

Incremental Sampling Methodology Significantly Reduces Arsenic Remediation Costs for Orchard Redevelopment

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Agenda

- Project background
- Initial assessment
- ISM Sampling Implementation
- Remediation
- Simplification
- Lessons learned
- Project status

Project Background

- Phase I Request
- Schedule Challenges
- Priority Tasks

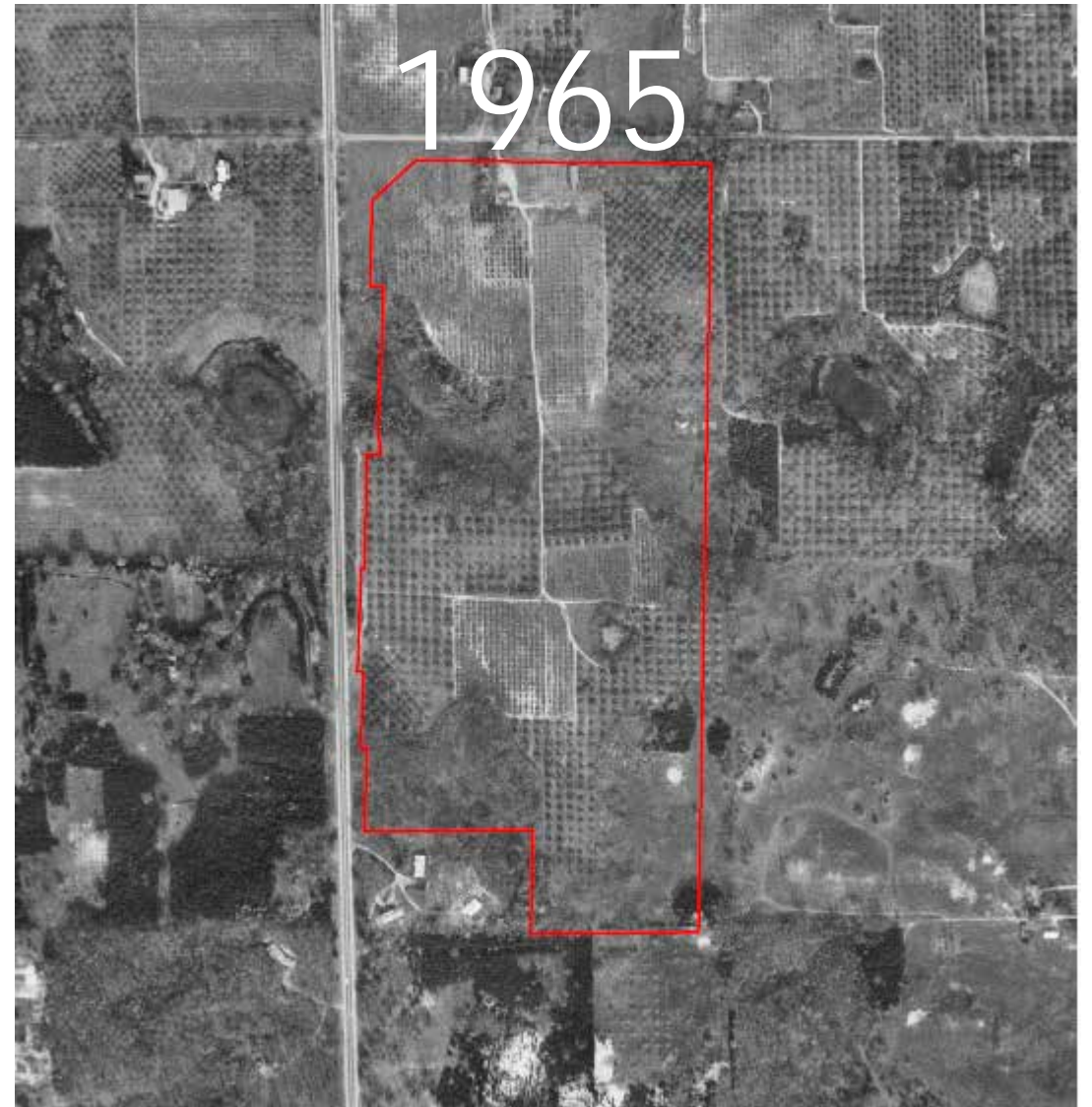
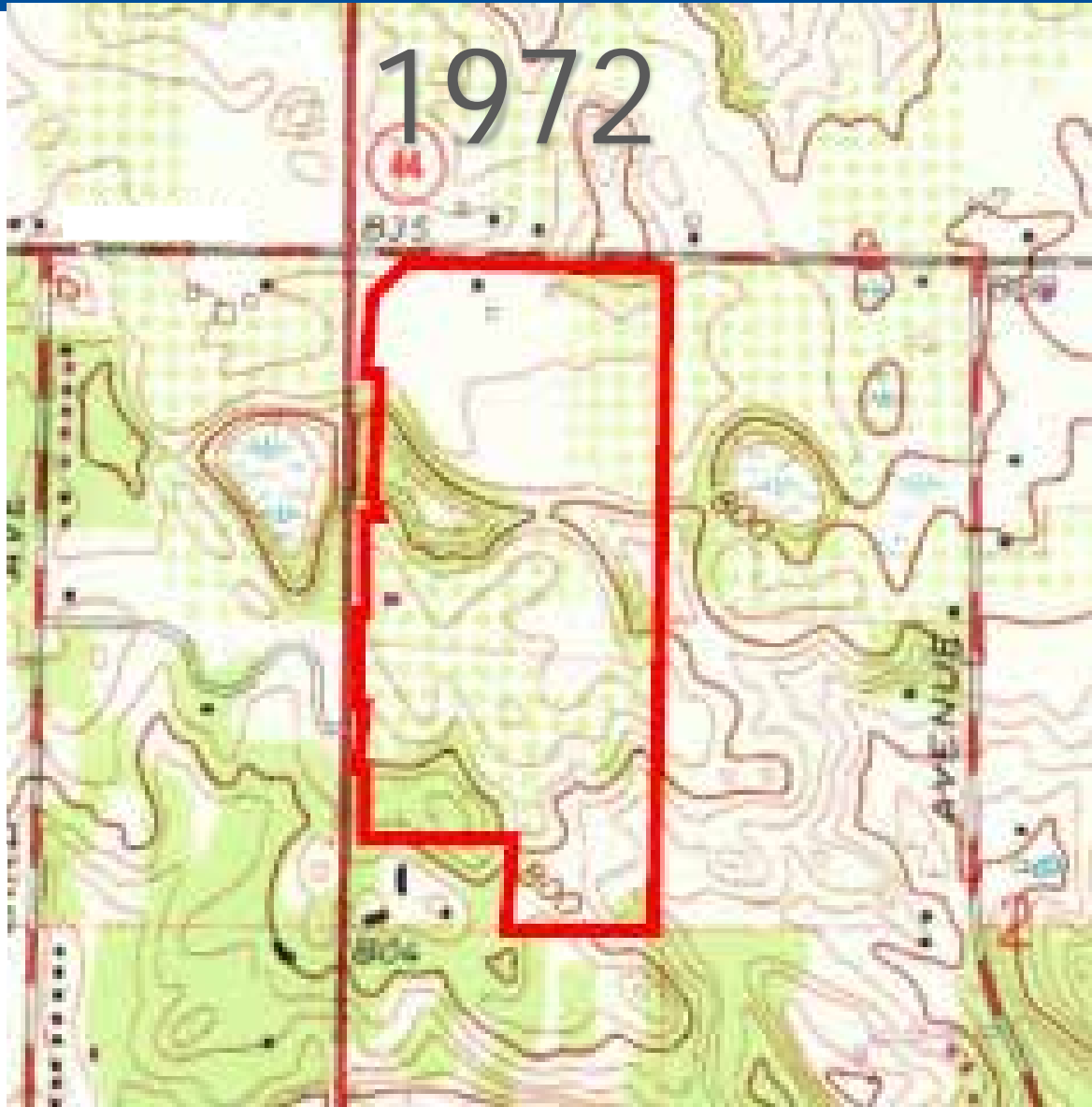


Project Background – Site History

- 80 acres
- Recent use – Recreational & Non-Profit
- Limited Historical Knowledge

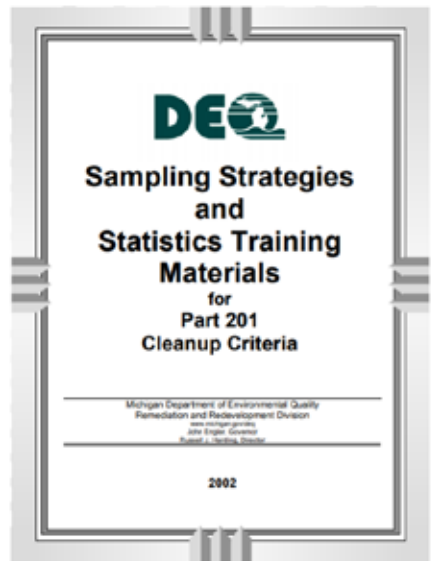
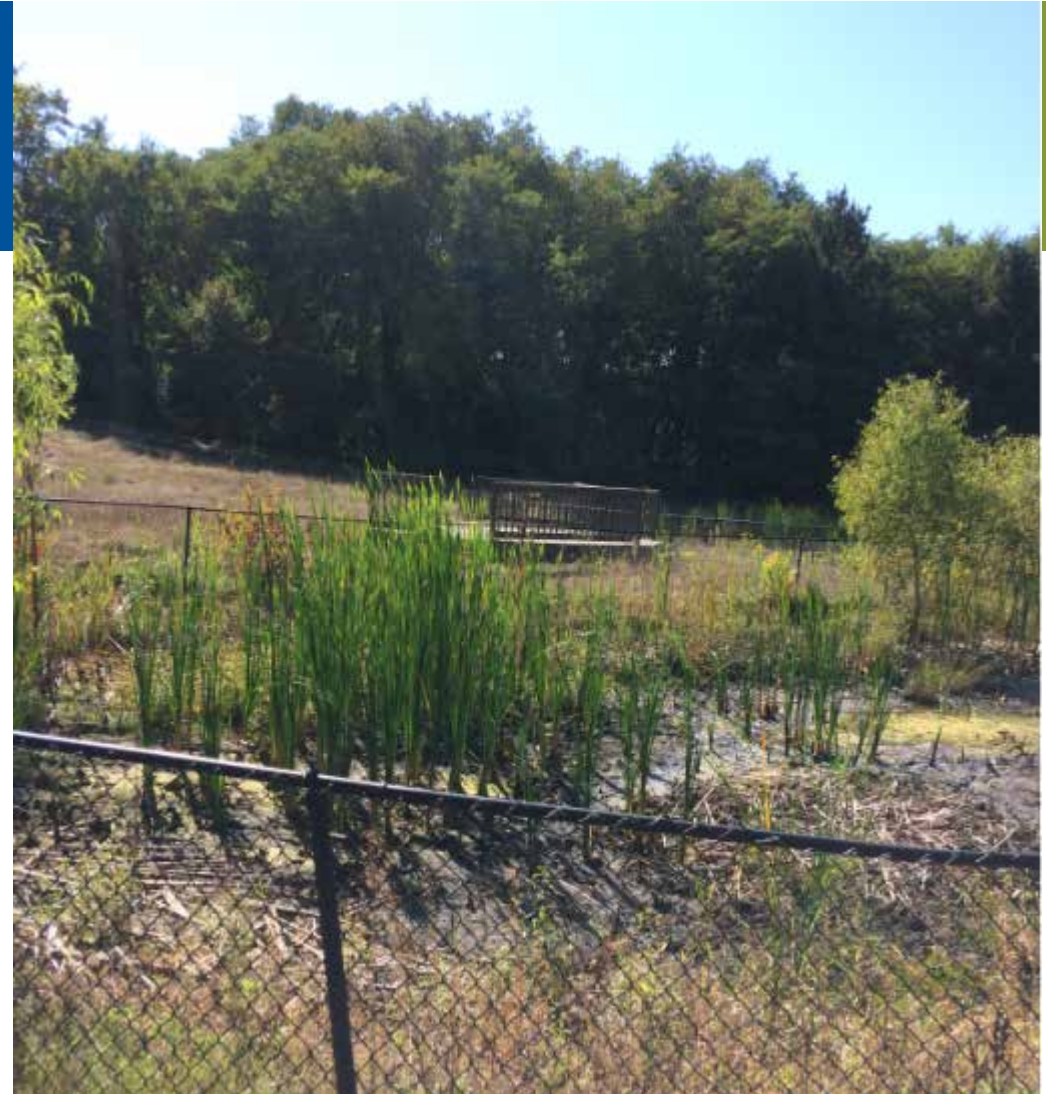


Project Background



Initial Assessment

- Schedule coordination
- 99 borings (surface samples and 141 subsurface)



Initial Assessment

Sample frequency (average)

- 1.2 borings per acre

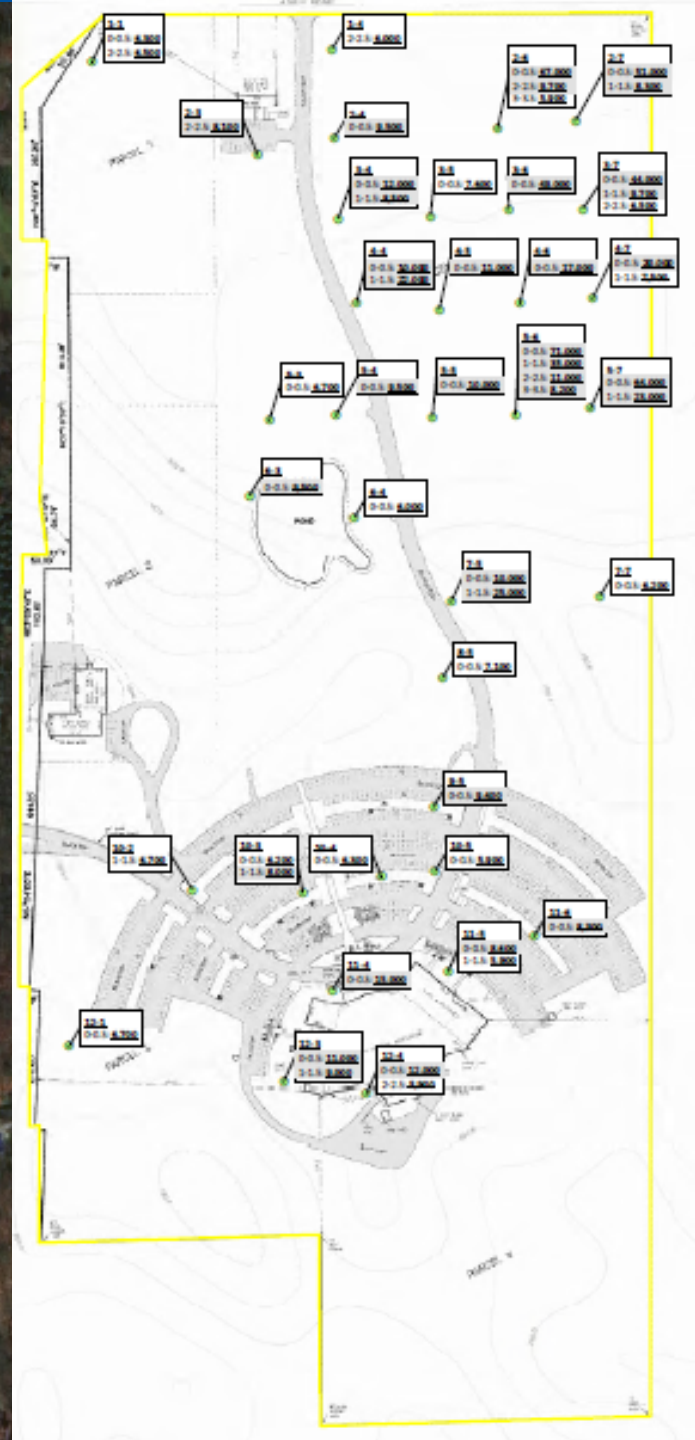
Surface samples (0-0.5')

Subsurface samples

- 0.5-1.5
- 1.5-2.5 (every third sample)
- 2.5-3.5 (as needed)

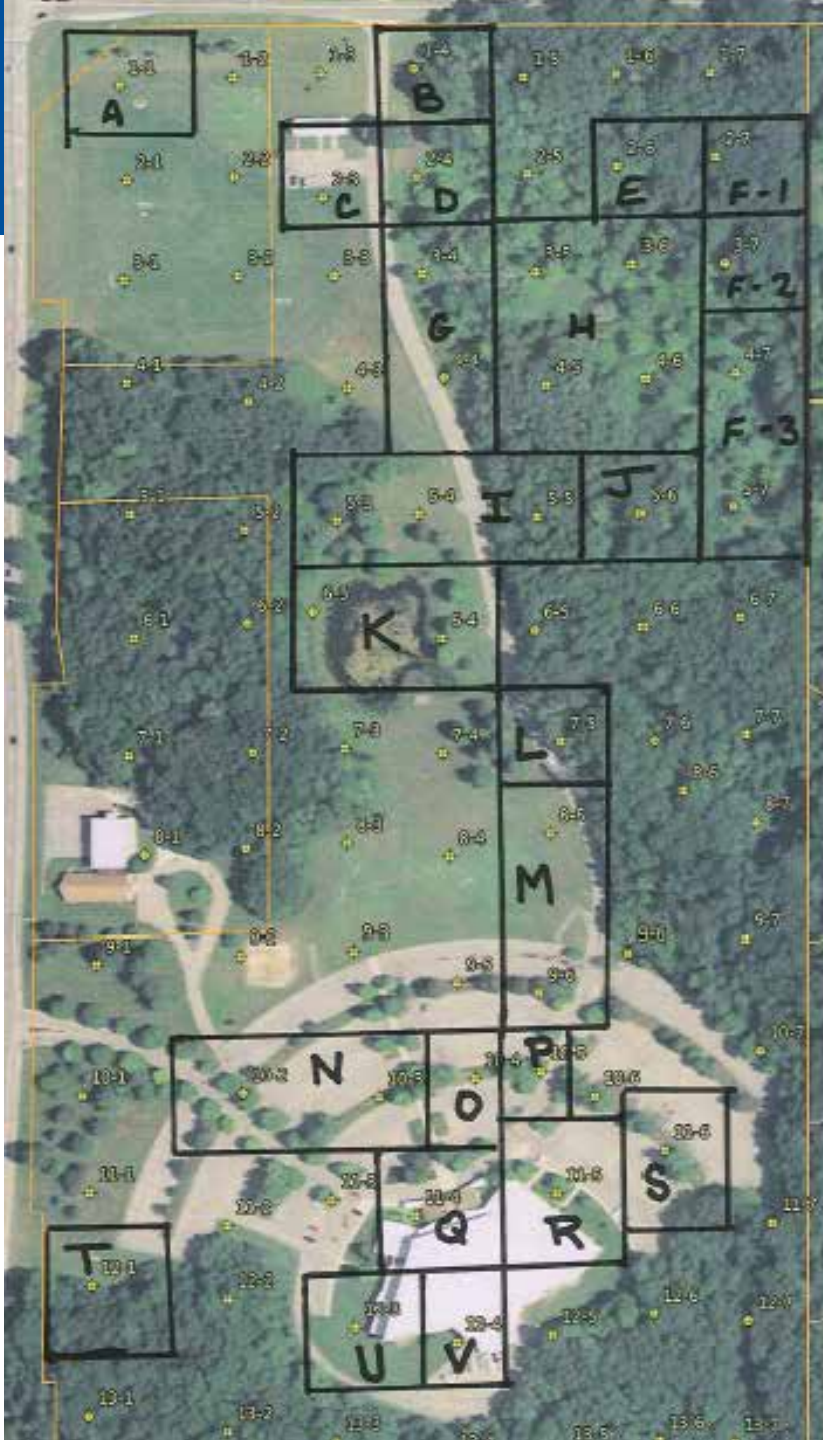
Purpose

- Determine Facility status
- Evaluate Development Options



Initial Assessment

- Soil relocation
- Soil removal
- Site use limits
- and many more....



area name	length	width	depth	Area cu ft	Wooded area Acre
	feet				
A	180	200	3	108,000	
B	180	160	3	86,400	0.33
C	170	160	3	81,600	
D	170	160	1	27,200	0.62
E	150	150	3	67,500	0.52
F	720	170	2	244,800	2.81
G	360	170	2	122,400	0.70
H	370	320	1	118,400	2.72
I	180	470	1	84,600	0.97
J	180	170	3	91,800	0.70
K	200	330	1	66,000	
L	170	150	2	51,000	0.59
M	390	170	1	66,300	
N	190	400	2	152,000	
O	190	120	1	22,800	
P	150	100	1	15,000	
Q	190	200	1	38,000	
R	200	230	2	92,000	
S	220	160	1	35,200	
T	200	210	1	42,000	0.96
U	180	180	2	64,800	
V	190	130	3	74,100	

ISM Sampling Implementation



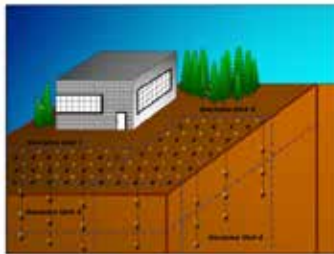
Remediation and Redevelopment Division

Michigan Department of Environmental Quality



INCREMENTAL SAMPLING METHODOLOGY AND APPLICATIONS

REMEDICATION AND REDEVELOPMENT DIVISION
RESOURCE MATERIALS



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RRD-RESOURCE MATERIALS-JX 2014-01
June 2015

Protecting Michigan's Environment. Ensuring Michigan's Future.



TGM for the Implementation of the Hawai'i State Contingency Plan
Section 4.0
DECISION UNIT and MULTI INCREMENT SAMPLING FOR SOIL AND SEDIMENT
CHARACTERIZATION

SECTION 4 DECISION UNIT and MULTI INCREMENT SAMPLING FOR SOIL AND SEDIMENT CHARACTERIZATION

Interim Draft - November 2015

State of Hawai'i
Department of Health
Office of Hazard Evaluation and Emergency Response
919 Ala Moana Boulevard, Room 206
Honolulu, Hawai'i 96814

Interim Draft - November 2015



Incremental Sampling Methodology

Representative Sampling, Confident Decisions



ISM Sampling Implementation

Decision Units (DU)

Laterally - Based on Unique Fields/Orchards

Vertically – Soil Horizons and Previous Investigation Information

- Surface Soil (0-6 inches)
- 1-foot intervals at depth



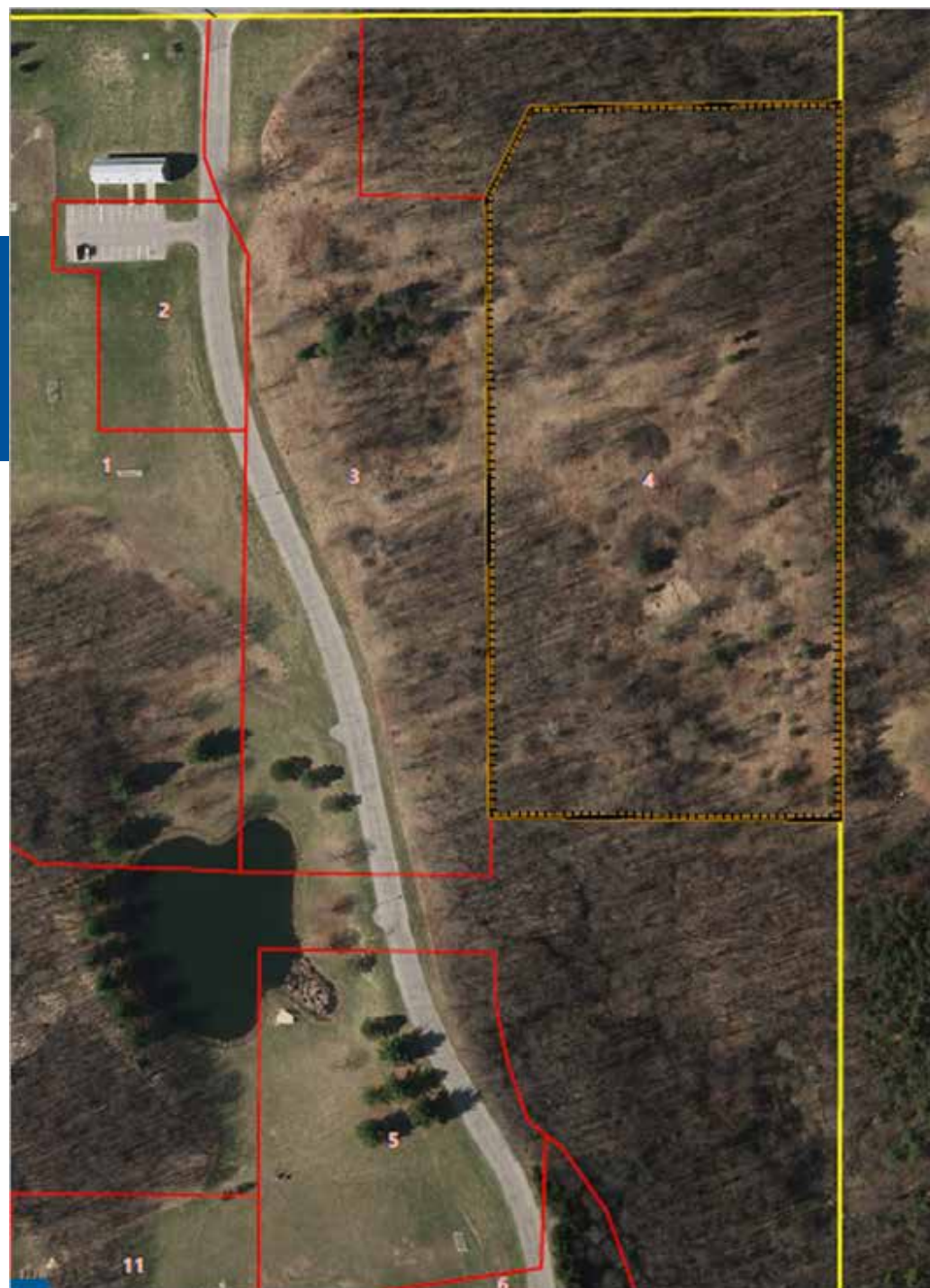
ISM Sampling Implementation

Sample/Statistic	Units	Arsenic
ISM-DU4 (0-0.5)	mg/Kg	36
Replicate A	mg/Kg	37
Replicate B	mg/Kg	34
Mean (\bar{x})	mg/Kg	36
Standard deviation (s)	mg/Kg	1.5
Relative standard deviation ($RSD=100*s/\bar{x}$)	%	4.3

Sampling Methodology is key



Remediation



Remediation

6.5 acres (375 feet by 750 feet)



DU-4 (0-0.5') and (0.5'-1.0')



Simplification

- 80 Acres
 - Assessment
 - Remediation
 - Verification sampling
 - Reporting



Lessons Learned

- Careful planning
- Sampling technique
- Teamwork/communication

Project Status

Verification samples confirmed concentrations below criteria

EGLE involvement throughout the process

No Further Action report in progress

Unrestricted residential use

ANY
QUESTIONS
?