

Explosives in Groundwater within an Impact Area at the Massachusetts Military Reservation

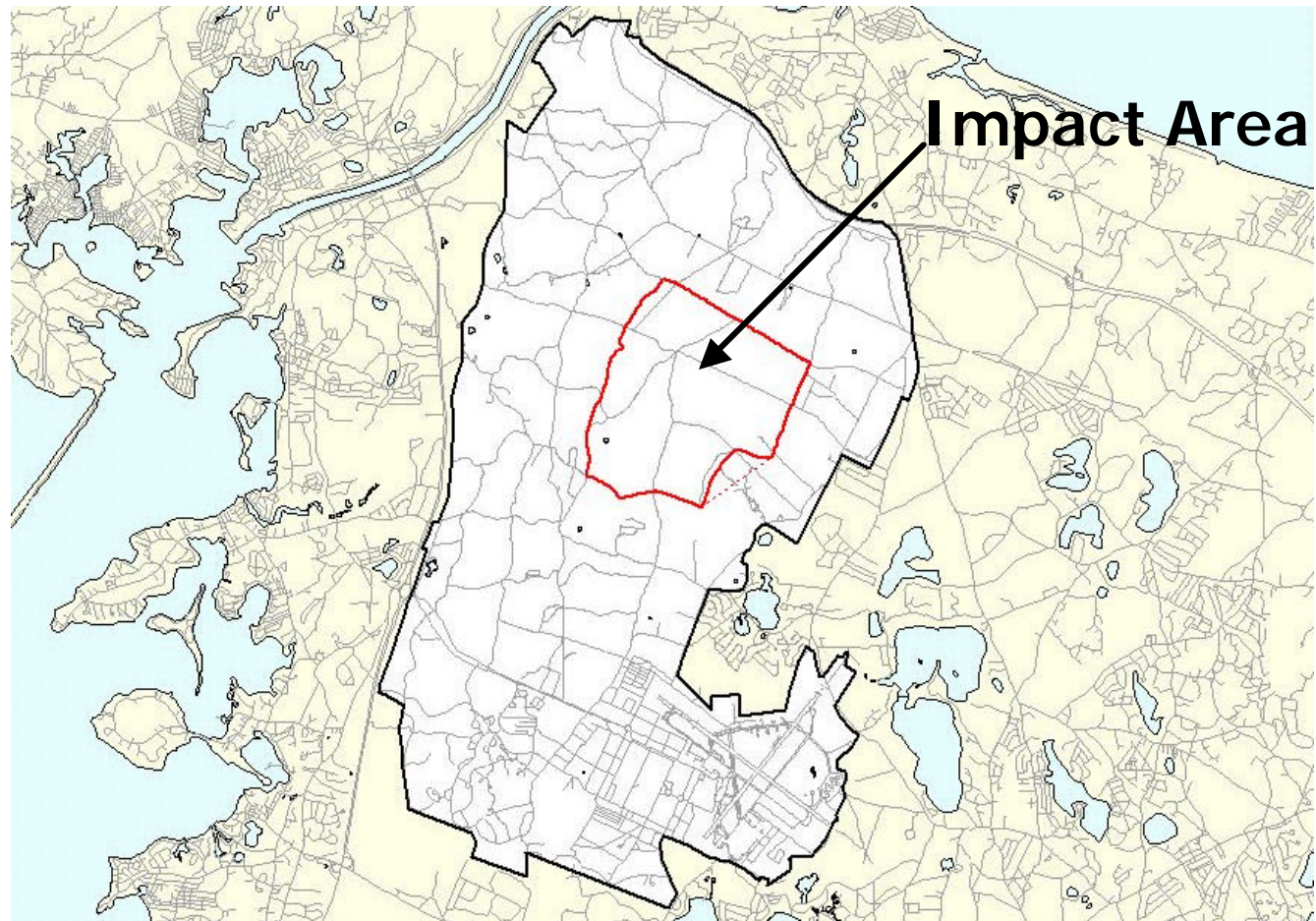
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Presented at National Ground Water Association National Convention, December 13-14, 2000. Las Vegas, NV (IAGWSPO Contact Ben Gregson, 508-958-5821).

Site Location



Massachusetts Military Reservation



Has training with artillery and mortar weapon systems had an impact on groundwater at Camp Edwards (past, present, future)?

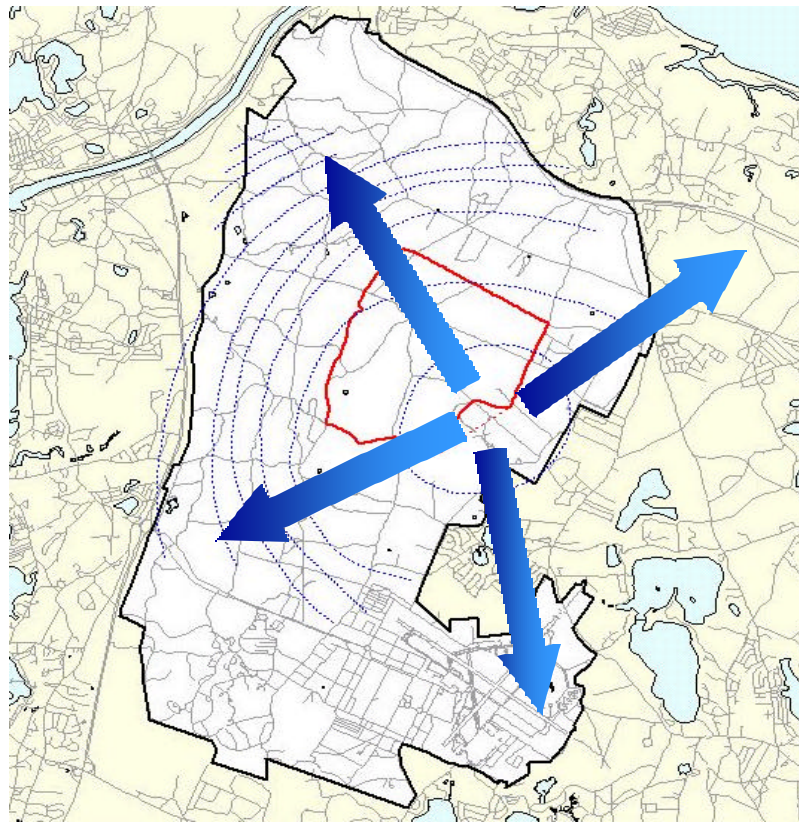


Camp Edwards History

- Training and Impact Areas used since 1911
- Designed to house 30,000 troops during WWII
- Records for 1989 indicate 6456 mortar practice and HE rounds and 1799 artillery practice rounds fired into the Impact Area
 - munitions usage could have been 200 times higher during wartime



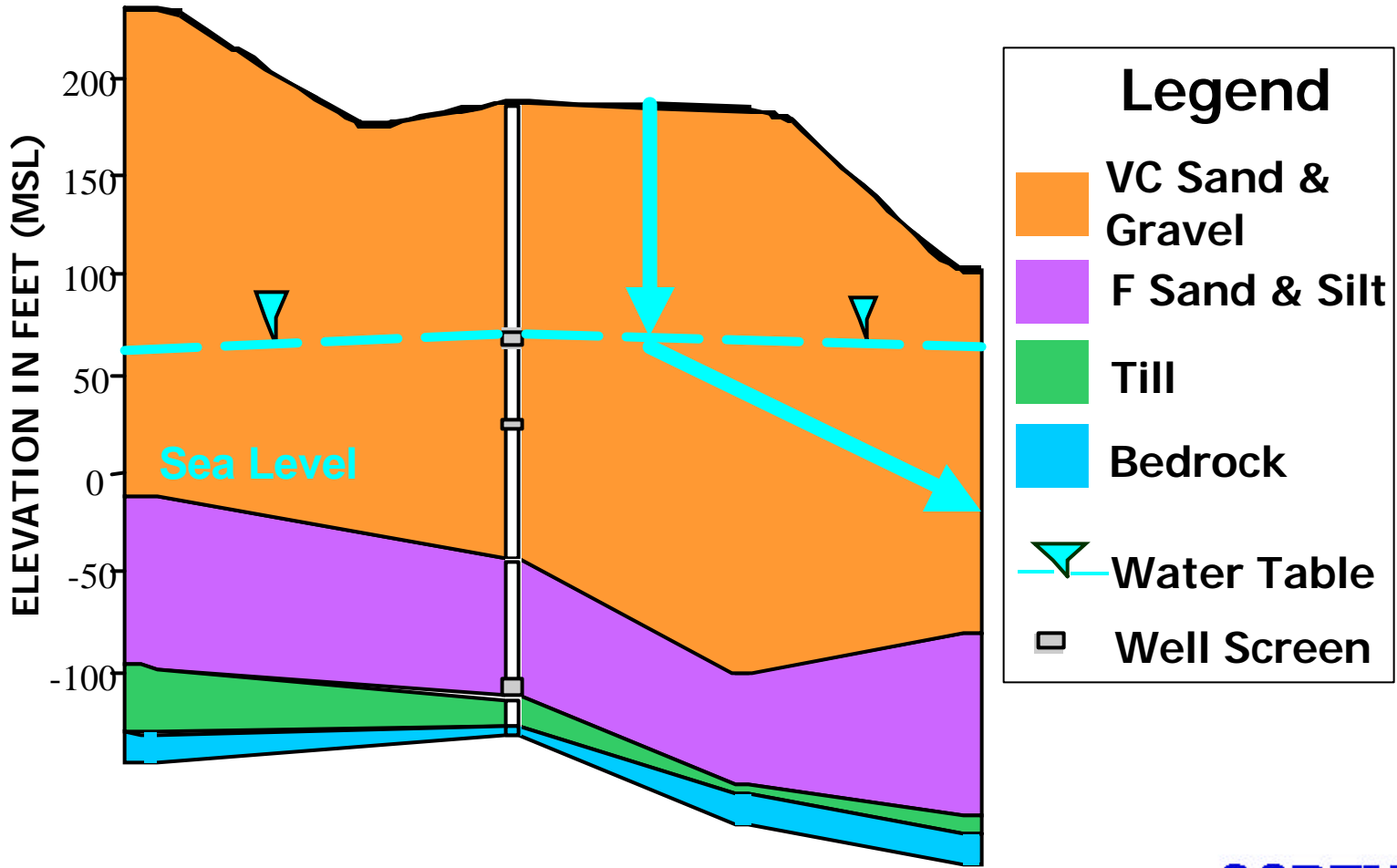
Camp Edwards Hydrogeologic Model



Groundwater flow is radial from a mound to the southeast of the Impact Area in the J Range Area



Camp Edwards Lithology



Explosive Fate-and-Transport Conceptual Model

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

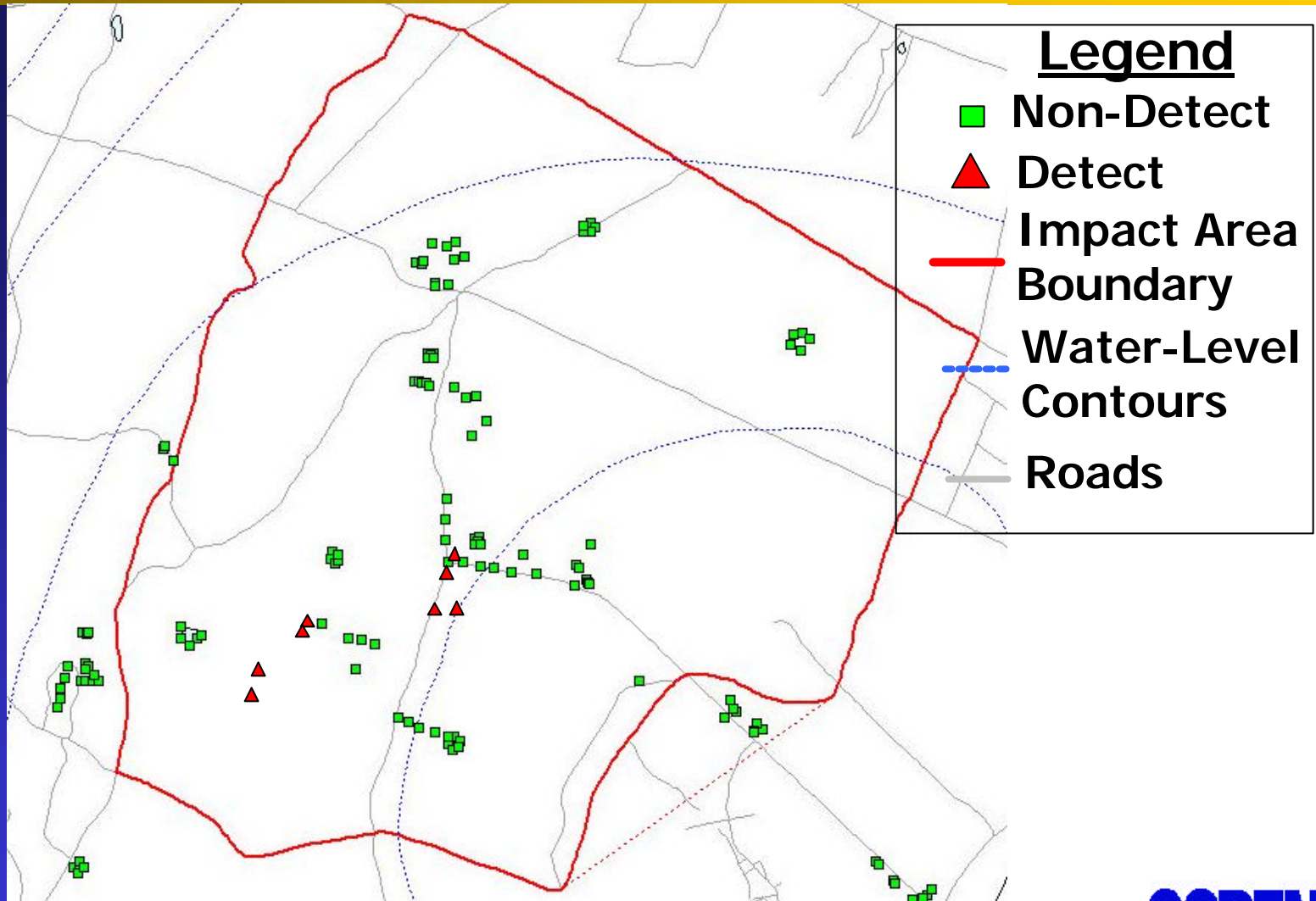


RDX Distribution Hypothesis

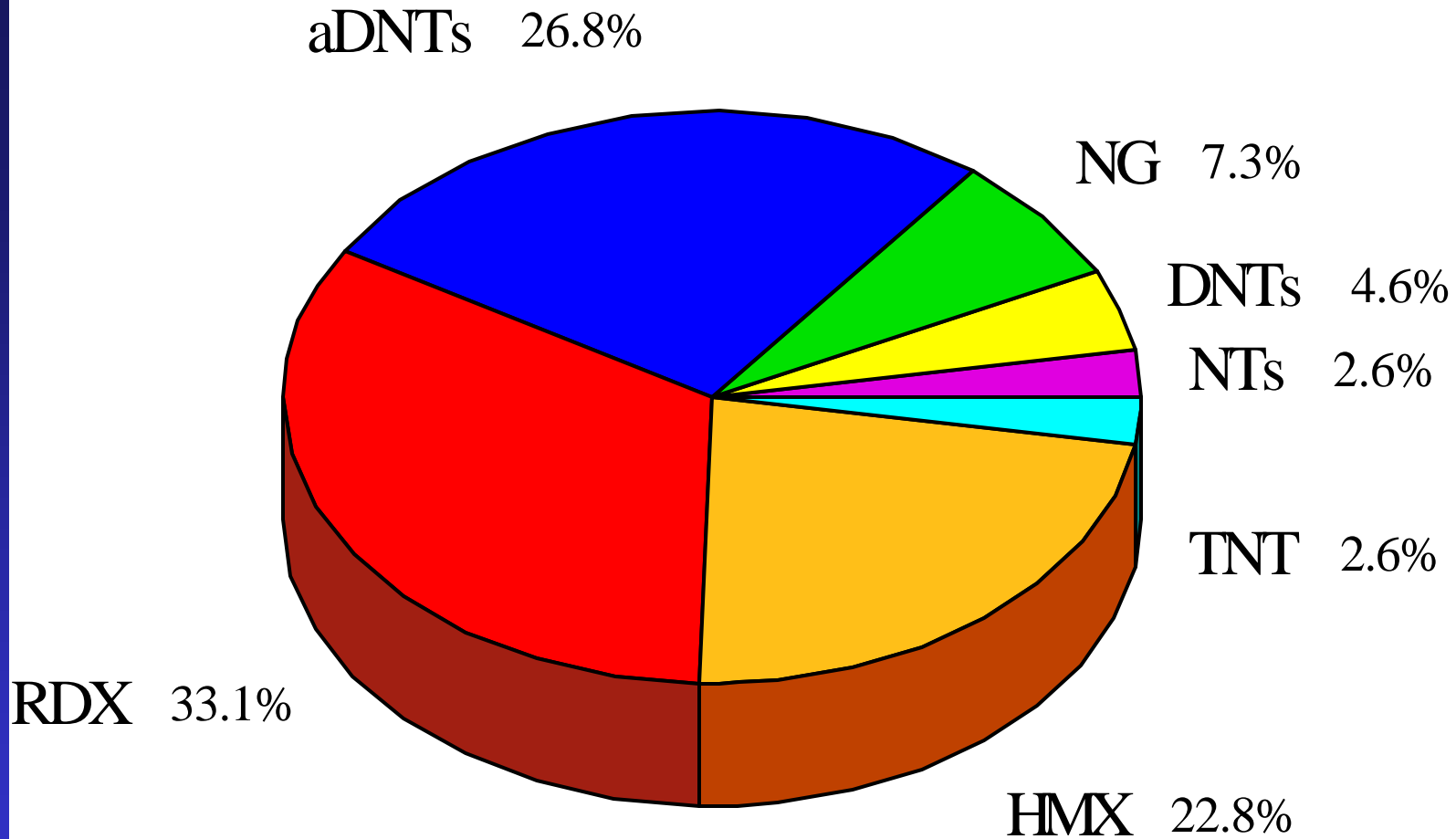
- **Shallow surface soil detections reflect presence of solid particulates**
 - evidence of soil concentrations in excess of RDX solubility limit
- **Absence of RDX in deeper soil may be the result of:**
 - very small spatial footprint
 - dissolved RDX only present in wetting front
 - the amount of RDX residual in solution is inconsequential compared to the total volume of soil
- **RDX present in groundwater**



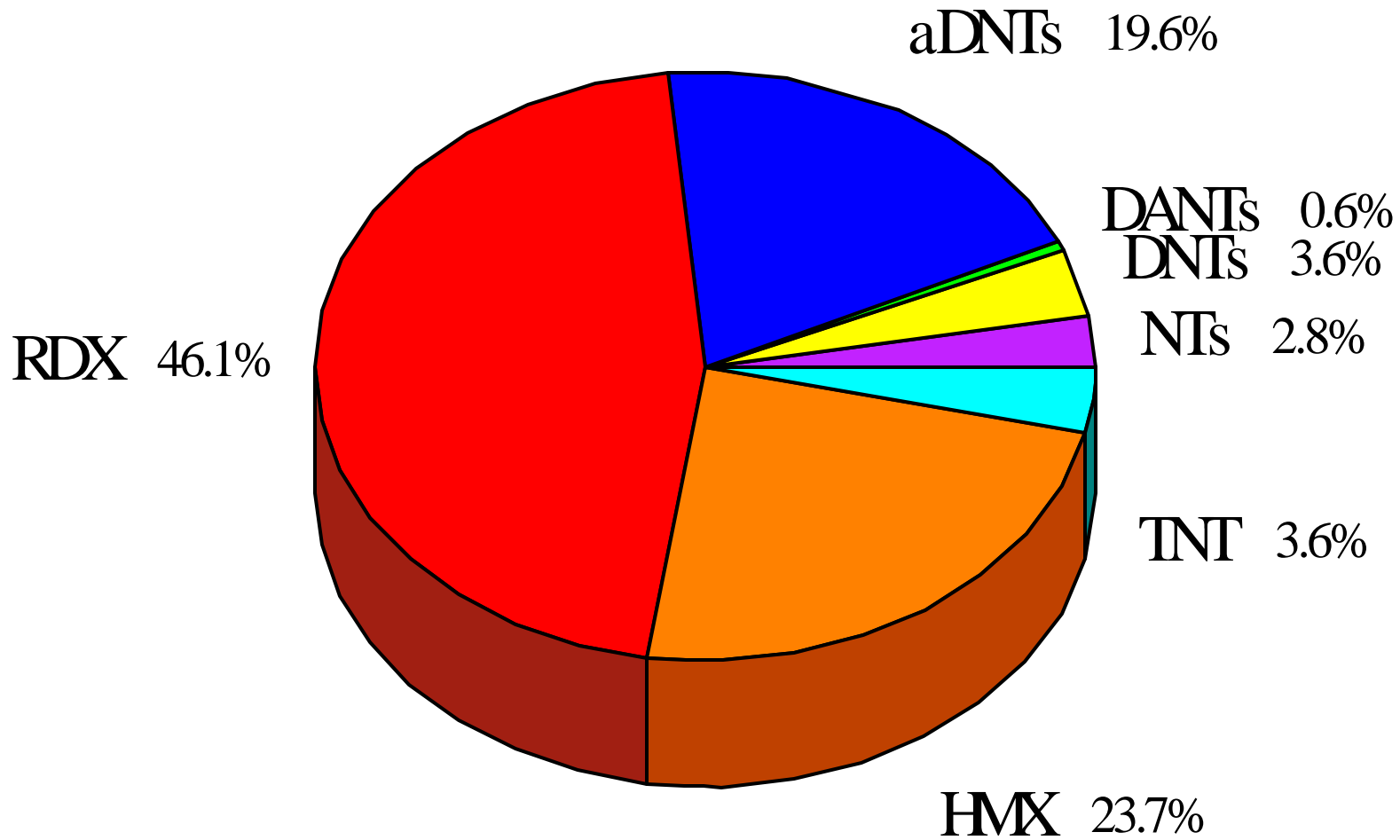
Soil Results



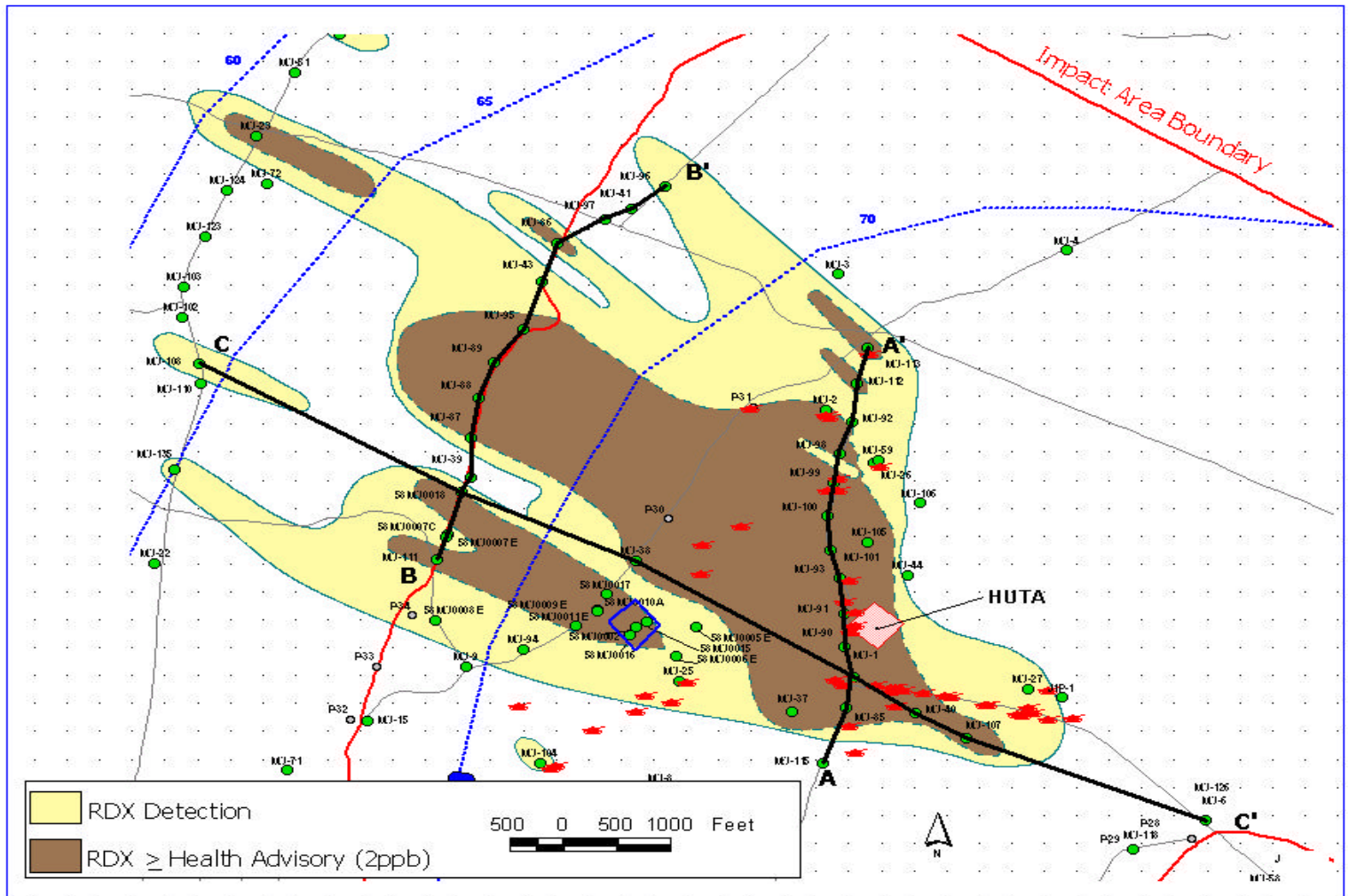
Explosive Distribution in Surface Soil



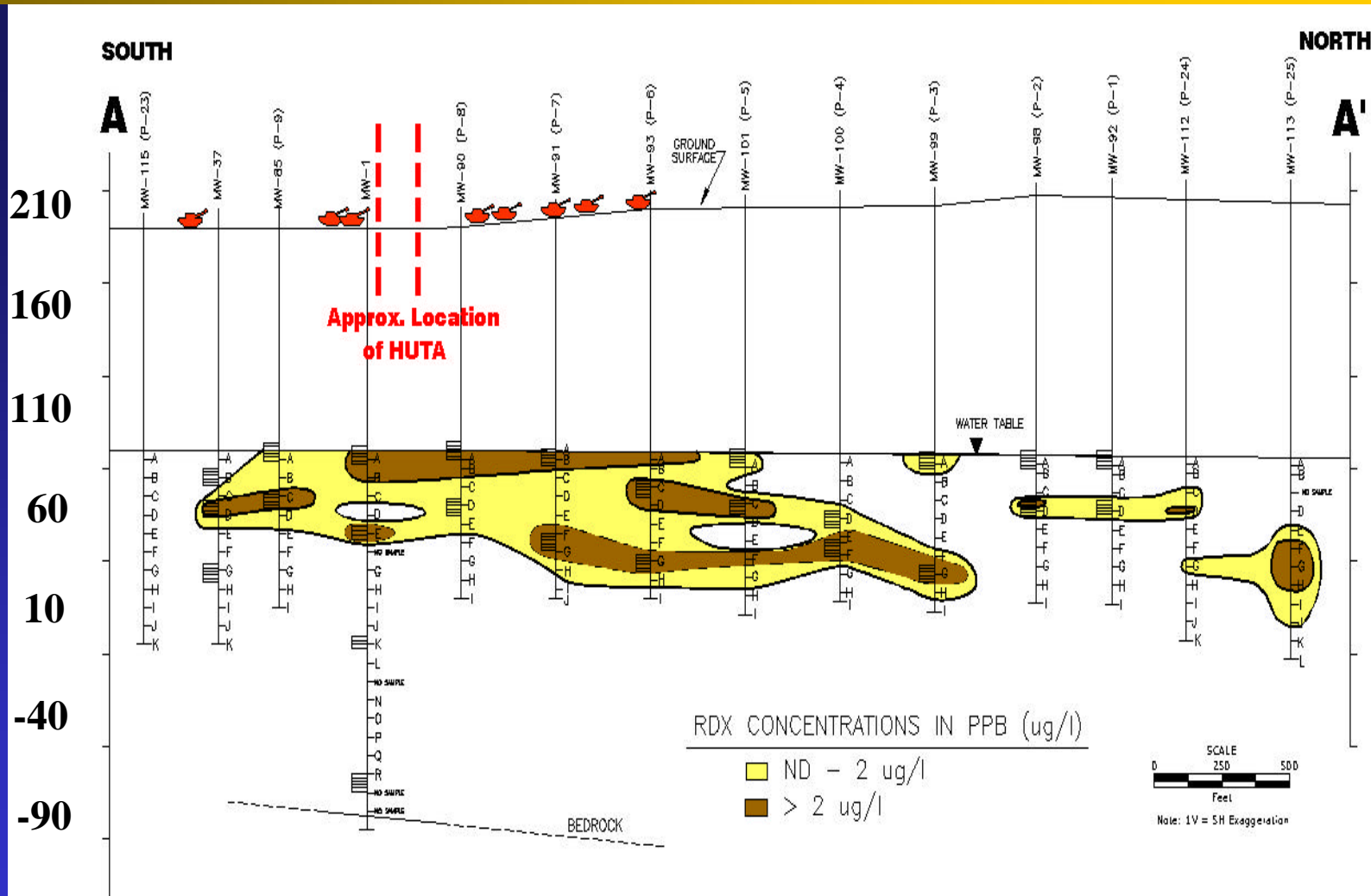
Explosive Distribution In Groundwater



Plan View of RDX Detections in the Impact Area

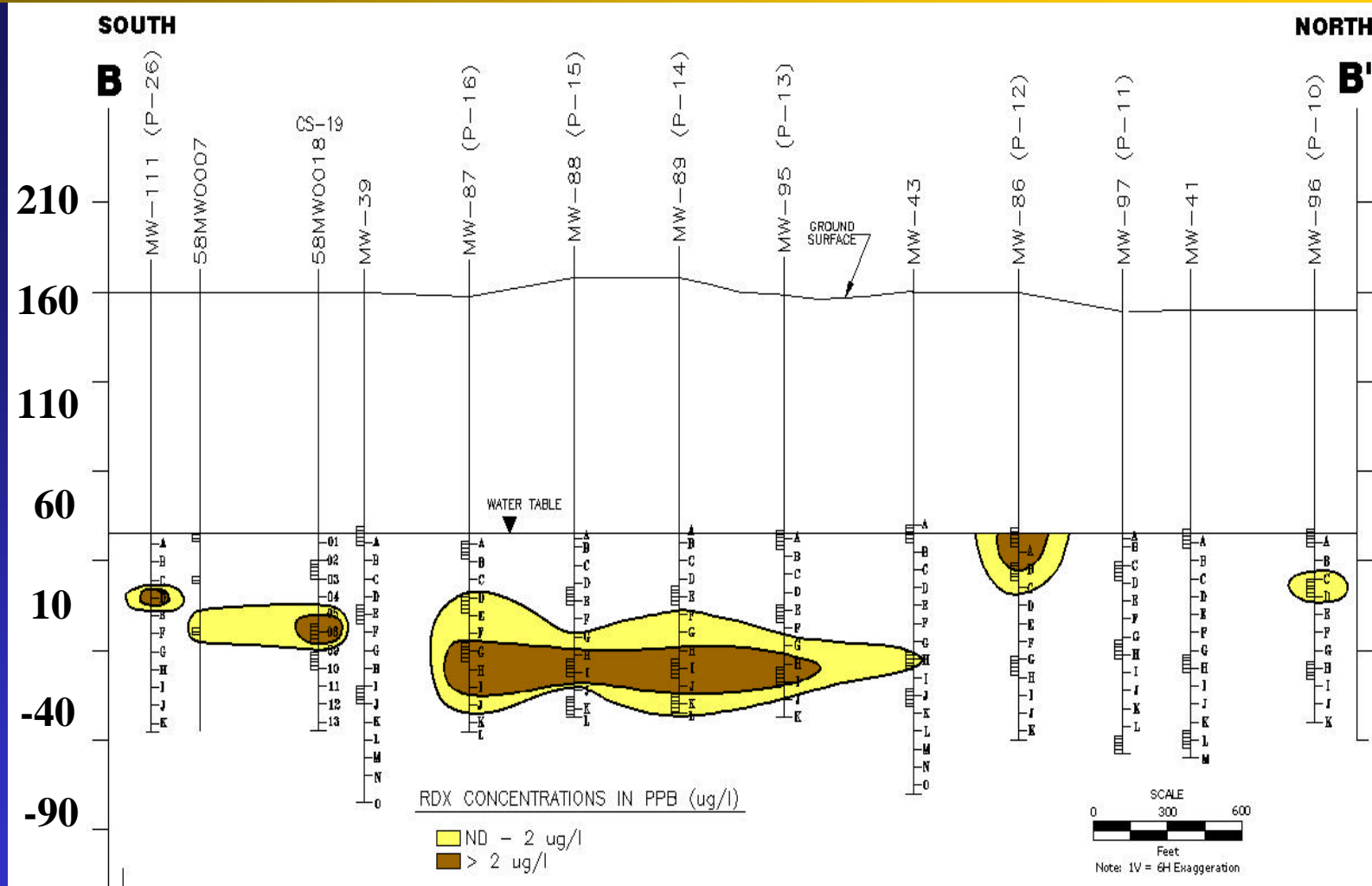


Inner Groundwater Transect within the Impact Area

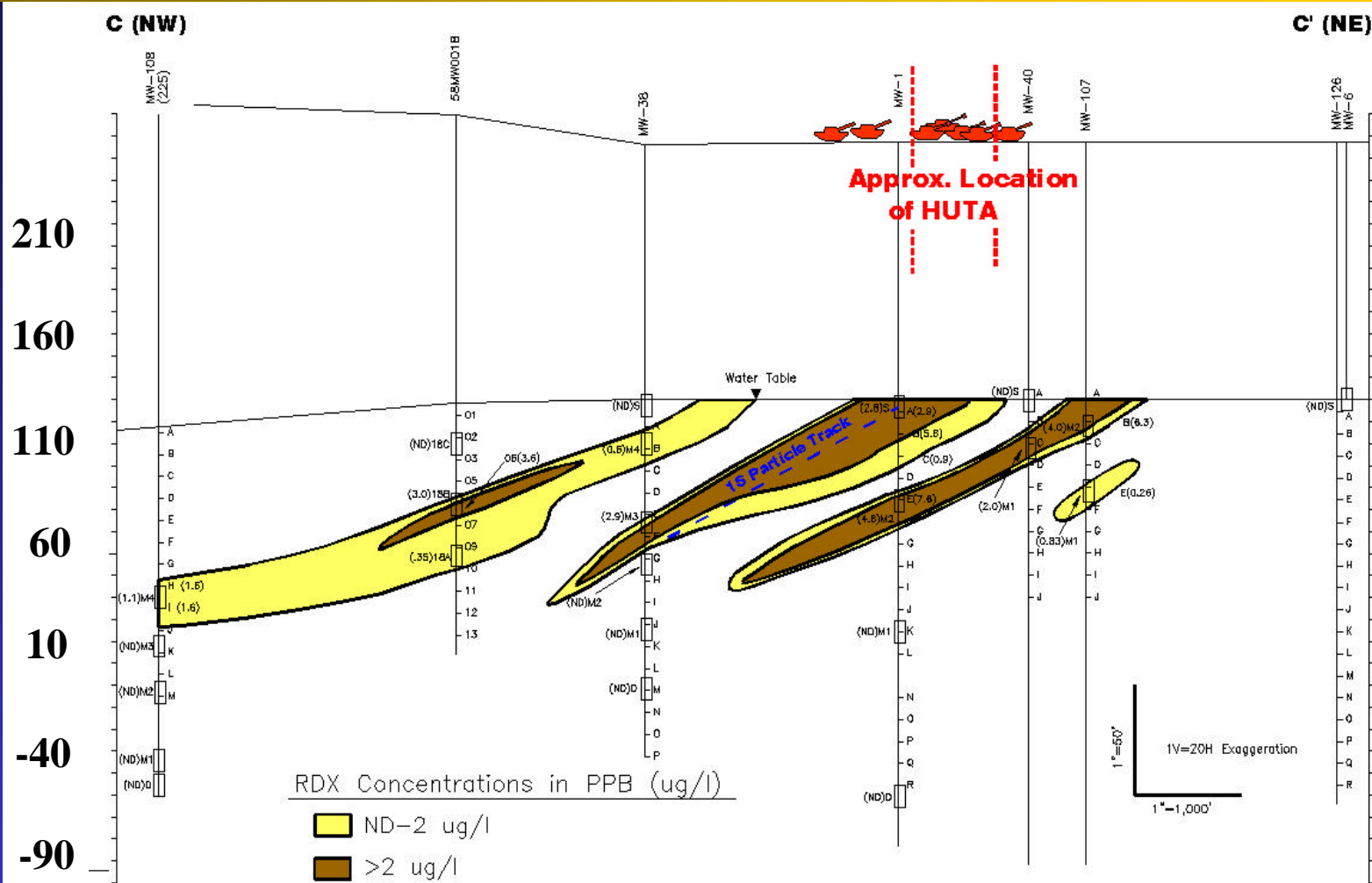


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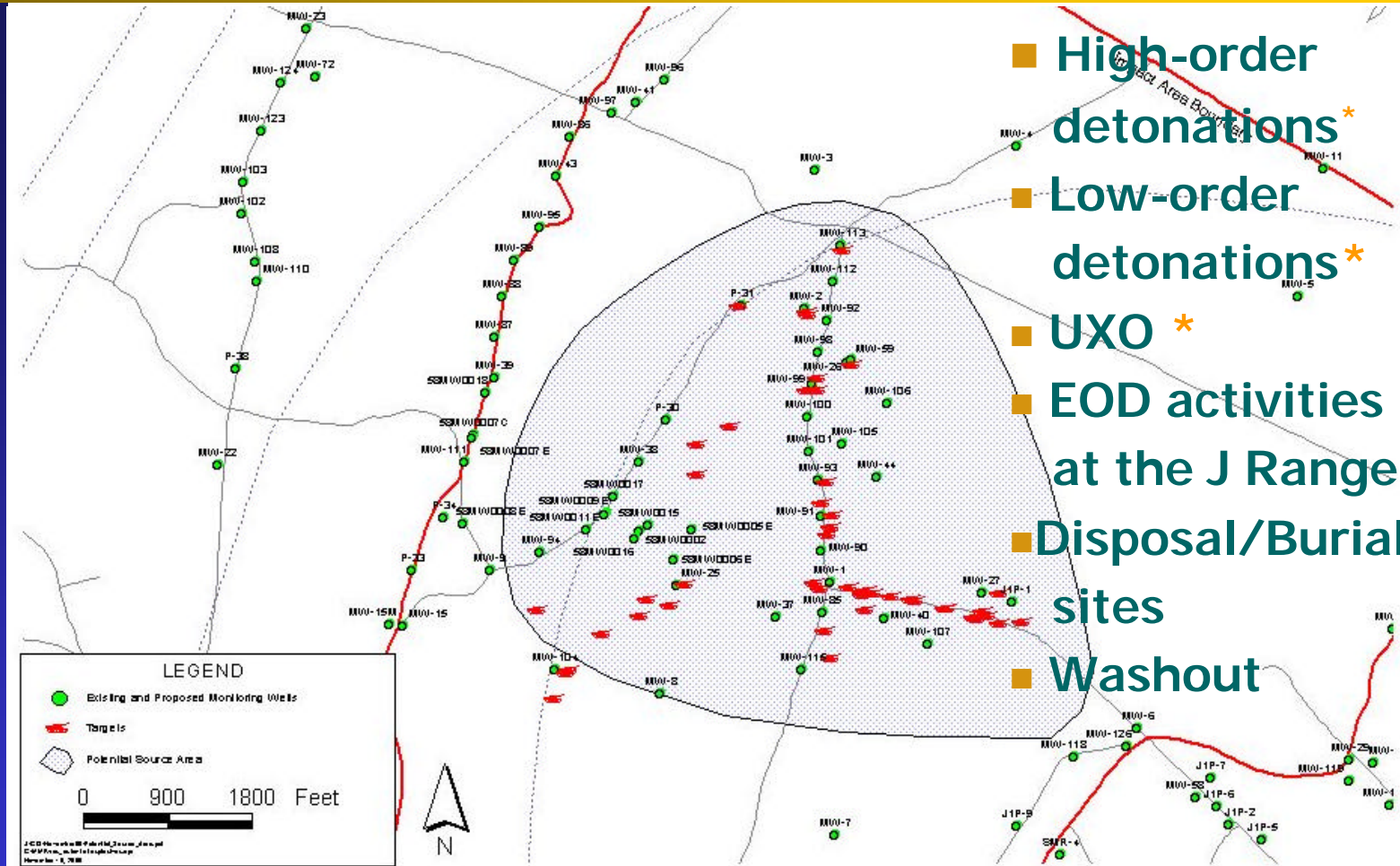
Outer Groundwater Transect within the Impact Area



Longitudinal Cross-Section through the Impact Area



Possible Source Terms



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



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- RDX and HMX present in surface soil immediately adjacent targets
- RDX and HMX present in groundwater downgradient of targets
- TNT is largely degraded before reaching groundwater



- Training using artillery rounds (UXO, low/high-order detonation, or both) appears to have resulted in an impact to groundwater
- Training with mortar rounds and its impact on groundwater is pending
- MMR findings are potentially applicable to other bombing ranges and battlefields

