

Case Study of Environmental Impacts due to Military Training Activities

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OGDEN

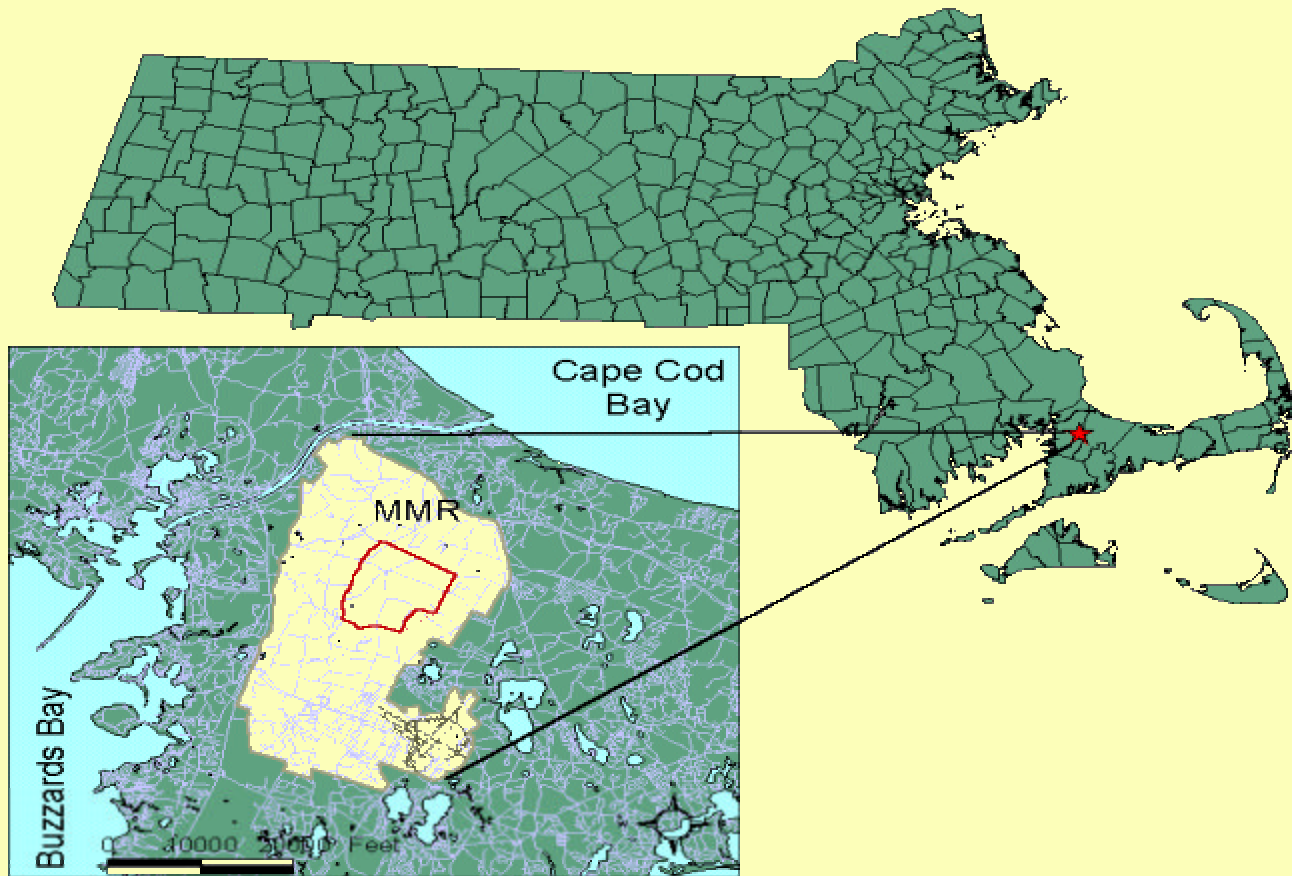


ENVIRONMENTAL AND ENERGY SERVICES

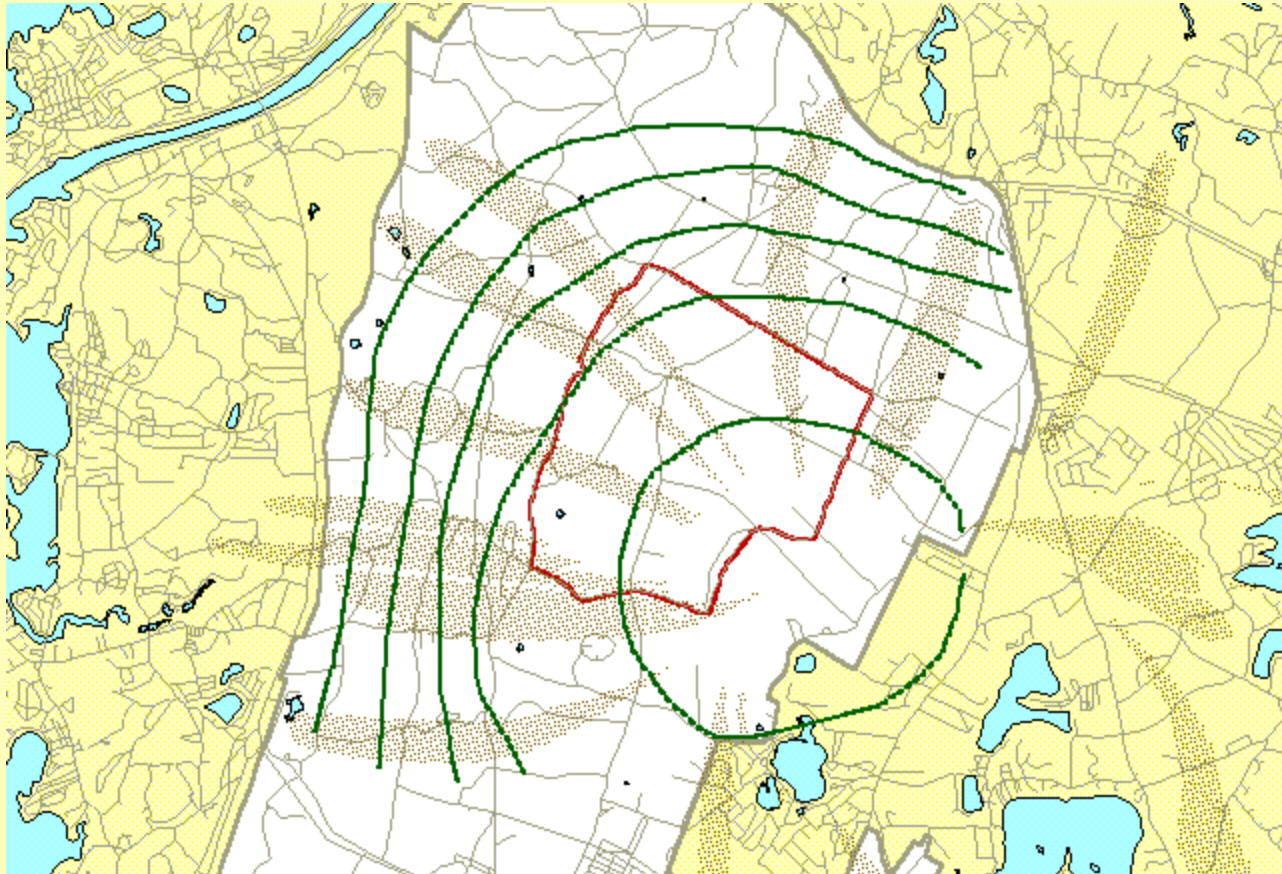
ENVIRONMENTAL AND ENERGY SERVICES



Location Map



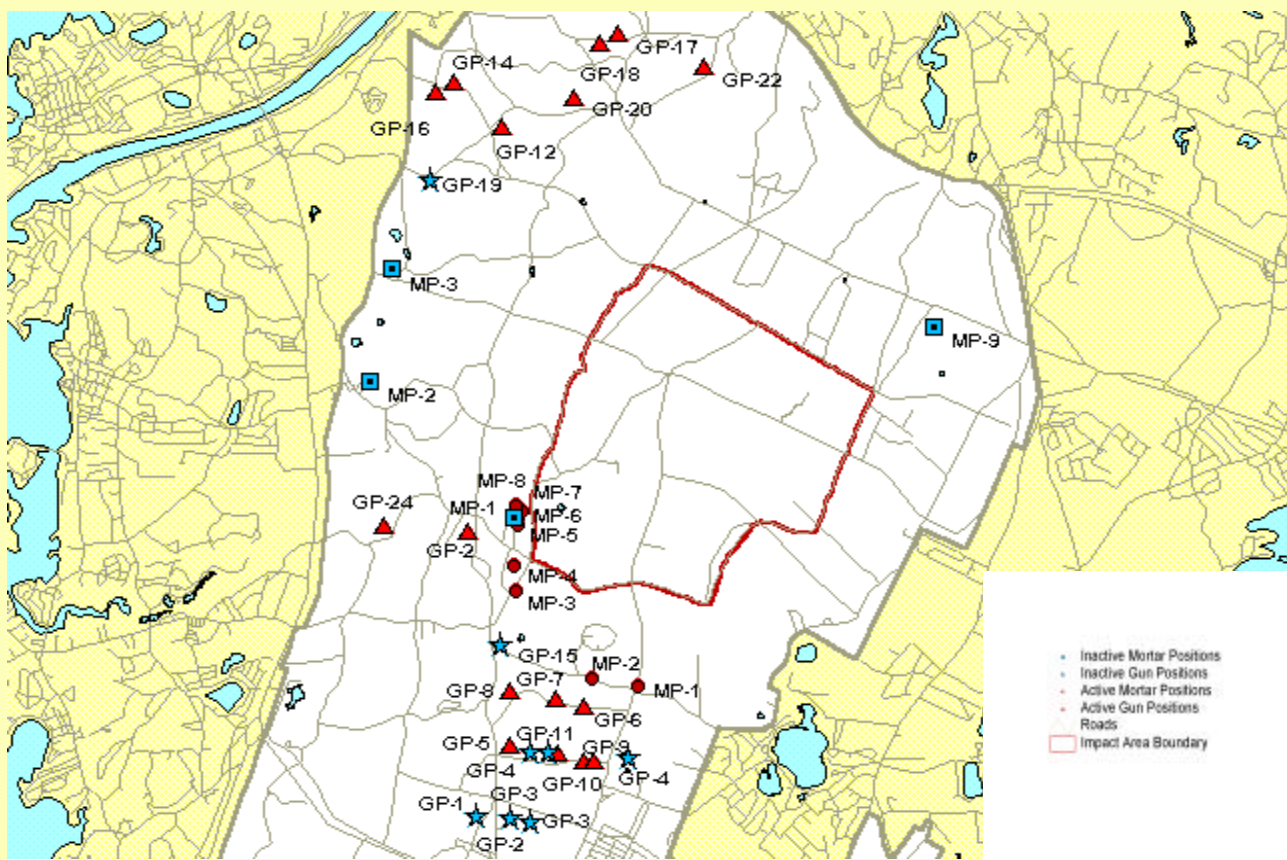
Water Table & ZOCs



Nature of Usage

- Impact Area
 - Artillery Rounds
 - Mortars
 - Rockets
- Small Arms Ranges (42)
 - Rifles, Shotgun, Pistol, and Machine Guns
 - Grenades
- Demolition Areas (2)

Map of Mortar and Gun Positions



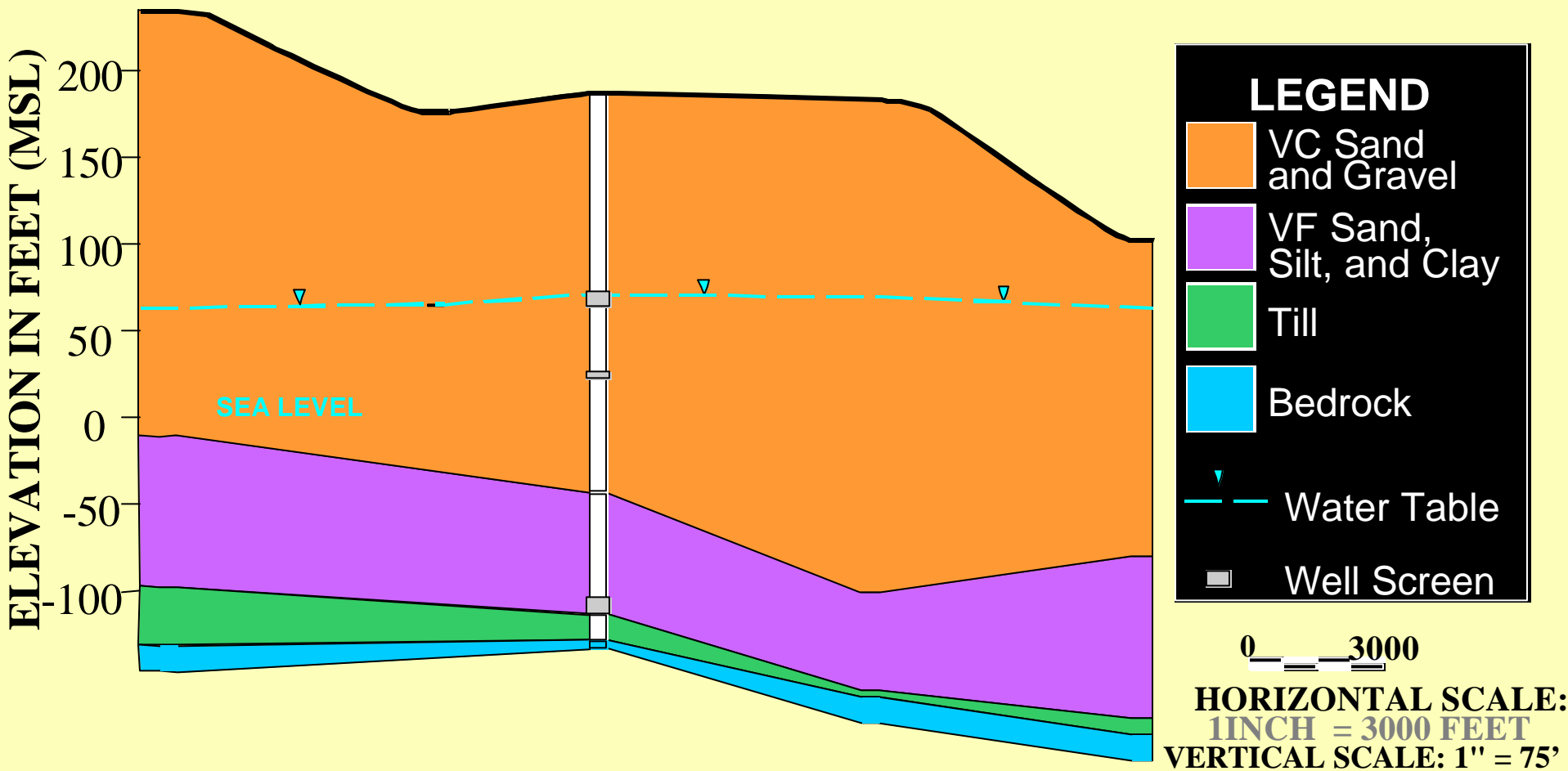
Potential Contaminants of Concern

- Nitramines (RDX, HMX)
- Nitroaromatics (TNT, DNT, tetryl, picric acid)
- Nitrate esters (PETN, nitrocellulose, nitroglycerin)
- metals (lead, copper, phosphorous)

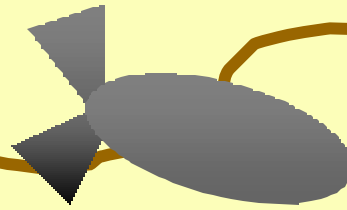
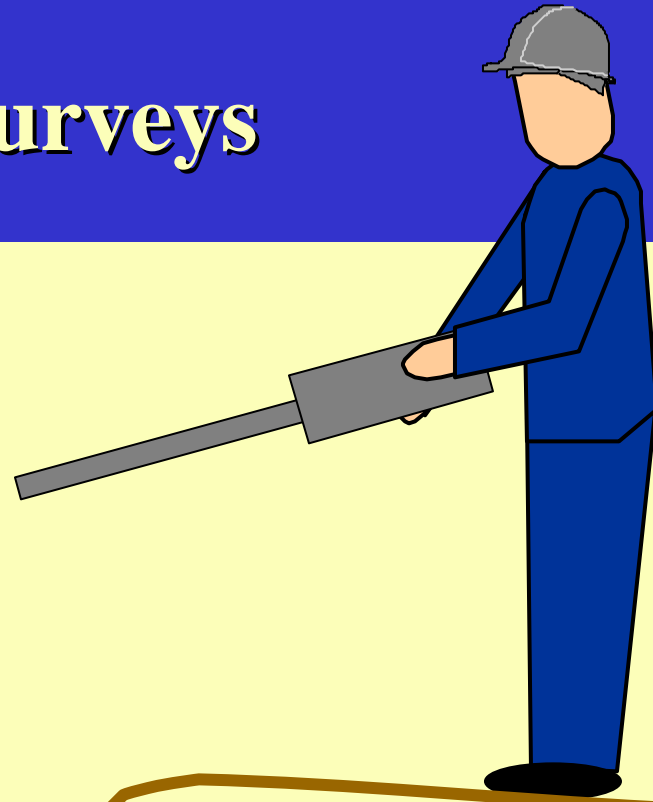
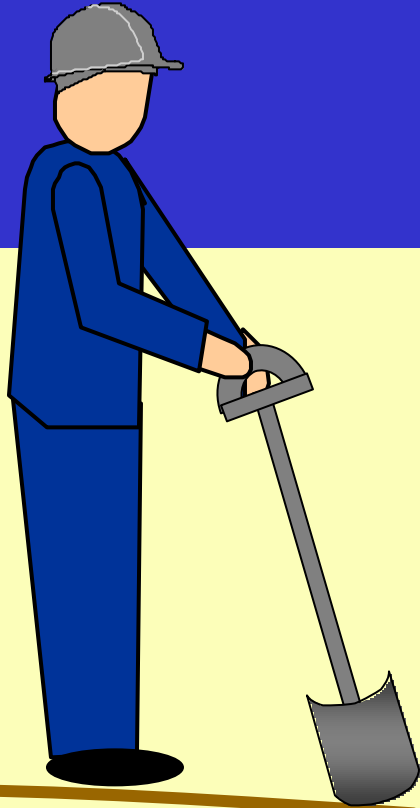
Explosive Properties

- Crystalline solid at room temperature
- Low water solubility
- Low vapor pressure
- TNT sorbed to soil, RDX less so
- Susceptible to photolysis and biological degradation

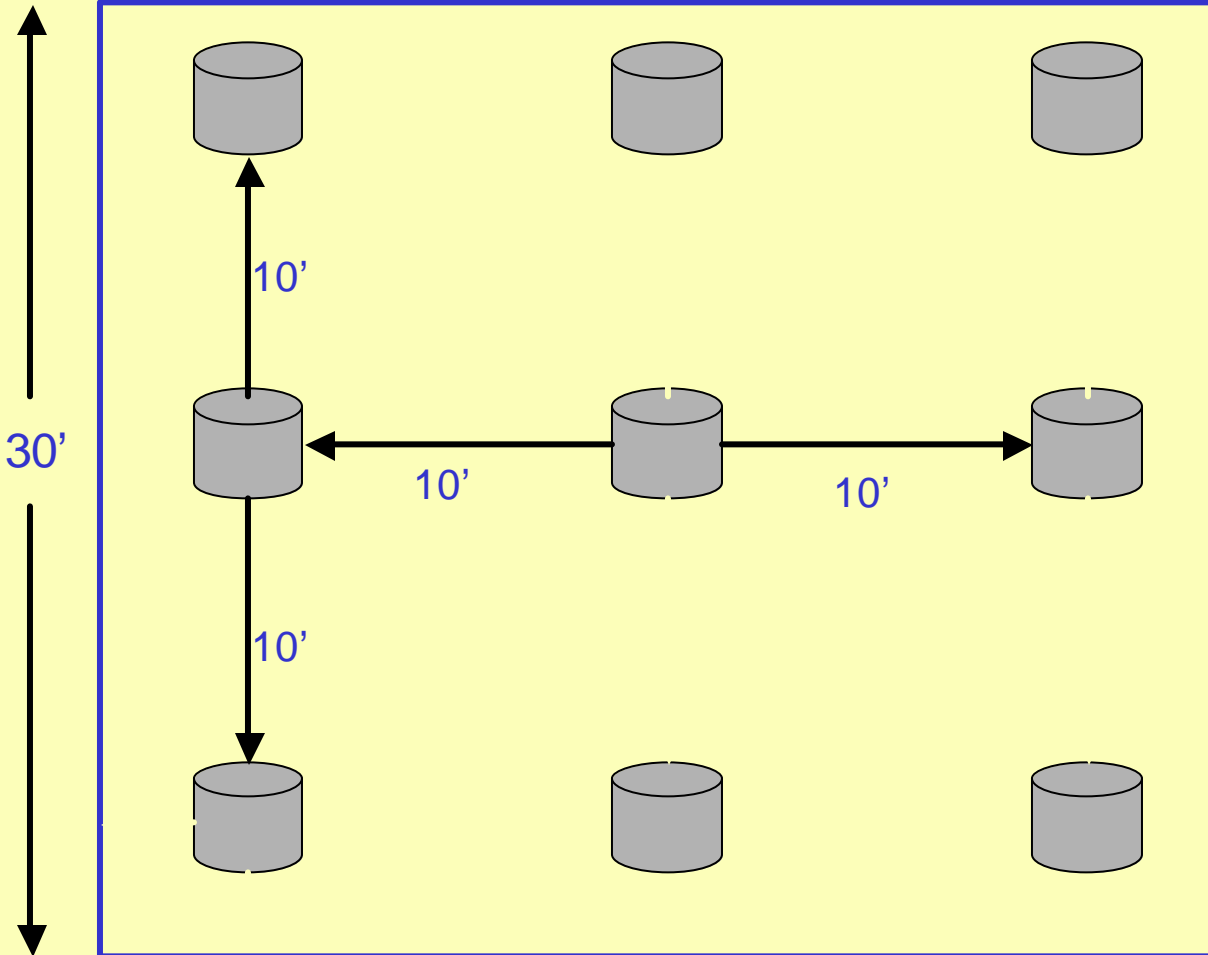
Conceptual Cross-Section



UXO Surveys



Plan of Soil Sampling Grid



Soil Sampling Point:

0-6" Sample

submitted for:

Inorganics
Explosives
other analytes

Composite

VOC - *Grab*

18-24" Sample

submitted for:

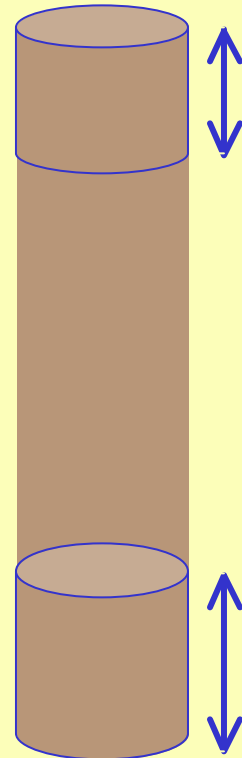
Inorganics
Explosives

Composite

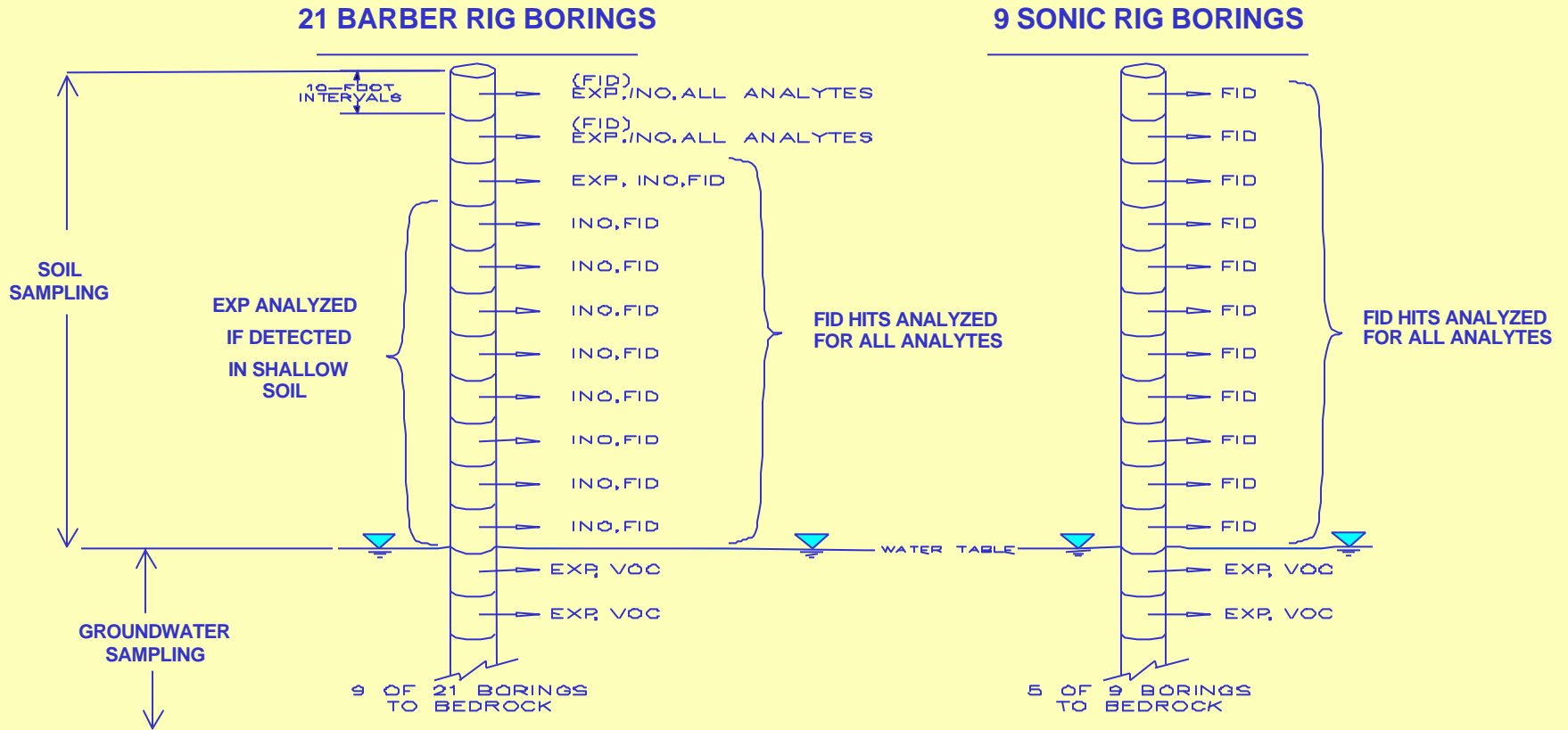
VOC - *Grab*

submitted if
detected in 0-6":

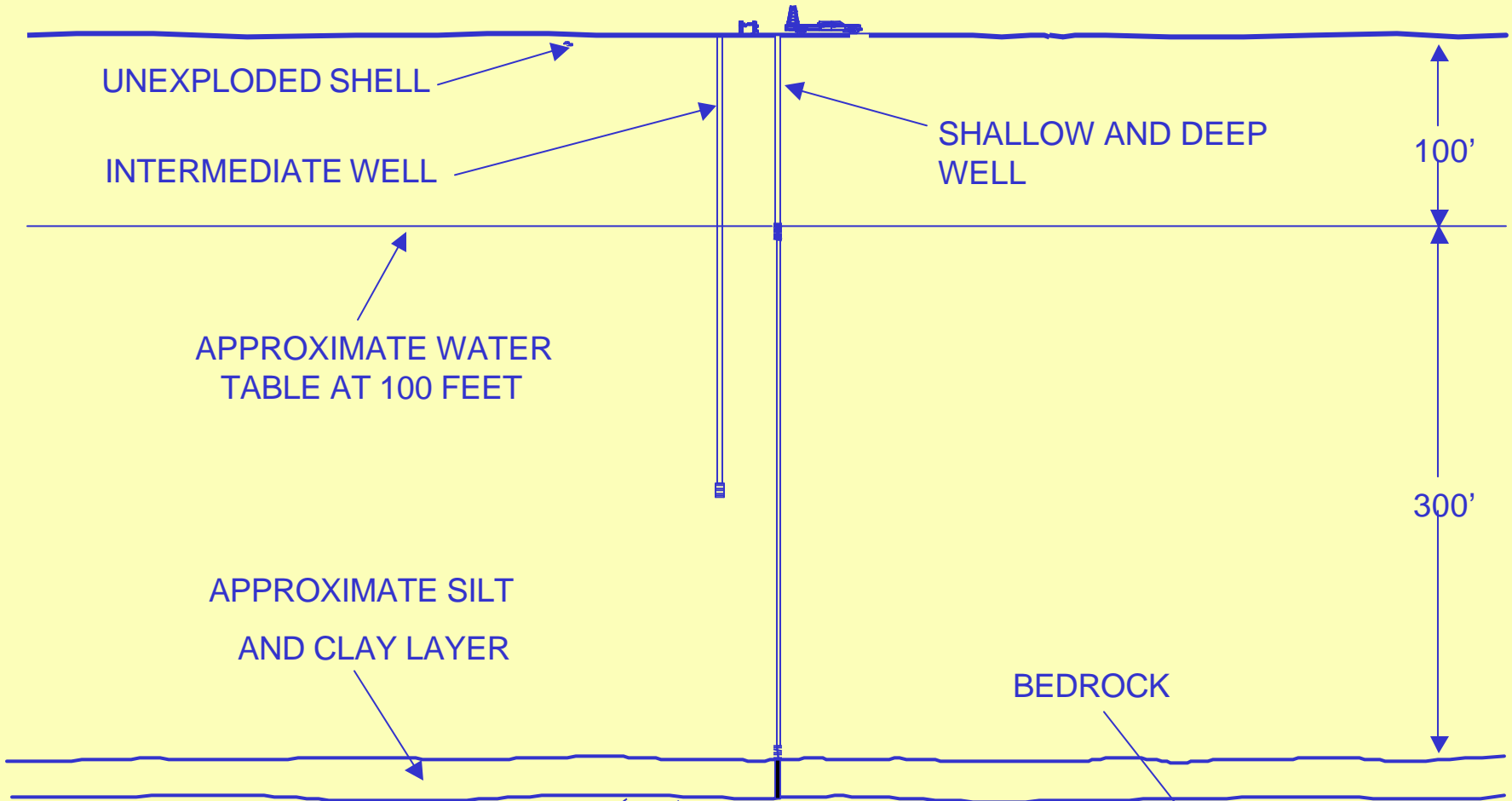
other analytes - *Composite*



Subsurface Soil and Groundwater Sampling



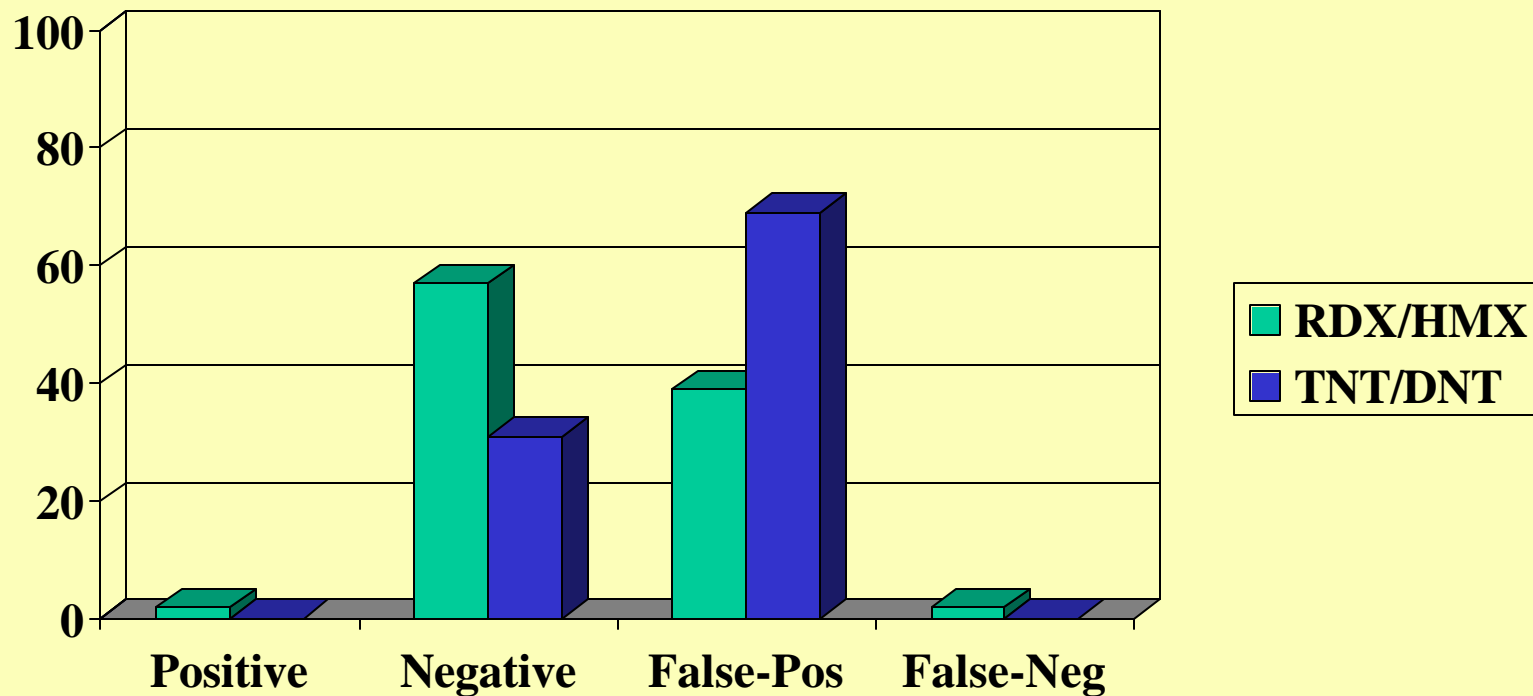
Typical Monitoring Well Installation



Analytical Methods for the IAGS

- Explosives - Method 8330 & screening
- Metals - ICP
- Volatile & Semivolatile Organics - GC/MS
- Pesticides, PCBs, Herbicides - GC

Preliminary Results of Soil Screening

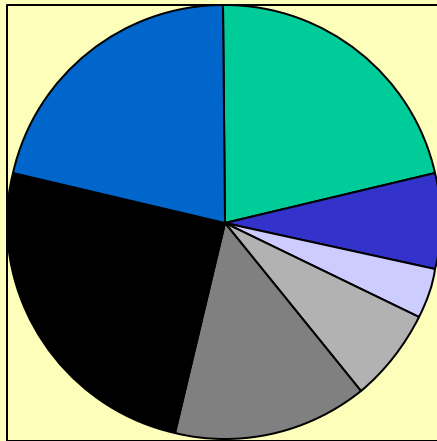


Profiling vs. Monitoring Well Results

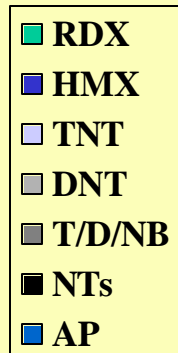
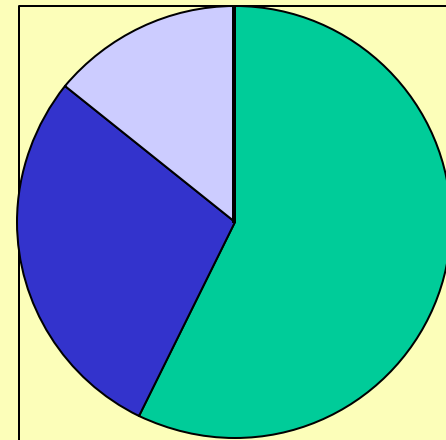
Analytes	Profiling (120')	Monitoring Well (114'-124')	
HMX	0.72 NJ	0.59	
RDX	2.9 J	2.5	
TNT	U	U	
1,3,5-TNB	10 J	U	
1,3-DNB	1.3	U	
NB	U	U	
4-A,2,6-NT	U	U	
2,6-DNT	0.26 NJ	U	
2,4-DNT	0.54	U	
2-NT	0.28	U	N = TENTATIVE ID
4-NT	0.53	U	J = ESTIMATED VALUE
3-NT	0.40	U	U = NOT DETECTED

Distribution of Compounds

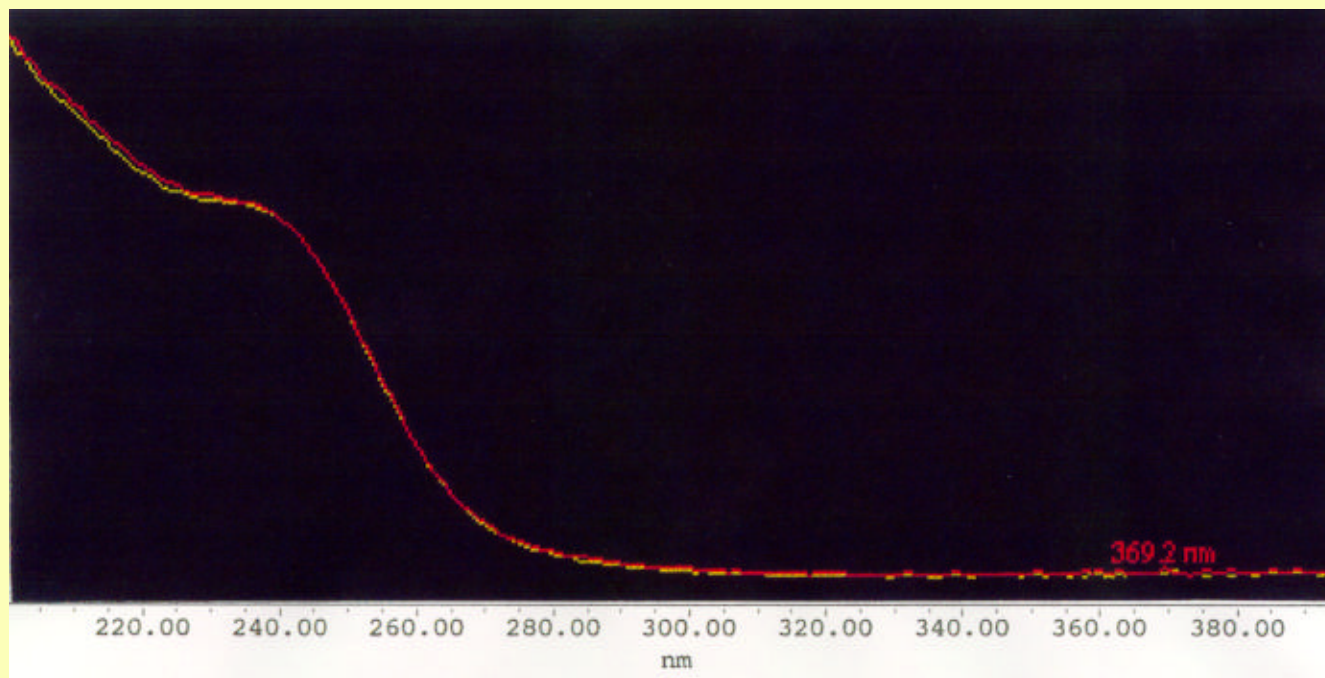
**Groundwater
Profiling Samples**



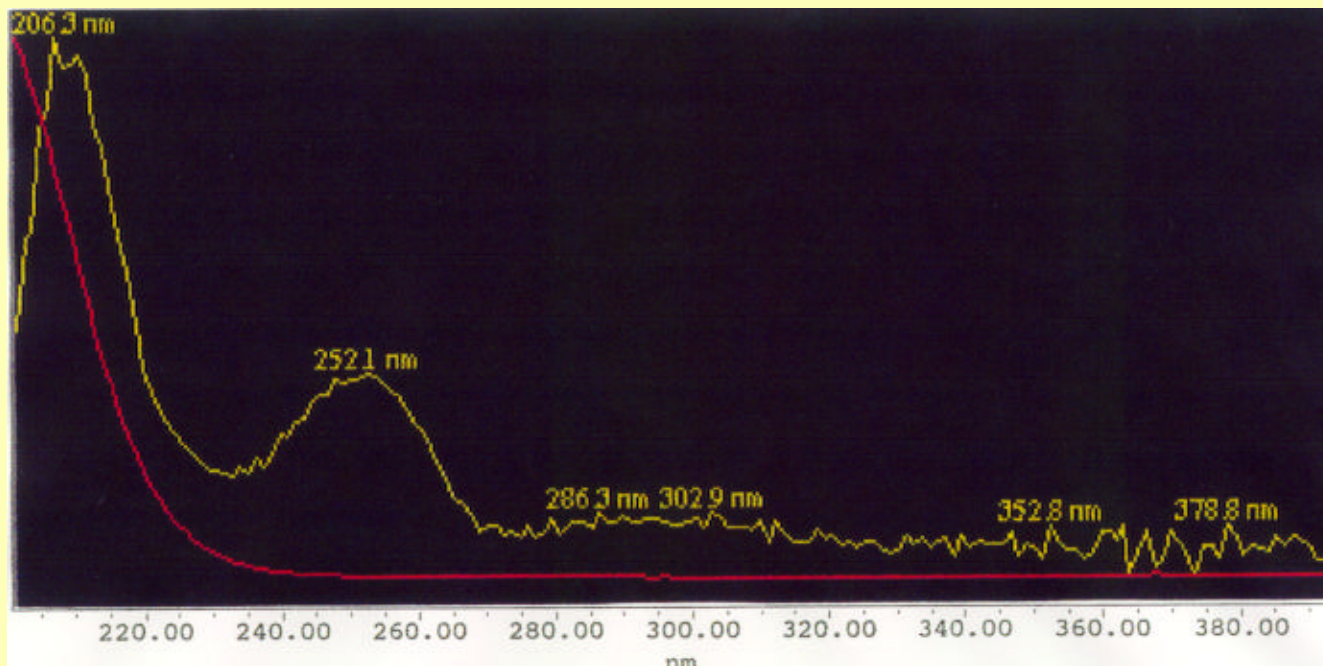
**Monitoring Well
Samples**



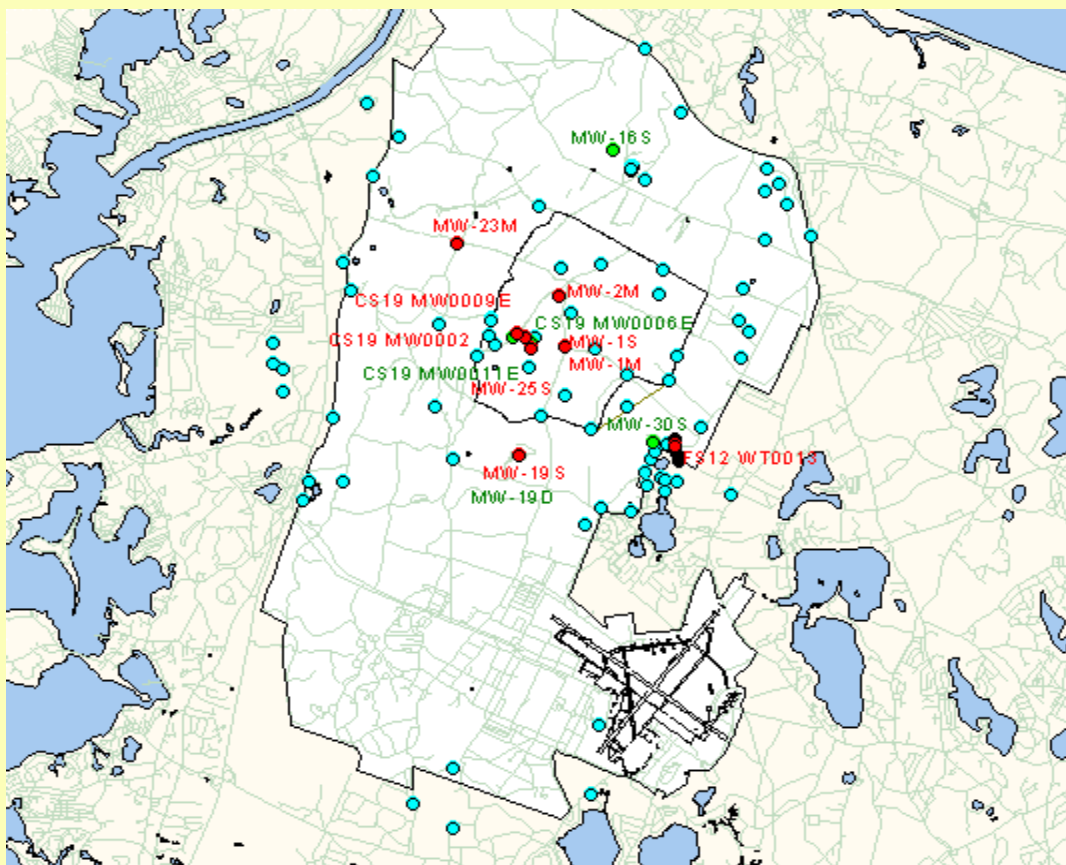
PDA Spectra for RDX



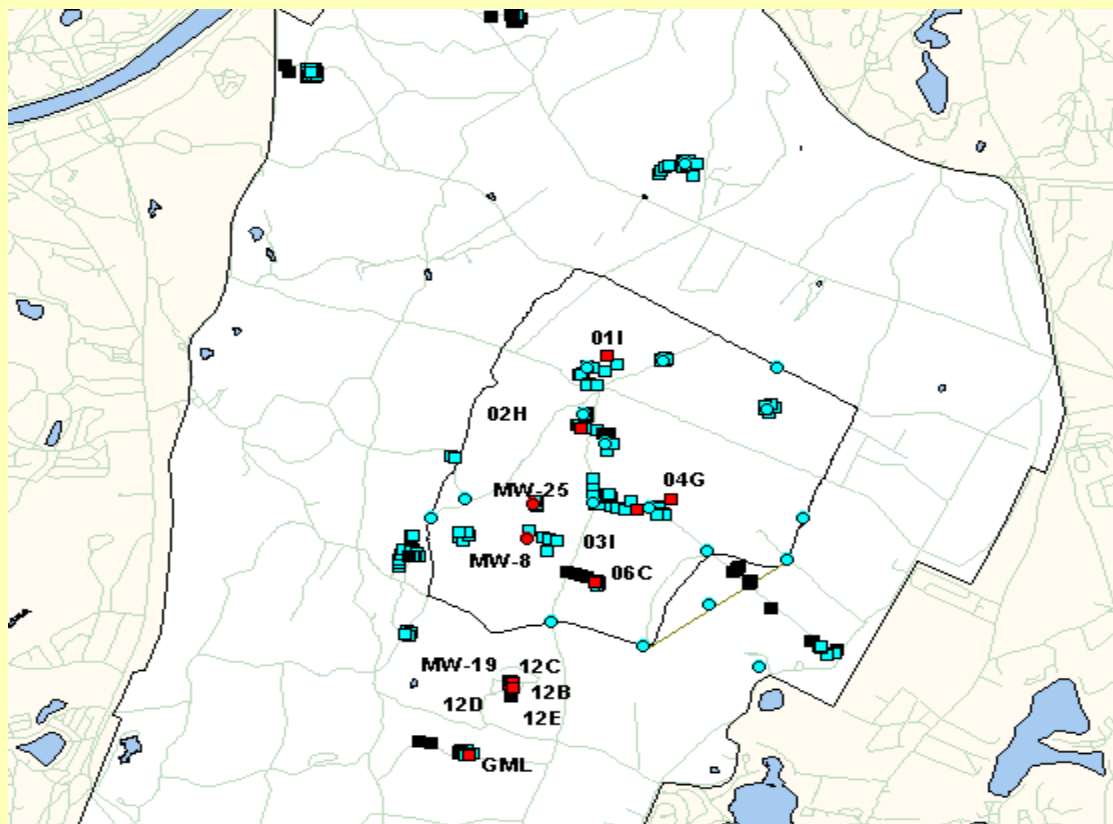
PDA Spectra for PETN



Explosives in Groundwater



Explosives in Soil



Soil Explosive Detects Demo Area 1

Explosives Results For Soils In Area 12

S19 (0-6") Soil Boring

2-Amino-4,6-Dinitrotoluene	0.350 ppm	
4-Amino-2,6-Dinitrotoluene	0.280 ppm	J
RDX	0.610 ppm	
HMX	0.600 ppm	NJ

S19 (0-6" Duplicate) Soil Boring

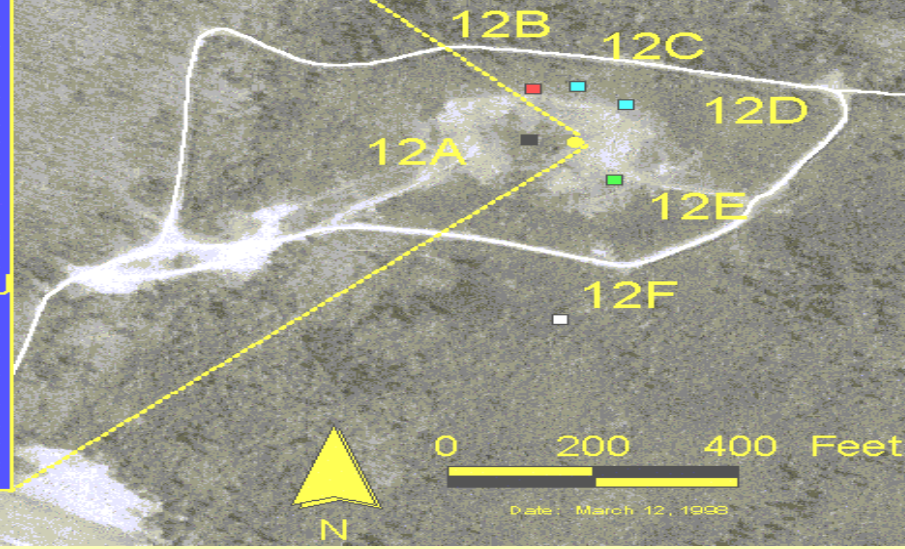
2,4-Dinitrotoluene	1.800 ppm	J
2,6-Dinitrotoluene	0.040 ppm	J
2-Amino-4,6-Dinitrotoluene	0.220 ppm	
4-Amino-2,6-Dinitrotoluene	0.200 ppm	J
RDX	0.520 ppm	
HMX	0.690 ppm	NJ

S19 (10-12') Soil Boring

RDX	0.120 ppm	J
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Legend For Soil Grids (Preliminary Results)

- Non-detects For Explosives
- HMX, RDX
- HMX, RDX, 2-A-4,6-DNT
- HMX
- Awaiting Lab Results



Conclusions

- Explosives contamination concentrated in Demo Area 1
- Limited explosives in groundwater elsewhere
- Limited explosives detected in soil indicate no current widespread source of groundwater contamination
- Distribution of low-level RDX and HMX in groundwater suggest multiple sources near J Ranges, Demo Area 2, and Impact Area