

Appendix K.11

*Results of Phase II Munitions and Explosives of
Concern (MEC) RCRA Facility Investigation (RFI)
Union Carbide Corporation, Woodbine, Camden
County, Georgia*

CH2M Hill

March 2010

30 Pages



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March 26, 2010

Mr. John Fonk
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Georgia Department of Natural Resources
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Re: Results of Phase II Munitions and Explosives of Concern (MEC)
RCRA Facility Investigation (RFI)
Union Carbide Corporation, Woodbine, Camden County, GA,
EPD ID No. GA981235294

Dear Mr. Fonk:

On behalf of Union Carbide Corporation (UCC), we are pleased to submit the enclosed report, *Results of Phase II MEC RFI*, which provides detailed results from data collection to aid in the characterization of the extent of MEC releases at UCC-Woodbine. This document addresses comments from the Georgia Department of Natural Resources, Environmental Protection Division, dated February 19, 2010. Responses to those comments are also included.

If you have any questions on this document, please feel free to contact me at 404-474-7640 or at tom.roth@ch2m.com, or Tim King of UCC at 304-747-3763.

Sincerely,

CH2M HILL

A handwritten signature in black ink, appearing to read "Thomas M. Roth".

Thomas M. Roth, P.E.
Senior Project Manager

cc: Tim King/Union Carbide
Keith Ogden/CH2M HILL-RDU

DOCUMENT: Results of Phase II Munitions and Explosives of Concern (MEC)
RCRA Facility Investigation (RFI) (November 2009)
Union Carbide Corporation
Woodbine, Georgia
GAD 981235294

REVIEWER: Georgia Department of Natural Resources
Environmental Protection Division
Remedial Sites Unit
(February 19, 2010)

DATE: March 26, 2010

1. Please remove the word "draft" from the cover page.

RESPONSE: The cover has been revised as requested.

2. Several references cited in the text are not included in the references section. Please review the text and add all cited references to Section 6.

RESPONSE: Reference citations have been corrected in the text and added to Section 6 for the Our Georgia History website, The Camden County Tribune, and Thiokol Corporation's "Georgia Division - History and Background".

3. Page 1-4 states: "At MRA-2, DGM transects did not cover the entire MRA because the proposed MRA boundaries extended off UCC property to the south and southeast ..." UCC took a 5% random sample of MRA-2, found potentially explosive material (MPPEH), and correctly concluded that the area needed a corrective measures study. However, the off-site segments are part of the area under investigation and the conclusion reached for the on-site section also holds for the off-site section. Considering the results of the investigation of MRA-2 (218 geophysical anomalies, 8 MPPEH) the offsite segment of MRA-2 must be included in any corrective measures study.

RESPONSE: The off-site segment of MRA-2 will be addressed in the corrective measures study.

4. Pages 1-5 and 4-1 refer to a total of 30 quality control (QC) seeds. This is not consistent with statements in Section 3 that refer to 29 QC seeds in MRA-1, 10 QC seeds in MRA2, and 10 QC seeds in MRA -3. Please either explain or correct the text.

RESPONSE: The reference to 29 QC seeds in MRA-1 should have read "19 QC seeds and 10 geophysical prove-out test plot items." The text has been revised to clarify this statement. Only one QC seed was placed in MRA-3; the reference to 10 QC seeds was a typographical error and the text has been corrected.

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5. Page 5-1 states: "Four MEC items were located in the south side of MRA-1 ... and one to the west of the former 81mm Mortar Test Range." The MEC item west of the 81 mm range is not shown in Figure 5-1. Please correct the figure.

RESPONSE: The figure is correct. The text incorrectly refers to two items of munitions debris, one that is west of the 81mm mortar range and one at the firing point of the 81mm mortar range, that are shown as MPPEH on Figure 3-1. The text has been corrected to read as follows: "Two MEC items were located in the south side of MRA-1 along the centerline of the Former 81mm Mortar Test Range."

6. Section 5 states: "consideration should also be given to reducing the boundaries of the MRA based on the distribution of MEC and MPPEH." MPPEH was found at or near the boundaries of MRA-1 and MRA-2; therefore, reducing the boundaries is questionable. If UCC wishes to pursue this approach, more defensible boundaries should be defined.

RESPONSE: Reduction of the MRA boundaries may be evaluated in the corrective measures study. If so, the proposed boundaries will be defined in the CMS.

7. Page 5-2, section 5.2.2, paragraph 1, line 1 incorrectly refers to MRA-1 rather than MRA-2. Please correct the text.

RESPONSE: The text has been corrected.

8. Figure 3-1 and Figure 5-1 show the southern margin of MRA-2 truncated by the property boundary. This is not consistent with the original definition of MRA-2 or with Figure 1-2 and 2-1. Please revise the figures.

RESPONSE: The figures have been revised as requested.

**Results of Phase II
Munitions and Explosives of Concern
RCRA Facility Investigation**

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person(s) who manage the system or those person(s) directly responsible for gathering information, the information submitted to me is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Union Carbide Corporation (UCC), Woodbine Georgia Facility

Signature: _____

Name: Tim King

Title: UCC Remediation Leader

Date: 3/26/2010

Results of Phase II Munitions and Explosives of Concern RCRA Facility Investigation

**Union Carbide Corporation-Woodbine
Woodbine, Georgia**

**Contract No. NA-1022
Purchase Order No. 93228228**

Prepared for
Union Carbide Corporation

Prepared by
 **CH2MHILL**

March 2010

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Acronyms and Abbreviations

BIP	blow-in-place
CMS	corrective measures study
CS	orthochlorobenzalmalononitrile
DGM	digital geophysical mapping
Dow	The Dow Chemical Company
EPD	Environmental Protection Division
HE	high explosive
MD	munitions debris
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
MRA	munitions response area
NAEVA	NAEVA Geophysics, Inc.
PMSOW	project memorandum statement of work
PMWP	project memorandum work plan
QC	quality control
RCRA	Recourse Conservation and Recovery Act
RFA	Recourse Conservation and Recovery Act facility assessment
RFI	Recourse Conservation and Recovery Act facility investigation
SWMU	solid waste management unit
Thiokol	Thiokol Corporation
UCC	Union Carbide Corporation
UXO	unexploded ordnance

Introduction

1.1 Project Authorization

CH2M HILL submitted a project memorandum work plan (PMWP) to Union Carbide Corporation (UCC) on November 14, 2008. UCC is A Wholly Owned Subsidiary of The Dow Chemical Company (Dow). The PMWP provided a project description, key objectives, and scope of work for conducting a Phase II Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) to address munitions and explosives of concern (MEC) at UCC's facility at Woodbine, Georgia (hereafter referred to as "facility").

Dow issued a remediation and environmental services agreement project memorandum statement of work (PMSOW) authorizing the Phase II MEC RFI on November 19, 2008. The work is being performed under Purchase Order 93228228 to Contract NA-1022.

A draft *Work Plan to Conduct Phase II MEC RCRA Facility Investigation* was submitted to the Georgia Environmental Protection Division (EPD) for review and approval on April 7, 2009. EPD provided comments and conditional approval of the work plan on April 21, 2009. Responses to comments and the revised pages, which finalized the work plan (CH2M HILL 2009b), were submitted to EPD on May 26, 2009. This work plan identified the activities that were conducted in support of the Phase II MEC RFI and provided detailed implementation instructions to the project team.

1.2 Purpose and Scope

The purpose of the Phase II MEC RFI was to expand on the results of the Phase I MEC RFI to evaluate the nature and extent of MEC releases over three identified munitions response areas (MRAs) at the facility. An intrusive investigation of geophysical anomalies was conducted during the Phase II investigation using digital geophysical mapping (DGM) data collected during the Phase I investigation.

1.3 Report Organization

This Phase II RFI report has been prepared to document the activities that were conducted in support of the Phase II MEC RFI at the facility and to provide the results of that investigation. This Phase II RFI report is organized as follows:

- **Section 1, Introduction** – The remainder of this section provides background information about the facility, including project location, site description and history, current and projected land use, and summaries of previous site investigations.
- **Section 2, Field Investigation Summary** describes the site investigation activities that were conducted during the Phase II RFI.

- **Section 3, Investigation Results** presents the results of the field investigation activities conducted during the Phase II RFI.
- **Section 4, Quality Control** discusses the quality control (QC) program implemented during the Phase II MEC RFI.
- **Section 5, Conclusions and Recommendations** provides a summary of the data, conclusions drawn from the data, and recommendations for further actions.
- **Section 6, References** identifies the sources of information used to develop this report.

1.4 Project Location

The facility is a 4,012-acre parcel of a former manufacturing facility located approximately 11.5 miles due east of the town of Woodbine, in Georgia Militia District No. 31, Camden County, Georgia. The nearest major cities are Jacksonville, Florida (30 miles southwest) and Brunswick, Georgia (15 miles north). The Satilla River and Todd Creek are north of the site; the Cumberland River, Floyd Creek, and the Bayer CropScience property are southeast of the facility; and the Sea Island Land Company owns property west of the facility. Figure 1-1 is a regional map showing the facility location. The Phase II MEC RFI addressed three MRAs (Figure 1-2).

1.5 Site Description

1.5.1 Topography

The facility is in the Atlantic Coastal Plain Physiographic Province on flat uplands on a point known as Floyds Neck. The topography is generally flat with slight depressions and shallow drainage ways. Adjacent rivers, Todd Creek, Floyd Basin, and Cumberland River, have eroded steep banks. The facility grounds contain few natural streams. Stormwater is controlled by culverts located along the roadways. There are several depressions and seasonally flooded areas throughout the upland areas. The elevations of the MRAs range between 10 and 25 feet above mean sea level.

1.5.2 Vegetation

The MRAs are mostly heavily forested, consisting of either hardwoods or pines. The majority of the pines are planted in rows. Undergrowth in all of the forests is thin to moderate brush.

1.5.3 Geology

The facility is in the Barrier Island Sequence District of the Atlantic Coastal Plain Physiographic Province. The Barrier Island Sequence is a series of barrier islands and salt marsh deposits, deposited during Pleistocene sea level changes. The facility is situated on the Princess Anne terrace complex. The terrace deposits consist of a mantle of undifferentiated surficial sands and the underlying Satilla Formation. The Satilla Formation consists of variably fossiliferous, shelly sands and clays of offshore, inner shelf origin; bedded and non-bedded barrier island deposits; and marsh deposits. The Satilla Formation,

exposed at areas of bank erosion mentioned above, consists of fine to medium, indistinctly bedded sand overlaying a layer of reddish humate-cemented sandstone (Apex 1996).

The two dominant soil types at the facility are reported as the Mandarin fine sand and Pottsburg sand. The Mandarin fine sand is a deep, somewhat poorly drained, nearly level soil on slight ridges and broad flats. The subsurface soil is underlain by typically 15 inches of an organic hardpan layer. The permeability is rapid (6 to 20 inches per hour) except in the hardpan where the permeability is moderate (0.6 to 20 inches per hour). Mandarin soils are found in the central, south central, and western portions of the property. The Pottsburg sand has characteristics similar to the Mandarin soils. The main difference is the depth and thickness of the hardpan layer which, in the typical soil profile, is at a depth of 63 to 80 inches. Although not listed, the permeability of the hardpan layer is probably similar to the Mandarin soils. Pottsburg soils are found in the eastern and north eastern portions of the property (Apex 1996).

1.6 Site History

In 1962, Thiokol Corporation (Thiokol) purchased the facility property for the production and testing of solid rocket motors for the National Aeronautics and Space Administration (NASA). In 1967, Thiokol began to manufacture orthochlorobenzalmalononitrile (CS) for Edgewood Arsenal, Maryland. This work developed into Thiokol's production of several "deterrent containing" munitions items, including a 40-millimeter (mm) CS round and the XM-15 (CS canister cluster). Later production included M49 trip flares, 81mm mortar illuminating cartridges, and M84A1 fuzes. During the following seven to 8 years, Thiokol continued to operate with sales from two distinct areas, custom toll processing and government contracts for specialty chemicals and munitions items (Thiokol, no date).

On February 3, 1971, an explosion occurred at the Thiokol Chemical Plant. A newspaper article in *The Camden County Tribune* (1971) describes the tragic event as follows: "The Thiokol Chemical Plant... was working on a U.S. Army contract for trip flares (flares that are ignited by an external trigger, normally an enemy soldier approaching a camp's perimeter). Suddenly an explosion leveled one building and damaged three others." Other research indicates that the explosion occurred in Building M132 located on current Bayer CropScience property and places the death toll at 27 and the number injured at 34. The online article states that the building was "shattered" and the blast was felt 50 miles away (Our Georgia History, no date). No information regarding post-explosion evaluations or cleanup activities has been located to date.

In 1976, UCC purchased the property from Thiokol. A UCC subsidiary operated the facility from 1976 to 1986 as an agricultural chemical formulation and manufacturing facility. In December 1986, UCC sold the manufacturing plant and some of the adjacent land to Rhone-Poulenc, which later was renamed Aventis CropScience and then Bayer CropScience. UCC retained ownership of approximately 4,012 acres (the facility). UCC continues operations and maintenance of the landfill. Bayer CropScience owns and operates the adjacent manufacturing facility.

In March 2006, personnel working at the site noted the presence of potential MEC in the area west of the hazardous waste landfill. CH2M HILL munitions response personnel

subsequently were called to the site to inspect the item and recommend an appropriate response. The item was identified as an expended 81mm illumination mortar projectile and was classified as munitions debris (MD), posing no explosive hazard.

During a May 15, 2006, site visit, Milton Lynn, the current site caretaker who has been employed at the site since the 1960s, accounted a site history that involved manufacture and testing of 40mm CS and experimental (XM) CS canisters, 81mm mortar illumination projectiles and M84 fuzes, and M49 trip flares, as well as onsite MEC disposal. Mr. Lynn also indicated that potential MEC items remained onsite despite past remediation efforts.

In 2006 and 2007, CH2M HILL conducted a RCRA facility assessment (RFA) with respect to past use of MEC at the facility (CH2M HILL 2007). Findings of the RFA indicated that MEC associated with historical activity prior to UCC's acquisition of the site was present, but the extent had not been defined.

In February and March 2008, CH2M HILL conducted a Phase I RFI with the purpose of continuing to define the extent of MEC contamination at the facility. Details of the Phase I RFI are presented in Section 1.8.1.

1.7 Current and Projected Land Use

The MRAs are on undeveloped private land owned by UCC. Much of the area is planted in pines. These areas have been logged in the past or are planned to be logged in the future. Future land use is undetermined. UCC is evaluating potential uses for the property. The results of this MEC RFI will be used in that evaluation.

1.8 Previous Site Investigations

1.8.1 Phase I MEC RFI (2008)

A Phase I MEC RFI was conducted in February and March 2008 to provide a preliminary characterization of the extent of MEC over three identified MRAs. The results of the RFI are presented in the Phase I MEC RFI report (CH2M HILL 2009a) and summarized below.

Two-meter-wide transects were established for the performance of surface MEC removal and DGM. Vegetation less than 3 inches in diameter was removed from the transects prior to these activities.

At MRA-2, DGM transects did not cover the entire MRA because the proposed MRA boundaries extended off UCC property to the south and southeast, and the northwestern boundary extended into a wetlands area. During the surface clearance, three 40 mm CS grenades and eighteen 40 mm high explosive (HE) grenades were found in MRA-1 and one M71A2 primer, one M7A1 primer, and five partial M84 fuzes were discovered in MRA-2. No surface MEC was discovered at MRA-3.

After the transects were established and the surface clearance completed, DGM surveys were performed using a man-portable EM61-MK2 time domain electromagnetic metal detector. Surveys along the transects consisted of side-by-side passes, providing a 2-meter-wide footprint. Approximately 5 percent of the land area was covered by the DGM

transects, comprised of the following approximate total transect lengths: 32,000 linear meters at MRA-1; 16,000 linear meters at MRA-2; and 630 linear meters at MRA-3.

A total of 831 geophysical anomalies with the potential to be subsurface MEC were detected along the transects. Of the 831 anomalies identified, 72 percent (597) were found at MRA-1, 26 percent (218) were detected at MRA-2, and 2 percent (16) were present at MRA-3. (QC seed items placed by CH2M HILL are responsible for 30 of the anomalies, with the remainder having unknown sources.)

1.8.2 Other Investigations and MEC Clearances

In addition to the Phase I MEC RFI discussed above, several other environmental investigations and MEC clearances have been performed at this site. The results of these activities are summarized in Table 1-1. Details are provided in the Phase I MEC RFI report (CH2M HILL 2009a).

TABLE 1-1
Summary of Past RFI and MEC Related Activities

Study	Date	Project Objectives	MEC Related Activities
Phase I RFI – SWMUs 02, 03, 04, 05, 06, and 07	1991	Complete soils and groundwater investigation to identify nature and extent of contamination. Included soils sampling at all SWMUs, groundwater wells and sampling at all SWMUs except 02 and 07.	Pre-RFI surface debris removal completed. SWMUs 03, 04, 05, 06, and 07 were swept of visible debris including munitions. Munitions-related items were found in SWMUs 03 and 07. Munitions were not discovered in SWMUs 05 and 06.
Phase II RFI	1996	Collect additional information to address GAEPD comments to Phase I. Included background soils samples at all SWMUs, limited geophysical investigation at SWMUs 03, 06, and 07; collect subsurface soil samples at SWMUs 03, 04, 06 and 07; install wells at SWMU 03 and sample monitoring wells and 03, 04, 05, 06, and 07; complete test pitting at SWMUs 03, 06, and 07; and identify, remove and deactivate UXO.	Surface MEC removal only at SWMUs 03 and 07. Recommended additional surface/subsurface removal.
Expanded Phase II RFI	1996 and 1997	Address GAEPD comments by resampling wells with an improved methodology, complete additional surface MEC removal at SWMU 03, complete additional soil borings at SWMUs 04 and 06.	Surface and subsurface munitions and debris removal at SWMUs 03 and 07 and UXO avoidance in support of other remediation activities.
RCRA Facility Assessment	2006 and 2007	Archival review of past uses of MEC at the site and to evaluate the site's suitability for future land use.	Visual site inspection confirmed the presence of surface and subsurface MD.
Phase I MEC RFI	2008	Collect data on the presence of surface MEC and collect geophysical data at three MRAs to aid in the characterization of the extent of MEC contamination and to provide data for later investigations.	Surface MEC removal and DGM in transects covering approximately 5 percent of each of three MRAs.

1.9 Identification of Munitions Response Areas

Three MRAs were identified for investigation during the Phase I and Phase II MEC RFIs. These MRAs are shown on Figure 1-2 and described below.

1.9.1 MRA-1 – Former 40mm Test Range/SWMU 03 and Former 81mm Test Range

A visual inspection during the 2006 MEC RFA identified surface MEC within the bounds of a former 40mm test range. MEC identified in this area included 40mm CS and 40mm HE grenades.

Three previous surface and subsurface MEC clearances within the bounds of the former 40mm test range were intended to clear specific areas of MEC hazards to facilitate the investigation of the nature and extent of chemical contamination. They were not designed to characterize the nature or extent of MEC hazards.

The Phase I MEC RFI confirmed the presence of surface MEC at MRA-1, which consisted of 40mm CS and 40mm HE grenades. The locations of most surface MEC were consistent with the historical use of the 40mm test range, as all but one MEC item was discovered within or near the boundaries of the 40mm test range, or near the assumed firing point for the range. One surface MEC item was discovered well outside the boundaries of the former 40mm test range, near Todd Creek. This MEC could be the result of firing 40mm grenades in a direction away from the former 40mm test range impact area, or could have been transported to this location by a site worker or trespasser who discovered the item elsewhere.

81mm mortars were reported to have been test fired in the vicinity of the former 81mm test range. MEC in the form of mortar fuzes have on occasion been found on the property by the site caretaker. The potential for MEC within the vicinity of the area identified as the former 81mm mortar range was deemed possible, given that this area was not previously characterized. However, no surface MEC associated with the 81mm mortar range was found during the Phase I MEC RFI.

The landfill is excluded from the investigation of MRA-1. The cap was placed after the period during which the test ranges were active. Also, although it is possible that MEC is buried in the landfill, non-intrusive investigation technologies do not allow for the discrimination between MEC and other metallic debris that may be present beneath the cap. Confirmation of MEC would require removing portions of the landfill cap.

No documentation has been identified through historical records review that identifies the specific practices that were followed during historical test firing of munitions and disposal of waste munitions on the facility property. In absence of these kinds of operational records, potential areas of interest for MEC have been identified through personnel interviews, visual site inspection, and the application of standard 40mm and 81mm mortar range surface danger zones.

1.9.2 MRA-2 – Former MEC Disposal Area/SWMU 07

The history of site operations suggests MEC ejection or kickout occurred during past waste munitions disposal activities at SWMU 07. Additionally, the limitations of historical MEC removal activities in this area suggest residual MEC in heavily vegetated areas and mounds may be present. Because of the dense vegetation and thick ground cover and limitations of the visual site inspection, the presence or absence of MEC could not be confirmed during the 2006 MEC RFA visual inspection.

The Phase I MEC RFI confirmed the presence of surface MEC at MRA-2. Surface MEC consisted of one M71A2 primer, one M7A1 primer, and five partial M84 fuses. The locations of the surface MEC were consistent with the history of the site's use for munitions demolition in the center of the site, as most items were found in the demolition area or within a distance that would be expected to receive kickouts from the demolition area.

1.9.3 MRA-3 – Former Scrap Metal Surface Disposal Area/SWMU 01

A visual site inspection conducted in 2006 for the MEC RFA identified surface and subsurface MD in the vicinity of the hazardous waste landfill access road in the area encompassing the original SWMU 01. However, no surface MEC was discovered at MRA-3 during the Phase I MEC RFI.

Field Investigation Summary

2.1 Overall Approach to Munitions Response Activities

This Phase II MEC RFI was conducted as a follow-up to the geophysical characterization performed during the Phase I MEC RFI. The Phase II effort was conducted to investigate the nature and extent of subsurface MEC at three identified MRAs. This information will be used to appropriately address MEC liability at the facility and will be factored into decisions about appropriate future land management and property uses.

2.2 Site Preparation

Vegetation less than 3 inches in diameter was removed from the investigation transects during the Phase I MEC RFI field effort to allow access for DGM and surface clearance activities. Where necessary, regrown vegetation was removed from the transects for the Phase II MEC RFI field effort to allow access for surveying and intrusive investigation teams. Transect locations are shown on Figure 2-1.

Vegetation removal was conducted by East Coast Land Improvement of Swansboro, North Carolina. MEC avoidance was conducted by a CH2M HILL UXO technician.

2.3 MEC Intrusive Investigation

2.3.1 Anomaly Reacquisition/Intrusive Investigation

Geophysical anomalies identified in the Phase I MEC RFI as representing potential subsurface MEC were reacquired by ARC Surveying, Inc. of Jacksonville, Florida, a Georgia-licensed professional land surveyor. Each anomaly was marked with a pin flag labeled with the corresponding anomaly identification. The geophysical anomaly locations are shown on Figure 2-1.

Geophysical anomalies within a 1-meter radius of the flagged anomaly location were located using Schonstedt GA-52CX magnetometers and White's electromagnetic metal detectors. (Magnetometers detect only ferrous metals while electromagnetic metal detectors detect both ferrous and non-ferrous metals.) Individual geophysical anomalies were excavated by UXO technicians using hand-excavation tools in accordance with the procedures in the Phase II MEC RFI work plan (CH2M HILL 2009b). Excavation was conducted to a maximum depth of 2 feet.

2.3.2 Removal Verification

After intrusive investigation of an anomaly location, the holes were left open to the depth investigated to allow inspection by the UXO QC specialist. A minimum of 10 percent of the intrusively investigated anomaly locations were inspected using an EM-61-MK2 metal

detector, the instrument used to collect the original data, to determine whether detectable metallic items within a 1-meter radius of the hole had been removed. The locations checked were distributed in a spatially representative sample across each MRA. If anomalies were found to remain, UXO technicians reinvestigated the anomaly location. The results of the removal verification are presented in Section 4.

2.3.3 MEC Identification, Removal, and Disposal

UXO personnel demilitarized MEC items using blow-in-place (BIP) procedures by countercharging these items with an explosive donor charge and detonating the donor charge. MD received two 100 percent independent inspections by UXO-qualified personnel who certified that the material was free of explosive hazards. Inspections were documented on U.S. Department of Defense Form 1348-1A.

Investigation Results

3.1 MRA-1 – Former 40mm Test Range/SWMU 03 and Former 81mm Test Range

The Phase I MEC RFI at MRA-1 identified 597 geophysical anomalies, including 29 QC items (19 QC seeds and 10 geophysical prove-out test plot items), that represented potential subsurface MEC. Excavation of these anomalies during the Phase II MEC RFI resulted in the discovery of 26 subsurface munitions-related items that were material potentially presenting an explosive hazard (MPPEH). Table 3-1 identifies the MPPEH items along with the type of filler, the fuzed status, and the quantity of each type of item.

TABLE 3-1
Summary of MPPEH Recovered at MRA-1

Item Comment	Filler	Fuzed	Quantity
Grenade, 40mm, Canister, XM-15	Empty	N/A	9
Grenade, 40mm, Canister, XM-15	CS	N/A	1
Grenade, 40mm, M406	HE	Yes	7
Grenade, 40mm, M406	HE	No	4
Grenade, 40mm, M406	Empty	No	3
Grenade, 40mm, M406, Component	Empty	N/A	1
Mortar 81mm Illum, M301, Component	Empty	N/A	1

These items were found at 20 anomaly locations, which are shown on Figure 3-1 and identified in Table 3-2 along with the type of filler, fuzed status, and quantity at each location. Sixteen of the MPPEH items were classified as MEC, requiring BIP explosive demolition. These items were found at 13 anomaly locations. The following types and quantities of subsurface MEC were discovered and BIP at MRA-1:

- Grenade, 40mm, M406, HE filler, Fuzed (7)
- Grenade, 40mm, M406, HE filler, Unfuzed (4)
- Grenade, 40mm, M406, No filler, Unfuzed (3)
- Grenade, 40mm, M406, Component, No filler (1)
- Grenade, 40mm, Canister, XM-15, CS filler (1)

Descriptions of the MPPEH items are provided in Section 5.2.

TABLE 3-2
Locations of MPPEH Recovered at MRA-1

Anomaly ID	Filler	Fuzed	Item	Quantity	Demolition Required
MRA1-T16-00001	Empty	N/A	Grenade, 40mm, Canister, XM-15	1	
MRA1-T46-00004	HE	Yes	Grenade, 40mm, M406	1	X
MRA1-T52-00040	HE	Yes	Grenade, 40mm, M406	1	X
MRA1-T52-00043	Empty	N/A	Grenade, 40mm, Canister, XM-15	1	
MRA1-T52-00054	Empty	N/A	Mortar 81mm Illum, M301, Component	1	
MRA1-T52-00080	Empty	N/A	Grenade, 40mm, Canister, XM-15	1	
MRA1-T52-00089	Empty	N/A	Grenade, 40mm, Canister, XM-15	1	
MRA1-T53-00008	HE	Yes	Grenade, 40mm, M406	1	X
MRA1-T53-00013	HE	Yes	Grenade, 40mm, M406	1	X
MRA1-T53-00019	HE	No	Grenade, 40mm, M406	1	X
MRA1-T84-00033	Empty	No	Grenade, 40mm, M406	3	X
MRA1-T84-00043	HE	Yes	Grenade, 40mm, M406	2	X
MRA1-T84-00051	Empty	N/A	Grenade, 40mm, Canister, XM-15	2	
MRA1-T84-00051	CS	N/A	Grenade, 40mm, Canister, XM-15	1	X
MRA1-T84-00057	HE	No	Grenade, 40mm, M406	1	X
MRA1-T84-00068	Empty	N/A	Grenade, 40mm, Canister, XM-15	3	
MRA1-T85-00002	HE	No	Grenade, 40mm, M406	1	X
MRA1-T86-00012	HE	No	Grenade, 40mm, M406	1	X
MRA1-T86-00021	Empty	N/A	Grenade, 40mm, M406, Component	1	X
MRA1-T86-00028	HE	Yes	Grenade, 40mm, M406	1	X

3.2 MRA-2 – Former MEC Disposal Area/SWMU 07

The Phase I MEC RFI at MRA-2 identified 218 geophysical anomalies, including 10 QC items that represented potential subsurface MEC. Excavation of these anomalies during the Phase II MEC RFI resulted in the discovery of eight subsurface munitions-related items that were MPPEH. Table 3-3 identifies the MPPEH items along with the type of filler, the fuzed status, and the quantity of each type of item.

TABLE 3-3
Summary of MPPEH Recovered at MRA-2

Item Comment	Filler	Fuzed	Quantity
Flare, Surface Trip, M49, Component	N/A	No	2
Fuze, M84, PTT, Component	Functioned	N/A	5
Mortar primer/initiator	Functioned	N/A	1

These items were found at eight anomaly locations, which are shown on Figure 3-1 and identified in Table 3-4 along with the type of filler, fuzed status, and quantity at each location. None of the MPPEH at MRA-2 was classified as MEC, so no explosive demolition operations were performed at this MRA. Descriptions of the MPPEH items are provided in Section 5.2.

TABLE 3-4
Locations of MPPEH Recovered at MRA 2

Anomaly ID	Filler	Fuzed	Item Comment	Quantity
MRA2-T06-00002	Functioned	N/A	Fuze, M84, PTT, Component	1
MRA2-T10-00006	N/A	No	Flare, Surface Trip, M49, Component	1
MRA2-T10-00027	Functioned	N/A	Mortar Primer/Initiator	1
MRA2-T11-00013	Functioned	N/A	Fuze, M84, PTT, Component	1
MRA2-T17-00002	Functioned	N/A	Fuze, M84, PTT, Component	1
MRA2-T24-00021	N/A	No	Flare, Surface Trip, M49, Component	1
MRA2-T24-00024	Functioned	N/A	Fuze, m84, PTT, Component	1
MRA2-T24-00029	Functioned	N/A	Fuze, m84, PTT, Component	1

3.3 MRA-3 – Former Scrap Metal Surface Disposal Area/ SWMU 01

The Phase I MEC RFI at MRA-3 identified 16 geophysical anomalies, including one QC item that represented potential subsurface MEC. Excavation of these anomalies during the Phase II MEC RFI resulted in the discovery of no subsurface munitions-related items.

Quality Control

An extensive QC program was implemented for the project work and included:

- Geophysical instrument QC tests
- Anomaly source removal verification
- Recovery of QC Seed items in the survey area

4.1 Quality Control Tests

The instrument QC tests outlined in the geophysical investigation plan (CH2M HILL, 2009b) were performed on a daily basis, and no quality issues were observed.

4.2 MEC Removal Verification

QC inspections were performed on randomly selected anomaly locations at each MRA. At MRA-1, QC checks were performed on 79 of the 597 anomalies (13 percent) to evaluate the effectiveness of the dig teams in finding the sources of the geophysical anomalies. At MRA-2, 48 of 218 (22 percent) anomalies were QC checked. At MRA-3, two of 16 (13 percent) anomalies were QC checked.

No subsurface MPPEH was found during the QC checks, indicating that the intrusive investigation methodology was effective in discovering subsurface MPPEH in the locations that were investigated.

4.3 QC Seed Items

A total of 30 QC seeds, comprised of 6- to 18-inch pieces of steel fence posts, were emplaced at varying locations and depths (up to 2 feet below ground surface) along the transects to be surveyed before performing the DGM surveys. The QC seeds were visible in the data provided to CH2M HILL by NAEVA Geophysics, Inc. (NAEVA) and were selected as geophysical anomalies during NAEVA's interpretation of the data. The locations of the seeds were unknown to the dig teams. All of the QC seeds were found during the intrusive investigation.

Conclusions and Recommendations

5.1 Conclusions

5.1.1 MRA-1 – Former 40mm Test Range/SWMU 03 and Former 81mm Test Range

Approximately 5 percent of MRA-1 was investigated for surface and subsurface MEC during the Phase I and Phase II MEC RFIs. MEC was identified both on the surface and within 2 feet below ground surface. The locations of both surface and subsurface MEC are shown on Figure 5-1.

All MEC and MD were related to 40mm grenades and 81mm mortars, consistent with historical information on the site.

The majority of the MEC and MD items were concentrated on the north end of MRA-1 in the area of the Former 40mm test range. The distribution of MEC and MD in this area is relatively consistent between surface and subsurface locations. The locations of most surface MEC were consistent with the historical use of the 40mm test range, as all but one MEC item was discovered within or near the boundaries of the 40mm test range, or near the assumed firing point for the range.

One surface MEC item was discovered well outside the boundaries of the former 40mm test range, near Todd Creek. This MEC could be the result of firing 40mm grenades in a direction away from the former 40mm test range impact area, or could have been transported to this location by a site worker or trespasser who discovered the item elsewhere.

Two MEC items were located in the south side of MRA-1 along the centerline of the former 81mm mortar test range. No surface MEC was found in this area.

Based on the distribution of MEC and MD within and close to the supposed firing points and firing ranges, with the exception of one MEC item found on the surface near Todd Creek, it may be concluded that the boundaries of MRA-1 have been adequately defined as currently drawn.

5.1.2 MRA-2 – Former MEC Disposal Area/SWMU 07

Approximately 5 percent of MRA-2 was investigated for surface and subsurface MEC during the Phase I and Phase II MEC RFIs. MEC was identified both on the surface and within 2 feet below ground surface. The locations of both surface and subsurface MEC are shown on Figure 5-1.

The locations of both surface and subsurface MEC and MD were consistent with the history of the site's use for munitions demolition in the center of the site, as most items were found in the demolition area, or within a distance that would be expected to receive kickouts from

the demolition area. The majority of the MEC and MD items were located in the center of the MRA-2 area, and no MEC was found near the boundaries of MRA-2.

Based on the distribution of MEC and MD at and near the supposed demolition area, it may be concluded that the boundaries of MRA-2 have been adequately defined as currently drawn.

5.1.3 MRA-3 – Former Scrap Metal Surface Disposal Area/SWMU 01

Approximately 5 percent of MRA-3 was investigated for surface and subsurface MEC during the Phase I and Phase II MEC RFIs. No MEC or MD was discovered on the ground surface or in the subsurface at MRA-3. Based on the results of the Phase I and Phase II MEC RFIs, it can be concluded that the likelihood of MEC or MD being present at MRA-3 is low.

5.2 Recommendations

5.2.1 MRA-1 – Former 40mm Test Range/SWMU 03 and Former 81mm Test Range

No further field investigations are recommended at MRA-1.

Based on the results of the Phase I and Phase II MEC RFIs, the performance of a corrective measures study (CMS) is recommended. The CMS should include an evaluation of risk posed by both surface and subsurface MEC under current and future use scenarios. Consideration should also be given to reducing the boundaries of the MRA based on the distribution of MEC and MPPEH.

5.2.2 MRA-2 – Former MEC Disposal Area/SWMU 07

No further field investigations are recommended at MRA-2.

Based on the results of the Phase I and Phase II MEC RFIs, the performance of a CMS is recommended. The CMS should include an evaluation of risk posed by both surface and subsurface MEC under current and future use scenarios. Consideration should also be given to reducing the boundaries of the MRA based on the distribution of MEC and MPPEH.

5.2.3 MRA-3 – Former Scrap Metal Surface Disposal Area/SWMU 01

Based on the results of the Phase I and Phase II MEC RFIs, which found no MEC or MPPEH, no further action is recommended at this MRA.

SECTION 6

References

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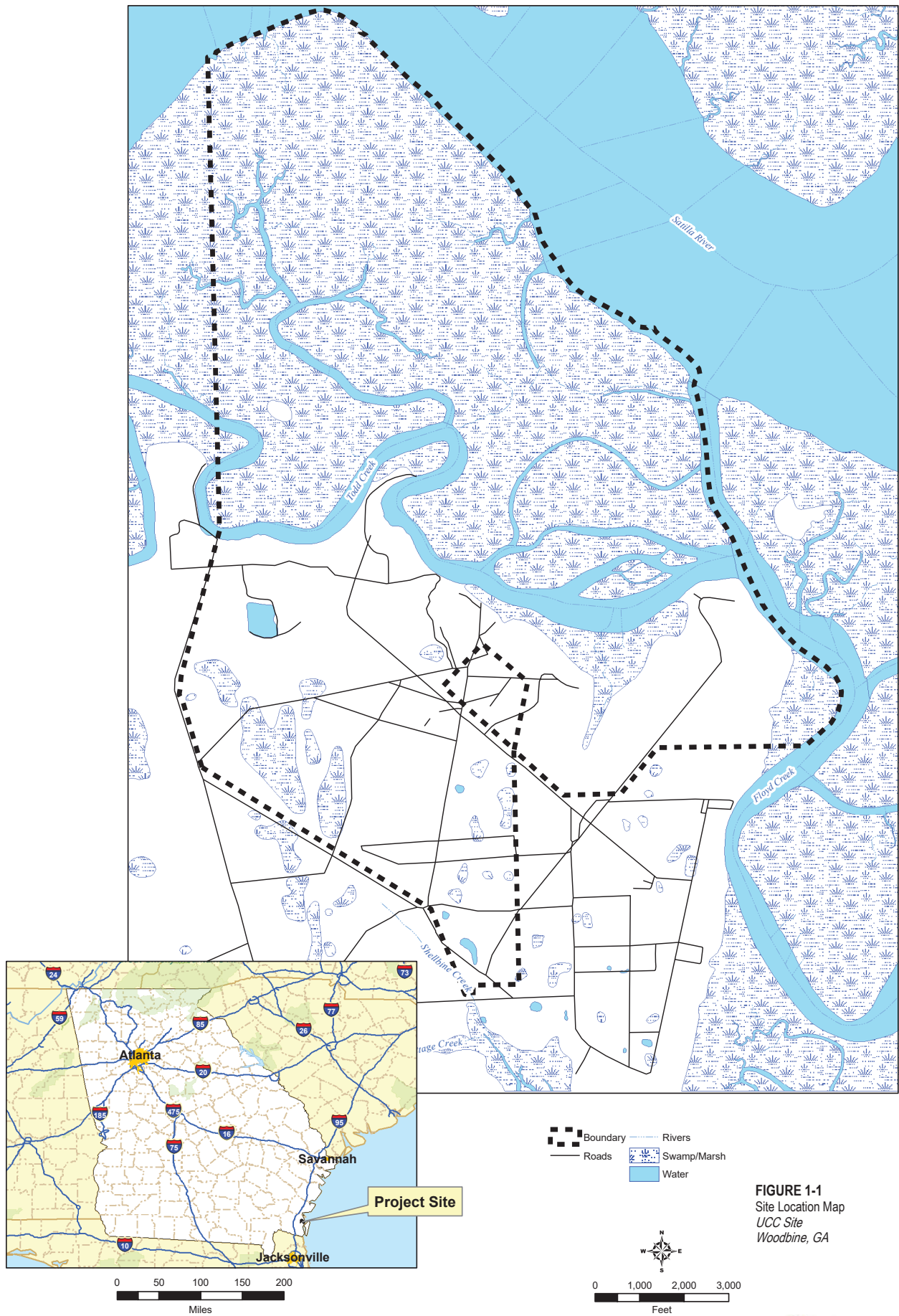
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Figures



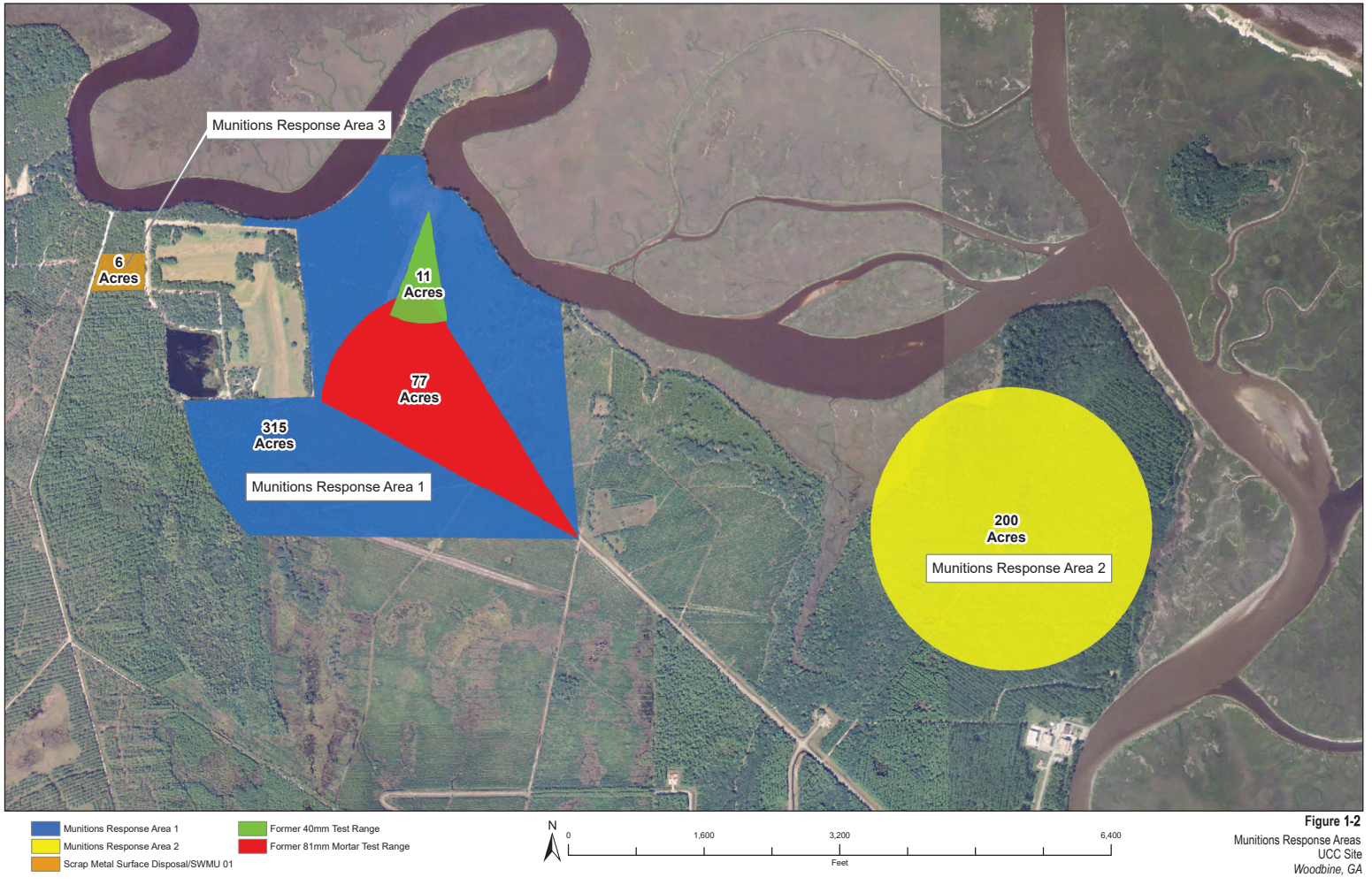


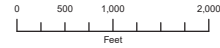


Figure 2-1

MRA Transects and Geophysical Targets
UCC Site
Woodbine, GA



- Geophysical Anomaly
- MRA Transect
- Former 40mm Test Range
- Former 81mm Mortar Test Range
- 81mm Range Buffer Zone
- Former Open Burning/Open Detonation Area



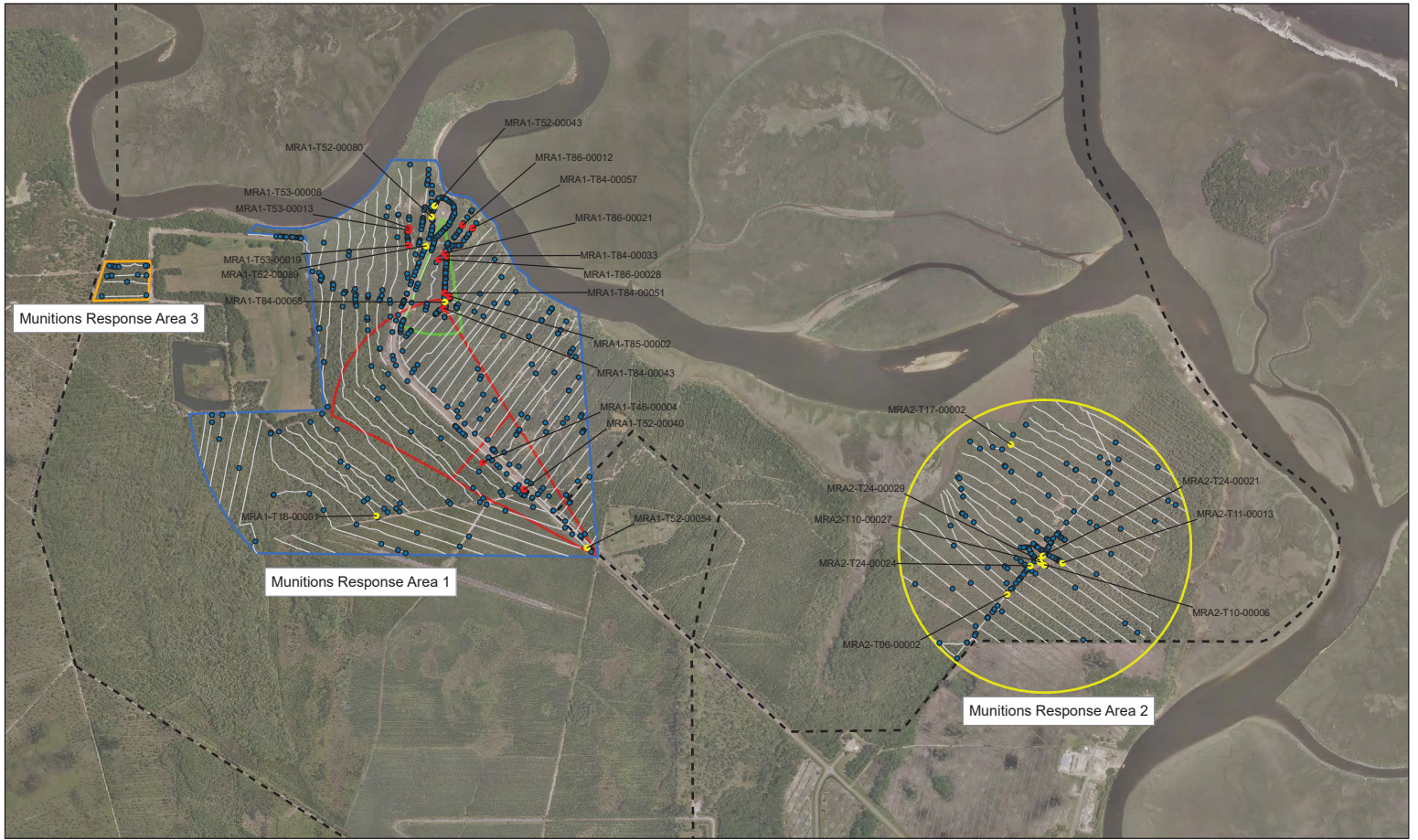
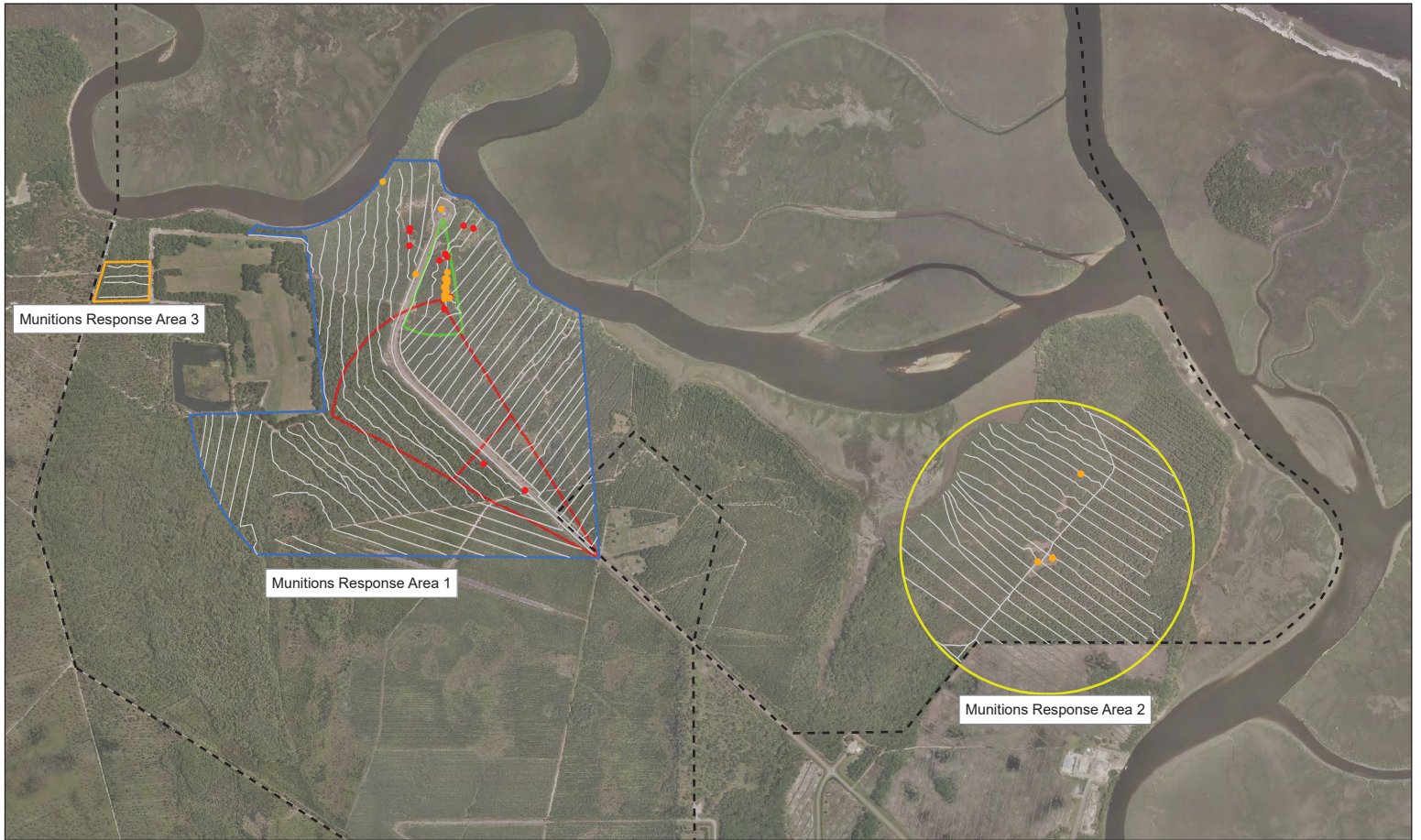


Figure 3-1

Phase II MEC RFI Results
UCC Site
Woodbine, GA



- Surface MEC (Phase I RFI)
- Subsurface MEC (Phase II RFI)
- MRA Transect
- - - Site Boundary
- Former 40mm Test Range
- Former 81mm Mortar Test Range
- Munitions Response Area 1
- Munitions Response Area 2
- Scrap Metal Surface Disposal/SWMU 01

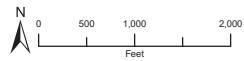


Figure 5-1
Phase I and Phase II MEC RFI Investigation Results
UCC Site
Woodbine, GA