APPLICATION OF ERT AND IP FOR IMAGING BURIAL PITS AT MUNITIONS REMEDIATION SITES

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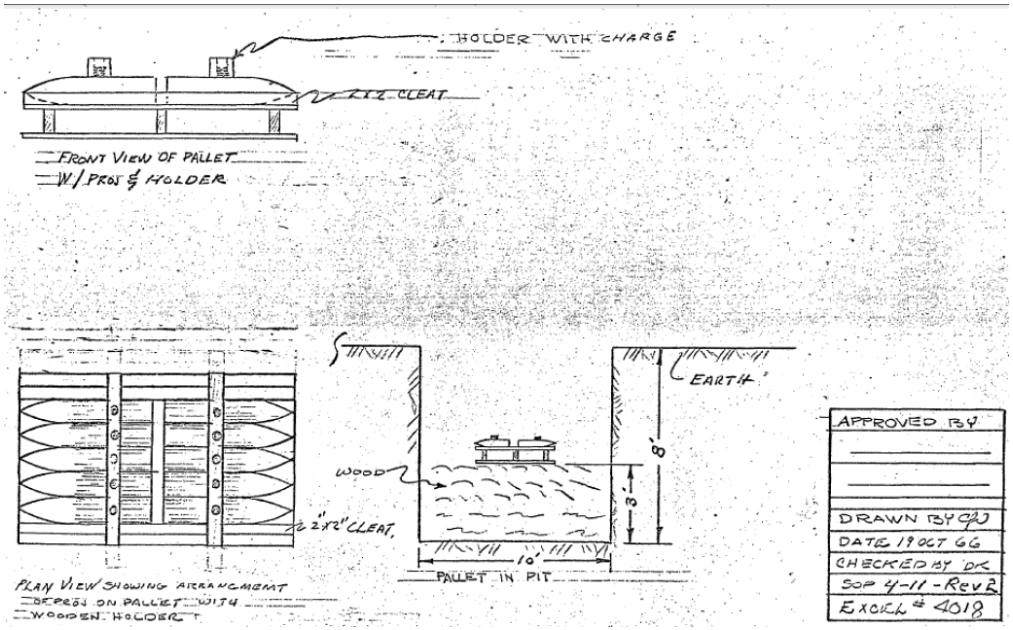
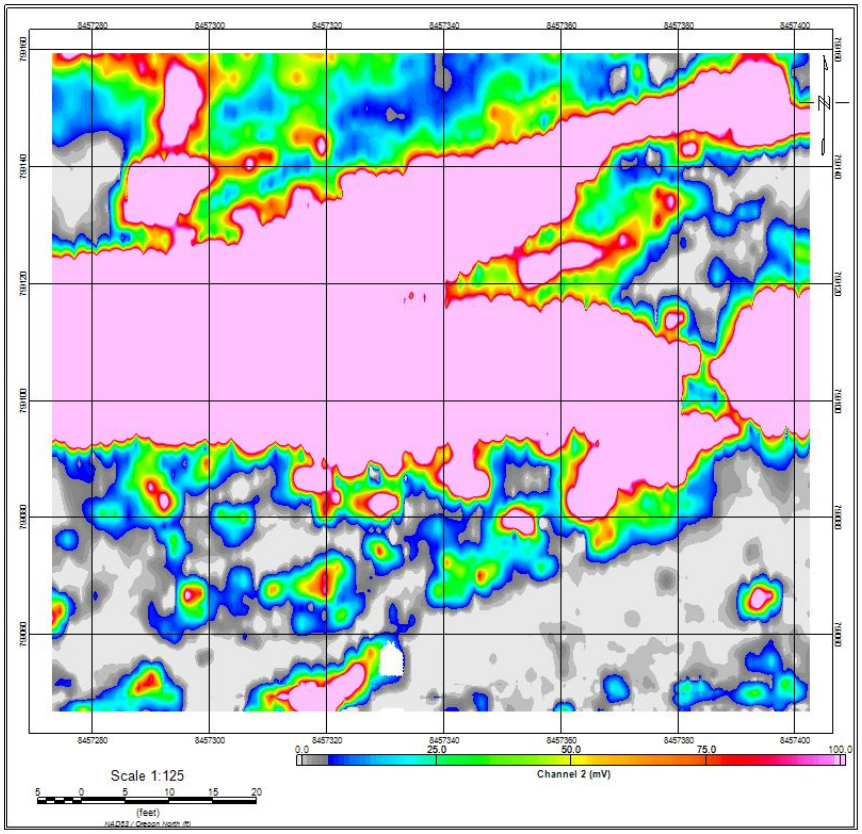
BACKGROUND

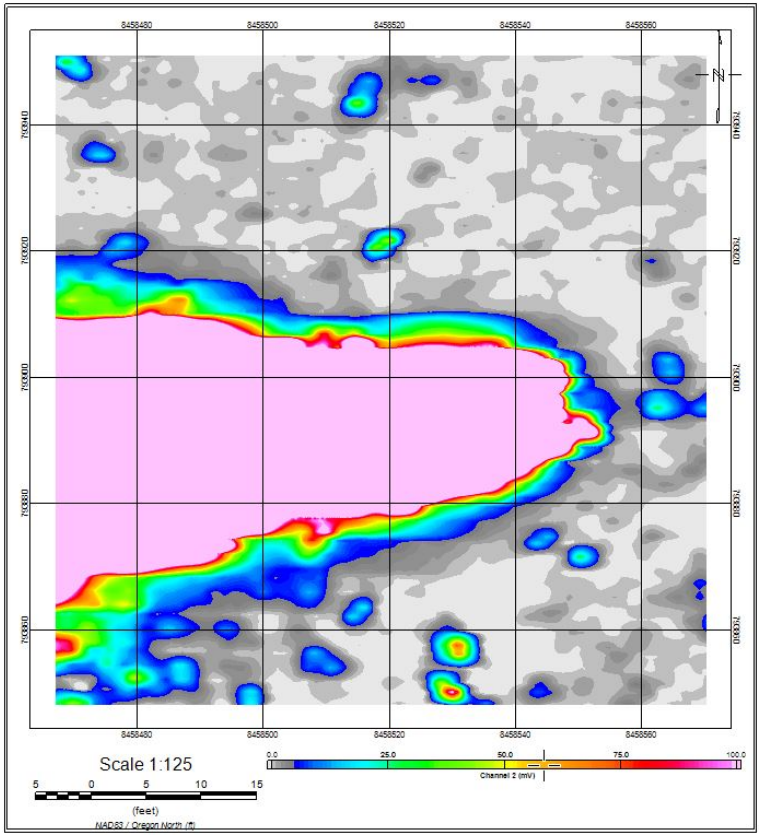
1. Open Burn / Open Detonation
2. General Burial Trenches/Pits



BACKGROUND

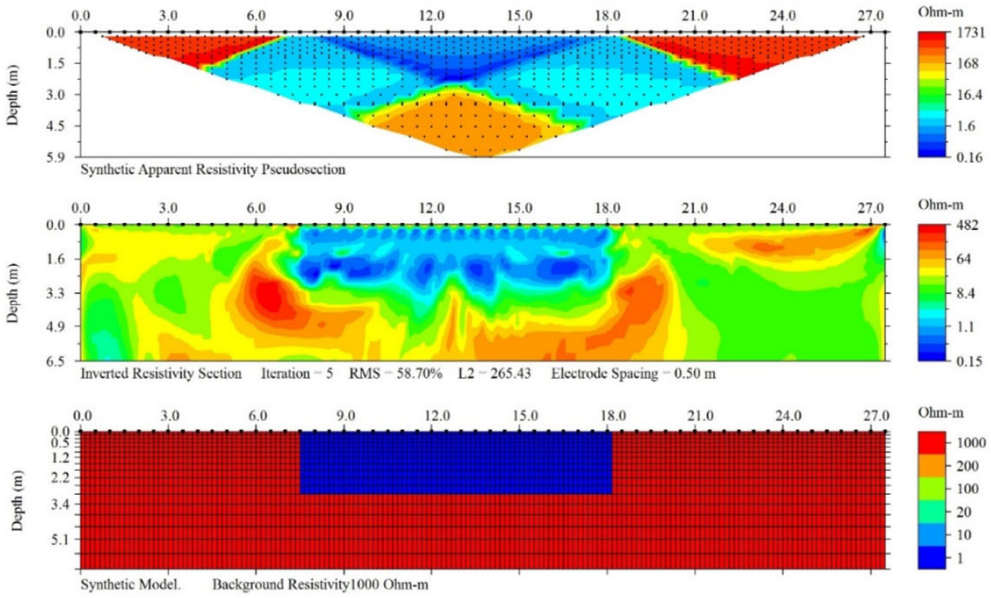
Saturated Response Area (SRA) – Dense target population.

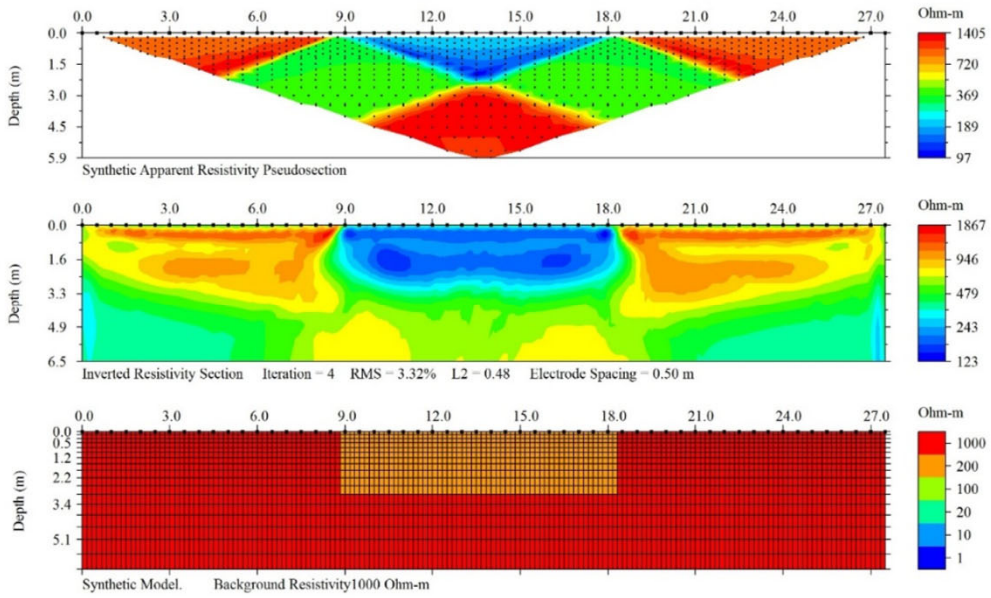




APPLYING ERT

- Synthetic robust modeling results
  - High resistivity contrast RMS > 50% at 5 iterations
  - Low resistivity contrast RMS 3.3 at 4 iterations



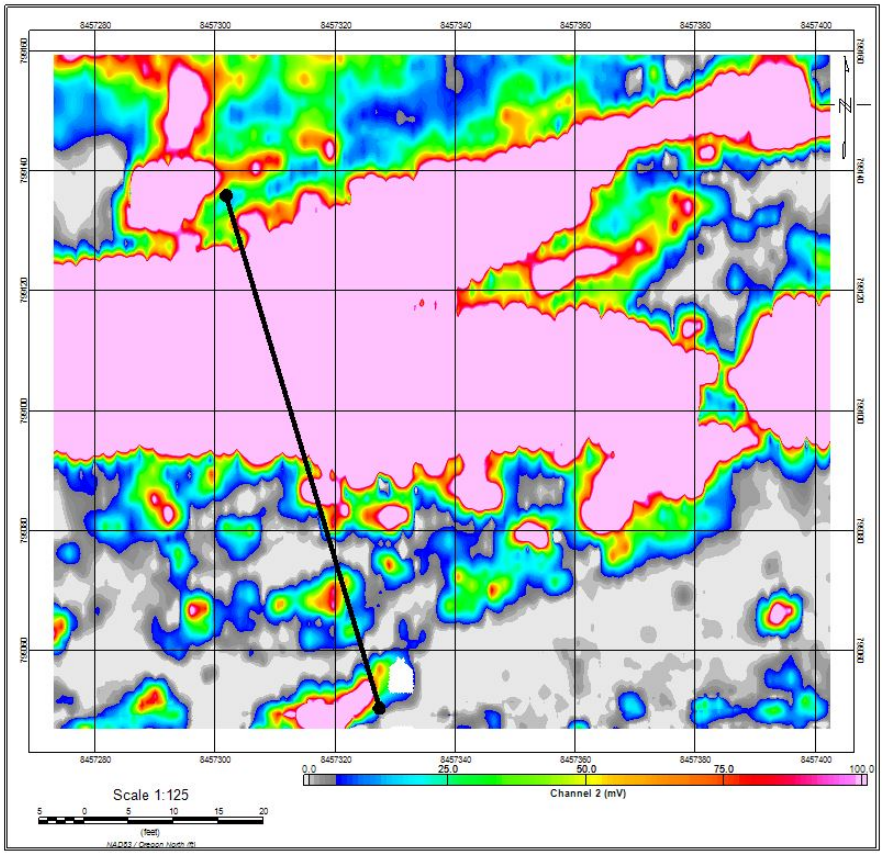


SITE CONSIDERATIONS

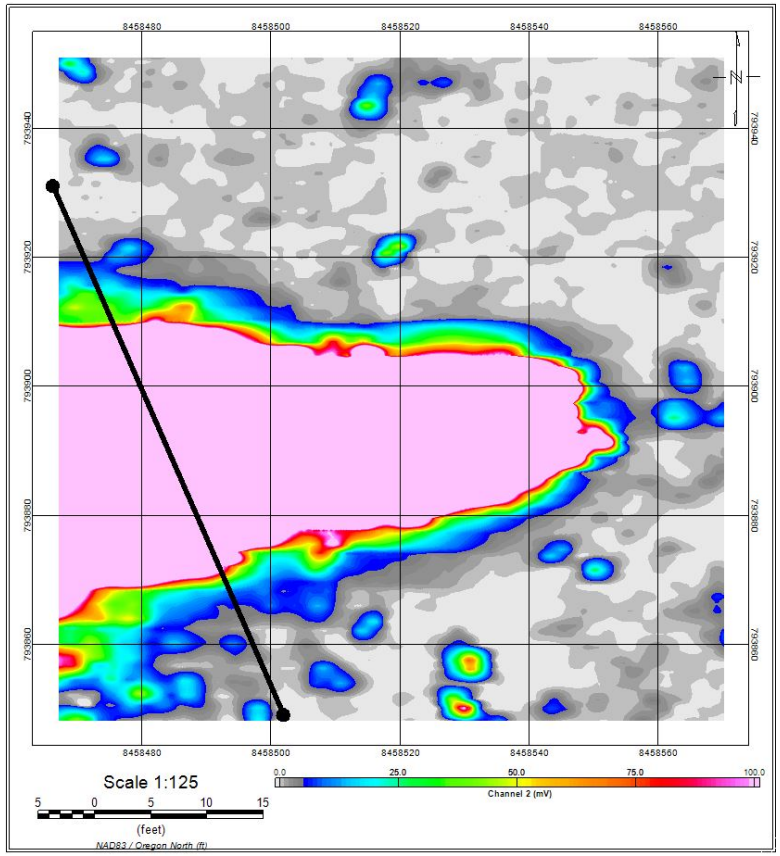
- MMRP hazards and safety
- Accessibility of site.

ERT CASE STUDY – UMATILLA, OR

- 2 surficially similar SRAs chosen at random.



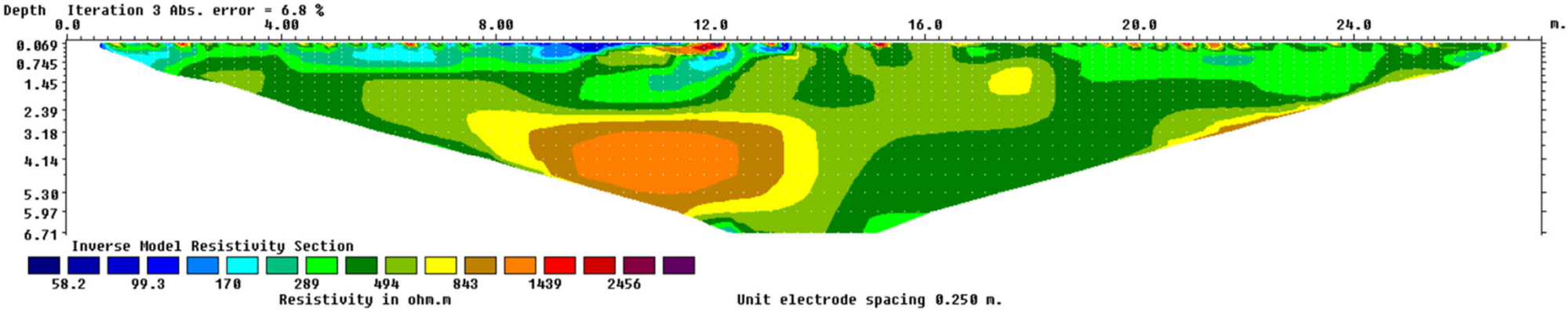
#1



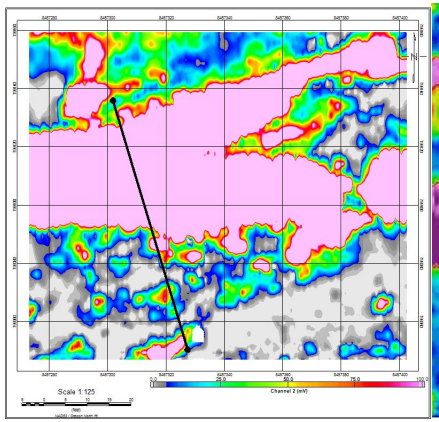
#2

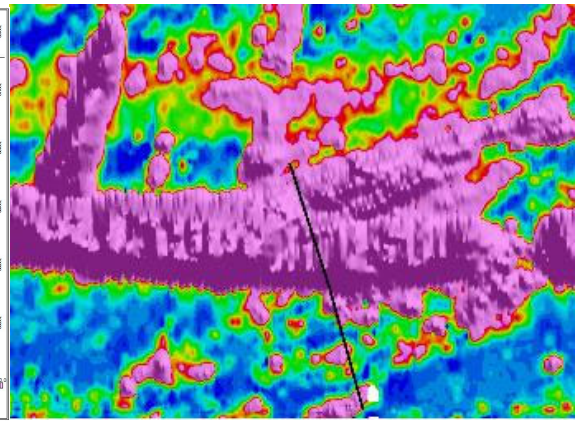
ERT CASE STUDY – UMATILLA, OR – SRA 1

#1: SRA cross-section with minimal vertical response.



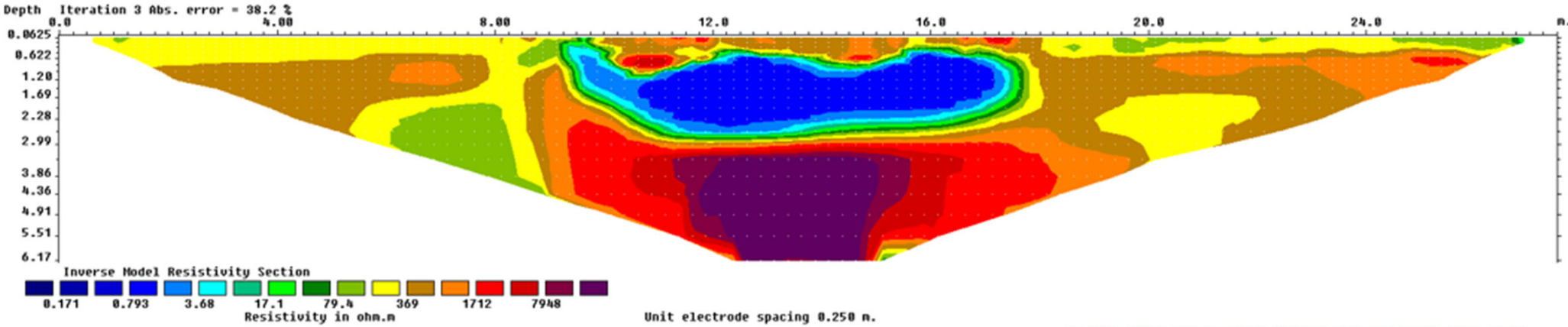
- Data collected with AGI supersting R8
- 56 Electrodes at 0.5 m spacing
- Non-intrusive electrode placement
- Dipole-Dipole array, standard system settings.

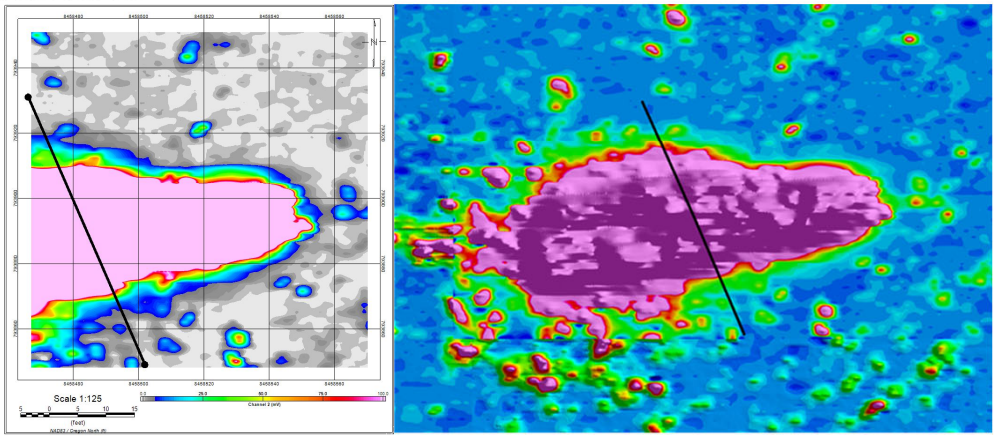




ERT CASE STUDY – UMATILLA, OR – SRA 2

#2: SRA cross-section with significant vertical saturation.





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- 56 Electrodes at 0.5 m spacing
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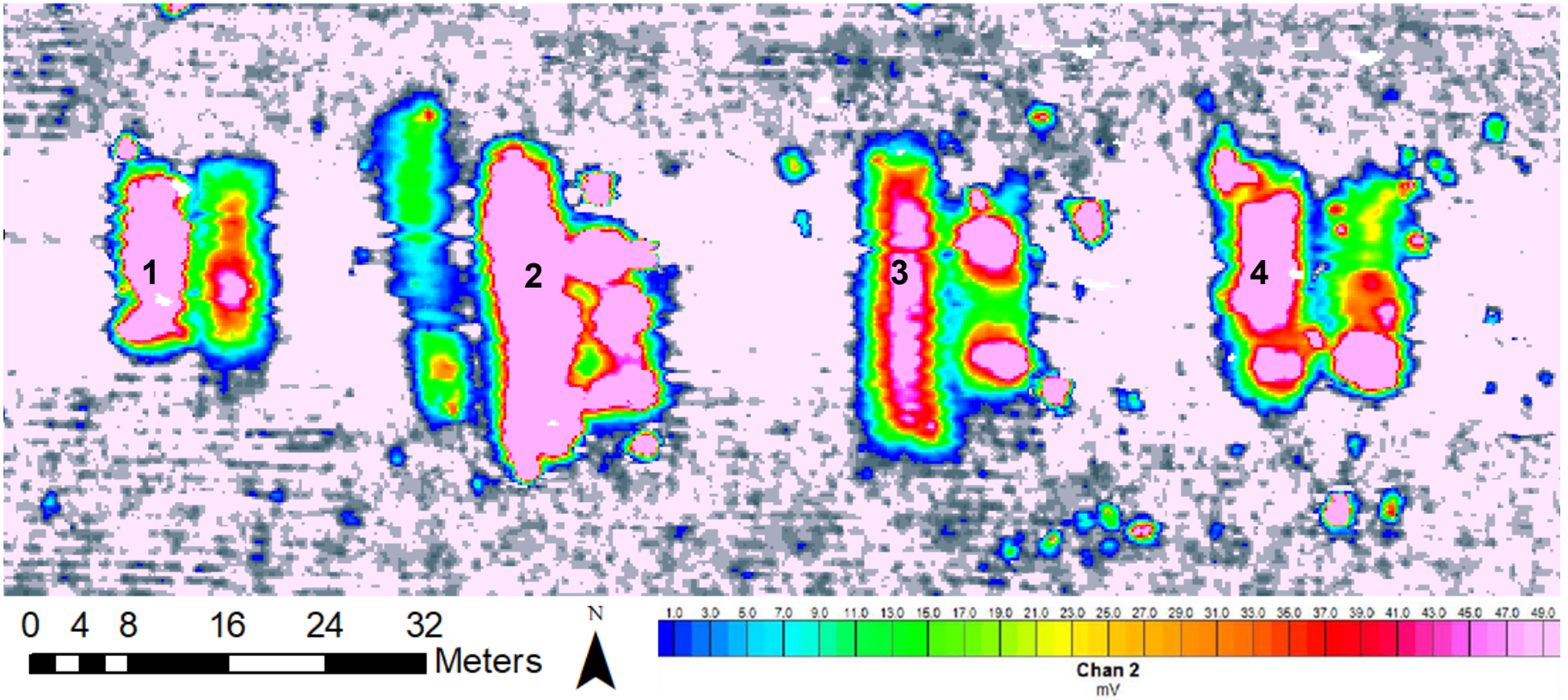
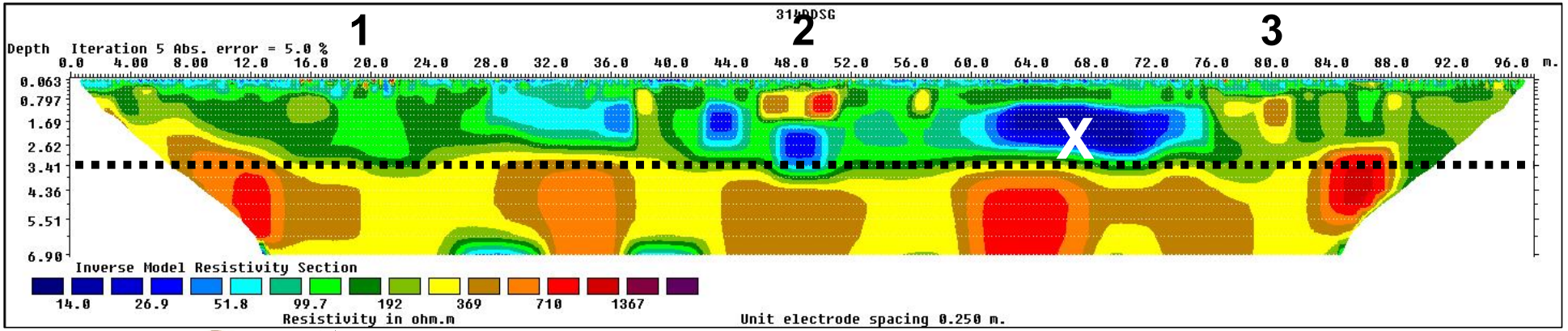
- Dipole-Dipole array, standard system settings.

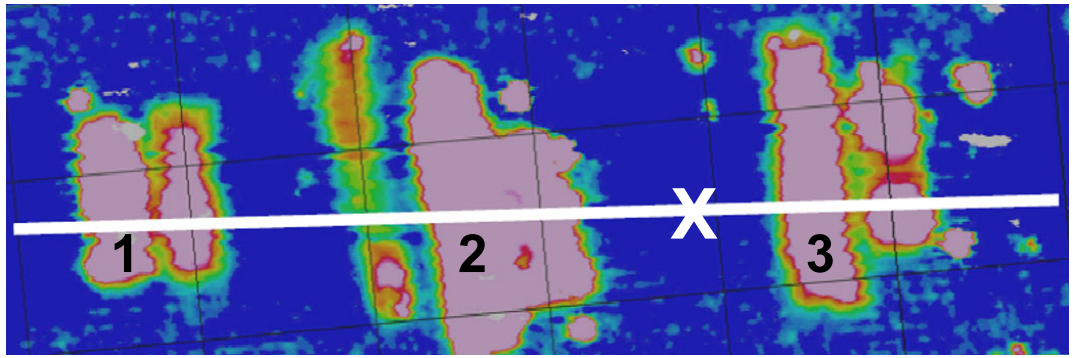
CASE STUDY - PUEBLO, CO

- 4 known disposal pits surveyed with ERT and IP.
- Depth and content data available from previous investigations.

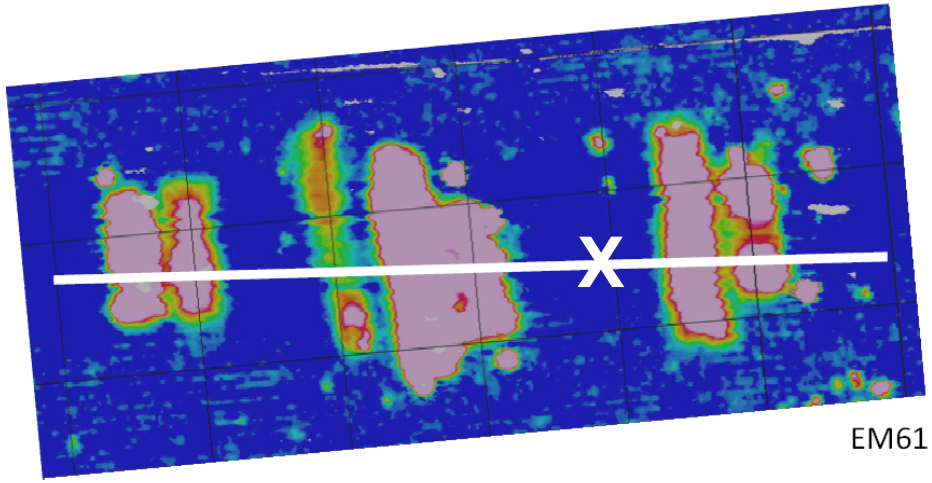


CASE STUDY - PUEBLO, CO – ERT TRENCH 1-3

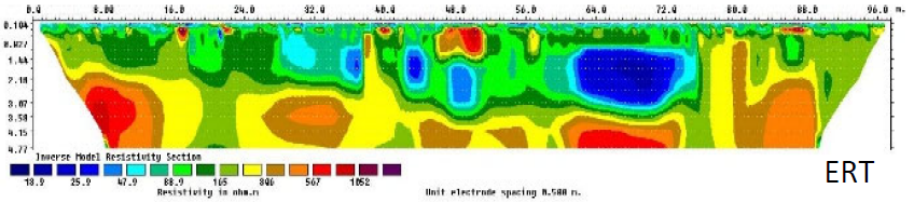




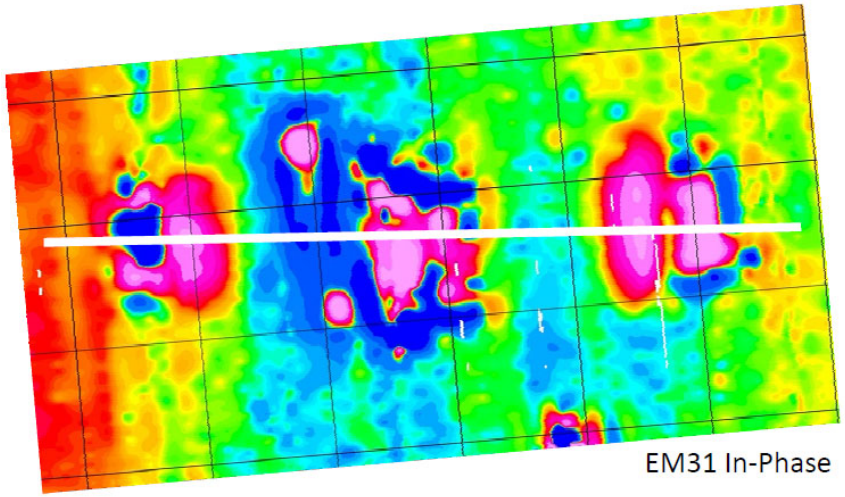
CASE STUDY - PUEBLO, CO – ERT TRENCH 1-3



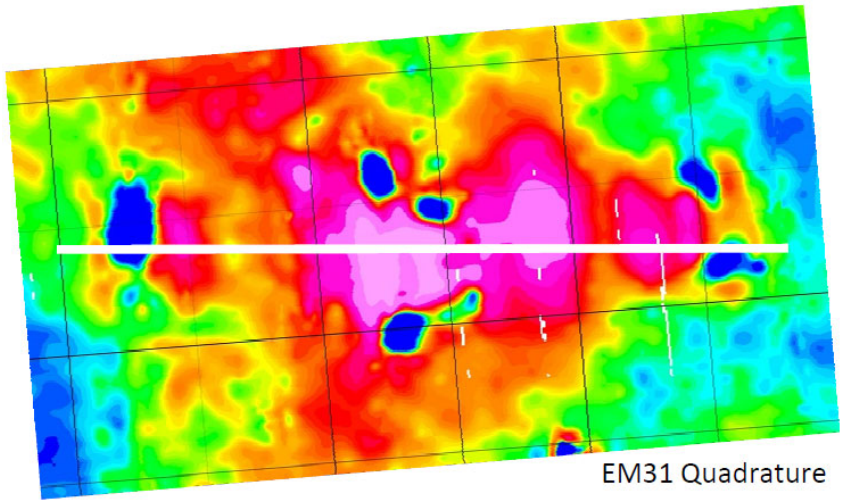
EM61



ERT



EM31 In-Phase

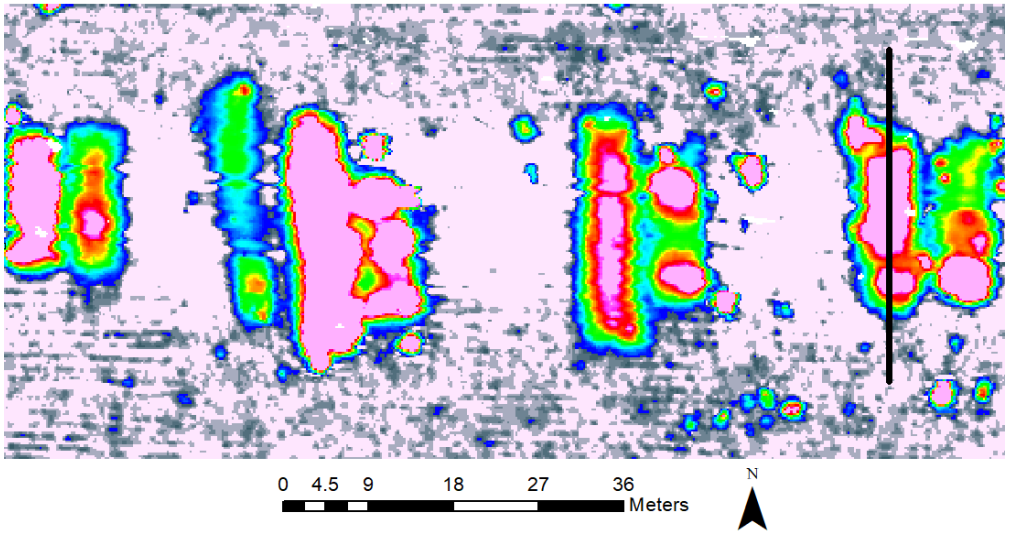


EM31 Quadrature

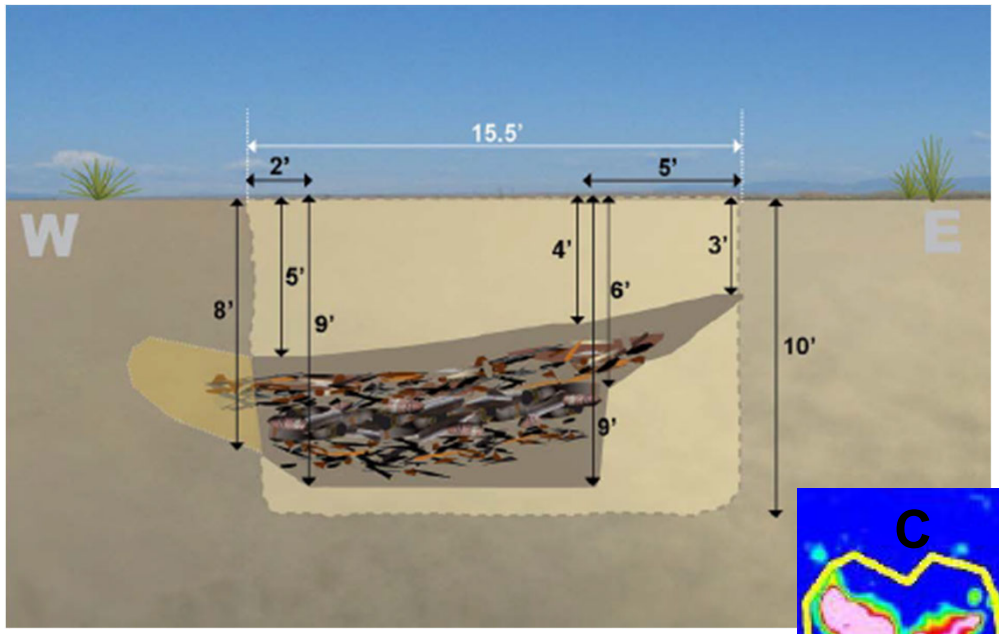
CASE STUDY - PUEBLO, CO – IP TRENCH 4

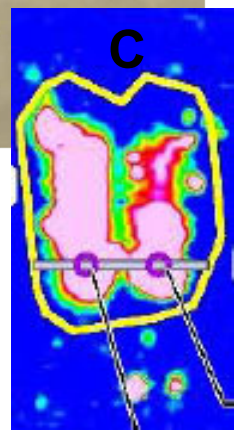
CASE STUDY - PUEBLO, CO – IP TRENCH 4

A



B

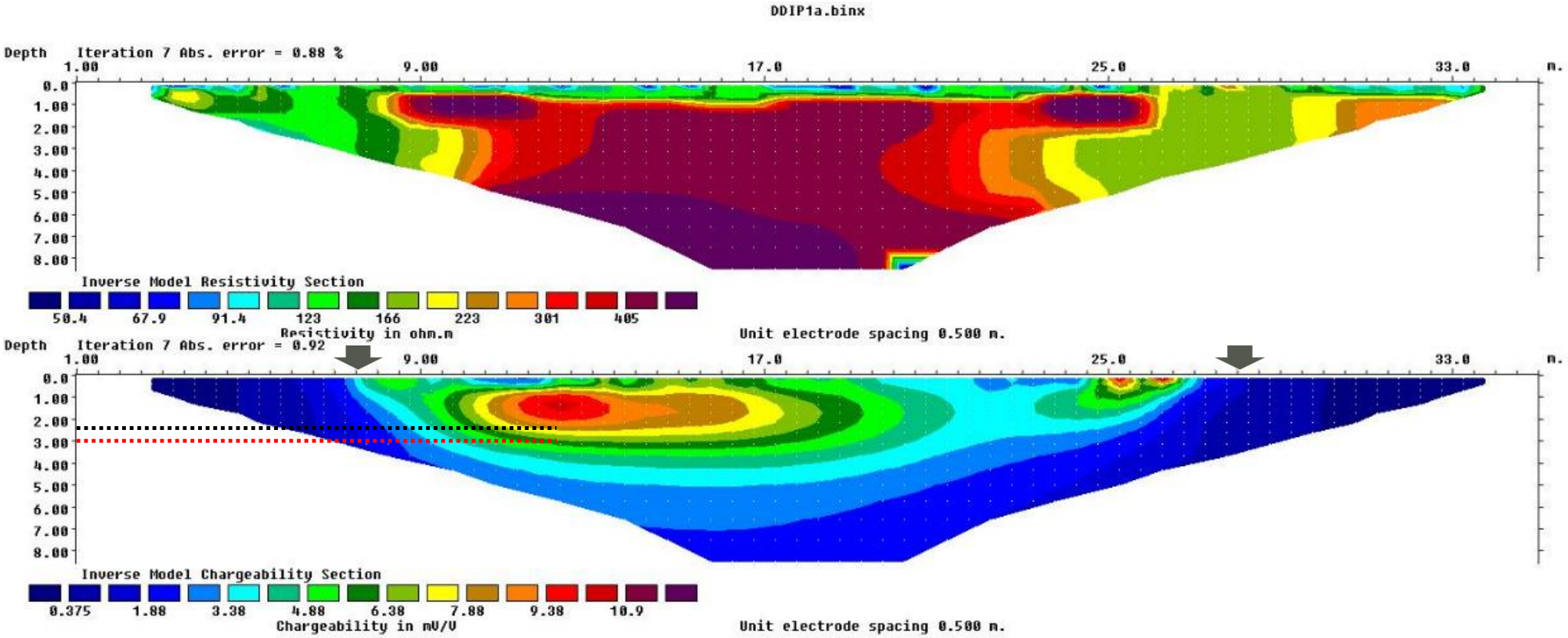




- Figure A: IP transect location.
- Figure B: Test pit findings.
- Figure C: Excavation location.

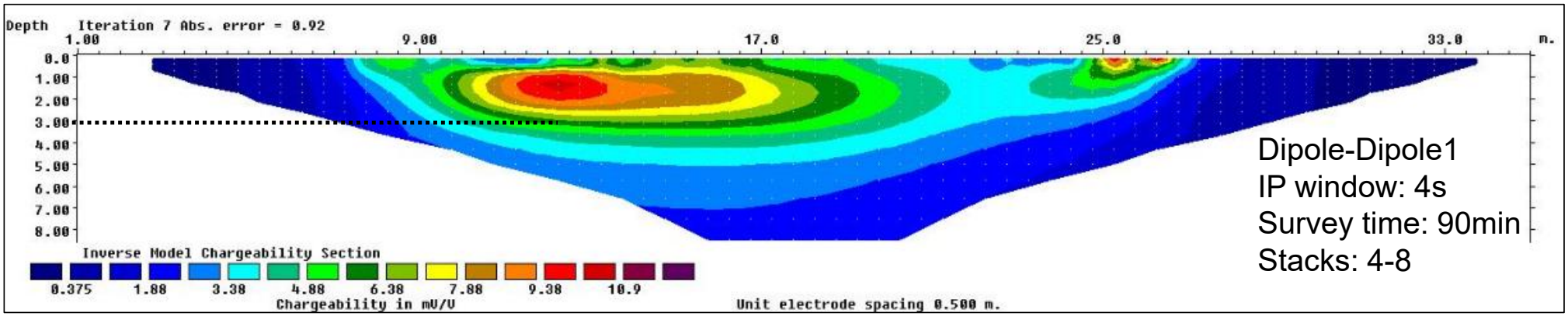
- Munitions disposal pit
- Items found at 4-7.5’ / 1.2-2.3 m
- Native soil reached at 10’ / 3 m
- 23 x 155mm bodies
- 1 x 4.2 inch mortar

CASE STUDY - PUEBLO, CO – IP TRENCH 4

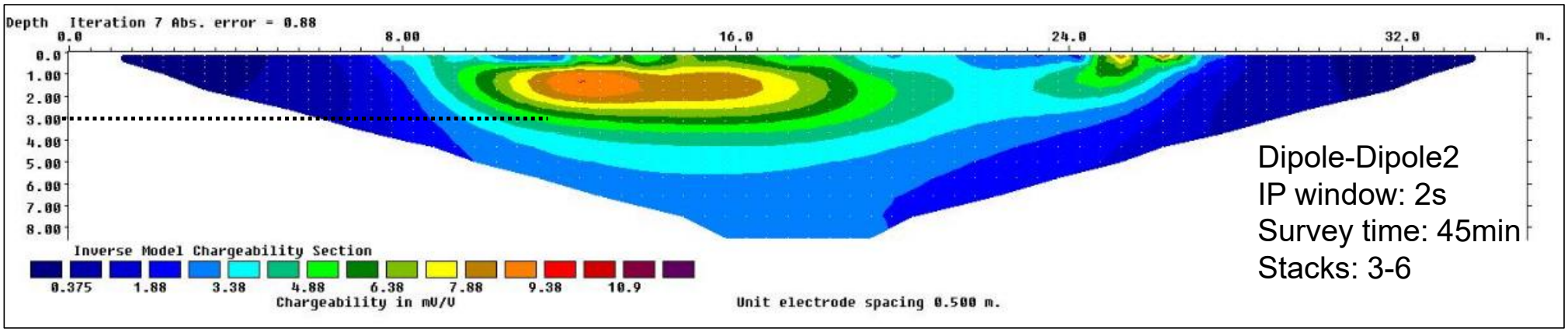


CASE STUDY - PUEBLO, CO – IP TRENCH 4

Data collection time analysis for deployment on MMRP projects.



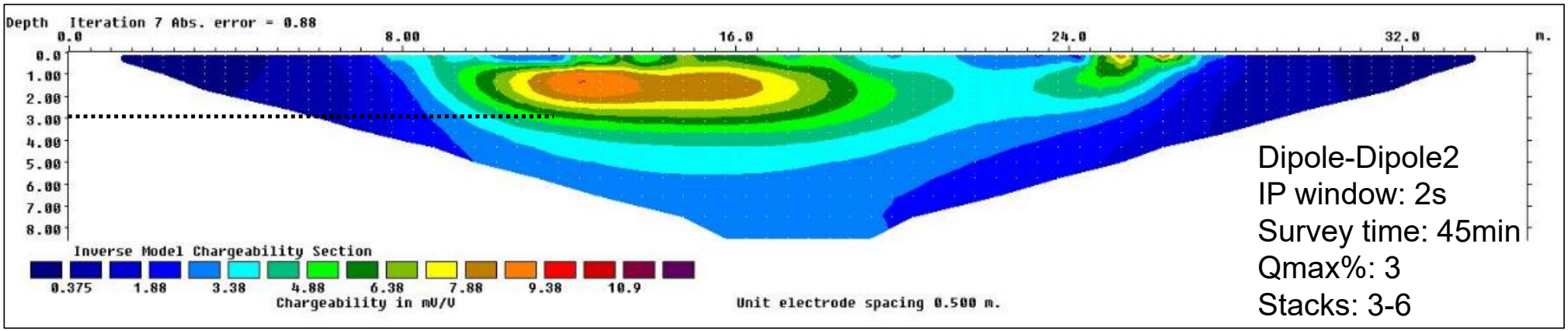
Dipole-Dipole1
IP window: 4s
Survey time: 90min
Stacks: 4-8



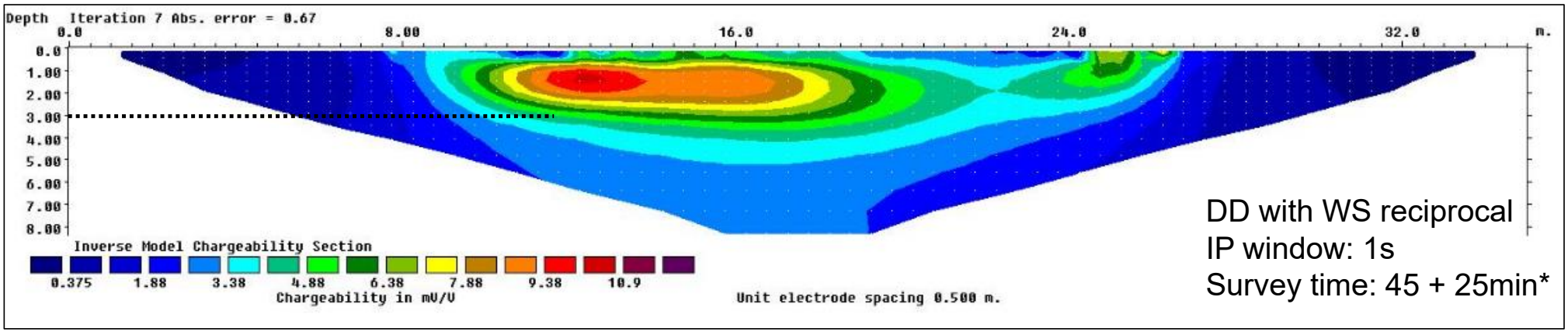
Dipole-Dipole2
IP window: 2s
Survey time: 45min
Stacks: 3-6

CASE STUDY - PUEBLO, CO – IP TRENCH 4

Data collection time analysis for deployment on MMRP projects.



Dipole-Dipole2
IP window: 2s
Survey time: 45min
Qmax%: 3
Stacks: 3-6



DD with WS reciprocal
IP window: 1s
Survey time: 45 + 25min*

SUMMARY AND LESSONS LEARNED

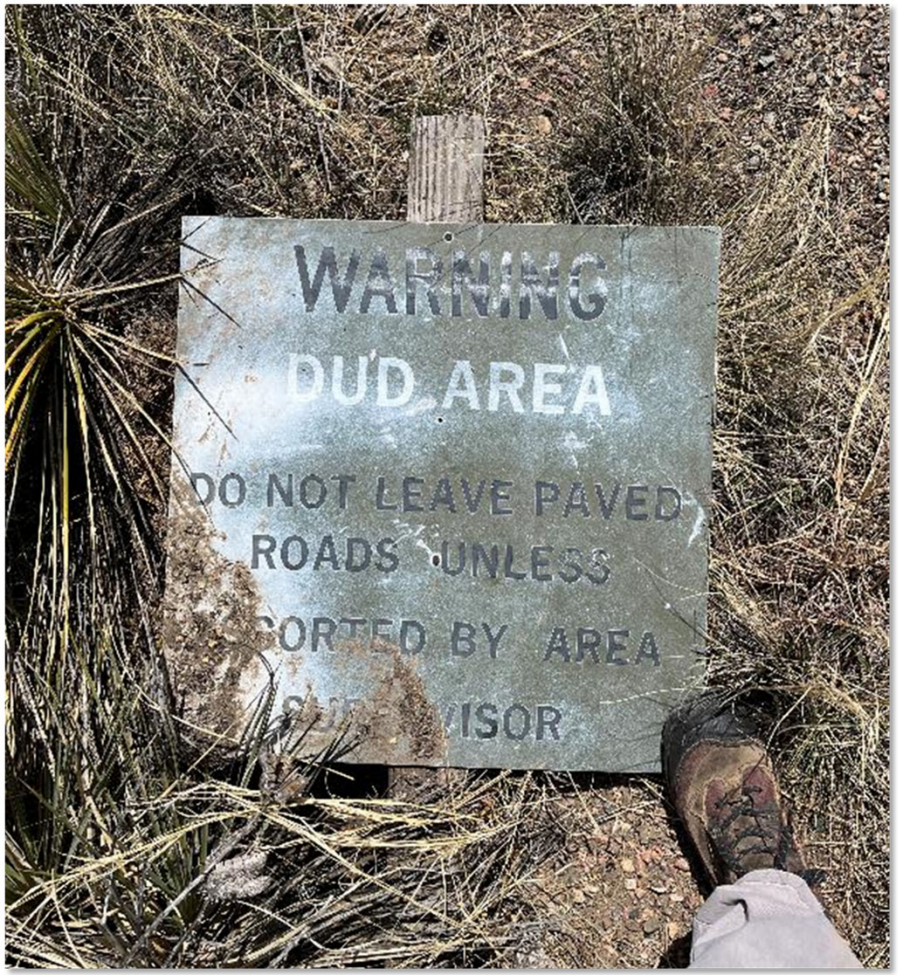
SUMMARY

- ERT can be useful tool for qualification and maybe modeling depth.
- IP shows most potential for accurate depth and geometry modeling.
- Both methods enhance characterization of site non-intrusively.
  - Increases confidence in determining remedial action requirements at appropriate sites.

LESSONS LEARNED

- Resistive anomalies as indicators in ERT data.
  - Material related.
  - Deeper modeling artifacts.
- Combination of geophysical methods is always preferred.
- Different pits at different sites will lead to varying ERT/IP results.
- Intrusive electrode placement not a necessity, but non-intrusive is time consuming.
- Unsure how well this would work at sites with more challenging geology.

QUESTIONS SLIDE



Recognize
Retreat
Report

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