

**FINAL
RECORD OF DECISION**

**MMRP MUNITIONS RESPONSE SERVICES
NATIONAL GUARD BUREAU**

**NON-DOD NON-OPERATIONAL DEFENSE SITES
REMEDIAL INVESTIGATION / FEASIBILITY STUDY PROGRAM**

**MAROON CRATER ARTILLERY RANGE CONCENTRATED MUNITIONS USE
AREA (AZHQ-009-R-01)
MAROON CRATER ARTILLERY RANGE BUFFER AREA (AZHQ-009-R-02)**

COCONINO COUNTY, ARIZONA

**Contract No. W912DR-09-D-0006
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Prepared For:



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LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
%	percent
§	Section
ACHP	Advisory Council on Historic Preservation
AEDB-R	Army Environmental Database Restoration
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AGC	advanced geophysical classification
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
ARNG	Army National Guard
ARPA	Archaeological Resources Protection Act
ATV	all-terrain vehicle
AZARNG	Arizona Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIP	Community Involvement Plan
CMUA	Concentrated Munitions Use Area
CSM	conceptual site model
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DMM	discarded military munitions
DoD	Department of Defense
DoDM	Department of Defense Manual
EM	Engineering Manual
ES&T	EA Engineering, Science, and Technology, Inc.
FS	Feasibility Study
GAP	Gap Analysis Program
HAZWOPER	Hazardous Waste Operations and Emergency Response
HRR	Historical Records Review
I&E	Installations and Environment
LTM	long-term monitoring
LUC	land use control
MC	munitions constituents

LIST OF ACRONYMS AND ABBREVIATIONS (CONT.)

MD	munitions debris
MDAS	material documented as safe
MEC	munitions and explosives of concern
MEC HA	Munitions and Explosives of Concern Hazard Assessment
mg/kg	milligrams/kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRA	Munitions Response Area
MRS	Munitions Response Site
NAAQS	National Ambient Air Quality Standards
NCP	National Oil and Hazardous Substances Contingency Plan
NDNODS	Non-Department of Defense, Non-Operational Defense Sites
NEPA	National Environmental Policy Act
NFA	no further action
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NMRD	non-munitions related debris
NRHP	National Register of Historic Places
O&M	operation and maintenance
PA	Preliminary Assessment
PA	Programmatic Agreement
PP	Proposed Plan
PTW	principal threat waste
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Officer
SI	Site Inspection
TBC	to-be-considered
TWG-HA	Technical Working Group – Hazard Assessment
U.S.	United States

LIST OF ACRONYMS AND ABBREVIATIONS (CONT.)

USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTV	utility terrain vehicle
UU/UE	unlimited use/unrestricted exposure
UXO	unexploded ordnance
VSP	Visual Sample Plan
WESTON	Weston Solutions, Inc.
WP	white phosphorus
WRCC	Western Regional Climate Center

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1.0 DECLARATION

1.1 SITE NAMES AND LOCATIONS

Site Name: Maroon Crater Artillery Range Concentrated Munitions Use Area (CMUA) Munitions Response Site (MRS)

Site Location: Coconino County, Arizona

AEDB-R¹: AZHQ-009-R-01

Site Name: Maroon Crater Artillery Range Buffer Area MRS

Site Location: Coconino County, Arizona

AEDB-R¹: AZHQ-009-R-02

Note:

¹Army Environmental Database - Restoration

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedies for the Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS located in Coconino County, Arizona. The former Maroon Crater Artillery Range MRS has been converted to a Munitions Response Area (MRA) and divided into the Maroon Crater CMUA MRS and the Maroon Crater Buffer Area MRS. The document has been developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). The selected remedies for each MRS were chosen based on the Administrative Record (AR) for these MRSs.

This ROD is issued by the Army National Guard (ARNG) as the lead federal agency. As the lead federal agency, ARNG has selected the remedy. The remedy was developed by ARNG in coordination with the Arizona Army National Guard (AZARNG) and the United States (U.S.) Army Corps of Engineers (USACE). ARNG is managing the investigation of the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS in accordance with CERCLA, as required by the Defense Environmental Restoration Program (DERP).

ARNG coordinates with the Arizona Department of Environmental Quality (ADEQ) regarding regulatory issues for the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS. Additionally, ARNG has coordinated with the primary landowner, the U.S. Forest Service (USFS). ADEQ and the USFS reviewed AR documentation for the MRSs and concurred with the selected remedies. ARNG anticipates that the ROD will be the final decision related to the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS.

The AR files, containing information supporting this decision, are located at the Papago Park, Research Library, Building M5330, 5636 E McDowell Road, Phoenix, Arizona, 85008. Additionally, an Information Repository is located at the Cline Library, Special Collections and Archives, Northern Arizona University, 1001 S. Knoles Drive, P.O. Box 6022, Flagstaff, AZ, 86011 and at the ADEQ Records Management Center, 1110 West Washington Street, Phoenix, AZ. The AR includes the following documents: Preliminary Assessment (PA) (EA Engineering, Science, and Technology, Inc. [ES&T], 2008 and ARNG, 2011), Historical Records Review (HRR) (Weston Solutions, Inc. [WESTON], 2011), Site Inspection (SI) (WESTON, 2012), Remedial Investigation (RI) (WESTON, 2017a), Feasibility Study (FS) (WESTON, 2017b), and Proposed Plan (PP) (WESTON, 2018).

1.3 ASSESSMENT OF SITE

The response action selected in this ROD will protect public health and welfare and the environment from actual or threatened releases of Department of Defense (DoD) military munitions from past munitions-related activities. Munitions may be determined to be munitions and explosives of concern (MEC) upon evaluation by DoD Explosive Ordnance Disposal or similarly qualified personnel.

1.4 DESCRIPTION OF SELECTED REMEDY

ARNG, in concurrence with ADEQ and the USFS, determined that the Maroon Crater Artillery Range Buffer Area MRS requires no further action (NFA).

ARNG in concurrence with ADEQ and the USFS, determined that the Maroon Crater Artillery Range CMUA MRS will receive further remedial action: Land Use Controls (LUCs) (internal USFS monitoring, such as updating internal maps to prevent fire fighters from working on fires within the CMUA MRS) and Surface and Subsurface (to 24-Inches below Ground Surface [bgs]) Removal of DoD Military Munitions using Advanced Geophysical Classification (AGC) Methods. Surface and subsurface removal of (DoD) military munitions (approximately 12 months of remedial operations) will be implemented across the entire MRS, where accessible. The total area of the MRS is 565 acres. An estimated 71 acres of the MRS is inaccessible due to steep terrain; therefore, LUCs will be implemented for the inaccessible portions of the MRS. The anticipated cost for this remedy is \$4,727,000 (2017-30 year present net worth calculated) (WESTON, 2017b, Alternative 4B).

The removal of potential DoD military munitions (i.e., unexploded ordnance [UXO] and discarded military munitions [DMM]) will reduce the potential explosive hazards at the MRS. All DoD military munitions, including material potentially presenting an explosive hazard (MPPEH), encountered during the remedial action will be intentionally detonated, re-inspected along with munitions debris (MD), and reclassified as inert material documented as safe (MDAS) to be sent to a licensed facility for demilitarization. Please note that in prior documents related to the Maroon Crater Artillery Range MRA, DoD military munitions were previously referred to as munitions and explosives of concern or MEC.

These decisions are based on the results of the Army's inventory of Non-DoD Non-Operational Defense Sites (NDNODS) sites which met the requirements of a CERCLA PA (ES&T, 2008 and ARNG, 2011), a HRR (WESTON, 2011), a SI (WESTON, 2012), and a RI (WESTON, 2017a). The final selected remedies were evaluated for effectiveness, implementability, and cost in a FS (WESTON, 2017b) and proposed to the public in a PP (WESTON, 2018).

The original 12,817-acre Maroon Crater Artillery Range MRS was not identified during the 2008 PA phase for Arizona (ES&T, 2008) but was identified during the research conducted in support of the HRR (WESTON, 2011) for the nearby NDNODS Fort Tuthill Artillery Range. In 2011, a PA was completed by ARNG (ARNG, 2011). As part of the HRR, information regarding artillery training at the MRS on display at the Fort Tuthill Military Museum was reviewed (WESTON, 2011). The historical information indicated that 60-millimeter (mm) and 81-mm mortars and 105-mm artillery were used at the MRS.

Prior to the SI fieldwork, a review of historical documents and data was conducted and it was recommended that the 12,817-acre MRS be revised to the current 12,177-acre MRS. The MRS acreage was reduced from 12,817 acres to 12,177 acres based on the removal of privately-owned property in the northeast portion of the MRS boundary where no evidence of historical use of DoD military munitions had been identified. The SI (WESTON, 2012) revealed evidence of 105-mm and 75-mm artillery MD and 60-mm and 4.2-inch mortar MD and recommended further action for DoD military munitions in a RI. Soil samples were collected and analyzed for metals and explosives. All munitions constituents (MC) concentrations were below Arizona SI screening levels; and the SI recommended NFA for MC.

The RI field work was completed in 2016 (WESTON, 2017a) using both analog and digital geophysical mapping transects to determine the nature and extent of DoD military munitions at the MRS. The RI revealed no DoD military munitions items and 224 MD items (Grenade, Smoke, M15, White Phosphorus [WP]; 81-mm mortar fin and tail booms; 60-mm bodies, fins, tail booms and fuze parts; 4.2-inch high explosive M3 mortar base; blasting cap; fuze adapter ring; and unidentifiable fragments). The majority of the MD was encountered in a target cluster area (CMUA) on the southern and western sides of the Maroon Crater cinder cone. MC samples were not collected. The RI recommended that the Maroon Crater Artillery Range MRS be converted to an MRA and divided into two (2) MRSs: the Maroon Crater Artillery Range CMUA MRS (1,863 acres) and the Maroon Crater Artillery Range Buffer Area MRS (10,314 acres). The RI recommended further action for DoD military munitions and NFA for MC for the Maroon Crater Artillery Range CMUA and NFA for both DoD military munitions and MC at the Maroon Crater Artillery Range Buffer Area MRS.

Alternatives for the Maroon Crater Artillery Range CMUA MRS were presented in an FS (WESTON, 2017b). During the FS, ARNG, USACE, and AZARNG recommended revising the MRS boundaries for the Maroon Crater Artillery Range CMUA MRS to include 565 acres and the Maroon Crater Artillery Range Buffer Area MRS to include 11,612 acres. The Maroon Crater Artillery Range CMUA MRS boundary was originally drawn to include all MD items encountered during the RI; however, the frag (Grenade, Smoke, M15 WP items) found at the edge of the MRS boundary were considered to be outliers and the boundaries were re-drawn to remove these items

with concurrence from ADEQ and the USFS. After the boundary changes, the following alternatives were evaluated in the FS: 1) No Action; 2) LUCs (internal USFS monitoring, such as updating internal maps to prevent fire fighters from working on fires within the CMUA MRS); 3) LUCs and Surface Removal of DoD Military Munitions; 4A) LUCs and Surface and Subsurface (24-inches bgs) Removal of DoD Military Munitions using Digital Geophysical Mapping (DGM); and 4B) LUCs and Surface and Subsurface (24-inches bgs) Removal of DoD Military Munitions using AGC. A subsurface removal depth of 24-inches bgs was selected for the alternatives because all munitions-related material recovered during the RI was encountered between zero (0)-inches and 24-inches bgs. The selected subsurface removal depth also considers the detection capabilities of the DGM and analog geophysical detection equipment. All items encountered near 24-inches bgs were fragments.

The preferred remedy (Alternatives 4B) for the Maroon Crater Artillery Range CMUA MRS, and the preferred remedy (NFA) for the Maroon Crater Artillery Range Buffer Area MRS were presented to the public in a PP and advertised in a local newspaper for a 35-day comment period from 17 December 2017 to 22 January 2018. No comments were received.

1.5 STATUTORY DETERMINATIONS

This ROD presents the selected remedies under CERCLA for the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS. The Maroon Crater Artillery Range Buffer Area MRS was recommended for NFA on the basis that no action is required for protection of human health and welfare and the environment. The remedy for the Maroon Crater CMUA MRS is 1) protective of human health and welfare and the environment, 2) complies with promulgated requirements that are applicable or relevant and appropriate to the remedial action, and 3) is cost effective. The selected remedy represents the maximum extent to which 4) permanent solutions can be used in a practicable manner at the Maroon Crater Artillery Range CMUA MRS and 5) satisfies the preference for treatment as a principal element of the remedy (reduces explosives hazards). The remedy provides the best balance of trade-offs in terms of balancing criteria, while also considering the bias against off-site treatment and disposal and considering state and community acceptance.

The anticipated land use for both the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS is expected to remain the same as today: grazing and recreational use.

Munitions response activities for the Maroon Crater Artillery Range Buffer Area MRS are now considered to have reached the Response Complete stage, in accordance with to the DoD Manual (DoDM) 4715.20, Enclosure 3, Section 4b(15), page 40 (DoD, 2012). No other remedial action is necessary to ensure the protection of human health and welfare and the environment.

Munitions response activities for the Maroon Crater Artillery Range CMUA MRS will not result in unlimited use/unrestricted exposure (UU/UE) at the MRS. Therefore, Five-Year Reviews, as required under CERCLA Section (§) 121(c) and the NCP, Code of Federal Regulations ([CFR] §300.430(f)(4)(ii)) will be needed upon completion of the final remedy. There are no imposed

statutory deadlines associated with a Federal Facilities Agreement or a Resource Conservation and Recovery Act (RCRA) permit.

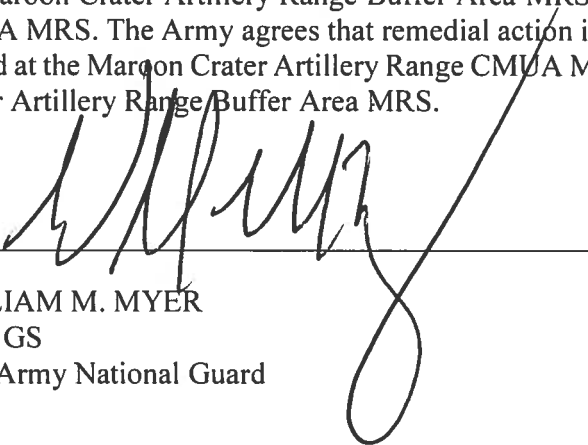
1.6 DATA CERTIFICATION CHECKLIST

In accordance with the U.S. Environmental Protection Agency's (USEPA's) *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedial Selection Decision Document* (USEPA, 1999), the following information is included in the ROD's Decision Summary (Section 2):

- Current and reasonably anticipated future land use assumptions (Section 2.8);
- Key factors that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the threshold, balancing, and modifying criteria) (Section 2.13);
- Estimated capital, annual Operations and Maintenance (O&M), periodic, and total present value costs for all alternatives considered (Section 2.13.1);
- Potential land uses that will be available as a result of the selected remedy (Section 2.13.2); and
- Source materials that may constitute principal threat wastes will be addressed (Section 2.14).

1.7 AUTHORIZING SIGNATURES

The signature sheet documents ARNG approval with the remedies described in this ROD for both the Maroon Crater Artillery Range Buffer Area MRS and for the Maroon Crater Artillery Range CMUA MRS. The Army agrees that remedial action is required to address the potential explosive hazard at the Maroon Crater Artillery Range CMUA MRS and that NFA is required for the Maroon Crater Artillery Range Buffer Area MRS.


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I&E, Army National Guard

16 Sept 2018

Date

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2.0 DECISION SUMMARY

This decision summary provides a description of the characteristics of the Maroon Crater Artillery Range MRA, presents the selected remedial alternatives for the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS, summarizes the analysis of the alternative options, presents the legal and public involvement concerns, and summarizes risk evaluation results. The proposed final remedy was presented in the *Final Proposed Plan, Maroon Crater Artillery Range Munitions Response Site, Coconino County, Arizona, AZHQ-009-R-01* (WESTON, 2018).

2.1 SITE NAME, LOCATION, AND DESCRIPTION

Both the Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS make up the Maroon Crater Artillery Range MRA. The MRA is a 12,177-acre artillery range located north of Leupp Road approximately seven (7) miles northeast of Flagstaff in Coconino County, Arizona. The eastern and western portions of the MRS are located in the U.S. Geological Survey Merriam Crater Quadrangle and the Sunset Crater East Quadrangle, respectively. The MRA includes area located in Sections 1, 2, 11, 12, 13, and 14 of Township 22 North, Range 9 east and in Sections 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, and 21 of Township 22 North, Range 10 East of the Gila and Salt River Principal Meridians as shown in **Figure 2-1**. The MRA is located on land owned by the USFS/Coconino National Forest (**Figure 2-2**). **Figure 2-3** presents the location of the two (2) MRSs within the Maroon Crater Artillery Range MRA. A Special Use Permit from the USFS was acquired by the Arizona National Guard in 1948 (WESTON, 2012). The permit describes an area for artillery training with a designated firing point and impact site on Maroon Crater.

As part of the DoD Military Munitions Response Program (MMRP), ARNG is statutorily responsible to provide DoD military munitions response services at the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS. As required in Section 117(a) of CERCLA, ARNG is publishing this ROD to document public comment on the selection of NFA for the Maroon Crater Artillery Range Buffer Area MRS and further action for DoD military munitions for the Maroon Crater Artillery Range CMUA MRS.

As the lead agency for remedial activities, ARNG has conducted environmental investigations at the Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS, in accordance with CERCLA under DERP, which was established by Section 211 of SARA of 1986. As the regulatory review agency, ADEQ provides primary oversight of the environmental restoration actions.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The original Maroon Crater Artillery Range MRS (AZHQ-009-R-01) was used for artillery practice in the late 1940s and early 1950s. Artillery training was purportedly conducted previously at Fort Tuthill by Battery E 158th Field Artillery Regiment based out of Mesa, Arizona during the 1930s, as recorded in documents pertinent to that range (WESTON, 2011). However, personnel at

the Fort Tuthill Military Museum indicated that no live-fire artillery training was conducted at that location. Construction of Pulliam Airport after World War II resulted in a restriction of training activities at Fort Tuthill. These restrictions may have led to the AZARNG requesting a Special Use Permit from the USFS for an area named “Maroon Crater” to use for live-fire artillery practice. Maroon Crater is an extinct volcanic cinder cone in the eastern portion of the San Francisco Volcanic Field. Although other volcanic features and cinder cones exist in the area, Maroon Crater refers specifically to the physical topographical feature shown on **Figure 2-1**. Descriptions of the previous investigations conducted at the MRA are provided in **Section 2.6**.

No regulatory enforcement actions have been reported for the Maroon Crater Artillery Range MRA. The MRA is not listed on the National Priorities List as maintained by the USEPA. However, the Army has been managing the Environmental Restoration Program at the installation in accordance with CERCLA and Executive Order 12580, as required by DERP. By issuing this ROD, the Army is fulfilling requirements of CERCLA §120(e) and NCP §§300.430(f)(2), 300.430(f)(4) and 300.435(c)(2) as outlined in USEPA’s *Guide to Preparing Superfund Proposed Plans, Records of Decisions, and Other Remedy Selection Decision Documents* (USEPA, 1999).

2.3 COMMUNITY PARTICIPATION

NCP Section 300.430(f)(3) establishes a number of public participation activities that the lead agency must conduct following preparation of the PP and review by the support agency. ARNG, USACE, AZARNG, ADEQ, and USFS have kept the community and other interested parties apprised of the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS activities through press releases. A Community Involvement Plan (CIP) (WESTON, 2015) was initiated by ARNG and USACE in 2015. The CIP and MMRP documents relevant to the investigations performed at the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS are included in the Information Repository maintained at the Cline Library, Special Collections and Archives, Northern Arizona University located at 1001 South Knoles Drive, Flagstaff, Arizona, 86011. The AR was established to make documents and information, such as technical reports, data, and regulatory correspondence, pertaining to the Maroon Crater Artillery Range MRSs accessible to the public. The AR File Index for the documents used in selecting a remedy for the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS is provided as **Appendix A**.

ARNG published a public notice to announce the availability of the PP for the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS in the *Arizona Daily Sun* on 17 December 2017. In the PP, no further remedial action under CERCLA was recommended for the Maroon Crater Artillery Range Buffer Area MRS and further remedial action under CERCLA was recommended for the Maroon Crater Artillery Range CMUA MRS. From 17 December 2017 to 22 January 2018, ARNG held a 35-day public comment period to accept comments on the PP and on information contained in the AR. Documentation of the public notice is included as **Appendix B**. In the public notice, ARNG announced a public meeting would be held if contacted by the public by 22 January 2017. No request for a meeting was received from the public, and no comments were received during the public comment period. A summary of the community participation process is provided in the Responsiveness Summary (**Section 3.0**).

2.4 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The NFA decision for the Maroon Crater Artillery Range Buffer Area MRS presented in this ROD is intended to protect human health and welfare and the environment. No additional response actions are deemed necessary at this time for the Maroon Crater Artillery Range Buffer Area MRS based on the lack of DoD military munitions findings during site investigations.

Based on results of investigations, the Maroon Crater Artillery Range CMUA MRS is recommended to continue the CERCLA process through remedial action. Potential DoD military munitions hazard areas have been identified at the MRS and present a potential explosive hazard. The scope and role of the selected remedy includes LUCs and surface and subsurface removal of DoD military munitions to attain protection of human health and welfare and the environment.

2.5 SITE CHARACTERISTICS

The following subsections present the site characteristics of the Maroon Crater Artillery Range MRA.

2.5.1 Demographics

According to the U.S. Census Bureau's 2010 Census, the population of Coconino County in 2010 was 134,421 with a density of 7.2 persons per square mile. The population estimate of Coconino County for 2016 is 140,908. Of the 46,711 households in Coconino County, the average household size is 2.69 persons, and the median household income is \$50,234. Approximately 61.7 percent (%) of the population is reported to be white, approximately 27.3% is reported to be American Indian and Alaska Native, approximately 1.2% of the population is reported to be African American, and approximately 1.4% is reported to be Asian (U.S. Census Bureau, 2010). Flagstaff, Arizona has a population of 65,870 (U.S. Census Bureau, 2010).

2.5.2 Topography

The topography of the Maroon Crater Artillery Range MRA is gently rolling with flat to steep hills and cinder cones and rough exposed basalt surfaces. The elevation ranges from 5,566-feet to 6,954-feet above mean sea level.

2.5.3 Climate

The Maroon Crater Artillery Range MRA is located in Coconino County in north-central Arizona. Based on information from the Western Regional Climate Center (WRCC) station for Sunset Crater NM, Arizona (station #028329) (WRCC, 2017) from 01 December 1969 to 10 June 2016, the region is subject to discernible temperature contrasts between summer and winter:

- Mean annual average temperature in the region is 45.8 degrees Fahrenheit (°F).
- Mean maximum annual temperature is 63.3 °F.
- Mean minimum annual temperature is 28.4°F.
- Mean summer temperature is 63.7 °F.

- Mean winter temperature is 29.2 °F.
- Average annual precipitation is 16.79-inches.
- The highest precipitation occurs in August, with an average of 2.99-inches.

2.5.4 Geology

The Maroon Crater Artillery Range MRA is located in the San Francisco Volcanic Field, which extends across 1,930 square miles around Flagstaff, Arizona. The volcanic field contains approximately 600 individual volcanic vents, the majority of which are single vents and have associated cinder cones. Several notable large volcanoes are composite type, including Kendrick Peak, Sitgreaves Mountain, and the San Francisco Peaks. The majority of rock types in the volcanic field are basaltic in composition, with notable concentrations of andesite, rhyolite, and dacite. The predominant types of volcanic material at the MRA are Quaternary basalts, cinders, and pyroclastic sheet deposits, with minor amounts of Quaternary alluvium (Moore and Wolfe, 1987). A total of four (4) distinct volcanic vents with associated cinder cones are present within the MRS, including Maroon Crater which was used as the target for artillery training. The basaltic volcanic material has a high ferrous content and is magnetically responsive.

2.5.5 Hydrology and Hydrogeology

No perennial surface water drainages are present on the Maroon Crater Artillery Range MRA and the majority of precipitation is absorbed by the ground or evaporates. Ephemeral runoff may occur during periods of intense, short-term precipitation.

Direct measurements of groundwater depths at the Maroon Crater Artillery Range MRA are limited to existing water supply wells installed in the 1970s or earlier. A single well is present near the private residences located northeast of Maroon Crater and the MRA. Records obtained from the Arizona Department of Water Resources (ADWR) indicate that the well was drilled to a depth of 2,400-feet bgs and cased to a depth of 1,138-feet bgs. A depth to groundwater was not cited in the well completion records, although the electronic database maintained by ADWR indicates a depth to groundwater dating from 1966 of between 1,100 to 1,200-feet bgs. A separate well located approximately one-half mile east of the MRS has depths to groundwater of 1,023-feet bgs recorded in 1973 and 1,112-feet bgs dating from 1975 (ADWR, 2014).

A series of cathodic protection wells were installed from 1992 to 2013 by corporations related to several pipelines that traverse the MRA. Two (2) wells are within the MRA, and a third lies one-half mile west of the northwestern corner of the MRA. The cathodic protection wells were completed at depths ranging from 500 to 950-feet bgs, none of which encountered groundwater based upon well completion records available from ADWR. An additional well is registered in the ADWR database within the MRS, but no associated construction information is included, implying that the well was not drilled or was abandoned. The location of this well is at the western edge of the MRA. The combined drilling records from the wells indicate that the shallowest water-bearing interval is in the C Aquifer, likely in the Supai Group. The depth of the 2,400-feet well cited above possibly intersects the Redwall Aquifer, but since no information regarding depth to groundwater is listed, the actual water-bearing interval is unknown.

2.5.6 Vegetation

Vegetation at the Maroon Crater Artillery Range MRA consists of Piñon-Juniper Woodland (Hendricks, 1985; Center for Sonoran Desert Studies, 2014) consisting mainly of a low-growing, sparse shrub layer averaging from 30% to 60% of ground cover, with pine growth more prevalent on the western side of the MRA.

Additional information regarding the vegetation and habitats of potential ecological receptors was obtained to ensure field activities were protective of the environment, and for risk assessment evaluations. The National Land Cover Database (NLCD) provides information regarding the characteristics of the land surface, with general descriptors for the types of cover (NLCD, 2014). The types of land cover for the Maroon Crater Artillery Range MRA obtained from the NLCD consist primarily of Evergreen Forest, Shrub/Scrub, and Barren Land where rock is exposed. Information regarding specific types of vegetation obtained from the Gap Analysis Program (GAP) indicates the majority of the MRS is characterized by Colorado Plateau Piñon-Juniper Woodland and Inter-Mountain Basins Juniper Savanna. Southern Rocky Mountain Ponderosa Pine Woodland exists in the western portions of the MRA and in isolated areas near Cochrane Hill in the south-central MRA (U.S. Geological Survey [USGS], 2011). The remainder of the MRA is classified as Inter-Mountain Basins Semi-Desert Grassland and Inter-Mountain Basins Semi-Desert Shrub Steppe. Exposed bedrock is classified as Inter-Mountain Basins Volcanic Rock and Cinder Land. The GAP units are described in **Table 2-1**.

2.5.7 Wildlife

The Maroon Crater Artillery Range MRA is located on land designated as forest, grasslands, and barren land. Local wildlife includes numerous mammals, birds, and reptiles (WESTON, 2012). Based on the U.S. Fish and Wildlife Services (USFWS) website, five (5) threatened or endangered species are potentially present on the Maroon Crater Artillery Range MRS. These include the endangered California condor (*Gymnogyps californianus*), the threatened Yellow-billed Cuckoo (*Coccyzus americanus*), the threatened Mexican spotted owl (*Strix occidentalis lucida*), the threatened Narrow-headed gartersnake (*Thamnophis rufipunctatus*), and the threatened Northern Mexican gartersnake (*Thamnophis eques megalops*) (USFWS, 2017). However, the Narrow-headed gartersnake and Northern Mexican gartersnake are unlikely to be found on the MRS as they require aquatic habitats and no surface water features are present on the MRS (NatureServe, 2017). While the Mexican spotted owl is located near the MRS, maps produced by the USFS do not place any critical habitat within the MRS (Noble, et al., 2015). Additionally, the Yellow-billed Cuckoo is not known to have potential habitat in the MRS (Noble, et al., 2015). The California condor may be present on the MRS as part of a nonessential experimental population (Noble, et al., 2015).

All species listed by the USFWS as being at risk in Coconino County are listed in **Table 2-2** (USFWS, 2017).

**Table 2-1
Vegetation Type Descriptions**

Class	Description
Forest and Woodland	Colorado Plateau Pinyon-Juniper Woodland – These woodlands occur on dry mountains and foothills of the Colorado Plateau Region from the Western Slope Colorado to the Wasatch Range, south to the Mogollon Rim. Pinyon-juniper woodlands are the predominant low elevation woodlands of this region, on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe weather events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal zones. Two-needle pinyon and Utah juniper are the most common trees. Shrubs and grasses may be scattered or absent, some of the most common include manzanita, sagebrush, mountain-mahogany, blackbrush, cliffrose, bitterbrush, Gambel oak, blue grama, James' galleta, bluebunch wheatgrass, curly bluegrass, or muttongrass.
Forest and Woodland	Southern Rocky Mountain Ponderosa Pine Woodland – This very widespread ecological system is most common throughout the cordillera of the Rocky Mountains, from the Greater Yellowstone region south. These woodlands occur where montane forests give way to valley grasslands or shrublands, typically in warm, dry, exposed sites. These woodlands are found on all slopes and aspects but can be common on steep slopes or ridgetops. Ponderosa pine is the common tree; Douglas-fir, two-needle pinyon, lodgepole pine, quaking aspen, and juniper may be present. Under the trees is usually shrubby, with sagebrush, manzanita, bearberry, mountain-mahogany, cliffrose, bitterbrush, Gambel oak, snowberry, choke cherry, Saskatoon serviceberry (less so in Montana), and wild rose. Diverse mixes of grasses and herbs are also found. The patterns of fire are variable, with sometimes high-intensity, infrequent fires, or in some cases more frequent, low intensity fires. The rocky sites usually do not allow fires to spread very far, except under unusually dry, hot conditions.
Barren	Inter-Mountain Basins Volcanic Rock and Cinder Land – These are recent, usually barren, lava flows found throughout the arid areas of the west. The volcanic flows sometimes have inclusions of uncovered natural vegetation (kapukas), and often include basalt dikes ridges. Most sites have clear lines marking the edge of the lava flows, although in a few areas, older lava flows are slowly being colonized by shrub species. Rock and cinder land are usually un-vegetated, but at lower elevations scattered trees or shrubs from the adjacent vegetation types can be found, especially in cracks and crevices.
Steppe/Savanna	Inter-Mountain Basins Juniper Savanna – In the intermountain west, these are dry savannas and open woodlands dominated by Utah juniper, found on plateaus, basins, foothills and lower mountain slopes. A savanna is a very open woodland that usually is accompanied by abundant perennial bunchgrasses (growing in clumps) and wildflowers. These very open woodlands grade into true pinyon - juniper forests and woodlands, and to the south Utah juniper can be replaced by desert or one-seeded juniper, or hybrids with Utah juniper.
Steppe/Savanna	Inter-Mountain Basins Semi-Desert Shrub Steppe – These are dry, open grasslands with a mix of low to medium tall shrubs, found throughout the intermountain west. It occurs on flats and gentle lower slopes, on well drained, usually deep soils. This semi-arid shrub-steppe is typically dominated by grasses, with open to moderately dense cover of shrubs, usually a mix of species but sometimes a single species. Sagebrush can be present, but not dominant, with rabbitbrush, horsebrush, winterfat or mormon tea as the most common shrubs. Characteristic grasses include Indian ricegrass, blue grama, saltgrass, curly bluegrass, muttongrass, alkali sacaton, needle-and-thread, James' galleta, and Salinas lyme grass. Annual grasses, especially the exotics Japanese brome and cheatgrass, may be present to abundant in poor condition stands.
Herbaceous	Inter-Mountain Basins Semi-Desert Grassland – These are dry grasslands found on a variety of landforms, including swales, playas, mesas, alluvial flats, and plains. The soils are often sandy or loamy. This systems is almost always dominated by drought-resistant perennial bunchgrasses (growing in clumps), especially Indian ricegrass, threeawn, blue grama, needle-and-thread, muhly, or James' galleta. Scattered shrubs and dwarf-shrubs often are present, especially basin big sagebrush, Wyoming big sagebrush, saltbush, blackbrush, jointfir, broom snakeweed, and winter-fat. These grasslands typically integrate into salt-desert shrubs or sagebrush, and support grasslands due to unusual soils (sand, gravel or alluvium), and low rainfall.

Note: Data in table is from the USGS (2011).

Table 2-2
Sensitive Wildlife Species Identified in Coconino County, Arizona

Species (Common Name)	Scientific Name	State Status
Birds		
California Condor	<i>Gymnogyps californianus</i>	Endangered
Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Recovery
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Threatened
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened
Reptiles/Amphibians		
Chiricahua Leopard Frog	<i>Rana chiricahuensis</i>	Threatened
Northern Mexican Gartersnake	<i>Thamnophis eques megalops</i>	Threatened
Narrow-Headed Gartersnake	<i>Thamnophis rufipunctatus</i>	Threatened
Mammals		
Black-Footed Ferret	<i>Mustela nigripes</i>	Endangered
Mexican Wolf	<i>Canis lupus baileyi</i>	Endangered
Fish		
Apache Trout	<i>Oncorhynchus apache</i>	Threatened
Gila trout	<i>Oncorhynchus gilae</i>	Threatened
Virgin River Chub	<i>Gila seminude (=robusta)</i>	Endangered
Gila Chub	<i>Gila intermedia</i>	Endangered
Roundtail Chub	<i>Gila robusta</i>	Proposed Threatened
Loach Minnow	<i>Tiaroga cobitis</i>	Endangered
Little Colorado Spinedace	<i>Lepidomeda vittata</i>	Threatened
Razorback Sucker	<i>Xyrauchen Texanus</i>	Endangered
Spikedace	<i>Meda fulgida</i>	Endangered
Flowering Plants		
Fickeisen Plains Cactus	<i>Pediocactus peeblesianus fickeiseniae</i>	Endangered
Sentry Milk-Vetch	<i>Astragalus cremnophylax var. cremnophylax</i>	Endangered
Navajo Sedge	<i>Carex specuicola</i>	Threatened
Brady Pincushion Cactus	<i>Pediocactus bradyi</i>	Endangered
Siler Pinchusion Cactus	<i>Pediocactus (=Echinocactus, =Utahia) sileri</i>	Threatened
San Francisco Peaks Ragwort	<i>Packera franciscana</i>	Threatened
Welsh's Milkweed	<i>Asclepias welshii</i>	Threatened
Snails		
Kanab Ambersnail	<i>Oxyloma haydeni kanabensis</i>	Endangered

Note: Data in table is from the USFWS (2017).

2.6 PREVIOUS INVESTIGATIONS

Table 2-3 lists the total acreage for the Maroon Crater Artillery Range MRA and MRSs through different phases of the CERCLA process. Previous investigation activities conducted at the Maroon Crater Artillery Range MRA are summarized in **Table 2-4** and discussed in the following subsections.

**Table 2-3
Acreage Summary**

Study Investigation	MRS	Acreage
PA	Maroon Crater Artillery Range MRS	12,817 acres
HRR	Maroon Crater Artillery Range MRS	12,817 acres
SI	Maroon Crater Artillery Range MRS	12,177 acres
RI	<u>Maroon Crater Artillery Range MRA</u>	<u>12,177 acres</u>
	Maroon Crater Artillery Range CMUA MRS	1,863 acres
	Maroon Crater Artillery Range Buffer Area MRS	10,314 acres
FS	<u>Maroon Crater Artillery Range MRA</u>	<u>12,177 acres</u>
	Maroon Crater Artillery Range CMUA MRS	565 acres
	Maroon Crater Artillery Range Buffer Area MRS	11,612 acres
PP	<u>Maroon Crater Artillery Range MRA</u>	<u>12,177 acres</u>
	Maroon Crater Artillery Range CMUA MRS	565 acres
	Maroon Crater Artillery Range Buffer Area MRS	11,612 acres
ROD (this document)	<u>Maroon Crater Artillery Range MRA</u>	<u>12,177 acres</u>
	Maroon Crater Artillery Range CMUA MRS	565 acres
	Maroon Crater Artillery Range Buffer Area MRS	11,612 acres

**Table 2-4
Study/Investigation Summary**

Study/Investigation	Date	Study/Investigation Summary
PA	2008/2011	The PA included review of records to inventory NDNODS sites in Arizona (ES&T, 2008). The Maroon Crater Artillery Range MRS was not identified until the HRR/SI Work Plan phase. Once it was identified, ARNG completed a PA for the site and recommended it be investigated in an SI (ARNG, 2011).
SI Work Plan / HRR	2011	The SI Work Plan/HRR includes review of historical records to further document historical and other known information for the Maroon Crater Artillery Range MRS and to supplement the information developed during the PA (WESTON, 2011). Information regarding artillery training at the MRS on display at the Fort Tuthill Military Museum was reviewed as part of the HRR. Multiple historical photographs at the Museum depict firing of 105-mm howitzers, impacts on Maroon Crater, and use of 60-mm and 80-mm mortars.
SI	2012	The purpose of the SI was to determine the presence or absence of DoD military munitions at the MRS through the use of instrument-aided visual surveys and soil sampling. The SI identified MD at the Maroon Crater Artillery Range MRS consisting of 105-mm and 75-mm artillery, 60-mm mortar, 105-mm smoke or leaflet round, and 4.2-inch WP mortar fragments. No DoD military munitions were identified. Twenty-one soil samples were collected but MC were not detected at concentrations above screening levels (WESTON, 2012). The SI recommended NFA for MC but further action for DoD military munitions during the RI phase of the CERCLA process.
RI	2017	During the RI, 747 anomalies were investigated. No DoD military munitions items were encountered; however, 224 MD items were recovered. The RI Report recommended the MRS to be converted into an MRA and divided into two (2) MRSs: Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS. The RI Report recommended NFA for DoD military munitions and MC at the Maroon Crater Artillery Range Buffer Area MRS and further action for DoD military munitions and NFA for MC at the Maroon Crater Artillery Range CMUA MRS (WESTON, 2017a).
FS	2017	The Army conducted an FS for the Maroon Crater Artillery Range CMUA MRS to determine a remedial alternative for DoD military munitions. Four (4) alternatives were evaluated: 1) No Action; 2) LUCs; 3) LUCs and Surface Removal of DoD Military Munitions; and 4A) and 4B) LUCs and Surface and Subsurface Removal of DoD Military Munitions (to 24-Inches bgs) using DGM/AGC Methods. The alternatives were evaluated against the NCP criteria and compared to one another and the recommended alternative was Alternatives 4A/4B: LUCs and Surface and Subsurface Removal of DoD Military Munitions (WESTON, 2017b).
PP	2017	The PP presented the preferred remedial alternatives to the public during a 35-day comment period from 17 December 2017 to 22 January 2018. The preferred remedial alternative is Alternative 4A/4B: LUCs and Surface and Subsurface Removal of DoD Military Munitions (24-Inches bgs) using DGM/AGC Methods. An announcement was placed in a local publication, the <i>Arizona Daily Sun</i> , and a copy of the PP was added to the AR at the Cline Library, Special Collections and Archives, Northern Arizona University, Flagstaff, Arizona. No comments or requests for public meetings were received during the public comment period (WESTON, 2018)

2.6.1 Preliminary Assessment

A Final State/Territory Inventory Report (referred to as a PA) was completed for sites in Arizona by ES&T in 2008 (ES&T, 2008) to determine whether sites in Arizona were eligible for inclusion in the MMRP; however, Maroon Crater was not identified during the inventory. The Maroon Crater Artillery Range MRS was identified during the research conducted in support of the HRR and SI for the NDNODS Fort Tuthill Artillery Range (WESTON, 2011 and 2012). In June 2011, a PA was completed by the ARNG based upon information provided by WESTON resulting from HRR research (ARNG, 2011), and the 12,817-acre MRS was designated with the AEDB-R Number AZHQ-009-R-01. No prior investigations relating to the operations of artillery training, or for DoD military munitions hazards, were performed prior to the PA.

2.6.2 Historical Records Review

Information regarding artillery training at the MRS on display at the Fort Tuthill Military Museum was reviewed as part of the HRR (WESTON, 2011). Multiple historical photographs at the museum depict firing of 105-mm howitzers, impacts on Maroon Crater, and use of 60-mm and 81-mm mortars. The direction of fire based upon historical information was from west to east, toward an impact area on the west face of Maroon Crater.

Historical information obtained from AZARNG Pamphlet 870-5 (Arizona National Guard, 2002) indicates that after World War II, the 480th Field Artillery Battalion, consisting of 105-mm towed howitzers, was allocated to the 158th Regimental Combat Team in Mesa, Arizona. The unit was constituted in August 1946 and federally recognized in July 1947. The unit was subsequently designated to operate heavy mortars, but the dates for this aspect of operations are unknown. The activation of the 158th Field Artillery Battalion in Arizona coincides with the request for a Special Use Permit discussed below and training of 105-mm howitzers at the Maroon Crater Artillery Range MRS in 1948. Special Use Permits and Memoranda also indicate the use of 60-mm and 81-mm mortars and machine guns for training at the Maroon Crater Artillery Range MRS. Historical information indicates that artillery training took place during two (2)-week training periods during late August, from 1948 to the early-mid 1950s. Based upon distribution of MD observed during the SI in 2011 and 2012, the direction of fire was from the west or southwest portion of the Maroon Crater Artillery Range MRS toward Maroon Crater, and was consistent with information supplied in permit documents (WESTON, 2012).

2.6.3 Site Inspection

The next phase of the CERCLA process at Maroon Crater Artillery Range MRS was the SI. Prior to the SI fieldwork, a review of historical documents and data was conducted. It was recommended that the 12,817-acre MRS be revised to the current 12,177-acre MRS. The boundary was changed to exclude private property that was not used during training at the MRS (WESTON, 2012).

SI fieldwork was conducted at the MRS from 08 December through 12 December 2011, and from 13 April through 21 April 2012. With the aid of handheld metal detectors, approximately 177.97 line miles of visual survey transects were completed using a meandering-path approach within the boundary of the MRS. The transects included portions of the MRS that were indicated as proximal

to the impact point of Maroon Crater and surrounding areas including the historical designated firing point at the western edge of the MRS (**Figure 2-4**).

Evidence of 105-mm and 75-mm artillery MD was observed on the western and southern faces of Maroon Crater and at the base of the southwestern face of the cinder cone. Evidence of 60-mm (M49A2) mortar MD was encountered at the base of the southern face of Maroon Crater (**Figure 2-4**). Surface features observed on the slope of Maroon Crater were consistent with detonations of artillery. An expended 105-mm round identified as a smoke or leaflet round by the markings imprinted on the shell, was discovered approximately 350-feet west of Maroon Crater. Although the shell did not contain a bursting charge, the relatively intact condition of the round posed concerns regarding the perception of the round as functional if it was encountered by civilians. The field team notified the ARNG of the condition and location of the MD item, which was communicated to the USFS, the property owner. The USFS notified the Coconino County Sheriff's Department of the item, and a Deputy subsequently met the field team at the MRS and took possession of the item. The City of Flagstaff Explosives Disposal Team removed the MD item from the MRS for disposal after the Coconino County Sheriff's Deputy relinquished possession. The field team was released to continue surveys after the Coconino County Sheriff's Deputy took possession of the MD item. Additional MD items were identified as a 4.2-inch WP mortar and 105-mm artillery fragments. No evidence of DoD military munitions was observed during the SI field activity. Evidence of civilian use was documented by the presence of isolated, expended 12-gauge, 9-mm, .22 caliber, and 7.62-mm small arms casings/bullets (**Figure 2-4**). Additional civilian debris was observed that consisted of empty drums and partially buried remains of automotive body parts.

A total of 21 surface soil samples (17 discrete, three [3] quality control, and one [1] composite) were collected from the MRS and analyzed for selected MC metals and explosives (**Figure 2-4 and Table 2-5**). Eight (8) discrete sample locations were on the sides or base of Maroon Crater where munitions detonations or significant MD finds were located and the remaining samples were located at MD finds or distributed around the MRS at drainages. A single seven (7)-point spoke and- hub composite sample was collected at the location where the intact expended 105-mm round was located. Additionally, five (5) discrete ambient samples were collected from the perimeter of, or outside of, the MRS boundary (**Table 2-5**).

Analyses of the SI soil samples detected copper, lead, and zinc in each sample at concentrations below their respective Arizona SI screening levels. The SI screening levels were determined as the lowest value of the Residential and Non-Residential Arizona Soil Remediation Levels, and USEPA Residential or Industrial Regional Screening Levels for human health exposure. Reported concentrations ranged from 22 to 46 milligrams per kilogram (mg/kg) for copper, 0.38 to 0.95 mg/kg for antimony, 2.5 to 32 mg/kg for lead, and 29 to 63 mg/kg for zinc in investigative soil samples. The reported concentrations of copper, antimony, lead, and zinc in discrete background samples were within the ranges cited above for investigative samples. Estimated concentrations (J flag) of antimony were reported for five (5) samples (four [4] discrete and one [1] spoke-and-hub composite) at concentrations ranging from 0.38 to 0.95 mg/kg which are below the Arizona SI screening level. Antimony was not detected in the remaining soil samples. Explosive analytes were not detected in the soil samples with the exception of estimated detections (J flag) of

cyclotrimethylenetrinitramine (RDX) reported in two (2) ambient samples. RDX concentrations were below the Arizona SI screening level.

Table 2-5
SI Sampling Locations and Rationale

Sample Designation	Sample Location Degrees and Decimal Minutes		Sample Type	Rationale
	Latitude	Longitude		
AZHQ-009-SO-001	35 18.260'	-111 21.595	Discrete	Collected at location of 105mm primer (MD)
AZHQ-009-SO-001-D	35 18.260'	-111 21.595	Discrete	
AZHQ-009-SO-002	35 18.371'	-111 21.745	Discrete	Collected west of target area, possible concentration point for MC
AZHQ-009-SO-003	35 18.298'	-111 21.568	Discrete	Collected at location of 105mm base plate (MD)
AZHQ-009-SO-004	35 18.293'	-111 21.536	Discrete	Collected at location of potential impact crater
AZHQ-009-SO-005	35 18.293'	-111 21.505	Discrete	Collected at location of potential impact crater
AZHQ-009-SO-006	35 18.250'	-111 21.630	Discrete	Collected at location of potential impact crater
AZHQ-009-SO-007	35 18.316'	-111 21.734	Discrete	Collected at location of 75mm round (MD).
AZHQ-009-SO-008	35 18.597'	-111 21.802	Discrete	Collected sample in drainage area to west of Maroon Crater in top of lava flows
AZHQ-009-S-009	35 18.208	-111 21.798	7-Point Composite	Sampled at location of MD find, 105mm smoke or leaflet round
AZHQ-009-S-010	35 17.682	-111 23.420	Discrete	Collected in drainage area in western portion of MRS, possible concentration point for MC
AZHQ-009-S-011	35 18.813	-111 21.391	Discrete	Collected in drainage east of target area, possible concentration point for MC
AZHQ-009-S-012	35 18.983	-111 20.089	Discrete	Collected in drainage area in eastern portion of MRS, possible concentration point for MC.
AZHQ-009-S-012-D	35 18.983	-111 20.089	Discrete	
AZHQ-009-S-013	35 17.248	-111 21.370	Discrete	Collected in drainage area in southern portion of MRS, possible concentration point for MC
AZHQ-009-S-014	35 19.333	-111 19.809	Discrete	Collected in drainage area in eastern portion of MRS, possible concentration point for MC
AZHQ-009-S-015	35 17.638	-111 24.517	Discrete	Collected in drainage area in south western portion of MRS, possible concentration point for MC.
AZHQ-009-S-015-D	35 17.638	-111 24.517	Discrete	
AZHQ-009-S-016	35 16.987	-111 21.361	Discrete	Collected in drainage area in southern portion of MRS, possible concentration point for MC
AZHQ-009-S-017	35 18.912	-111 24.438	Discrete	Collected in drainage area in north western portion of MRS, possible concentration point for MC
AZHQ-009-S-018	35 18.981	-111 22.441	Discrete	Collected in drainage area in north central portion of MRS, possible concentration point for MC
AZHQ-009-S-A01	35 16.307	-111 22.684	Discrete	Southern Ambient Sample
AZHQ-009-S-A02	35 18.949	-111 19.477	Discrete	Eastern Ambient Sample
AZHQ-009-S-A03	35 20.281	-111 23.488	Discrete	Northern Ambient Sample
AZHQ-009-S-A04	35 17.941	-111 25.207	Discrete	Western Ambient Sample
AZHQ-009-S-A05	35 16.877	-111 24.240	Discrete	Southwestern Ambient Sample

Conceptual site models (CSMs) for DoD military munitions and MC were generated for the MRS based upon the data collected during the SI. While no potential for MC exposure was anticipated, a potential pathway existed for DoD military munitions due to the presence of MD observed during SI field inspections. For this reason, the Maroon Crater Artillery Range MRS was designated for further investigation with an RI for DoD military munitions. NFA was recommended for MC; however, characterization of MC was stipulated if DoD military munitions or MD was encountered during the RI.

2.6.4 Remedial Investigation

The RI field activities were conducted from 24 June to 26 August 2016. The goal of the RI was to determine the nature and extent of DoD military munitions and MC, and evaluate the hazards and risks to human health and welfare and the environment at the MRS. The characterization activities were also used to determine whether further action was required under the CERCLA process.

2.6.4.1 Department of Defense Military Munitions Investigation and Results

Characterization of DoD military munitions employed during the RI at the Maroon Crater Artillery Range MRS included surveying DGM and analog geophysical transects and 100% coverage grids to identify subsurface anomalies that were then subject to intrusive investigation.

For the RI investigation, the 12,177-acre Maroon Crater Artillery Range MRS consisted of two (2) areas based on past and current land use (**Figure 2-5**):

Area 1 – 2,015.5 acres within approximately a one (1)-mile radius centered on the Maroon Crater cinder cone. This area was centered on the target/impact point located based upon historical records and the SI evidence of 105-mm and 75-mm artillery fragment on the western and southern faces of Maroon Crater and 60-mm mortar fragment at the base of the cinder cone. Historical records and the SI results in Area 1 identified a high potential for munitions-related items. Portions of Area 1 with relatively flat or moderate topography were surveyed using DGM. Rugged terrain of basalt flows and cinder cones with steep slopes were surveyed using analog methods.

Area 2 – Approximately 10,161.5 acres that comprised the remainder of the MRS, excluding Area 1. The area has variable topography with a variety of vegetation and a low probability for presence of munitions items. Analog survey transects were used to characterize potential DoD military munitions in Area 2.

The final geophysical survey for data collected in the field is presented in **Figure 2-5** and consisted of visual and geophysical surveys across the MRS. A three (3)-phased approach was employed to characterize the nature and extent of DoD military munitions at the MRS, as described below:

1. DGM transects were used in Area 1 of the MRS to evaluate anomaly distribution patterns and detect and traverse potential anomaly cluster areas that may be associated with DoD military munitions impact features. Only portions of Area 1 with relatively flat or moderate topography were surveyed using DGM. DGM transects were spaced 400-feet apart based

on Visual Sample Plan (VSP) to identify a target with 95% probability at the density of 17 anomalies per acre above background. DGM transects were collected using a Geonics EM61-MK2A all metal detector supported by real-time kinematic global positioning system. The EM61-MK2A was used in a towed array configuration and as a single sensor configuration. The towed array was used on 13.12 miles (out of 20.8 miles), but due to the nature of loose cinders and rugged terrain, the single sensor cart was used to complete the remaining transects. Approximately 100-feet of the planned DGM transects could not be completed due to impassible terrain. Additionally, the planned transect around the top of Cochrane Hill could not be completed due to steep terrain (terrain > 30 degree slope) (**Figure 2-5**).

2. Analog instrument transect surveys were used to evaluate anomaly distribution patterns and to detect and traverse potential anomaly cluster areas that may be associated with DoD military munitions impact features in Area 1 and Area 2. Portions around Maroon Crater were too rugged or steep for application of DGM and required analog instrument surveys. Area 2 was not expected to contain significant numbers of munitions items based on historical investigations. Analog methods were more suitable to the size of Area 2, with associated terrain and vegetation limitations for use of DGM. Analog instrument transects were spaced at 200-feet in Area 1 and 1,356 feet in Area 2 based on VSP to identify a target with 95% probability at the density of 17 anomalies per acre above background.
3. DGM and analog grids were placed at locations where target clusters were identified during either the analog or DGM transect surveys. Full coverage DGM and analog grid surveys were conducted to characterize the target cluster areas at the 1.0 UXO per acre level with 95% confidence (UXO Estimator). Four (4) DGM grids (1.16 acres) and 12 analog grids (2.08 acres) were collected (**Figure 2-6**).
4. Step-out transects were considered if DoD military munitions items or MD items were found along the MRS boundary. Additional transect segments would be added, spaced consistently with the outlying transect as those in the main path and extending 30-feet behind and ahead of the MD item. No Step-out transects were required during the RI investigation as no DoD military munitions or MD items were encountered near the MRS boundary.

2.6.4.2 Nature and Extent of Department of Defense Military Munitions

The results of the RI confirmed the nature (type) of MD at the MRS. Of the 747 total items recovered during both the surface and subsurface DGM and analog geophysical transect and DGM and analog geophysical grid investigations, 224 items were MD, 90 items were small arms, 63 items were hot rocks (e.g. rocks with elevated iron), 102 items were no contact (meaning a target was identified yet validation did not yield a target), one (1) item was a duplicate target, and 267 items were non-munitions related debris (NMRD) (**Figure 2-7**). No DoD military munitions items were encountered during the RI. MD items were recovered from zero (0)-inches to 24- inches bgs in DGM transects and grids and zero (0)-inches to eight (8)-inches bgs for analog geophysical transects and grids. The Grenade, Smoke, M15, WP items were found on the ground surface.

Of the 224 MD items, 161 items were recovered as part of the analog geophysical investigation:

- 152 fragments;
- (5) fragments – Grenade, Smoke, M15, WP;
- (2) fragments – 81-mm mortar – fin, tail boom;
- (1) fragment – 60-mm mortar – tail boom; and
- (1) blasting cap.

Of the 224 MD items, a total of 63 items were recovered as part of the DGM investigation:

- (34) fragments;
- (15) fragments – 81-mm mortar - tail boom;
- (1) fragment – 60-mm mortar – fin;
- (10) fragments – 60-mm mortar – body, tail boom, fuze parts;
- (1) fragment – 4.2-in., high explosive, M3 mortar base; and
- (2) fragments – fuze – fragment, adapter ring.

The locations of the MD items are shown on **Figure 2-7**. A CMUA was determined using both DGM and analog MD distributions. The CMUA boundary is considered very conservative. The CMUA acreage is 353.3 acres (**Figure 2-8**). The characterization acreage was determined using UXO Estimator at 95% confidence at the 1.0 UXO per acre level.

2.6.4.3 Munitions Constituents Investigation and Results

The 2012 Final SI report for the Maroon Crater Artillery Range MRS (WESTON, 2012), recommended NFA for MC. However, a phased sampling approach was developed for the MRS during the RI as the potential for an MC release existed if additional DoD military munitions or a high density of MD was identified. Samples were to be collected if DoD military munitions were encountered on site; if DoD military munitions/MPPEH/MD was encountered on site to be damaged, corroded, or potentially leaking MC; or if accumulations of MD or areas where DoD military munitions/MD may concentrate were encountered. Sample collection associated with individual MD items was not proposed. For the RI, soil sampling was not required because no DoD military munitions items were encountered, and no leaking, damaged or corroded DoD military munitions/MPPEH/MD were found.

2.6.4.4 Remedial Investigation Summary

Based on the results of the RI field activities and VSP analysis, the following conclusions and recommendations were presented in the RI Report for the Maroon Crater Artillery Range MRS:

- A total of 183.16 acres were investigated at the Maroon Crater Artillery Range MRS during the RI.
- The Maroon Crater Artillery Range MRS should be divided into two (2) MRSs. The Maroon Crater Artillery Range CMUA MRS (1,863-acres) covers the portions of the MRA where all MD items were encountered. The Maroon Crater Artillery Range Buffer Area

MRS (10,314-acres) covers the portion of the MRA where no DoD military munitions/MD or small arms items were encountered during the SI or RI (**Figure 2-9**).

- No DoD military munitions items and 224 MD items (unidentifiable fragments and pieces of 81-mm mortars, 60-mm mortars, 4.2-inch mortars, and smoke grenades) were discovered on the Maroon Crater Artillery Range MRS during the SI and RI field activities. The MD items were located in a CMUA distributed throughout the southern and western face of Maroon Crater.
- Based on the MC sampling criteria set forth in the RI, no MC samples were collected during RI field activities. Conditions at the Maroon Crater Artillery Range Buffer Area MRS are considered safe for current and future uses; therefore, NFA was recommended for DoD military munitions and MC.
- Further action for DoD military munitions in a FS was recommended for the Maroon Crater Artillery Range CMUA MRS.

ARNG, AZARNG, USACE, ADEQ, and USFS concurred with the RI Report recommendations. At a meeting held on 25 April 2017 in Flagstaff, Arizona, AZARNG, ARNG, and USACE discussed changing the Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS boundaries. The CMUA MRS boundary was originally drawn to include all MD items encountered during the RI. However, the frag (Grenade, Smoke, M15, WP items) found at the edge of the Area 1 boundary (**Figure 2-7** and **Figure 2-9**) are considered to be outliers. During the RI investigation no additional items were found in the vicinity despite a thorough visual investigation. Therefore, based on AZARNG, ARNG, and USACE concurrence, the boundaries were re-drawn to include only the VSP-determined target area for the Maroon Crater Artillery Range CMUA MRS (**Figure 2-10**). ADEQ and USFS concurred with the boundary changes (Appendix L, WESTON, 2017b). The revised Maroon Crater Artillery Range CMUA MRS is comprised of 565 acres (**Figure 2-10**). The revised Maroon Crater Artillery Range Buffer Area MRS is comprised of 11,612 acres (**Figure 2-10**). No DoD military munitions items are expected to be encountered outside of the MRS based on the results of the RI investigation; however, should an item or items be encountered, it will be addressed by ARNG.

2.6.5 Feasibility Study

The purpose of the FS was to identify and evaluate remedial action alternatives for the Maroon Crater Artillery Range CMUA MRS (WESTON, 2017a). The FS included a detailed and comparative analysis based on criteria outlined in the NCP for the following four (4) alternatives:

- Alternative 1 – No Action;
- Alternative 2 – LUCs;
- Alternative 3 – LUCs and Surface Removal of DoD Military Munitions;
- Alternative 4A – LUCs and Surface and Subsurface (to 24-Inches bgs) Removal of DoD Military Munitions using DGM Methods; and
- Alternative 4B – LUCs and Surface and Subsurface (to 24-Inches bgs) Removal of DoD Military Munitions using AGC Methods.

Alternatives 4A and 4B were presented as the preferred alternatives.

2.6.6 Proposed Plan

The PP presented the findings of the FS and the preferred alternative for addressing DoD military munitions at the Maroon Crater Artillery Range CMUA MRS. The preferred alternatives are 4A and 4B: LUCs and Surface and Subsurface (to 24-Inches bgs) Removal of DoD Military Munitions using DGM/AGC Methods. NFA was presented in the PP as the preferred alternative at the Maroon Crater Artillery Range Buffer Area MRS.

2.7 CONCEPTUAL SITE MODEL

A CSM was developed for the Maroon Crater Artillery Range CMUA MRS to depict the potential relationship or exposure pathway between chemical or explosive sources and receptors. Receptors for the MRS include recreational users, site visitors, construction workers, ranch workers, and USFS employees. An exposure pathway describes the means by which a receptor can be exposed to the chemicals and explosive hazards in the environmental media. The DoD military munitions and MC pathways are summarized based upon current and potential future land uses. The CSM for the Maroon Crater Artillery Range CMUA MRS is shown on **Figure 2-11**. The DoD military munitions and MC sources and the relevant pathways to receptors are discussed below.

2.7.1 Department of Defense Military Munitions

A pathway for exposure to DoD military munitions is considered complete if human receptors can come into physical contact with DoD military munitions. The hazard from DoD military munitions arises from direct contact as a result of human activities and access.

Zero (0) DoD military munitions items and multiple MD items were identified during investigation activities at the Maroon Crater Artillery Range CMUA MRS. The MD items were encountered between zero (0)-inches and 24-inches bgs. DoD military munitions are considered to be potentially present in the Maroon Crater Artillery Range CMUA MRS, as depicted in **Figure 2-11**.

As described in **Section 2.1**, the MRA is located within land owned by the USFS approximately seven (7) miles northeast of the city of Flagstaff, in Coconino County, Arizona. Accessibility is unimpeded from all directions but access to portions of the MRS is limited due to steep terrain. Receptors have the potential to come into contact with DoD military munitions. Within the Maroon Crater Artillery Range CMUA MRS, the DoD military munitions pathway is considered potentially complete for the surface and subsurface based on the results of the RI (**Figure 2-7**). A pathway for contact with DoD military munitions is considered incomplete for the Maroon Crater Artillery Range Buffer Area MRS.

2.7.2 Munitions Constituents

A complete pathway for MC consists of four (4) elements: source of contaminants, transport mechanism of contamination, mechanism for exposure, and current and potential receptors. A

pathway for MC is incomplete if one (1) of the above elements is missing and there is no expected change to MRS conditions that would make all four (4) elements available. The risk assessment conducted during the RI concluded that there is no unacceptable risk at the Maroon Crater Artillery Range CMUA MRS or the Maroon Crater Artillery Range Buffer Area MRS from MC; therefore all pathways relating to MC are considered incomplete.

2.8 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Both the Maroon Crater Artillery Range Buffer Area MRS and the Maroon Crater Artillery Range CMUA MRS are located on USFS-managed land used for recreational purposes and livestock grazing (**Figure 2-2**). Future land use is not expected to change.

Recreational use may include all-terrain vehicles (ATVs), utility terrain vehicles (UTVs), dirt bikes, hiking, horse-back riding, camping, scenic driving, and bicycling. Recreational use is not anticipated to impact the site below 24-inches bgs and the remedy will address from zero (0) to 24-inches bgs.

2.9 SUMMARY OF SITE RISKS

2.9.1 Human Health and Ecological Risk Assessment

The purposes of a human health risk assessment and an ecological risk assessment are to document whether MRS conditions may pose a potential risk to current or future MRS human and ecological receptors and to identify which, if any, MRS conditions need to be addressed further in the CERCLA process. Soil samples were not collected during the RI and detected constituent concentrations in the soil samples collected during the SI were below Arizona screening levels. Therefore, site-specific human health and ecological risk assessments were not performed for the Maroon Crater Artillery Range MRS. MC in soil are not identified as being of potential human health or ecological concern.

2.9.2 Munitions and Explosives of Concern Hazard Assessment

The purpose of the Munitions and Explosives of Concern Hazard Assessment (MEC HA), as described in the *Interim Munitions and Explosives of Concern Hazard Assessment Methodology* (Technical Working Group – Hazard Assessment [TWG-HA], 2008), is to support the hazard management decision-making process by analyzing site-specific information to assess existing explosive hazards, evaluate hazard reductions associated with removal and remedial alternatives, and evaluate hazard reductions associated with land use activity decisions. The MEC HA is designed to be used at the end of an RI. The risk of exposure to MEC at the MRS is based on historical findings from the SI and RI. The following three (3) components are used to evaluate the potential for explosive hazard incidents:

- Severity, which is the potential consequences of the effect on a human receptor should a DoD military munitions item detonate;
- Accessibility, which is the likelihood that a human receptor will be able to come in contact with a DoD military munitions item; and

- Sensitivity, which is the likelihood that a human receptor will be able to interact with a DoD military munitions item such that it will detonate (TWG-HA, 2008).

A MEC HA score was generated for current use activities and response alternatives using the following input factors:

- Energetic material type;
- Location of additional human receptors;
- Site accessibility;
- Potential contact hours;
- Amount of DoD military munitions;
- Minimum DoD military munitions depth relative to maximum intrusive depth;
- Migration potential;
- DoD military munitions classification; and
- DoD military munitions size.

The Maroon Crater Artillery Range Buffer Area MRS received a score of 145 out of 1,000 points (hazard level category of four [4]) for current activities. Hazard level category four (4) represents the lowest possible category and the lowest hazard.

The Maroon Crater Artillery Range CMUA MRS received a score of 865 out of 1,000 points (hazard level category one [1], with one [1] having the highest hazard potential) for current use activities at the MRS. Hazard level category one (1) represents the highest possible category and the highest hazard.

Scores were also generated for the Alternatives screened in the FS for the Maroon Crater Artillery Range CMUA MRS. Future activities were assumed to be the same as current activities. The score for Alternative 1: No Action is 864 (hazard level category one [1]). The score for Alternative 2: LUCs is 865 (hazard level category one [1]). The score for Alternative 3: LUCs and Surface Removal of DoD Military Munitions is 710 (hazard level category three [3]). The score for Alternatives 4A and 4B: LUCs and Surface and Subsurface Removal (24-Inches bgs) of DoD Military Munitions using DGM (4A)/AGC (4B) Methods is 540 (hazard level category of three [3]).

2.10 REMEDIAL ACTION OBJECTIVES

The final remedy for the Maroon Crater Artillery Range CMUA MRS will be designed to achieve the remedial action objective (RAO) described in this section. The RAO, as described in the Final FS for the Maroon Crater Artillery Range MRS (WESTON, 2017b), is to:

- Prevent direct contact with surface and subsurface DoD military munitions to 24-inches bgs by current and future receptors, including recreational users, site visitors, construction workers, and USFS employees.

2.11 COMPARATIVE ANALYSIS OF ALTERNATIVES

Remedial alternatives were developed in the FS by assembling the evaluated remedial technologies (WESTON, 2017b). Remedial alternatives must meet the RAO in order to ensure that the selected remedy is protective of human health and welfare and the environment and complies with applicable regulations. The following technologies were assembled into alternatives in the FS: 1) no action; 2) LUCs (educational controls and long-term monitoring [LTM]); and 3) DoD military munitions removal. Based on the technology screening in the FS, the following alternatives were assembled:

- Alternative 1 – No Action;
- Alternative 2 – LUCs;
- Alternative 3 – LUCs and Surface Removal of DoD Military Munitions;
- Alternative 4A – LUCs, Surface, and Subsurface (24-Inches bgs) Removal of DoD Military Munitions using DGM Methods; and
- Alternative 4B – LUCs, Surface, and Subsurface (24-inches bgs) Removal of DoD Military Munitions using AGC Methods.

The following sections provide a description of each remedial alternative and how each remedial alternative meets the RAO for the Maroon Crater Artillery Range CMUA MRS. CERCLA and the NCP [CERCLA § 121(c) and NCP § 300.430(f)(4)(ii)] require Five Year Reviews where UU/UE is not achieved (USEPA, 2001). Recurring reviews determine if a remedial action continues to minimize the hazard, continues to be protective of human health and welfare and the environment, and provide an opportunity to assess the applicability of new technologies for addressing previous impracticability determinations.

2.11.1 Alternative 1 – No Action

The no action alternative is carried through the analysis to provide a baseline for comparison to the other alternatives. This alternative does not provide mitigation of hazards, contaminant reduction, monitoring, or LUCs and is the least preferred category. This alternative does not meet the RAO but is required by DERP and the NCP. Site access is assumed to be unrestricted and there are no limitations on current or future site use or activities.

2.11.2 Alternative 2 – Land Use Controls

Alternative 2 includes LUCs for the Maroon Crater Artillery Range CMUA MRS and was developed as an alternative to achieve the CERCLA/NCP/DERP requirement that one (1) remedial alternative be provided that involves little or no treatment. Alternative 2 LUCs include educational controls, engineering controls, and legal controls to achieve the RAO and compliance with applicable or relevant and appropriate requirements (ARARs) identified for the MRS. Contaminant toxicity, mobility and volume would not be reduced by implementation of Alternative 2; however, protection of human health and welfare and the environment and ultimately the RAO would be achieved if implemented.

A Five-Year Review is required for this remedy, as selection of Alternative 2 for the MRS remedial approach would result in hazards remaining at the MRS above levels that allow for unrestricted use (USEPA, 2001). The Five-Year Review would include an inspection of the Maroon Crater Artillery Range CMUA MRS every five (5) years as part of LTM to substantiate LUC restrictions. **Figure 2-12** presents the LUCs associated with Alternative 2.

Implementation of Alternative 2 would be protective of the environment since no removal actions would be conducted to cause disturbance to the area. Implementation of Alternative 2 would be partially protective of human health and welfare by preventing fire fighters from responding to fires within the Maroon Crater Artillery Range CMUA MRS (**Figure 2-12**). LUCs to restrict firefighter access to the MRS would protect them from potential explosive hazards; however, LUCs would not prevent recreational users, site visitors, construction workers, and ranch workers from coming in contact with potential hazards. Educational controls such as fact sheets and community meetings would be difficult to implement due to the variable population that uses this area for recreation. Alternative 2 would partially meet the RAO but would not prevent all receptors from potentially coming into contact with explosive hazards. Alternative 2 would meet ARARs but would not meet NCP requirements. Additionally, this alternative offers no contaminant reduction.

In addition, periodic informal inspections between Five-Year Reviews in consultation with USFS, will be performed to ensure site conditions have not changed. Legal controls in the form of construction support (UXO escort) during pipeline maintenance will be required to protect pipeline workers. Engineering controls, in the form of signs, will be placed along road access points to inform recreational users and site visitors of potential hazards in the area. A Signage Plan will also be included in the Removal Action Work Plan.

2.11.3 Alternative 3 – Land Use Controls and Surface Removal of DoD Military Munitions

Alternative 3 includes DoD military munitions detection, removal, and disposal technologies to mitigate the potential explosive hazards at the Maroon Crater Artillery Range CMUA MRS across the entire MRS, where accessible (**Figure 2-13**) and therefore would prevent receptors from direct contact with potential DoD military munitions on the ground surface and would meet the RAO for the MRS. It is estimated that on approximately 71 acres of the 565-acre Maroon Crater Artillery Range CMUA MRS it may be too difficult to remove DoD military munitions due to the steep terrain (>25 degree slope) and the unstable nature of the cinders on the Maroon Crater cinder cone. Please note that during the RI, a >30-degree slope was used as the slope at which it is considered too dangerous for field crew members to traverse safely. However, based on conversations with field personnel from the RI, they recommended that a >25 degree slope be incorporated for the removal action due to the unstable nature of the slope of the cinder cone. In addition, LUCs (as presented for Alternative 2) would be implemented for the entire Maroon Crater Artillery Range CMUA MRS to mitigate the hazards.

The surface removal of DoD military munitions would be implemented across the Maroon Crater Artillery Range CMUA MRS, where accessible, to remove exposed DoD military munitions, MD,

and NMRD. To prevent the disturbance of any archeological items that may be present on the MRS, methods similar to those used during the RI field work would be implemented. This includes full compliance with the National Historic Preservation Act (NHPA) and the Archeological Resources Protection Act (ARPA) and a four (4)-hour awareness training for UXO Technicians and other field personnel to help them identify prehistoric and historic artifacts and avoid significant cultural resources as they clear the MRS. This would also include an archeological survey of the staging area and monitoring of UXO Technicians and field personnel as they conduct their work. An archaeologist would be required to accompany each UXO Team, if more than one (1) UXO Team is on site. An archeological report would also be provided at the end of the field work. This is the process that was followed during the RI and a programmatic agreement will be developed to achieve NHPA compliance prior to implementation of the selected alternative.

If any consultations regarding threatened or endangered species are required, they will be conducted. Additionally, seasonal timing due to pronghorn fawning and any implemented fire restrictions would be followed.

2.11.4 Alternatives 4A and 4B – Land Use Controls and Surface and Subsurface (24-Inches below Ground Surface) Removal of DoD Military Munitions using Digital Geophysical Mapping/Advanced Geophysical Classification Methods

Alternatives 4A and 4B include DoD military munitions detection, removal, and disposal technologies to eliminate the potential explosive hazard at the Maroon Crater Artillery Range CMUA MRS across the entire MRS (565 acres), where accessible, down to 24-inches bgs using either DGM (Alternative 4A) or AGC methods (Alternative 4B) (**Figure 2-14**) and would meet the RAO for the MRS. It is estimated that on approximately 71 acres of the 565-acre Maroon Crater Artillery Range CMUA MRS it may be too difficult to remove DoD military munitions due to the steep terrain (>25 degree slope) and the unstable nature of the cinders on the Maroon Crater cinder cone. Please note that during the RI, a >30-degree slope was used as the slope at which it is considered too dangerous for field crew members to traverse safely. However, based on conversations with field personnel from the RI, they recommended that a >25 degree slope be incorporated for the removal action due to the unstable nature of the slope of the cinder cone. In addition, LUCs (as presented for Alternative 2) would be implemented for the entire Maroon Crater Artillery Range CMUA MRS to mitigate the hazards.

The surface and subsurface removal of DoD military munitions (to 24-inches bgs), would be conducted across the CMUA MRS, where accessible, to remove exposed DoD military munitions, MD, and NMRD. For Alternative 4A, surface removal of DoD military munitions would include walking the MRS with handheld all-metals detectors to remove metallic items. Subsurface removal of DoD military munitions would include a DGM survey. Digital geophysical data would be sent to a data processing geophysicist to identify locations with anomalous readings. The anomalies would then be reacquired using a global positioning system and intrusively investigated.

For Alternative 4B, surface removal of DoD military munitions would include walking the MRS with handheld, all-metals detectors to remove metallic items. Subsurface remove of DoD military

munitions would include an DGM survey. Digital geophysical data would be sent to a data processing geophysicist to identify locations with anomalous readings. A cued interrogation survey would occur at each anomaly location in order to collect the data necessary to make AGC decisions. The AGC process uses advanced electromagnetic induction sensors and a data analysis software to allow geophysical analysts to estimate parameters such as depth, size, density, wall thickness, and shape of buried metallic items. Decisions can be made as to whether buried metallic items are potentially DoD military munitions or nonhazardous scrap. The cued survey data would be transferred to the processing geophysicist for analysis. Anomaly locations identified as potential DoD military munitions or locations that could not be analyzed would be selected for reacquisition and excavation. The AGC process is assumed to reduce the overall list of anomalies requiring excavation by 95%. In addition, AGC process typically requires additional verification digs to confirm classification results.

To prevent the disturbance of any archeological items that may be present on the MRS, methods similar to those used during the RI field work would be implemented for both Alternatives 4A and 4B. This includes full compliance with NHPA and ARPA and a four (4)-hour awareness training for UXO Technicians and other field personnel to help them identify prehistoric and historic artifacts and avoid significant cultural resources as they clear the MRS. This would also include an archeological survey of the staging area and monitoring of UXO Technicians and field personnel as they conduct their work. An archaeologist would be required to accompany each UXO Team, if more than one (1) UXO Team is on site. An archeological report would also be provided at the end of the field work. This is the process that was followed during the RI and a programmatic agreement will be developed to achieve NHPA compliance prior to implementation of the selected alternative.

If any consultations regarding threatened or endangered species are required, they will be conducted. Additionally, seasonal timing due to pronghorn fawning and any implemented fire restrictions would be followed.

2.12 COMPARATIVE ANALYSIS OF ALTERNATIVES

The detailed individual and comparative analyses of alternatives have been combined to summarize the remedial alternatives available for the Maroon Crater Artillery Range CMUA MRS. The alternatives were evaluated per the nine (9) criteria in NCP §300.430(e)(9)(iii), which encompasses the CERCLA statutory requirements and technical, cost, and institutional considerations. The criteria are arranged into three (3) categories: threshold criteria, balancing criteria, and modifying criteria. The criteria are summarized in **Table 2-6**.

Table 2-7 presents a summary of the comparative analysis of the No Action alternative and the four (4) response action alternatives. Each alternative was evaluated against all nine (9) criteria according to the ability of the alternative to achieve the RAO. Evaluation of the modifying criteria (i.e., state and community acceptance) was considered subsequent to the public comment period and rated qualitatively with a “Yes”, “No”, or “No Response.” “No Response” is indicated for all alternatives because no comments were reported during the public comment period. A numerical score is applied for comparative purposes, with zero (0) being the least preferred and three (3)

being the most preferred. In some cases, where the relative preference is not significant, more than one (1) alternative is given the same numerical score.

Table 2-6
Criteria for Detailed Evaluation of the Alternatives

Criterion	How the Criterion is Applied
Threshold Criteria	
Overall protection of human health and the environment	Assesses the ability of an alternative to eliminate, reduce, or control the risks associated with exposure pathways including direct contact, potential migration, and risks to ecosystems.
Compliance with ARARs and to-be considered (TBC) criteria	Evaluates the potential of an alternative to achieve chemical-, location-, and action-specific ARARs and TBCs.
Balancing Criteria	
Short-term effectiveness	Assesses the capability of an alternative to protect human health and welfare and the environment during implementation of the alternative (e.g., the construction, removal, and disposal).
Long-term effectiveness and permanence	Measures the ability of an alternative to permanently protect human health and welfare and the environment.
Reduction in toxicity, mobility, or volume of contaminants	Evaluates the ability of an alternative to permanently or significantly reduce the toxicity, mobility, or volume of contaminants particularly through treatment.
Implementability	Evaluates the technical feasibility or difficulty of applying the alternative at the site, the reliability of the technology, the unknowns associated with the alternative, and the need for treatability studies. Assesses regulatory agency concurrence and the need for permits and waivers. Assesses mobilization needs, the accessibility of equipment, and number of trained personnel required to complete the alternative.
Cost	Assesses the capital and operation and maintenance (O&M) costs of each alternative.
Modifying Criteria	
State acceptance	Evaluates the likelihood of approval by the ADEQ.
Community acceptance	Assesses the anticipated level of acceptance by the community.

Table 2-7
Summary of Comparative Analysis of Alternatives

Detailed Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B
	No Action Alternative	LUCS	LUCs and Surface Removal of DoD Military Munitions	LUCs and Surface and Subsurface Removal (to 24-Inches bgs) of DoD Military Munitions using DGM Methods	LUCs and Surface and Subsurface Removal (to 24-Inches bgs) of DoD Military Munitions using AGC Methods
Description	Per the NCP, the No Action Alternative is included for baseline comparison	Protecting certain receptors by limiting access to potential DoD military munitions using LUCs	Protecting receptors by removing potential DoD military munitions from the surface and using LUCs	Protecting receptors by removing potential DoD military munitions from the surface and subsurface and using LUCs	Protecting receptors by removing potential DoD military munitions from the surface and subsurface and using LUCs
Overall Protectiveness of Human Health and the Environment	0	0	2	3	3
Compliance with ARARs	0	3	3	3	3
Long-Term Effectiveness and Permanence	0	0	2	3	3
Reduction of Toxicity, Mobility, or Volume through Treatment	0	0	1	3	3
Short-Term Effectiveness	3	2	1	0	0
Implementability	3	3	3	3	3
Cost (Total Present Value)	3 \$0	2 \$208,000	1 \$1,963,000	0 \$5,018,000	0 \$4,727,000
Stakeholder Acceptance	No	No	No	Yes	Yes
Community Acceptance	No Response	No Response	No Response	No Response	No Response
Total Score	9	10	13	15	15

2.13 PRINCIPAL THREAT WASTE

DMM or UXO, if any, that remain present at the Maroon Crater Artillery Range CMUA MRS (AZHQ-009-R-01) may constitute a principal threat to human health at the MRS due to the potential for it to pose an explosive hazard if the material is moved, handled or disturbed. If UXO or DMM are later encountered on surfaces in those areas originally addressed by the selected remedy, DoD explosive ordnance disposal personnel or similarly qualified personnel will evaluate the material to determine if it poses an explosive hazard. Such material that is determined to pose an explosive hazard (which may also be categorized as munitions and explosives of concern [MEC]) will normally be treated on-site or removed for destruction per applicable DoD explosives safety standards and environmental laws and regulations. The Department of Army and the USEPA will consult, in accordance with the terms of the applicable agreement, to make a determination as to whether the material encountered and determined to pose an explosive hazard, should be classified as a principal threat waste (PTW), as defined by CERCLA, the NCP and USEPA guidance. If the material is determined to be a PTW, the Department of Army will take the necessary actions to ensure protectiveness of human health and welfare and the environment to address unacceptable risks posed by the material designated as a PTW. There are no PTW at the Maroon Crater Artillery Range CMUA MRS.

2.14 DESCRIPTION OF SELECTED FINAL REMEDY

The Army, with concurrence from ADEQ (**Appendix C**), recommends Alternative 4B – LUCS and Surface and Subsurface (24-Inches bgs) Removal of DoD Military Munitions using AGC Methods as the preferred alternative for the Maroon Crater Artillery Range CMUA MRS (**Figure 2-14**). While both Alternatives 4A and 4B were presented as the preferred alternatives in the PP, Alternative 4B was chosen as the final remedy as AGC is considered to be more beneficial than DGM. AGC is the latest and most advanced technology and will provide a digital record while reducing the number of intrusive investigations.

MPPEH and DoD military munitions encountered during implementation of the remedy will be intentionally detonated, re-inspected along with MD encountered, and reclassified as inert MDAS to be sent to a licensed facility for demilitarization. This alternative was selected because it will achieve substantial risk reduction by treating the source materials constituting principal threats at the MRS in the areas most-used by the public. This satisfies the statutory preference for treatment and provides a permanent reduction of risk.

Based on information currently available, the lead agency believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The Army expects the preferred alternative to satisfy the following statutory requirements of CERCLA 121(b):

- 1) Be protective of human health and welfare and the environment;
- 2) Comply with ARARS (or justify a waiver);
- 3) Be cost-effective;

- 4) Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and
- 5) Satisfy the preference for treatment as a principal element.

2.14.1 Summary of Estimated Final Remedy Costs

The final remedial costs are broken into three (3) parts: capital costs, annual O&M costs, and periodic costs for 30 years, all of which sum to a total present value cost. The cost components of the selected remedy are as follows:

- Capital Costs: \$4,564,000
- Annual O&M Costs: \$0
- Periodic Costs: \$163,000

The present worth cost to implement the selected remedial action is \$4,727,000. The present worth cost is the estimated total cost to implement the remedial action over time in terms of today's dollar value. The cost estimate is expected to be accurate within a range of plus 50% to minus 30%.

2.14.2 Expected Outcomes of the Selected Final Remedy

The selected remedy at the Maroon Crater Artillery Range CMUA MRS will include the investigation and removal of DoD military munitions from accessible areas of the MRS. Upon completion of the final remedy, the MRS will continue to be monitored through LUCs, including educational controls and Five-Year Reviews.

2.15 STATUTORY DETERMINATION SUMMARY

Based on the previous investigations for DoD military munitions and MC completed at the Maroon Crater Artillery Range Buffer Area MRS, ARNG determined that the selected remedy of NFA is protective of human health and welfare and the environment. The utilization of alternative treatment technologies or resource recovery technologies is not applicable under the recommended remedy. ARNG also concluded that additional reduction in the volume, toxicity, or mobility of the constituents of concern or off-site disposal of untreated wastes is not necessary.

Munitions response activities for the Maroon Crater Artillery Range Buffer Area MRS in Coconino County, Arizona, are now considered to be at the Response Complete stage. ARNG has documented the determination, and has received regulatory concurrence. Therefore, no additional activity is required or necessary to ensure the protection of human health and welfare and the environment.

Implementation of the selected final remedy at the Maroon Crater Artillery Range CMUA MRS will be protective of human health and welfare and the environment, comply with ARARs, be cost effective, and provide the utilization of permanent treatment solutions. The following sections summarize how the selected remedy meets the regulatory requirements of CERCLA §121, as required by NCP §300.430(f)(5)(ii).

2.15.1 Protection of Human Health and Welfare and the Environment

Implementation of the selected remedy (Alternative 4B) will be protective of human health and welfare and the environment by permanently removing DoD military munitions at the Maroon Crater Artillery Range CMUA MRS, thereby eliminating potential explosive hazards in accessible areas and providing LUCs to warn firefighters of potential MEC hazards in the inaccessible areas.

2.15.2 Compliance with Applicable or Relevant and Appropriate Requirements

Selected response actions are required, pursuant to NCP §300.430(f)(1)(ii)(B), to attain ARARs to the extent practicable. According to the NCP, ARARs fall into three (3) categories: chemical-, action-, and location-specific. Because ARARs do not exist for every chemical or circumstance, non-promulgated federal or state advisories, criteria, or guidance materials [“TBC” materials] may help determine the levels or goals that are protective for a site and the necessary approach to carry out certain actions or requirements. The NCP does not require agencies to follow TBCs; however, it does suggest that TBCs be used when ARARs do not exist and when ARARs alone would not adequately protect human health and welfare and the environment.

Federal and State chemical-, location-, and action-specific ARARs and TBCs, pertinent to the evaluation of response actions for the MRS, are summarized in the following subsections. The selected remedy complies with the ARARs and TBCs described in the following subsections.

2.15.2.1 Chemical-Specific Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

The following chemical-specific TBCs were identified for the Maroon Crater Artillery Range CMUA MRS:

- **Arizona Administrative Code R18-7-201 et seq. – Arizona Soil Remediation Standards** – A person who is remediating a site shall comply with the numeric soil remediation standards identified in Appendix A or Appendix B of this administrative code, as required.
- **40 USC 6901 et seq.; 40 CFR 261.24 – Solid Waste Disposal Act/Toxicity Characteristics** – A waste must be evaluated to determine whether it is a hazardous waste (i.e. either a listed waste or a characteristic waste). A characteristic waste is determined by its 1) ignitability, 2) corrosivity, 3) reactivity, or 4) toxicity, as determined by the USEPA toxicity characteristic leaching procedure.
- **USEPA Regional Screening Levels** – Establishes benchmark concentrations at which no unacceptable human health risks would be expected. To be considered following detonation of DoD military munitions onsite to verify no residual MC is left in place.
- **40 CFR Part 50 – Clean Air Act – National Ambient Air Quality Standards (NAAQS)** – Establishes primary and secondary NAAQS for ambient air quality to protect public health and welfare, and the environment. Applicable to alternatives that have the potential to impact ambient air quality.

2.15.2.2 Location-Specific Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

The following location-specific ARARs were identified for the Maroon Crater Artillery Range CMUA MRS:

- **16 U.S. Code (USC) 703-712—Migratory Bird Treaty Act** – The act prohibits the taking, possessing, buying, selling, or bartering of any migratory bird, including feathers or other parts, nest eggs, or products, except as allowed by regulations. This includes disturbing nesting birds. Migratory birds may be present within the MRS during certain times of the year.
- **16 USC 1538(a)(1)(B) and (1)(2)(B) – Endangered Species Act** – The endangered species act provides for the conservation of endangered and threatened species. Endangered and threatened species, while unlikely, are potentially present on the MRS.
- **16 USC 668-668c – Bald and Golden Eagle Protection Act** – The Bald and Golden Eagle Protection Act is a U.S. federal statute that protects the two (2) species of eagle. The act prohibits the “taking” of these birds, including their parts, nests, or eggs, or molesting or disturbing the birds. Bald eagles are potentially present on the MRS.
- **16 USC 470 – National Historic Preservation Act of 1966, as amended** – Requires protection of cultural resources (including prehistoric, historical, tribal, etc. resources) to the maximum extent practicable. Cultural resources have been identified at the MRS.
- **16 USC 470aa-470mm, Public Law 96-95 and amendments) – Archaeological Resources Protection Act of 1979** – ARPA regulates the preservation of cultural resources (including prehistoric, historical, tribal, etc. resources). Cultural resources have been found on the MRS.
- **43 CFR Part 10 – Native American Graves Protection and Repatriation Regulations** – Any person who knows or has reason to know that he or she has discovered inadvertently human remains, funerary objects, sacred objects, or objects of cultural patrimony on Federal or tribal lands, must provide immediate telephone notification of the inadvertent discovery, with written confirmation, to the responsible Federal agency official with respect to Federal lands. No human remains, funerary objects, sacred objects, or objects of cultural patrimony are known to have been identified on the MRS.

No location-specific TBCs were identified for the Maroon Crater Artillery Range CMUA MRS.

2.15.2.3 Action-Specific Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

The following action-specific ARARs were identified for the response action at the Maroon Crater Artillery Range CMUA MRS:

- **29 CFR 1910.120 – Hazardous Waste Operations and Emergency Response (HAZWOPER)** – Site conditions at the MRS are not known or believed to be hazardous; however, at a minimum, personnel on-site will be 40-hour HAZWOPER trained. Training

is designed for persons engaged in hazardous substance removal or other associated activities.

- **40 CFR Part 264 Subpart X –RCRA**– Relevant parts relate to the management of DoD military munitions that is recovered, including characterization as hazardous waste and requirements for treatment, storage, and transportation. Establishes actions required for the disposal of waste explosives by open burning or open detonation. May be applicable if storage and transportation of recovered DoD military munitions is performed during remedial actions. May also be applicable if disposal of explosives is performed during remedial actions.
- **40 CFR 266, Subpart M – Management of DoD Military Munitions** – Describes when military munitions are exempt from being managed as solid or hazardous waste.
- **40 CFR Part 300 – Hazardous Substance Release Response** – Establishes requirements for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. Applicable to preparing for and responding to site contaminants (i.e. DoD military munitions).

The following action-specific TBCs were identified for the response action at the Maroon Crater Artillery Range CMUA MRS:

- **6055.99-STD, February 2008, Chapter 12 – DoD Ammunitions and Explosives Sites Standards** – Provides guidance for assessment, remedial planning, and remedial processes in support of reuse/redevelopment of sites contaminated with ammunition, explosives, or chemical agents.
- **EM 200-1-15 – USACE Technical Guidance for Military Munitions Response Actions** – Provides technical guidance for executing the technical aspects of military munitions response actions. To be considered during munitions response projects.

2.15.3 Cost Effectiveness

The selected remedy meets the statutory requirement that remedies be cost effective. A cost effective remedy is one whose “costs are proportional to its overall effectiveness” [NCP §300.430(f)(1)(ii)(D)]. The “overall effectiveness” of a remedial alternative is determined by evaluating the following three (3) of the five (5) balancing criteria used in the detailed analysis of alternatives: 1) long-term effectiveness and permanence; 2) reduction in toxicity, mobility, and volume through treatment; and, 3) short-term effectiveness. “Overall effectiveness is then compared to cost” to determine whether a remedy is cost-effective [NCP §300.430(f)(1)(ii)(D)].

Implementation of the selected remedy provides a cost-effective response action according to the criteria established by the NCP. Evaluation of “overall effectiveness” and “cost-effectiveness” concluded that:

- Long-term effectiveness and permanence will be achieved by removing all potential DoD military munitions in all accessible areas.

- A reduction of toxicity, mobility, and volume will be achieved by removal of DoD military munitions in all accessible areas.
- The short-term effectiveness, as well as implementability, is considered favorable. Although removal of DoD military munitions has the potential to cause serious injury and death, adherence with USACE Engineering Manual (EM) 385-1-1 (USACE, 2014) and other guidance documents can significantly mitigate these hazards if properly followed.
- Further evaluation with respect to present value cost identifies the selected remedy as being cost-effective based on the large size of the MRS and accessibility.

The selected final remedy is effective in achieving the RAO, protecting human health and welfare and the environment, implementability, having “overall effectiveness”, and meeting the criteria for being cost-effective.

2.15.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

Implementation of DoD military munitions removal utilizes a permanent solution to eliminate the potential explosive hazard at the MRS in accessible areas. Subsequent to the remedial action, the Maroon Crater Artillery Range CMUA MRS will use LUCs and Five-Year Reviews to monitor conditions at the MRS. The selected remedy provides the best long-term effectiveness; reduces toxicity, mobility, and volume of contaminants; is protective of human health and welfare and the environment; complies with ARARs; and achieves the RAO.

2.15.5 Preference for Treatment as a Principal Element

The NCP §300.430(a)(1)(iii)(A) establishes the expectation that treatment will be used to address the principal threats at a site where practicable. DoD military munitions removal in accessible areas provides the best option to mitigate exposure to potential explosive hazards at the Maroon Crater Artillery Range CMUA MRS.

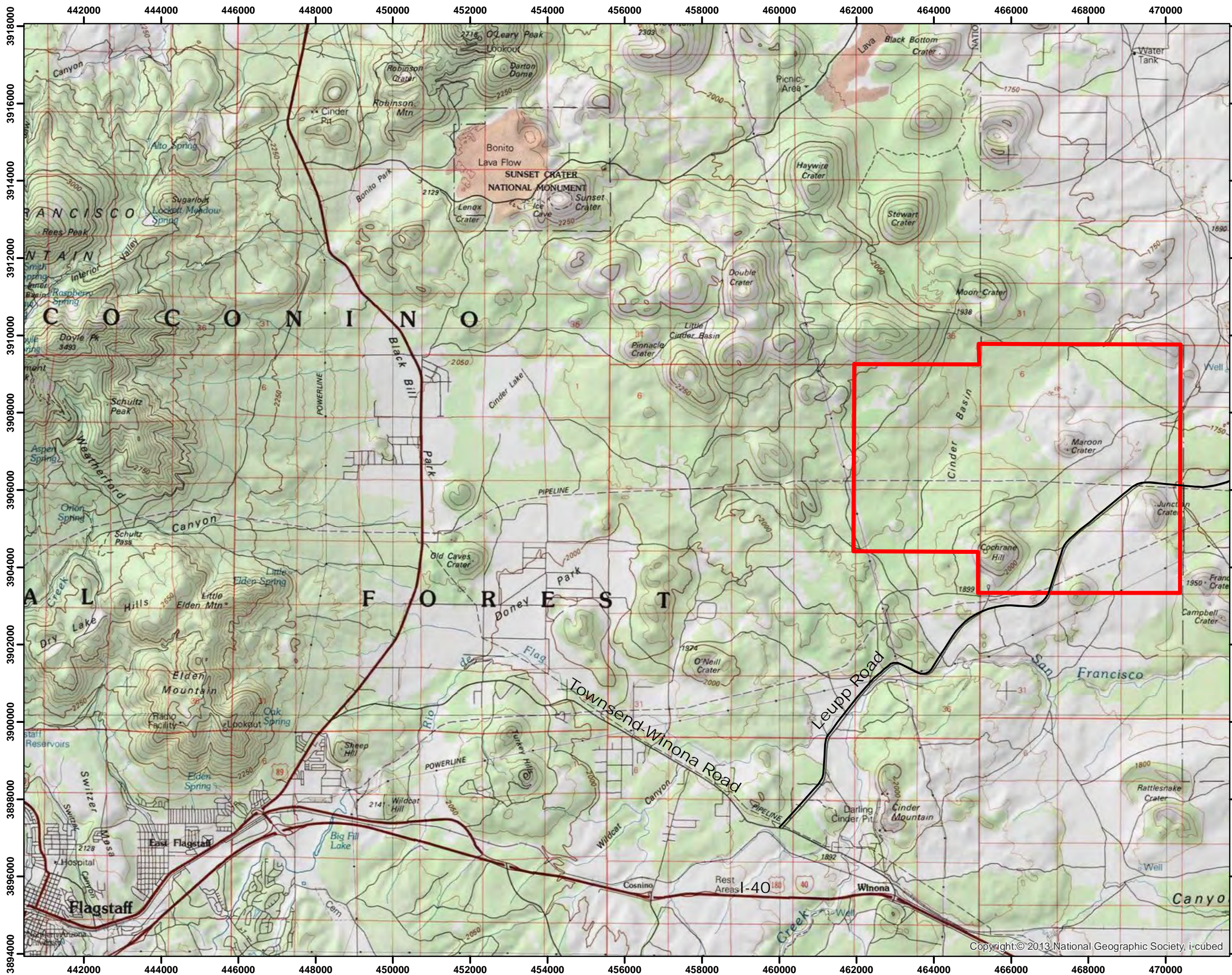
2.15.6 Five-Year Review Requirement

NCP §300.430(f)(4)(ii) requires a Five-Year Review if the remedial action results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for UU/UE. After implementation of the selected final remedy, potential explosive hazards will remain at the Maroon Crater Artillery Range CMUA MRS in areas that are inaccessible due to steep, unstable terrain and the MRS will receive Five-Year Reviews to assess site conditions.


2.16 DOCUMENTATION OF SIGNIFICANT CHANGES


The PP for the Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS was released for public comment on 17 December 2017. The PP identifies NFA as the preferred alternative for the Maroon Crater Artillery Range Buffer Area MRS and LUCs and Surface and Subsurface (24-inches bgs) Removal of DoD Military Munitions using AGC as the preferred alternative for the Maroon Crater Artillery Range CMUA MRS. No request for a meeting was received from the public, and no comments were received from the public comment

period. It was determined that no significant changes to the preferred NFA alternative for the Maroon Crater Artillery Range Buffer Area MRS and LUCs and Surface and Subsurface (24-inches bgs) Removal of DoD Military Munitions using AGC alternative for the Maroon Crater Artillery Range CMUA MRS, as originally identified in the PP, were necessary or appropriate.



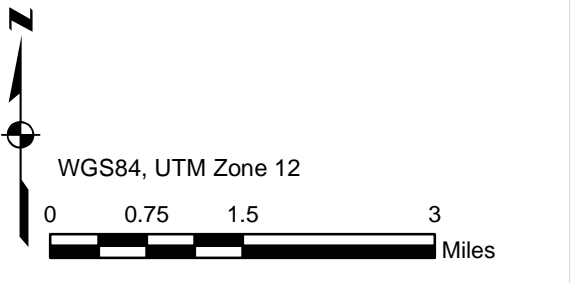
Legend

 MRS Boundary - Maroon Crater Artillery Range (AZHQ-009-R-01)[12,177 acres, RI, 2016]

 Primary Road

Acronyms

MRS - Munitions Response Site
NDNODS - Non-Department of Defense, Non-Operational Defense Sites
RI - Remedial Investigation

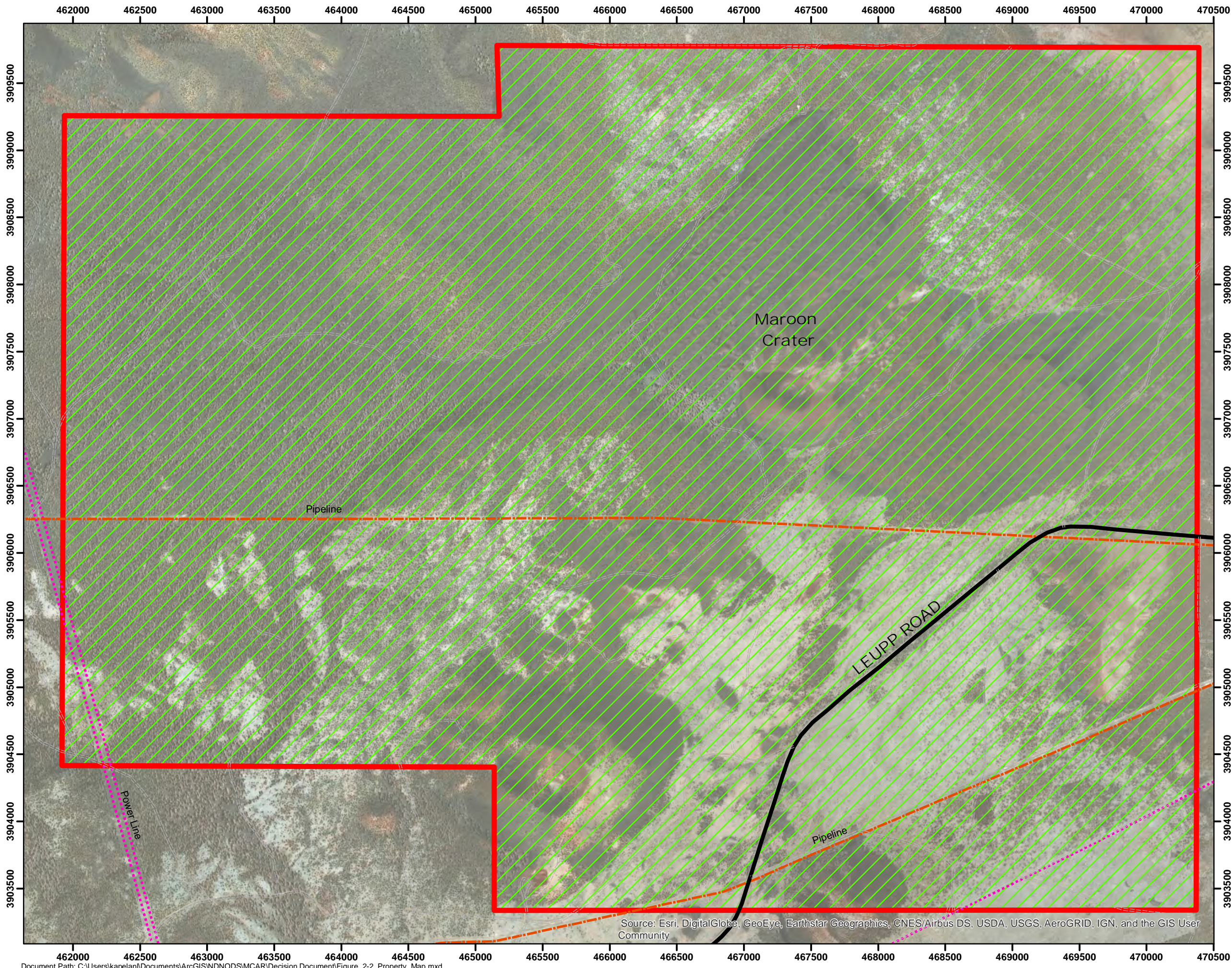


Site Location Map
NDNODS Maroon Crater Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ



Figure 2-1

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Legend

- Primary Road
- Secondary Road
- Pipeline
- Power Line
- United States Forest Service-Managed Property
- MRS Boundary - Maroon Crater Artillery Range (AZHQ-009-R-01)[12,177 acres, RI, 2016]

Acronyms

MRS - Munitions Response Site
NDNODS - Non-Department of Defense, Non-Operational Defense Sites



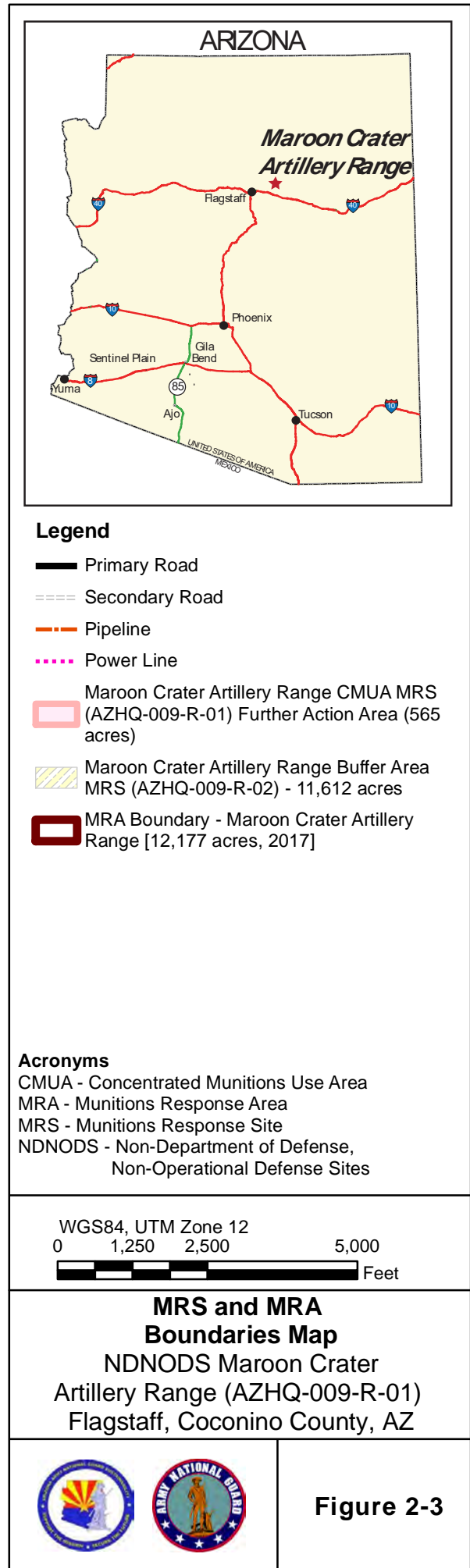
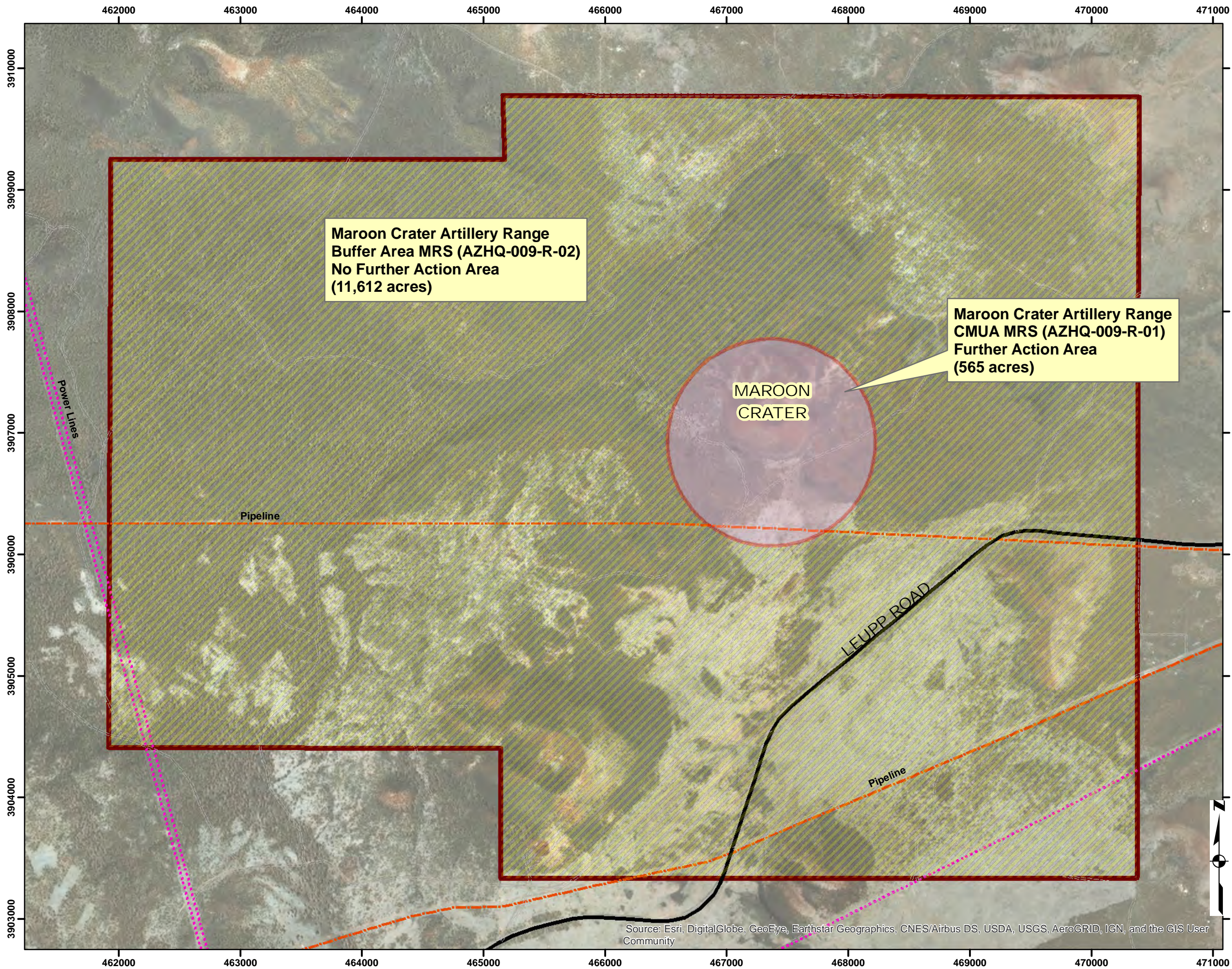
WGS84, UTM Zone 12
0 1,125 2,250 4,500 Feet

Property Owner Map
NDNODS Maroon Crater
Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ

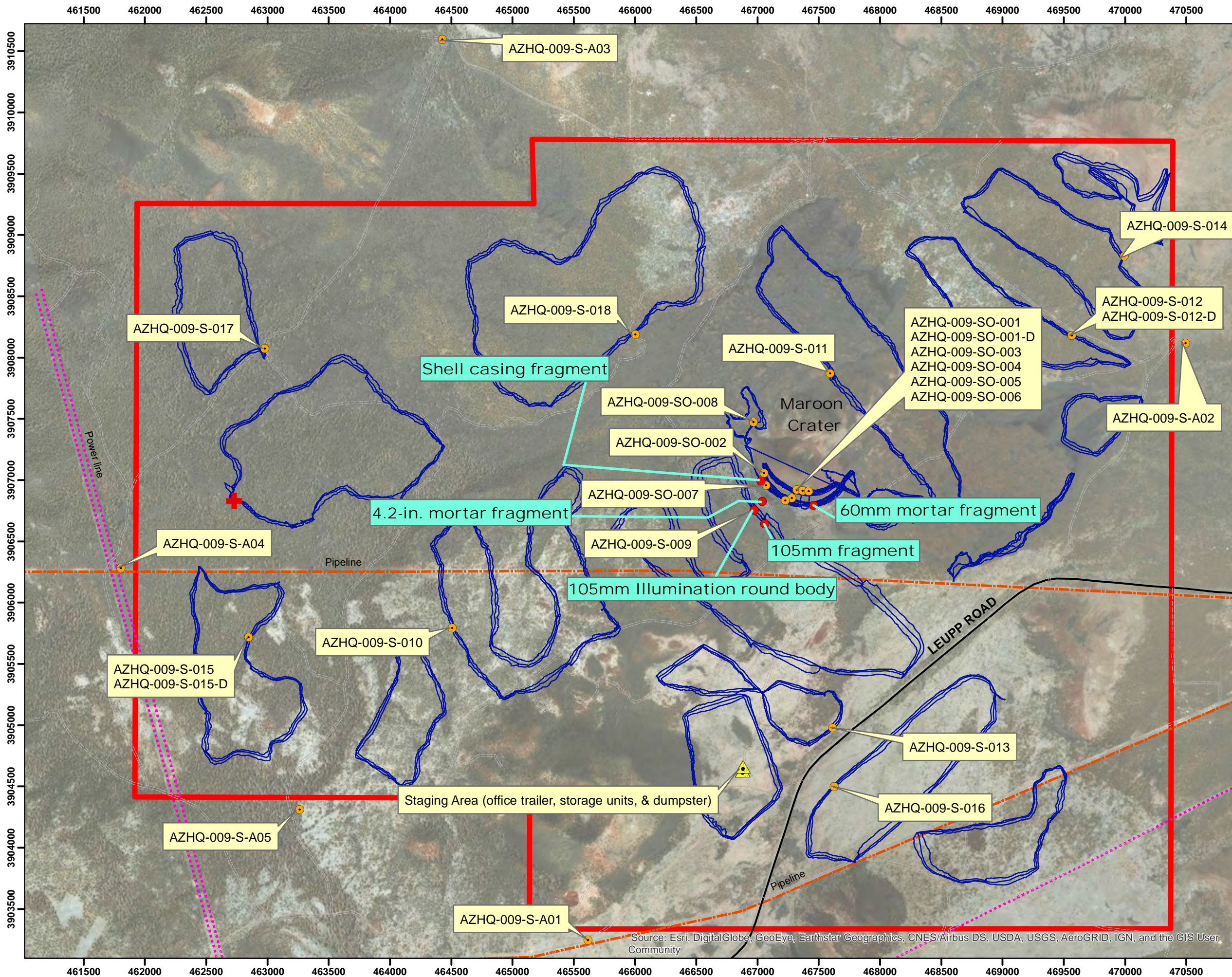


Figure 2-2

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ARIZONA

Maroon Crater Artillery Range

Flagstaff

Phoenix

Sentinel Plain

Gila Bend

Ajo

Tucson

Yuma

UNITED STATES OF AMERICA

MEXICO

Legend

- ✚ Firing Point (Historically Designated)
- SI Munitions Debris [SI, 2012]
- SI Munitions Constituents Sample Location [SI, 2012]
- ▲ Survey Benchmarks
- Primary Road
- Secondary Road
- SI Transects [SI, 2012]
- ... Power Lines
- - - Pipelines
- ▭ MRS Boundary - Maroon Crater Artillery Range (AZHQ-009-R-01) [12,177 acres, SI, 2012]

Acronyms

in. - inch
mm - millimeter
MRS - Munitions Response Site
NDNODS - Non-Department of Defense,
Non-Operational Defense Sites
SI - Site Inspection

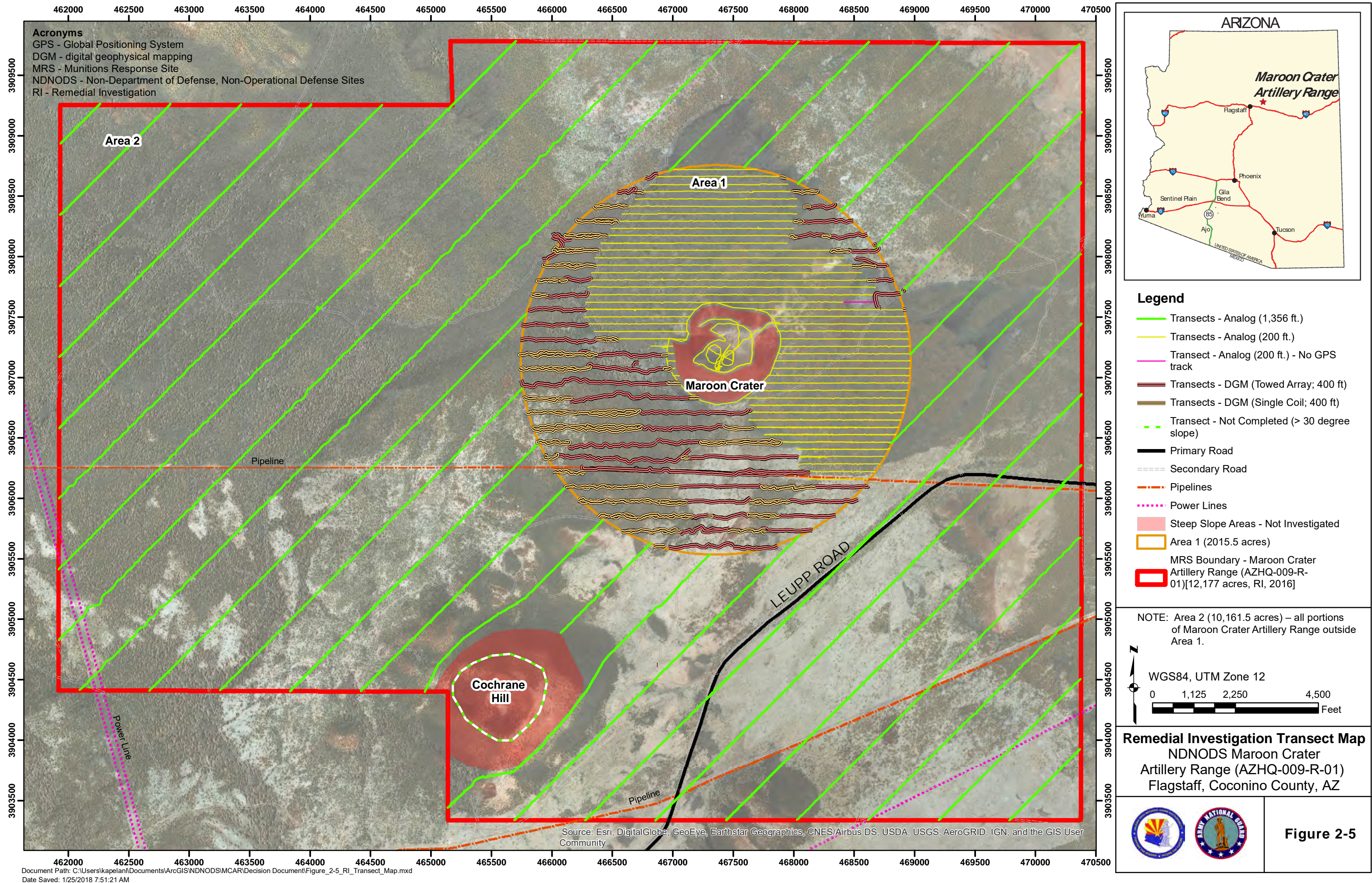
WGS84, UTM Zone 12

0 1,250 2,500 5,000 Feet

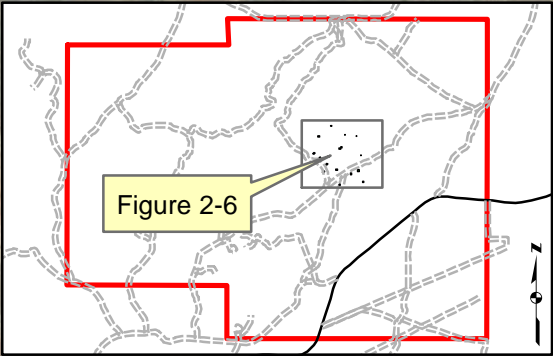
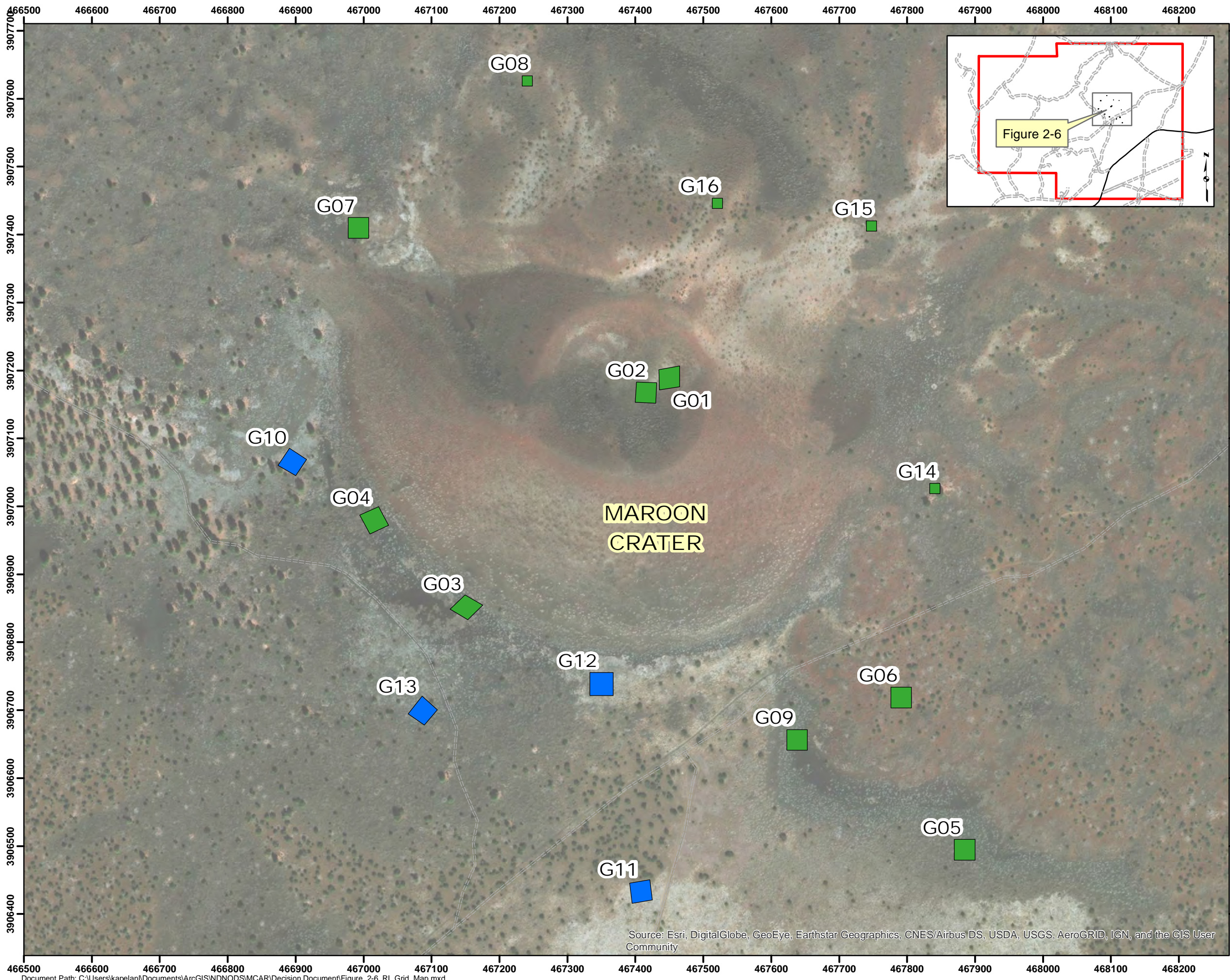
Site Inspection Results Map
NDNODS Maroon Crater Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ

Figure 2-4

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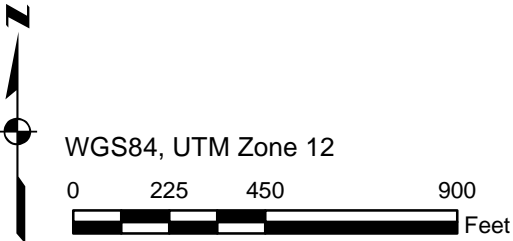


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- Legend**
- Secondary Road
 - DGM Grid (EM-61 Single Coil)
 - Analog Grid (All-Metal Detector)
 - MRS Boundary - Maroon Crater
 - Artillery Range (AZHQ-009-R-01)[12,177 acres, RI, 2016]

Acronyms
DGM - digital geophysical mapping
MRS - Munitions Response Site
NDNODS - Non-Department of Defense, Non-Operational Defense Sites
RI - Remedial Investigation



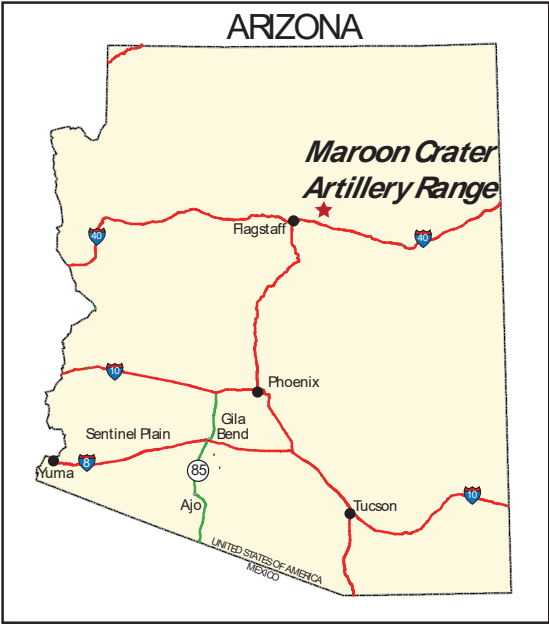
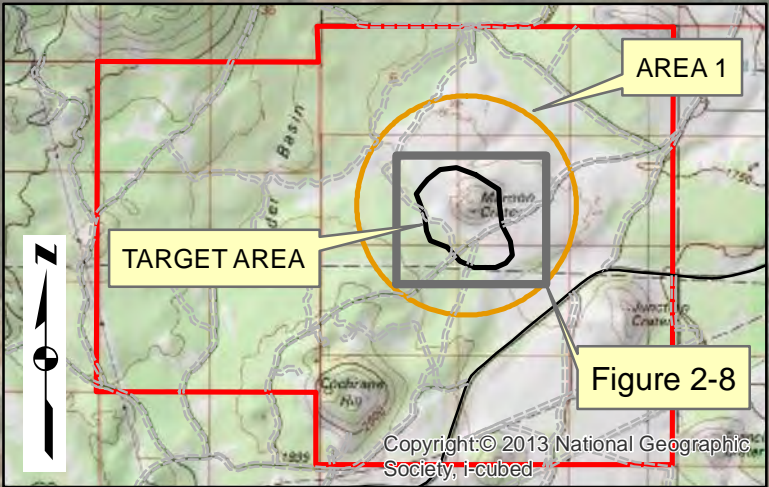
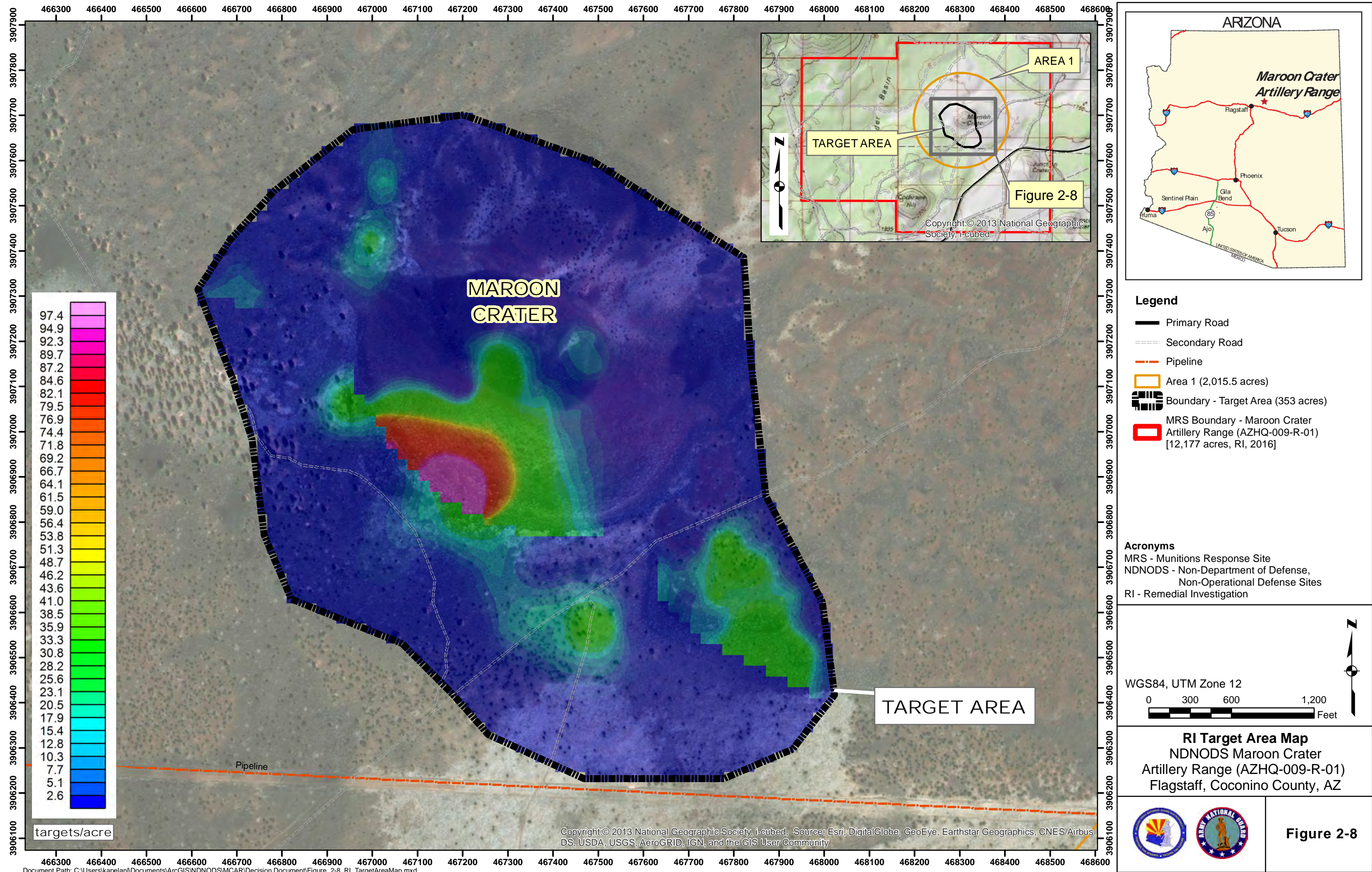
Remedial Investigation Grid Map
NDNODS Maroon Crater
Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ



Figure 2-6

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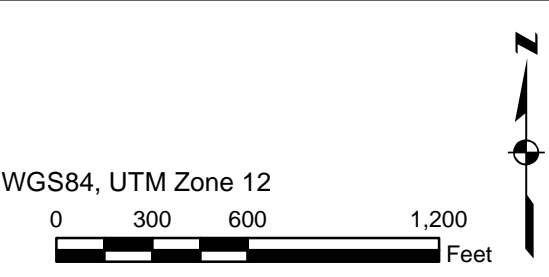


Legend

- Primary Road
- Secondary Road
- Pipeline
- Area 1 (2,015.5 acres)
- Boundary - Target Area (353 acres)
- MRS Boundary - Maroon Crater Artillery Range (AZHQ-009-R-01) [12,177 acres, RI, 2016]

Acronyms

- MRS - Munitions Response Site
- NDNODS - Non-Department of Defense, Non-Operational Defense Sites
- RI - Remedial Investigation

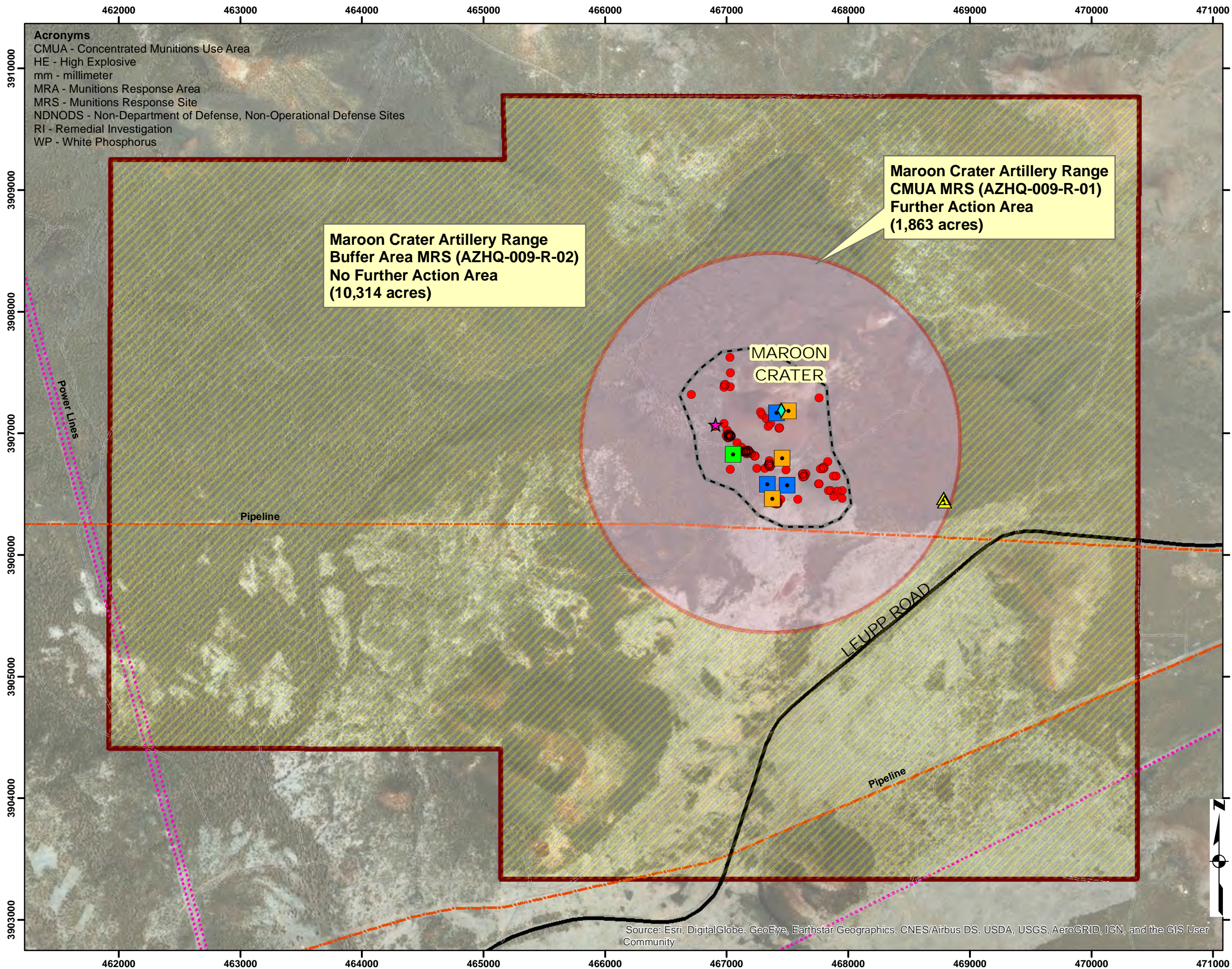


RI Target Area Map
NDNODS Maroon Crater
Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ



Figure 2-8

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Acronyms
CMUA - Concentrated Munitions Use Area
HE - High Explosive
mm - millimeter
MRA - Munitions Response Area
MRS - Munitions Response Site
NDNODS - Non-Department of Defense, Non-Operational Defense Sites
RI - Remedial Investigation
WP - White Phosphorus

**Maroon Crater Artillery Range
Buffer Area MRS (AZHQ-009-R-02)
No Further Action Area
(10,314 acres)**

**Maroon Crater Artillery Range
CMUA MRS (AZHQ-009-R-01)
Further Action Area
(1,863 acres)**

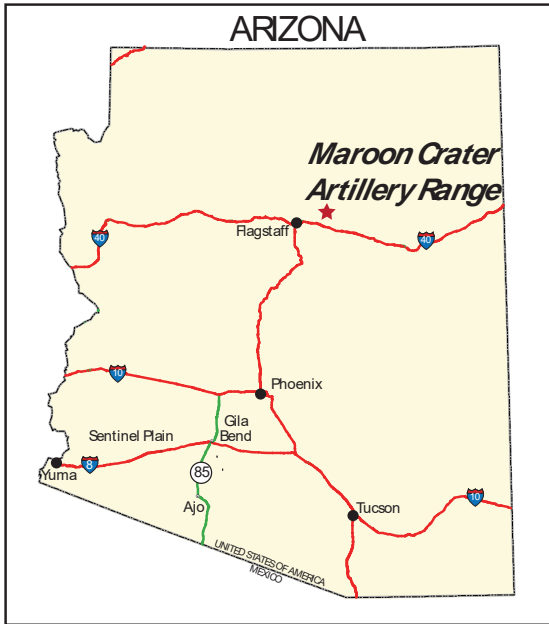
MAROON
CRATER

LEUPP ROAD

Pipeline

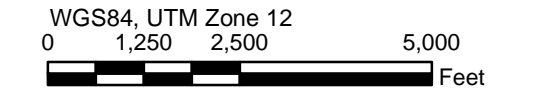
Pipeline

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- Blasting Cap
- Frag
- Frag: Fuze - fragments, adapter ring
- Frag: Grenade, Smoke, M15, White Phosphorus
- Frag: 81mm mortar - fin, tail boom
- Frag: 4.2-in., HE, M3, mortar - base
- Frag: 60mm mortar - tail boom
- Primary Road
- Secondary Road
- Power Line
- Pipeline
- Maroon Crater Artillery Range CMUA MRS (AZHQ-009-R-01) - Further Action Area (1,863 acres)
- Maroon Crater Artillery Range Buffer Area MRS (AZHQ-009-R-02) - No Further Action Area (10,314 acres)
- Boundary - Target Area (353 acres)
- Maroon Crater Artillery Range MRA [12,177 acres, RI, 2017]

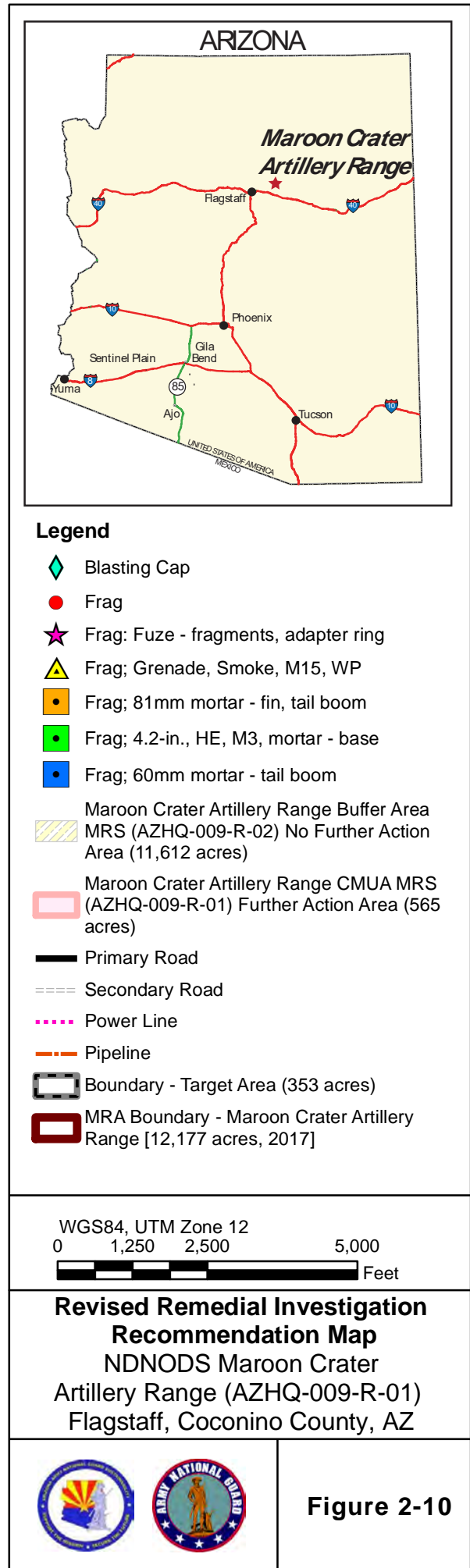
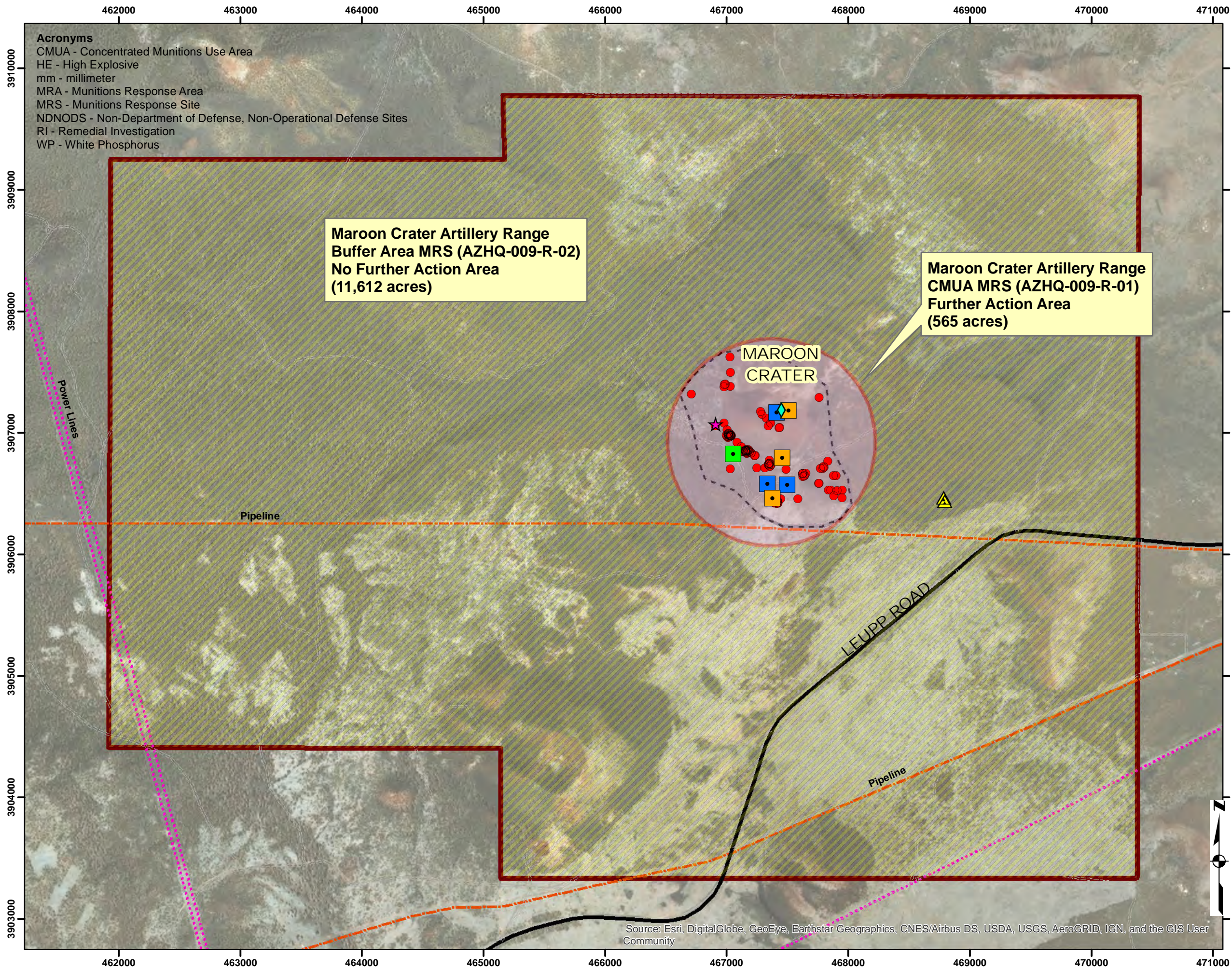


**Remedial Investigation
Recommendation Map**
NDNODS Maroon Crater
Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ



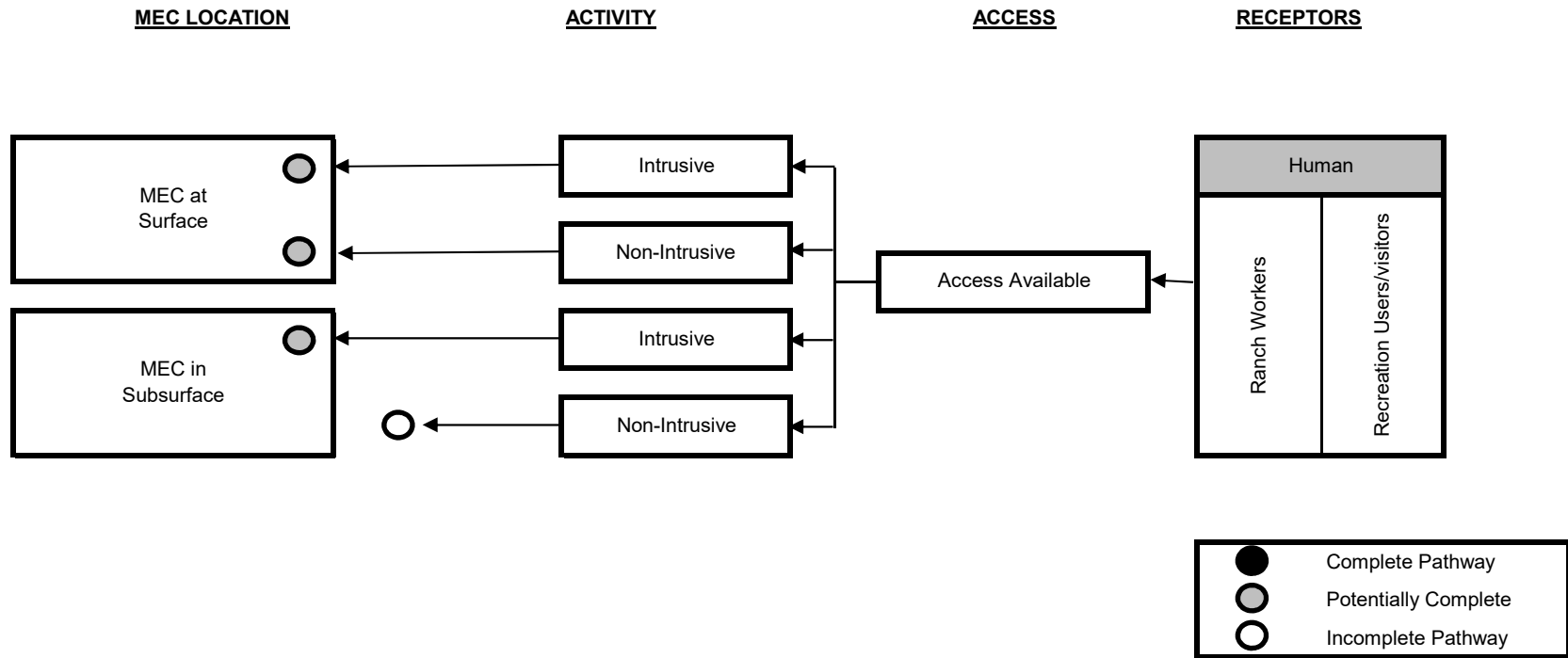
Figure 2-9

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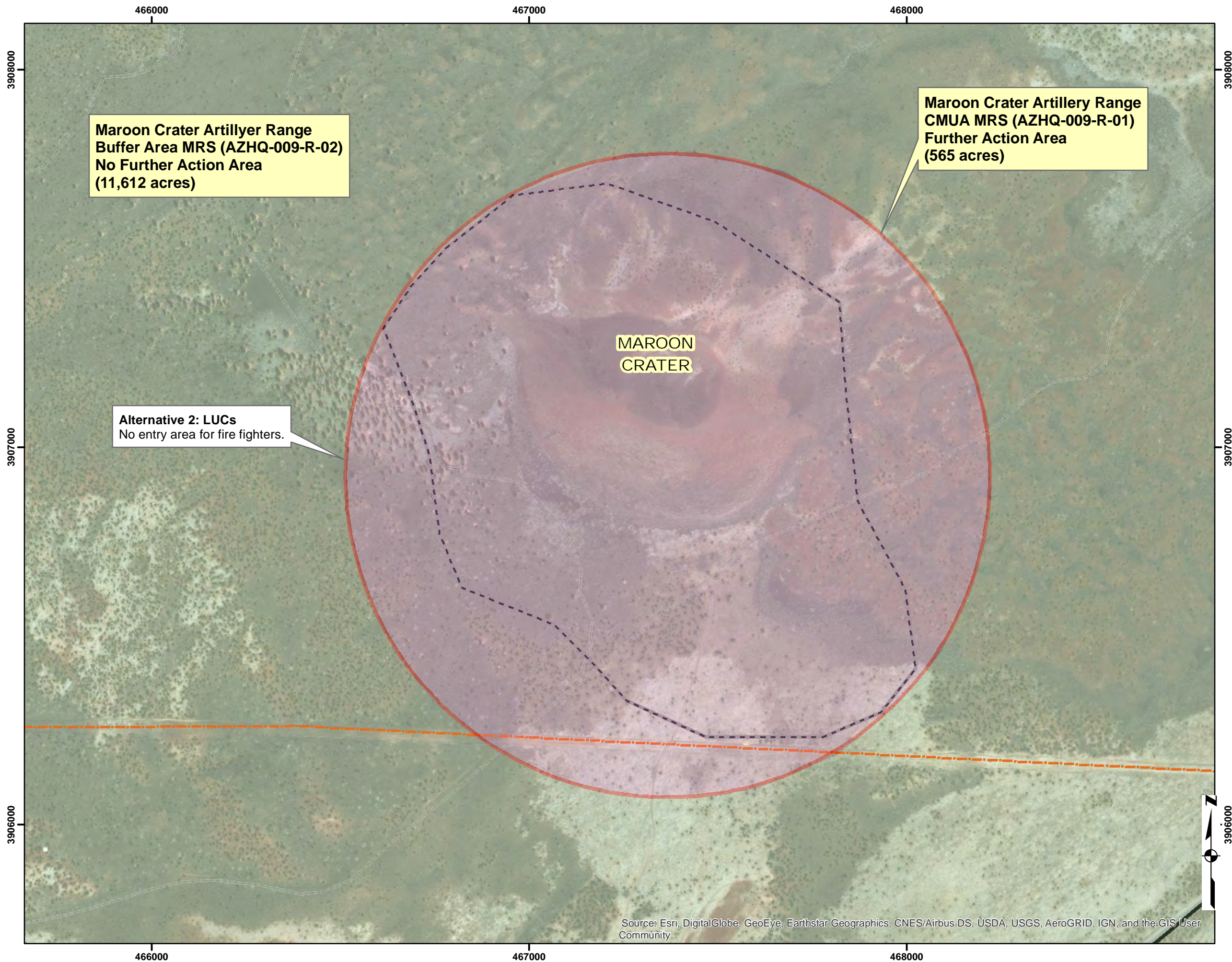


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Figure 2-11
DoD Military Munitions CSM



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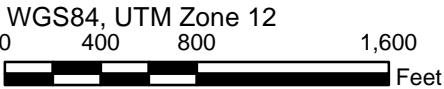


Legend

- Primary Road
- Secondary Road
- Pipeline
- Maroon Crater Artillery Range Buffer Area MRS (AZHQ-009-R-02) (11,612 acres)
- Maroon Crater Artillery Range CMUA MRS (AZHQ-009-R-01) Further Action Area (565 acres)
- Boundary - Target Area (353 acres)

Acronyms

- CMUA - Concentrated Munitions Use Area
- MRS - Munitions Response Site
- NDNODS - Non-Department of Defense, Non-Operational Defense Sites

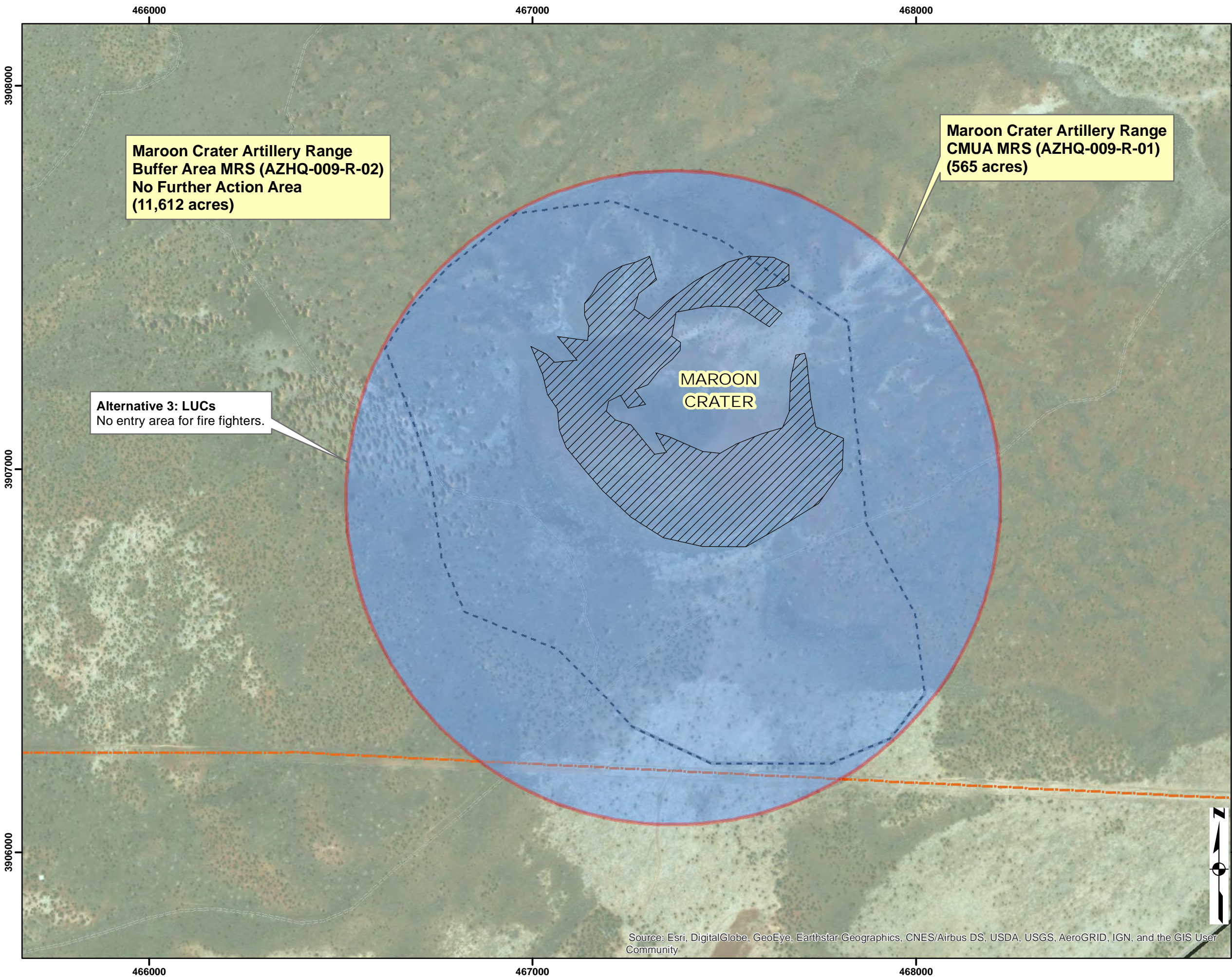


Alternative 2: Land Use Controls
NDNODS Maroon Crater
Artillery Range (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ



Figure 2-12

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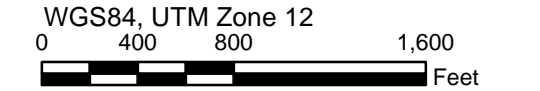


Legend

- Primary Road
- Secondary Road
- Pipeline
- Steep Slope Area (71 acres)
- Surface Clearance where Accessible (~494 of 565 acres)
- Boundary - Target Area
- Maroon Crater Artillery Range CMUA MRS (AZHQ-009-R-01) Further Action Area (565 acres)
- Maroon Crater Artillery Range Buffer Area MRS (AZHQ-009-R-02) (11,612 acres)

Acronyms

- CMUA - Concentrated Munitions Use Area
- LUC - Land Use Control
- MRS - Munitions Response Site
- NDNODS - Non-Department of Defense, Non-Operational Defense Sites



Alternative 3: LUCs and Surface Removal of Military Munitions
NDNODS Maroon Crater Artillery Range CMUA MRS (AZHQ-009-R-01)
Flagstaff, Coconino County, AZ



Figure 2-13

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3.0 RESPONSIVENESS SUMMARY

This section provides a summary of the public comments regarding the PP for NFA at the Maroon Crater Artillery Range Buffer Area MRS and LUCs and Surface and Subsurface (to 24-inches bgs) Removal of DoD Military Munitions using AGC Methods for the Maroon Crater Artillery Range CMUA MRS located in Coconino County, Arizona. From 17 December 2017 to 22 January 2018, ARNG held a 35-day public comment period to accept comments on the PP. No comments were received during the public comment period, and no request for a public meeting was made.

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

ADEQ provided written concurrence with the ROD for NFA at the Maroon Crater Artillery Range Buffer Area MRS and LUCs and Surface and Subsurface (to 24-inches bgs) Removal of DoD Military Munitions using AGC for the Maroon Crater Artillery Range CMUA MRS (**Appendix C**).

Written comments from ADEQ and USFS and responses are also provided in **Appendix C**.

3.2 TECHNICAL AND LEGAL ISSUES

The USFS identified the following technical or legal issues during their review of the ROD. They have requested that the following information be included in the ROD:

Forest Service Handbook 2309.12, Chapter 40.1 identifies that “NEPA [National Environmental Policy Act] analysis is considered unnecessary under CERCLA, though NEPA values, including cultural resources, must be integrated into the CERCLA process where feasible and appropriate.” Given the nature of this project with CERCLA determinations at the RI stage, a cultural resource survey identified 72 new archeological sites and 382 isolated occurrences and concluded that the undertaking receive a finding of No Adverse Effect.

ARNG, AZARNG, and USACE have been working with Arizona State Historic Preservation Officer (SHPO) on follow-up measures and will institute formal consultation when developing implementation plans with the potential to effect historic properties. This will likely include the development of a Programmatic Agreement (PA). The PA would contain stipulations that would be implemented in order to take into account the effect of the undertaking on historic properties, and would satisfy all responsibilities under Section 106 of the NHPA for the involved regulatory agencies. The USFS will be a signatory to the PA.

Section 106 of the NHPA requires Federal agencies to consider the potential effects of its actions on historic properties prior to approving the expenditure of federal funds on an undertaking. Historic properties include prehistoric or historic, architectural, or archaeological resources that are eligible for inclusion on the National Register of Historic Places (NRHP). Sites that are determined unevaluated for eligibility to the NRHP are to be treated as eligible until an eligibility is complete.

The NHPA provides comprehensive direction to Federal agencies to identify, evaluate, treat, protect, and manage historic properties. The NHPA expands the NRHP and it establishes the Advisory Council on Historic Preservation (ACHP) and SHPOs. Section 106 of the NHPA directs all Federal agencies to take into account effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. The ACHP's regulations (36 CFR §800) implement Section 106 of the NHPA.

4.0 REFERENCES

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USEPA, 2001. EPA 540-R-01-007, *Comprehensive Five-Year Review Guidance*. June.

U.S. Fish and Wildlife Service (USFWS). 2017. Species by County Report; County: Coconino County, Arizona. Accessed on 19 October 2017 via website: <https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=04005>

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WESTON, 2015. *Final Community Involvement Plan for Remedial Investigation/Feasibility Study, National Guard Bureau, Non-DoD, Non-Operational Defense Sites, Maroon Crater Artillery Range (AZHQ-009-R-01), Coconino County, Arizona*. December.

WESTON, 2017a. *Final Remedial Investigation Report, MMRP Munitions Response Services, National Guard Bureau, Non-Department of Defense Non-Operational Defense Sites, Remedial Investigation/Feasibility Study Program, Maroon Crater Artillery Range (AZHQ-009-R-01), Coconino County, Arizona*. June.

WESTON, 2017b. *Final Feasibility Study, MMRP Munitions Response Services, National Guard Bureau, Non-DoD Non-Operational Defense Sites, Remedial Investigation/Feasibility Study Program, Maroon Crater Artillery Range (AZHQ-009-R-01), Coconino County, Arizona*. September.

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APPENDIX A

ADMINISTRATIVE RECORD INDEX

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ADMINISTRATIVE RECORD FILE INDEX

Index Sorted by: Document Date

Originally Compiled: February 2018

Maroon Crater Artillery Range Munitions Response Site (MRS) Coconino County, Arizona

Title < Subject	Date	Author	Author Affiliation	Pages	Recipient	Document Type
State/Territory Inventory Report < The purpose of the Inventory Report was to collect specific information to develop an inventory of MRSs in Arizona and develop a draft Munitions Response Site Prioritization Protocol (MRSPP) for each MRS. The Inventory Report did not identify the Maroon Crater Artillery Range MRS.	Nov. – 2008	EA Engineering, Science, and Technology, Inc.	EA Engineering, Science, and Technology, Inc.	129	AZARNG ARNG USAEC USACE	Report
Historical Records Review (HRR)/Site Inspection (SI) Work Plan < The HRR conducted as part of the SI Work Plan was to further document historical and other known information for the Arizona MRSs, to supplement the information developed during the Inventory Report, and to address data gaps. During the HRR for the Fort Tuthill MRS, the Maroon Crater Artillery Range MRS was identified. Interviews were conducted and aerial photos were reviewed during the HRR for the Maroon Crater Artillery Range MRS.	Nov. – 2011	Weston Solutions, Inc.	Weston Solutions, Inc.	175	ARNG USACE	Report
SI Report < The purpose of the SI was to determine the presence or absence of military munitions and munitions constituents (MC) at the Arizona MRSs that may pose a threat to human health and the environment. Munitions debris was identified during the SI and it was recommended that the Maroon Crater Artillery Range MRS go forward in a Remedial Investigation (RI).	Oct. – 2012	Weston Solutions, Inc.	Weston Solutions, Inc.	271	ARNG USACE	Report
Community Involvement Plan (CIP) < The CIP describes methods for distributing public information and seeking community input regarding the Maroon Crater Artillery Range MRS.	Dec.-2015	Weston Solutions, Inc.	Weston Solutions, Inc.	122	ARNG USACE	Report
RI Work Plan < The RI Work Plan presented the technical approach for conducting field work for the RI. The purpose of the RI is to gather sufficient on-site data necessary to characterize the nature and extent of military munitions and MC at the Maroon Crater Artillery Range MRS.	May – 2016	Weston Solutions, Inc.	Weston Solutions, Inc.	1,256	USACE ARNG	Report

ADMINISTRATIVE RECORD FILE INDEX

Index Sorted by: Document Date

Originally Compiled: February 2018

Maroon Crater Artillery Range Munitions Response Site (MRS) Coconino County, Arizona

Title < Subject	Date	Author	Author Affiliation	Pages	Recipient	Document Type
RI Report < The purpose of the RI report was to present information gathered during the RI field work to determine the nature and extent of military munitions and MC at the Maroon Crater Artillery Range MRS. The RI recommended that the MRS should be converted to a Munitions Response Area (MRA) and be divided into two MRSs: the Maroon Crater Artillery Range Concentrated Munitions Use Area (CMUA) MRS and the Maroon Crater Artillery Range Buffer Area MRS. It recommended that the Maroon Crater Artillery Range CMUA MRS go forward in a Feasibility Study (FS) to address potential military munitions hazards at the site. No further action (NFA) was recommended for MC. For the Maroon Crater Artillery Range Buffer Area MRS, NFA was recommended for both military munitions and MC.	May-2017	Weston Solutions, Inc.	Weston Solutions, Inc.	342	USACE ARNG	Report
FS < The purposes of the FS is to determine the best approach to mitigate the explosive hazards that potentially remain at the Maroon Crater Artillery Range CMUA MRS by identifying and screening remedial technologies and process options, developing and screening alternatives, and performing a detailed comparative evaluation of the alternatives. The FS recommended Land Use Controls (LUCs) and a Surface and Subsurface Removal (to 24-Inches below Ground Surface [bgs]) Removal using Digital Geophysical Mapping (DGM)/Advanced Geophysical Classification (AGC) Methods. The FS recommended NFA for the Maroon Crater Artillery Range Buffer Area MRS.	Sep. – 2017	Weston Solutions, Inc.	Weston Solutions, Inc.	160	USACE ARNG	Report
Proposed Plan < The Proposed Plan presents the chosen action for the Maroon Crater Artillery Range CMUA MRS and the Maroon Crater Artillery Range Buffer Area MRS. The Proposed Plan recommended LUCs and Surface and Subsurface (to 24-Inches bgs) Removal of Military Munitions using DGM/AGC Methods for the Maroon Crater Artillery Range CMUA MRS and NFA for the Maroon Crater Artillery Range Buffer Area MRS.	Jan. – 2018	Weston Solutions, Inc.	Weston Solutions, Inc.	15	ARNG USACE	Report

APPENDIX B

DOCUMENTATION OF PUBLIC NOTICES

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AFFIDAVIT/PROOF OF PUBLICATION

STATE OF ARIZONA

County of Coconino

Bobbie Crosby being duly sworn deposes and says:

That she is the legal clerk of the Arizona Daily Sun

a newspaper published at Flagstaff, Coconino County, Arizona; that the

Legal 20752

a copy of which is

hereunto attached, was first published in said newspaper in its issue dated

the 17 day of December, 2017, and was

published in each one issue of said newspaper for one

consecutive day the last publication being in the issue dated the

17 day of December, 2017.



Subscribed and sworn to before me this

20th day of DECEMBER, 2017

VANIA FUNE

Notary Public

My Commission expires OCT. 30, 2021

Legal No. 20752
PUBLIC NOTICE
The Army National Guard Invites Your Comments on the Proposed Plan for the Maroon Crater Artillery Range Munitions Response Site, Coconino County, Arizona
As part of the Department of Defense's (DoD) Military Munitions Response Program (MMRP), the U.S. Army National Guard invites the public to review and comment on the proposed restoration plan and prioritization for the Maroon Crater Artillery Range Concentrated Munitions Use Area (CMUA) Munitions Response Site (MRS) and the Maroon Crater Artillery Range Buffer Area MRS located approximately 7 miles northeast of Flagstaff, Arizona in Coconino County. The sites are on land managed by the U.S. Forest Service. The Army is the lead agency responsible for environmental investigations and cleanup activities of these sites under the Comprehensive Environmental Response, Compensation, and Liability Act. The Arizona Department of Environmental Quality is a supporting agency in the decision making process.
The Proposed Plan for the Maroon Crater Artillery Range Buffer Area MRS (AZHQ-009-R-02) is to implement No Further Action. This plan was developed based on site investigations that indicated no munitions and explosives of concern (MEC), or munitions constituents, are present on this site. The Arizona Department of Environmental Quality concurs with the proposed plan of No Further Action for the site.
The Proposed Plan for the Maroon Crater Artillery Range CMUA MRS (AZHQ-009-R-01) is to implement a removal action (surface and subsurface) as well as to implement land use controls (internal monitoring for the U.S. Forest Service) to address the risks associated with a potential MEC hazard at the site. This plan was developed based on site investigations that indicated MEC associated with historical military training activities are potentially present at the site, resulting in a potential explosive hazard to human health which requires additional action. No munitions constituents were found to be present on this site. The Arizona Department of Environmental Quality concurs with the proposed plan of removal action and land use controls for the site.
MMRP sites are prioritized for response based on the potential risk posed to human health and the environment. An MRS assigned Priority 1 has the highest relative priority, while an MRS assigned Priority 8 has the lowest relative priority. Based on the explosive hazard evaluation, the Maroon Crater Artillery Range CMUA MRS has been prioritized as "Priority 3." The Maroon Crater Artillery Range Buffer Area MRS has been prioritized as "no longer required." The prioritization determinations were made in accordance with the DoD Munitions Response Site Prioritization Protocol, which focuses efforts on addressing sites with the highest risk potential, first, in order to efficiently and effectively expedite response actions and follow DoD policy.
We invite your questions and comments on the Proposed Plan and information supporting the development of the prioritization score during the public comment period from 17 December 2017 – 22 January 2018. The Maroon Crater Artillery Range Proposed Plan is available to the public at the following location: Cline Library, Special Collections and Archives, Northern Arizona University, 1001 S. Knolls Drive, Flagstaff, Arizona 86011, (928) 523-2173.
Written comments for the Maroon Crater Artillery Range MRS Proposed Plan should be postmarked and e-mailed no later than 22 January 2018 and sent to: LTC James Crowley
Cleanup Branch Chief (ARNG-JED)
111 South George Mason Drive
Arlington, VA 22204-1373
E-Mail: james.c.crowley.mil@mail.mil
General questions concerning the site should be directed to LTC Crowley at (703) 601-7785 or the addresses above.
The project team has not scheduled a public meeting regarding the Proposed Plan because of generally low interest in the project by area residents. Typically a public meeting for a Proposed Plan includes a presentation about the remedial alternatives, an explanation of why the proposed alternative is preferred, a time for questions and answers about the project, and an opportunity for members of the public to comment verbally and in writing on the Proposed Plan. If you would like to attend and participate in a public meeting for the Maroon Crater Artillery Range CMUA MRS and Maroon Crater Artillery Range Buffer Area MRS, the project team will coordinate the event. Please contact LTC Crowley at the above contact information by 22 January 2017 if you are interested in attending a public meeting for the Maroon Crater Artillery Range MRS.
For further information regarding U.S. Army MMRP efforts, visit <http://aec.army.mil/Services/Restore/MilitaryMunitionsResponseProgram.aspx>.
For information regarding the DoD's MMRP prioritization process, visit: www.denix.osd.mil/mmnp.
PUB: Dec. 17, 2017 20752

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APPENDIX C

STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

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Douglas A. Ducey
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY



Misael Cabrera
Director

VIA U.S. Mail and Email

July 24, 2018

FPU 19-016

Mr. James Lukasko
Project Manager
US Army Corps of Engineers
Sacramento District CESP-K-PM-H
1325 J Street
Sacramento, CA 95814

Re: Maroon Crater Artillery Range – ADEQ Review of Updated Response to Comments on the Stakeholder Draft Final Record of Decision, received on July 20, 2018

Dear Mr. Lukasko:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the above referenced updated response to comments and red-lined Final document. ADEQ finds the responses acceptable and concurs with the Final Record of Decision.

Should you have any questions regarding this correspondence, please do not hesitate to contact me at (602) 771-0361 or harker.karin@azdeq.gov.

Sincerely,

Karin Harker
Project Manager
Federal Projects Unit
Waste Programs Division, ADEQ

Cc: John Haines, Army National Guard (via email)
Kim Birdsall, Arizona Department of Emergency and Military Affairs (via email)
Tim Trego, Weston Solutions, Inc. (via email)
Tom Bourque, UXO Pro, Inc. (via email)

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From: Mollet, Debra L -FS [mailto:dmollet@fs.fed.us]
Sent: Friday, July 6, 2018 12:09 PM
To: Trego, Tim <Tim.Trego@WestonSolutions.com>; Karin L. Harker <Harker.Karin@azdeq.gov>
Cc: Ann Howard <ahoward@azstateparks.gov>; john.b.haines.ctr@mail.mil; Lukasko, James J CIV USARMY CESPCK (US) <James.J.Lukasko@usace.army.mil>; Birdsall, Kim <Kim.Birdsall@fmo.azdema.gov>; Lugo (Kapelanczyk), Lara <Lara.Kapelanczyk@WestonSolutions.com>
Subject: RE: Maroon Crater Artillery Range MRS Stakeholder Draft Record of Decision (ROD) Response to Comments

Apologies Tim – I was out of the country for a while and I am just getting through my emails. I have reviewed the documents – thank you for addressing our comments. The blank line on the spreadsheet was a mistake, so there are no responses missing.

Debra

From: Trego, Tim [mailto:Tim.Trego@WestonSolutions.com]
Sent: Thursday, June 14, 2018 7:56 AM
To: Karin L. Harker <Harker.Karin@azdeq.gov>; Mollet, Debra L -FS <dmollet@fs.fed.us>
Cc: Ann Howard <ahoward@azstateparks.gov>; john.b.haines.ctr@mail.mil; Lukasko, James J CIV USARMY CESPCK (US) <James.J.Lukasko@usace.army.mil>; Birdsall, Kim <Kim.Birdsall@fmo.azdema.gov>; Trego, Tim <Tim.Trego@WestonSolutions.com>; Lugo (Kapelanczyk), Lara <Lara.Kapelanczyk@WestonSolutions.com>
Subject: Maroon Crater Artillery Range MRS Stakeholder Draft Record of Decision (ROD) Response to Comments

Karin and Debra,

Good morning.

Attached are the response to comments and associated redlined document regarding the Maroon Crater Stakeholder Draft ROD for your review and approval.

I would greatly appreciate your approval or additional questions on or before 28 June 2018.

Let me know if you have any questions regarding this submission.

Take care,

Timothy A. Trego, P.E. | Senior Project Manager



Weston Solutions, Inc.

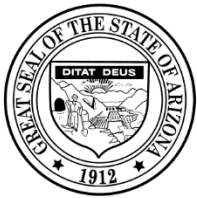
1435 Garrison Street, Suite 100

Lakewood, CO 80215

Office: (303) 729-6107 Internal Ext. 1107

Cell: (210) 606-7441

Fax: (303) 729-6101



Douglas A. Ducey
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY



Misael Cabrera
Director

VIA U.S. Mail and Email

May 4, 2018
FPU 18-223

Mr. James Lukasko
Project Manager
US Army Corps of Engineers
Sacramento District CESP-K-PM-H
1325 J Street
Sacramento, CA 95814

Re: Maroon Crater Artillery Range – ADEQ Review of Stakeholder Draft Final Record of Decision, received March 15, 2018

Dear Mr. Lukasko:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the above referenced document and provides the following comments:

General Comments

1. ADEQ concurs with the Record of Decision's selection of Remedial Alternative 4B to use a combination of surface and subsurface clearance, along with Land Use Controls (LUCs) and follow-up Five Year Reviews to provide a greater degree of protectiveness to human health and welfare, and the environment.
2. In compliance with Applicable or Relevant and Appropriate Requirements (ARARs), it would seem relevant to add the following ARARs or To Be Considered to the Record of Decision (ROD):
 - Arizona Soil Remediation Standards (AAC R18-7-201 et seq.). It's assumed that a phased sampling approach would also be applicable to any detonation or DoD military munitions encountered exhibiting a release during the Subsurface Clearance of Alternative 4B even if no munitions items have been encountered thus far but may still be feasible.
 - Solid Waste Disposal Act, as amended (42 USC 6901 et seq); 40 CFR 261.24, Toxicity Characteristics). A waste must be evaluated to determine whether it is a hazardous waste (i.e., either a listed waste or a characteristic waste). A characteristic waste is determined by its (1) ignitability, (2) corrosivity, (3) reactivity or (4) toxicity, as determined by EPA toxicity characteristic leaching procedure (TCLP).

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- Clean Air Act, National Ambient Air Quality Standards (NAAQS, 40 CFR Part 50). Establishes primary and secondary NAAQS for ambient air quality to protect public health and welfare, and the environment. Applicable to alternatives that have the potential to impact ambient air quality.
 - Hazardous Substance Release Response (40 CFR Part 300). Establishes requirements for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. Applicable to preparing for and responding to site contaminants (i.e., MEC).
 - USEPA Regional Screening Levels. Establishes benchmark concentrations at which no unacceptable human health risks would be expected. To be considered following detonation of MEC onsite to verify no residual MC is left in place.
 - USACE Technical Guidance for Military Munitions Response Actions: EM 200-1-15. Provides technical guidance for executing the technical aspects of military munitions response actions. To be considered during munitions response projects.
3. The remedy does not identify if the removal action will include step outs for MEC/MD found along the site border. A step out contingency plan should be included in the ROD in the event MEC is found along the border that would result in potential reassessment of the NFA area with notification provided to ADEQ.
 4. Please add additional clarification in the text to Alternative 4B stating that DGM and AGM will also be utilized as a part of the clearance.
 5. Please add more detail regarding what recreational activities is expected. As an example, are there any dirt bike, 4 wheel drive or ATV trails may cause the exposure of subsurface MEC deeper than 24 inches due to ruts caused by the tires within the site area. If this is the case then the Army should consider adding annual inspections to the LUCs for all off road trails to ensure that recreational activities are not intrusively below the clearance depth in these areas.
 6. As indicative of Alternative 2 that correlates to Alternative 4B, implementation of LUCs will consist of educational controls for the USFS to include internal monitoring, such as updating internal maps with the Maroon Crater Artillery Range CMUA boundary for the USFS to protect fire fighters from working on fires within the Maroon Crater Artillery Range CMUA MRS where MEC may still be present. In addition to the above, please clarify the following:
 - a. If any other institutional controls are included in the LUCs such as restricting intrusive activities, signage and fencing around uncleared areas, periodic inspections in between the 5-year reviews to verify conditions of the site, identify any concerns such as erosion, migration of MEC from uncleared areas, etc. In addition, construction workers are considered a receptor at the site and a pipeline is noted transecting the southern portion of the site. ADEQ is concerned that there are no LUCs to address the potential of intrusive construction, pipeline maintenance activities and that hunters and hikers will not be aware or informed of the hazards associated with the areas not cleared.
 - b. While LUCs would restrict fire fighters from entering this area, could there still be an explosive hazard beyond the boundary that would require a hazard fragmentation buffer as part of the LUCs in the event of a fire?

Specific Comments

1. Lines 5-6, Page 2-3, Section 2.4. ADEQ suggests adding more justification to support this statement such as "No additional response actions ~~will be~~ *is deemed necessary at this time* for the Maroon Crater Artillery Range Buffer Area MRS *based on the lack of findings during the investigations in this area.*
2. Line 11, Page 2-3, Section 2.4. Please add *and welfare* after human health for consistency.
3. Page 2-7, Section 2.5.7. Please clarify if Arizona Game and Fish was in addition consulted for threatened and endangered species for the project area and add a discussion to the ROD.
4. Lines 21-42, Page 2-11, Section 2.6.3. Please add a table showing for reference the soil sampling conducted at the site for support (Refer to General Comment #2).
5. Line 2, Page 2-26. Please delete 4A as a selected remedy.
6. Line 13, Page 2-13 and Figure 2-5. There appears to be an inconsistency in the text with the reported steep terrain degree slope. Please revise accordingly on the determined degree slope (25 versus 30). The Feasibility Study references a 30 degree slope.
7. Figure 2-11. Please add all receptors as identified in Section 2.7 to the CSM in addition to biota. The potential leaching of MEC constituents should also be added as a potential path from MEC in subsurface in the CSM.
8. Appendix C, Munitions and Explosive of Concern Hazard Assessment page. Please delete this page.

ADEQ respectfully requests response to comment submittals be accompanied with a red-lined version of the document for review. Should you have any questions or consider a clarification meeting necessary regarding this correspondence, please do not hesitate to contact me at (602) 771-0361 or harker.karin@azdeq.gov.

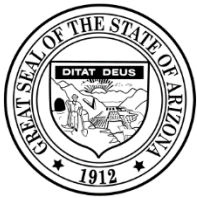
Sincerely,



Karin Harker
Project Manager
Federal Projects Unit
Waste Programs Division, ADEQ

Cc: John Haines, Army National Guard (via email)
Kim Birdsall, Arizona Department of Emergency and Military Affairs (via email)
Tim Trego, Weston Solutions, Inc. (via email)

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Douglas A. Ducey
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY



Misael Cabrera
Director

VIA U.S. Mail and Email

June 29, 2018

FPU 18-272

Mr. James Lukasko
Project Manager
US Army Corps of Engineers
Sacramento District CESP-K-PM-H
1325 J Street
Sacramento, CA 95814

Re: Maroon Crater Artillery Range – ADEQ Review of Response to Comments on the Stakeholder Draft Final Record of Decision, received June 14, 2018

Dear Mr. Lukasko:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the above referenced document and generally finds the responses acceptable except for the following:

General Comments

3. The remedy does not identify if the removal action will include step outs for MEC/MD found along the site border. A step out contingency plan should be included in the ROD in the event MEC is found along the border that would result in potential reassessment of the NFA area with notification provided to ADEQ.

Response: Non-concur

Respectfully, Step-Outs were included in the Remedial Investigation (RI) field effort to define the nature and extent of munitions. During the RI field effort, the area of concern was defined and conservatively delineated such that Step-Outs will not be required as part of the Removal Action effort. No munitions are expected outside of this delineated area.

ADEQ Supplement Comment:

Please add the section within the RI Report that discusses the step-out placement and result of transects or grids. While this may not be anticipated the contingency plan would account for any potential reassessment along the border in the event this was to occur.

5. Please add more detail regarding what recreational activities is expected. As an example, are there any dirt bike, 4 wheel drive or ATV trails may cause the exposure of subsurface MEC deeper than 24 inches due to ruts caused by the tires within the site area. If this is the case then

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the Army should consider adding annual inspections to the LUCs for all off road trails to ensure that recreational activities are not intrusively below the clearance depth in these areas.

Response: Concur

The following paragraph has been added to Section 2.8:

Recreational use may include all-terrain vehicles (ATVs), utility terrain vehicles (UTVs), dirt bikes, hiking, horse-back riding, camping, scenic driving, and bicycling. Recreational use is not anticipated to impact the site below 24-inches bgs and the remedy will address from zero (0) to 24-inches bgs.

ADEQ Supplement Comment:

The response is partially acceptable. Please see below general supplement comment #6. While recreational use may not be anticipated please clarify how this will be verified. ADEQ continues to recommend the Army consider annual inspections.

6. As indicative of Alternative 2 that correlates to Alternative 4B, implementation of LUCs will consist of educational controls for the USFS to include internal monitoring, such as updating internal maps with the Maroon Crater Artillery Range CMUA boundary for the USFS to protect fire fighters from working on fires within the Maroon Crater Artillery Range CMUA MRS where MEC may still be present. In addition to the above, please clarify the following:
 - a. If any other institutional controls are included in the LUCs such as restricting intrusive activities, signage and fencing around uncleared areas, periodic inspections in between the 5-year reviews to verify conditions of the site, identify any concerns such as erosion, migration of MEC from uncleared areas, etc. In addition, construction workers are considered a receptor at the site and a pipeline is noted transecting the southern portion of the site. ADEQ is concerned that there are no LUCs to address the potential of intrusive construction, pipeline maintenance activities and that hunters and hikers will not be aware or informed of the hazards associated with the areas not cleared.
 - b. While LUCs would restrict fire fighters from entering this area, could there still be an explosive hazard beyond the boundary that would require a hazard fragmentation buffer as part of the LUCs in the event of a fire?

Response: Concur

Once the removal action has been implemented, MEC may remain in inaccessible areas of the site. Inaccessible areas of the site include those areas on slopes greater than 25% (~71 acres).

(a) The Site's LUCs include educational controls (preventing fire fighters from accessing the area) and Five-Year Reviews. These LUCs are considered sufficient to be protective of human health and welfare and the environment. The accessible areas will have been cleared of MEC to 24-inches bgs or investigated to determine that MEC is not present in the upper 24-inches. Therefore, no additional LUCs are considered necessary or appropriate.

(b) Implemented LUCs will include designation of a buffer area to ensure an adequate safety margin in the event of an explosion in the inaccessible areas.

ADEQ Supplement Comment:

The response does not fully address the comment. Please explain how the LUCs are protective of pipeline maintenance activities, the eventual maintenance or inspections of the pipeline are likely to occur. This could be addressed by requiring an UXO escort for all pipeline activities and if intrusive activities are to take place then construction support could be required. The inaccessible areas have been identified as 25 degree slopes and greater. How will recreational users and trespassers be kept out of these areas that did not undergo a removal action? LUCs should address these site users. Signage at a minimum should be placed at a frequency around these areas to ensure the site users are informed of the explosive hazard present. Since signage is the most cost effective means to inform site users, annual inspections should be included in the remedy to inspect and maintain the signs.

Should you have any questions or consider a clarification meeting necessary regarding this correspondence, please do not hesitate to contact me at (602) 771-0361 or harker.karin@azdeq.gov.

Sincerely,



Karin Harker
Project Manager
Federal Projects Unit
Waste Programs Division, ADEQ

Cc: John Haines, Army National Guard (via email)
Kim Birdsall, Arizona Department of Emergency and Military Affairs (via email)
Tim Trego, Weston Solutions, Inc. (via email)

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Comments for the Stakeholder Draft Record of Decision MMRP Munitions Response Services Army National Guard Bureau Maroon Crater Artillery Range (AZHQ-009-R-01), Arizona Contract No.: W912DR-09-D-0006 Delivery Order No. 0011							
Comment Number	Commenter	Page(s)	Section	Line(s)	Comment	Response Code	Response
TECHNICAL COMMENTS							
1	AH				None comments received.		
EDITORIAL COMMENTS							
1	AH				No comments received.		
COMMENTS PROVIDED BY							
Initials	Name	Department/Organization			Email Address		Phone
AH	Ann Howard	AZ SHPO			ahoward@azstateparks.gov		602-542-7138

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Comments for the
Stakeholder Draft Record of Decision
MMRP Munitions Response Services
Army National Guard Bureau
Maroon Crater Artillery Range (AZHQ-009-R-01), Arizona
Contract No.: W912DR-09-D-0006
Delivery Order No. 0011

Comment Number	Commenter	Page(s)	Section	Line(s)	Comment	Response Code	Response
TECHNICAL COMMENTS							
1	USFS	Entire Document			<p>Would you be open to adding the following language to the ROD (location to be determined; maybe 2-27?). I think it solves our concerns on how things are worded around archaeology (this would be in replacement to what was sent before).</p> <p>Forest Service Handbook 2309.12, Chapter 40.1 identifies that "NEPA analysis is considered unnecessary under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), though NEPA values, including cultural resources, must be integrated into the CERCLA process where feasible and appropriate." Given the nature of this project with CERCLA determinations at the Remedial Investigation stage, At the (XX) phase, a cultural resource survey identified 72 cultural resources. Through consultation with the AZ SHPO, (XX) sites were determined to be historic properties, having a determination of (XXX No Adverse Effect?). (I am not sure this was done).</p> <p>XXX has been working with Arizona State Historic Preservation Officer (SHPO) on follow-up measures and will institute formal consultation when developing implementation plans with the potential to effect historic properties.</p> <p>This will likely include the development of a Programmatic Agreement (PA). The PA would contains stipulations that would be implemented in order to take into account the effect of the undertaking on historic properties, and would satisfy all responsibilities under Section 106 of the National Historic Preservation Act (NHPA) for the involved regulatory agencies. The Forest Service will be a signatory to the PA.</p> <p>National Historic Preservation Act of 1966 - Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to consider the potential effects of its actions on historic properties prior to approving the expenditure of federal funds on an undertaking. Historic properties include prehistoric or historic, architectural, or archaeological resources that are eligible for inclusion on the National Register of Historic Places (NRHP). Sites that are determined unevaluated for eligibility to the National Register of Historic Places are to be treated as eligible until an eligibility is complete.</p> <p>The NHPA provides comprehensive direction to Federal agencies to identify, evaluate, treat, protect, and manage historic properties. The NHPA expands the NRHP and it establishes the Advisory Council on Historic Preservation (ACHP) and SHPOs. Section 106 of the NHPA directs all Federal agencies to take into account effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. The ACHP's regulations (36 CFR §800) implement Section 106 of the NHPA.</p>	Concur	<p>The text, with some minor edits for clarity/acronyms has been added to section 3.2 (Page 3-2 ,Lines 15-35 and Page 3-3, Lines: 1-6)</p> <p>The USFS identified the following technical or legal issues during their review of the ROD. They have requested that the following information be included in the ROD:</p> <p>Forest Service Handbook 2309.12, Chapter 40.1 identifies that "NEPA [National Environmental Policy Act] analysis is considered unnecessary under CERCLA, though NEPA values, including cultural resources, must be integrated into the CERCLA process where feasible and appropriate." Given the nature of this project with CERCLA determinations at the RI stage, a cultural resource survey identified 72 new archeological sites and 382 isolated occurrences and concluded that the undertaking receive a finding of No Adverse Effect.</p> <p>ARNG, AZARNG, and USACE have been working with Arizona State Historic Preservation Officer (SHPO) on follow-up measures and will institute formal consultation when developing implementation plans with the potential to effect historic properties. This will likely include the development of a Programmatic Agreement (PA). The PA would contains stipulations that would be implemented in order to take into account the effect of the undertaking on historic properties, and would satisfy all responsibilities under Section 106 of the NHPA for the involved regulatory agencies. The USFS will be a signatory to the PA.</p> <p>Section 106 of the NHPA requires Federal agencies to consider the potential effects of its actions on historic properties prior to approving the expenditure of federal funds on an undertaking. Historic properties include prehistoric or historic, architectural, or archaeological resources that are eligible for inclusion on the National Register of Historic Places (NRHP). Sites that are determined unevaluated for eligibility to the NRHP are to be treated as eligible until an eligibility is complete.</p> <p>The NHPA provides comprehensive direction to Federal agencies to identify, evaluate, treat, protect, and manage historic properties. The NHPA expands the NRHP and it establishes the Advisory Council on Historic Preservation (ACHP) and SHPOs. Section 106 of the NHPA directs all Federal agencies to take into account effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. The ACHP's regulations (36 CFR §800) implement Section 106 of the NHPA.</p>
2	USFS	p.				Please clarify	Is there a comment that was to be inserted here?
3	USFS	p. 2-27		3-8	Lines 4-5 say no historical or cultural resources have been identified. Line 8 says cultural resources HAVE been found. An archaeological survey was done by Cornerstone Environmental Consultants and a report on their findings produced. It indicates there are at least 81 archaeological sites, 4 features, 177 scatters, and 201 isolated artifacts.	Concur	The text has been revised to indicate that historical and cultural resources have been identified at the MRS (Section 3.2, Page 3-1, Lines 21-22).
4	USFS	p. 2-27		4-5	NHPAA also includes places of traditional importance to Native Americans - "Traditional Cultural Properties". The document does not cite consultations it has made with the tribes to learn if there are TCP's present. We do have one copy of a letter from the Hopi Tribe to Col. Ladd requesting consultation on any activity that has the potential to adversely affect prehistoric sites. We do not know if Col. Ladd's letter requested information about potential TCP's or not. It would be good to mention this consultation in the ROD to clarify interactions with the tribes.	Non-Concur	Respectfully, we do not think it is appropriate to put stakeholder correspondence in the ROD. Copies of the ROD will be provided to stakeholders who have previously expressed an interest in site activities.

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Comment Number	Commenter	Page(s)	Section	Line(s)	Comment	Response Code	Response
5	USFS	2-20		26-38	This indicates the project will be in full compliance with NHPA, and this is generally documented through consultation with the State Historic Preservation Office (SHPO). This process focuses on two major decision points: If sites are present, do they meet the criteria of eligibility of the National Register and, if so, what is the effect the project will have on them. From documentation we have, there is no evidence that eligibility determinations have been made as of yet, so it is assumed that it will be completed as part of the Programmatic Agreement. Without at least some determinations of eligibility, a determination of effect cannot be made. Suggestion is reference the language presented in this section as the process followed for the RI and insert that a programmatic agreement will be developed to achieve NHPA compliance prior to implementation of the selected alternative.	Concur	The following sentence has been added to section 2.11.3 (Page 2-21, lines 40-41): "To prevent the disturbance of any archeological items that may be present on the MRS, methods similar to those used during the RI field work would be implemented. This includes full compliance with the National Historic Preservation Act (NHPA) and the Archeological Resources Protection Act (ARPA) and a four (4)-hour awareness training for UXO Technicians and other field personnel to help them identify prehistoric and historic artifacts and avoid significant cultural resources as they clear the MRS. This would also include an archeological survey of the staging area and monitoring of UXO Technicians and field personnel as they conduct their work. An archaeologist would be required to accompany each UXO Team, if more than one (1) UXO Team is onsite. An archeological report would also be provided at the end of the field work. <i>This is the process that was followed during the RI and a programmatic agreement will be developed to achieve NHPA compliance prior to implementation of the selected alternative.</i> "
5	USFS	2-21		14-25	This indicates the project will be in full compliance with NHPA, and this is generally documented through consultation with the State Historic Preservation Office (SHPO). This process focuses on two major decision points: If sites are present, do they meet the criteria of eligibility of the National Register and, if so, what is the effect the project will have on them. From documentation we have, there is no evidence that eligibility determinations have been made as of yet, so it is assumed that it will be completed as part of the Programmatic Agreement. Without at least some determinations of eligibility, a determination of effect cannot be made. Suggestion is reference the language presented in this section as the process followed for the RI and insert that a programmatic agreement will be developed to achieve NHPA compliance prior to implementation of the selected alternative.		The following sentence has been added to section 2.11.4 (Page 2-23, Lines 9-11): "To prevent the disturbance of any archeological items that may be present on the MRS, methods similar to those used during the RI field work would be implemented. This includes full compliance with the National Historic Preservation Act (NHPA) and the Archeological Resources Protection Act (ARPA) and a four (4)-hour awareness training for UXO Technicians and other field personnel to help them identify prehistoric and historic artifacts and avoid significant cultural resources as they clear the MRS. This would also include an archeological survey of the staging area and monitoring of UXO Technicians and field personnel as they conduct their work. An archaeologist would be required to accompany each UXO Team, if more than one (1) UXO Team is onsite. An archeological report would also be provided at the end of the field work. <i>This is the process that was followed during the RI and a programmatic agreement will be developed to achieve NHPA compliance prior to implementation of the selected alternative.</i> "
EDITORIAL COMMENTS							
6	USFS	2-27		5	Clarification on Incorrect terminology. "Historical resources " ARE cultural resources. There are a number of different cultural resources, prehistoric, historic, tribal, etc.	Concur	The text has been revised as follows (Section 2.15.2.2, Page: 2-29, Lines 18 and 22) <input type="checkbox"/> 16 USC 470 – National Historic Preservation Act of 1966, as amended – Requires protection of cultural resources (including prehistoric, historical, tribal, etc.) to the maximum extent practicable. Cultural resources have been identified at the MRS. <input type="checkbox"/> 16 USC 470aa-470mm, Public Law 96-95 and amendments) – Archaeological Resources Protection Act of 1979 – ARPA regulates the preservation of cultural resources (including prehistoric, historical, tribal, etc.). Cultural resources have been found on the MRS.
7	USFS	2-27		4,5,and 8	These two sentences seem contradictory.	Concur	See response to comment #6.
					END		
COMMENTS PROVIDED BY							
Initials	Name	Department/Organizati	Email Address				Phone
USFS	Debra Mollet	USFS	dmollet@fs.fed.us				928-527-8214

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GENERAL COMMENTS									
1	KH	-	-	-	1. ADEQ concurs with the Record of Decision's selection of Remedial Alternative 4B to use a combination of surface and subsurface clearance, along with Land Use Controls (LUCs) and follow-up Five Year Reviews to provide a greater degree of protectiveness to human health and welfare, and the environment.	Concur	Comment noted.	None	NA
2	KH				2. In compliance with Applicable or Relevant and Appropriate Requirements (ARARs), it would seem relevant to add the following ARARs or To Be Considered to the Record of Decision (ROD): <ul style="list-style-type: none">• Arizona Soil Remediation Standards (AAC R18-7-201 et seq.). It's assumed that a phased sampling approach would also be applicable to any detonation or DoD military munitions encountered exhibiting a release during the Subsurface Clearance of Alternative 4B even if no munitions items have been encountered thus far but may still be feasible.• Solid Waste Disposal Act, as amended (42 USC 6901et seq); 40 CFR 261.24, Toxicity Characteristics). A waste must be evaluated to determine whether it is a hazardous waste (i.e., either a listed waste or a characteristic waste). A characteristic waste is determined by its (1) ignitability, (2) corrosivity, (3) reactivity or (4) toxicity, as determined by EPA toxicity characteristic leaching procedure (TCLP).• Clean Air Act, National Ambient Air Quality Standards (NAAQS, 40 CFR Part 50). Establishes primary and secondary NAAQS for ambient air quality to protect public health and welfare, and the environment. Applicable to alternatives that have the potential to impact ambient air quality.• Hazardous Substance Release Response (40 CFR Part 300). Establishes requirements for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. Applicable to preparing for and responding to site contaminants (i.e., MEC).• USEPA Regional Screening Levels. Establishes benchmark concentrations at which no unacceptable human health risks would be expected. To be considered following detonation of MEC onsite to verify no residual MC is left in place.• USACE Technical Guidance for Military Munitions Response Actions: EM 200-1-15. Provides technical guidance for executing the technical aspects of military munitions response actions. To be considered during munitions response projects.	Concur	The ARARs/TBCs have been added to Section 2.15.2 (Pages 2-28 to 2-30)	None	NA
3	KH				3. The remedy does not identify if the removal action will include step outs for MEC/MD found along the site border. A step out contingency plan should be included in the ROD in the event MEC is found along the border that would result in potential reassessment of the NFA area with notification provided to ADEQ.	Non-concur	Respectfully, Step-Outs were included in the Remedial Investigation (RI) field effort to define the nature and extent of munitions. During the RI field effort, the area of concern was defined and conservatively delineated such that Step-Outs will not be required as part of the Removal Action effort. No munitions are expected outside of this delineated area.	Please add the section within the RI Report that discusses the step-out placement and result of transects or grids. While this may not be anticipated the contingency plan would account for any potential reassessment along the border in the event this was to occur.	<p>The results of the RI are included in Section 2.6.4 that describe the nature and extent of MEC/MD. The following text has also been added to Section 2.6.4.1 regarding step-out transects in the RI:</p> <p><i>4. Step-out transects were considered if DoD military munitions items or MD items were found along the MRS boundary. Additional transect segments would be added, spaced consistently with the outlying transect as those in the main path and extending 30-feet behind and ahead of the MD item. No Step-out transects were required during the RI investigation as no DoD military munitions or MD items were encountered near the MRS boundary.</i></p> <p>Additionally, the following text was added to Section 2.6.4.4:</p> <p><i>No DoD military munitions items are expected to be encountered outside of the MRS based on the results of the RI investigation; however, should an item or items be encountered, it will be addressed by ARNG.</i></p>

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Comment Number	Commenter	Page(s)	Section	Line(s)	Comment	Response Code	Response	ADEQ Back check Comment	Response
4	KH				4. Please add additional clarification in the text to Alternative 4B stating that DGM and AGM will also be utilized as a part of the clearance.	Concur	Additional text regarding DGM and AGC has been added to Section 2.11.4 as requested. (Page 2-22, Lines 21-41).	None	NA
5	KH				5. Please add more detail regarding what recreational activities is expected. As an example, are there any dirt bike, 4 wheel drive or ATV trails may cause the exposure of subsurface MEC deeper than 24 inches due to ruts caused by the tires within the site area. If this is the case then the Army should consider adding annual inspections to the LUCs for all off road trails to ensure that recreational activities are not intrusively below the clearance depth in these areas.	Concur	<p>The following paragraph has been added to Section 2.8:</p> <p>Recreational use may include all-terrain vehicles (ATVs), utility terrain vehicles (UTVs), dirt bikes, hiking, horse-back riding, camping, scenic driving, and bicycling. Recreational use is not anticipated to impact the site below 24-inches bgs and the remedy will address from zero (0) to 24-inches bgs.</p>	<p>The response is partially acceptable. Please see below general supplement comment #6. While recreational use may not be anticipated please clarify how this will be verified. ADEQ continues to recommend the Army consider annual inspections.</p>	<p>The following text has been added to Section 2.11.2:</p> <p><i>In addition, periodic informal inspections between Five-Year Reviews in consultation with USFS, will be performed to ensure site conditions have not changed. Legal controls in the form of construction support (UXO escort) during pipeline maintenance will be required to protect pipeline workers. Engineering controls, in the form of signs, will be placed along road access points to inform recreational users and site visitors of potential hazards in the area. A Signage Plan will also be included in the Removal Action Work Plan.</i></p> <p>ADEQ will receive and be provided the opportunity to review and comment on the Removal Action Work Plan.</p>
6	KH				<p>6. As indicative of Alternative 2 that correlates to Alternative 4B, implementation of LUCs will consist of educational controls for the USFS to include internal monitoring, such as updating internal maps with the Maroon Crater Artillery Range CMUA boundary for the USFS to protect fire fighters from working on fires within the Maroon Crater Artillery Range CMUA MRS where MEC may still be present. In addition to the above, please clarify the following:</p> <p>a. If any other institutional controls are included in the LUCs such as restricting intrusive activities, signage and fencing around uncleared areas, periodic inspections in between the 5-year reviews to verify conditions of the site, identify any concerns such as erosion, migration of MEC from uncleared areas, etc. In addition, construction workers are considered a receptor at the site and a pipeline is noted transecting the southern portion of the site. ADEQ is concerned that there are no LUCs to address the potential of intrusive construction, pipeline maintenance activities and that hunters and hikers will not be aware or informed of the hazards associated with the areas not cleared.</p> <p>b. While LUCs would restrict fire fighters from entering this area, could there still be an explosive hazard beyond the boundary that would require a hazard fragmentation buffer as part of the LUCs in the event of a fire?</p>	Concur	<p>Once the removal action has been implemented, MEC may remain in inaccessible areas of the site. Inaccessible areas of the site include those areas on slopes greater than 25% (~71 acres).</p> <p>(a) the Site's LUCs include educational controls (preventing fire fighters from accessing the area) and Five-Year Reviews. These LUCs are considered sufficient to to be protective of human health and welfare and the environment. The accessible areas will have been cleared of MEC to 24-inches bgs or investigated to determine that MEC is not present in the upper 24-inches. Therefore, no additional LUCs are considered necessary or appropriate.</p> <p>(b) Implemented LUCs will include designation of a buffer area to ensure an adequate safety margin in the event of an explosion in the inaccessible areas.</p>	<p>The response does not fully address the comment. Please explain how the LUCs are protective of pipeline maintenance activities, the eventual maintenance or inspections of the pipeline are likely to occur. This could be addressed by requiring an UXO escort for all pipeline activities and if intrusive activities are to take place then construction support could be required. The inaccessible areas have been identified as 25 degree slopes and greater. How will recreational users and trespassers be kept out of these areas that did not undergo a removal action? LUCs should address these site users. Signage at a minimum should be placed at a frequency around these areas to ensure the site users are informed of the explosive hazard present. Since signage is the most cost effective means to inform site users, annual inspections should be included in the remedy to inspect and maintain the signs.</p>	See response to Comment #5.
SPECIFIC COMMENTS									
1	KH	2-3	2.4	5-6	1. Lines 5-6, Page 2-3, Section 2.4. ADEQ suggests adding more justification to support this statement such as "No additional response actions will be is deemed necessary at this time for the Maroon Crater Artillery Range Buffer Area MRS based on the lack of findings during the investigations in this area.	Concur	The text has been revised as requested. (Section 2.4, Page 2-3, Lines 3-5).	None	NA
2	KH	2-3	2.4	11	2. Line 11, Page 2-3, Section 2.4. Please add and welfare after human health for consistency.	Concur	The text has been revised as requested. (Section 2.4, Page 2-3, Line 10)	None	NA

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3	KH	2-7	2.5.7		3. Page 2-7, Section 2.5.7. Please clarify if Arizona Game and Fish was in addition consulted for threatened and endangered species for the project area and add a discussion to the ROD.	Non-concur/ Concur	Databases and documents regarding threatened and endangered animal species were consulted for the RI. No additional text regarding this has been added to the ROD. However, text has been added to the ends of Sections 2.11.3 (Page 2-22, Lines 1-2) and 2.11.4 (Page 2-23, Lines 12-13) stating that as part of the Removal Action effort, additional consultation regarding threatened and endangered species will be conducted.	None	NA
4	KH	2-11	2.6.3	21-42	4. Lines 21-42, Page 2-11, Section 2.6.3. Please add a table showing for reference the soil sampling conducted at the site for support (Refer to General Comment #2).	Concur	A table of samples collected during the SI and rationale has been added to Section 2.6.3 _(Page 2-12).	None	NA
5	KH	2-26		2	5. Line 2, Page 2-26. Please delete 4A as a selected remedy.	Concur	The text has been revised as requested (Section 2.15.1, Page 2-28, Line 2).	None	NA
6	KH	2-13		13	6. Line 13, Page 2-13 and Figure 2-5. There appears to be an inconsistency in the text with the reported steep terrain degree slope. Please revise accordingly on the determined degree slope (25 versus 30). The Feasibility Study references a 30 degree slope.	Concur	To clarify, the RI used a 30-degree slope as the slope at which it is considered too dangerous to traverse for field crew members. Discussions of the alternatives in the FS use a 25-degree slope as conversations with personnel who were in the field during the RI indicated that a 25-degree slope was more appropriate and recommended it for the FS and ROD, which is why it is included. All discussion of 30-degree slopes refers only to the field work completed during the RI. A couple sentences explaining this have been added to Sections 2.11.3 (Page 2-21, Lines 24-26) and 2.11.4 (Page 2-22, Lines 14-16).	None	NA
7	KH				7. Figure 2-11. Please add all receptors as identified in Section 2.7 to the CSM in addition to biota. The potential leaching of MEC constituents should also be added as a potential path from MEC in subsurface in the CSM.	Non-concur/ Concur	The receptors identified in Section 2.7 have been added to the CSM (Figure 2-11). Biota has not been added to the CSM as a receptor because in accordance with EM-200-1-15 ecological receptors are not evaluated for MEC. MC is not included in the CSM because the potential risk posed by MC was evaluated during the RI. The RI did not identify MC as a potential source.	None	NA
8	KH				8. Appendix C, Munitions and Explosive of Concern Hazard Assessment page. Please delete this page	Clarification needed	We are unclear as to what this comment refers to as Appendix C for the ROD is a placeholder for stakeholder comments and lead agency responses/concurrence letters. Please note that the appendix title has been revised to reflect this.	None	NA
COMMENTS PROVIDED BY									
Initials	Name	Department/Organization	Email Address				Phone		
KH	Karin Harker	ADEQ	harker.karin@azdeq.gov				602-771-0361		

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