DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

20 July 2016

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Mr. Chuck Hendrickson, Project Manager
RCRA Corrective Action Section (6MM-RC)
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1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Hendrickson,

Holloman AFB is pleased to submit the Draft-Final Engineering Evaluation/Cost Analysis for the ML865 Ballistics Rain Field and RR869a Debris Field Munitions Response Sites, Holloman Air Force Base, NM.

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.

If you have any questions regarding this submittal, please contact me at (575) 572-6675.

Sincerely,

Digitally signed by KUSMAK.ADAM.M.1263331806
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USAF, cn=KUSMAK.ADAM.M.1263331806
Date: 2016.07.25 15:11:57 -06'00'

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Attachment:
Engineering Evaluation/Cost Analysis for the ML865 Ballistics Rain Field and RR869a Debris Field Munitions Response Sites, Holloman Air Force Base, NM.

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DRAFT-FINAL

ENGINEERING EVALUATION/COST ANALYSIS

ML865 BALLISTICS RAIN FIELD MUNITIONS RESPONSE SITE (MRS) and RR869a DEBRIS FIELD MRS

HOLLOMAN AIR FORCE BASE
NEW MEXICO

Performance Based Remediation
Contract Number: FA8903-13-C-0008

Prepared for:

AIR FORCE CIVIL ENGINEER CENTER
2261 Hughes Ave., Suite 163
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July 2016

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EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) was prepared by FPM Remediations, Inc. (FPM) under FPM's Air Force Civil Engineer Center Contract FA8903-13-C-0008, to support the United States Air Force (USAF) Military Munitions Response Program. The purpose of the EE/CA is to develop and evaluate Remedial Action (RA) alternatives for reduction of Munitions and Explosives of Concern (MEC)/Material Potentially Presenting an Explosive Hazard (MPPEH) risks to human health potentially present at the ML865 Ballistics Rain Field and RR869a Debris Field Munitions Response Sites (MRSs) located at Holloman Air Force Base (AFB), near Alamogordo, New Mexico. The MEC/MPPEH may be present in the subsurface of the ground due to past military munitions use of the property.

Holloman AFB is located in south-central New Mexico, seven miles west of the city of Alamogordo in Otero County. The 18.30-acre ML865 MRS is located west of the High Speed Test Track, just north of Hay Draw. The site was used to create artificial rain for the purpose of testing the effects on artillery. The direction of fire was from the east to the west, although the firing point was not identified. The period of operation for the site is unknown; however; aerial photography from 1972 shows the earth and timber target butt at the western end of a road perpendicular to the HSTT. Based on the Comprehensive Site Evaluation (CSE) Phase II and Remedial Investigation (RI), munitions that may be found at this site include 20, 37, 75, 105, and 155 millimeter (mm) projectiles and 5-inch rockets.

The 3.50-acre RR869a MRS is located in the south-central portion of the Base north of Munitions Storage Buildings 1197 and 1198 and south of Ritas draw. The exact historical munitions use at the site is unknown, however based on CSE Phase II visual survey and RI surface clearance results the following items may be found in the subsurface of this site: 2.75-inch rocket, 5-inch rocket, hand grenades, electric squibs, and small arms ammunition (5.56mm, 7.62mm, and .50 calibers).

Since 100% surface clearance and 100% coverage Digital Geophysical Mapping was performed at both sites during the RI, the following three RA alternatives were evaluated for ML856 and RR869a as part of this EE/CA:

1. Alternative 1 - No Action,
2. Alternative 2 - Land Use Controls (LUCs),
3. Alternative 3 - Subsurface Removal of MEC/MPPEH.

No Action alternative involves no active response or land use restrictions to locate, remove, dispose of, or limit the exposure to any potential MEC/MPPEH present within the MRSs. The No Action approach is routinely retained in the EE/CA evaluation of alternatives in accordance with the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to provide a baseline for comparison of other response technologies and alternatives.

The LUCs alternative includes engineering controls (i.e., signs) and administrative LUCs such as institutional controls (e.g., military orders preventing access to the MRS), educational programs designed to raise community understanding and awareness of the hazards associated with subsurface MEC, notifications to contracting, summary of hazards updated in the Base Real Property Record and the Geographic Information System (GIS) database, dig permits, and UXO construction support activities. As part of this alternative, signage would be placed along the perimeters of the sites.

Alternative 3 includes 100% removal of the subsurface anomalies identified during the RI including all individual geophysical anomalies above the established site-specific thresholds, as well as anomalies that show characteristics of burial pits. Removal activities will be performed by experienced UXO-qualified personnel. Following removal of all identified anomalies, the intrusive investigated area will be restored as close as possible to its original state.

These three alternatives were evaluated using the effectiveness, implementability, and cost criteria set forth in the NCP guidance for conducting EE/CAs. Alternative 3 is the recommended RA alternative for both the ML865 and RR869a MRSs. It is the most protective of human health over the long term (both MRSs) and the most cost effective (RR869a only).

According to Sections 300.415(m) and 300.820 of the NCP, community relations and administrative record activities will be performed as two forms of public participation necessary for all RAs. The Lead Agency (USAF) will designate a spokesperson to inform the public about the release and actions taken, to respond to questions, and to notify immediately affected citizens, and State and local officials. In addition, the USAF will establish an administrative record and make the administrative record available to the public at a central location or near the site, if applicable. Comments from the public on the selection of this RA alternative will be incorporated into the Action Memorandum identifying the preferred alternative for the site.

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LIST OF ABBREVIATIONS AND ACRONYMS

%	Percent
°F	Degrees Fahrenheit
AAAF	Alamogordo Army Air Field
AFB	Air Force Base
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BIP	Blow-in-Place
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSE	Comprehensive Site Evaluation
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DID	Data Item Description
DoD (DD)	Department of Defense
DMM	Discarded Military Munitions
EE/CA	Engineering Evaluation/Cost Analysis
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
ESL	Ecological Screening Level
ESS	Explosives Safety Submission
FPM	FPM Remediations, Inc.
FS	Feasibility Study
ft	feet
G-858	Geometrics G-858 Cesium Vapor Magnetometer
GRA	General Response Action
GSV	Geophysical System Verification
HASP	Health and Safety Plan
HDR	HDR Environmental, Operations and Construction, Inc.
HE	High Explosive
HHSL	Human Health Screening level
HSTT	High Speed Test Track
IAW	in accordance with
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
IVS	Instrument Verification Strip
lb	pound
LUC	Land Use Control
m	meter
MC	Munitions Constituents
MD	Munitions Debris
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
mg/kg	milligram per kilogram

LIST OF ABBREVIATIONS AND ACRONYMS (continued)

MHAT	MEC Hazard Assessment Tool
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
NA	Not Applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NMED	New Mexico Environment Department
nT/m	nanoTesla per meter
NTCRA	Non-Time-Critical Removal Action
ppm	parts per million
PRSC	Post Removal Site Control
RA	Remedial Action
RACER	Remedial Action Cost Engineering and Requirements
RAO	Remedial Action Objective
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
SDA	Safe Disposal Area
TBC	To Be Considered
TDS	Total Dissolved Solids
SKY	Sky Research, Inc.
TMV	Toxicity, Mobility or Volume
U.S.	United States
USAF	U.S. Air Force
USACE	U. S. Army Corp of Engineers
U.S.C.	U.S. Code
USEPA	U.S. Environmental Protection Agency
UXO	Unexploded Ordnance
WP	Work Plan
WSMR	White Sands Missile Range
WWII	World War II

1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) is being performed in support of the United States Air Force (USAF) Military Munitions Response Program (MMRP) at Holloman Air Force Base (AFB) near Alamogordo, New Mexico. The purpose of this EE/CA is to develop and evaluate Remedial Action (RA) alternatives and associated costs to mitigate hazards associated with subsurface Munitions and Explosives of Concern (MEC)/Material Potentially Presenting an Explosive Hazard (MPPEH) suspected to be present within the ML865 Ballistics Rain Field and RR869a Debris Field Munitions Response Sites (MRSs). This hazard was identified during the Remedial Investigation (RI) which consisted of 100 percent (%) surface MEC/MPPEH removal and 100 % coverage Digital Geophysical mapping (DGM) at both sites (FPM Remediations, Inc. [FPM], 2015). The EE/CA assumes that no additional site assessment activities will be necessary to determine the appropriate RA alternative.

This document follows the U.S. Environmental Protection Agency's (USEPA's) guidance provided in document 540/R93/057 Guidance on Conducting Non-Time-Critical Removal Actions (NTCRAs) under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA, 1993).

1.1 Project Authorization

The Department of Defense (DoD) MMRP falls under the authority of the Defense Environmental Restoration Program (DERP) and is in accordance with (IAW) the CERCLA of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and is part of the overall remedial action process. The MMRP was created by Congress in 2001 under the DERP as established by Section 211 of the SARA and is codified in Sections 2701-2710 of Title 10 of the United States Code. The MMRP addresses Unexploded Ordnance (UXO), Discarded Military Munitions (DMM), and Munitions Constituents (MC) at locations that are or were owned by, leased to, or otherwise possessed or used by the DoD. The USAF is the Lead Agency for this EE/CA.

The EE/CA is being completed by the FPM Team, under FPM's Air Force Civil Engineer Center Contract FA8903-13-C-0008, to support the USAF MMRP.

1.2 Purpose and Scope

The purpose of this EE/CA is to evaluate alternatives to reduce risks associated with suspected subsurface explosive hazards at the ML865 Ballistics Rain Field and RR869a Debris Field MRSs to support a NTCRA. The Comprehensive Site Evaluation (CSE) Phase II (HDR Environmental, Operations and Construction, Inc. [HDR], 2013) and RI found physical evidence of Munitions Debris (MD) at the surface of both MRSs indicating the potential presence of subsurface MEC. The EE/CA documents existing site characterization data, provides an analysis of alternatives, and identifies the preferred action to protect human health and the environment.

1.3 Report Organization

The EE/CA has been organized as follows:

Section 1: Introduction – describes the project authorization and purpose and scope.

Section 2: MRS Characterization – presents Holloman AFB location and operational history, ML865 and RR869a MRS descriptions, previous investigations performed at both MRSs, and streamlined risk evaluation.

Section 3: Development of Remedial Action Objectives (RAOs) – describes the regulatory requirements for the RA, including Applicable or Relevant and Appropriate Requirements (ARARs) and the RAOs.

Section 4: Identification and Analysis of RA Alternatives – provides detailed description and analysis of RA alternatives.

Section 5: Comparative Analysis of RA Alternatives – provides a comparative analysis of alternatives.

Section 6: Recommendations – summarizes the recommended RA alternative and provides the RA schedule.

Section 7: References – provides a list of references used to develop this EE/CA.

2.0 MRS CHARACTERIZATION

2.1 Installation Location and Background

Holloman AFB is located in south-central New Mexico, seven miles west of the city of Alamogordo in Otero County (**Figure 2-1**). It is adjacent to the White Sands Missile Range (WSMR). A portion of the Base to the south is bordered by Route 70, which also runs roughly north-south and parallel to the eastern boundary of the Base. Holloman AFB occupies approximately 50,763 acres of land. It is contiguous to the much larger (2.2 million acre) WSMR, and located to the east of the WSMR. The southern portion of Holloman AFB contains the flight line, composed of a series of runways running north-south, east-west, and northeast southwest. The Main Base is located at the southeast corner of the installation, where Route 70 borders the installation. The Main Base contains housing and administrative buildings. The West Area and the North Area refer to the improved areas around the original airfield (southeastern triangle formed by the runways). The High Speed Test Track (HSTT) runs north-south and is located northwest of the airfield. The track is the world's longest of its kind at 9.5 miles and has been used for an array of missile testing for decades and is still in use today. Access to Holloman AFB requires admittance through the security gate and there is a fence around the installation.

Holloman AFB began nine months after the U.S. entered World War II (WWII), and was an integral facility in the early stages of the U.S. space program throughout the Cold War. On 6 February 1942, construction began on an extensive bombing and gunnery range later known as the Alamogordo Bombing and Gunnery Range. On 10 August 1942, the Alamogordo Army Air Field (AAAF) was officially established. Because the facility was initially intended to be used by Great Britain as part of their WWII British Training Program for bomber crews, the Base was designed after Royal Air Force bases. The first atomic bomb was detonated at the Trinity Site in the northwest corner of the Alamogordo Bombing and Gunnery Range (now the WSMR) on 16 July 1945. In 1946, as more lands became available within the Tularosa Basin, the AAAF was reassigned to be a missile development facility. With the creation of the USAF as a separate service, the facility came under the direction of the Air Materiel Command, which decided that the facility would be used to conduct guided missile programs. On 13 January 1948, the Base was renamed Holloman AFB, after Col. George V. Holloman, an early pioneer in guided missile development.

To support the Holloman mission of developing guided missiles, the Army Ordnance Corps built White Sands Proving Grounds at about this time. The combination of the White Sands Proving Grounds and Alamogordo Bombing Range was 100 miles long and 40 miles wide. On 1 September 1952, the two ranges were combined to form the Integrated White Sands Range. From 1952 to 1970, missile development and testing at White Sands included the Snark, Matador, Mace, Falcon, Aerobee, JB-2 Loon, and Firebee missiles. High speed sled tests, high altitude balloon projects, and Aeromedical Field Laboratory experiments were also conducted. Testing activities included the Central Inertial Guidance Test Facility and the Radar Target Scatter Test Facility.

In 1972, the Base was taken over by Tactical Air Command and became primarily a fighter base with some continued developmental testing. On 15 November 1991, command responsibility passed from the 833rd Air Division to the 49th Wing. Today, the 49th Wing provides leadership

to the installation. Two projects begun during the Cold War era continue on the Base: the HSTT and the Primate Research Lab (both considered tenant organizations).

2.2 Site Description and Operational History of ML865 MRS

The ML865 Ballistic Rain Field MRS is 18.30-acre site located west of the HSTT, just north of Hay Draw (**Figures 2-1** and **2-2**). Initially it was identified as 5.20-acre Munitions Response Area (MRA) 865; however, due to the presence of MD items observed during the CSE Phase II (HDR, 2013) beyond the boundary of the original MRA, the size of the area was increased to 18.30 acres and the entire MRA was identified as ML865 MRS at the conclusion of the CSE Phase II.

The MRA was used to create artificial rain for the purpose of testing the effects on artillery. The direction of fire was from the east to the west, although the firing point was not identified. The period of operation for MRA 865 is unknown; however; aerial photography from 1972 shows the earth and timber target butt at the western end of a road perpendicular to the HSTT.

Based on CSE Phase II visual survey (HDR, 2013) and RI surface clearance results (FPM, 2015) munitions that may be found in the subsurface of this site include:

- 20 millimeter (mm),
- 37 mm,
- 75 mm,
- 105 mm, and
- 155 mm projectiles, and
- 5-inch rockets.

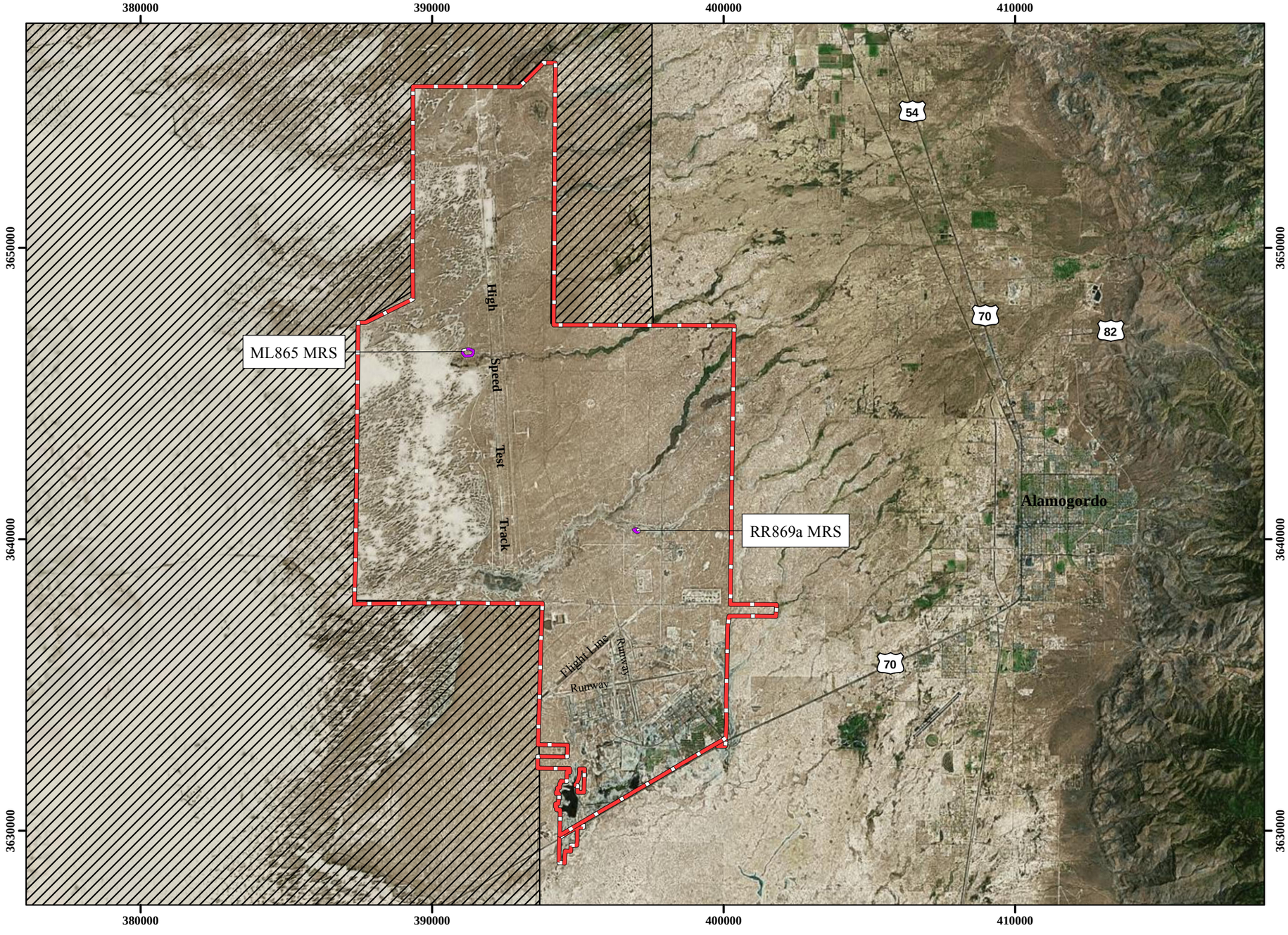
No MEC were discovered at this MRS during the 100% surface clearance performed during the RI. The potential for MEC remains in the subsurface of this site and is the focus of this EE/CA.

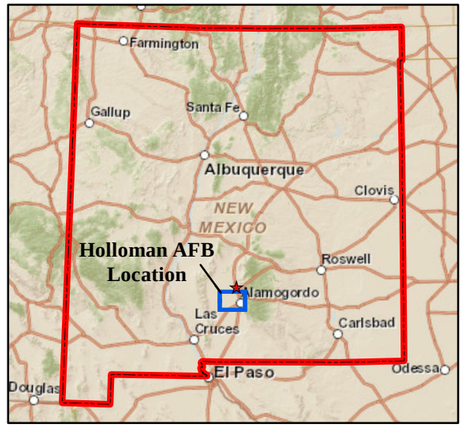
2.3 Site Description and Operational History of RR869a MRS

The RR869a Debris Field MRS is a 3.50-acre site located in the south-central portion of the Base north of Munitions Storage Buildings 1197 and 1198 and south of Ritas Draw (**Figures 2-1** and **2-3**). Initially the site was identified as 3.60-acre MRA 869; however, due to overlapping boundaries with Installation Restoration Program (IRP) Site OT-04, the CSE Phase II investigation (HDR, 2013) recommended splitting the MRA 869 into two MRSs. The RR869 Debris Field MRS (0.1 acres) is comprised of the overlapping portion with IRP Site OT-04, which was investigated under the IRP and is therefore ineligible under the MMRP, and the RR869a Debris Field MRS, consisting of the remaining 3.50 acres.

Exact historical munitions use at MRA 869 are unknown, however during previous investigations, debris consistent with a possible missile/drone crash were observed along with 5-inch rocket motor fragments, small arms projectiles, small amounts of clay target debris, possible 2.75-inch rocket launcher debris, one expended hand grenade fuze, and squibs, one of which was complete and treated as MEC during the CSE Phase II. Based on CSE Phase II visual survey and RI surface clearance results the following items may be found in the subsurface of this site:

- 2.75-inch rocket,





Legend

- White Sands Missile Range
- Installation Boundary

NOTES:

Revision Date: 12/29/2015

Coordinate System:NAD 1983 UTM Zone 13N
Projection: Transverse Mercator — Horizontal Datum: North American 1983
False Easting: 500,000.0000 — False Northing: 0.0000
Central Meridian: -105.0000 — Scale Factor: 0.9996
Latitude Of Origin: 0.0000 — Units: Meter
Base Map Date: (c) 2010 Microsoft Corporation and its data suppliers
Base Map Source: ESRI Online Bing Data Source

1 inch = 12,000 feet

0 1,850 3,700 Meters

0 6,000 12,000 Feet

N W E S

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New Mexico-Arizona
Holloman Air Force Base
Alamogordo, NM
AFCEC

FIGURE 2-1

Holloman Air Force Base Location

FPM Remediations, Inc.

2015

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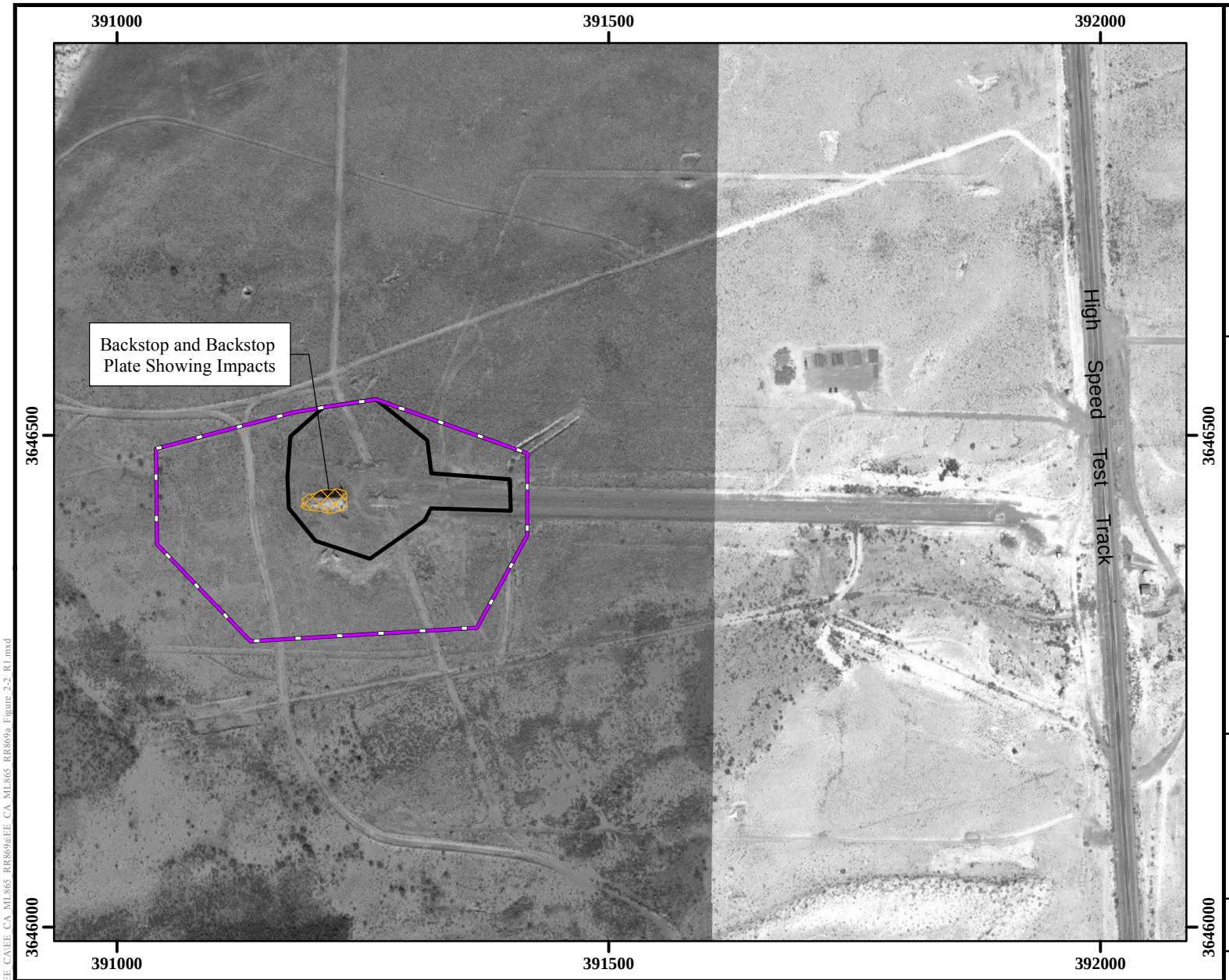

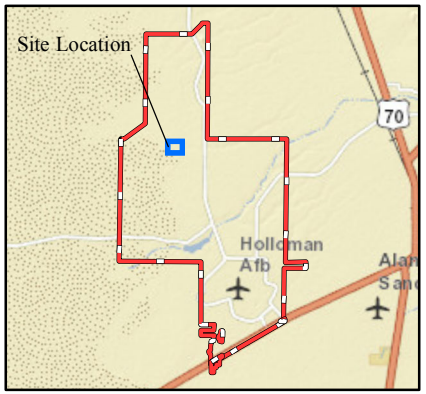

Legend

- MRA 865 Ballistics Rain Field Original Boundary (5.2 acres)
- ML865 MRS Ballistics Rain Field Revised Boundary Based on CSE Phase II (18.3 acres)
- Installation Boundary

NOTES:
Revision Date: 12/29/2015

Coordinate System:NAD 1983 UTM Zone 13N
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Central Meridian: -105.0000 — Scale Factor: 0.9996
Latitude Of Origin: 0.0000 — Units: Meter
Base Map Date: (c) 2010 Microsoft Corporation and its data suppliers
Base Map Source: ESRI Online Bing Data Source

1 inch = 500 feet

0 75 150 Meters

0 250 500 Feet

N W E S

Performance Based Remediation
New Mexico-Arizona
Holloman Air Force Base
Alamogordo, NM
AFCEC

FIGURE 2-2

ML865 Ballistics Rain Field
MRS Location

FPM Remediations, Inc.

2015

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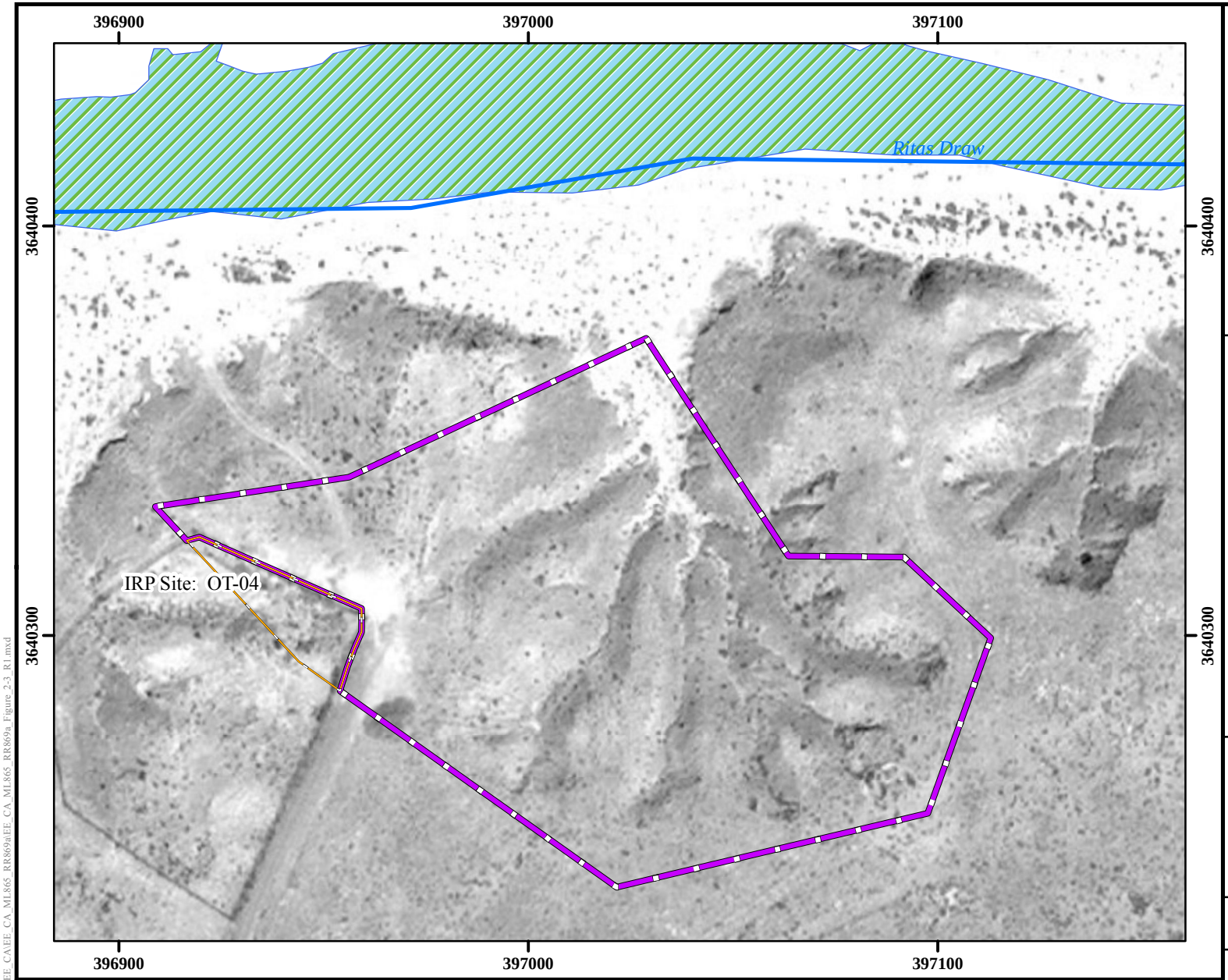

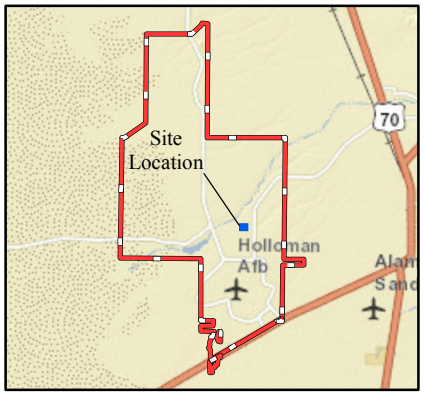

Legend

- Stream
- Wetlands
- RR869a MRS Debris Field Revised Boundary Based on CSE Phase II (3.5 acres)
- RR869 Debris Field MRS Addressed under the IRP (0.1 acres)
- Installation Boundary

NOTES:

1. SR859 MRS boundary based on CSE Phase II findings.
2. HHSL - Human Health Screening Level
3. Revision Date: 12/29/2015

Coordinate System:NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
False Easting: 500,000.0000
Central Meridian: -105.0000
Latitude Of Origin: 0.0000
Horizontal Datum: North American 1983
False Northing: 0.0000
Scale Factor: 0.9996
Units: Meter

1 inch = 120 feet

0 18 36 Meters

0 60 120 Feet

N W E S

Performance Based Remediation
New Mexico-Arizona
Holloman Air Force Base
Alamogordo, NM
AFCEC

FIGURE 2-3

RR869a Debris Field MRS Location

FPM Remediations, Inc.

2015

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- 5-inch rocket,
- Hand grenades,
- Electric squibs, and
- Small arms ammunition (5.56mm, 7.62mm, and .50 calibers).

No MEC was discovered at this MRS during the 100% surface clearance performed during the RI. The potential for MEC remains in the subsurface of this site and is the focus of this EE/CA.

2.4 Physical Description

2.4.1 Climate

Holloman AFB is located in a semi-arid region within the northern portion of the Chihuahuan Desert. Its climate resembles other semi-arid regions with warm to hot summer days, cool nights, and mild winters. Monthly mean high temperatures range from 55 degrees Fahrenheit (°F) in January to 93.6°F in August. Monthly mean low temperatures range from 29°F in January to 66°F in July. Evapotranspiration is usually high due to dry air, large daily solar radiation totals, seasonally high winds, and warm temperatures. Seasonal fluctuation in precipitation rates is a result of prevailing wind directions, which can bring in frontal storms from the north or the Pacific or Caribbean cyclonic systems. Holloman averages 13.20 inches of annual rainfall. Nearly half of this amount falls within the months of July through September, known as the summer monsoons. Monsoon thunderstorms are generally short in duration and high in intensity. Occurrences are highly variable from year to year and one or two short-term events may contain a large percentage of the net annual precipitation. Average annual snowfall is approximately 4.5 inches.

2.4.2 Topography

Holloman AFB lies within the Tularosa basin of south-central New Mexico. This area is part of the Mexican Highland section of the Basin and Range physiographic province and is characterized by fault block mountains interspersed with low desert plains and basins. The Base lies on relatively flat alluvial plains below the Sacramento Mountains. These plains are bordered to the west by the White Sands dune field. Elevations range from 4,000 to 4,250 feet (ft) above mean sea level (Sky Research, Inc. [SKY], 2011)

The ML865 MRS exhibits relatively flat topography. The topography of the RR869a MRS consists of heavily sloping terrain with gorges and gullies associated with Ritas Draw to the north.

2.4.3 Soils

The soils on Holloman AFB are basin fill deposits formed primarily from alluvial and aeolian processes. All soils have a high gypsum and salt content, primarily due to the eastern migration of gypsum sands from WSMR and White Sands National Monument. Holloman AFB has three primary soil types: several associations and complexes of Holloman, Gypsum Land, and Yesum soils, located in the flats; Dune Land, found in the White Sands dunes; and Mead silty clay loam soil, found in the alluvial floodplains (including most jurisdictional wetlands). None of the soil types are very productive, due to high gypsum and salt content, and all are highly subject to both wind and water erosion when the vegetation is sparse or the soil is exposed.

Soils at the ML865 MRSs consist of Yesum Sandy Loam while soils at the RR869a MRS consist of the Gypsic Haplosalid.

2.4.4 Geology and Hydrogeology

Holloman AFB is located in the Tularosa Basin, a downfaulted, closed, intermountain basin located in the southern portion of the Rio Grande Rift. The Tularosa Basin is a bolson, which is a basin with no surface drainage outlet, in which sediments are carried by surface water into the closed basin and deposited (Bhate Environmental Associates, Inc., 2007). Basin fill of the Tularosa Basin is derived from the erosion of the uplifted material and fluvial deposits from the Rio Grande River. The Basin fill consists of unconsolidated coarse- to fine-grained alluvial fan deposits along the rims of the basin that are gradational toward the basin into finer-grained alluvial, fluvial, and lacustrine deposits. Evaporite materials, such as selenite, are present.

Prominent local physiographic features include the Sacramento Mountains to the east, San Andres Mountains, and White Sands National Monument to the west (49th Fighter Wing, 2009). The Tularosa Basin was formed as a structural trough during the Middle to Late Cenozoic era. Alluvial fill deposition includes; sand, gravel, and clay in alluvial fans along the basin margins and extensive lake, alluvial, and evaporate deposits within the interior basin. Streams sustained by groundwater discharge within the basin include Salt Creek and Malpais Spring. It is estimated that the groundwater resources of the Tularosa Basin contain over 100 million-acre ft of brackish groundwater. A wide range of water chemistries including sodium chloride, carbonate, and sulfate-based brine waters exist in the basin and water with salinity from 1,000 parts per million (ppm) Total Dissolved Solids (TDS), approximate to fresh water, to over 20,000 ppm TDS, approximate to sea water, can be found within the basin. The primary source of groundwater recharge is percolation of rainwater and a minor contribution from stream run-off along the western edge of the Sacramento Mountains.

Beneath Holloman AFB, groundwater ranges from 5 to 50 ft below ground surface (bgs), with shallower groundwater found on the southern end of the Base. Groundwater flow is generally toward the southwest with localized influences from the variations in Base topography with shallower groundwater found on the southern end of the Base (SKY, 2011).

2.4.5 Hydrology

The only permanent water in the Tularosa Basin is found in small streams between Alamogordo and Three Rivers, New Mexico. There are no perennial streams within Holloman AFB or in the nearby surrounding landscape; however, a set of perennial pools exist within the Base. They are the final one-third of the Lost River, a set of pools near the confluence of Ritas and Malone Draws, and the Salt Lakes just south of the Lost River and Camera Pad Road Pond. There are at least nine prominent east-west drainages that receive intermittent flows during seasonal thunderstorms. The largest of these drainages is the Lost River drainage system, including Malone Draw, Carter Draw, and Ritas Draw. Prior to extensive management of the surface topography and construction of U.S. Highway 70/82, Dillard Draw emptied into the Main Base, creating a network of flats and playas including what are now Lake Holloman, Stinky Playa, and Pond G. Construction activities have disrupted the natural flow of this wetland ecosystem (SKY, 2011).

There are no wetlands or surface water associated with the ML865 and RR869a MRSs. However, wetlands associated with Ritas draw are in close proximity to the northern boundary of the RR869a MRS.

2.4.6 Vegetation

The vegetation of Holloman AFB is consistent with that of the Tularosa Basin and includes mesquite, creosote bush, and grasses. Succulents such as cactus, agave, and yucca also occur (SKY, 2011).

Vegetation at the ML865 and RR869a MRSs is consistent with desert scrubland.

2.4.7 Ecological Profile

No federally listed species covered under the Endangered Species Act currently reside at Holloman AFB. Several federally listed species, however, have been observed at the Base in the past. Mountain plover (proposed federally threatened) nested at Lake Holloman during the 1980s. Brown pelicans (recently delisted) are occasionally observed at Lake Holloman and the constructed wetlands. Peregrine falcons (recently delisted) regularly forage at Lake Holloman. Five other sensitive species currently receive no federal protection: a lichen (*A. clauzadeana*), proposed for rare and endangered listing; the grama grass cactus, included due to its former candidate status; the White Sands pupfish, a state-endangered species; the western burrowing owl, a species of concern; and the western snowy plover, also a species of concern.

No rare, threatened or endangered species are expected to inhabit the ML865 and RR869a MRSs. However, according to the INRMP Ritas Draw, which is in close proximity to the northern border of the RR869a MRS, is classified as a Limited Use Area where activities must be managed to ensure that degradation of Essential Habitat for the White Sands Pupfish (*Cyprinodon tularosa*) does not occur through direct or indirect effects.

2.4.8 Structures and Utilities

ML865 Ballistics Rain Field

No buildings are located at the ML865 MRS. There are 12 buildings located within a two-mile radius of the site. Operational mission support, recreational, and flight line support buildings are located to the south of the ML865 within a nine-mile radius.

Facilities still present at the location include piping and nozzles for the artificial rain, and the earth and timber target structure with a steel plate at the face of the structure.

RR869a Debris Field

The RR869a Debris Field MRS is unused and characterized by open space with vegetation consistent with desert scrubland. A portion of the MRS boundary is shared with IRP Site OT-04; however, this site is fenced off from the MRS. There are 100 buildings located within a 2-mile radius of the RR869a MRS. Operational mission support, recreational, and buildings that support the flight line are located to the south of the site within a 4-mile radius (HDR, 2013). No known utilities exist on/near the location of the RR869a MRS.

2.4.9 Current and Future Land Uses

ML865 Ballistics Rain Field

The ML865 Ballistic Rain Field MRS is currently unused and no known changes to the future land use have been indicated. There is no fencing or other controls associated with the ML865 MRS; however, access to Holloman AFB requires admittance through the security gate and there is a fence around the installation. Access coordination with HSTT personnel is required. Therefore, access to the ML865 MRS is restricted for the general public, but is open to Base personnel, Base residents, authorized contractors, visitors, recreational users, and trespassers.

RR869a Debris Field

The RR869a Debris Field MRS is currently unused open space and no known changes to the future land use have been indicated. The site is located north of gate IP-11, which is secured with a combination lock. There is no fencing or other controls associated with the site; however, access to Holloman AFB requires admittance through the security gate and there is a fence around the installation. Therefore, access to the MRS is restricted for the general public, but is open to Base personnel, authorized contractors and trespassers.

2.5 Previous Investigations

MMRP investigations conducted at the ML865 and RR869a MRSs include:

- Modified CSE Phase I (Shaw Environmental, Inc., 2010),
- CSE Phase II (HDR, 2013), and
- RI (FPM, 2015).

2.5.1 Modified CSE Phase I

A Modified CSE Phase I was completed in 2010. Prior to the start of the CSE Phase I, no MRAs had been discovered at Holloman AFB and it was believed that there was a low probability of a significant number of MRAs being found at the Base. Therefore, the USAF modified the CSE Phase I process by deferring some actions typically performed in a Phase I, to the CSE Phase II, if a Phase II is required. Since it was considered that substantial number of MRAs would not be discovered, it was determined that a Conceptual Site Model and Munitions Response Site Prioritization Protocol (MRSPP), and Hazard Ranking System scoring elements were not required for this modified CSE Phase I, and if MRAs were identified that require future evaluation, these tools would be employed during a CSE Phase II. The activities performed during the CSE Phase I included identification and review of data repositories located both on and off the Installation, interviews with Base personnel, and visual surveys.

2.5.1.1 Modified CSE Phase I Results for Ballistics Rain Field

Based on the Holloman AFB personnel reports, the Ballistics Rain Field MRA 865 was identified as 5.20-acre artillery range, used to test the effects of artificially created rain on artillery. The direction of fire was from the east to the west, although the firing point was not identified. The period of operation for the MRA 865 is unknown; however, aerial photography from 1972 shows the earth and timber target butt at the western end of a road perpendicular to the HSTT.

A Visual Survey was performed at the MRA 865 during the Modified CSE Phase I. It was observed that the earth and timber target structure was still intact. A steel plate located at the center of the face of the target structure showed evidence of repeated impact; and the bottom, left corner of the plate was missing. Small pieces of artillery shell fragments were scattered across the site, with larger identifiable pieces of 75-mm, 105-mm, and 155-mm artillery shell fragments. Some of the artillery fragments appeared to be the result of low order detonations. Filler observed in the larger shell fragments appeared to resemble trinitrotoluene. Additionally, some inert fillers were dyed to resemble High Explosive (HE) filler, complicating the identification. Based on reports that Explosive Ordnance Disposal (EOD) was aware of, the filler in the partial artillery projectiles observed was assumed to be inert, but this was not verified. In addition, two stand-off fuzes were observed at the site. MD observed was concentrated to the north of the earth and timber target structure.

Based on available information and visual survey results it was concluded that ballistics testing conducted at the Ballistics Rain Field MRA 865 resulted in the presence of MD, and may have resulted in the presence of MEC and MC on the ground surface and possibly below the ground surface. Therefore, the MRA 865 was recommended for further evaluation during the CSE Phase II.

2.5.1.2 Modified CSE Phase I Results for Debris Field

During the Modified CSE Phase I field survey activities, debris was observed along the southern slope of Rita's Draw, north of Munitions Storage Buildings 1197 and 1198. Upon further examination, debris consistent with a possible missile/drone crash was observed. Additional MD observed at the site included fragments of 5-inch rocket motors (Shaw, 2010).

During the field investigation, no structural features were observed. The field team observed potential high explosive fragments and MD consistent with a missile or drone crash site.

Recommendations for the CSE Phase II included surface soil and subsurface soil sampling to assess if MC has been released to the environment at the Debris Field.

2.5.2 CSE Phase II

A CSE Phase II investigation was performed at MRAs 865 and 869. The field activities included visual surveying to identify MEC or MEC-related items and/or features. The sites were prioritized for further munitions response actions, based on relative risk, using the MRSPP scoring system. The MRS Priority is determined by selecting the highest rating from the Explosives Hazard Evaluation, Chemical Hazard Evaluation, and Human Health Hazard Evaluation modules and ranges from 1 to 8. Priority 1 and 8 indicate the highest and the lowest potential hazards, respectively. Only a site with a chemical warfare hazard can receive an MRS Priority of 1.

2.5.2.1 CSE Phase II Results for 865 MRA

The raised gravel, asphalt mound, and reinforced berm backstop were observed at the 5.20-acre MRA 865 during the CSE Phase II visual survey. The asphalt mound is running east-west, beginning near the HSTT and continuing west to a reinforced berm backstop. The western half of this raised gravel mound is lined on either side by the pipes and nozzles used to mimic rain conditions during ballistics tests.

Since the original MRA 865 (5.20 acres) is littered with debris from 75-mm, 105-mm, 155-mm projectiles, expended projectile fuzes, and 5-inch rockets, the visual survey was extended beyond this MRA boundary showing the continued presence of MD outside of the original MRA. In addition, one partial 20-mm projectile was observed, and one possible partial missile casing was observed southwest of the MRA. Two expended 5-inch rocket motors were documented to the southeast of the MRA.

Potential MEC items observed during the visual survey included 7 intact 105-mm rounds reported to Holloman EOD for disposal, where it was confirmed that the fillers were inert. Four surface soil samples were collected in the vicinity of damaged potential MEC items and analyzed for explosives. All sample results were non-detect.

Based on the surface MD present outside the original MRA boundary, the overall acreage of the Ballistics Rain Field MRA 865 increased from 5.20 acres to 18.30 acres at the conclusion of the CSE Phase II (**Figure 2-2**). The identified 18.30-acre ML865 MRS obtained an MRSPP score of 4 and was recommended for further munitions response action.

2.5.2.2 CSE Phase II Results for 869 MRA

During the field investigation, visual survey transects were completed at the Debris Field MRA. Metal scrap was observed throughout the area. Small arms-related debris consisted of one .50 cal projectile and sparse clay target debris. The field team observed various items that were identified as rocket launcher and possible rocket debris including 2.75-inch launcher debris and possible 5-inch rocket debris among other unidentifiable items. These items were documented as MD. One expended hand grenade fuze was also observed. Expended electric squibs were observed, along with one squib with a single intact charge. Holloman EOD was notified of the intact squib and collected the item for disposal. No other MEC items were discovered. No craters indicative of a target area were identified.

Sampling was not conducted during the CSE Phase II because no potential sources of MC were found during MRA surveys. Any risk at this MRA is expected to be similar to background conditions. The unfired squib round identified, are typically used to initiate an aircraft counter measure device and are considered a low explosive hazard. Squibs are not considered high explosive and the quantities of explosives in the items are not high enough in concentration to pose an explosives hazard; therefore sampling for explosives was not justified during this investigation.

The results from the CSE Phase II were also used to modify the investigated MRA boundary resulting in two MRSs (**Figure 2-3**). The RR869 Debris Field MRS (0.10 acres) was investigated as part of OT-04 under the IRP and is therefore ineligible under the MMRP. The RR869a Debris Field MRS consists of 3.50 acres and was recommended for further munitions response action.

The RR869a Debris Field MRS obtained an MRSPP score of 5 and was recommended for further munitions response action. Due to RR869 Debris Field MRS being ineligible for the MMRP it was not scored using the MRSPP.

2.5.3 Remedial Investigation

The RI was performed at the ML865 and RR869a MRSs in 2015 (FPM, 2015). The field activities included:

- Detector-aided surface clearance across the entire footprint of both MRSs,
- 100% coverage DGM across both sites utilizing the Geometrics Cesium Vapor Magnetometer G-858 (G-858),
- Limited Intrusive investigation of subsurface anomalies consisting of:
    - Exploratory test pits located in high anomaly density areas in ML865, and
    - Investigation of all DGM target anomalies located at and in close proximity to the bordering fence (RR969a/OT-04 boundary),
- Composite soil sampling for analysis of explosives and metals (ML865 MRS only).

Both MRSs were prioritized for further munitions response actions based on relative risk using the MRSPP scoring system.

Note since both MRSs were planned for the removal of all subsurface anomalies above the site-specific thresholds during the follow-on NTCRA (recommended alternative in this EE/CA), only limited intrusive investigation of subsurface anomalies was performed during the RI.

2.5.3.1 RI Results for ML865 MRS

A surface clearance was performed across the entire footprint of the MRS (18.30 acres) as well as in area outside the MRS (1.17 acres) to facilitate DGM data collection in this area (**Figure 2-4**). No MEC was identified and approximately 8,293 pounds (lbs) of MD was removed from the surface of the MRS during the RI. Identified MD items included: M1, 105mm projectiles - inert, M48, 75mm projectiles – inert, and expended 5-inch rocket motors.

DGM was performed across the entire footprint of the MRS (18.30 acres) and in 1.17 acres outside the MRS (**Figure 2-4**) due to MPPEH surface finds located in the vicinity of the western MRS boundary. A total of 6,176 magnetic anomalies exceeding the site-specific threshold of 43 nanoTeslas per meter (nT/m) were identified during the RI DGM.

Eight exploratory test pits located in high anomaly density areas in ML865 were intrusively investigated during the RI to assess the nature of the anomaly sources in those areas (**Figure 2-4**). Since the purpose of intrusive investigation of test pits was to assess the contents only, they were not dug to depth and were not cleared of metal. No MEC and approximately 325 lbs of MD were discovered and removed from the test pits. The MD consisted of 75mm and 105mm inert projectiles and projectile pieces.

Composite soil samples for analysis of explosives and metals were collected at 9 locations at ML865 (8 locations where significant amounts of surface MD (>500 lbs) were encountered and one location where the Safe Disposal Area [SDA] was located). Explosive compounds were either not detected or were well below their respective Human Health Screening levels (HHSLs) and Ecological Screening Levels (ESLs). All metals except copper, were detected at concentrations below approved Basewide background concentrations and well below their respective HHSLs and ESLs. Copper was detected at concentrations ranging from 4.4 to 21.9 milligrams per kilogram (mg/kg), well below the HHSL, but slightly above the no-effect ESL for the most sensitive receptor category (15 mg/kg) for one sample (21.9 mg/kg). As a result, copper in surface soil at ML865 was further evaluated. An Exposure Point Concentration of copper in the surface soil was estimated following USEPA guidance (USEPA, 1989). According to this guidance, the most appropriate measurement of central tendency for exposure to

environmental chemical concentrations is the arithmetic mean. The 95% Upper Confidence Level of the arithmetic mean concentration of copper in the surface soil was calculated using the USEPA ProUCL (V4.0) statistical software. The calculation resulted in a copper value of 12.89 mg/kg, which is assumed to represent the concentrations to which receptors could be exposed at ML865. This value is below the no-effect ESL for the most sensitive receptor category (15 mg/kg) suggesting that further evaluation for copper in surface soil is not necessary. As a result, it was determined that metals in surface soil do not pose any hazard to the environment, and further ecological risk evaluation of metals in surface soil at the ML865 MRS was not recommended. However, since a systematic subsurface investigation was not conducted at the MRS, potential risks to human health and ecological receptors associated with MC (explosives and metals) may exist in the subsurface of the ML865 MRS.

The ML865 Ballistics Rain Filed MRS obtained an MRSPP score of 6, and was recommended for further munitions response action at the conclusion of the RI due to potential presence of subsurface MEC.

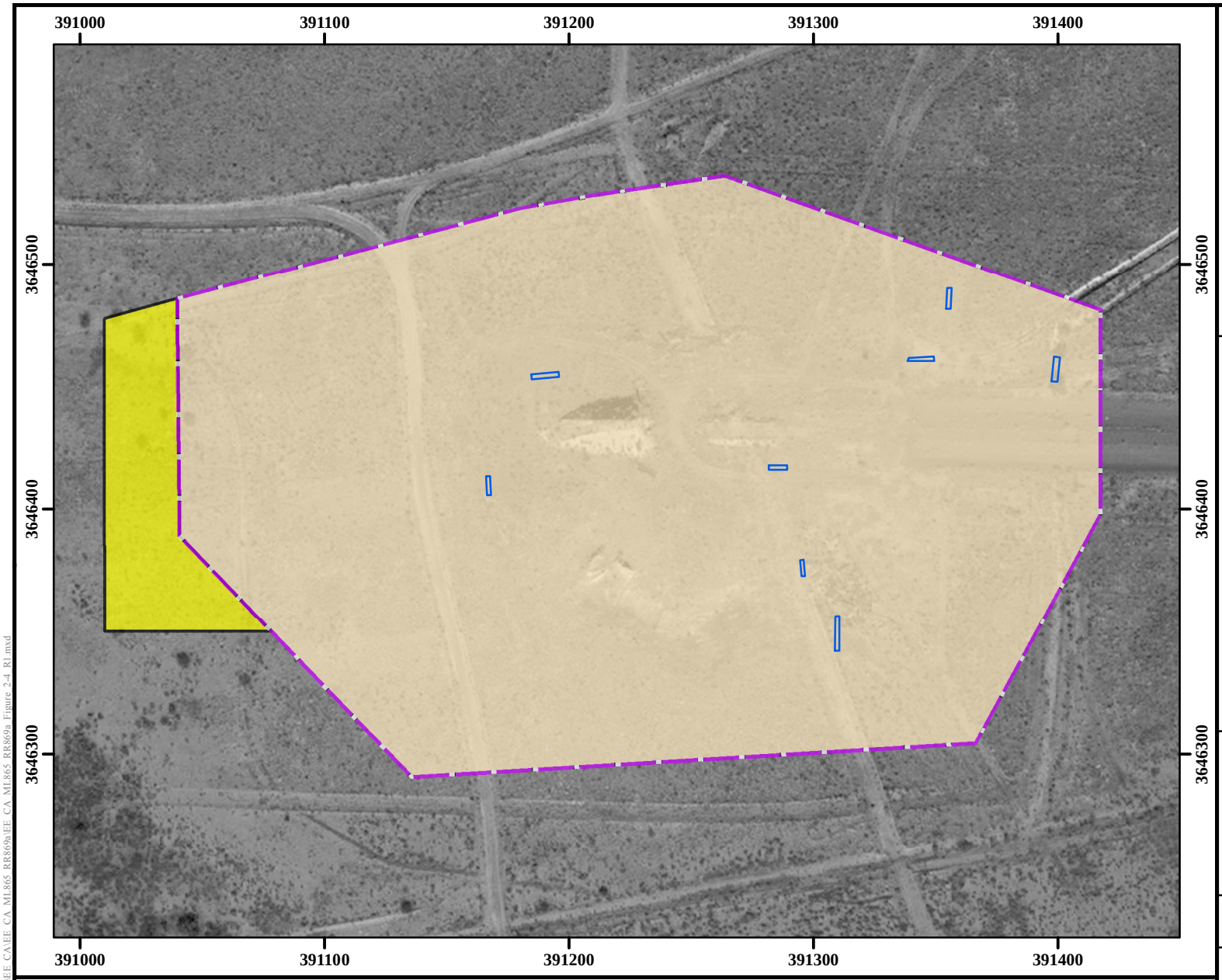
2.5.3.2 RI Results for RR869a MRS

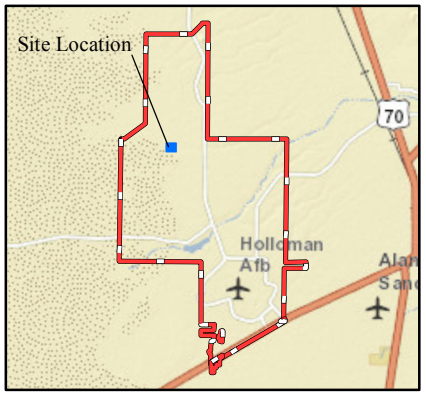
A surface clearance was performed across the entire footprint of the MRS (3.50 acres) as well as in areas outside the MRS (a total of 0.26 acres) to facilitate DGM data collection in these areas (**Figure 2-5**). No MEC was identified and approximately 221 lbs of MD was removed from the surface of the MRS during the RI. Identified MD items included: M18, smoke grenade (expended fuze components) and MK10, 5-inch rocket motor venturi.

DGM was performed across the entire footprint of the MRS (3.50 acres). The fence bordering the portion of the RR869a MRS and IPR site OT-04 had to be removed temporarily to avoid its interference during the G-858 data collection. G-858 data were collected at the fence location as well as across 0.13 acres located at the other side of the fence (within IRP Site OT-04) (**Figure 2-5)** to determine the nature and extent of subsurface anomalies identified at the boundary of the RR869a MRS. DGM was also extended beyond the MRS boundary in two additional areas (A [0.08 acres], and B [0.05 acres]) (**Figure 2-5)** to better characterize the extent of perimeter anomalies seen in the original magnetic data**.**

Intrusive investigation of anomalies located at and in close proximity to the bordering fence (RR869a/OT-04 boundary) was performed during the RI to avoid removing the fence a second time during the follow-on NTCRA (**Figure 2-5).** Since intrusive investigation occurred immediately upon completion of the DGM, the 65 nT/m site-specific threshold had not yet been determined. As a result, FPM selected a very conservative threshold (30 nT/m) for selecting targets in this area to ensure the USAF concurrence on this selection. A total of 75 DGM target anomalies above the 30 nT/m threshold (11 within the MRS and 64 outside the MRS) were investigated during this effort. No MEC, MD, or small arms debris was discovered in the subsurface at this location.

Since potential sources of MC (MEC items and areas with significant amounts of MD) were not identified during the RI at RR869a, no MC sampling was performed at this site. However, since a systematic subsurface investigation was not conducted at the MRS, potential risks to human health and ecological receptors associated with MC (explosives and metals) may exist in the subsurface of the RR869a MRS.





Legend

- Test Pit Area
- RI Surface Clearance and DGM ML865 MRS (19.3 acres)
- RI Surface Clearance and DGM Area Outside the ML865 MRS (1.17 acres)
- Installation Boundary

Performance Based Remediation
New Mexico-Arizona
Holloman Air Force Base
Alamogordo, NM
AFCEC

FIGURE 2-4

RI Field Activity Areas
ML865 MRS

NOTES:
Revision Date: 12/29/2015

Coordinate System:NAD 1983 UTM Zone 13N
Projection: Transverse Mercator — Horizontal Datum: North American 1983
False Easting: 500,000.0000 — False Northing: 0.0000
Central Meridian: -105.0000 — Scale Factor: 0.9996
Latitude Of Origin: 0.0000 — Units: Meter
Base Map Date: (c) 2010 Microsoft Corporation and its data suppliers
Base Map Source: ESRI Online Bing Data Source

1 inch = 200 feet

0 30 60 Meters

0 100 200 Feet

N W E S

FPM Remediations, Inc.

2015

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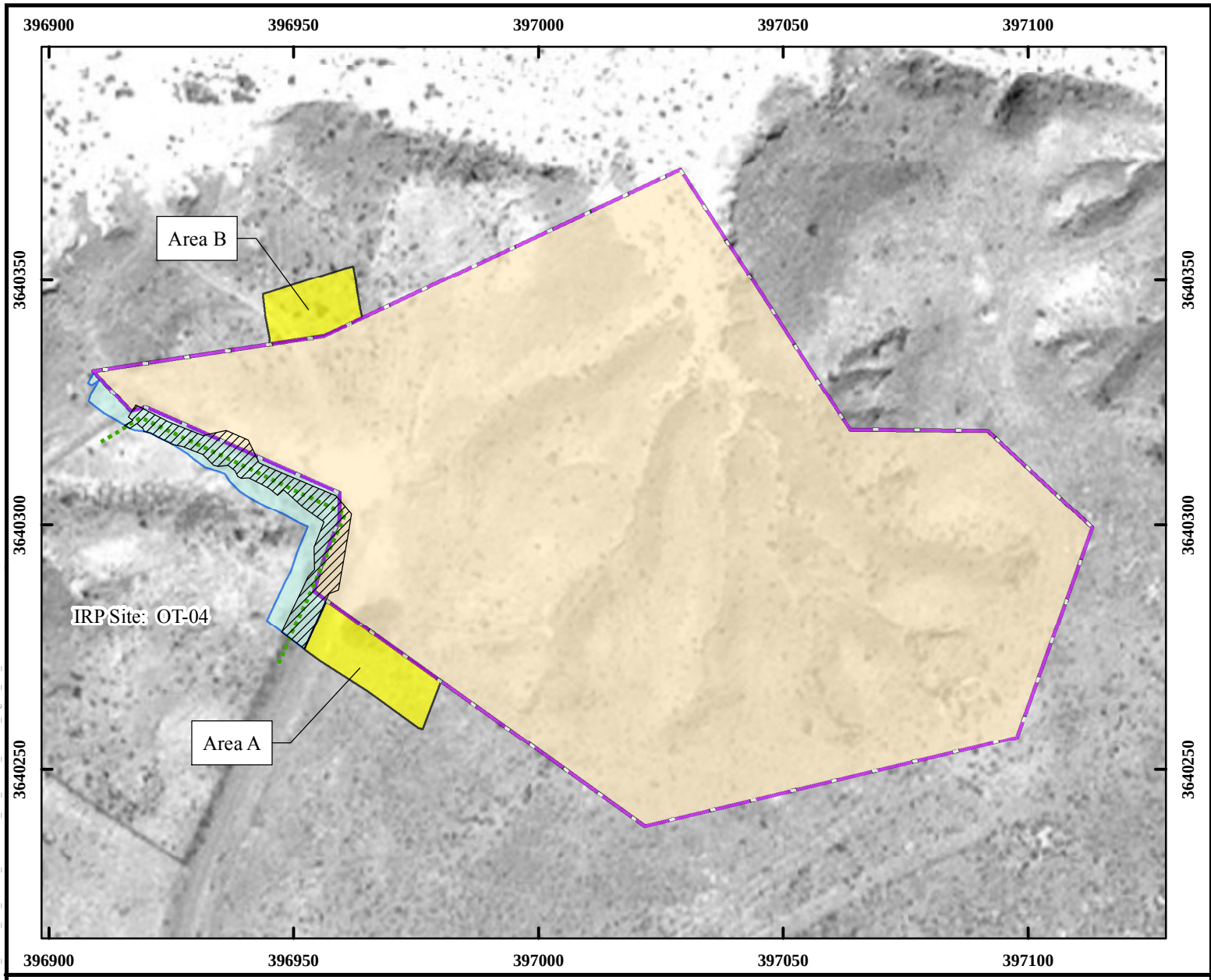

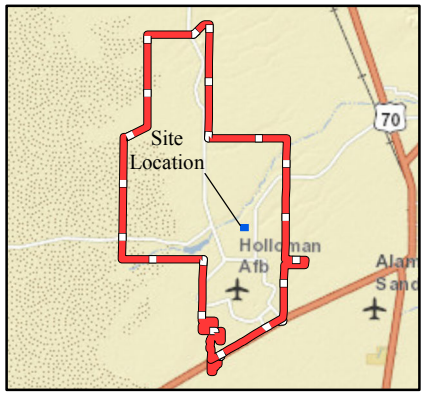

Legend

- RI Surface Clearance and DGM RR869 MRS (3.5 acres)
- RI Surface Clearance and DGM Areas A and B Outside the RR869 MRS (0.13 acres)
- RI Surface Clearance and DGM Fence-Line Area Outside the RR869 MRS (0.13 acres)
- Intrusive Investigation Fence-Line Area (0.09 acres)
- Fence
- Installation Boundary

Performance Based Remediation
New Mexico-Arizona
Holloman Air Force Base
Alamogordo, NM
AFCEC

FIGURE 2-5

RI Field Activity Areas
RR869a MRS

NOTES:
Revision Date: 12/29/2015

Coordinate System:NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
False Easting: 500,000.0000
Central Meridian: -105.0000
Latitude Of Origin: 0.0000
Horizontal Datum: North American 1983
False Northing: 0.0000
Scale Factor: 0.9996
Units: Meter

1 inch = 100 feet

0 15 30 Meters

0 50 100 Feet

N W E S

FPM Remediations, Inc.

2015

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The RR869a Debris Field MRS obtained an MRSPP score of 6, and was recommended for further munitions response action at the conclusion of the RI due to potential presence of subsurface MEC.

2.6 Streamlined Risk Evaluation

2.6.1 MEC Exposure Pathway Analysis

The MEC Exposure Pathway Analyses for the ML865 and RR869a MRSs are shown in **Figures 2-6 and 2-7**, respectively. Based on the RI results the potential for MEC/MPPEH at both MRSs was found in the form of surface MD associated with 155-mm, 105-mm, 75-mm, 37-mm, and 20-mm projectiles as well as unidentified MD (ML865) and M18 smoke grenades and MK10 5-inch rocket motors (RR869a).

A variety of naturally occurring processes may alter the condition of the land at the site resulting in a potentially explosive subsurface item being exposed at the surface and becoming more accessible to contact with people or the environment. These processes may include frost heave, flooding and erosion. A variety of intrusive activities by people also may alter the condition of the land at the site in a manner that a subsurface MEC item may become exposed at the surface. These may include construction activities that involve excavation.

The ML865 MRS is accessible by human receptors, including Base personnel, Base residents, authorized contractors, visitors, recreational users and trespassers. The RR869a MRS is accessible by human receptors, including Base personnel, authorized contractors and trespassers. Exposure pathways are shown to be incomplete for all of these receptor categories for MEC on the soil surface and potentially complete for MEC in the subsurface.

Biota are generally not considered when evaluating MEC risk because, with the exception of threatened and endangered species, risk to biotic receptors is usually evaluated at the population level. Though an individual ecological receptor may experience a negative affect from encountering MEC, MEC does not pose risk to biotic populations unless a large area of habitat were to be destroyed, for example, by a large detonation. Since rare, threatened or endangered species are not expected to inhabit the ML865 and RR869a MRSs, MEC exposure pathways to biota are shown as incomplete.

2.6.2 MC Exposure Pathway Analysis

The MC Exposure Pathway Analyses for the ML865 and RR869a MRSs are shown in **Figures 2-8 and 2-9**, respectively.

In general, migration pathways involve movement via air, water, soil, and the interfaces between these media. Based on the types of releases and the characteristics of MC, the fate and transport of contaminants at Holloman AFB is expected to occur mainly in the terrestrial environment, but there is potential for migration by aquatic and atmospheric pathways as well.

In the terrestrial environment, if the contaminant is released to soil, it may volatilize, adhere to the soil by sorption, leach into the groundwater with precipitation, or degrade due to chemical (abiotic) or biological (biotic) processes. If the contaminant is volatilized from soil, it may be released to the atmosphere or migrate to groundwater. Constituents that are dissolved in groundwater may eventually be transported to a surface aquatic environment. There are no known aquatic environments present within the ML865 and RR869a MRSs. Therefore, this pathway is believed to be incomplete.

In the atmospheric environment, contaminants may exist as vapors or as suspended particulate matter. The transport of contaminants relies mostly on wind currents, and continues until the contaminants are returned to the earth by wet or dry deposition. Degradation of organic compounds in the atmosphere can occur due to direct photolysis, reaction with other chemicals, or reaction with photochemically generated hydroxyl radicals. Based upon the data collected during RI activities, transport of MC via the atmospheric environment is unlikely at Holloman AFB and therefore at ML865 and RR869a as well.

Human receptors at ML865 include Base personnel, Base residents, authorized contractors, visitors, recreational users, and trespassers. Human receptors at RR869a include Base personnel, authorized contractors, and trespassers. The exposure pathways include direct (or incidental) ingestion of soil, dermal contact with soil, and inhalation of volatiles and fugitive dusts from contaminated soil. The exposure pathways are shown to be incomplete for all of these receptor categories for MC in surface soil. The exposure pathways are shown to be potentially complete for MC in subsurface soil for all human scenarios.

Ecological receptors at both sites include terrestrial invertebrates, plants, and terrestrial birds, mammals, and reptiles. MC exposure pathways to biota are shown as incomplete for surface soil and potentially complete for subsurface soil for the ML865 and RR869a MRSs.

There is no present-day human exposure to groundwater at Holloman AFB. The aquifer below Holloman AFB is an unconfined sole source brackish aquifer, with an average depth to groundwater of 5 to 50 ft bgs. Groundwater flow beneath the installation generally occurs from the northeast to the southwest, and depths to groundwater tend to be shallowest toward the main installation. Depending on future land use, there is a possibility that groundwater supply wells could be put in place for domestic and/or industrial uses, though the high total dissolved solids in the aquifer indicates that the water would likely need pretreatment before it was considered potable. Therefore, exposure pathways are shown to be incomplete for MC in ground water for all receptors at the ML865 and RR869a MRSs.

Figure 2-6 ML865 MRS MEC Pathway Analysis

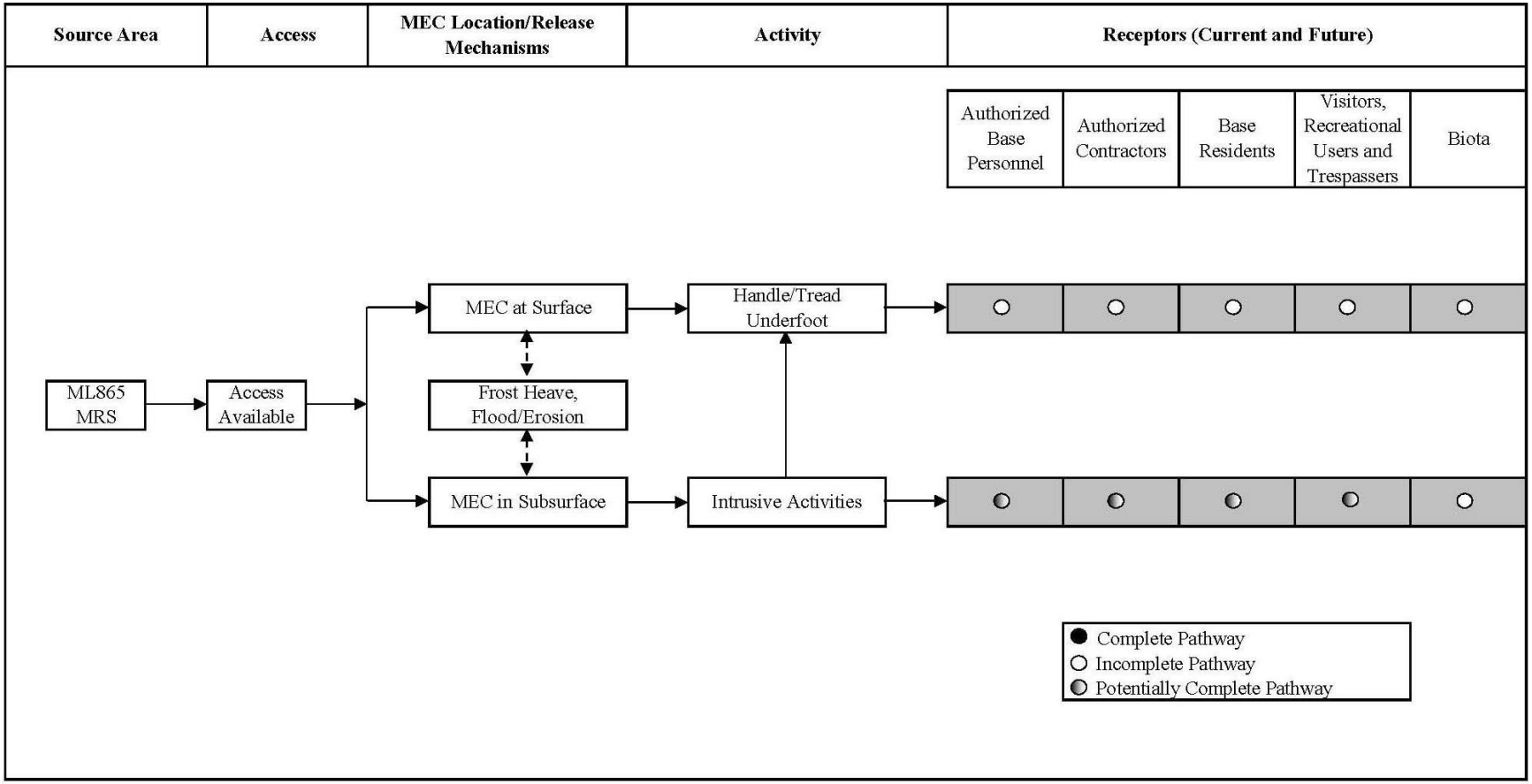


Figure 2-7 RR869a MRS MEC Pathway Analysis

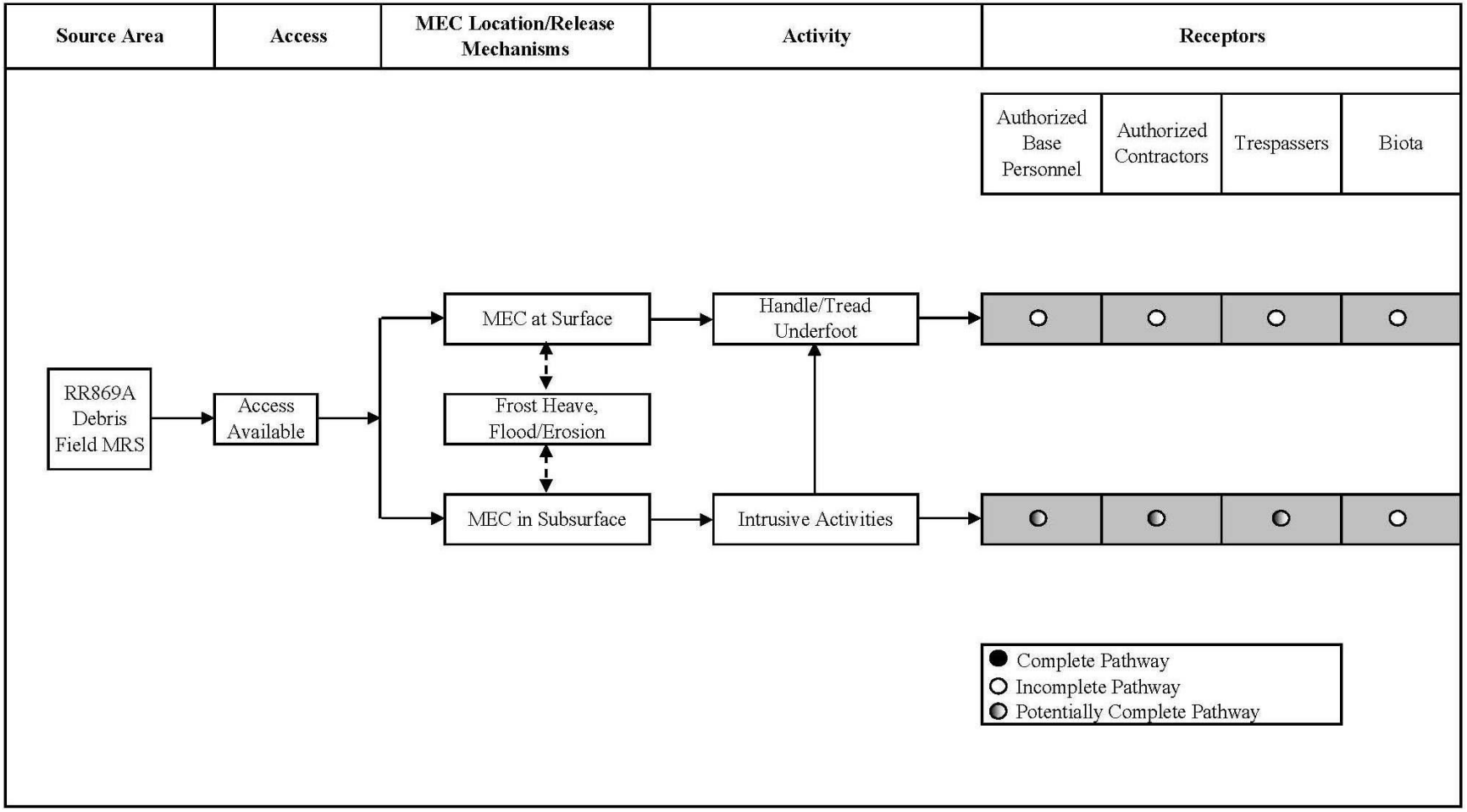


Figure 2-8 ML865 MRS MC Pathway Analysis

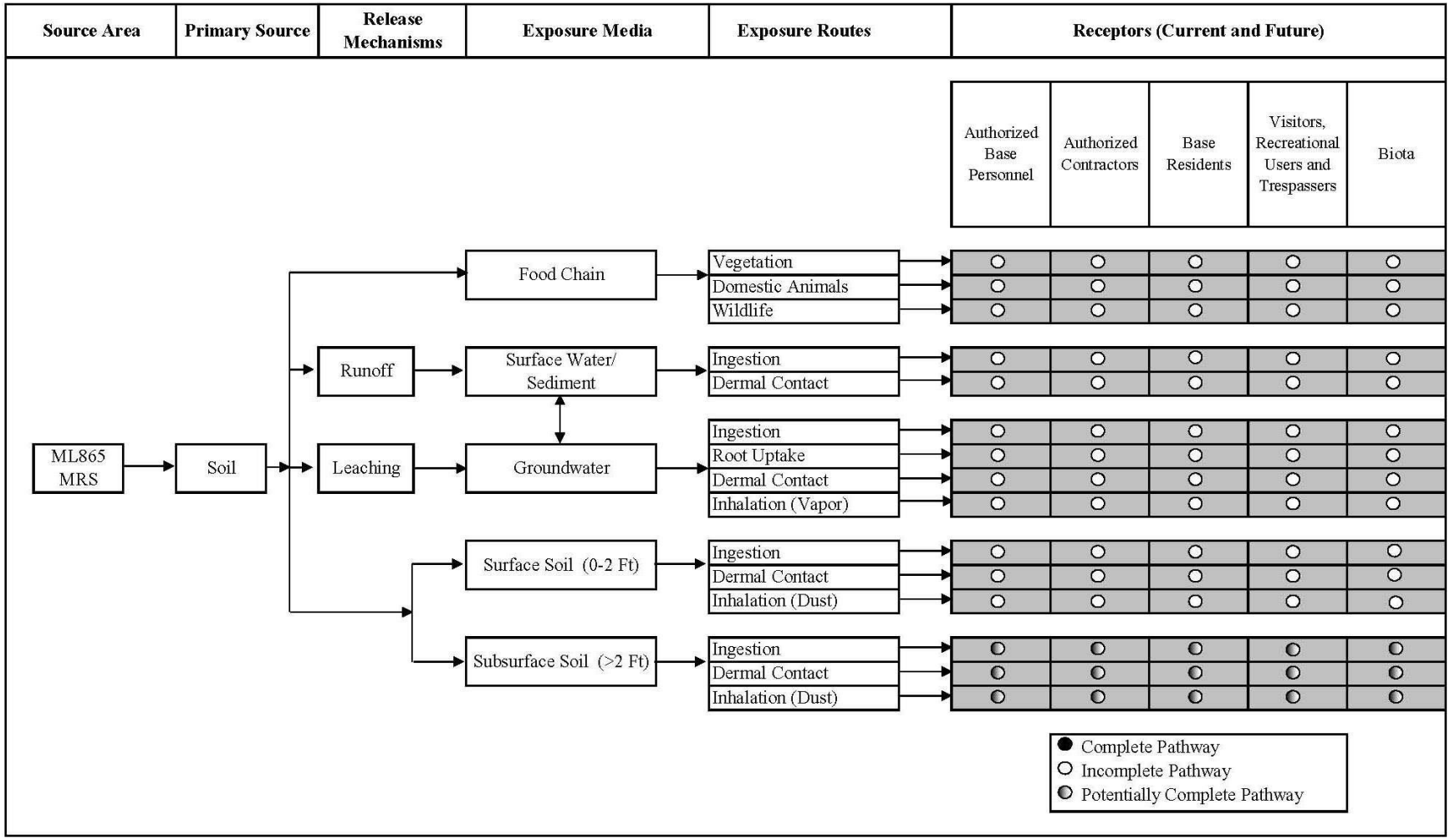
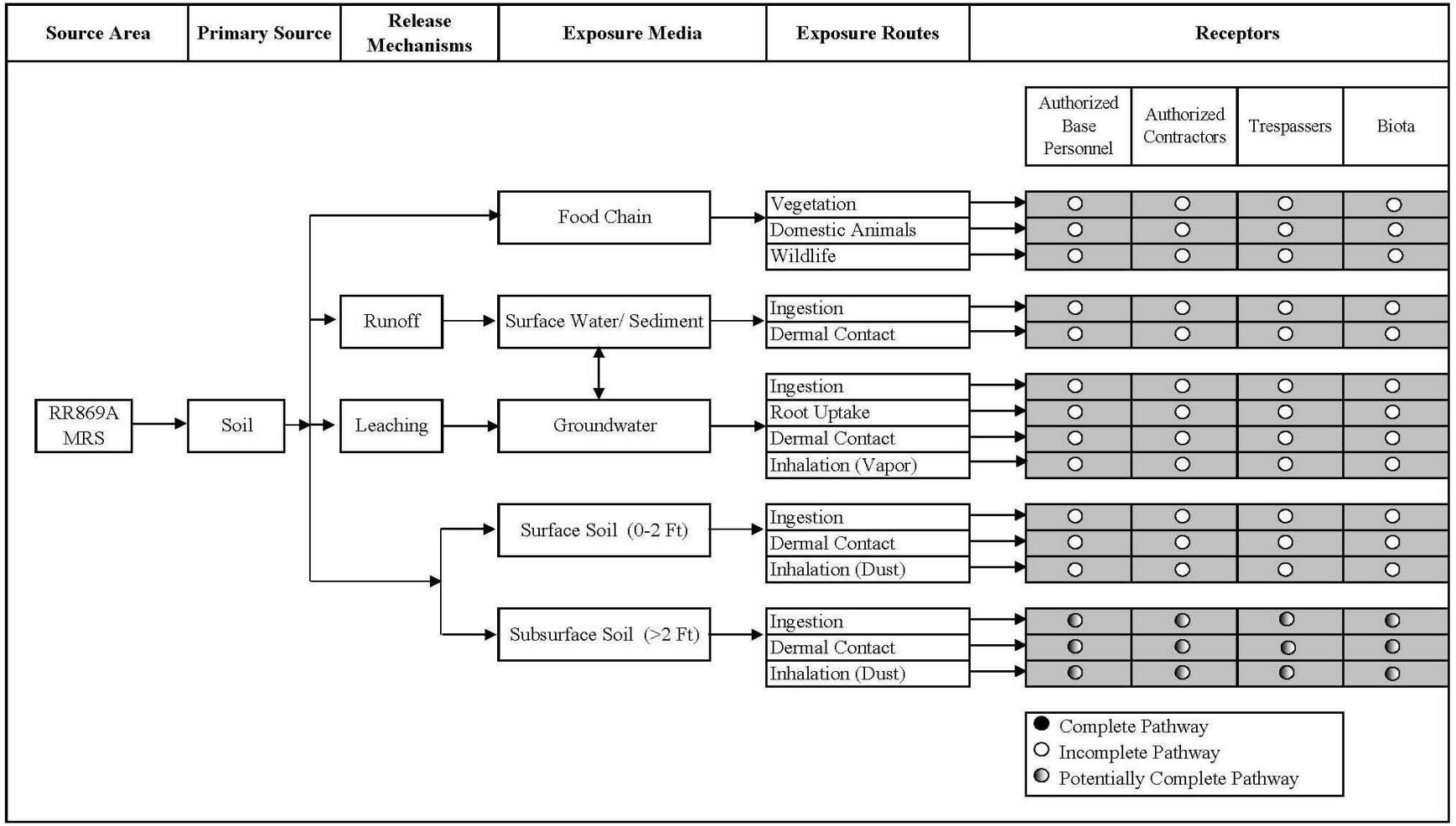


Figure 2-9 RR869a MRS MC Pathway Analysis



3.0 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

The following sections discuss the justification for the NTCRA, the ARARs, and the specific RAOs developed for the NTCRA at the ML865 and RR869a MRSs.

3.1 Justification for the Proposed Removal Action

The MEC/MPPEH potentially present in the subsurface of the ground poses a potential and avoidable threat to human health and welfare. The removal of these items would reduce risk/hazards suspected to be present due to historic use of the property. Threats to human health or the environment, though not time-critical, are sufficiently serious that conditions at the ML865 and RR869a MRSs meet the USEPA 40 Code of Federal Regulations (CFR) § 300.415(b)(2)(vi) - threat of fire or explosion - criterion for initiating a removal action.

3.2 Applicable or Relevant and Appropriate Requirements

The ARARs addressing contaminated environmental media are identified in this section. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300.5) defines "applicable" requirements as: "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." Only those promulgated state standards identified by a state in a timely manner that are substantive and equally or more stringent than federal requirements may be applicable.

The NCP (40 CFR 300.5) further defines "relevant and appropriate" requirements as: "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility citing laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site." Like "applicable" requirements, the NCP also provides that only those promulgated state requirements identified in a timely manner and are more stringent than corresponding federal requirements may be relevant and appropriate.

USEPA identifies three basic types of ARARs. They include the following: chemical-specific, location-specific, and action-specific.

- Chemical-specific ARARs are generally health- or risk-based values that, when applied to site-specific conditions, result in numerical values. These values establish the acceptable concentration of a chemical that may be found in, or discharged to, the ambient environment.
- Location-specific ARARs are restrictions placed upon removal activities of hazardous substances solely because they are occurring in a particular place.
- Action-specific ARARs are generally technology or activity-based requirements on actions taken with respect to hazardous substances. These requirements are triggered by the particular activities that are selected to accomplish a remedy. Thus, action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be achieved. The MEC/MPPEH removal action

will be conducted in compliance with DoD, USAF, and U.S. Army Corp of Engineers (USACE) explosive safety standards and munitions response procedures.

3.2.1 Chemical Specific ARARs

There are no chemical-specific ARARs associated with MEC.

3.2.2 Location-Specific ARARs

Location-specific ARARs set restrictions on the types of activities that can be performed based on site-specific characteristics or location. Alternative actions may be restricted or precluded based on proximity to wetlands or floodplains, presence of natural or cultural resources, or to man-made features such as existing disposal areas and local historic buildings. No location-specific ARARs guidance was identified. Final location-specific ARARs (statutes and regulations) will be determined in consultation with the USEPA, New Mexico Environment Department (NMED), and other appropriate federal and/or state agencies. These agencies are responsible for administration of programs that implement the potential location-specific ARARs.

3.2.3 Action-Specific ARARs

Based on the RA alternatives developed to address MEC at the ML865 and RR869a sites, certain action-specific ARARs will be considered. The action-specific ARARs are presented in **Table 3-1**. At present, New Mexico regulates military munitions through CERCLA. In addition, an RA plan must incorporate all substantive requirements of state and federal law, including public participation and review, compliance with state and federal laws and regulations, and all other technical elements to ensure protection of public health and the environment.

3.3 Remedial Action Objective

Based on the NCP requirements and the applicable ARARs previously discussed, the following RAO was developed for the RA at the ML865 and RR869a MRSs:

- Implement measures within ML865 and RR869a that will minimize explosives hazards associated with subsurface MEC/MPPEH that pose a potential explosives safety risk to human health and ecological receptors.

Table 3-1 List of Potential Action-Specific ARARs

Standard, Requirement, or Criteria	Description	Comment
FEDERAL		
Solid Waste Disposal Act, as amended by Resource Conservation and Recovery Act of 1976 (42 United States Code (U.S.C.) Sect. 6901-6992K)		
Standards Applicable to Generators of Hazardous Waste (Subtitle C) (40 CFR Part 262)	Establishes standards for generators of hazardous waste.	Applicable if RA involves off-site disposal or treatment of hazardous waste. On-site generation triggers selected provisions (i.e., waste determination, accumulation time).
Standards Applicable to Transporters of Hazardous Waste (Subtitle C) (40 CFR Part 263)	Establishes standards which apply to persons transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	Applicable if RA involves off-site transportation of hazardous waste.
Standards for the Management of Specific Hazardous Wastes and Specific types of Hazardous Waste Management Facilities (40 CFR Part 266)	Establishes requirements which apply to recyclable materials that are recovered or disposed on the land.	Applicable as recovered MPPEH certified as Material Documented as Safe (MDAS) would be recycled as appropriate.

Standard, Requirement, or Criteria	Description	Comment
Clean Water Act (33 USCA Sect. 1251-1376)		
National Pollutant Discharge Elimination System (40 CFR Parts 122.26(b)(14)(x))	Requires that storm water runoff be monitored and controlled on construction sites greater than one acre.	Applicable for remedial actions that involve vegetation removal that could result in storm water runoff.
Clean Air Act, as amended 42 U.S.C. Sect. 7401-7671Q		
Approval and promulgation of Implementation Plans 40 CFR 52, Subpart T, Louisiana	Establishes Air Quality Control Regions and attainment dates for national standards in those regions.	Applicable for remedial activities that involve air emissions (including dust particulates) e.g., excavation.
Hazardous Materials Transportation Act (49 U.S.C. Sect. 1801-1813)		
Hazardous Materials Transportation Regulations (49 CFR Parts 107, 171-177)	Regulates transportation of hazardous materials.	Applicable if the remedial action involves transportation of hazardous materials.
U.S. Department of Transportation Regulations (49 CFR Parts 170-179)	Establishes regulations for the transportation of hazardous materials by private, common, or contract carriers by motor vehicle.	Applicable if the remedial action involves transportation of hazardous materials.
Occupational Safety and Health Act of 1970 PL 91-596; 29 USCA Sect. 651-678		
Occupational Safety and Health Standards	Establishes safety and health requirements for personnel working with hazardous materials	Applicable to on-site remedial activities.

Standard, Requirement, or Criteria	Description	Comment
(29 CFR Part 1910)	and hazardous waste.	
Safety and Health Regulations for Construction (29 CFR Part 1926)	Establishes protection standards (e.g., hazard communication, excavation and trenching requirements) for workers involved in hazardous waste operations.	Applicable to on-site remedial activities.
Work Plans (WPs) MMRP-09-001 (USACE, 2009a)	WPs will be used to describe the goals, methods, procedures, and personnel used for field activities for all munitions response remedial or removal responses and other munitions related actions.	To Be Considered (TBC) for all alternatives that will require potential interaction with MEC/MPPEH.
Explosives Management Plan MMRP-09-002 (USACE, 2009b)	The Explosives Management Plan will be used to provide details for management of explosives for a specific munitions response or other munitions related project IAW applicable regulations. This Data Item Description (DID) contains the instructions for preparing WP chapters addressing explosives management for specific munitions response or other munitions related projects.	TBC for those alternatives that may encounter MPPEH as part of remedial process.
Safety Submissions MMRP-09-003 (USACE, 2009c)	The Explosives Safety Submission (ESS) is used to provide the appropriate safety criteria for planning and siting of operations for munitions response, Recovered Chemical Warfare Material and other related projects that are in an investigative or characterization phase where there will be intentional physical contact with MPPEH, or presenting a chemical hazard.	TBC to those alternatives that will require removal of MEC/MPPEH as part of the remedial process.
Accident Prevention Plan	Instructions for preparing an Accident	TBC to those alternatives that will require

Standard, Requirement, or Criteria	Description	Comment
MMRP-09-005 (USACE, 2009d)	Prevention Plan for conventional ordnance and explosives projects.	removal of MEC/MPPEH as part of the remedial process.
EE/CA, RI and Feasibility Study (FS) Reports MMRP-09-010 (USACE, 2009e)	The EE/CA Report, the RI Report and the FS Report are used to document the methods employed during site characterization and present the results of the site characterization, an analysis of response action alternatives, and the recommended response alternative. This DID provides the requirements for preparing these reports as part of the MMRP response process and other munitions related actions.	Portions of this guidance are TBC to the completion of this EE/CA.
Accident / Incident Reports MMRP-09-011 (USACE, 2009f)	The Accident/Incident Reports will be used for reporting accidents/ incidents that occur on the work site or in connection with the stated work of this contract.	TBC. Any accidents or incidents that occur during the implementation of remedial alternatives will need to be reported accordingly.
Personnel Qualifications Certification Letter MMRP-09-012 (USACE, 2009g)	The Personnel Qualifications Certification Letter is submitted by the contractor certifying that key personnel and personnel filling core labor categories meet the training and experience requirements for the position held. Resumes will be used to document personnel qualifications and experience.	TBC. Proof of training would be maintained for all UXO personnel that would work on the site in various capacities IAW the work required for the alternatives presented in this EE/CA. Use of properly trained personnel is required by MMRP guidelines.
Implementation of Department of Defense Explosives Safety Board (DDESB) Guidance on Minimum Separation Distances for Unintentional Detonations (DDESB, 2013)	The USACE has endorsed the use of the Hazard Fragmentation Distance for determining the minimum separation distance for unintentional detonations for MMRP responses/ projects for all MEC	TBC for all alternatives that will require potential interaction with MEC.

Standard, Requirement, or Criteria	Description	Comment
USAF, MEC Hazard Assessment Tool (MHAT) Methodology (USAF, 2011a)	This document describes the MHAT methodology for assessing potential explosive hazards to human receptors at MRS. The MHAT allows a project team to evaluate the potential explosive hazard associated with an MRS, given current or reasonably anticipated future conditions, and under various cleanup, land use activities, and Land Use Control (LUC) alternatives.	TBC for all alternatives that will involve LUCs, surface clearances, and/or subsurface clearances.
USACE Technical Guidance for Military Munitions Response Actions, Environmental and Munitions Center of Expertise Interim Guidance Document 14-01; Engineer Manual (EM) 200-1-15. (USACE, 2015)	This manual provides USACE processes for executing the technical aspects of munitions response projects for all phases of the MMRP.	TBC for technical aspects of munitions response projects under the MMRP.
USACE Safety and Health Requirements Manual; EM 385-1-1 (USACE, 2014)	This manual prescribes the safety and health requirements for all USACE activities and operations.	TBC for all on-site remedial activities.
USACE Explosives Safety and Health Requirements Manual; EM 385-1-97 (USACE, 2013)	This manual prescribes the safety and health requirements for all USACE activities and operations that involve explosives related work.	TBC for all alternatives that will require potential interaction with MEC/MPPEH.
Air Force manual 91-201; Explosives Safety Standards (USAF, 2011b)	These standards establish a central source for explosive safety criteria. It identifies hazards and states safety precautions and rules when working with explosives.	TBC for all alternatives that will require potential interaction with MEC/MPPEH.

Standard, Requirement, or Criteria	Description	Comment
DoD Ammunition and Explosives Safety Standards; 6055.09-M (DoD, 2012)	These standards are designed to manage risks associated with DoD-titled ammunition and explosives by providing protection criteria to minimize serious injury, loss of life, and damage to property.	TBC for all alternatives that will require potential interaction with MEC/MPPEH.
Department of Defense Instruction 4140.62, Material Potentially Presenting an Explosive Hazard (DoD, 2014)	This instruction provides policy and responsibilities for the management and disposition of MPPEH.	TBC for all alternatives that will require potential interaction with MEC/MPPEH.
STATE		
NMED New Mexico Administrative Code Title 20 Chapter 9	Applies to the transportation, storage, transfer, processing, recycling, composting, nuisance abatement and disposal of solid waste.	Applicable for remedial actions that involve recycling of solid waste or disposal of solid waste at an approved off-site landfill.
New Mexico Statutes and Codes Chapter 74 – Environmental Improvement.	Establishes a department that will be responsible for environmental management.	Applicable for remedial actions that involve waste management and cleanup.
NMED New Mexico Administrative Code Title 20 Chapter 2 Part 1 and 75	Fugitive emissions fee A fee that specifically allows fugitive dust producing operations or activities is responsible for controlling windblown dust from earthmoving and other activities.	Potentially applicable to fugitive dust emissions during excavation, backfilling, and landscaping activities.
NMED New Mexico Administrative Code Title 20 Chapter 2 Part 7	General Provisions Emission of an air contaminant, including a fugitive emission, in excess of the quantity, rate, opacity or concentration specified by an air quality regulation or permit condition.	Potentially applicable to fugitive dust emissions during excavation, backfilling and landscaping activities.

4.0 IDENTIFICATION AND ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

This section identifies and describes the RA alternatives that address the RAO for the ML865 and RR869a MRSs. The RA alternatives were developed by combining the most qualified General Response Actions (GRAs) that have been selected in the past at sites with similar conditions. The main objective of development of different alternatives is to provide decision-makers with an appropriate range of options and sufficient information to adequately compare alternatives against one another.

4.1 General Response Actions

The GRAs are broad classes of medium-specific actions such as no action, Land Use Controls (LUCs), subsurface removal, or a combination of these that will achieve the RAO. The GRAs can be implemented through different remedial technologies and process options, defined as follows:

- Remedial technologies are the general categories of remedies such as detection, removal, disposal, and access restrictions;
- Process options are specific categories of remedies within each remedial technology, and are used to implement each remedial technology.

4.1.1 Identifications of Technologies and Process Options

The GRAs with corresponding remedial technologies and process options that were used for development of RA alternatives for the ML865 and RR869a MRSs are summarized in **Table 4-1** and described as follows:

- **No Action** – No remedial action would be taken to address the potential MEC/MPPEH, MD, or range related debris hazards.
- **LUCs** – This GRA includes access restrictions and educational programs. In general access restrictions may include installing and maintaining fencing around controlled areas, posting warning signs prohibiting entry, or implementing zoning, planning or deed restrictions. In addition, as part of this alternative, administrative controls (including anomaly avoidance measures and UXO Construction Support) and deed restrictions would be implemented that could include stipulation that property could be used only for surface activities. Construction support would include a qualified UXO team, usually consisting of a minimum one UXO Technician III and one UXO Technician I, provides MEC avoidance by escorting site users in high risk areas and observing grading or other construction activities. The UXO team would halt all activities if MEC is encountered. For excavation activities in the MRS, this process option would likely require UXO personnel conducting a removal action to the maximum excavation depth or the maximum penetration depth prior to excavation activities. Zoning/planning could be implemented to control the designated land use (agricultural, etc.). Educational programs would be tailored to community needs and could include public meetings, distribution of fact sheets, exhibits, videos, and educational signage at the MRS.
- **Subsurface MEC/MPPEH Removal** - Removal of subsurface anomalies, potentially representing MEC/MPPEH, to a depth based on the anticipated penetration of suspected munitions or technology limitation. The most common digital detection technologies

Table 4-1 Potentially Applicable MEC Technologies and Process Options at ML865 and RR869a MRSs

General Response Action	Remedial Technology	Process Option
No Action	None	None
LUCs	Access Restrictions - Administrative Controls	Zoning, Planning and/or Deed Restrictions
		Educational Awareness Program
		UXO Escort/Construction Support
	Access Restrictions - Engineering/Physical Controls	Fencing
		Signage
Subsurface MEC/MPPEH Removal	Detection	Digital Metal Detectors
		Analog Metal Detectors
	Removal	Manual Removal Methods (Shovels, Hand Equipment)
		Mechanical Methods (Earth Moving Machinery)
	Disposal	MPPEH Inspections
		Demolition (MEC)
		Manual Demilitarization (If Required)
		MDAS Disposal (recycling)

considered for detecting and mapping subsurface anomalies are electromagnetic induction sensors (e.g., Geonics EM61-MK2] and magnetometers (e.g., G-858). In general, the G-858 represents a more robust system for detecting and mapping munitions of interest at greater depths than EM61. The detection capabilities of magnetometers and electromagnetic induction sensors are not anticipated to be impacted by site geology or anthropogenic sources. This should be confirmed with use of Instrument Verification Strip (IVS)/Geophysical System Verification (GSV).

Recovered MEC/MPPEH would be handled, stored, destroyed, and demilitarized IAW the Department of Defense Explosives Safety Board (DDESB) Guidance for Clearance Plans (DDESB, 1998), and the USACE Technical Guidance for Military Munitions Response Actions EM 200-1-15 (USACE, 2015). All recovered MD and other metallic cultural debris would be moved to a central location inspected, certified as MDAS. MEC would be destroyed by detonation using Blow-in-Place (BIP) or consolidated detonation procedures. BIP is the destruction of MEC for which the risk of movement beyond immediate vicinity of discovery is not considered acceptable. Normally, this is accomplished by placing an explosive charge alongside the item. Waste streams generated from BIP operations may fall

under further regulatory guidance with respect to treatment and/or final disposition. Consolidated Detonations are defined as the collection, configuration, and subsequent destruction by explosive detonation of MEC for which the risk of movement has been determined to be acceptable either within a current working sector or at an establish demolition ground. This option has an increased risk associated with handling and transporting live MEC, and requires oversight by specially trained UXO technicians or EOD personnel and restricted access during detonation. EOD and other applicable organizations require notification of detonation activities. All MDAS would be transported from the site to an alternate off-site location for disposal/recycling.

4.2 Alternative Description

Since 100% surface clearance and 100% coverage DGM were performed at both sites during the RI (as described in **Section 2.5.3**), the following three RA alternatives were developed for the ML865 and RR869a MRSs:

1. Alternative 1 - No Action,
2. Alternative 2 - LUCs, and
3. Alternative 3 - Subsurface Removal of MEC/MPPEH.

A description of each of these alternatives is provided below

4.2.1 Alternative 1 - No Action

The No Action alternative involves no action to be performed under current or future land-use scenarios. No RA would be performed at the site, and no institutional controls such as warning signs or land use restrictions are included in the No Action alternative. No cost would be associated with this alternative. This alternative is included as a baseline comparison for other alternatives.

4.2.2 Alternative 2 - Land Use Controls

Alternative 2 - LUCs would include warning signs, summary of hazards updated in the Base real property records and Geographic Information System database, notifications during contracting, dig permits, UXO construction support, and recurring reviews.

In general, signs would be installed around the perimeter of each MRS. Larger signs/billboards would be placed at significant entry points to the MRS (e.g., roads). Intrusive work would be required during sign installation; therefore, MEC avoidance would be required.

Educational programs would be developed to inform Base personnel, residents, contractors (including utility workers) and visitors of the potential hazards due to the potential presence of subsurface MEC/MPPEH in each MRS. These programs would include brochures and/or fact sheets. The information would include MEC recognition and safety education requirements for the Base personnel, site workers/contractors (including utility workers), and residents.

As part of the contracting process, notifications would be made to all contractors with operations (whether Air Force contractors or utility workers) that may result in disturbance of the soil and potential MEC/MPPEH hazards, and associated contractual work requirements (e.g., educational requirements, dig permits, and UXO construction support services) in the affected areas.

The Dig Permit is an official USAF form (AF Form 103) that is required for any subsurface work penetrating greater than three (3) inches below the ground surface. The form is completed by receiving signatory approval from all appropriate Installation offices.

If Holloman AFB transfers the land associated with the ML865 and/or RR869a MRSs, then LUCs including restrictions and a description of hazards present at the MRS would need to be incorporated into any real property documents necessary for transferring ownership from Holloman AFB.

4.2.3 Alternative 3 - Subsurface Removal of MEC/MPPEH

This alternative includes 100% removal of the following subsurface anomalies identified at ML865 and RR869a during the RI:

- All individual geophysical anomalies above the site-specific thresholds and
- Those that show characteristics of burial pits.

In no case would any excavations and removals exceed 10 feet. In addition, if MEC was identified during intrusive investigation of perimeter anomalies indicating the potential for MEC presence beyond the MRS boundary, FPM would extend the DGM and intrusive investigations to determine the extent of contamination. This includes the associated MC contamination, if any.

All DGM target anomalies identified for intrusive investigation during the RI would be removed using both manual removal techniques (e.g., shovels, hand equipment) and earth moving machinery. Recovered MEC/MPPEH would be handled, stored, destroyed, and demilitarized IAW with the guidance set forth in the DDESB-approved ESS developed for the ML865 and RR869a MRSs (FPM, 2014). The excavated MEC for which the risk of movement beyond immediate vicinity of discovery is not considered acceptable would be destroyed using BIP procedures. MEC for which the risk of movement has been determined to be acceptable either within a current working sector or at an establish demolition ground would be disposed by consolidated shot procedures.

In addition, as part of Alternative 3, excavation of the earth and timber target butt (including backstop and backstop plate) with heavy equipment would be performed to address the potential for MEC/MPPEH remaining in that area. The excavated soil would be spread over an area certified free of anomalies. A 100% coverage DGM survey using a magnetometer G-858 coupled with the Real-Time Kinematic Global Positioning System would be performed to identify anomalies within the excavated soil. In addition, barbed-wire fences responsible for high anomalous responses in the RI DGM data would be removed and those narrow areas would be covered with 100% DGM. All identified DGM anomalies would be intrusively investigated and recovered MEC/MPPEH handled, stored, destroyed, and demilitarized IAW the ESS.

Subsurface soil samples would be collected from areas containing isolated locations of confirmed MEC and from areas with significant amounts of MD using composite soil sampling techniques to determine the presence or absence of MC contamination (explosives and metals). In addition, MC soil sampling would be performed before and after BIPs and consolidated shots. The more conservative of the NMED residential soil screening levels (NMED, 2015) and USEPA residential soil regional screening levels (USEPA, 2016) would be used as the risk-based screening level to determine whether MC contamination exists.

In the unlikely event (based on previous investigation results) that MC contamination is identified, a risk assessment would be performed to determine if further RA is necessary. If the risk assessment determines that the concentrations of explosives and/or metals in soil pose a significant threat to human health and/or the environment, then a removal of the contaminated soil would be conducted. Prior to removal, step-out sampling will be performed to identify the extent of contamination.

4.3 Evaluation Criteria

This section provides evaluation of three alternatives using the effectiveness, implementability, and cost criteria set forth in the NCP and the USEPA guidance for conducting EE/CAs (USEPA, 1993). The following sections provide a discussion of the pertinent evaluation criteria for each alternative.

Effectiveness

The effectiveness of a technology refers to its capability of removing the specific items in the volumes required, the degree to which the technology achieves the RAO, and the reliability and performance of the technology over time, including protection of human health and the environment, compliance with ARARs to the extent practical, long-term effectiveness and permanence, reduction in explosive safety hazard, and short-term effectiveness. As explained in **Section 3.3**, the RAO for the ML865 and RR869a MRSs is to implement measures that will minimize MEC hazards which may contain energetic materials that pose a potential explosive safety hazard to human health and the environment. Levels of effectiveness were assessed based upon the number of effectiveness criteria that would be satisfied by each alternative. Effectiveness criteria include: protection of human health, protection of workers during implementation, compliance with location and action- specific ARARs, short-term effectiveness, long-term effectiveness, and reduction in the toxicity, mobility, or volume (TMV) of contaminants.

Implementability

The ease of implementation of a technology refers to the availability of commercial services to support it, the constructability of the technology under specific site conditions, and the acceptability of the technology to all parties involved (regulators, public, owner, etc.), including technical feasibility, administrative feasibility, availability of services, support agency acceptance, and community acceptance. Levels of implementability were assessed based upon the number of implementability criteria satisfied by each alternative. Implementability criteria include: technical feasibility, administrative feasibility, and community and regulatory acceptance.

Cost

For the detailed cost analysis of alternatives, the expenditures required to complete each alternative were estimated in terms of capital costs and Post Removal Site Control (PRSC) cost. Capital costs include costs to complete initial RA activities. The PRSC costs include annual operation and maintenance for 30 years and periodic costs to perform Five-Year Reviews for 30 years. By combining the different costs associated with each alternative, a present-worth calculation for each alternative can be made for comparison. For the purposes of the cost estimate summaries (**Appendix A**), Remedial Action Cost Engineering and Requirements

(RACER) was utilized to develop alternative costs. RACER is an environmental remediation/corrective action cost-estimating system developed for DoD cost-estimating use.

4.4 Individual Analysis of Alternatives

4.4.1 Alternative 1 – No Action

Effectiveness

Alternative 1 provides no additional protection to human health and the environment. Potential MEC/MPPEH would remain onsite, which would potentially expose authorized personnel/workers, Base residents, and visitors to explosive safety hazards associated with MEC/MPPEH. In addition, this alternative would not protect the environment from future releases of explosive-related contaminants. No risk reduction will be accomplished through this alternative.

Action-specific ARARs do not apply to this alternative. Alternative 1 does not provide any short term effectiveness at the ML865 and RR869a MRSs as it does not limit or eliminate risks to human health and the environment. Alternative 1 does not provide any long-term effectiveness. Since no RA is performed for Alternative 1, there is no reduction in the TMV of contaminants.

Implementability

Alternative 1 is the No Action alternative; therefore, implementability does not apply. Alternative 1 is not protective of human and ecological receptors; therefore it would not be accepted by regulators.

Cost

The total estimated cost for Alternative 1 is $0. There are no capital or PRSC costs, contingencies, or professional or technical services associated with this alternative.

4.4.2 Alternative 2 – Land Use Controls

Effectiveness

Alternative 2 provides a limited level of protection to human health and the environment at the ML865 and RR869a MRSs. This alternative would reduce the explosive safety risk to humans by raising public awareness and modifying receptor behavior related to activities performed at the MRS, and protecting construction workers with UXO oversight, which would result in increased protection for human health. LUCs would not prevent migration of MEC/MPPEH from the site through erosion/re-deposition; however, there is a low probability of this occurring. No potential environmental benefits are realized from this alternative because munitions items would remain in place.

As with any MEC site, Alternative 2 does have worker safety issues to address prior to implementation. The main hazard to workers during implementation associated with this alternative is working in areas with live munitions. All personnel working in the area will be led by UXO personnel who will provide MEC avoidance support. Establishing the engineering controls (signage) would involve intrusive activities during installation, therefore the area must be free of subsurface MEC/MPPEH prior to working in that immediate area. Worker safety would be a concern for this alternative, but is a normal, manageable component of MEC-related work activities.

MEC left in place does not conflict with the ability to comply with potential action- specific ARARs, therefore, Alternative 2 is in compliance with ARARs.

Alternative 2 is effective in the short term by providing signage warning receptors of MEC/MPPEH hazards in contaminated areas. Alternative 2 provides limited long-term effectiveness. Engineering controls cannot eliminate the long term risks to human health. Signage can be compromised by trespassers and weather and the receptors would in turn have access to restricted areas. Alternative 2 does not include the removal of on-site MEC/MPPEH; therefore the risk to human health is high if engineering controls are compromised. Long term and extensive operation and maintenance would be required to maintain signs in good repair.

Since no MEC/MPPEH would be performed during implementation of Alternative 2, there would be no reduction in the TMV of contaminants.

Implementability

This alternative is technically feasible, administratively feasible, and services and materials necessary to implement the LUCs are readily available in the local community. This alternative is considered technically feasible because the action is achievable using readily available MEC avoidance support services and tools. Possible constraints to implementing the LUCs would be extreme weather conditions. In the case of extreme weather conditions, the installation of the warning signage would be temporarily postponed. This alternative is considered administratively feasible because there are no foreseeable obstacles to implement LUCs. There are no permits, waivers, easements, or right-of-way agreements necessary to install warning signage for the MRSs. All equipment, personnel, and services necessary to implement Alternative 2 are available in the vicinity of Holloman AFB.

Alternative 2 provides an adequate level of protection to human health as long as LUCs are enforced. Since this alternative will not address the removal of the hazard, it is unlikely that the regulators will accept this alternative.

Cost

The total estimated cost for Alternative 2 is $343,831 for ML865 and $341,947 for RR869a (**Appendix A**). Alternative 2 includes capital costs ($17,744 for ML865 and $16,011 for RR869a) for developing and implementing LUCs including institutional restrictions and engineering controls. Engineering controls include installation of warning signs. PRSC costs associated with this alternative ($ 326,087 for ML865 and $325,936 for RR869a) include annual operation and maintenance for 30 years and periodic costs to perform Five-Year Reviews for 30 years.

4.4.3 Alternative 3 – Subsurface Removal of MEC/MPPEH

Effectiveness

Alternative 3 provides the highest level of protection to human health and the environment within the ML865 and RR869a MRSs. Authorized and unauthorized personnel accessing the sites would be protected from MEC/MPPEH items currently in the subsurface and the potential release of explosive related contamination will be eliminated because the subsurface MEC/MPPEH items will be removed and disposed of.

Alternative 3 has worker safety issues to address prior to implementation. The main hazard to workers during implementation associated with this alternative is working with/around

potentially live munitions. All personnel involved with the MEC/MPPEH removal would be qualified to work on a site contaminated with MEC/MPPEH and would have documented proof of qualifications. All applicable safety requirements would be followed for handling, storage, and demolition/demilitarization. To protect both the site workers and visitors to the site (authorized and unauthorized), areas where the removal is taking place would have exclusion zones established for explosive safety purposes. Only authorized personnel would be allowed in the exclusion zone during the normal working hours, however, authorized visitors would be allowed in the exclusion zone under conditions specified in the DDESB-approved ESS. Worker safety would be a concern for this alternative, but is a normal, manageable component of MEC-related work activities. The methodologies to safely perform these activities would be described in the Site-Specific NTCRA WP and the Health and Safety Plan (HASP).

For Alternative 3, subsurface MEC/MPPEH would be removed and destroyed and all activities conducted in a manner consistent with applicable ARARs.

Alternative 3 is effective in the short term by minimizing the explosive safety risk of MEC/MPPEH by permanently removing the items from the subsurface. Alternative 3 is effective in the long-term by eliminating the explosive safety hazard by permanently removing MEC/MPPEH from the subsurface.

Alternative 3 provides reduction of TMV since the MEC/MPPEH that are encountered during the NTCRA will be either BIP or transported to the MRS SDA for demolition. Additional residuals include trace amounts of metals and potential residual explosives. An evaluation of the concentrations of these residuals would be performed.

Implementability

The removal of subsurface MEC/MPPEH from the ML865 and RR869a MRSs is technically and administratively implementable. MEC removal support services and tools are readily available through a number of commercial contractors.

Alternative 3 provides the highest level of protection to human health and the environment among the three alternatives and will result in the site closeout and unrestricted land use at the ML865 and RR869a MRSs. Therefore, the regulatory agencies are likely to consider the Alternative 3 as the most acceptable alternative at the ML865 and RR869a MRSs.

Cost

The total estimated cost for Alternative 3 is $734,238 for ML865 and $270,389 for RR869a (**Appendix A**). Alternative 3 includes capital costs ($734,238) for excavation of all anomalies above the established site-specific thresholds, demolition of MEC, and offsite disposal of MDAS. Since this alternative will result in site closeout, no PRSC costs are associated with this alternative.

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

This section presents a comparative analysis of RA alternatives for the ML865 and RR869a MRSs. In order to rank the alternatives, each alternative was ranked numerically from 1 to 2 for each criterion. The No Action alternative was rated as Not Applicable (NA). The alternative that was determined to be the best alternative when assessed with the criterion, received a numerical ranking of 1. The second best alternative received a numerical ranking of 2. Once the numerical ranking was determined for the three criteria (effectiveness, implementability, and cost) the overall score was determined by adding up the individual numerical rankings for each alternative. An alternative ranked "3" for effectiveness, "1" for implementability, and "3" for cost would have an overall score of "7". The overall scores were used to arrange the alternatives in rank order, with the lowest score being ranked the highest.

5.1 Effectiveness

Table 5-1 provides the ranking of effectiveness criteria of the three alternatives. Alternative 1 does not achieve the RAO. Alternative 2 and 3 have been developed because they were able to achieve RAO identified in **Section 3.3**. If the RAO is achieved, then human health and the environment are protected. Workers can be protected during implementation of Alternative 3 using standard personal protective equipment and MEC detecting devices and procedures. The explosive safety risk to the human health will be minimized through the removal of MEC contamination, which, if left in place, could also potentially serve as a source of chemical environmental contamination. Therefore, Alternative 3 is more protective of the human health and the environment than Alternative 2 because it directly addresses the explosive hazard through removing MEC/MPPEH from the subsurface of the site.

Both alternatives can comply with the action-specific ARARs, which apply to the implementation of the alternatives. The subsurface removal of MEC/MPPEH will adhere to all regulations regarding environmentally sensitive locations, excavations, detonations, and explosives transportation, use, and storage. Therefore, subsurface removal meets more ARARs than LUCs.

For the short term effectiveness, the LUCs alternative is ranked 1 because it reduces risk upon implementation, requires little time to implement, and has minimal adverse effects on the public and the environment. The subsurface removal alternative is ranked 2 because it requires more planning and has more of an impact on the environment.

For the long-term effectiveness, Alternative 3 is ranked 1 because it would eliminate any buried MEC/MPPEH in the area. For the same reason Alternative 3 is ranked 1 for the reduction of TMV.

As shown in **Table 5-1**, Alternative 3 is ranked best in terms of effectiveness.

5.2 Implementability

All of the alternatives are technically and administratively feasible. Implementing Alternative 2 would be easier than implementing Alternative 3, from both an administrative and a technical feasibility perspective. In addition, Alternative 2 could be accomplished in a relatively shorter length of time than that required to implement Alternative 3.

From technical and administrative perspectives, implementation of a subsurface removal is the least feasible. A subsurface removal requires excavation equipment (in addition to specially

trained and qualified personnel and a means of MEC disposal, which is required for all removal actions). Work Plans (WPs) and removal reports are more difficult to document.

Table 5-1 Effectiveness Criteria Evaluation ML865 and RR869a MRSs

Alternative	Protection of Human Health	Protection of Workers	Compliance with ARARs	Short-Term	Long-Term	Reduction of TMV	Overall Score	Rank
Alternative 1 No Action	NA	NA	NA	NA	NA	NA	NA	NA
Alternative 2 LUCs	2	1	2	1	2	2	10	**2**
Alternative 3 Subsurface Removal of MEC/MPPEH	1	1	1	2	1	1	7	**1**

Considering the high MEC/MPPEH risk level, it was determined that the regulatory agencies and community are likely to consider Alternative 3 – Subsurface Removal of MEC/MPPEH as the most acceptable alternative in this area. Therefore, the subsurface removal alternative is ranked 1 in terms of state agency and community acceptance. LUCs are ranked 2, as state agencies and community are likely to prefer a response action that addresses removal of the hazards.

As shown in **Table 5-2,** both alternatives have the same rank in terms of implementability.

Table 5-2 Implementability Criteria Evaluation ML865 and RR869a MRSs

Alternative	Technical Feasibility	Admin Feasibility	Regulatory Acceptance	Community Acceptance	Overall Score	Rank
Alternative 1 No Action	NA	NA	NA	NA	NA	NA
Alternative 2 LUCs	1	1	2	2	6	**1**
Alternative 3 Subsurface Removal of MEC/MPPEH	2	2	1	1	6	**1**

5.3 Cost

The present-worth costs for each of the alternatives are summarized in **Tables 5-3** and **5-4** for ML865 and RR869a MRSs, respectively. The detailed cost breakdown for each alternative is provided in **Appendix A**.

5.4 Overall Ranking of Alternatives

The overall rankings of the different alternatives in terms of their effectiveness, implementability, and cost are presented in **Tables 5-5** and **5-6** for ML865 and RR869a MRSs, respectively.

Table 5-3 Cost Criteria Evaluation ML865 MRS

Alternative	Total Project Duration (Years)	Capital Cost	Total O&M Cost	Total Present Cost of Alternative	Rank
Alternative 1 No Action	NA	NA	NA	NA	NA
Alternative 2 LUCs	30	$17,744	$326,087	$343,831	**1**
Alternative 3 Subsurface Removal of MEC/MPPEH	5	$734,238	$0	$734,238	**2**

Table 5-4 Cost Criteria Evaluation RR869a MRS

Alternative	Total Project Duration (Years)	Capital Cost	Total O&M Cost	Total Present Cost of Alternative	Rank
Alternative 1 No Action	NA	NA	NA	NA	NA
Alternative 2 LUCs	30	$16,011	$325,936	$341,947	**2**
Alternative 3 Subsurface Removal of MEC/MPPEH	5	$270,389	$0	$270,389	**1**

As shown in **Table 5-5**, both alternatives, Alternative 2 and Alternative 3, have the same overall ranking for ML865 MRS, However, Alternative 3, although less cost-effective to implement than Alternative 2, is recommended alternative for this site since provides the greatest protection of human health and the environment and long term effectiveness. For RR869a MRS (**Table 5-6**), Alternative 3 has the best overall ranking, and is also recommended alternative for this site.

Table 5-5 Alternatives Evaluation ML865 MRS

Alternative	Effectiveness Rank	Implementability Rank	Cost Rank	Overall Score	Overall Rank
Alternative 1 No Action	NA	NA	NA	NA	NA
Alternative 2 LUCs	2	1	1	4	**1**
Alternative 3 Subsurface Removal of MEC/MPPEH	1	1	2	4	**1**

Table 5-6 Alternatives Evaluation RR869a MRS

Alternative	Effectiveness Rank	Implementability Rank	Cost Rank	Overall Score	Overall Rank
Alternative 1 No Action	NA	NA	NA	NA	NA
Alternative 2 LUCs	2	1	2	5	**2**
Alternative 3 Subsurface Removal of MEC/MPPEH	1	1	1	3	**1**

6.0 RECOMMENDATIONS

This EE/CA presents the selected RA alternative for the MEC/MPPEH hazards at the ML865 and RR869a MRSs at Holloman AFB in Otero County, New Mexico, developed IAW CERCLA as amended and consistent with the NCP. This decision is based on the information gathered during the previous investigations completed at the site and included in the Administrative Record for the site. The action recommended for this site is Alternative 3 –Subsurface Removal of MEC/MPPEH, which will achieve the RAO with a higher certainty of success and is consistent with what is anticipated to be overall final remedy for the site. This alternative addresses the explosive safety issues associated with MEC/MPPEH, while the other alternatives leave them in place with no means to mitigate the hazard. Additionally, Alternative 3 provides the greatest protection of human health and the environment and long term effectiveness. Implementation of this alternative will permit closeout of both sites which means that no restrictions on future land use are needed for these sites and no further restoration funds are required to be expended at the ML865 and RR869a MRSs. Conditions at the site meet the USEPA 40 CFR § 300.415(b)(2)(vi) - threat of fire or explosion - criterion for initiating a removal action. The total project cost, if approved, is estimated to be $734,238 for ML865 and $270,389 for RR869a with no PRSC costs.

6.1 Public Participation

Following completion of the EE/CA, community relations and administrative record activities necessary for all RAs will be performed.

According to Section 300.415(m) of the NCP, the Lead Agency (USAF) will conduct the following community relations activities:

- Designate a community relations spokesperson,
- Establish the information repository,
- Conduct community interviews,
- Prepare Community Relations Plan, and
- Issue public notice in the Alamogordo Daily News of availability of the EE/CA.

According to Section 300.820 of the NCP, the Lead Agency will conduct the following administrative record requirements:

- Establish the administrative record file,
- Publish public notice of the availability of the administrative record file,
- Hold a public comment period,
- Develop written responses to significant public comments, and
- Complete the administrative record file after selecting the response.

Written responses to significant comments will be summarized in an Action Memorandum and will be included in the Administrative Record.

6.2 Removal Action Schedule

The general completion time frames for activities associated with the NTCRA at the ML865 and RR869a MRSs are summarized in **Table 6-1**.

Table 6-1 Removal Action Schedule

EE/CA (preparation, review, and approval)	June 2015 to July 2016
Action Memorandum (with public comment period)	July 2016 to December 2016
Explosives Safety Submission	Final DDESB approved ESS currently in place
NTCRA WP (preparation, review, and approval)	January 2017 to July 2017
Fieldwork	August 2017 to October 2017
After Action Report	November 2017 to May 2018
Site Closeout	June 2018 to February 2020

7.0 REFERENCES

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Appendix A
Remedial Action Alternatives Cost Estimates

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ML865 MRS

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Alternative 1
No Action

There is no cost associated with Alternative 1.

Alternative 2
Land Use Controls

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Phase Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location

State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

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Phase Cost Detail Report
(with Markups)

Site:

Site ID: ML865
Site Name: ML865
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: None

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

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Phase Cost Detail Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

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Phase Cost Detail Report
(with Markups)

Phase:

Phase Type: Operations & Maintenance
Phase Name: Alternative 2 - LUC/ICs and Signage
Description:

Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
MEC Institutional Controls	Yes	100	0

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Phase Cost Detail Report
(with Markups)

Technology	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
ADMINISTRATIVE LAND USE CONTROLS	$133,004							$106,314	$239,318
(100% Prime)		$0	$0	$76,423	$12,029	$0	$17,862		
MEC Institutional Controls	$12,460							$5,284	$17,744
(100% Prime)		$0	$0	$2,587	$1,086	$0	$1,612		
Total Phase Cost	$145,464	$0	$0	$79,010	$13,114	$0	$19,475	$111,598	$257,062
						Escalation			$86,769
						Escalated Phase Cost			$343,831

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Phase Cost Detail Report
(with Markups)

Markup Template

System Defaults	Markup Percentage
Professional Labor Overhead/G&A	132.0
Field Office Overhead/G&A	25.0
Subcontractor Profit	8.0
Prime Profit	8.0
Contingency	0.0
Owner Cost	11.0

Comment:

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Phase Cost Over Time Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location
State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

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Phase Cost Over Time Report
(with Markups)

Site:

Site ID: ML865
Site Name: ML865
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: None

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

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Phase Cost Over Time Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

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Phase Cost Over Time Report
(with Markups)

Phase:

Phase Type: Operations & Maintenance
Phase Name: Alternative 2 - LUC/ICs and Signage
Description:

Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
MEC Institutional Controls	Yes	100	0

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Phase Cost Over Time Report
(with Markups)

Technology	2014	2015	2016	2017	2018	2019
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$17,744	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$25,721	$7,977	$7,977	$7,977
Escalation Factor	1.0508	1.0687	1.0869	1.1053	1.1241	1.1432
Escalated Phase Cost	$8,383	$8,525	$27,956	$8,817	$8,967	$9,120

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Phase Cost Over Time Report
(with Markups)

Technology	2020	2021	2022	2023	2024	2025
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.1627	1.1824	1.2026	1.2230	1.2438	1.2649
Escalated Phase Cost	$9,275	$9,432	$9,593	$9,756	$9,922	$10,090

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Phase Cost Over Time Report
(with Markups)

Technology	2026	2027	2028	2029	2030	2031
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.2864	1.3083	1.3305	1.3532	1.3762	1.3996
Escalated Phase Cost	$10,262	$10,437	$10,614	$10,795	$10,978	$11,165

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Phase Cost Over Time Report
(with Markups)

Technology	2032	2033	2034	2035	2036	2037
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.4234	1.4476	1.4722	1.4972	1.5226	1.5485
Escalated Phase Cost	$11,355	$11,548	$11,744	$11,944	$12,146	$12,353

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Phase Cost Over Time Report
(with Markups)

Technology	2038	2039	2040	2041	2042	2043
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.5748	1.6016	1.6288	1.6565	1.6847	1.7133
Escalated Phase Cost	$12,563	$12,776	$12,993	$13,214	$13,439	$13,667

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Phase Cost Over Time Report
(with Markups)

Technology	Total
ADMINISTRATIVE LAND USE CONTROLS	$239,318
MEC Institutional Controls	$17,744
Total Phase Cost	$257,062
Escalation Factor	
Escalated Phase Cost	$343,831

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Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location

State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID: ML865
Site Name: ML865
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: None

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator
Agency/Org./Office: FPM

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com

Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Technology Cost Detail Report (with Markups)

Phase:

Phase Type: Operations & Maintenance
Phase Name: Alternative 2 - LUC/ICs and Signage
Description:

Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
MEC Institutional Controls	Yes	100	0

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Phase Technology Cost Detail Report (with Markups)

Technology: ADMINISTRATIVE LAND USE CONTROLS

Element: Monitoring & Enforcement

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010108	Sedan, Automobile, Rental	2.00	DAY	0.00	0.00	0.00	63.64	$127.28	☐	☑
33010202	Per Diem (per person)	3.00	DAY	0.00	0.00	0.00	123.00	$369.00	☑	☐
33022038	Overnight delivery service, 1 lb package	6.00	LB	0.00	0.00	0.00	49.11	$294.66	☐	☑
33041101	Airfare	2.00	LS	0.00	0.00	0.00	800.00	$1,600.00	☑	☐
33220102	Project Manager	2.00	HR	0.00	193.20	0.00	0.00	$386.39	☐	☑
33220106	Staff Engineer	16.00	HR	0.00	186.89	0.00	0.00	$2,990.24	☐	☑
33220110	QA/QC Officer	2.00	HR	0.00	158.97	0.00	0.00	$317.93	☐	☑
33220112	Field Technician	8.00	HR	0.00	115.90	0.00	0.00	$927.21	☐	☑
33220114	Word Processing/Clerical	2.00	HR	0.00	81.71	0.00	0.00	$163.42	☐	☑
33220115	Draftsman/CADD	2.00	HR	0.00	89.68	0.00	0.00	$179.36	☐	☑
33220119	Health and Safety Officer	2.00	HR	0.00	142.09	0.00	0.00	$284.19	☐	☑
33240101	Other Direct Costs	1.00	LS	337.60	0.00	0.00	0.00	$337.60	☑	☑

Total Element Cost **$7,977.27**

Total 1st Year Technology Cost **$7,977.27**

This report for official U.S. Government use only.

Phase Technology Cost Detail Report (with Markups)

Technology: MEC Institutional Controls

Element: Implementation

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010108	Sedan, Automobile, Rental	12.00	DAY	0.00	0.00	0.00	63.64	$763.69	☐	☑
33010202	Per Diem (per person)	12.00	DAY	0.00	0.00	0.00	123.00	$1,476.00	☑	☐
33040927	UXO Senior Scientist	98.00	HR	0.00	120.59	0.00	0.00	$11,817.38	☐	☑
33240101	Other Direct Costs	1.00	LS	118.17	0.00	0.00	0.00	$118.17	☑	☑

Total Element Cost **$14,175.25**

Element: Engineering Controls

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
18040501	Hazardous Waste Signing	35.00	EA	63.89	38.07	0.00	0.00	$3,568.71	☐	☑

Total Element Cost **$3,568.71**

Total 1st Year Technology Cost **$17,743.96**

Total Phase Cost **$25,721.23**

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Alternative 3
Subsurface Removal of MEC/MPPEH

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Phase Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location

State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Site:

Site ID: ML865
Site Name: ML865
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: None

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Phase:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Subsurface Clearance
Description:

Approach: Ex Situ
Start Date: October, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Excavation	Yes	100	0
Load and Haul	Yes	100	0
Professional Labor Management	Yes	100	0
MEC Removal Action	Yes	100	0

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Phase Cost Detail Report
(with Markups)

Technology	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
Excavation	$51,912							$26,381	$78,293
(100% Prime)		$0	$0	$13,398	$5,225	$0	$7,759		
Load and Haul	$141,231							$70,404	$211,635
(100% Prime)		$0	$0	$35,308	$14,123	$0	$20,973		
Professional Labor Management	$15,659							$0	$15,659
(100% Prime)		$0	$0	$0	$0	$0	$0		
MEC Removal Action	$263,748							$106,199	$369,947
(100% Prime)		$0	$0	$52,873	$21,459	$0	$31,867		
Total Phase Cost	$472,551	$0	$0	$101,579	$40,807	$0	$60,598	$202,983	$675,534
						Escalation			$58,704
						Escalated Phase Cost			$734,238

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Phase Cost Detail Report
(with Markups)

Markup Template

System Defaults	Markup Percentage
Professional Labor Overhead/G&A	132.0
Field Office Overhead/G&A	25.0
Subcontractor Profit	8.0
Prime Profit	8.0
Contingency	0.0
Owner Cost	11.0

Comment:

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Phase Cost Over Time Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location
State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Site:

Site ID: ML865
Site Name: ML865
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: None

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

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Phase Cost Over Time Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

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Phase Cost Over Time Report
(with Markups)

Phase:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Subsurface Clearance
Description:

Approach: Ex Situ
Start Date: October, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Excavation	Yes	100	0
Load and Haul	Yes	100	0
Professional Labor Management	Yes	100	0
MEC Removal Action	Yes	100	0

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Phase Cost Over Time Report
(with Markups)

Technology	2016	Total
Excavation	$78,293	$78,293
Load and Haul	$211,635	$211,635
Professional Labor Management	$15,659	$15,659
MEC Removal Action	$369,947	$369,947
Total Phase Cost	$675,534	$675,534
Escalation Factor	1.0869	
Escalated Phase Cost	$734,238	$734,238

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Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location

State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID: ML865
Site Name: ML865
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: None

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator
Agency/Org./Office: FPM

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com

Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Subsurface Clearance
Description:

Approach: Ex Situ
Start Date: October, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Excavation	Yes	100	0
Load and Haul	Yes	100	0
Professional Labor Management	Yes	100	0
MEC Removal Action	Yes	100	0

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Phase Technology Cost Detail Report (with Markups)

Technology: Excavation

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17020416	12 CY Dump Truck Haul/Hour	132.00	HR	0.00	103.33	64.98	0.00	$22,217.52	☐	☑
17030277	Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	2,400.00	BCY	0.00	1.42	0.97	0.00	$5,733.84	☐	☑
17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	2,760.00	CY	11.86	1.46	1.27	0.02	$40,327.62	☐	☑
18050402	Seeding, Vegetative Cover	0.60	ACR	4,743.63	673.64	290.18	0.00	$3,424.47	☐	☑
33020401	Disposable Materials per Sample	38.00	EA	14.06	0.00	0.00	0.00	$534.27	☐	☑
33021710	Testing, soil & sediment analysis, metals (1 cp) (6010)	10.00	EA	0.00	0.00	0.00	20.58	$205.82	☐	☑
33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	10.00	EA	0.00	0.00	0.00	299.48	$2,994.77	☐	☑
33220102	Project Manager	5.00	HR	0.00	193.20	0.00	0.00	$965.99	☐	☑
33220108	Project Scientist	7.00	HR	0.00	195.71	0.00	0.00	$1,370.00	☐	☑
33220110	QA/QC Officer	1.00	HR	0.00	193.86	0.00	0.00	$193.86	☐	☑
33220112	Field Technician	1.00	HR	0.00	115.90	0.00	0.00	$115.90	☐	☑
33220114	Word Processing/Clerical	1.00	HR	0.00	99.65	0.00	0.00	$99.65	☐	☑
33220115	Draftsman/CADD	1.00	HR	0.00	109.36	0.00	0.00	$109.36	☐	☑

Total Element Cost	**$78,293.07**
Total 1st Year Technology Cost	**$78,293.07**

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Phase Technology Cost Detail Report (with Markups)

Technology: Load and Haul

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
17020401	Dump Charges	2,400.00	EA	52.45	0.00	0.00	0.00	$125,874.00	☑	☑
17030222	926, 2.0 CY, Wheel Loader	33.00	HR	0.00	110.73	61.13	0.00	$5,671.37	☐	☑
17030287	20 CY, Semi Dump	431.00	HR	0.00	103.33	82.49	0.00	$80,089.85	☐	☑

Total Element Cost	**$211,635.21**
Total 1st Year Technology Cost	**$211,635.21**

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Phase Technology Cost Detail Report (with Markups)

Technology: Professional Labor Management

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33220149	Lump Sum Percentage Labor Cost	1.00	LS	0.00	15,659.00	0.00	0.00	$15,659.00	☑	☐

Total Element Cost	**$15,659.00**
Total 1st Year Technology Cost	**$15,659.00**

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Phase Technology Cost Detail Report (with Markups)

Technology: MEC Removal Action

Element: UXO Mapping

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010202	Per Diem (per person)	137.00	DAY	0.00	0.00	0.00	123.00	$16,851.00	☑	☐
33021530	Differential GPS Unit Rental	2.00	MO	95.35	0.00	0.00	0.00	$190.70	☐	☑
33040210	Geonics EM-61 Metal Locator, Towed (Weekly Rental)	1.00	WK	0.00	0.00	0.00	602.73	$602.73	☐	☑
33040223	Ordnance Locator, Schoenstedt, Model GA-72CD, weekly rental	21.00	WK	0.00	0.00	0.00	146.10	$3,068.04	☐	☑
33040230	Geonics EM-61 Metal Locator, Hand Held (Weekly Rental)	1.00	WK	0.00	0.00	0.00	485.20	$485.20	☐	☑
33040651	4 X 4 Truck- Rental/Lease	41.00	DAY	0.00	0.00	110.31	0.00	$4,522.89	☐	☑
33040653	All Terrain Vehicle (ATV) - Rental/Lease	1.00	DAY	299.18	0.00	0.00	0.00	$299.18	☐	☑
33040934	UXO Technician II	660.00	HR	0.00	51.46	0.00	0.00	$33,963.49	☐	☑
33040935	UXO Technician III (UXO Supervisor)	120.00	HR	0.00	61.74	0.00	0.00	$7,409.28	☐	☑
33040936	Geophysicist (UXO)	20.00	HR	0.00	77.71	0.00	0.00	$1,554.14	☐	☑
33041101	Airfare	10.00	LS	750.00	0.00	0.00	0.00	$7,500.00	☑	☐
33240101	Other Direct Costs	1.00	LS	3,218.67	0.00	0.00	0.00	$3,218.67	☑	☑
					Total Element Cost			**$79,665.33**		

Element: UXO Removal

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010202	Per Diem (per person)	3.00	DAY	0.00	0.00	0.00	123.00	$369.00	☑	☐

This report for official U.S. Government use only.

Phase Technology Cost Detail Report (with Markups)

Element: UXO Removal

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33040230	Geonics EM-61 Metal Locator, Hand Held (Weekly Rental)	1.00	WK	0.00	0.00	0.00	485.20	$485.20	☐	☑
33040651	4 X 4 Truck- Rental/Lease	2.00	DAY	0.00	0.00	110.31	0.00	$220.63	☐	☑
33040935	UXO Technician III (UXO Supervisor)	10.00	HR	0.00	61.74	0.00	0.00	$617.44	☐	☑
33040936	Geophysicist (UXO)	20.00	HR	0.00	77.71	0.00	0.00	$1,554.14	☐	☑
33041001	16oz Standard TNT Booster	800.00	EA	0.56	0.00	0.00	0.00	$445.50	☐	☑
33041002	50 gr/ft Det -Cord (1000 ft roll)	120.00	EA	794.36	0.00	0.00	0.00	$95,323.49	☐	☑
33041004	12 ft Lead Primadet Non-Electric Detonators	400.00	EA	9.53	0.00	0.00	0.00	$3,812.94	☐	☑
33240101	Other Direct Costs	1.00	LS	5,129.03	0.00	0.00	0.00	$5,129.03	☑	☑
				Total Element Cost				**$107,957.36**		

Element: Site Management

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010202	Per Diem (per person)	168.00	DAY	0.00	0.00	0.00	123.00	$20,664.00	☑	☐
33040651	4 X 4 Truck- Rental/Lease	168.00	DAY	0.00	0.00	110.31	0.00	$18,532.84	☐	☑
33040921	Senior UXO Supervisor (SUXOS)	240.00	HR	0.00	77.16	0.00	0.00	$18,518.51	☐	☑
33040923	UXO Project Manager	240.00	HR	0.00	100.91	0.00	0.00	$24,218.32	☐	☑
33040930	UXO QC Specialist	240.00	HR	0.00	71.05	0.00	0.00	$17,052.58	☐	☑
33040931	UXO Safety Officer	240.00	HR	0.00	70.21	0.00	0.00	$16,851.19	☐	☑
33041101	Airfare	4.00	LS	750.00	0.00	0.00	0.00	$3,000.00	☑	☐

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Phase Technology Cost Detail Report
(with Markups)

Total Element Cost **$118,837.44**

Element: Stakeholder Involvement

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33040923	UXO Project Manager	12.00	HR	0.00	100.91	0.00	0.00	$1,210.92	☐	☑
33040935	UXO Technician III (UXO Supervisor)	12.00	HR	0.00	61.74	0.00	0.00	$740.93	☐	☑
33041302	Site Specific Workplan (Moderate Complexity)	1.00	EA	155.60	22,597.37	0.00	0.00	$22,752.96	☐	☑
33041305	Explosive Safety Submission (Moderate Complexity)	1.00	EA	311.19	10,491.28	0.00	0.00	$10,802.48	☐	☑
33041314	UXO Removal Report (Moderate Complexity)	1.00	EA	311.19	27,668.51	0.00	0.00	$27,979.70	☐	☑

Total Element Cost **$63,486.99**

Total 1st Year Technology Cost **$369,947.12**

Total Phase Cost **$675,534.40**

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RR869a MRS

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Alternative 1
No Action

There is no cost associated with Alternative 1.

Alternative 2
Land Use Controls

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Phase Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location

State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Site:

Site ID: RR869
Site Name: RR869
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (not residual)
Secondary: Ordnance (not residual)

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

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Phase Cost Detail Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Phase:

Phase Type: Operations & Maintenance
Phase Name: Alternative 2 - LUC/ICs and Signage
Description:

Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
MEC Institutional Controls	Yes	100	0

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Technology	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
ADMINISTRATIVE LAND USE CONTROLS	$133,004							$106,314	$239,318
(100% Prime)		$0	$0	$76,423	$12,029	$0	$17,862		
MEC Institutional Controls	$11,303							$4,708	$16,011
(100% Prime)		$0	$0	$2,297	$970	$0	$1,440		
Total Phase Cost	$144,307	$0	$0	$78,721	$12,999	$0	$19,303	$111,022	$255,329
						Escalation			$86,618
						Escalated Phase Cost			$341,947

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Phase Cost Detail Report
(with Markups)

Markup Template

System Defaults	Markup Percentage
Professional Labor Overhead/G&A	132.0
Field Office Overhead/G&A	25.0
Subcontractor Profit	8.0
Prime Profit	8.0
Contingency	0.0
Owner Cost	11.0

Comment:

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location
State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Site:

Site ID: RR869
Site Name: RR869
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (not residual)
Secondary: Ordnance (not residual)

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Phase:

Phase Type: Operations & Maintenance
Phase Name: Alternative 2 - LUC/ICs and Signage
Description:

Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
MEC Institutional Controls	Yes	100	0

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Phase Cost Over Time Report
(with Markups)

Technology	2014	2015	2016	2017	2018	2019
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$16,011	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$23,988	$7,977	$7,977	$7,977
Escalation Factor	1.0508	1.0687	1.0869	1.1053	1.1241	1.1432
Escalated Phase Cost	$8,383	$8,525	$26,072	$8,817	$8,967	$9,120

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Phase Cost Over Time Report
(with Markups)

Technology	2020	2021	2022	2023	2024	2025
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.1627	1.1824	1.2026	1.2230	1.2438	1.2649
Escalated Phase Cost	$9,275	$9,432	$9,593	$9,756	$9,922	$10,090

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Phase Cost Over Time Report
(with Markups)

Technology	2026	2027	2028	2029	2030	2031
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.2864	1.3083	1.3305	1.3532	1.3762	1.3996
Escalated Phase Cost	$10,262	$10,437	$10,614	$10,795	$10,978	$11,165

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Technology	2032	2033	2034	2035	2036	2037
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.4234	1.4476	1.4722	1.4972	1.5226	1.5485
Escalated Phase Cost	$11,355	$11,548	$11,744	$11,944	$12,146	$12,353

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Phase Cost Over Time Report
(with Markups)

Technology	2038	2039	2040	2041	2042	2043
ADMINISTRATIVE LAND USE CONTROLS	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
MEC Institutional Controls	$0	$0	$0	$0	$0	$0
Total Phase Cost	$7,977	$7,977	$7,977	$7,977	$7,977	$7,977
Escalation Factor	1.5748	1.6016	1.6288	1.6565	1.6847	1.7133
Escalated Phase Cost	$12,563	$12,776	$12,993	$13,214	$13,439	$13,667

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Phase Cost Over Time Report
(with Markups)

Technology	Total
ADMINISTRATIVE LAND USE CONTROLS	$239,318
MEC Institutional Controls	$16,011
Total Phase Cost	$255,329
Escalation Factor	
Escalated Phase Cost	$341,947

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\daniel.FPM-GROUP\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: NM-AZ Group-EE/CAs-FSs

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location

State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID: RR869
Site Name: RR869
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (not residual)
Secondary: Ordnance (not residual)

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator
Agency/Org./Office: FPM

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com

Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type: Operations & Maintenance
Phase Name: Alternative 2 - LUC/ICs and Signage
Description:

Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
ADMINISTRATIVE LAND USE CONTROLS	Yes	100	0
MEC Institutional Controls	Yes	100	0

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Phase Technology Cost Detail Report (with Markups)

Technology: ADMINISTRATIVE LAND USE CONTROLS

Element: Monitoring & Enforcement

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010108	Sedan, Automobile, Rental	2.00	DAY	0.00	0.00	0.00	63.64	$127.28	☐	☑
33010202	Per Diem (per person)	3.00	DAY	0.00	0.00	0.00	123.00	$369.00	☑	☐
33022038	Overnight delivery service, 1 lb package	6.00	LB	0.00	0.00	0.00	49.11	$294.66	☐	☑
33041101	Airfare	2.00	LS	0.00	0.00	0.00	800.00	$1,600.00	☑	☐
33220102	Project Manager	2.00	HR	0.00	193.20	0.00	0.00	$386.39	☐	☑
33220106	Staff Engineer	16.00	HR	0.00	186.89	0.00	0.00	$2,990.24	☐	☑
33220110	QA/QC Officer	2.00	HR	0.00	158.97	0.00	0.00	$317.93	☐	☑
33220112	Field Technician	8.00	HR	0.00	115.90	0.00	0.00	$927.21	☐	☑
33220114	Word Processing/Clerical	2.00	HR	0.00	81.71	0.00	0.00	$163.42	☐	☑
33220115	Draftsman/CADD	2.00	HR	0.00	89.68	0.00	0.00	$179.36	☐	☑
33220119	Health and Safety Officer	2.00	HR	0.00	142.09	0.00	0.00	$284.19	☐	☑
33240101	Other Direct Costs	1.00	LS	337.60	0.00	0.00	0.00	$337.60	☑	☑

Total Element Cost **$7,977.27**

Total 1st Year Technology Cost **$7,977.27**

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Phase Technology Cost Detail Report (with Markups)

Technology: MEC Institutional Controls

Element: Implementation

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010108	Sedan, Automobile, Rental	12.00	DAY	0.00	0.00	0.00	63.64	$763.69	☐	☑
33010202	Per Diem (per person)	12.00	DAY	0.00	0.00	0.00	123.00	$1,476.00	☑	☐
33040927	UXO Senior Scientist	98.00	HR	0.00	120.59	0.00	0.00	$11,817.38	☐	☑
33240101	Other Direct Costs	1.00	LS	118.17	0.00	0.00	0.00	$118.17	☑	☑

Total Element Cost **$14,175.25**

Element: Engineering Controls

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
18040501	Hazardous Waste Signing	18.00	EA	63.89	38.07	0.00	0.00	$1,835.34	☐	☑

Total Element Cost **$1,835.34**

Total 1st Year Technology Cost **$16,010.58**

Total Phase Cost **$23,987.85**

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Alternative 3
Subsurface Removal of MEC/MPPEH

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Phase Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\Daniel\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: AZ-NM

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location
State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

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Phase Cost Detail Report
(with Markups)

Site:

Site ID: RR869
Site Name: RR869
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (not residual)
Secondary: Ordnance (not residual)

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

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Phase Cost Detail Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Phase:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Subsurface Clearance
Description:

Approach: Ex Situ
Start Date: October, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
MEC Site Characterization & Removal Assessment	Yes	100	0

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Technology	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
MEC Site Characterization & Removal Assessment (100% Prime)	$173,295	$0	$0	$37,739	$15,186	$0	$22,551	$75,476	$248,771
Total Phase Cost	$173,295	$0	$0	$37,739	$15,186	$0	$22,551	$75,476	$248,771
						Escalation			$21,618
						Escalated Phase Cost			$270,389

This report for official U.S. Government use only.

Phase Cost Detail Report
(with Markups)

Markup Template

System Defaults	Markup Percentage
Professional Labor Overhead/G&A	132.0
Field Office Overhead/G&A	25.0
Subcontractor Profit	8.0
Prime Profit	8.0
Contingency	0.0
Owner Cost	11.0

Comment:

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\Daniel\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: AZ-NM

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location
State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Site:

Site ID: RR869
Site Name: RR869
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (not residual)
Secondary: Ordnance (not residual)

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Agency/Org./Office: FPM
Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com
Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Phase:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Subsurface Clearance
Description:

Approach: Ex Situ
Start Date: October, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
MEC Site Characterization & Removal Assessment	Yes	100	0

This report for official U.S. Government use only.

Phase Cost Over Time Report
(with Markups)

Technology	2016	Total
MEC Site Characterization & Removal Assessment	$248,771	$248,771
Total Phase Cost	$248,771	$248,771
Escalation Factor	1.0869	
Escalated Phase Cost	$270,389	$270,389

This report for official U.S. Government use only.

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Phase Technology Cost Detail Report
(with Markups)

System:

RACER Version: 10.4.0
Database Location: C:\Users\Daniel\Application Data\AECOM\RACER 10.4\Racer.mdb

Folder:

Folder Name: AZ-NM

Project:

Project ID: Holloman-Additional-2015
Project Name: Holloman-Additional-2015
Project Category: None

Location
State / Country: NEW MEXICO
City: HOLLOMAN AFB

Location Modifier	Default	User
	1.093	1.093

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Site:

Site ID: RR869
Site Name: RR869
Site Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (not residual)
Secondary: Ordnance (not residual)

Phase Names

Pre-Study: ☐
Study: ☑
Design: ☐
Removal/Interim Action: ☑
Remedial Action: ☑
Operations & Maintenance: ☑
Long Term Monitoring: ☑
Site Closeout: ☑

Documentation

Description:
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources usn the preparation of the estimate.

Estimator Information

Estimator Name: Daniel Baldyga
Estimator Title: FPM Estimator
Agency/Org./Office: FPM

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Business Address: FPM
Rome, New York 13441
Telephone Number: 315-336-7721
Email Address: d.baldyga@fpm-remediations.com

Estimate Prepared Date: 04/12/2013

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed:

Reviewer Signature: _____ **Date:** _____

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Phase:

Phase Type: Remedial Action
Phase Name: Alternative 3 - Subsurface Clearance
Description:

Approach: Ex Situ
Start Date: October, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markups: System Defaults

Technology Markups	Markup	% Prime	% Sub.
MEC Site Characterization & Removal Assessment	Yes	100	0

This report for official U.S. Government use only.

Phase Technology Cost Detail Report (with Markups)

Technology: MEC Site Characterization & Removal Assessment

Element: Scoping/Management

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33041316	Workplan for Study Phase (Low Complexity)	1.00	EA	1,166.98	38,391.71	0.00	0.00	$39,558.69	☐	☑

Total Element Cost **$39,558.69**

Element: Site Planning

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010108	Sedan, Automobile, Rental	12.00	DAY	0.00	0.00	0.00	63.64	$763.69	☐	☑
33010202	Per Diem (per person)	20.00	DAY	0.00	0.00	0.00	123.00	$2,460.00	☑	☐
33040671	Portable GPS Set with Mapping, 5 cm Accuracy	1.00	MO	1,144.21	0.00	0.00	0.00	$1,144.21	☐	☑
33040921	Senior UXO Supervisor (SUXOS)	10.00	HR	0.00	77.16	0.00	0.00	$771.60	☐	☑
33040923	UXO Project Manager	86.00	HR	0.00	100.91	0.00	0.00	$8,678.23	☐	☑
33040925	UXO Staff Engineer	16.00	HR	0.00	69.28	0.00	0.00	$1,108.43	☐	☑
33040926	UXO Junior Engineer	208.00	HR	0.00	51.03	0.00	0.00	$10,614.35	☐	☑
33040929	UXO Word Processor	8.00	HR	0.00	33.82	0.00	0.00	$270.55	☐	☑
33040930	UXO QC Specialist	10.00	HR	0.00	71.05	0.00	0.00	$710.52	☐	☑
33040931	UXO Safety Officer	58.00	HR	0.00	70.21	0.00	0.00	$4,072.37	☐	☑
33040935	UXO Technician III (UXO Supervisor)	10.00	HR	0.00	61.74	0.00	0.00	$617.44	☐	☑
33040936	Geophysicist (UXO)	152.00	HR	0.00	77.71	0.00	0.00	$11,811.45	☐	☑
33040938	Geologist (UXO)	48.00	HR	0.00	60.67	0.00	0.00	$2,912.19	☐	☑

This report for official U.S. Government use only.

Phase Technology Cost Detail Report
(with Markups)

Element: Site Planning

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33040939	UXO Drafter	8.00	HR	0.00	38.46	0.00	0.00	$307.71	☐	☑
33040940	GIS Manager (UXO)	104.00	HR	0.00	65.51	0.00	0.00	$6,813.07	☐	☑
33041101	Airfare	4.00	LS	0.00	0.00	0.00	750.00	$3,000.00	☑	☐
33220213	Surveying - 3-man Crew	1.00	DAY	0.00	1,133.40	22.67	0.00	$1,156.07	☐	☑
33240101	Other Direct Costs	1.00	LS	14,985.00	0.00	0.00	0.00	$14,985.00	☑	☑
					Total Element Cost			**$72,196.87**		

Element: Site Characterization

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33010202	Per Diem (per person)	61.00	DAY	0.00	0.00	0.00	123.00	$7,503.00	☑	☐
33021530	Differential GPS Unit Rental	1.00	MO	95.35	0.00	0.00	0.00	$95.35	☐	☑
33040223	Ordnance Locator, Schoenstedt, Model GA-72CD, weekly rental	4.00	WK	0.00	0.00	0.00	146.10	$584.39	☐	☑
33040646	Backhoe - Rental/Lease	7.00	DAY	0.00	0.00	332.41	0.00	$2,326.85	☐	☑
33040651	4 X 4 Truck- Rental/Lease	35.00	DAY	0.00	0.00	110.31	0.00	$3,861.01	☐	☑
33040921	Senior UXO Supervisor (SUXOS)	30.00	HR	0.00	77.16	0.00	0.00	$2,314.81	☐	☑
33040923	UXO Project Manager	30.00	HR	0.00	100.91	0.00	0.00	$3,027.29	☐	☑
33040930	UXO QC Specialist	30.00	HR	0.00	71.05	0.00	0.00	$2,131.57	☐	☑
33040931	UXO Safety Officer	30.00	HR	0.00	70.21	0.00	0.00	$2,106.40	☐	☑
33040934	UXO Technician II	240.00	HR	0.00	51.46	0.00	0.00	$12,350.36	☐	☑

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Phase Technology Cost Detail Report (with Markups)

Element: Site Characterization

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33040935	UXO Technician III (UXO Supervisor)	40.00	HR	0.00	61.74	0.00	0.00	$2,469.76	☐	☑
33041001	16oz Standard TNT Booster	40.00	EA	0.56	0.00	0.00	0.00	$22.27	☐	☑
33041002	50 gr/ft Det -Cord (1000 ft roll)	6.00	EA	794.36	0.00	0.00	0.00	$4,766.17	☐	☑
33041004	12 ft Lead Primadet Non-Electric Detonators	20.00	EA	9.53	0.00	0.00	0.00	$190.65	☐	☑
33041101	Airfare	11.00	LS	0.00	0.00	0.00	750.00	$8,250.00	☑	☐
33240101	Other Direct Costs	1.00	LS	29.97	0.00	0.00	0.00	$29.97	☑	☑
				Total Element Cost				**$52,029.86**		

Element: Alternative Analysis/Reporting

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33040921	Senior UXO Supervisor (SUXOS)	64.00	HR	0.00	77.16	0.00	0.00	$4,938.27	☐	☑
33040922	UXO Program Manager	24.00	HR	0.00	134.69	0.00	0.00	$3,232.54	☐	☑
33040923	UXO Project Manager	88.00	HR	0.00	100.91	0.00	0.00	$8,880.05	☐	☑
33040924	UXO Senior Engineer	44.00	HR	0.00	94.61	0.00	0.00	$4,162.68	☐	☑
33040925	UXO Staff Engineer	180.00	HR	0.00	69.28	0.00	0.00	$12,469.79	☐	☑
33040926	UXO Junior Engineer	120.00	HR	0.00	51.03	0.00	0.00	$6,123.66	☐	☑
33040927	UXO Senior Scientist	40.00	HR	0.00	98.88	0.00	0.00	$3,955.21	☐	☑
33040928	UXO Staff Scientist	16.00	HR	0.00	69.28	0.00	0.00	$1,108.43	☐	☑
33040929	UXO Word Processor	150.00	HR	0.00	33.82	0.00	0.00	$5,072.80	☐	☑
33040931	UXO Safety Officer	120.00	HR	0.00	70.21	0.00	0.00	$8,425.60	☐	☑

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Phase Technology Cost Detail Report (with Markups)

Element: Alternative Analysis/Reporting

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Unit Cost	Extended Cost	Cost Override	Markups Applied
33040932	UXO Certified Industrial Hygenist	40.00	HR	0.00	101.79	0.00	0.00	$4,071.51	☐	☑
33040936	Geophysicist (UXO)	64.00	HR	0.00	77.71	0.00	0.00	$4,973.24	☐	☑
33040939	UXO Drafter	40.00	HR	0.00	38.46	0.00	0.00	$1,538.53	☐	☑
33040940	GIS Manager (UXO)	16.00	HR	0.00	65.51	0.00	0.00	$1,048.16	☐	☑
33240101	Other Direct Costs	1.00	LS	14,985.00	0.00	0.00	0.00	$14,985.00	☑	☑

Total Element Cost	**$84,985.47**
Total 1st Year Technology Cost	**$248,770.89**
Total Phase Cost	**$248,770.89**

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