



An Interactive Tool for Visualizing High-Resolution LNAPL Characterization Results

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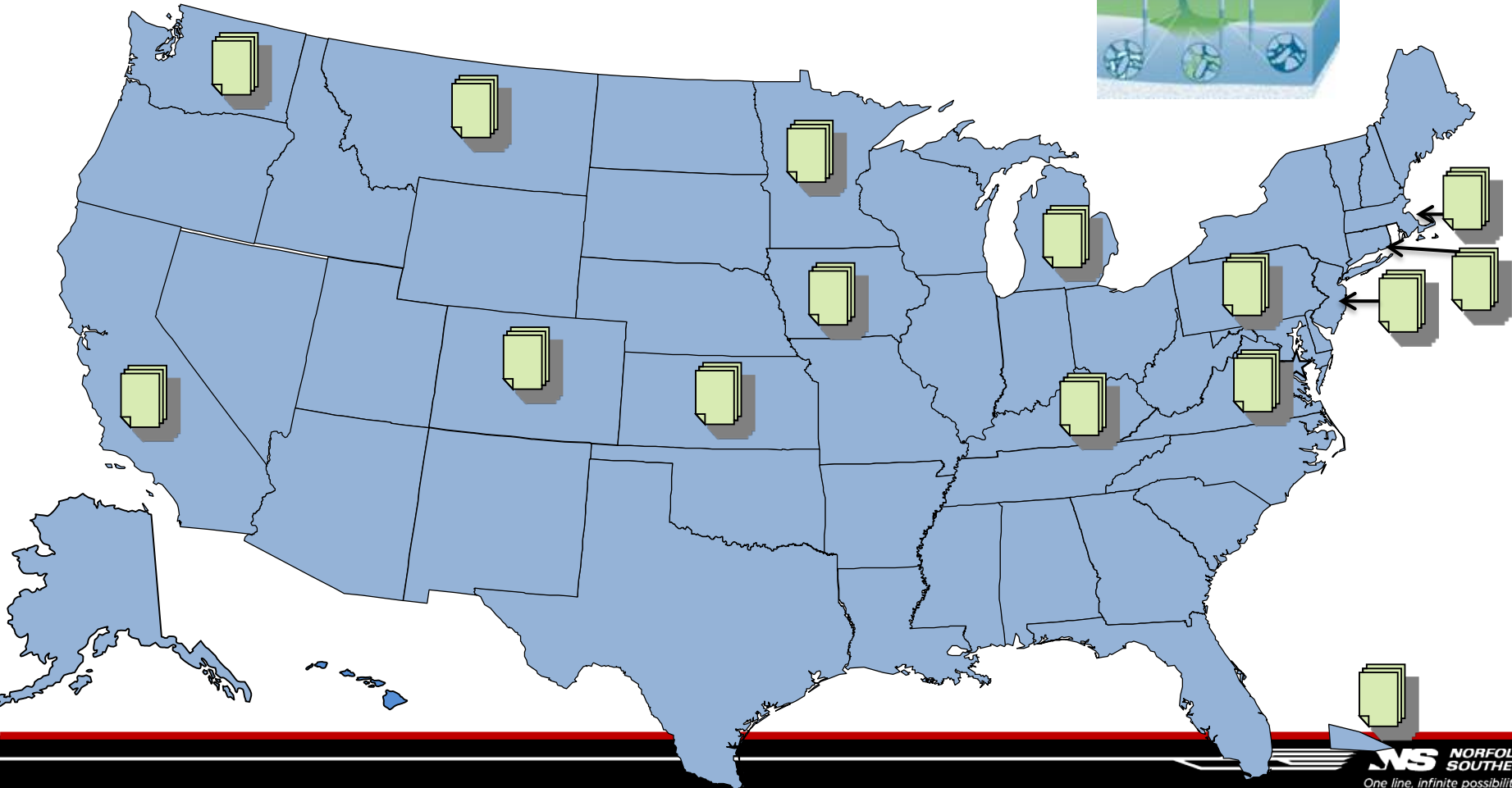
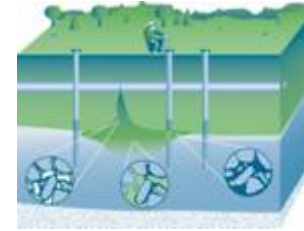
² Norfolk Southern Corporation, Atlanta, Georgia

- Regulatory changes - perspective from industry
- Rail yard case study background
- Risk characterization approach
- Demonstration of data sharing and decision support tool

Regulatory Changes

updated Oct. 2015

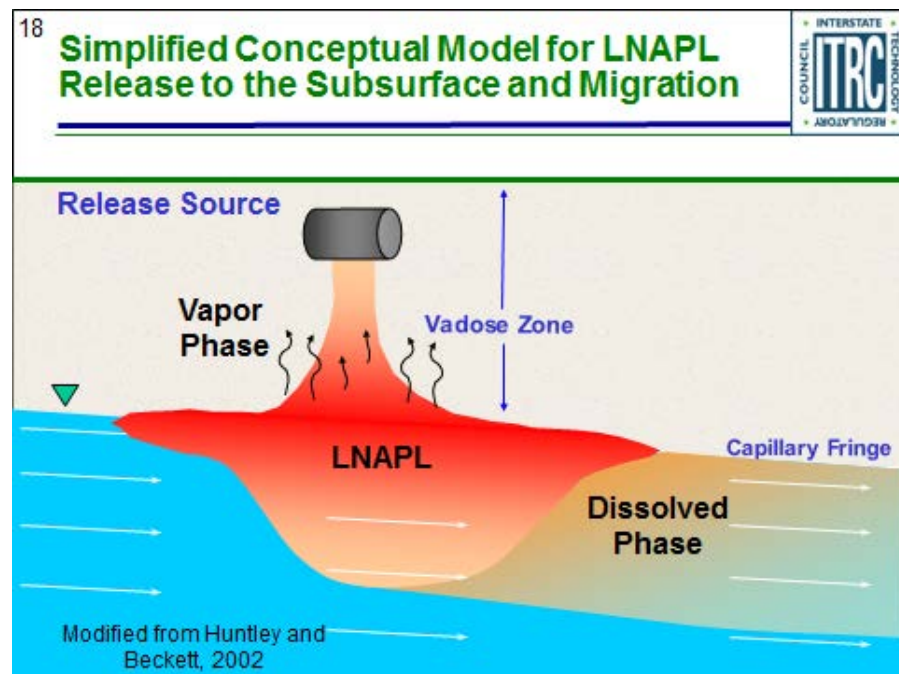
-  ITRC LNAPLs guidance used or referenced in the development of current or draft state guidance
-  ITRC LNAPL document used or planned use at sites



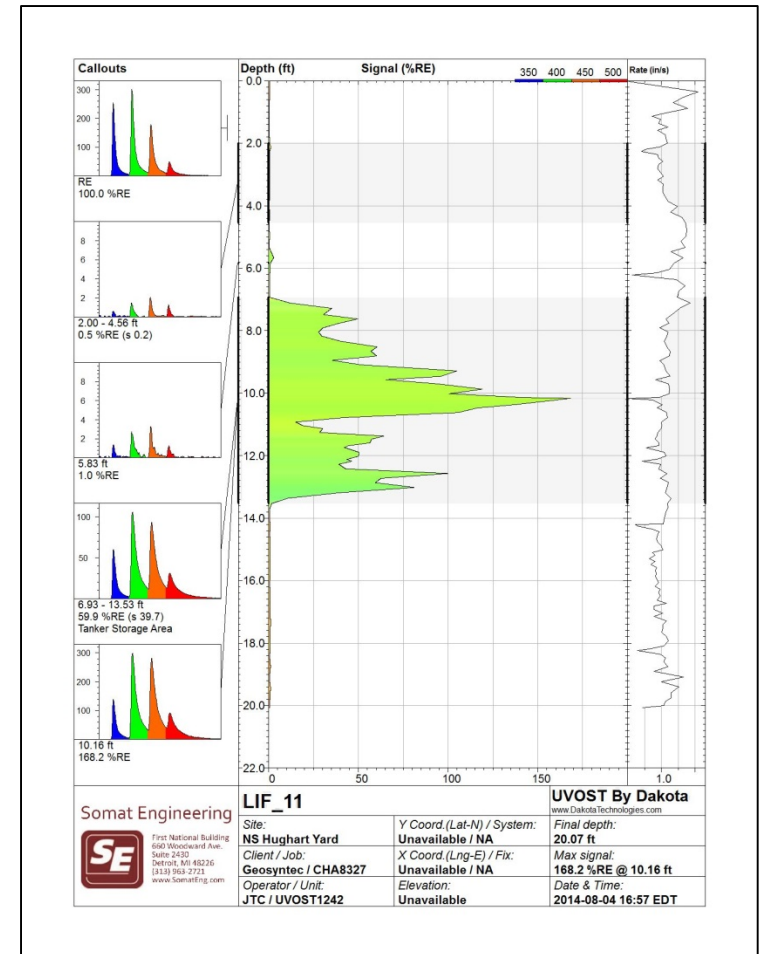
- Located in Grand Rapids, Michigan
- Active rail yard for over 100 years
- Historic diesel/fuel oil releases
- Various environmental investigations conducted since 1994



- Risks based on LNAPL characterization:
 - Saturational Risks
 - Potential for mobility
 - Compositional Risks
 - Vapor Intrusion
 - Direct Contact
 - Groundwater-Surface Water Interface
 - Downgradient Delineation
- LNAPL Conceptual Site Model (CSM)



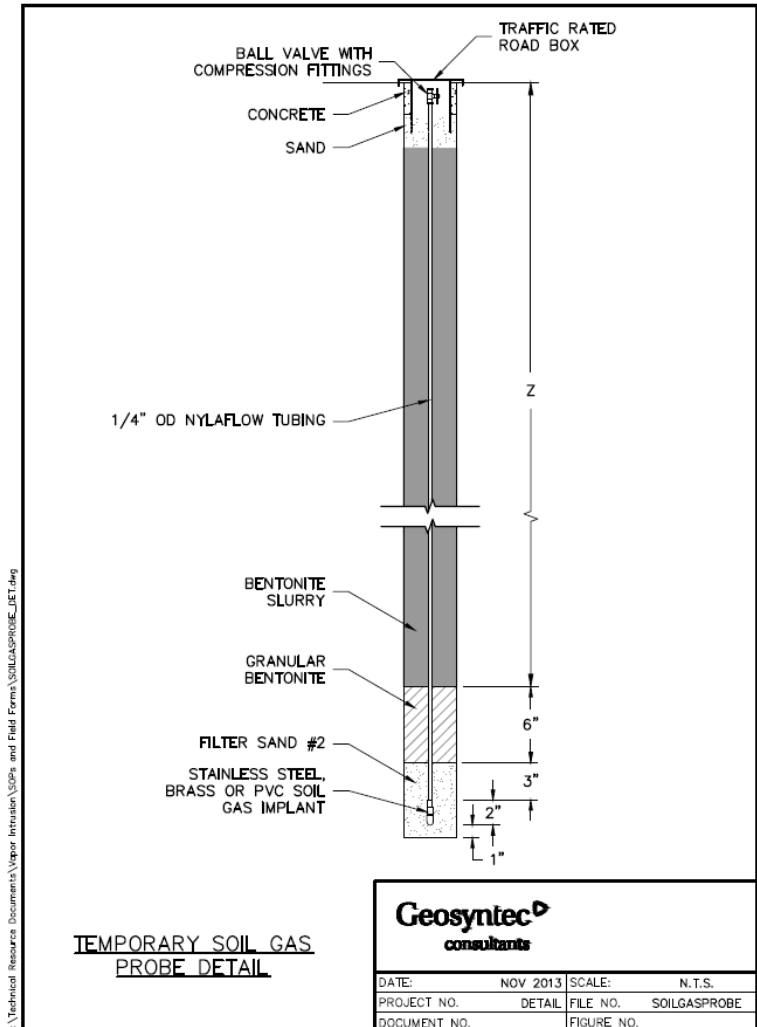
- Remove passive recovery systems to assess ambient conditions and seasonal variability
- Continue to measure LNAPL thickness within monitoring wells
- Use laser-induced fluorescence (LIF) technology to delineate LNAPL
- Advance concurrent soil borings for:
 - Soil TPH data, saturation %
 - Visual logging



MULTIPLE LINES OF EVIDENCE

Vapor Intrusion Investigation

- Install soil gas probes:
 - Near on-site buildings and historical exceedances in soil
 - Above LNAPL body
- Analyze soil gas samples for VOCs and PAHs



Direct Contact

- Extensive historical sampling

Groundwater-Surface Water Interface

- Characterization of impacts migrating towards the Silver Creek Drain

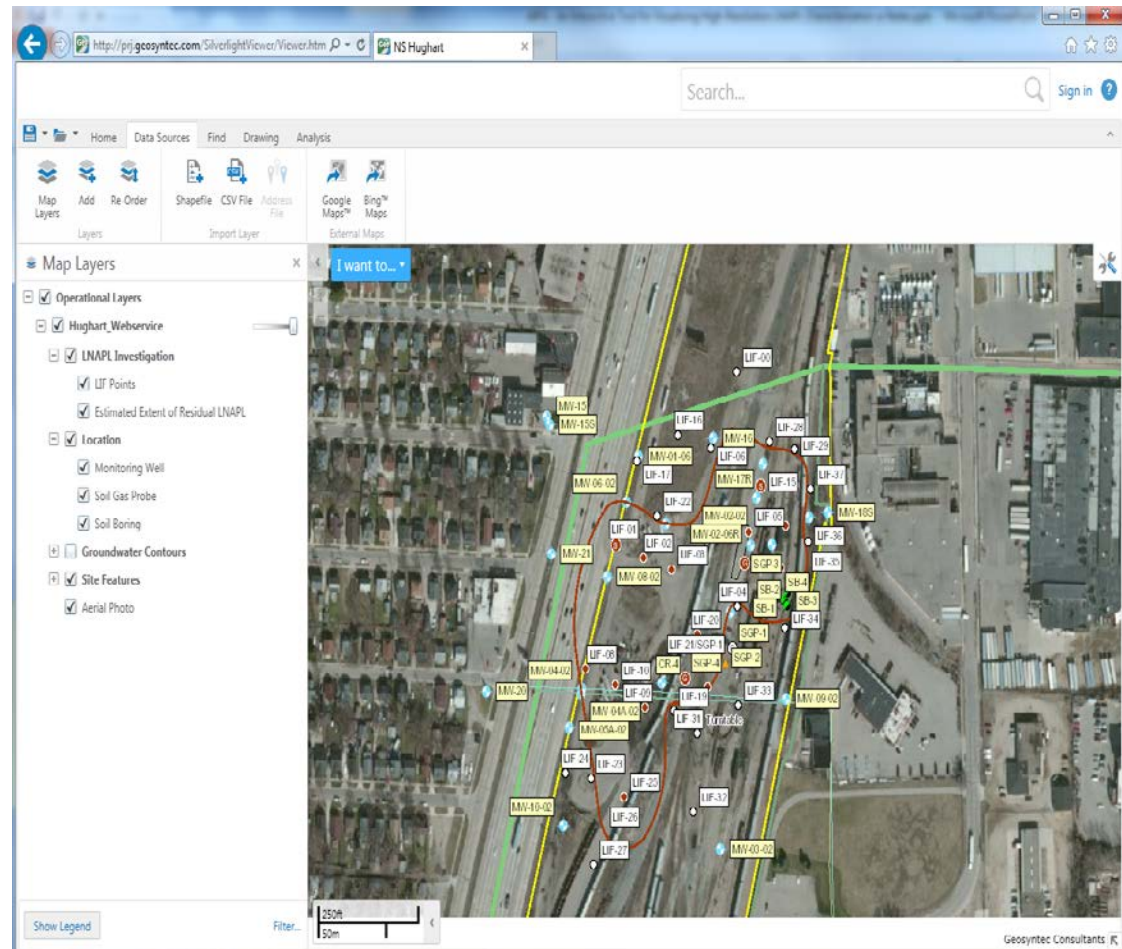
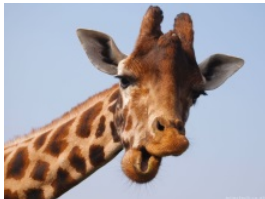
Downgradient Delineation

- New off-site monitoring wells installed

Groundwater Monitoring

- MNA demonstration (quarterly monitoring, geochemical parameters, statistical data interpretation)

- Data are presented via a web-based, interactive map.
- The map is intended to be a “living figure” that will be updated as new data are collected.



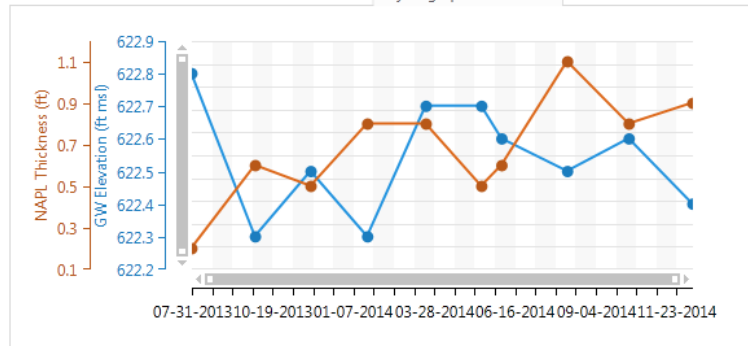
- The webmap platform provides the ability to:
 - Turn layers on and off
 - Pan and zoom
 - Identify features
 - Search for / Query features

MW-08-02



[Zoom to Feature](#) | [Pan to Feature](#) | [Create a Report](#) | [Copy to Drawing](#) | [Add to Selected](#)
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Details | Attributes | LNAPL & GW Elevations | **Hydrograph/LNAPL Plot**



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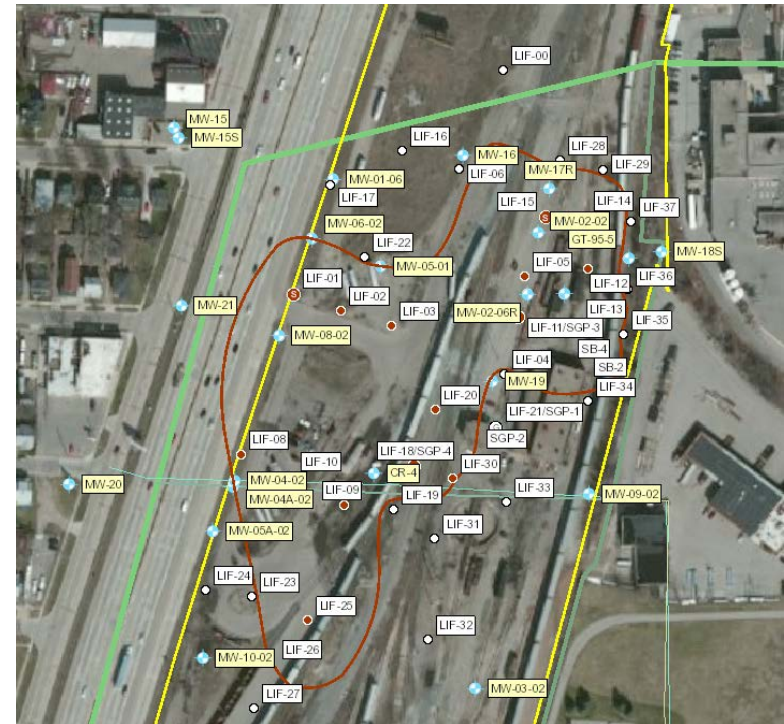
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Details | Attributes | LNAPL & GW Elevations | **Analytical** | Hydrograph/LNAPL Plot

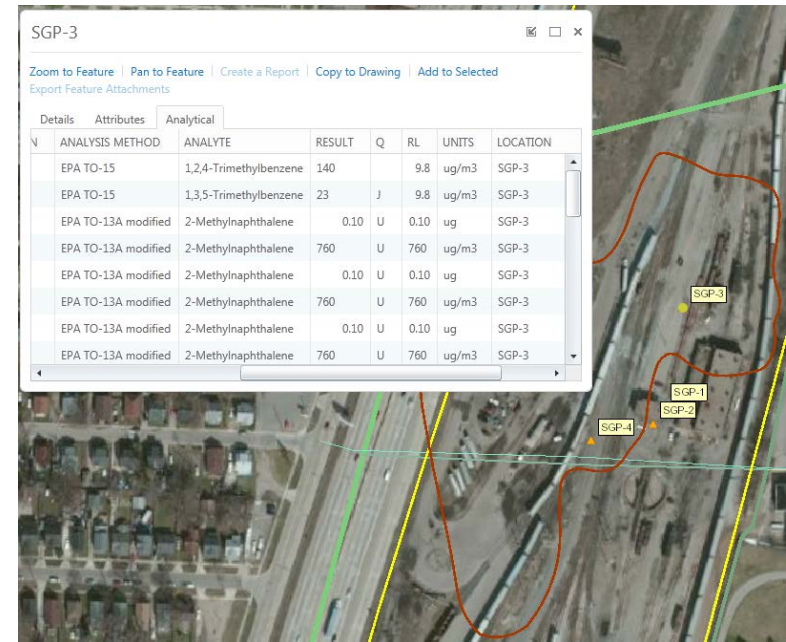
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10/08/2014	VOC	SW-846 8260B	1,2,4-Trimethylbenzene	20		1
10/08/2014	VOC	SW-846 8260B	1,2,4-Trimethylbenzene	20		1
10/08/2014	VOC	SW-846 8260B	1,3,5-Trimethylbenzene	1	J	1
10/08/2014	VOC	SW-846 8260B	1,3,5-Trimethylbenzene	1	J	1
10/08/2014	SVOC	SW-846 8270D	2-Methylnaphthalene	0.1	U	
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10/08/2014	SVOC	SW-846 8270D	Acenaphthene	0.1	U	
10/08/2014	SVOC	SW-846 8270D	Acenaphthene	0.1	U	

		Client: Norfolk Southern Project: CHA8327 Address: 1440 Hynes Avenue, Grand Rapids, MI	BORING LOG Boring No. MW-21 Page: 1 of 1																																																																																																																																																																																																								
Borehole Cl. Date: 12/9/2014 Borehole Cl. Company: Fibertec Borehole Cl. Method: Hand Auger Drilling Start Date: 12/9/2014 Drilling End Date: 12/9/2014 Drilling Company: Fibertec Drilling Method: Direct Push	Boring Depth (ft): 13 Boring Diameter (in): 2.25 Sampling Method(s): Direct Push Logged By: Bryan VanDuijn Boring Location (X): Boring Location (Y): Boring Elevation (Z):	Well Depth (ft): 12 Well Diam. (in): 2 Screen Slot S. (in): 0.010 Riser Material: Sch 40 PVC Screen Material: Sch 40 PVC Slotted Seal Material(s): Bentonite Chips Filter Pack: Sand																																																																																																																																																																																																									
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- LNAPL delineated
- TPH data collected at four LIF locations
 - Used to estimate saturation and total LNAPL mass



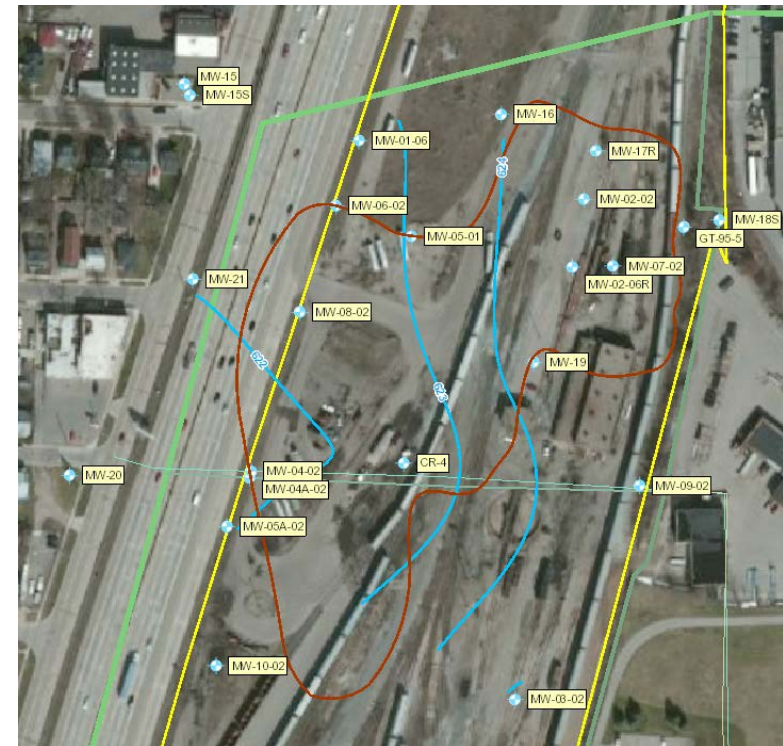
- VI pathway appears incomplete:
 - VOCs over an order of magnitude less than MDEQ VI screening levels
 - PAHs not detected
 - Soil gas probes placed in areas of highest expected impact



- PAHs detected below applicable screening levels at resample location
- Soil impacts well characterized by previous investigations



- No evidence of LNAPL or dissolved-phase impacts at new monitoring well MW-21
- Impacts do not extend to Silver Creek Drain or to residences downgradient of Drain



- A multifaceted investigation was designed and conducted to address data gaps and advance the site toward regulatory closure.
- Data are presented via an interactive webmap that allows results to be communicated more quickly and intuitively and allows stakeholders to be better-informed.