

**Final Proposed Plan, Revision 2  
for  
Camp Butner  
Formerly Used Defense Site (FUDS) Projects I04NC000902, 04, 05, 06, 07, 08, 09, 10 and 11**

**FORMER CAMP BUTNER  
GRANVILLE, PERSON, AND DURHAM COUNTIES,  
NORTH CAROLINA**

**Prepared for:**



**US Army Corps  
of Engineers®**

**U.S. Army Corps of Engineers  
U.S. Army Engineering and Support Center, Huntsville**

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## 1.0 INTRODUCTION

This **Proposed Plan**<sup>1</sup> is being presented by the U.S. Army Corps of Engineers (USACE)<sup>2</sup> to facilitate public involvement to review and comment on the **Preferred Alternative** recommendation for multiple areas within the Camp Butner FUDS Munitions Response Area (MRA), Project 02 (Figure 1).

USACE is issuing this plan as a part of its public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**, also known as **Superfund**, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Public comments on the **Proposed Plan** will be accepted during a public review and comment period. USACE, in coordination with affected stakeholders and supporting agencies, will review public comments and make a recommendation concerning future action to be taken at the MRSs.

USACE is the lead agency for investigating, reporting, making remedial decisions, and taking remedial actions at the MRSs. The regulatory agency is the North Carolina Department of Environmental Quality (NCDEQ). NCDEQ concurs with the recommendations presented in this Proposed Plan.

The MRA discussed in this plan was investigated during the **Remedial Investigation (RI)** with focus on multiple Areas of Interest (AOIs). The areas investigated during the RI were established as shown in Figure 2. These areas were evaluated during the **Final Feasibility Study (FS)**, completed 2019. As a result of the evaluation, the AOI boundaries were revised, and are proposed as independent Munitions Response

Sites (MRSs) in this Proposed Plan for management efficiency. The proposed MRSs are located within the boundaries of the former Camp Butner FUDS, is located in Granville, Person, and Durham counties, North Carolina. The general locations of the Camp Butner FUDS and the nine proposed MRSs are shown

USACE invites the public to become involved in the process of finalizing the proposed remedy for this site. Local community members and other interested parties are encouraged to review the Proposed Plan and submit comments. Public comments are considered before any action is selected and approved.

**Public Comment Period:** USACE will accept written comments on the Proposed Plan during the public comment period. The public comment period will be between **March 26 and April 30, 2018.**

**Public Meeting: April 16, 2018**

USACE will hold a public meeting to explain the Proposed Plan, during which oral and written comments will be encouraged. The meeting will be held at:

Butner Town Hall  
Multi-Purpose Room  
415 Central Avenue  
Butner, North Carolina  
6:00 p.m. to 8:00 p.m.

**For more information, see the Administrative Record file at the following location:**

South Granville Public Library  
1550 S Campus Drive  
Creedmoor, NC 27522  
(919) 582-1752  
<http://www.granville.lib.nc.us/>

Hours of Operation:  
Monday–Friday: 10:00 a.m.–8:00 p.m.  
Saturday: 12:00 p.m.–5:00 p.m.  
Sunday: Closed

<sup>1</sup> The terms used in this Proposed Plan that appear in **bold type** are defined in the Glossary at the back of this document.

<sup>2</sup> A list of acronyms and abbreviations used in this Proposed Plan is presented following the Glossary at the back of this document.

in Figure 3. The rationale for the revisions to the MRS names and boundaries are described in the Final FS (HGL, 2019) and are described in Table 1.

The RI concluded no unacceptable risk at a portion of the MRA, which is comprised of areas surrounding the MEC contaminated and buffer areas. Because there was no MEC contamination, no remedial alternatives were evaluated for MRS-09 in the FS, and no remedial action is recommended in this Proposed Plan. The remainder of this Proposed Plan addresses areas within the Camp Butner FUDS where an unacceptable risk was determined to be present.

This Proposed Plan summarizes the remedial alternatives evaluated in the **Final FS** for the MRSs (HGL, 2019) and presents the Preferred Alternative for the remedial response for each MRS. The Preferred Alternative addresses the unacceptable risk due to the presence of **munitions and explosives of concern (MEC)** contamination identified during the **RI** (HGL, 2016) and previous investigations. There was no unacceptable risk from **munitions constituents (MC)** contamination identified during the RI. The remedial alternatives for the MEC-contaminated areas (eight MRSs) within the Camp Butner FUDS (see Table 1 and Figure 3) are presented in this document for public review. The delineation of Project 02 is as follows:

Project	Name	Acreage	MRS ID (FS)
02	NFA Areas	7,148	09
04	Military Training Buffer Area	391	02
05	Buffer Area	924	03
06	Central MEC Contaminated Area	2,202	04
07	Northern MEC Contaminated Area	1,807	05
08	Eastern MEC Contaminated Area	1,451	06
09	Western MEC Contaminated Area	1,385	07
10	South MEC Contaminated Area	1,179	08
11	Military Training MEC Contaminated Area	1,429	01
<b>Total MRA Acreage</b>		<b>17,915</b>	

MRS-01 includes MEC contaminated areas which are currently used for National Guard small arms training.

MRS-02 includes buffer areas which are currently used for National Guard small arms training.

MRS-03 includes all other buffer areas not used for National Guard small arms training.

MRS-04, 05, 06, 07, and 08 are separate MEC contaminated areas divided by geographic location and/or munition types.

Additional information on the depth of the explosive hazards identified in each proposed MRS are included in Section 2.2.1 and Table 1.

This Proposed Plan is part of the USACE community relations program and is a requirement of Section 117(a) of CERCLA. This Proposed Plan will be followed by a **Decision Document** for each of the proposed MRSs. The Decision Document will select the Final Remedy for the proposed MRSs. USACE responses to public comments on this Proposed Plan will appear in the “Responsiveness Summary” section of the future Decision Document.

## 2.0 SITE BACKGROUND

Camp Butner was used for various military training activities from 1942 to 1946. Following World War II; the camp was closed; limited ordnance clearances were performed; and the property was conveyed to the Army National Guard (ARNG), the State of North Carolina, local municipalities, and private owners. Camp Butner is located about 15 miles north of Durham, North Carolina, and encompasses approximately 40,384 acres in Granville, Person, and Durham counties.

The ARNG property is eligible for FUDS and is not considered a PRP because the ARNG

**Table 1. Proposed Munitions Response Sites and Remedial Action Objectives**

Proposed MRS/Project #	Acreage	MRS Description	Remedial Action Objective / Land Use Description	Munitions Present / Depth	Description of Explosive Hazard Risk	Explosive Hazard Risk
01/11	1,429	Military Training MEC Contaminated	Mitigate the unacceptable risk of an incident to occur for ARNG users over 1,429 acres to the detection depths of the applicable munitions of concern listed in Tables 2 and 3 such that a determination can be made that there is a negligible risk of an incident to occur. /  This MRS is military land use only.	3.25-inch Target Rocket; 30 mm HE projectile (expended); 37 mm projectile; 57 mm projectile; 57 mm projectile (AP-T, HE); 60 mm HE mortars and debris (fins, frag, tail boom, expended fuze); 75 mm projectile (base); 81 mm mortar (fin, frag, tail boom); 155 mm projectile; Hand grenade; Rifle grenade (M9, illumination-spent, frag); Slap flare; T-bar fuze; unidentifiable fragmentation debris; and unidentifiable types of mortar debris  MEC present to 18-inches bgs	MEC and significant quantities of MD confirmed.  Access to this MRS is controlled and the receptors receive education from the National Guard concerning the explosive hazards which are present.	Unacceptable
02/04	391	Military Training Buffer Area	Mitigate the unacceptable risk of an incident to occur for ARNG users over 391 acres to the detection depths of the applicable munitions of concern listed in Tables 2 and 3 such that a determination can be made that there is a negligible risk of an incident to occur./  This MRS is military land use only.	60 mm mortar (fins, frag, tail boom, expended fuze) and unidentifiable fragmentation debris  MD present to 40-inches bgs	MD only confirmed.  Access to this MRS is controlled and low quantities of MD, only (no MEC), were identified in this MRS.	Unacceptable

**Table 1. Proposed Munitions Response Sites and Remedial Action Objectives (cont.)**

Proposed MRS/Project #	Acreage	MRS Description	Remedial Action Objective/Land Use Description	Munitions Present/Depth	Description of Explosive Hazard Risk	Explosive Hazard Risk
03/05	923	Buffer Area	<p>Mitigate the unacceptable risk of an incident to occur for human receptors over 924 acres to the detection depths of the applicable munitions of concern listed in Tables 2 and 3 such that a determination can be made that there is a negligible risk of an incident to occur./</p> <p>This MRS includes residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use.</p>	<p>37 mm projectile; 57 mm projectile (AP-T, HE); 75 mm projectile base; and unidentifiable fragmentation debris</p> <p>MD present to 40-inches bgs</p>	<p>MD only confirmed.</p> <p>Low quantities of MD, only (no MEC), were identified in this MRS.</p>	Unacceptable
04/06	2,202	Central MEC Contaminated	<p>Mitigate the unacceptable risk of an incident to occur for human receptors over the entire proposed MRS to the detection depths of the applicable munitions of concern listed in Tables 2 and 3 such that a determination can be made that there is a negligible risk of an incident to occur. /</p> <p>These MRSs include residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use.</p>	<p>105 mm (MK1, HE); 155 mm (projectile, rotating band); 2.36-inch rocket and warhead; 37 mm projectile; 60 mm Mortar, 81 mm Mortar and fin, frag, tail boom debris; Rifle grenade (illumination-spent, frag); T-bar fuze and unidentifiable fragmentation debris</p> <p>MD present to 32-inches bgs</p>	<p>MEC and significant quantities of MD confirmed.</p> <p>These MRSs contain an unacceptable risk of exposure of humans to explosive hazards due to the presence of DoD military munitions, confirmed to be MEC, identified during the RI.</p>	Unacceptable



**Table 1. Proposed Munitions Response Sites and Remedial Action Objectives (cont.)**

Proposed MRS/Project #	Acreeage	MRS Description	Remedial Action Objective/Land Use Description	Munitions Present/Depth	Description of Explosive Hazard Risk	Explosive Hazard Risk
05/07	1,807	Northern MEC Contaminated	<p>Mitigate the unacceptable risk of an incident to occur for human receptors over the entire proposed MRS to the detection depths of the applicable munitions of concern listed in Tables 2 and 3 such that a determination can be made that there is a negligible risk of an incident to occur. /</p> <p>These MRSs include residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use.</p>	<p>105 mm (MK1, HE); 2.36-inch rocket; 37 mm projectile; 40 mm projectile (expended); 57 mm projectile (AP-T, HE); 60 mm mortar; 81 mm mortar; 155 mm projectile rotation band; MKII HE and TP Hand Grenade; M9 Rifle grenade; T-bar fuze; and unidentifiable fragmentation debris</p> <p>MEC present to 6-inches bgs</p>	<p>MEC and significant quantities of MD confirmed.</p> <p>These MRSs contain an unacceptable risk of exposure of humans to explosive hazards due to the presence of DoD military munitions, confirmed to be MEC, identified during the RI.</p>	Unacceptable
06/08	1,451	Eastern MEC Contaminated		<p>2.36-inch rocket; 37 mm projectile; 40 mm expended projectile; 57 mm projectile; 60 mm mortar; 75 mm projectile base; 81 mm Mortar; 105mm projectile rotation band; MKII HE and TP Hand Grenade; M9 Rifle grenade; T-bar fuze; and unidentifiable fragmentation debris;</p> <p>MEC present to 6-inches bgs</p>		
07/09	1,385	Western MEC Contaminated		<p>2.36-inch rocket warhead; 37 mm projectile; 40 mm expended projectile; 57 mm projectile; 57 mm projectile (AP-T, HE); 105 mm (MK1, HE); 155 mm projectile (rotating band); Hand grenade; and unidentifiable fragmentation debris; MEC present to 6-inches bgs</p>		

**Table 1. Proposed Munitions Response Sites and Remedial Action Objectives (cont.)**

<b>Proposed MRS/Project #</b>	<b>Acreage</b>	<b>MRS Description</b>	<b>Remedial Action Objective/Land Use Description</b>	<b>Munitions Present/Depth</b>	<b>Description of Explosive Hazard Risk</b>	<b>Explosive Hazard Risk</b>
08/10	1,179	Southern MEC Contaminated	<p>Mitigate the unacceptable risk of an incident to occur for human receptors over the entire proposed MRS to the detection depths of the applicable munitions of concern listed in Tables 2 and 3 such that a determination can be made that there is a negligible risk of an incident to occur. /</p> <p>These MRSs include residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use.</p>	<p>2.36-inch rocket warhead; 37 mm projectile; 105 mm (MK1, HE), 57 mm projectile; 60 mm Mortar; 75 mm projectile base; 81 mm Mortar and fin, frag, tail boom debris; 155 mm projectile (rotating band); Hand grenade; Grenade pins and spoons, M1 Mine Spotting Charge, M1A1 Mine and Practice Landmine, M1A1 Smoke Cartridge, M9 Rifle Grenade, Smoke Grenade (expended), Smoke Grenade frag, Smoke Pot, WP Grenade, and unidentifiable fragmentation debris</p> <p>MEC present to 32-inches bgs</p>	<p>MEC and significant quantities of MD confirmed.</p> <p>These MRSs contain an unacceptable risk of exposure of humans to explosive hazards due to the presence of DoD military munitions, confirmed to be MEC, identified during the RI.</p>	Unacceptable
09/02	7,148	The area within the FUDS property not part of a recommended MEC contaminated area from the RI Report. This area includes the Hand Grenade Range and the Gas Chamber (used for tear gas training),		None	None	Acceptable
<b>Total</b>	<b>17,915</b>					

installation has only been used for small arms (since transfer of the property by Department of Defense (DoD)) and was documented by a memorandum for record (14 June 2012) located on FRMD (I04NC000902\_03.01\_0507) and Savannah District Real Estate documentation (I04NC000902\_01.01\_0002).

## 2.1 HISTORY

Camp Butner was primarily established to train infantry, artillery, and engineering combat troops for development and redeployment overseas during World War II. The installation was active from 1942 until 1946; however, training was only conducted through 1943. The various acres comprising the Camp Butner FUDS were acquired by the War Department by:

- 40,201 acres acquired in fee;
- 128.4 acres acquired in 82 easements;
- 2.5 acres acquired in licenses; and
- 52.4 acres acquired in 26 leased tracts (USACE, 1993).

The installation included approximately 15 live-fire ammunition training ranges, a grenade range, a 1,000-inch range, a gas chamber, and a flame thrower training pad. Munitions used at the site included small arms, 2.36-inch rockets, rifle and hand grenades, 37-millimeter (mm) through 155mm high explosive (HE) projectiles, 60 and 81mm mortars, and antipersonnel practice mines. Training activities also included the use of demolition items such as trinitrotoluene (TNT) and various initiating and priming materials. Though historical documents identified the 240mm HE projectile as previously used at Camp Butner, the historical investigations and results of the RI do not support that this munition is present at this FUDS. Following World War II, the camp was closed, limited ordnance clearances were performed, and the property was conveyed to the ARNG, the State

of North Carolina, local municipalities, and private owners.

A complete history of Camp Butner is presented in the RI (HGL, 2016) and Final FS (HGL, 2019). A summary of previous munitions confirmed to be present at each of the AOI investigated during the RI is presented in Table 2. As summarized in the RI, removal actions, time critical removal actions, geophysical surveys, and intrusive investigations were previously conducted to delineate the areas of potential MEC contamination within the MRSs.

## 2.2 CONTAMINATED MEDIA

### 2.2.1 MEC Contamination

During the RI field activities (October 2012 through May 2013), explosive hazards were confirmed to be present at Camp Butner, with DoD military munitions as the source of the explosive hazard. MEC and munitions debris (MD) were recovered from the Camp Butner FUDS (HGL, 2016). MEC were classified into one of the five following categories; grenade, landmine, mortar, projectile, or rocket. Specific MEC items included M9 Rifle Grenades, 37 mm projectiles and 155mm projectiles, mortars, and 2.36' rockets. The RI defined MEC contaminated areas by the identification of MEC or more than 5 pieces of MD per grid. The conclusions of the RI indicate there are two main target areas (Figure 4) shown by the high anomaly density areas present in the north and south; however, intrusive data did not fully support that MEC is found within the high anomaly density areas only. MEC has been found in grids (both historically and during the RI) which are not located in the highest anomaly density areas as indicated in the digital geophysical mapping data. Each of the contaminated proposed MRS (01 through 08) contains varying types of these DoD military munitions as detailed in Table 2. Two proposed MRS, (02 and 03) contained

minor quantities of MD only, and although no MEC was identified, is considered potentially present. The remaining MRS (01 and 04 through 08) contained both MEC and significant quantities of MD, at depths ranging from the surface to 40-inches below ground surface (bgs). MRS 09 is not considered part of a MEC contaminated area in the RI.

### **2.2.1.1 Background of MEC Contamination**

As presented in the FS, the MEC-contaminated area was further evaluated for current land use and munitions confirmed to be present. Areas associated with each land use category and munitions type were identified. The MEC contaminated area determined during the RI was recommended in the FS to be divided into nine different areas, based on the identified and predominant land uses and munitions types within each proposed MRS. Details on each proposed MRS are summarized below and in Table 1:

- MRS-01/Project 11 includes MEC contaminated areas which are currently used for military training by the National Guard;
- MRS-02/Project 04 includes buffer areas currently used for military training by the National Guard where minor amounts of MD (and no MEC) were identified;
- MRS-03/Project 05 includes all other buffer areas not used for military training where minor amounts of MD (and no MEC) were identified;
- MRS 04, 05, 06, 07, and 08/Projects 06, 07, 08, 09, and 10 respectively are separate MEC contaminated areas divided by geographic location and munitions types. The receptors are identical for these MRSs and include residents, agricultural workers, commercial/industrial workers, visitors, and recreational users; and

- Project 02 is the no action area which was part of the MRA but not part of an RI-recommended MEC Contaminated area. Project 02 has had minimal (less than five pieces) of MD located historically. The proposed MRS also includes the areas historically identified as the Hand Grenade Range and the Gas Chamber (used for tear gas training) which are also recommended for No Action. Historical information and previous investigations identified no MEC items or MEC hazards associated with the Hand Grenade Range and Gas Chamber.

As documented in the FS, comparison of the FUDS property boundary, the munitions response area boundary, and the individual MRS boundaries used in the RI report were compared to the current data recorded in FUDSMIS, the USACE repository which documents FUDS property acreages. Discrepancies in the total acreages and the property boundaries were identified; the shapefiles when compared to the GIS calculated acreages do not match historical figures for the MRSs. The boundaries used did not match the historical record; therefore, based on the evaluation of USACE real estate information for Camp Butner, the most accurate, updated acreages were re-calculated. The proposed MRS boundaries are shown on Figure 3 and the acreages are listed in Table 1. These calculations reflect the most current GIS data available for these MRSs. Improvements in GIS data over time support an updated calculation of the FUDS property acreages. Therefore, acreages summarized in the RI Report for the FUDS property boundary, acreages summarized in the FS and this PP, and the future recommended MRSs will not match current FUDSMIS totals.

**Table 2. Historical Depths of MEC and MD Identified Within Each MRS**

Munition	Classification	MRS-01/ Project 11 Depth Range (# MEC/MD)	MRS-02/ Project 04 Depth Range (# MEC/MD)	MRS-03/ Project 05 Depth Range (# MEC/MD)	MRS-04/ Project 06 Depth Range (# MEC/MD)	MRS-05/ Project 07 Depth Range (# MEC/MD)	MRS-06/ Project 08 Depth Range (# MEC/MD)	MRS-07/ Project 09 Depth Range (# MEC/MD)	MRS-08/ Project 10 Depth Range (# MEC/MD)	MRS-09/ Project 02 No MEC or MD
105 mm (MK1, HE)	MEC	--	--	--	Surface	Surface	UNK	UNK	Surface	None
155 mm (projectile, rotating band)	MEC/MD	UNK	--	--	3 (0 / 1)	UNK	UNK	UNK	UNK	None
2.36-inch rocket	MEC	--	--	--	3-6 (0 / 3)	3	3-6	--	--	None
2.36-inch rocket warhead	MEC	--	--	--	UNK	--	--	2 (0 / 1)	--	None
3.25-inch Target Rocket	MD	30 (0 / multiple)	--	--	--	--	--	--	--	None
30 mm HE projectile (expended)	MD	3 (0 / 1)	--	--	--	--	--	--	--	None
37 mm projectile	MEC/MD	2-6 (0 / 1)	--	2-6 (0 / 2)	2-6 (2 / 10)	2-6 (1 / 0)	2-6 (0 / 6)	2-6	UNK	None
40 mm projectile (expended)	MD	--	--	--	--	6	UNK	UNK	--	None
57 mm projectile	MEC	Surface	--	--	--	--	UNK	UNK	UNK	None
57 mm projectile (AP-T, HE)	MD	6-14 (0 / 1)	--	6-14 (0 / 1)	--	6-14 (0 / 1)	6-14 (0 / 1)	6-14 (2 / 1)	--	None
60 mm HE mortars	MEC	0-1 (0 / 2)	--	--	--	--	--	--	--	None
60 mm Mortar	MEC	--	--	--	6-8	UNK	UNK	--	6-8	None
60 mm mortar (fins, frag, tail boom, expended fuze)	MD	0-12 (0 / 75)	0-12 (0 / 2)	--	--	--	--	--	--	None
75 mm projectile (base)	MD	6 (0 / 1)	--	UNK	--	--	UNK	--	UNK	None
81 mm Mortar	MEC/MD	--	--	--	0-32	UNK	0-32	--	0-32	None
81 mm mortar (fin, frag, tail boom)	MD	3-4 (0 / 6)	--	--	UNK	--	--	--	UNK	None
Grenade pins and spoons	MD	--	--	--	--	--	--	--	1-3 (0 / multiple)	None
Hand grenade	MEC	5-18 (3 / 0)	--	--	--	UNK	UNK	UNK	UNK	None
M1 Mine Spotting Charge	MEC	--	--	--	--	--	--	--	2-3	None
M1A1 Mine and Practice Landmine	MEC/UXO/MD	--	--	--	--	--	--	--	0-12	None
M1A1 Smoke Cartridge	MD	--	--	--	--	--	--	--	0-6	None
M9 Rifle Grenade	MEC	UNK	--	--	--	UNK	UNK	--	3	None
Rifle grenade (illumination-spent, frag)	MD	2-6 (0 / 6)	--	--	UNK	--	--	--	--	None
Slap flare	MD	1	--	--	--	--	--	--	--	None
Smoke Grenade (expended)	MEC	--	--	--	--	--	--	--	Surface	None
Smoke Grenade frag	MD	--	--	--	--	--	--	--	0-8	None
Smoke Pot	MEC	--	--	--	--	--	--	--	3	None
T-bar fuze	MD	0-23 (0 / 15)	--	--	0-23 (0 / 2)	0-23 (0 / 7)	--	--	--	None
Unknown Frag	MD	0-40 (0 / 2,032)	0-40 (0 / 11)	0-40 (0 / 16)	0-40 (0 / 1,734)	0-40 (0 / 399)	0-40 (0 / 369)	0-40 (0 / 7)	0-40 (0 / 81)	Minimal (less than five)
Unknown Mortar Frag (fins and booms)	MD	4-10	--	--	--	--	--	--	--	None
WP Grenade	MEC/MD	--	--	--	--	--	--	--	0-8	None

Frag = fragmentation  
 HE = high explosive  
 MD = munitions debris  
 MEC = munitions and explosives of concern  
 Mm = millimeter  
 WP = white phosphorus

Depth is given in inches.  
 Quantities of MEC and MD are given in parenthesis (MEC quantity / MD quantity)  
 Note: Historical identification of munitions by type was not always possible and quantities are estimated, if no quantities are shown, historical information was missing.  
 UNK = unknown depths

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**Table 3. DGM Depth of Detection Table for Munitions Identified**

Munition Item	TDEM (EM61-MK2)	AGC Sensor (MetalMapper 2x2) Dynamic Mode (3ms)	
	NRL Typical Detection Depth* (in)	Forward Model detection depth** (in).	DOD Library ID
Hand Grenade	12	13.2	Grenade Hand MK2_BlossomPoint_TP79
M9 Rifle Grenade	N/A	14.4	Rifle Grenade M9A1_Eglin_73_002_11
37 mm, M63, M51	12.0	12.0	37mm Projectile M51 CL_83_002_11
40 mm, M677 (MK 19)	N/A	13.2	40mm Projectile Mk2 BP_57_001_11
57 mm, M306A1	N/A	19.2	57mm Projectile M70_BP_100_002_11
60 mm mortar, M49A2	24.0	16.8	60mm Mortar M49A2 BP_87_002_11
2.36" Rocket, M6A1	20.4	18.0	2.36-in Bazooka Warhead M6_Eglin_65_002_11
75 mm, M48	32.4	24.0	75mm Shrapnel Projectile Mk1 Shrapnel_29P_4_001_11
81 mm mortar, M43A1 (charge 8)	25.2	21.6	81mm Mortar M43A1_BPTEM_48_003_11
105 mm, M1 (charge 7)	45.6	28.8	105mm Projectile M1_BPTEM_82_001_11
155 mm, M107	58.8	32.4	155mm Projectile M107_BPTEM_103_001_11

AGC= advanced geophysical classification

DGM = digital geophysical mapping

in = inchesms= millisecond

NRL = Naval Research Laboratory

TDEM = Time-Domain Electromagnetic

\*MR-9155 EM61-MK2 Response of Standard Munitions Items, October 2008, Naval Research Laboratory.

Depths indicated are for items centered under the coil at horizontal (worst case) orientation, 5 mV, EM61 Channel 2.


\*\*Forward models generated using Geosoft's Oasis Montaj UX-Analyze module (v. 9.3.3) and the standard and full DOD 3ms Libraries. The detection threshold set at 0.76 mV/A (time gate 5 (0.134 ms) was based on the minimum response at one foot bgs of all 6 Library ID's for the 37mm M51 projectile, which is smaller than the M63 version. Sensor configuration was the "MetalMapper 2x2 3ms 19gates" at 0.26 m above ground level with the item in a horizontal, cross-line orientation. Of the multiple Library ID's for the same item (multiple measurements taken at various depths and orientations), the one with the smallest UX\_A\_Size at time gate 5 was used for the forward model.

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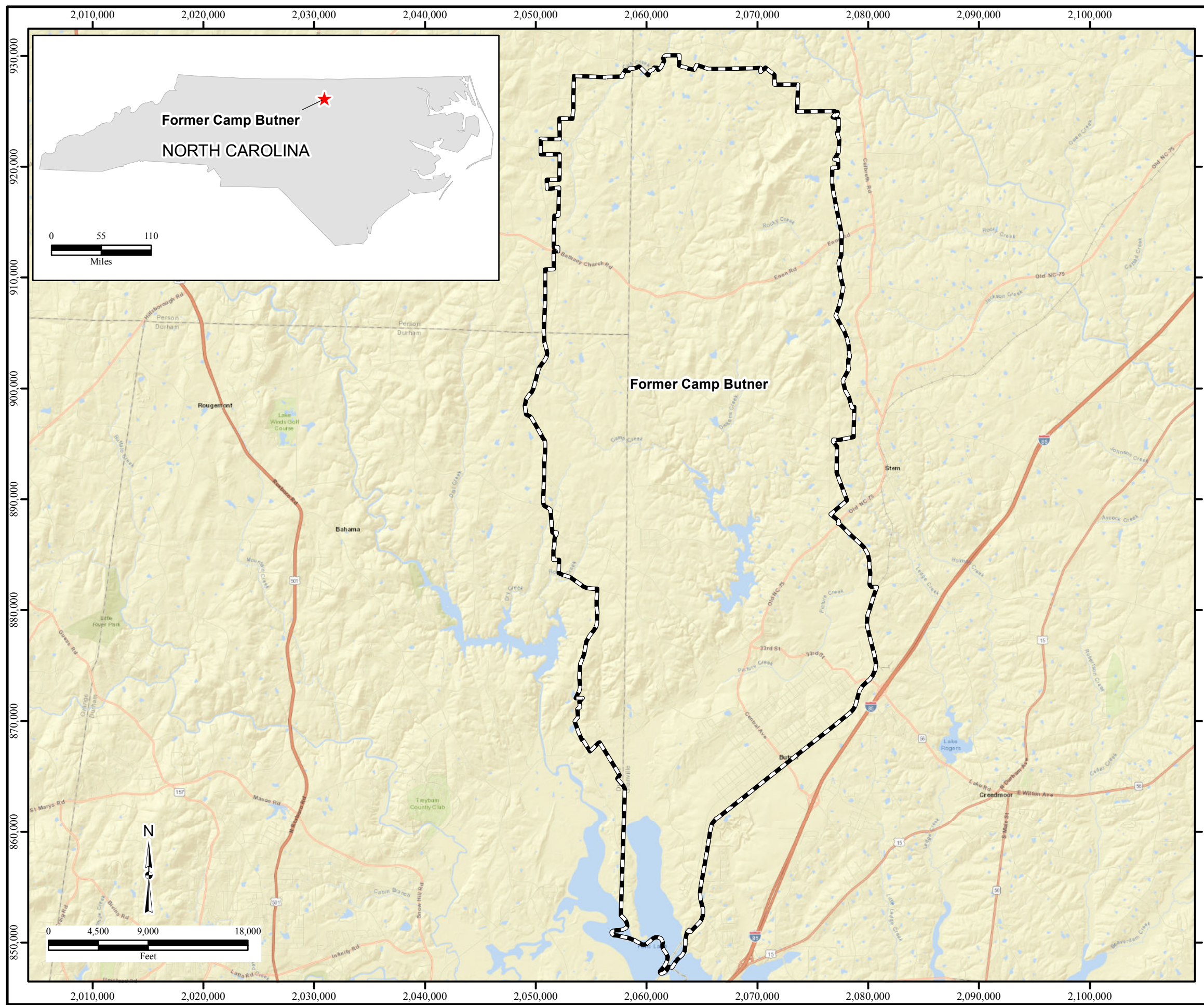


### Figure 1 Camp Butner Location

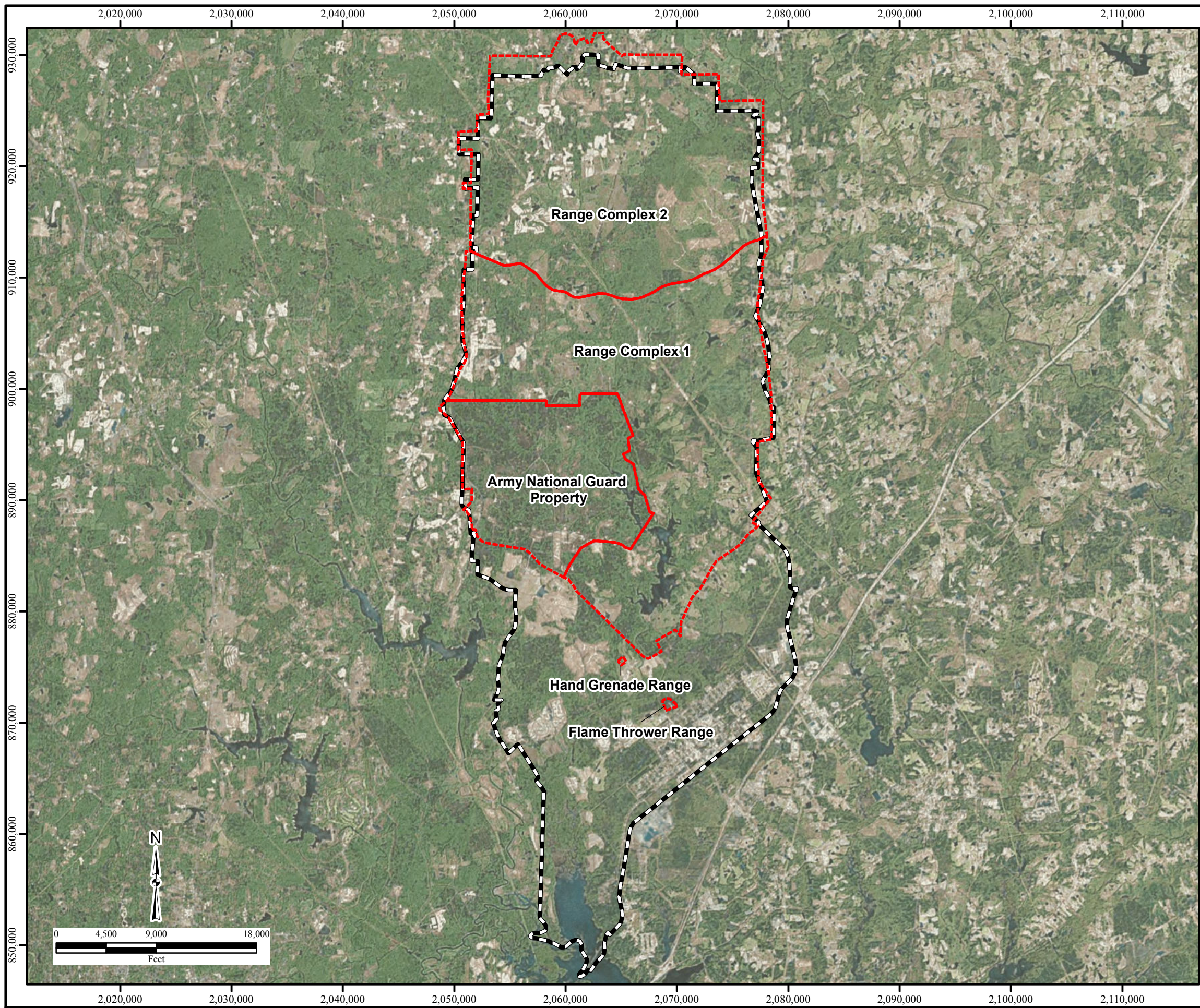
Legend

 Former Camp Butner

\\Gst-srv-01\HGLGIS\Camp\_Butner\MSIW\Proposal\_Plan\  
(01)Butner\_Loc.mxd  
11/6/2017 JAR  
Source: HGL, USACE  
ArcGIS Online Street Map





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**Figure 2**  
**Remedial Investigation**  
**MRS Locations**

Legend

-  MRS Boundary, FUDSMIS
-  Former Camp Butner

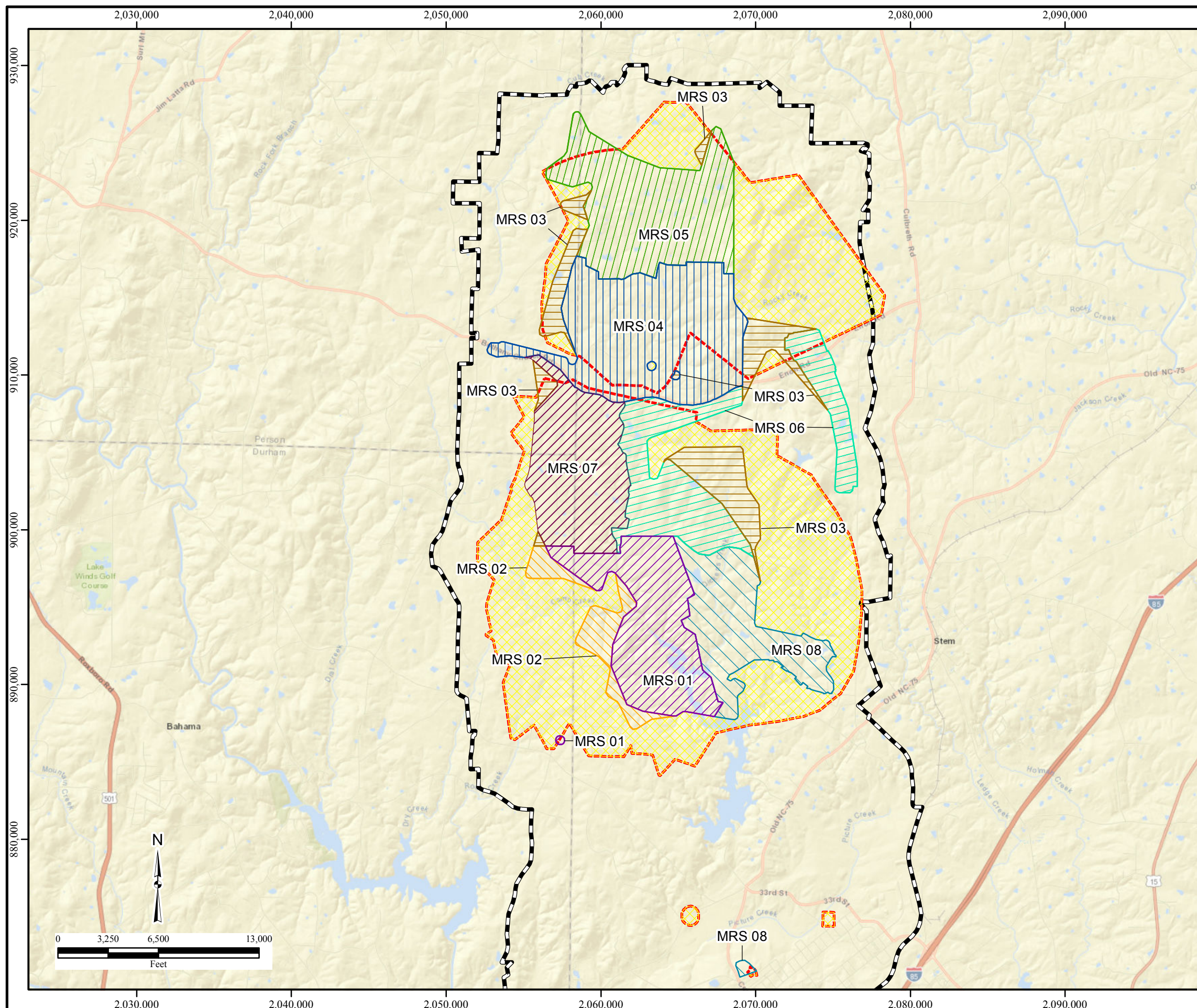
Note:  
MRS=Munition Response Site  
FUDSMIS=Formerly Used Defense Site Management Information System (data from 2014)

\\Gst-srv-01\HGLGIS\Camp\_Butner\_MSIW\Proposal\_Plan\  
(02)RIMRS\_Areas.mxd  
11/6/2017 JAR  
Source: HGL, USACE  
ESRI Online Aerial Imagery



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**Figure 3**  
**Proposed Plan MRS Locations**



**Legend**

**FS Recommended MRS**

-  MRS 01
-  MRS 02
-  MRS 03
-  MRS 04
-  MRS 05
-  MRS 06
-  MRS 07
-  MRS 08
-  MRS 09

-  MRS Boundary, FUDSMIS
-  Former Camp Butner

Notes:  
 Areas are calculated using the projection NAD 1983 UTM Zone 17N.  
 MRS 01 = 1,429.41 acres  
 MRS 02 = 390.86 acres  
 MRS 03 = 923.54 acres  
 MRS 04 = 2,201.77 acres  
 MRS 05 = 1,806.34 acres  
 MRS 06 = 1,450.83 acres  
 MRS 07 = 1,384.52 acres  
 MRS 08 = 1,178.81 acres  
 MRS09 = 7,148.15 acres

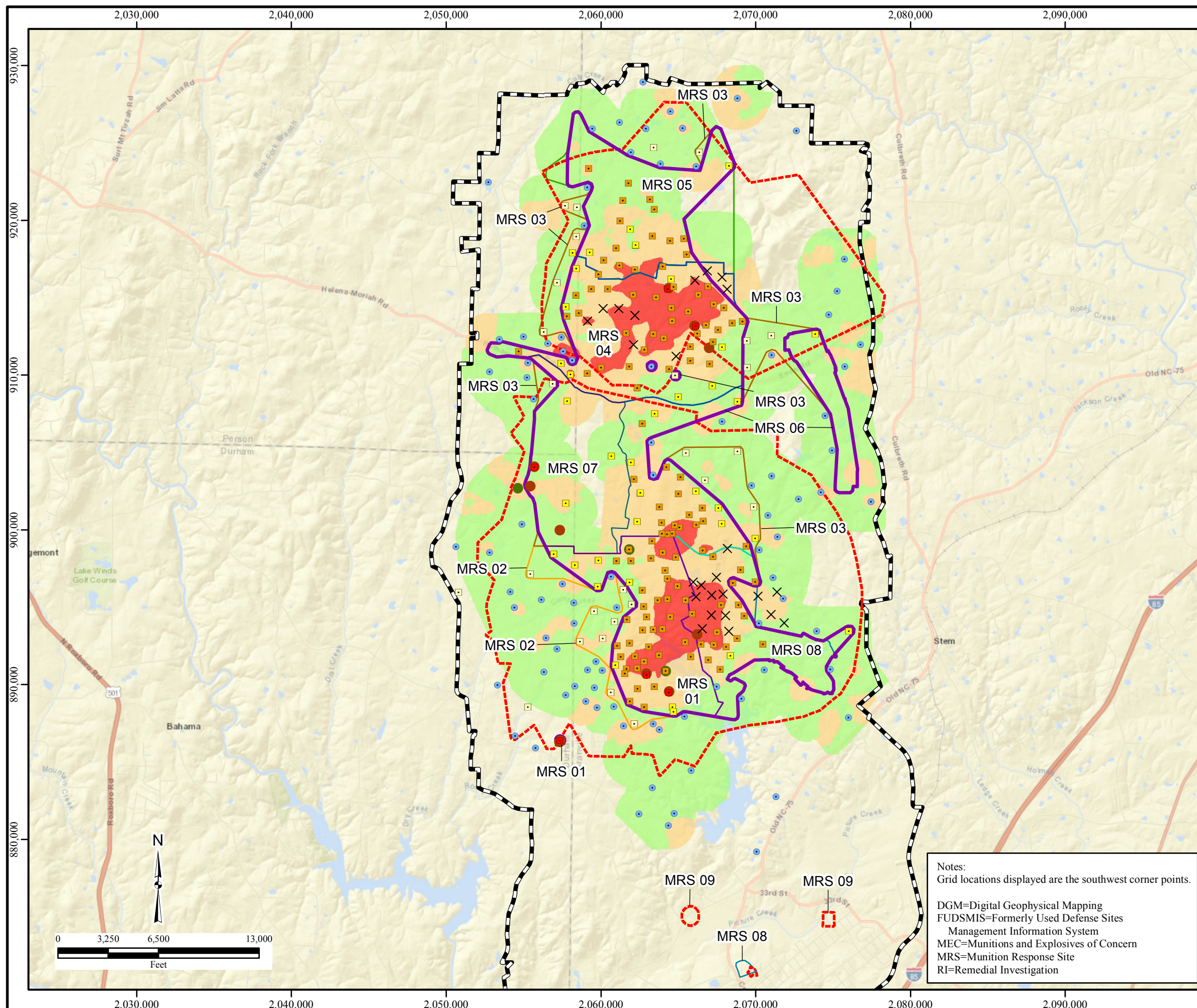
MRS=Munition Response Site  
 FUDSMIS=Formerly Used Defense Site Management Information System (data from 2014)

\\Gst-srv-01\hglgis\Camp\_Butner\MSIW\Proposal\_Plan\  
 (03)ProposedMRS\_Area.mxd  
 10/23/2017 JAR  
 Source: HGL, USACE  
 ESRI Online Aerial Imagery



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**Figure 4**  
**MRS Boundaries and**  
**RI Digital Geophysical Mapping**  
**Anomaly Density Boundaries**



**Legend**

- MEC
  - Munition Debris
- Grid Intrusive Results**
- MEC
  - Munition Debris
  - Low Density Munitions Debris <5 Pieces
  - One Piece of Munitions Debris
  - Cultural Debris
  - × Access Refused
- FS Recommended MRS**
- MRS 01
  - MRS 02
  - MRS 03
  - MRS 04
  - MRS 05
  - MRS 06
  - MRS 07
  - MRS 08
  - MRS 09
- MEC Contamination
  - High Anomaly Density
  - Medium Anomaly Density
  - Low Anomaly Density
  - MRS Boundary, FUDSMIS
  - Former Camp Butner

Notes:  
Grid locations displayed are the southwest corner points.

DGM=Digital Geophysical Mapping  
FUDSMIS=Formerly Used Defense Sites  
Management Information System  
MEC=Munitions and Explosives of Concern  
MRS=Munition Response Site  
RI=Remedial Investigation

\\gst-srv-01\HGLGIS\Camp\_Butner\MSIW\Proposal\_Plan\  
(04)MRS\_Density.mxd  
4/10/2018 CNL  
Source: HGL, USACE  
ESRI Online Aerial Imagery



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The data compiled from previous investigations and RI field activities sufficiently characterized the nature and extent of MEC for the eight proposed MRSs (Figure 3). The RI established there is an unacceptable risk for potential human exposure to MEC within the eight proposed MRSs.

### **2.2.2 Munitions Constituents Contamination**

MC sampling was conducted at each MRS during RI activities (HGL, 2016). Analysis of samples focused on explosives and metals potentially present in munitions known to have been used at the MRSs, such as 2,4,6-TNT, hexahydro-trinitro-triazine (RDX), antimony, copper, lead, and zinc. Soil samples were collected in areas with high anomaly densities and MC was detected in low concentrations. No unacceptable risk from MC-related contamination to either human health or the environment was identified in the proposed MRSs. Based on the absence of MC contamination in the surface soils, sampling of the groundwater was not warranted. Therefore, no remedy for MC-related contamination is necessary.

## **2.3 PREVIOUS PUBLIC INVOLVEMENT**

To keep the public informed, multiple Restoration Advisory Board (RAB) meetings and site visits relating to RI activities and the Feasibility Study for the Camp Butner FUDS have been conducted. RAB meetings and site visits were announced through notices in the local newspaper. Information was conveyed to the public via presentations, a project web site, and the information repositories. Public input was obtained through RAB meetings that included community involvement and requests for public comments.

## **3.0 PROJECT SITE CHARACTERISTICS**

### **3.1 PHYSICAL CHARACTERISTICS AND LAND USE**

The Camp Butner FUDS is located 15 miles north of Durham, North Carolina, and encompasses approximately 40,384 acres in Granville, Person, and Durham counties. Most of the land is used for agricultural purposes, but also includes residential and commercial land uses. Of the approximately 1,100 separate parcels identified within the Camp Butner FUDS, there are approximately 750 landowners, with some landowners owning multiple parcels. Most landowners are individual citizens; about 50 landowners are corporations or governmental entities. The agricultural use land is mixed timber forest cultivation and combination of local cropland clearings located within expanses of woodlands and rural residences. A site location map is provided as Figure 1.

### **3.2 NATURE AND EXTENT OF CONTAMINATION**

#### **3.2.1 Human Health Risks from Explosive Hazards**

The RI confirms an unacceptable risk of explosive hazards in areas where site accessibility could result in a potential MEC exposure within proposed MRS 01 through 08, in Figure 3. The explosive risk is due to the presence of DoD military munitions within the MRSs with the potential to impact human receptors. Potential human receptors include residents, recreational users, commercial/industrial workers and visitors. No MC was detected at levels that pose a threat to human health or ecological receptors; therefore, it was concluded that no exposure pathways are complete and MC-related contamination does not pose a threat to current or future site users (HGL, 2018).

The unacceptable risk for each MRS is summarized as follows:

- MRS-01 (Project 11) includes MEC contaminated areas which are currently used for military training by the National Guard;
- MRS-02 (Project 04) includes buffer areas currently used for military training by the National Guard where only minor amounts of MD were identified;
- MRS-03 (Project 05) includes all other buffer areas where only minor amounts of MD were identified and receptors include residents, agricultural workers, commercial/ industrial workers, visitors, and recreational users;
- MRS-04, MRS-05, MRS-06, MRS-07 and MRS-08 (Projects 06 through 10 respectively) are separate MEC contaminated areas divided by geographic location and munitions types. The receptors are identical for these MRSs and include residents, agricultural workers, commercial/industrial workers, visitors, and recreational users; and
- MRS-09 (Project 02) is the no action area of the FUDS property but not part of an RI-recommended MEC Contaminated area. MRS-09 has had minimal (less than five pieces) of MD located historically. MRS-09 also includes the Hand Grenade Range and the Gas Chamber (used for tear gas training) which are also recommended for No Action based on historical information.

#### **4.0 SCOPE AND ROLE OF THE RESPONSE ACTION**

A response action is used to prevent or minimize the potential interaction with MEC so that it does not cause danger to present or future public health and welfare. The response action manages unacceptable risk from potential residual MEC hazards and incorporates input from the landowner and

other interested community members. Surface and subsurface MEC removal using advanced geophysical classification (AGC) methods (Alternative 5) is the proposed response action for MEC-contaminated areas that are not access controlled or used for military training. **Land Use Controls (LUCs)** described in Alternative 2 are proposed for MRS-01 through -03 (Projects 11, 04, and 05 respectively). LUCs include educational materials and signage that prevent or reduce risks to human health by means of education. USACE is responsible for LUC oversight.

The overall remedial strategy to address MEC hazards at MRS 01-09 (Projects 04-11) was designed to reduce the potential for human receptor exposure to surface and subsurface DoD military munitions to an acceptable risk.

### **5.0 SUMMARY OF PROJECT SITE RISKS**

This section provides a summary of the explosive hazards present at the eight proposed MRSs that require a remedy.

#### **5.1 SUMMARY OF MC RISKS**

Metal sample results in soil were below health based screening levels or determined to be representative of background conditions. Explosive compound sample results in soil for the final sampling event were below residential screening levels. The Human Health Risk Assessment (HHRA) determined there was no unacceptable risk to human health due to MC.

Copper, lead, and zinc were retained as a chemicals of potential ecological concern (COPECs). A food web evaluation determined these constituents posed no or minimal threat to ecological receptors. The screening level ecological risk assessment (SLERA) concluded there was no actionable

ecological risk at the Camp Butner FUDS. More detail regarding the risk assessment for MC can be found in section 7.2 of the RI Report (HGL, 2016).

## **5.2 POTENTIAL EXPOSURE TO EXPLOSIVE HAZARDS, POTENTIAL RECEPTORS, AND EXPOSURE PATHWAYS**

Figure 3 demonstrates the extent of the explosive hazards due to the presence of DoD military munitions at the eight proposed MRSs included in this Proposed Plan. The delineated nature and extent of the explosive hazards combined with the anticipated future land use and human activities results in an unacceptable risk for potential exposure to explosive hazards at the Camp Butner FUDS.

The potential receptors include National Guard trainees, construction/utility business workers, hunters, and visitors (current for MRS 1 and 2) and residents, recreational users, workers (commercial, industrial, construction, and utility), hunters, and visitors (current/future for MRS 3, 4, 5, 6, 7, and 8). Future receptors for MRS 1 and 2 include those receptors for MRS 3, 4, 5, 6, 7, and 8 in addition to the current receptors at MRS 1 and 2.

Munitions can be encountered by humans on the surface and subsurface. Explosive hazards can be encountered on the surface by unintentionally treading on MEC or by intentionally tampering with MEC. Since most MEC is below the ground, MEC can also be found during excavation (i.e. digging foundations, utility work, planting trees, clearing land, etc.). Populations which could interact with these exposure pathways include residents, visitors, workers (e.g., road and trail construction, employees of various utility businesses working on-site) or hunters. Potential exposures to various employees include direct contact with munitions (i.e. during activities such as digging via timber logging, etc.). For workers, the degree of potential exposure varies according to the

nature of their work with utility installation for all MRS is expected to be the deepest at 15 feet. For National Guard trainees, the degree of potential exposure varies according to anticipated training activities, which includes small arms training and maintenance of facilities to include some intrusive activities. MEC at MRS 1 and 2 (ARNG property) has been discovered on the surface to 18 inches bgs. MEC in the subsurface can also be exposed through erosion either by natural forces or contact with off road vehicles, etc.

## **5.3 SUMMARY OF EXPLOSIVE RISKS**

The explosive risk present in each proposed MRS is summarized below.

**MRS-01 (Project 11) - Military Training MEC Contaminated Area.** Access is restricted to this MRS; however, there is still potential for receptors to access the MEC contaminated area within the National Guard facility. MRS-01 is exclusively military land use as it is completely within the ARNG training center. As such, access to the MRS is restricted and controlled, and receptors consist of National Guard trainees or site visitors only. The MRS will continue to be operated by the Army National Guard as an active small arms weapons training center. An unacceptable explosive risk to National Guard trainee receptors is present in this MRS.

**MRS-02 (Project 04) - Military Training Buffer Area.** Access is restricted to this MRS; however, there is still potential for receptors to access the buffer area of this military training MRS. MRS-02 is exclusively military land use as it is completely within the ARNG training center. As such, access to the MRS is restricted and controlled and receptors consist of National Guard trainees and site visitors only. The MRS will continue to be operated by the Army National Guard as an active small arms weapons training center. No MEC was confirmed during previous investigations, and only small amounts of MD and frag were

discovered in the MRS. There is a potential for MEC which is an unacceptable explosive risk to receptors. Training is provided to National Guard trainees in recognition of MEC.

**MRS-03 (Project 05) - Buffer Area.** This MRS has unrestricted access and includes privately owned parcels surrounding the areas where MEC presence was confirmed. No MEC was confirmed in this buffer area during previous investigations. Only small amounts of MD and frag were discovered. These conditions are indicative of a low potential for MEC to be present which would present an explosive risk to receptors. This MRS has unrestricted access with residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use parcels. There is an unacceptable explosive risk to receptors.

**MRS-04 (Project 06) - Central MEC Contaminated.** This MRS has unrestricted access and includes privately owned parcels where MEC presence has been confirmed. This MRS includes residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use parcels. There is an unacceptable explosive risk to receptors. This MRS includes the northern target area identified during the RI.

**MRS-05 (Project 07) - Northern MEC Contaminated.** This MRS has unrestricted access and includes privately owned parcels where MEC presence has been confirmed. This MRS includes residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use parcels. There is an unacceptable explosive risk to receptors. This MRS includes the MEC contaminated area north of the northern target area identified during the RI.

**MRS-06 – (Project 08) Eastern MEC Contaminated,** This MRS has unrestricted access and includes privately owned parcels where MEC presence has been confirmed. This MRS includes residential, commercial/industrial, agriculture,

undeveloped woodlands and recreational land use parcels. There is an unacceptable explosive risk to receptors. This MRS includes the MEC contaminated area to the east (where removal actions were previously conducted) and the central MEC contaminated area extending south to edge of the southern target area and to the National Guard property.

**MRS-07 (Project 09) - Western MEC Contaminated.** This MRS has unrestricted access and includes privately owned parcels where MEC presence has been confirmed. This MRS includes residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use parcels. There is an unacceptable explosive risk to receptors. This MRS includes the MEC contaminated area on the west extending south to the National Guard property.

**MRS-08 (Project 10) - South MEC Contaminated.** This MRS has unrestricted access and includes privately owned parcels where MEC presence has been confirmed. This MRS includes residential, commercial/industrial, agriculture, undeveloped woodlands and recreational land use parcels. There is an unacceptable explosive risk to receptors. This MRS includes the MEC contaminated area where removal actions were conducted in the past, the southern target area, and extends west to the National Guard property.

**MRS-09 (Project 02) – No Action Area.** There is no explosive risk in this MRS. MRS-09 is the no action acres within the FUDS property not part of a recommended MEC contaminated area from the RI. MRS-09 also includes the Hand Grenade Range and the Gas Chamber (tear gas training) which are also recommended for No Action based on historical information as previously established in the RI work plan.

It is the USACE's current judgment that the Preferred Alternatives identified in this Proposed Plan are necessary to protect public health, welfare, and the environment from

actual or threatened releases of explosively hazardous substances (DoD military munitions) into the environment.

## **6.0 REMEDIAL ACTION OBJECTIVES**

The remedial action objectives (RAOs) describe what the Preferred Alternative is intended to accomplish (Table 1). The RAOs address the goals for reducing the risks to ensure protection of human health, safety and the environment (USEPA, 1992). There is no risk due to MC-related contamination to human health or the environment at Camp Butner. Therefore, development of the RAOs addresses unacceptable risks associated with the presence of DoD military munitions at each MRS. The potential receptors vary within the MRSs at Camp Butner, based on specific land use. Across Camp Butner, the following land use categories occur:

MRS -01 and -02 (Projects 11 and 04 respectively): military training only.

MRS -03 thru -08 (Projects 05 through 10 respectively): agriculture, residential, recreational, commercial/industrial, and undeveloped woodlands. (see Table 1). The military training MRS (-01 and -02) are restricted access areas within the Camp Butner National Guard training area and are accessed by the National Guard trainees and hunters, only.

It is not anticipated that most intrusive human receptor activities (i.e. digging, trenching, etc.) for the land uses within the proposed MRSs will exceed 2 feet below ground surface (bgs), but it is possible that future construction, such as utility installation, may exceed this depth. Based on the results of the RI and previous investigations, DoD military munitions (confirmed as MEC) are not expected to be found at depths below 40 inches bgs. Table 1 presents the RAOs which vary by MRS.

No regulatory guidelines have been promulgated specifying an acceptable risk level associated with MEC contamination. In lieu of such guidelines, the acceptable risk level is defined herein as achieving any one of the acceptable end-states described below. Each is developed for the protection of human health and the environment at Camp Butner FUDS and is based on the current Conceptual Site Model (CSM), which depicts the relationship between potential site hazards, pathways for receptors to encounter hazards, and potential current and future human and ecological receptors. The acceptable end states correspond to the intent of the RAO (presented in Table 1): to prevent human interaction with surface and subsurface MEC, to a depth of detection (Table 3). The depths MEC is detected and removed will be evaluated post-remedial action to verify that RAOs were protective and whether UU/UE is achieved. During the development of this Proposed Plan, each alternative has been evaluated against the end states to determine if it meets the proposed RAOs.

- Acceptable End State #1: If a physical search for MEC is performed over 100 percent of the MEC-Contaminated Area and the vertical extent (see Note below) for all recovered MEC is within the reliable detection depth ranges for each specific munition type (Table 2 and Table 3), then the risk of a potential MEC encounter is negligible. Based on the post-remedial action data analysis, this end state may achieve UU/UE.
- Acceptable End State #2: If a physical search for MEC is performed over all accessible areas with the same vertical findings as #1, but the horizontal MEC distribution indicates MEC may exist under inaccessible areas (e.g., [1] where existing slope / terrain make portions of the site inaccessible to remedial action field personnel, and/or [2] where dense

vegetation is impenetrable to field personnel and equipment, then receptor behavior modification is required to achieve a negligible risk of an incident to occur.

- Acceptable End State #3: If a physical search is performed but the vertical extent for one or more recovered MEC extends deeper than the reliable detection depth ranges for that specific munition type (Table 3), then receptor education is required to achieve a negligible risk of an incident to occur.
- Acceptable End State #4: The implementation of LUCs as a remedial action results in receptor behavior modification to achieve a negligible risk that the receptor will be injured by interaction with MEC. The LUCs remedy includes public education (fact sheets and educational pamphlets) and signage to limit exposure to MEC. Public education informs the anticipated receptors of potential explosive hazards. Warning signs will reduce the risk of interaction by alerting receptors entering the site to the potential explosive hazards.

Because Acceptable End States #2-4 will not achieve UU/UE, five-year reviews will evaluate the effectiveness of the selected remedy to protect human health and the environment.

Note: Section 15.0 of the Final RI and Section 2.2.1.4 of the Final FS Reports provide a distribution and vertical depth, or extent, of MEC and MD identified during field activities.

## **7.0 SUMMARY OF REMEDIAL ALTERNATIVES**

A portion of the MRA (proposed MRS-09/Project 02) has no unacceptable risk present and therefore no action is proposed for this area. For the other MRS 01/Project 11 and MRS 02 through -08/Projects 04 through 10

respectively) where unacceptable risk is present, this section summarizes the alternatives evaluated during the FS. Based on the RAOs developed for the MRS within Camp Butner, the remedial alternatives listed below were developed and a detailed analysis was performed in the Final FS (HGL, 2019). USACE cannot currently determine the actual length of the remedial activity for alternatives involving LUCs. For cost estimation purposes, the estimates are limited to 30 years per USEPA guidance (EPA, 1988).

- Alternative 1: No Action
- Alternative 2: LUCs, Public Education and Signage
- Alternative 3: Surface Clearance of MEC with Analog Detection Methods, and LUCs
- Alternative 4: Surface and Subsurface Removal of MEC to a Depth of Detection using DGM Methods (UU/UE Method A)
- Alternative 5: Surface Clearance and Subsurface Removal of MEC to Depth of Detection with Advanced Geophysical Classification Methods (UU/UE Method B)

### **7.1 ALTERNATIVE 1: NO ACTION**

The No Action alternative means that a remedy would not be implemented to reduce potential explosive hazards that remain at the site. No action would be taken to address the MEC identified at the project site. This alternative, if implemented, would involve continued use of the site in its current condition. Under CERCLA, evaluation of a No Action alternative is required pursuant to the NCP (42 Code of Federal Regulations [CFR] 300.430(f)(4)(ii)) to provide a baseline for comparison with other remedial technologies and alternatives.

Alternative 1 does not implement any remedy to reduce potential risk; therefore, it does not provide long-term protection of human health and the environment. Alternative 1 is retained

for evaluation for comparison purposes only for proposed MRSs 01 (Project 11) and MRS 02 through 08 (Projects 04 through 10 respectively). As established in the RI and FS, no action was recommended for proposed project-02.

**Estimated Costs for all MRSs:**

Capital Cost: \$0

Maintenance Cost for 30 years: \$0

Five-Year Review Costs for 30-years: \$0

**7.2 ALTERNATIVE 2: LUCS**

LUCs consist of public education (fact sheets, website, and educational pamphlets) and signage which limit exposure to MEC. An educational pamphlet would inform the public of potential MEC hazards and safety precautions to be taken to avoid contact with MEC. Warning signs would also limit exposure to MEC by attempting to alert humans to explosive hazards. Both signage and educational materials would alert receptors to the hazards present by providing the “3Rs” (Recognize, Retreat, and Report) munitions safety awareness training. Costs would cover initial installation of signs and development of the educational materials, and annual maintenance to replace and repair damaged signs and distribute the educational pamphlets. This alternative is proposed for the MRSs currently used for military training and for the Buffer Areas (MRS-01 (Project 11), MRS-02 and MRS-03 (Projects 04 and 05 respectively). Five-year reviews, as required by the NCP, would also be conducted.

The RAO would be achieved through implementation of Alternative 2. Exposure through interaction of human receptors with surface and subsurface MEC within the MEC-contaminated area would be reduced to a negligible risk through receptor education from the National Guard concerning the explosive hazards which are present. This alternative would provide overall protection of human health and the environment and satisfy the balancing factor of permanence; but, not

reduction of toxicity, mobility, and volume (TMV) through treatment, and potentially not long-term effectiveness. Alternative 2 could be readily implemented from a technical and administrative perspective, and there would be minimal risks posed to the field crew through the implementation of this alternative. Five-year reviews would be conducted following implementation of Alternative 2 until a determination can be made that all site impacted media has reached UU/UE. The costs associated with implementing this alternative would be low

**Estimated Costs for each MRS / all MRSs:**

Capital Cost: \$131,339 / \$1,050,712

Maintenance Cost for 30 years: \$48,224 / \$385,792

Five-Year Review Costs for 30-years: \$201,560 / \$1,612,480

**7.3 ALTERNATIVE 3: SURFACE REMOVAL OF MEC USING ANALOG DETECTION METHODS**

Alternative 3 would include surface removal of MEC within the MRSs using analog detection methods. Surface clearance of MEC at the selected project site would result in a reduction in accessible MEC hazards; however, MEC may remain on site in subsurface soils within the cleared area below the surface. An educational pamphlet would inform the public of potential MEC hazards and safety precautions to be taken to avoid contact with MEC, and warning signs would be installed in locations at the perimeter of the MRSs.

Field tasks associated with Alternative 3 would include professional land surveying, vegetation clearance, surface clearance, investigation and removal of anomalies potentially representing MEC using analog magnetometers, and disposal of any MEC. Vegetation cutting/clearance would only be

conducted where necessary to complete MEC clearance operations. Surface clearance would be completed by qualified UXO technicians using analog magnetometers, such as the Schonstedt GA-52Cx, or equivalent.

The RAO would only be partially achieved through implementation of surface clearance, alone, in that it would potentially reduce exposure of human receptors with surface MEC within the MEC-contaminated area but would not remove subsurface MEC. The RAO would be achieved by including the LUCs from Alternative 2. Exposure through interaction of human receptors with surface and subsurface MEC within the MEC-contaminated area would be reduced to a negligible risk. Overall protection would be achieved by including the LUCs of Alternative 2. Alternative 3 would not satisfy the balancing factor of permanence and would not reduce toxicity, mobility, and volume of subsurface MEC. Alternative 3 would not provide long-term effectiveness due to the presence of remaining MEC in the subsurface. Alternative 3 could be readily implemented from a technical perspective, and there would be minimal risks posed to the field crew through the implementation of this alternative. Five-year reviews would be conducted following implementation of Alternative 3 until a determination can be made that all site impacted media has reached UU/UE. The costs associated with implementing this alternative would be comparatively low. The length of implementation of LUCs is unknown, and for cost estimation purposes the estimate is limited to 30 years per USEPA guidance (EPA, 1988).

**Estimated Costs for each MRS / summed for all MRSs:**

Capital Cost: \$134,299,832 (summed)  
Maintenance Cost for 30 years: \$39,142 (each MRS) / \$313,136 (summed)  
Five-Year Review Costs for 30-years:  
\$201,560 (each MRS) / \$1,612,480 (summed)

**7.4 ALTERNATIVE 4: SURFACE CLEARANCE AND SUBSURFACE REMOVAL OF MEC TO THE DEPTH OF INSTRUMENT DETECTION USING DGM DETECTION METHODS (UU/UE METHOD A)**

Alternative 4 would include conducting surface and subsurface removal of MEC to the depth of detection over attempted 100 percent coverage of the MRSs using DGM methods. Alternative 4 is anticipated to achieve UU/UE based on the current site conditions and the completion of removal of MEC to the depths of detection identified for each munition type, in each MRS, as shown on Table 3. The depths that MEC is detected and removed will be evaluated post-remedy to verify that UU/UE is achieved.

The primary component of Alternative 4 is surface clearance and subsurface removal of MEC from the MRSs. Surface clearance and subsurface removal of MEC at the MRS would result in a complete removal of accessible MEC hazards.

Field tasks associated with Alternative 4 would include: professional land surveying, vegetation clearance, surface clearance, DGM surveying, intrusive investigation, and removal of all anomalies potentially representing subsurface MEC to depth of detection and disposal of any MEC. Vegetation cutting/clearance would only be conducted where necessary to complete MEC clearance operations. Subsurface investigations would be completed by qualified unexploded ordnance (UXO) technicians to the depth of instrument detection. All anomalies that exceed a certain millivolt threshold would be excavated until the source of the anomaly is found. Additionally, 100 percent coverage of the MRSs would be attempted. Alternative 4 would be readily implemented from a technical perspective but analog methods may be necessary in areas of treacherous terrain where



no other geophysical method is feasible. Surface clearance and subsurface removal of MEC at the project site would result in complete removal of accessible MEC hazards. Surface clearance and subsurface removal of MEC under this alternative would allow UU/UE to be achieved and no further action would be required to protect receptors; therefore, no LUCs are included. A post remedial assessment will be conducted to confirm the achievement of the alternative (UU/UE). If the assessment determines there were impediments to UU/UE, LUCs (Alternative 2) will be implemented and these areas will be delineated into a new MRS/Project.

**Estimated Costs summed for all MRSs:**

Capital Cost: \$656,724,523

Maintenance Cost for 30 years: \$0

Five-Year Review Costs for 30-years: \$0

**7.5 ALTERNATIVE 5: SURFACE CLEARANCE AND SUBSURFACE REMOVAL OF MEC TO A DEPTH OF DETECTION USING ADVANCED GEOPHYSICAL CLASSIFICATION METHODS (UU/UE METHOD B)**

Alternative 5 would include conducting surface clearance and subsurface removal of MEC to the depth of instrument detection over attempted 100 percent coverage of the MRSs utilizing Advanced Geophysical Classification Methods. Alternative 5 is anticipated to achieve UU/UE based on the current site conditions and the completion of removal of MEC to the depths of detection identified for each munition type, in each , as shown on Table 3. The depths that MEC is detected and removed will be evaluated post-remedial to verify the UU/UE is achieved.

Field tasks associated with Alternative 5 would be equivalent to those identified for Alternative 4, with the exception that the

removal of anomalies potentially representing subsurface MEC would be supplemented by Advanced Geophysical Classification data to be gathered and intrusive investigation would be to the depth of instrument detection. The anomalies identified as targets of interest would be excavated until the source of the anomaly is found. Surface clearance and subsurface removal of MEC at the project site would result in complete removal of MEC hazards. Alternative 5 would be readily implemented from a technical perspective but analog methods may be necessary in areas of treacherous terrain where no other geophysical method is feasible. Additionally, vegetation cutting/clearance would only be conducted where necessary to complete MEC clearance operations, and MEC clearance areas would be restored and reseeded. Surface clearance and subsurface removal of MEC under this alternative would allow UU/UE and no further action would be required to protect receptors; therefore, no LUCs are included. A post remedial assessment will be conducted to confirm the achievement of the alternative (UU/UE). If the assessment determines there were impediments to UU/UE, LUCs (Alternative 2) will be implemented and these areas will delineated into a new MRS/Project.

**Estimated Costs summed for all MRSs:**

Capital Cost: \$185,349,980

Maintenance Cost for 30 years: \$0

Five-Year Review Costs for 30-years: \$0

**8.0 EVALUATION OF ALTERNATIVES**

A detailed analysis was completed for the remedial alternatives developed to address the MEC hazards at the MRSs. The detailed analysis involves evaluating each remedial alternative against nine criteria defined by CERCLA. These nine criteria fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria. A description and purpose of the three groups of evaluation criteria are explained further in Table 4 below.

Response actions under CERCLA must identify and attain or formally waive what are determined to be applicable or relevant and appropriate requirements (ARARs) under federal and state laws (NCP, 40 CFR 300.400[g]).

ARARs are used as a starting point for determining the protectiveness of a potential remedy. Chemical-specific ARARs are considered when developing RAOs and establishing preliminary remediation goals. No location-specific, or chemical-specific ARARs have been identified for Camp Butner. One action-specific ARAR has been identified, the Resource Conservation and Recovery Act (RCRA) Subpart X 40 CFR 264.601. Any consolidated shot or consolidated and blow activities conducted in future would need to comply with this ARAR.

The alternatives developed for MEC hazards were evaluated in the Final FS (HGL, 2019). In addition, during the development of this Proposed Plan, the alternatives were updated to incorporate regulatory feedback. The alternatives were also evaluated within the Proposed Plan development relative to the acceptable end states to determine their effectiveness for achieving the RAO for each MRS.

**Table 4. Nine Criteria for Detailed Analysis of Remedial Alternatives**

<b>Threshold Criteria</b>	1. Overall protection of human health and the environment 2. Compliance with ARARs
<b>Primary Balancing Criteria</b>	3. Long-term effectiveness and permanence 4. Reduction of toxicity, mobility, or volume through treatment 5. Short-term effectiveness 6. Implementability 7. Cost
<b>Modifying Criteria</b>	8. State acceptance 9. Community acceptance

All alternatives except Alternative 1 (no action) achieves the RAO for the MRSs for which they were considered and are overall

protective. No ARARs were identified for Alternative 2. One ARAR (RCRA Subpart X 40 CFR 264.601) was identified for Alternatives 3 – 5. Actions taken to implement Alternatives 3-5 would ensure compliance with the ARAR. Alternatives 4 and 5 were determined to provide the best long-term effectiveness and permanence because they would significantly reduce the risk due to possible remaining presence of MEC. Alternatives 2 and 3 are less effective long-term due to higher amount of MEC presence after implementation. Alternatives 4 and 5 provide the greatest reduction of TMV through treatment as a result of subsurface removal of the source to the maximum anticipated depth of MEC contamination. Alternative 3 provides a partial reduction of TMV through treatment as a result of surface only removal of MEC. Alternative 2 offers no reduction in TMV through treatment of contaminants. Alternative 2 is considered to be effective in the short-term, and present minimal risk to workers implementing the alternative. Alternative 3 has some short-term effectiveness and also presents risks to workers implementing the removal. Alternatives 4 and 5 are determined to have the least short-term effectiveness because of the risk to workers conducting removal. All alternatives are readily implementable administratively. Alternatives 2 and 3 are readily implementable technically. Under most conditions, Alternatives 4 and 5 are readily implementable technically except in steep-sloped areas. Completion of Alternatives 4 and 5 over 100 percent of the MRS would also achieve UU/UE (as defined), warranting no further action for the MRSs. However, the costs associated with Alternatives 4 and 5 are comparatively higher than Alternative 3, which is comparatively higher than Alternative 2.

**9.0 SUMMARY OF THE PREFERRED ALTERNATIVE**

Upon comparison of the retained alternatives, two alternatives are preferred for the MRSs. Alternative 2, LUCs, is recommended for implementation at MRS-01 (Project 11), MRS-02, and MRS-03 (Projects 04 and 05 respectively). Two of these proposed MRSs (MRS-01 and MRS-02) are restricted access (used for National Guard military training and recreational hunting). Proposed MRS-03 is a Buffer Area where only a small amount of munitions debris has been identified, and no explosive hazards have been confirmed.

Alternative 5, surface and subsurface removal of MEC to depth of detection using advanced geophysical classification methods, is recommended for implementation at MRSs -04, -05, -06, -07, and -08 (Projects 06 through 10 respectively). Alternative 5 is the Preferred Alternative because it is the most effective alternative for reducing MEC hazards at the proposed MRSs while minimizing costs associated with the action. Therefore, the deciding factors for the selection of Alternative 5 as the Preferred Alternative are reduction of toxicity, mobility, or volume through treatment, long-term effectiveness and permanence, and cost.

USACE believes that implementation of both Alternative 2 for MRSs 1-3 (Projects 11, 4-5) and Alternative 5 for MRSs 4-8 (Projects 6-10) would achieve the RAO of mitigating the unacceptable risk of an incident to occur for receptors to the detection depths of the applicable munitions of concern listed in Table 2 such that a determination can be made that there is a negligible risk of an incident to occur.

It is anticipated that full implementation of Alternative 5 over 100 percent of these MRSs will result in the full recovery of any MEC at the site. As such, the site will not leave contamination behind and will be available for UU/UE. However, as part of this alternative, a post-removal action data analysis will be

performed and provided to all regulators. This analysis will show that all portions of the site have been cleared of MEC, or it will highlight those portions of the site that were not cleared due to unforeseen obstacles (inaccessible areas, ROE availability, etc.). If the analysis

**Table 5 Preferred Alternative by MRS/Project**

MRS/Project	Preferred Alternative
MRS-01/Project 11	Alternative 2, LUCs
MRS-02/Project 04	
MRS-03/Project 05	
MRS-04/Project 06	Alternative 5, Surface and Subsurface Removal of MEC to a Depth of Detection using AGC Methods
MRS-05/Project 07	
MRS-06/Project 08	
MRS-07/Project 09	
MRS-08/Project 10	

finds that portions of the site were not cleared as planned, the LUCs described in Alternative 2 will be implemented and Five-Year Reviews will be required. No LUCs will be necessary or implemented for portions of the site which have achieved UU/UE.

Land use for the proposed MRSs is not anticipated to change in the future following implementation of the preferred remedy. Therefore, the proposed MRSs will continue to be used as stated in Table 1. Additional cost evaluation information for the alternatives are presented in Table 6-2 of the Final FS, and detailed costs can be found in Appendix A of the Final FS (HGL, 2019).

Based on information currently available, USACE believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The USACE expects the Preferred Alternative to satisfy the following

statutory requirements of CERCLA § 121 (b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element (or justify not meeting the preference).

## 10.0 COMMUNITY PARTICIPATION

USACE is the lead agency for investigating, reporting, making remedial decisions, and taking remedial actions at the Camp Butner FUDS. As the lead agency, USACE will solicit public comments on the Preferred Alternatives recommended for each MRS addressed by this Proposed Plan. The Final RI report (HGL, 2016) and Final FS report (HGL, 2019), for the eight proposed MRSs at the Camp Butner FUDS, Granville County North Carolina, are comprehensive documents that describe the history of the site, provide details of the investigations conducted for each proposed MRS, assess potential risks, and present conclusions and recommendations. The reports on the proposed MRSs and this Proposed Plan are available for review at the information repositories listed below.

The Preferred Alternative can change in response to public comment or new information; therefore, the local community is encouraged to comment on this Proposed Plan and the Preferred Alternatives: Alternative 2 and Alternative 5.

USACE will hold a public meeting to explain the alternatives presented in the Final FS. The public meeting was advertised in local newspapers, inviting any interested parties to attend. Oral and written comments will be accepted during the meeting and reviewed and addressed in the Decision Document's Responsiveness Summary as appropriate. The public meeting will be held at the Butner Town Hall, April 16, 2018, to discuss this Proposed Plan.

Comments on this Proposed Plan will be accepted throughout a public comment period between March 26 and April 30, 2018. Correspondence should be postmarked no later than April 30, 2018, and should be sent to USACE at the following address:

Mr. Raymond Livermore  
U.S. Army of Corps of Engineers  
Wilmington District  
69 Darlington Avenue  
Wilmington, NC 28402-1890

Copies of the RI and FS reports for the MRSs (and this Proposed Plan) are included in the Administrative Record file housed at the public repository listed below:

South Granville Public Library  
1550 S Campus Drive  
Creedmoor, NC 27522  
(919) 582-1752  
<http://www.granville.lib.nc.us/>

Hours of Operation:  
Monday–Friday: 10:00 a.m.–8:00 p.m.  
Saturday: 12:00 p.m.-5:00 p.m.  
Sunday: Closed

## 11.0 GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan are defined below:

**Advanced Geophysical Classification (AGC)** – AGC provides a process for determining whether a buried metal object is a military munition. High-quality data is collected on detected metallic objects buried in the ground and is interpreted using computer-based models to estimate the size, shape, and other physical attributes of the buried object. Analysts use this information to determine whether the buried object is likely a munition or harmless debris.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**,

**otherwise known as Superfund)** – A federal law that addresses the funding for and remediation of abandoned or uncontrolled hazardous waste sites. This law also establishes criteria for the creation of key documents such as the Remedial Investigation Report, Feasibility Study, Proposed Plan, and Decision Document.

**Below ground surface (bgs)** – a distance that demonstrates depth (typically in inches or in feet) applicable for the item being described.

**Decision Document** – A document establishing the reasoning for the choice of a cleanup plan or final remedial action at CERCLA sites.

**Digital Geophysical Mapping** – This method of geophysical surveying uses an instrument that acquires geophysical data and position data using self-recording instruments. The data is then post-processed by analysts to identify anomalies for further investigation.

**Discarded Military Munitions** – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for disposal. The term does not include UXO, military munitions being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

**Feasibility Study (FS)** – The process during which potential remedial alternatives for a site are developed and evaluated to provide the basis of a rationale for remedy selection.

**Munitions Constituents (MC)** – Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

**Munitions Debris (MD)** – Remnants of munitions (for example, penetrators, projectiles, shell casings, links, and fins) remaining after munitions use, demilitarization, or disposal. Munitions debris is confirmed inert and free of explosive hazards by technically qualified personnel.

**Munitions and Explosives of Concern (MEC)** – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means (a) unexploded ordnance; (b) **discarded military munitions**; or (c) explosive MC (for example, TNT and RDX) present in high enough concentrations to pose an explosive hazard.

**Munitions Response Site (MRS)** – A discrete location that is known to require a munitions response.

**Preferred Alternative** – The alternatives that, when compared to other potential alternatives, was determined to best meet the CERCLA evaluation criteria and is proposed for implementation at an MRS.

**Proposed Plan** – A plan that identifies the preferred remedial alternative(s) for a site and is made available to the public for comment.

**Remedial Investigation (RI)** – An inspection conducted at a site to define the nature and extent of contamination present, and to assess potential related hazards and risks.

**Superfund** – See CERCLA above.

**Unexploded Ordnance (UXO)** – Military munitions that (a) have been primed, fuzed, armed, or otherwise prepared for action; (b) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (c) remain unexploded either by malfunction, design, or any other cause.

**Unlimited Use/Unrestricted exposure** – UU/UE in general refers to the situation when

no exposure or use limitations are required for the remedy at a site to be protective.

## LIST OF ACRONYMS AND ABBREVIATIONS

AGC	advanced geophysical classification	RAB	Restoration Advisory Board
ARAR	applicable or relevant and appropriate requirements	RAO	remedial action objectives
ARNG	Army National Guard	RCRA	Resource Conservation and Recovery Act
bgs	below ground surface	RDX	hexahydro-trinitro-triazine
CEHNC	U.S. Army Engineering and Support Center Huntsville	RI	Remedial Investigation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	ROE	right-of-entry
CFR	Code of Federal Regulations	TDEM	Time-Domain Electromagnetic
CSM	Conceptual Site Model	TMV	toxicity, mobility, and volume
DGM	Digital Geophysical Mapping	TNT	trinitrotoluene
DoD	U.S. Department of Defense	TPP	Technical Project Planning
FS	Feasibility Study	USEPA	U.S. Environmental Protection Agency
HE	high explosive	UU/UE	unlimited use/unrestricted exposure
HGL	HydroGeoLogic, Inc.	USACE	U.S. Army Corp of Engineers
LUC	land use controls	UXO	unexploded ordnance
MC	munitions constituents		
MD	munitions debris		
MEC	munitions and explosives of concern		
mm	millimeter		
MMRP	Military Munitions Response Program		
MPPEH	material potentially presenting an explosive hazard		
MRS	munitions response sites		
NCDEQ	North Carolina Department of Environmental Quality		
NCP	National Oil and Hazardous Substances Pollution Contingency Plan		
NRL	Naval Research Laboratory		

## 12.0 REFERENCES

- HydroGeoLogic, Inc. (HGL), 2016. Final Remedial Investigation Report, Range Complex 1 MRS Range Complex 2 MRS North Carolina Army National Guard MRS Hand Grenade Range MRS and Flame Thrower Range MRS, Camp Butner, Granville County, North Carolina. March.
- HGL, 2019. Final Feasibility Study Range Complex 1, Range Complex 2, Army National Guard and Flame Thrower Range Munitions Response Sites Former Camp Butner Granville, Person, and Durham Counties, North Carolina. March.
- U.S. Army Corps of Engineers (USACE), 2003. Archives Search Report Supplement, Former Camp Butner, Butner, North Carolina. June.
- U.S. Environmental Protection Agency (EPA), 1988. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", EPA/540/G-89/004, OSWER Directive 9355.3-01, October.
- USEPA, 1992. "CERCLA/SUPERFUND Orientation Manual," EPA/542/R-92/005, U.S. Environmental Protection Agency - Office of Solid Waste and Emergency Response Technology Innovation Office, October.



