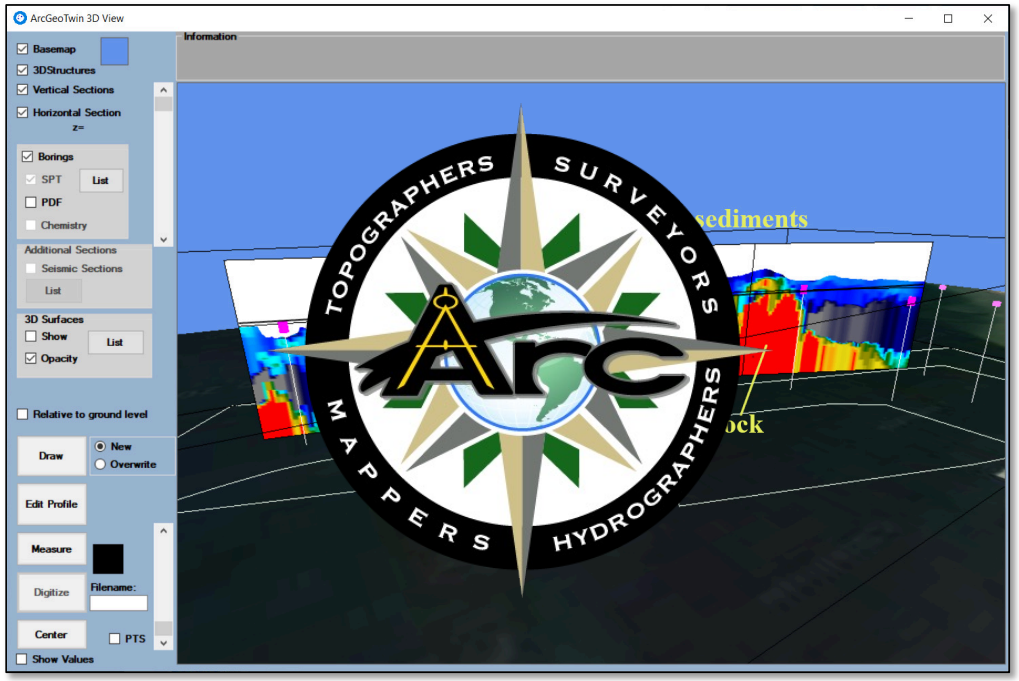
Advanced Geophysical Surveying
Understanding the Subsurface



Arc Surveying & Mapping, Inc.

- **Quonset, RI**

Rock Dredging Encounter

- **Boston Harbor, MA**

Rock Location Pre-Dredging

- **Jacksonville, FL**

Channel & Harbor Deepening

- **Jacksonville, FL**

Drydock Excavation

- **Rockledge, FL**

Sediment Remediation

- **Bayou Chico, FL**

Sediment Remediation

- **Port Canaveral**

Channel Widening & Berth Construction

- **Fort Lauderdale**. FL

Sand Trap Plan & Spec

- **Miami, Fl**

Pre-Dredge Rock Location

- **Freeport Harbour, Bahamas**

Sheet Pile to Top of Rock

- **San Juan, PR**

Pre-Dredge Widening

- **Mobile, AL**

Nearshore Disposal Area

- **Portland, OR**

Sediment Remediation

- **Coos Bay, OR**

Harbor Deepening & Widening

- **Kissimmee, FL**

Contaminated Lake Sediments

- **Mobile, AL**

Channel Deepening & Widening

- **Brunswick, GA**

Pre-bid Investigation

San Juan Harbor, Puerto Rico Deepening & Widening Survey

Curtin Maritime specializes in clamshell dredging, tackling large scale capital projects with difficult geotechnical conditions. We carry many different sized buckets in our fleet to tackle varying strata of material and it's important that we are able to select the correct tool for the job each and every day. The industry standard for project owners is to provide typically outdated boring logs taken sporadically through the dredge areas to provide an idea of what the geological composition of the in-situ dredge material is. While a trusted and true method, it requires a lot of interpolation and can lead to many inaccuracies, which then leads to poor planning for project bucket utilization. Swapping between different buckets frequently can cause lengthy downtime delays and increased costs and schedule for stakeholders.

A more concise method is to perform a geophysical survey to create visual and digital understanding of the of the dredge template, like the method that Arc Surveying & Mapping is leading in the US.

We recently hired Arc to conduct a geophysical survey for our deepening and widening project in San Juan, Puerto Rico: a project slated to be our company's most complicated bucket strategy yet due to varying resistance values in the material. Arc was able to create a 3D model mapping our dig areas with different useful visuals depending on how we needed to plan. *The data from the survey has lined up better than any boring log ever has based on material we've removed to date*, and we at Curtin can recommend that federal agencies, ports, and harbors should consider this service as a valuable investment tool for any capital dredging project that's guaranteed to save on cost and schedule.

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Quonset, Rhode Island
Channel Deepening & Widening

"On several occasions Foth has worked with ARC to develop geophysical data for marine projects. The results of the Aquares survey have provided valuable information that helped move our projects forward. We have found good correlation with other methodologies and were particularly excited about the coverage the system attained. Arc was forthright in explaining the benefits and limitations of the system and helped guide us through the analysis and use of the data produced by the system. The use of the Aquares system improved our overall site analysis."

Regards,

Mike Campagnone, P.E.
Senior Technology Manager – Geophysical Surveys
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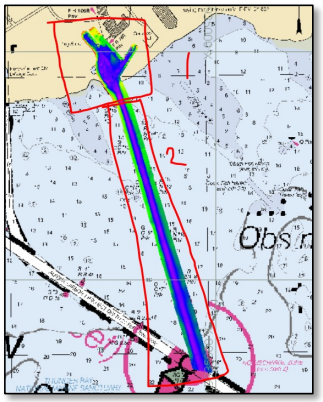

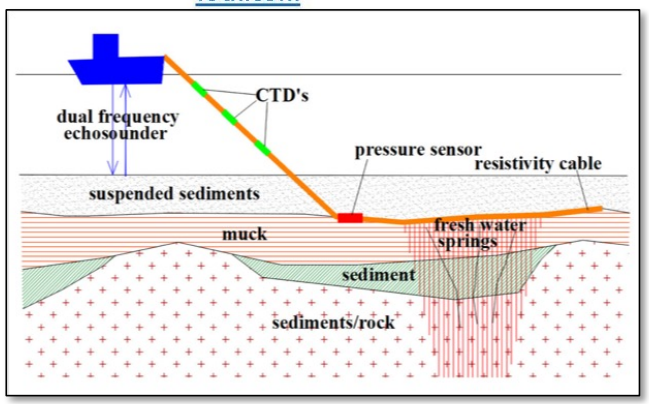

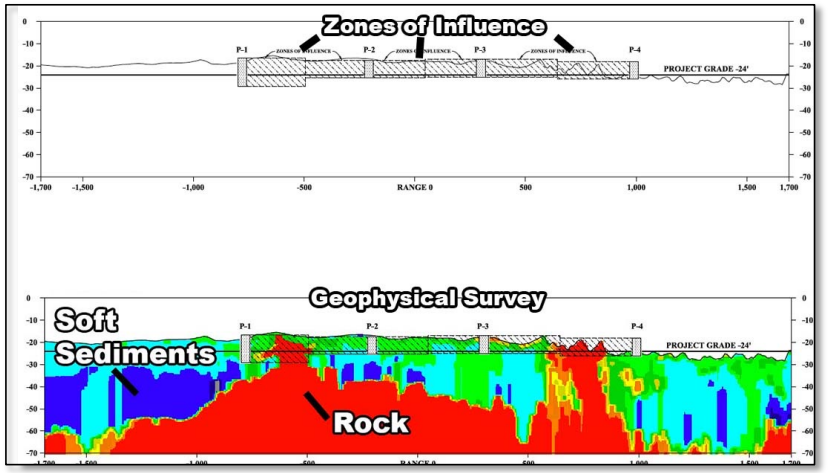

Lakeland, Florida
Contaminated Sediment Survey

On behalf of AECOM, I would like to commend Arc Surveying and Mapping for their outstanding effort in completing the electrical resistivity surveying and subsurface profiling of Lake Bonnet in Lakeland, FL. This high-profile project, which has received over $42 million in grant funding to reduce flooding, required a comprehensive subsurface profile of the lake's sediments to evaluate the best alternatives. Your team's technical expertise and extensive knowledge of the dredging industry have been invaluable in helping us visualize the subsurface sediments in an accurate and manageable manner.

I have relied on Arc Surveying and Mapping's expertise for over 20 years and consider them to be one of the best bathymetric and geophysical surveyors in the business. Their commitment to excellence and consistent delivery of high-quality results make them a trusted partner for any surveying and mapping needs.

Dan

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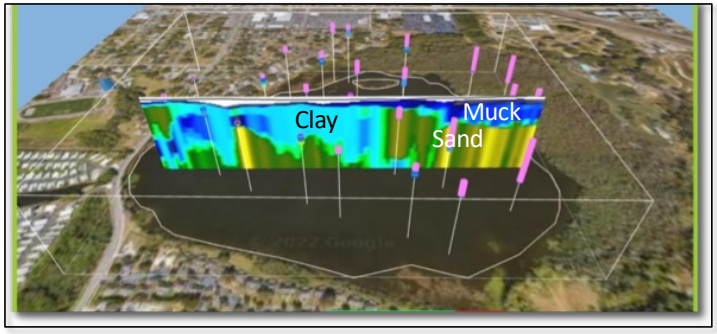
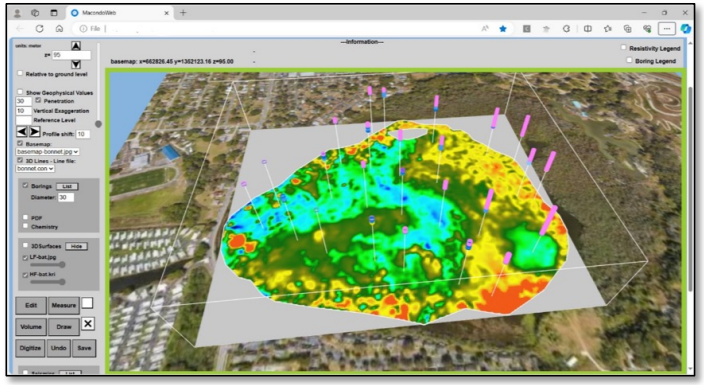
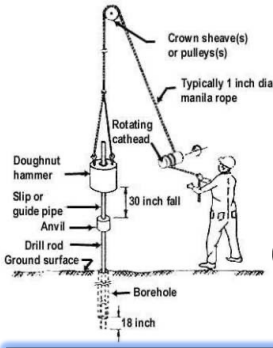
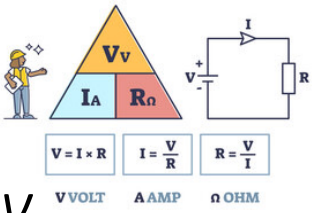
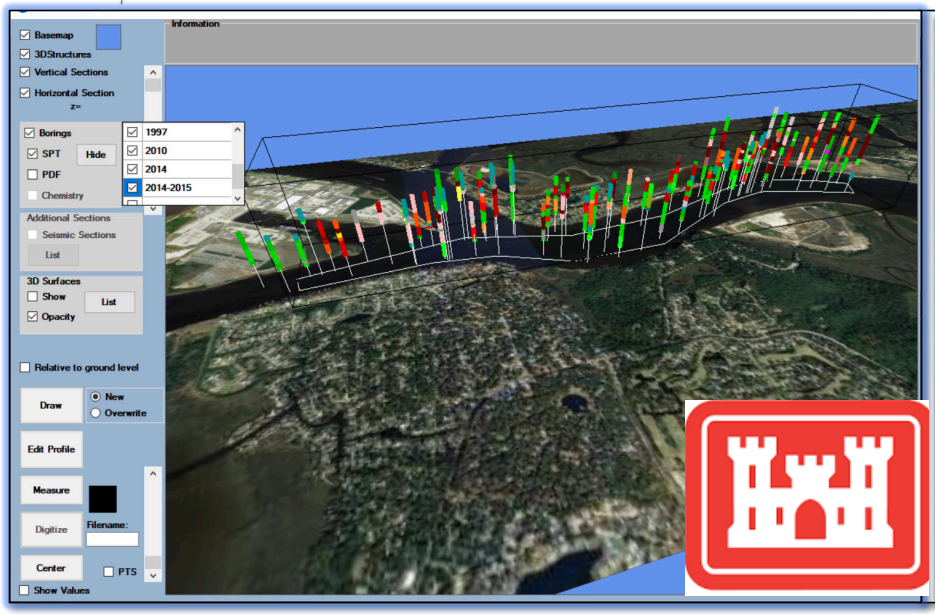


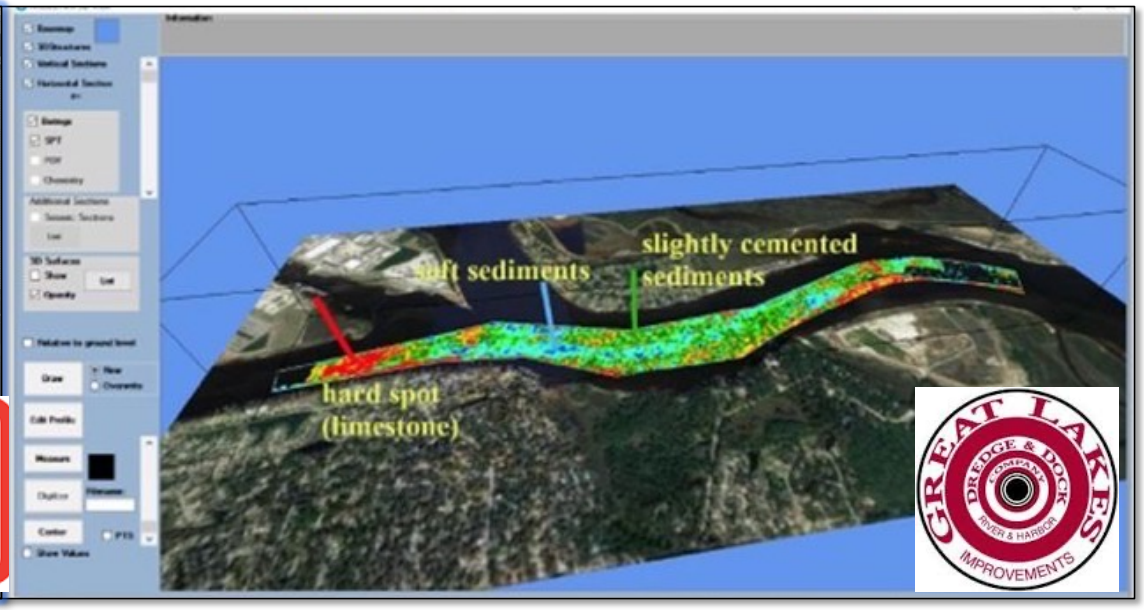




Jacksonville Florida
Deepening and Widening Project
Core Borings Versus Aquares Geophysical Survey



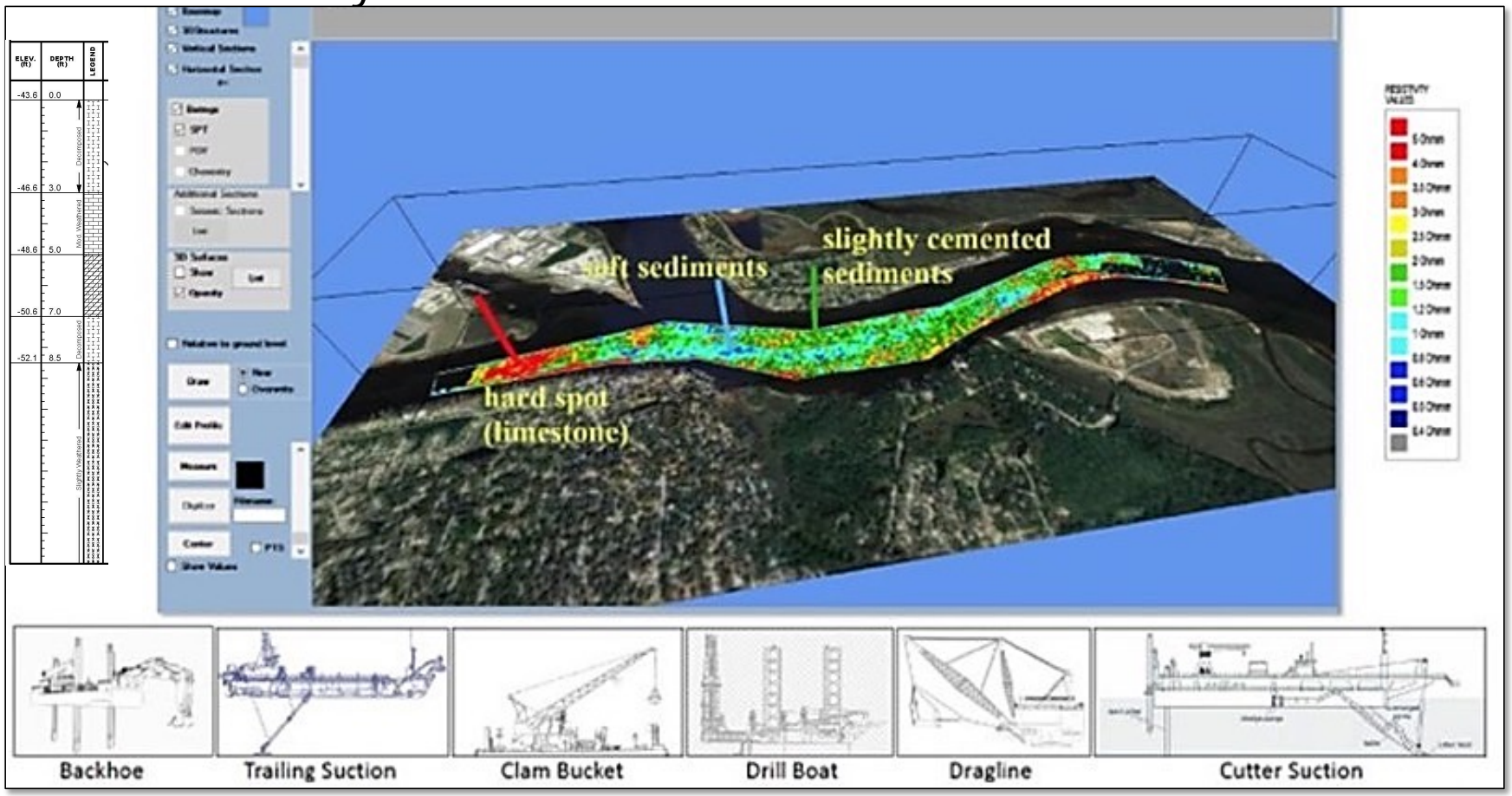




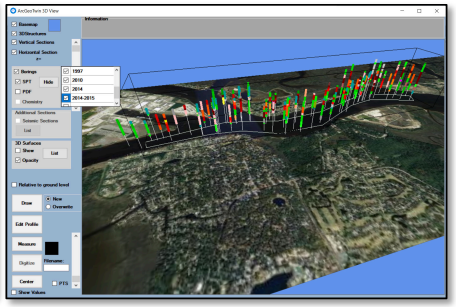
Over 80 core borings required by the ACOE to describe the Jacksonville Harbor Deepening subsurface.

An Arc Aquares Geophysical Survey described the entire Jacksonville Harbor subsurface requiring minimal core boring to describe the geotechnical characteristics.

Choose Equipment Types Scientifically
Understand the electrical resistivity and mechanical strengths of the materials to be excavated

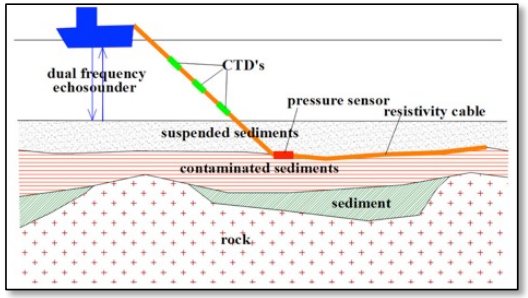


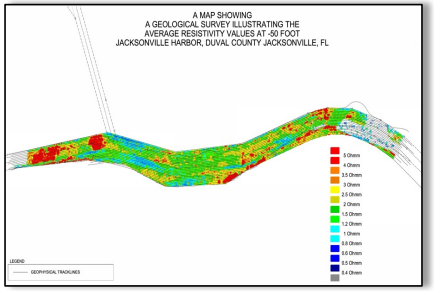
Identify the Entire Subsurface
Reduce the Number of Borings
Substantially Reduce Subsurface Investigative Costs



Core borings are necessary to describe subsurface material strengths and types.

Core borings require a Jackup barge to acquire subsurface samples due to existing channel depths which are usually in excess of 30 feet deep. Boring locations are often dependent on ship traffic and sometimes not acquired in heavy ship traffic channels. Many days are required to mobilize and acquire core samples.





Resistivity surveys are necessary to describe 100% of subsurface geological structures.

An electrical resistivity survey is accomplished in two or three days and describes the entire subsurface to a depth of 40 feet below existing bottom. A 3D Integrated digital geologic model is provided identifying changes in subsurface geology and a scientific method od choosing core boring locations.

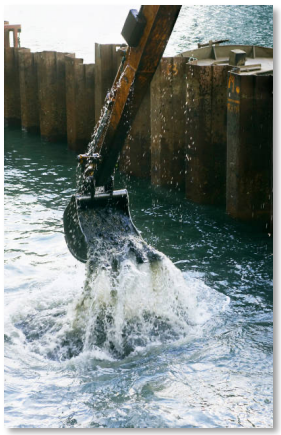
In most cases, the cost of an Arc Aquares geophysical survey is less than the mobilization cost of a Jackup barge.
Reduce the number of borings necessary to describe subsurface strengths and material types by performing a geophysical survey.

Understand the Subsurface in Clear Detail Permitting Selection of Different Buckets & Cutters for Different Material Types

72 cy Bucket

Hard Material Backhoe

Rock Grapple



Medium Backhoe

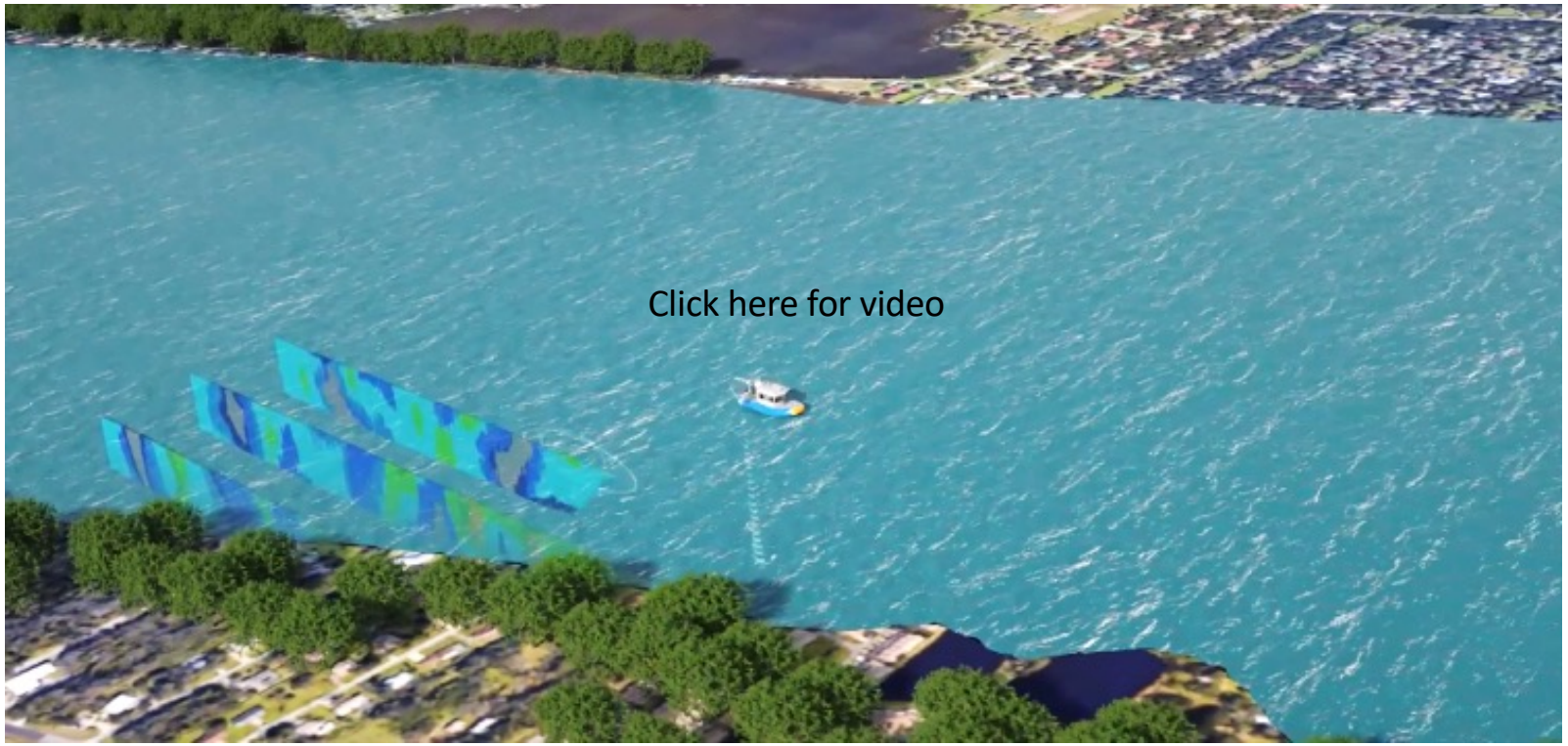
Rock Hydraulic Cutter

Backhoe Clam

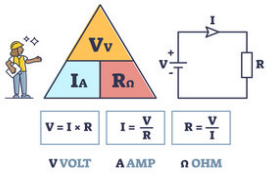
Medium Material Clam

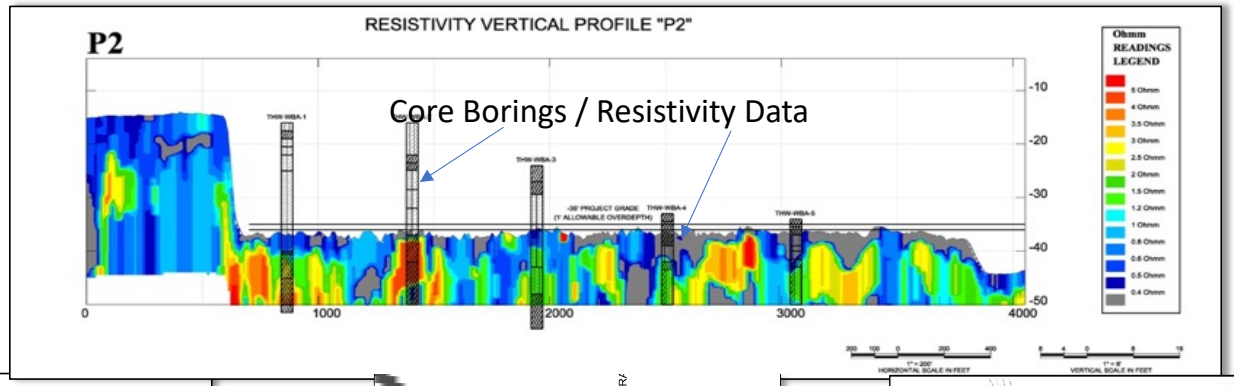
Trailing Suction

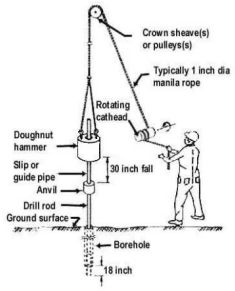
Rockledge Florida
Contaminated Sediment Location Survey
How the System Works

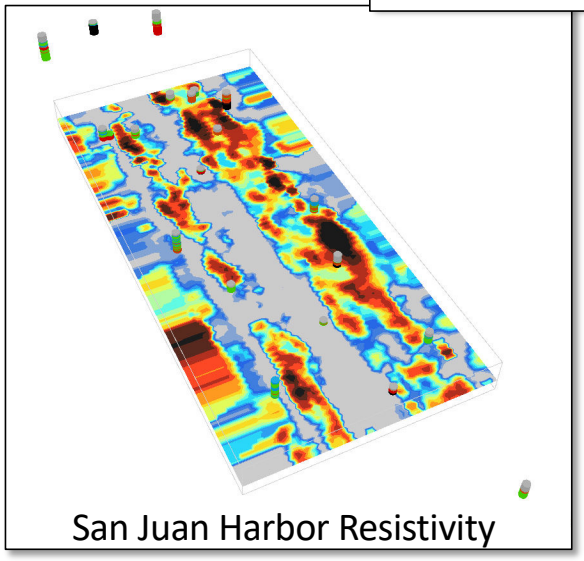


Quality Control
Comparing Bathymetry / Core Borings and Aquares Data

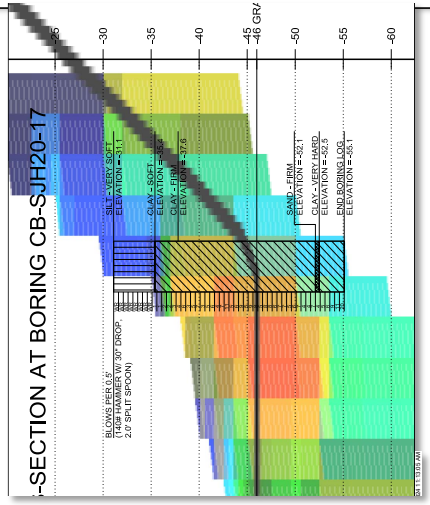




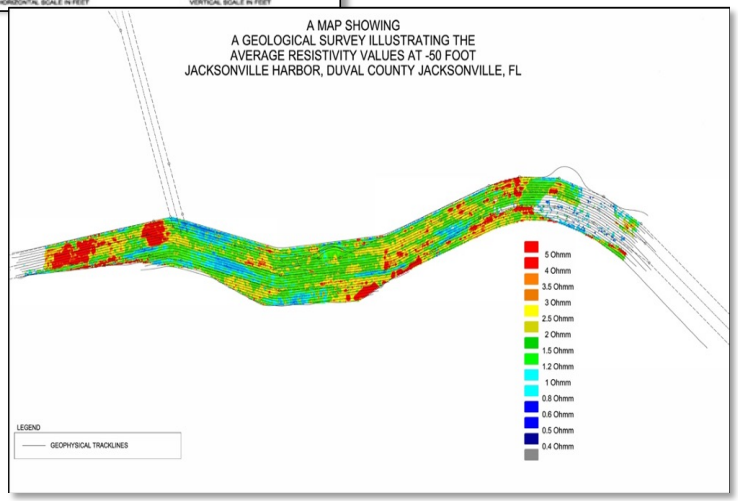




San Juan Harbor Resistivity

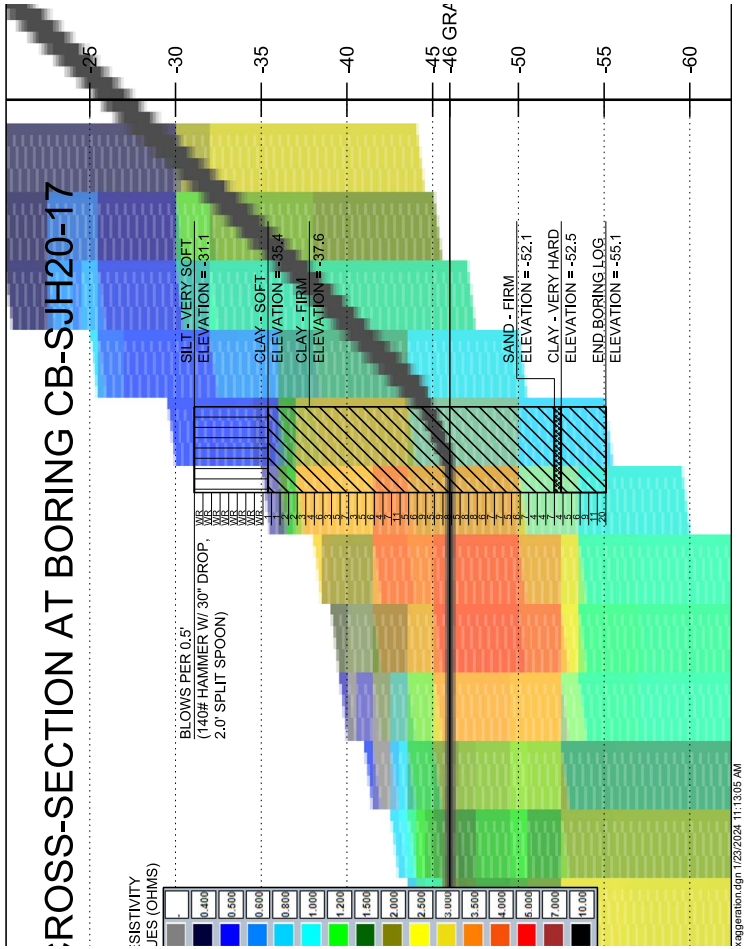


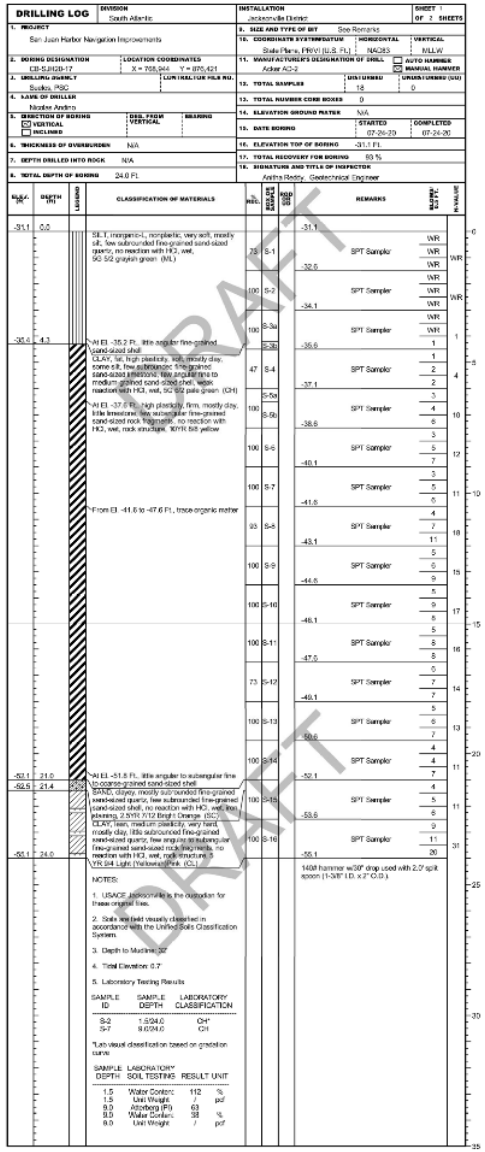
Combined Boring & Resistivity



Jacksonville Harbor Resistivity

Comparison of SPT Material Strength to Resistivity Data





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