

# ***Use of Ground Penetrating Radar (GPR) to Locate Contaminant Beneath Railroad Track***

**Jim Hyslip – HyGround Engineering**

**Christopher Oakes – Norfolk Southern**

**Russell McDaniel – Norfolk Southern**

**Kenneth Battyanyi - WSP**

**Railroad Environmental Conference  
University of Illinois, Urbana-Champaign  
28 – 29 October, 2014**



# Outline

- ▶ Basis for the Work – Derailment and Aftermath
- ▶ Track Substructure
- ▶ Ground Penetrating Radar (GPR)
- ▶ Remediation
- ▶ Conclusions



Arcadia, OH  
February 6, 2011



# Release and Site Characteristics

## ➤ Denatured Ethanol

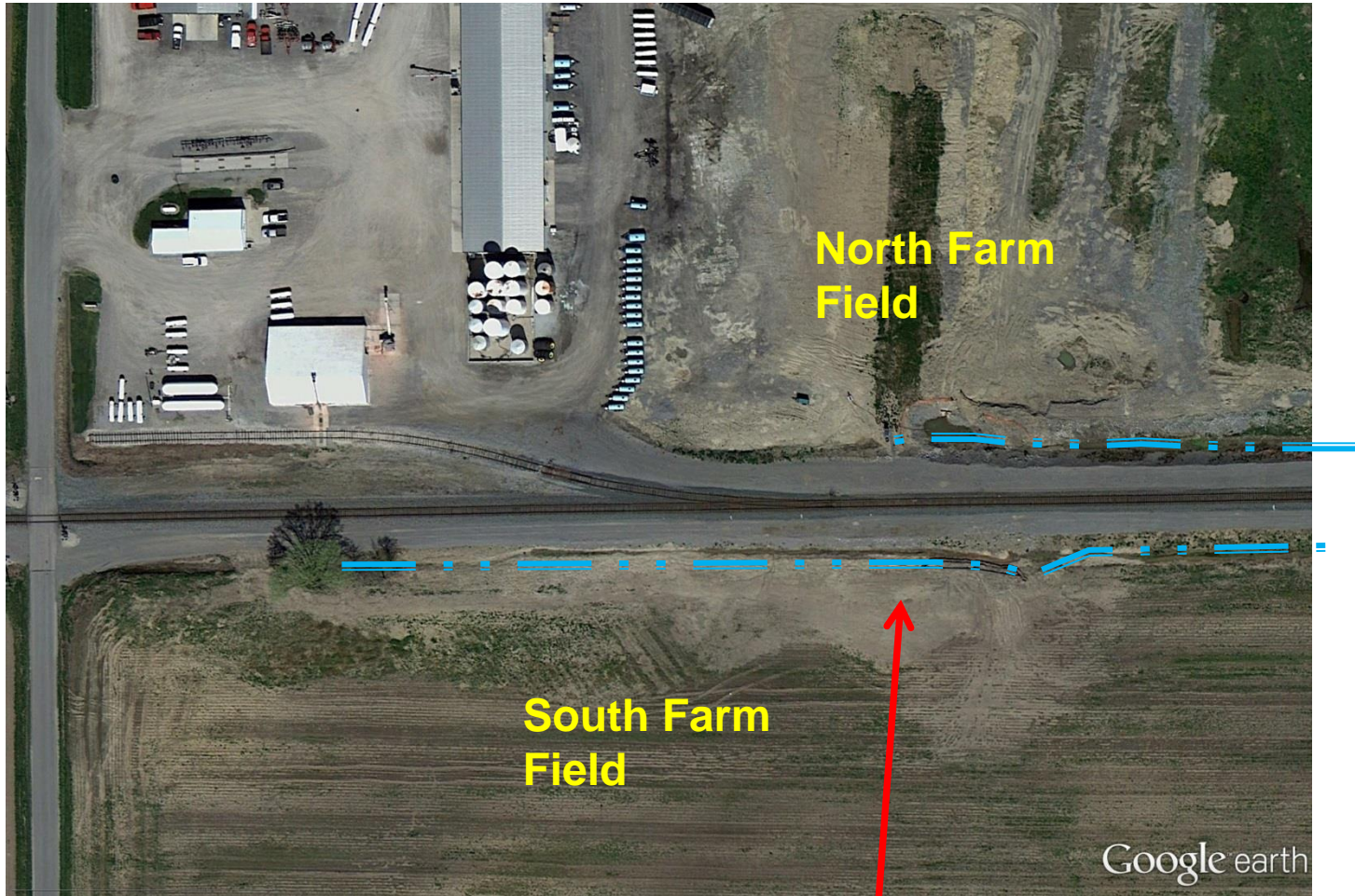
- No Regulatory Standard for Ethanol
- 2% - 5% Natural Gasoline (Low octane)
- Contains BTEX which are the regulated compounds

## ➤ Geology

- Elevated track bed with perched water
- Below track bed is a 35 foot clay later about 10 feet below grade
- True groundwater is over 50 feet



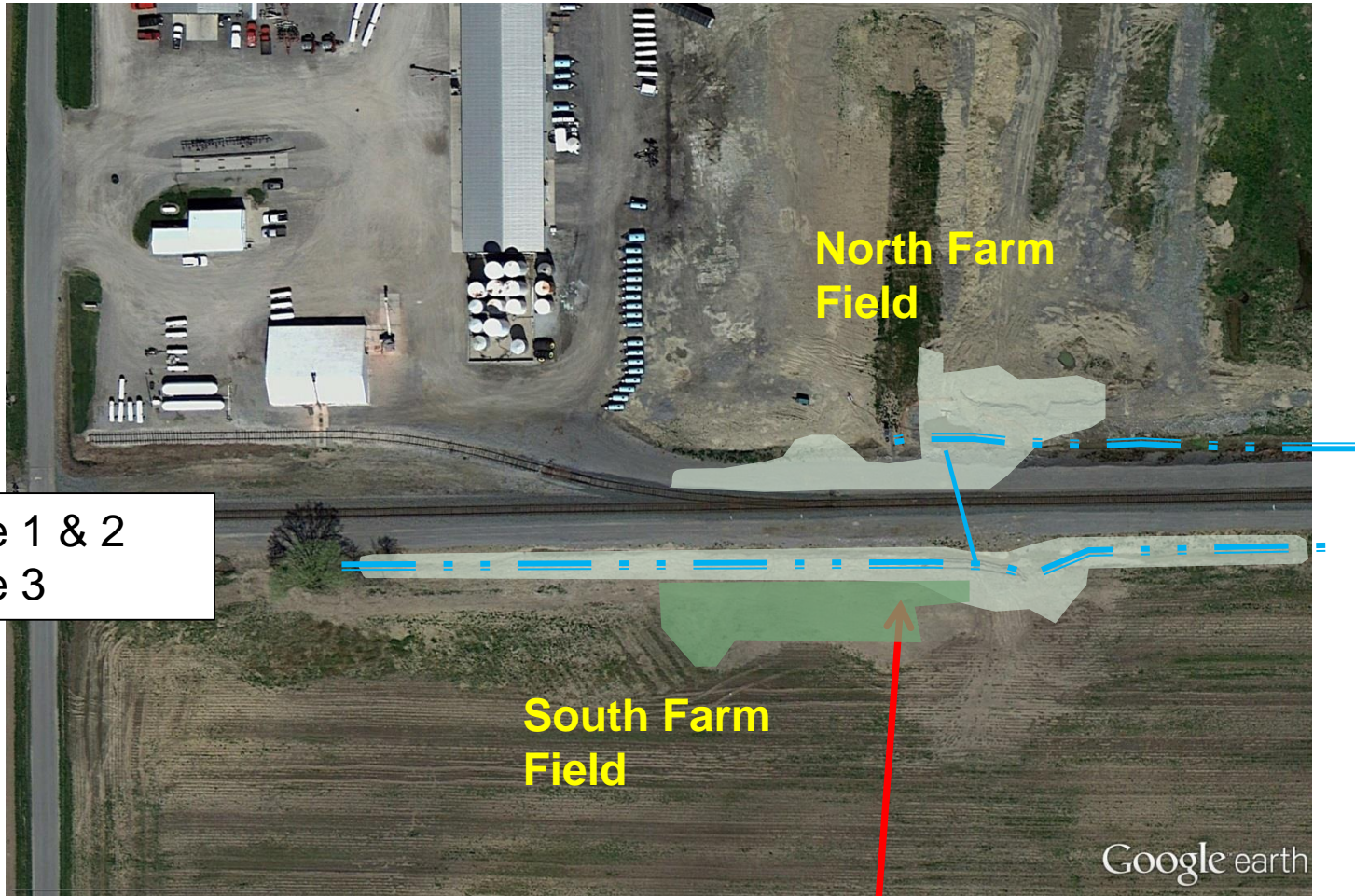
# Site Areas



Derailment Area



# Are we Done Yet??



Phase 1 & 2

Phase 3

South Farm Field

North Farm Field

Google earth

Derailment Area



# Long-Term Issues



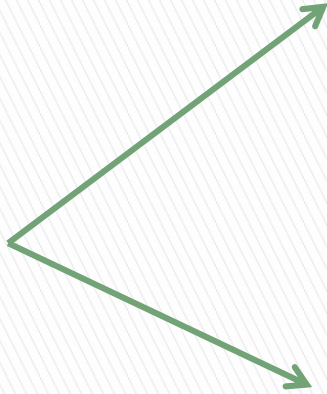
- Seeps Continued from Beneath Track Bed
  - Affected D.O. in Surface Water
  - Impacted Sediment in Drainage Ditches

# Not Done!!

## What about beneath the track???

▶ How to investigate this area AND minimize track closure??

▶ Where is the mass??



Already understand the geology; low perm layer likely trapping mass

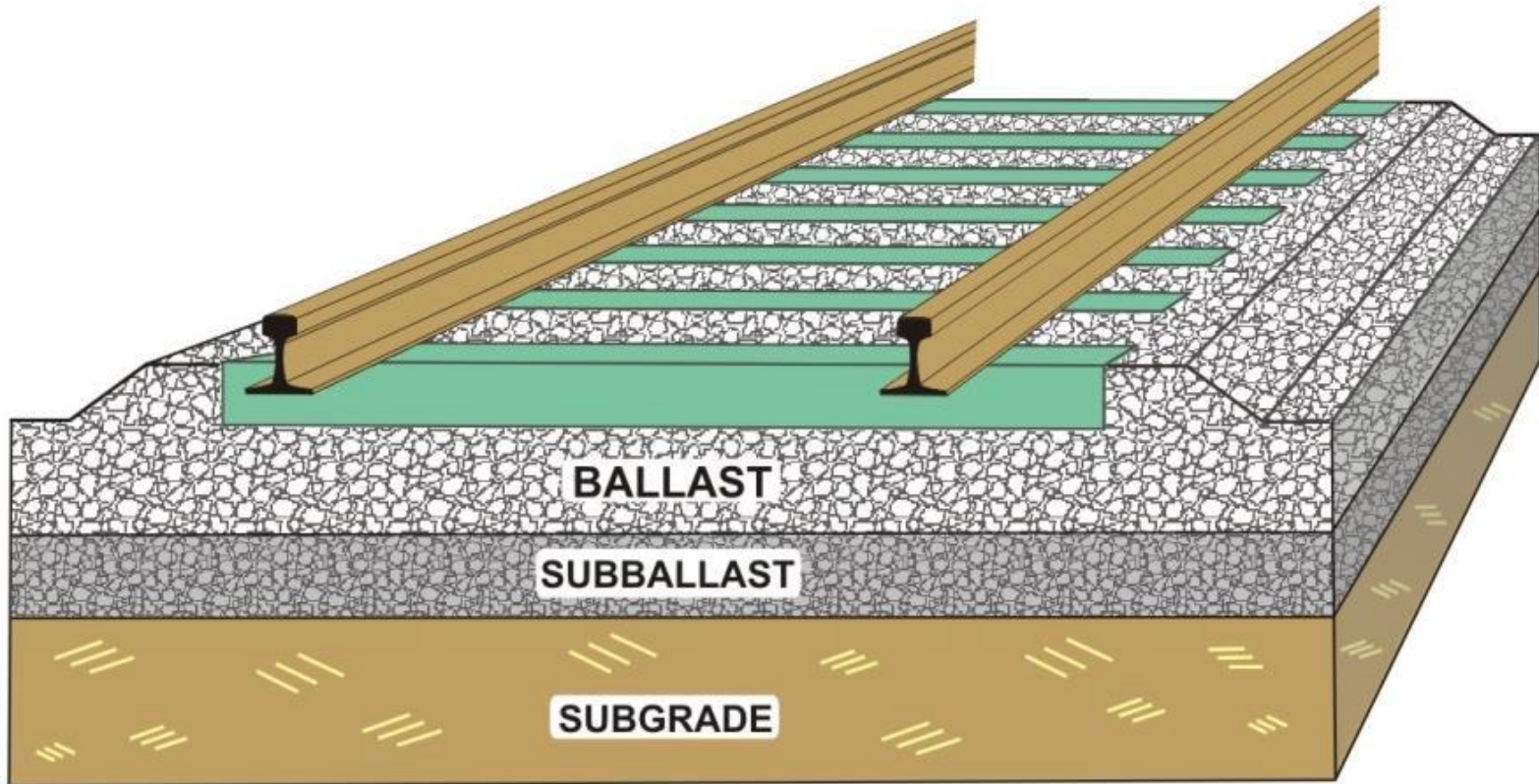
Seepage due to perched water in track; deplete of oxygen

Typical methods=3 weeks

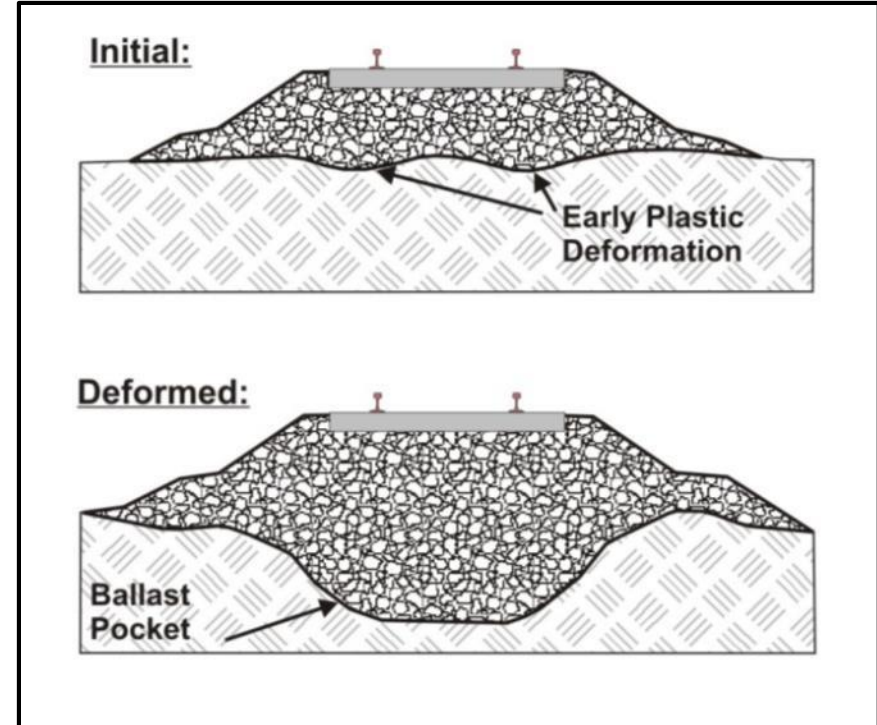
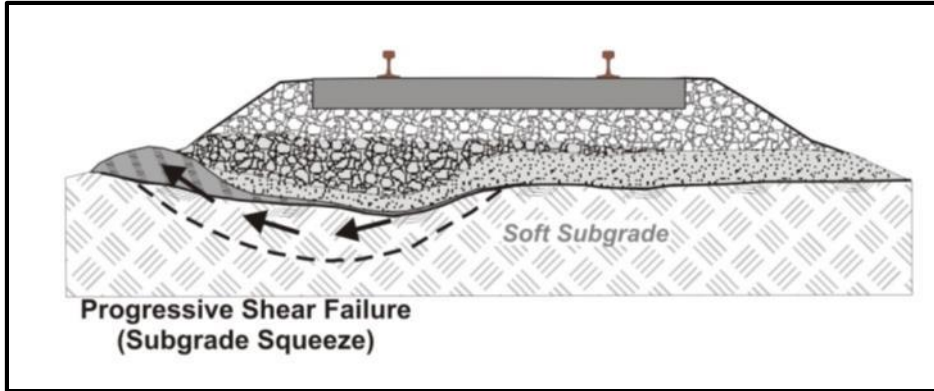
Innovative method=1 day



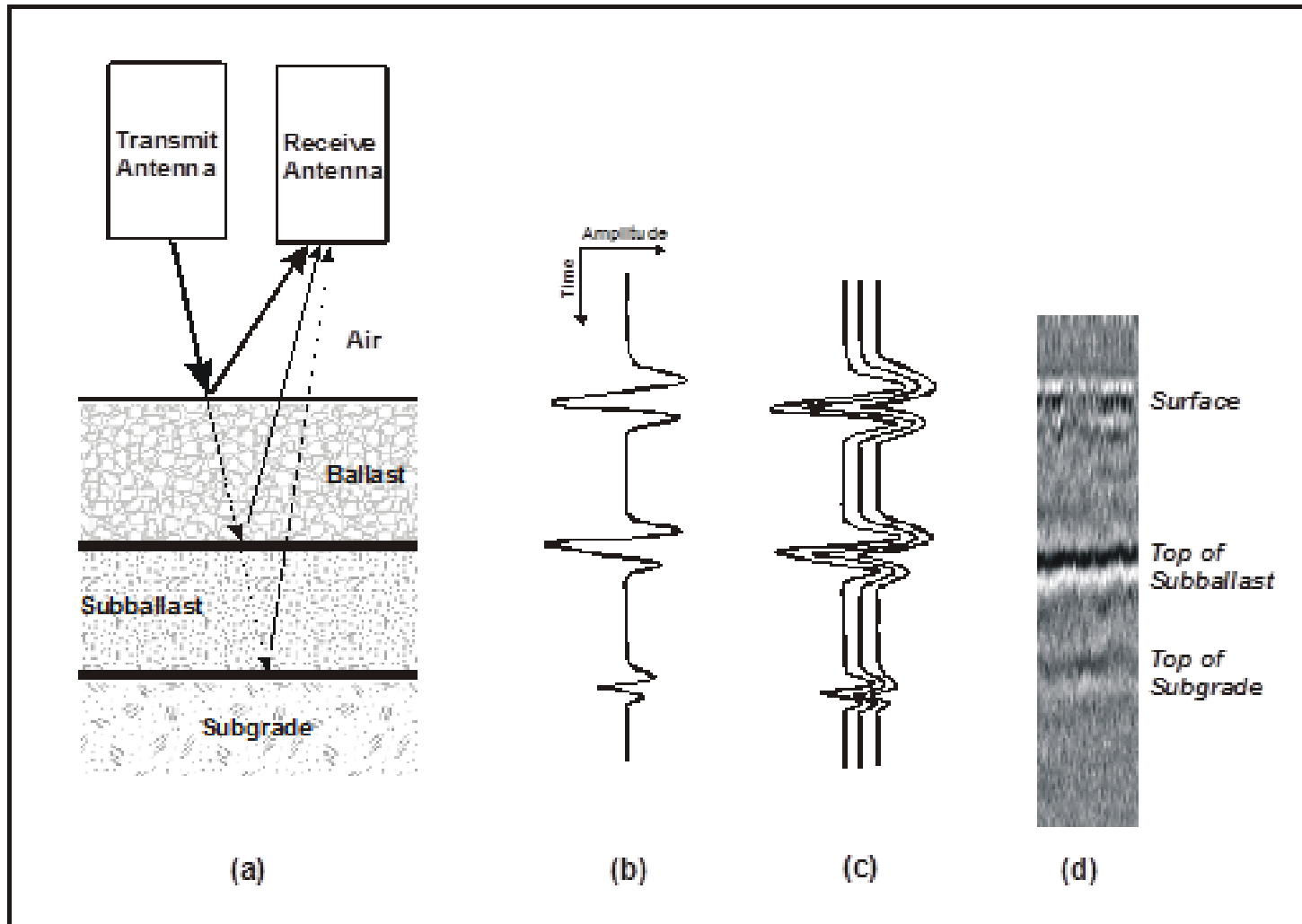
# Track Substructure



# Track Substructure Deformation

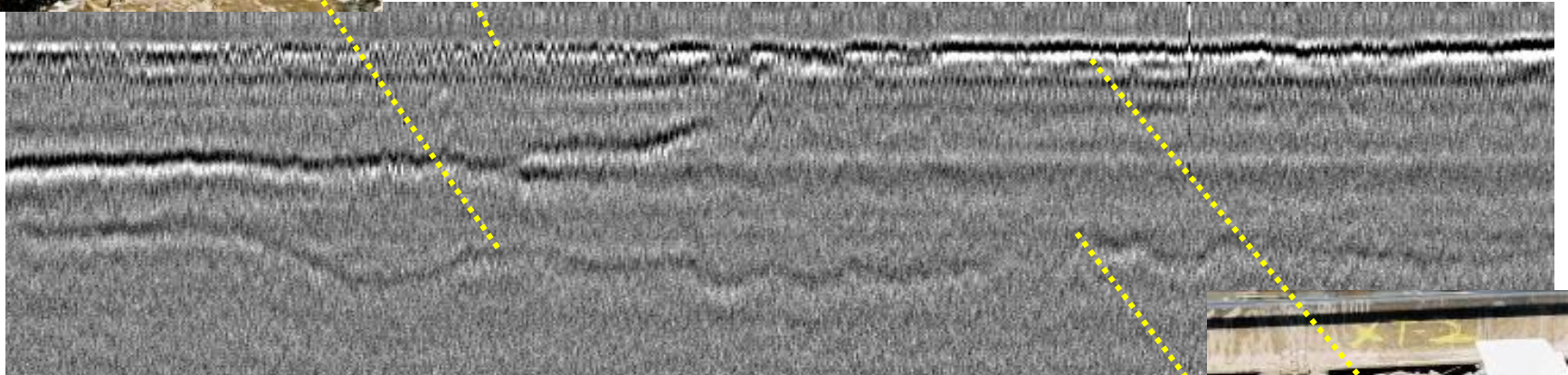


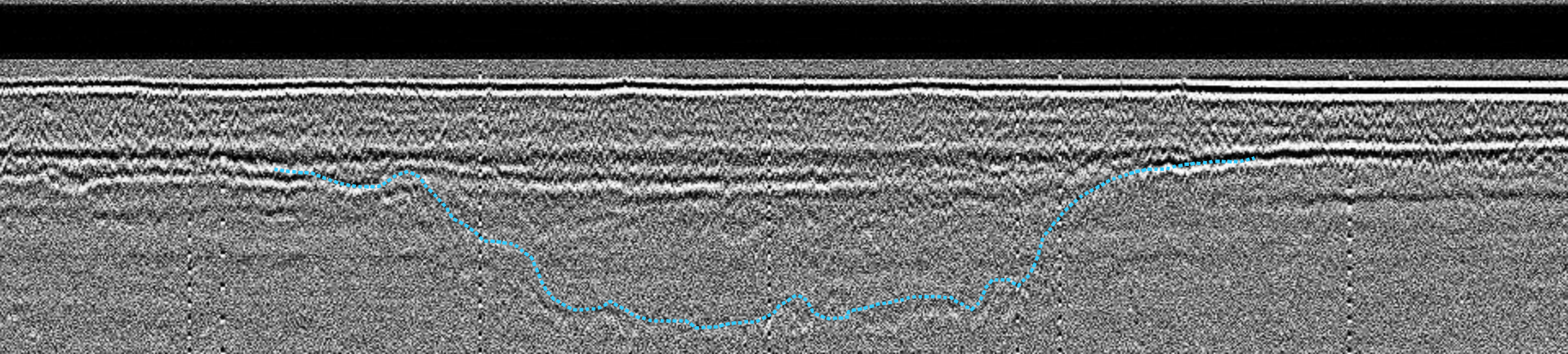
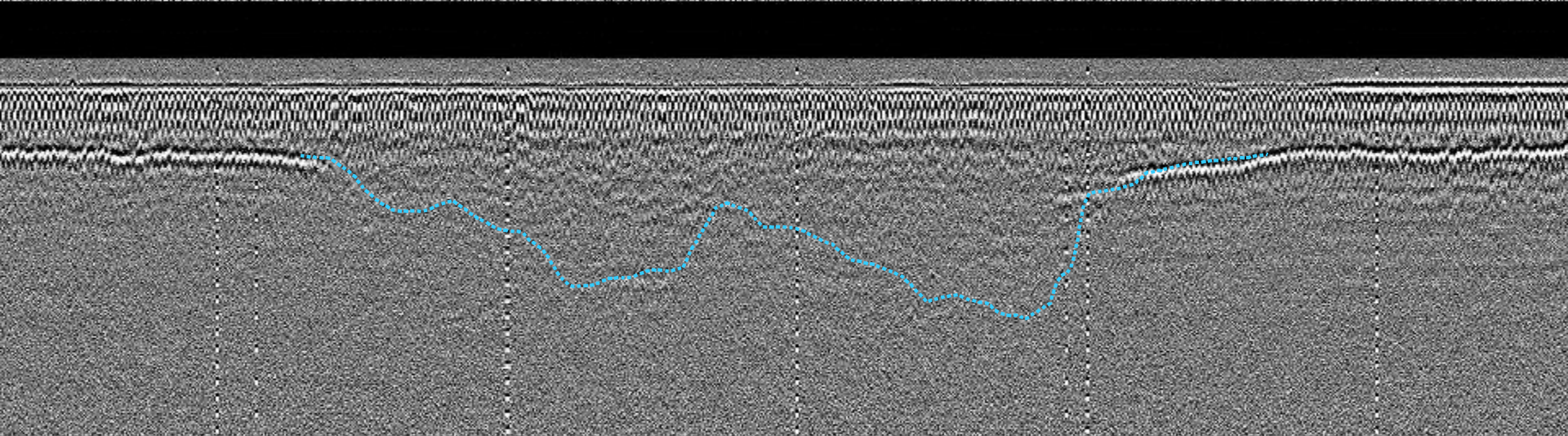
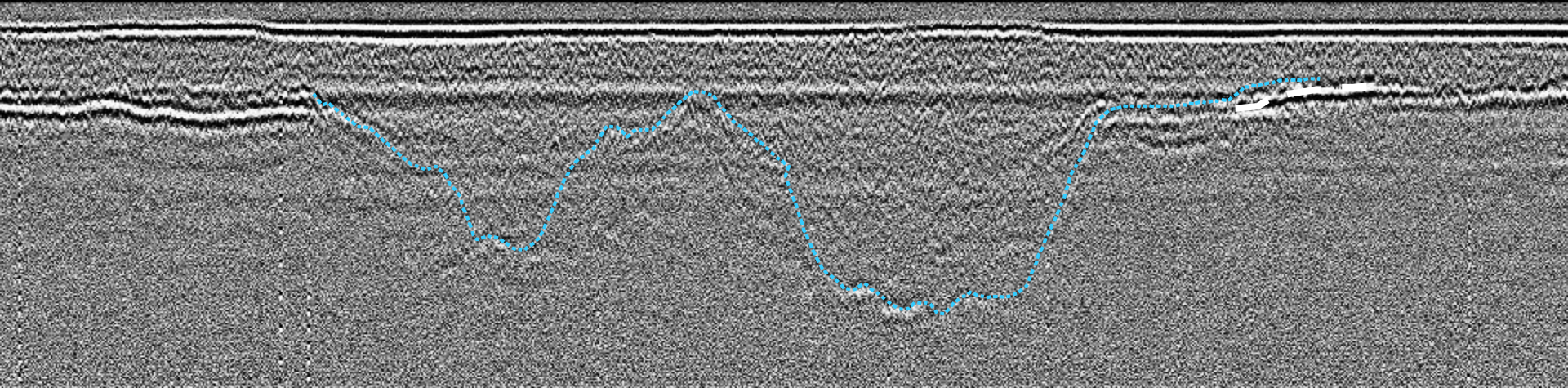
# GPR Technique



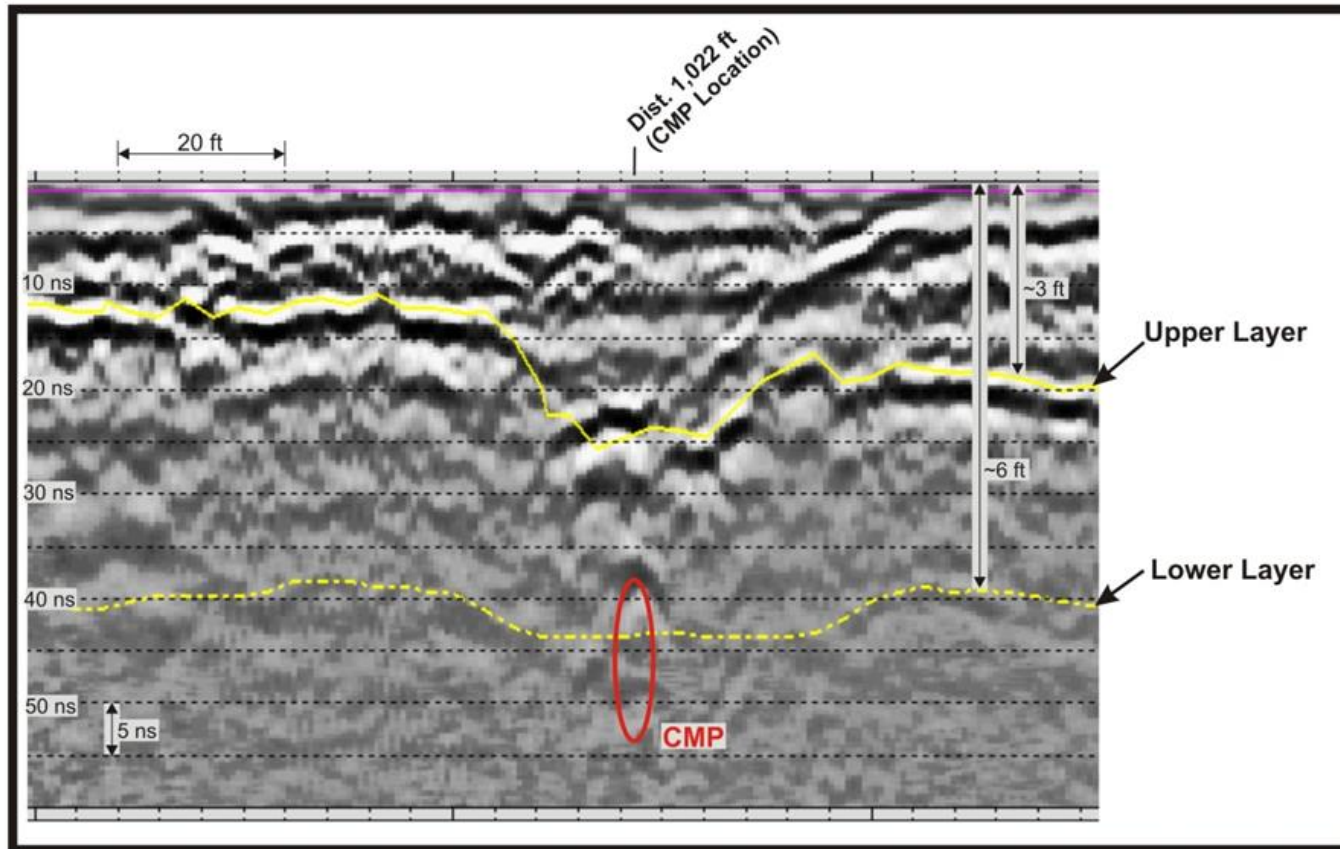
# GPR Inspection System







# GPR Results – Arcadia



# Subgrade Surface Contours - Arcadia

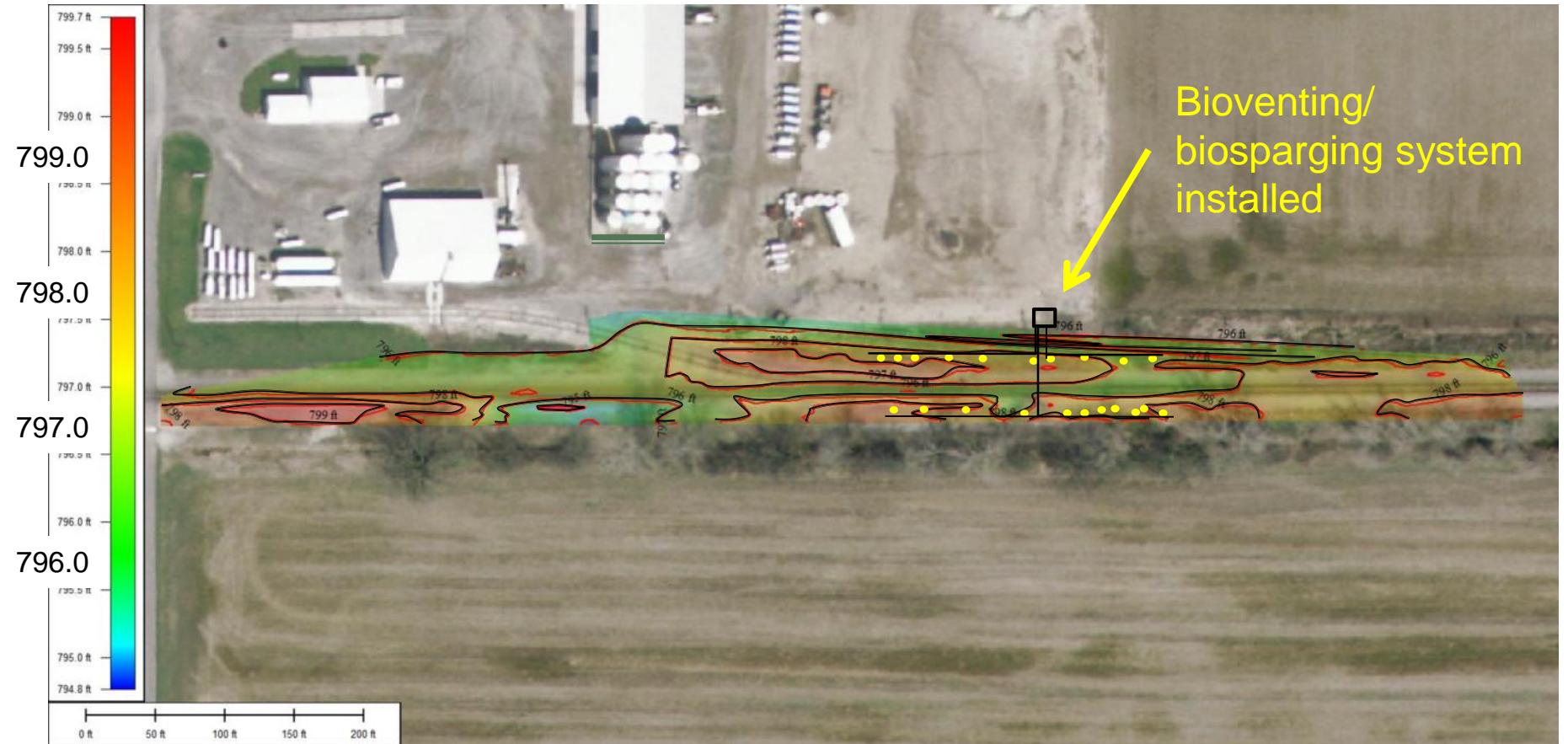




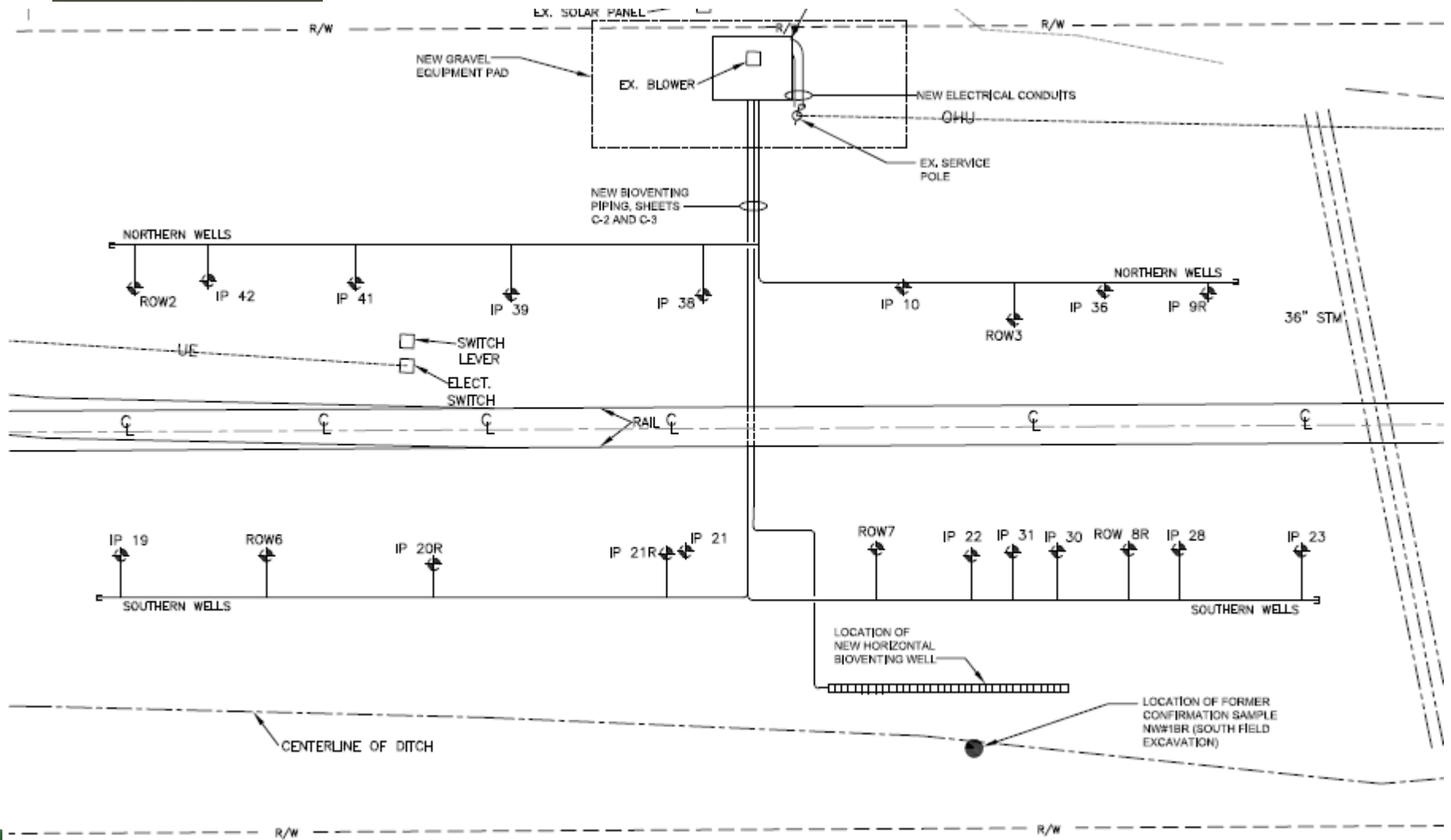
# Subgrade Surface Contours - Arcadia



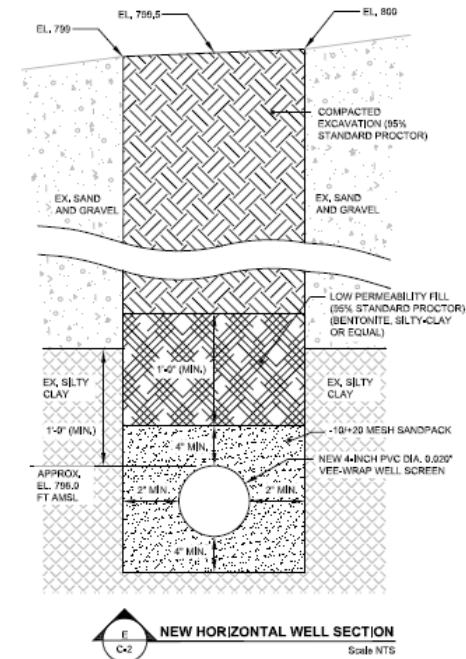
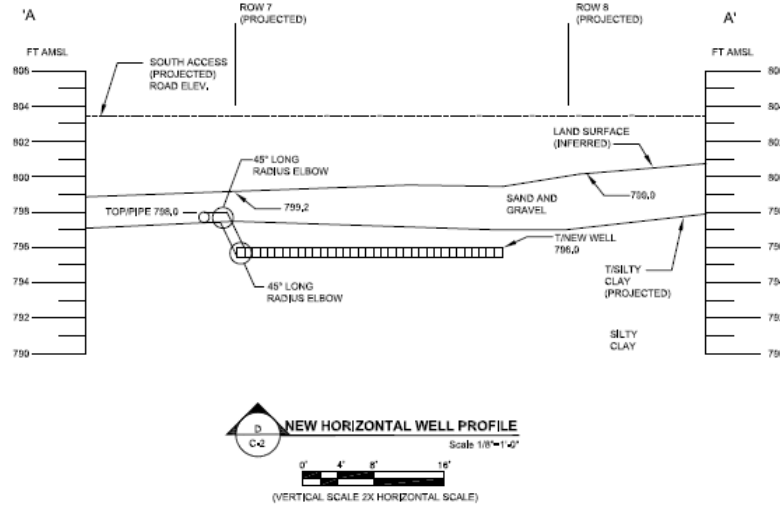
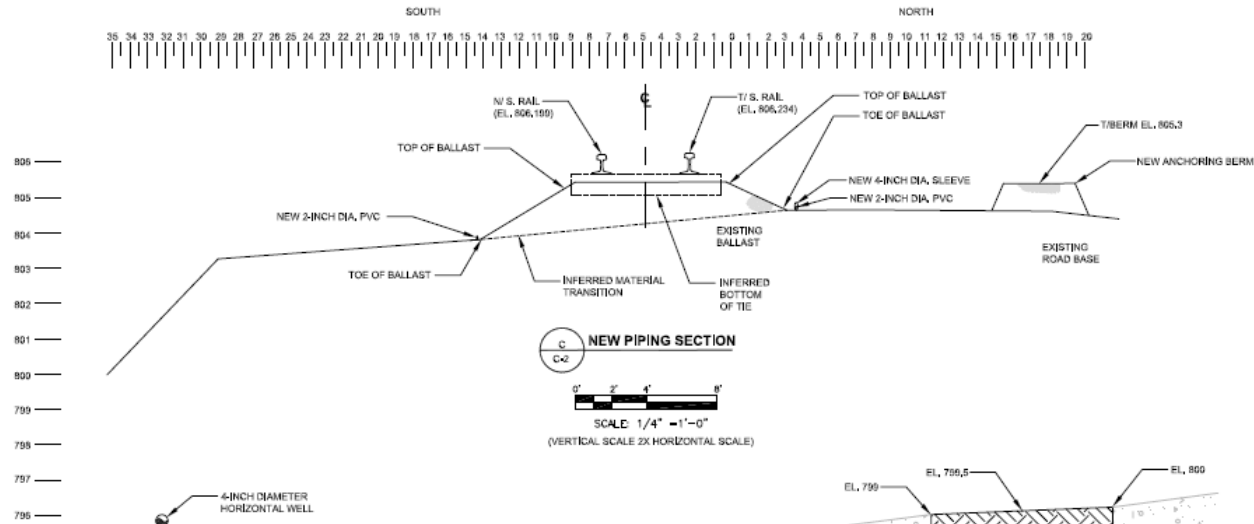
# Subgrade Surface Contours - Arcadia



# As-built



# As-built



# Conclusions

- Using GPR allowed
  - MINIMAL TRACK SHUTDOWN (low loss of revenue)
  - Observation of the low permeability zone without creating waste
  - Was part of characterization of nearly 3 acres in less than 1 day
  - Provided Real-Time Actionable Data
- GPR Information Used to Aid in the Design of the Final Remedial System (placement of bioventing points)

