainee is the most sensitive of the identified current and future potential users that may become exposed to any potentially remaining MEC and MC at the MRS. Ecological receptors are based on animal and aquatic species that are likely to occur in the terrestrial and aquatic habitats at the MRS. The primary MRS-specific biota identified for the MRS include aquatic biota, terrestrial invertebrates (earthworms), voles, shrews, rabbits, robins, foxes, hawks, muskrats, ducks, minks, and benthic invertebrates (insect larvae, crayfish, snails, clams, and bivalves) (USACE, 2003c).

A statistical approach was taken for the investigation at the Atlas Scrap Yard MRS and a portion of the MRS was investigated by visual survey, DGM survey, and intrusive investigation. No MEC or MD was identified on the ground surface or in the subsurface in the 6.1 acres investigated. The UXO Estimator® module (USACE, 2003a) calculated the statistical upper bound density of MEC to be 0.455 MEC per acre based on the percentage of area investigated at the MRS and the actual investigation results. This value was within the DQO target density of 0.5 MEC per acre and means that the investigation was adequate to be 95 percent confident that there is less than 0.455 MEC per acre at the MRS. Although the UXO Estimator® results indicate that a statistical potential for MEC may remain at the MRS, no MEC or MD have been found and it is anticipated that no MEC source or explosive safety hazard is present at the Atlas Scrap Yard MRS.

Given that no MEC source has been identified to date and an explosive safety hazard is not anticipated to exist at the Atlas Scrap Yard MRS, there are no activity/access/receptor interactions ongoing or anticipated under future land use where a receptor may come into contact with MEC. As a result, the revised CSM for MEC identifies incomplete exposure pathways in surface soil, subsurface soil, surface water, and sediment for all receptors having access to the MRS.

MC Exposure Analysis

Since no MEC was identified during the RI investigations at the Atlas Scrap Yard MRS, sampling was not warranted at the MRS in accordance with the Work Plan (Shaw, 2011). Therefore, the CSM for MC identifies incomplete exposure pathways for all receptors at the MRS. Evaluation for the chemicals of concern identified during previous investigations under the IRP at the Atlas Scrap Yard MRS will continue to be addressed under the IRP.

ES.6 Conclusions and Recommendations

The RI was prepared in accordance with the project DQOs and included evaluations for explosives hazards and potential sources of MC that may pose threats to likely receptors. The following statements can be made for the Atlas Scrap Yard MRS based on the results of the RI field activities:

- A total of 6.1 acres were investigated at the 66-acre MRS during the RI and exceeds the proposed spatial coverage of 5.6 acres.
- The nature and extent of MEC and MD has been adequately defined at the MRS.
- No physical evidence of MEC or MD was identified during the RI field activities and an explosive safety hazard is not anticipated to exist at the MRS.
- MC sampling was not warranted since no MEC or MD was found at the MRS during the RI field activities.

After evaluating the RI results, it is determined that the DQOs for the Atlas Scrap Yard MRS have been satisfied and the MRS has been adequately characterized. No Further Action is recommended for the Atlas Scrap Yard MRS under the Military Munitions Response Program, and the next course of action will be to proceed to a No Further Action Proposed Plan.

1.0 INTRODUCTION

This Remedial Investigation (RI) Report documents the findings and conclusions of the RI field activities for the Atlas Scrap Yard (RVAAP-050-R-01) Munitions Response Site (MRS) located at the former Ravenna Army Ammunition Plant (RVAAP) in Portage and Trumbull Counties, Ohio. This RI Report was prepared by CB&I Federal Services LLC company, under Delivery Order 0002 for Military Munitions Response Program (MMRP) environmental services at the facility under the *Multiple Award Military Munitions Services Performance-Based Acquisition* Contract No. W912DR-09-D-0005. The Delivery Order was issued by the United States Army Corps of Engineers (USACE), Baltimore District on May 27, 2009.

This RI Report presents the results of the RI field activities that were conducted at the Atlas Scrap Yard MRS between July and October 2011. This report was developed in accordance with the *Final Work Plan for Military Munitions Response Program Remedial Investigation Environmental Services* (Shaw Environmental & Infrastructure, Inc. [Shaw], 2011) at the facility, hereafter referred to as the Work Plan, and the *Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009).

1.1 Purpose

Environmental cleanup decision making under the MMRP follows the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) of 1980 prescribed sequence of RI, Feasibility Study (FS), Proposed Plan, and Record of Decision. The RI serves as the mechanism for collecting data to characterize MRS conditions, determining the nature and extent of the contamination, and assessing potential risks to human health and the environment from this contamination. While not all munitions and explosives of concern (MEC) or munitions constituents (MC) under the MMRP constitute CERCLA hazardous substances, pollutants, or contaminants, the Defense Environmental Response Program (DERP) statute provides the Department of Defense (DoD) the authority to respond to releases of MEC/MC, and DoD policy states that such responses shall be conducted in accordance with CERCLA and the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP).

The purpose of the RI was to determine whether the Atlas Scrap Yard MRS warranted further response action pursuant to CERCLA and the NCP. More specifically, the RI was intended to determine the nature and extent of MEC and MC and to subsequently determine the hazards and potential risks posed to likely human and ecological receptors by MEC and

MC. Additional data are also presented in this RI Report to support the identification and evaluation of alternatives in a FS, if required.

1.2 Problem Identification

The Atlas Scrap Yard was used as a construction camp and later a storage area/scrap yard for nonexplosive scrap material, but may also have been used to store munitions. Any munitions made or stored at the facility, including small arms, explosives, pyrotechnics, propellants, mortars, medium and large caliber munitions, landmines, hand grenades, flares, bombs, detonators, and fuzes, may have been disposed at the MRS. Further, it was reported that 40-millimeter (mm) fragmentation shells were buried in the central portion of the MRS (environmental-engineering Management, Inc. [e^2M], 2008).

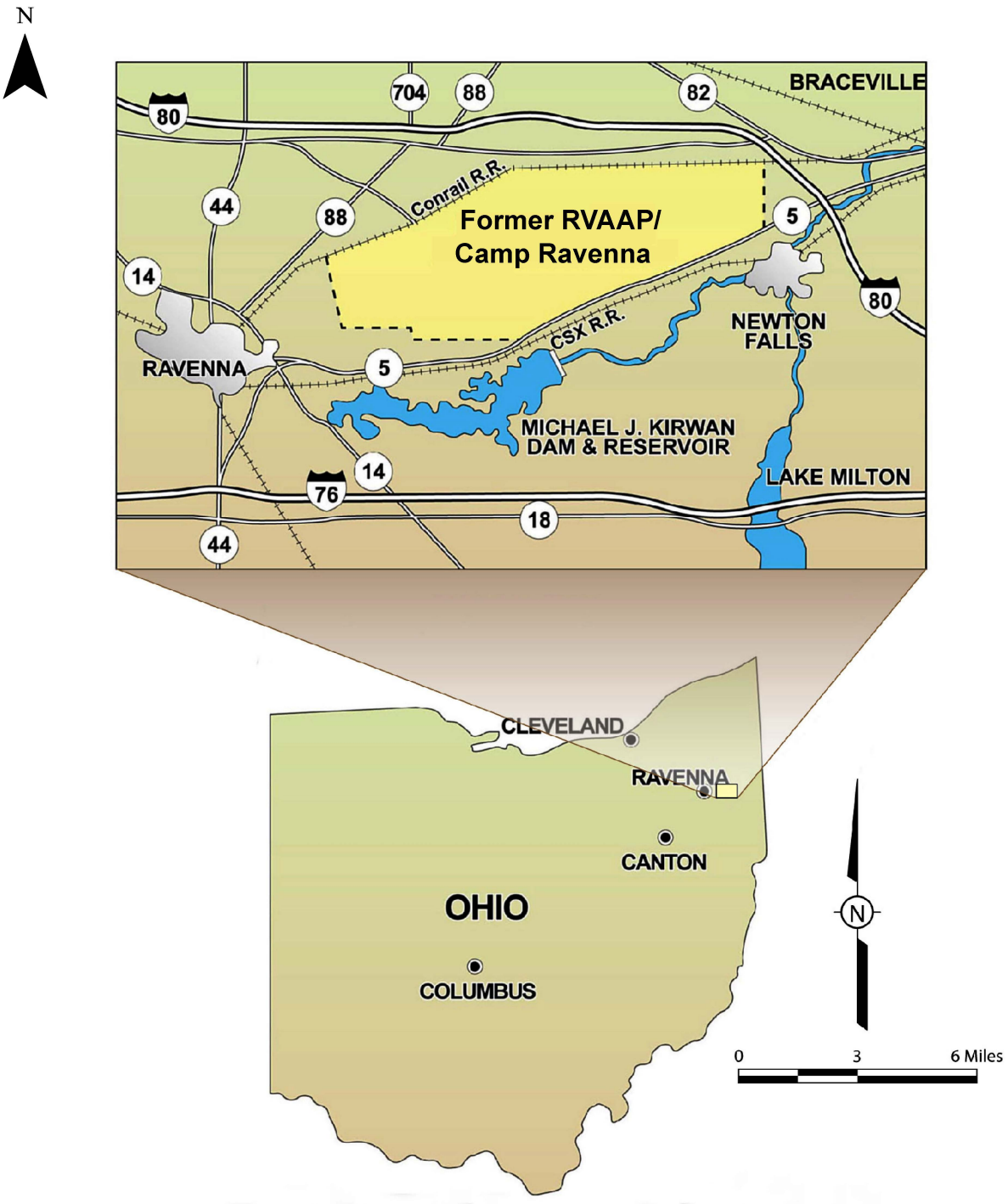
The *Final Site Inspection Report* (e^2M, 2008), hereafter referred to as the SI Report, concluded that there was a potential for buried MEC at the MRS and recommended "Further Characterization" for MEC be performed under the MMRP. No further evaluation for MC was recommended in the SI Report since site-related chemicals (SRCs) identified during previous investigations are being further addressed under the Installation Restoration Program (IRP).

1.3 Physical Setting

This section presents the physical characteristics of the facility, the Atlas Scrap Yard MRS, and the surrounding environment that are factors in understanding fate and transport, receptors, and exposure scenarios for potential human health and ecological risks. The physiographic setting, hydrology, climate, and ecological characteristics of the facility were compiled from information originally presented in the SI Report (e^2M, 2008), which included the Atlas Scrap Yard MRS, and the *Integrated Natural Resources Management Plan and Environmental Assessment* (AMEC Earth and Environmental [AMEC], 2008) for the facility that was prepared for the Ohio Army National Guard (OHARNG).

1.3.1 Location

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



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Showing the Former RVAAP/Camp Ravenna Location

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

MILITARY MUNITIONS RESPONSE PROGRAM

FORMER RVAAP/CAMP RAVENNA
PORTAGE AND TRUMBULL COUNTIES, OHIO

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FIGURE 1-1 INSTALLATION LOCATION MAP

The Atlas Scrap Yard MRS is an approximate 66-acre parcel located at the central portion of the facility within Portage County, southwest of the intersection at Newton Falls Road and Paris-Windham Road (**Figure 1-2**). The MRS is collocated with an IRP Area of Concern (AOC) identified as Army Environmental Database-Restoration Module (AEDB-R) number RVAAP-50.

Administrative control of 21,683-acre facility has been transferred to the United States (U.S.) Property and Fiscal Officer for Ohio and subsequently licensed to the OHARNG for use as a training site, Camp Ravenna. The restoration program involves cleanup of former production areas across the facility related to former operations under the former RVAAP.

The MRS is located on federal property that is managed by the Army National Guard (ARNG) and the OHARNG. **Table 1-1** summarizes the administrative description for the Atlas Scrap Yard MRS. The table includes the facility AEDB-R numerical designation for the MRS, the current MRS acreage, and the agencies responsible for the MRS.

Table 1-1
Administrative Summary of the Atlas Scrap Yard MRS

MRS Name	AEDB-R MRS Number	MRS Area (acres)	Property Owner	MRS Management Responsibility
Atlas Scrap Yard	RVAAP-050-R-01	66.04	USP&FO	ARNG/OHARNG

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

1.3.2 Current and Projected Land Use

This section presents the current and anticipated future land use for the Atlas Scrap Yard MRS. The future land use is based on information provided in the *RVAAP's Facility-Wide Human Health Risk Assessor Manual* (USACE, 2005) and information provided by the OHARNG during preparation of the Work Plan (Shaw, 2011).

Current activities at the Atlas Scrap Yard MRS include storage of construction materials, maintenance activities, natural resource management activities, and environmental sampling under the IRP. Potential users associated with the current land uses at the MRS include facility personnel, contractors, and occasional trespassers.

The future activities at the Atlas Scrap Yard MRS will be military training. The potential user for the future activities at the MRS is the National Guard Trainee (USACE, 2005).

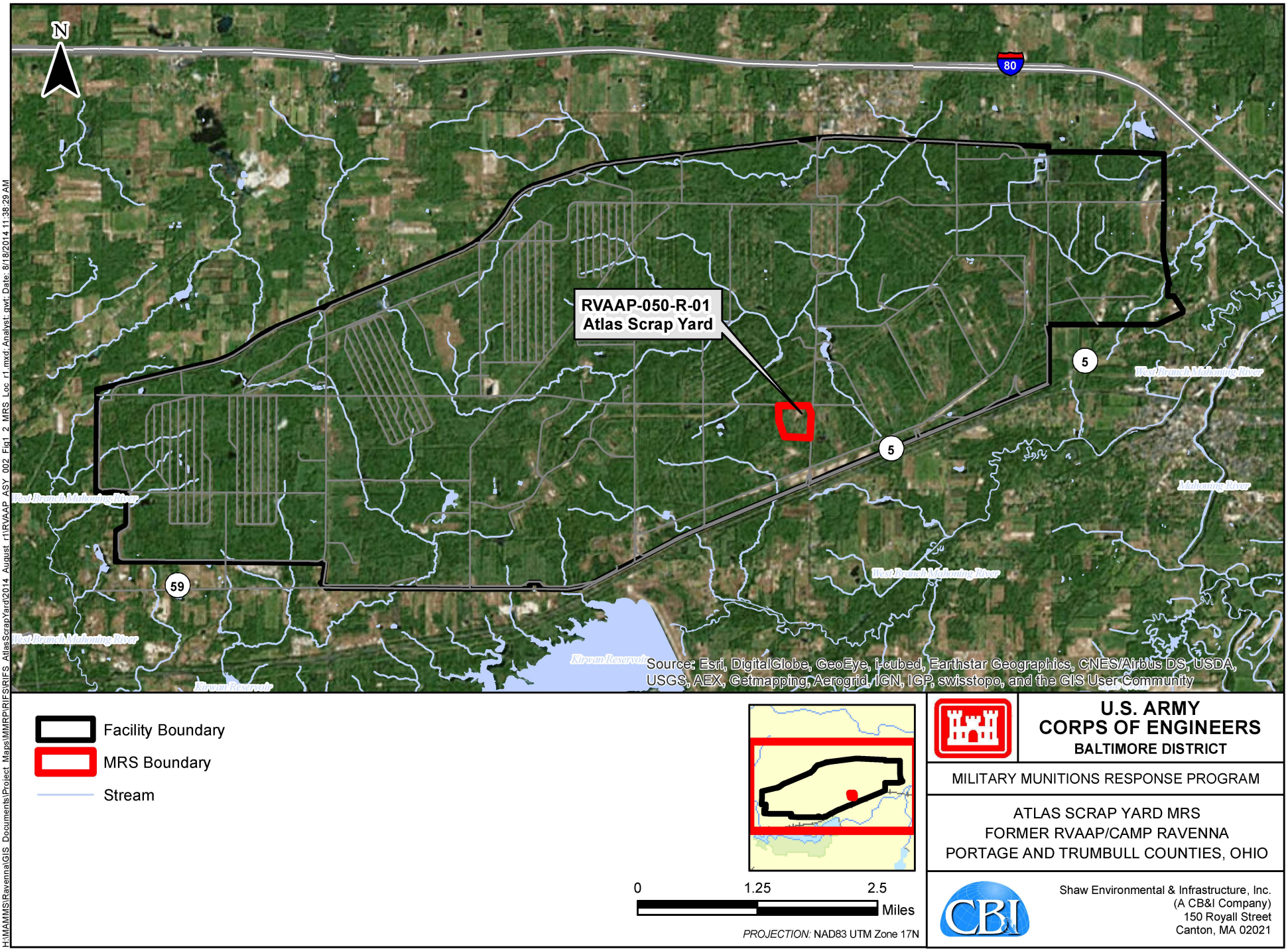

FIGURE 1-2 MRS LOCATION MAP

1.3.3 Climate

The climate at the facility is classified as humid continental, and the region is characterized by warm, humid summers and cold winters. The National Weather Service identified the average annual precipitation for Ravenna, Ohio as 40.23 inches, with February as the driest month and July as the wettest month. **Table 1-2** reflects the annual climate and weather normally encountered at nearby Youngstown Municipal Airport.

Table 1-2
Climatic Information, Youngstown Municipal Airport, Ohio

Temperature Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal Max Temperature (°F)	32.4	36.0	46.3	58.2	69.0	77.1	81.0	79.3	72.1	60.7	48.4	37.3
Normal Min Temperature (°F)	17.4	19.3	27.1	36.5	46.2	54.6	58.7	57.5	50.9	40.9	33.0	23.4
Mean Precipitation (inches)	2.34	2.03	3.05	3.33	3.45	3.91	4.10	3.43	3.89	2.46	3.07	2.96
Mean Snowfall (inches)	13.1	9.6	10.4	2.2	0	0	0	0	Trace	0.6	4.5	12.3

Source: National Oceanic and Atmospheric Administration Climatography of the United States Nos. 20 and 81 1971–2000.
°F denotes degrees Fahrenheit.

1.3.4 Topography

The facility is located within the Southern New York Section of the Appalachian Plateaus physiographic province. Rolling topography containing incised streams and dendric drainage patterns are prevalent in the province. Rounded ridges, filled major valleys, and areas covered with glacially derived unconsolidated deposits were the product of glaciation in the Southern New York Section. In addition, bogs, kettle lakes, and kames are evidence of past glacial activity in the province. Old stream drainage patterns were disturbed and wetlands were created within the province as a result of past glacial activity (e^2M, 2008).

Atlas Scrap Yard MRS Topography

The topography at the Atlas Scrap Yard MRS ranges from flat to gently rolling hills. The relative elevation at the MRS is approximately 980 feet above mean sea level. Natural drainage is toward the wetland area at the northeast portion of the MRS. The topographical features at the Atlas Scrap Yard MRS are presented in **Figure 1-3**.

MRS Boundary

Elevation Contour (2 Foot Intervals)

0 250 500 Feet

PROJECTION: NAD83 UTM Zone 17N

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MILITARY MUNITIONS RESPONSE PROGRAM

ATLAS SCRAP YARD MRS
FORMER RVAAP/CAMP RAVENNA
PORTAGE AND TRUMBULL COUNTIES, OHIO

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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FIGURE 1-3 TOPOGRAPHIC MAP

1.3.5 Hydrology and Hydrogeology

The facility is located within the Ohio River Basin. The major surface stream at the facility is the West Branch of the Mahoning River, which flows adjacent to the western end of the facility, generally from north to south, before flowing into the Michael J. Kirwan Reservoir. After leaving the reservoir, the West Branch joins the Mahoning River east of the facility.

Surface water features within the facility include a variety of streams, lakes, ponds, floodplains, and wetlands. Numerous streams drain the facility, including approximately 19 miles of perennial streams. The total combined stream length at the facility is 212 linear miles (AMEC, 2008).

Three primary watercourses drain the facility: (1) the south fork of Eagle Creek, (2) Sand Creek, and (3) Hinkley Creek. Eagle Creek and its tributaries, including Sand Creek, are designated as State Resource Waters. With this designation, the stream and its tributaries fall under the Ohio State Antidegradation Policy. These waters are protected from any action that would degrade the existing water quality.

Approximately 153 acres of ponds are found on the facility (AMEC, 2008). Most of the ponds were created by beaver activity or small man-made dams and embankments. Some were constructed within natural drainage ways to function as settling ponds for effluent or runoff.

A planning level survey (i.e., desktop review of wetlands data and resources [National Wetland Inventory maps, aerials, etc.]) for wetlands was conducted for the entire facility, including the MRS. Wetlands located within the facility include seasonally saturated wetlands, wet fields, and forested wetlands (MKM Engineers, Inc. [MKM], 2007). Sand and gravel aquifers are present within the buried-valley and outwash deposits in Portage County. In general, the aquifer is too thin and localized to provide large quantities of water; however, yields are sufficient for residential water supplies. Wells located on the facility were primarily located within the sandstone facies of the Sharon Member.

Although groundwater recharge and discharge areas have not been delineated at the facility, it is assumed that the extensive uplands areas at the facility are regional recharge zones. Sand Creek, Hinkley Creek, and Eagle Creek are presumed to be major groundwater discharge areas (e^2M, 2008).

Atlas Scrap Yard MRS Hydrology and Hydrogeology

Surface water drainage generally flows to the east, following the topography at the Atlas Scrap Yard MRS. Drainage ditches run parallel to the roads and receive surface water runoff during rain events. There are no natural streams or ponds located within the MRS. The Atlas

Scrap Yard MRS is located south of the Sand Creek and is not located within the Sand Creek flood plain (MKM, 2007).

Jurisdictional wetland delineation has not been performed at the MRS. The planning level survey identified five wetland locations throughout the Atlas Scrap Yard MRS. The total area of wetlands at the MRS is approximately 3 acres. The largest area of wetland is approximately 1.6 acres and used to be an ice skating pond when the MRS was a construction camp. This wetland is located at the northeast portion of the MRS. The wetlands present within the MRS are currently either forested wetlands or wet fields. No bogs, kettle lakes, or kames have been identified as being present within the MRS. Wetland areas identified at the MRS during the planning level survey are shown on **Figure 1-4** (AMEC, 2008). Groundwater is present at the MRS between 12 and 16 feet below ground surface (bgs) in unconsolidated sediments. Groundwater flow is to the south in the southern portion of the MRS and to the north in the northwestern portion of the MRS (MKM, 2007).

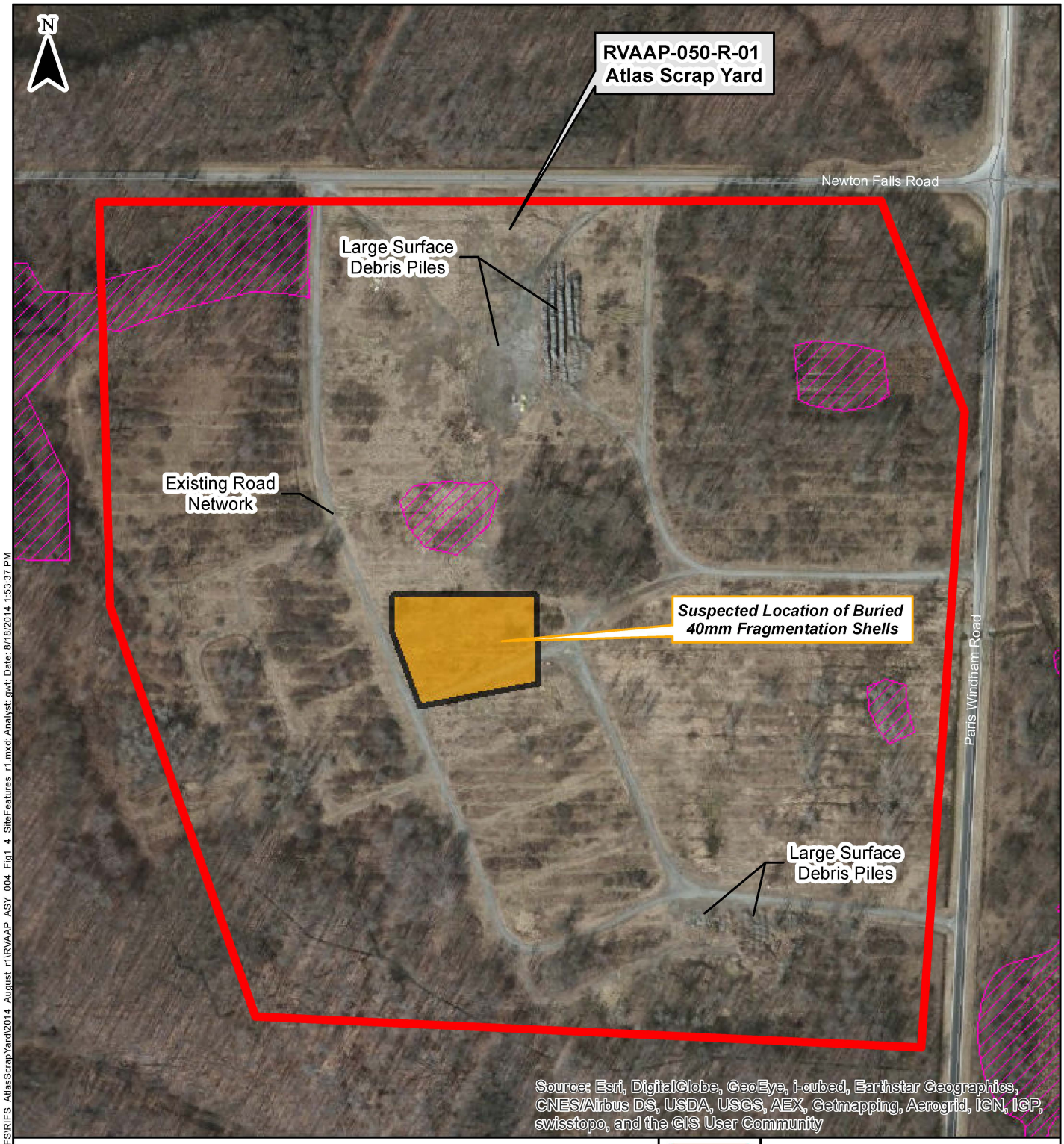
1.3.6 Geology and Soils

Based on regional geology, the facility consists of Mississippian and Pennsylvanian age bedrock strata, which dips to the south at approximately 5 to 10 feet/mile. The bedrock is overlain by unconsolidated glacial deposits of varying thickness.

Bedrock is overlain by deposits of Wisconsin-aged Lavery Till and Hiram Till in the western and eastern portions of the facility, respectively. The thickness of the glacial deposits varies throughout the facility ranging from ground surface in parts of the eastern portion of the facility to an estimated 150 feet in the south-central portion of the facility.

Bedrock is present near the ground surface in many locations at the facility, including Load Line 1 at the east end of the facility. Where glacial deposits are still present, their distribution and character are indicative of ground moraine origin. Laterally discontinuous groupings of yellow-brown, brown, and gray silty clays to clayey silts, with sand and rock fragments are present. Glacial-age standing water body deposits may be present at the facility, in the form of uniform light gray silt deposits over 50 feet thick.

At approximately 200 feet bgs, the Mississippian Cuyahoga Group is present throughout most of the facility. In the northeastern corner of the facility, the Meadville Shale Member of the Cuyahoga Group is present close to the surface. The Meadville Shale Member of the Cuyahoga Group is blue-gray silty shale characterized by alternating thin beds of sandstone and siltstone.



MRS Boundary

Suspect Area

Planning Level
Wetland (AMEC, 2008)

0 300 600 Feet

Projection : NAD_1983_UTM_Zone_17N

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MILITARY MUNITIONS RESPONSE PROGRAM

ATLAS SCRAP YARD MRS
FORMER RVAAP/CAMP RAVENNA
PORTAGE AND TRUMBULL COUNTIES, OHIO

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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FIGURE 1-4 SITE FEATURES MAP

The Sharon Member of the Pennsylvanian Pottsville Formation unconformably overlies the Meadville Shale Member of the Mississippian Cuyahoga Group. A relief of as much as 200 feet exists in Portage County, which can be seen in the Sharon Member thickness variations. The Sharon Member is made up of shale and a conglomerate.

The Sharon Member conglomerate unit is identified as highly porous, permeable, cross bedded, frequently fractured and weathered quartzite sandstone, which is locally conglomeratic and has an average thickness of 100 feet. A thickness of as much as 250 feet exists in the Sharon Conglomerate where it was deposited in a broad channel cut into Mississippian rocks. In marginal areas of the channel, the conglomerate unit may thin out to approximately 20 feet; in some places, it may be missing owing to nondeposition on the uplands of the early Pennsylvanian erosional surface. Thin shale lenses occur intermittently within the upper part of the conglomerate unit.

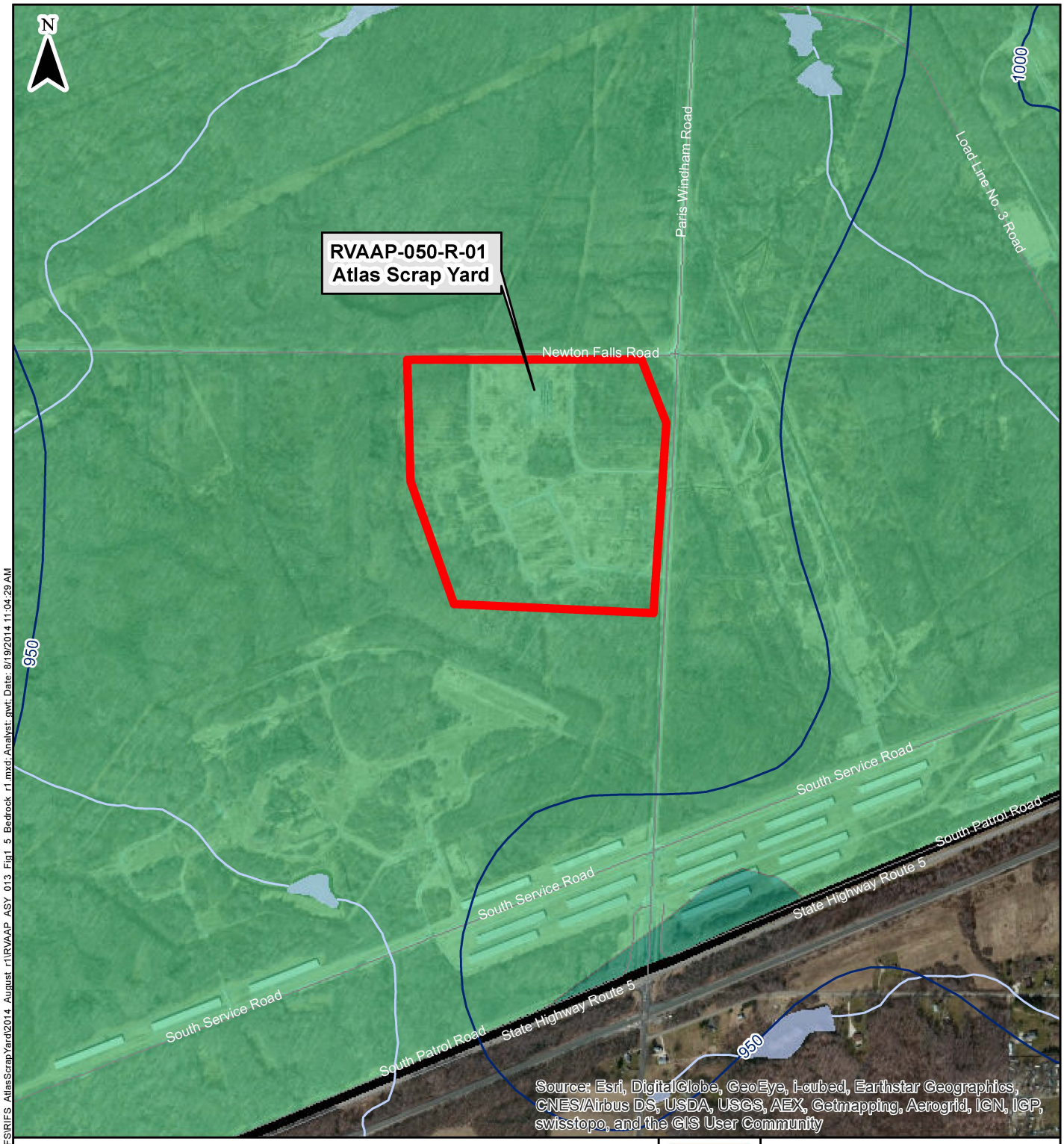
The Sharon Member shale unit is identified as a light to dark-gray fissile shale, which overlies the conglomerate in some locations; however, it has been eroded throughout the majority of the facility. The Sharon Member outcrops in many locations in the eastern half of the facility.

The remaining members of the Pottsville Formation overlie the Sharon Member in the western portion of the facility. Due to erosion and because the land surface was above the level of deposition, the Pottsville Formation is not found in the eastern half of the facility.

The Connoquenessing Sandstone Member, which is sporadic, relatively thin channel sandstone comprised of gray to white, coarse-grained quartz with a higher percentage of feldspar and clay than the Sharon Conglomerate, unconformably overlies the Sharon Member. The Mercer Member, which is found above the Connoquenessing Sandstone, consists of silty to carbonaceous shale with many thin and discontinuous lenses of sandstone in its upper part. The Homewood Sandstone Member unconformably overlies the Mercer and consists of the uppermost unit of the Pottsville Formation. The Homewood ranges from well-sorted, coarse-grained, white quartz sandstone to a tan, poorly sorted, clay-bonded, micaceous, medium- to fine-grained sandstone. The Homewood occurs as a caprock on bedrock highs in the subsurface (e^2M, 2008).

Geology and Soils at the Atlas Scrap Yard MRS

The Atlas Scrap Yard MRS is located over the Sharon Sandstone Conglomerate Unit and the bedrock elevation is approximately 950 feet above mean sea level. Depth to bedrock at the MRS is approximately 20 to 29 feet (MKM, 2007). **Figure 1-5** illustrates the bedrock formation beneath the MRS.



Ravenna Army Ammunition Plant Boundary

MRS Boundary

Geologic Formation

Berea Sandstone

Sharon Sandstone Conglomerate Unit

Bedrock Elevation Contour (feet above sea level)

Stream

0 1,000 2,000 Feet

Projection : NAD_1983_UTM_Zone_17N

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FIGURE 1-5 BEDROCK MAP

The soils identified at the facility are generally derived from the Wisconsin-age silty clay glacial till. The natural soil types associated with the MRS consist of silt or clay loams ranging in permeability from 6.0×10^{-7} to 1.4×10^{-3} centimeters/second and are identified as the Mahoning silt loam with 2 to 6 percent slopes and the Trumbull silt loam with 0 to 2 percent slopes (United States Department of Agriculture et al., 1978). **Figure 1-6** illustrates the soil types and distribution across the MRS.

The Mahoning silt loam makes up the majority of the interior of the MRS and consists of deep, somewhat poorly drained, nearly level to gently sloping soils that formed in silty clay loam or clay loam glacial till. The Mahoning silt loam with 2 to 6 percent slopes is characterized by more gently sloped land with medium to rapid runoff with erosion as a hazard. These low areas are slow to dry out in spring. Seasonal wetness and slow permeability is a characteristic of this soil type (MKM, 2007).

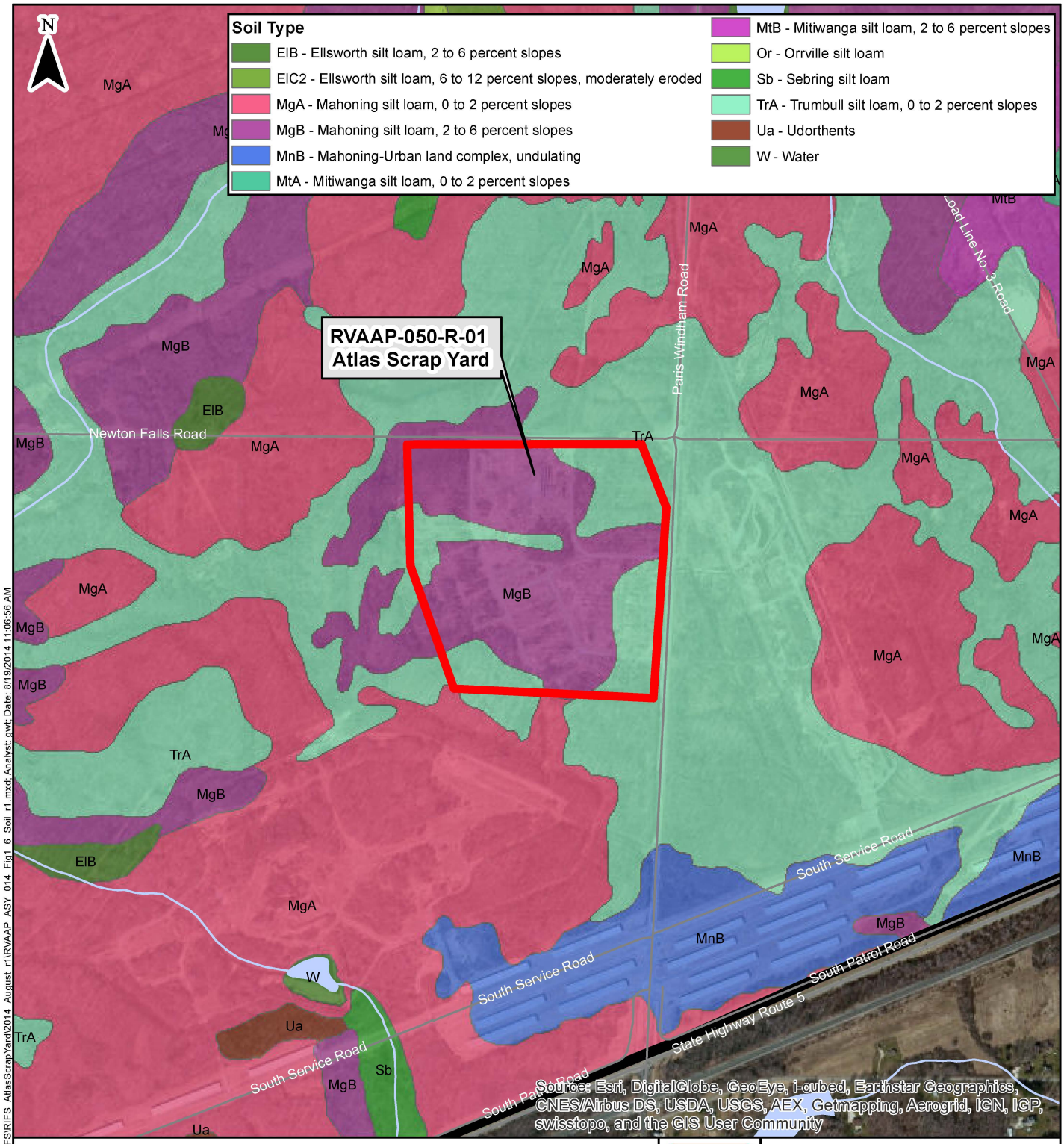
The Trumbull silt loam covers the southwest corner and an area near the eastern boundary of MRS. There is also a thin finger of Trumbull silt loam that extends into the center of the MRS from the west side. The Trumbull series consists of deep, poorly drained, nearly level soils. These soils formed in silty clay loam, clay loam, or silty clay glacial till. Permeability is very slow in the subsoil and underlying glacial till. Runoff is slow and ponding is common after heavy rains. Trumbull soils are slow to dry in spring. Trumbull silt loam with 0 to 2 percent slopes is a nearly level soil mainly along small drainage ways or in small depressions adjacent to the better drained Mahoning and Remsen soils. Seasonal wetness and very slow permeability are limitations associated with this soil type (MKM, 2007).

1.3.7 Vegetation

The facility has a diverse range of vegetation and habitat resources. Habitats present within the facility include large tracts of closed-canopy hardwood forest, scrub/shrub open areas, grasslands, wetlands, and open-water ponds and lakes. Vegetation at the facility can be grouped into three categories: (1) herb-dominated, (2) shrub-dominated, and (3) tree-dominated. Tree-dominated areas are most abundant, covering approximately 13,000 acres on the facility. Shrub vegetation covers approximately 4,200 acres. A plant species survey identified 18 vegetation communities on the facility. The facility has as total of seven forest formations, four shrub formations, eight herbaceous formations, and one nonvegetated formation (AMEC, 2008).

Vegetation at the Atlas Scrap Yard MRS

At the Atlas Scrap Yard MRS, the majority of the area is herb-dominated (dry early-successional herbaceous field) with some areas of tree-dominated areas (oak/maple swamp forest) (AMEC, 2008). Vegetation at the MRS has also been influenced by man-made improvements including a network of former roads that are unpaved.



Ravenna Army Ammunition Plant Boundary

MRS Boundary

Stream

0 1,000 2,000 Feet

Projection : NAD_1983_UTM_Zone_17N

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ATLAS SCRAP YARD MRS
FORMER RVAAP/CAMP RAVENNA
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FIGURE 1-6 SOILS MAP

1.3.8 Threatened, Endangered, and Other Rare Species

Federal status as a threatened or endangered species is derived from the *Endangered Species Act* (16 United States Code § 1538, et seq.) and is administered by the United States Fish and Wildlife Service. While there are species under federal review for listing, there are currently no federally listed species or critical habitats at the facility. State-listed plant and animal species are determined by the Ohio Department of Natural Resources. Although biological inventories have not occurred within the MRS boundary and no confirmed sightings of state-listed species have been reported, there is the potential for state-listed or rare species to be within the MRS boundary. Information regarding threatened, endangered, and candidate species at the facility was obtained from the Camp Ravenna *Rare Species List* (2010). **Table 1-3** presents state-listed species that have been identified to be on the facility by biological inventories and confirmed sightings.

Table 1-3
Camp Ravenna Rare Species List

Common Name	Scientific Name
State Endangered	
American bittern	*Botaurus lentiginosus*
Northern harrier	*Circus cyaneus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Golden-winged warbler	*Vermivora chrysoptera*
Osprey	*Pandion haliaetus*
Trumpeter swan	*Cygnus buccinators*
Mountain brook lamprey	*Ichthyomyzon greeleyi*
Graceful underwing	*Catocala gracilis*
Bobcat	*Felis rufus*
Narrow-necked Pohl's moss	*Pohlia elongate var. Elongata*
Sandhill crane (probable nester)	*Grus canadensis*
Bald eagle (nesting pair)	*Haliaetus leucocephalus*
State Threatened	
Barn owl	*Tyto alba*
Dark-eyed junco (migrant)	*Junco hyemalis*
Hermit thrush (migrant)	*Catharus guttatus*
Least bittern	*Ixobrychus exilis*
Least flycatcher	*Empidonax minimus*

Table 1-3 (continued)
Camp Ravenna Rare Species List

Common Name	Scientific Name
Caddisfly	*Psilotreta indecisa*
Simple willow-herb	*Epilobium strictum*
Woodland horsetail	*Equisetum sylvaticum*
Lurking leskea	*Plagiiothecium latebricola*
Pale sedge	*Carex pallescens*
State Potentially Threatened Plants	
Gray birch	*Betula populifolia*
Butternut	*Juglans cinerea*
Northern rose azalea	*Rhododendron nudiflorum var. Roseum*
Hobblebush	*Viburnum alnifolium*
Long beech fern	*Phegopteris connectilis*
Straw sedge	*Carex straminea*
Tall St. John's wort	*Hypercium majus*
Water avens	*Geum rivale*
Shining ladies-tresses	*Spiranthes lucida*
Swamp oats	*Sphenopholis pensylvanica*
Arbor vitae	*Thuja occidentalis*
American chestnut	*Castanea dentate*
Tufted moisture-loving moss	*Philonotis fontana var. Caespitosa*
State Species of Concern	
Pygmy shrew	*Sorex hovi*
Woodland jumping mouse	*Napaeozapus insignis*
Star-nosed mole	*Condylura cristata*
Sharp-shinned hawk	*Accipiter striatus*
Marsh wren	*Cistothorus palustris*
Henslow's sparrow	*Ammodramus henslowii*
Cerulean warbler	*Dendroica cerulean*
Prothonotary warbler	*Protonotaria citrea*
Bobolink	*Dolichonyx oryzivorus*
Northern bobwhite	*Colinus virginianus*

Table 1-3 (continued)
Camp Ravenna Rare Species List

Common Name	Scientific Name
Common moorhen	*Gallinula chlorpus*
Great egret (migrant)	*Ardea alba*
Sora	*Porzana carolina*
Virginia rail	*Rallus limicola*
Creek heelsplitter	*Lasmigona compressa*
Eastern box turtle	*Terrapene carolina*
Four-toed salamander	*Hemidactylium scutatum*
Mayfly	*Stenonema ithica*
Coastal plain apamea	*Apamea mixta*
Willow peasant	*Brachylomia algens*
Sedge wren	*Cistothorus platensis*
State Special Interest	
Canada warbler	*Wilsonia canadensis*
Little blue heron	*Egretta caerula*
Magnolia warbler	*Dendroica magnolia*
Northern waterthrush	*Seiurus noveboracensis*
Winter wren	*Troglodytes troglodytes*
Back-throated blue warbler	*Dendroica caerulescens*
Brown creeper	*Certhia americana*
Mourning warbler	*Oporornis philadelphia*
Pine siskin	*Carduelis pinus*
Purple finch	*Carpodacus purpureus*
Red-breasted nuthatch	*Sitta canadensis*
Golden-crowned kinglet	*Regulus satrapa*
Blackburnian warbler	*Dendroica fusca*
Blue grosbeak	*Guiraca caerulea*
Common snipe	*Gallinago gallinago*
American wigeon	*Anas americana*
Gadwall	*Anas strepera*
Green-winged teal	*Anas crecca*

Table 1-3 (continued)
Camp Ravenna Rare Species List

Common Name	Scientific Name
Northern shoveler	*Anas clypeata*
Redhead duck	*Aythya americana*
Ruddy duck	*Oxyura jamaicensis*

Source: Camp Ravenna Rare Species List, April 27, 2010.

1.3.9 Cultural and Archeological Resources

A number of archeological surveys have been conducted at the facility. Cultural and archeological resources have been identified at the facility during past surveys. The Atlas Scrap Yard MRS has not been previously surveyed for cultural or archeological resources; however, due to the disturbed nature of the ground from former activities, it is unlikely that cultural and/or archeological resources exist at the MRS. No cultural or archeological resources were identified during the RI field activities at the MRS.

1.4 Facility History and Background

During operations as an ammunition plant, the former RVAAP was a government-owned and contractor-operated industrial facility. Former industrial operations at the facility 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 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. Following cleaning, the "pink water" waste water, which contained 2,4,6-trinitrotoluene and Composition B, 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 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, 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 facilities at the former RVAAP include MRSs that 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 MRSs include explosives, propellants, metals, and waste oils. Other AOCs present at the facility include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities (Science Applications International, Inc. [SAIC], 2011).

Atlas Scrap Yard MRS History and Background

The Atlas Scrap Yard MRS is located at the central portion of the facility and encompasses approximately 66 acres of mostly open land that contains a network of former roads (**Figure 1-4**). The MRS was originally used as a construction camp beginning in 1940. After the conclusion of World War II, the construction camp facilities were demolished and, in 1969, became a storage area/scrap yard for nonexplosive scrap material; however, the MRS may have also been used to store munitions. Debris piles comprised of construction debris, dunnage, and metal are still apparent at the MRS. Following the 2007 site inspection (SI), information was provided to e^2M indicating that a 40 mm fragmentation shell burial area was located in the central portion of the Atlas Scrap Yard MRS (e^2M, 2008).

The U.S. Army Closed, Transferring, and Transferred (CTT) Range/Site Inventory was reviewed during the *Final Historical Records Review* (HRR) completed by e^2M in 2007 and reported that a MEC item had been uncovered in the southwest corner of the MRS. The document further reported that MEC and munitions debris (MD) had been sorted and removed from the MRS in 2003. However, neither the type and disposition of the MEC item uncovered nor the MEC/MD removal operation could be verified (e^2M, 2007).

Any munitions made or stored at the facility, including small arms, explosives, pyrotechnics, propellants, mortars, medium and large caliber munitions, landmines, hand grenades, flares, bombs, detonators, and fuzes, may have been disposed at the MRS (e^2M, 2008). Although the munitions disposal activities could not be verified, photographic evidence indicates that many of these items were stockpiled by the sides of the roads running through the MRS (Ohio Environmental Protection Agency [Ohio EPA], 2013). These items were reportedly removed in 2003; however, no records documenting the removal action are available (e^2M, 2007).

1.5 Previous Investigations and Actions

This section briefly summarizes the investigations and actions as it pertains to the facility MRS discussed in this RI Report. This information was obtained primarily from the HRR (e^2M, 2007) and the SI Report (e^2M, 2008).

1.5.1 2004 USACE Final Archives Search Report

The USACE conducted an archives search in 2004 under the DERP as a historical records search and SI for the presence of MEC at the facility. The *Final Archives Search Report* (ASR) was prepared by the USACE in 2004 and identified 12 AOCs as well as 4 additional locations with the potential for MEC. Based on the ASR, 12 of the 15 AOCs were identified as potential MRSs containing MEC. The MRSs included the Ramsdell Quarry Landfill, Erie Burning Grounds, Open Demolition Area #1, Load Line 12 and Dilution/Settling Pond, Building 1200 and Dilution/Settling Pond, Quarry Landfill/Former Fuze and Booster Burning Pits, 40 mm Firing Range, Building 1037—Laundry Waste Water Sump, Anchor Test Area, Atlas Scrap Yard, Block D Igloo, and Tracer Burning Furnace. Confirmed MEC was identified at Open Demolition Area #2, Landfill North of Winklepeck, Load Line #1 and Dilution/Settling Pond, and Load Line #3 and Dilution/Settling Pond (USACE, 2004).

The USACE assessment team that completed the ASR reported that there were some debris at the Atlas Scrap Yard, but no ordnance related debris was located. The assessment team reported that the Atlas Scrap Yard was considered to have potential explosive ordnance presence until the remaining debris was identified (USACE, 2004).

1.5.2 2007 e^2M Final Historical Records Review

The HRR was performed by e^2M in January 2007. The primary objective of the HRR was to perform a limited-scope records search to document historical and other known information on MRSs identified at the former RVAAP, to supplement the U.S. Army CTT Range/Site Inventory, and to support the technical project planning process designed to facilitate decisions on those areas where more information was needed to determine the next step(s) in the CERCLA process.

Of the 19 MMRP-eligible MRSs identified during the U.S. Army CTT Inventory, the HRR identified 18 MRSs that qualified for the MMRP due to the demolition and/or disposal activities that occurred. These activities may have resulted in the presence of MEC and/or MC at the MRSs where the releases occurred prior to September 2002 (e^2M, 2008). These 18 MRSs identified during the HRR included the following:

- Ramsdell Quarry Landfill (RVAAP-001-R-01)
- Erie Burning Grounds (RVAAP-002-R-01)

- Open Demolition Area #2 (RVAAP-004-R-01)
- Load Line #1 (RVAAP-008-R-01)
- Load Line #12 (RVAAP-012-R-01)
- Fuze and Booster Quarry (RVAAP-016-R-01)
- Landfill North of Winklepeck (RVAAP-019-R-01)
- 40 mm Firing Range (RVAAP-032-R-01)
- Firestone Test Facility (RVAAP-033-R-01)
- Sand Creek Dump (RVAAP-034-R-01)
- Building Nos. #F-15 and F-16 (RVAAP-046-R-01)
- Anchor Test Area (RVAAP-048-R-01)
- Atlas Scrap Yard (RVAAP-050-R-01)
- Block D Igloo (RVAAP-060-R-01)
- Block D Igloo TD (RVAAP-061-R-01)
- Water Works #4 Dump (RVAAP-062-R-01)
- Areas Between Buildings 846 and 849 (RVAAP-063-R-01) (now identified as "Group 8")
- Field at the Northeast Corner of Intersection (RVAAP-064-R-01)

Following the HRR, the Field at the Northeast Corner of the Intersection (RVAAP-064-R-01), otherwise known as the Old Hayfield MRS, was classified as an operational range. This MRS was removed from eligibility under the MMRP, reducing the number of active MRS at the former RVAAP to 17.

The HRR determined that little information was available detailing the use and or disposal operations at the Atlas Scrap Yard. The U.S. Army CTT Range/Site Inventory was reviewed during the HRR and reported that a MEC item had been uncovered in the southwest corner of the MRS. The discovery was documented in a removal report funded by the Joint Munitions Command; however, the reference was not provided. The document further reported that MEC and MD had been sorted and removed from the MRS in 2003. However, neither the type and disposition of the MEC item uncovered nor the MEC/MD removal operation could be verified (e^2M, 2008). Therefore, based on the results of the HRR, it was anticipated that MEC, MD, and/or MC were present throughout the MRS.

1.5.3 2008 e²M Final Site Inspection Report

In 2007, e²M conducted an SI at each of the 17 MRSs under the MMRP. The primary objectives of the SI activities were to collect the appropriate amount of information to support recommendations of "No Further Action," "Immediate Response," or "Further Characterization" concerning the presence of MEC and/or MC at each of the MRSs. The SI also included a review of the HRR for each of the applicable MRSs. Out of the 17 MRSs evaluated during the SI, 14 were recommended for "Further Characterization" under the MMRP that included the Atlas Scrap Yard (RVAAP-050-R-01). A summary of the SI Report (e²M, 2008) recommendations for the Atlas Scrap Yard MRS are presented in **Table 1-4** and are discussed below.

Table 1-4
Site Inspection Report Recommendations

MRS	MRSPP Priority	Recommendation	Basis for Recommendation	
			MEC	MC
Atlas Scrap Yard MRS (RVAAP-050-R-01)	3	Further Characterization of MEC.	MEC potentially buried and contained within debris piles.	MC is covered under the IRP AOC RVAAP-50.

AOC denotes Area of Concern.
IRP denotes Installation Restoration Program.
MC denotes munitions constituents.
MEC denotes munitions and explosives of concern.
MRS denotes Munitions Response Site.
MRSPP denotes Munitions Response Site Prioritization Protocol.

The Atlas Scrap Yard MRS was assigned a *Munitions Response Site Prioritization Protocol* (MRSPP) priority of 3. The MRSPP is a funding mechanism typically performed during the Preliminary Assessment/SI stage to prioritize funding for MRSs on a priority scale of 1 to 8, with a Priority 1 being the highest relative priority. Based on the MRSPP identified for the MRS in the SI Report (e²M, 2008), the Atlas Scrap Yard MRS was selected for inclusion for "Further Characterization." The following subsections summarize the investigation activities performed at the Atlas Scrap Yard MRS during the 2007 SI and the conclusions and recommendations for the MRS as identified in the SI Report (e²M, 2008).

During the 2007 SI, an instrument- and metal-detector-assisted unexploded ordnance (UXO) survey was conducted in the south-central section of the MRS where MEC and MD were reported, and a meandering path survey was conducted around the remaining debris piles in the northern and eastern sections. No surface MEC or MD were found at any of the survey locations. The areas investigated at the Atlas Scrap Yard MRS during the SI field activities are presented on **Figure 1-7**.

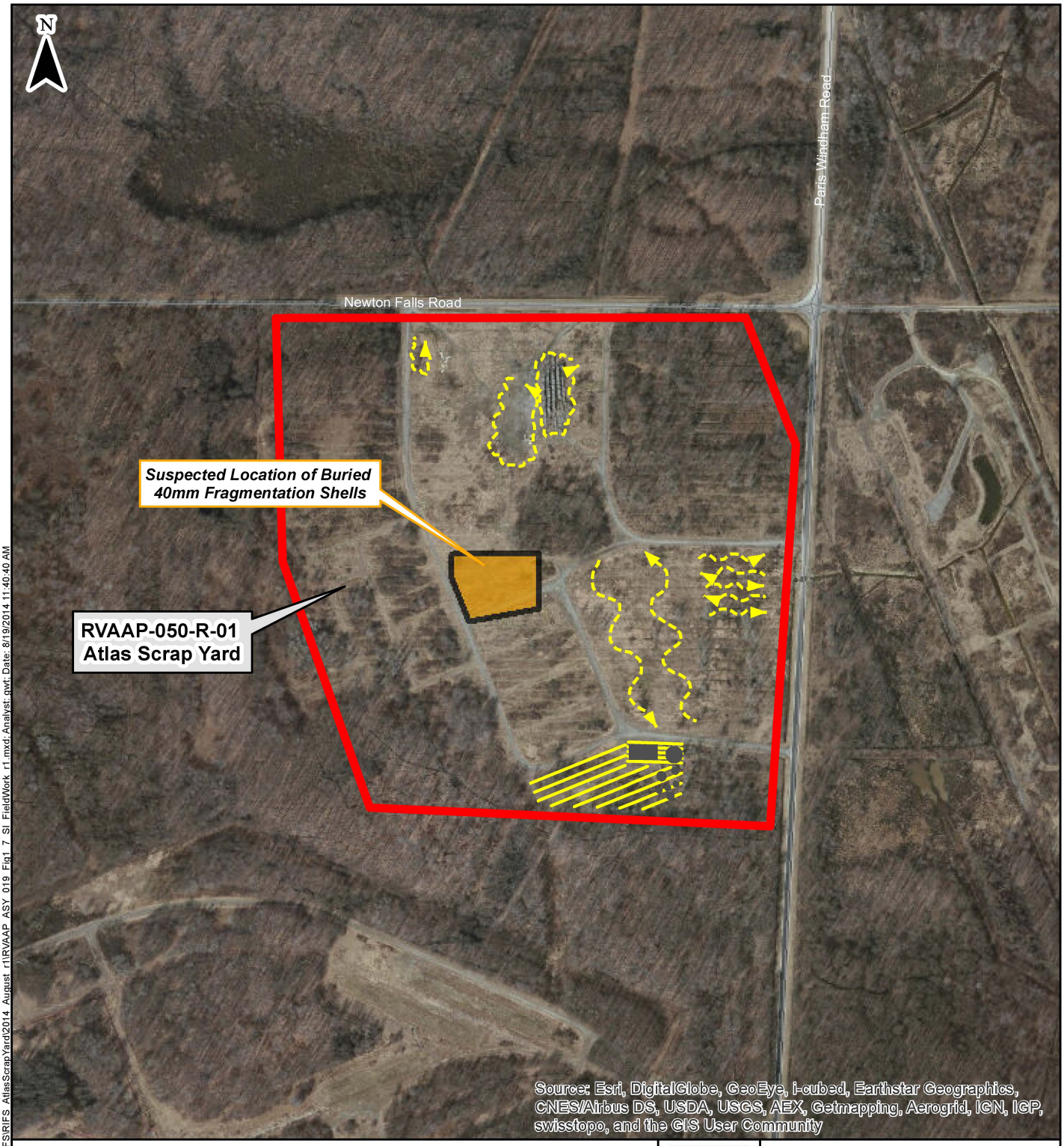

FIGURE 1-7 SI FIELD WORK AND FINDINGS

At the time of the 2007 SI, the presence of demolition debris limited access to the south-central portion of the MRS. A few scattered subsurface anomalies were detected within this area and multiple subsurface anomalies were detected around three piles of debris; however, interference from the metal scrap in the debris piles may have been significant. Very few subsurface anomalies were recorded in the east-central portion of the MRS. As the potential 40 mm fragmentation shell burial area was identified after the completion of the SI field activities; it was not included in the SI survey.

The SI Report noted that detected concentrations of semivolatile organic compounds (SVOCs) and metals exceeded the U.S. Environmental Protection Agency's Preliminary Remedial Goals (PRGs) in soils, sediment, surface water, and groundwater media at the MRS. The PRGs were the screening criteria used at the facility prior to establishing the final facility-wide cleanup goals that are currently used. Low concentrations of an explosive (2,4,6-dinitrotoluene) were detected in surface soil, sediment, and surface water; and a propellant (nitrocellulose) was detected in surface soil only. The explosives and propellant concentrations were all below the screening criteria (MKM, 2007). Evaluation of the chemicals of concern (COCs) identified during the previous investigations under the IRP will continue to be addressed under the IRP; therefore, an MC conceptual site model (CSM) was not developed for the Atlas Scrap Yard MRS for the SI Report. The SI Report recommended "Further Characterization" to address the MEC concerns identified at the Atlas Scrap Yard during the HRR (e^2M, 2007).

1.6 RI Report Organization

The contents and order of presentation of this RI Report are based on the requirements of the *Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009). Specifically, this RI Report includes the following sections:

- **Section 1.0**—Introduction
- **Section 2.0**—Project Objectives
- **Section 3.0**—Characterization of MEC and MC
- **Section 4.0**—Remedial Investigation Results
- **Section 5.0**—Fate and Transport
- **Section 6.0**—MEC Hazard Assessment
- **Section 7.0**—Human Health Risk Assessment
- **Section 8.0**—Ecological Risk Assessment

- **Section 9.0**—Revised Conceptual Site Model
- **Section 10.0**—Summary and Conclusions
- **Section 11.0**—References

Appendices included at the end of this RI Report are as follows:

- **Appendix A**—Digital Geophysical Mapping Report
- **Appendix B—**Ohio EPA Correspondence
- **Appendix C—**Photograph Documentation Log
- **Appendix D—**Intrusive Investigation Results
- **Appendix E—***Munitions Response Site Prioritization Protocol* Worksheets
- **Appendix F—**Responses to Ohio EPA Comments
- **Appendix G—**Ohio EPA Approval Letter

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2.0 PROJECT OBJECTIVES

This chapter presents the preliminary CSM for MEC at the Atlas Scrap Yard MRS based on historical information, identified data gaps associated with the preliminary CSM, and the data quality objectives (DQOs) necessary to achieve the project objectives.

A CSM for an MRS provides an analysis of potential exposures associated with MEC and/or MC and an evaluation of the potential transport pathways MEC and/or MC take from a source to a receptor. Each pathway includes a source, activity, access, and receptor component, with complete, potentially complete, or incomplete exposure pathways identified for each receptor. Each component of the CSM analysis is discussed below:

- **Sources—**Sources are those areas where MEC or MC have entered (or may enter) the physical system. A MEC source is the location where material potentially presenting an explosive hazard (MPPEH) or ordnance is situated or are expected to be found. A MC source is a location where MC has entered the environment.
- **Activity—**The hazard from MEC and/or MC arises from direct contact as a result of some human or ecological activity. Interactions associated with activities describe ways that receptors come into contact with a source. For MEC, movement is not typically significant, and interaction will occur only at the source area as described above, limited by access and activity. However, there can be some movement of MEC through natural processes such as frost heave, erosion, and stream conveyance. For MC, this can include physical transportation of the contaminant and transfer from one medium to another through various processes such that media other than the source area can become contaminated. Interactions also include exposure routes (ingestion, inhalation, and dermal contact) for each receptor. Ecological exposure can include coming into contact with MEC or MC lying on the ground surface or through disturbing buried MEC/MC while burrowing.
- **Access—**Access is the ease in which a receptor can come into contact with a source. The presence of access controls help determine whether an exposure pathway to a receptor is complete, as fences or natural barriers can limit human access to a source area. Furthermore, the depth of MEC items in subsurface soils and associated MC may also limit access by a receptor. Ease of entry for adjacent populations (e.g., lack of fencing) can facilitate trespassing at the MRS, either intentional or accidental.
- **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 and activities, as receptors are determined on that basis. If present, MEC and/or MC on the ground surface and near the surface can be accessed by facility personnel, contractors, visitors, trespassers, and biota.

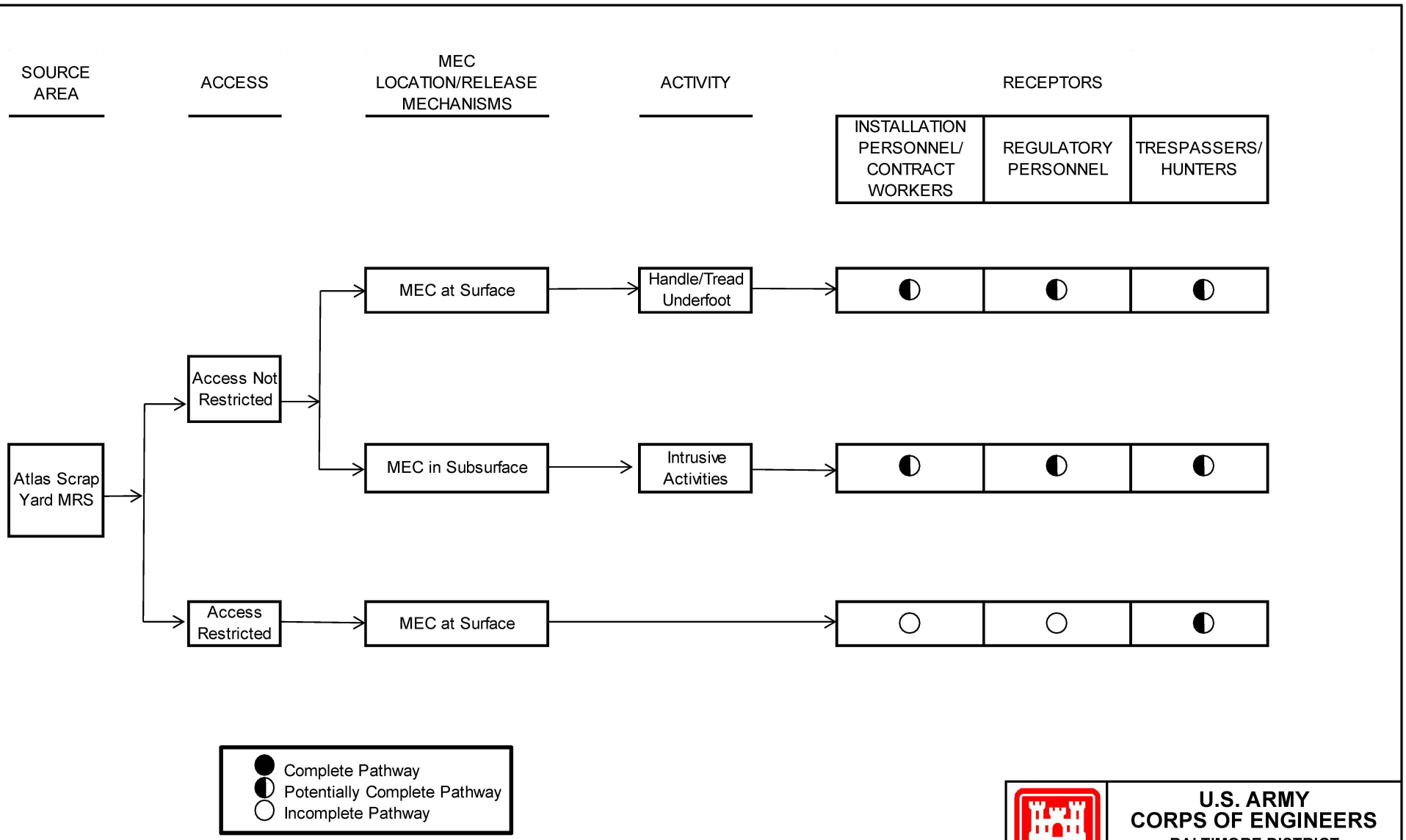
The preliminary CSM developed during the SI identified ecological receptors (biota) to be state-listed species identified as being present at the former RVAAP and listed in **Table 1-3**. For the purposes of the CSMs revised or created based on the RI, biota is identified as the listed and unlisted mammals, birds, and wetland species known to be present at the facility and, based on the MRS physical setting, are reasonably anticipated to be present on either a permanent or transient basis.

In general, the CSM for each MRS is intended to assist in planning, interpreting data, and communicating MRS-specific information. The CSMs are used as a planning tool to integrate information from a variety of resources, to evaluate the information with respect to project objectives and data needs, and to evolve through an iterative process of further data collection or action. A discussion of the preliminary CSM identified for the Atlas Scrap Yard MRS, as presented in the SI Report (e^2M, 2008), is presented in the following section. The data collected during the RI are evaluated in the following chapters and incorporated into this model as discussed in Section 9.0, "Revised Conceptual Site Model."

2.1 Preliminary CSM and Project Approach

The preliminary CSM for the Atlas Scrap Yard MRS is based on MRS-specific data and general historical information including literature reviews, maps, training manuals, technical manuals, and field observations. The MEC CSM was originally developed during the SI process based on guidance from USACE Engineering Manual 1110-1-1200, *Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects* (USACE, 2003a) and is represented by the diagram provided as **Figure 2-1**. An MC CSM was not developed during the SI as MC was being addressed under the IRP and was not recommended for "Further Characterization" under the MMRP. A summary of each of the factors evaluated for the preliminary MEC CSM is discussed below:

- **Sources—**Munitions-related burial and or disposal activities were considered as the primary source of the potentially-explosive MEC at the Atlas Scrap Yard MRS. Based on review of the archival records and available documentation, the principal sources of MEC at the Atlas Scrap Yard MRS were munitions from disposal activities as well as potential burial of 40 mm fragmentation shells. These activities resulted in the potential for MEC/MD to be present in the surface and subsurface soil at the Atlas Scrap Yard MRS.
- **Activity—**Human activities considered for the preliminary CSM were security activities, maintenance activities, environmental sampling under the IRP, and natural resource management activities that had the potential to result in moving or somehow disturbing MEC that could have caused it to detonate.



Source: Final Site Inspection Report, Ravenna Army Ammunition Plant, Ohio (e^2M, 2008)

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

MILITARY MUNITIONS RESPONSE PROGRAM

ATLAS SCRAP YARD MRS
FORMER RVAAP/CAMP RAVENNA
PORTAGE AND TRUMBULL COUNTIES, OHIO

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

FIGURE 2-1 PRELIMINARY MEC CONCEPTUAL SITE MODEL

- **Access—**At the time of the SI, there was no fence surrounding the MRS; the MRS was not physically restricted and was readily accessible to authorized and unauthorized personnel. These personnel would have had direct access to any potential MEC lying on the ground surface when accessing the MRS.
- **Receptors—**At the time of the SI, current and reasonably anticipated receptors included facility personnel, contractors, hunters, and trespassers. If present, MEC and/or MD and associated MC on the ground surface and near the surface could have been accessed by receptors. The SI considered biota to be state-listed species identified as being present at the facility. The SI determined that no state-listed species were present at the MRS and specific species of biota were not identified as a receptor for the purposes of the CSM.

The release mechanisms identified for MEC during the SI field activities were the reported open storage of munitions in ammunition boxes and the disposal of munitions items. If present, MEC items were expected to be lying on the ground surface, mixed in a pile with other debris, or buried at the MRS. The SI Report (e^2M, 2008) identified the exposure pathways to include direct contact with MEC through handling and treading under foot and through the disturbance of subsurface soil. Transport of MEC off the MRS was considered unlikely; however, it was considered possible that the MEC items could be brought to the surface or otherwise exposed by frost heave or disturbance of the debris piles. The preliminary CSM for MEC at the Atlas Scrap Yard MRS, as presented in the SI Report (e^2M, 2008), is shown in **Figure 2-1**.

2.2 Applicable or Relevant and Appropriate Requirements and "To Be Considered" Information

Applicable or relevant and appropriate requirements (ARARs) and "to be considered" (TBC) guidance for future anticipated and reasonable remedial actions at the former RVAAP under the MMRP are currently under development. Once ARARs and/or TBC materials have been identified, preliminary remediation goals and remedial action objectives will be developed. The identified ARARs, TBC information, preliminary remediation goals, and remedial action objectives will be included in the follow-on documents as required per the CERCLA process.

2.3 Data Quality Objectives and Data Needs

The DQOs and data needs were determined at the planning stage and are outlined in the Work Plan (Shaw, 2011). The data needs included characterization for MEC and MC associated with former activities at the MRS. The DQOs were developed to ensure the reliability of field sampling, chemical analyses, and physical analyses; the collection of sufficient data; the acceptable quality of data generated for its intended use; and the inference of valid assumptions from the data.

2.3.1 Data Quality Objectives

The DQOs were developed for MEC in accordance with the *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the RVAAP* (SAIC, 2011), hereafter referred to as the FWSAP, and the U.S. Environmental Protection Agency (EPA) *Data Quality Objectives Process for Hazardous Waste Site Investigations*, EPA QA/G-4HW (2000). **Table 2-1** identifies the DQO process at the Atlas Scrap Yard MRS as presented in the Work Plan (Shaw, 2011).

Table 2-1
Data Quality Objectives Process at the Atlas Scrap Yard MRS

Step	Data Quality Objective
1. State the problem.	Atlas Scrap Yard was used as a storage area for nonexplosive scrap starting in 1969. In 2003, MEC items were identified and removed from the MRS. In addition, a 40 mm fragmentation shell burial area was reportedly located in the central portion of the MRS. Therefore, there is a potential for MEC/MD and MC at the Atlas Scrap Yard MRS. Based on the potential storage and burial activities, there is a potential for MEC/MD on the ground surface and subsurface. In addition, there is a potential for environmental impacts from MC at the MRS.
2. Identify the decision.	The goal of the investigation at Atlas Scrap Yard is to identify the areas impacted with MEC/MD. Sampling for MC will be performed in areas of concentrated MEC/MD in order to further characterize the nature and extent of contamination associated with munitions activities at the MRS. The information obtained during the RI will be used to assess the potential risk and hazards posed to human health and the environment at the MRS.
3. Identify inputs to the decision.	• Historical information • Geophysical investigation • Intrusive inspection • Discrete and incremental environmental media sampling
4. Define the study boundaries.	The RI investigation will be performed in the Atlas Scrap Yard MRS boundaries as defined at the conclusion of the SI Report (e^2M, 2008).
5. Develop a decision rule.	Although formal visual survey transects are not planned at the Atlas Scrap Yard MRS, a visual survey of the surface will be performed during the geophysical investigation. A geophysical survey will be performed at the Atlas Scrap Yard to assess the presence of buried MEC/MD. The geophysical transects will be placed using UXO Estimator® (USACE, 2003b). Shaw and the USACE agreed upon UXO Estimator® inputs of 95 percent confidence and 0.5 MEC per acre. Shaw will dig 100 percent of the anomalies. Incremental samples and discrete samples (surface and subsurface soil) will be collected in areas where concentrated MEC/MD is encountered.
6. Specify limit of decision errors.	QC procedures are in place so that all field work will be performed in accordance with all applicable standards. Further details on the QC process implemented during the RI are located in Section 4 of the Work Plan (Shaw, 2011).

Table 2-1 (continued)
Data Quality Objectives Process at the Atlas Scrap Yard MRS

Step	Data Quality Objective
7. Optimize the design for obtaining data.	The information gathered as part of the field investigation at the Atlas Scrap Yard MRS will be used to determine what potential risks or hazards, if any, are present at the MRS. Shaw will perform a MEC HA to identify the potential MEC hazards. In addition, a facility site-specific HHRA and ERA will be performed on the analytical results for the samples collected. If unacceptable potential risks or hazards to human health and the environment are determined to exist at the MRS at the conclusion of the investigation, then the MRS will be identified for "Further Characterization" under the CERCLA process.

CERCLA denotes Comprehensive Environmental Response, Compensation, and Liability Act of 1980.
ERA denotes ecological risk assessment.
HHRA denotes human health risk assessment.
MC denotes munitions constituent.
MD denotes munitions debris.
MEC denotes munitions and explosives of concern.
MEC HA denotes MEC hazard assessment.
MRS denotes Munitions Response Site.
mV denotes millivolt(s).
QC denotes quality control.
RI denotes Remedial Investigation.
Shaw denotes Shaw Environmental & Infrastructure, Inc.
USACE denotes United States Army Corps of Engineers.
UXO denotes unexploded ordnance.

2.3.2 Data Needs

For MEC, data needs include determining the types, locations, condition, and number of MEC items present at the MRS so that the potential hazard to likely human and environmental receptors can be assessed and remedial decisions can be made. The DQOs were developed in accordance with the FWSAP (SAIC, 2011), the EPA DQO guidance (2000), and past experience with MRSs containing MEC. The data needs for MEC were evaluated using the most applicable methods and technologies, such as UXO Estimator® (USACE, 2003b), which are discussed in the following sections.

For MC, data needs include sufficient information to determine the nature and extent of MC, determine the fate and transport of MC, and characterize the risk of MC coming into contact with potential receptors by performing a human health risk assessment (HHRA) and ecological risk assessment (ERA). More specifically, the data needed are concentrations of MC in the environmental media at the MRS based on the results of the MEC investigation to include sampling and analysis of surface and subsurface soils that potentially pose unacceptable risk to human and ecological receptors. Samples for MC were only collected if

concentrated areas of MEC and/or MD were identified at the MRS unless predetermined sample locations were identified in the Work Plan (Shaw, 2011).

2.4 Data Incorporated into the RI

Whenever possible, existing data is incorporated into this RI. The following is a summary of existing data and how data were used:

- **Historical Records Review—**The HRR provides historical documentation regarding the MRS and identifies the types of activities previously conducted, the types of munitions used, and historical finds and incidents. These data were used to identify the expected baseline conditions and other hazards that may be present (e^2M, 2007).
- **IRP Data—**Data collected under the IRP at various MRSs include analytes considered to be MC associated with previous activities at the MRS, although it should be noted that not all analytes are considered as MC. The previous IRP investigations at the MRS have identified SRCs consisting of SVOCs and metals in soils, sediment, surface water, and groundwater that exceeded the PRG screening criteria. Low concentrations of an explosive (2,4,6-dinitrotoluene) were detected in surface soil, sediment, and surface water. A propellant (nitrocellulose) was detected in surface soil only. Neither the explosive nor propellant concentrations exceeded the PRG screening criteria (MKM, 2007). In the event that media sampling was conducted under the RI based on the results of the MEC investigation, the IRP data may be incorporated with the sampling data in order to close any potential data gap. Existing SRCs at the Atlas Scrap Yard MRS continues to be addressed under the IRP.

  For the Atlas Scrap Yard MRS, the IRP data was reviewed and it was determined that incorporation of the data was not necessary, as no MEC or MD that would constitute a source of MC was identified during the RI field effort. Therefore, sampling for MC was not warranted for the RI.
- **SI Data—**The MMRP SI conducted at the facility in 2007 provides subsurface geophysical data obtained from a limited instrument- and metal detector-assisted survey, which was used to preliminarily delineate areas where MEC and/or MD may have been stored or disposed of by burial. MC sampling was not performed during the SI at the Atlas Scrap Yard MRS (e^2M, 2008).

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3.0 CHARACTERIZATION OF MEC AND MC

This chapter documents the approaches used to investigate MEC and MC at the Atlas Scrap Yard MRS in accordance with the DQOs presented in Section 2.0, "Project Objectives." The MEC and MC characterization activities were conducted in accordance with Section 3.0, "Field Investigation Plan," of the Work Plan (Shaw, 2011).

3.1 MEC Characterization

The following section summarizes the geophysical, anomaly reacquisition, and subsequent intrusive investigation activities that were performed at the Atlas Scrap Yard MRS during the RI field activities. Based on the potential storage and burial activities associated with the MRS, it was determined in the SI reporting stage that there is a potential for MEC/MD on the ground surface and subsurface at the MRS. The initial step in evaluating for buried MEC at the Atlas Scrap Yard MRS consisted of performing a digital geophysical mapping (DGM) investigation throughout the MRS as presented in the Work Plan (Shaw, 2011). Visual surveys of surface conditions were performed in conjunction with the geophysical investigation. The results of the DGM survey and intrusive investigation activities are discussed in Section 4.0, "Remedial Investigation Results."

3.1.1 Geophysical Survey Activities

In June and July of 2011, a DGM investigation was performed at the Atlas Scrap Yard MRS to identify potential subsurface areas of MEC and/or MD. The approved sampling coverage presented in the Work Plan (Shaw, 2011) utilized the UXO Estimator® software (USACE, 2003b) to determine the proposed sampling strategy based on the size of the MRS and the expectation that MEC was randomly distributed throughout the MRS. The UXO Estimator® module required a minimum of 5.6 acres of DGM data to be collected over the 66-acre MRS (8.4 percent) based on inputs of 95 percent confidence that there is less than 0.5 MEC per acre. If the proposed area was investigated based on these inputs and the suggested DGM coverage and no MEC is found, the software is then used to evaluate whether the performance criteria have been met based on the actual field data results.

Instrumentation used for the DGM survey consisted of a Geonics EM61-MK2 time domain electromagnetic instrument and a Leica 1200 real-time kinematic (RTK) global positioning system (GPS) for positioning. The DGM platform consisted of a modified standard-wheeled configuration with the lower coil 16 inches above the ground surface. To accommodate the rough and uneven terrain at the Atlas Scrap Yard MRS, the standard metal handle was replaced by a PVC cradle that allowed two people to maneuver the instrument to ensure a

steady and even pace for data acquisition. The team that performed the DGM survey consisted of two geophysicists.

The *Digital Geophysical Mapping Report for the Atlas Scrap Yard MRS (RVAAP-050-R-01*), hereafter referred to as the DGM Report, is presented in **Appendix A**. The DGM Report provides a comprehensive review of the DGM survey at Atlas Scrap Yard MRS with regard to data acquisition, processing and analysis, anomaly reacquire, and results of the DGM quality control program.

The DGM system used for the Atlas Scrap Yard MRS investigation and other MRSs at the facility was validated during the start-up phase of the project at an instrument verification strip (IVS) located at Load Line 7. The results of the initial IVS effort are documented in a report titled, *Instrument Verification Strip Technical Memorandum in support of Digital Geophysical Mapping Activities for Military Munitions Response Program Remedial Investigation Environmental Services*. This report/technical memorandum is included as an attachment to the DGM Report in **Appendix A**.

Prior to the DGM survey at the Atlas Scrap Yard MRS, a civil survey and vegetation clearance were performed to prepare the site for the DGM activities.

3.1.1.1 Civil Survey

A Registered Ohio Land Surveyor established two survey monuments at the Atlas Scrap Yard MRS. Each monument was established with third-order horizontal accuracy (residual error less than or equal to 1 part in 10,000). In areas where data could be acquired using the RTK-GPS, the survey monuments were used to provide positional data streamed directly to the EM61-MK2. Portions of some transects were acquired with the fiducial position method due to the extremely dense vegetation that exists at the MRS. In areas where the tree cover prohibited the use of RTK-GPS, the control monuments were used as a source to generate additional control points for the fiducial mode surveys. Additionally, all of the survey data documenting MRS features and obstructions is referenced to the two established survey monuments.

For quality control (QC) purposes, the RTK-GPS positioning system was used to reacquire a known, fixed location each time the system was setup on one of the two survey monuments. Per the project metrics defined in the Work Plan (Shaw, 2011), static measurements for the positioning system were required not to exceed 0.5 foot. The RTK-GPS system provides centimeter level accuracy, and 100 percent of location checks satisfied the metric. All mapping was developed in the North American Datum 1983 Universal Transverse Mercator Zone 17 North Coordinate System.

3.1.1.2 Vegetation Clearance and Inaccessible Areas

Much of the MRS consists of dense vegetation that includes high grasses, thick brush and trees with low-hanging limbs. Vegetation removal was required along transects in order to provide adequate ground clearance for the DGM equipment. Vegetation removal was minimized to the extent possible to allow for the execution of work. No grass mowing was performed between the months of April or August due to the potential for disturbing grassland nesting species.

The wetland at the northwest corner of the MRS is an environmentally sensitive area and vegetation removal at this portion of the MRS was not permitted per direction from the Ohio EPA. The dense vegetation limited the ability for the DGM equipment to access the area and no DGM data were acquired at this portion of the MRS in order to avoid impacting the sensitive areas. In the southeast section of the MRS, no DGM data were acquired due to the presence of a debris pile and associated wetlands area that obstructed data collection. In the north-central section of the MRS, a debris pile consisting primarily of stacked railroad ties prevented DGM data collection at this location. Correspondence with the Ohio EPA regarding the protection of the environmental sensitive area at the MRS is provided in **Appendix B**.

3.1.1.3 Data Collection and Site Coverage

In order to meet the proposed investigation coverage requirement, DGM data were acquired within the MRS boundaries on 49 transects spaced 13 meters apart. Within the suspected 40 mm burial area, the transect spacing was reduced to 6 meters in order to more accurately delineate the potential burial area. The DGM data were collected in all accessible areas within the MRS, and the actual spatial coverage was calculated to be 6.1 acres following the investigation, which represents MRS coverage of 9.2 percent and exceeds the proposed sampling coverage of 5.6 acres presented in the Work Plan (Shaw, 2011). The 6.1 acres of actual DGM coverage equates to a total transect distance of 16.7 miles, with each transect being 1 meter wide. The general DGM procedures performed for data acquisition at the Atlas Scrap Yard MRS consisted of the following:

- The DGM survey area was reviewed by performing a MRS walk-over. Special attention was given to difficult terrain and the presence of obstacles, which created potential safety issues.
- The positioning system was set up at a documented control point of known location or a location was determined by using a minimum of two known control points (e.g., RTS). The location control was checked by at least one “checkshot” to a different control point of known location.
- DGM system instrument functional checks were performed at the start and end of each day and the results were documented.

- DGM data were collected over the area in a systematic fashion with respect to the terrain, vegetation, and obstacles present. The acquisition protocol used navigation techniques proven at the IVS.
- Field logs were used to document MRS conditions during data collection. The field logs included information and observations regarding the data collection process, weather, field conditions, data acquisition parameters, and quality checks performed. The positioning system was used to document the presence of significant site features related to terrain, vegetation, and cultural features so these features could be accounted for during the interpretation of the data.

At the end of each day, the field geophysicist uploaded the DGM data to the site computer, where the data was archived, backed-up, and initially processed and analyzed. Data were also transferred to the Shaw Processing Center in Concord, California on a daily basis for processing and review by the data processor. Raw and final processed data were transferred to USACE at intervals specified in Data Item Description (DID) MMRP-09-004, *Geophysics* (USACE, 2009).

Figure 3-1 provides the area of DGM coverage proposed in the Work Plan (Shaw, 2011). The actual area covered during the DGM survey is discussed and presented in Section 4.0.

3.1.1.4 Data Processing and Interpretation

The geophysical data were processed, analyzed, and interpreted using the methods and approach outlined in the Work Plan (Shaw, 2011). A 5-millivolt (mV) threshold for Channel 2 of the EM61-MK2 was used to initially select anomalies as presented in the Work Plan (Shaw, 2011). Important factors that were considered during the interpretation process include the following:

- Data acquisition methodology (one-dimensional as is the case for Atlas Scrap Yard MRS).
- Types of MEC most likely present at the MRS based on historical data.
- Anomaly shape and signal intensity in relation to the spatial sample density (along track and across track).
- Anomaly time constants.
- Local background conditions.
- Presence of surrounding anomalies (anomaly density).
- Presence of cultural features and sources of interference.
- Anomaly characteristics from the IVS items.

MRS Boundary

Suspect Area

Proposed DGM Transect (15.6 Miles)
Transect Center Line Spacing:
Within 40mm Suspect Area - 13 Transects Spaced 6 Meters Apart
Within Remainder of MRS - 49 Transects Spaced 13 Meters Apart

0 300 600 Feet

Projection : NAD_1983_UTM_Zone_17N

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

MILITARY MUNITIONS RESPONSE PROGRAM

ATLAS SCRAP YARD MRS
FORMER RVAAP/CAMP RAVENNA
PORTAGE AND TRUMBULL COUNTIES, OHIO

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

H:\MAMMS\Ravenna\GIS Documents\Project Maps\MMRP\RIFS\RIFS AtlasScrapYard\2014 August r1\RVAAP ASY 005 Fig3 1 PropDGMTransects r1.mxd; Analyst: gwt; Date: 8/18/2014 1:58:10 PM

FIGURE 3-1 PROPOSED DGM TRANSECTS

Detailed processing and interpretation procedures are provided in the DGM Report in **Appendix A**.

3.1.1.5 Geophysical Field Quality Control Procedures

The geophysical field QC procedures consisted of tests performed at the start and end of each day to ensure the geophysical sensor and positioning equipment were functioning properly and the data were of sufficient quantity and quality to meet the RI objectives in the Work Plan (Shaw, 2011). The performance metrics for the DGM system were derived from a combination of DID MMRP-09-004, *Geophysics* (USACE, 2009) and the USACE Table *Performance Requirements for Remedial Investigations/Feasibility Studies using DGM Methods* (U.S. Army, 2009). Quality objectives and metrics associated with MRS coverage, signal quality during data acquisition, anomaly reacquire, and the intrusive investigation were also developed from the referenced documents.

The DGM field team and the data processor/analyst reviewed and documented the results of the DGM QC program on a Microsoft© Excel Spreadsheet that was updated on a daily basis and delivered to the client for approval. The Microsoft© Excel Spreadsheet is part of the geophysics digital data deliverable and is included in the DGM Report in **Appendix A**.

3.1.2 Anomaly Investigation Activities

Following the completion of the DGM survey in July 2011, anomaly reacquisition was conducted for the locations identified as potentially containing subsurface MEC and/or MD between August and October 2011. These locations were identified as potentially containing subsurface MEC and/or MD based on the results of the DGM data review. From previous facility experience, locations which have EM61-MK2 signal strength (Channel 2) greater than 8 mV are more likely to be MEC/MD than locations with signal strengths less than 8 mV. Based on the results of the DGM survey, the locations were evaluated to determine if they were high density anomalous areas that required excavation using mechanical equipment or were single point anomalies that could be manually investigation (hand dug). All anomaly investigation activities were performed by UXO-qualified personnel. Selection of investigation areas based on the DGM results is discussed further in Section 4.1, “MEC Investigation Results.”

3.1.2.1 Individual Anomaly Reacquisition and Investigation Procedures

The UXO-qualified personnel used a Schonstedt magnetometer to first reacquire and then investigate ferrous anomalies identified during the DGM survey as single point anomalies. These personnel used hand tools to unearth an item and as the excavation progressed toward the anomaly source, the UXO technician continued to use the Schonstedt magnetometer to determine the item location both horizontally and vertically. To locate the ground position of

the interpreted anomaly coordinates, the navigational system "Waypoint Location" mode was used for the RTK-GPS positioning system. A nonmetallic pin flag, labeled with the unique anomaly identification, was placed in the ground at the interpreted location. Reacquisition of any sampling or dig sheet locations (i.e., interpreted location) was performed to ± 0.5 foot of the coordinates specified on the dig sheet.

Once found, the item was assessed to determine if it was MEC, MD, or other metallic material. Once the item was determined not to be MEC, it was temporarily removed from the excavation hole and a Schonstedt magnetometer was used to confirm no additional ferrous items were located beneath the first item. Once confirmed that the source had been identified and no MEC or MD was present, the item was replaced and the soil was returned back into the investigation hole in reverse order from which it was excavated. The UXO-qualified personnel were also conscious of encountering any cultural artifacts associated with historical cultural or archeological resources.

3.1.2.2 High-Density Anomalous Area Reacquisition and Investigation Procedures

Trenching was performed at locations identified as having high density areas of buried anomalies. Locating the ground position for these areas was similar to the single point anomalies except on a larger scale. The navigational system "Waypoint Location" mode was used for the RTK-GPS positioning system to locate the coordinates of the trench boundary. Nonmetallic pin flag, labeled with the unique anomaly identification, were placed in the ground at the interpreted location of the trench. As for the single point anomaly locations, reacquisition of any sampling or dig sheet locations (i.e., interpreted location) was performed to ± 0.5 foot of the coordinates specified on the dig sheet.

All trenches were mechanically excavated using an excavator. Each trench was approximately 20 to 25 feet long and 3 feet wide and continued in depth until the target anomalies were identified, native material was identified and a clear, distinct boundary between the native and fill material was evident, a maximum depth of 10 feet was attained, or the water table was reached. The maximum depth of excavation at any of the trench locations was 4.5 feet. Soil material in each trench was removed in layers at approximately 1-foot intervals. At the areas identified as having subsurface anomalies, the UXO team worked directly with the excavation crew to identify the anomaly. One UXO technician stood in a safe area at the front of the operation and was responsible for examining the area to be advanced into and to visually observe for the presence of MEC or MD before the MRS was disturbed. Once the soils were excavated, they were spread on 6-mil polyethylene sheeting in an adjacent area where the UXO team member visually examined it for MEC and/or MD materials. Once the item was determined not to be MEC, it was temporarily removed from the excavation hole and a Schonstedt magnetometer was used to confirm no additional ferrous items were located beneath the first item. Once confirmed that the source

had been identified and no MEC or MD was present, the item was replaced and the soil was returned back into the investigation trench in reverse order from which it was excavated. No soil was segregated for offsite disposal.

3.1.2.3 Anomaly Investigation Documentation

All anomalies identified during the reacquisition and intrusive investigation activities were logged and recorded in accordance with DID MMRP-09-004, *Geophysics* (USACE, 2009). The ShawGeo and/or ShawMEC software was used to record any discrepancies between the dig sheet location and the actual required location and to note any anomalies that could not be investigated. The anomaly reacquisition and investigation results are further discussed in Section 4.0.

3.1.2.4 Anomaly Field Quality Control Procedures

Ground-truth excavation data reported on anomaly-specific dig sheets was the primary basis for field QC. The dig sheets documented the item description; location; and approximate weight, shape, orientation, and depth. Dig sheets were reviewed by the site geophysicist on a daily basis to determine whether the excavation data were representative of the mV reading for the selected anomaly. Anomalies that were not representative of the excavation results were revisited by the site geophysicist and the UXO QC specialist.

3.1.3 UXO Estimator® Analysis

Following completion of the investigation activities, the UXO Estimator® module was then used to calculate if enough investigation had been performed to satisfy the performance criteria of 0.5 MEC per acre at a 95 percent confidence level based on the actual field data as well as calculate an average ordnance density. The data incorporated into the module for this exercise included the size of the MRS (66 acres), the actual area investigated (6.1 acres), the number of MEC items identified during the investigation, and a 95 percent confidence level. The results of DGM investigation and the UXO Estimator® calculation to determine whether the performance criteria were achieved are discussed in Section 4.1.3.3, "UXO Estimator® Analysis Results."

3.2 MC Characterization

The DQOs in the Work Plan (Shaw, 2011) stated that incremental samples and discrete samples (surface and subsurface soil) would be collected in areas with concentrated MEC or MD. No MEC or MD was identified at the Atlas Scrap Yard MRS during the anomaly reacquisition and intrusive investigation activities and sampling for MC was not warranted.

4.0 REMEDIAL INVESTIGATION RESULTS

This chapter presents a discussion of the results of the RI data that were collected for MEC at the Atlas Scrap Yard MRS in accordance with the procedures discussed in Section 3.0, "Characterization of MEC and MC." These results will be used to determine the nature and extent of MEC and subsequently determine the potential hazards and risks posed to likely human and ecological receptors. Once the risks are determined, they will then be integrated into the preliminary CSMs developed during the SI (e^2M, 2008) that were presented in Section 2.0, "Project Objectives." Photographs of the RI activities performed at the MRS are presented in **Appendix C**.

4.1 MEC Investigation Results

The following sections present the results of the RI field efforts that were performed to achieve the DQOs defined in Section 2.3.1, "Data Quality Objectives," and define the nature and extent of MEC and/or MD in the surface and subsurface at the Atlas Scrap Yard MRS. These efforts included a combination of visual and DGM surveys and intrusive investigations that were conducted in accordance with the Work Plan (Shaw, 2011).

The UXO Estimator® program is a USACE software tool that is used to determine a field sampling plan for ordnance sites and analyze field data after it has been collected (USACE, 2003b). As discussed in Section 3.1.1, "Geophysical Survey Activities," the UXO Estimator® program was used for the purposes of the RI field work at the Atlas Scrap Yard MRS to provide performance criteria that were agreed upon among the stakeholders (0.5 MEC/acre at a 95 percent confidence level) and the confidence level of the actual field data after the field work was complete. Following evaluation of the field results, UXO Estimator® was used to advise if enough sampling had been performed to satisfy the performance criteria.

4.1.1 Visual Survey Results

While no visual survey transects were proposed for the MRS, the potential presence of MEC and/or MD on the ground surface were investigated during the geophysical investigation. A total of 16.7 miles of DGM transects were covered during the geophysical investigation, and no MEC or MD was identified on the ground surface.

4.1.2 Geophysical Survey Results

A total of 6.1 acres (9.2 percent of total MRS area) was surveyed with the DGM equipment at the Atlas Scrap Yard MRS. As is discussed in Section 3.1.1.2, vegetation removal in the wetland at the northwest corner of the MRS was not permitted by the Ohio EPA in order to

avoid negatively impacting this area, which is considered to be environmentally sensitive (**Appendix B**). Therefore, no DGM data were acquired at this portion of the MRS. In addition, identified wetland areas and a large debris pile located in the southeast section of the MRS obstructed data collection and no DGM could be acquired. Lastly, a second debris pile consisting primarily of stacked railroad ties prevented the collection of DGM data at the north-central section of the MRS. **Figure 4-1** identifies the inaccessible areas where no DGM was collected due to the presence of environmentally sensitive wetlands and debris piles, and provides the transect where the DGM surveys were conducted.

Based on a review of the historical and DGM data, Shaw divided the MRS into three distinct regions for anomaly reacquisition and investigation. **Table 4-1** presents the areas where the anomalies were identified, the suspected distribution of anomalies (i.e., segregated or high density areas), the rationale for individual point anomaly or combined investigation due to high density areas and the recommended method of investigation.

Table 4-1
Summary of Proposed Intrusive Investigation Activities

Area at MRS	Anomalies Identified[1]	Actual Anomalies Investigated	Investigation Method
Suspected 40 mm Burial Area	6 well-defined areas with a high density of anomalies within and adjacent to the suspected burial area boundaries	6 well-defined areas with a high density of anomalies within and adjacent to the suspected burial area boundaries	6 burial features within and adjacent to the suspected burial area boundaries to be excavated by 6 excavation trenches[2]
14 areas of relatively high anomaly density of varying shape and size distributed throughout the MRS	2,477 clusters of anomalies that represent aggregates of subsurface metal over 14 well-defined regions	14 high density anomalous regions representing the 2,477 cluster of anomalies	14 high density anomalous regions to be excavated by 27 trenches
Single point anomalies throughout remainder of the MRS	3,621 single point anomalies	3,185 single point anomalies[3]	Hand digging at all 3,185 single point locations[4]

[1] Based on response for 5 mV (Channel 2) for the EM61-MK2.

[2] All trenches excavated mechanically.

[3] Selection of 3,185 of the 3,621 single point anomalies was determined based on EM61-MK2 signal strength (Channel 2) greater than 8 mV (Section 3.1.2).

[4] All single point source anomalies excavated by hand.

mm denotes millimeter.

MRS denotes Munitions Response Site.

mV denotes millivolt(s).

FIGURE 4-1 ACTUAL DGM TRANSECTS

Figures 4-2 and **4-3** display the results of the EM61-MK2 survey. **Figure 4-2** provides a sensitive color-scale that highlights all single point anomalies above a signal threshold of 5 mV (Channel 2), while **Figure 4-3** uses a lower sensitivity color-scale to delineate the major aggregates of buried metal with increased definition. Further discussion of the anomalies identified and the rationale for investigation at the three different distinct area types identified at the Atlas Scrap Yard MRS is presented in the following sections.

4.1.2.1 Suspected 40 mm Burial Area

The DGM data exhibited four contiguous areas of high density anomalies greater than or equal to the 5-mV threshold within the suspected 40 mm burial area and were identified as areas for potential investigation. Two areas of high density anomalies were identified greater than or equal to 5 mV adjacent to the southeast of the suspected 40 mm burial area and were at least partially associated with debris piles observed on the ground surface at the suspected burial area.

The Work Plan (Shaw, 2011) specified that 100 percent of anomalies identified during the DGM survey at the Atlas Scrap Yard MRS were to be investigated since less than 100 percent of the MRS was covered by DGM; however, since the anomalous locations detected were indicative of mass burial areas, the recommended investigation method at the suspected 40 mm burial area was mechanical trenching. A total of six trenches were recommended to investigate the six burial features identified within and adjacent to the suspected burial area, each approximately 20 to 25 feet in length. The rationale for mechanical excavation is presented in Section 4.1.2.4, "Field Work Variance," and is in accordance with the *Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009).

4.1.2.2 Other High-Density Anomaly Areas

Besides the suspected 40 mm burial area, there were 14 other areas that were characterized by high anomaly densities greater than or equal to the 5-mV threshold, defined shapes, and elevated EM61-MK2 signal intensity. In all, a total of 2,477 clusters of anomalies were detected within the 14 high density regions. Distinct subsurface linear features appeared to be related to cultural features such as former utility lines and/or possible burial debris. Available utility maps for the facility were reviewed to identify any existing abandoned utility lines and these features were removed from requiring further investigation.

The Work Plan (Shaw, 2011) specified that 100 percent of anomalies identified during the DGM survey at the Atlas Scrap Yard MRS were to be investigated since less than 100 percent of the MRS was covered by DGM; however, since the anomalous locations detected were indicative of mass burial areas, the recommended investigation method at the 14 areas of high density anomalies was mechanical trenching. A total of 27 trenches were proposed

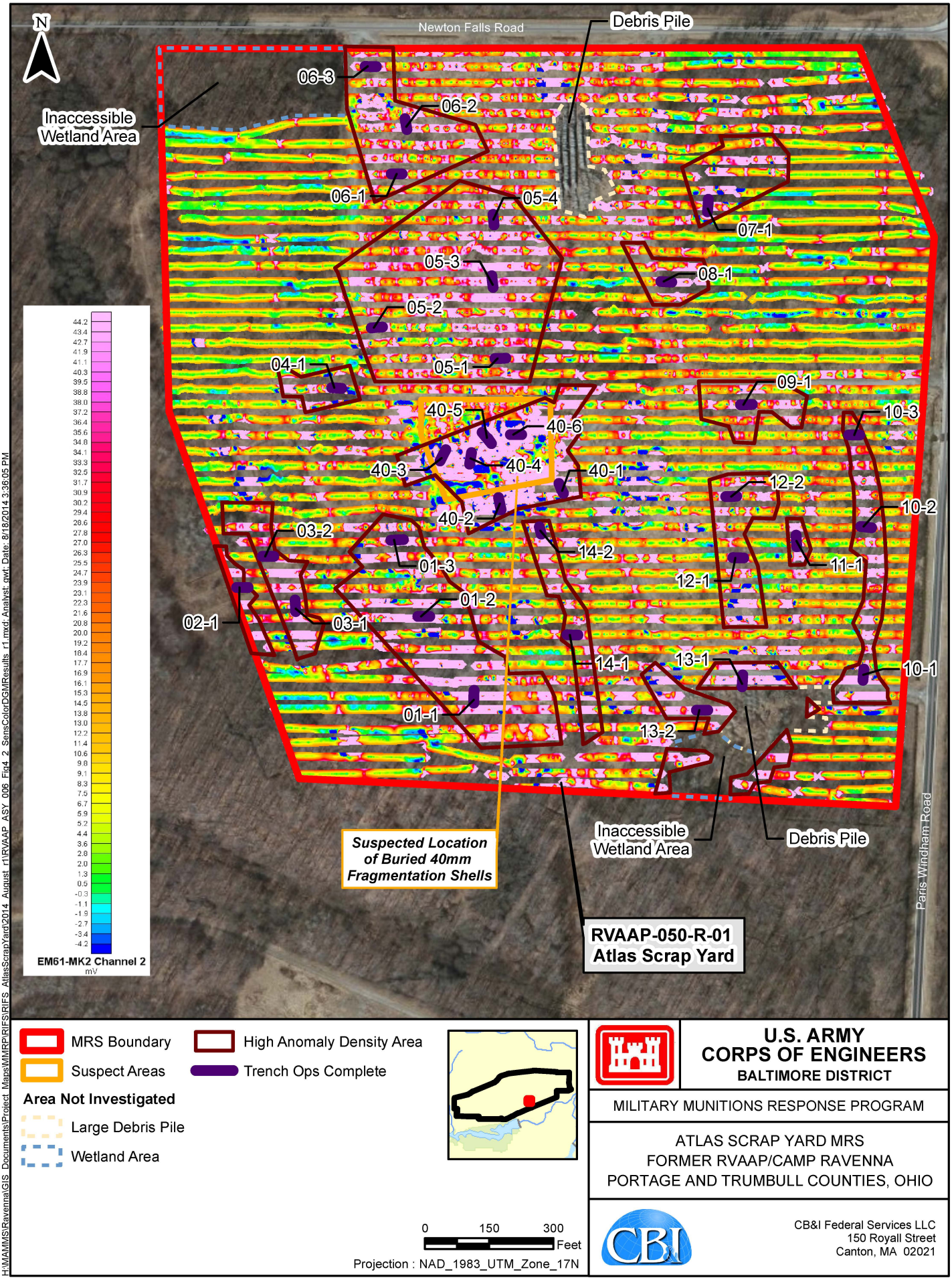

FIGURE 4-2 SENSITIVE COLOR-SCALE DGM RESULTS

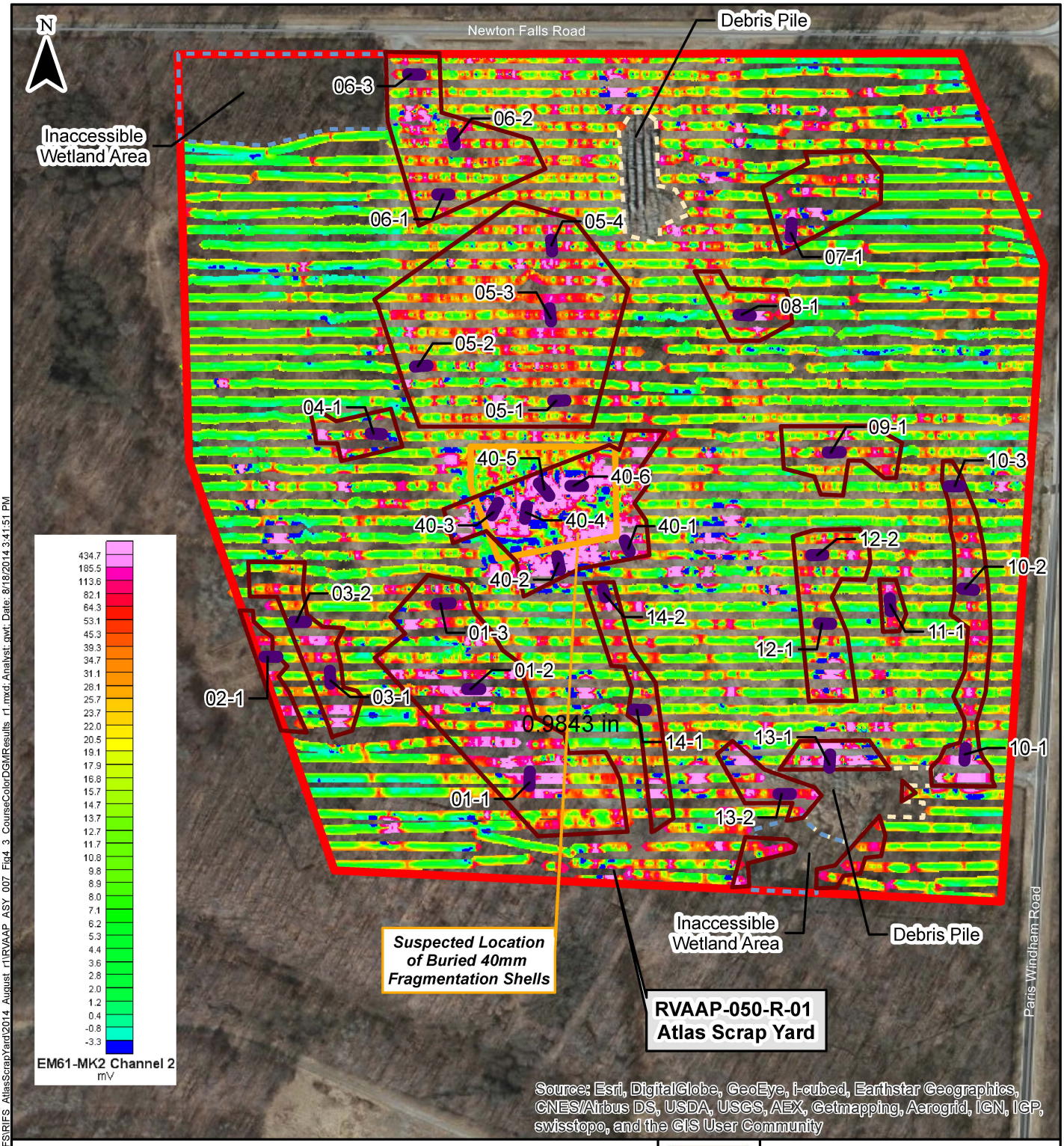

FIGURE 4-3 COARSE COLOR-SCALE DGM RESULTS

between the 14 high density anomaly areas, each approximately 20 to 25 feet in length, to adequately evaluate the detected subsurface items. The rationale for mechanical excavation is presented in Section 4.1.2.4 and is in accordance with the *Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009).

4.1.2.3 Single Point Anomalies

Outside of the 40 mm burial area and the 14 high anomaly density regions, a total of 3,621 single point anomalies were identified greater than or equal to the 5-mV threshold throughout the MRS. The Work Plan (Shaw, 2011) specified that 100 percent of anomalies identified during the DGM survey at the Atlas Scrap Yard MRS were to be investigated since less than 100 percent of the MRS was covered by DGM; however, only 3,185 individual anomalies were recommended for further investigation. A total of 250 anomalies were removed from requiring evaluation since they were either identified by the UXO team as a cultural feature on the ground or were nails placed flush on the ground surface for the fiducial transects. Another 174 anomalies were recommended to be removed from requiring investigation since the responses were less than or equal to 8 mV, which is notably higher than the 5-mV threshold used to identify anomalies during the DGM survey. The rationale for reducing the number of individual anomaly locations and increasing the requisition response threshold to 8 mV is discussed in further detail in Section 4.1.2.4.

4.1.2.4 Field Work Variance

The Work Plan (Shaw, 2011) originally called for a 100 percent investigation of all single point anomalies identified during the DGM investigation since 100 percent of the MRS was not covered by DGM. However, based on the unanticipated large-scale burial areas and extensive number of individual point anomalies detected during the DGM survey, field changes were requested to the approved intrusive investigation process. These field changes were included in a memorandum to the Ohio EPA entitled *DGM Survey Results and Proposed Intrusive Investigation Locations for the Atlas Scrap Yard (RVAAP-050-R-01)*. The memorandum is presented as an attachment in to the DGM Report in **Appendix A**.

This memorandum provided a summary of the DGM results and suggested that 100 percent of single point anomalies found to be greater than or equal to 8 mV (348 items) be investigated along with a random selection of 50 percent of the single point anomalies less than 8 mV (174 items). This recommendation was based on the results of the IVS where smaller MEC items in the near surface produced a response that exceeds 8 mV as well as the DGM results at other MRSs at the facility under the MMRP where intrusive activities indicated that no items identified below 8 mV were MEC or MD. The memorandum suggested that a total of 3,023 anomalies greater than or equal to 8 mV (excluding cultural

features and transect nails) and 174 anomalies less than 8 mV be investigated (total of 3,197). After the submittal of the memorandum, ongoing review of the DGM data resulted in the identification of anomaly locations which had multiple targets that were subsequently removed and replaced with a single target location. Therefore, a total of 3,185 single point anomalies were identified for reacquisition and subsequent intrusive investigation.

In addition to the single point anomalies, 6 distinct burial features at and immediately adjacent to the suspected 40 mm burial area and 2,477 clusters of anomalies detected at 14 areas throughout the MRS were identified during the DGM survey. The memorandum recommended mechanical trenching at these locations since this method would provide more useful information in the areas of high density anomalies where extensive buried debris over small areas were anticipated. Mechanical trenching is considered as an effective method in the *Military Munitions Response Program Munitions Response Remedial Investigation/Feasibility Study Guidance* (U.S. Army, 2009) for investigating larger areas of heavy ferrous metal concentrations. The Ohio EPA approval of the memorandum is provided in **Appendix B**.

4.1.2.5 Geophysical Quality Control Results

The DGM data were processed and interpreted consistent with the Work Plan (Shaw, 2011). Data was acquired in all areas void of thick vegetation, wetlands, debris piles, and deadfall. The DGM quality objectives and metrics were achieved for all data collected. The geophysical data files generated during the DGM activities consist of field data and QC test files. This data and the results of the DGM quality objectives and metrics are discussed and presented in further detail in the DGM Report in **Appendix A**.

4.1.3 Intrusive Investigation Results

The section presents the results of the anomaly investigation activities performed at the Atlas Scrap Yard MRS based on the DGM survey findings. A total of 3,185 single point source anomaly locations, 6 distinct burial features at and immediately adjacent to the suspected 40 mm burial area, and 14 high density areas of anomalies throughout the remainder of the MRS were intrusively investigated. All single point source anomalies selected for intrusive investigation were manually investigated by hand digging. The 14 high density areas and the six burial features within and adjacent to the suspected 40 mm burial area were investigated using mechanical excavation at 33 trenches. **Table 4-1** provides a summary of the proposed intrusive investigation activities.

4.1.3.1 Trench Investigation Results

A total of four trenches were excavated within the suspected 40 mm burial area and two trenches were excavated adjacent to the southeast boundaries of the suspected 40 mm burial

area. Twenty-seven trenches were excavated at the remaining 14 high density anomaly areas. No MEC or MD was uncovered during the excavations conducted at the 33 trench locations. Trenches were excavated until the target anomalies were identified; native material was identified and a clear, distinct boundary between the native and fill material was evident; a maximum depth of 10 feet was attained; or the water table was reached. For the majority of trenches, native soil was encountered between 36 and 56 inches bgs. A total of 12,851 pounds of "Other Debris" items were identified within the 33 trenches. "Other Debris" can represent any form of debris determined not to be munitions related, including scrap metal, hot rocks (i.e. slag), nails, pipe, and construction debris. The "Other Debris" quantities were determined by the UXO teams in the field. All items were left in place and the trenches backfilled with excavated material. **Table 4-2** summarizes the results and includes each trench, the maximum depth attained, a description of the "Other Debris" uncovered, and the estimated weight of the debris.

Table 4-2
Trench Investigation Results

Trench Number	Maximum Depth (inches bgs)	Description of "Other Debris"	Approximate Weight (lbs)
40-1	48	Scrap Metal	100
40-2	36	Scrap Metal	500
40-3	54	Scrap Metal	200
40-4	48	Scrap Metal	1
40-5	48	Scrap Metal	500
40-6	48	Scrap Metal	500
01-1	24	Utility Pipe	50
01-2	30	Pipe and Concrete	50
01-3	18	Pipe, Wire, Construction Debris	50
02-1	48	Slag Pipe Construction Debris	100
03-1	36	Hot Rocks and Slag	100
03-2	48	Pipe and Slag	50
04-1	24	Water Pipe and Construction Debris	100
05-1	36	Hot Rocks/Soil	2,000
05-2	36	Hot Rocks/Soil	2,000
05-3	48	Railroad Ties with Bolts	1,000
05-4	18	Scrap Metal	5
06-1	36	Scrap Steel	30
06-2	48	Reinforced Concrete Slab	5,000

Table 4-2 (continued)
Trench Investigation Results

Trench Number	Maximum Depth (inches bgs)	Description of "Other Debris"	Approximate Weight (lbs)
06-3	48	Scrap Steel	10
07-1	24	Fence Post	10
08-1	12	Water Pipe	30
09-1	36	Scrap Metal	5
10-1	24	Scrap Metal	35
10-2	3	Wire, Scrap Metal, and Slag	5
10-3	36	Wooden Crates with Hardware	30
11-1	6	Scrap Metal	10
12-1	6	Pipe and Slag	100
12-2	24	Pipe and Wire	50
13-1	6	Concrete Slab	100
13-2	18	Bolt	20
14-1	2	Scrap Metal	10
14-2	24	Scrap Metal	100
		Total:	**12,851**

bgs denotes below ground surface.
lbs denotes pounds.

Further details of the high density anomaly investigation results at the trench locations are presented in **Appendix D**. The results of the intrusive investigations are presented in **Figure 4-4**.

4.1.3.2 Single Point Source Anomaly Investigation Results

A total of 3,185 single point source anomalies were identified for reacquisition following the DGM survey. During the reacquisition process, 60 of the 3,185 single point source anomalies were determined to have the source item on the ground surface rather than buried below the surface, and therefore did not require intrusive investigation to resolve. An additional 34 anomalies were not intrusively investigated due to not finding the peak during reacquisition. The average initial EM61-MK2 signal strength (Channel 2) of the 34 anomalies was 6 mV, which is near the lower limit of the 5- to 8-mV selection criteria. During the reacquisition process the geophysicist reported that at 31 of the 34 locations, the anomaly was likely originally detected as a result of the rugged terrain encountered during data acquisition, as the average EM61-MK2 Channel 2 reacquire value for the 31 locations was 1.2 mV. At the

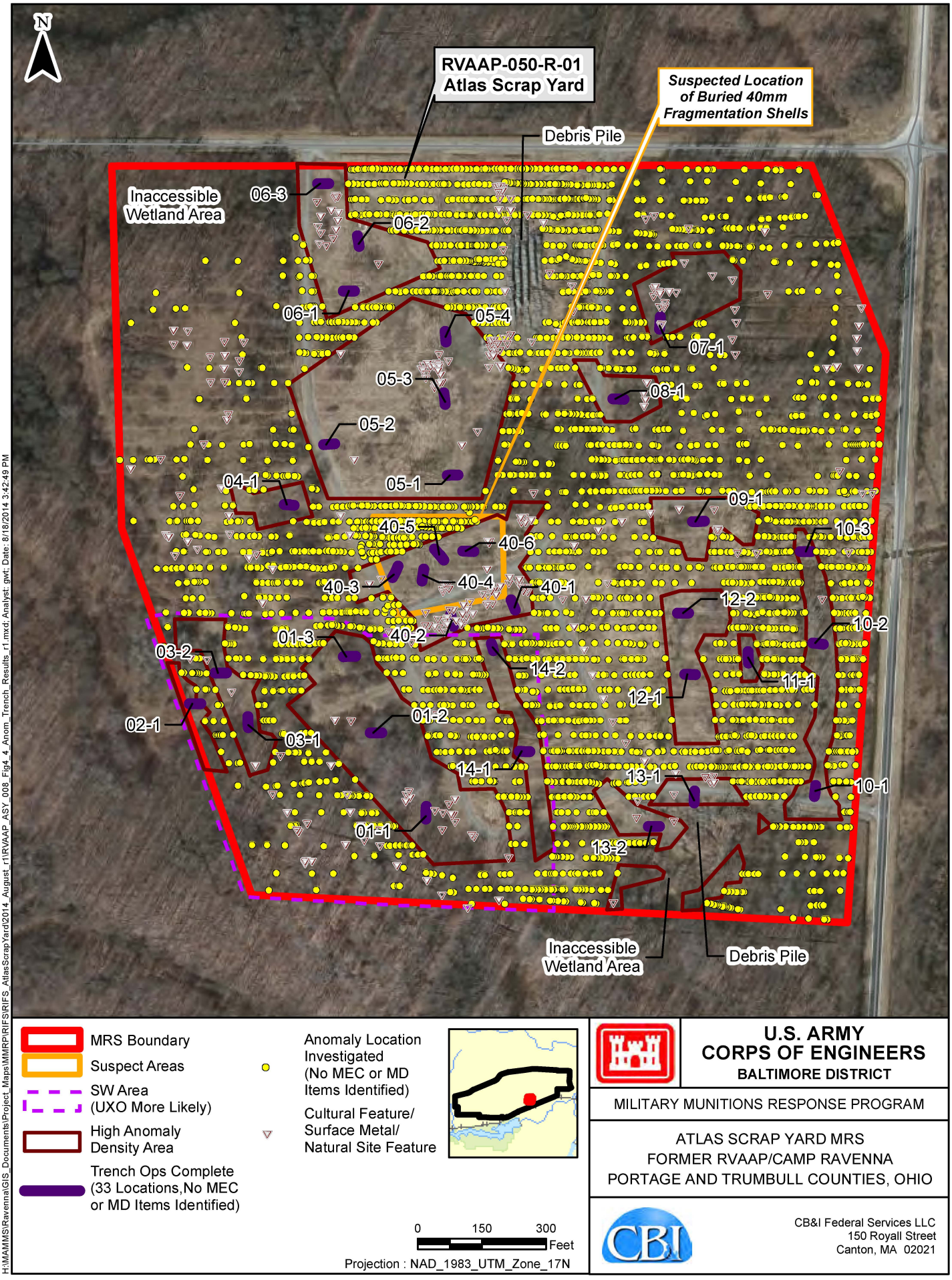

FIGURE 4-4 SINGLE ANOMALY AND TRENCH INTRUSIVE INVESTIGATION RESULTS

three remaining locations, the average Channel 2 response during reacquire was 2 mV. The stated reacquire values for the 34 anomalies that were not investigated are well below the 5- to 8-mV selection criteria. A root cause analysis was not required, as less than 15 percent (1.06 percent) of the anomalies produced inconsistent results meaning that the reacquisition results were well within the acceptable limits.

A total of 3,090 single point anomalies were intrusively investigated by hand following reacquisition. During the intrusive investigation for the point source anomalies, no MEC or MD was identified. A total of 58,008 pounds of "Other Debris", consisting primarily of construction debris and scrap metal, were determined by the UXO teams in the field at the 3,090 individual source anomaly locations. All "Other Debris" was left in place. Further details of the investigation results at the individual target locations are presented in **Appendix D**. The results of the intrusive investigations are presented in **Figure 4-4**.

4.1.3.3 UXO Estimator® Analysis Results

The UXO Estimator® module (USACE, 2003b) was used to analyze the data collected during the intrusive trench and single point anomaly investigations to determine if the performance criteria target density of 0.5 MEC per acre at a 95 percent confidence level were met for the Atlas Scrap Yard MRS. A total of 6.1 acres of the 66-acre MRS were investigated and no MEC was found; therefore, UXO Estimator® calculated that sampling was adequate to achieve the DQOs. Based on the results of the SI and RI field investigations, it is not expected that a MEC source or explosive safety hazard is present at the Atlas Scrap Yard MRS, as no MEC or MD have been found to date.

5.0 FATE AND TRANSPORT

This intent of this chapter is to describe the fate of contaminants in the environment and potential transport mechanisms for MEC and MC identified at the Atlas Scrap Yard MRS. Contaminant fate refers to the expected final state that an element, compound, or group of compounds will achieve following release to the environment. Contaminant transport refers to migration mechanisms away from the source area. However, as no MEC or MD was found at the Atlas Scrap Yard MRS during the SI and RI field activities and an explosive hazard is not anticipated to exist at the MRS, a discussion on the fate and transport of MEC at the MRS is determined to be unwarranted.

Since no MEC or MD was found during the RI, the release of MC from a MEC item is highly unlikely. Because existing SRCs at the Atlas Scrap Yard MRS are being addressed under the IRP, fate and transport of MC and environmental conditions affecting such fate and transport are best addressed under the IRP program.

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6.0 MEC HAZARD ASSESSMENT

In accordance with the Work Plan (Shaw, 2011), an evaluation of the MEC hazard at the Atlas Scrap Yard MRS was to be prepared in accordance with the *Interim Munitions of Concern Hazard Assessment (MEC HA) Methodology* (EPA, 2008). The MEC hazard assessment (HA) process was developed to evaluate the potential explosive hazard associated with conventional MEC present at an MRS under a variety of MRS conditions, including various cleanup scenarios and land use assumptions. The MEC HA addresses human health and safety concerns associated with potential exposure to MEC at a MRS. No MEC or MD items were identified at the MRS during either the 2007 SI or 2011 RI field activities, and these results have been interpreted to indicate that no MEC source or explosive safety hazard is present for likely receptors at the MRS. Based on the findings of the RI field work, the calculation of a MEC HA score was not warranted for the Atlas Scrap Yard MRS.

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7.0 HUMAN HEALTH RISK ASSESSMENT

The purpose of an HHRA is to document whether MRS conditions may pose a potential risk to current or future MRS receptors and to identify which, if any, MRS conditions need to be addressed further in the CERCLA process. No MEC or MD was identified at the Atlas Scrap Yard MRS during the RI field activities; sampling for MC was not warranted in accordance with the Work Plan (Shaw, 2011). Therefore, an HHRA was not required for inclusion in this report. An HHRA is being conducted under the IRP since SRCs were detected during previous IRP investigations.

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8.0 ECOLOGICAL RISK ASSESSMENT

An ERA evaluates the potential for adverse effects posed to ecological receptors from potential releases at a MRS. No MEC or MD was identified at the Atlas Scrap Yard MRS during the RI field activities; sampling for MC was not warranted in accordance with the Work Plan (Shaw, 2011). Therefore, an ERA was not required for inclusion in this RI Report. An ERA is being conducted under the IRP since SRCs were detected during previous IRP investigations.

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9.0 REVISED CONCEPTUAL SITE MODEL

This chapter presents the revised CSM for MEC at the Atlas Scrap Yard MRS based on the results of the data collected for the RI and previous information provided in the SI Report (e^2M, 2008) and the HRR (e^2M, 2007). The preliminary MEC CSM was discussed in Section 2.0 and the summary of the RI results were presented in Section 4.0. Following the integration of the RI results into the CSM for MEC, the MRSPP evaluation for the MRS was reevaluated to include the results of the RI.

9.1 MEC Exposure Analysis

This section summarizes the RI data results for the MEC exposure pathway analyses for the MRS. As discussed in Section 2.1, "Preliminary CSM and Project Approach," each pathway includes a source, activity, access, and receptor, with complete, potentially complete, and incomplete exposure pathways identified for each receptor. A pathway is considered complete when a source (MEC) is known to exist and when receptors have access to the MRS while engaging in some activity that results in contact with the source. A pathway is considered potentially complete when a source (MEC) has not been confirmed, but is suspected to exist and when receptors have access to the MRS while engaging in some activity that results in contact with the source. Lastly, an incomplete pathway is any case where one of the four components (source, activity, access, or receptors), is missing from the MRS.

9.1.1 Source

A MEC source is the location where MPPEH or ordnance is situated or is expected to be found. The Atlas Scrap Yard MRS was used as a storage area for nonexplosive scrap and anecdotal evidence was identified during the HRR to suggest that munitions items may have been disposed of at the MRS. In addition a 40 mm fragmentation shell burial area was suspected to be at the MRS. As discussed in Section 1.4, the CTT Range/Site Inventory reported that a MEC and MD removal activity had occurred at the MRS in 2003. During the HRR and subsequent investigations, the type, location, and disposal of the items could not be verified.

The UXO survey activities during the 2007 SI field effort resulted in no MEC or MD findings. At the end of the SI Report (e^2M, 2008), it was determined that the extent of MEC lying on the ground or buried at the MRS was not fully understood, in particular the potential for buried 40 mm fragmentation shells. Based on historical operations at the MRS, the MEC source would be expected to be found on the surface and/or subsurface soils.

During the RI field activities, no MEC or MD was identified during the visual survey or subsurface investigation. As discussed in Section 4.1.3.3, "UXO Estimator® Analysis Results," sampling was determined to be adequate to satisfy the target density DQO of 0.5 MEC per acre at a 95 percent confidence level. Although only a statistical portion of the MRS was investigated, no evidence of MEC or MD was encountered during the intrusive investigation at the 33 trenches within high density areas, including 6 trenches within and adjacent to the suspected 40 mm fragmentation shell burial area, and the 3,185 single item anomalies. These results suggest that there is no MEC source or explosive safety hazard present at the Atlas Scrap Yard MRS.

9.1.2 Activity

Activity describes ways that receptors come into contact with a source. Current activities at the Atlas Scrap Yard MRS include storage of construction materials, maintenance activities, natural resource management activities, and environmental sampling under the IRP. Most of these activities involve foot traffic only; however, the sampling and remedial activities may include disturbing surface and subsurface soils. Biota activities at the MRS may include meandering on the ground surface or burrowing activities. The OHARNG anticipated future land use for the Atlas Scrap Yard MRS is military training.

9.1.3 Access

Access describes the degree to which a MEC source or environment containing MEC is available to potential receptors. Once on the installation, there is currently no unrestricted access to the MRS for current authorized or unauthorized receptors. Siebert stakes and signs are currently present along the perimeter of the MRS identifying the presence of the MRS and restricting access; however, these mechanisms do not physically restrict receptors from being able to enter the MRS. Once on the MRS, receptors would have access to any MEC in surface soil; however, receptors associated with any environmental sampling activities would have access to any MEC in both surface and subsurface soils.

9.1.4 Receptors

A receptor is an organism (human or ecological) that comes into physical contact with MEC. Human receptors identified for the Atlas Scrap Yard MRS include both current and anticipated future land users. Receptors (biota) are based on animal and aquatic species that are likely to occur in the terrestrial and aquatic habitats at the MRS. The primary MRS-specific biota identified for the MRS include aquatic biota, terrestrial invertebrates (earthworms), voles, shrews, rabbits, robins, foxes, hawks, muskrats, ducks, minks, and benthic invertebrates (insect larvae, crayfish, snails, clams and bivalves) (USACE, 2003c).

Potential users associated with the current activities include facility personnel, contractors, and occasional trespassers. The National Guard Trainee has been identified as the potential

user for military training, the future land use at the MRS, and is considered the most sensitive of the identified current and future potential users that may become exposed to any potentially remaining MEC at the MRS.

9.1.5 MEC Exposure Conclusions

The information collected during the RI was used to update the preliminary MEC CSM for the Atlas Scrap Yard MRS and to identify all actual, potentially complete, or incomplete source-receptor interactions for the MRS for current and future land uses. Evaluation of the end-use receptors for future land use in the revised CSM is consistent with the facility human health risk assessment approach (USACE, 2005). The revised MEC Exposure Pathway Analysis is presented on **Figure 9-1**.

A statistical approach was taken for the investigation at the Atlas Scrap Yard MRS and a portion of the MRS was investigated by visual survey, DGM survey, and intrusive investigation. No MEC or MD was identified on the ground surface or in the subsurface within the 6.1 acres investigated. Based on the results of the SI and RI field investigations, it is not expected that a MEC source or explosive safety hazard is present at the Atlas Scrap Yard MRS, as no MEC or MD have been found to date.

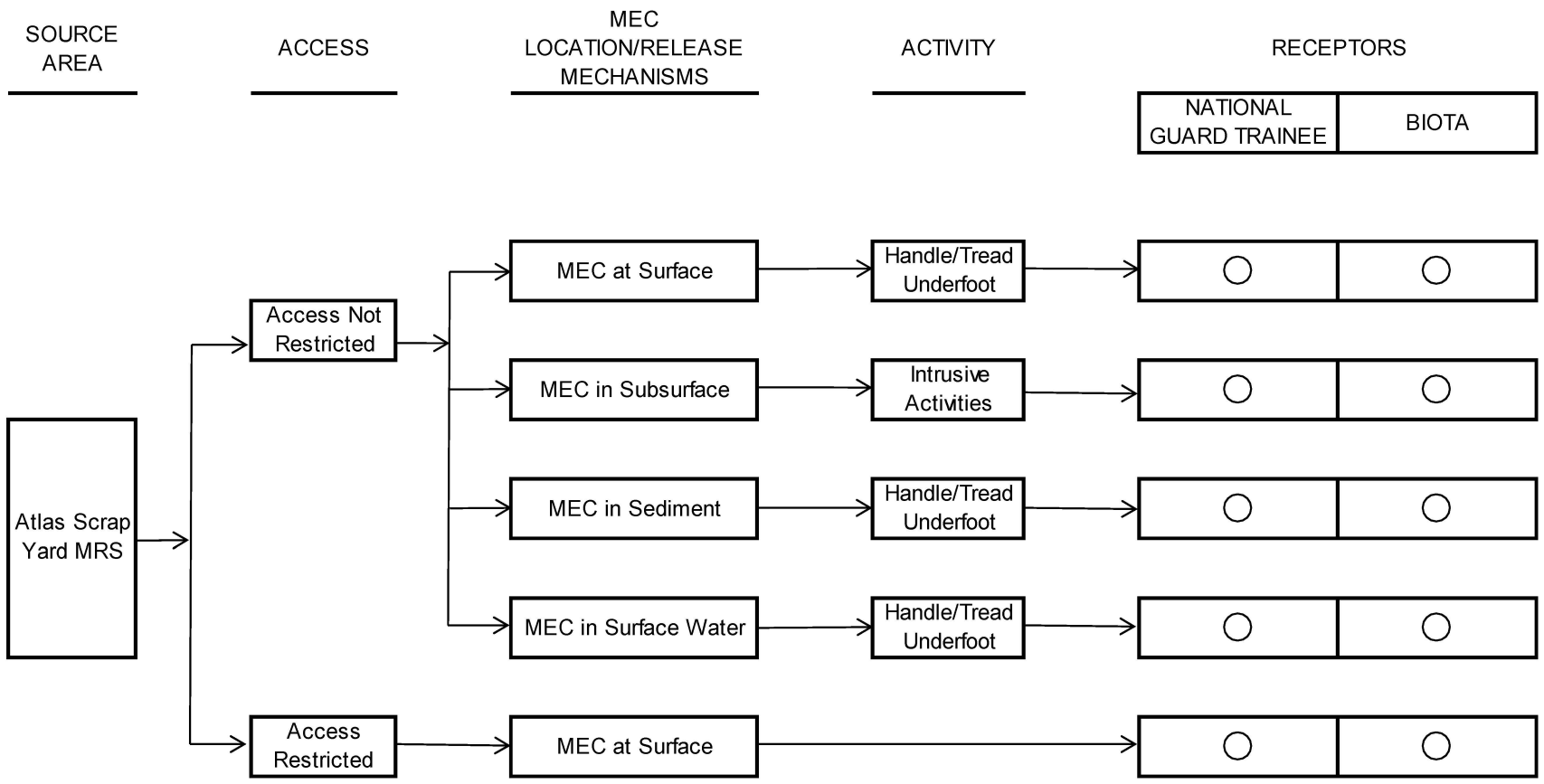
Given that no MEC source has been identified and an explosive safety hazard is not anticipated to exist at the Atlas Scrap Yard MRS, there are no activity/access/receptor interactions ongoing or anticipated under the future land use where a receptor may come into contact with MEC. As a result, the revised CSM for MEC identifies incomplete exposure pathways in surface soil, subsurface soil, surface water, and sediment for all receptors having access to the MRS.

9.2 MC Exposure Analysis

Since no MEC was identified during the RI investigations at the Atlas Scrap Yard MRS, sampling was not warranted at the MRS in accordance with the Work Plan (Shaw, 2011). Therefore, the CSM for MC identifies incomplete exposure pathways for all receptors at the MRS. Evaluation for COCs identified during previous investigations under the IRP at the Atlas Scrap Yard MRS will continue to be addressed under the IRP.

9.3 Uncertainties

The primary uncertainty related to the evaluation of the RI results at the Atlas Scrap Yard MRS is associated with the incomplete record of the historical operations at the MRS since demolition of the construction camp buildings following World War II and the statistical investigation approach utilized for the RI.



U.S. ARMY
CORPS OF ENGINEERS
BALTIMORE DISTRICT

MILITARY MUNITIONS RESPONSE PROGRAM

ATLAS SCRAP YARD MRS
FORMER RVAAP/CAMP RAVENNA
PORTAGE AND TRUMBULL COUNTIES, OHIO

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

FIGURE 9-1 REVISED MEC CONCEPTUAL SITE MODEL

Review of the historical records and previous investigations conducted at the Atlas Scrap Yard MRS indicates any munitions produced or used at the facility may have been stored or disposed at the MRS, including small arms, explosives, pyrotechnics, propellants, mortars, medium and large caliber munitions, landmines, hand grenades, flares, bombs, detonators, or fuzes. Although the disposal of munitions at the MRS has not been confirmed, historical photographic evidence indicates that many of these items were stockpiled by the sides of the roads running through the MRS prior to 2003 (Ohio EPA, 2013). The DGM survey and intrusive investigation covered only approximately 9 percent of the MRS and although no MEC or MD was encountered, there is minimal uncertainty with regard to the nature of the risk posed by any potentially remaining MEC within the remaining areas of the MRS that were not investigated during the RI field activities.

The DGM survey coverage for the RI was designed based on the UXO Estimator® program that at a 95 percent confidence level, a minimum MEC density of 0.5 MEC/acre was expected to be found at the MRS. The UXO Estimator® calculated the statistical upper bound density of MEC to be 0.445 MEC per acre at a 95 percent confidence level based on actual field results. Therefore, it is statistically possible that MEC may be present at the MRS even though confirmed discoveries have not been made to date. However, as the DQOs were met and no MEC/MD was discovered during the RI field activities, the uncertainty that MEC is present at the MRS is greatly reduced. Although the potential for MEC/MD items to be present at the MRS is considered to be low, in the event that MEC/MD is found at the MRS in the future, the U.S. Army will be responsible for subsequent removal and cleanup.

9.4 Munitions Response Site Prioritization Protocol

The DoD proposed the MRSPP (32 Code of Federal Regulations Part 179) to assign a relative potential risk priority to each defense MRS in the MMRP Inventory for response activities. These response activities are to be based on the overall conditions at each location, taking into consideration various factors related to explosive safety and environmental hazards (68 Federal Regulations 50900 [32 Code of Federal Regulations 179.3]). The revised MRSPP document for the Atlas Scrap Yard MRS is being prepared separately and is included in this RI Report as **Appendix E** for reference only.

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10.0 SUMMARY AND CONCLUSIONS

This chapter summarizes results of the RI field activities conducted at the Atlas Scrap Yard MRS. The purpose of the RI was to determine whether the Atlas Scrap Yard MRS warrants further response action pursuant to CERCLA and the NCP. More specifically, the RI was intended to determine the nature and extent of MEC and MC and subsequently determine the potential hazards and risks posed to likely human and ecological receptors by MEC and MC. Additional data are also presented in this RI Report to support the identification and evaluation of alternatives in a FS, if required. A summary of the RI results for the Atlas Scrap Yard MRS is presented in **Table 10-1**.

Table 10-1
Summary of Remedial Investigation Results

MRS Name	Proposed Investigation Area (Acres)	Actual Area Investigated (Acres)	MEC and/or MD Found?	MC Detected?	MC Risk Analysis
Atlas Scrap Yard	5.6	6.1	No	NS	No Further Action

MC denotes munitions constituents.
MD denotes munitions debris.
MEC denotes munitions and explosives of concern.
MRS denotes Munitions Response Site.
NS denotes not sampled.

10.1 Summary of Remedial Investigation Activities

Information from the Atlas Scrap Yard MRS relating to the potential presence of MEC and associated MC is compiled and evaluated in this RI Report. The sources of this information were obtained during previous investigations, including the ASR (USACE, 2004), the HRR (e^2M, 2007), and the SI Report (e^2M, 2008).

The preliminary MEC CSM was developed during the SI (e^2M, 2008) phase of the CERCLA process and was used to identify data needs and DQOs as outlined in the Work Plan (Shaw, 2011). The data needs and DQOs were determined at the planning stage of the RI activities and included characterization of the nature and extent of MEC and MC associated with former activities at the MRS. The DQOs were developed to ensure the reliability of field sampling, chemical analyses, and physical analyses; the collection of sufficient data; the acceptable quality of data generated for its intended use; and the inference of valid assumptions from the data. The DQOs for the Atlas Scrap Yard MRS identified the following decision rules that were implemented in evaluating the MRS:

- Perform a geophysical investigation to identify if buried MEC or MD was present.
- Perform an intrusive investigation of anomalies identified during the geophysical investigation to evaluate if MEC/MD was present.
- Collect incremental and/or discrete soil samples (surface and subsurface) in areas with concentrated MEC/MD, if any, to evaluate for MC.
- Process the information to evaluate whether there are unacceptable risks to human health and the environment associated with MEC and/or MC and make a determination if further investigation was required under the CERCLA process.

10.1.1 Geophysical Investigation

In June and July of 2011, Shaw performed a DGM investigation to identify potential subsurface areas of MEC and/or MD at the Atlas Scrap Yard MRS. The DGM data were collected in all accessible areas within the MRS, and the spatial coverage was calculated to be 6.1 acres, which represents site coverage of 9.2 percent and exceeds the proposed sampling coverage of 5.6 acres presented in the Work Plan (Shaw, 2011). The 6.1 acres equates to a total transect distance of 16.7 miles where each transect width covered was 1 meter wide.

10.1.2 Anomaly Selection

Evaluation of the data collected during the DGM survey identified 3,621 single point anomalies, high density areas within and adjacent to the suspected 40 mm burial area, and 14 additional high density areas within remainder of the MRS. Four contiguous areas of high anomaly density were observed within the suspected 40 mm burial area. Two areas of high anomaly density were identified adjacent to the southeast portion of the suspected 40 mm burial area and are at least partially associated with debris piles observed on the ground surface at the suspected burial area. In the remainder of the MRS, 14 additional regions were characterized by high anomaly densities, defined shapes, and elevated EM61-MK2 signal intensity where trench investigations were considered more appropriate. Distinct subsurface linear features appeared to be related to cultural features such as former utility lines and/or possible burial debris. The corners of the MRS were characterized by significantly lower anomaly densities.

10.1.3 Intrusive Investigations

Following the completion of the DGM survey in July 2011, reacquisition and intrusive investigation was conducted between August and October 2011 for the locations identified as potentially containing subsurface MEC and/or MD based on an analysis of the DGM survey data. A total of 3,185 single point source anomaly locations and the high density regions of the MRS were identified for excavation as part of the intrusive investigation. The high

density areas were investigated by 6 trenches within and adjacent to the suspected 40 mm burial area and 27 trenches at the remaining 14 high density anomaly areas. All trenches were mechanically excavated and no MEC or MD was identified in any of the 33 trenches. At total of 12,851 pounds of "Other Debris" items were identified within the 33 trenches.

During the reacquisition process for the single point source anomalies, 60 of the single point source anomalies were determined to have the source item on the ground surface rather than buried below the surface and therefore did not require intrusive investigation to resolve. An additional 34 single point anomalies were not intrusively investigated due to not finding the peak during reacquisition. A total of 3,090 single point anomalies were successfully intrusively investigated by hand following reacquisition. No MEC or MD was identified and a total of 58,008 pounds of "Other Debris" were identified from the 3,090 individual source anomalies.

The "Other Debris" quantities for both the mechanical trench excavation and manually excavated single point source anomalies were determined by the UXO teams in the field. All debris was left in place.

10.1.4 MC Sampling

The DQOs stated that incremental samples and discrete samples (surface and subsurface soil) would be collected in areas with concentrated MEC or MD. Since no MEC or MD was identified at the Atlas Scrap Yard MRS during the RI field activities, sampling for MC was not warranted in accordance with the Work Plan (Shaw, 2011).

10.2 MEC Hazard Assessment

The *Interim Munitions and Explosives of Concern (MEC HA) Methodology* (EPA, 2008) addresses human health and safety concerns associated with potential exposure to MEC at a MRS under a variety of site conditions, including various cleanup scenarios and land use assumptions. If an explosive hazard is identified for this RI, the MEC HA evaluation will include the information available for the MRS up to and including the RI field activities and provide a scoring summary for the current and future land use activities. If no explosive hazard is found at the MRS, then there is no need to calculate a MEC HA score since there are no human health safety concerns. No MEC or MD items were identified at the MRS during either the 2007 SI or 2011 RI field activities, which indicate that no MEC source or explosive safety hazard is present at the MRS. Therefore, calculation of a MEC HA score was not warranted for the Atlas Scrap Yard MRS.

10.3 Conceptual Site Model

A discussion of the preliminary MEC CSM for the Atlas Scrap Yard MRS, based on previous data and historical information identified prior to the RI activities, is presented in Section 2.1, "Preliminary CSM and Project Approach." The information collected during the RI field activities was used to update the MEC CSM and evaluate if the development of an MC CSM was warranted. The purpose of the CSM is to identify all complete, potentially complete, or incomplete source-receptor interactions for reasonably anticipated future land use activities at the MRS. An exposure pathway is the course a MEC item or MC takes from a source to a receptor. Each pathway includes a source, activity, access, and receptor.

10.3.1 MEC Exposure Analysis

Potential users associated with the current land use include facility personnel, contractors, and occasional trespassers. The National Guard Trainee has been identified as the potential user for military training, the future land use at the MRS, and is considered the most likely potential user that may become exposed to any potentially remaining MEC and MC at the MRS.

Sensitive ecological areas at the MRS include several wetlands. Ecological receptors are based on animal and aquatic species that are likely to occur in the terrestrial and aquatic habitats at the MRS. The primary MRS-specific biota identified for the MRS include aquatic biota, terrestrial invertebrates (earthworms), voles, shrews, rabbits, robins, foxes, hawks, muskrats, ducks, minks, and benthic invertebrates (insect larvae, crayfish, snails, clams and bivalves) (USACE, 2003c).

A statistical approach was taken for the investigation at the Atlas Scrap Yard MRS and a portion of the MRS was investigated by visual survey, DGM survey, and intrusive investigation. No MEC or MD was identified on the ground surface or in the subsurface in the 6.1 acres investigated. The UXO Estimator® module (USACE, 2003b) calculated the statistical upper bound density of MEC to be 0.455 MEC per acre based on the percentage of area investigated at the MRS and the actual investigation results. This value was within the DQO target density of 0.5 MEC per acre and means that the investigation was adequate to be 95 percent confident that there is less than 0.455 MEC per acre at the MRS. Although the UXO Estimator® results indicate that a statistical potential for MEC may remain at the MRS, no MEC or MD have been found and it is anticipated that no MEC source or explosive safety hazard is present at the Atlas Scrap Yard MRS.

Given that no MEC source has been identified to date and an explosive safety hazard is not anticipated to exist at the Atlas Scrap Yard MRS, there are no activity/access/receptor interactions ongoing or anticipated under future land use where a receptor may come into

contact with MEC. As a result, the revised CSM for MEC identifies incomplete exposure pathways in surface soil, subsurface soil, surface water, and sediment for all receptors having access to the MRS.

10.3.2 MC Exposure Analysis

Since no MEC was identified during the RI investigations at the Atlas Scrap Yard MRS, sampling was not warranted at the MRS in accordance with the Work Plan (Shaw, 2011). Therefore, the CSM for MC identifies incomplete exposure pathways for all receptors at the MRS. Evaluation for COCs identified during previous investigations under the IRP at the Atlas Scrap Yard MRS will continue to be addressed under the IRP.

10.4 Uncertainties

The primary uncertainty related to the evaluation of the RI results at the Atlas Scrap Yard MRS is associated with the incomplete record of the historical operations at the MRS since demolition of the construction camp buildings following World War II and the statistical investigation approach utilized for the RI.

Review of the historical records and previous investigations conducted at the Atlas Scrap Yard MRS indicates any munitions produced or used at the facility may have been stored or disposed at the MRS, including small arms, explosives, pyrotechnics, propellants, mortars, medium and large caliber munitions, landmines, hand grenades, flares, bombs, detonators, or fuzes. Although the disposal of munitions at the MRS has not been confirmed, historical photographic evidence indicates that many of these items were stockpiled by the sides of the roads running through the MRS prior to 2003 (Ohio EPA, 2013). The DGM survey and intrusive investigation covered only approximately 9 percent of the MRS and although no MEC or MD was encountered, there is minimal uncertainty with regards to the nature of the risk posed by any potentially remaining MEC within the remaining areas of the MRS that were not investigated during the RI field activities.

The DGM survey coverage for the RI was designed based on the UXO Estimator® program that at a 95 percent confidence level, a minimum MEC density of 0.5 MEC/acre was expected to be found at the MRS. The UXO Estimator® program calculated the statistical upper bound density of MEC to be 0.445 MEC per acre at a 95 percent confidence level based on actual field results. Therefore it is statistically possible that MEC may be present at the MRS even though confirmed discoveries have not been made to date. However, as the DQOs were met and no MEC/MD was discovered during the RI field activities, the uncertainty that MEC is present at the MRS is greatly reduced. Although the potential for MEC/MD items to be present at the MRS is considered to be low, in the event that MEC/MD

is found at the MRS in the future, the U.S. Army will be responsible for subsequent removal and cleanup.

10.5 Conclusions and Recommendations

The RI was prepared in accordance with the project DQOs and included evaluations for explosives hazards and potential sources of MC that may pose threats to likely receptors. The following statements can be made for the Atlas Scrap Yard MRS based on the results of the RI field activities:

- A total of 6.1 acres were investigated at the 66-acre MRS during the RI, which exceeds the proposed spatial coverage of 5.6 acres.
- The nature and extent of MEC and MD has been adequately defined at the MRS.
- No physical evidence of MEC or MD was identified during the RI field activities and an explosive safety hazard is not anticipated to exist at the MRS.
- MC sampling was not warranted since no MEC or MD was found at the MRS during the RI field activities.

After evaluating the RI results, it is determined that the DQOs for the Atlas Scrap Yard MRS have been satisfied and the MRS has been adequately characterized. No Further Action is recommended for the Atlas Scrap Yard MRS under the MMRP, and the next course of action will be to proceed to a No Further Action Proposed Plan.

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Appendix A
Digital Geophysical Mapping Report

Appendix B
Ohio EPA Correspondence

Appendix C
Photograph Documentation Log

Appendix D
Intrusive Investigation Results

Appendix E
Munitions Response Site Prioritization Protocol Worksheets

Appendix F
Responses to Ohio EPA Comments

Appendix G
Ohio EPA Approval Letter