Expediting Remedial Excavations through Extensive Site Characterization and Real-Time Data Processing

MSECA
Midwestern States Environmental Consulting Association

SITE INVESTIGATION & REMEDIATION DESIGN

MAY 4TH, 2023

Mundell
Consulting Professionals for the Earth and the Environment

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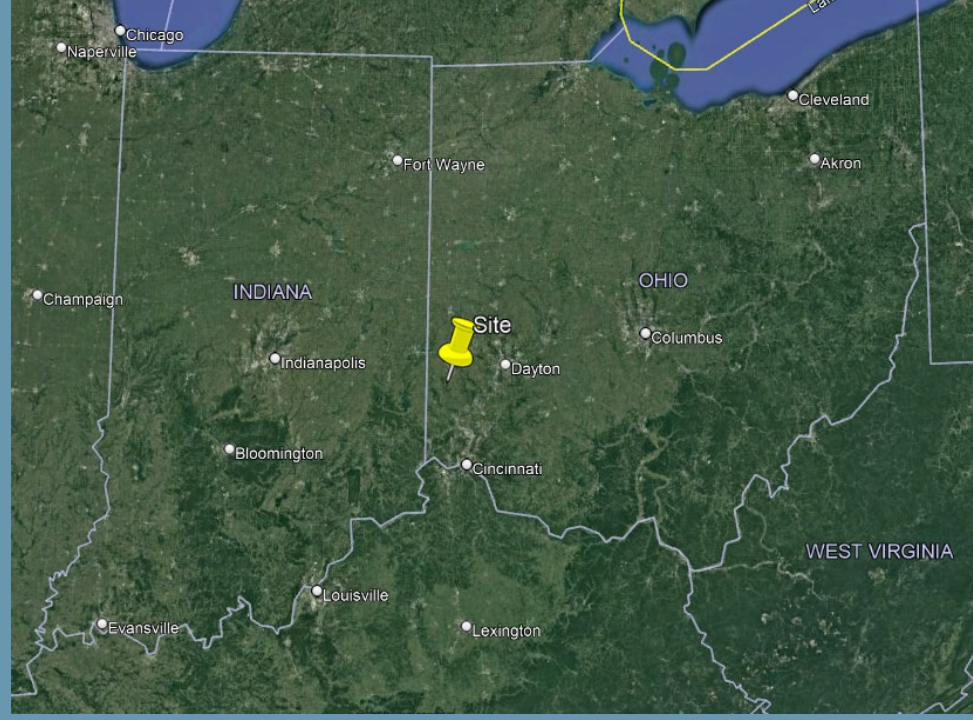
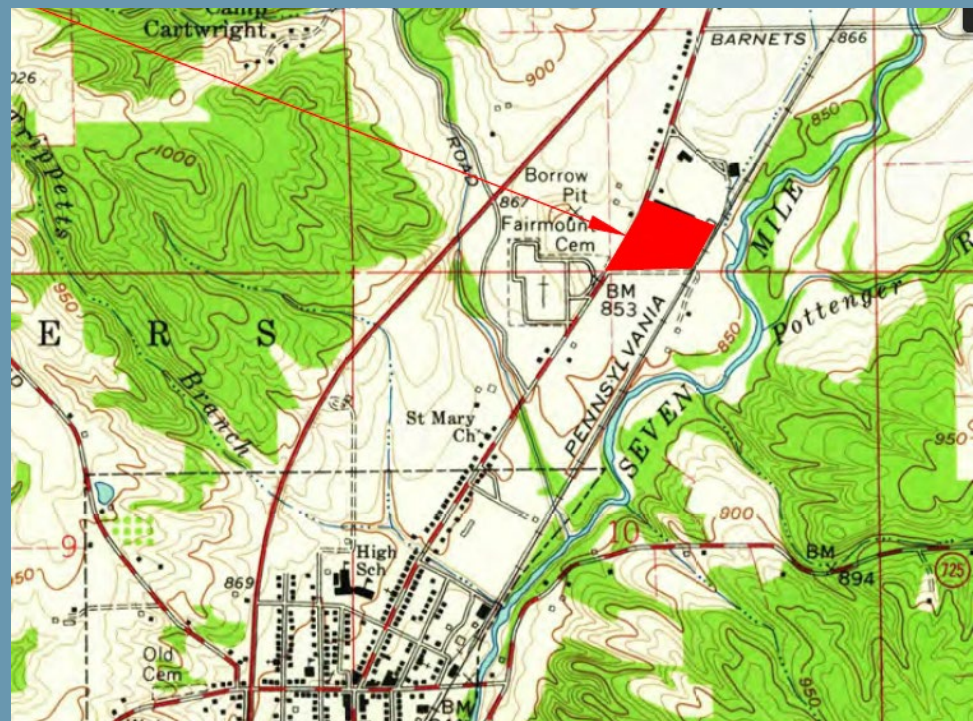
Outline

- Site Background
- Site Investigation
- Remedial Design (Excavation)
- Remediation - Data Collection
  - Closure
  - Real-time Data Processing
- Results and Conclusions



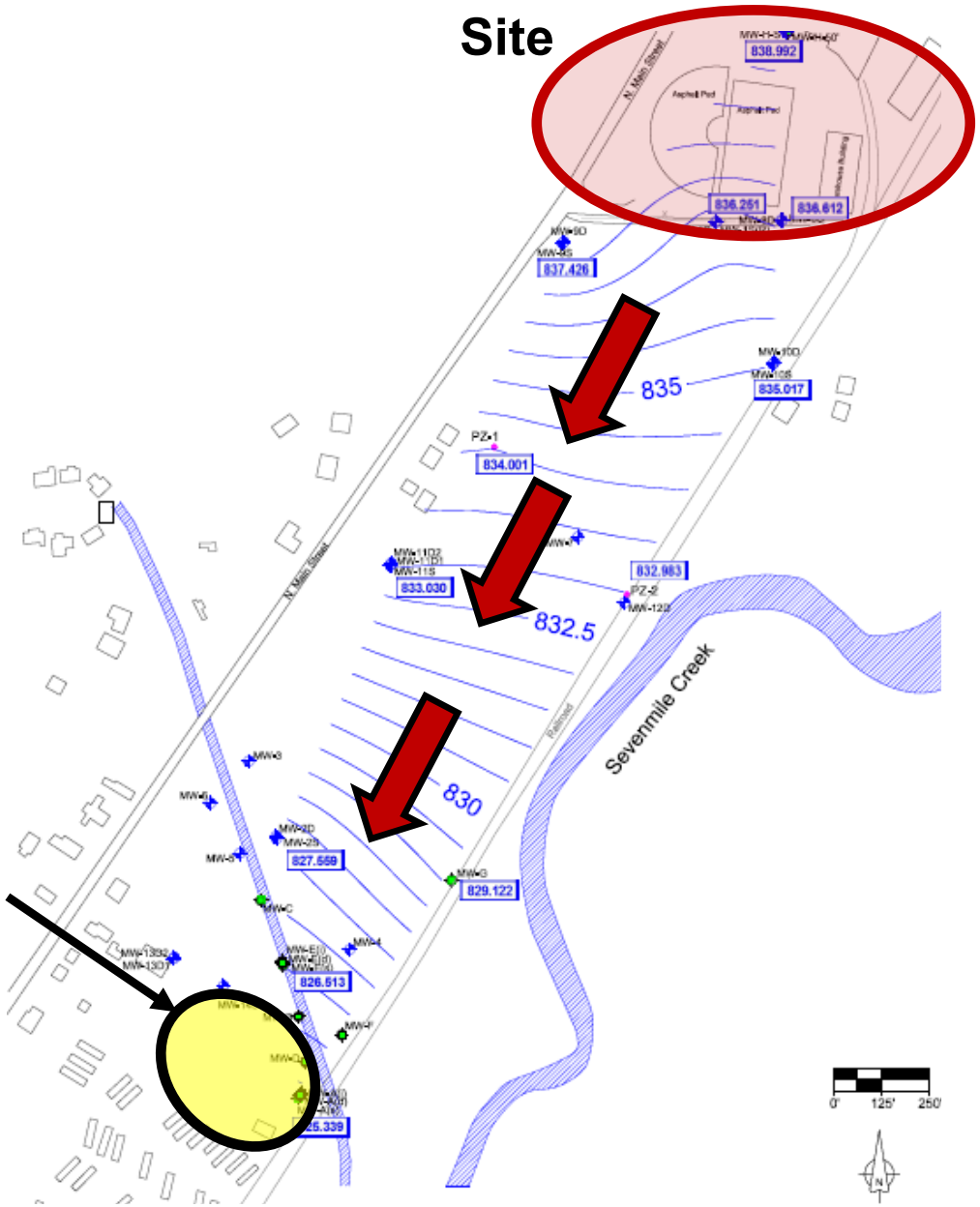


Site Background

- Outdoor Salt Storage (2008-2011)
- Municipal Wells ~ 2,500 Feet Downgradient
  - Chloride > 250 mg/L (Secondary MCL)

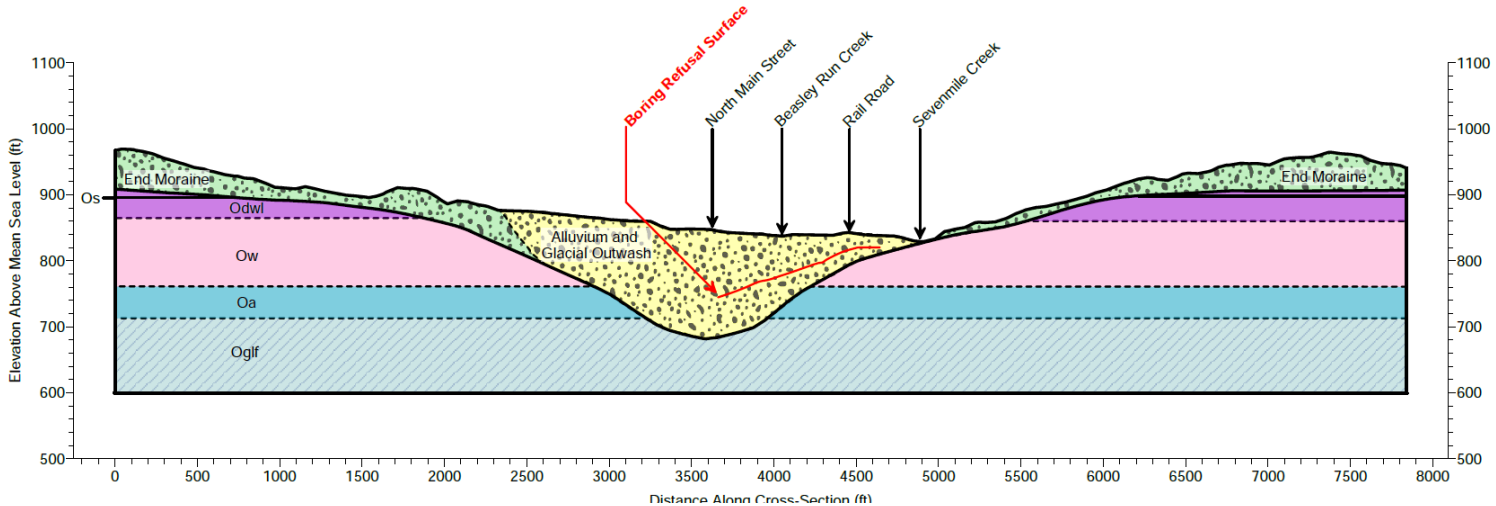
Site Within Town's Wellfield
5-Year Time of Travel

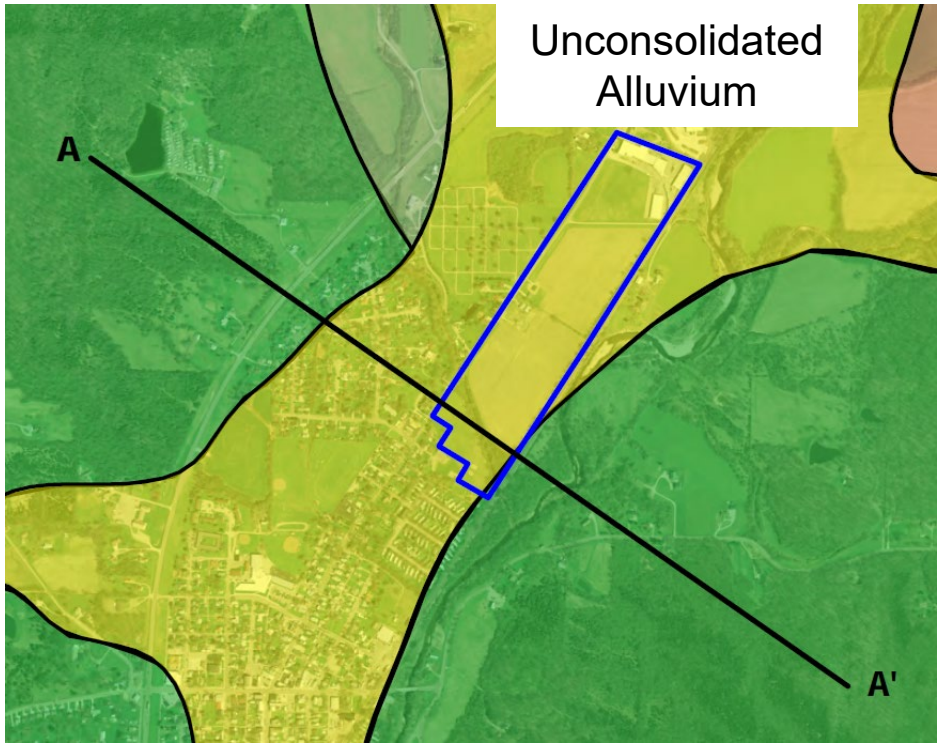
Municipal Wells



Hydrogeologic Setting

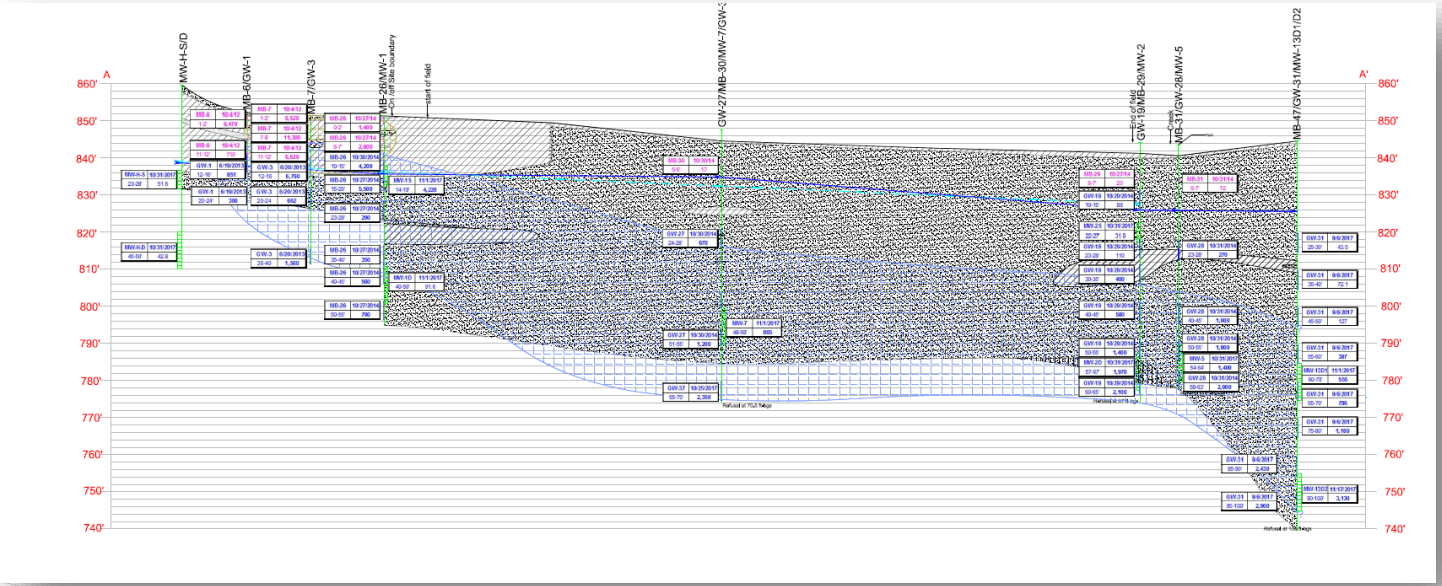
- Alluvial/Outwash Valley
- Unconsolidated Thickness (30-180 Feet)
  - Sand and Gravel
  - Silt and Clay Glacial Till

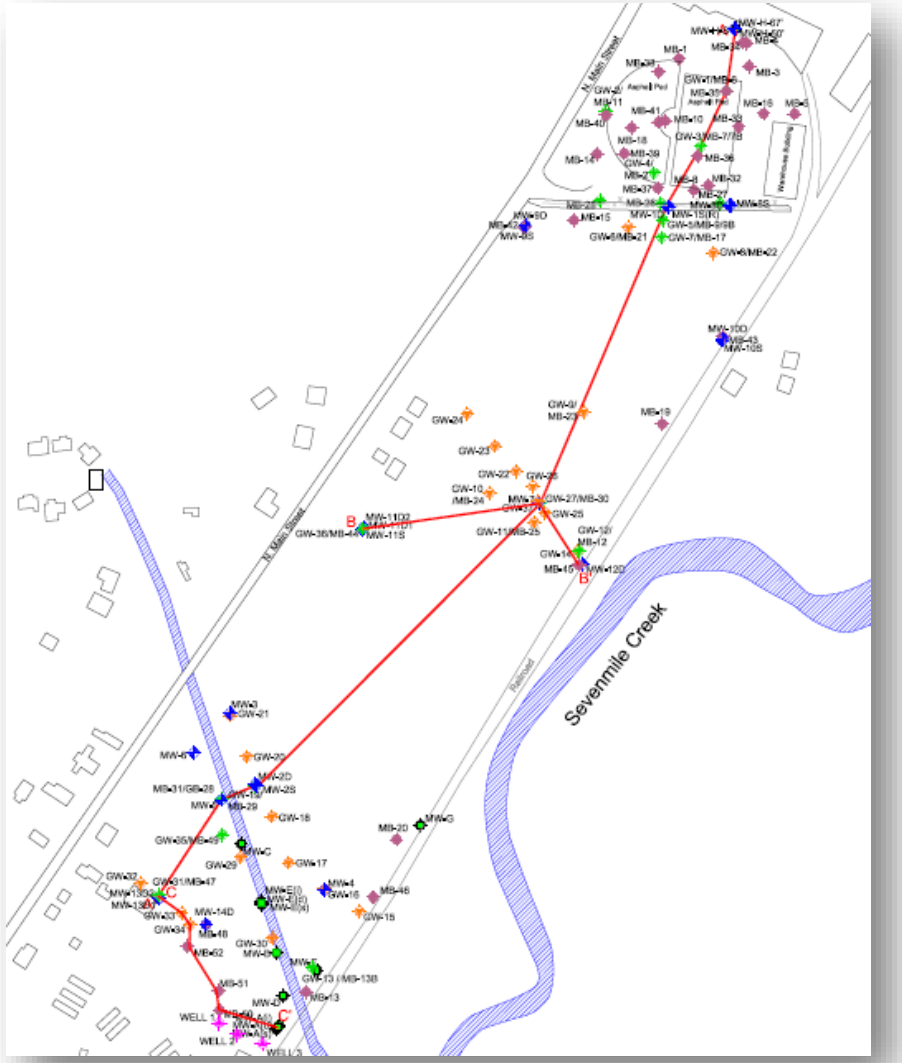




Site Characterization

- Source / Plume Delineation
- Lithology
- Quarterly Monitoring
- Modeling (MODFLOW, Stream-Aquifer, Pumping)
- Leaching – Source dilution





Source Characterization

Geophysics

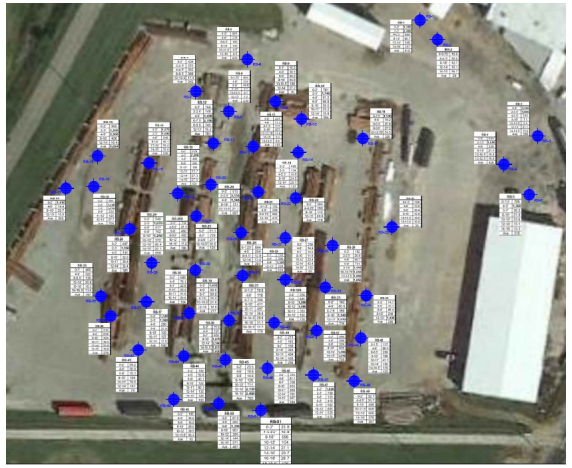
EM-31
Electromagnetic
Terrain Conductivity
Method

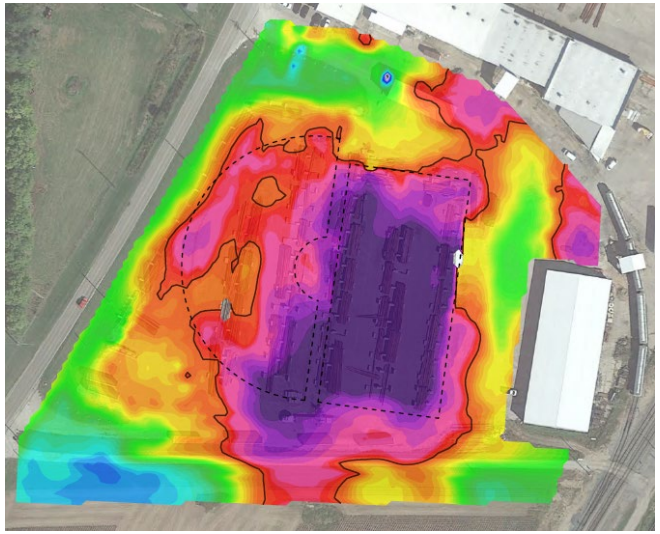
Guided →

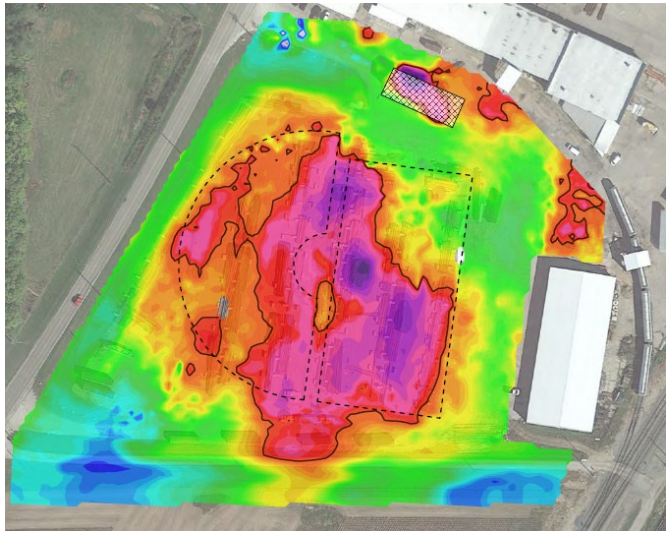
Soil Investigations

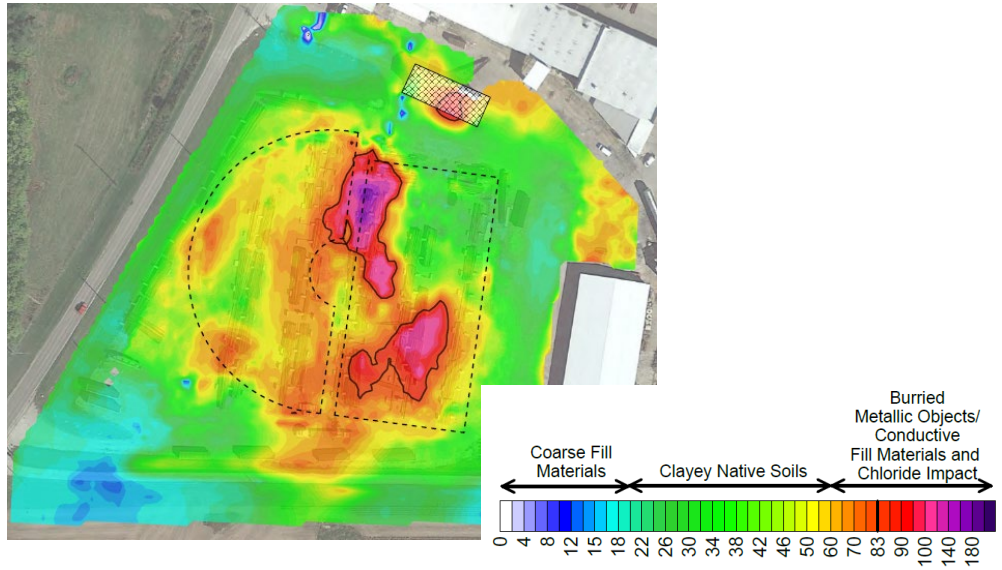
→ Source Delineation

→ Remediation Design

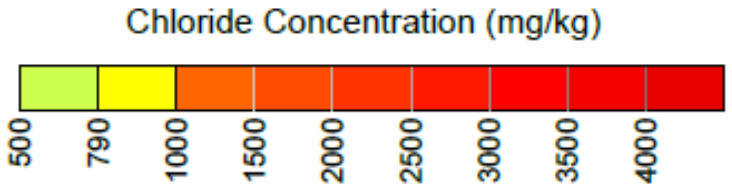








Layered Contamination

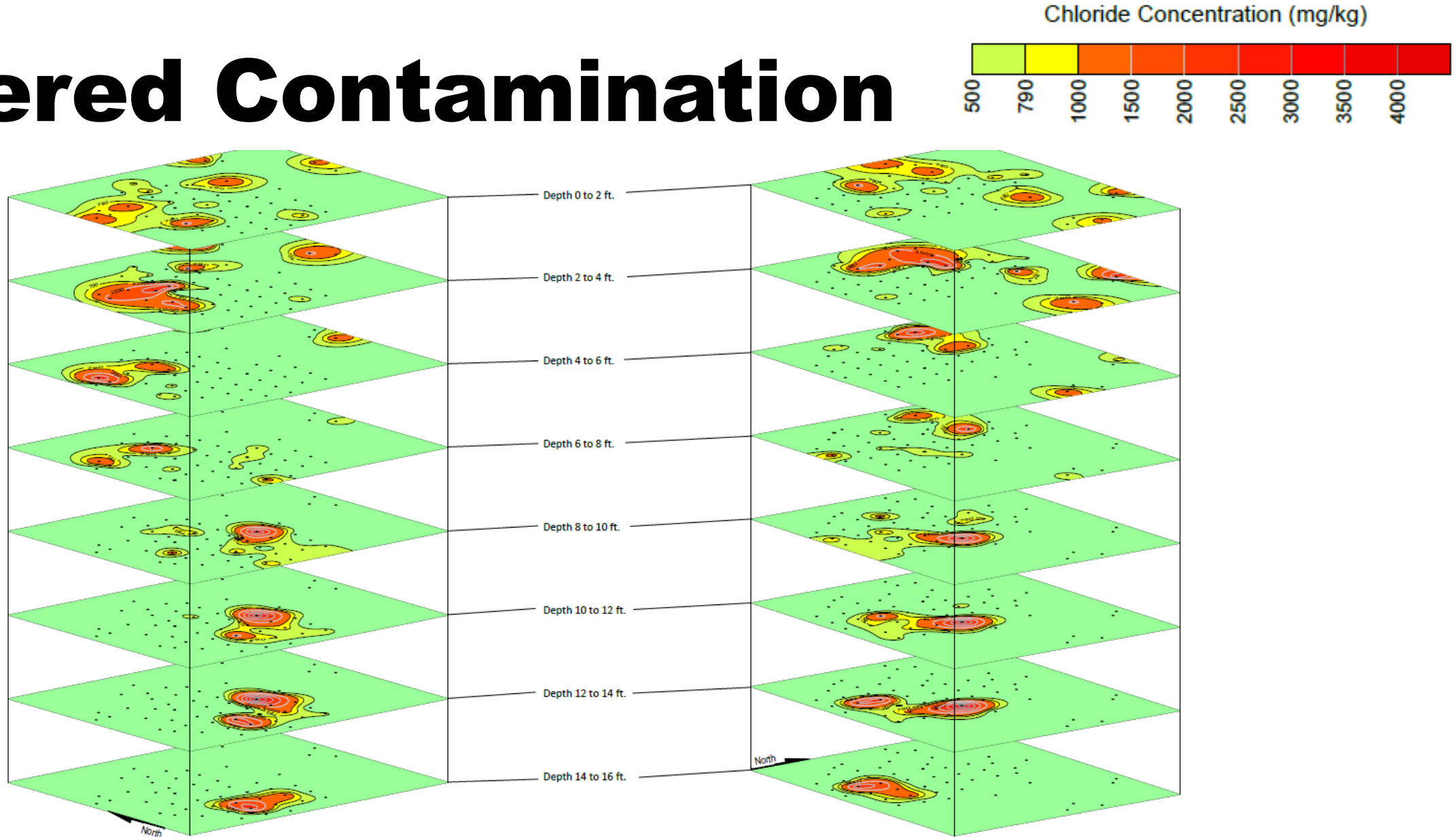


0-2 Feet

2-4 Feet

4-6 Feet

Layered Contamination



Remedial Design

1) Excavation → **Stair Stepped** & **Layered**
2) **Landfill: 13,500 tons** Chloride-Impacted Soils > 1,000 mg/Kg
3) **Re-Use: 35,000 tons** of clean, overburden soil
   a) Excavated, stockpile, **use as backfill**

↓

Save Client $ Million+

↓

*Provided **Soil Segregated***

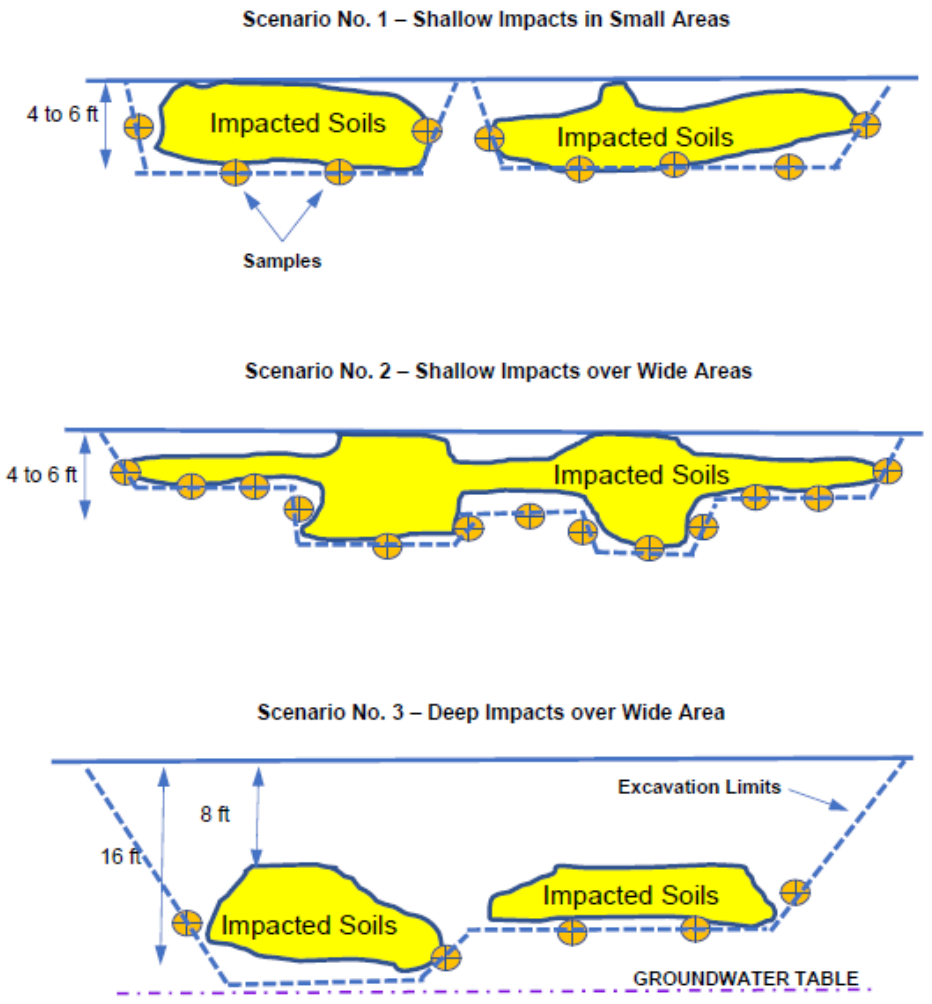
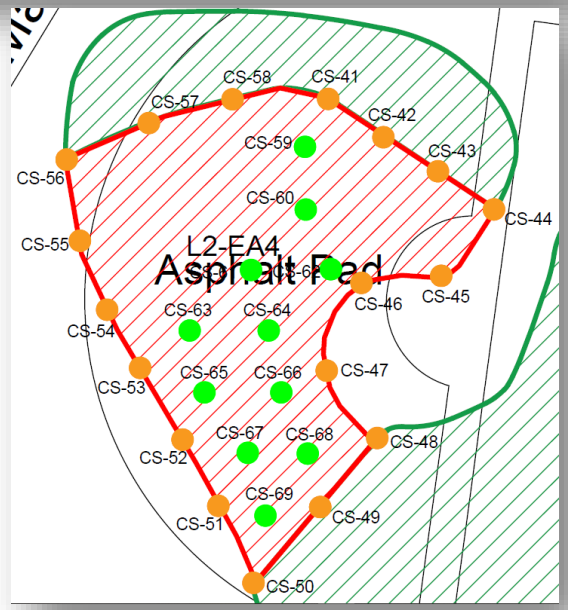


Figure 5. Confirmation Sampling Strategy

Logistical Challenges <u>PART 1</u>

1) Court Ordered **Deadline**
2) **Segregating** Soil
   a) Vertical and Horizontal Excavation Extents → Tight Control
3) Confirmatory Samples → **Minimum 172 samples**
   a) Sidewall: every 20 to 60 feet
   b) Bottom: 1/600 ft^2
4) Lab → 1.5 Hours
5) Lab → COVID Pandemic → No Rush Turnaround → 10 Business Days

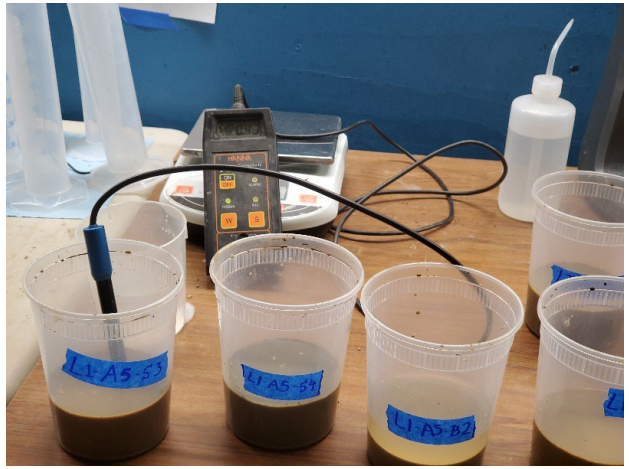


Solution: Field Testing

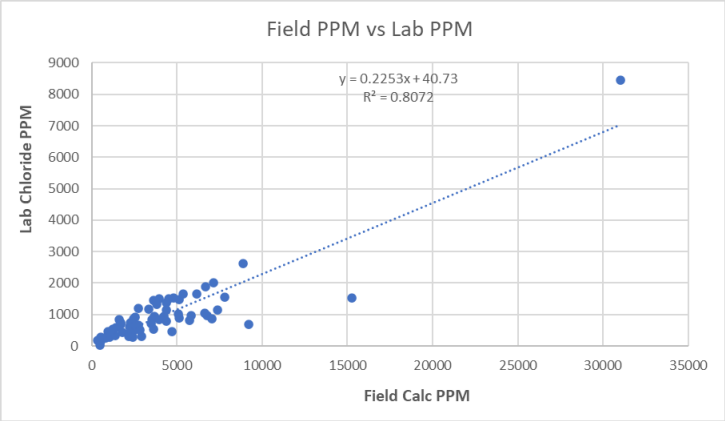
- Expedite Decision Making
- Predict Lab Results?

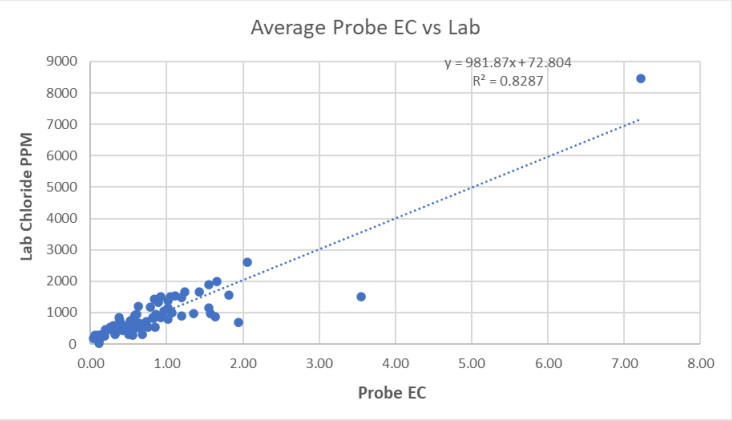
Soil-Salinity Field Testing Methods

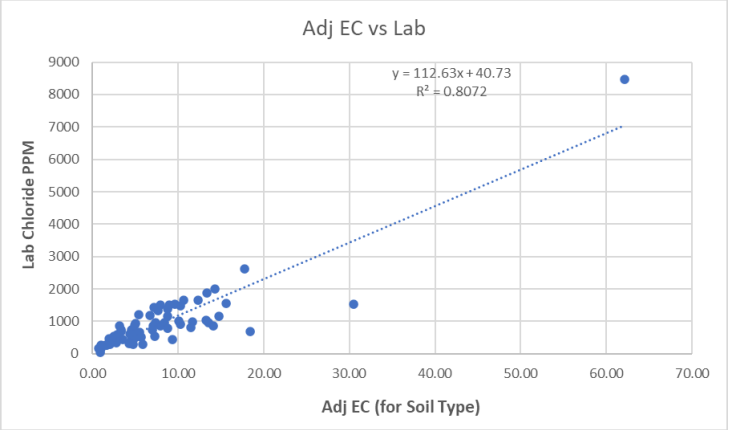
- Research
- Test – Soil from Site
- Varying Methods
  - High Labor → High accuracy?
  - Minimal Labor → Low Accuracy?

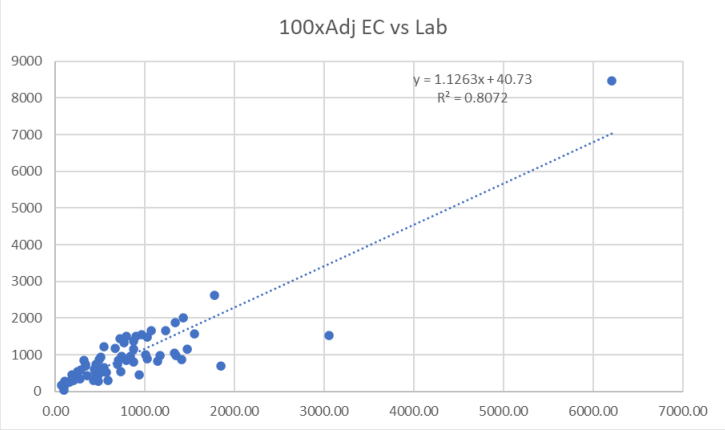


Data Analysis: Phase I









1) Strong Correlation → Use as Predictor
2) Same Accuracy → Use Most Straightforward

Phase II Issues

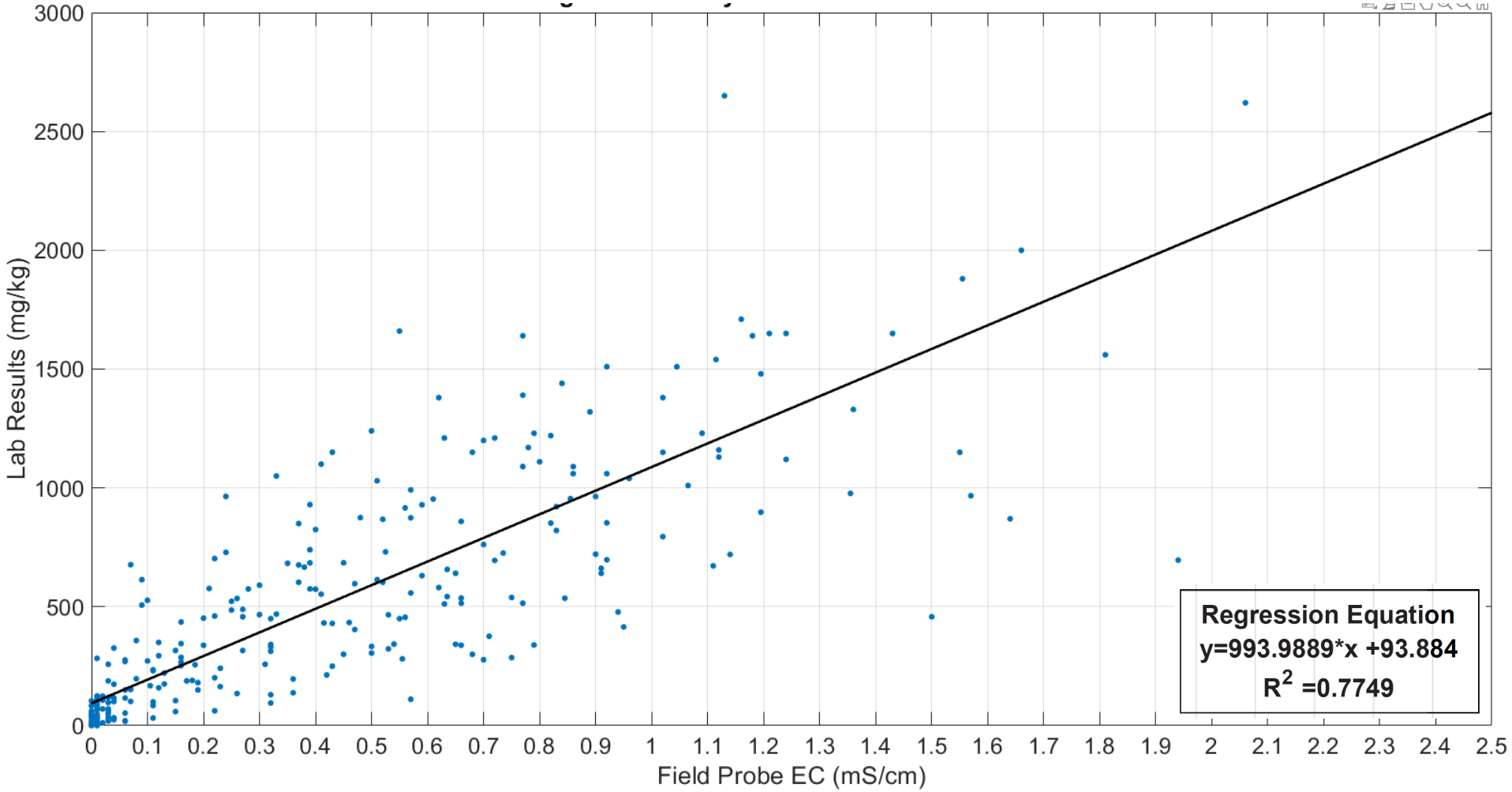
Practical Concerns

1) **Depth → Safety**
2) Dewatering

Solution

1) Field Testing → Close Excavation?
2) OEPA Allow?

Data Analysis: Phase II

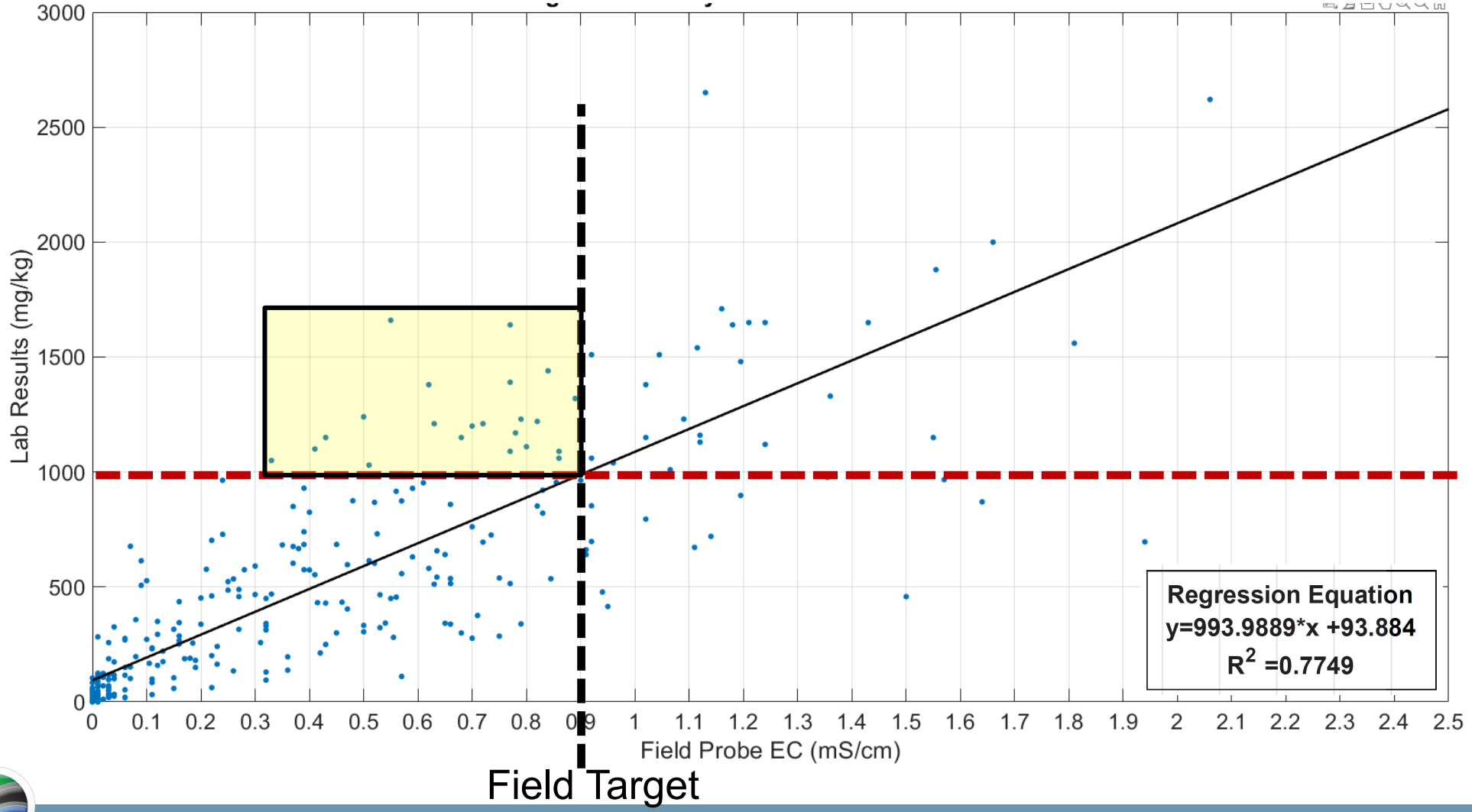


1) Expedite
2) Streamline
3) Safety
4) Success

Statistically Significant Relationship

How Use?

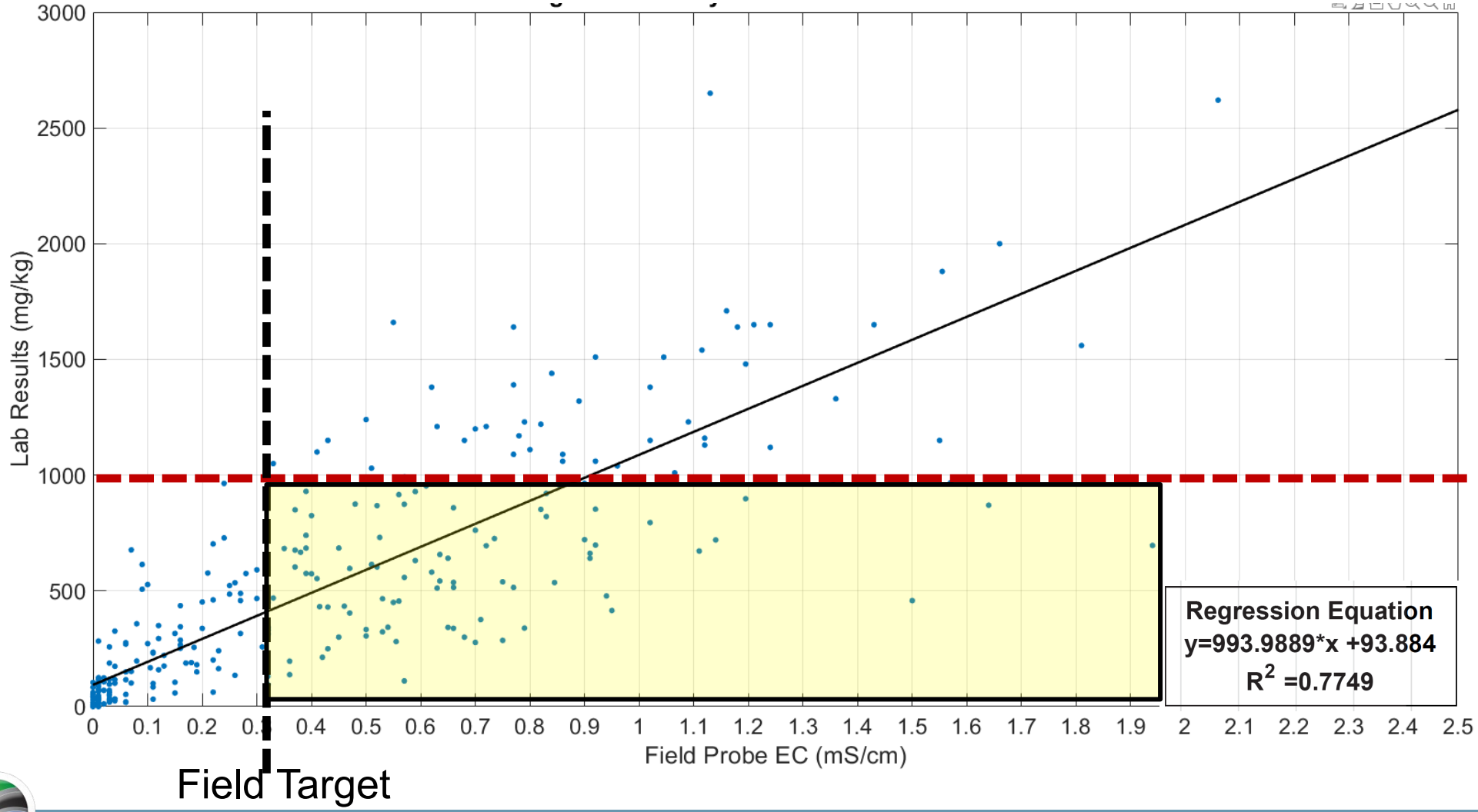
Data Analysis: Phase II



Not Conservative

Lab Target

Data Analysis: Phase II

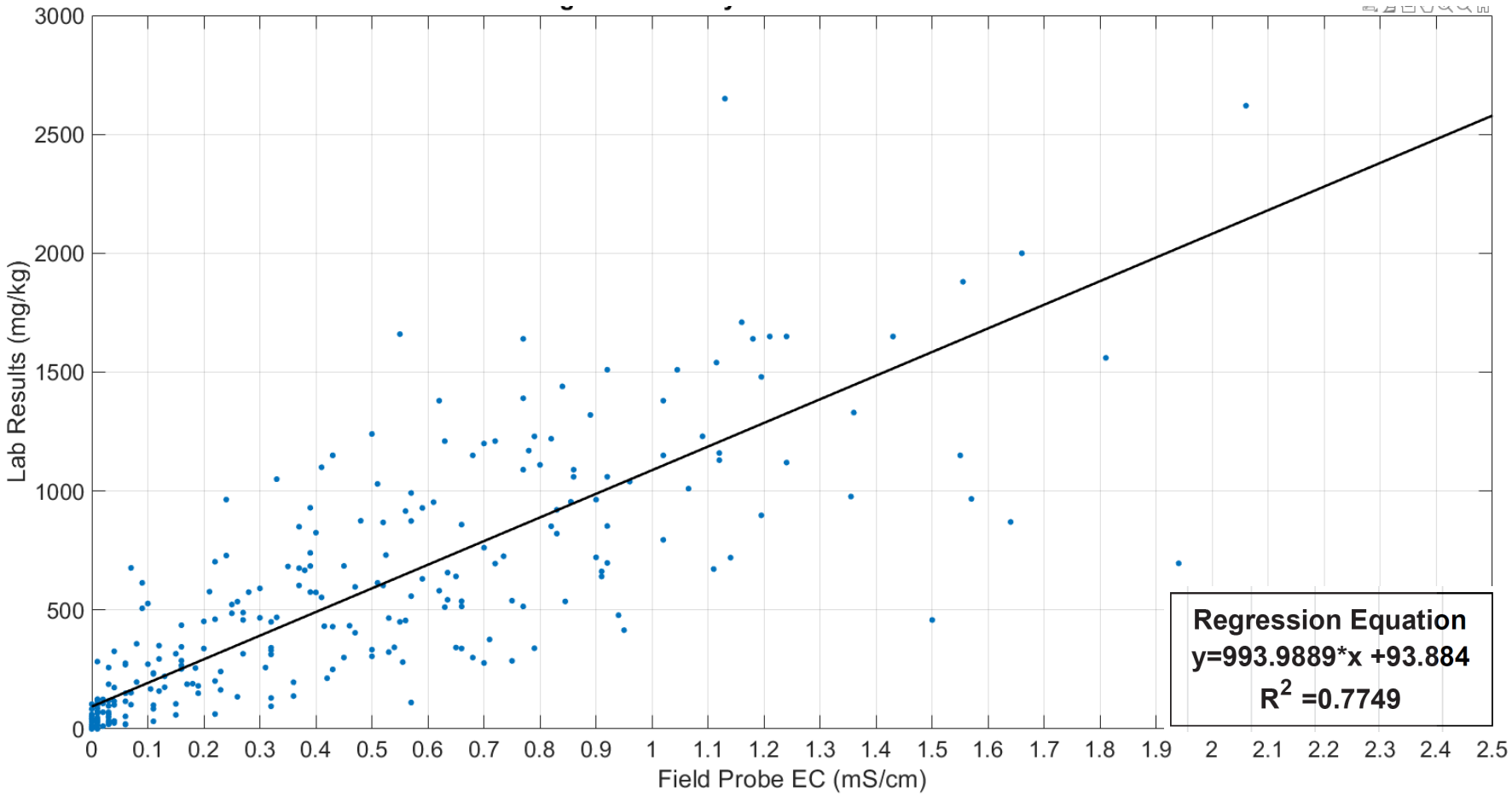


Over Conservative

Over Excavation

Data Analysis: Phase II

Further Statistics



1) Confidence Interval
2) Prediction Interval

Regression Line

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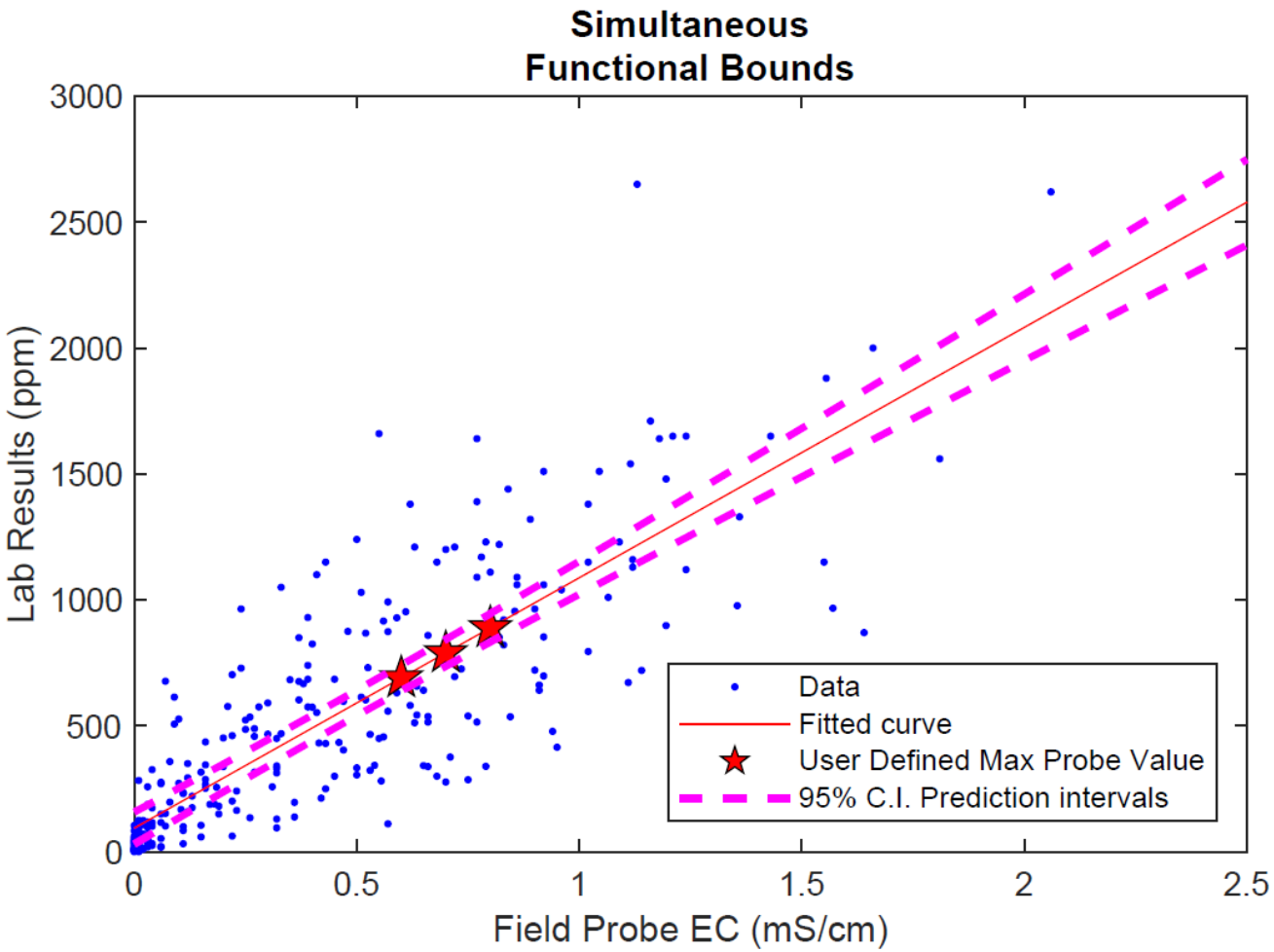
Point Estimate of ***Mean***

Sampling Plan → Average

Data Analysis: Phase II

Further Statistics: Confidence Intervals

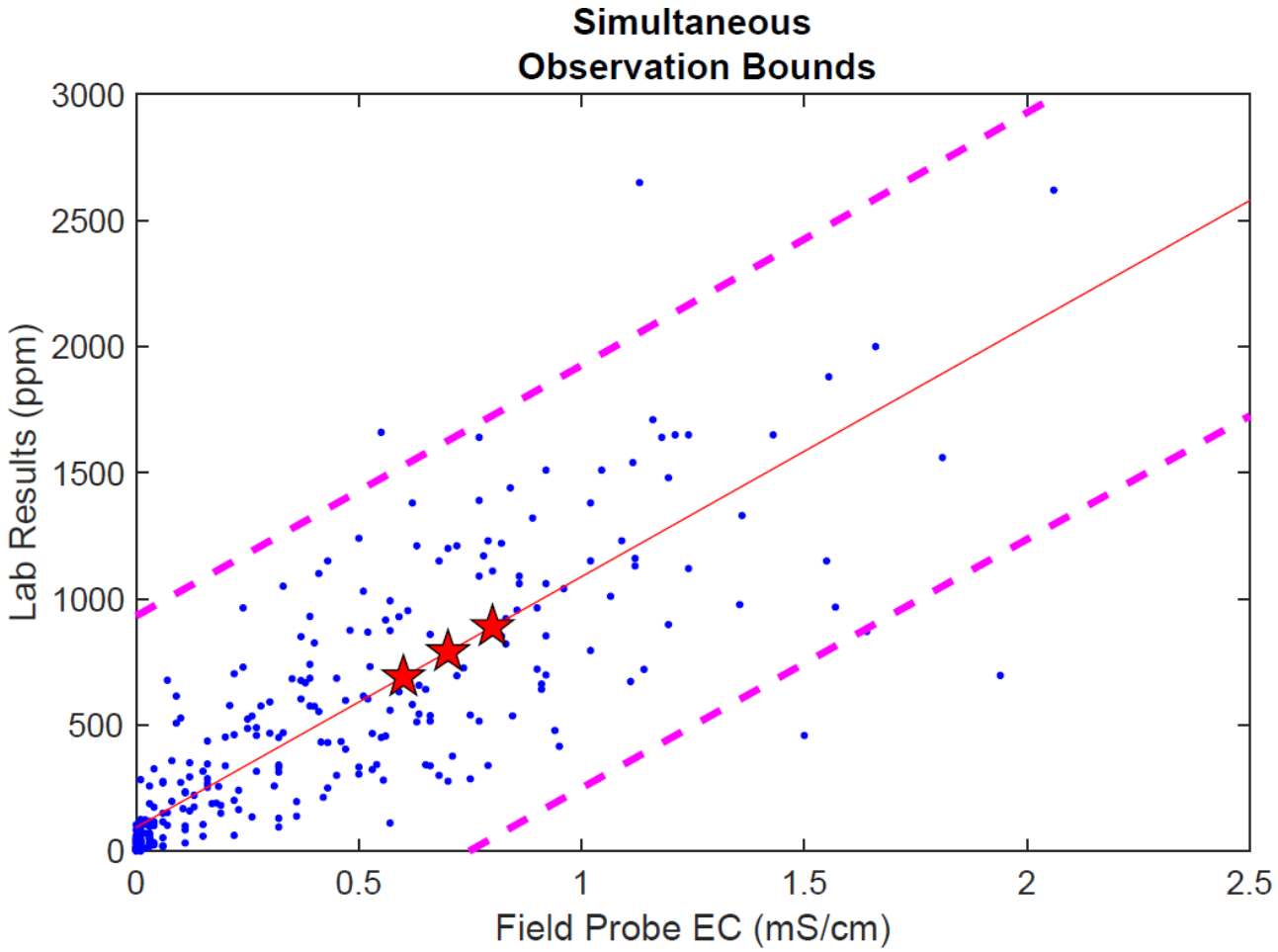


95% Confidence,

<u>Mean</u> Within Threshold

Data Analysis: Phase II

Further Statistics: Prediction Intervals

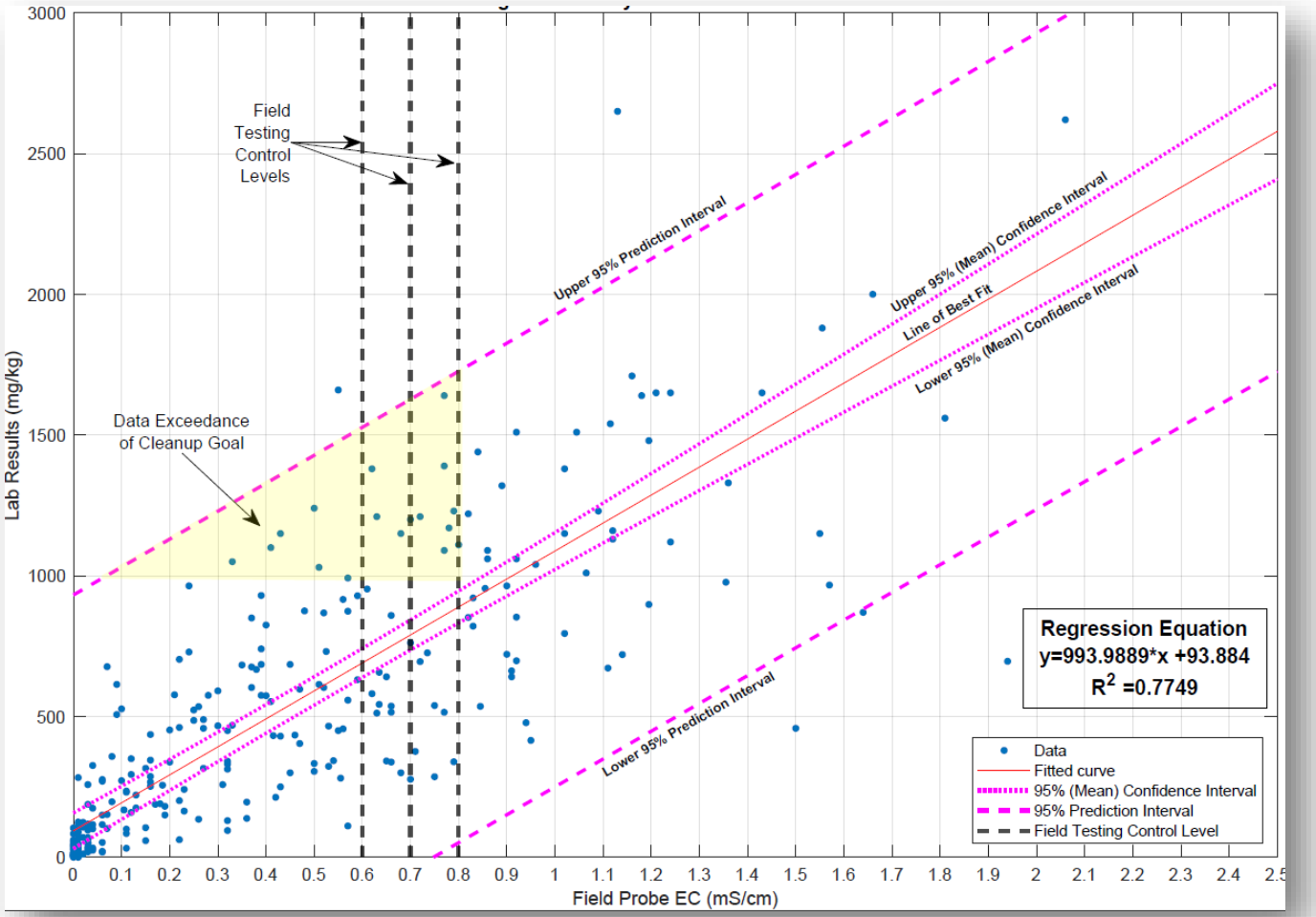


95% Confidence,

Plausible Value in Threshold

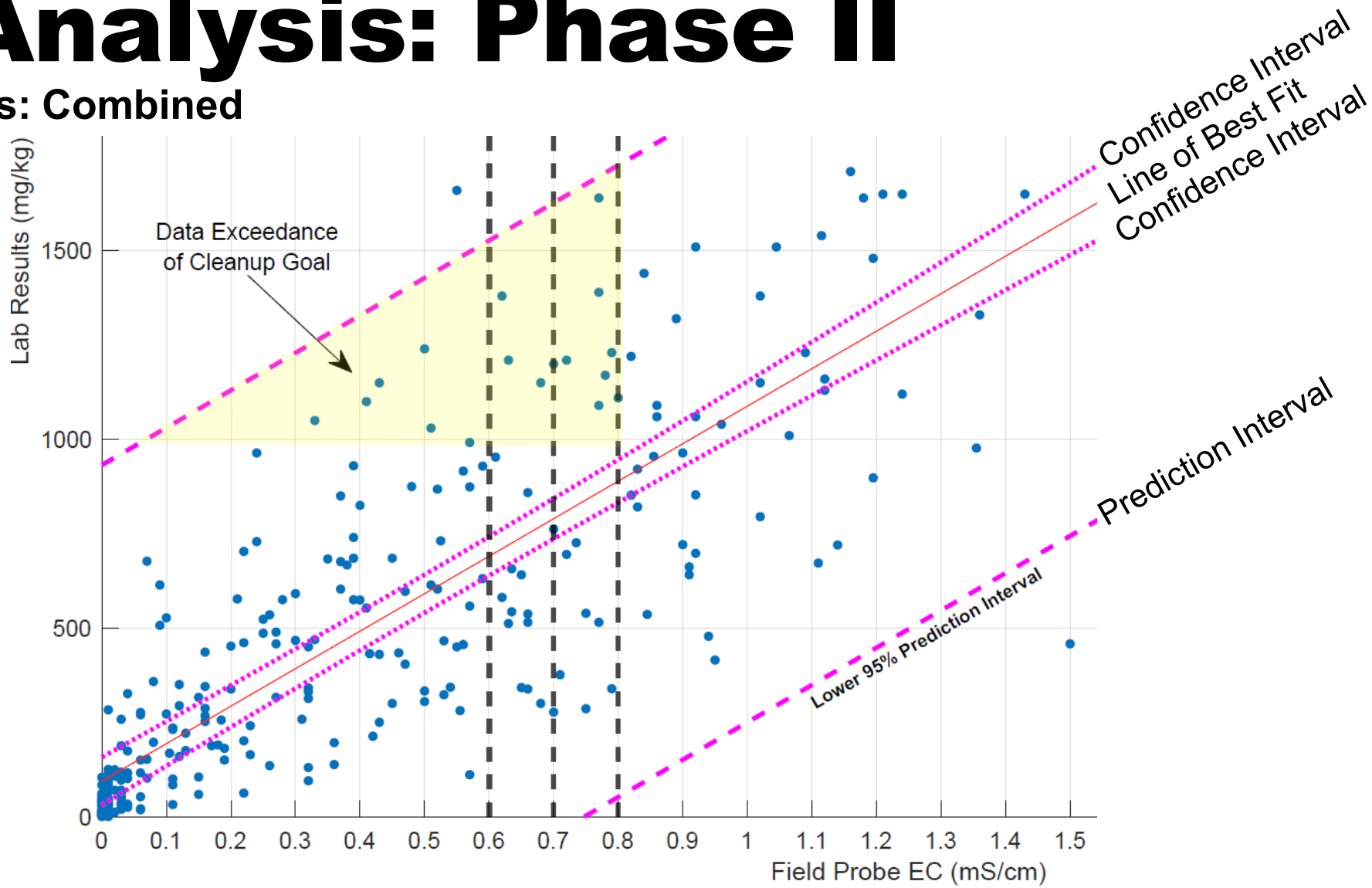
Data Analysis: Phase II

Further Statistics: Combined



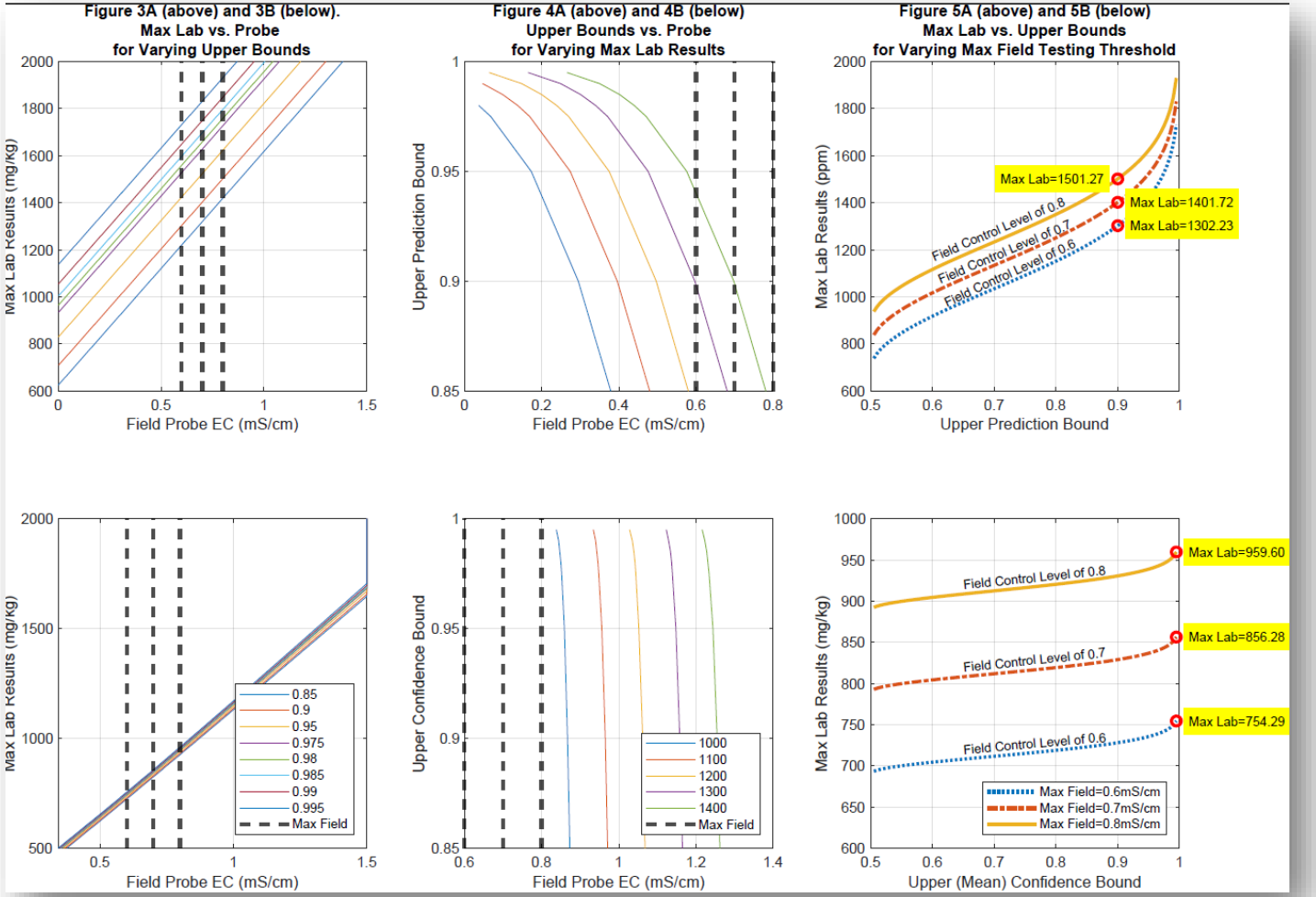
Data Analysis: Phase II

Further Statistics: Combined



Data Analysis: Phase II

Further Statistics: Sensitivity Analysis



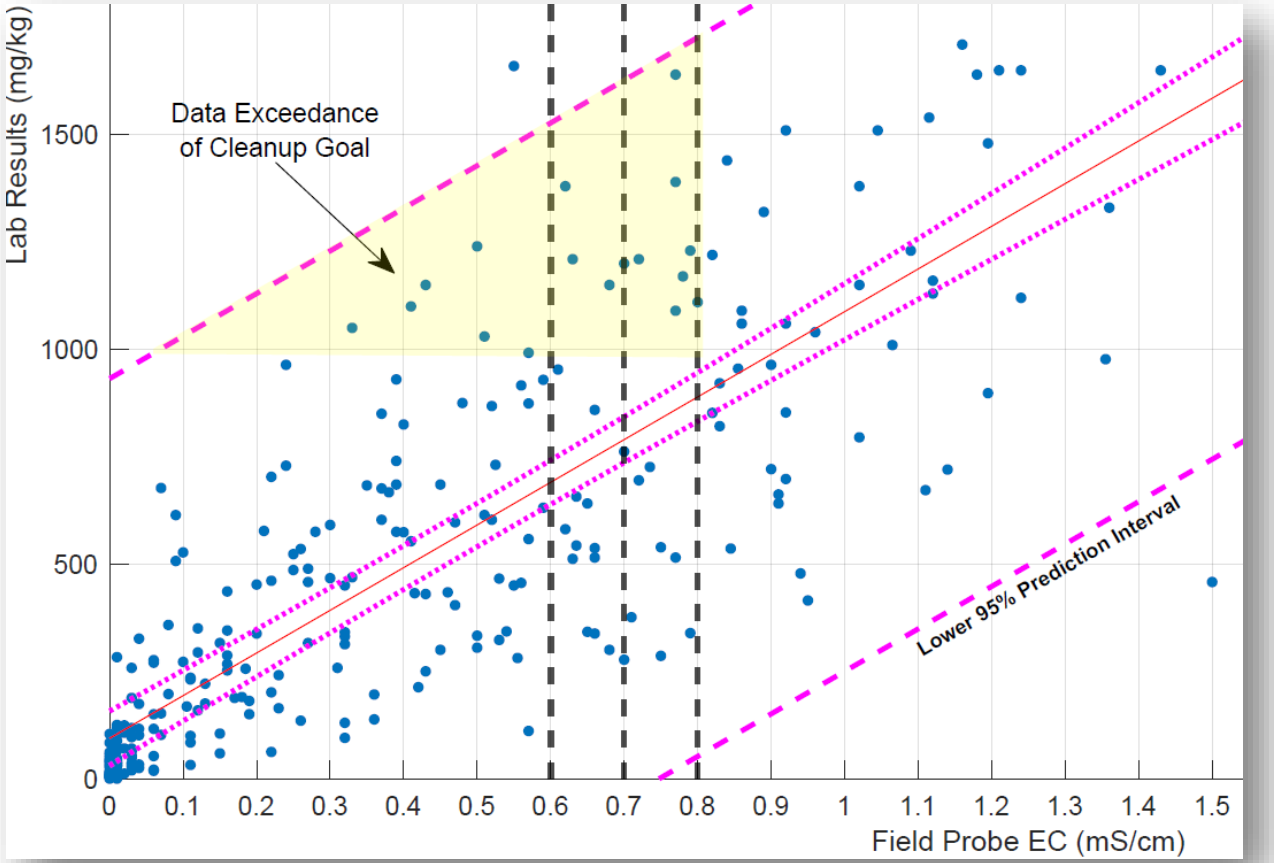
Data Analysis: Phase II

Conclusion

1) Proposed Field Probe of **0.6 mS/cm**
   a) 99.5% Confidence Level Mean < 755 ppm
   b) Max Plausible Value below 1300ppm at a prediction level of 90%
   c) Close Excavation w/o re-excavating
   d) Still Obtain Lab Confirmatory Samples
2) **OEPA Agreed**

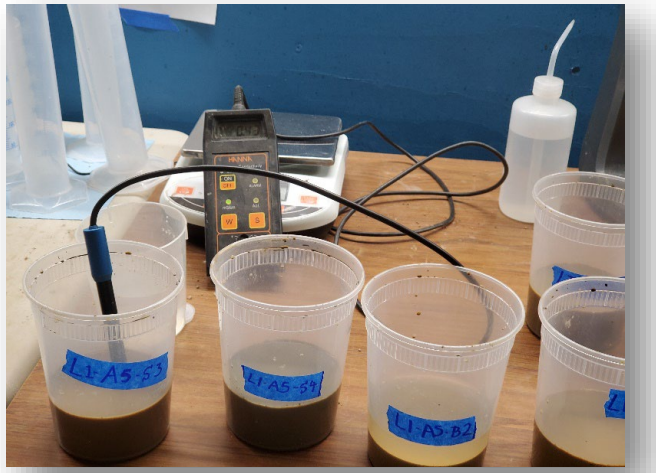
<u>Results</u>

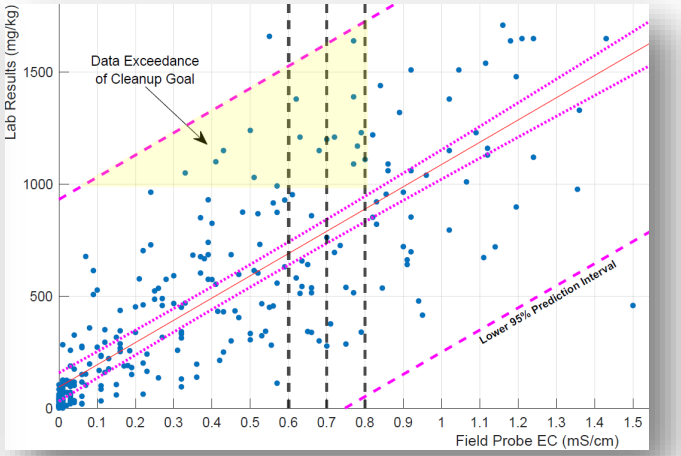
Use of field probe target of 0.6 mS/cm **<u>met cleanup goal for 100%</u>** of all Lab Confirmatory Samples.

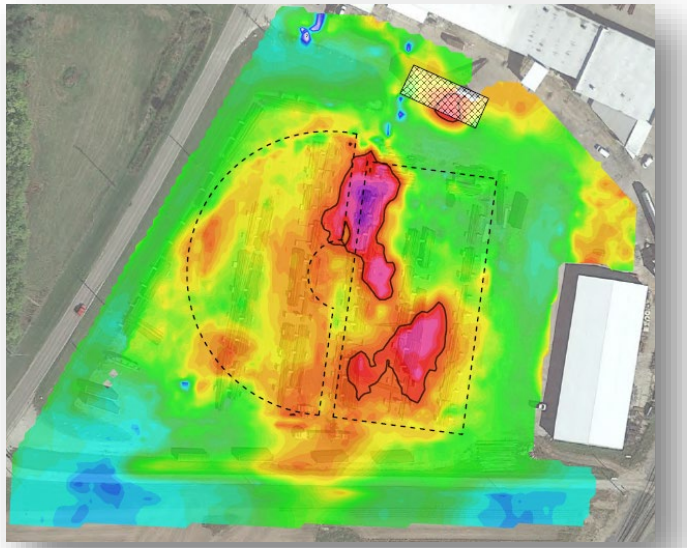


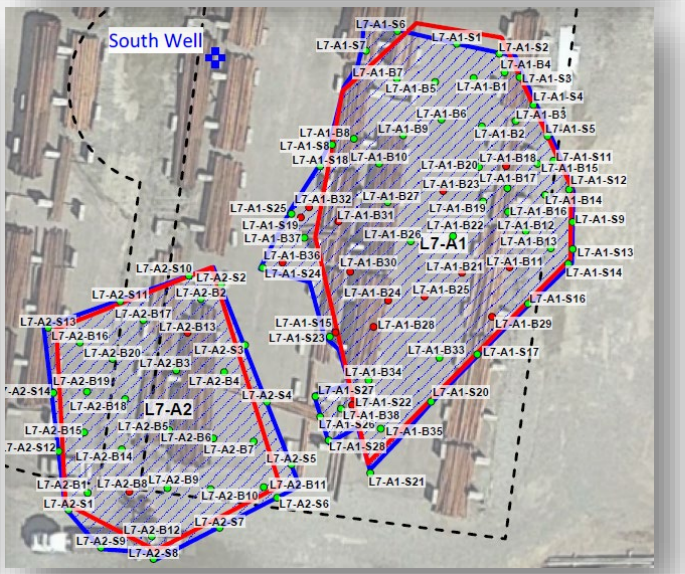
Conclusion

1) Site Delineation – Remedial Planning
2) Data During Remediation
   a) **Collect & Analyze** Effectively
   b) **Communicate** – Justify Modification
   c) Increase **Efficiency** & Decrease **Costs**









THANK YOU!

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