

DISTRIBUTION AND FATE OF ENERGETICS AT THE MMR IMPACT AREA AND TRAINING RANGES



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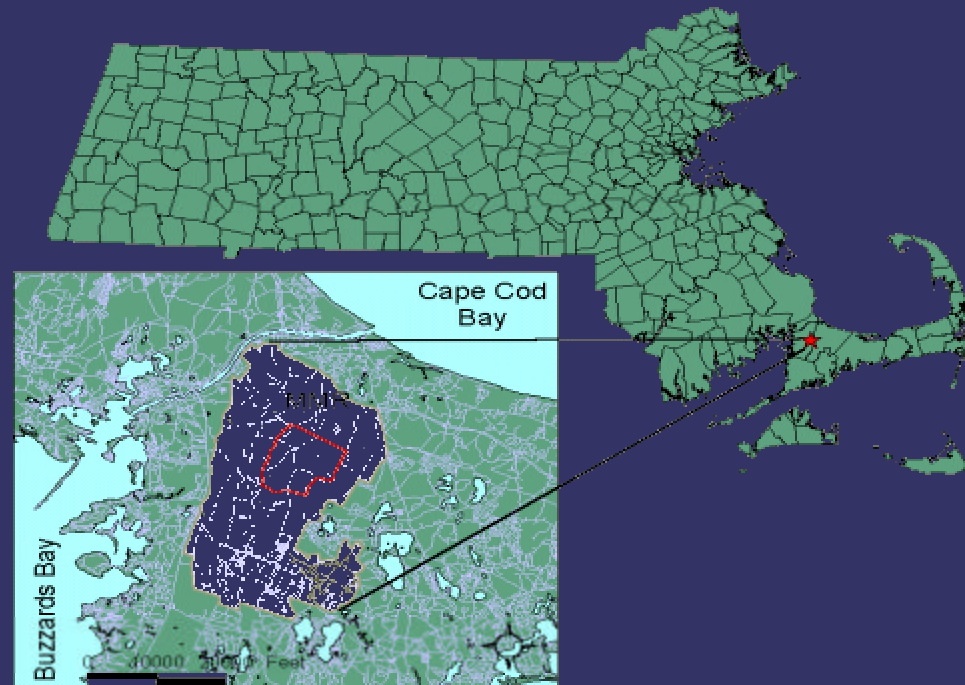
Introduction

- Military training ranges under scrutiny
 - Potential impacts to ecology and environment
 - Complex issues and problems
- Major ranges receiving attention
 - Massachusetts Military Reservation (MMR) - ARNG
 - NoMan Island
 - Vieques, Puerto Rico - U.S. Navy

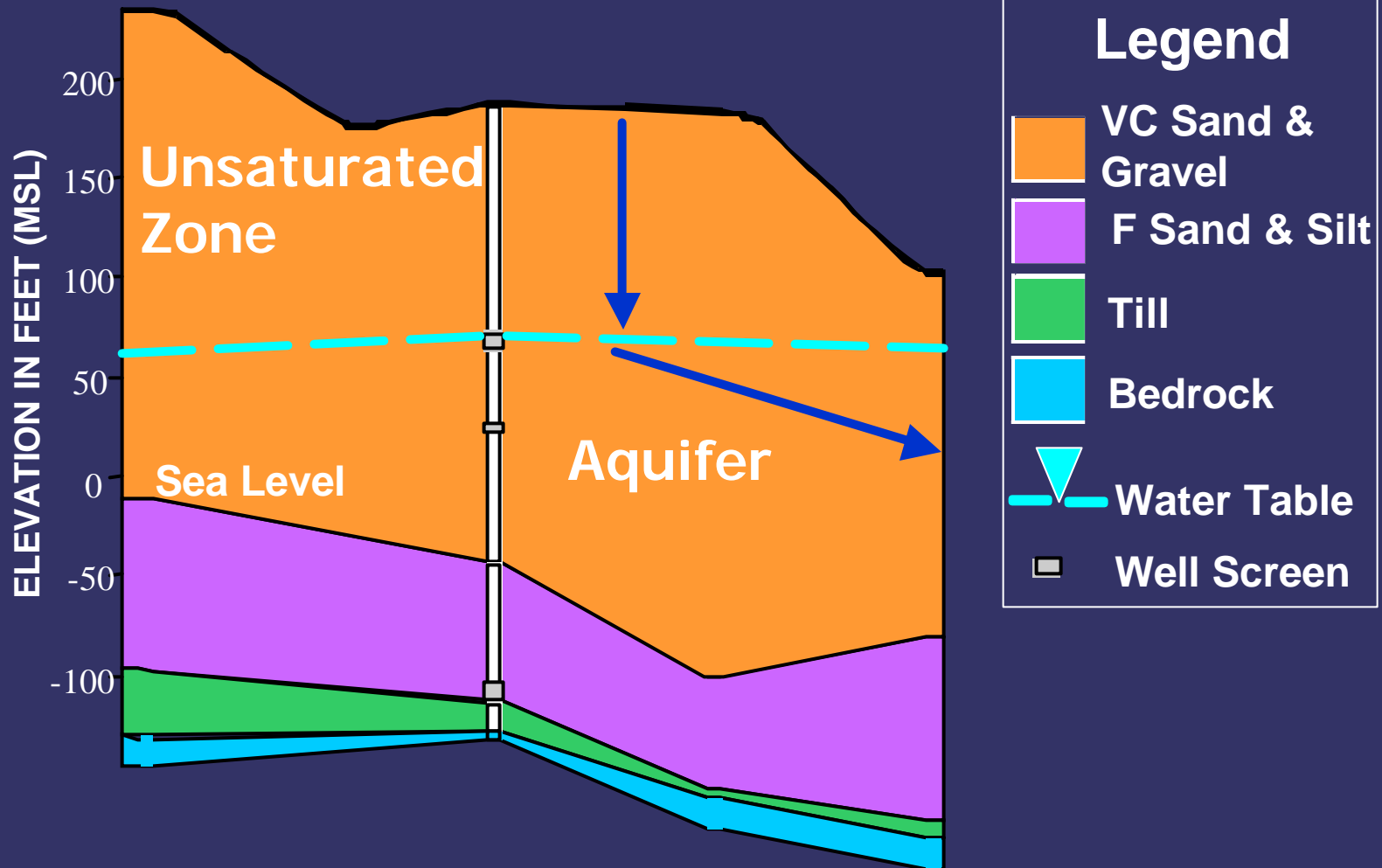


Camp Edwards - Site History

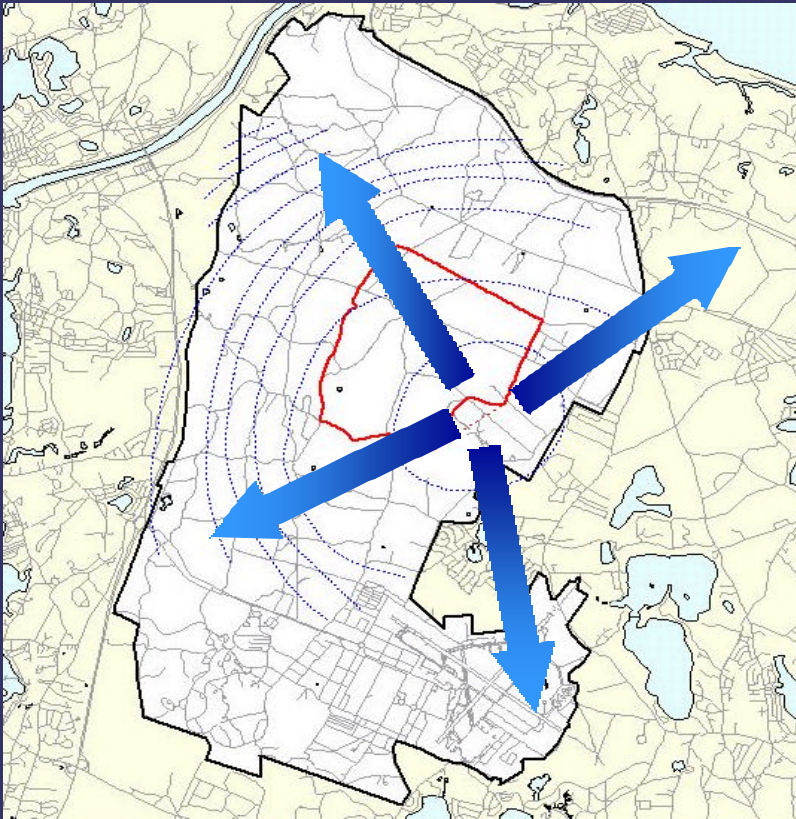
- Training and Impact Areas used since 1911
- Designed to house 30,000 troops during WWII
- USEPA banned training in 1997 through an administrative order



Site Lithology

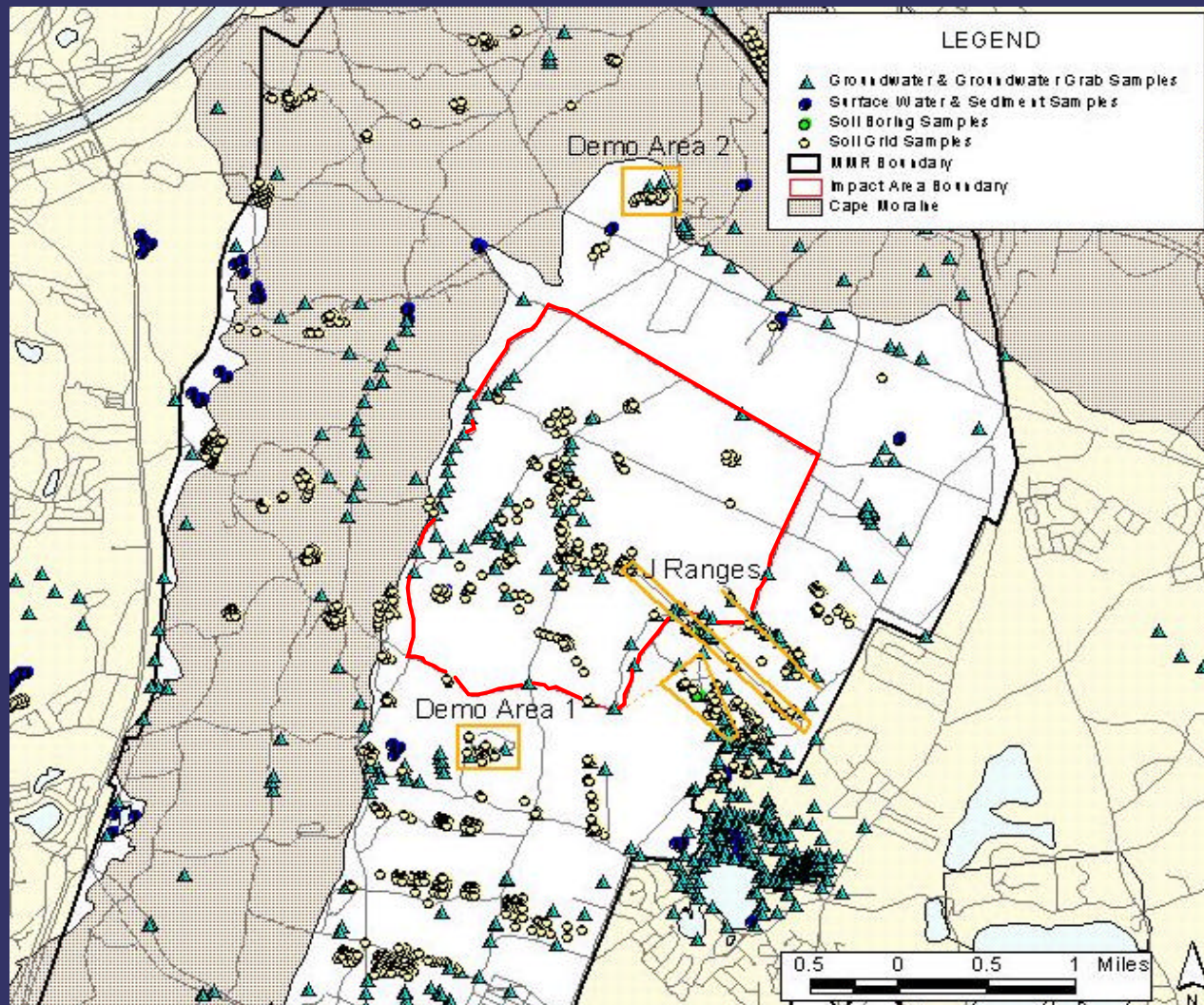


Hydrogeologic Model

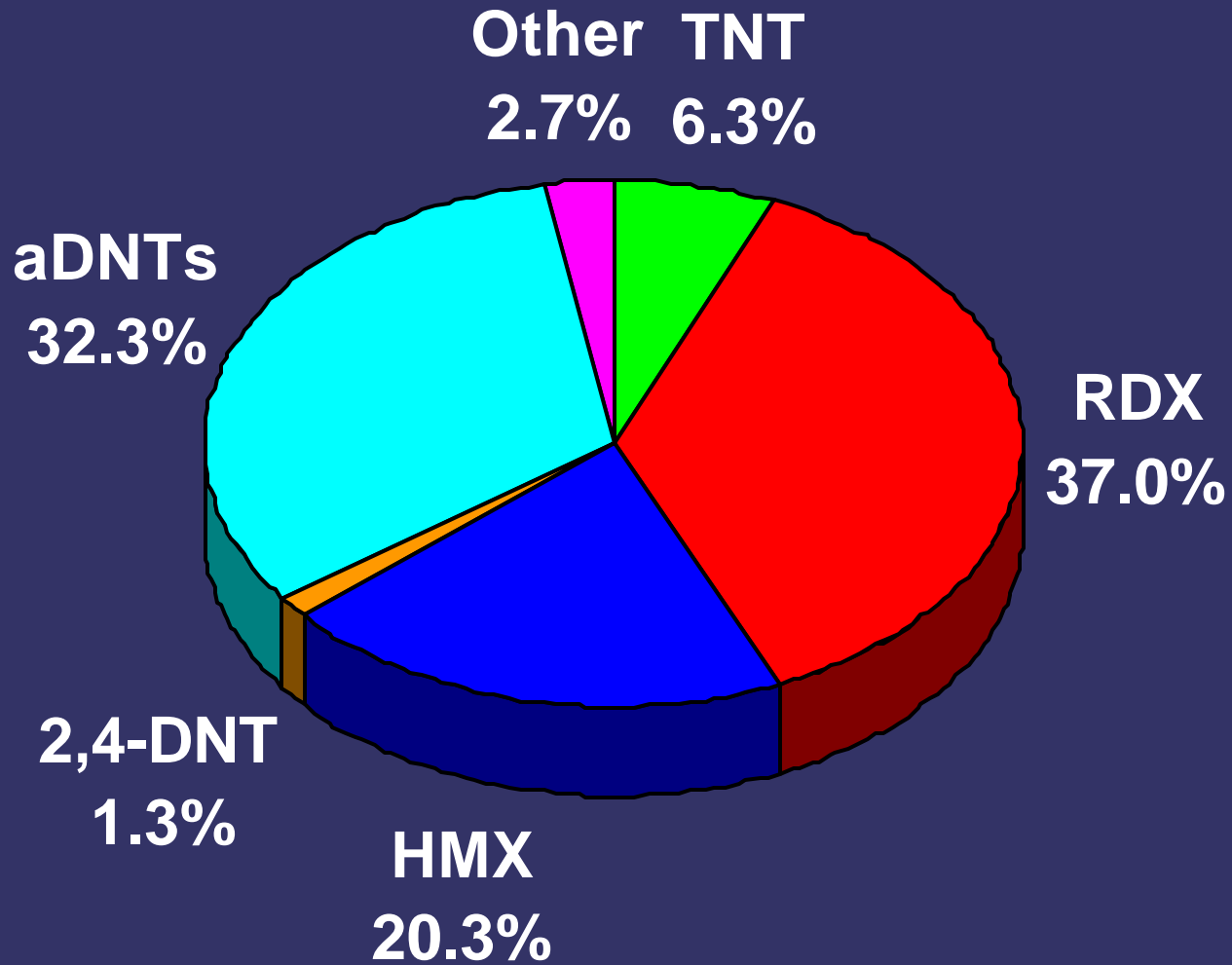


- Groundwater flow is radial with the mound to the southeast of the Impact Area in the J Range Area
- Groundwater flow is approximately one foot per day

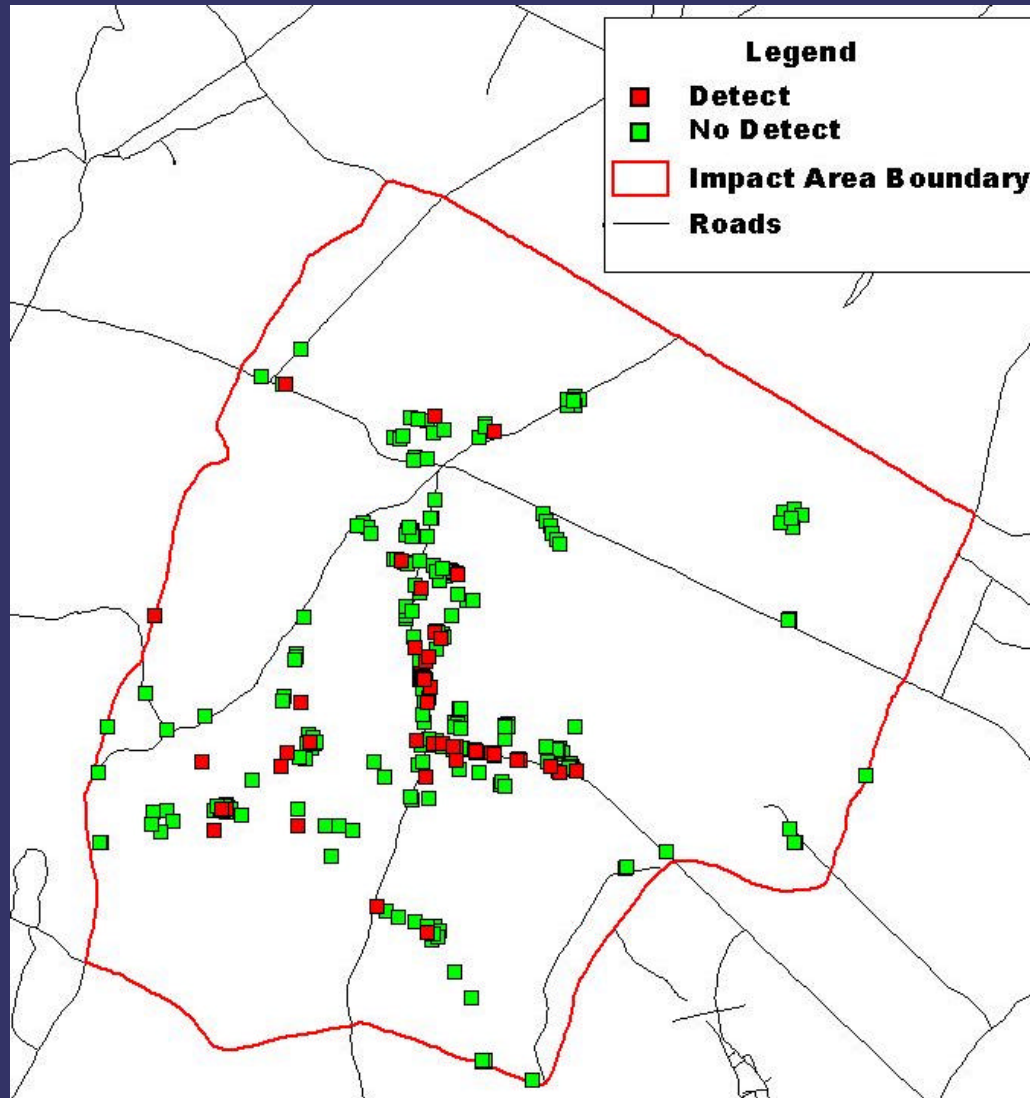
Areas of Investigation



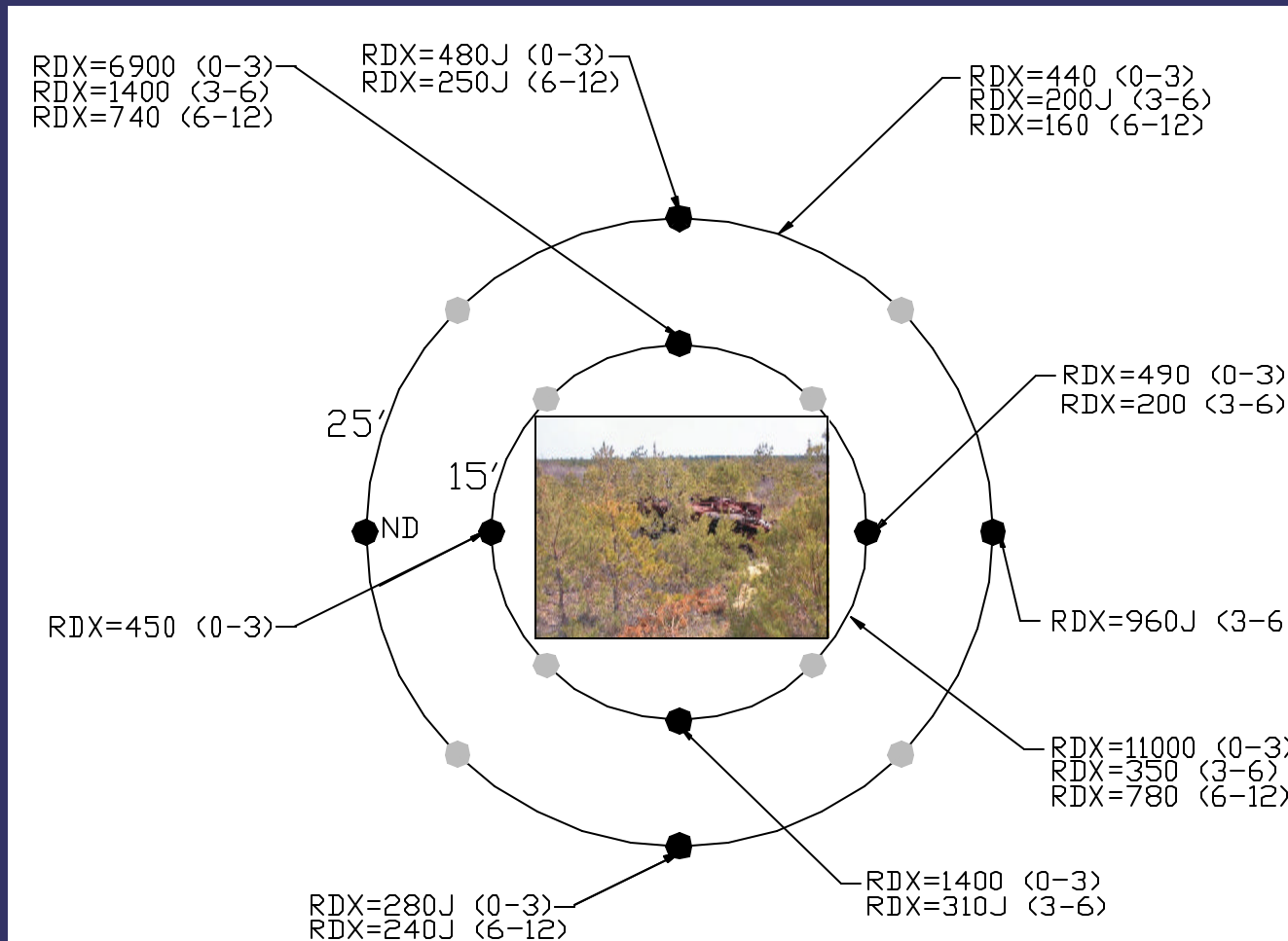
Surface Soil Findings



Soil Results (explosives)

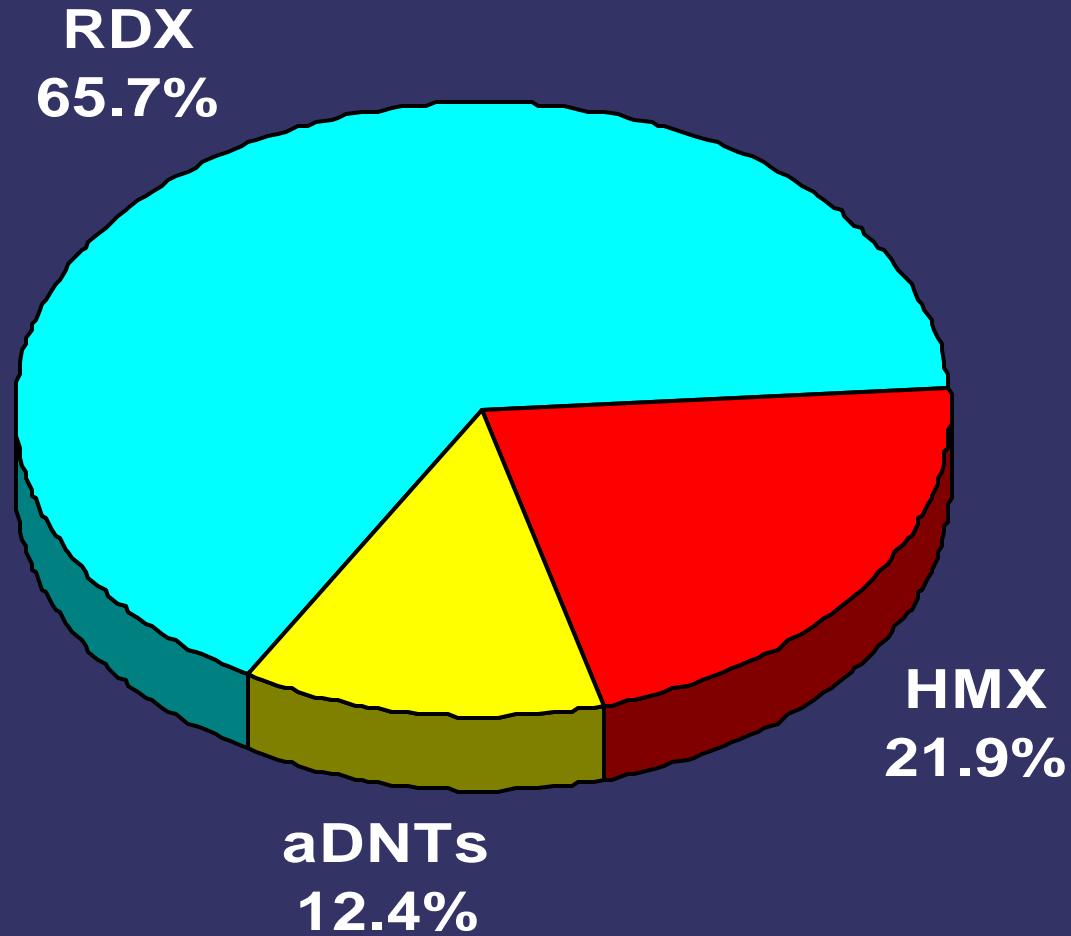


Soil Results at Artillery Target 42

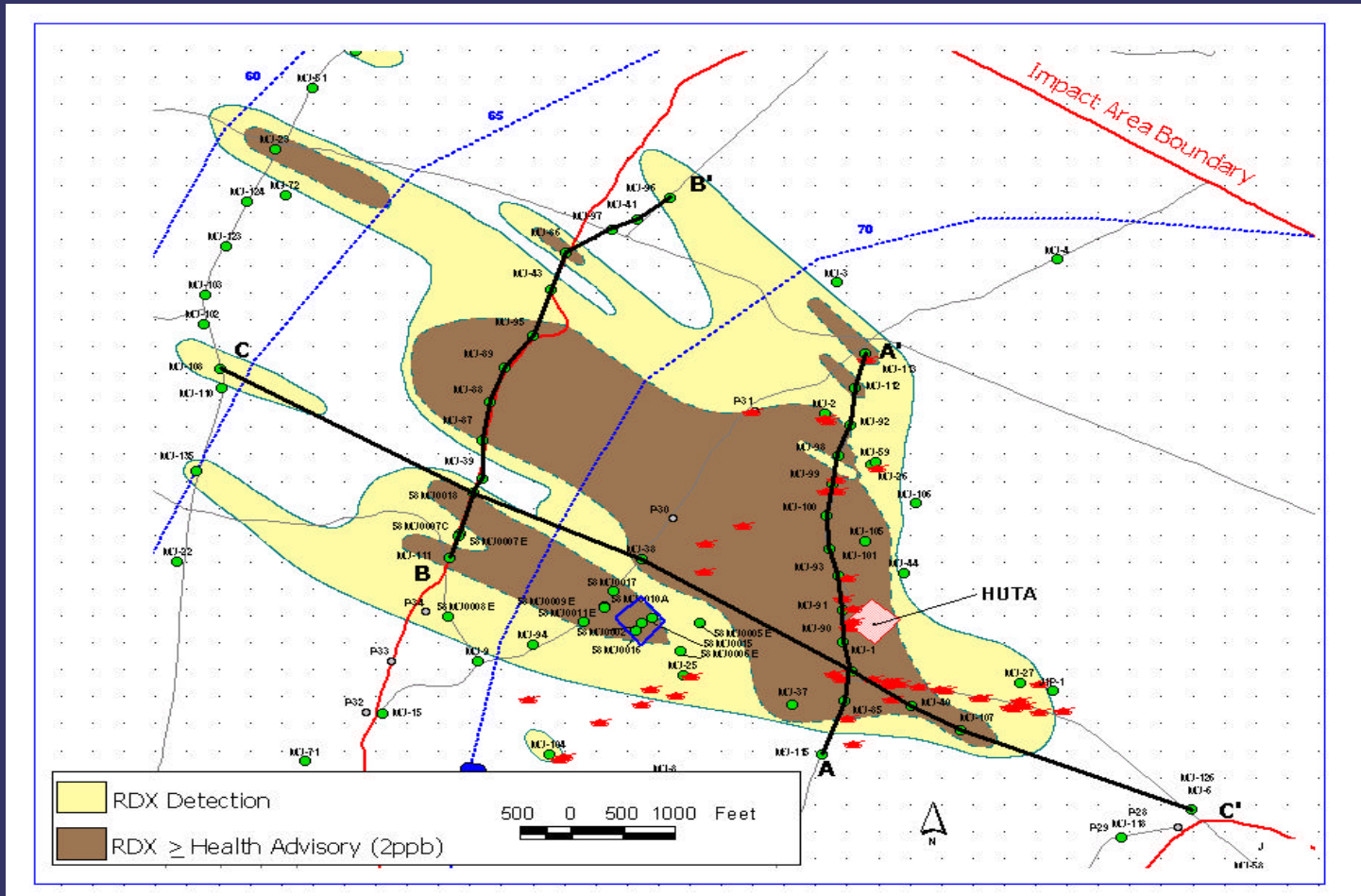


● COMPOSITE ONLY (PPB)
 ● DISCRETE & COMPOSITE (PPB)
 DEPTH = INCHES

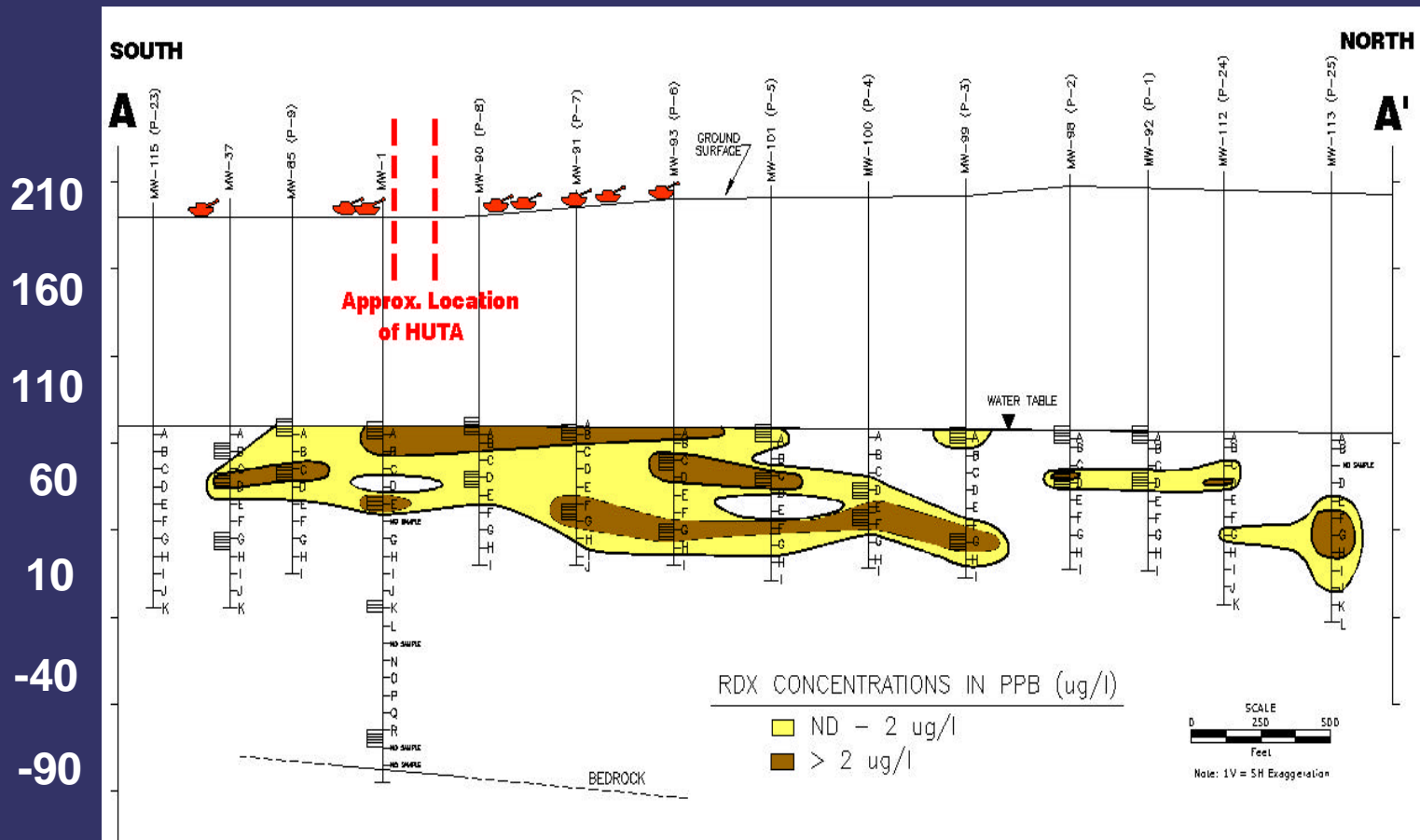
Groundwater Findings (explosives)



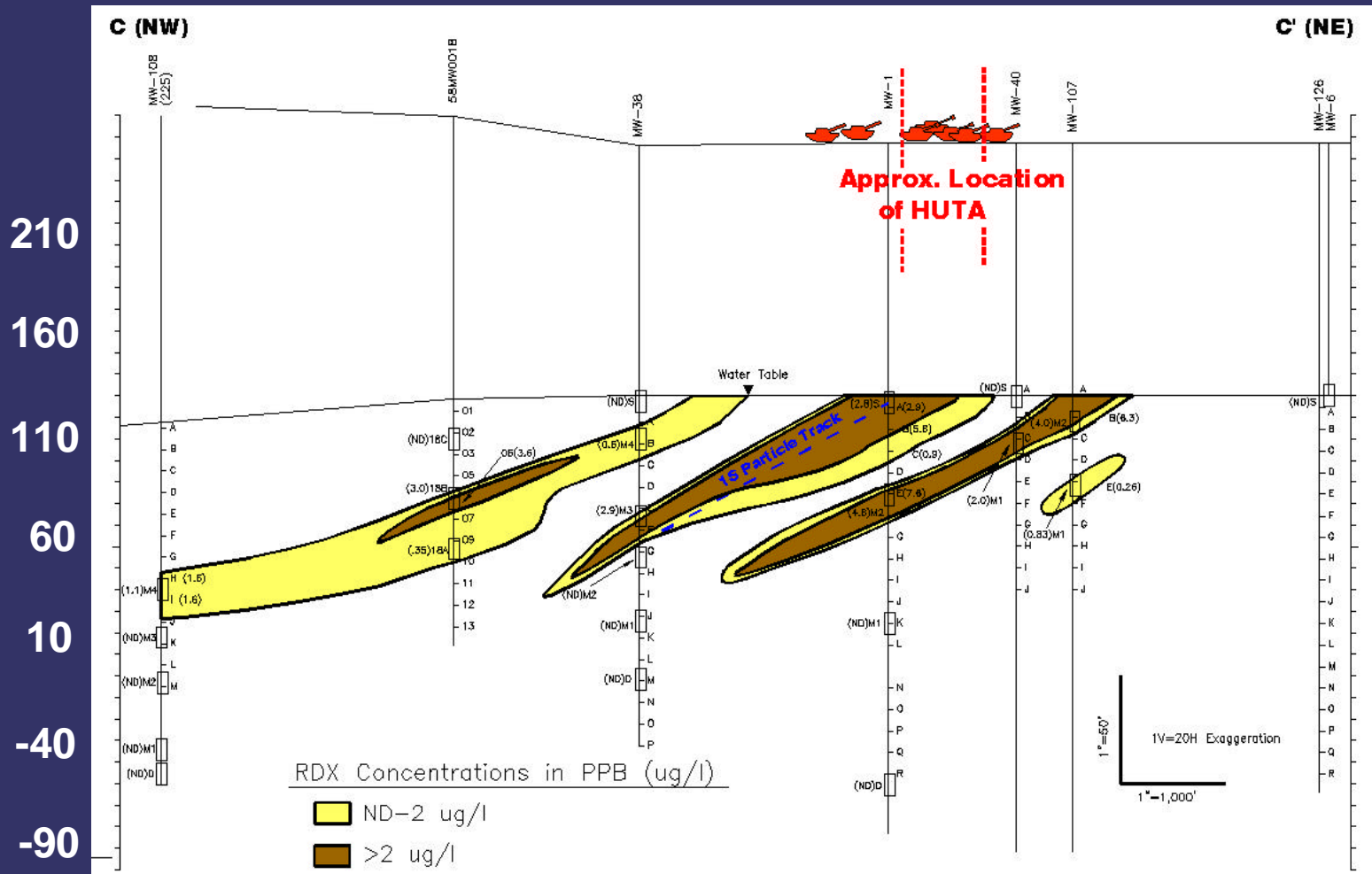
Plan View of RDX Detections in the Impact Area



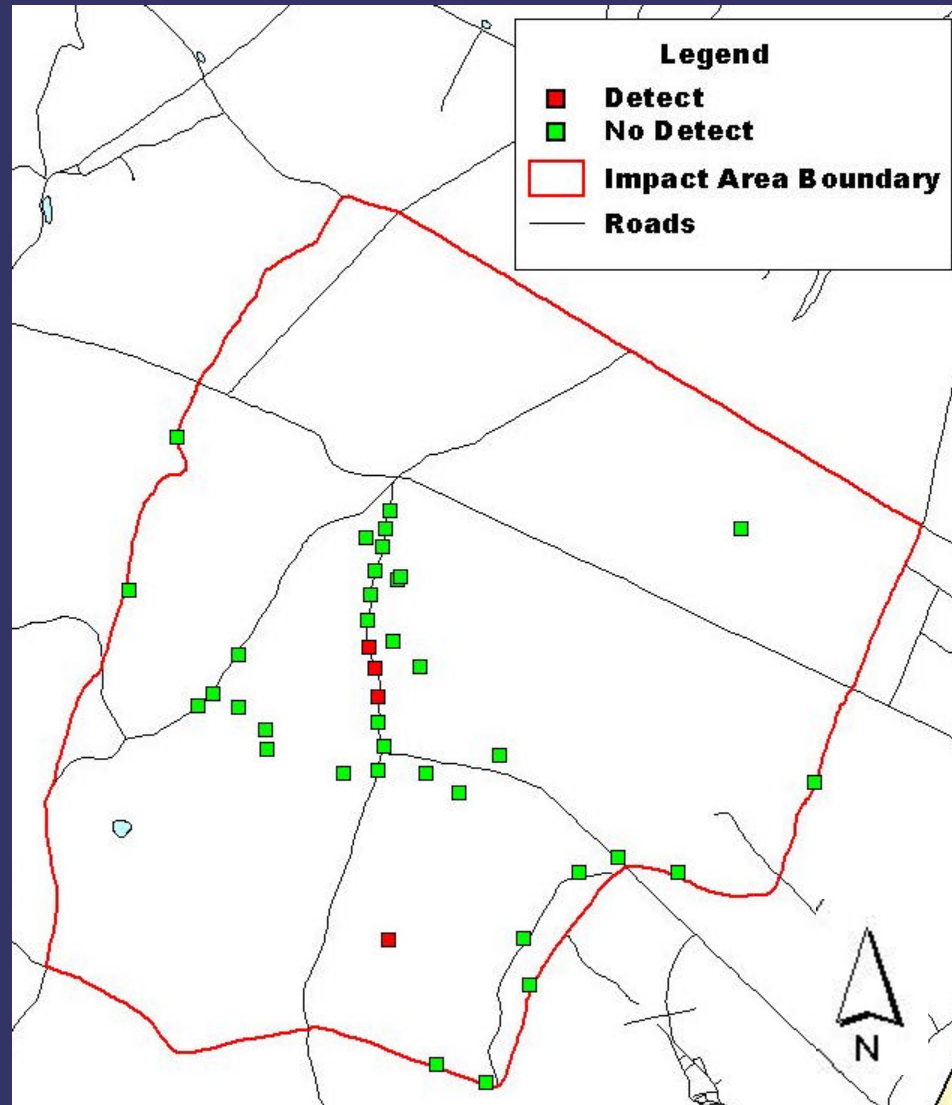
Inner Groundwater Transect within the Impact Area



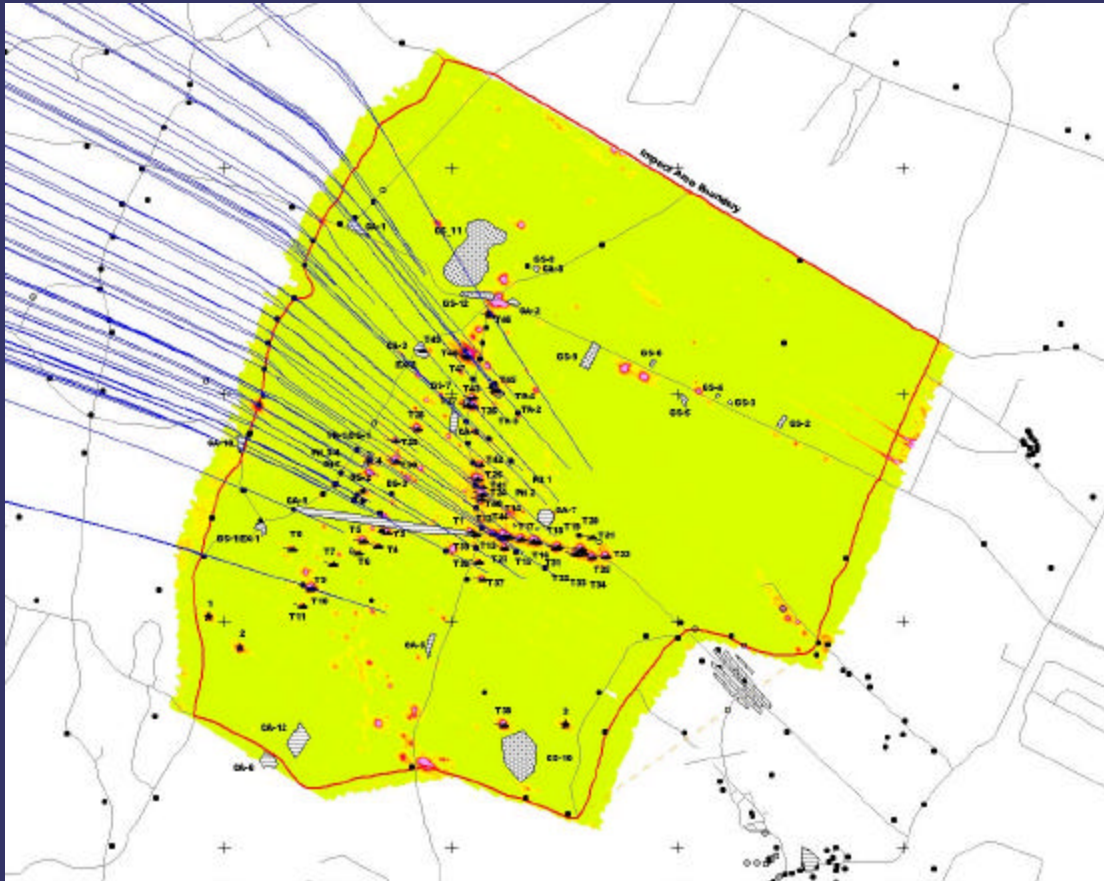
Longitudinal Cross-Section through the Impact Area



Location of Perchlorate In Groundwater at MMR



Potential Source Area



- High-order detonations
- Low-order detonations
- UXO
- EOD activities at the J Range
- Disposal/Burial sites
- Washout

Explosive Fate-and-Transport Conceptual Model

- Deposition of particulates to ground surface
- Slow dissolution of particulates
- Rapid movement of dissolved explosives through unsaturated zone, leaving little residual contamination (RDX and HMX)
- Introduction to groundwater results in rapid transport away from source

Conclusions

- RDX and HMX present in surface soil adjacent to artillery and mortar targets
- RDX and HMX present in groundwater downgradient of primary target area (i.e. Tank Alley) within the Impact Area
- TNT which is a component of the munitions appears to be degraded before reaching groundwater



Conclusions (cont.)

- Training using HE artillery and mortar rounds (UXO, detonation, or both) appears to have resulted in an explosive impact to groundwater at MMR
- Some metals, PAHs, and pesticides/herbicides present in surface soil but no evidence of impacts to groundwater
- PCNs may be an issue for soil and perchlorate may be an issue for groundwater
- MMR findings are potentially applicable to other bombing ranges and battlefields



Lessons Learned

- Compositing explosive soil samples is necessary
- Modifications to explosive analytical methods may be needed
 - expanded analyte list
 - changes to sample preparation
 - lower detection limits
- Perchlorate (OB/OD) and PCNs for ranges may be issues
- Maintain strong technical focus
- OB/OD is worse case (concentration)