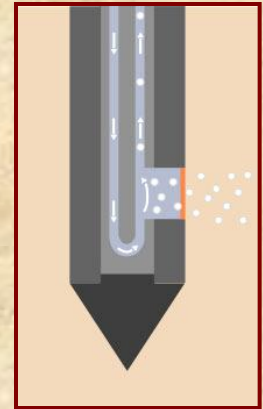


# MIP System Field Test for Mid-High Level X-VOCs

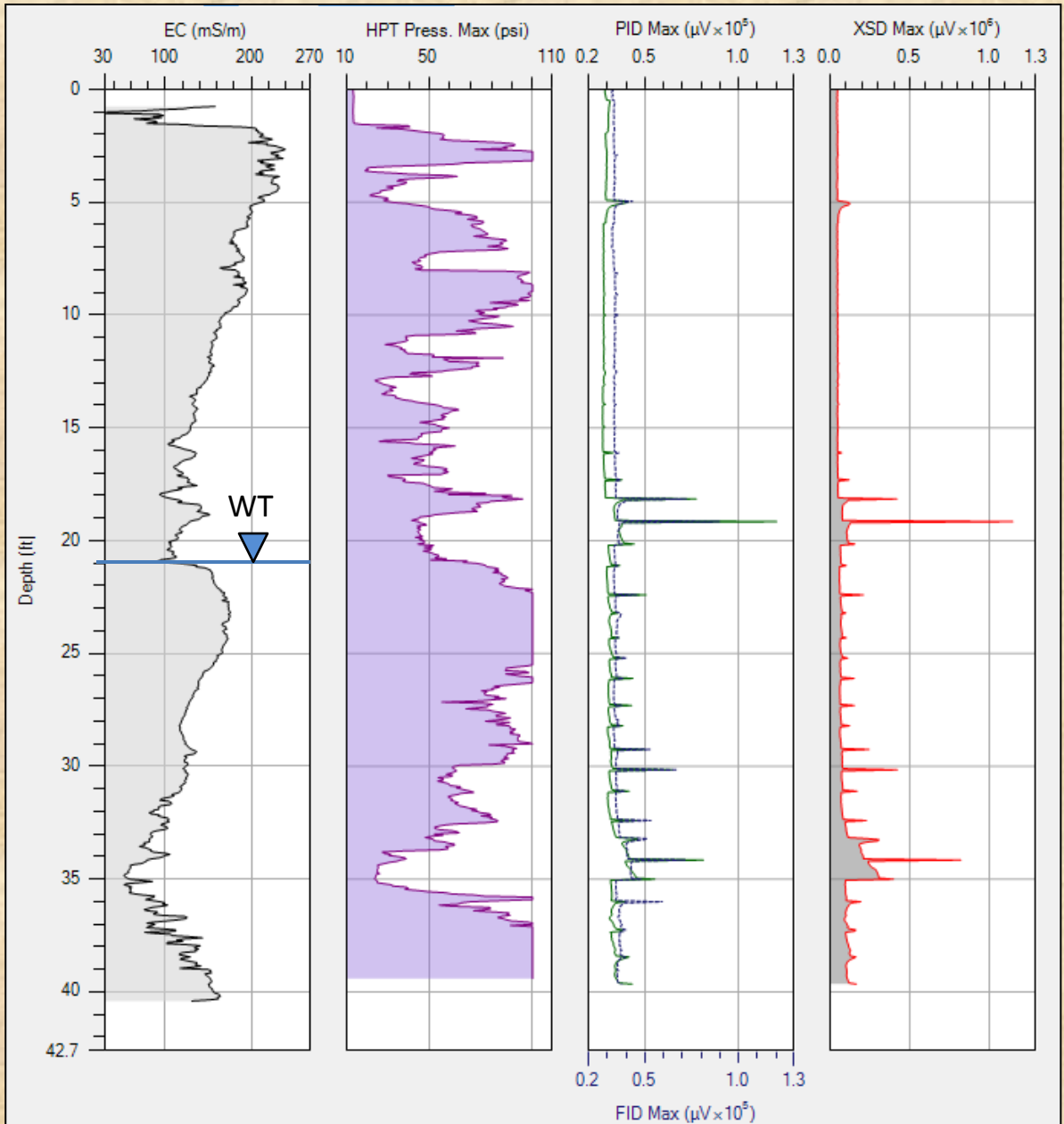


Schematic of MIP Probe with VOCs penetrating the membrane.

Dan Pip and Blake Slater of Geoprobe Systems® running an MiHPT log at the Wall St. location in Salina, KS.

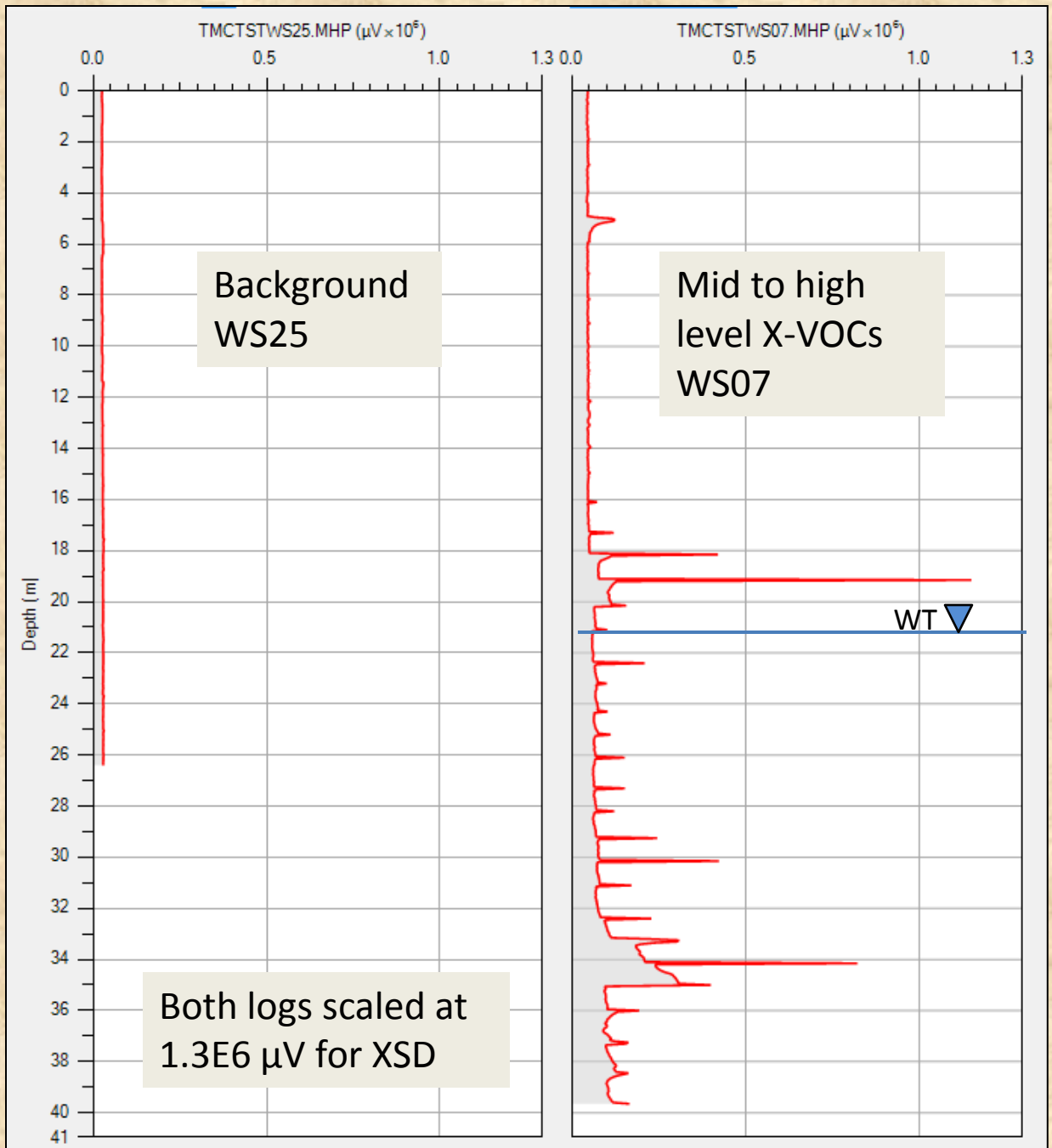
This presentation describes testing performed by Geoprobe Systems® to compare MIP log results to lab analysis of co-located soil samples. The focus of this study was primarily to compare the MIP detector response in the saturated zone to soil analytical results. The logs and samples were obtained at a site where chlorinated volatile organic compounds (X-VOCs) were released at a former air force base during World War II. TCE and other solvents were used at the former base for degreasing operations. There was medium to high level X-VOC contamination (> 1 ppm) at the location studied here. The primary contaminants detected at this location include TCE (trichloroethene),  $\text{CCL}_4$  (carbon tetrachloride) and  $\text{CHCL}_3$  (chloroform).

# WS07 MiHPT Log



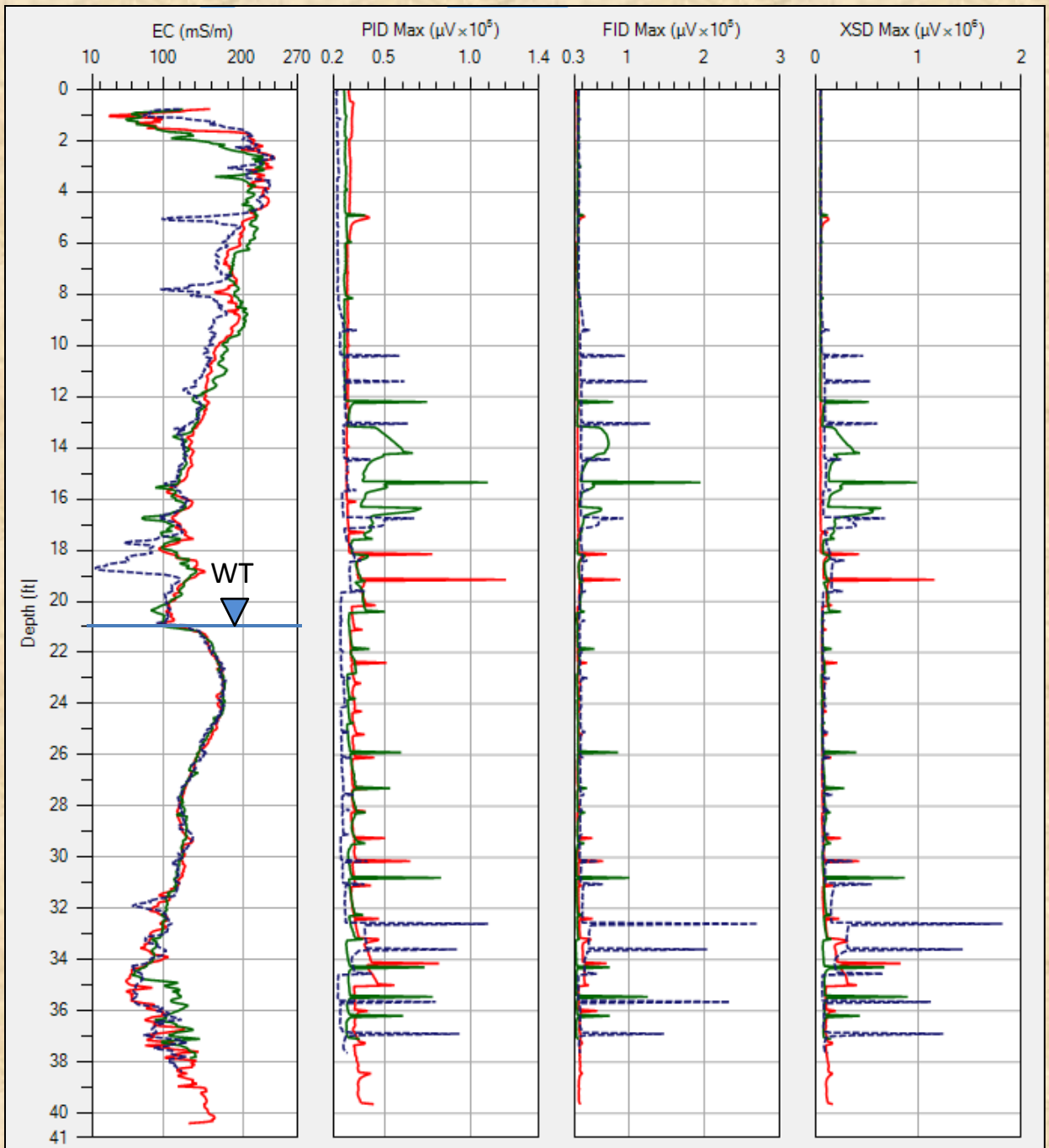
The logs presented here were obtained during field testing of the MiHPT probe under development by Geoprobe in 2011. In the WS07 log both the PID and FID maximum responses are just below  $1.3\text{E}5\mu\text{V}$  while the XSD maximum response is about an order of magnitude higher ( $<1.3\text{E}6\mu\text{V}$ ) suggesting the presence of moderate to high concentrations of chlorinated VOCs. The EC log and HPT pressure logs indicate primarily fine grained materials in the formation with some coarser materials interspersed with the fines at various depths (confirmed by sampling). The water table (WT) at this location is approximately 21ft (6.4m) below grade.

# Background Log Versus Mid-High Level X-VOCs on XSD Detector



The WS07 MIP log exhibits a moderate to high level XSD response for this area of contamination. Here, comparison of the WS07 log to a non-impacted location at the site (WS25) demonstrates that the WS07 MIP-XSD signal is robust and easily discernable from background signal.

# Overlay of WS07, 08 & 09 Logs



Overlay of WS07 and two other logs run about 5 feet from this location (see map, next slide) show consistent EC results. The detector results show some variation but the XSD responses are generally consistent indicating medium to high level X-VOCs in the local formation. Based primarily on the XSD detector responses soil samples were collected from 16ft to 38ft to assess the concentrations of X-VOCs present in the subsurface.

# MiHPT07 Log Locations Wall St. X-VOC Site

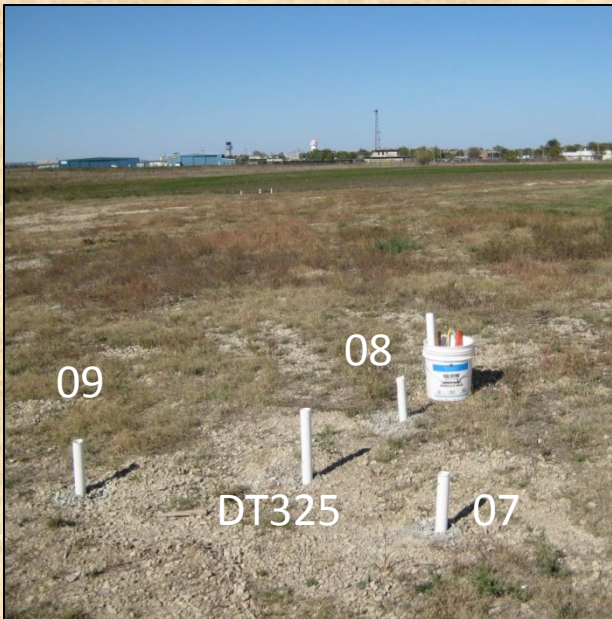
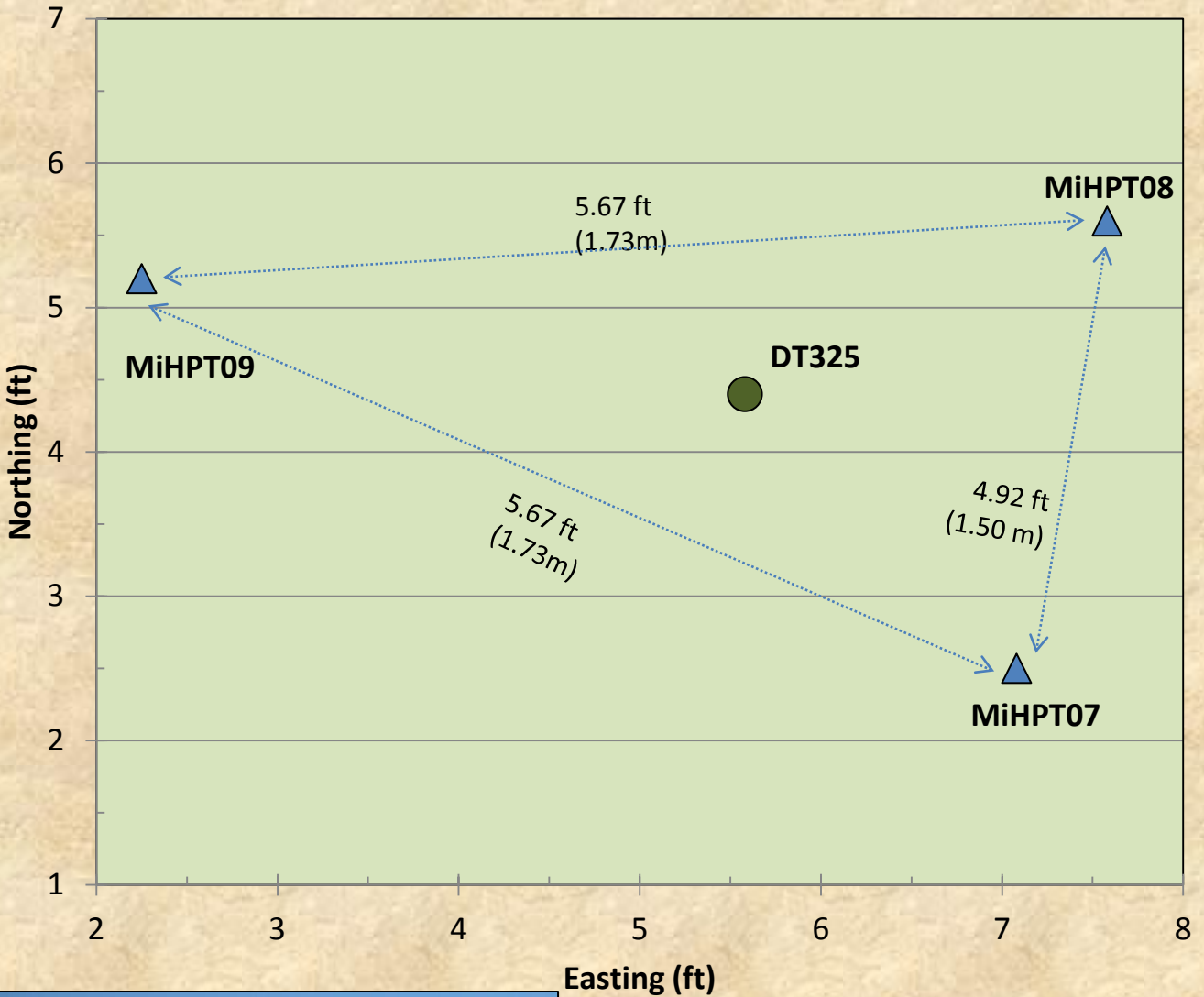


Photo of the MiHPT07, 08 & 09 log locations. Looking generally north toward the Salina airport control tower. Old source is former fire training area to the west (left) of the photo. Soil cores were collected with the DT325 system at the location shown here.

# Using the DT325 System to Collect Soil Cores at the WS07 Location

The dual tube DT325 system equipped with a 5ft (1.52m) sample tube and PVC liner was used to collect 4ft (1.22m) long soil cores to a depth of 32ft (9.8m) between the replicate logs at the mid-high level X-VOC area. (See map above)



A Terra Core™ tool (En Novative Tech. Inc.) was used to collect about 5 grams of sample from a hole cut in the side of the DT325 liner at each targeted depth.

The soil core was then transferred immediately to a tared VOA vial already prepared with a stir bar and reagent grade water.



Once the transfer was completed the VOA vials were stored on ice in a cooler until delivered to the lab for analysis.

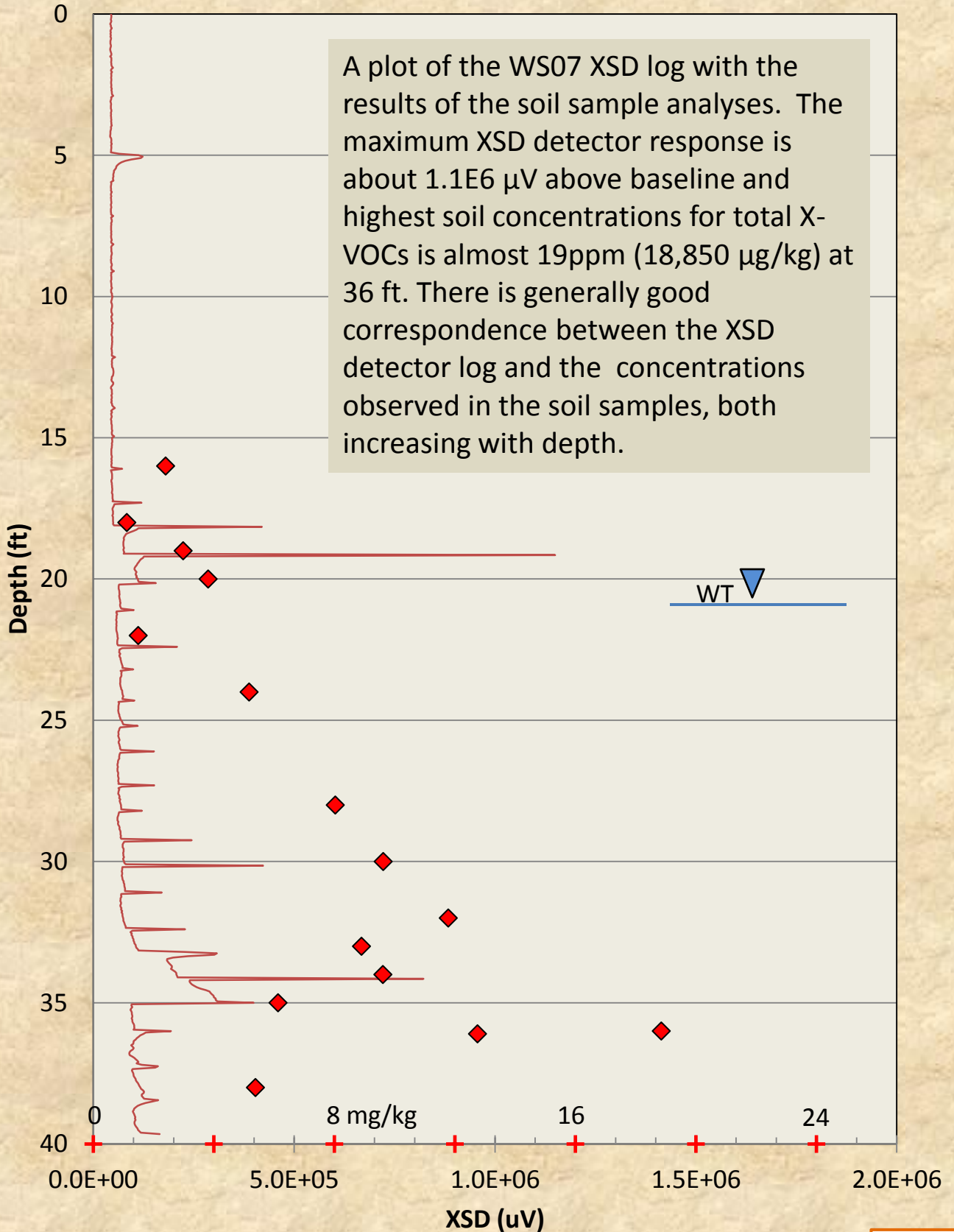
# Soil Sample Analytical Results for X-VOCs

Depth (ft)	Carbon	Cloroform	Trichloroethene	Total X-VOC ( $\mu\text{g}/\text{kg}$ )	Depth (m)
	Tetrachloride ( $\mu\text{g}/\text{kg}$ )	( $\mu\text{g}/\text{kg}$ )	( $\mu\text{g}/\text{kg}$ )		
16	539	120	1740	2399	4.9
18	270	63	778	1111	5.5
19	890	140	1950	2980	5.8
20	1110	180	2520	3810	6.1
22	729	54	706	1489	6.7
24	3290	180	1700	5170	7.3
28	6080	190	1760	8030	8.5
30	7080	230	2310	9620	9.1
32	8550	250	2980	11780	9.8
33	6380	210	2310	8900	10.1
34	6950	210	2450	9610	10.4
35	4390	140	1600	6130	10.7
36*	13000	370	5480	18850	11.0
36.1*	9120	290	3340	12750	11.0
38	2900	110	2370	5380	11.6

The soil samples were submitted to Continental Analytical Services (CAS) Laboratory, Salina, KS for analysis by EPA Method 8260B GC-MS for high level VOCs. The method reporting limit was approximately  $50\mu\text{g}/\text{kg}$  (parts per billion) depending on the mass of sample recovered and other factors.

Analytes:  $\text{CCL}_4$ = carbon tetrachloride, TCE = trichloroethene,  $\text{CHCL}_3$ =Chloroform. (\* Field Duplicates)

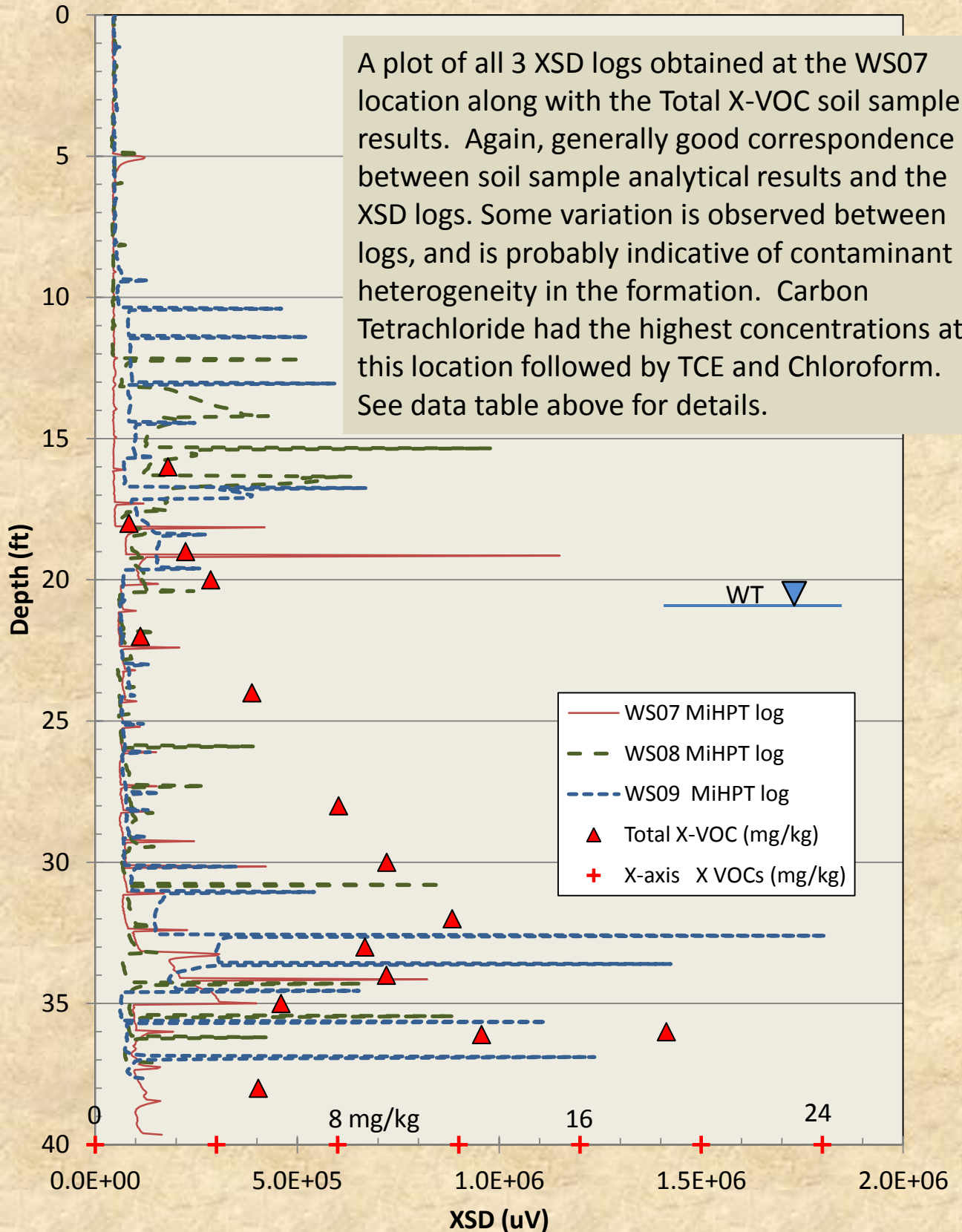
# WS07 XSD





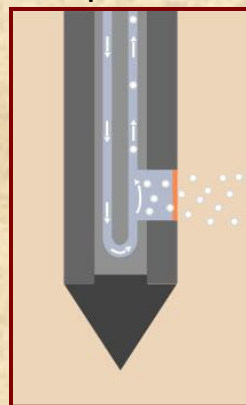
# WS07, 8 & 9 XSD

A plot of all 3 XSD logs obtained at the WS07 location along with the Total X-VOC soil sample results. Again, generally good correspondence between soil sample analytical results and the XSD logs. Some variation is observed between logs, and is probably indicative of contaminant heterogeneity in the formation. Carbon Tetrachloride had the highest concentrations at this location followed by TCE and Chloroform. See data table above for details.



## Summary for WS07 Mid-High Level X-VOC Location

- The MIP-XSD system Clearly defined the zones of elevated X-VOC contamination in the fine grained sediments at the Wall St. Area.
- Replicate MIP logs with the XSD detector show generally good correspondence in detector response for moderate to high level X-VOCs in the saturated soils studied here.
- Dual tube DT325 soil sampling was used to collect soil cores across the zone of positive detector response. Five gram samples were analyzed by GCMS to identify and quantitate contaminant concentrations.
- Good correspondence is observed between the XSD detector responses and the total X-VOC analytical results for the soil samples collected from the saturated zone.
- In general, the soil X-VOC results are lower over the zones where the MIP-XSD system displays lower response above the baseline.
- The soil X-VOC results are elevated over the intervals where the MIP detectors display elevated response in the replicate logs.
- Soil coring and sub-sampling techniques for volatiles analysis can have a substantial impact on the analytical results as well as the correspondence between MIP results and soil sample results.
- It is also important to collect the soil cores in close proximity (spatially and chronologically) to the MIP logs to get a good correlation between the MIP log and analytical results.



To learn more about the MIP system  
visit

[www.geoprobe.com/mip](http://www.geoprobe.com/mip)

**MIP System Specifications for this Study:**

Probe: Combined MIP-HPT Probe, PN MK6530

GC and Detectors: SRI Model 310C GC equipped  
with XSD detector, 10.6eV PID and FID detectors

MIP Controller Model MP6505

Field Instrument Model FI6000

Carrier Gas: N<sub>2</sub> at 40ml/min

Trunkline equipped with an unheated 1/16" OD x  
0.04" ID stainless steel return gas line

**Acknowledgement:** Work on this project was  
funded in part under a cooperative development  
agreement with the Danish Capitol Region.

