OPTIMIZING PV SAFETY GROUNDING

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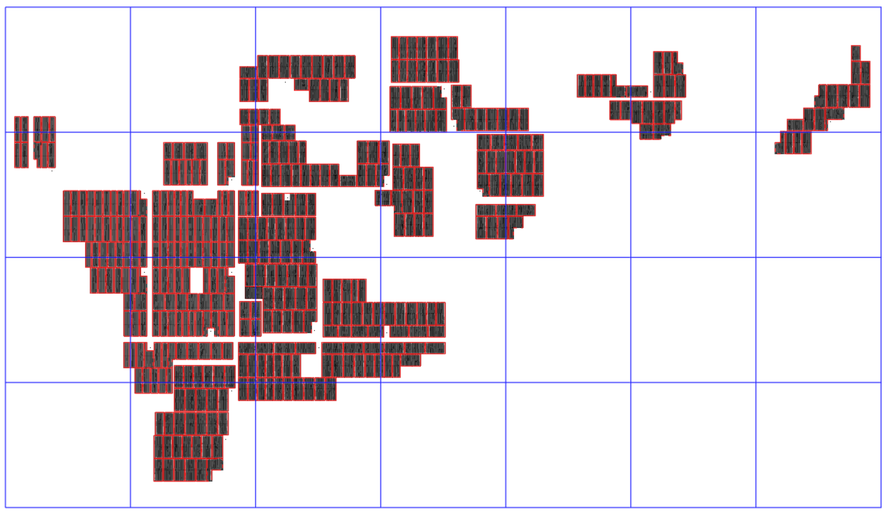
INTRODUCTION

The complex design of PV site grounding systems can create a challenging task to engineer a safely grounded facility for protection of personnel and equipment. Since PV facilities are generally odd-shaped and spaced out, the challenges of creating a safe grounding network are seen more apparently here than in other cases like substations or other renewables technologies.



SITE INVESTIGATION

Obtaining quality soil data is influential in grounding analysis.

It is recommended to follow IEEE 2778 guidance for collecting electrical resistivity test (ERT) data.

This graphic overlays a grid of ERT test locations on a typical PV layout.

IMPACT OF MITIGATIONS WITHIN THE PV FIELD

A typical solar array block touch potentials are shown in Figures 01 through 04 with increasing amounts of grounding mitigation applied to achieve a safe touch design.

The impact that each additional grounding mitigation has in terms of impact to the grounding network varies.

HIGH IMPACT

RESISTIVITY
FAULT CURRENT
SPLIT FACTOR
GROUND CONDUCTOR LENGTH
SAFETY ASSUMPTIONS
GROUND RODS
TRACKER PILES
INVERTER LOCATION
DEPTH OF RODS
SIZE OF GROUND WIRE

LOW IMPACT

KEY CONSIDERATIONS

1. Geotechnical data is often questionable but has the largest impact - don't skimp!
2. Bonding the ground network to the perimeter fence can reduce safety.
3. Bonding the tracker piles to the torque tube has a major impact.
4. Including boot resistance in modified IEEE 80 dramatically improves results.
5. Split factor analysis must include trench ground and concentric neutrals.
6. Best practices are still evolving - designs (and costs) are impacted significantly.

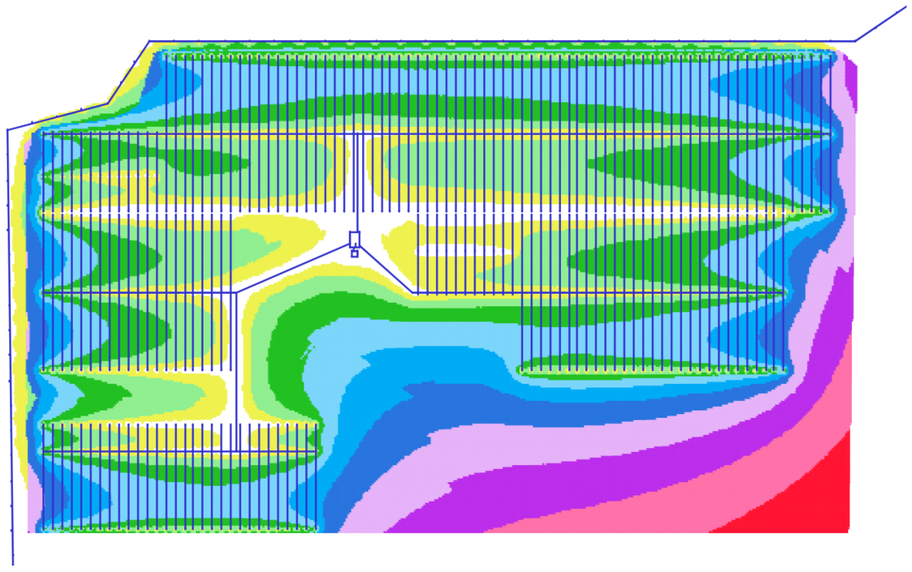


Figure 01: Tracker End & Center Bonded Piles

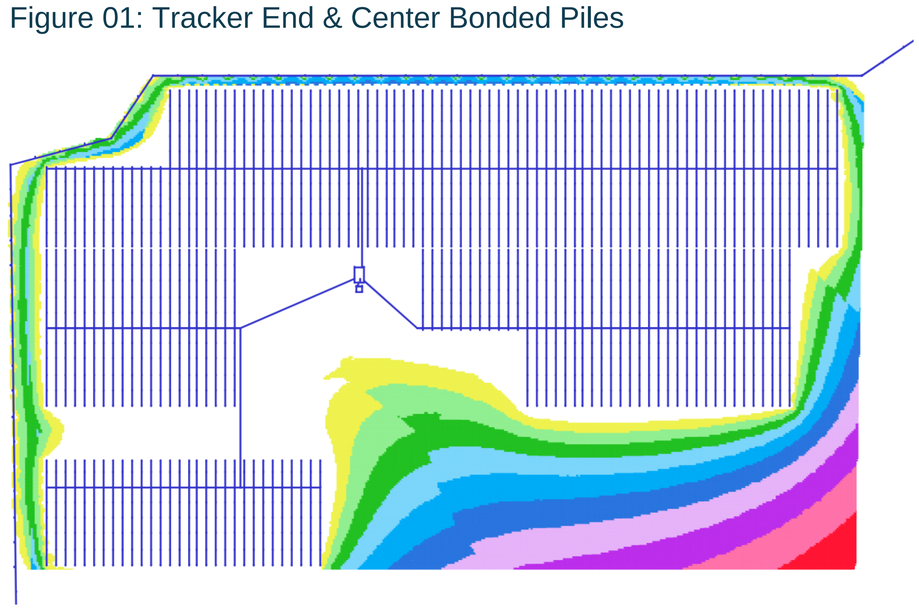


Figure 02: All Tracker Piles Bonded

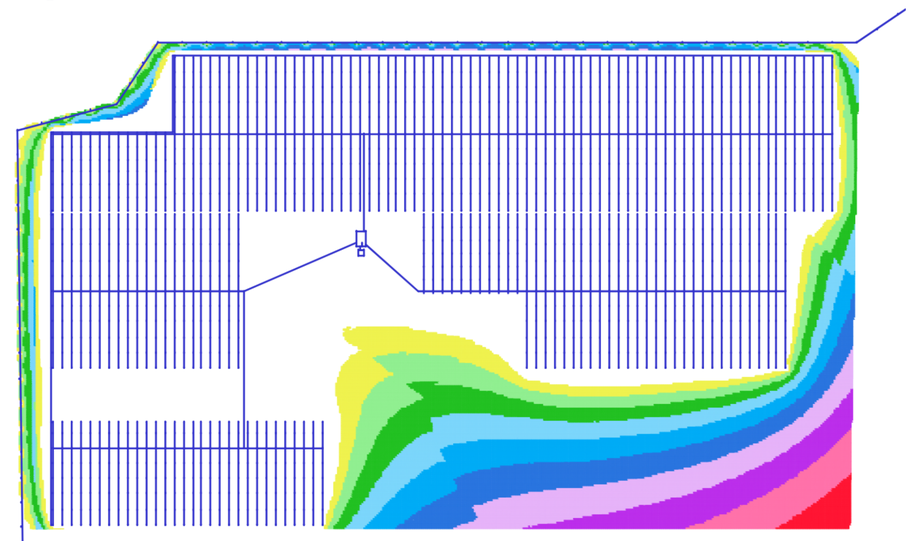


Figure 03: Perimeter DC Trench Ground

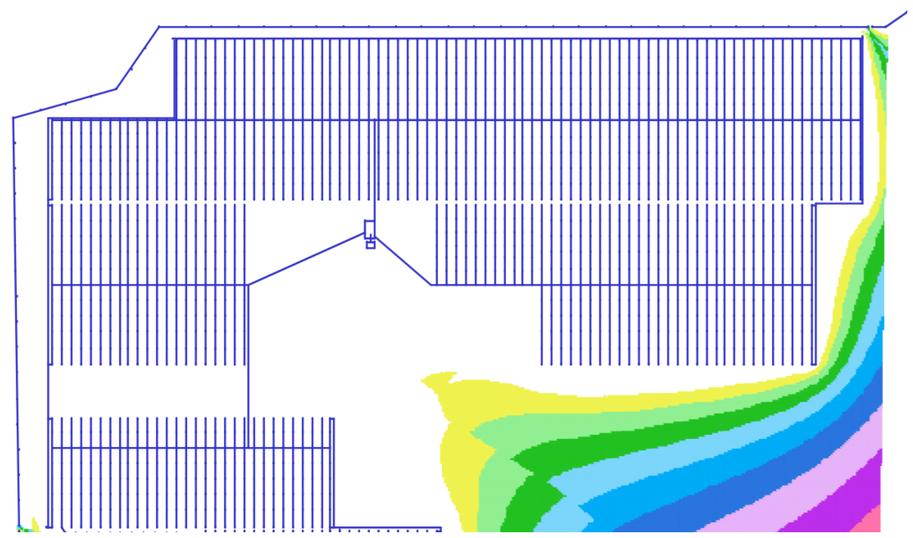


Figure 04: Adjacent PV Trackers Connected

CONCLUSION

Since there are several variables driving a grounding analysis, there is no single "quick-fix" solution for grounding systems. NEI recommends healthy communication between all involved parties, including developers, surveyors, procurement teams, and construction teams, to keep the ground system design in regular discussion. This focused conversation enables recognition of trade-offs in equipment selection and ultimately provides the PV site with an optimized ground system.