

Remedial Investigation Findings at the former Camp Croft, South Carolina FUDS No. I04SC001603

US Army Corps of Engineers – CESAS/CESAW/CESAC

US Army Engineering and Support Center, Huntsville

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US Army Corps of Engineers
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Agenda

- Info Repository – Spartanburg Library
 - ▶ 151 S. Church Street (Kennedy Room)
 - ▶ Hard copy and DVD of RI Report available
- Legal Framework and Stakeholders
- Remedial Investigation (RI)
 - ▶ Purpose and Objective
 - ▶ Summary and Findings
- Questions

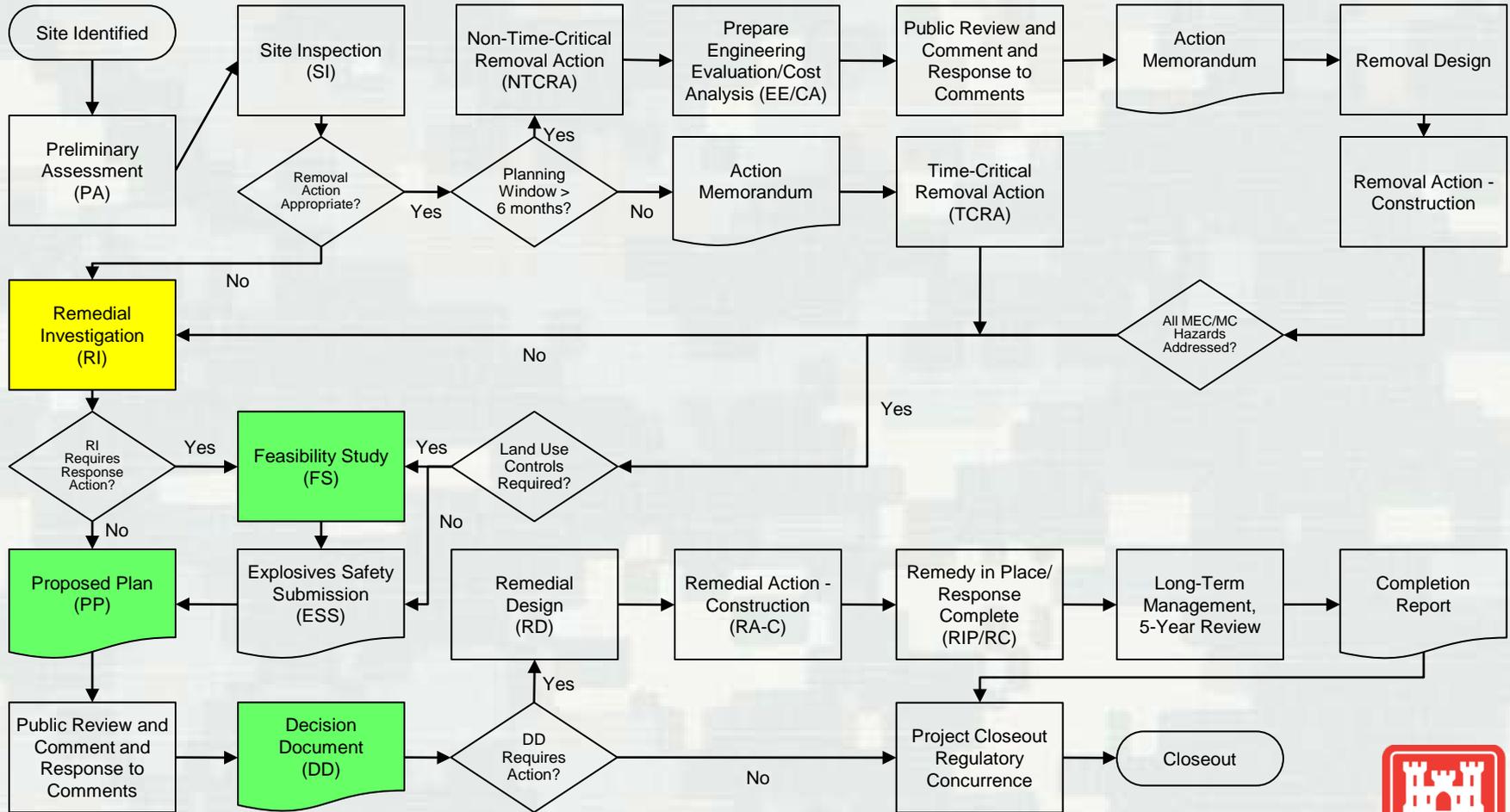


Acronyms and Abbreviations

AIR	Analog Instrument Reconnaissance	MEC	Munitions and Explosives of Concern
AoPI	Area of Potential Interest	MRS	Munitions Response Site
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	MRSPP	Munitions Response Site Prioritization Protocol
COPC	Chemical of Potential Concern	NFA	No Further Action
DGM	Digital Geophysical Mapping	OOU	Ordnance Operable Unit
DMM	Discarded Military Munitions	PWS	Performance Work Statement
FS	Feasibility Study	RI	Remedial Investigation
HE	High Explosive	SCDHEC	South Carolina Department of Health & Environmental Control
MC	Munitions Constituents	UXO	Unexploded Ordnance
MD	Munitions Debris	XRF	X-Ray Fluorescence



CERCLA Process



Stakeholder Involvement

- Stakeholders provide input throughout the CERCLA process
 - ▶ SC DHEC has actively participated in planning work and reviewing documents
 - ▶ Restoration Advisory Board has met consistently to monitor progress
 - ▶ Planning and reporting documents are provided to public at Information Repository
 - ▶ Public Open House in November 2011



Purpose and Objective

- Remedial Investigation (RI):
 - ▶ Purpose: Characterize the nature and extent of **risks** posed by uncontrolled MEC/MC impacts due to historical Department of Defense usage.
 - ▶ Objective: Gather information sufficient to support an informed risk management decision regarding potential remedial alternatives.



Investigation Basics

- Two primary “munitions” categories
 - ▶ Solid metallic material (potential MEC)
 - Digital data vs. Analog data
 - Intrusive investigation
 - ▶ Chemicals (MC)
 - Media sampling (soil, sediment, water)
 - Laboratory analysis
 - Explosives and metals



Investigation Basics

- Munitions and Explosives of Concern (MEC) is defined as:

- ▶ Unexploded ordnance (UXO)

- *10 U.S.C. 101(e)(5)*

- ▶ Discarded military munitions (DMM)

- *10 U.S.C. 2710(e)(2)*

- ▶ Munitions constituents (MC) – at conc. high enough to pose an explosive hazard (10%)

- *10 U.S.C. 2710(e)(3)*



Investigation Basics

- Munitions Debris (MD)
 - ▶ Remnants of munitions remaining after use, demilitarization, or disposal
 - Fragments
 - Penetrators
 - Projectiles
 - Casings
 - Links
 - Fins



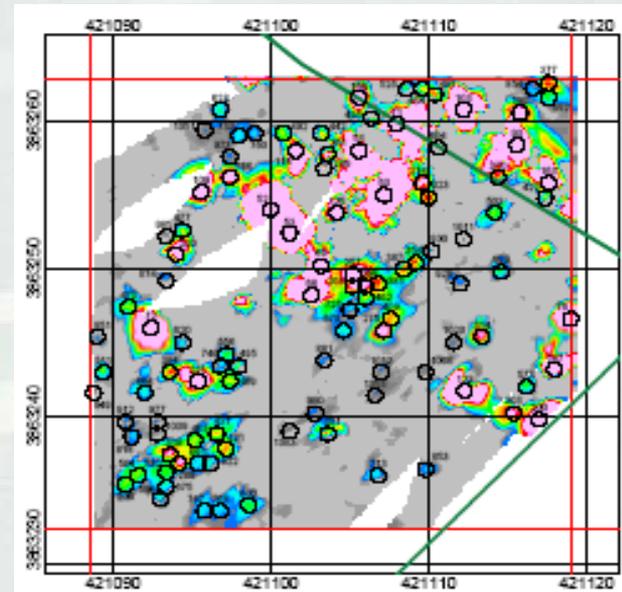
Investigation Basics

- Primary MEC investigative methods
 - ▶ **DGM** - Digital Geophysical Mapping
 - Transects at appropriate spacing
 - 100% Grid coverage
 - ▶ **AIR** - Analog Instrument-assisted Reconnaissance, usually along transects
 - ▶ **Mag-and-Dig** - Analog Instrument-assisted Intrusive Investigation
 - Transects at appropriate spacing
 - 100% Grid coverage



Investigation Basics

- Digital Geophysical Mapping (DGM)
 - ▶ Data are digitally recorded and analyzed
 - ▶ Selected anomalies intrusively investigated



Investigation Basics

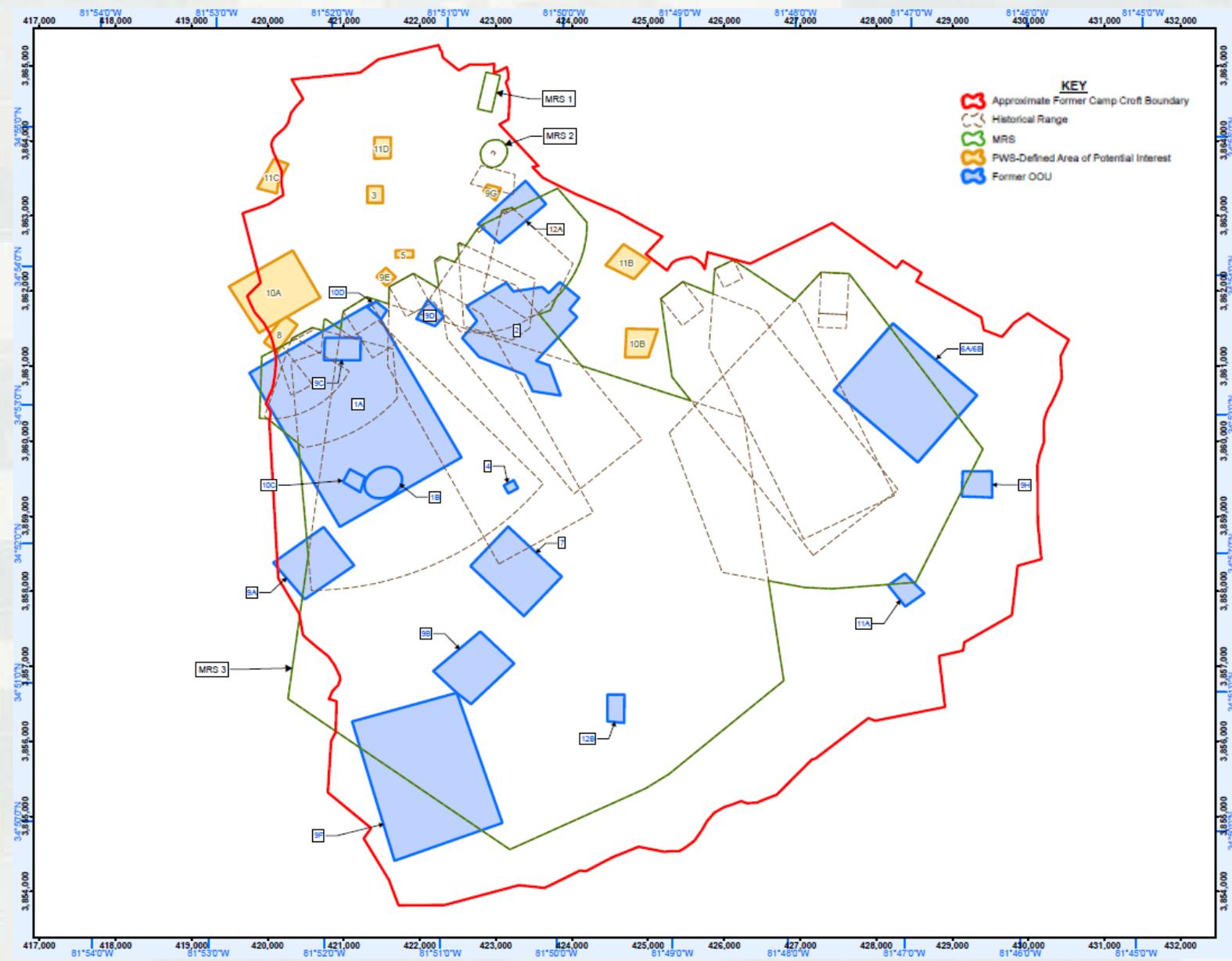
- Analog Instrument-assisted surveys
 - ▶ Audible signal indicates anomaly
 - ▶ AIR – anomalies are only counted
 - ▶ Mag-and-Dig – anomalies are intrusively investigated.



Investigation Basics

- Our approach generally followed;
 - ▶ Transects set at various spacings
 - AIR - anomaly distribution and surface MEC type
 - Mag-and-Dig - anomaly distribution and MEC type
 - ▶ Grids placed in high, medium, and low anomaly distribution areas
 - Mag-and-Dig grids at AIR transects
 - DGM grids at Mag-and-Dig transects
 - ▶ MC samples from areas with high anomaly distribution concentrations



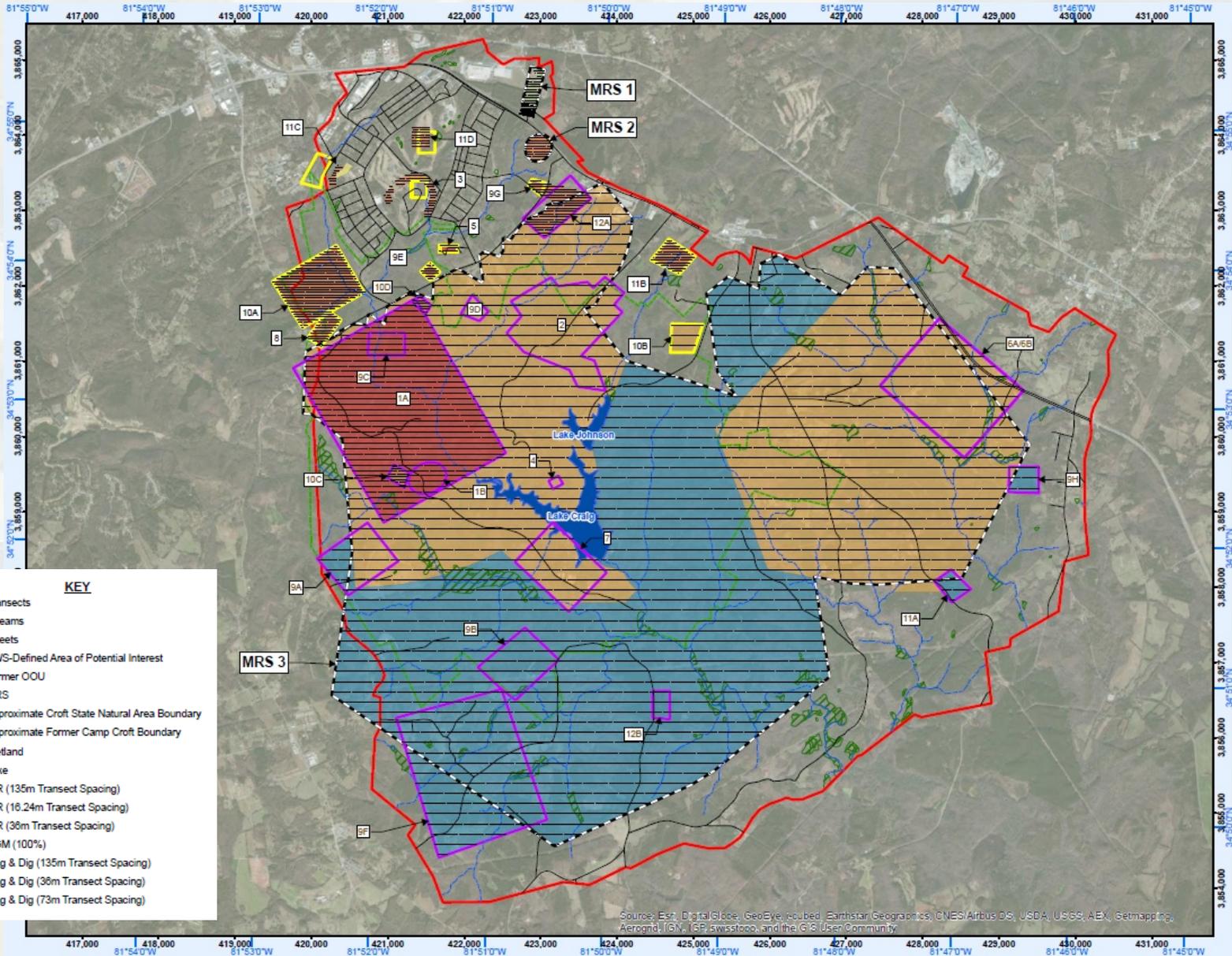


- KEY**
-  Approximate Former Camp Croft Boundary
 -  Historical Range
 -  MRS
 -  PWS-Defined Area of Potential Interest
 -  Former OOU

Planned Investigation



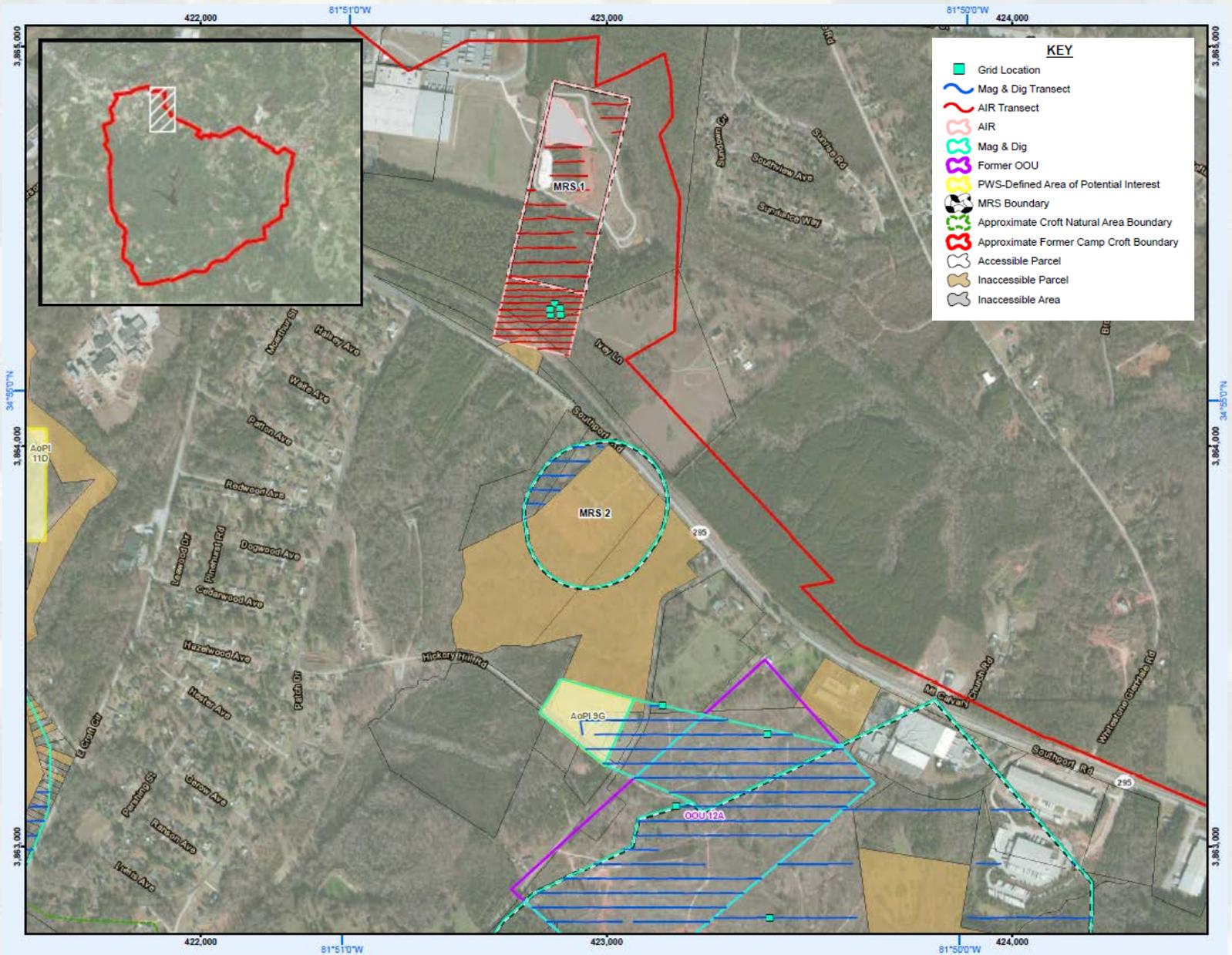
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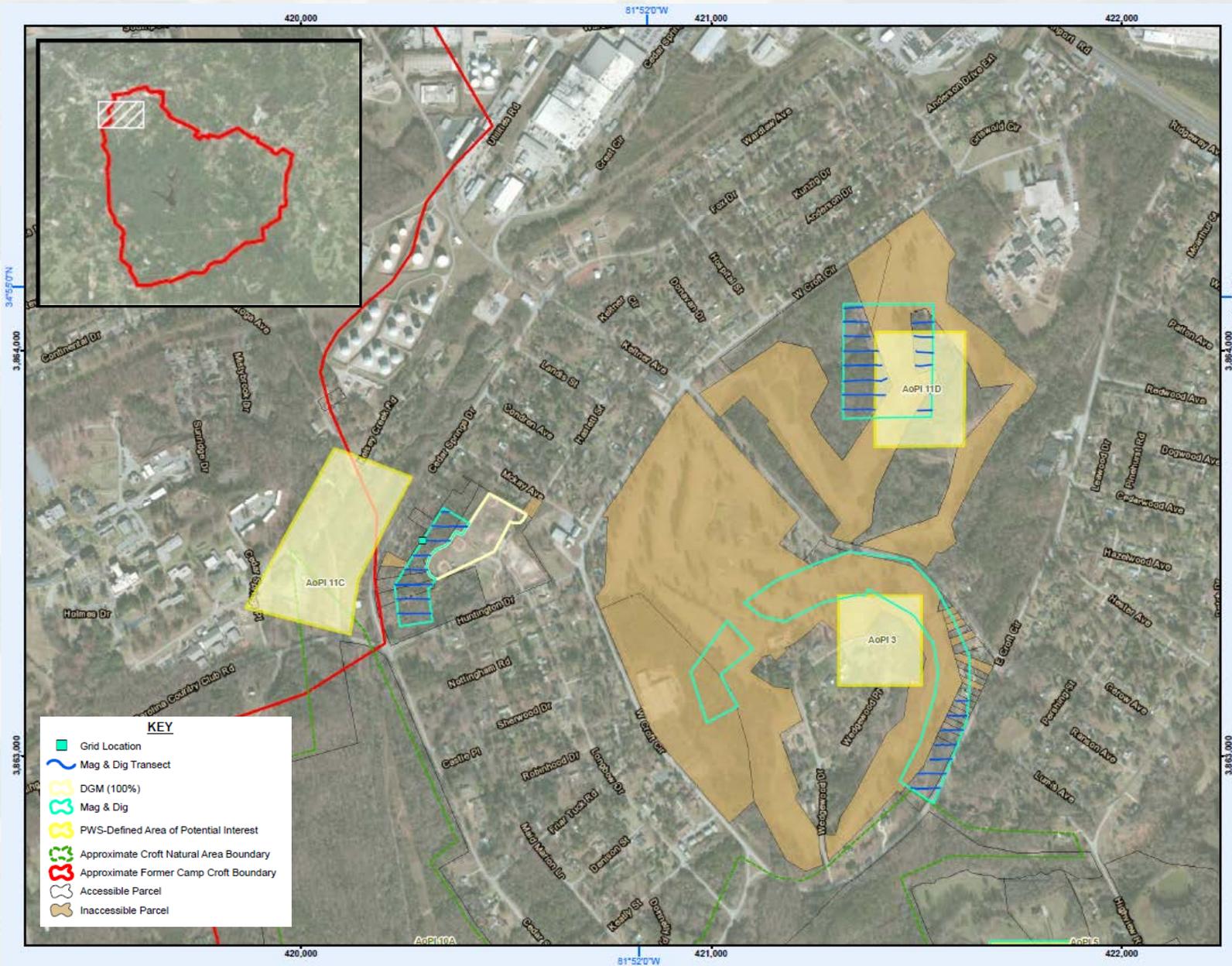


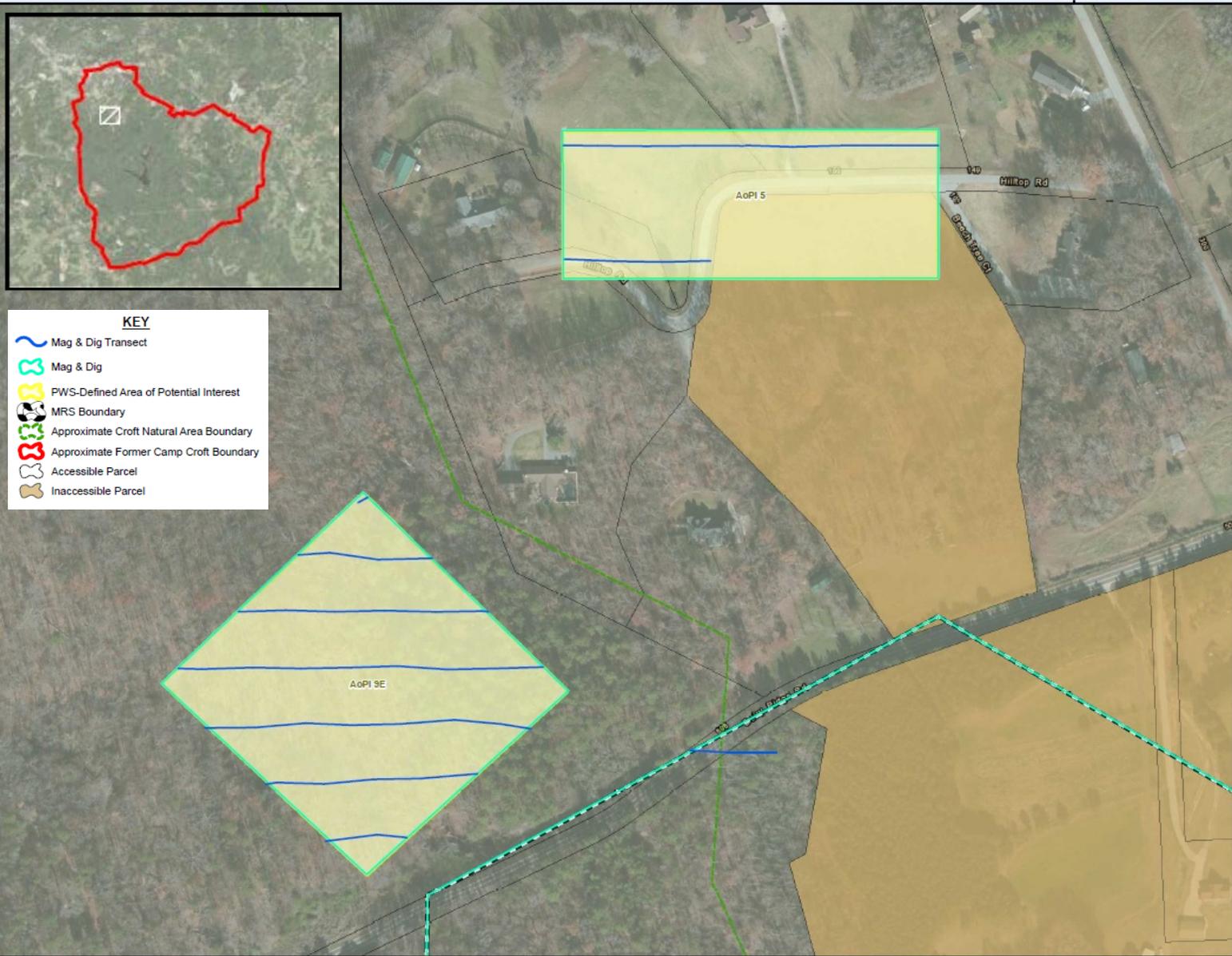
Investigation Coverage



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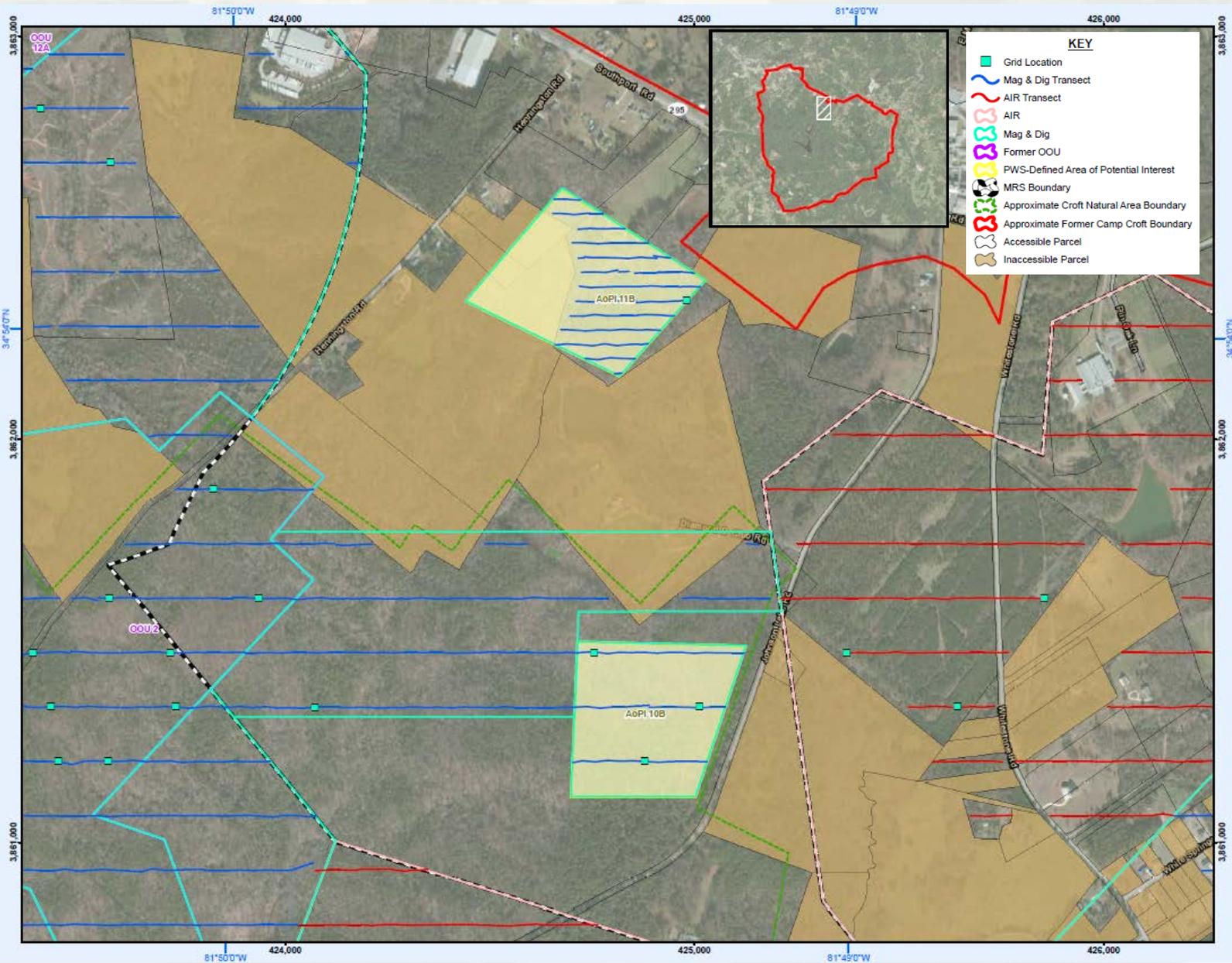
KEY

- Mag & Dig Transect
- Mag & Dig
- PWS-Defined Area of Potential Interest
- MRS Boundary
- Approximate Croft Natural Area Boundary
- Approximate Former Camp Croft Boundary
- Accessible Parcel
- Inaccessible Parcel

34°54'0"N

34°54'0"N

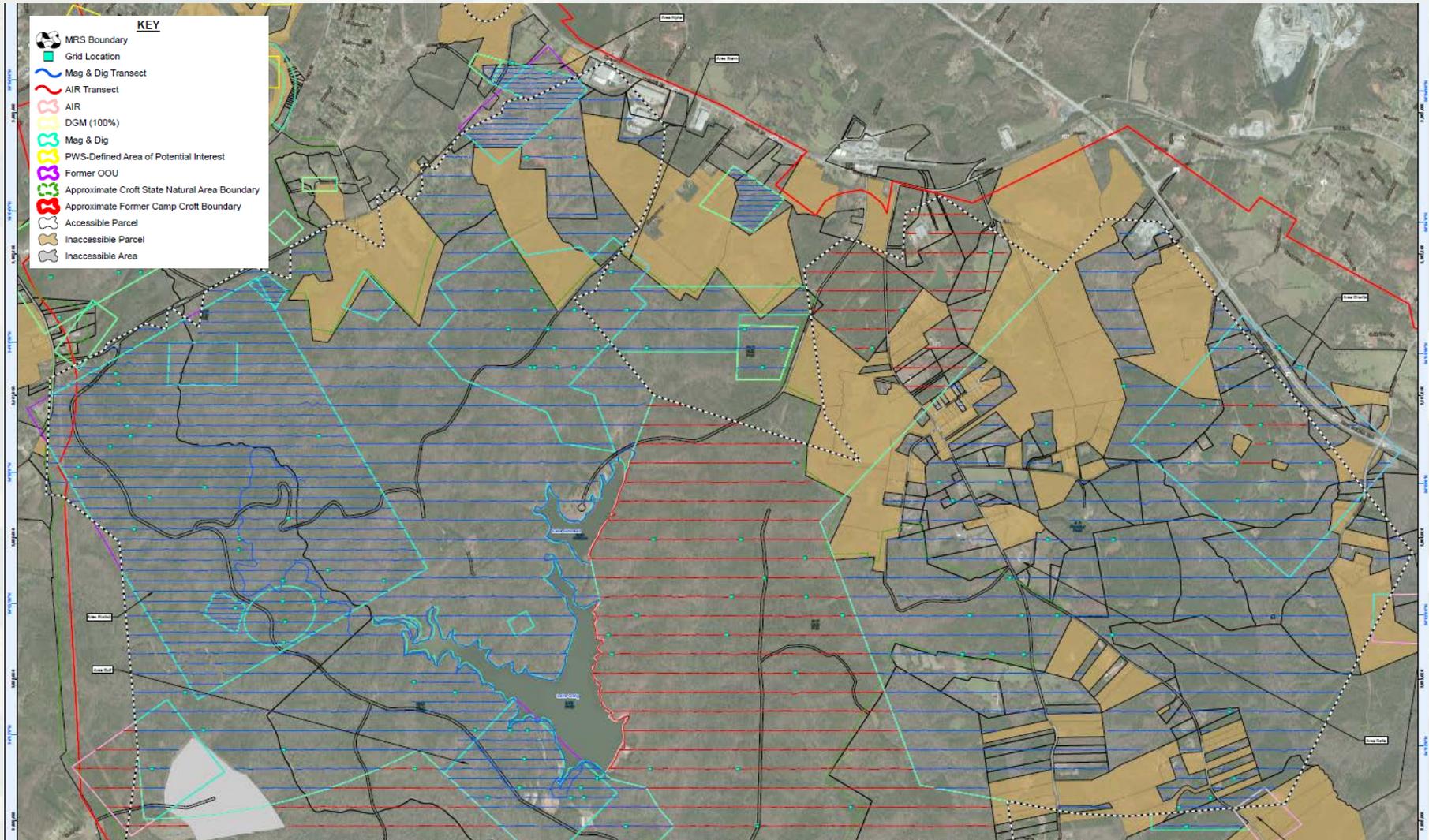


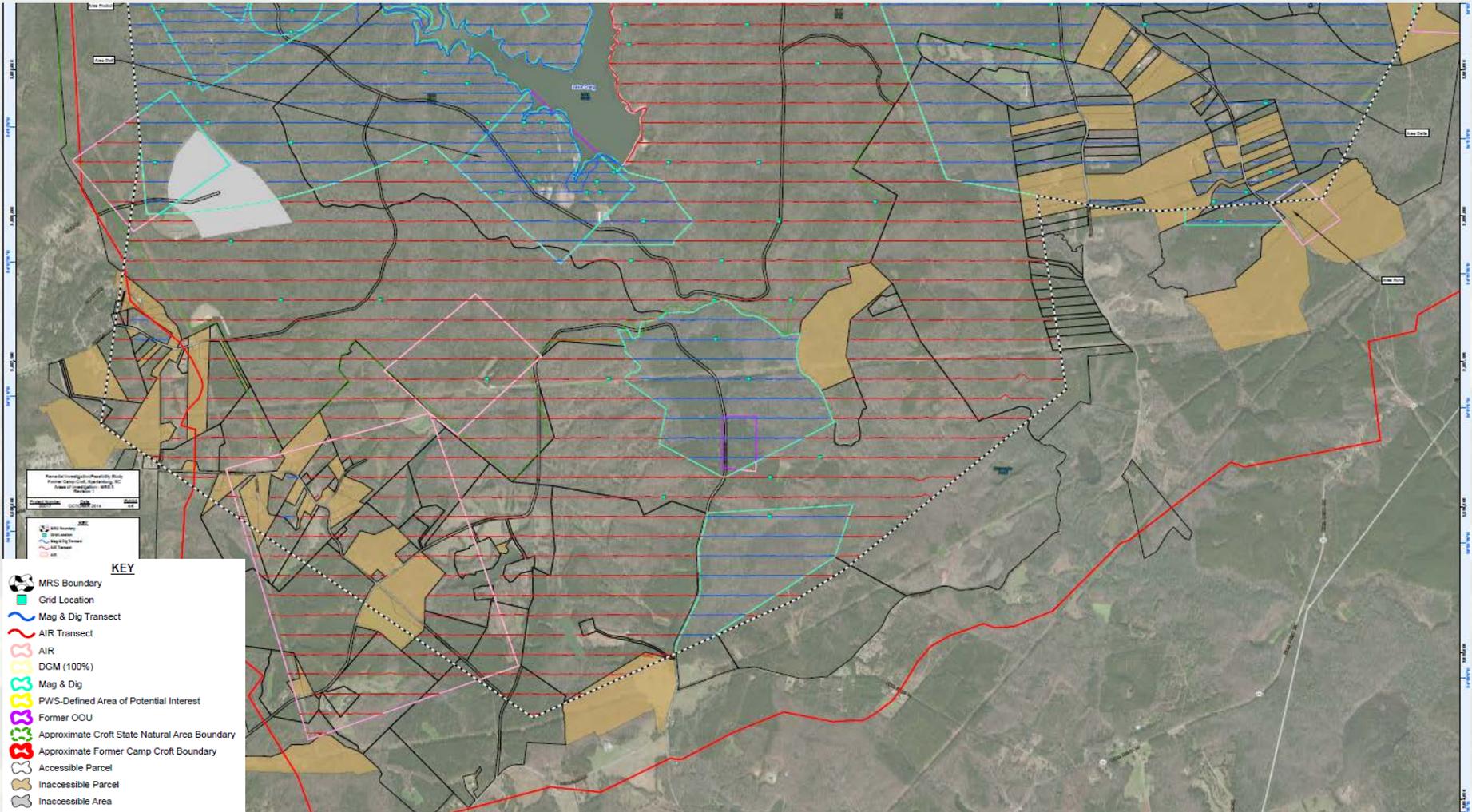


KEY

- Grid Location
- Mag & Dig Transect
- AIR Transect
- AIR
- Mag & Dig
- Former OOU
- PWS-Defined Area of Potential Interest
- MRS Boundary
- Approximate Croft Natural Area Boundary
- Approximate Former Camp Croft Boundary
- Accessible Parcel
- Inaccessible Parcel







Field Photographs



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Anomaly Reacquisition



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Various "Practice" MD

37mm/57mm
projectiles



60mm mortar

tail fins

grenades

.50 caliber



60mm HE Mortar (UXO)



®

MKII Hand Grenade (UXO)



2.36" Rocket (UXO)



Investigation Findings Summary

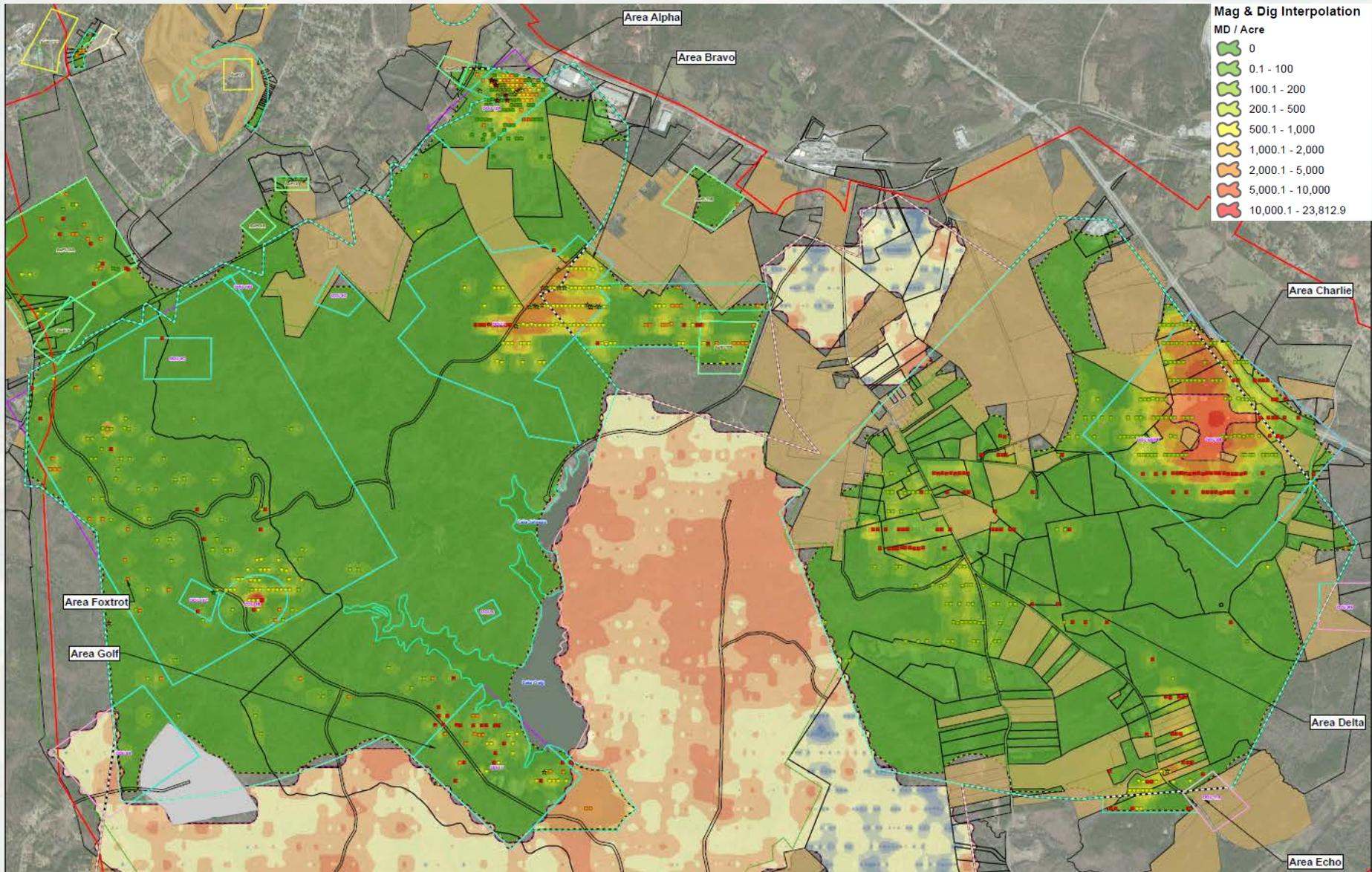


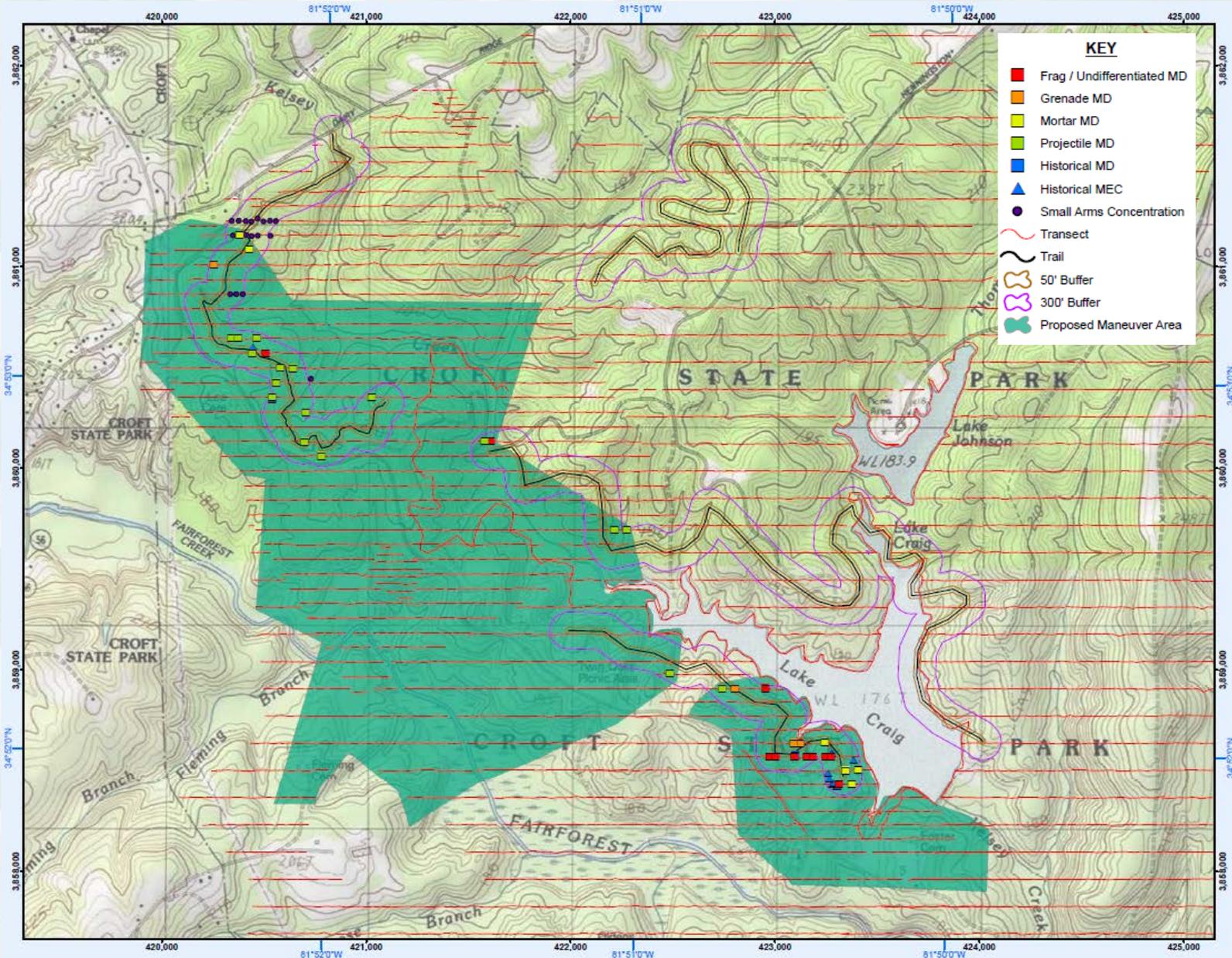
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Site-wide Observations

- Eight areas – MEC and/or very high MD concentrations
 - ▶ 39 UXO, 1 DMM, >2,000 lbs. of MD
 - ▶ Directly accessible to humans
- Large areas – small arms / minimal MD
 - ▶ North central Croft State Park
 - ▶ Southern portion of former Camp Croft



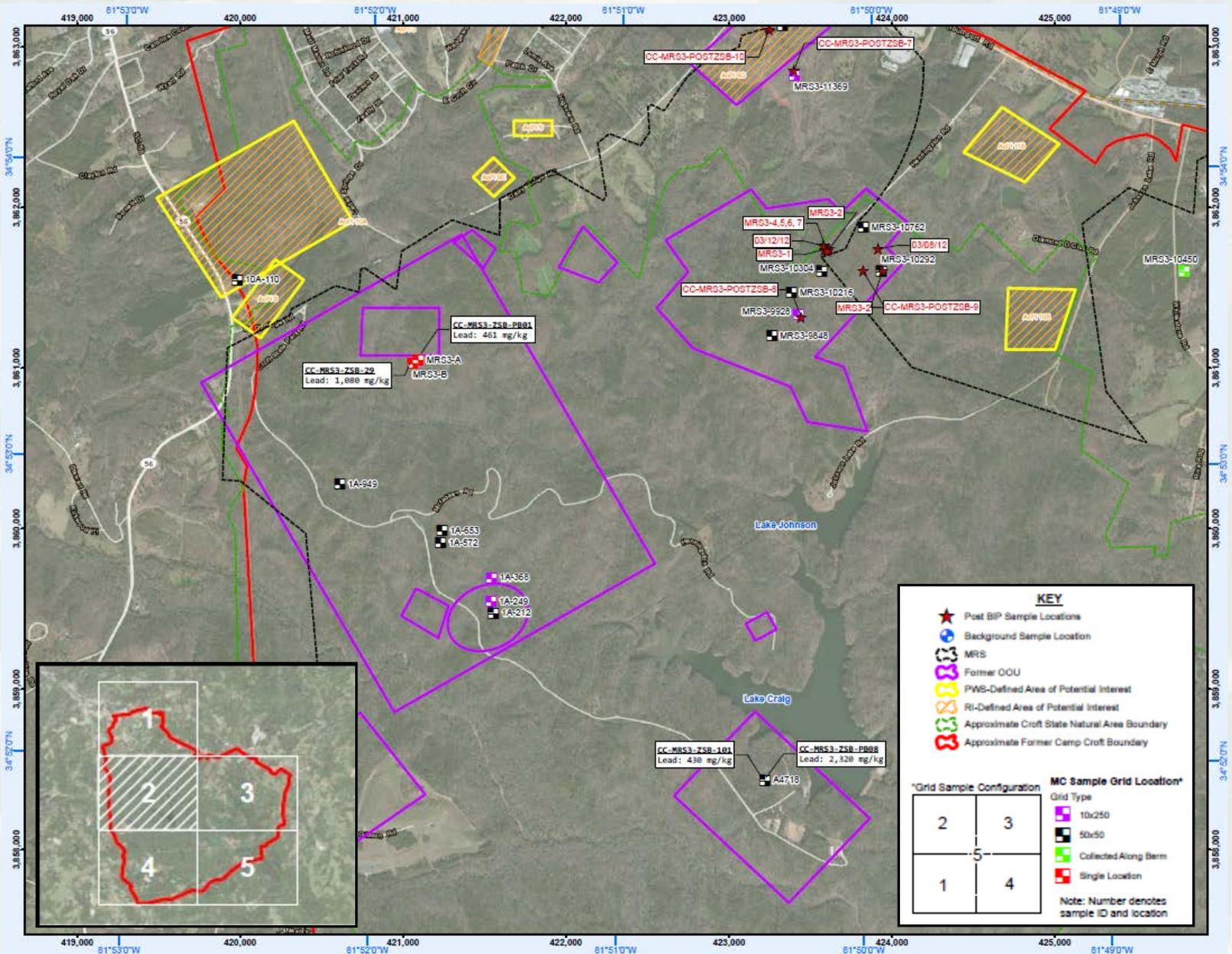




Environmental (MC) Sampling

- 120 discrete surface soil samples
 - ▶ 3 of 120 contained lead above 400 mg/kg
 - Additional soil samples collected (w/ XRF)
 - Localized exceedances are limited
 - ▶ No explosives were detected
- 10 composite post-blow-in-place samples
 - ▶ No explosives or metals were detected





MC Human Risk Summary

- Maximum exposure concentrations for COPCs were compared to residential screening levels
 - ▶ Except for lead, max. exposure conc. were below residential screening levels – RISK considered negligible
 - ▶ Based on further analytical modeling for lead in children, lead is not a concern.
 - ▶ **NO THREATS** from MC!



MC Ecological Risk Summary

- Limited metal COPC concentrations exceed conservative screening levels protective of insectivorous birds and mammals.
 - ▶ Small metal fragments are not readily bioavailable and may overestimate potential risk.
 - ▶ Small affected areas represent only a fraction of overall habitat of receptors.
 - ▶ Thus, it is not anticipated that significant adverse risks occur and that remedial actions would not be necessary to protect ecological receptors.



Primary MEC/MD Observed

- MEC and MD items observed
 - ▶ Grenade – MK I (practice), MK II, M15 (smoke), and M19 rifle grenade (illumination)
 - ▶ Landmine – M1 anti-tank
 - ▶ Mortar – 60mm (training, illumination, HE), 81mm (training, HE)
 - ▶ Projectile – 37mm, 57mm, 105mm (HE and illumination),
 - ▶ Rocket – 2.36” Bazooka



MEC Hazard Assessment

- MEC Hazard Assessment
 - ▶ Supports hazard management decision-making process
 - ▶ Addresses explosives safety concerns posed by MEC to human receptors
 - ▶ Does not address environmental or ecological concerns
 - ▶ Range of (possible) scores:
 - 1 (highest) to 4 (lowest)



MEC Hazard Assessment Scores

Area	Hazard Level Category	Score
105mm Area	1	950
Maneuver Area	1	1,000
60mm Mortar Area	3	705
60/81mm Mortar Area	1	965
Rocket & Rifle Grenade Area	1	905
Rocket/Grenade Maneuver Area	2	760
Grenade Maneuver Area	2	755

- Hazard Level Categories:
 - ▶ Level 1 – 1,000 to 840 (Highest Hazard)
 - ▶ Level 2 – 835 to 725
 - ▶ Level 3 – 720 to 530
 - ▶ Level 4 – 525 and under (Lowest Hazard)



MRSPP Scoring

- Munitions Response Site Prioritization Protocol (MRSPP)
 - ▶ Facilitates a standardized Department of Defense assignment of relative priority for response activities across the nation
 - ▶ Scoring process is iterative; can be adjusted based on new information
 - ▶ Range of (possible) scores:
 - 1 (highest) to 8 (lowest)



MRSPS Scores

Area	MRSPS Score
MRS 1	7
MRS 2	4
105mm Area	3
Maneuver Area	3
60mm Mortar Area	4
60/81mm Mortar Area	4
Rocket & Rifle Grenade Area	3
Rocket/Grenade Maneuver Area	4
Remaining Lands	6
Grenade Area	5

- MRSPS Scores:
 - ▶ Range from 1 (highest) to 8 (lowest)



MRSPP Scores

Area	MRSPP Score
Rocket Area	4
Grenade Maneuver Area	4
Practice Grenade Area	4
Mortar/Rifle Grenade Area	4

- MRSPP Scores:
 - ▶ Range from 1 (highest) to 8 (lowest)



Investigation Summary

Area	Size (acres)	Comments
MRS 1	23.8	No MEC/MD observed
MRS 2	24.9	Minimal access; Suspected grenade court
105mm Area	1,399.7	105mm projectiles (primary)
Maneuver Area	1,276.5	Mixed munitions use
60mm Mortar Area	303.4	Mixed munitions use; Primarily mortars
60/81mm Mortar Area	301.3	Mixed munitions use; Primarily mortars
Rocket & Rifle Grenade Area	108.5	Mixed munitions use
Remaining Lands	9,093.4	No MEC and minimal MD observed
Grenade Area	19.2	Minimal access; Suspected grenade court
AoPI 5	5.5	No MEC/MD observed

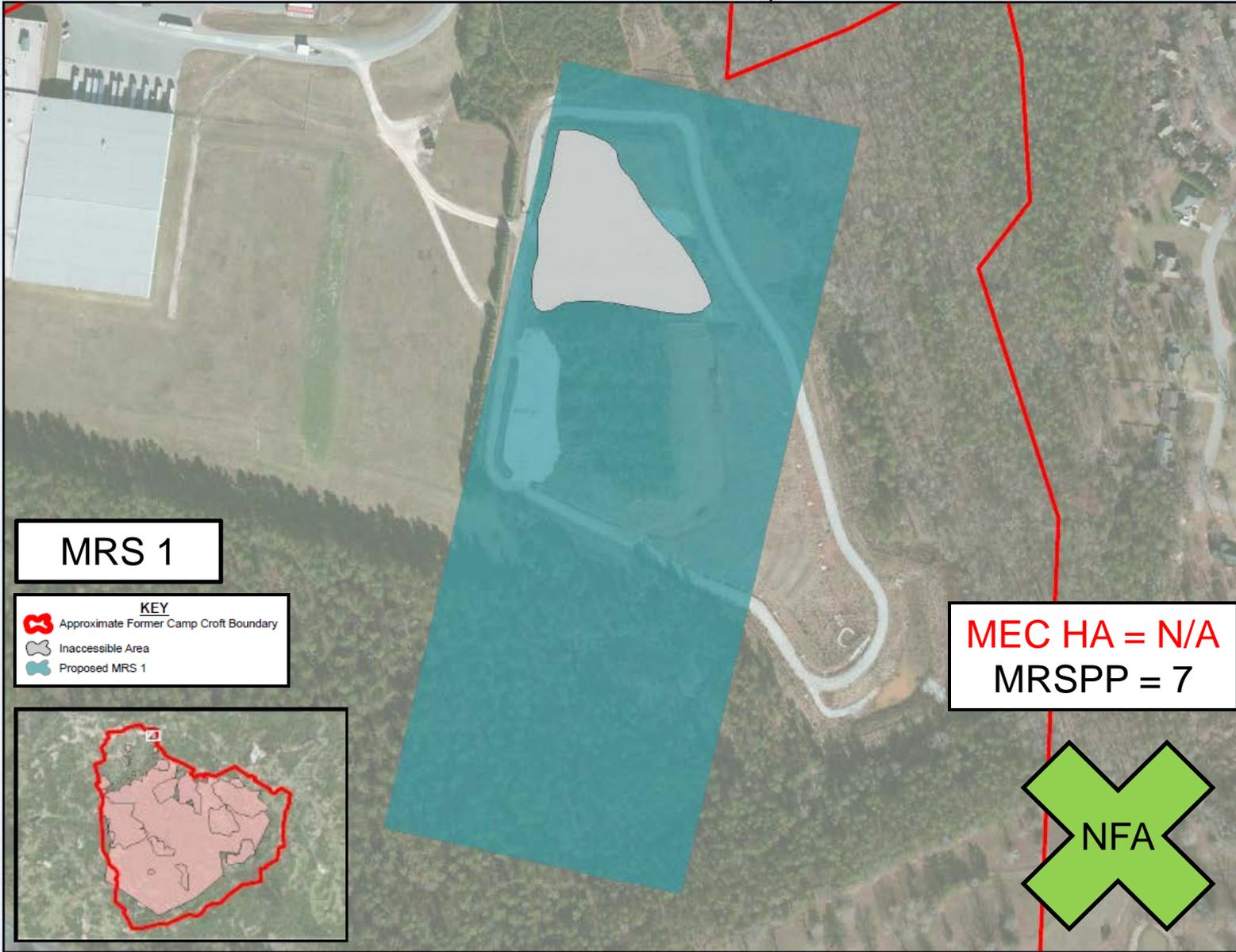


Investigation Summary

Area	Size (acres)	Comments
AoPI 8	23.9	No MEC/MD observed
AoPI 9E	7.6	No MEC/MD observed
AoPI 9G	6.6	No MEC/MD observed
Rocket Area	93.9	Mixed munitions use; Primarily rockets
Grenade Maneuver Area	450.5	Mortars (and grenades) observed
Practice Grenade Area	6.4	Grenades observed
Mortar/Rifle Grenade Area	22.9	Mortars (and grenades) observed



423,000



MRS 1

KEY

- Approximate Former Camp Croft Boundary
- Inaccessible Area
- Proposed MRS 1

MEC HA = N/A
MRSP = 7

NFA



423,000



423,000

3,864,000

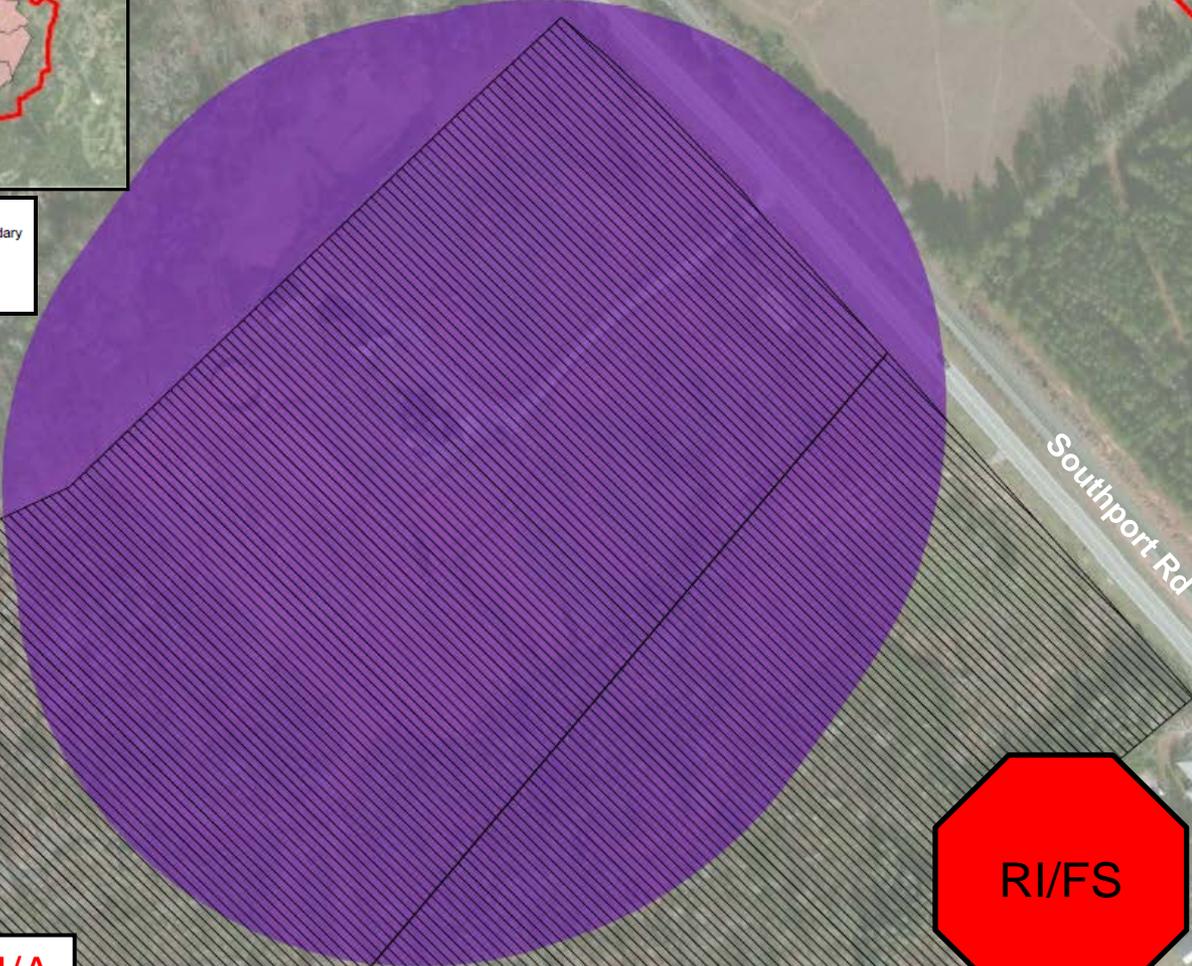
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KEY

-  Approximate Former Camp Croft Boundary
-  Inaccessible Parcel
-  Proposed MRS 2

MRS 2



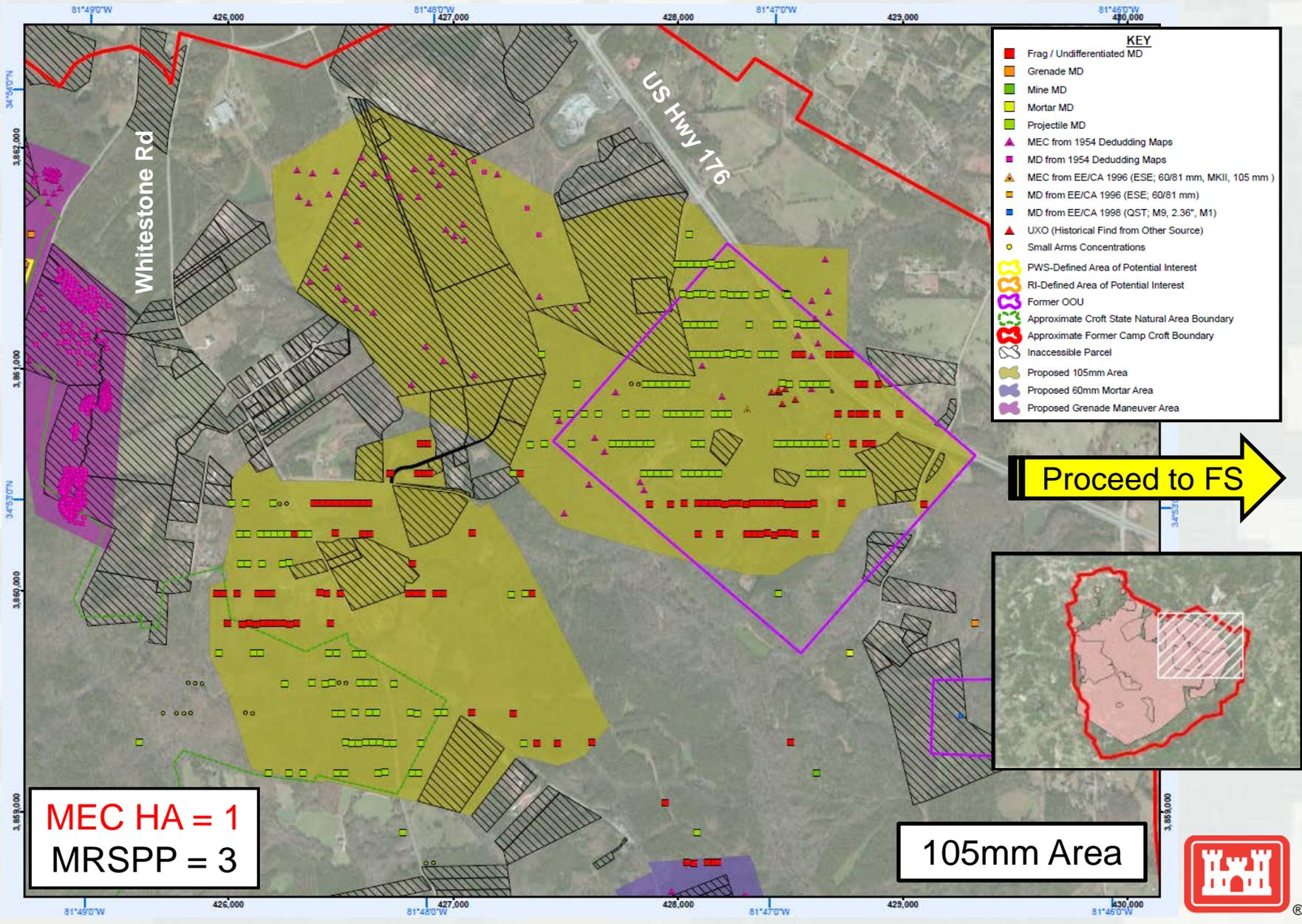
Southport Rd

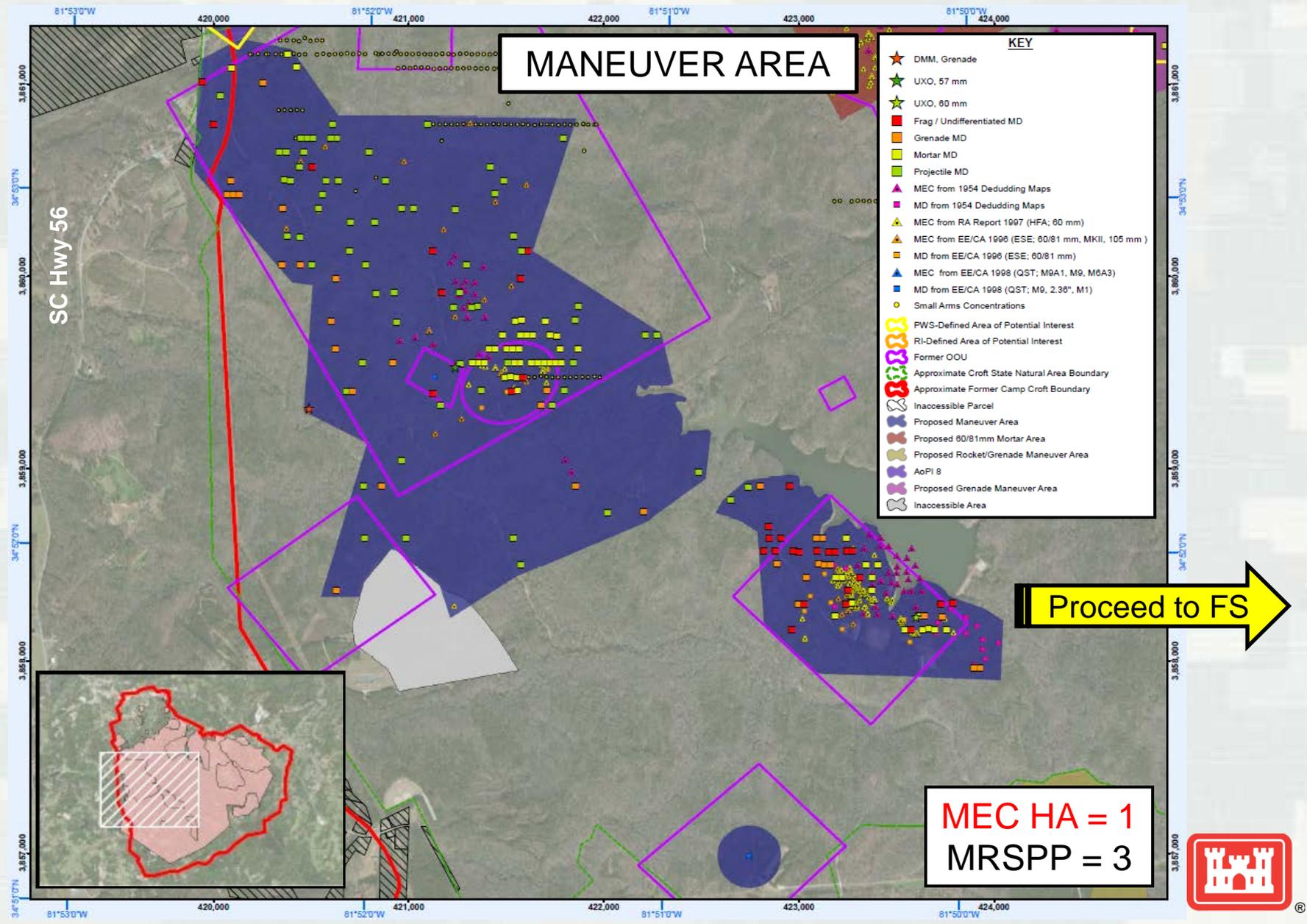


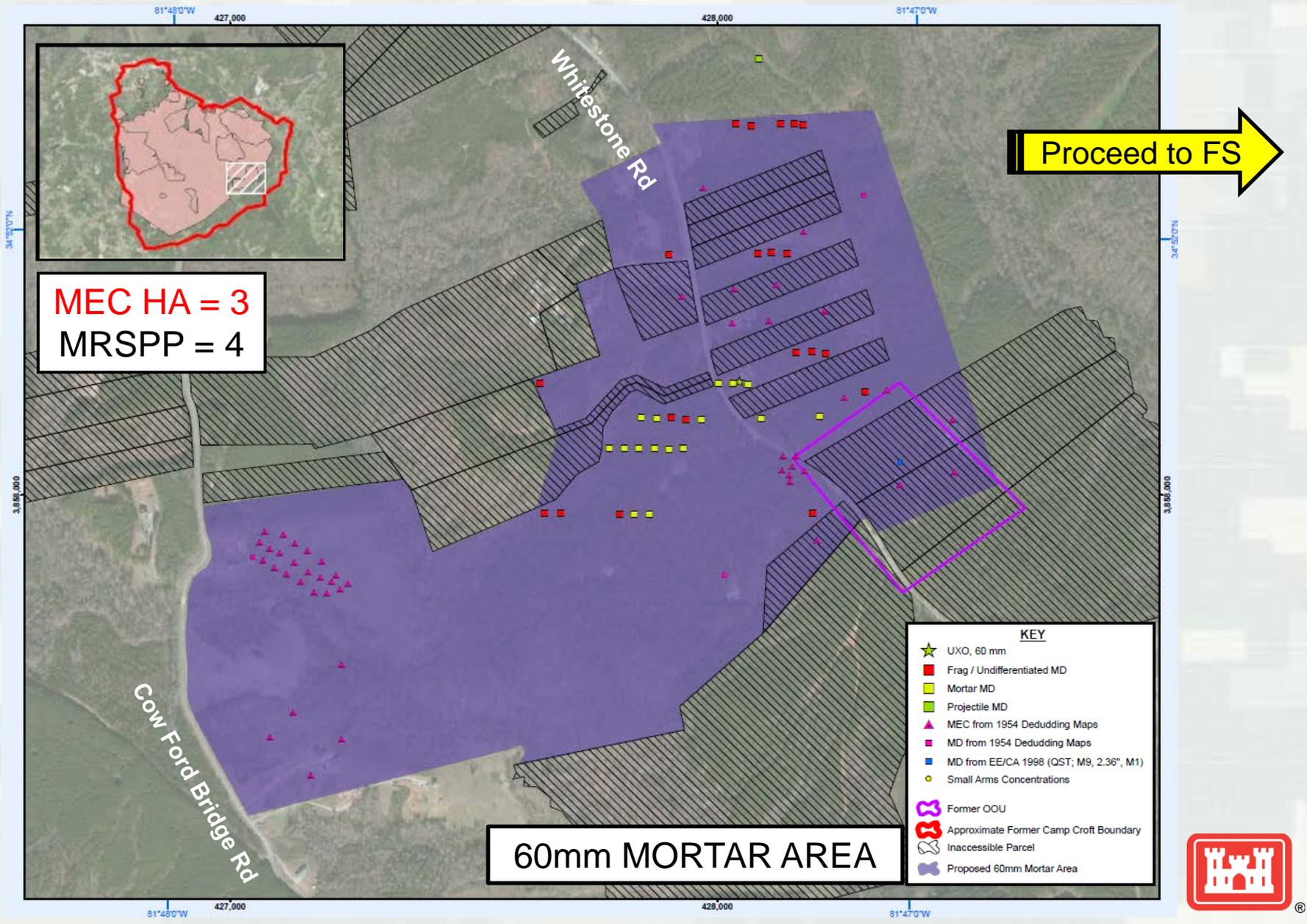
MEC HA = N/A
MRSP = 4

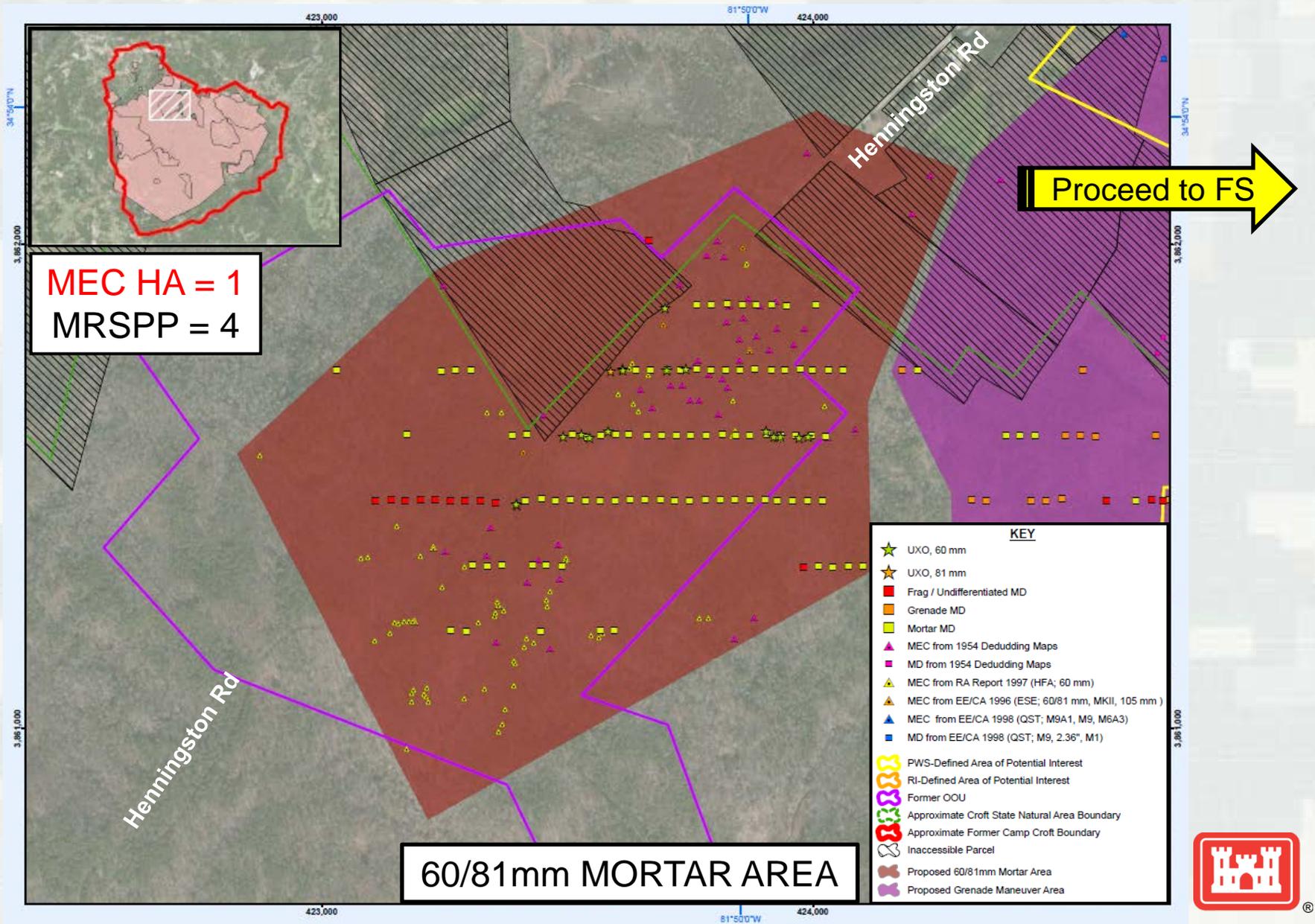
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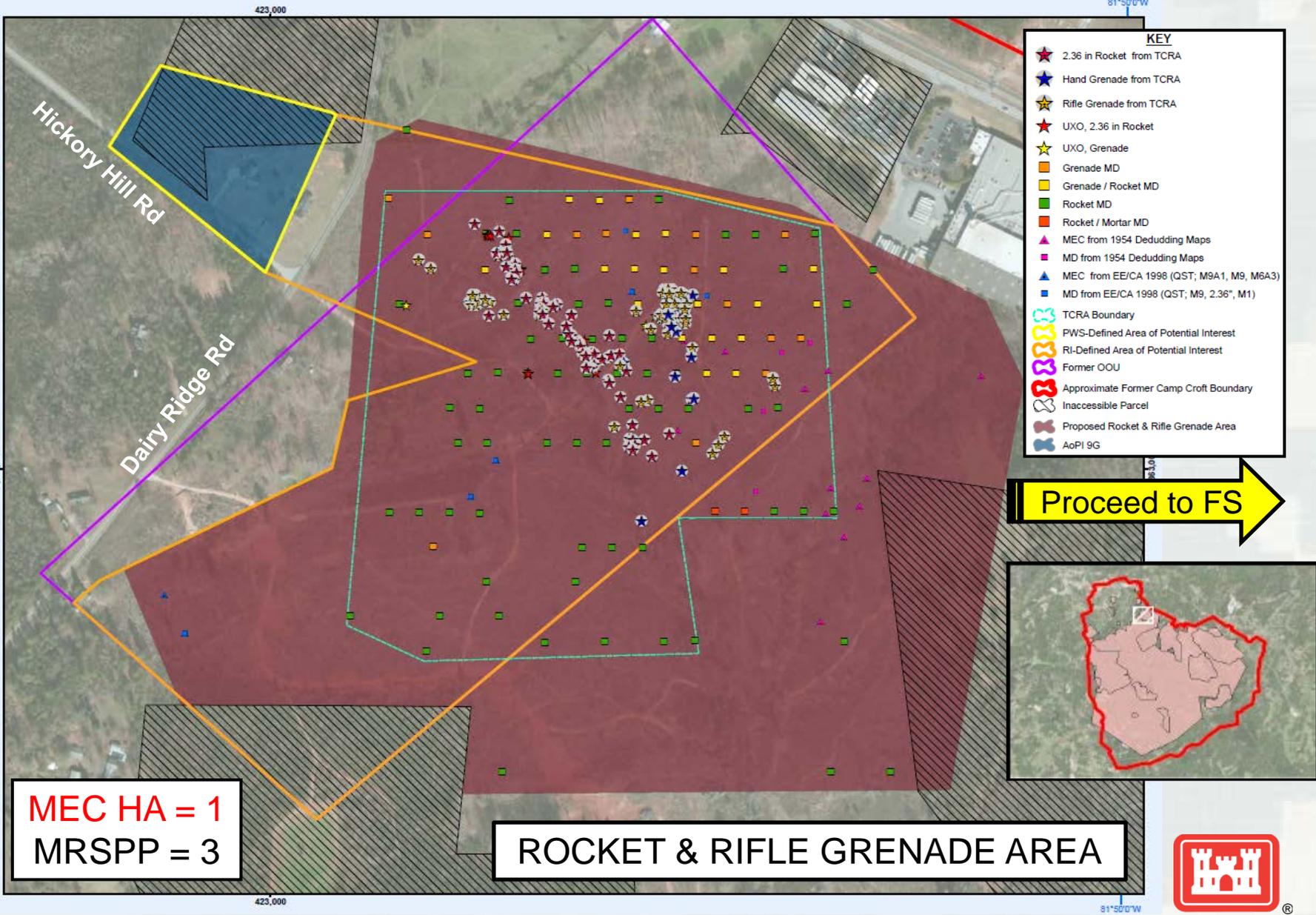












ROCKET/GRENADE MANEUVER AREA



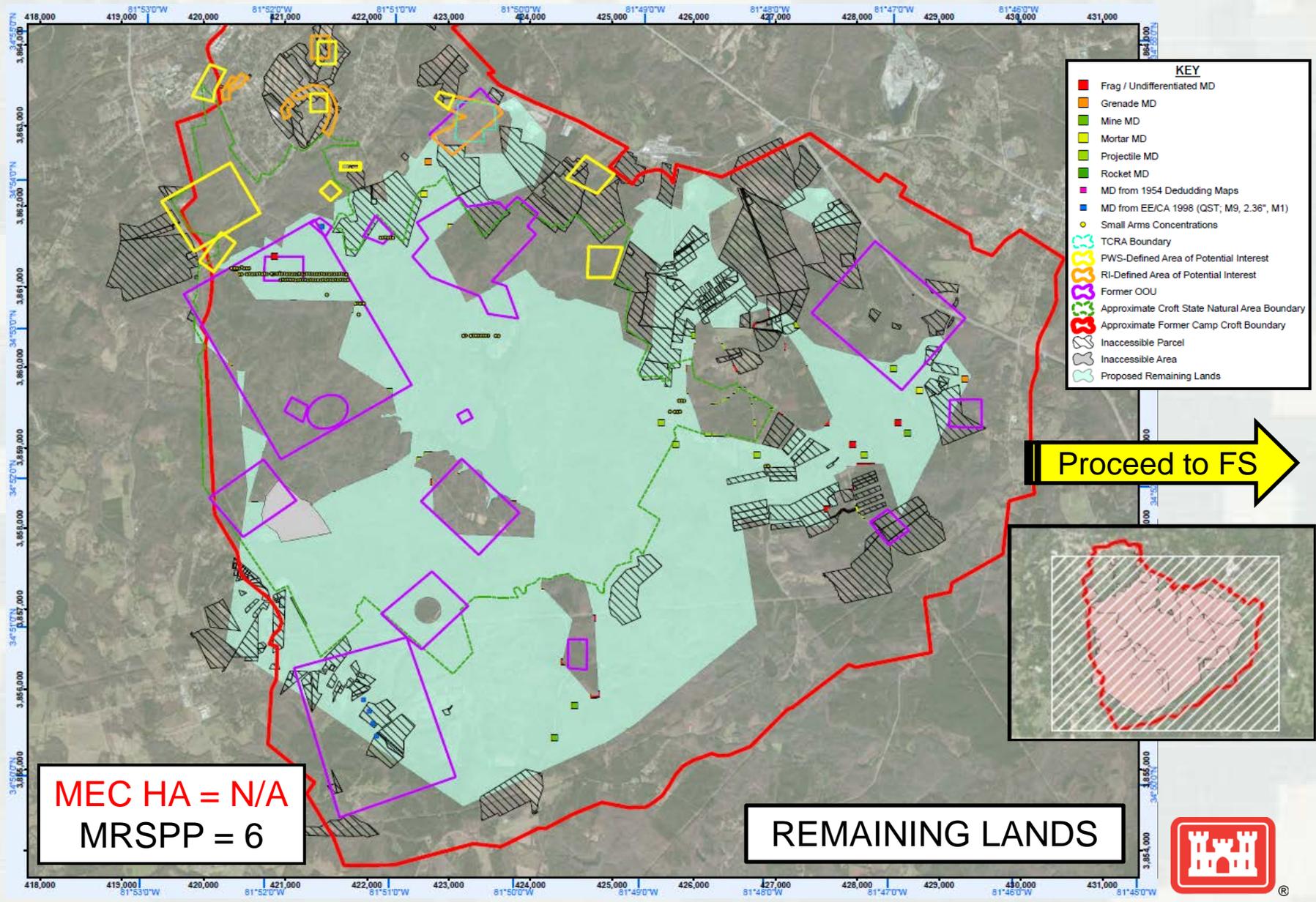
- KEY**
- ★ UXO, Fuze
 - Frag / Undifferentiated MD
 - Grenade MD
 - Mine MD
 - ▲ MEC from EE/CA 1998 (QST; M9A1, M9, M6A3)
 - Former OOU
 - Approximate Croft State Natural Area Boundary
 - Approximate Former Camp Croft Boundary
 - Inaccessible Parcel
 - Proposed Rocket/Grenade Maneuver Area

MEC HA = 2
MRSP = 4

Proceed to FS →

Foster Mill Cir

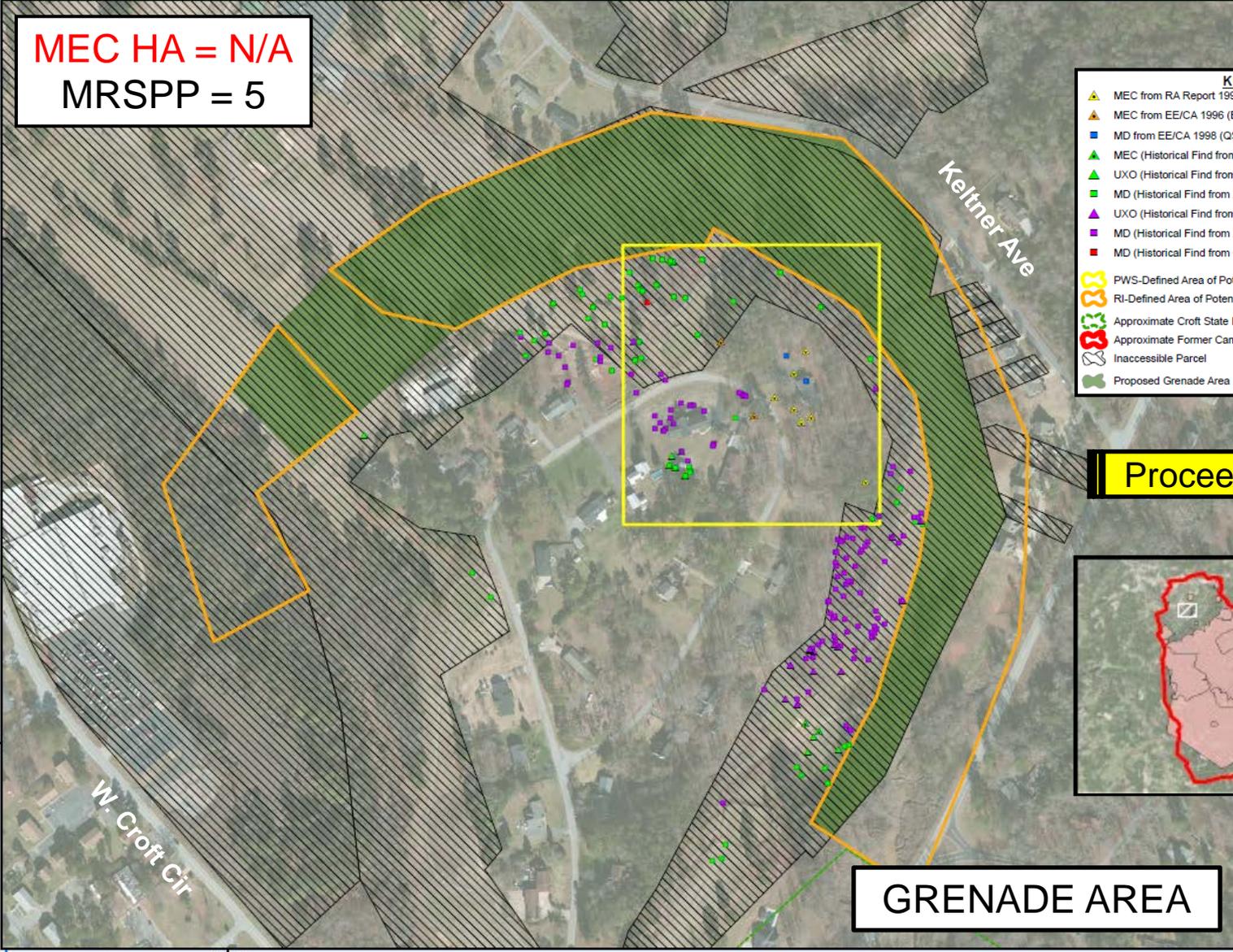




81°52'0"W

421,000

MEC HA = N/A
MRSPP = 5



- KEY**
- ▲ MEC from RA Report 1997 (HFA; 60 mm)
 - ▲ MEC from EE/CA 1996 (ESE; 60/81 mm, MKII, 105 mm)
 - MD from EE/CA 1998 (GST; M9, 2.36", M1)
 - ▲ MEC (Historical Find from 2005; MKII)
 - ▲ UXO (Historical Find from 2005; M15, MKII)
 - MD (Historical Find from 2005; MKII)
 - ▲ UXO (Historical Find from 2006; MKII)
 - MD (Historical Find from 2006; MKII)
 - MD (Historical Find from Other Source)
 - 👤 PWS-Defined Area of Potential Interest
 - 👤 RI-Defined Area of Potential Interest
 - 👤 Approximate Croft State Natural Area Boundary
 - 👤 Approximate Former Camp Croft Boundary
 - 👤 Inaccessible Parcel
 - 👤 Proposed Grenade Area

Proceed to FS →



GRENADA AREA



3,883,000

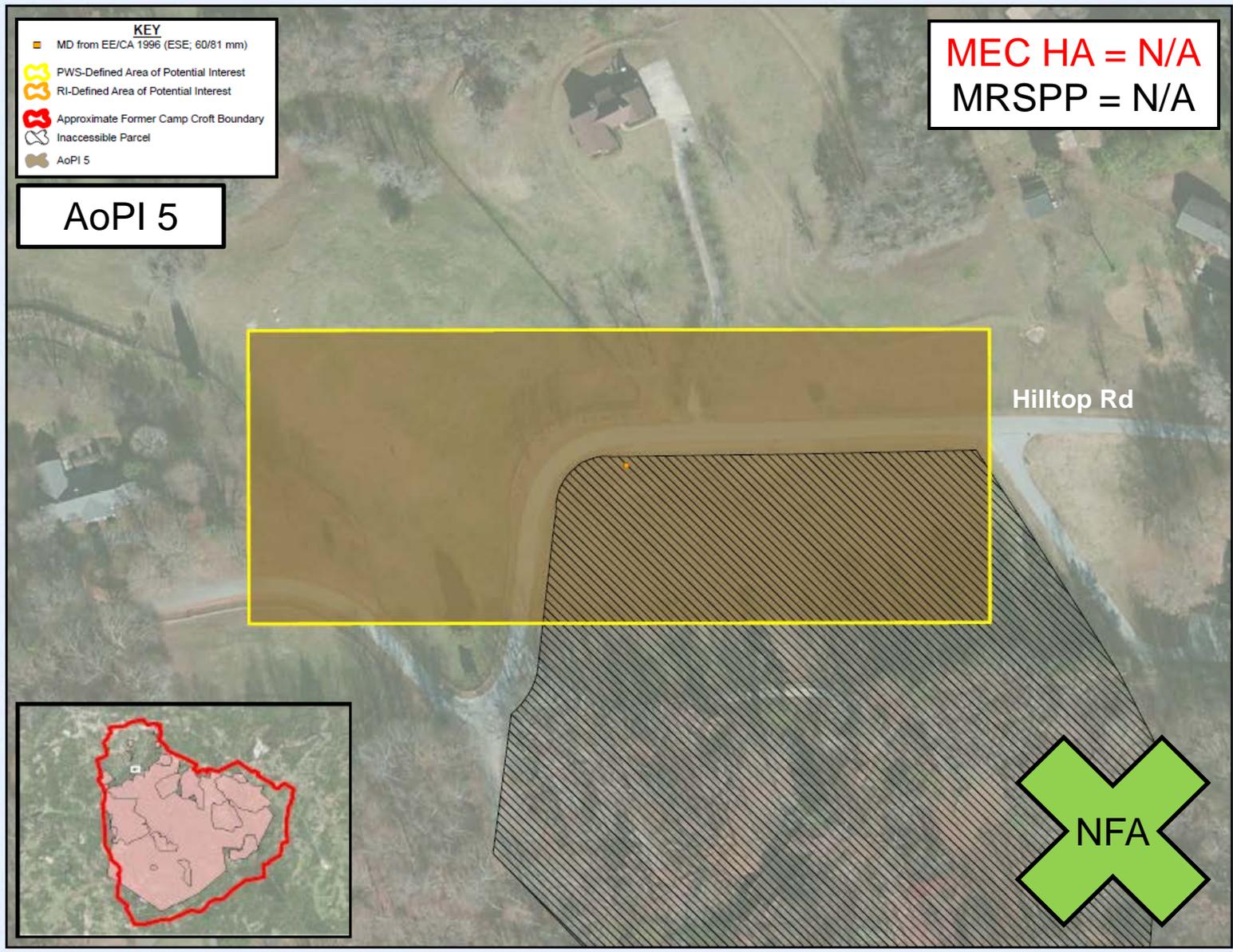
81°52'0"W

421,000

- KEY**
- MD from EE/CA 1996 (ESE; 60/81 mm)
 - PWS-Defined Area of Potential Interest
 - RI-Defined Area of Potential Interest
 - Approximate Former Camp Croft Boundary
 - Inaccessible Parcel
 - AoPI 5

MEC HA = N/A
MRSPP = N/A

AoPI 5

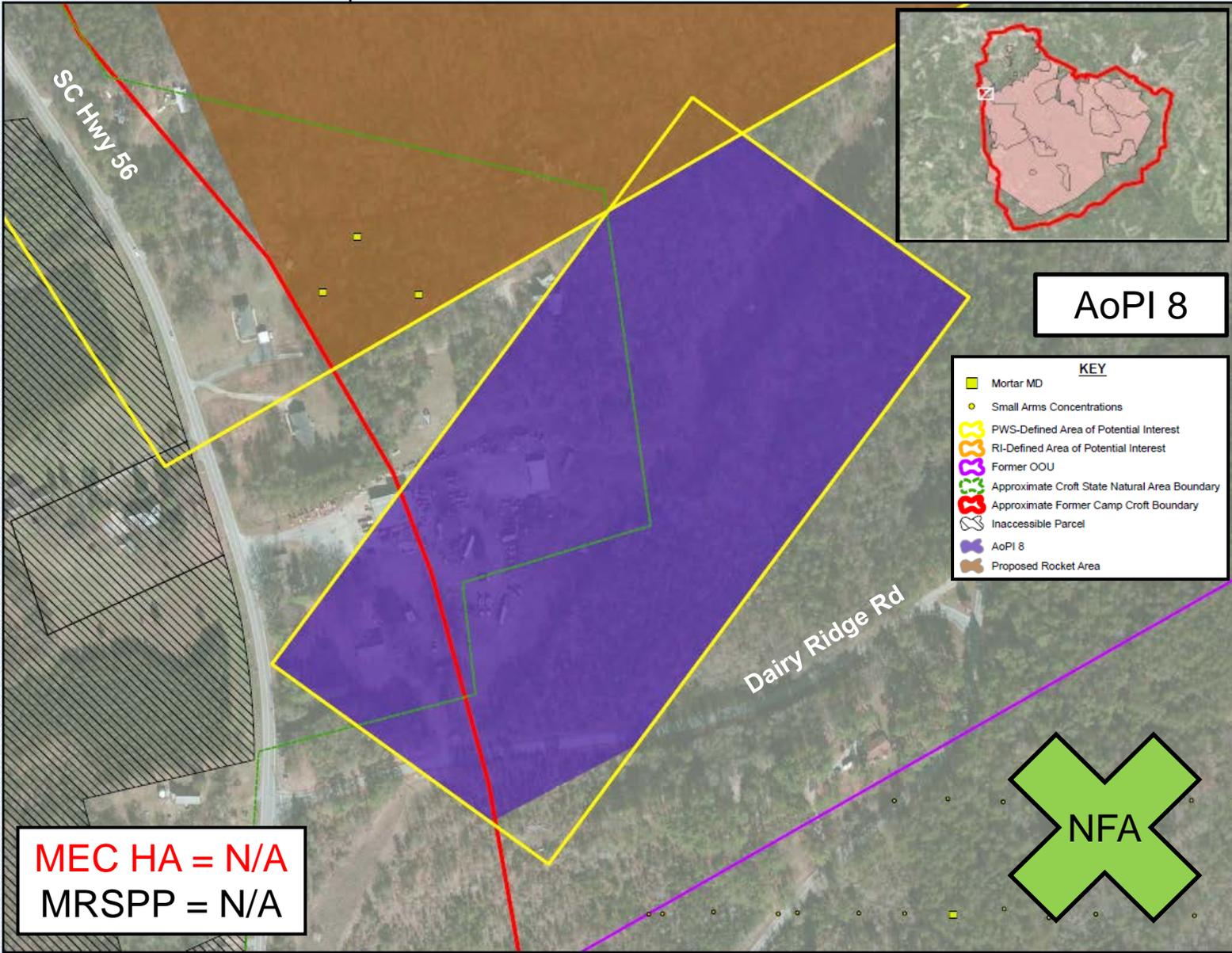


Hilltop Rd

NFA



420,000



MEC HA = N/A
MRSPP = N/A

AoPI 8

- KEY
- Mortar MD
 - Small Arms Concentrations
 - PWS-Defined Area of Potential Interest
 - RI-Defined Area of Potential Interest
 - Former OOU
 - Approximate Croft State Natural Area Boundary
 - Approximate Former Camp Croft Boundary
 - Inaccessible Parcel
 - AoPI 8
 - Proposed Rocket Area

NFA



MEC HA = N/A
MRSP = N/A



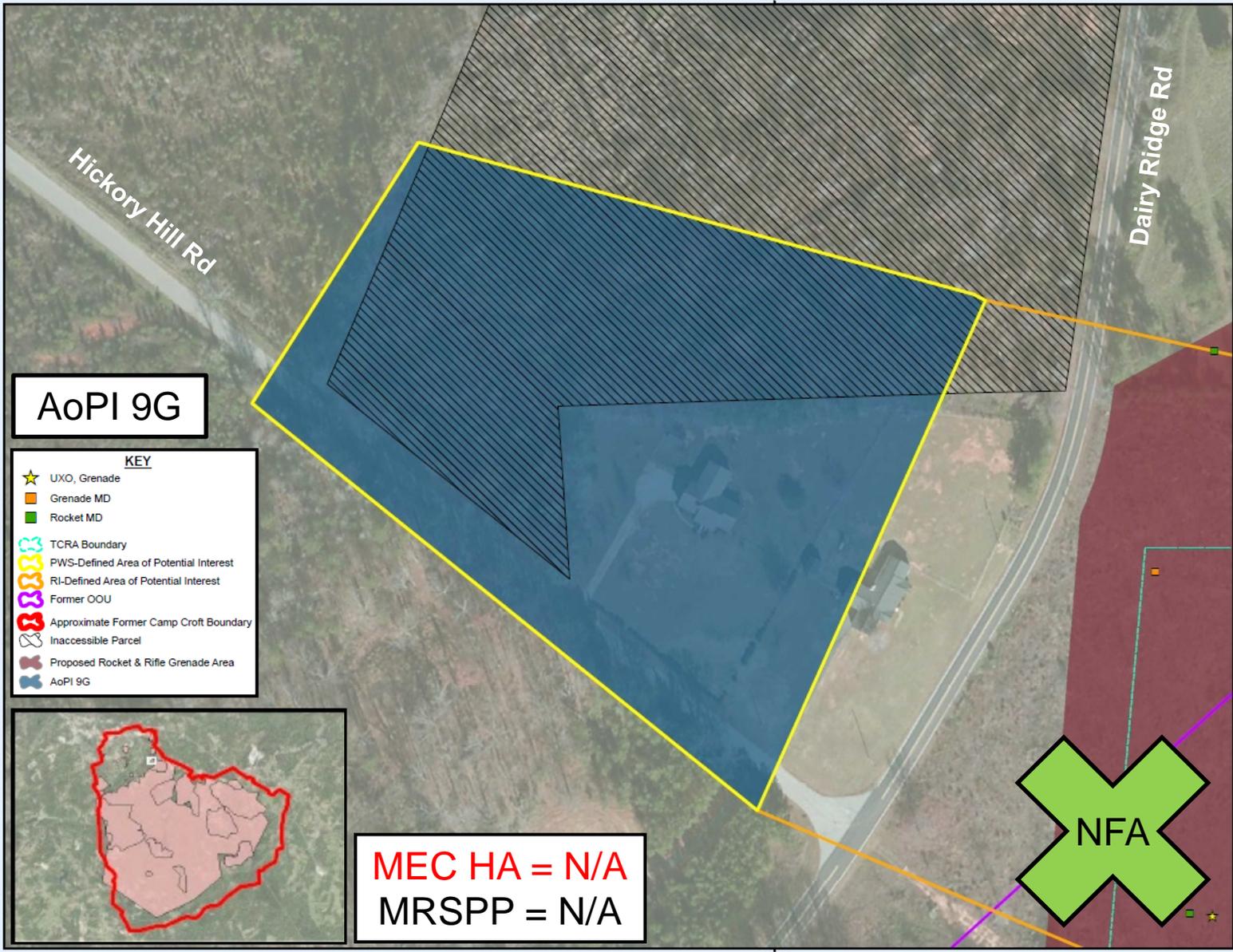
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- PWS-Defined Area of Potential Interest
 - RI-Defined Area of Potential Interest
 - Approximate Croft State Natural Area Boundary
 - Approximate Former Camp Croft Boundary
 - AoPI 9E

AoPI 9E



423,000

423,000



AoPI 9G

- KEY**
- ★ UXO, Grenade
 - Grenade MD
 - Rocket MD
 - TCRA Boundary
 - PWS-Defined Area of Potential Interest
 - RI-Defined Area of Potential Interest
 - Former OOU
 - Approximate Former Camp Croft Boundary
 - Inaccessible Parcel
 - Proposed Rocket & Rifle Grenade Area
 - AoPI 9G



MEC HA = N/A
MRSPP = N/A

NFA



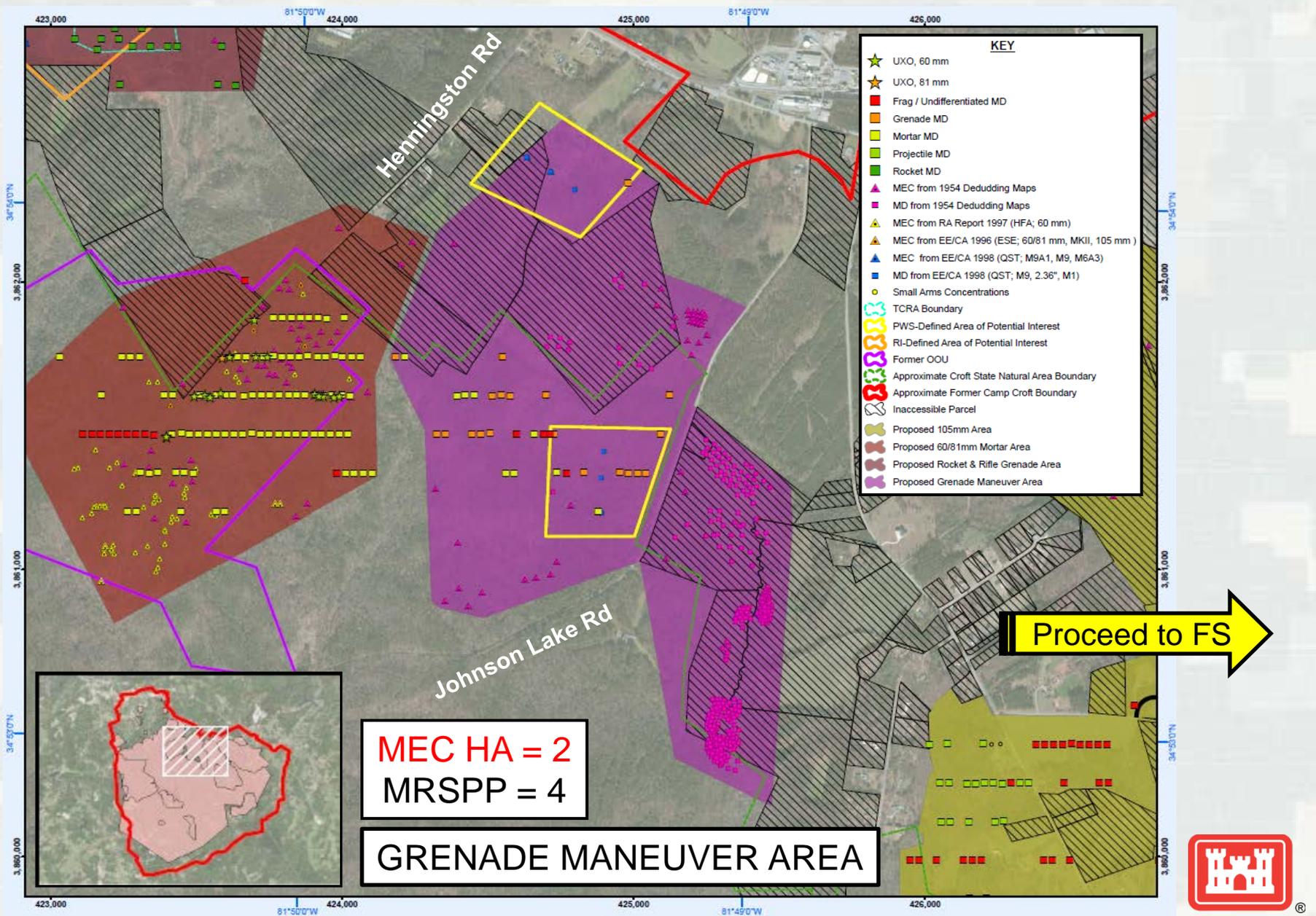
MEC HA = N/A
MRSPP = 4

- KEY**
- Frag / Undifferentiated MD
 - Grenade MD
 - Mine MD
 - Mortar MD
 - Projectile MD
 - Rocket MD
 - MD from EE/CA 1996 (QST; M9, 2.36", M1)
 - PWS-Defined Area of Potential Interest
 - RI-Defined Area of Potential Interest
 - Former OOU
 - Approximate Croft State Natural Area Boundary
 - Approximate Former Camp Croft Boundary
 - Inaccessible Parcel
 - AoPI 8
 - Proposed Rocket Area

ROCKET AREA

Proceed to FS



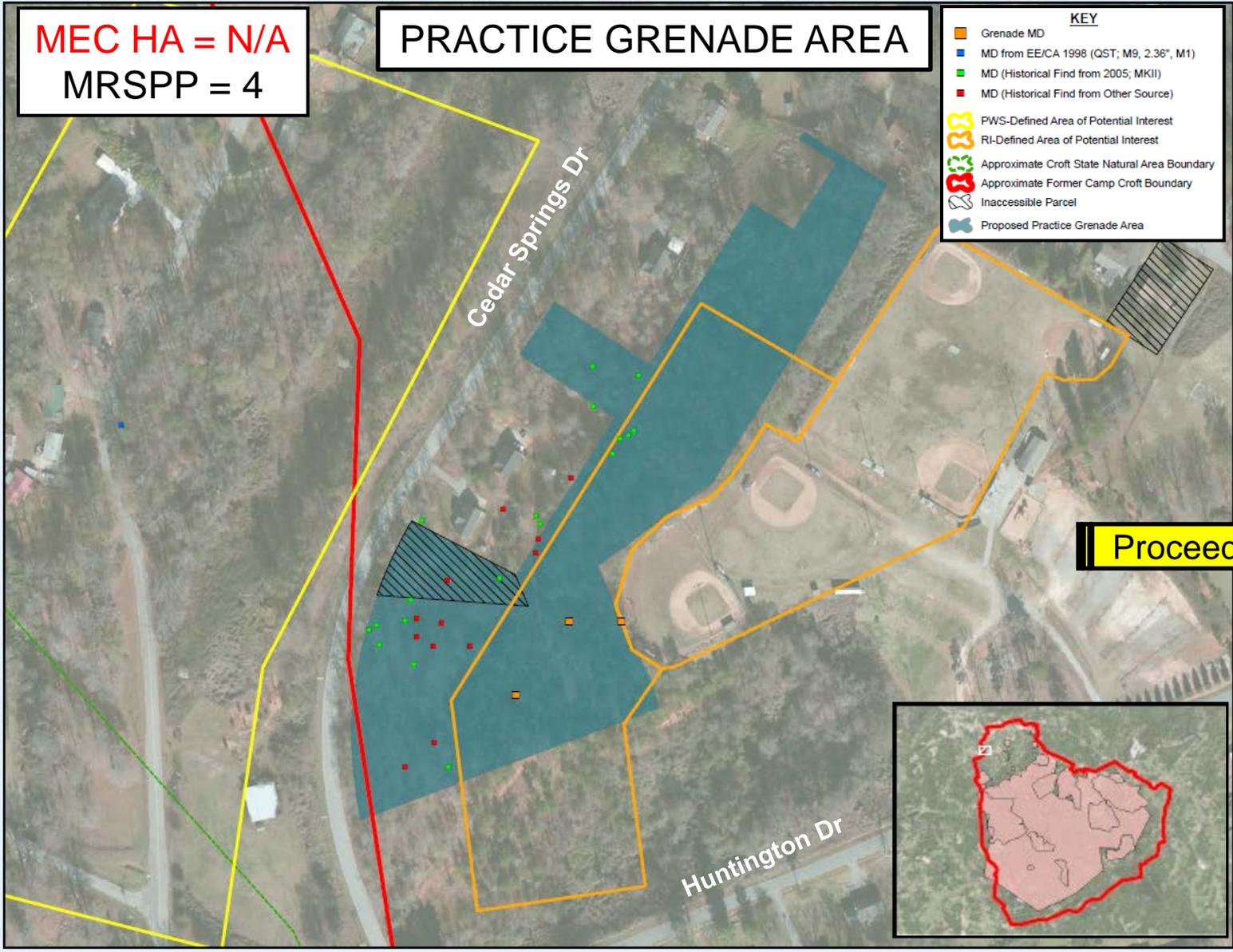


MEC HA = N/A
MRSPP = 4

PRACTICE GRENADE AREA

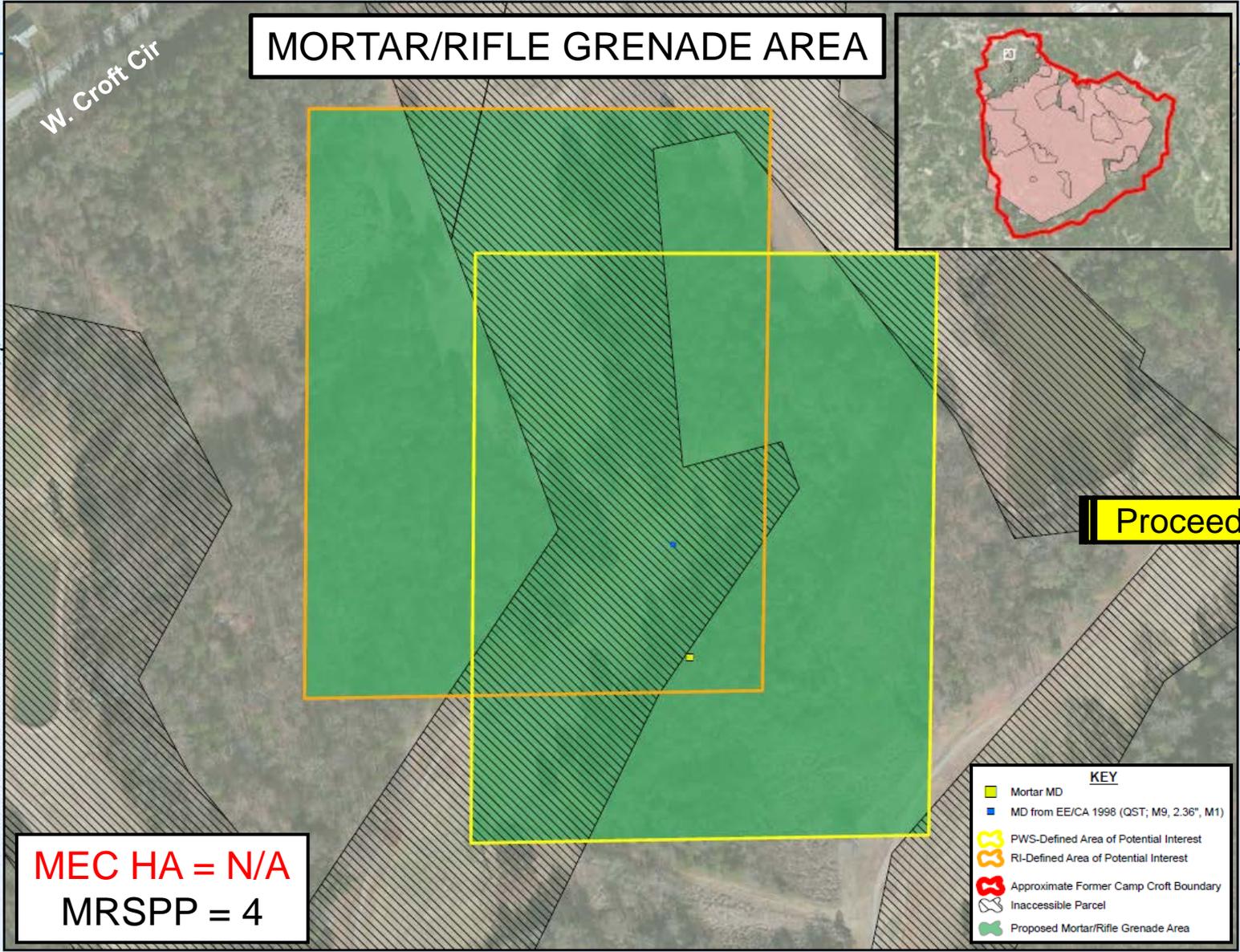
KEY

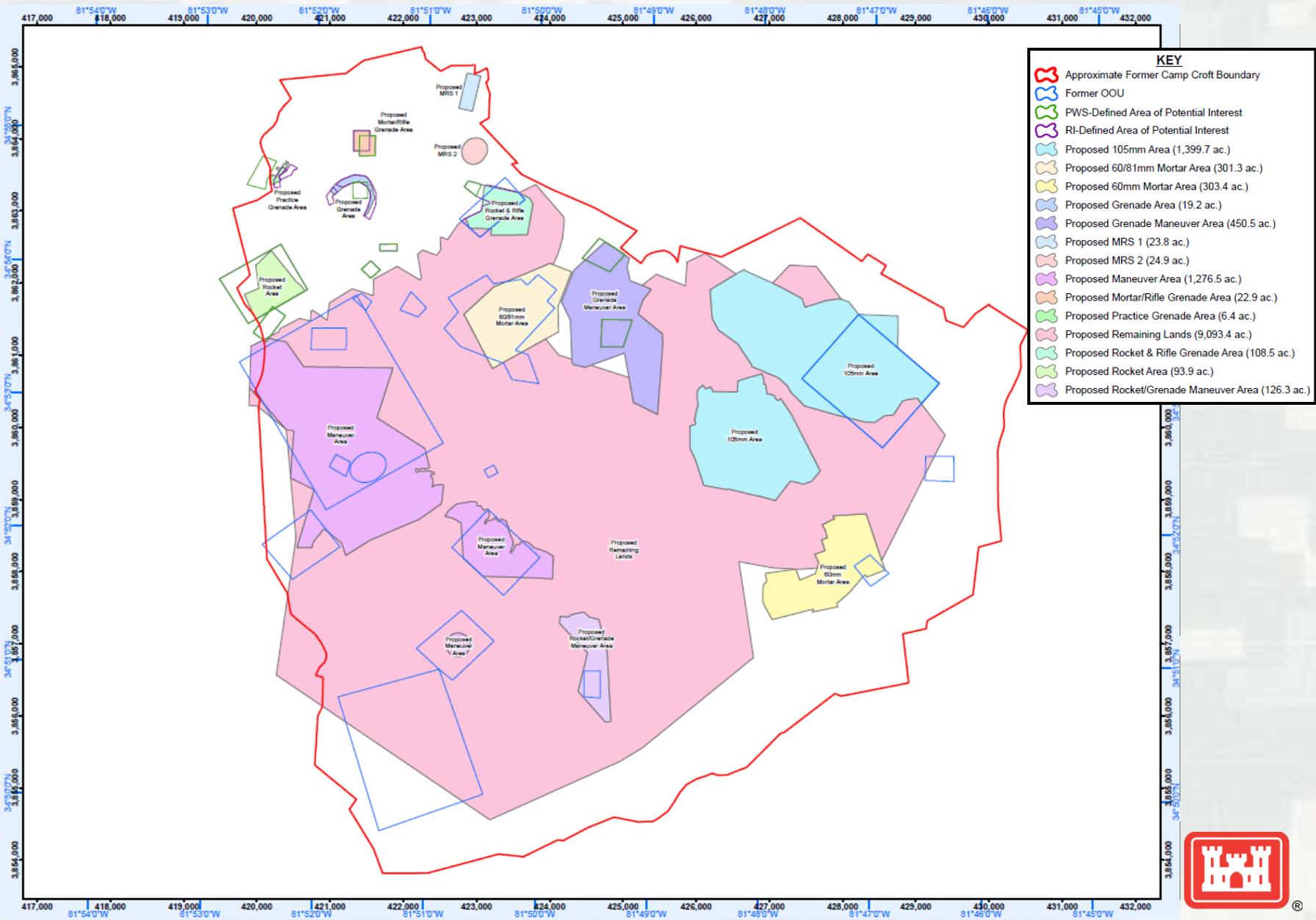
- Grenade MD
- MD from EE/CA 1998 (QST; M9, 2.36", M1)
- MD (Historical Find from 2005; MKII)
- MD (Historical Find from Other Source)
- PWS-Defined Area of Potential Interest
- RI-Defined Area of Potential Interest
- Approximate Croft State Natural Area Boundary
- Approximate Former Camp Croft Boundary
- Inaccessible Parcel
- Proposed Practice Grenade Area



Proceed to FS







- KEY**
-  Approximate Former Camp Croft Boundary
 -  Former OOU
 -  PWS-Defined Area of Potential Interest
 -  RI-Defined Area of Potential Interest
 -  Proposed 105mm Area (1,399.7 ac.)
 -  Proposed 60/81mm Mortar Area (301.3 ac.)
 -  Proposed 60mm Mortar Area (303.4 ac.)
 -  Proposed Grenade Area (19.2 ac.)
 -  Proposed Grenade Maneuver Area (450.5 ac.)
 -  Proposed MRS 1 (23.8 ac.)
 -  Proposed MRS 2 (24.9 ac.)
 -  Proposed Maneuver Area (1,276.5 ac.)
 -  Proposed Mortar/Rifle Grenade Area (22.9 ac.)
 -  Proposed Practice Grenade Area (6.4 ac.)
 -  Proposed Remaining Lands (9,093.4 ac.)
 -  Proposed Rocket & Rifle Grenade Area (108.5 ac.)
 -  Proposed Rocket Area (93.9 ac.)
 -  Proposed Rocket/Grenade Maneuver Area (126.3 ac.)



Upcoming Schedule

- Tentative dates for upcoming documents
 - ▶ Feb 2015 – Feasibility Study
 - Presents response alternatives
 - ▶ April 2015 – Proposed Plan
 - Suggests recommended alternatives
 - Public Meeting held to present recommendations; public feedback incorporated into final planning
 - ▶ June 2015 – Decision Document
 - Documents selected response alternatives



Safety

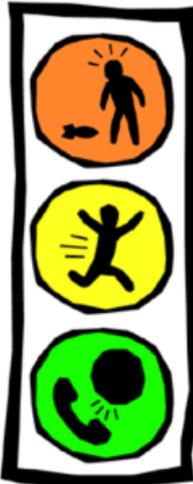
■ UXO Safety Procedures

▶ The Three R's

- **Recognize** – Military munitions/ordnance becomes a danger only when it is disturbed. When you see an item, STOP.
- **Retreat** – Do not move closer to get a better look! Never attempt to remove anything near it. Do not touch, move, or disturb. MOVE AWAY.
- **Report** – Immediately report any suspected military munitions. **CALL 911**



Remember the 3R's of UXO Safety!



RECOGNIZE

RETREAT

REPORT

