

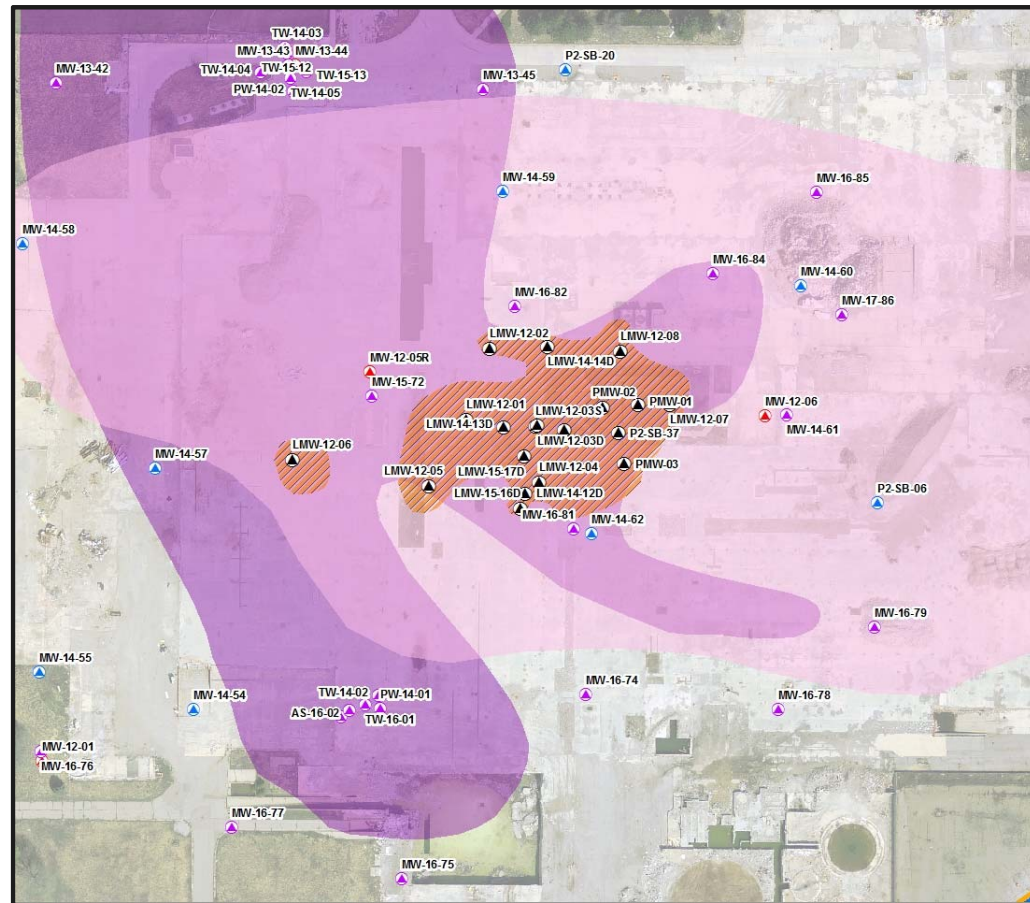
THIRD QUARTER PROGRESS REPORT

RACER Lansing, Plants 2, 3 & 6

October 9, 2017

Agenda

- Corrective Action Objectives
- Site Wide Management Controls
- Soil Corrective Measures
- LNAPL CSM
 - Perched VOCs
 - Weathered Bedrock VOCs
- LNAPL Corrective Measures
- GW Corrective Measures
- Tasks and Proposed Budget for 2018
- Remaining Schedule for 2017



Corrective Action Objectives

Media	Human Health (Res & Non-Res)	Cross-Media Transfer	Source Reduction
Soil	Prevent non-residential exposure to: <ul style="list-style-type: none"> Metals above PSIC and DC in soils (2012 and/or proposed 2017 criteria¹) PCBs above DC 	NA	NA
LNAPL	Prevent direct exposure to LNAPL and vapor exposure of LNAPL related constituents	Limit infiltration of groundwater through LNAPL areas to minimize leaching and impacting GW	Natural attenuation of LNAPL and LNAPL related constituents
Groundwater	Prevent DW exposure above Residential DW criteria: <ul style="list-style-type: none"> 1,4-D < 7.2 ug/L (2017 Res DW) 	Prevent unacceptable vapor exposure from groundwater to occupied buildings (potential future use)	Reduce 1,4-D mass in contact with DW aquifer with a goal of 72 ug/L
Surface Water	Prevent groundwater from impacting SW above GSI through storm sewer infrastructure	NA	NA
Air (Indoor)	Prevent unacceptable vapor exposure onsite (future use) and offsite	Prevent unacceptable vapor exposure from groundwater to occupied buildings onsite (potential future use) and offsite	NA

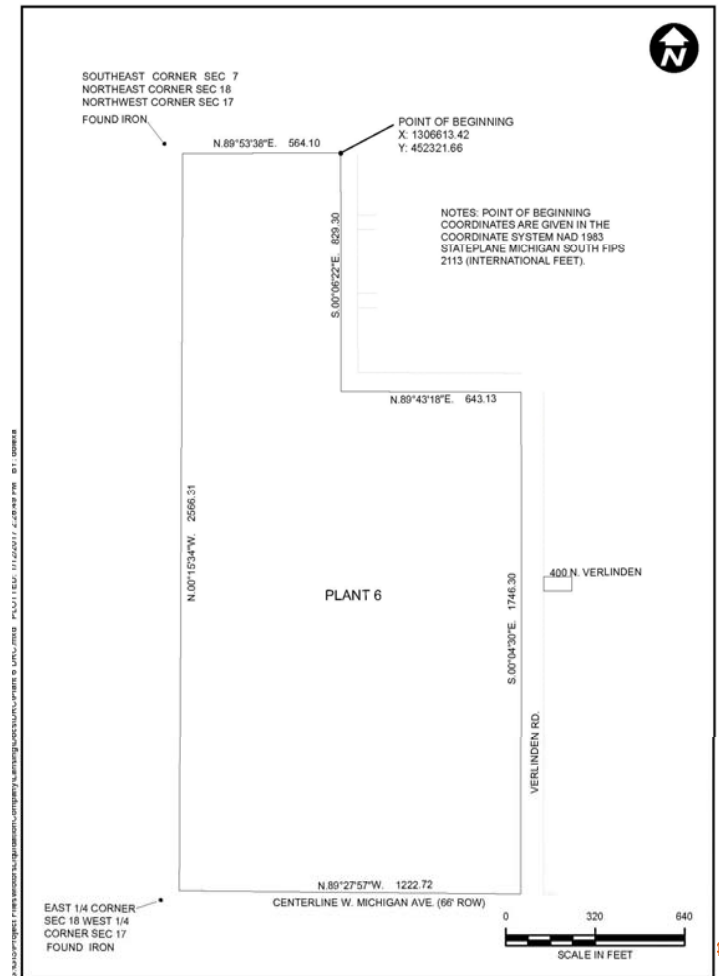
Note: Based on current and anticipated future use, there are no ecological receptors identified at the Site

¹ Protective of 2012 and 2017 criteria or only 2017 if it is protective based on the best available science (e.g, Mn PSIC)

Site Wide Management Controls

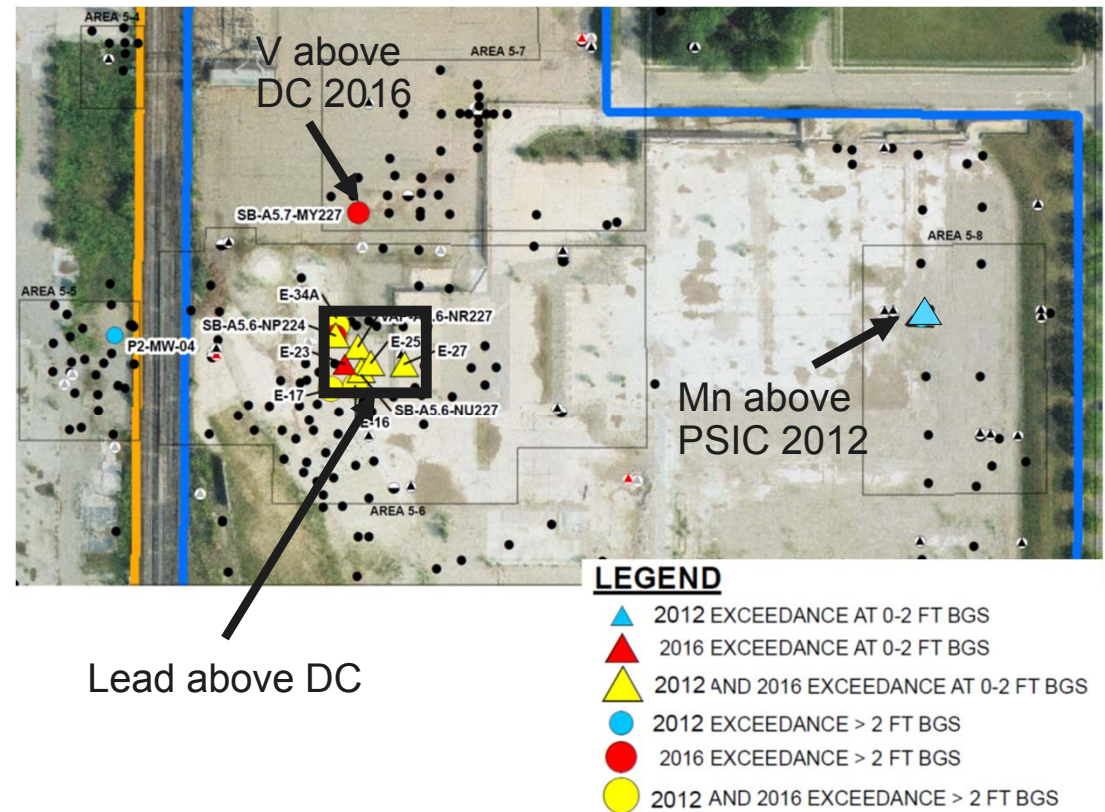
- Land Use Controls
 - Land Use Restrictions – non-residential
 - Contaminated Soil Management Requirements
 - Construction Restriction – assessment and/or engineering controls to eliminate the potential for vapor intrusion to indoor air
 - Health and Safety Requirements for Intrusive Activities, as applicable
 - Subgrade utility restrictions – approval by MDEQ and RACER and engineering controls to eliminate potential for water or vapor to enter/migrate along utility corridors
- On-site Groundwater Use Restrictions

Site Wide management controls to prevent unacceptable risk on-site for current and future uses for the property



Soil Corrective Measures

- Utilizing restrictions and due care for soil exposure risks below 2 feet
- Evaluated corrective measures where soil exceeded direct contact and/or particulate soil inhalation criteria at 0-2' bgs
- Utilized 2012 and draft 2017 criteria. Generally, protective of both criteria or best available science (e.g. Mn PSIC)
- Corrective measures alternatives considered for 0-2' depth:
 - Cover
 - Excavation

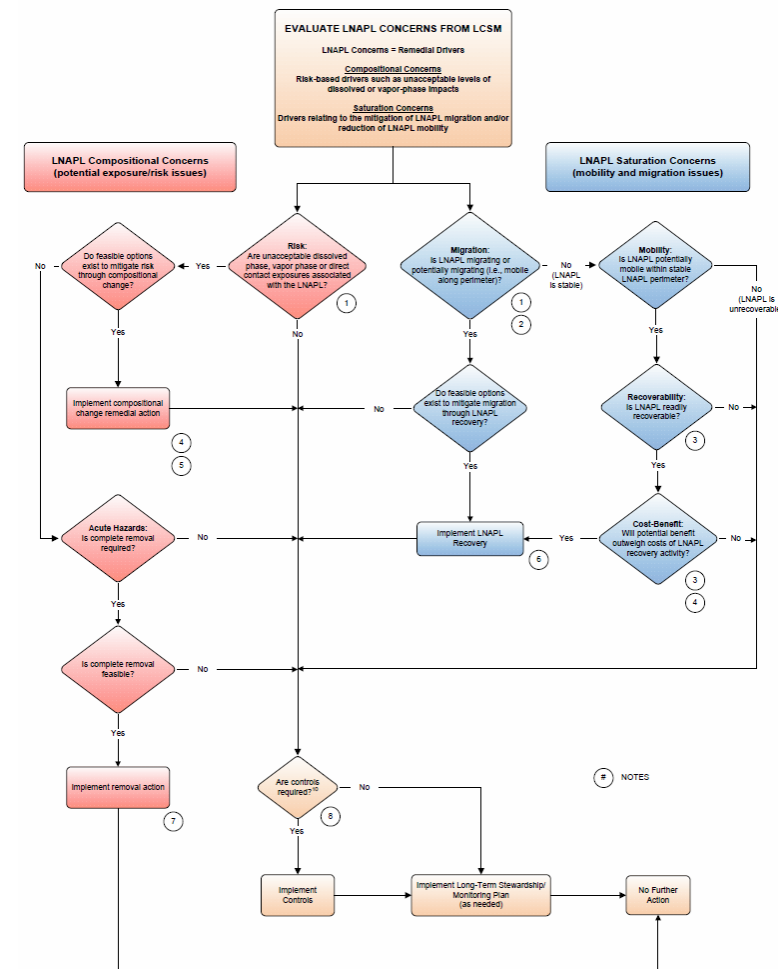


CAO for soil is to prevent unacceptable exposure. Covers are recommended based on being protective, easily implemented and cost effective

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LNAPL

- Land use controls to prevent on-site risks (i.e. vapor exposure, construction workers/subgrade exposure, soils management, etc.)
- Remaining potential risks are off-site exposures associated with LNAPL/LNAPL related constituents
- Utilized the LNAPL CSM Decision Tree developed in collaboration with the MDEQ TAPs team to evaluate corrective measures

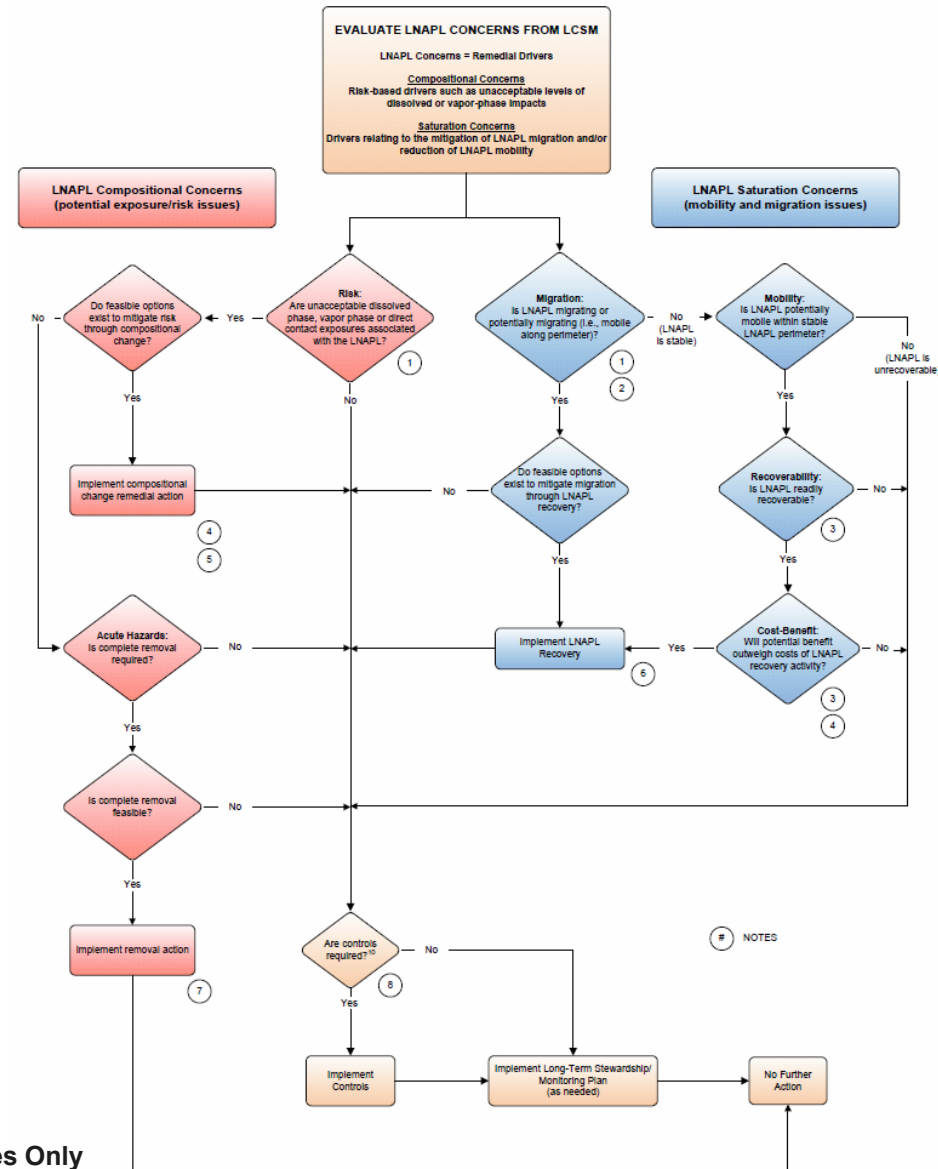


CAO for LNAPL is to prevent unacceptable direct exposure, vapor exposure, and minimize leaching to limit the potential to impact groundwater.

05 October 2017

Area 5-2 LNAPL Saturation

- Saturation Concern: Is LNAPL migrating?
 - LNAPL thickness stable or absent in wells on the perimeter of the LNAPL
 - Large LNAPL thicknesses are due to confining conditions/upward expression, not to a large amount of LNAPL mass
 - No ongoing source + low transmissivity = no potential for migration in the future
 - No risk to off-site receptors
- Is LNAPL recoverable and will the benefit outweigh the cost?
 - Low transmissivity (<0.1 ft²/d) based on bail down testing completed
 - Recovery will have minimal benefit or effect on overall LNAPL mass and risk (or lack of risk)

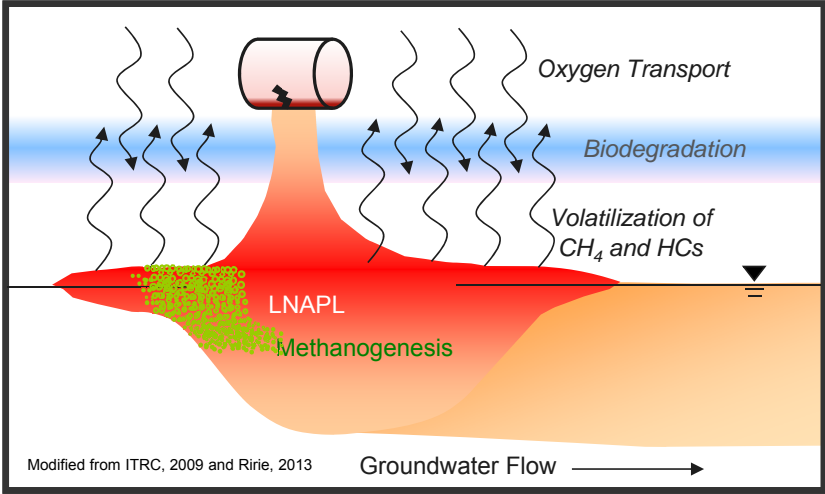


LNAPL Removal vs. NSZD

- Periodic LNAPL recovery (monthly/quarterly bailing) produced less <100 gallons over 2 years
- Natural LNAPL depletion results at RACER Site in Michigan are as high as ~ 900 gallons/acre/year
- Natural source zone depletion processes help stabilize the LNAPL body and limit the duration of any potential risks
- Area 5-2 LNAPL is discontinuous lenses, not a single LNAPL body. Increased surface area which may enhance NSZD rates

NSZD Processes include:

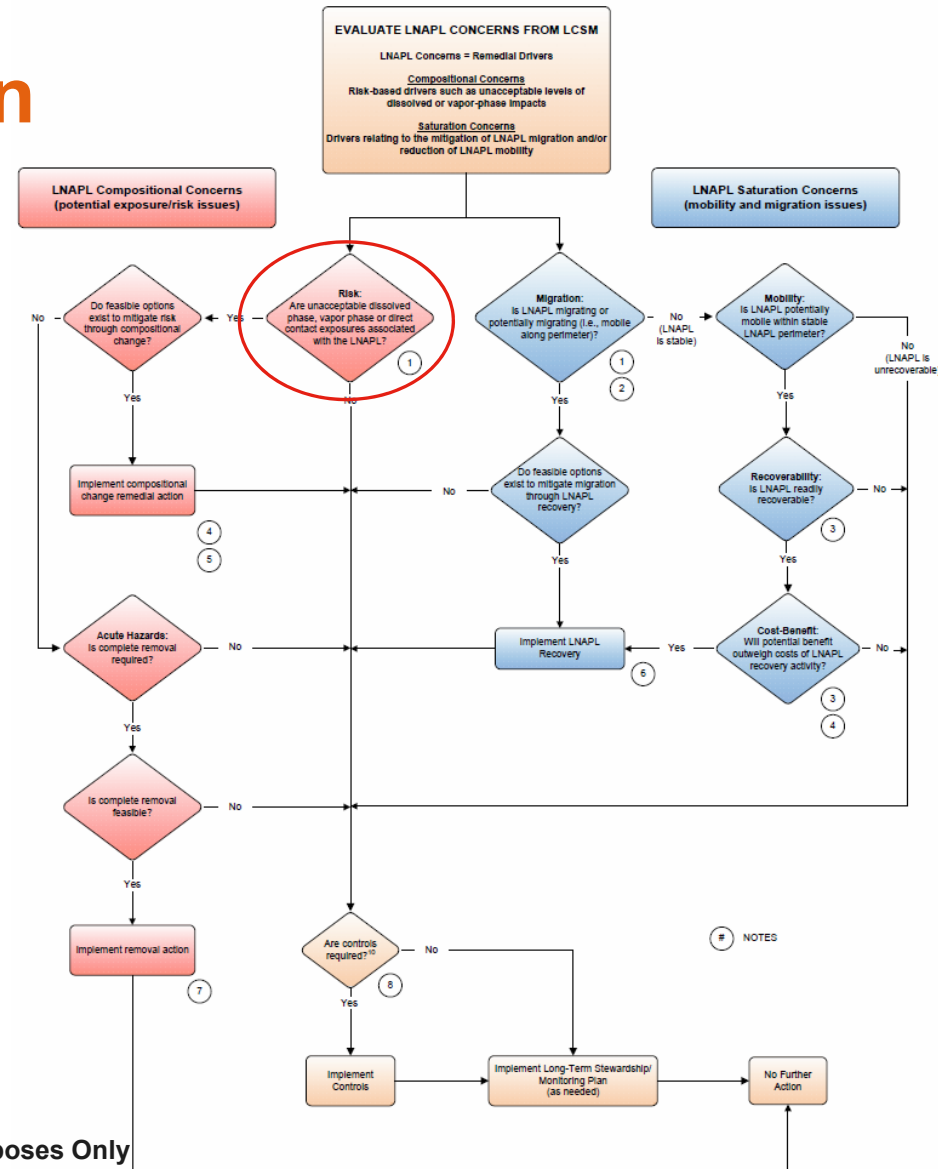
- Volatilization
- Dissolution
- Biodegradation



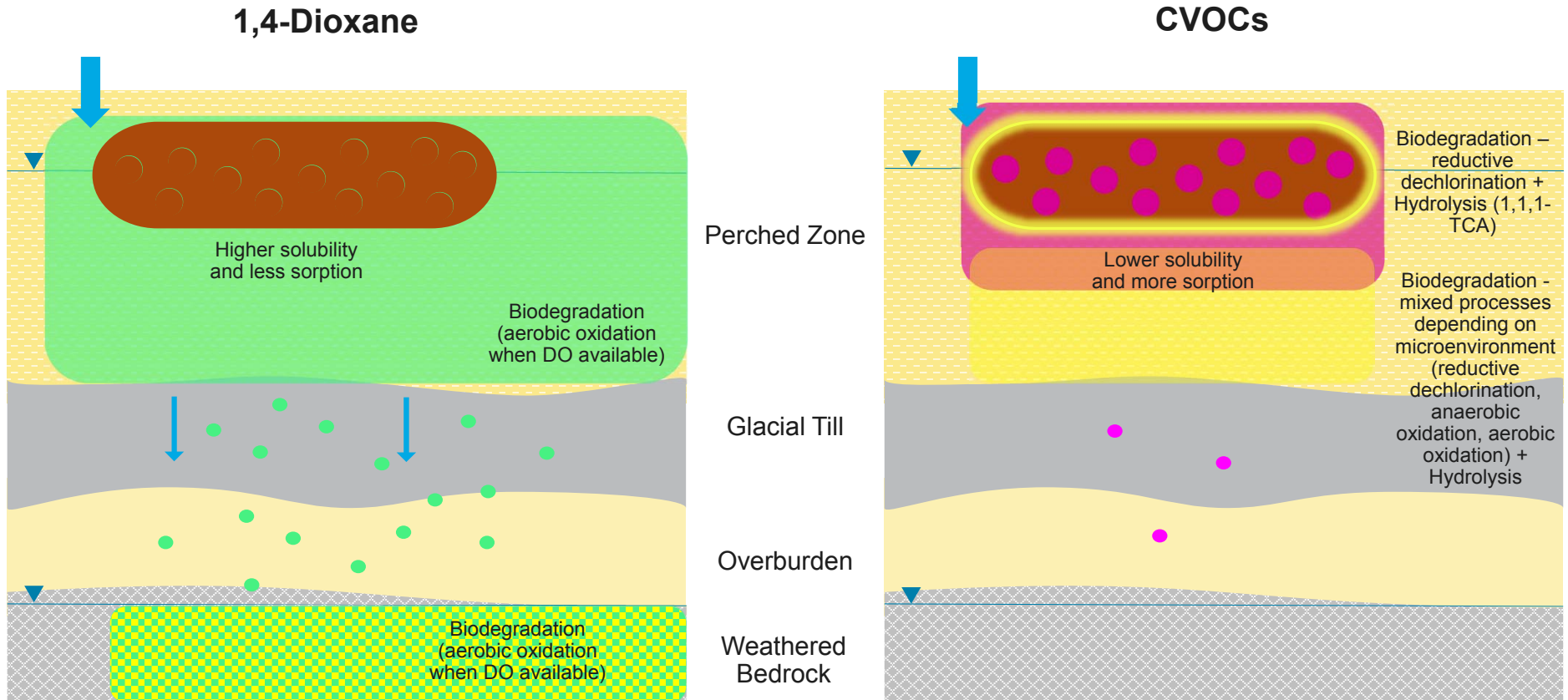
LNAPL is going away on its own, and based on the low transmissivity of LNAPL at the Site, active recovery will not meaningfully change the rate of overall mass removal.

Area 5-2 LNAPL Composition

- Compositional Concern: are there currently or is there a potential in the future to be unacceptable dissolved phase groundwater exposures associated with the LNAPL?
- Main constituents of concern related to the LNAPL are 1,4-dioxane, chlorinated ethenes and ethanes (CVOCs) and lower concentrations of other VOCs
- On-site restrictions to prevent unacceptable potential exposure to LNAPL and on-site GW
- Potential groundwater exposure risk related to Area 5-2 LNAPL:
 - Off-site drinking water wells
 - Off-site VI



Fate/Transport of 1,4-D vs. CVOCs

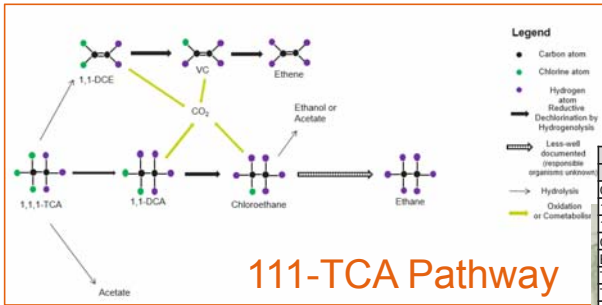


CVOCs not detected in weathered bedrock

Perched 1,4-Dioxane vs VOCs

- 1,4-Dioxane –
 - Present in perched groundwater
 - Impacts related to Area 5-2 LNAPL delineated on site to below DW
 - Concentrations stable near LNAPL
 - Concentrations decreasing away from the LNAPL
 - Preliminary CSIA (microbes) and dissolved gases (food) work indicate potential for natural attenuation of 1,4-D to occur
 - Low 1,4-D concentrations present in LNAPL saturated soils
- VOCs –
 - Present in perched groundwater
 - Impacts related to Area 5-2 LNAPL delineated on site to below DW
 - Exceedances localized around the Area 5-2 LNAPL
 - CVOOC biodegradation by-products present
 - Elevated concentrations of VOCs (primarily CVOOCs) present in LNAPL

VOCs in Perched Groundwater



Compound	RES DW Criteria	GSI Criteria
1,1,1-Trichloroethane	200	89
1,1-Dichloroethene	7	130
1,1-Dichloroethane	1,200	740
1,2-Dichloroethane	5	360
Chloroethane	240	1,100
Trichloroethene	5	200
Vinyl chloride	2	13
Benzene	5	200

Location: SB-A5.2-NR128
Interval: 4 - 8

Chloromethane	15 (<5)
1,1,2,2-Tetrachloroethane	3.1 (<2)
1,1-Dichloroethane	9.8 (9.8)
Chloroethane	120 (120)
Benzene	1.3 (1.2)
Toluene	1.4 (1.1)
Total Xylenes	0.56 (<6)
Cyclohexane	1.1 (<2)
Naphthalene	1.7 (1.9)

Location: VAP-A5.2-NV120
Interval: 8 - 9 | 20 - 22

2-Hexanone	20	<20
1,1,2-Dichloroethane	6.4	12
Chloroethane	470	220
Toluene	0.69	1.8
Total Xylenes	1.8	<6
1,2,4-Trimethylbenzene	1.4	0.89
1,3,5-Trimethylbenzene	0.96	<2.0
Naphthalene	0.93	<2.0

Location: SB-A5.2-NO106
Interval: 9 - 13

Naphthalene	0.86
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Location: VAP-A5.2-NV98
Interval: 13 - 15

1,1,1-Trichloroethane	30
1,1-Dichloroethane	61
1,1-Dichloroethene	4.8

Location: SB-A5.2-NV133
Interval: 12 - 13.68

1,1-Dichloroethane	9.2
1,1-Dichloroethene	6.2
1,2-Dichloroethane	5.3
cis-1,2-Dichloroethene	6.5
trans-1,2-Dichloroethene	0.97
Trichloroethene	6.4
Chloroethane	800
Benzene	0.43
Toluene	4.8

Location: VAP-A5.2-NK132
Interval: 10 - 11 | 21 - 22

Acetone	<100	15
1,1,1-Trichloroethane	500 [530]	185
1,1-Dichloroethane	400 [360]	124
1,1-Dichloroethene	12 [14]	4
cis-1,2-Dichloroethene	3.4 [3]	1
trans-1,2-Dichloroethene	0.43 [0.47]	<1
Trichloroethene	10 [9.7]	3
Tetrachloroethene	2.5 [2.6]	<1
Vinyl chloride	4.2 [3.6]	2
Chloroethane	150 [140]	144
Benzene	<10	0.25
Toluene	30	8
Total Xylenes	0.64 [0.7]	<1
1,2,4-Trimethylbenzene	1.4 [1.5]	<2.0
Naphthalene	5.2 [6.2]	1.0

Location: SB-A5.2-NE150
Interval: 16 - 20

Acetone: 76

Location: MW-14-60
Sample Date: 04/25/17

1,2-Dichloroethane	1
Vinyl chloride	7
Chloroethane	33
Ethane	0.70
Ethene	0.15

Location: SB-A5.2-NE157
Interval: 17 - 21

Acetone	57
1,1-Dichloroethane	0.48
Naphthalene	10

Location: SB-A5.2-NJ145
Interval: 7 - 11 | 16.5 - 20.5

Acetone: 60 | 160

Location: SB-A5.2-NJ162
Interval: 14.5 - 18.5

Acetone: 190

Location: SB-A5.2-NO156
Interval: 6 - 10

1,1,1-Trichloroethane	0.30
1,1-Dichloroethane	0.79
Naphthalene	11

Location: VAP-A5.2-NU137
Interval: 16 - 18 | 24 - 26

Chloroethane	3.0	<2.0
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Location: MW-14-62
Sample Date: 04/28/17

1,1-Dichloroethane	52 [47]
Chloroethane	5 [<1]
Ethane	7.5
Ethene	0.69

Location: SB-A5.2-OD154
Interval: 9 - 13

Methylene chloride	0.75
1,1-Dichloroethane	7.7

Location: SB-A5.2-OH162
Interval: 17 - 21

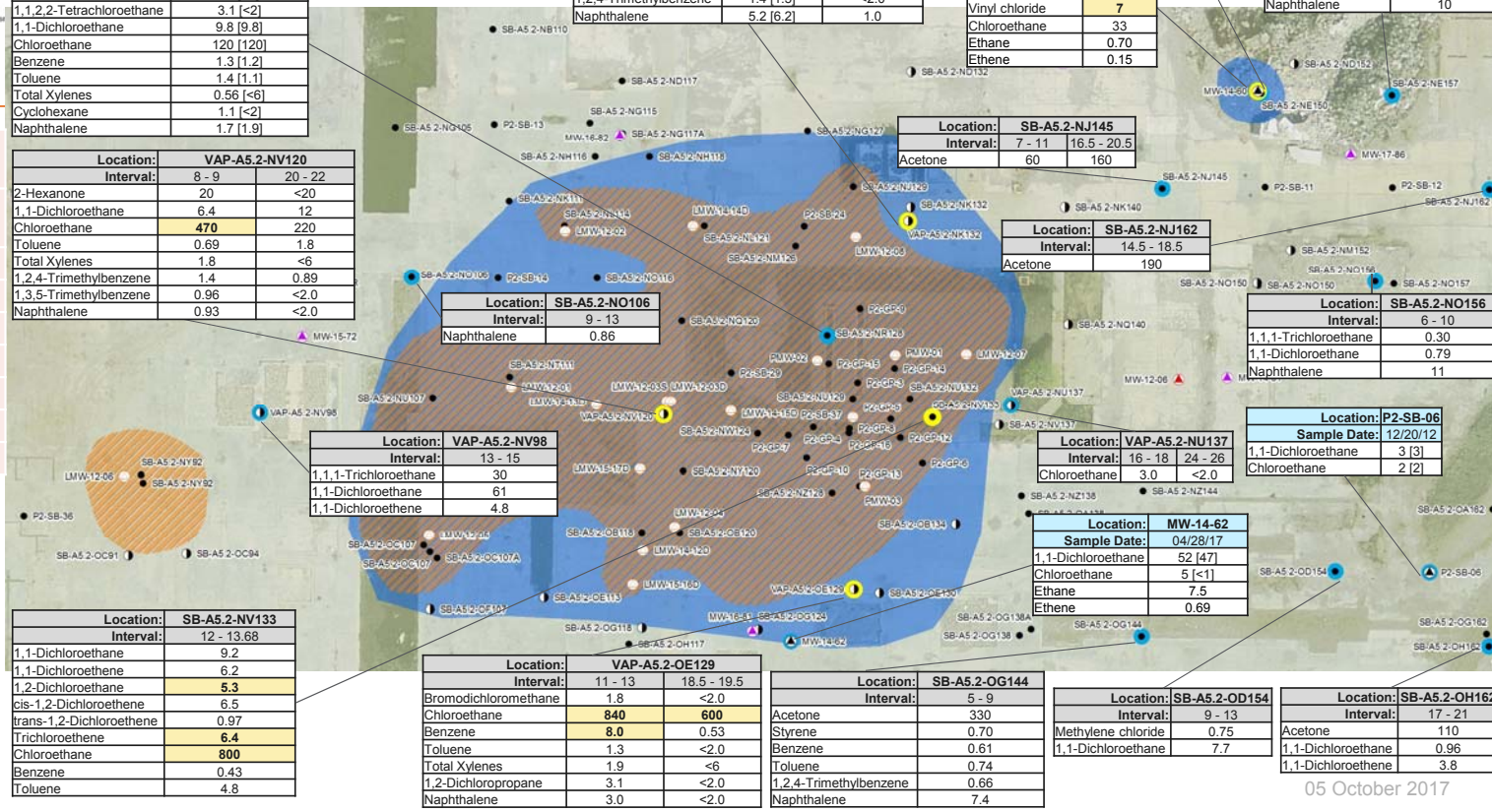
Acetone	110
1,1-Dichloroethane	0.96
1,1-Dichloroethene	3.8

Location: VAP-A5.2-OE129
Interval: 11 - 13 | 18.5 - 19.5

Bromodichloromethane	1.8	<2.0
Chloroethane	840	600
Benzene	8.0	0.53
Toluene	1.3	<2.0
Total Xylenes	1.9	<6
1,2-Dichloropropane	3.1	<2.0
Naphthalene	3.0	<2.0

Location: SB-A5.2-OG144
Interval: 5 - 9

Acetone	330
Styrene	0.70
Benzene	0.61
Toluene	0.74
1,2,4-Trimethylbenzene	0.66
Naphthalene	7.4



- BEDROCK MONITORING WELL
- PERCHED MONITORING WELL
- LNAPL MONITORING WELL
- WEATHERED BEDROCK MONITORING WELL
- HPT/VAP BORING LOCATION
- SOIL BORING LOCATION
- GROUNDWATER VOC EXCEEDANCE
- GROUNDWATER SAMPLE COLLECTED
- ESTIMATED EXTENT OF LNAPL
- VOCs ABOVE CRITERIA IN PERCHED GROUNDWATER

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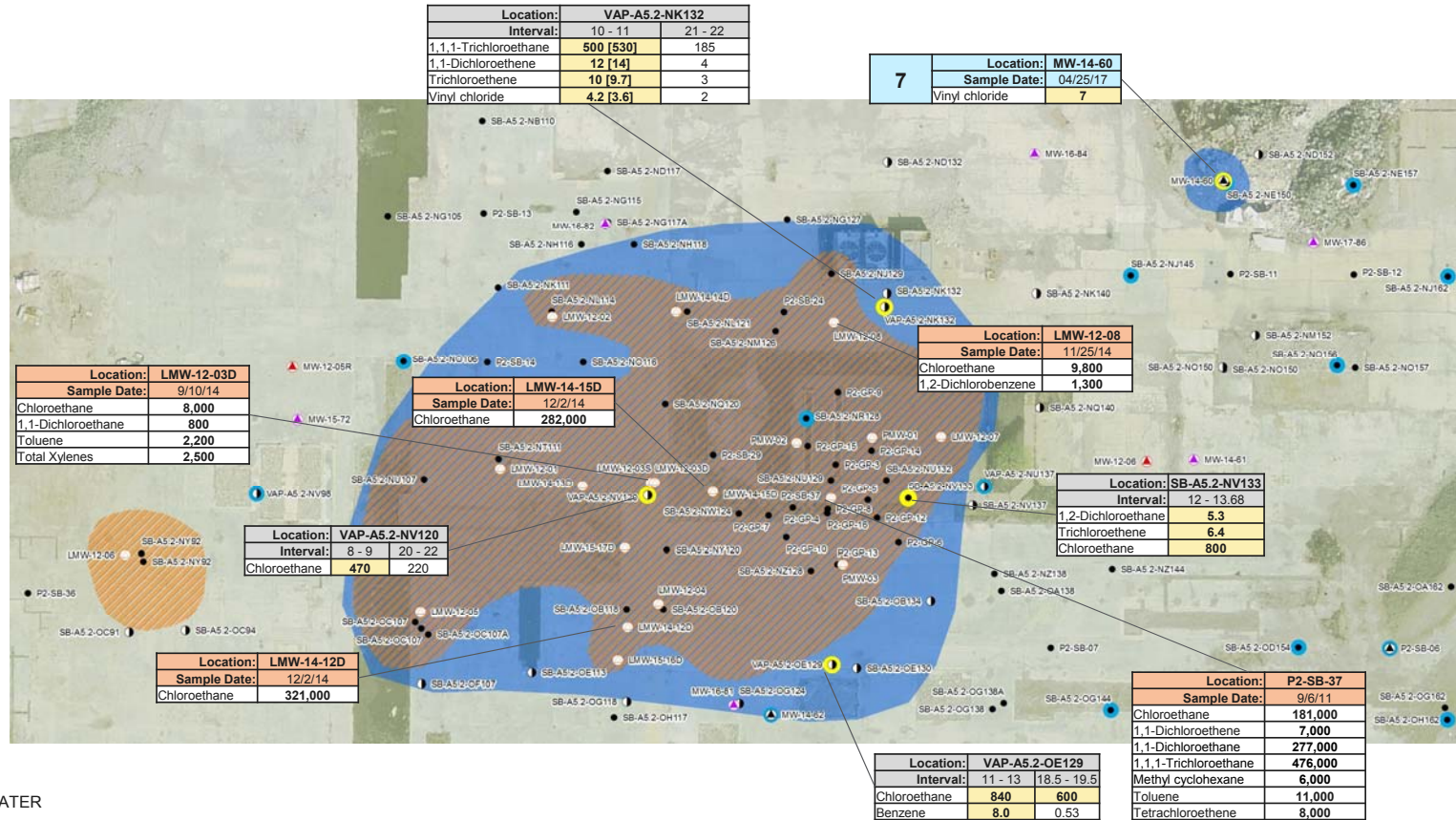
Perched Groundwater and LNAPL VOCs

CVOCs dominate in LNAPL and account for most perched groundwater exceedances

- Attenuate under anaerobic conditions

LEGEND

- BEDROCK MONITORING WELL
- PERCHED MONITORING WELL
- LNAPL MONITORING WELL
- WEATHERED BEDROCK MONITORING WELL
- HPT/VAP BORING LOCATION
- SOIL BORING LOCATION
- GROUNDWATER VOC EXCEEDANCE
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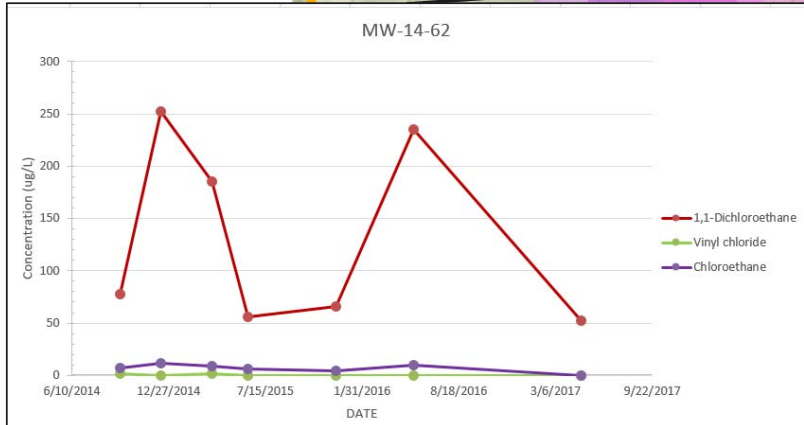
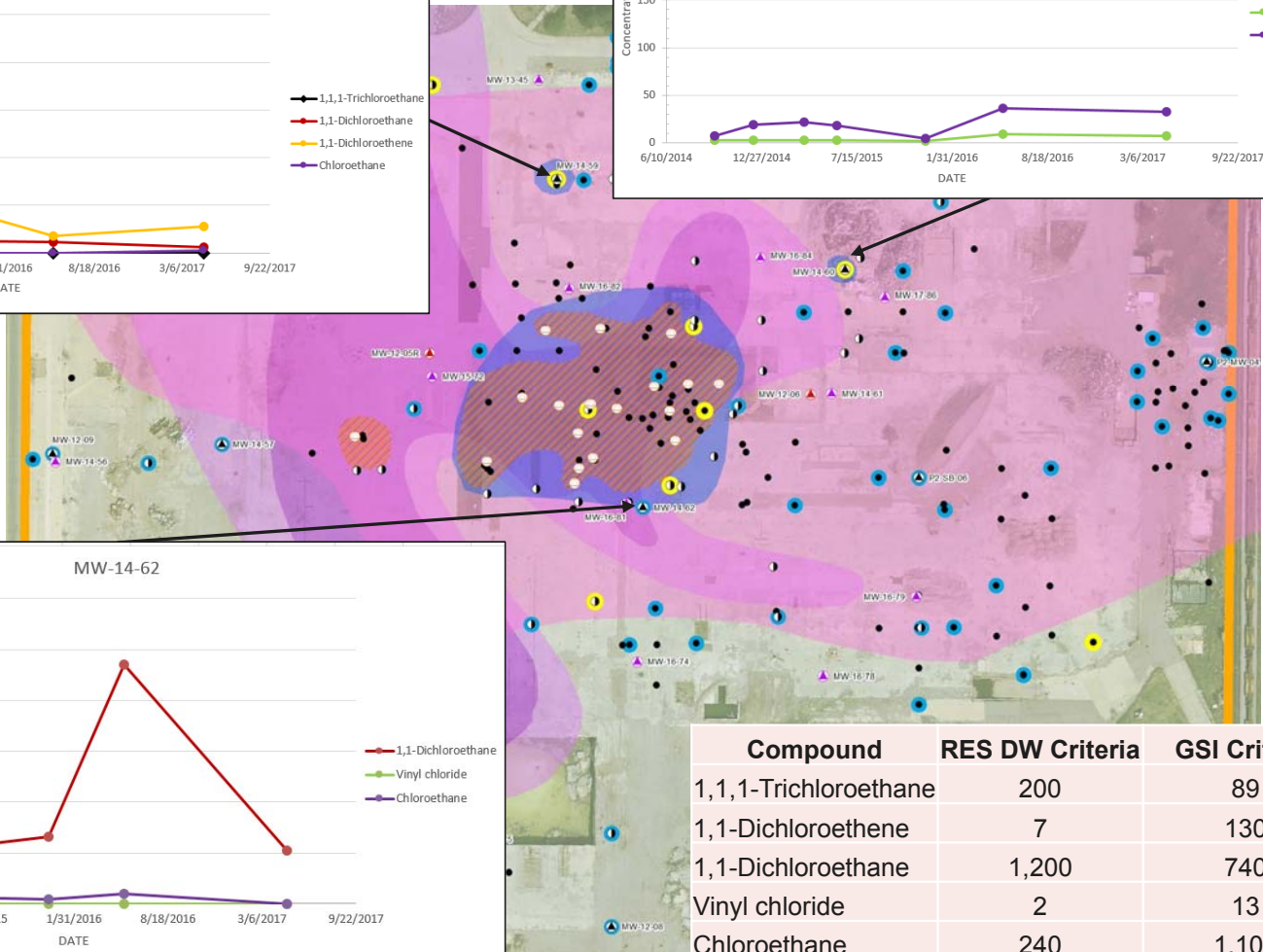
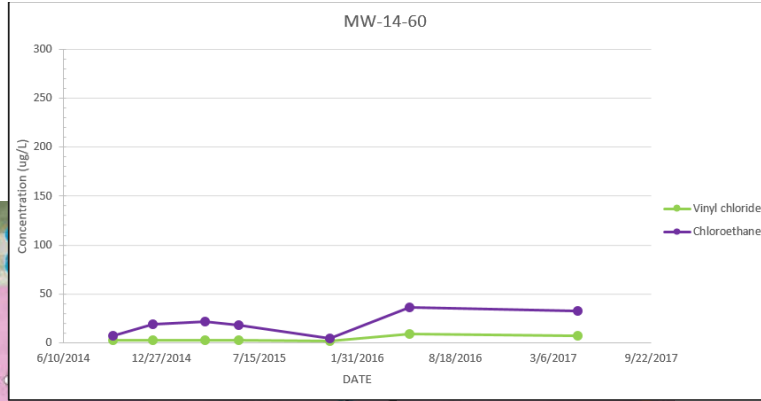
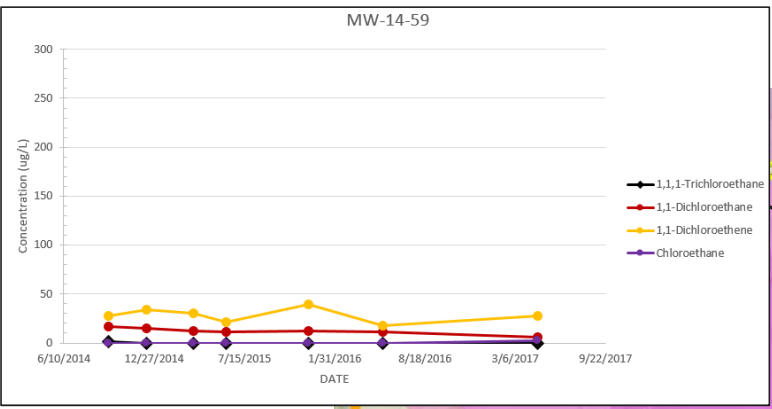


VOC Trends in Perched Groundwater

Only one VOC parameter in one perched well meets criteria for Mann-Kendall analysis

- MW-14-59 for 1,1-DCE – no trend

Dominance of daughter compounds demonstrates degradation of CVOCs



Compound	RES DW Criteria	GSI Criteria
1,1,1-Trichloroethane	200	89
1,1-Dichloroethene	7	130
1,1-Dichloroethane	1,200	740
Vinyl chloride	2	13
Chloroethane	240	1,100

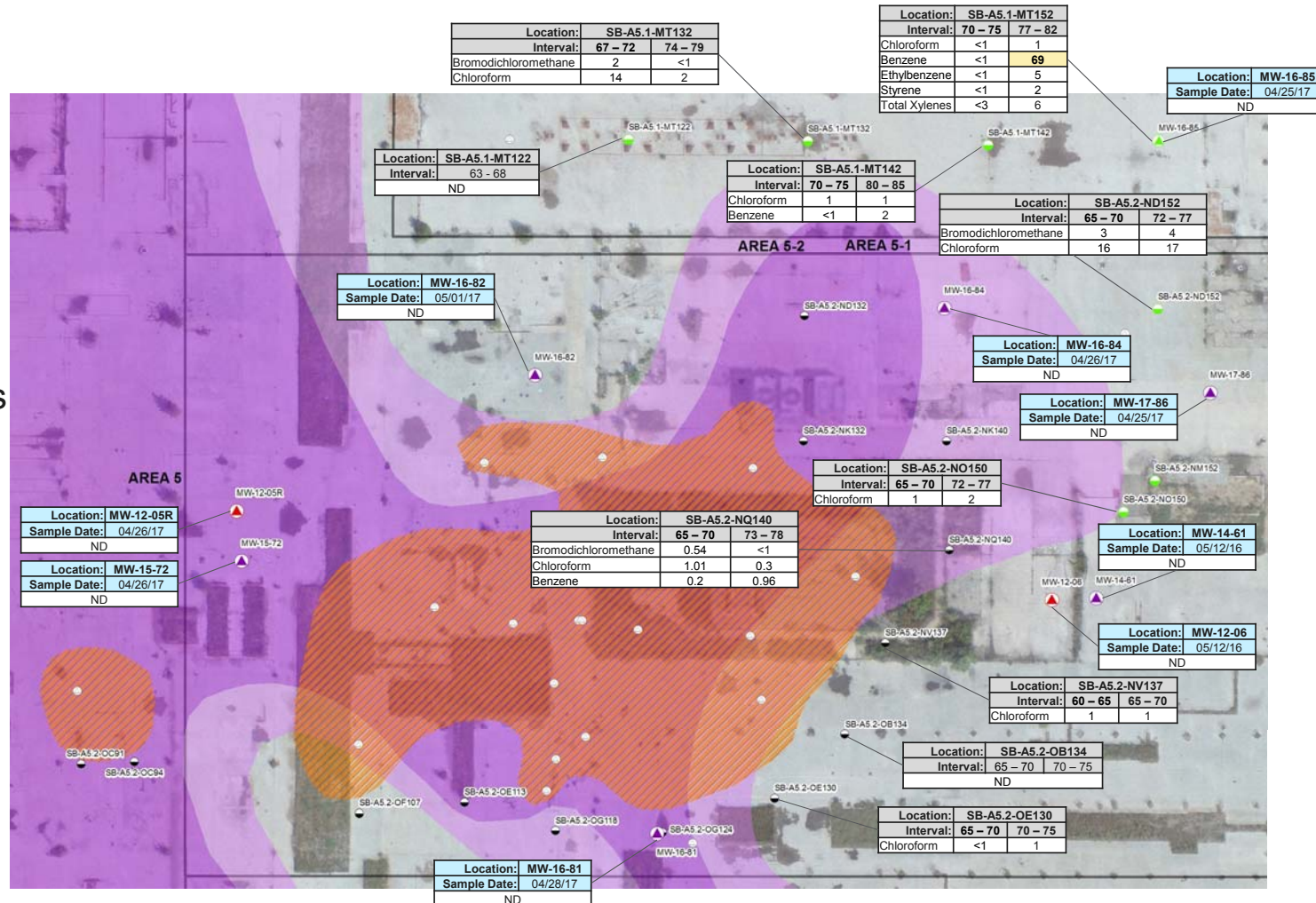
1,4-Dioxane vs VOCs in Weathered Bedrock

- 1,4-Dioxane –
 - 1,4-D present in weathered bedrock
 - *Delineated on-site to below DW*
 - *Former source in Plant 3 near coliseum and leakage through the till associated with hydraulic head from infiltration in the Plant 2 LNAPL area (present in dissolved phase/storage zones, minimal in LNAPL)*
 - Very low probability that 1,4-dioxane from the Site has or will ever reach the DW wells at detectable concentrations –
 - *Groundwater from Site is not flowing toward the DW wells*
 - *1,4-D concentrations in bedrock are less than 2 ppb below the core of the plume*
 - *At current 1,4-D concentrations and using “worst case scenarios” assumptions not consistent with CSM (i.e. groundwater flow direction), 1,4-D from Site unlikely to reach DW wells at detectable levels*
- VOCs –
 - No CVOCs in weathered bedrock
 - *Very low concentrations or no CVOCs detected in soils between perched and weathered bedrock zone to a maximum depth of ~50 feet bgs (weathered bedrock starts at ~70 feet)*
 - Low concentration, sporadic detections of other VOCs in deep overburden soil and weathered bedrock groundwater.
 - *VOCs not detected in monitoring wells*

VOCs in Weathered Bedrock and Bedrock

CVOCs have not been detected in WB/B

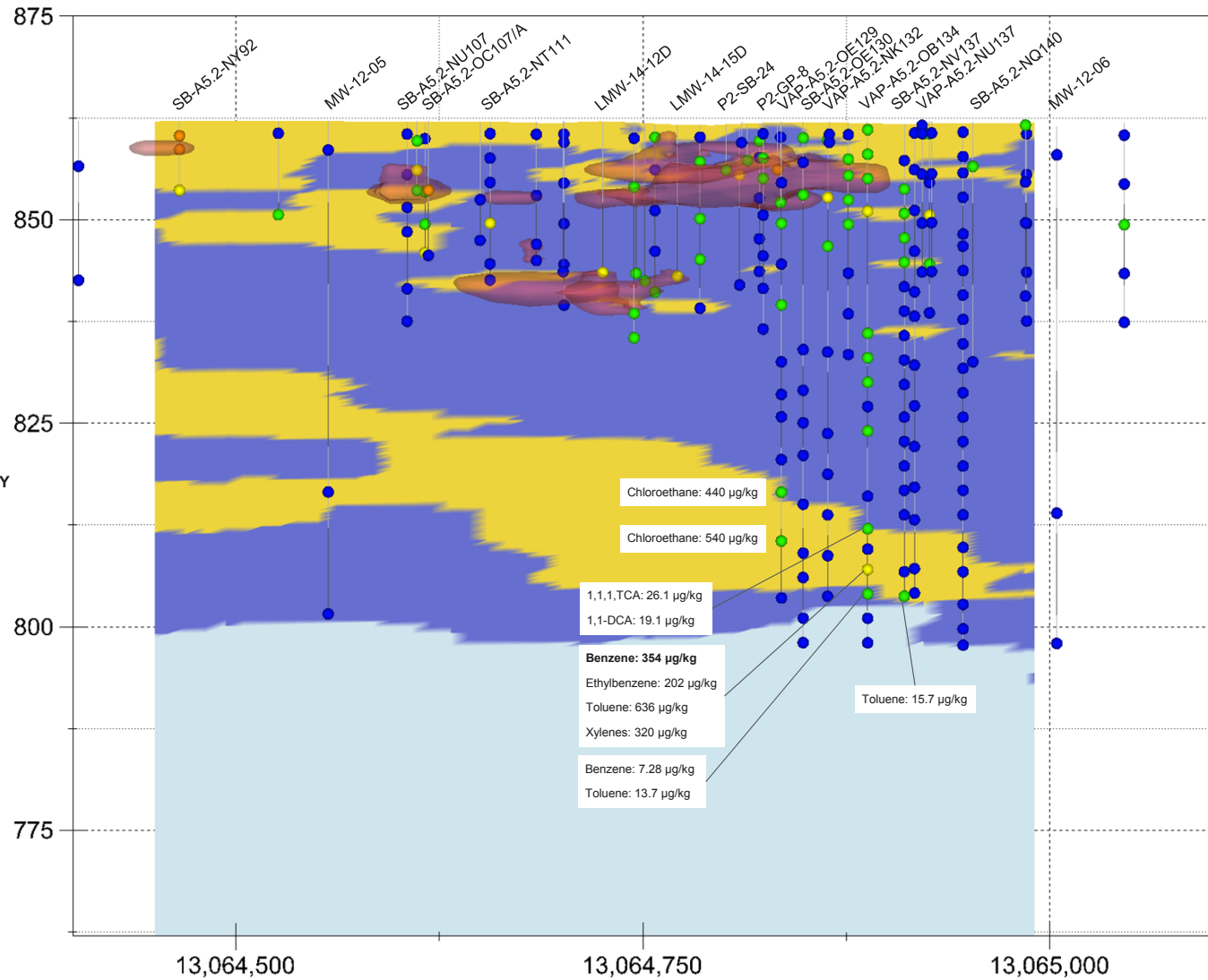
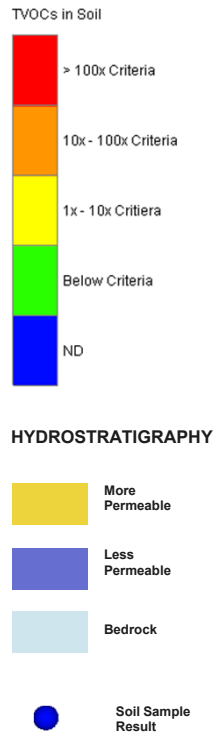
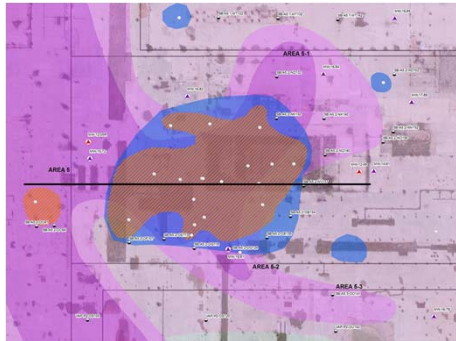
Low-level detections of other VOCs not related to LNAPL (trihalomethanes) or not confirmed with monitoring wells (BTEX)



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Vertical Delineation Soil

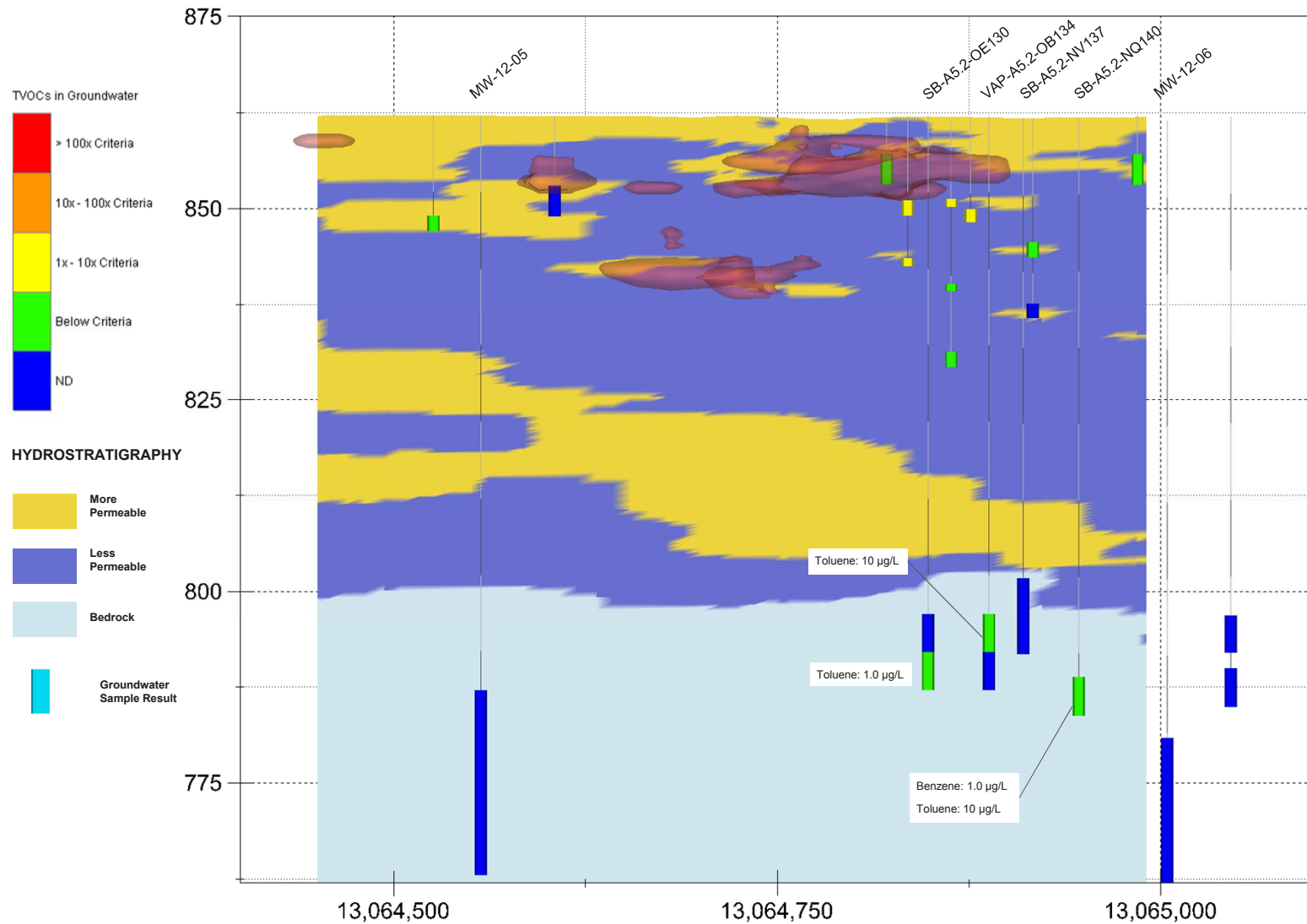
Low concentrations of VOCs detected in deep overburden soils, attenuate quickly and are not observed in permanent monitoring wells



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Vertical Delineation GW

- Sporadic detections of other VOCs not detected in monitoring wells
- Benzene and toluene degrades under aerobic conditions
- BTEX addressed with biosparge

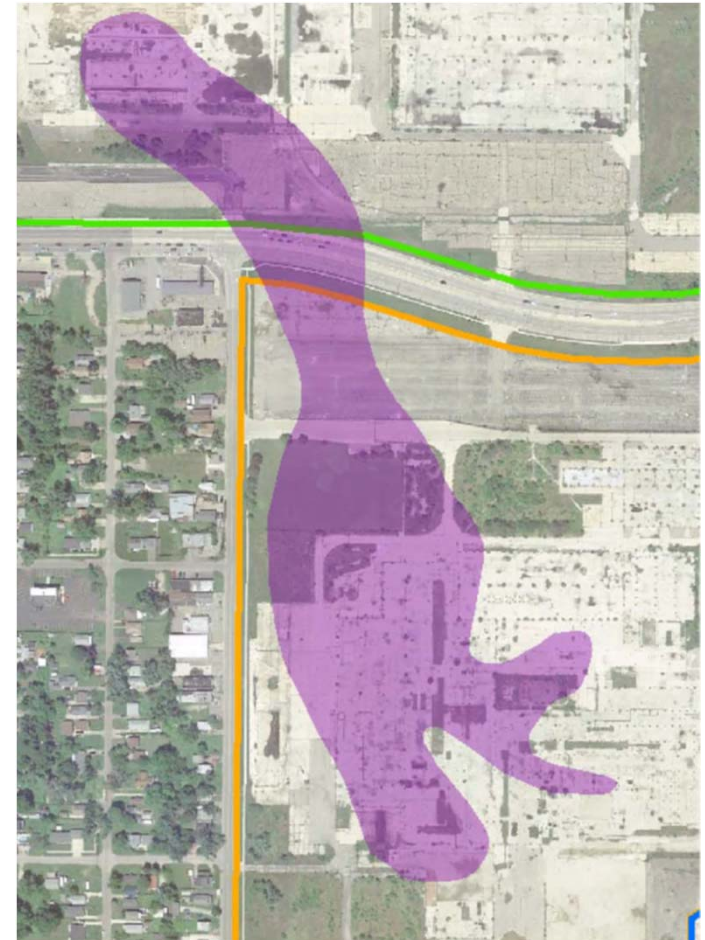


Compositional Summary 1,4-Dioxane vs CVOCs

- 1,4-Dioxane –
 - 1,4-D does not sorb to soils, is completely miscible in GW. Prefers water to LNAPL/soil
 - Fewer biodegradation options, but does degrade aerobically.
 - Aerobic conditions are present away from the LNAPL.
 - In the perched zone, away from the LNAPL, groundwater data trends show stable to decreasing trends
- VOCs –
 - VOCs sorb to soil, prefers LNAPL/soils to water
 - VOCs readily undergoes biodegradation under suitable conditions
 - Conditions near LNAPL reducing/anaerobic amenable for degradation of CVOCs
 - Carbon source present (e.g. LNAPL) to facilitate anaerobic degradation of CVOCs
 - BTEX compound readily degrade aerobically away from the LNAPL
 - Evidence of natural attenuation based on presence of CVOC degradation by-products and concentrations trends near the LNAPL
 - Degradation by-products of CVOCs in soil indicate ongoing biodegradation, as well as hydrolysis

Groundwater Corrective Measures

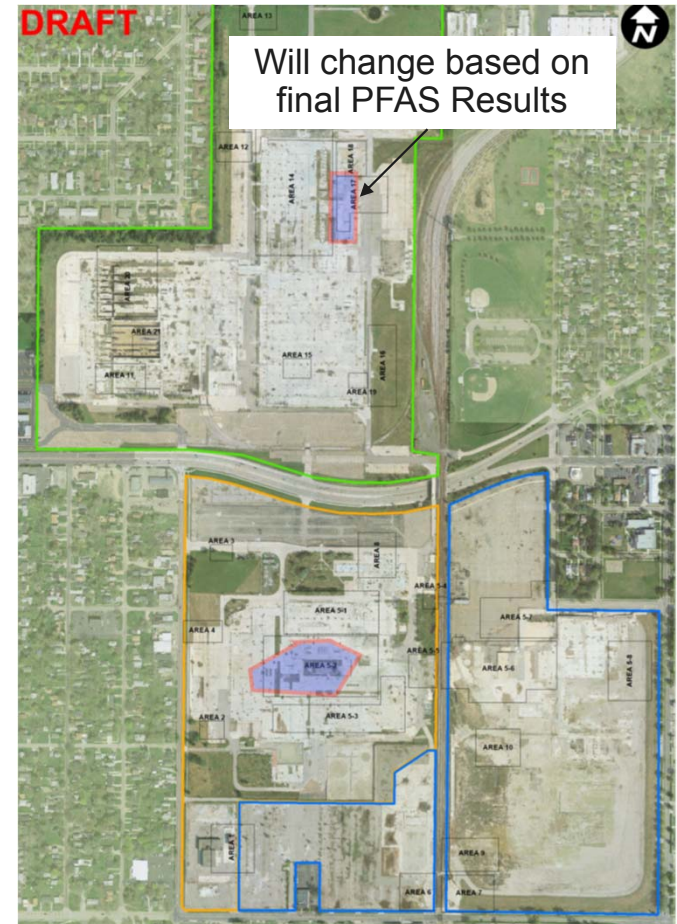
- The human health CAO for groundwater is currently met, GW is delineated on site to well below DW criteria
- Continue to monitor to ensure compliance with the human health CAO is maintained
- 1,4-D present in weathered bedrock at some locations may not be stable due to:
 - Leakage through the till associated with hydraulic head from infiltration in the Plant 2 LNAPL area (will be addressed by capping associated with LNAPL corrective measure)
 - Reduction in hydraulic conductivity and GW velocity from north to south may result in the plume spreading laterally
 - Co-mingling with APC to the west



CAO for groundwater is to prevent drinking water exposure above residential DW criteria.

Groundwater Corrective Measures

- Monitored plume stability recommended
 - On going groundwater monitoring to collect the data necessary for evaluating trends and assessing stability
 - Capping above Area 5-2 LNAPL and Plant 3 LNAPL (and PFAS)
 - Restrictions
- Evaluated active corrective measures to implement in conjunction with monitored plume stability to further decrease probability of off-site migration on 1,4-dioxane:
 - Biosparge
 - Pump and treat
 - Groundwater recirculation



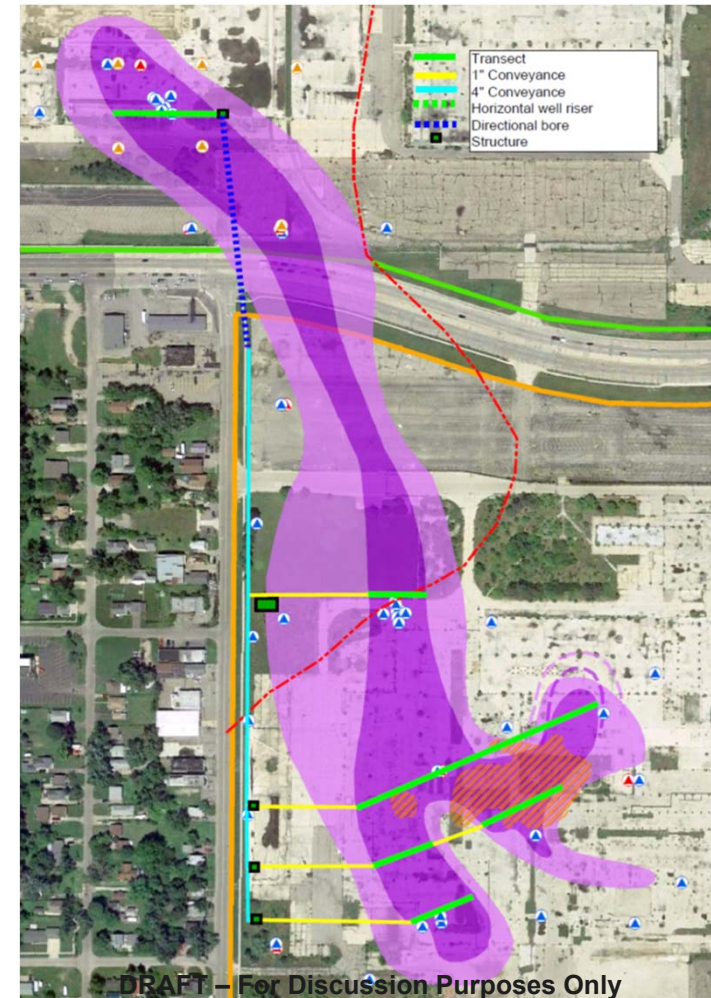
CAO for groundwater is to prevent drinking water exposure above residential DW criteria.

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Groundwater Corrective Measures

- Biosparge is the recommended corrective measure for the lower 1,4-D plume for source reduction
- Human health CAO for groundwater is currently met
- The biosparge system will be operated adaptively to most cost effectively reduce 1,4-D concentrations with a goal of 72 ug/L in the weathered bedrock
- Multiple performance metrics will be utilized to evaluate when it is acceptable to modify or shut down biosparge:
 - 1,4-D to below 72 ug/L in weathered bedrock;
 - Meet the requirements of the 95% UCL of the mean of 72 ug/L for 1,4-D in weathered bedrock;
 - Stable to decreasing trends; or
 - Maximum of 12 years of system operation.

CAO for groundwater is to prevent drinking water exposure above residential DW criteria.



Schedule for Remainder of 2017

September

- Plant 6 Exposure Barrier Workplan & RC Exhibit
- Plant 2 Hydraulic Enhancement Workplan
- Plant 3 PFAs Update Call?

October

- Updated RFI Summary Report
- Hydraulic Enhancement Well Install
- PFAs Phase 3 Investigation

TBD

- Stakeholder CMS Meeting