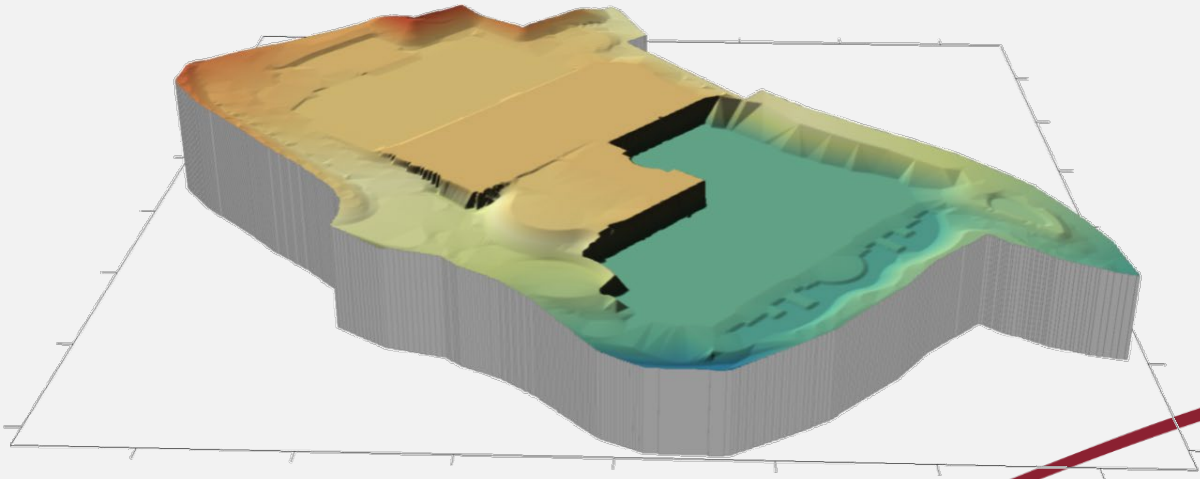


Rippability Assessment: Weathered Rock and Bedrock Excavation Volume Study Combining Drilling and Geophysical Methods



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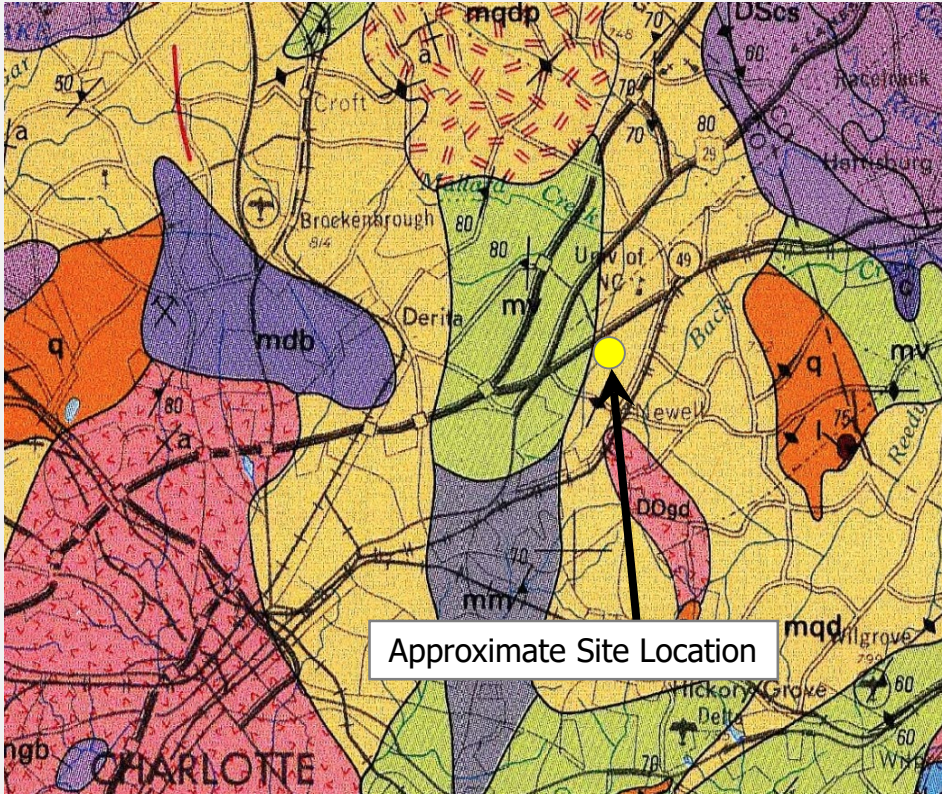
Draper Aden Associates
Engineering • Surveying • Environmental Services

Introduction

- ▶ Proposed new campus building.
- ▶ Previous nearby construction encountered significant cost overruns from rock.
- ▶ Preliminary drilling revealed highly irregular rock and weathered rock.
- ▶ Resistivity imaging and shear wave velocity data were collected to supplement drilling data.
- ▶ Data were used to estimate soil, weathered rock, and rock excavation volumes.



Geology

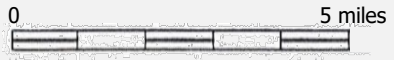


mqd

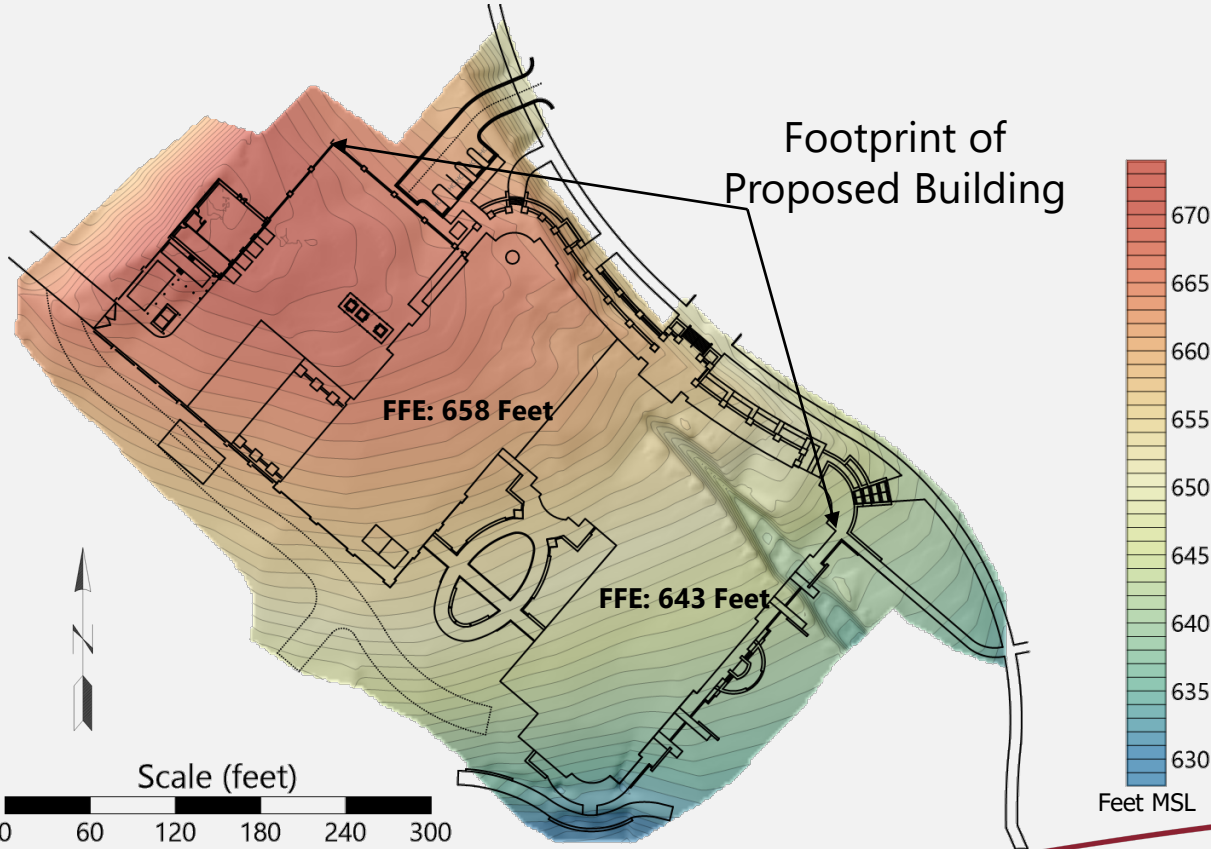
Metamorphosed quartz diorite and tonalite



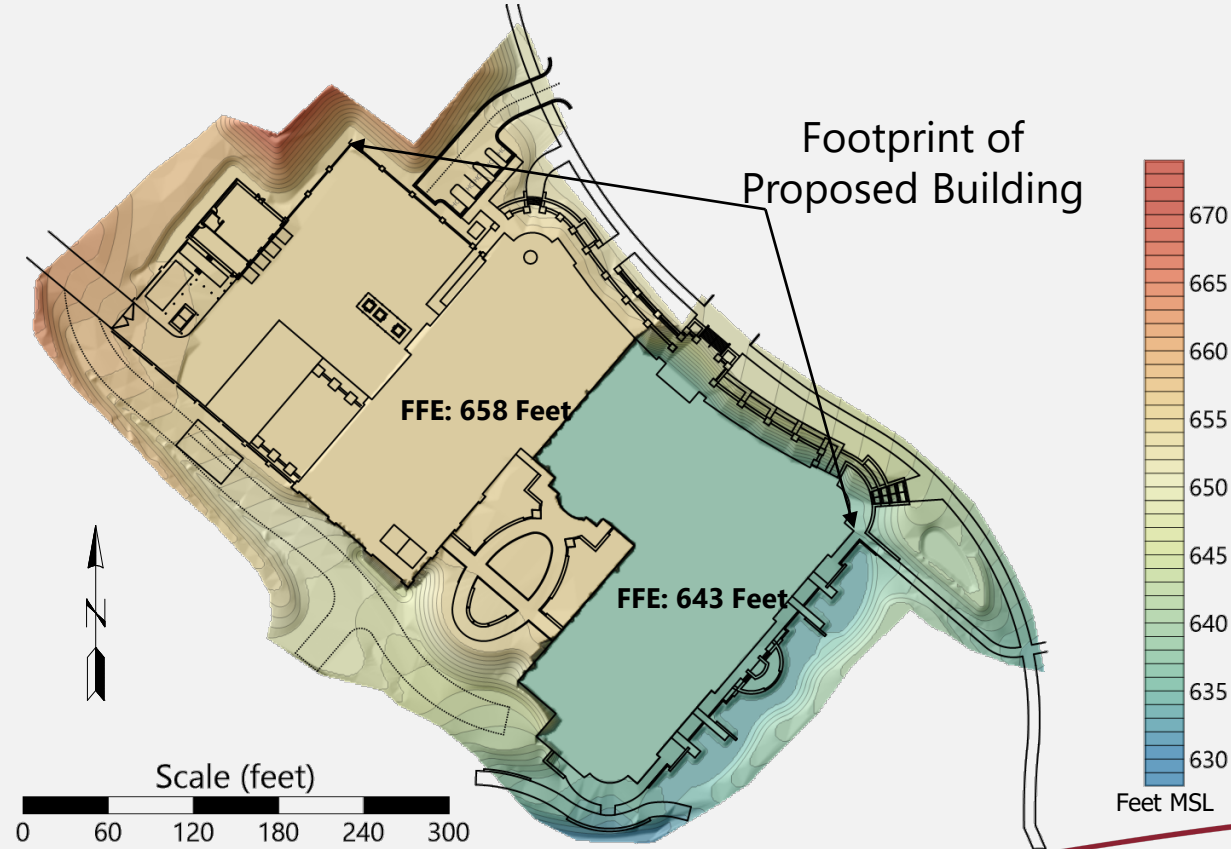
Approximate Site Location



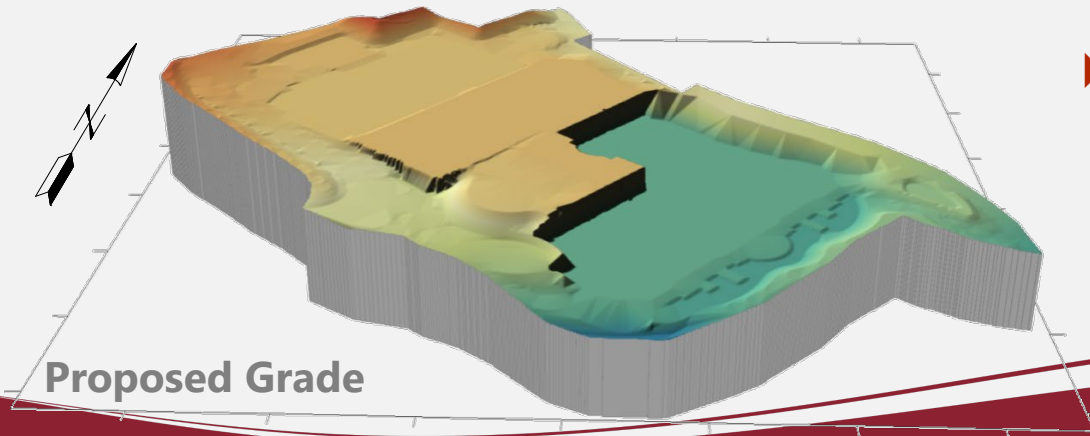
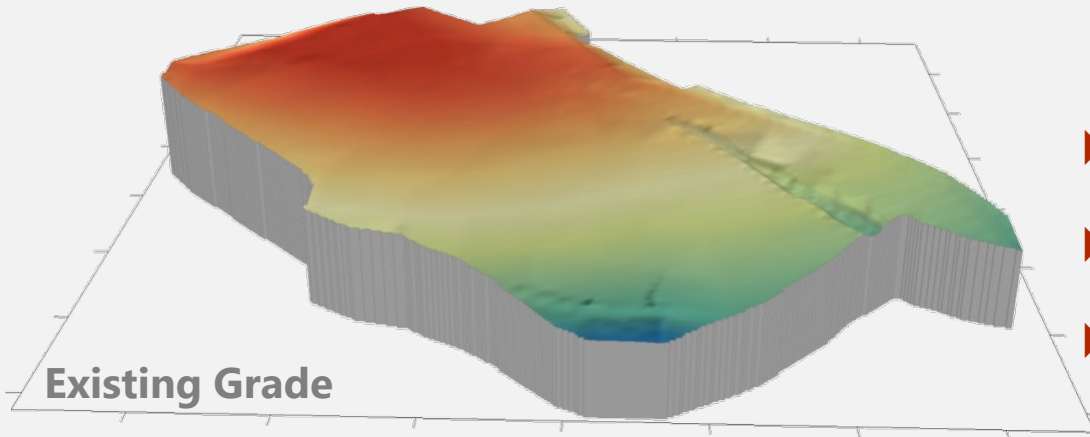
Existing Grade



Proposed Grade



Easy total volume calculation, but...

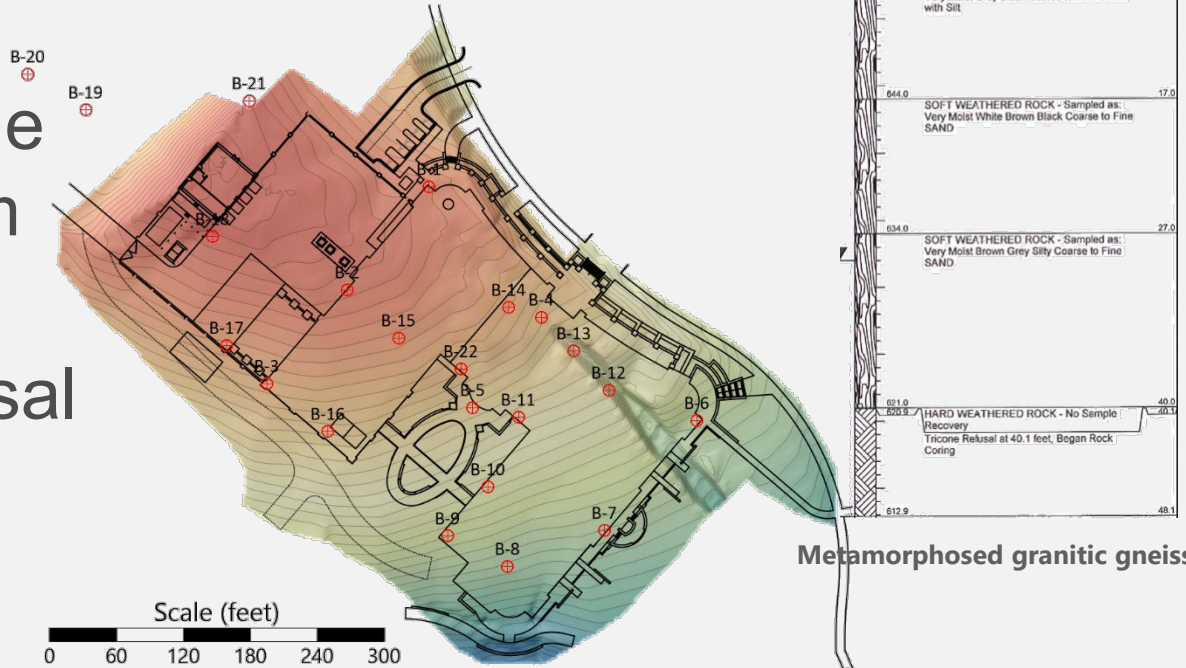


- ▶ ~60,000 yards
- ▶ What portion is soil?
- ▶ What portion is rippable weathered rock?
- ▶ What portion is unrippable rock?

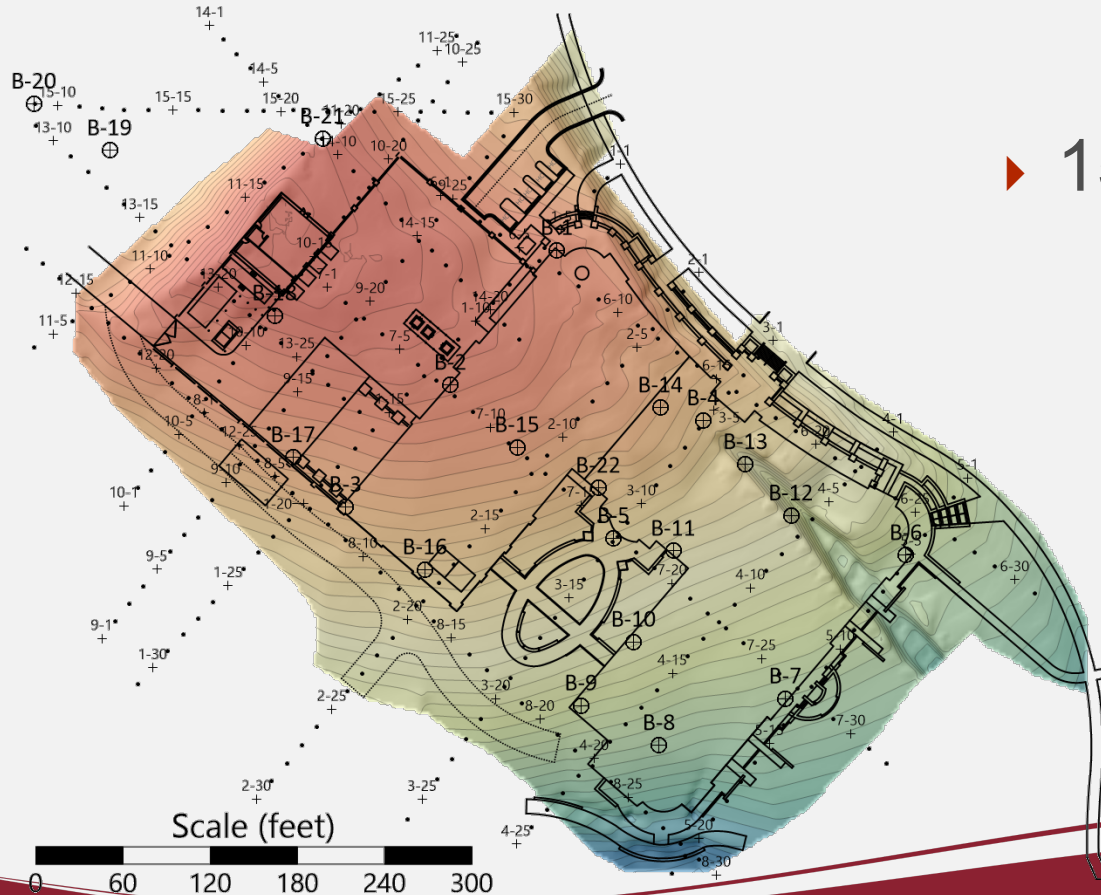


Geotechnical Borings

- ▶ 22 Borings.
- ▶ Thickness of rippable weathered rock from 7-43 feet.
- ▶ Depth to auger refusal from 7-49 feet.



Resistivity Imaging



▶ 15 Resistivity lines.

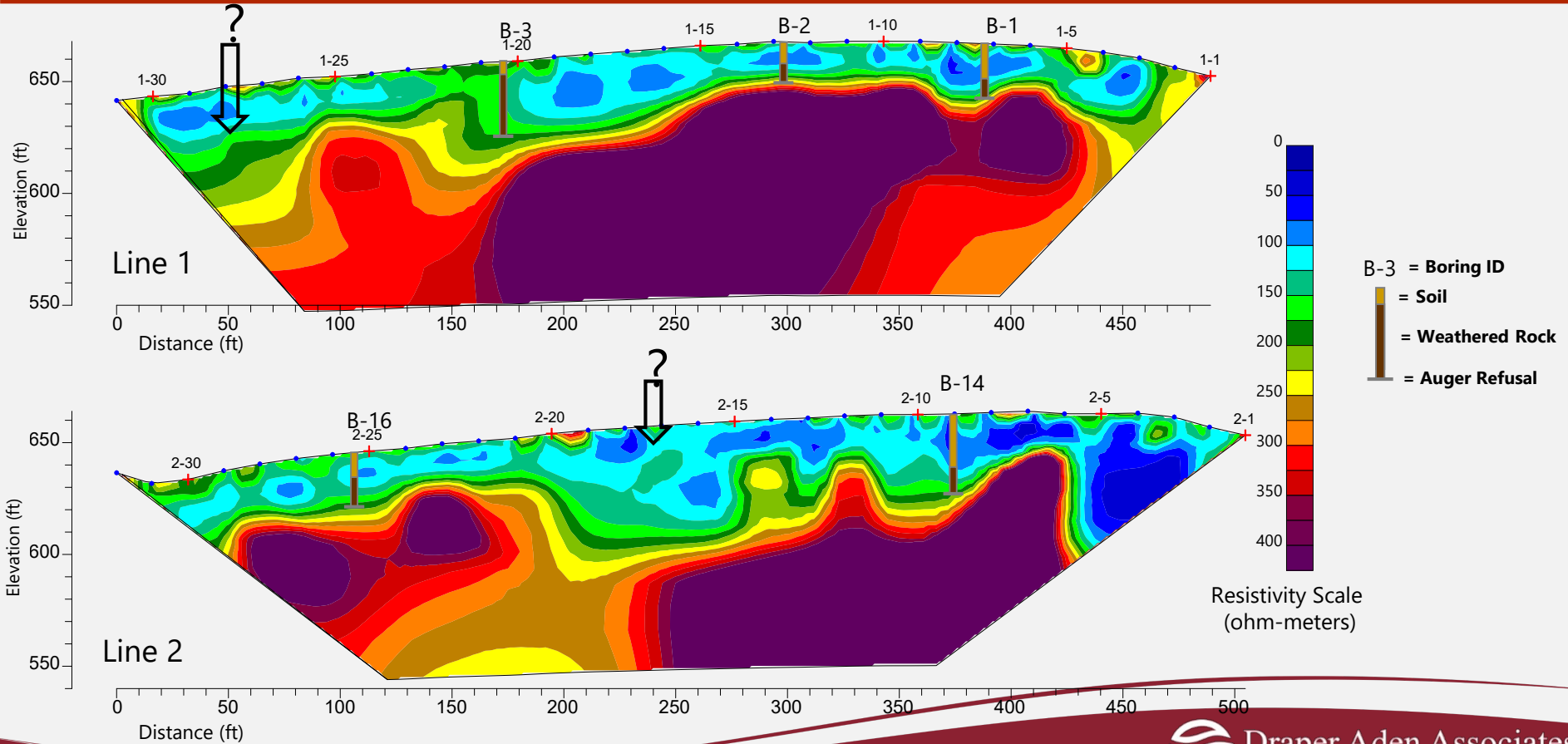


Resistivity Imaging Overview

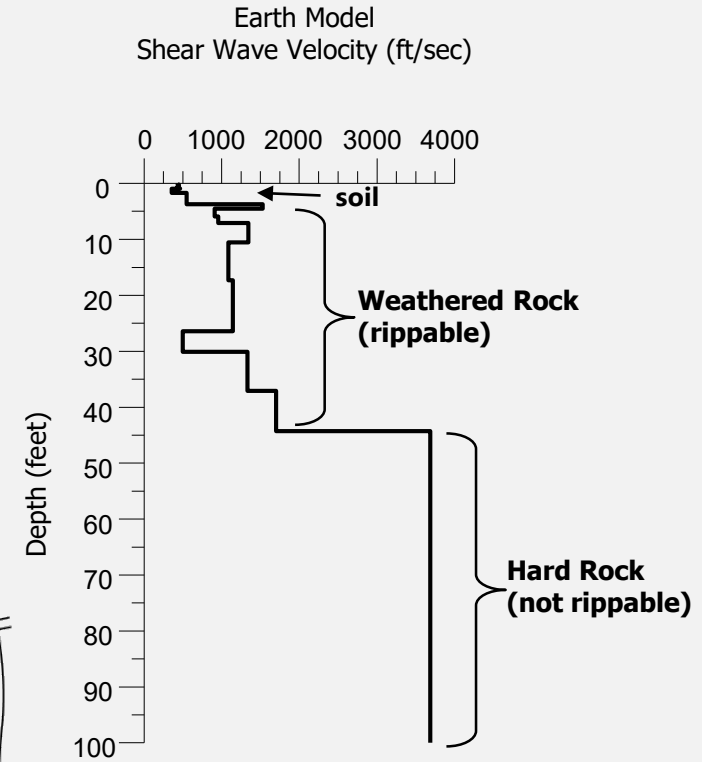
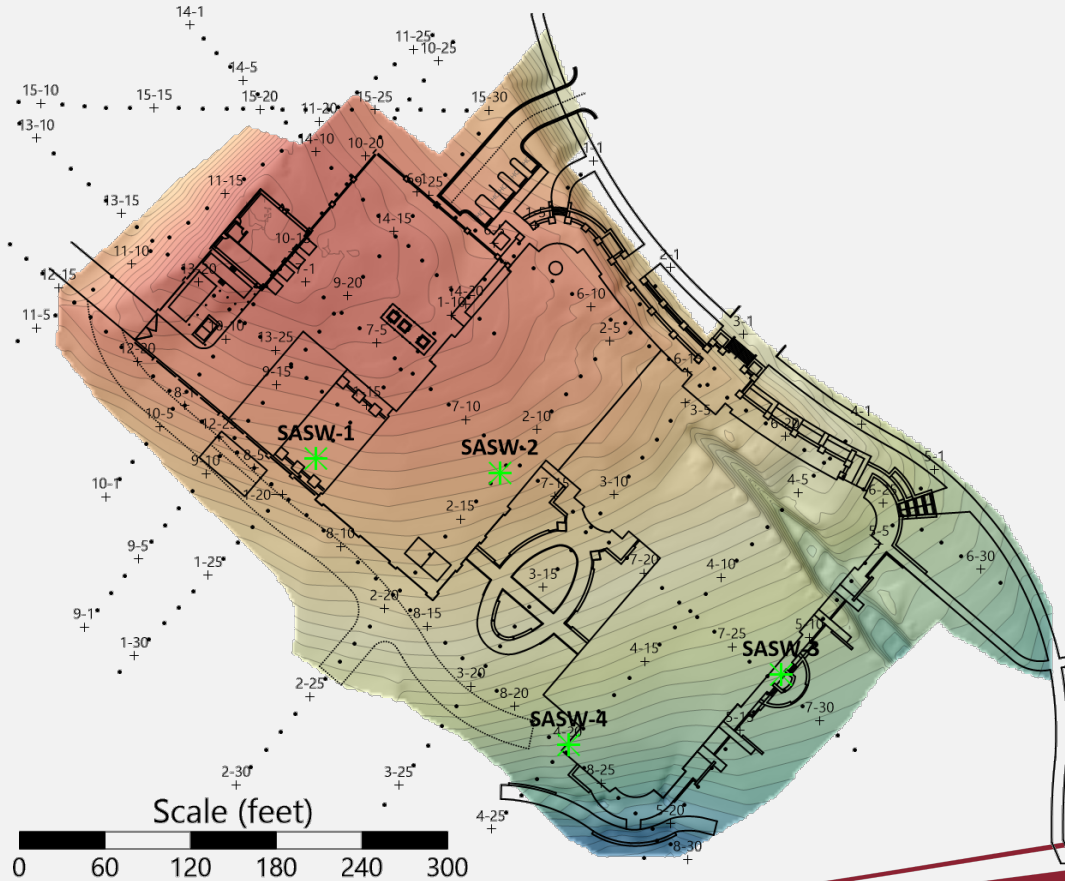
- ▶ Resistivity imaging provides cross-sectional images.
- ▶ Typically, soils exhibit low-resistivities and rock high-resistivities.
- ▶ Thick intervals of weathered rock are gradational.



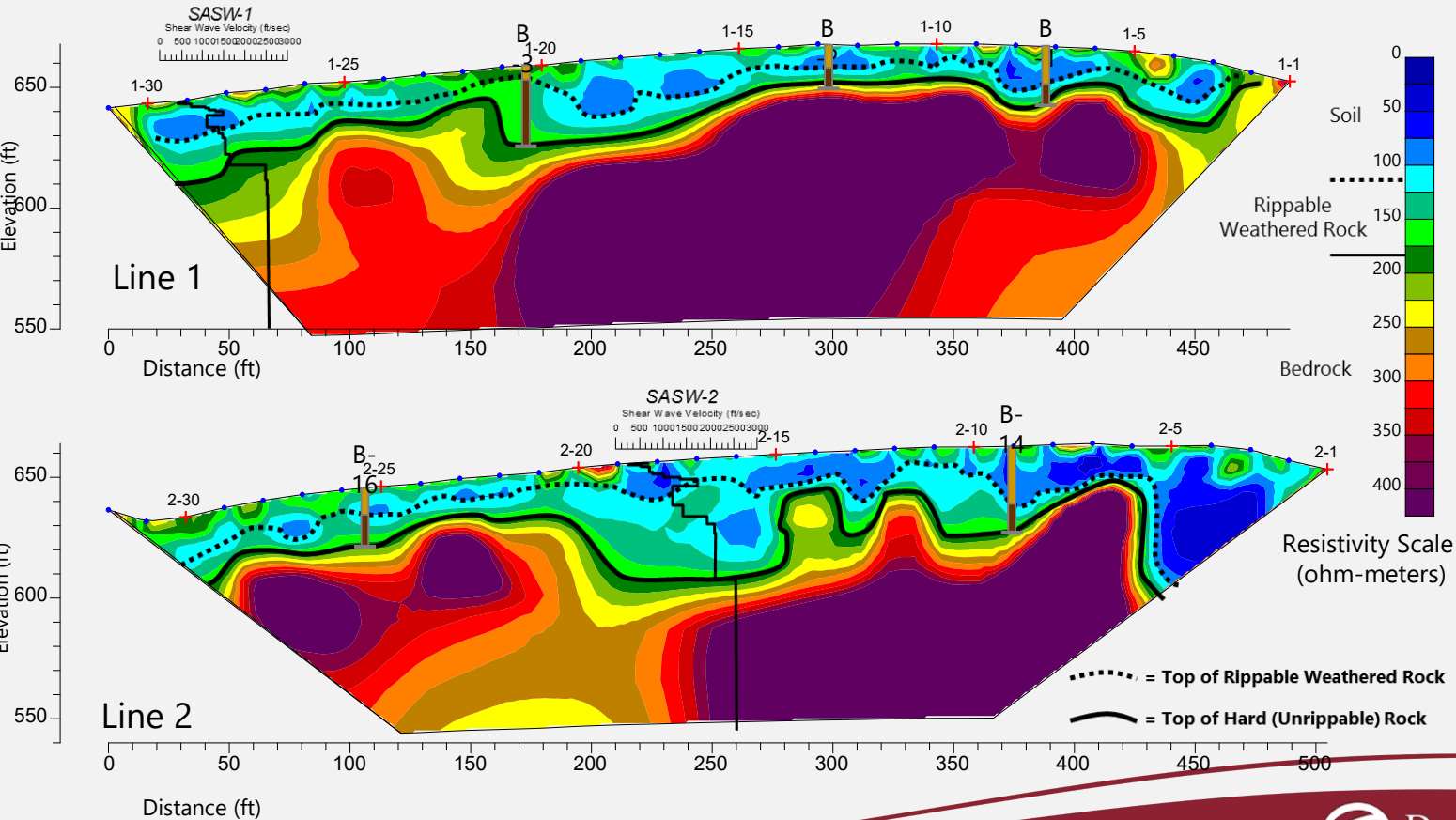
Resistivity Results with Drilling Correlations



Spectral Analysis of Surface Waves (SASW)



SASW and Resistivity Correlations

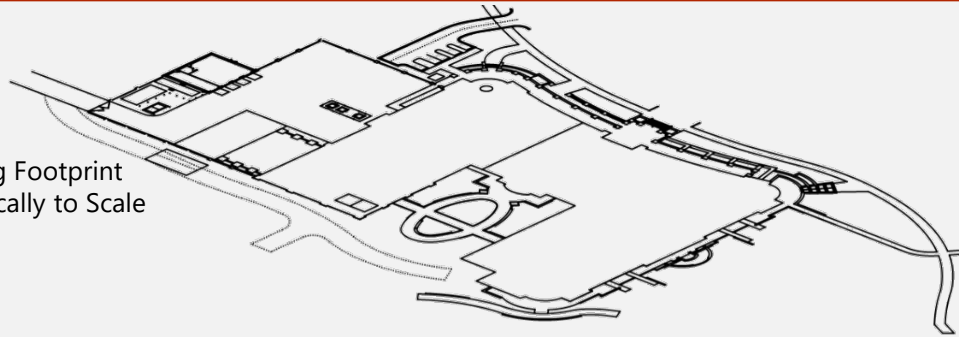


Generating Surface Models

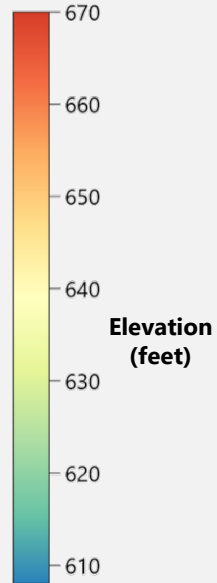
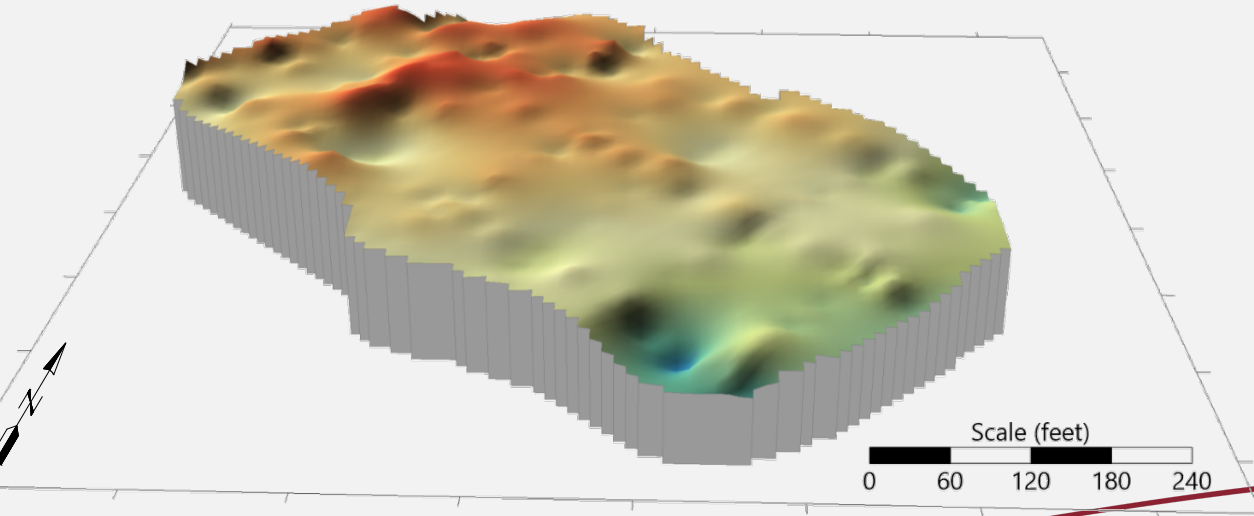
- ▶ Surfaces are defined by XYZ data.
- ▶ X and Y from GPS or survey.
- ▶ Z by digitizing geophysical and drilling data.



Rippable Weathered Rock



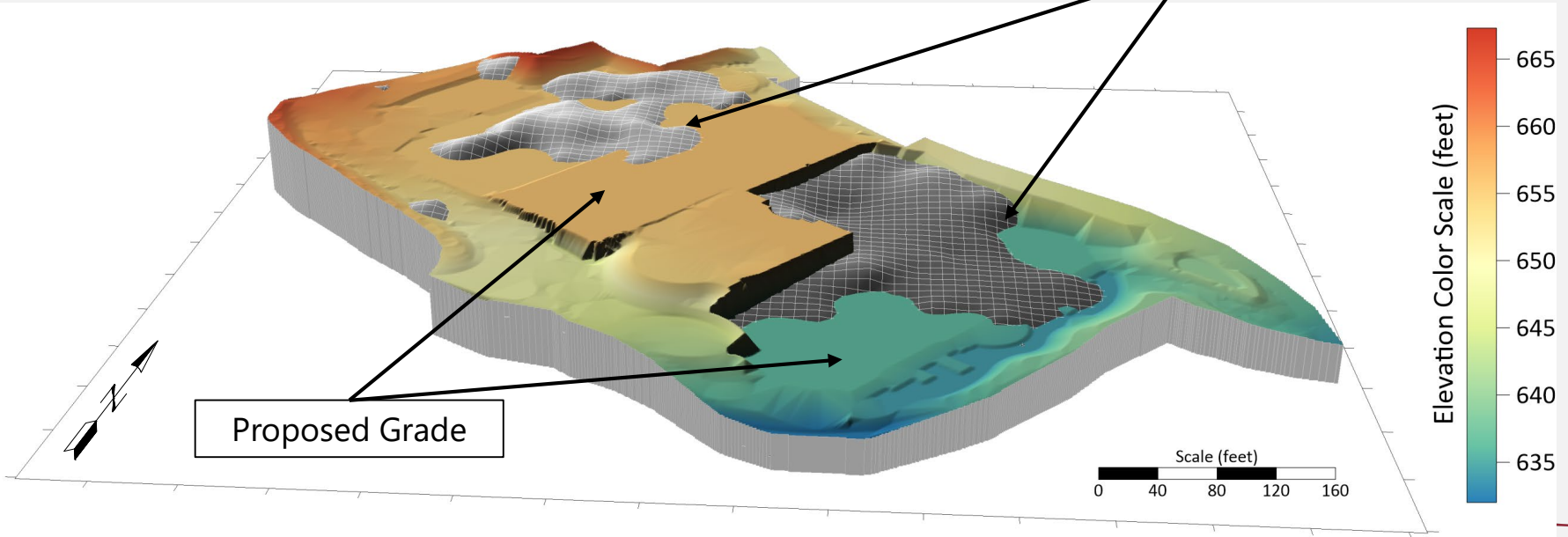
Building Footprint
Not Vertically to Scale



Rippable Weathered Rock Volume

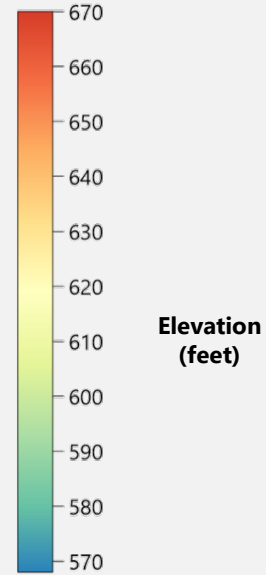
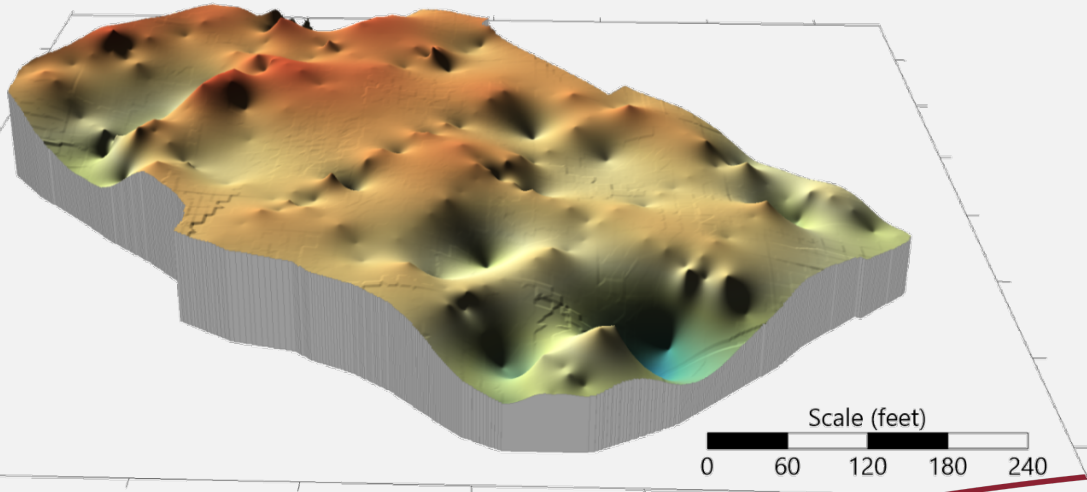
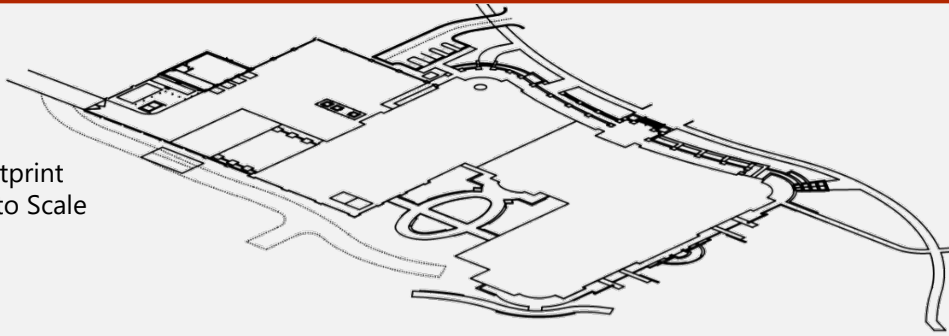
- ▶ Approximately 8,000 yards.

Rippable Weathered Rock Surface Above Proposed Grade (with mesh lines)



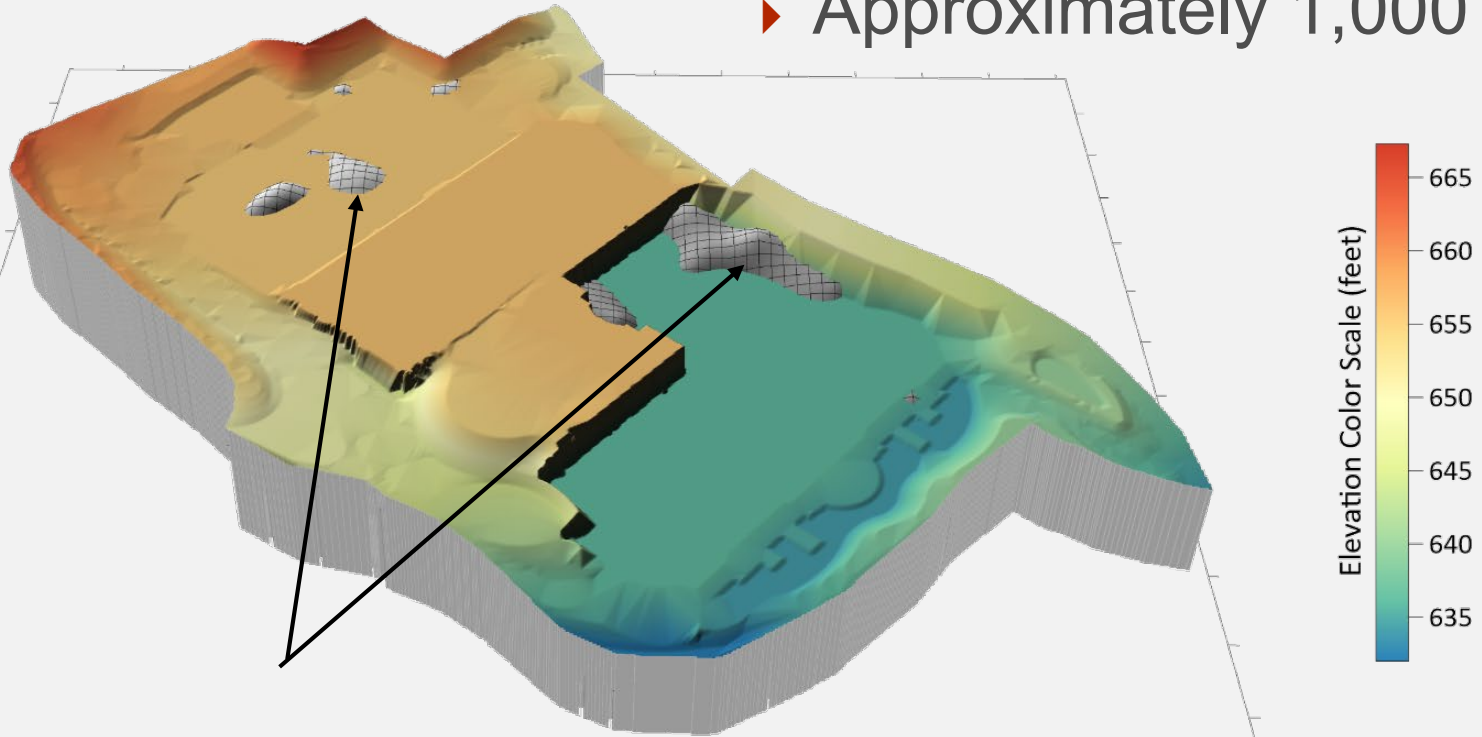
Bedrock Surface

Building Footprint
Not Vertically to Scale



Bedrock Volume

▶ Approximately 1,000 yards.



**Rippable Weathered Rock Surface Above
Proposed Grade (with mesh lines)**



Conclusions

- ▶ Geophysical data filled critical gaps between borings.
- ▶ Provided better information for estimating.
- ▶ Example of the A-Game.

