



Fort Indiantown Gap, Pennsylvania Military Munitions Response Program



Ricochet Area Overview of Remedial Investigation Report

30 June 2011



The Trusted Integrator for Sustainable Solutions

Overview

- Remedial Investigation Objectives
- Remedial Investigation Results
- Remedial Investigation Recommendations

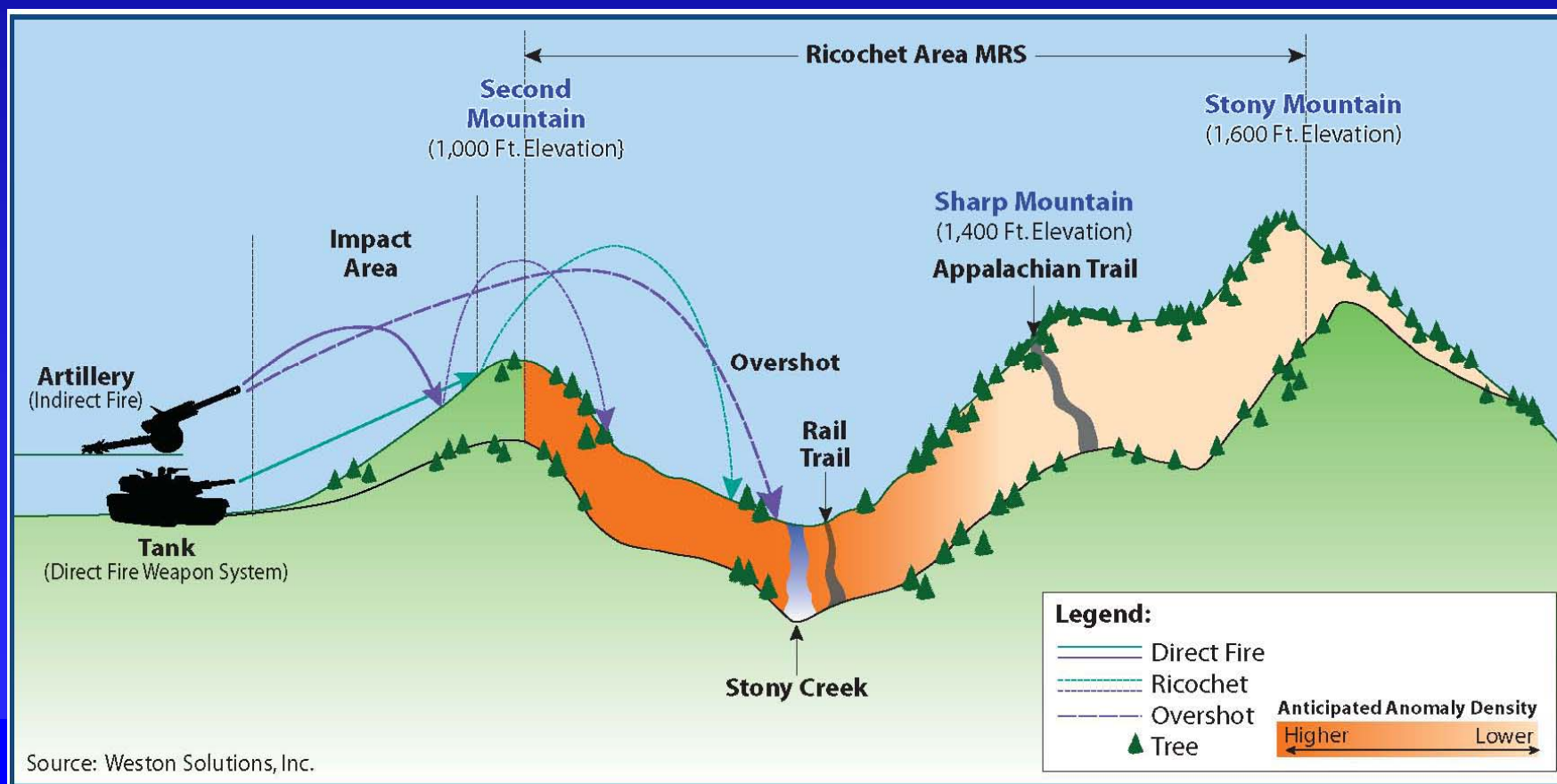
Remedial Investigation Objectives

- Investigate the Ricochet Area to determine:
 - Nature and extent of munitions and explosives of concern (MEC)
 - If MEC is present, assess explosive safety hazards
 - Characterize nature and extent of munitions constituents (MC), metals and explosives contamination
 - MEC → Hazard assessment
 - MC → Baseline risk assessment

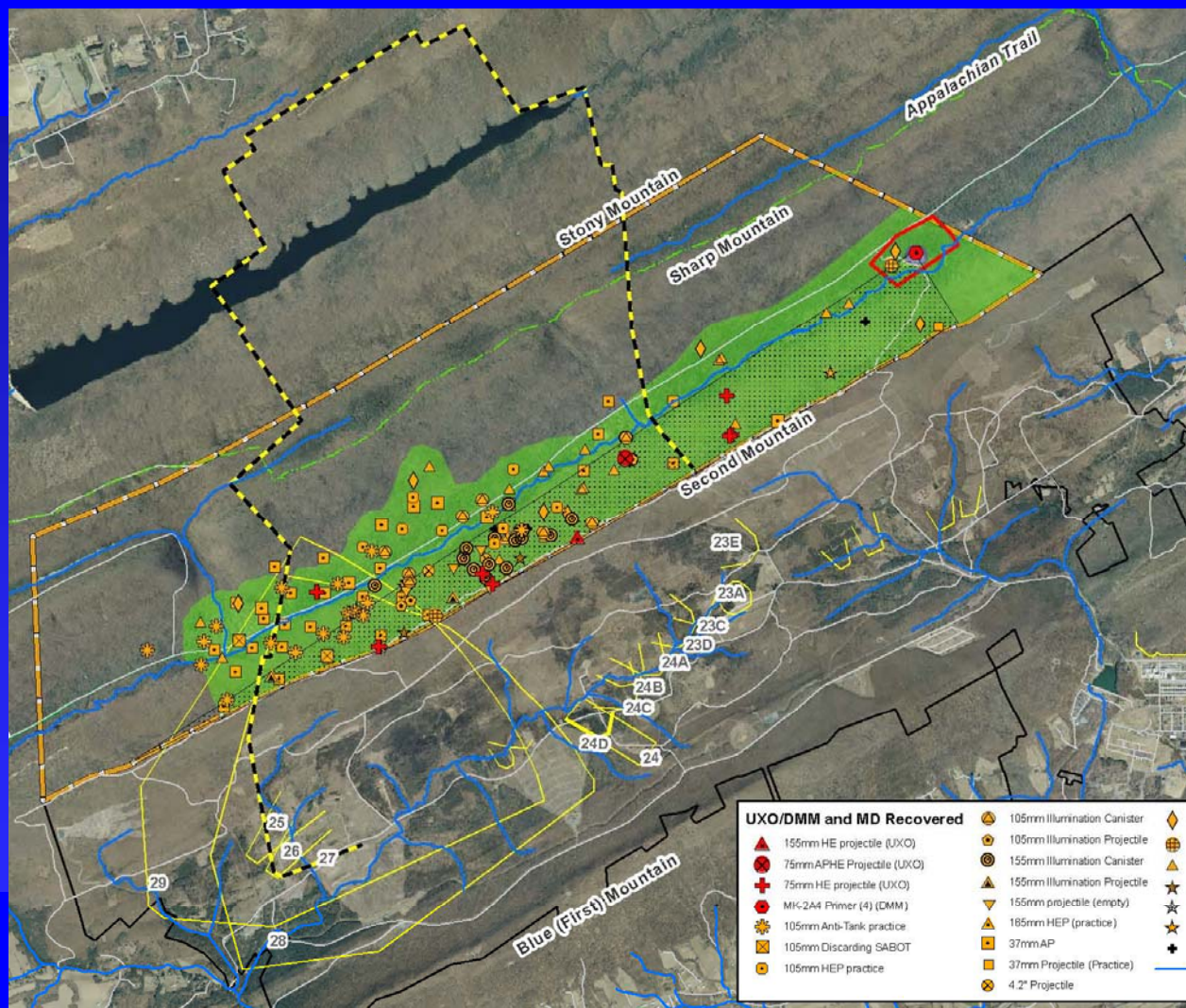


Conceptual Site Model

- Source and Release Mechanisms



Munitions Items Distribution



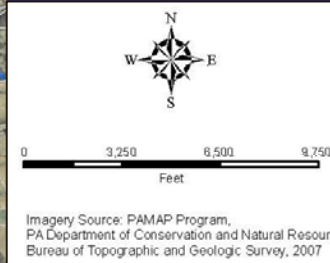
Legend

- FIG Installation Boundary
 - Ricochet Area MRS Boundary
 - Historic Range and Safety Fans
 - Potential Historic Range and Safety Fans
 - Former Cold Spring Reservation Boundary
 - Portion of the Cold Spring Range Fan
 - Area Most Likely to Contain UXO and MD
 - Area Most Likely to Contain DMM
 - Confirmed Locations of Munitions (Based on EOD Reports)
- 24C - Historical Range Nomenclature

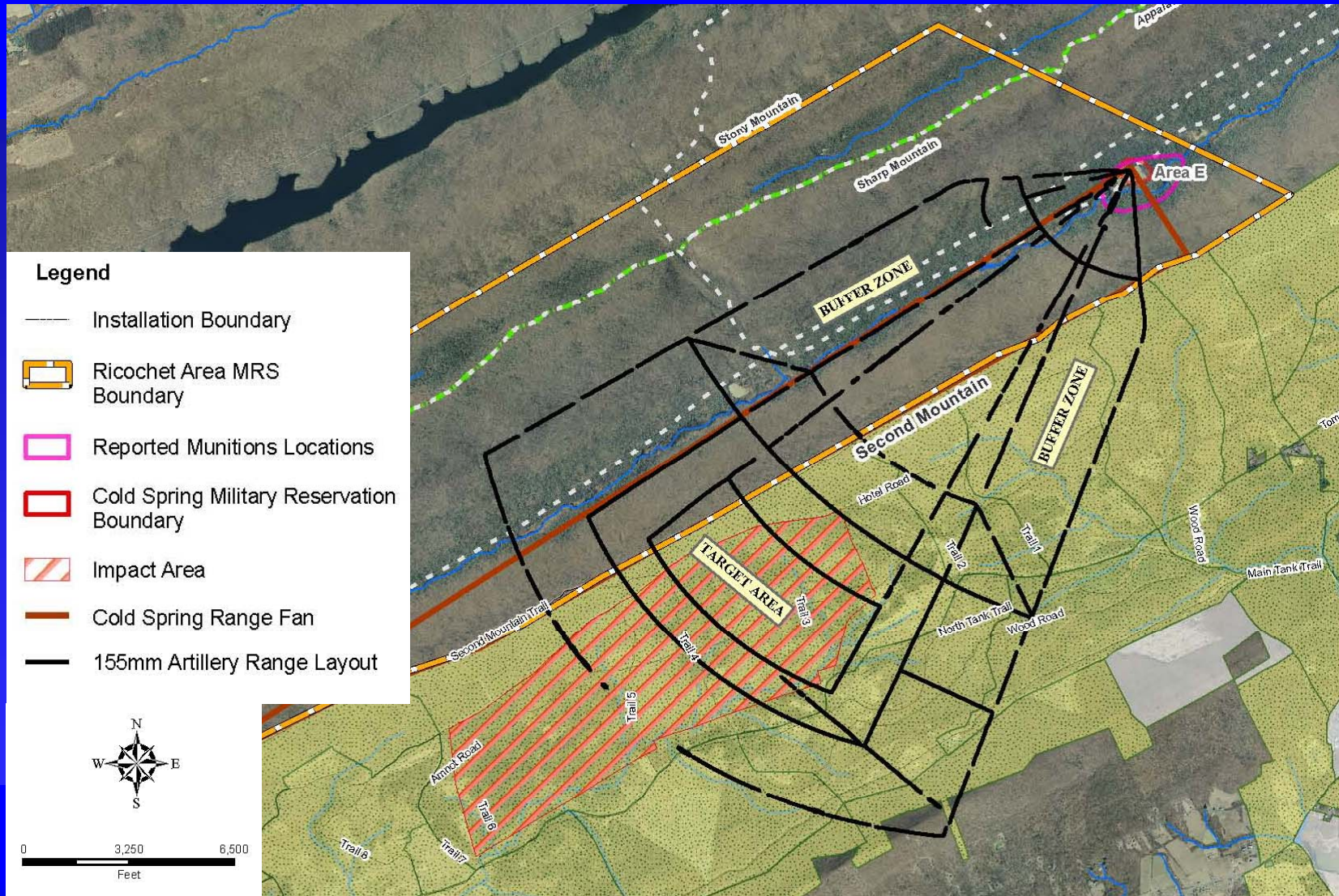
Note: Fans shown do not account for the elevation of the mountains which would have made it unlikely for overshots.

UXO/DMM and MD Recovered

- | | | |
|----------------------------|-------------------------------|------------------------------|
| 155mm HE projectile (UXO) | 105mm Illumination Canister | 57mm AP |
| 75mm APHE Projectile (UXO) | 105mm Illumination Projectile | 60mm Illumination Projectile |
| 75mm HE projectile (UXO) | 155mm Illumination Canister | 75mm AP Rounds |
| MK-244 Primer (4) (DMM) | 155mm Illumination Projectile | 81mm Illumination Mortar |
| 105mm Anti-Tank practice | 155mm projectile (empty) | 81mm Mortar Tailfin |
| 105mm Discarding SABOT | 185mm HEP (practice) | 81mm practice mortar |
| 105mm HEP practice | 37mm AP | Frag |
| | 37mm Projectile (Practice) | Stream |
| | 4.2" Projectile | |



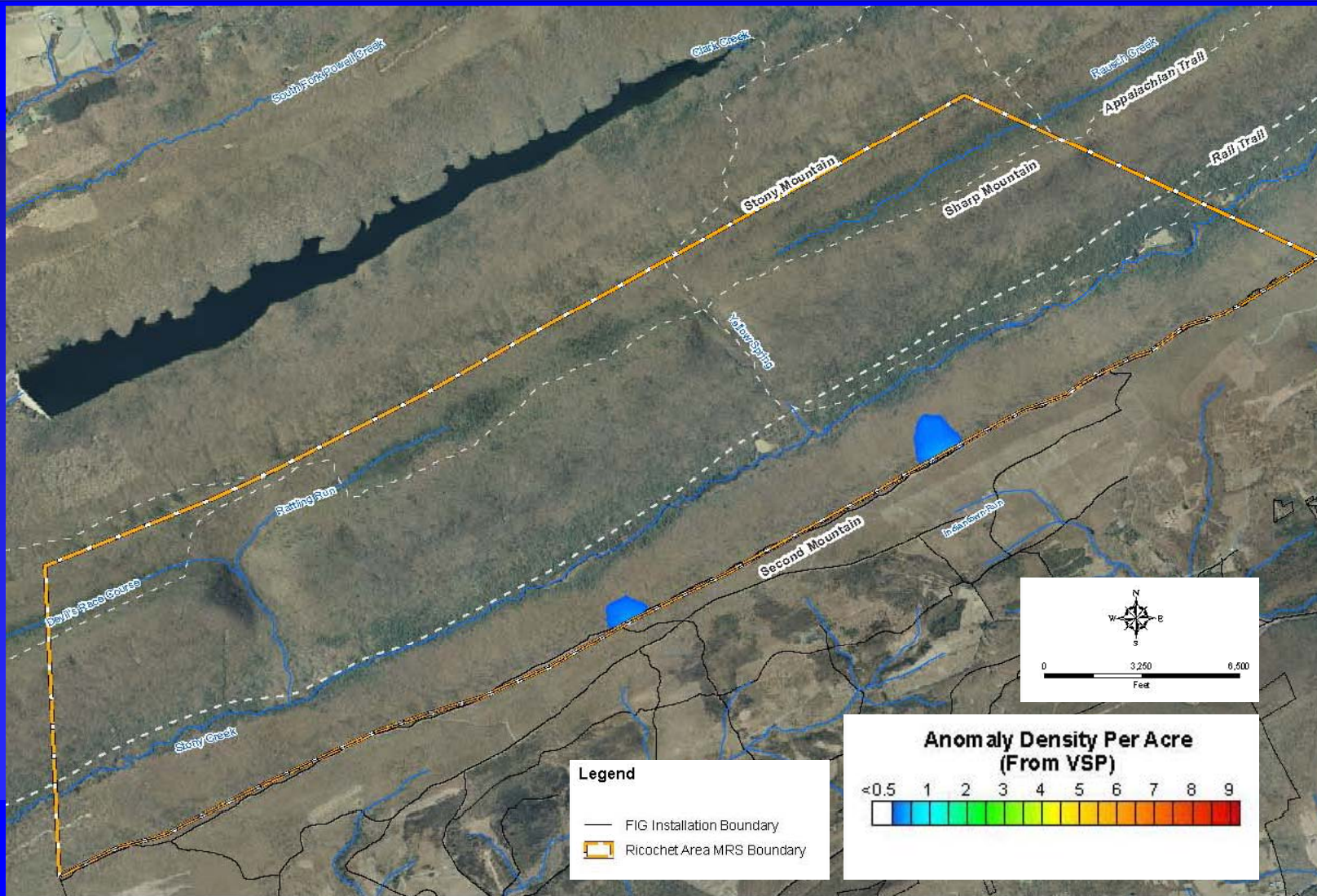
Cold Spring Firing Point



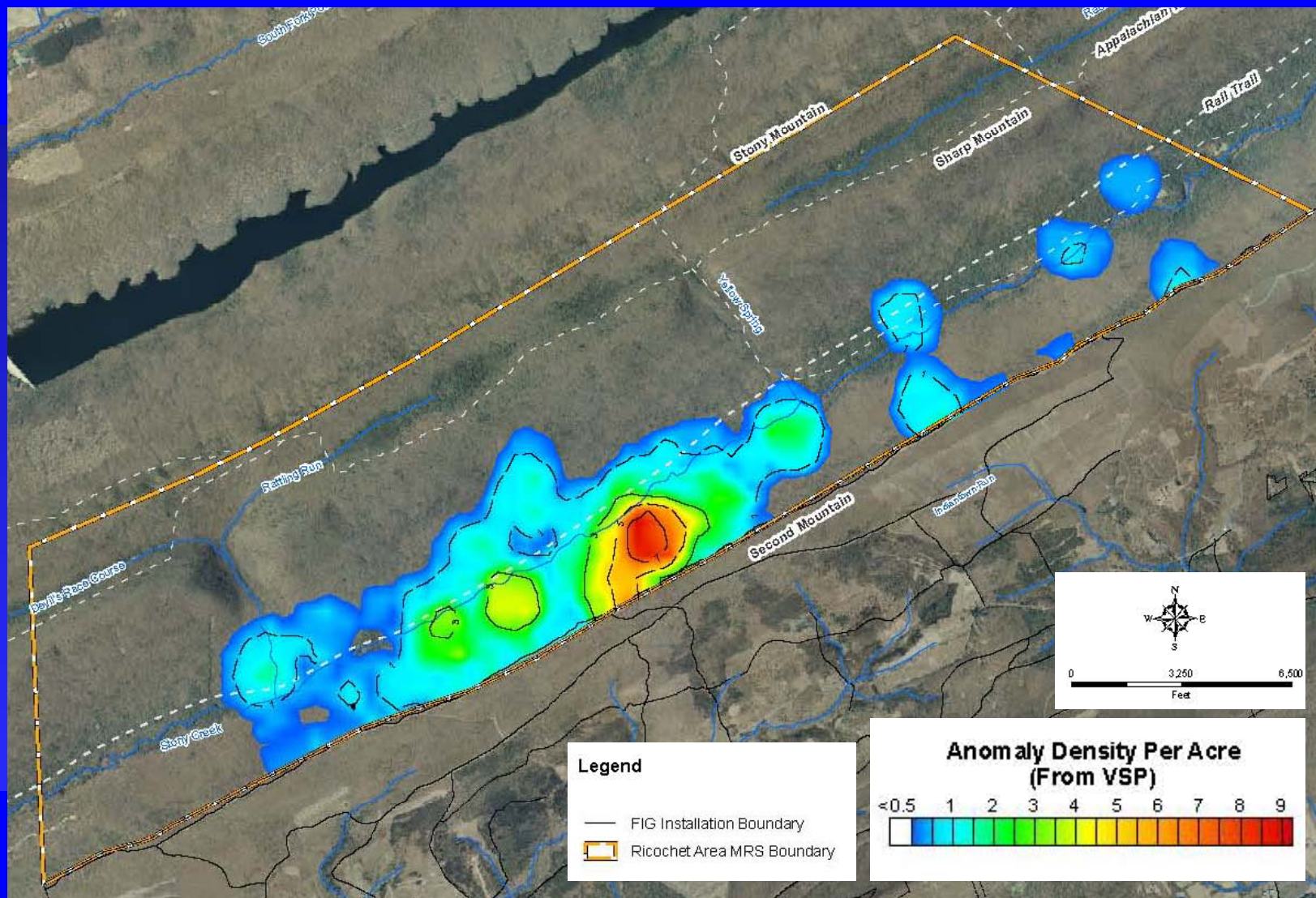
Conceptual Site Model

- Distribution and Density of MEC:
 - Highest density of MEC/MD → Second Mountain and Stony Creek
 - Munitions Response Site (MRS) subdivided to reflect density areas
 - Ricochet Area MRS – Boundary drawn on approximate 0.5 anomalies/acre contour line
 - Cold Spring MRS – Based on DMM and range related debris
 - Sharp Mountain MRS – No munitions found

Density Map of MEC



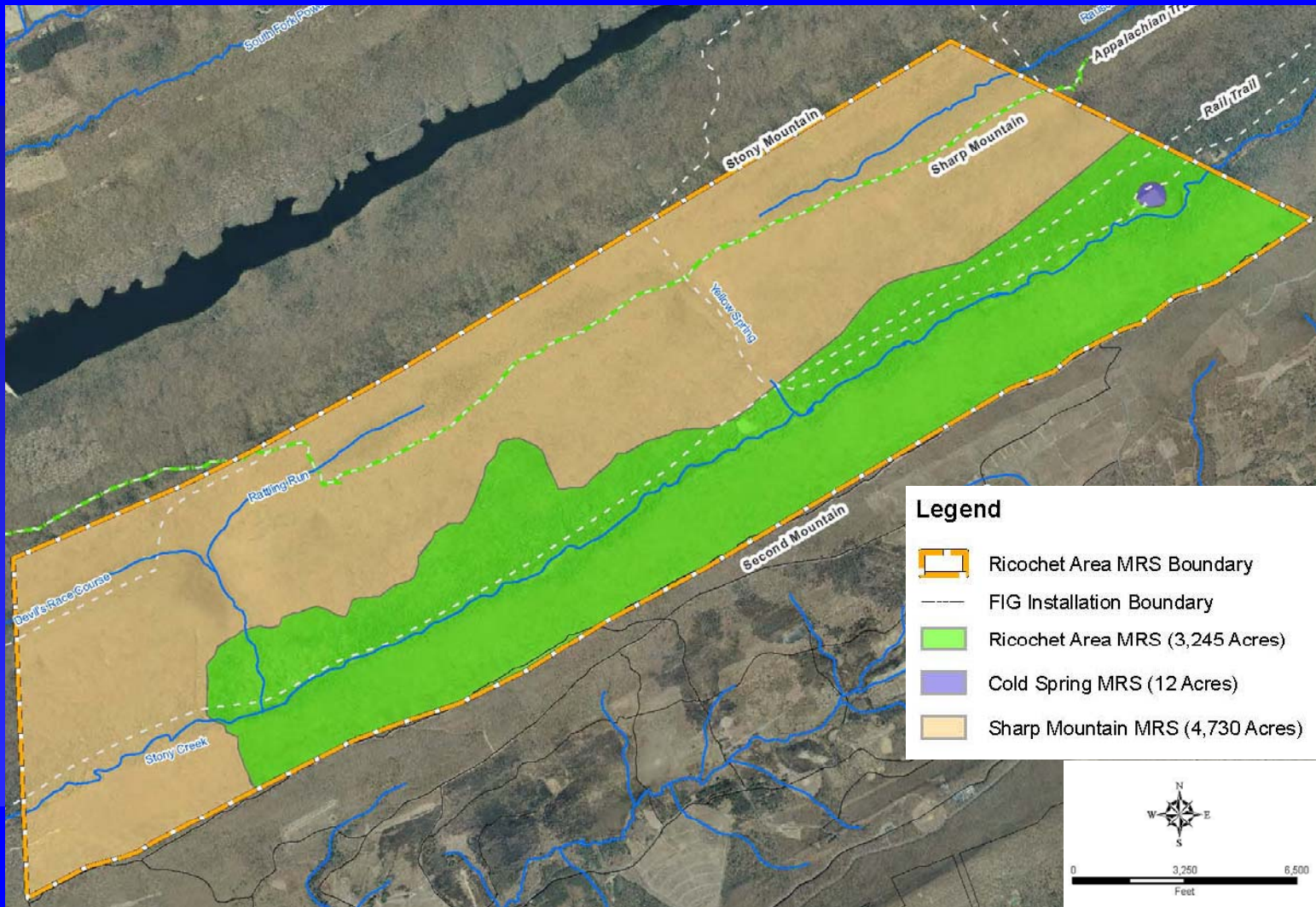
Density Map of MEC and All Munitions Debris



Depths of Munitions

- Munitions recovered surface or shallow subsurface
 - 66% of items were recovered on the surface
 - 25% at 0.25 ft below ground surface (bgs)
 - 9% located at 0.5 ft bgs or deeper
 - Depths and orientation consistent with ricochet and overshot/undershot deflecting off of rocks
- DMM found at a depth of 1 ft in Cold Spring MRS
 - Consistent with burial/discard of DMM at firing point

MRS Subdivision



Receptors



- Current Receptors

- Recreational Users – hunters, hikers, and anglers
- Trail maintenance personnel
- PA Game Commission personnel and contractors
- Firefighters

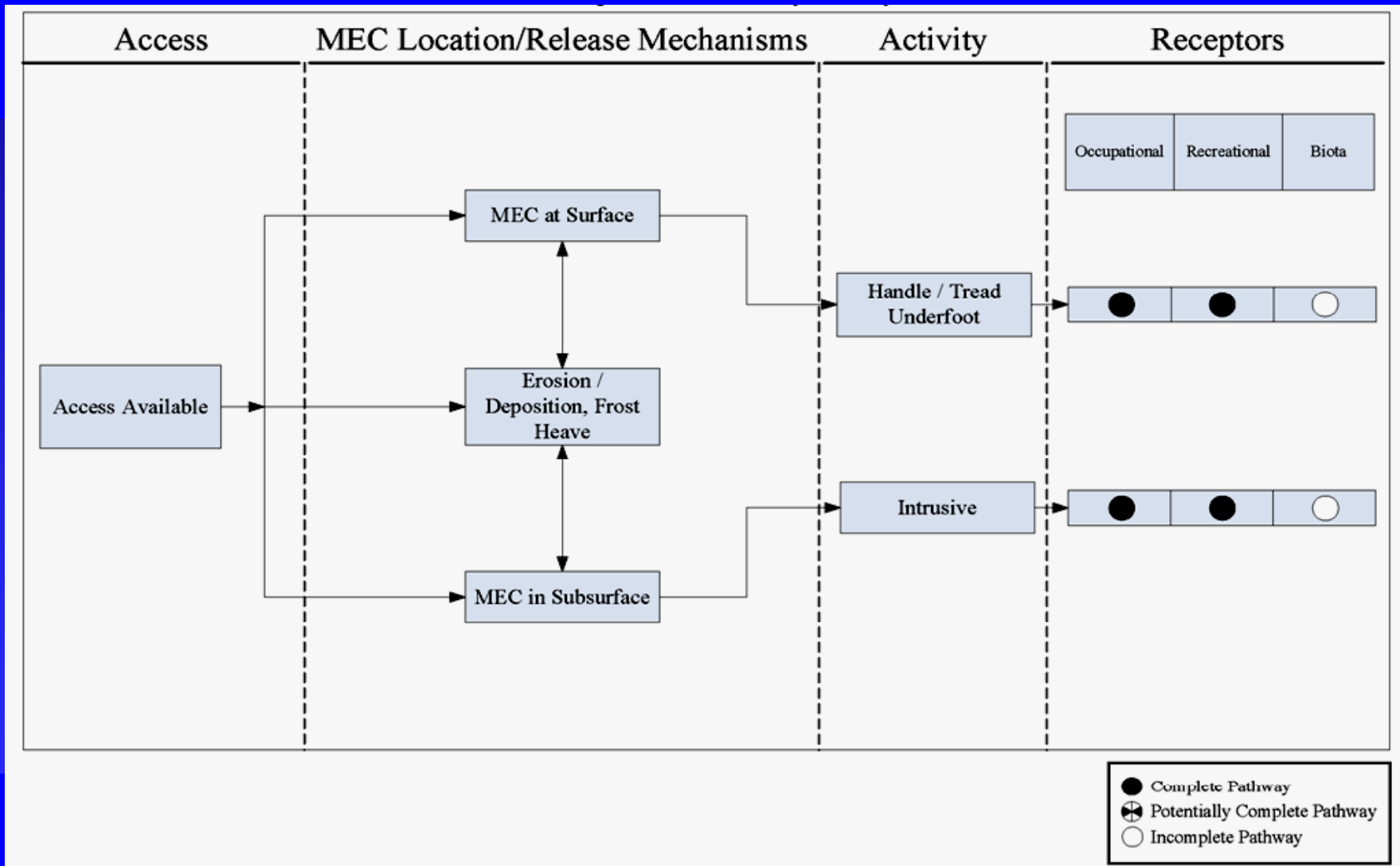


- Future Receptors

- Above list and construction workers



MEC Exposure Pathway



MEC Hazard Assessment

I. Energetic Material Type		V. Amount of MEC	
High Explosive and Low Explosive Filler in Fragmenting Round	100	Target Area	180
White Phosphorous	70	OB/OD Area	180
Pyrotechnic	60	Function Test Range	165
Propellant	50	Burial Pit	140
Spotting Charge	40	Maneuver Area	115
Incendiary	30	Firing Point	75
		Safety Buffer Area	30
II. Location of Additional Human Receptors		Storage Area	25
Inside MRS	30	Explosive Related Industrial Facility	20
Outside MRS	0		
III. Site Accessibility		VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	
Full Accessibility	80	Surface and Subsurface	240
Moderate Accessibility	55	Subsurface only	150
		Subsurface only with no interference	50
Limited Accessibility	15		
Very Limited Accessibility	5	VII. Migration Potential	
IV. Potential Contact Hours		Possible	30
Many Hours > 100,000,000 receptor hrs/year	120	Unlikely	10
Some Hours 100,000 to 999,999 hrs/year	70	VIII. MEC Classification	
Few Hours 10,000 to 99,000 hrs/year	40	UXO Special Case	180
Very Few Hours <10,000 hrs/year	15	UXO	110
		Fuzed DMM Special Case	105
		Fuzed DMM	55
		Unfuzed DMM	45
		Bulk Explosives	45
		IX. MEC Size	
		Small. Small enough to move by hand and start detonation	40
		Large. Greater than 90 lbs.	0

MEC Hazard Assessment

- Hazard Levels (1 through 4)
 - 1 highest hazard potential, imminent threat to human health from MEC
 - 2 high hazard, surface and subsurface MEC, moderate accessibility
 - 3 moderate hazard potential, safe for current land use but not future land use, restricted access or low number of contact hours
 - 4 lowest hazard potential, compatible with current and future land use.

Hazard Level	Maximum MEC HA Score	Minimum MEC HA Score
1	1000	840
2	835	725
3	720	530
4	525	125

MEC Hazard Assessment

Ricochet Area MRS

Safety Buffer Zone/Ricochet Area		
Response Action Cleanup: No Response Action		
Input Factor	Input Factor Category	Score
I. Energetic Material Type	High Explosive and Low Explosive Filler in Frag	100
II. Location of Additional Human Receptor	Inside the MRS or inside the ESQD arc	30
III. Site Accessibility	Moderate Accessibility	55
IV. Potential Contact Hours	100,000 to 999,999 receptor hrs/yr	70
V. Amount of MEC	Safety Buffer Areas	30
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC surface & subsurface. After Cleanup: Intrusive depth	240
VII. Migration Potential	Possible	30
VIII. MEC Classification	UXO	110
IX. MEC Size	Small	40
		Total Score
		705
		Hazard Level Category
		3
Response Action Cleanup: No MEC Cleanup		
Input Factor	Input Factor Category	Score
Same Input Factors and Input Factor Category as above		
		Total Score
		705
		Hazard Level Category
		3
Characteristics of the MRS		
Is critical infrastructure located within the MRS or within the ESQD arc?		No
Are cultural resources located within the MRS or within the ESQD arc?		Yes
Are significant ecological resources located within the MRS or within the ESQD arc?		Yes
Conclusions		
Moderate explosive hazard as MEC and MD on surface and subsurface		
Low number of contact hours by public and maintenance staff		

MEC Hazard Assessment

Cold Spring MRS

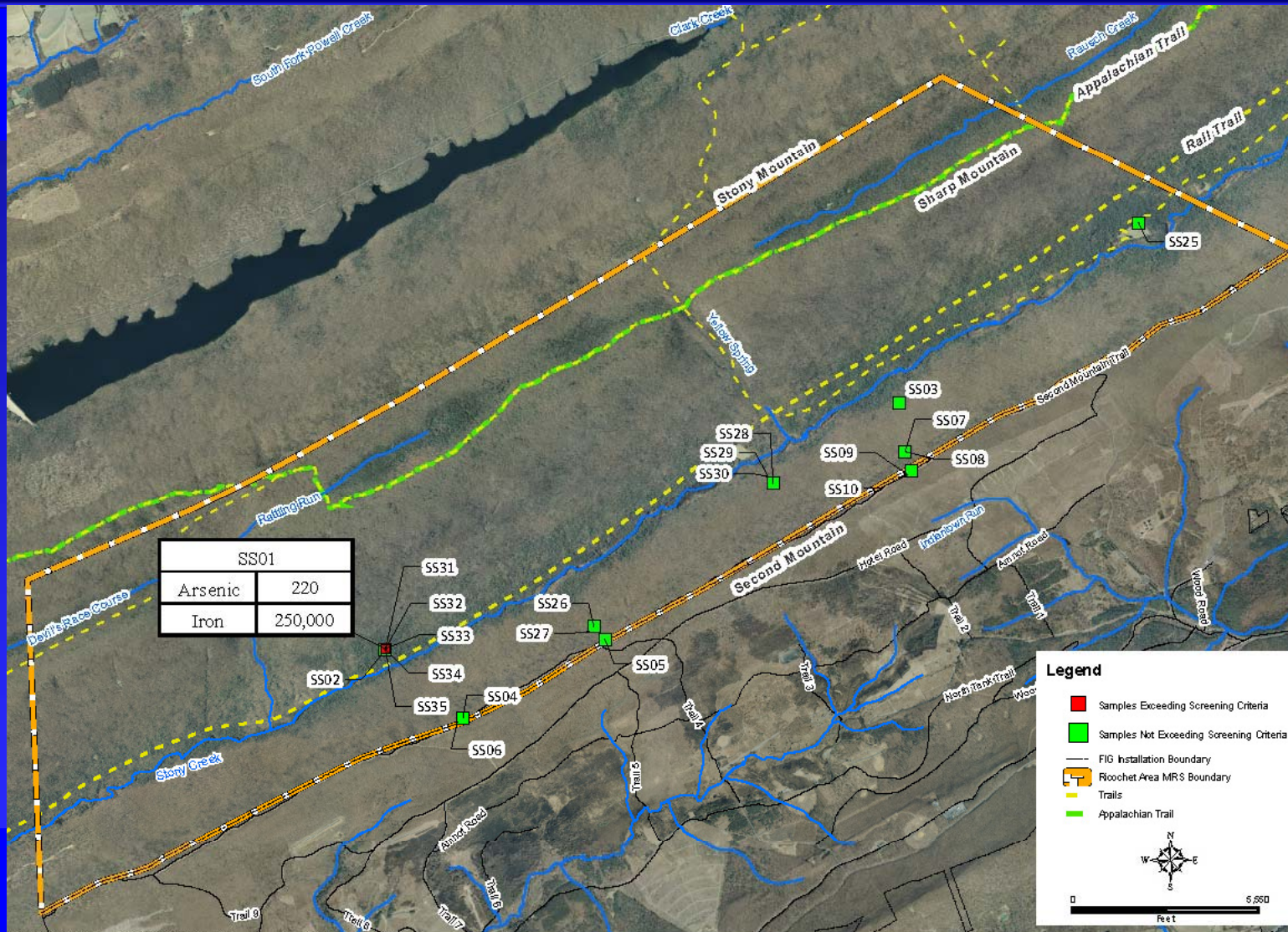
Firing Point		
Response Action Cleanup: No Response Action		
Input Factor	Input Factor Category	Score
I. Energetic Material Type	Propellant	50
II. Location of Additional Human Receptor	Inside the MRS or inside the ESQD arc	30
III. Site Accessibility	Moderate Accessibility	55
IV. Potential Contact Hours	<10,000 receptor-hrs/yr	15
V. Amount of MEC	Firing Points	75
VI. Minimum MEC Depth Relative to Maximum Intrusive	Baseline Condition: MEC located	150
VII. Migration Potential	Possible	30
VIII. MEC Classification	Unfuzed DMM	45
IX. MEC Size	Small	40
		Total Score
		490
		Hazard Level Category
		4
Response Action Cleanup: No MEC Cleanup		
Input Factor	Input Factor Category	Score
Same Input Factors and Input Factor Category as above		
		Total Score
		490
		Hazard Level Category
		4
Characteristics of the MRS		
Is critical infrastructure located within the MRS or within the ESQD arc?		No
Are cultural resources located within the MRS or within the ESQD arc?		Yes
Are significant ecological resources located within the MRS or within the ESQD arc?		Yes
Conclusions		
Low explosive hazard due to subsurface DMM		
Safe for current and future land use		

MC Sampling

- Sampling conducted under UXO/DMM where MC would most likely be present
 - None of the UXO or DMM appeared to be cracked or leaking
 - Analyzed for explosives and metals using EPA methods
- Background/reference sampling for metals
 - Used to conduct screening comparisons
 - Evaluation of risks



MC Sampling



MC Results - Metals



– After screening against the PADEP benchmarks all metals were below MSCs

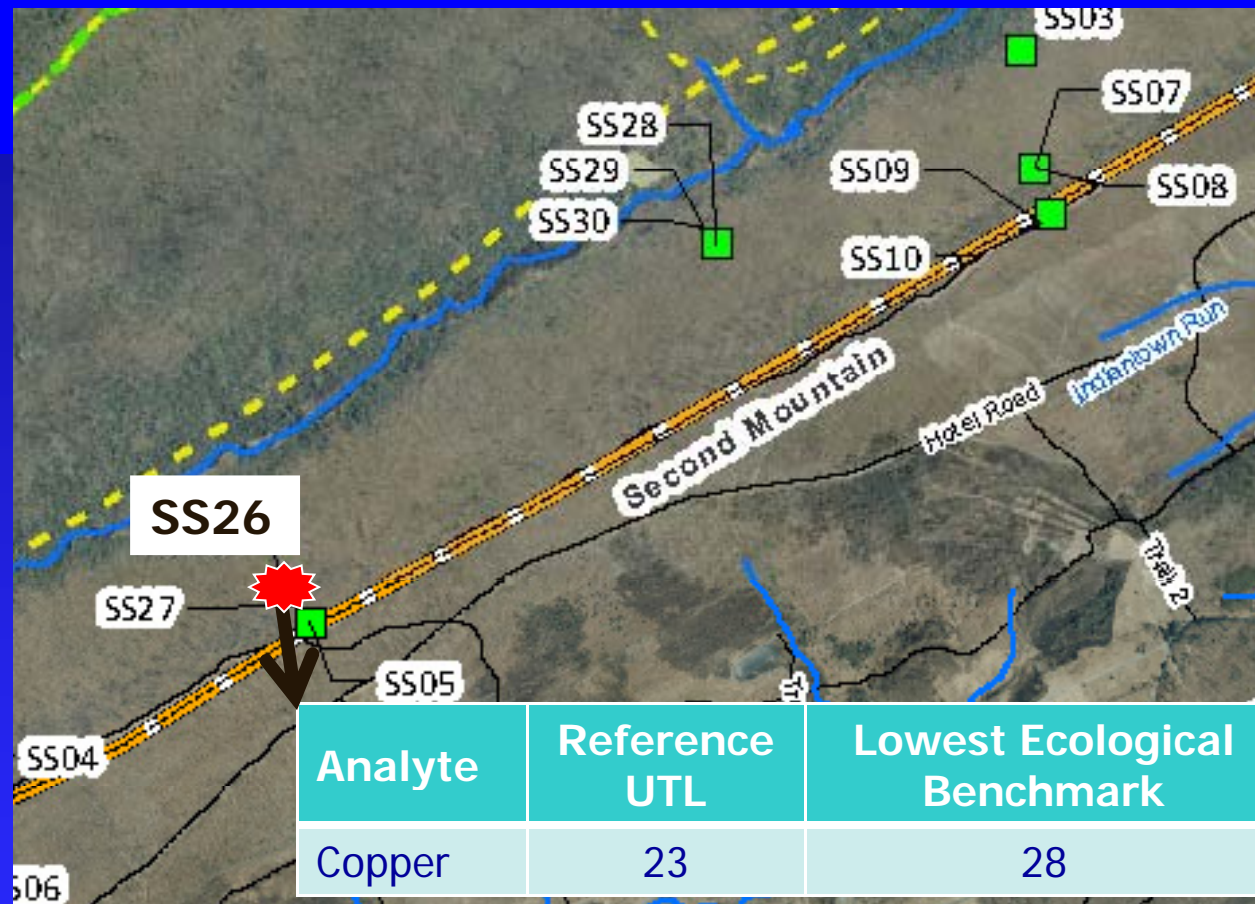
Risk Assessment Overview

- Human Health Risk Assessment (HHRA)
 - Evaluated potential risk associated with MC to human receptors
No chemicals exceeded risk screening guidelines
 - No further evaluation needed
- Screening Level Ecological Risk Assessment (SLERA)
 - Conducted to determine the potential risk to ecological receptors from exposure to MC detected
 - Chemicals exceeded risk screening guidelines
 - Further risk characterization conducted on manganese, aluminum, zinc and copper at specific locations

Screening Level Ecological Risk Assessment

- Prepared in accordance with EPA's *ERAGS*
 - Potential for risk based on very conservative assumptions and ecological screening levels.
 - Hazard Quotient - The ratio of the potential exposure and the level at which no adverse effects are expected.
 - HQ < 1, no adverse health effects expected.
 - HQ > 1, potential for adverse health effects.
 - HQ > 1, does not necessarily mean that adverse effects will occur.
- Results
 - Potential for risk from copper concentration at one location.
 - HQ > 10 for dove, shrew and woodcock due to copper at SS26. Isolated occurrence, not distributed across the site.
 - Ecological risk for populations from MC in soil is low

Ecological Exceedance at SS26



All units mg/kg
UTL = upper tolerance limit

Screening Level Ecological Risk Assessment



**Avian
Insectivore
(woodcock)
EcoSSL = 28
HQ = 30.7**



**Mammalian
Carnivore
(weasel)
EcoSSL = 560
HQ = 1.54**



**Mammalian
Insectivore
(shrew)
EcoSSL = 49
HQ = 17.6**



**Avian Herbivore
(dove)
EcoSSL = 76
HQ = 11.32**



**Mammalian
Herbivore
(vole)
EcoSSL = 1,100
HQ = 0.78**

**Avian Carnivore
(hawk)
EcoSSL = 1,600
HQ = 0.54**

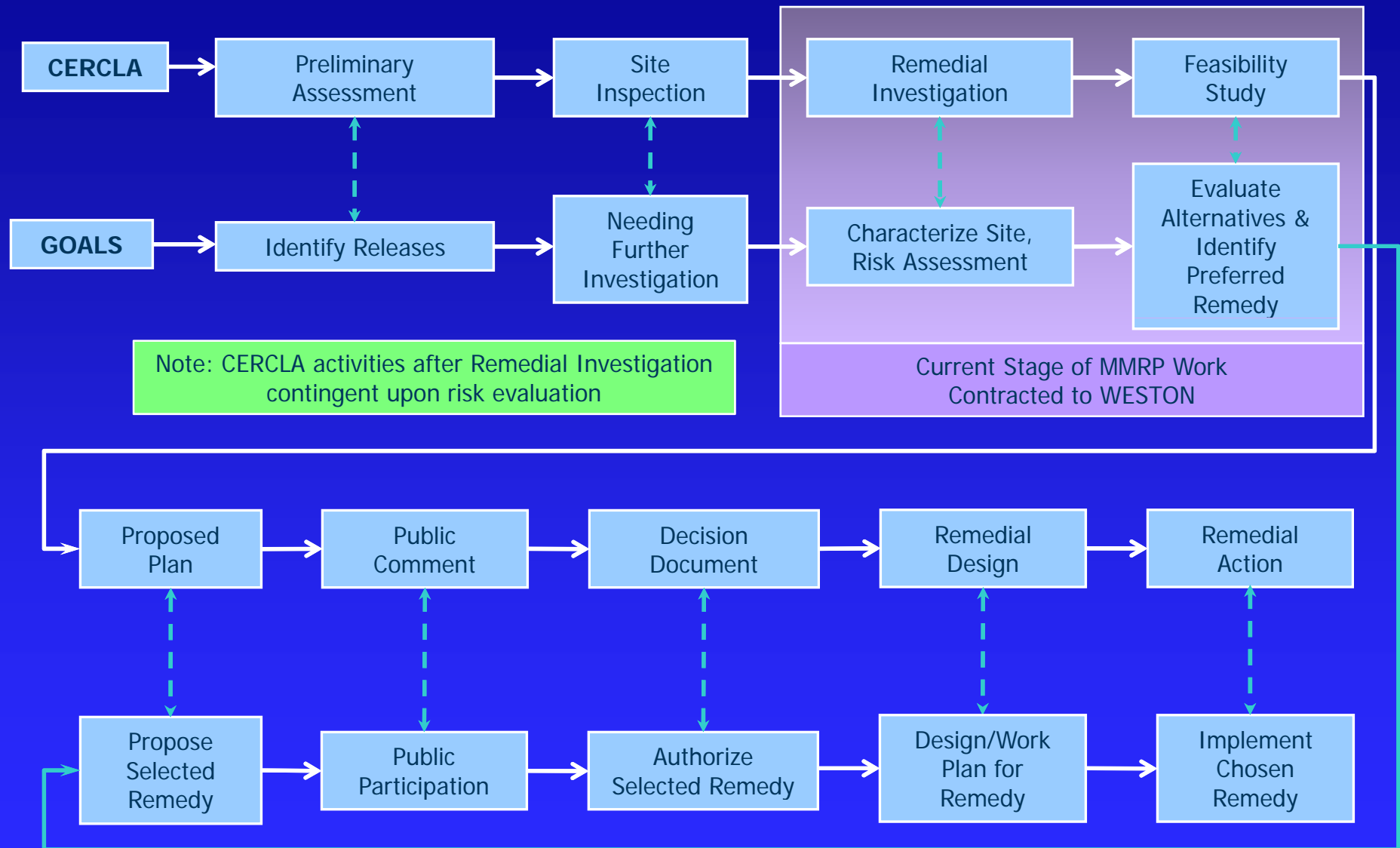


- Assess risk based on contact with soil and ingesting other organisms
- EcoSSL = ecological soil screening level
- HQ = hazard quotient; ratio of concentration to EcoSSL

Remedial Action Objectives

- Ricochet Area MRS
 - Recommended for further remedial alternative evaluation as part of Feasibility Study to be protective of human health
- Cold Spring MRS
 - Recommended for further remedial alternative evaluation as part of Feasibility Study to be protective of human health
- Sharp Mountain MRS
 - No further action recommended based on absence of MEC observed during the RI

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Military Munitions Response Program (MMRP) Flow Chart



Remedial Investigation Schedule

- Remedial Investigation Report
 - Draft Final (11 May 2011)
 - Final (29 July 2011)
- Feasibility Study
 - Draft (20 June 2011)
 - Draft Final (August 2011)
 - Final (October 2011)
- Proposed Plan (2012)
- Decision Document (2012)
- Remedial Action (TBD)