Munitions and Explosives of Concern Remediation After Action Report Munitions Response Site 6

Bravo Munitions Response Area, McClellan, Anniston, Alabama

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McClellan Development Authority

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McCLELLAN
DEVELOPMENT AUTHORITY

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STATEMENT OF REMOVAL OF MUNITIONS AND EXPLOSIVES OF CONCERN

Munitions and Explosives of Concern (MEC) have been removed from Munitions Response Site 6 (MRS-6) and its associated step-outs in accordance with the *Revision 1 to the Final Program-Level Work Plan Munitions and Explosives of Concern Remediation, Alpha and Bravo Munitions Response Areas of McClellan, Anniston, Alabama* (PWP) dated September, 2007 and the *Munitions Response Site 6 (MRS-6) Site-Specific Work Plan* (SSWP) dated December, 2008 and associated Field Change Requests (FCRs) as approved by the Alabama Department of Environmental Management (ADEM). This removal action was performed by contractors to the McClellan Development Authority (MDA) under the oversight of Matrix Environmental Services, LLC (MES).

This removal action for MRS-6 completes the required response for portions of three Army-designated sectors (M3-2H Mortar Area-PR, M3-2H Mortar Area-D, and M3-1L Rocket Area-D) under the Environmental Services Cooperative Agreement (ESCA) No. W9128F-07-2-0163 and ADEM Clean-up Agreement No. AL4 210 020 562. To increase operational efficiencies, the boundary of MRS-6 was adjusted to conform to the bordering MRS boundaries and the McClellan 100-foot state plane coordinate line grid, resulting in a clearance area of approximately 134.73 acres excluding step-outs, and 137.51 acres including step-outs.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted 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.

Richard Satkin, PG

Vice President, MES

EXECUTIVE SUMMARY

This Munitions and Explosives of Concern (MEC) After Action Report prepared by Matrix Environmental Services, LLC (MES) documents MEC remediation at MRS-6 Munitions Response Site (MRS). MEC remediation was conducted in accordance with the *Revision 1 to the Final Program-Level Work Plan Munitions and Explosives of Concern Remediation, Alpha and Bravo Munitions Response Areas of McClellan, Anniston, Alabama* (PWP)(MES, 2007) and the *Munitions Response Site 6 (MRS-6) Site-Specific Work Plan* (SSWP) (MES, 2008b). The Alabama Department of Environmental Management (ADEM) concurred with the SSWP in February 2009. During the course of fieldwork through March 2010, ADEM approved three Field Change Requests (FCRs) FCR-7, 8, and 9 to the PWP.

The majority of MEC remediation activities in MRS-6 occurred from January 2009 through March 2010. The pond in Tract 9D, a previous exception area, was drained and cleared in May-July 2014. Approximately 107.34 acres of MRS-6 were designated as non-McClellan Park System future use and approximately 27.39 acres in the central portion and southern portion of MRS-6 were designated as McClellan Park System future use. An additional 2.78 acres of step-outs were performed for a total clearance area of 137.51 acres.

Clearance activities involved the following major tasks:

- Land surveying
- Surface sweep
- Brush clearing
- An aggressive (6-inch) surface/near surface clearance of MEC items and metallic non-MEC items in advance of digital geophysical mapping (DGM)
- DGM based clearance to depth of detection for non-McClellan Park System future use areas
- Mag and dig based clearance to depth of 1 foot for McClellan Park System future use areas
- Clearance to the depth of detection or to one foot in four step-outs
- Draining and clearance to the depth of detection of the pond exception area in 2014
- Explosive demolition of material potentially presenting an explosive hazard (MPPEH)
- Site restoration activities
- Inspection, demilitarization, certification and disposal of munitions related debris

The MEC clearance was performed in accordance with a rigorous Quality Control (QC) and Quality Assurance (QA) program, which identified specific methods and procedures for measuring effectiveness of each task. Lessons learned were identified by the project team,

proposed as FCRs, reviewed by ADEM, and if approved, incorporated into the MEC remediation program.

In total, 137.51 acres were cleared either to the depth of detection (109.50 acres) or to a depth of 1 ft. (28.01 acres) during MRS-6 remediation, including 2.78 acres of step-outs. The following totals of MEC and materials were removed during the clearance:

- 1,438 MEC items were recovered and destroyed.
- 12,913 pounds of non-MEC scrap (technically Material Documented as Safe (MDAS) per current Department of Defense (DoD) guidance, but "non-MEC scrap" terminology is used here for consistency with existing documents).
- 78,322 pounds of Munitions Debris (MD also referred to here, for consistency with previous documents, as "MEC scrap").

The 137.51 acre area was heavily seeded to test the clearance processes. 460 of 466 (98.7%) QC and Quality Assurance (QA) blind seeds testing the clearance operations were recovered.

Survey and Geographical Information System (GIS) shape files for the MRS-6 boundary and clearance area boundary are presented in Appendix B.

All of MRS-6 will have a land use control (LUC) consisting of a deed notification of the property's former use as a military base. All areas cleared to the depth of detection are recommended for unrestricted land use. All areas cleared to a depth of 1 ft. are recommended for LUCs consisting of a prohibition on intrusive activities without UXO construction support. Environmental Covenants pursuant to the Alabama Uniform Environmental Covenants Act (UECA), Code of Alabama 1975, §§ 35-19-1 to 35-19-14 for MRS-6 are included in Appendix K.

This removal action for MRS-6 completes the required response for portions of the Army-designated sectors (M3-2H Mortar Area-PR, M3-2H Mortar Area-D, and M3-1L Rocket Area-D) under the Environmental Services Cooperative Agreement (ESCA) No. W9128F-07-2-0163 and ADEM Clean-up Agreement No. AL4 210 020 562 as approved by ADEM in the Action Memorandum for MRS-6 (MES, 2010a). To increase operational efficiencies, the boundary of MRS-6 was adjusted to conform to the bordering MRS boundaries and the McClellan 100-foot state plane coordinate line grid, resulting in a baseline clearance area of 134.73 acres.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ASR	Archives Search Report
BGS	Below Ground Surface
BIP	Blow In Place
BRAC	Base Realignment and Closure
CD	Compact Disk
DB	database
DFW	Definable Feature of Work
DGM	Digital Geophysical Mapping
DNR	Deficiency Notice Report
DoD	Department of Defense
DoDI	DoD Instruction
DQO	Data Quality Objective
EM61-MK2	Geonics EM61-MK2 time domain electromagnetic metal detector
EODT	EOD Technology, Inc. (now Sterling Global Operations)
ERT	Earth Resources Technology Inc.
ESCA	Environmental Services Cooperative Agreement
ESS	Explosives Safety Submission
EZ	Exclusion Zone
FCA	Function Check Area
FCR	Field Change Request
ft.	foot/feet
FTP	File Transfer Protocol website
GeoQA	Geophysical Quality Assurance
GeoQCS	Geophysical QC Specialist
GIS	Geographic Information System
GPO	Geophysical Prove-Out
Harmon	Harmon Engineering & Contracting Co., Inc.
HDTA	High Density Target Area
HE	High Explosive
in.	inch
LI Smith	L.I. Smith and Associates, Inc.
LUC's	Land Use Controls
McClellan	Former Fort McClellan
MD	Munitions Debris
MDA	McClellan Development Authority
MDAS	Material Documented as Safe
MDEH	Material Documented as Explosively Hazardous
MEC	Munitions and Explosives of Concern
MES	Matrix Environmental Services, LLC.
mm	millimeter
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA	Munitions Response Area
MRS	Munitions Response Site
MSL	Mean Sea Level
mV	millivolt
NAEVA	NAEVA Geophysics, Inc.
PDA	Personal Data Assistant
PIKA	PIKA International, Inc.
PWP	Program-Level Work Plan

QA	Quality Assurance
QAP	Site-Wide DGM QA Plan
QC	Quality Control
SGO	Sterling Global Operations (formerly EODT Inc.)
SOP	Standard Operating Procedure
SRA	Saturated Response Area
SSWP	Site-Specific Work Plan
TTFW	TetraTech Foster Wheeler, Inc.
UECA	Uniform Environmental Covenants Act
UoP	Unit of Production
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAE	USA Environmental, Inc.
UXO	Unexploded Ordnance
UXOQCS	UXO QC Specialist

1.0 INTRODUCTION

This Munitions and Explosives of Concern (MEC) After Action Report for MRS-6 Munitions Response Site (MRS) has been prepared by Matrix Environmental Services, LLC (MES) for the McClellan Development Authority (MDA). MEC remediation was conducted in accordance with the *Revision 1 to the Final Program-Level Work Plan Munitions and Explosives of Concern Remediation, Alpha and Bravo Munitions Response Areas of McClellan, Anniston, Alabama* (PWP)(MES, 2007) and the *Munitions Response Site 6 (MRS-6) Site-Specific Work Plan* (SSWP) (MES, 2008b). The Alabama Department of Environmental Management (ADEM) concurred with the SSWP in February 2009. Explosives safety was performed in accordance with the McClellan Alpha and Bravo Explosives Safety Submission (ESS)(ECC, 2006) as modified by ESS Amendment 5 (MES, 2008a) and ESS Amendment 7 (MES, 2009) for MRS-6.

The main MEC remediation activities in the MRS-6 occurred from January 2009 through March 2010. An exception area, a pond in tract 6D, was subsequently drained and cleared to the depth of detection in May-July 2014. In total, 137.51 acres were cleared to the either to the depth of detection or to a depth of 1 ft. and 1,438 MEC items were destroyed. A total of 12,913 pounds of non-MEC scrap[1] and 78,322 pounds of MEC-scrap were removed from the site. Of 467 QC and QA blind seeds emplace to test the effectiveness of the clearance, 461 – 98.7% - were recovered.

These organizations performed the following tasks as part of this MEC remediation:

- Matrix Environmental (MES) – overall management, demolition activities, UXO quality control (QC), Geophysical and UXO quality assurance (QA), data management QA, and MEC remediation
- NAEVA Geophysics (NAEVA) - digital geophysical mapping (DGM), Geophysical QC, and data/database management
- USA Environmental (USAE) – MEC surface sweep activities from January 2009 through February 2009, MEC aggressive surface/near surface clearance remediation activities prior to DGM in Tract 6C and 6D from March 2009 August 2009, and Clearance to one foot in Tracts 6A and 6B during August 2009 through October 2009

[1] Current Department of Defense (DoD) terminology (DODI, 2008) is to refer to non-MEC scrap as Material Documented as Safe (MDAS). Material prior to determination of its explosives safety status, potentially contains explosives or munitions and is referred to as Material Potentially Presenting an Explosive Hazard (MPPEH). MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present and for which the chain of custody has been established and maintained is referred to as Material Documented as Explosive Hazard (MDEH) and is no longer considered MPPEH. In this report, to be consistent with existing plans and documents, we have continued to use MEC Scrap terminology.

- PIKA International (PIKA) –MEC remediation activities in clearance to depth of detection in Tracts 6C, 6D, and UoP SN001 step-out from August 2009 through October 2010 and in December 2009 clearance to one foot in Tract 6D step-out (UoP SN002)
- EOD Technology, Inc. (EODT – now Sterling Global Operations (SGO)) – MEC remediation activities during January 2010 – clearance to one foot in Tract 6A step-outs (UoP SP001, and SP002) and clearance to depth of detection in the Pond exception area in June 2014
- Earth Resources Technology, Inc. (ERT) provided third party geophysical remapping support for QA
- Harmon Engineering & Contracting Co., Inc. performed brush clearing
- L.I. Smith and Associates Inc. provided land surveying
- HVF LLC provided destruction and recycling of scrap metal

This report presents the objectives of the remediation, the procedures used, the quality control/quality assurance methods used to verify effectiveness of the remediation activities, and the results of the remediation.

This report includes the following Appendices, which are included electronically on a compact disk (CD):

- Appendix A Geophysical Prove Out (GPO) Certifications
- Appendix B Survey and GIS Data
- Appendix C Project Database
- Appendix D DGM Data
- Appendix E Quality Control
- Appendix F Daily Reports
- Appendix G Field Change Requests
- Appendix H Waste Disposal Records
- Appendix I Photo Log
- Appendix J Quality Assurance
- Appendix K Environmental Covenants

1.1 PROJECT DESCRIPTION AND OBJECTIVE

This MEC After Action Report describes the methods, activities, and results of the MEC remediation of MRS-6 at the former Fort McClellan (McClellan). McClellan, which is located in Anniston, Alabama, contains Alpha, Bravo, and Charlie Munitions Response Areas (MRAs) as

shown in Figure 1-1. MRS-6 comprises approximately 137 acres and borders MRS-3 and MRS-11 to the east, and the facility boundary to the west, north, and south as shown in Figure 1-1.

The work was completed in MRS-6 between January 2009 and March 2010 in accordance with Revision 1 of the PWP (MES, 2007), the MRS-6 Site Specific Work Plan (SSWP), and approved Field Change Requests (FCRs). During the course of fieldwork, ADEM approved FCRs 7, 8, and 9 to the PWP (Appendix G). Digital geophysical mapping-based clearance to depth of detection was performed over approximately 109.50 acres comprising MRS-6 Tracts C, and D and stepout UoP SN001). An analog based clearance to a depth of 1 ft. was performed over the 28.01 acres comprising MRS-6 Tracts A and B (and stepout UoPs SP001, SP002, and SN002).

1.2 BACKGROUND INFORMATION AND SITE HISTORY

1.2.1 SITE LOCATION AND DESCRIPTION

McClellan occupies 18,929 acres in the City of Anniston, Calhoun County, Alabama (Figure 1-1). To the west and southwest of McClellan are the commercial and residential areas of Anniston, the cities of Weaver and Blue Mountain, and the (active) Anniston Army Depot. The cities of Jacksonville and Oxford bound McClellan to the north and south, respectively. The eastern half of McClellan is minimally developed and is bounded by the Talladega Forest.

1.2.1.1 Site Description

MRS-6 covers approximately 137 acres and is located in the southwestern portion of the Bravo MRA of McClellan. The area is moderately to heavily wooded with mixed pines and hardwoods, with some open areas that were cleared for various activities during the active operation of the installation. The MRS overlaps with portions of Army-designated sectors M3-2H Mortar Area-PR, M3-2H Mortar Area-D, and M3-1L Rocket Area-D (Figure 1-2). MRS-6 is accessible by a few dirt roads including one road that follows the installation boundary. Remote portions of the site are only accessible by foot or using All-Terrain vehicles.

The most prominent cultural feature is a small pond located within approximately 75 feet of the north boundary of the site. No buildings or other permanent or operational structures are located within the MRS.

MRS-6 is bounded to the west, north, and south by the McClellan boundary. The area adjacent to MRS-6 is undeveloped to the south and is a wooded buffer to park and industrial areas to the north. MES 6 is bounded to the east and southeast by MRS-3 and MRS-11.

1.2.1.2 Geology, Hydrology, Topography, and Climate

McClellan is situated near the southern terminus of the Appalachian Mountain chain. All but the easternmost portion of the former Main Post lie within the Valley and Ridge Province of the Appalachian Highlands. The portion of McClellan east of Choccolocco Creek lies within the Piedmont Province. The age of consolidated sedimentary and metamorphic rocks ranges from

Precambrian to Pennsylvanian. On a large scale, most of the rocks have been intensely folded into an aggregate of northeast-southwest trending anticlines and synclines with associated thrust faults. The shallow geology in the area is characterized by colluvial deposits overlying the Paleozoic metamorphic rocks. The presence of metamorphic rocks, as well as iron-bearing cements within the sedimentary rocks, increases the potential for minerals such as magnetite and other associated magnetic minerals.

There is one standing water body in MRS-6. The small pond located within approximately 75 feet of the north boundary of the site and an unnamed drainage in the central portion of the site flow in a general northwest direction eventually merging with Cane Creek.

The elevation of MRS-6 ranges from approximately 800 feet to over 1120 feet above mean sea level. The highest elevations are along the southern portion of the site and the lowest elevation occurs along the unnamed drainage that exits the site near Lagarde Park. Along the east side of the site are a number of steep sloped hills. West of the unnamed drainage, the elevations gradually decline toward the installation boundary.

Calhoun County sits on 611 square miles in the foothills of the Appalachian Mountains in northeastern Alabama. The mean annual temperature is 61 degrees Fahrenheit, with seasonal averages of 38 in January and 80 in July. The average annual precipitation is 65 inches.

1.2.2 SITE HISTORY

1.2.2.1 McClellan

Military training has been documented in the McClellan area since 1912, when the Alabama National Guard used it for artillery training. However, units stationed at Camp Shipp in the Blue Mountain Area during the Spanish American War could have used the Choccolocco Mountains for artillery training as early as 1898. The 29th Infantry Division also trained in this area prior to deployment to France during World War I. In 1917, Congress authorized the establishment of Camp McClellan. In 1929, the camp was officially designated Fort McClellan. Prior to World War II, the 27th Infantry Division assembled at Fort McClellan for training, and during the war, many other units used the site for various training purposes. Following World War II, in June 1947, Fort McClellan was placed in inactive status. Fort McClellan was reactivated in January 1950 and the site was used for National Guard training and was selected as the site for the Army's Chemical Corps School.

The history of the McClellan area, as described in the *Archives Search Report* (ASR) *Findings* (United States Army Corps of Engineers [USACE], 1999a) and *ASR Conclusions and Recommendations* (USACE, 1999b), includes training activities and demonstrations that used conventional weapons (i.e., mortars, anti-tank guns, and artillery pieces). Former ranges and training areas potentially containing MEC cover the majority of McClellan including the subject MRS. McClellan was recommended for closure under the 1995 Base Realignment and Closure (BRAC) Program. McClellan was officially closed in September of 1999 and the property was

transferred to the MDA (formerly the Anniston-Calhoun County Fort McClellan Development Joint Powers Authority) and other federal entities.

1.2.3 BRAVO ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

An EE/CA for the Bravo MRA was performed by Tetra Tech Foster Wheeler, Inc. (TTFW) in 2003. The MRS overlaps with the M3-2H Mortar Area-PR, M3-2H Mortar Area-D, and M3-1L Rocket Area-D Army designated sectors. Grids and transects were previously used to characterize this area in the Draft Bravo EE/CA (TTFW, 2004).

MEC items were found on the surface and to depths of 12 inches during field activities in this sector. The following types of MEC items were identified (detailed list in Draft Bravo EE/CA, TTFWI 2004):

- 60mm Mortar (HE)
- 60mm Mortar (Smoke)
- 60mm Mortar (WP)
- 2.36 Inch Rocket

1.2.4 CURRENT AND FUTURE SITE USE

For the purposes of this clearance, MRS-6 was divided into four tracts (6A through 6D) based on the future land use designation as shown in Figure 1-3. Approximately 27.39 acres of the MRS designated as McClellan Park System (Tracts 6A and 6B) were cleared to one foot using mag/dig methods. The McClellan Park System will be used for passive recreation and LUCs will be implemented prohibiting digging without UXO construction support.

Approximately 107.34 acres of the MRS not designated as part of the McClellan Park System (Tracts 6C and 6D), were cleared to the depth of detection based on unrestricted future use.

1.3 GENERAL OVERVIEW OF TECHNICAL APPROACH

1.3.1 INTRODUCTION

The general approach to the project was to perform brush clearing, land survey, and a DGM-based clearance to depth in conjunction with an analog-based clearance to one foot in the MRS. The MRS was divided into four tracts, designated 6A through 6D. A DGM-based clearance to depth of detection was performed in Tracts 6C and 6D. Analog-based clearance to the depth of one foot was performed in Tracts 6A and 6B. Quality control was performed to ensure that the MEC clearance was executed in accordance with the SSWP (Section 4 and Appendix E). Quality assurance (QA) was performed to verify QC and to document the acceptability of the clearance (Section 5 and Appendix J).

1.3.2 CLEARANCE GRIDS

To facilitate organization of work activities, safety zones, and data management, the site was divided into standard units of clearance area called grids - which are 100 ft. x 100 ft. in size (except for partial grids truncated by the MRS boundary). The grid network for MRS-6 is shown

on Figure 1-4. The north-south and east-west grid boundary lines are coincident with the 100-foot Alabama State Plane coordinate system. Each grid has a unique name indicting its position in the grid system. The leading digit is a grid zone indicator. Northing and easting position are described by a numeric sequence incrementing to the east. For example, grid N139E016 is the northern-most grid in MRS-6.

1.3.3 UNITS OF PRODUCTION (UoPs)

Each grid is associated with a UoP to facilitate QC testing. Each UoP consists of a group of approximately 4 to 9 contiguous grids. UoPs were initially assigned in the SSWP. Additional UoPs were established for each set of step-out grids. The UoPs for MRS-6 are presented in Figure 1-5. UoPs are named by their end use and use a sequential numbering system for the entire McClellan area. The UoP's begin with the letter "P" designating the grids fall in the Park System of McClellan or an "N" designating the grids fall in the Non-Park System of McClellan, for example N0065 is the northernmost UoP. Step-out UoPs begin with the letter "S."

1.3.4 DEFINABLE FEATURES OF WORK (DFW)

DFWs for the remediation fieldwork are as follows:

- GPO Certification
- UXO Surface Sweep prior to vegetation removal
- Brush Clearing
- Aggressive Surface/Near Surface Clearance prior to DGM
- Surveying
- Digital Geophysical Mapping
- Intrusive Investigation Clearance to Depth of Detection
- Intrusive Investigation Clearance to Depth of One Foot
- MEC-Related Scrap Inspection/Certification
- Data Management
- Backfill and Site Restoration

1.3.5 DATA QUALITY OBJECTIVES (DQO)

DQOs are the performance criteria for the remediation. The DQOs used for this project focus on specific elements of the definable features of work and are discussed in detail in Section 4.1.

1.3.6 DESCRIPTION AND OPERATION OF DATABASE (DB)

A comprehensive site DB was established to:

- Ensure that all project data were properly captured
- Ensure conformity of nomenclature and reporting standards
- Track project progress
- Create forms, tables and reports

- Enable use and synchronization of handheld personal data assistants (PDAs) for field data entry
- Assist in performing systematic QC and QA

DBs for the MRS data were implemented in Microsoft Access 2007 and managed by NAEVA. Separate databases are included for the geophysical data collection parameters and for the 2014 exception area effort, which included the MRS-6 pond area clearance. The DBs are included in this report as Appendix C.

1.3.7 USE OF PERSONAL DATA ASSISTANTS

Electronic personal data assistants (PDAs) were used to record major aspects of data collection including: geophysical mapping, target reacquisition, surface sweep operations, aggressive surface/near surface clearance, mag and dig operations, intrusive investigations, data gap clearances, demolitions operations and blind seed placement. PDA drop-down menus were used to ensure all personnel used consistent terminology and that all data was properly recorded and transcription errors were minimized. Operational results were recorded on the PDAs and synchronized with the site DB daily.

2.0 FIELD OPERATIONS

2.1 FIELD CHANGE REQUESTS

Field work was conducted in accordance with the approved SSWP and PWP. When situations arose that made strict compliance with the SSWP unsafe and/or a more effective method was developed through lessons learned, MES would submit a field change request to ADEM for their review and approval. FCRs are presented in Appendix G. The following table summarizes the FCRs for the MRS-6 MEC remediation.

TABLE 2-1: FCR LOG

FCR	Description of Change (all to the PWP)	Date Initiated	Status	Effective Date
7	Modify reacquisition procedures with the EM61-MK2 utilized in analog mode to eliminate targets (targeted at 7mV) with reacquired peak amplitudes less than 10mV.	7/28/09	Approved by ADEM	8/31/09
8	Approve use of portable X-ray imagery to determine whether certain munitions are inert or MEC.	8/26/09	Approved by ADEM	11/05/09
9	Approve the Whites DXF 300 sensor for surface, near-surface, and 1-foot clearance operations.	9/21/09	Approved by ADEM	11/05/09

2.2 GEOPHYSICAL PROVE OUT (GPO) AREA

The GPO test grid was previously constructed using inert munitions and simulants at blind locations to test and document that personnel and equipment were successful in locating MEC in a controlled environment.

2.2.1 GEOPHYSICAL PROVE OUT REPORT

A GPO was performed in 2006. The final GPO report was included as Appendix A to the *Munitions and Explosives of Concern After Action Report Munitions Response Site 1 and Southern Alpha, Alpha and Bravo Munitions Response Areas of McClellan, Anniston, Alabama*, (MES, 2010b). Applicable personnel and instrument certifications for MRS-6 are included in Appendix A.

2.2.2 INSTRUMENT AND OPERATOR CERTIFICATION

The GPO was used to test and document detection equipment and operator performance. Before and throughout the fieldwork, the GPO was utilized to confirm that detection systems operated within expected parameters. Previous GPO certifications of equipment and operators at McClellan were carried forward provided there was no demobilization or change in employer.

The only sensor used for DGM and reacquisition was the Geonics EM61-MK2 metal detector.

The following handheld detectors were approved for use in the various work tasks as follows:

- Surface Sweep and Aggressive Surface/Near Surface Clearance:
  Vallon VMH (large and small head)
  Schonstedt GA-92XT/52CX
  Whites DFX 300
- Clearance of DGM Data Gaps:
  Vallon VMH (large and small head)
  Schonstedt GA-92XT/52CX
  Geonics EM61-MK2 (analog mode)
- One Foot Clearance:
  Vallon VMH (large and small head)
  Schonstedt GA-92XT/52CX
  Whites DFX 300
  Geonics EM61-MK2 (analog mode)
- Clearance to Depth of Detection:
  Vallon VMH (large and small head)
  Schonstedt GA-92XT/52CX
  Geonics EM61-MK2 (analog mode)

2.2.3 FUNCTION CHECK AREA (FCA)

A permanent FCA near the GPO was established to allow UXO personnel to perform daily function tests of handheld (analog) equipment. Inert munitions items were buried with location and depth known to field crews so they could verify their handheld instrument's operability/battery condition daily prior to use.

Geophysical personnel established temporary FCAs in the field. Daily pre- and post-data collection function tests of DGM sensors (static, static-spike with a calibration jig, and cable shake tests) were performed in grid.

2.3 SURFACE SWEEP

A magnetometer assisted surface sweep was conducted by USAE to identify and remove surficial MEC hazards and metallic debris prior to brush clearing operations. In addition to the safety function, removal of metallic objects was performed to eliminate or reduce the number of anomalies for subsequent clearance activities. UXO personnel swept in advance of the brush cutters to identify, remove, eliminate MEC, and/or reduce metallic objects. Large pieces of debris were flagged and moved prior to brush clearing.

2.4 BRUSH CLEARING

Brush clearing was performed by Harmon Engineering and Contracting Co., Inc. to allow access for DGM and intrusive activities in accordance with the SSWP. UXO personnel also provided

oversight and MEC avoidance support during brush clearing operations. The UXO escort walked ahead of the brush cutters and performed an additional visual and hand-held magnetometer assisted surface sweep to identify and remove all MEC and non-MEC hazards. In addition, the escort acted as a safety observer to insure compliance with prescribed procedures.

2.5 LAND SURVEYING

Surveying of boundaries and grid corners was performed by L.I. Smith, an Alabama licensed professional land surveyor, in Alabama State Plane East Zone coordinates (1983) in U.S. Survey Feet in accordance with the SSWP. An MES UXO Technician escorted the survey crew and provided anomaly avoidance support. Survey data and reports are included in Appendix B.

A 100 ft. by 100 ft. grid system was established throughout the work site. A six inch survey nail was placed to identify the southwest corner of each grid. A 3-foot wooden stake was used as a visual reference for each corner point and was marked with the corresponding grid number.

Step-out boundaries comprising 200-foot radius arcs from MEC find locations were established as needed. The surveyors emplaced additional survey nails and witness stakes at included grid corners, intersection points of the grid lines and the boundary arcs, and approximately every 20-feet along the boundary arc.

2.6 CLEARANCE TO ONE-FOOT

UXO teams led by a UXO Tech III (Team Leader) conducted a MEC clearance to a depth of 1 foot over designated areas. The clearance teams utilized standard mag and dig clearing techniques, establishing 5-foot wide control lanes, and used approved hand held magnetometers and all metal detectors to assist in detection of MEC and MEC-like metal objects. The approved sensors for this effort were the Schonstedt GA-92XT/52CX Whites, DFX 300, Vallon VMH (large and small head), and the Geonics EM61-MK2 (analog mode).

MEC was consolidated within the grid for disposal and items unacceptable to move were marked for BIP procedures at the end of each day. All scrap was identified, inspected, and segregated into MEC scrap and non-MEC scrap. MEC scrap and non-MEC scrap were re-inspected for subsequent pickup and transported to a temporary holding area for QC and QA inspection, certification and final disposition.

The UXO Team Leader was responsible for team activities, identification and inspection of MEC items, and for entering data from the clearance into the team PDAs. Total non-MEC and total MEC scrap weights for each grid and additional positional and descriptive data for MEC items were entered into the PDA for synchronization to the project databases.

2.7 AGGRESSIVE SURFACE/NEAR-SURFACE CLEARANCE

In accordance with the SSWP, an additional aggressive surface/near-surface (0 – 6 inch) clearance was conducted in Tracts 6C and 6D to identify and remove MEC and non-MEC scrap after brush cutting and before conducting DGM. This operation was not a final product operation; its objective was to reduce the number of near surface metallic anomalies that could interfere with DGM. This operation is referred to as "UXO surface and near surface clearance after vegetation is removed" in Table 10-3 of the SSWP.

This operation was conducted utilizing the industry standard mag/dig procedures. Teams would delineate five-foot lanes using ropes and search the area using hand-held magnetometers. This proved to be effective in reducing the overall number of DGM anomalies, which improved production rates and directed focus on clearance of subsurface items.

2.8 DIGITAL GEOPHYSICAL MAPPING

NAEVA performed all DGM tasks in MRS-6 using two-person teams operating Geonics EM61-MK2s in accordance with the SSWP. The second EM61-MK2 time gate (Channel 2), was the primary data channel used for geophysical mapping and interpretation. A custom electronic odometer built into one of the wheels triggered the recording of geophysical data at a rate of one reading every 10 cm (approximately 3 readings per foot, twice the standard EM61-MK2 wheel-mode sampling rate).

2.8.1 GEOLOCATION USING FIDUCIAL METHODS

The use of GPS was precluded due to the presence of heavy woods with dense tree canopy conditions throughout the area of investigation. The use of local (fiducial) coordinates relative to the surveyed grid corners was selected in the GPO as the most appropriate means of achieving accurate data positioning. NAEVA's data acquisition teams pulled tape measures between the grid corner stakes. Survey ropes were laid perpendicular to the tape measures at 25 foot intervals and were marked with alternating paint dots every 2.5 feet to facilitate straight-line data collection paths. Geophysical data was collected every 10 cm along these data collection lines using the EM61-MK2's integrated survey wheel.

In addition to providing lateral control marks, the ropes also allowed the insertion of distance control fiducial marks into the dataset as the EM61-MK2 crossed the 25 foot increments. During pre-processing of the data, those marks were used to adjust the along-line locations of the data points.

2.8.2 IDENTIFICATION OF NON-DGM AREAS DURING DATA COLLECTION

The use of the DGM methods described above requires that all data be collected along straight, parallel transects to maintain accurate positioning. Obstacles encountered along the transects frequently required the field teams to pause data collection, maneuver around the obstacle, and then resume data collection along the same line. At each of the line breaks (data gaps), the field

team recorded the end point of the line segment, the start point of the new segment, and the reason for the gap in a specially designed drop down menu on the team PDA. The majority of data gaps were caused by trees, but other obstacles included creeks, steep slopes, and standing water. These data gaps, called non-DGM (clearance) areas, were identified on maps for separate clearance using hand held instruments.

2.9 DATA PROCESSING

NAEVA utilized qualified geophysicists to perform all data processing tasks for MRS-6. The raw and processed data files, contour maps, and target lists were posted to the project file transfer protocol (FTP) site for review by project QC and MES QA personnel.

2.9.1 PRE-PROCESSING

Digital geophysical data was reviewed to ensure complete coverage and data quality by a qualified geophysicist. Data was edited for line ends and fiducial positions using Geonics DAT61-MK2 software, and then exported to an ASCII file format to allow for initial contouring and evaluation. If any data was found to be missing or unacceptable, the data collection team would be directed to return to the grid for recollection. Once the data was prepared, evaluated, and determined to be complete and accurate, raw Geosoft XYZ files were generated and electronically transferred to the FTP site.

2.9.2 INITIAL PROCESSING

Upon completion of pre-processing and a review of the acceptability of the associated DGM team QC data, the digital geophysical data was further evaluated and processed to generate the final processed data files and associated maps using Geosoft's Oasis Montaj processing software with the UX-Detect module. The data processing procedures include:

- Data evaluation for down-line data density and coverage
- Auto-leveling of four bottom coil channels, with additional leveling refinement of Channel 2 data
- Lag correction
- Gridding of data
- Additional filtering and data enhancement, as necessary
- Generation of polygon files to clip gridded data at line breaks
- Spatial referencing of culture features noted during data collection
- Target selection and evaluation of anomalies at or above the designated 7 millivolt (mV) threshold
- Conversion of data from local coordinates to State Plane coordinates
- Generation of final geophysical maps (local and State Plane coordinates), target lists and XYZ files

The data processing methods and parameters for each grid are documented in the Data Processing tables of the project DB (Appendix C). A mosaic of the DGM results for Tracts C, and D is shown in Figure 2-1. Individual grid maps showing the geophysical data and selected targets are included in the grid packages in Appendix D.

2.9.2.1 TARGET SELECTION

Initial target selections were made using automated processing routines within UX-Detect software. In areas exhibiting low target density and discrete features initial target selections were made from the profile data. Within high target density areas where anomaly footprints overlapped, the initial target selections were made based on the gridded data. Data and targets were evaluated by qualified geophysicists as to their validity and position. Targets found to be invalid or incorrectly located were removed or adjusted. Additionally, anomalies that were not selected by the UX-Detect module, yet deemed to represent a potential target, were manually selected. Each target list provides a unique Target ID, x and y location for each target (in local grid coordinates and State Plane coordinates), the recorded peak response, and any appropriate comments (i.e. culture, suspected utility, possible geologic response, or relationships with adjacent anomalies/targets). The target selection threshold based on the approved GPO results was 7 mV on Channel 2. The targets selected for each grid are documented and tracked in the Anomaly Tracking Sheet table of the project DB (Appendix C).

2.9.2.2 DELINEATION OF NON-DGM AND SPECIAL CASE AREAS

In some areas, digital geophysical data could not be collected due to the presence of trees, creeks, steep slopes or other obstructions. In such cases, polygon files were generated based on the line paths to show breaks in the data collection line. The polygon files were drawn on the geophysical maps and used to mask areas in which no DGM actually occurred. Field notes collected during DGM were imported into Oasis Montaj and noted culture was placed on the map. It was agreed prior to the start of the project that any unlabeled data gaps shown on the grid maps would be assumed to be the result of single trees.

One Saturated Response Area, where overlapping strong responses precluded picking of discrete targets, was identified in the northern portion of Tract 6D. Individual point targets were selected within this area as appropriate and a boundary for follow-on mag and dig clearance was placed around the area.

2.10 REACQUISITION

All targets selected by NAEVA's data processors as well as any QA/QC picks made by the QC Geophysicist or the QA Geophysicist, were reacquired in the field by NEAVA DGM teams using an EM61-MK2 operated in analog mode. Although targets were selected using a 7mV threshold from the DGM data, the DGM measurement locations generally did not fall exactly over the center of the buried metallic items sourcing the anomalies such that the exact location

and peak response of the target was not targeted. The location of peak responses were found for each target and the peak response was measured and recorded. All targets with a reacquired peak (Channel 2) response of at least 10 mV were intrusively investigated and cleared. The reacquisition data for each target was documented and tracked in the Anomaly Tracking Sheet table of the project DB (Appendix C). In addition, the reacquisition teams marked the boundaries of the special case areas noted in Section 2.8.2 with spray paint.

2.10.1 FIELD METHODS

Upon arriving at the grid, the team located the targets based on the geophysical maps and marked each target with a uniquely numbered pin flag in accordance with the SSWP. Each flagged location was interrogated with an EM61-MK2 to find the peak response location. The peak response, offset, and any comments from the instrument operator were entered into the PDA.

The benefit of reacquiring selected targets with the original mapping instrument comes in the reduced time and effort required of the dig teams. In addition to adjusting the target location directly over the peak value, the reacquisition teams had the ability to add or remove (merge) targets as necessary (which were fully documented on the team PDAs). If any related or adjacent sub-peaks above the targeting threshold were identified in the field, they were flagged and added (daughter anomalies) to the dig list by the reacquisition team. Occasionally, rough terrain or other outside interference will result in elevated instrument response and the selection of a target where none is necessary. Reacquisition teams searched a minimum of 2.5 ft. around each target. If they could not locate a peak response above the target threshold, the flag would not be placed and an appropriate comment recorded in their PDA.

2.11 UXO INTRUSIVE INVESTIGATIONS

2.11.1 INTRUSIVE OPERATIONS

Intrusive teams were provided a grid information package containing DGM grid maps and target lists with mV readings and comments. The basic tactical approach to intrusive operations remained consistent throughout the clearance phases. In DGM area, all targeted locations were excavated until the geophysical response was below the 10mV reacquisition threshold criteria or the dig was inspected and approved by QC. As part of the QC process all (100%) of the DGM target excavations were inspected with an EM61-MK2. The clearance to depth of detection contractor initially had some issues adequately training UXO technicians to check their digs with an EM61-MK2 so NAVEA geophysicists were imbedded in the dig teams by the GeoQC to perform this check.

2.11.2 NON-DGM AREAS

UXO teams were required to check their DGM maps and identify any data gaps present in the grid. UXO teams used a Vallon or Schonstedt detector or an EM61-MK2 in analog mode to

clear around obstructed data gaps (trees, deadfall, fences, etc.) and 100% of the area of non-obstructed data gaps (such as creeks and steep slopes).

2.11.2.1 TREE GAPS

The MRS is heavily wooded. The Vallon or Schonstedt detector or an EM61-MK2 in analog mode was required to be used to clear to the depth of detection all data gaps around trees to a radius of 2 feet using mag and dig methodology.

2.11.2.2 STEEP SLOPES

In some isolated areas and drainages, the terrain was too steep to be safely mapped using an EM61-MK2. These non-DGM areas were marked in the field during reacquisition and were subsequently cleared using mag and dig methods with approved clearance to depth instruments.

2.11.2.3 STRUCTURES

There were no buildings or other permanent operational structures found in MRS-6.

2.11.2.4 OTHER NON-DGM AREAS

Downfall, logs, trenches, swamps, gullies, mounds, rocks, etc. were also identified on the DGM maps. UXO teams used a Vallon, Schonstedt, or an EM61-MK2 in analog mode to clear obstruction-caused data gaps (downfall, logs, rocks, etc.) and to clear 100% of other data gaps (trenches, swamps, gullies, mounds, etc.).

2.11.2.5 SRAS and HDTAs

A Saturated Response Area (SRA), consisting of dense, overlapping geophysical anomalies that made prosecuting individual targets impractical, was identified for MRS-6 in grid N137E017 was primarily prosecuted by backhoe excavation, followed by mag and dig clearance to the depth of detection.

2.11.2.6 Pond Exception Area

The pond, which included portions of six grids in Tract 6D, was designated as an exception area during the original clearance. Matrix returned in the summer of 2014 and drained the pond by installing a temporary drainage trench. An approximately 50 ft. x 30 ft. wet area remained which was cleared to the depth of detection by UXO Technicians using approved handheld sensors. The remaining previously submerged areas, were geophysically remapped and cleared to the depth of detection in July 2014.

2.12 STEP-OUTS

If a MEC item was identified within 200 feet of the boundary of the MRS, a step-out was performed to ensure a 200 foot buffer free of any MEC. Step-outs were not performed into MRS-3 which had already been cleared. MRS-6 step-outs are shown on Figures 1-4 and 3-1. Step-outs SP001 and SP002 in McClellan Park system areas were cleared to one foot by mag and

dig methods. SN001 was cleared to the depth of detection. SN002, which was driven by a non-penetrating illumination round, was cleared to a depth of one foot.

2.13 DEMOLITION OPERATIONS

Demolition operations were conducted throughout all phases of the MRS-6 remediation in accordance with the SSWP. For items determined to be safe to move, consolidated demolition operations were conducted within the grid. Items deemed not safe to move were rendered safe by blow in place (BIP) demolition procedures. Positive identification, location, and condition of the MEC item determined whether blast mitigation was required. For intentional detonations where blast mitigation was required (adjacent to roads, buildings, workers) procedures in *Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions*, HNC-ED-CS-S-98-7 (USACE, 1998) were used. No unintentional detonations occurred.

A total of 1,838 MPPEH items were found in MRS-6. Of these, 1,438 were determined to be MEC by explosive investigation or x-ray operations as summarized below in Table 2-2 below:

TABLE 2-2: MEC ITEMS

MEC Item	Total
60mm Mortar (HE)	1,335
60mm Mortar (Illumination)	5
60mm Mortar (WP)	9
105mm (HE)	6
105mm (WP)	1
2.36-in Rocket	48
Grenade (HE)	7
Grenade (Smoke)	1
Rifle Grenade (HE)	4
Rifle Grenade (Illumination)	11
Rifle Grenade (Smoke)	5
Slap Flare	2
Trip Flare	2
Other	2
Totals	**1,438**

Four hundred MPPEH items were determined to be MEC scrap by demolition or x-ray operations as indicated in Table 2-3.

TABLE 2-3: EXPLOSIVELY INVESTIGATED OR X-RAYED MEC SCRAP ITEMS

MEC Item	Total
2.36-in Rocket	395
60mm Mortar	4

Rifle Grenade (Practice)	1
Totals	**400**

2.14 WASTE DISPOSAL[2]

MEC-related scrap and non–MEC-related scrap were sorted and inspected in accordance with the SSWP and DODI 4140.62 *Material Potentially Presenting an Explosive Hazard,* (November 2008). This inspection process insured that MEC and non-MEC-scrap were properly identified and did not present an explosive hazard. The process included sorting, 100 % inspection and 100% re-inspection, demilitarization as needed, and securing in separate locked containers. Following this inspection program, non-MEC scrap and demilitarized MEC scrap was released to HVF LLC with a signed 1348-1A custody document. The containers of all scrap remained secured until they were processed and a certificate of disposition issued. MEC certification and disposal documents are included in Appendix H.

Scrap weights recycled were as follows:

- MEC Scrap – 78,322 lbs.
- Non-MEC scrap – 12,913 lbs.

[2] Current DOD terminology (DODI, 2008) is to refer to non-MEC scrap as MDAS. Material prior to determination of its explosives safety status, potentially contains explosives or munitions and is referred to as MPPEH. MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present and for which the chain of custody has been established and maintained is referred to as MDEH and is no longer considered MPPEH. In this report, to be consistent with existing plans and documents, we have continued to use MEC Scrap terminology.

3.0 MEC REMEDIATION RESULTS

Approximately 107.34 acres of MRS-6 were designated as non-McClellan Park System future use and were cleared to the depth of detection. Approximately 27.39 acres in the central portion and southern portion of MRS-6 were designated as McClellan Park System future use and were cleared to a depth of 1 foot. An additional 2.78 acres of step-outs were performed, and cleared to either 1 foot or the depth of detection, based on the future use of the driver item location – e.g. step-outs from MEC items in Tracts C and D were cleared to the depth of detection, and those from Tract A were cleared to 1 foot. This resulted in a total clearance area of 137.51 acres.

3.1 MEC ITEMS RECOVERED

A total of 1,438 MEC items were recovered from MRS-6 as itemized in Table 2-2. The locations of all MEC found are shown in Figure 3-1. The MEC found consisted primarily of 1,355 (94.2%) of 60mm mortars (various). The remaining MEC consisted of 2.36 Inch Rockets (3.3%), and a variety of miscellaneous projectiles, grenades mortars, and fuzes. The largest MEC item found was the 105mm (HE) projectile.

Clustering of MEC indicative of target/impact areas was identified. One high-density 60mm mortar impact area was cleared in the eastern portion of Tract C. This impact area extended eastward into (previously cleared) MRS-3. A smaller and lower density 60mm mortar impact area was cleared in Tracts D and B.

The MEC density for the MRS-6 clearance is 10.45 MEC/acre. The MEC items were recovered from the clearance operations as follows:

- 99 MEC items were recovered during the surface sweep
- 706 MEC items were recovered during the aggressive surface / near surface clearance operation
- 78 MEC items were recovered during the analog clearance to one-foot operation
- 554 MEC items were recovered during the clearance to depth of detection operation
- 1 MEC item was recovered during the 2014 clearance to depth of detection of the pond exception area

3.2 ANOMALY TRACKING

A total of 21,920 DGM anomalies were tracked during the DGM-based clearance (Table 3-1). The DGM target density for the clearance to depth of detection tracts is approximately 205 targets per acre. Of these, only 2.5% were MEC, 2.2% were MEC-scrap, 49.3% were MEC fragmentation, and 0.2% were small arms ammunition (SAA) (Table 3-2).

Of the MEC-scrap/MEC fragmentation recovered, the vast majority (93%) was 60mm mortar fragmentation.

Table 3-1: DGM Target Resolution

Total	%	Type	Comments
4,668	21.3%	Removed in Reac.	Removed in Reac, <10mV, same as adjacent target, corner pins
548	2.5%	MEC	60mm Mortar (HE), 60mm Mortar (WP), 2.36 Inch Rocket, Flare
478	2.2%	MEC Scrap	60mm Mortar (HE), 60mm Mortar (Illum.), 2.36 Inch Rocket
10,789	49.3%	MEC Fragmentation	60mm Mortar (HE), Grenade (HE)
4,987	22.8%	Non-MEC Scrap	Nails, barbed wire, wire, horseshoes, banding material
34	0.2%	SAA	
115	0.5%	Seeds	
301	1.4%	Geologic	
21,920	**100%**	**Totals**	

Table 3-2: DGM Target MEC Scrap/MEC Fragmentation

Quantity	%	Depth(in)	Type	Items
20,288	92.19%	0-36	MEC Fragmentation	60mm Mortar (HE)
218	0.99%	1-36	MEC Fragmentation	60mm Mortar (HE) plus other
606	2.75%	0-48	MEC Fragmentation	Grenade (HE)
22	0.10%	3-6	MEC Fragmentation	Grenade (HE) plus other
7	0.03%	0-8	MEC Fragmentation	Rifle Grenade (HE)
3	0.01%	6-10	MEC Fragmentation	37mm (HE)
19	0.09%	7-18	MEC Fragmentation	75mm (HE)
6	0.03%	48	MEC Fragmentation	75mm Shrapnel
4	0.02%	3-8	MEC Fragmentation	2.36 Inch Rocket
4	0.02%	3	MEC Fragmentation	SAA plus other
420	1.91%	0-48	MEC Scrap	2.36 Inch Rocket
8	0.04%	10-13	MEC Scrap	2.36 Inch Rocket plus other
184	0.84%	0-14	MEC Scrap	Fuze
80	0.36%	3-8	MEC Scrap	Grenade (Practice)
64	0.29%	3-24	MEC Scrap	60mm Drill
15	0.07%	1-12	MEC Scrap	Rifle Grenade (Illumination)
11	0.05%	6-24	MEC Scrap	60mm Mortar (Illumination)
12	0.05%	2-15	MEC Scrap	Slap Flare
12	0.04%	14	MEC Scrap	SAA
8	0.04%	24	MEC Scrap	Landmine (Practice)
7	0.03%	2-3	MEC Scrap	Rifle Grenade (Smoke)
5	0.02%	6	MEC Scrap	75mm Shrapnel
5	0.02%	12-18	MEC Scrap	81mm Mortar
2	0.01%	12-14	MEC Scrap	60mm (Practice)
5	0.02%	1-8	MEC Scrap	Other
22,015	**100.00%**	**Note: multiple (up to 25) items in some excavations**		

3.3 EXCEPTION AREAS

A pond was originally designated as an exception area, but it was subsequently drained and cleared to the depth of detection as part of the 2014 exception area effort. No exception areas remain in MRS-6.

4.0 QUALITY CONTROL (QC) TESTING

This section discusses the QC program that was implemented during the remediation of MRS-6. This section summarizes the DQOs and discusses the three phases of (quality) control, and the results of the QC program.

4.1 DATA QUALITY OBJECTIVES

The following approved DQOs were used for this project. All DQOs were met.

4.1.1 LAND SURVEYING

- Survey/positional accuracy – due to canopy cover, conventional survey methods were used to survey boundaries and grid corners, by L.I. Smith & Associates, an Alabama licensed professional land surveyor. Accuracy of these systems was within +/- 1 in.

4.1.2 GEOPHYSICAL INVESTIGATION

- The geophysical contractor personnel and equipment were certified as passing the GPO at a 95% seed detection level.
- Daily function checks of the geophysical instruments were within tolerances specified in the PWP and finalized in the GPO.
- There were no unexplained sensor or positional gaps in the geophysical data.
- DGM target anomalies were reacquired to within a critical radius of 2.5 feet at a greater than 99.5% rate.
- All blind seed items in DGM coverage areas were targeted.
- Along track sample density of at least 20 cm (10cm via survey wheel) and an across track spatial density of 2.5 feet for DGM, excepting obstacles, was achieved at a greater than 99.5% rate.

4.1.3 INTRUSIVE INVESTIGATION

- Daily performance checks of all hand-held detectors and data collection and positioning systems were performed IAW SOPs or manufacturer's specifications at a FCA.
- The DGM sensor (Geonics EM61-MK2) was used for reacquisition of all DGM targets and to interrogate all no-find/geologic locations.
- All MEC items were positively identified as to type, fuze, condition, and filler.
- The UXOQCS verified the identification of all MEC items.

4.1.4 MEC ITEM PERFORMANCE CLEARANCE DEPTHS

Performance clearance depths specified in the PWP are presented in Table 4-1.

TABLE 4-1: Performance Clearance Depths For MEC Items

MEC Item	Clearance Depth
Mk II Hand Grenade	0 – 14 in.
37mm Projectile	0 – 14 in.
M9 Rifle Grenade	0 – 18 in.
2.36-in. Rocket	0 – 24 in.
3.5-in. Rocket	0 – 24 in.
75mm Projectile	0 – 30 in.
3-in. Stokes Mortar	0 – 32 in.
60mm Mortar Projectile	0 – 24 in.
81mm Mortar Projectile	0 – 30 in.
3.8-in. Projectile Shrapnel	0 – 24 in
4.2-in. Mortar Projectile	0 – 36 in.
105mm Projectile	0 – 36 in.
155mm Projectile	0 – 48 in.
AT Mine	0 – 6 in.

4.1.5 SEEDING

As discussed in Section 4.8, QC blind seeding was performed substantially in excess of the minimum required density of 1 per UoP. UXO teams recovered 394 of 399 (98.7%) of the QC blind seeds, exceeding the 95% GPO DQO but not quite making the 100% DQO goal. This is an outstanding blind seed recovery rate considering the high level of seeding and indicates an acceptable level of quality.

4.1.6 REMAPPING

In accordance with the approved Sitewide Geophysical Mapping QA Plan (2004), quality of DGM-based clearance to depth of detection areas would be assured by a combination of QC and QA verification (pre-dig) and confirmation (post-dig) remapping, with associated intrusive investigation, of 10%-30% of the DGM area. As discussed in (QA) Section 5.1.2, a total of 10.3% of the area was remapped for MRS-6.

4.2 THREE PHASE QC PROGRAM

A three-phase QC program was implemented as a means to verify accomplishment of the DFWs. This program consisted of Preparatory, Initial, and Follow-up QC inspections. QC inspections are documented in Appendix E.

4.2.1 PREPARATORY PHASE INSPECTION

The Preparatory Phase was a pre-operational briefing and training prior to production start. It consisted of a briefing by the QC team for specific tasks. The briefing covered QC check sheet specifics and any SOPs relating to the task. During the briefing, the QC team and operations personnel identified specific procedures, and equipment needed to accomplish the task. Because many of the MRS-6 tasks were performed by contractor teams moved from performing the

identical work tasks in previous MRS clearances, (legacy) initial inspections were used as appropriate.

4.2.2 INITIAL PHASE INSPECTION

The QC team conducted an initial phase inspection the first time a DFW was performed. This inspection checked that preliminary work met contract specifications, was safely executed, and that an acceptable level of workmanship was achieved. Because many of the MRS-6 tasks were performed by contractor teams moved from performing the identical work tasks in previous MRS clearances, (legacy) initial inspections were used as appropriate.

4.2.3 FOLLOW-UP PHASE INSPECTION

Follow-up inspections ensured continued PWP compliance, workmanship quality, and safety. The QC team observed specific portions of the task in progress. Established procedures briefed at the QC preparatory briefings and initial inspections were observed.

4.3 UOP CERTIFICATION PROCESS

The UoP certification process was implemented in accordance with the PWP and incorporates the major QC steps. Verification of these steps are documented in the UoP Certification Process Spreadsheet Log and Certification Packages in Appendix E.

4.3.1 QC STEP 1: GPO, FCA, PREPARATORY AND INITIAL QC INSPECTION

The FCA and GPO were used to certify operators and instruments prior to commencing field operations. Operators were tested for their ability to detect buried seed items with specified equipment. GPO and FCA certifications are included in Appendix A. The preparatory phase inspection was conducted by QC personnel prior to contractor work team field deployment. The initial QC inspection was performed the first time selected DFWs were performed. Preparatory and Initial inspections are documented on the QC Surveillance Reports in Appendix E.

4.3.2 QC STEP 2: FOLLOW-UP QC PHASE INSPECTION

Follow-up QC Phase Inspections for each DFW were conducted in accordance with Table 10-3 of the PWP in accordance with the QC state (normal, relaxed or tightened) to ensure the tasks were being performed to the required PWP standards.

4.3.3 QC STEP 3: GEOPHYSICAL DATA REPROCESSING

The Geophysical QC Specialist (GeoQCS) independently reprocessed the geophysical data for on average one grid in each UoP and developed maps and target lists which were compared to the grid maps and target lists. Minor discrepancies in target selection existed due to the interpretative nature of geophysical target selection. If discrepancies between the grid maps and target lists existed, the GeoQCS and the geophysical data processor compared processing techniques and agreed to standard processing procedures. At this time, the GeoQCS also checked the blind QC seed items against the DGM results and target lists for this UoP. If any

QC issues were identified, the QC team would conduct a root cause analysis documenting what, when and where the problem occurred and who was involved and recommend potential solutions and corrective actions.

4.3.4 QC STEP 4: BLIND QC SEEDS

QC seed items were placed by the QC team at a minimum density of one seed item per UoP to monitor the Aggressive Surface/Near Surface Clearance Operations. A subsequent set of QC seeds were also installed at a minimum density of one seed item per UoP to monitor the Clearance to Depth Operations. Seed items consisted of inert munitions items placed below the vegetative mat for surface operations and to the maximum depth of detection for subsurface operations. QC seeding results are discussed in Section 4.8.

4.3.5 QC STEP 5: EXCAVATION SAMPLING REPORTS

Step 5 of the QC process consisted of post excavation dig checks and data gap checks to verify workmanship. This QC step utilized MIL-STD-1916, verification level III. The PWP specified three levels of QC state (tightened 35%, normal 25%, or relaxed 15%) which determined the minimum percentage of targets in a UoP that QC was required to check. The QC state for each team was based on its work history and quality performance. All teams started at the normal QC state. The QC state for each grid is recorded on each QC/QA Inspection report contained in Appendix E.

4.3.6 QC STEP 6: TARGET DATA MV COMPARISON TO EXCAVATION RESULTS

This step was actually performed prior to QC Step 5. Upon completion of all excavations in a UoP, the GeoQCS would compare the reacquisition team's target mV reading with intrusive results. If a mV response was inconsistent with the excavation results (based on GPO and intrusive history), GeoQCS selected that target for QC Step 5 inspection by the UXOQCS. These comparisons are documented on the GeoQC mV Comparison Tracking Sheets in Appendix E.

4.4 UOP CERTIFICATION

The UoP Certification Packages document each UoP successfully passing the six QC steps and are included in Appendix E. Part of the UoP certification process required that at least one grid from a UoP be selected and reprocessed by GeoQCS. Initially, grids were selected randomly from a UoP. However, as work progressed, grids with blind QC seed items were preferentially selected.

4.4.1 UOP CERTIFICATION REQUIREMENTS

All UoPs passed the certification requirements as indicated on Table 4-2. All raw and processed geophysical data and associated geophysical field QC data is included in Appendix D. UoP certification packages are presented in Appendix E**,** and include:

- GeoQC Grid Data Reports with Checklists and Reprocessed Data
- GeoQC mV Comparison Tracking Sheet
- GeoQC QA-QC Geo Tracking Sheet
- QC Surveillances
- QC Acceptance Reports
- QA/QC Grid Tracking Tables

TABLE 4-2: UoP QC Verification

UoP Certification Process Verification MRS-6								
UoP	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**	**QC Complete**	**Verified By**
	FCA, GPO, Prep, Initial	Follow-up Inspection	Data Reprocessing	Blind QC Seeding	QC Grid Inspection	Target mV Comparison	Date	QC
P0001	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0002	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0003	YES	YES	N/A	YES	N/A	N/A	10/1/2009	JBS
P0004	YES	YES	N/A	YES	N/A	N/A	10/14/2009	JBS
P0005	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0006	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0007	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0008	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0009	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0010	YES	YES	N/A	YES	N/A	N/A	10/13/2009	JBS
P0011	YES	YES	N/A	YES	N/A	N/A	8/25/2009	JBS
P0012	YES	YES	N/A	YES	N/A	N/A	8/25/2009	JBS
P0013	YES	YES	N/A	YES	N/A	N/A	8/25/2009	JBS
P0014	YES	YES	N/A	YES	N/A	N/A	9/9/2009	JBS
P0015	YES	YES	N/A	YES	N/A	N/A	9/11/2009	JBS
P0016	YES	YES	N/A	YES	N/A	N/A	9/9/2009	JBS
P0017	YES	YES	N/A	YES	N/A	N/A	9/11/2009	JBS
N0001	YES	YES	YES	YES	100%	10/15/2009	11/12/2009	JBS
N0002	YES	YES	YES	YES	100%	10/15/2009	11/12/2009	JBS
N0003	YES	YES	YES	YES	100%	10/21/2009	11/12/2009	JBS
N0004	YES	YES	YES	YES	100%	10/21/2009	11/12/2009	JBS
N0005	YES	YES	YES	YES	100%	11/12/2009	1/8/2010	JBS
N0006	YES	YES	YES	YES	100%	12/15/2009	1/8/2010	JBS

N0007	YES	YES	YES	YES	100%	10/21/2009	3/8/2010	JBS
N0008	YES	YES	YES	YES	100%	10/30/2009	3/8/2010	JBS
N0009	YES	YES	YES	YES	100%	11/20/2009	2/1/2010	JBS
N0010	YES	YES	YES	YES	100%	12/23/2009	3/8/2010	JBS
N0011	YES	YES	YES	YES	100%	11/15/2009	3/9/2010	JBS
N0012	YES	YES	YES	YES	100%	10/15/2009	11/16/2009	JBS
N0013	YES	YES	YES	YES	100%	10/30/2009	2/4/2010	JBS
N0014	YES	YES	YES	YES	100%	12/15/2009	2/3/2010	JBS
N0015	YES	YES	YES	YES	100%	12/23/2009	3/8/2010	JBS
N0016	YES	YES	YES	YES	100%	1/15/2010	2/2/2010	JBS
N0017	YES	YES	YES	YES	100%	1/26/2010	3/16/2010	JBS
N0018	YES	YES	YES	YES	100%	10/15/2009	11/13/2009	JBS
N0019	YES	YES	YES	YES	100%	11/20/2009	2/4/2010	JBS
N0020	YES	YES	YES	YES	100%	12/15/2009	2/4/2010	JBS
N0021	YES	YES	YES	YES	100%	12/15/2009	2/3/2010	JBS
N0022	YES	YES	YES	YES	100%	2/3/2010	3/8/2010	JBS
N0023	YES	YES	YES	YES	100%	10/15/2009	3/9/2010	JBS
N0024	YES	YES	YES	YES	100%	10/15/2009	11/13/2009	JBS
N0025	YES	YES	YES	YES	100%	12/15/2009	12/14/2009	JBS
N0026	YES	YES	YES	YES	100%	11/30/2009	12/14/2009	JBS
N0027	YES	YES	YES	YES	100%	11/20/2009	2/1/2010	JBS
N0028	YES	YES	YES	YES	100%	1/5/2010	2/1/2010	JBS
N0029	YES	YES	YES	YES	100%	2/3/2010	3/8/2010	JBS
N0030	YES	YES	YES	YES	100%	11/20/2009	1/27/2010	JBS
N0031	YES	YES	YES	YES	100%	9/28/2009	2/4/2010	JBS
N0032	YES	YES	YES	YES	100%	9/25/2009	10/20/2009	JBS
N0033	YES	YES	YES	YES	100%	10/15/2009	11/18/2009	JBS
N0034	YES	YES	YES	YES	100%	9/15/2009	2/8/2010	JBS
N0035	YES	YES	YES	YES	100%	9/2/2009	11/18/2009	JBS
N0036	YES	YES	YES	YES	100%	8/19/2009	11/18/2009	JBS
N0037	YES	YES	YES	YES	100%	9/25/2009	10/20/2009	JBS
N0038	YES	YES	YES	YES	100%	10/7/2009	2/11/2010	JBS
N0039	YES	YES	YES	YES	100%	11/13/2009	2/8/2010	JBS
N0040	YES	YES	YES	YES	100%	11/20/2009	12/9/2009	JBS
N0041	YES	YES	YES	YES	100%	1/15/2010	1/7/2010	JBS
N0042	YES	YES	YES	YES	100%	10/2/2009	10/20/2009	JBS
N0043	YES	YES	YES	YES	100%	10/30/2009	2/8/2010	JBS
N0044	YES	YES	YES	YES	100%	11/20/2009	12/10/2009	JBS
N0045	YES	YES	YES	YES	100%	9/22/2009	10/14/2009	JBS
N0046	YES	YES	YES	YES	100%	10/8/2009	2/8/2010	JBS
N0047	YES	YES	YES	YES	100%	9/15/2009	10/14/2009	JBS
N0048	YES	YES	YES	YES	100%	9/15/2009	10/14/2009	JBS
N0049	YES	YES	YES	YES	100%	8/19/2009	10/14/2009	JBS
N0050	YES	YES	YES	YES	100%	9/17/2009	9/23/2009	JBS
N0051	YES	YES	YES	YES	100%	9/17/2009	9/23/2009	JBS
N0052	YES	YES	YES	YES	100%	9/8/2009	9/23/2009	JBS
N0053	YES	YES	YES	YES	100%	9/17/2009	10/14/2009	JBS
N0054	YES	YES	YES	YES	100%	9/8/2009	10/14/2009	JBS
N0055	YES	YES	YES	YES	100%	9/8/2009	9/23/2009	JBS
N0056	YES	YES	YES	YES	100%	9/18/2009	10/14/2009	JBS
N0057	YES	YES	YES	YES	100%	9/18/2009	10/14/2009	JBS

N0058	YES	YES	YES	YES	100%	9/24/2009	10/14/2009	JBS
N0059	YES	YES	YES	YES	100%	9/24/2009	10/14/2009	JBS
N0060	YES	YES	YES	YES	100%	9/25/2009	10/14/2009	JBS
N0061	YES	YES	YES	YES	100%	9/18/2009	10/14/2009	JBS
N0062	YES	YES	YES	YES	100%	9/18/2009	9/15/2009	JBS
N0063	YES	YES	YES	YES	100%	9/18/2009	9/15/2009	JBS
N0064	YES	YES	YES	YES	100%	9/30/2009	10/14/2009	JBS
N0065	YES	YES	YES	YES	100%	9/23/2009	9/15/2009	JBS
N0066	YES	YES	YES	YES	100%	9/8/2009	9/15/2009	JBS
N0067	YES	YES	YES	YES	100%	10/8/2009	2/8/2010	JBS
SP001	YES	YES	N/A	YES	N/A	N/A	1/14/2010	JBS
SP002	YES	YES	N/A	YES	N/A	N/A	1/14/2010	JBS
SN001	YES	YES	YES	YES	100%	10/15/2009	2/4/2010	JBS
SN002	YES	YES	N/A	YES	N/A	N/A	12/7/2009	JBS
Pond ExArea	YES	YES	YES	YES	100%	6/23/2014	7/21/2014	JBS

MES QC grid inspections (Step 5 and Step 6) checked a minimum of 25% of DGM targets and data gaps in the DGM-based clearance grids. All grid QC inspections are documented in the QC inspection sheets in Appendix E.

4.5 QC FUNCTION TESTS

To ensure quality DGM data, NAEVA conducted daily QC tests, which were evaluated on a daily basis to ensure that both personnel and equipment were functioning at optimal levels. Each NAEVA DGM team conducted daily morning and end of day (AM and PM) static tests to document proper instrument function. In addition, a set of repeat data lines were collected for every grid dataset. All QC function tests were reviewed by the GeoQCS as part of the QC Process. The QC test data and results are included in Appendices D (DGM data) and E (Quality Control).

4.6 QC REMAPPING

After a UoP successfully passed the UoP certification (QC) process, it was then eligible for geophysical confirmation mapping and intrusive reinvestigation if needed. The labels for all data files generated during QC confirmation mapping were preceded by the letters “C” standing for confirmation or “P” standing for pre-dig verification. QC confirmation mapping was performed on selected grids by NAEVA using the same methods and equipment as the initial DGM phase. Note that QC and QA remapping results are totaled and evaluated together as part of the QA remapping evaluation in Section 5.1.2.

The primary goal of confirmation mapping was to provide a means of assessing the effectiveness of the grid clearance process by providing a “snapshot” of the geophysical conditions within the grids following intrusive operations. The project team recognized that at any site some residual response will remain after the first remediation pass, primarily in the spoils of the initial digs.

With this in mind, the secondary goal of the confirmation mapping process was to assess the nature of the residual geophysical anomalies and whether any MEC remained. Verification remapping was performed on select grids by a different mapping team to check the repeatability of the mapping results.

4.6.1 SELECTION OF REMAPPING GRIDS

MES took into account several factors when selecting grids for QC remapping. These included:

- Spatial distribution
- Including as many UoPs as practical
- Representing the full range of vegetation and terrain conditions
- Presence of MEC
- Field efficiency/team spacing considerations

NAEVA performed QC confirmation remapping on 18 grids in the clearance to depth of detection tracts, and the residual anomalies were targeted and investigated. In addition, NAEVA also performed pre-dig verification remapping on 8 grids. QC confirmation remapping data is included in Appendix E (Quality Control).

4.6.2 QC VERIFICATION REMAPPING RESULTS

NAEVA performed pre-dig verification remapping on the following 8 grids:

PN105E014	PN107E035
PN107E022	PN109E020
PN107E028	PN109E034
PN107E030	PN110E022

Verification remapping results were compared to the original NAEVA DGM data and target lists by the GeoQC. The DGM survey data, anomaly detection/delineation, target selection, location of non-DGM areas, and data quality were acceptably similar in all data sets.

4.6.3 QC CONFIRMATION MAPPING RESULTS

Table 4-3 illustrates the intrusive results of the QC remapping for 18 QC remapping grids conducted in MRS-6. The results of the confirmation mapping were acceptable. No MEC was found. Residual targets were mostly small 60mm, and fuze fragmentation. The largest piece of scrap was metal debris. The remapping was made more difficult by the presence of open excavations and spoils piles from the initial prosecution of the grids. In many cases, small bits of metal in spoils piles which were previously buried, showed higher geophysical response during remapping because they were now located above the original ground surface and closer to the EM61-MK2 sensor coils.

4.7 DEFICIENCY NOTICE REPORTS

The QC staff identified, documented, and tracked deficiencies during the course of field activities. In addition, they were tasked to recommend corrective actions, through a "root cause analysis" approach, and verify corrective actions were implemented and any rework satisfactorily accomplished. During the work in MRS-6 a total of 137.51 acres were cleared to one foot or to the depth of detection. The QC staff issued one Deficiency Notice Report (DNR) (Table 4-4) to USA for preparatory (not final product) work, and three DNRs to PIKA for clearance work. The DNRs are included in Appendix E.

TABLE 4-3: QC Confirmation Remapping and Dig Results

Tract	Grid ID	Targets	MEC	Items Recovered	Weight (lbs)	Comments
6-C	CN108E021	3	0	1	0.5	Nail
6-C	CN108E022	1	0	0	0	No targets remained after reac
6-C	CN109E031	84	0	0	0	No targets remained after reac
6-C	CN109E036	163	0	119	40.5	60mm mortar frag, fuze scrap, SAA
6-C	CN110E031	63	0	5	1.5	60mm frag
6-C	CN110E036	315	0	83	29	60mm mortar frag, fuze scrap
6-C	CN111E035	134	0	34	14	60mm mortar frag, fuze scrap
6-C	CN112E035	329	0	140	69.5	60mm mortar frag, fuze scrap
6-C	CN113E033	157	0	14	6.5	60mm mortar frag, fuze scrap
6-C	CN114E033	50	0	4	1.5	60mm mortar frag, fuze scrap
6-D	CN116E020	30	0	12	9.5	60mm frag
6-D	CN117E022	47	0	11	7.5	60mm frag
6-D	CN118E022	81	0	5	3.5	60mm frag
6-D	CN119E019	153	0	17	8.5	60mm frag
6-D	CN120E019	71	0	5	3	Metal debris
6-D	CN121E018	55	0	6	3	Metal debris
6-D	CN123E016	139	0	41	21	Grenade frag, fuze scrap, metal debris
6-D	CN136E021	168	0	8	8	Metal debris

Table 4-4: QC Deficiency Notice Reports

DNR	Description	Root Cause Analysis	Corrective Action Taken
DN-001	USAE Team 2 missed blind seed #006 in grid N137E018.	Failure to ensure 100% coverage of the grid with the analog instruments.	Grid N137E078 was reworked.
DN-002	PIKA Team 5 missed blind seed #6045G in grid N126E015.	Team failed to follow procedures for clearing data gaps.	The data gaps in grid N126E015 were reworked.
DN-003	PIKA Team 4 missed blind seed #6164G in grid N112E033, and #6163G in grid N112E034.	Team failed to follow procedures for clearing data gaps.	The data gaps in grid N112E033 and N112E034 were reworked.
DN-004	PIKA Team 2 missed blind seed #6317G in N104E0211S.	Team failed to follow procedures for clearing data gaps.	The data gaps in grid N104E0211S were reworked.

4.8 QC SEEDING

QC blind seeds were systematically placed in advance of DGM and UXO operations (Table 4-5). The contractor dig teams recovered 394 of the 399 seeds (98.7%) for all seeded operations.

- 179 QC seeds were placed to test the aggressive surface/near surface clearance operation performed in advance of DGM. All but one (99.4%) were recovered.

- 48 QC seeds were placed to test the analog clearance to one-foot operation performed in the non-DGM areas. 100% of the seeds for this operation type were recovered.
- A total of 172 QC seeds (1.57 per acre) were placed to test clearance to depth of detection operations. Both DGM and non-DGM areas (data gaps) were seeded. All but 5 seeds were recovered for a recovery rate of 98.7%.

TABLE 4-5: QC Seeding Results

Operation	Number of Seeds	Seeds Recovered	Seeds Missed	Acres/Seeding Density
Clearance to 6 Inches	179	178	1 (0.56%)	107.34 (1.67/acre)
Clearance to 1 Foot	48	48	0 (0%)	28.01 (1.71/acre)
Clearance to Depth of Detection	172	168	4 (2.33%)	109.50 (1.57/acre)
Totals	**399**	**394 (98.7%)**	**5 (1.3%)**	**244.85 (1.63/acre)**

4.8.1 QC CONCLUSIONS

MES QC was implemented as required by the PWP and SSWP to ensure that a quality MEC clearance work product was performed. MES QC signed off on all work products and clearance grids as being of acceptable quality.

5.0 QUALITY ASSURANCE (QA)

MES was responsible for both UXO QA and Geophysical QA (GeoQA), which are discussed separately as most DGM QA related to pre-dig activities and most UXO QA related to post-dig activities. DGM QA was performed in accordance with the *Site-Wide Digital Geophysical Mapping Quality Assurance Plan, McClellan, Anniston, Alabama* dated November 2004 (QAP). ERT provided DGM QA remapping support for MES. QA documentation is presented in Appendix J.

5.1 DGM QA

DGM QA was performed in accordance with the requirements stipulated in the QAP. The goal of the geophysical QA program is to ensure that the type and quantity of geophysical data collected are useable and sufficient to support the clearance of all detectable MEC from the removal action areas. The DGM QA process and results are summarized below.

The DGM related portions of the MEC Removal Action for MRS-6 were performed from April 2009 through March 2010. As outlined in the QAP, DGM QA measures performed are organized and discussed as follows:

- Review of work plan and GPO results
- Review of pre-dig DGM data packages
- Reprocessing of raw data
- Review of QC measures and reports
- Review of reacquisition and post-dig DGM DB
- DGM targeting of blind QA seeds
- QA remapping and confirmation sampling

5.1.1 DGM QA REVIEW

All SSWP and/or PWP changes were reviewed by GeoQA for technical acceptability and conformance with the project goals. FCRs-7-9 were reviewed for technical acceptability before submission to ADEM (Table 2-1).

All contractor geophysical teams and equipment were certified for field operations in the existing GPO Plot. As most teams and equipment had been in continuous use at McClellan, previously certified teams and equipment were not required to be recertified unless new personnel or equipment were utilized. GPO certifications are included in Appendix A.

The GPO was originally performed and approved by ADEM as part of the *MEC Remediation After Action Report, MRS-1 and Southern Alpha* (MES, 2010b Appendix A). Metrics for the ten critical Contractor DGM QC measures identified in the QAP were evaluated and finalized after review of the GPO data as follows:

Table 5-1: Contractor Critical DGM QC Measures and Metrics

Critical QC Measures	Metric
Blind Seeded QA Items	Target and recover all QA seeds
Background Noise	3.5mV peak-to-peak (Ch2) in static tests and "normal" histograms
Along Track Sampling	0.31 feet
Across Track Sampling	2.5 feet
Latency Correction	No visible "herring bones"
Data Leveling	Geosoft leveling - rolling window ≥ 100 points to baseline response
Signal to Noise Ratio Variance	Static noise 3.5mV peak-to-peak (Ch2) and standard static response variance ≤20%
Anomaly Selection	Geosoft UX-Detect threshold selection: 7mV (Ch2). Acceptable targeting of compound anomalies and delineation of SRAs. Flagging of special case targets (HDTAs, by fence, etc.).
Positioning Errors	Total error ≤2.5 feet for DGM data/targets
Reacquisition	Comparable mV response, position <2.5 feet

A total of 66 (12.5%) of the 527 DGM grid data and accompanying DGM QC packages (which includes data packages for 50 remapped grids) for MRS-6 underwent QA review (Table 5-2). Over 50% of this data was reprocessed, compared to the DGM data package, and found to be of acceptable quality. Additionally the daily geophysical function test data were reviewed and determined to be of acceptable quality. Systematic discrepancies were not found. During QA review of 66 grid data packages, 66 data packages passed, and 0 failed. Background noise levels, along track and across track sampling densities, latency corrections, data leveling, and anomaly selection and positioning were found to be of acceptable quality with respect to the established QC metrics.

TABLE 5-2: QA Review of DGM Data Packages

MRS	Grids	DGM Grid Packs Selected for QA			
		Pass	Check/Edit Pass	Fail	QA Targets
MRS-6	527	66	0	0	19

All QA seeds in mapped DGM areas were successfully targeted (and later recovered). There were no DGM targets which were not reacquired, although 1.35% were determined to be due to geologic response. The false alarm rate was acceptable (0%). No MEC or MEC-like items were found in 19 additional QA targets which were selected for intrusive investigation, although 4 were 60mm MD, Grenade MD, or 2.36 in. Rocket MD not exceeding two pounds in weight. The

reviews and QC-QA acceptances tracking of the DGM grid data packages and anomaly targeting are included in Appendix J.

Anomaly reacquisition data was found to be of acceptable quality for spatial offset and correspondence of anomaly amplitude. Anomalies were reacquired with the EM61-MK2 operated in analog mode. More than 99.5% of all targeted anomalies reacquired to 2.5 feet or less from the targeted location. The few exceptions were primarily on larger compound anomalies where reacquisition teams found stronger peaks within the anomaly. The QC mV comparison data was reviewed and it was confirmed that dig results with a disparate size difference to their targeted mV levels were identified and referred to the MES UXOQCS for intrusive QC investigation.

5.1.2 REMAPPING

In accordance with the approved Sitewide Geophysical Mapping QA Plan (2004), quality of DGM-based clearance to depth of detection areas would be assured by a combination of confirmation (pre-dig) and verification (post-dig) remapping, with associated intrusive investigation, of 10%-30% of the DGM area. In addition to the QC post-dig confirmation remapping discussed in Section 4.6, independent (third party) QA verification (pre-dig) and (post-dig) confirmation DGM remapping was performed by ERT on a limited number of grids to demonstrate consistency of NAEVA's DGM results and the overall quality of the removal process. The third party remapping data are included in Appendix J.

Verification (pre-dig) remapping was performed by ERT on the following 17 grids to assess the adequacy and repeatability of NAEVA's DGM results.

QAN105E024	QAN113E017	QAN126E015
QAN106E024	QAN113E021	QAN129E022
QAN107E034	QAN113E022	QAN130E022
QAN108E020	QAN113E036	QAN133E017
QAN108E034	QAN114E036	QAN134E017
QAN109E020	QAN126E014	

Verification remapping results were compared to the original NAEVA DGM data and target lists. The DGM survey data, anomaly detection/delineation, target selection, location of non-DGM areas, and data quality were acceptably similar in all data sets.

QA confirmation (post dig) remapping was performed on 8 grids in MRS-6 after completion of Contractor clearance and QC release, to demonstrate that the objectives of the grid clearance were achieved and that no MEC or MEC-like items remain.

QAN116E019	QAN129E023
QAN122E018	QAN135E017

QAN123E015 QAN136E107

QAN128E023 QAN136E108 (2014)

Confirmation sampling of the confirmation mapping targets was performed by the MES UXO QA. Confirmation mapping and sampling results indicated that the residual anomalies in the grids were primarily due to metallic scrap and (Table 5-3). No MEC or MEC-like items were found during QA confirmation sampling, and GeoQA and UXOQA signed off on all grid clearances.

TABLE 5-3: QA (Post-Dig) Remapping and Dig Results

Tract	Grid	QA Targets	MEC	Items Recovered	Weight (lbs)	Comments
6-D	QAN116E019	10	0	0	0	Geologic response
6-D	QAN122E018	73	0	37	18	60mm frag, fuze scrap
6-D	QAN123E015	31	0	39	85.5	60mm frag, nails, reinforced concrete
6-D	QAN128E023	17	0	4	2	2.36 in. Rocket scrap, SAA
6-D	QAN129E023	6	0	0	0	No targets remained after reac
6-D	QAN135E017	26	0	21	13.5	Grenade scrap, SAA, barbed wire, cans, nails
6-D	QAN136E017	82	0	23	11.5	60mm frag, SAA, nails, bolts, pipe, wire, cans
6-D	QAN136E018	2	0	0	0	Residual targets only on spoils piles

Total DGM remapping performed (QC + QA) is indicated on Table 5-4 below:

Table 5-4 DGM Remapping Totals

	Pre Dig Verification Grids	Post Dig Confirmation Grids
QC	8	18
QA	17	8
Total	25	24

Total remapping acreage of the 49 remapping grids was 11.25 acres, which is 10.3% of the 109.5 total clearance to depth of detection acreage of Tracts C and D.

In summary, the DGM QA program results for MRS-6 indicate that the Contractor data quality and QC performance goals for the removal action were met. No critical or systematic DGM performance discrepancies were found.

5.1.3 DEFICIENCY NOTICE REPORTS

One QA DNR was issued for a missed seed (QA-DN-001) as shown in Table 5-5. DGM grid data for the MRS was reviewed and all anomalies were targeted per the targeting criteria prior to intrusive activities.

Table 5-5: QA Deficiency Notice Reports

DNR	Description	Root Cause Analysis	Corrective Action Taken
QA-DN-001	USA Team 1 missed QA Seed #58 in grid N123E019.	Inadequate supervision, lack of skill or training - improper magnetometer techniques.	USA Team 1 reworked grid N123E019.

5.2 UXO QA

The goal of the UXO QA program is to ensure that the procedures and field operations were sufficient to support the clearance and removal of all detectable MEC in accordance with the removal depths specified in the project DQOs.

The UXO QA personnel conducted routine and random visits to each grid to ensure that procedures and processes were being performed in accordance with the SSWP and approved FCRs.

The UXO QA activities measures included the following tasks:

- Review of work plans and GPO Report
- QA blind seeding program
- Review of processes and procedures used by field crews
- Review of the QC process and reports
- Intrusive investigation of QA remapping targets, and
- Post-dig QA sweeps of grids.

5.2.1 UXO QA BLIND SEEDING PROGRAM

A total of 67 QA seed items were placed in MRS-6 by the UXOQA to test final product MEC clearance results (Table 5-6). 66 QA seeds were recovered resulting in a 98.5% recovery rate. This exceeds the 95% GPO DQO but not quite making the 100% DQO goal. This is an outstanding blind seed recovery rate and indicates an acceptable level of quality.

5.2.2 UXOQA ASSESSMENT

The UXOQA physically inspected a minimum of 25% of all DGM targets and 25% of all non-DGM areas in each grid using handheld sensors. QA inspection reports and grid sign-offs are included in Appendix J.

Table 5-6: QA Seeding Results

Tract	Tract Type	No. of QA Seeds	QA Seeds Recovered	Notes
6-A: USAE	Analog Clearance to 1 ft.	10	10	All recovered
6-B: USAE	Analog Clearance to 1 ft.	7	6	1 missed
6-C: PIKA	Clearance to Depth of Detection	27	27	All recovered
6-D: PIKA	Clearance to Depth of Detection	23	23	All recovered
Totals		**67**	**66 (98.5%)**	

5.3 QA CONCLUSIONS

The results and conclusions of the UXOQA and geophysical QA programs can be summarized as follows: with minor exceptions, which were documented and corrected during the QC/QA process:

- GeoQA did not identify any critical or systematic deficiencies and concluded that the geophysical data collected for the remediation was useable and sufficient to support the clearance of MEC.
- Geophysical remapping results for over 10.3% of the area confirmed and verified DGM mapping and clearance results of acceptable quality.
- 66 of 67 QA blind seeds were recovered.
- UXOQA did not identify any critical or systematic deficiencies and signed off on the clearance of all grids and UoPs.
- UXOQA and GeoQA concurred that the remediation met the quality objectives set forth in the QAP and the SSWP.

6.0 CONCLUSIONS

The MEC clearance for MRS-6 has been successfully accomplished in accordance with the PWP, SSWP and associated FCRs. In total, 137.51 acres were cleared to the depth of detection (109.5 acres) or to one foot (28.01 acres) during the MRS-6 remediation. The following totals of MEC and materials were removed during the clearance:

- 1,438 MEC items were recovered and destroyed
- 12,913 pounds of non-MEC scrap
- 78,322 pounds of MEC scrap (MD)

The 137.51 acre area was seeded in excess of SSWP requirements to test the clearance process. The dig teams recovered 394 of 399 QC blind seeds and 66 of 67 QA blind seeds. The blind seed recovery rate was 98.7% which is an outstanding performance.

QC was implemented as required by the SSWP to ensure that a quality MEC clearance work product was performed. MES QC signed off on all work products and clearance grids as being of acceptable quality.

MES QA inspected the work products and concurred that the MEC clearance product met the required performance standards specified in the SSWP and QAP.

All of MRS-6 will have a LUC consisting of a deed notification of the property's former use as a military base. In addition, unrestricted future use is recommended for Tracts 6C and 6D that underwent a clearance to the depth of detection. It is recommended that future LUCs include a prohibition on intrusive activities without UXO construction support in Tracts 6A and 6B that were cleared to a depth of one foot. Environmental Covenants pursuant to the Alabama Uniform Environmental Covenants Act (UECA), Code of Alabama 1975, §§ 35-19-1 to 35-19-14 for MRS-6 are included in Appendix K.

7.0 REFERENCES

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Figures

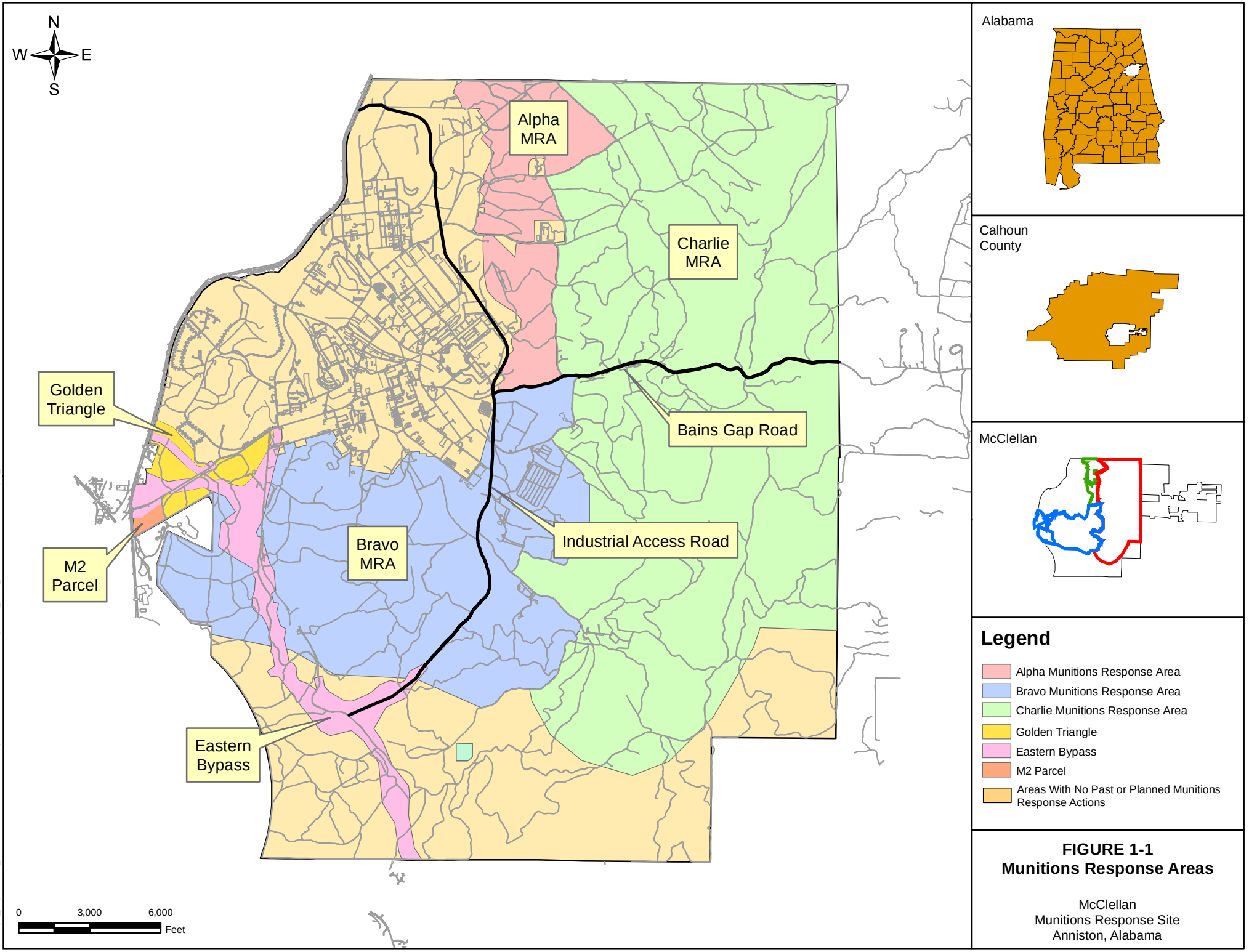

FIGURE 1-1
Munitions Response Areas

McClellan
Munitions Response Site
Anniston, Alabama

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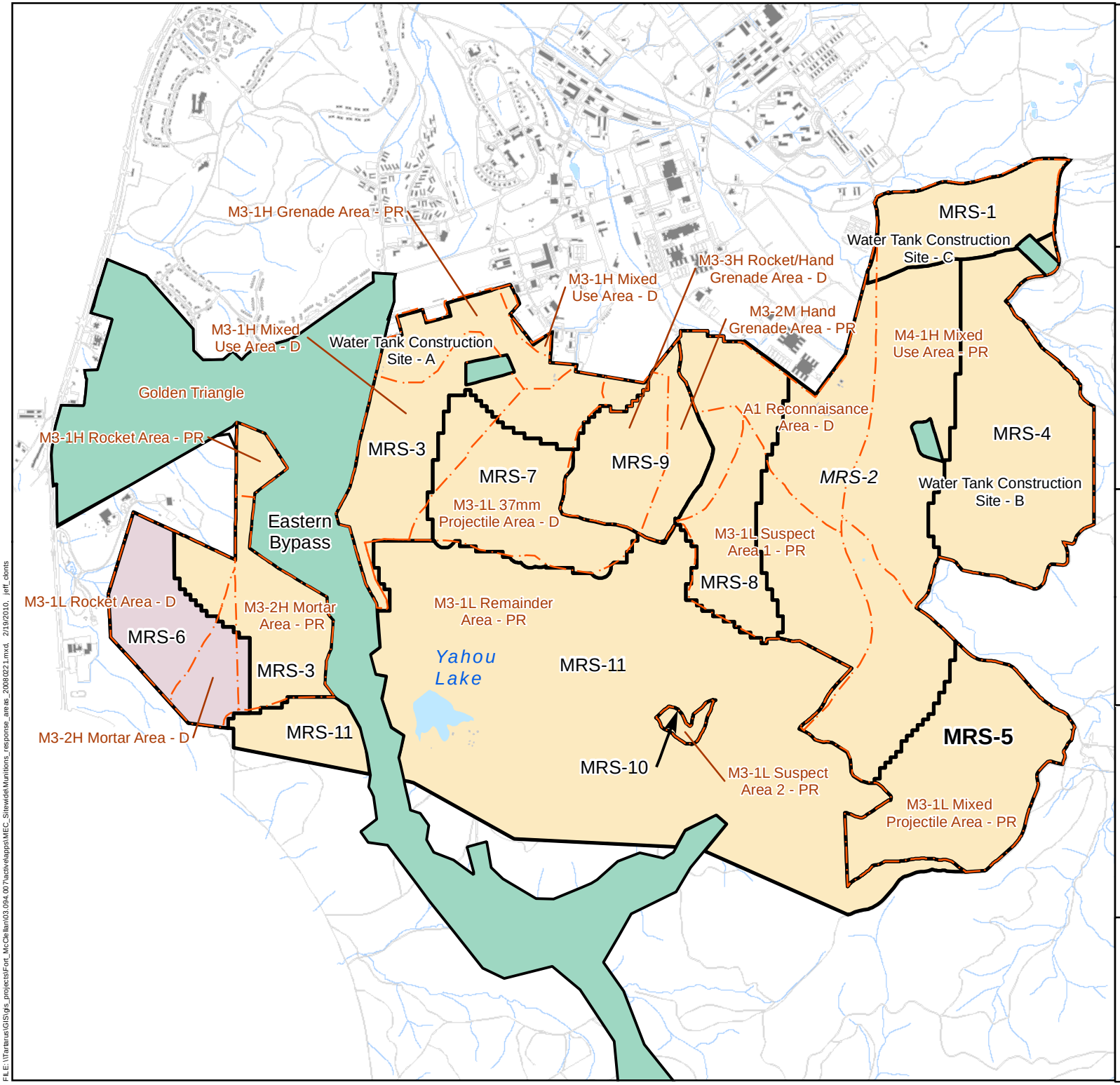
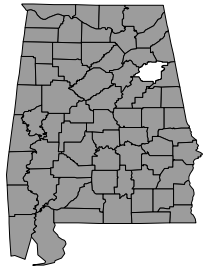
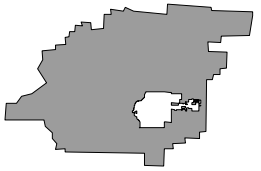
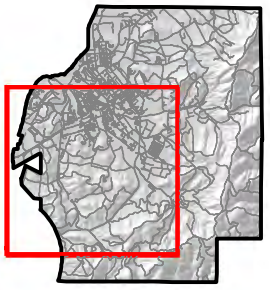


Alabama



Calhoun County





Legend

- MRS 6 Boundary
- Previously Cleared Parcels by U.S. Army
- Bravo Munitions Response Area
- Army EE/CA Sector Boundary
- Buildings
- Lakes
- Roads
- Streams

0 1,250 2,500 Feet

FIGURE 1-2
Bravo Munitions Response Area

McClellan
MRS-6 After Action Report
Anniston, Alabama

Matrix ENVIRONMENTAL

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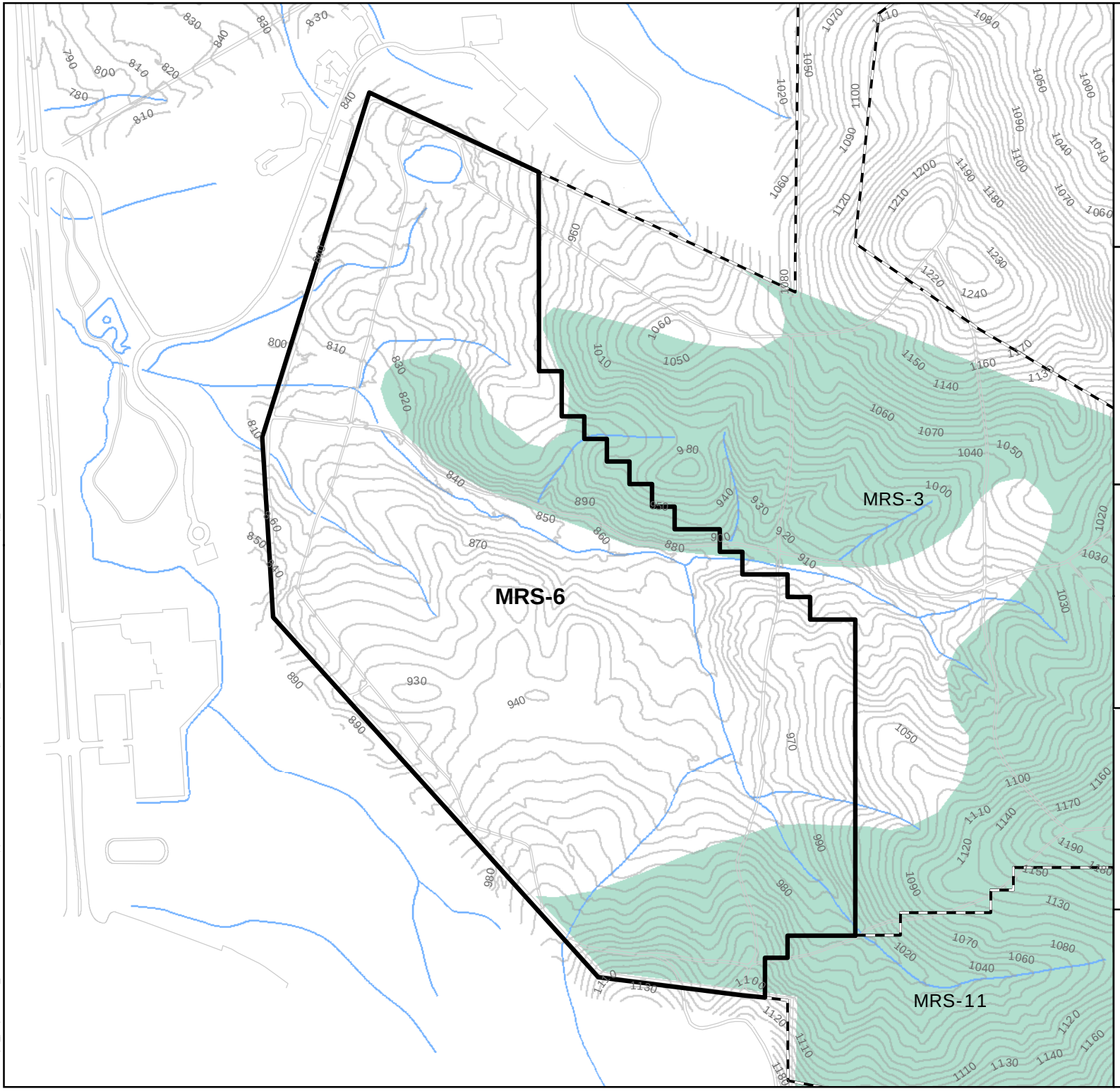

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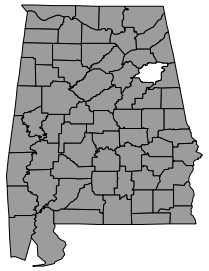

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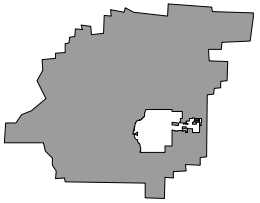

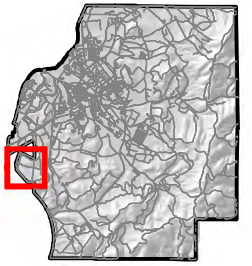

Legend

- MRS 6 Boundary
- Bravo Munitions Response Area
- McClellan Park Boundary
- Streams
- Roads
- Index Contour (10 ft)

0 300 600 Feet

FIGURE 1-3
Future Land Use

McClellan
MRS-6 After Action Report
Anniston, Alabama

Matrix ENVIRONMENTAL

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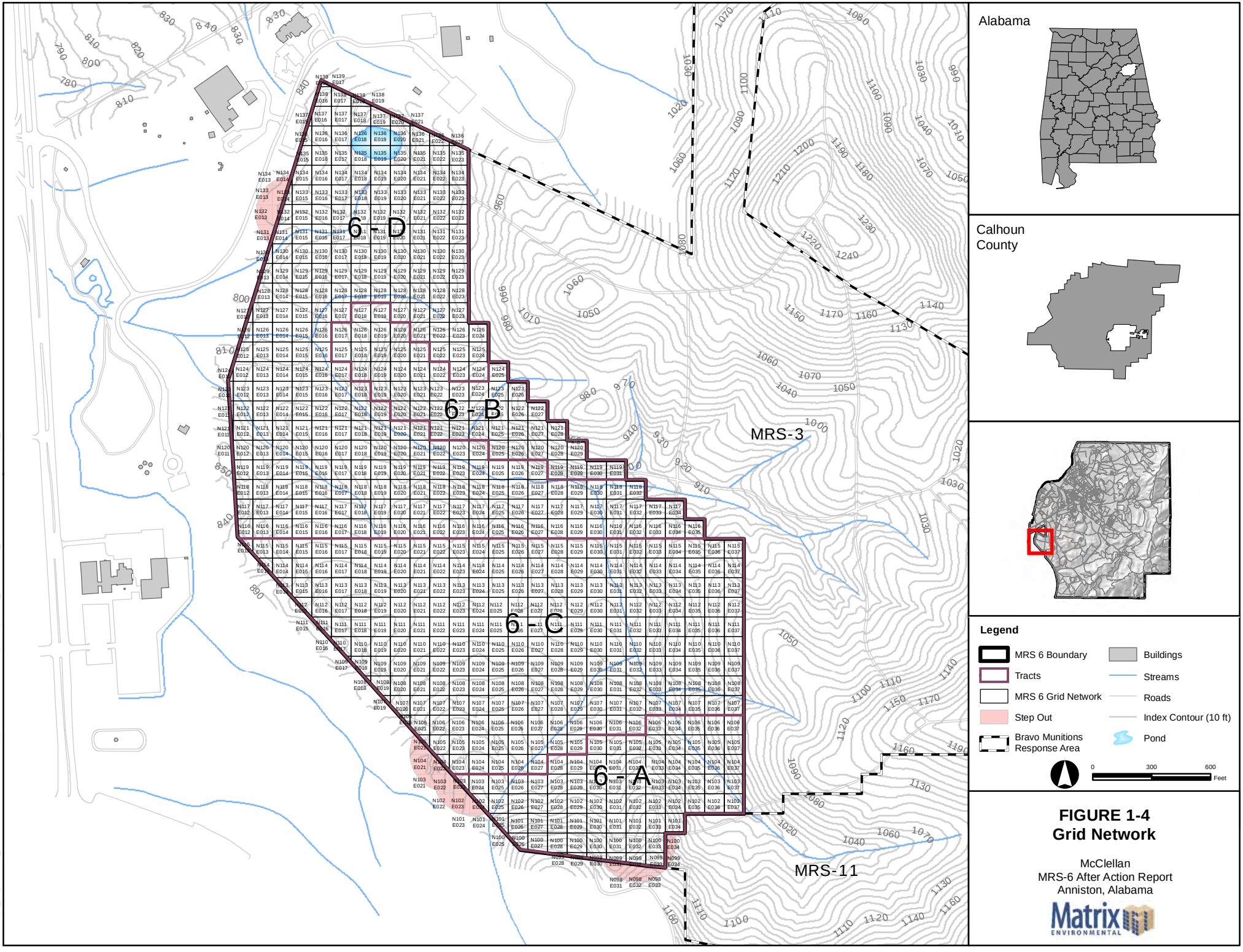

FIGURE 1-4
Grid Network

McClellan
MRS-6 After Action Report
Anniston, Alabama

Matrix ENVIRONMENTAL

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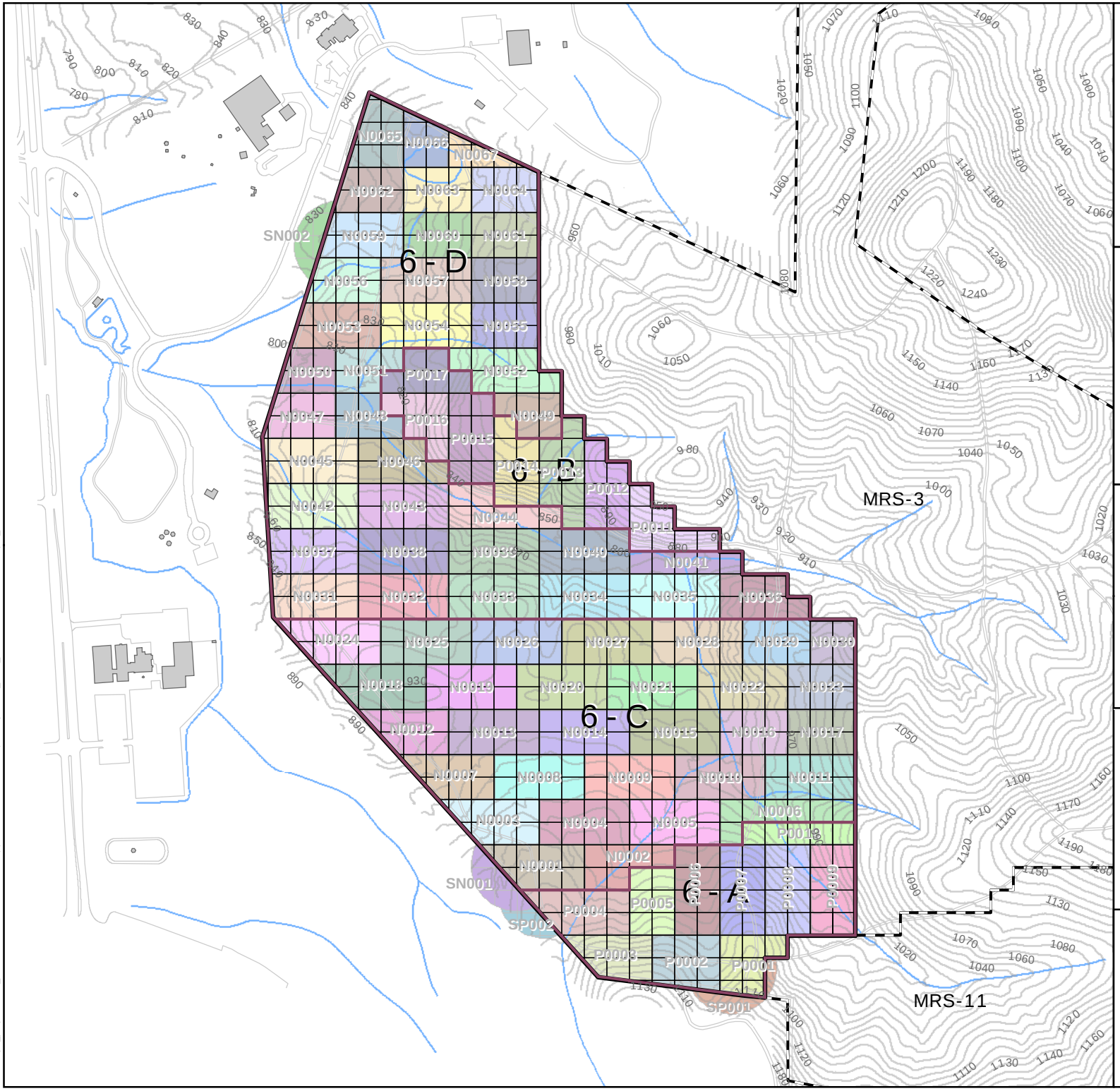

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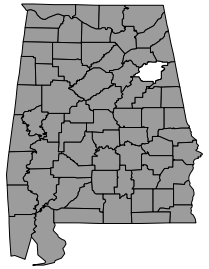
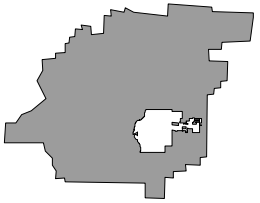
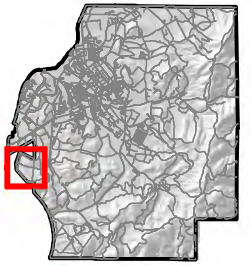


Calhoun County





Legend

- MRS 6 Boundary
- Tracts
- MRS 6 Grid Network
- P0027 UOP Designation
- Bravo Munitions Response Area
- Buildings
- Streams
- Roads
- Index Contour (10 ft)

0 300 600 Feet

FIGURE 1-5
Units of Production (UOP) Layout

McClellan
MRS-6 After Action Report
Anniston, Alabama

Matrix ENVIRONMENTAL

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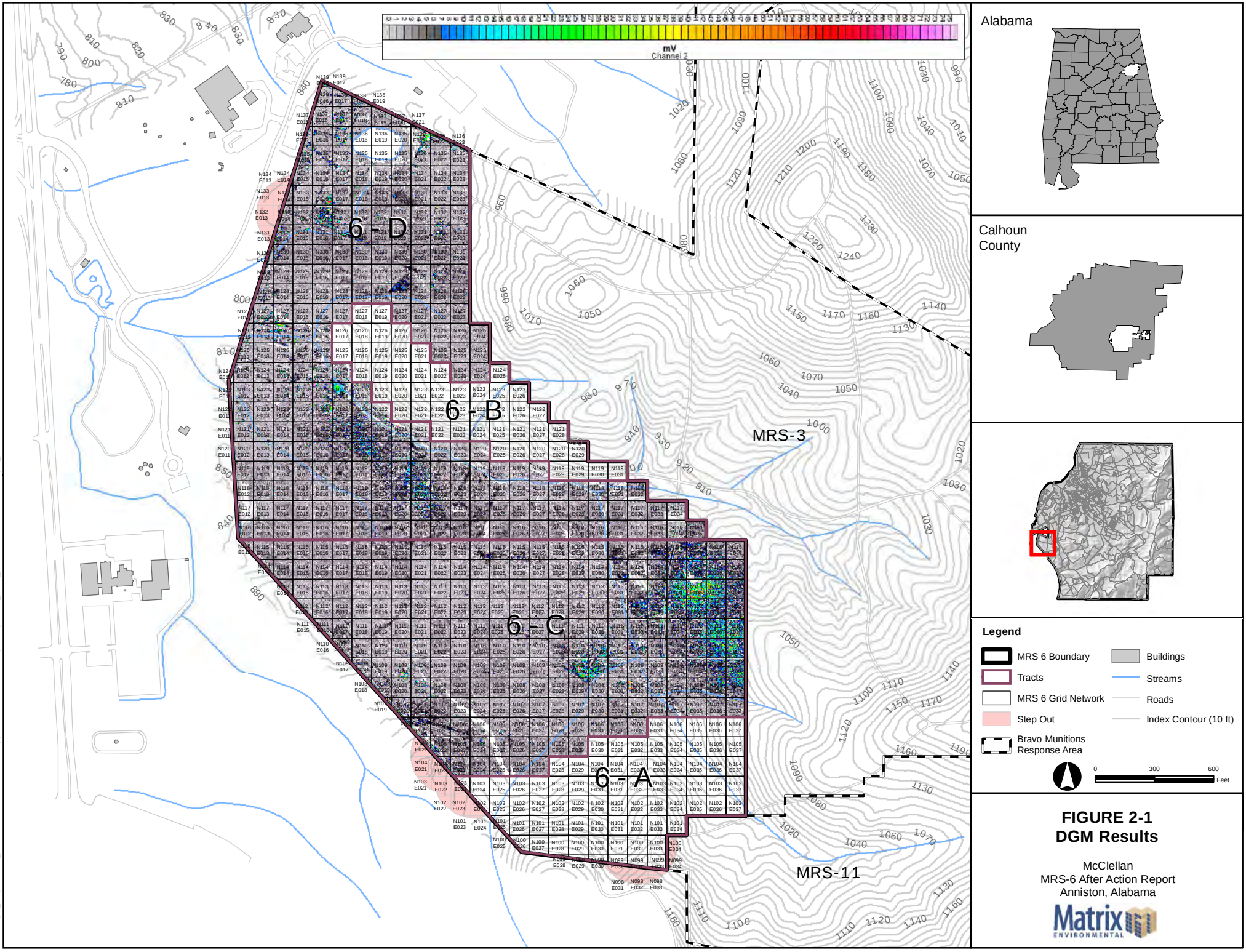

FIGURE 2-1
DGM Results

McClellan
MRS-6 After Action Report
Anniston, Alabama

Matrix ENVIRONMENTAL

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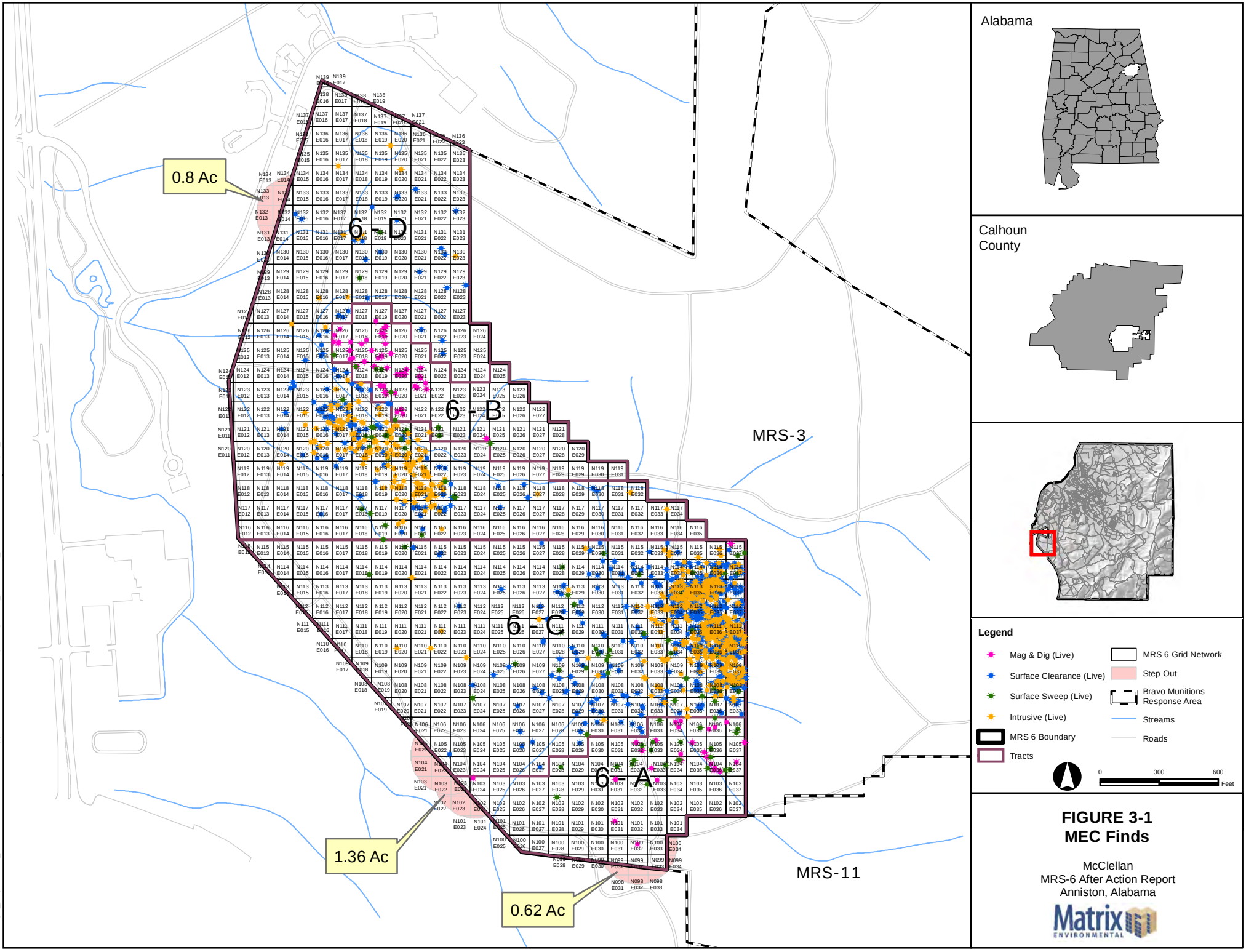

FIGURE 3-1
MEC Finds

McClellan
MRS-6 After Action Report
Anniston, Alabama

Matrix ENVIRONMENTAL

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