

Further evaluation of areas where there are high density anomalies associated with impact areas where military munitions with sensitive fuzes were fired.

Track 3 Impact Area Munitions Response Area  
Former Fort Ord, California.

# Acronyms

- AGC: advanced geophysical classification
- BLM: Bureau of Land Management
- DGM: digital geophysical mapping
- EMI: electromagnetic induction
- HE: high explosive
- LAW: light antitank weapon
- MSFFS: Munitions with Sensitive Fuzes Field Study
- MEC: munitions and explosives of concern
- MRA: Munitions Response Area
- MRS: Munitions Response Site
- RI/FS: Remedial Investigation/Feasibility Study
- ROD: Record of Decision
- UXO: unexploded ordnance

## Track 3 ROD

- “...subsurface removal will be conducted in selected areas identified to address specific risk and/or land use needs.”
- An example of such an area is “areas where there are high density anomalies associated with impact areas where military munitions with sensitive fuzes (all-ways-acting or piezoelectric fuzes, or 40mm grenade launcher high explosive [HE] or 40mm practice projectiles M382 series or M407 series [or any other 40mm practice series projectiles containing enough explosives to rupture the projectile]) were fired.”

(OE-0647)

# Studies in progress

- DGM data density analysis, with the goal of identifying techniques that could be used to address the risks in lieu of the large-scale excavation and sifting.
- **Refining the preliminarily-identified areas** for further evaluation.
- More specifically defining the risks to be addressed.

# The risks to be addressed

- In the Impact Area MRA, all ground-disturbing activities require construction support. Public access will be restricted to designated areas such as the regularly maintained fuel break roads, where subsurface removal has been conducted.
- The “further evaluation” areas occur inside work units, off of fuel breaks. Designated reuse activities are mostly surface activities such as habitat monitoring and weed management. Receptors in the off-fuel-break areas are limited to workers and trespassers.
- **Worker** activities are either
  - Intrusive with construction support (no additional mitigation is required) or
  - Non-intrusive. To support the long-term reuse by BLM, additional mitigation (e.g., additional removal action or institutional controls) would be evaluated to address **the risk to BLM workers from potentially encountering sensitive fuze-type UXO that could have become exposed from erosion or changes in site conditions.**
- **Trespassers** are typically found transiting on fuel break roads or bike riding. Intrusive activities are associated with illegal camps. The selected remedy includes access management measures such as the perimeter fence and security patrols. Continuation of an access management program similar to the MRS Security Program is the appropriate mitigation for this receptor type.

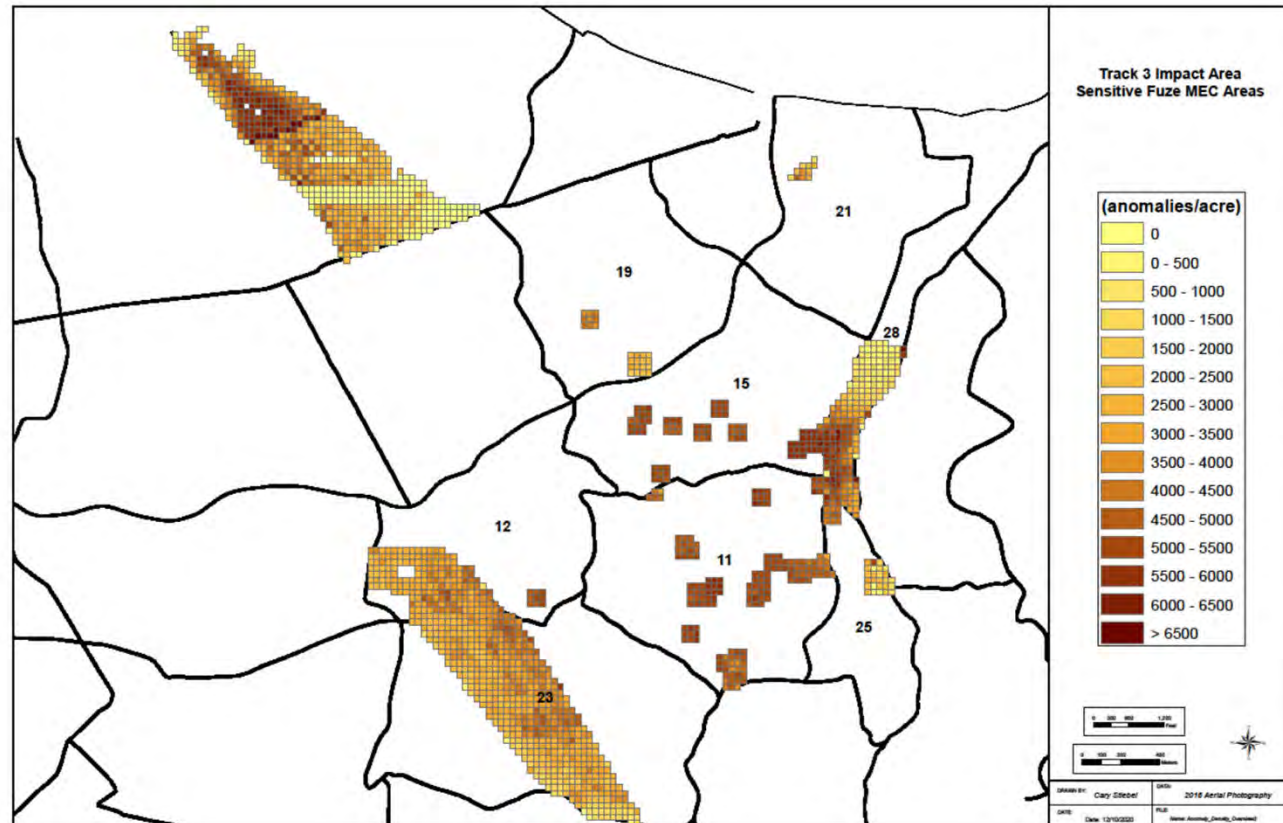
# DGM Data Density Analysis Preliminary Conclusions

## What makes the most sense given the RISK TO RECEPTORS?

- Public access is restricted
- Intrusive activities require construction support
- Non-intrusive activities: Goal is to support the long-term reuse by BLM, additional mitigation (e.g., additional removal action or institutional controls) would be evaluated to address the risk to BLM workers from potentially encountering sensitive fuze-type UXO that could have become exposed from erosion or changes in site conditions.

## We have options to appropriately address risk without the impacts of sifting:

1. Anomaly densities have been derived using a 14 mV threshold (37mm at 16 inches). Will a risk-reduction type clearance be protective of receptors?
2. Analog removal prior to DGM/AGC re-mapping
3. Go straight to AGC cuing operations or subsurface investigation using existing DGM data.



# Refining Preliminarily-identified Areas

# Refining Preliminarily-identified Areas

Areas have been preliminarily identified for further evaluation and identified in unit-specific technical memoranda and remedial action reports.

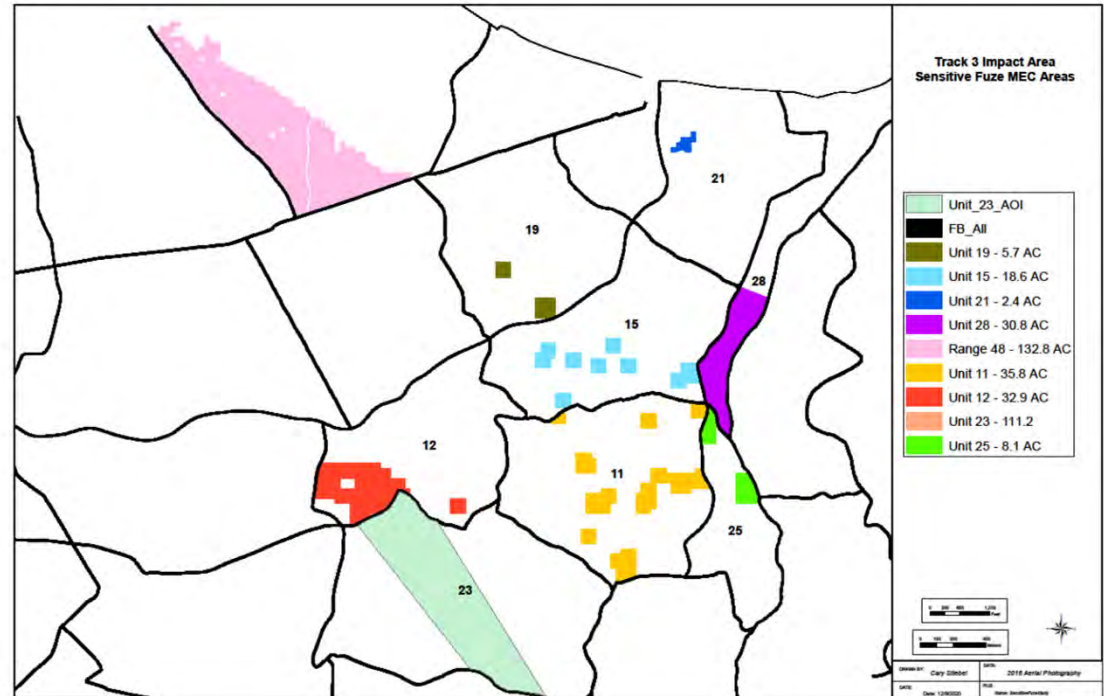
## Areas where both:

1. UXO of sensitive fuze-type were recovered during surface removal
2. DGM data show a high density of subsurface anomalies (> 900 anomalies/acre)

**Total Acreage ≈ 378.3 acres**

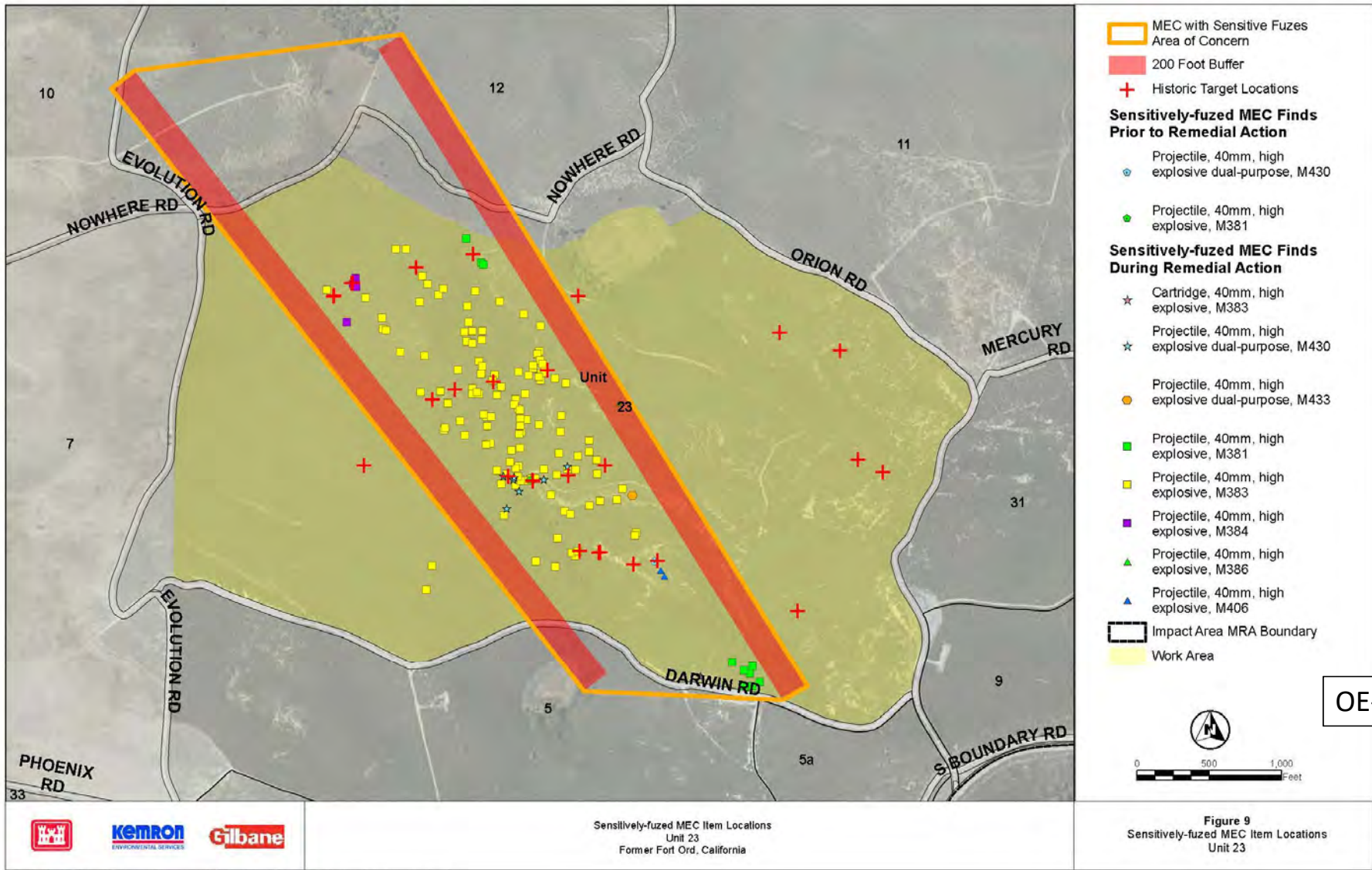
## Refinements are needed:

1. Some were delineated more broadly, to include buffers (e.g., area in Unit 23)
2. Additional work was conducted (e.g., near-surface removal in the Range 48 fan area)
3. Models of 40mm that are considered “sensitive fuze” have been clarified



**Primary Objective: Refine/validate areas where risks from sensitive fuze-type UXO are expected:** locations where they were fired; their potential to be present in shallow subsurface; if they are present, their potential to become exposed to the surface; and presence of human receptors.



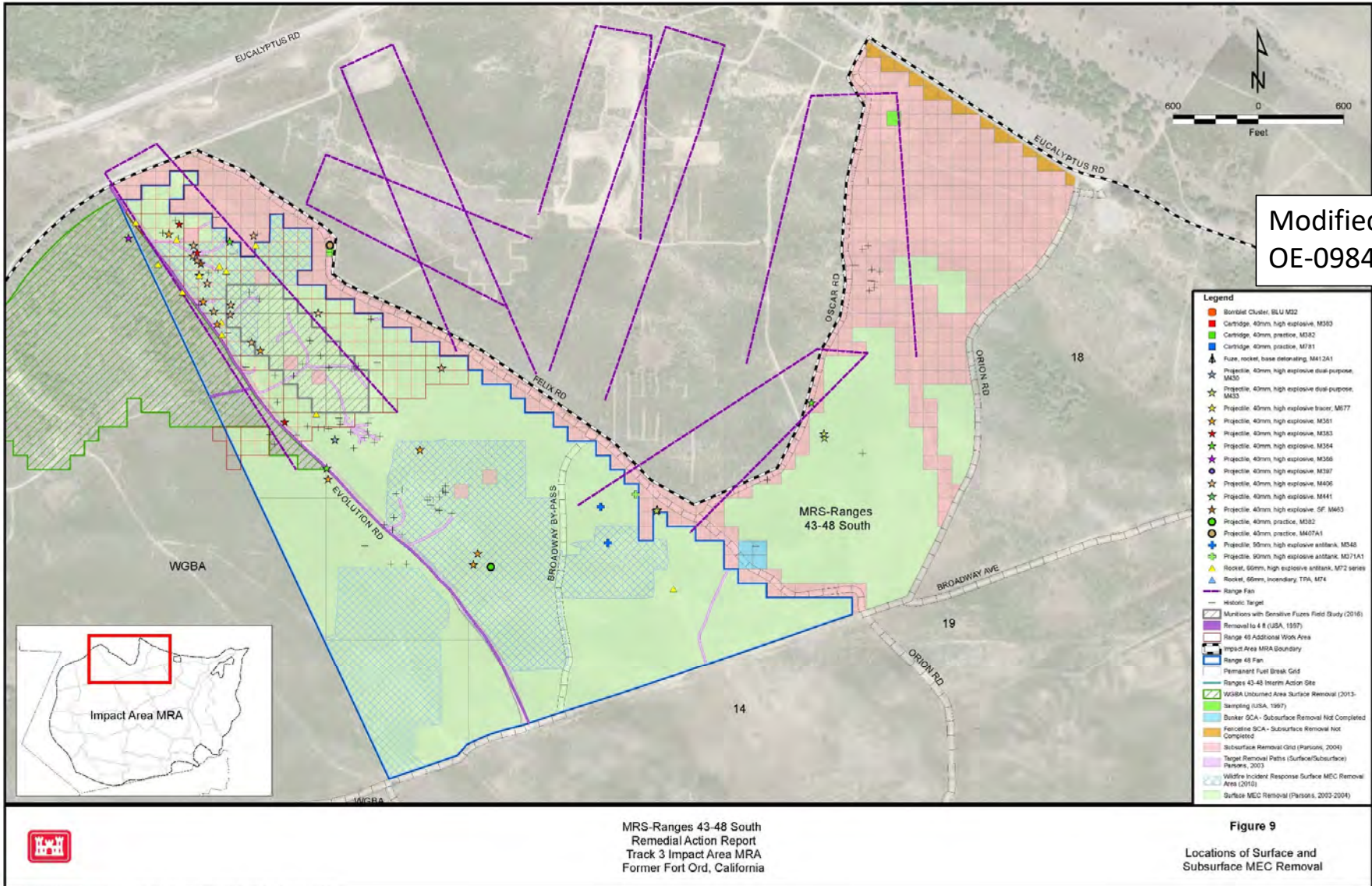


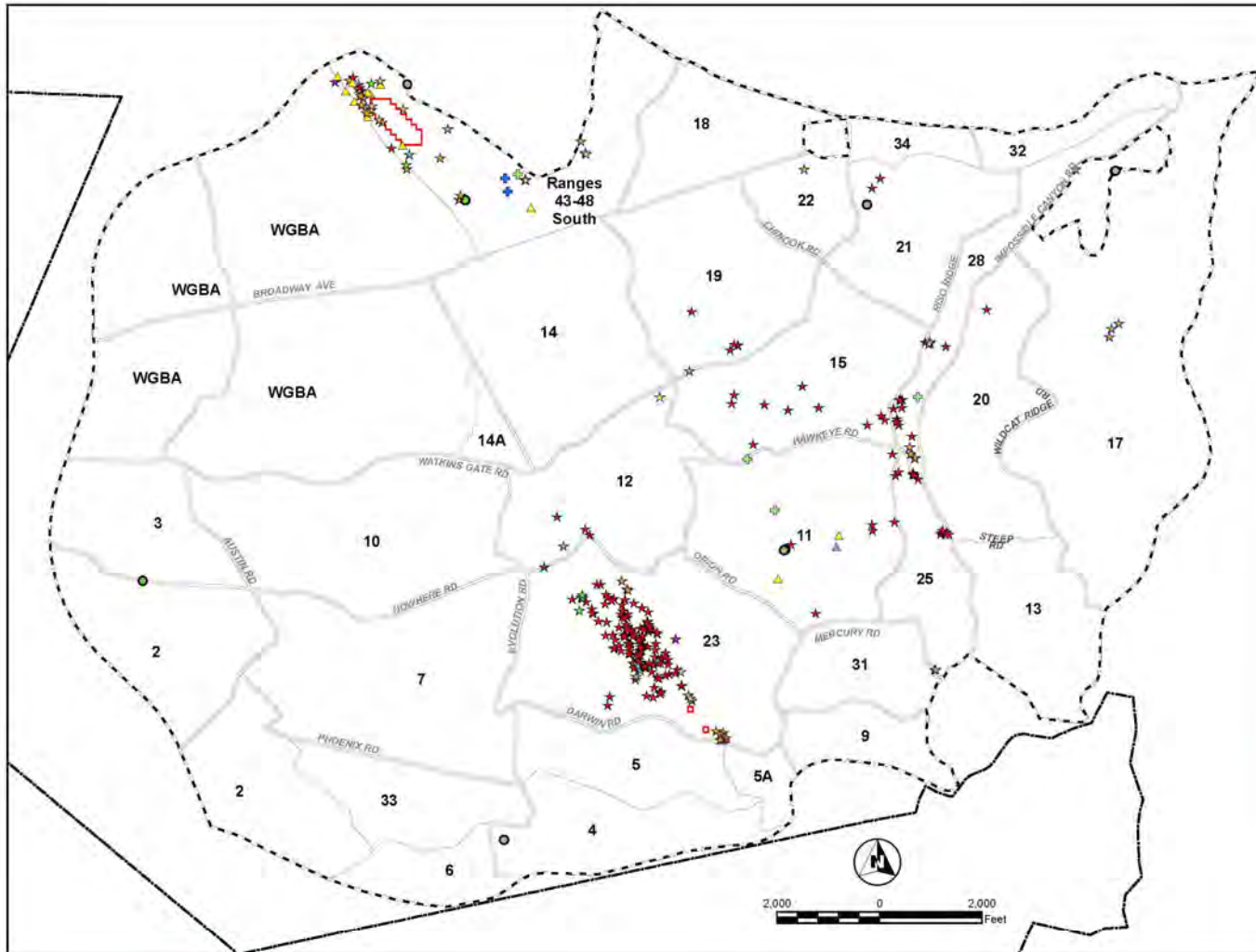
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Sensitively-fuzed MEC Item Locations  
Unit 23  
Former Fort Ord, California

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- UXO with Sensitive Fuzes**
- ★ Projectile, 40mm, high explosive dual-purpose, M430
  - ★ Projectile, 40mm, high explosive dual-purpose, M433
  - ★ Projectile, 40mm, high explosive tracer, M677
  - ★ Projectile, 40mm, high explosive, M381
  - ★ Projectile, 40mm, high explosive, M383
  - ★ Projectile, 40mm, high explosive, M384
  - ★ Projectile, 40mm, high explosive, M386
  - ★ Projectile, 40mm, high explosive, M406
  - ★ Projectile, 40mm, high explosive, M441
  - ★ Projectile, 40mm, high explosive, SF, M463
  - Projectile, 40mm, practice, M382
  - Projectile, 40mm, practice, M407A1
  - ★ Projectile, 90mm, high explosive antitank, M348
  - ★ Projectile, 90mm, high explosive antitank, M371A1
  - ▲ Rocket, 66mm, high explosive antitank, M72 series
  - ▲ Rocket, 66mm, incendiary, TPA, M74
- Field Study Area  
 Impact Area MRA  
 Fort Ord Boundary

Note: Updated from OE-0929B

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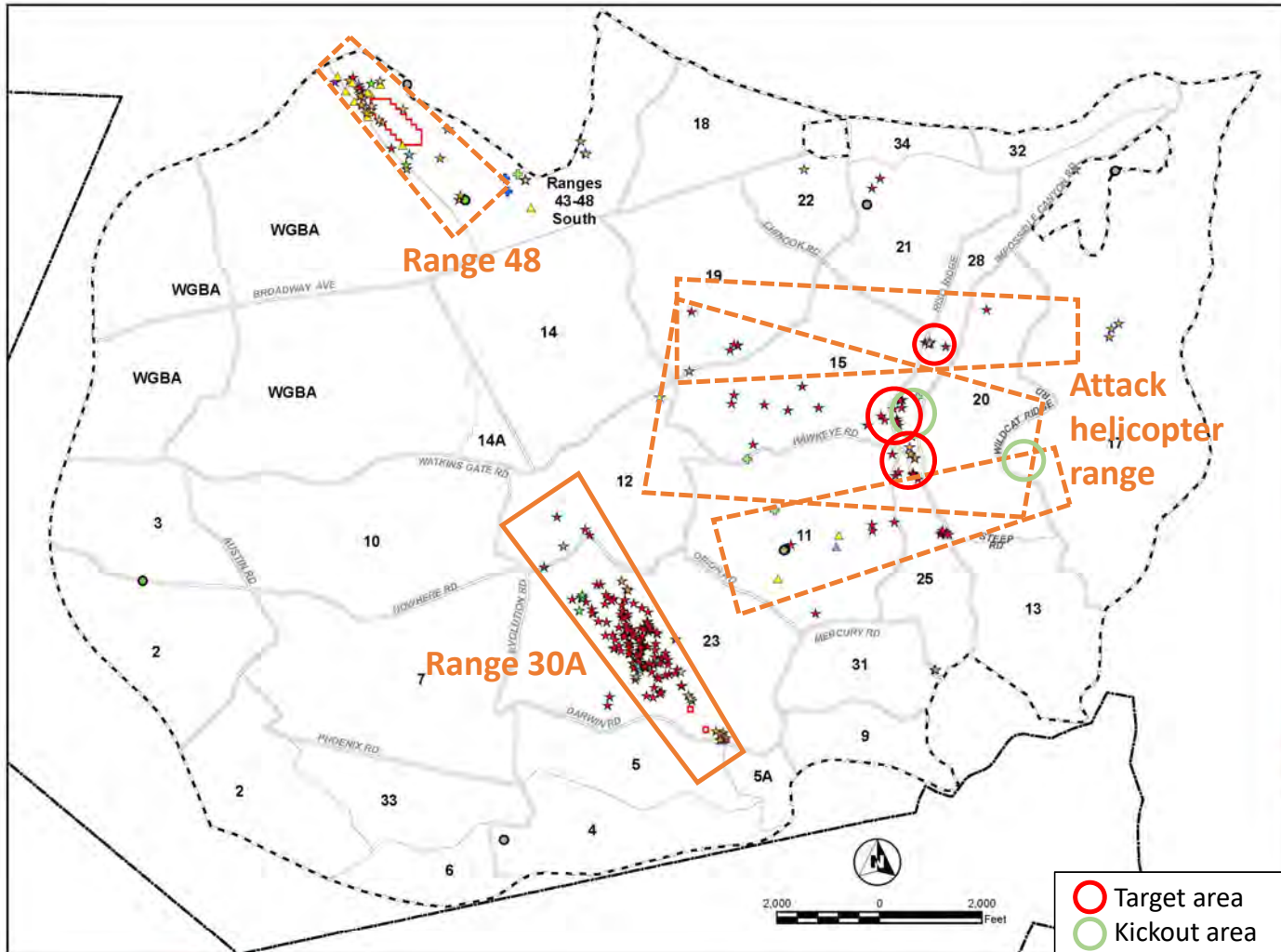


Track 3 Impact Area  
Munitions Response Area (MRA)  
Former Fort Ord, California

**Figure 6**  
Sensitive Fuze Type UXO

# Conceptual Site Model

- **The 2007 Track 3 Remedial Investigation/ Feasibility Study (RI/FS) and 2002 Interim Action RI/FS identified**
  - The M79 and M203 grenade launchers were authorized for use on Ranges 45 and possibly during the 1960s at Range 47.
  - The MK 19 Mod 3 machine gun was authorized for use at Range 30A (1990-1993).
  - Range 32, the Attack Helicopter range, that was active in the 1980s.
- **Remedial action data** indicate the distribution of sensitive fuze-type 40mm UXO is consistent with the ranges in which the use of 40mm munitions was authorized.
- Most of the items are located relative to:
  - Range 45 (remediated)
  - Range 47 (remediated)
  - Range 30A, the MK19 Gunnery Range in the 1990s (maximum range 2,200 meters; effective range 1,500 meters)
  - Range 32, the Attack Helicopter range established in mid-1980s (helicopter-mounted 40mm grenade launchers, maximum range 2,100 meters)
  - Range 48 (known as having been used for multiple types of weapons firing).



- UXO with Sensitive Fuzes**
- ☆ Projectile, 40mm, high explosive dual-purpose, M430
  - ☆ Projectile, 40mm, high explosive dual-purpose, M433
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  - ☆ Projectile, 40mm, high explosive, M386
  - ☆ Projectile, 40mm, high explosive, M406
  - ☆ Projectile, 40mm, high explosive, M441
  - ☆ Projectile, 40mm, high explosive, SF, M463
  - Projectile, 40mm, practice, M382
  - Projectile, 40mm, practice, M407A1
  - ✦ Projectile, 90mm, high explosive antitank, M348
  - ✦ Projectile, 90mm, high explosive antitank, M371A1
  - ▲ Rocket, 66mm, high explosive antitank, M72 series
  - ▲ Rocket, 66mm, incendiary, TPA, M74
- Field Study Area (Red dashed line)
- Impact Area MRA (Black dashed line)
- Fort Ord Boundary (Black solid line)

Note: Updated from OE-0929B

Updated from  
OE-0929B



Track 3 Impact Area  
Munitions Response Area (MRA)  
Former Fort Ord, California

**Figure 6**  
Sensitive Fuze Type UXO

# Potential for Sensitive Fuze-type UXO to be Present in the Subsurface

Munitions containing sensitive fuzes at Fort Ord are direct-fire munitions; If the items do not detonate upon impact with the ground surface, the majority can be expected to be on or near the surface.

## General observations:

- The majority of items with depth data is surface items.
- 90% of subsurface 40mm items were recovered from within 6-in depth (160 out of 178)
- For 66mm rockets, 93% of subsurface items were from within 6-in depth (28 out of 30)
- All previously recovered 90mm UXO items were surface items

Due to the historical overlapping uses of ranges, high density of anomalies in the preliminarily identified areas is not directly indicative of elevated likelihood of subsurface presence of sensitive fuze-type UXO.

Outside of dedicated, constructed 40mm ranges, the majority of subsurface sensitive fuze-type 40mm UXO items (if present) would be expected to be near the surface, no deeper than 6-in depth.

Depth distributions of sensitive fuze-type UXO at Fort Ord (data through Dec 2020)

Depth (in)	Quantity	% of those with depth data	Quantity	% of those with depth data	Quantity	% of those with depth data
	66mm rockets		90mm projectiles		40mm projectiles	
<b>All</b>	429		27		1164	
<b>no depth</b>	9		0		350	
<b>0</b>	390	<b>92.9</b>	27	<b>100</b>	607	<b>74.6</b>
<b>1 to 3</b>	23	<b>5.5</b>	0	<b>0</b>	125	<b>15.4</b>
<b>4 to 6</b>	5	<b>1.2</b>	0	<b>0</b>	35	<b>4.3</b>
<b>7 to 9</b>	1	<b>0.2</b>	0	<b>0</b>	8	<b>1.0</b>
<b>10 to 12</b>	1	<b>0.2</b>	0	<b>0</b>	10	<b>1.2</b>
<b>&gt;=13</b>	0	<b>0.0</b>	0	<b>0</b>	29	<b>3.6</b>

Notes:

1-40mm projectiles: 29 items > 12 in. They were recovered in five occasions. Two in MRS-13B (in Parker Flats) and CSU Footprint are burial and possible burial. Three in Ranges 43-48 are possible burial or associated with dedicated 40mm ranges.

2-Range 45 and Range 47 were dedicated, constructed ranges, used for 40mm grenade launchers. Recovery depths are not available for MEC recovered from excavation and sifting conducted in these ranges.

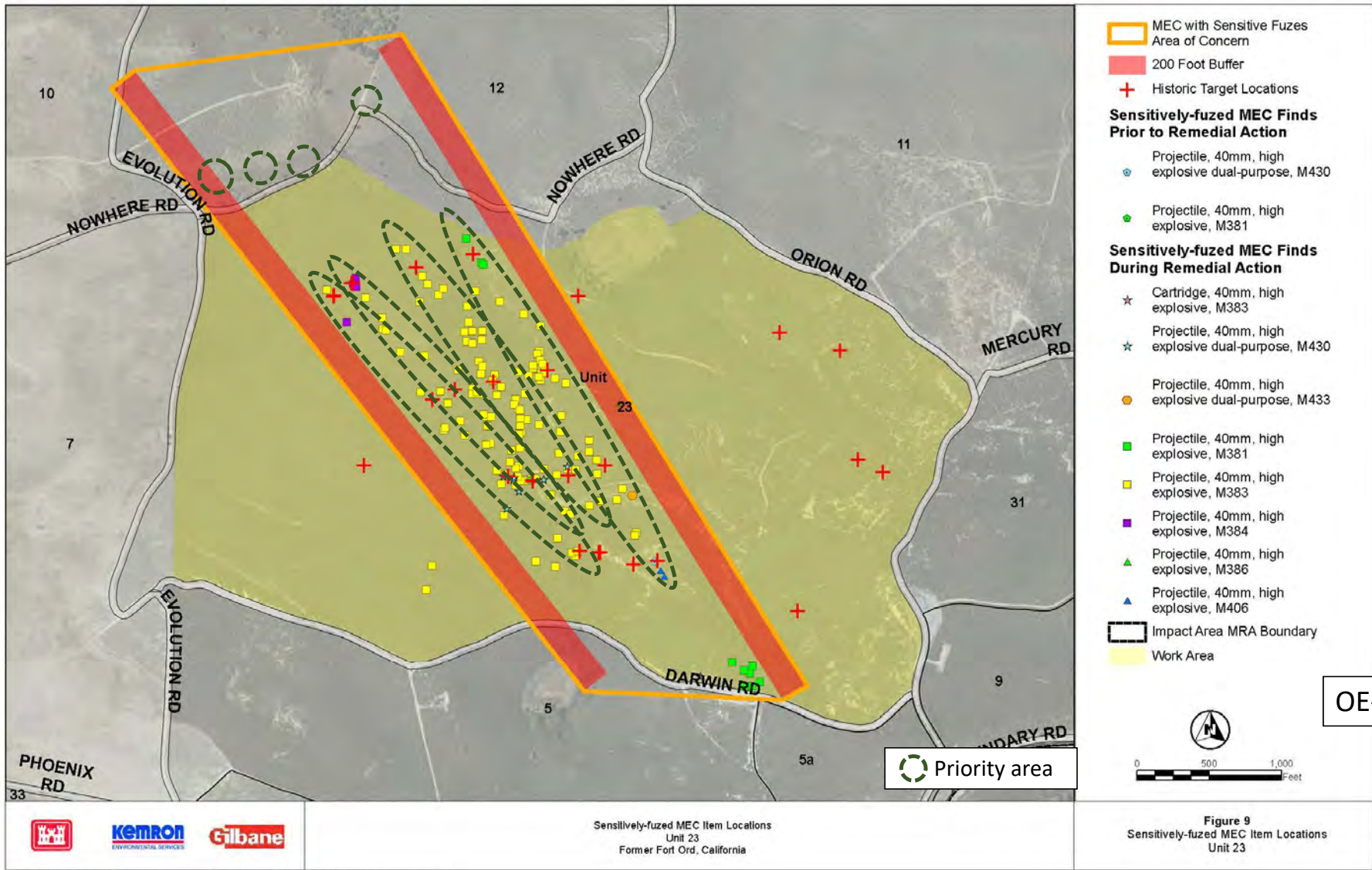
# Potential for Subsurface Sensitive Fuze-type UXO to Become Exposed

- In areas that contain much subsurface clutter and where ground surface has been disturbed, it is considered more likely for subsurface materials to become exposed due to erosion over time.
  - High-clutter areas are typically associated with target areas, and can also be indicated by high density of DGM anomalies.
  - Activities such as vegetation cutting and operating vehicles contribute to surface disturbance.
  - Areas of erosion concern (actual or potential) have been noted during post-surface-removal joint inspection with BLM and during surface monitoring.
- Based on BLM comments and joint unit inspections:
  - Specific areas with erosion concerns and future restoration areas have been identified in the units.
  - None of the erosion or future restoration areas were identified based on the presence of range targets.
  - While some of them are in part coincident with the ranges and targets, they were identified due to old access roads eroding, restoration associated with planned removal of hardstand, and restoration related to presence of wetlands.
- Based on recent surface monitoring:
  - Active erosion features (e.g., gullies) are noted in some units, without munitions discoveries.
  - Patches of exposed sandy areas with the presence of exposed munitions debris were noted in some units. However, larger areas (e.g., several grids in size) of erosion concern have not been recorded, with the exception of the southern portion of Unit 21 associated with Range 37 (not related to sensitive fuze-type munitions).

# Updated Conceptual Site Model

- **Range 45 and Range 47. Dedicated, constructed ranges for 40mm grenade launchers where high explosive munitions were fired.** A defined range area can be drawn. High density of subsurface clutter. Subsurface sensitive fuze-type 40mm UXO items at deeper depths (>12 inches) were removed during remedial actions that included excavation and sifting. (Remediation complete.)
- **Range 30A. MK19 Machine Gun Range where 40mm high explosive munitions were fired.** Targets were at fixed distances (400m, 600m, 800m, 1,100m, 1,500m and 2,100m) from the firing point. Sensitive fuze-type 40mm UXO items are to be expected on the surface and possibly in the shallow subsurface. Distributions of 40mm MEC items are consistent with range configuration. Projectiles found in the southwest portion of Unit 12 are consistent with the 1,500m to 2,100m target areas. (Surface removal has been completed in Unit 23 and Unit 12.)
  - Subsurface sensitive fuze-type 40mm UXO items at deeper depths (>6 inches) are not expected. Shallow subsurface items (≤6 inches) can be expected in areas near targets.
- **Range 32. Attack helicopter range where high explosive 40mm munitions were fired from helicopter-mounted 40mm grenade launchers.** Helicopters would emerge from behind ridges to fire at targets to the west. Sensitive fuze-type 40mm UXO items are to be expected on the surface and in the shallow subsurface in the target areas. Cartridges that were ejected from the weapon (when failed to fire) would have fallen onto the ground near the locations of firing. Although they are categorized as DMM (they have not been fired), they have the potential to detonate if present and disturbed. Groups of targets have been located near Riso Ridge Road and Hawkeye Road; and Riso Ridge Road near Chinook Road. Some targets in Unit 15 and Unit 11 may also have been used. Impossible Canyon Road was also likely have been fired at. (Surface removal has been completed in Units 28, 25, 11, 15 and 19. Subsurface removal has been completed along fuel break roads.)
  - Subsurface sensitive fuze-type 40mm UXO items at deeper depths (>6 inches) are not expected. Shallow subsurface items (≤6 inches) can be expected in areas near targets
  - Shallow subsurface cartridges (kickouts) (<6 inches) are possible in areas where helicopters were positioned for firing.





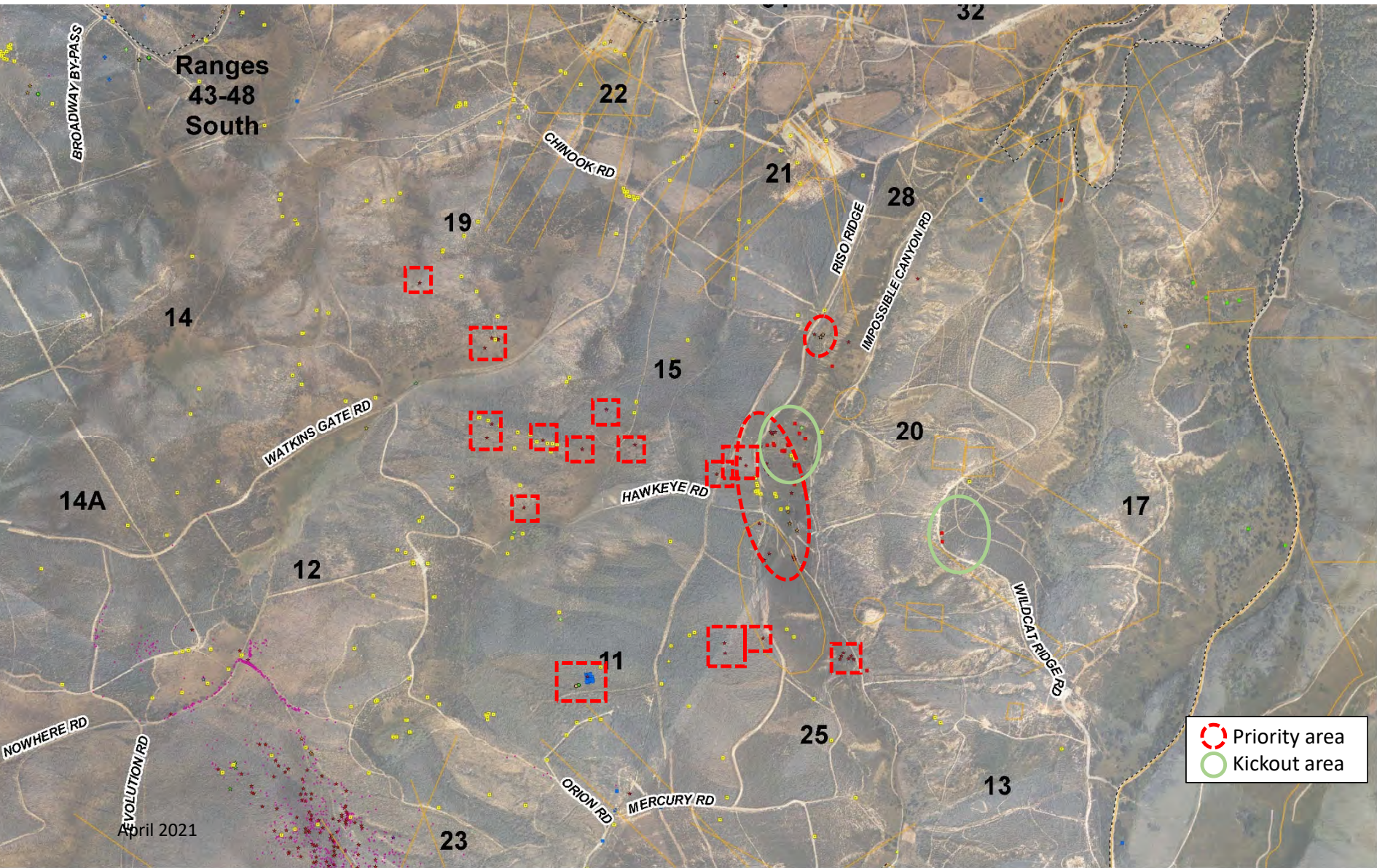
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Sensitively-fuzed MEC Item Locations  
 Unit 23  
 Former Fort Ord, California

Figure 9  
 Sensitively-fuzed MEC Item Locations  
 Unit 23

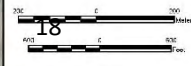
M:\10109\inf\_Ord\Line 22\Map\_Docs\Figure 9 - Sensitively-fuzed MEC Item Locations.mxd 12/9/2016 (1:28 PM) wkasetky, CGibane





- Legend**
- MEC with Sensitive Fuzes and Other Munitions
- Cartridge, 40mm, high explosive, M383
  - Cartridge, 40mm, practice, M382
  - Cartridge, 40mm, practice, M781
  - ✱ Projectile, 40mm, high explosive dual-purpose, M430
  - ✱ Projectile, 40mm, high explosive dual-purpose, M433
  - ✱ Projectile, 40mm, high explosive tracer, M677
  - ✱ Projectile, 40mm, high explosive, M381
  - ✱ Projectile, 40mm, high explosive, M383
  - ✱ Projectile, 40mm, high explosive, M384
  - ✱ Projectile, 40mm, high explosive, M386
  - ✱ Projectile, 40mm, high explosive, M406
  - ✱ Projectile, 40mm, high explosive, M441
  - Projectile, 40mm, practice, M382
  - Projectile, 40mm, practice, M385
  - Projectile, 40mm, practice, M407A1
  - Projectile, 40mm, practice, M518
  - ◆ Projectile, 50mm, high explosive antitank, M348
  - ◆ Projectile, 50mm, high explosive antitank, M371A1
  - ▲ Rocket, 60mm, high explosive antitank, M72 series
  - ▲ Rocket, 60mm, incendiary, TPA, M74
  - Historic Target
  - Firing Range Fan
  - - - Impact Area
  - Fort Ord Boundary

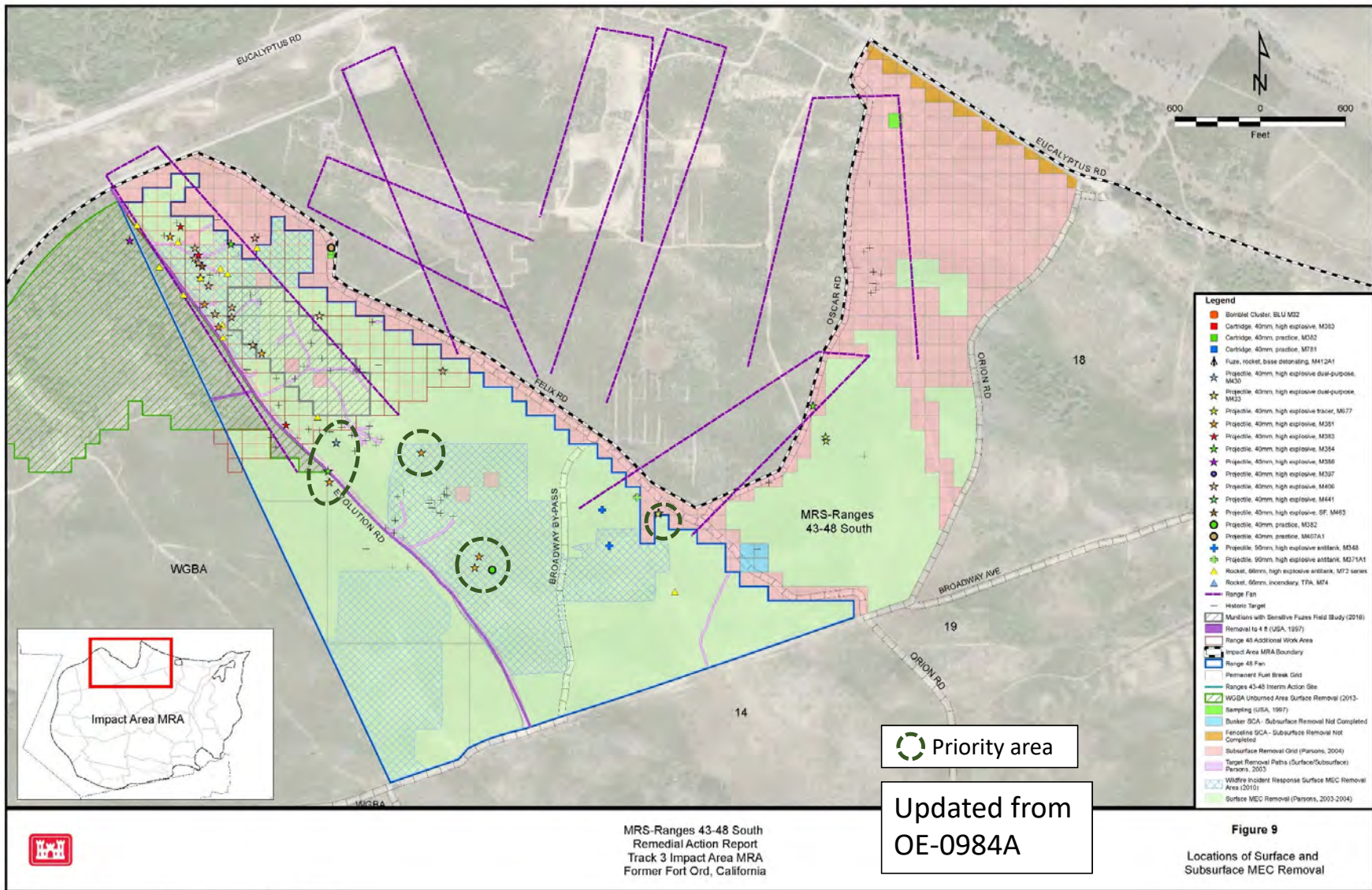
Priority area  
 Kickout area



April 2021

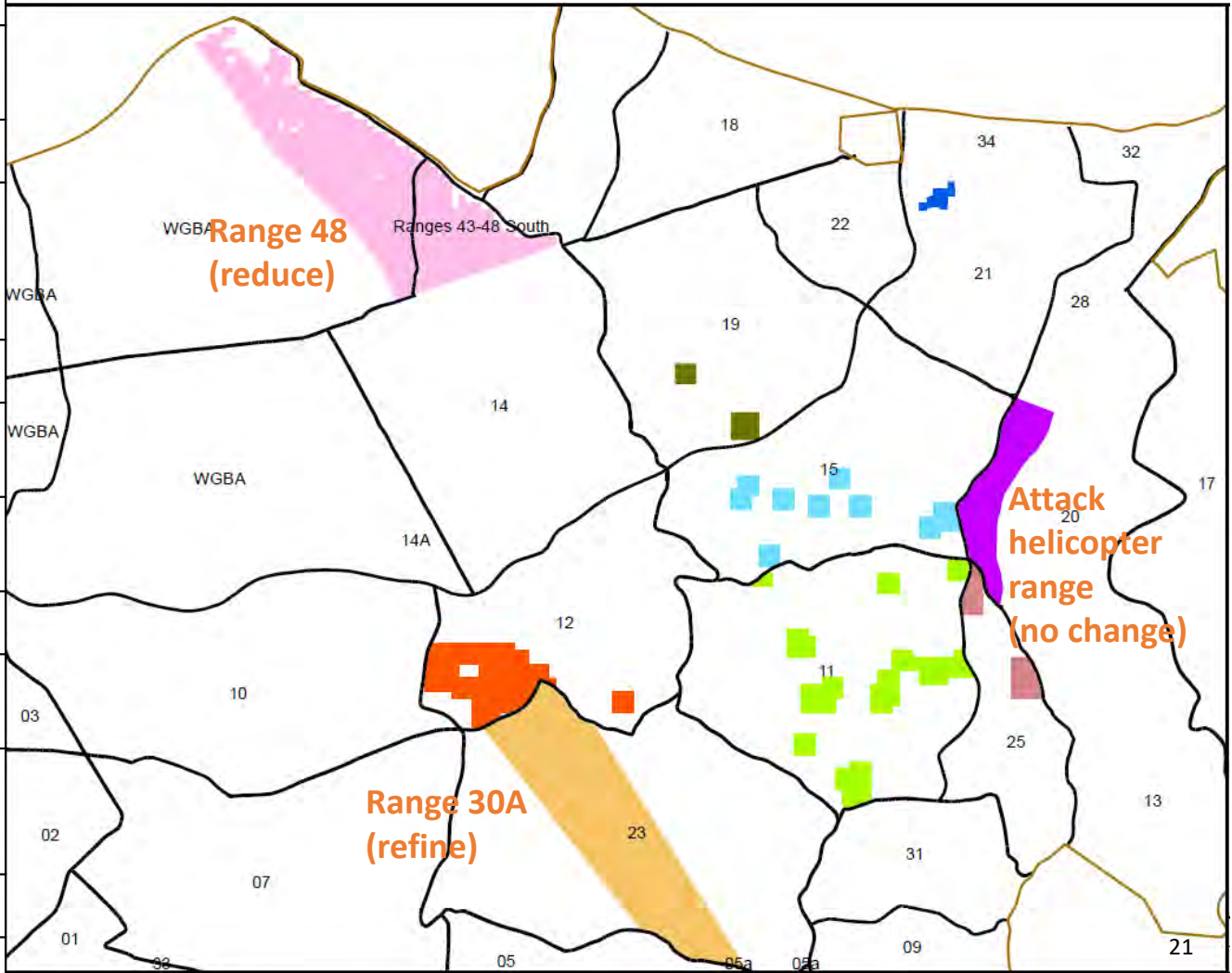
## Updated Conceptual Site Model (cont'd)

- **Range 48. A multi-use range where physical evidence confirmed that sensitive fuze-type 40mm munitions were fired. Historical records and physical evidence also confirm the firing of 66mm LAW rockets.** (Surface removal has been completed. Near-surface removal has been conducted in the northern portion of Range 48. Subsurface removal was conducted in portions of the range.)
  - Because these items are not expected to be present at depths greater than 6-in, no additional subsurface items are expected in the near-surface removal area.
  - To the south of the near-surface removal area, shallow subsurface 40mm items ( $\leq 6$  inches) are possible. Items recovered during previous removal actions were not clustered, all east of Evolution Road. The potential for penetration into the ground is low. Portions of this area had a second surface removal in 2010 after an accidental fire with no sensitive fuze-type MEC encountered.
  - To the south of the near-surface removal area, shallow subsurface 66mm items ( $\leq 6$  inches) are not expected. Only one 66mm UXO was recovered in this area.
  - In the western portion of the “Range 48 fan area” (west of Evolution Road), shallow subsurface 40mm items ( $\leq 6$  inches) are possible but not expected. There are no targets and recovery of sensitive fuze-type 40mm has been limited in this area.
- **Range 38** “Zero range, 25 M-2 Submachine Gun, Shotgun”. Remedial action report for Unit 21 indicated UXO 40mm munitions recovered in this area included M918 practice (2ea), M383 HE (2ea), and M407 practice (1ea.). Munitions debris in this vicinity has also been noted in the surface monitoring annual report for 2019. Project personnel have noted observing MD from practice 40mm grenades during past surface monitoring walks. The use of practice 40mm grenades (grenade launcher types) is possible, however, the mix of recovered models (MK19 Mod 3 types) do not make sense together.
- The distributions of recovered sensitive fuze-type UXO indicated some 40mm munitions in **Range 34**, area of **Mercury Hill** (in Unit 11) and at the **bottom of Seep Road** (in Unit 25). While additional items in the subsurface cannot be called out, extensive use of these munitions in these locations was not suggested by the quantities of recovered items.



# Areas for Further Evaluation Relative Priorities

High	Attack helicopter range. Target areas at intersection of Riso Ridge x Hawkeye.
High	Attack helicopter range. Southern portion of Unit 28 that includes other target areas along Riso Ridge Road.
High	Middle of Range 30A. Area between 400m target area and 1,100m target area.
High	Downrange portion of Range 30A. The 1,500m target area in the southwest portion of Unit 12 (four points of higher DGM density), each within 400 feet of Nowhere Road.
Med	Attack helicopter range. Groups of grids in downrange areas in Units 11, 15 and 19.
TBD	Attack helicopter range. Possible target areas east side of Impossible Canyon Road. (Unit 20 remedial action pending.)
TBD	Attack helicopter range. Kickout area east of Wildcat Ridge Road. (Unit 17 remedial action pending.)
Med	Groups of grids in Unit 12 not included in other rows.
Med	Range 48, south of near-surface removal area. Locations/vicinities of previously recovered sensitive fuze-type 40mm UXO.
Low	Range 48, south of near-surface removal area. Areas between locations of previously recovered sensitive fuze-type 40mm UXO.
Low	A group of grids in Mercury Hill area Unit 11.
Low	A group of grids in Unit 21 near Range 38.



# Proposed Refinements to Areas for Further Evaluation

- **Range 48. South of the near-surface removal areas near where sensitive fuze-type 40mm munitions were recovered.**
  - The northern portion of Range 48 (approximately 1,800 feet from Blueline) to the limits of near-surface removal areas, should be excluded.
  - Area east of Evolution Road can be excluded.
  - Areas between locations of previously recovered sensitive fuze-type 40mm UXO can be excluded or are low priority.
- **Range 30A. MK19 Machine Gun Range where 40mm high explosive munitions were fired.**
  - The 200-foot buffer areas can be excluded.
  - Areas between the firing points at Darwin Road to the 400m targets can be excluded.
  - Area of Unit 23 beyond the 1,100m targets can be excluded.
  - In the southwest portion of Unit 12, include the 1,500m target areas (four points of higher DGM density), each within 400 feet of Nowhere Road.
- **Range 32. Attack helicopter range where high explosive 40mm munitions were fired from helicopter-mounted 40mm grenade launchers.**
  - No adjustment is necessary. The preliminarily identified areas include a larger area that includes the target areas along Riso Ridge Road, and groups of grids in downrange areas in Units 11, 15 and 19.
- Other groups of grids that have been identified in Unit 11, Unit 12, and Unit 21 can remain as lower priority areas.

# Next Steps

- Refine the areas to be further evaluated for the risk to BLM workers from potentially encountering sensitive fuze-type UXO that could have become exposed from erosion or changes in site conditions.
- Complete the evaluation of AGC and other techniques as viable alternatives to address the risks in lieu of the large-scale excavation and sifting.
- Develop and evaluate alternative approaches for each of the identified areas to address the risks.