NORTH CAROLINA
Department of Transportation

NCDOT Location & Surveys Unit – UAS Update

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State Location & Surveys Engineer

1.24.2023 FEMA & NC Government Sector UAS Working Group

Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

NCDOT Location and Surveys Unit

Outline:

- Current Capabilities (Pilots & UAV's)
- Current UAS Usage.
- Project Highlights and Testing
- Future Uses

Current Capabilities (Pilots & UAV's)

Current UAS Status L&S Unit

L&S UAV Integration beginning in early 2020.

Currently have 38 Part 107 pilots in 16 offices across the state.

Current equipment includes:

14 - DJI Phantom 4 RTK

1 - DJI Matrice 210 with Zoom camera

30 – Propeller Aeropoint GCP Targets

1 – Wingtra 2 (Aviation)

Phantom 4 RTK

- Accuracy within +/- .10 foot
  is possible in certain situations
- Typical project:
  - 30 minutes to plan
  - 1-2 hours to fly
  - 1 day to process
- Does NOT produce Lidar Quality Data!

Phantom 4 RTK

2d Flight Plan:

- Camera pointed straight down (Gimbal angle = 90 degrees)
- Side and Vertical overlap = 70-80%
- No Cross-Hatch pattern

Phantom 4 RTK

3d Flight Plan:

- Camera not pointed straight down (Gimbal angle = 60-70 degrees)
- Side and Vertical overlap = 70-80%
- Cross-Hatch pattern provides greater coverage from multiple sides

Deliverables

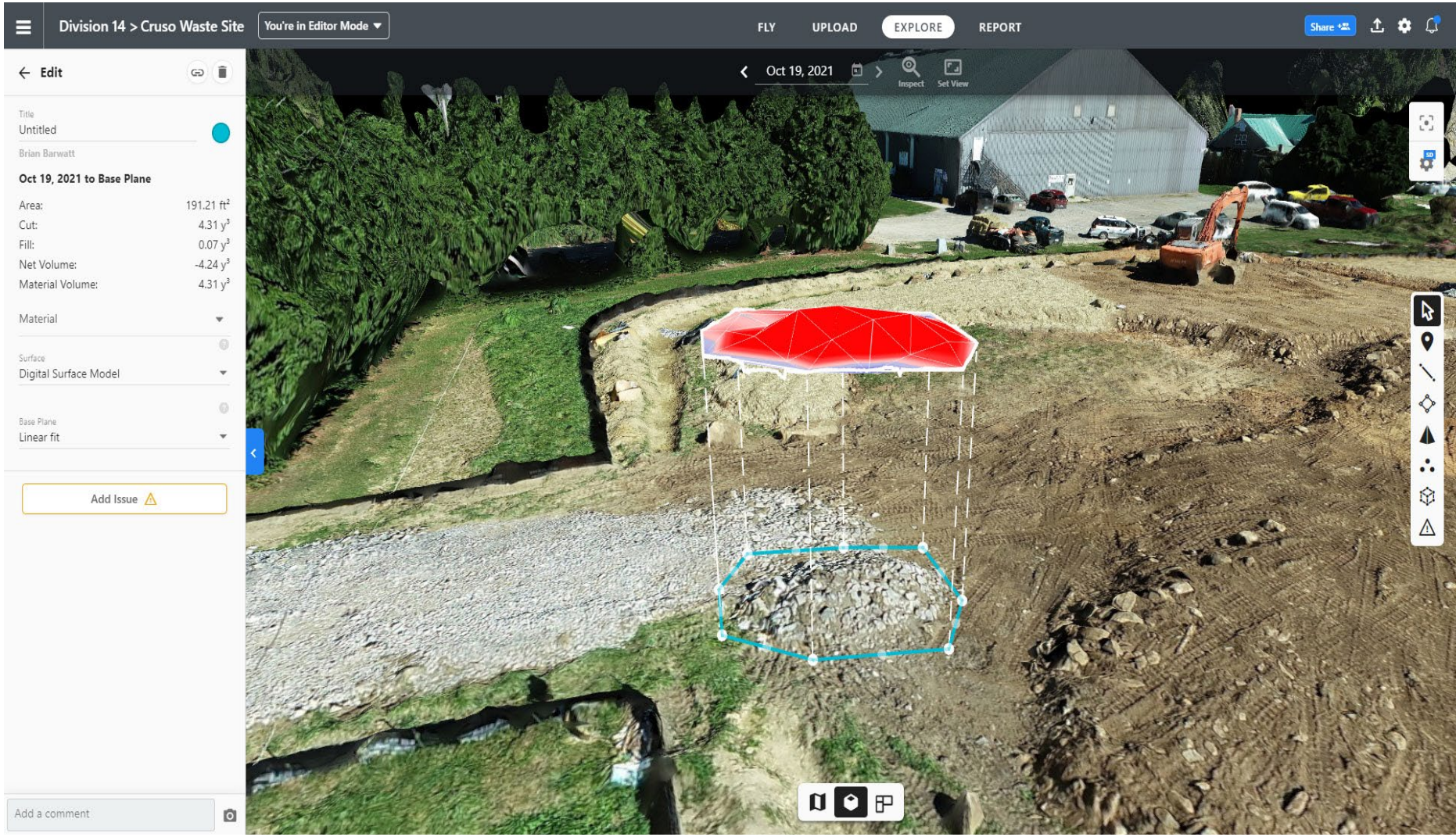
<u>Orthometric Photography</u>

- Field to Finished product in 1-2 days
- Provides a higher resolution product than typical photogrammetry because we can fly closer to ground level
- File Size = 6MB/acre (+/-)
  - For 200’ flight above ground level at 2 inch/pixel
  - (i.e. A jpg for a 30-acre site will be approx. 200MB in size)

Deliverables

Volumes

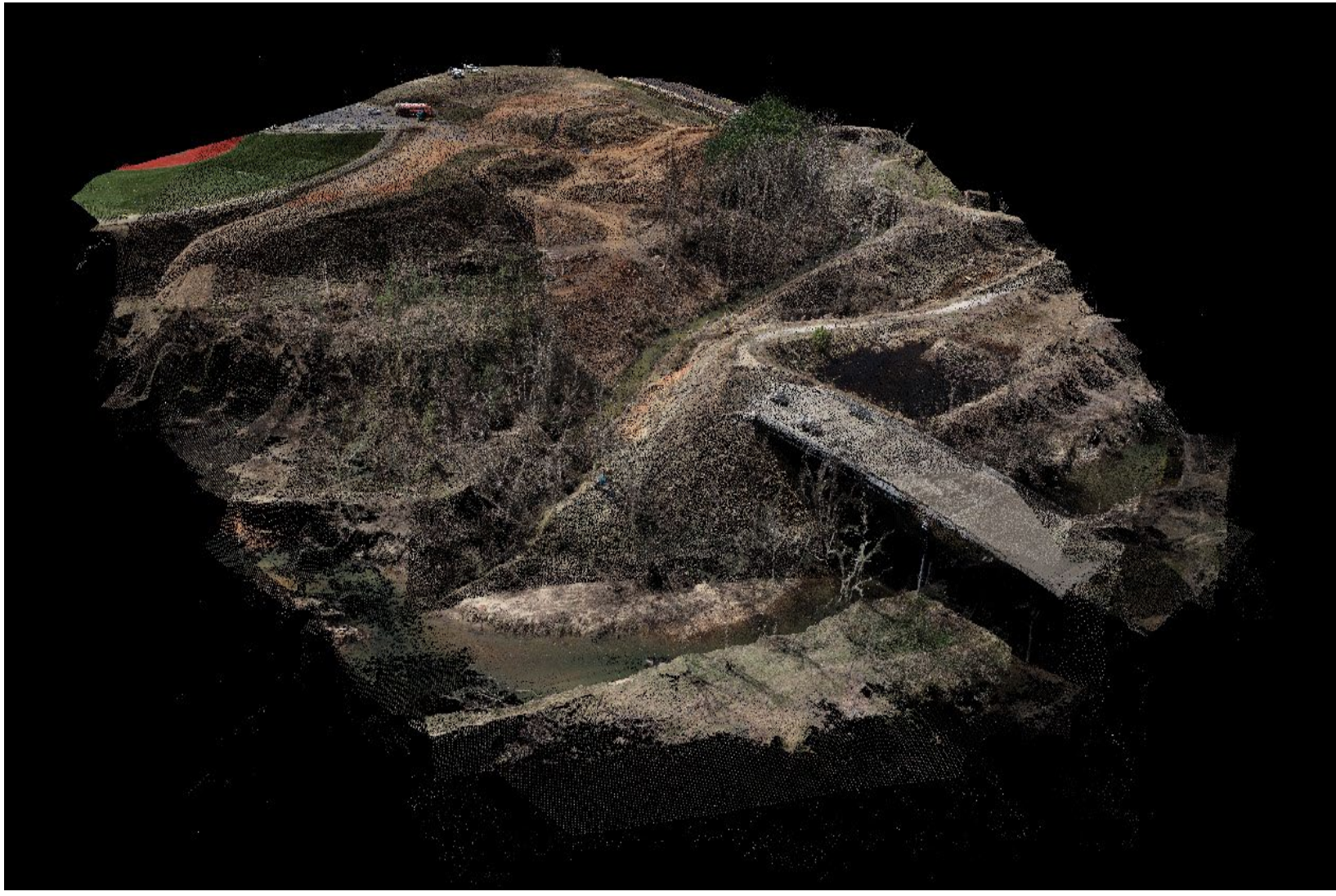
- On cleared sites (up to a certain size: 100 acres or less?)
  - Due to battery power
  - File size
  - Time in the field



Deliverables

Point Clouds

- Can be used to give a 3d visual representation of project site
- File size is manageable for ORD
  - 0.2 gygabytes file size per 25+/- acres



Deliverables

Reality Models

- Provides a photogrammetric 3d view of a project site that can be imported into ORD
- Has extremely large file size
  - 1-4 gigabytes for typical small bridge survey project
- Preferred software: ContextCapture
  - Is a Bentley Product (Same as Open Roads Designer)
  - Is available to all NCDOT employees

Propeller AeroPoint GCP

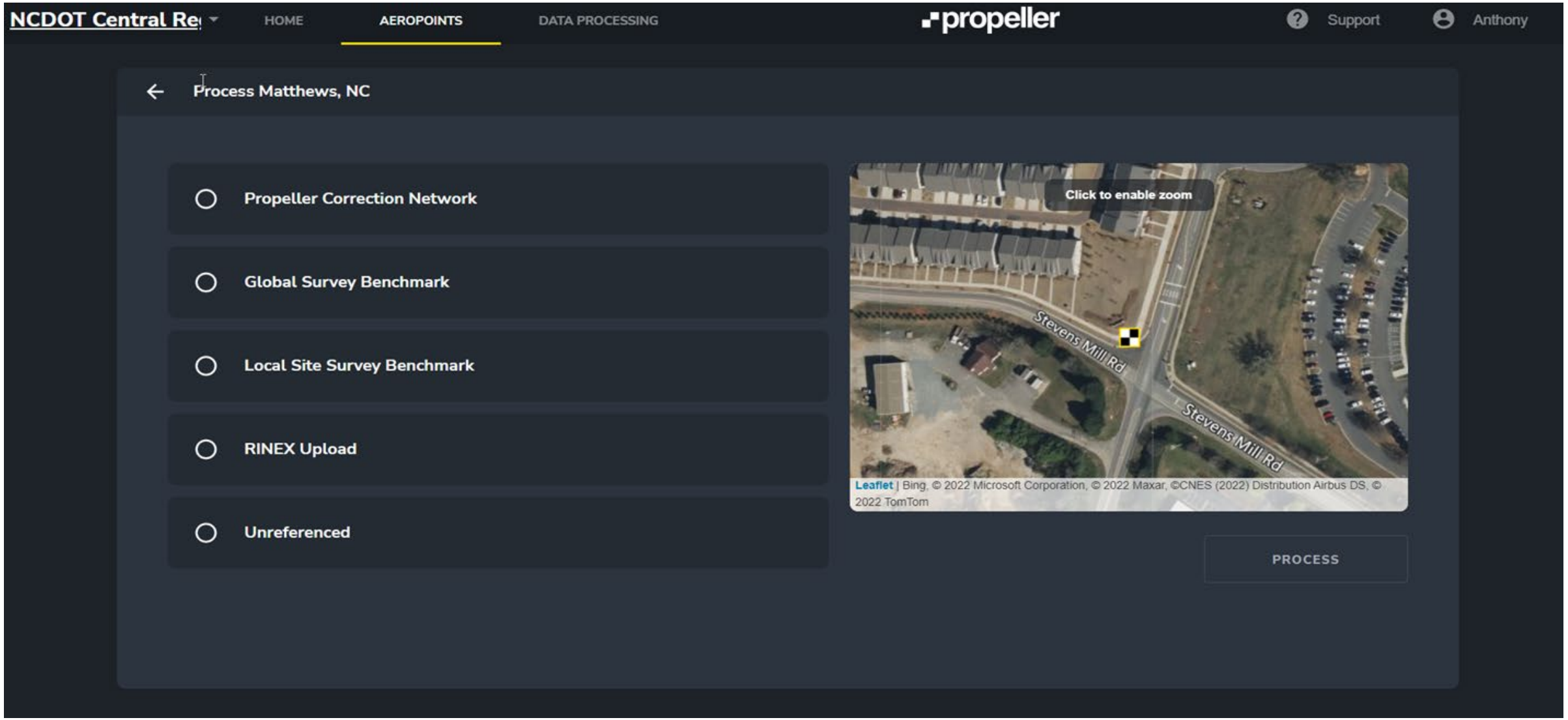
Durable, lightweight design
Forget complex surveying equipment and prevent human error with these durable, lightweight ground control points.

One-button operation
One-button operation means you don't need to be a GPS expert to use them. Just lay them out, and they'll do their job.

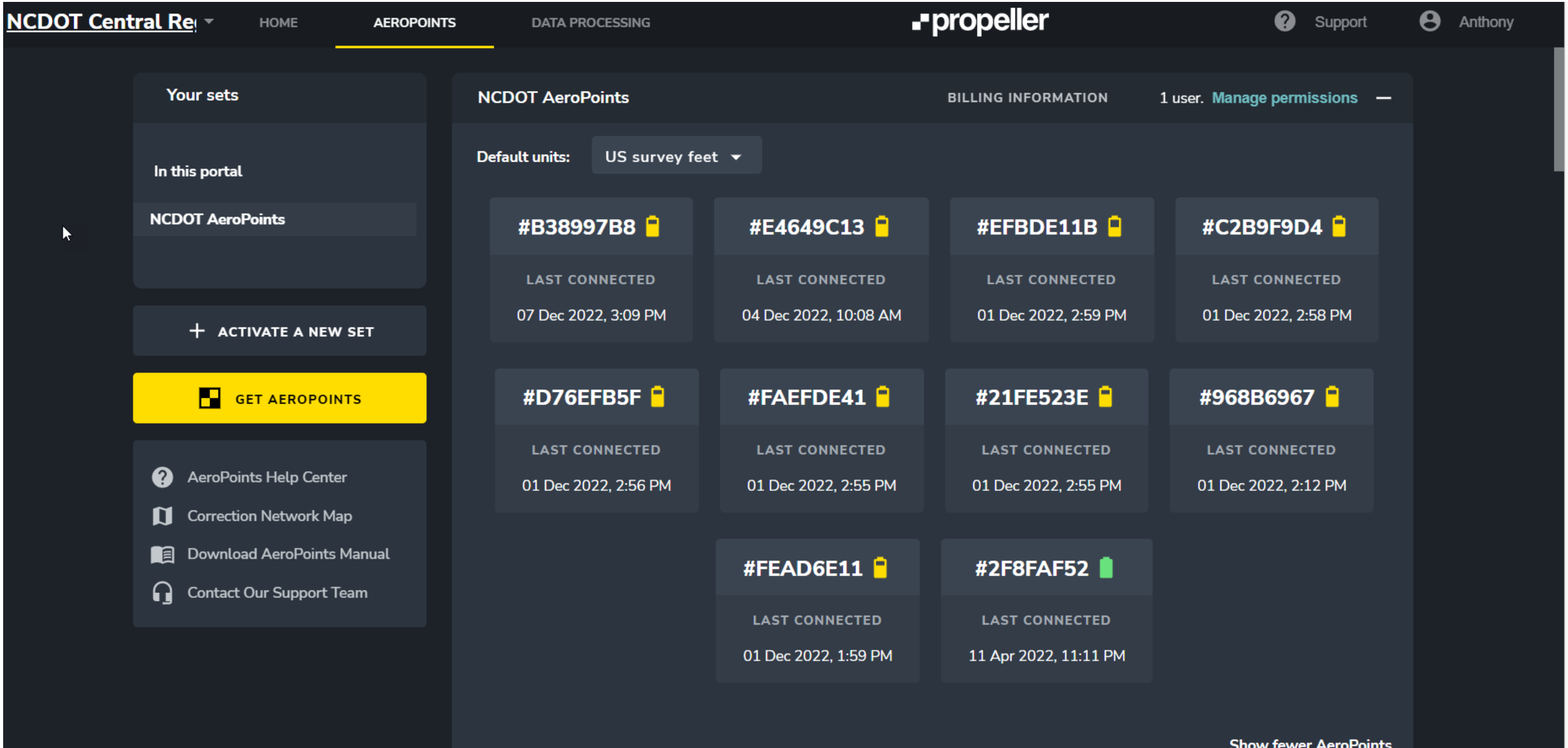
AeroPoints upload their ground control data wirelessly to your user portal from whenever you are. Never worry about processing your own data again.

A dedicated AeroPoints app delivers real-time diagnostics about your ground control hardware and makes configuration setup a breeze.

Propeller AeroPoint



Propeller AeroPoint



Current Processing Software(s)

- Drone Deploy
- Bentley MicroStation V8i
- Bentley Context Capture
- Bentley Open Roads Designer (Topo DOT)
- Trimble Business Center (currently)
- UAS Master

- Current UAS Usage.
- Project Highlights and Testing

UAS Test Site (Sanford, NC)

Project Highlight

BOOM Supersonic Survey

L&S tasked with:

- Providing Construction updates via videos / pictures.
- Updating DTMs periodically for future roadway. (project previously flown with traditional manned aircraft.)
- Stockpile Analysis & Volumetric Quantities.

TOKYO
TO
SEATTLE
4:30h
Instead of 8:30h

NEW YORK
TO
FRANKFURT
4:15h
Instead of 8:00h

TOKYO
TO
SEATTLE
4:30h
Instead of 8:30h

TOKYO
TO
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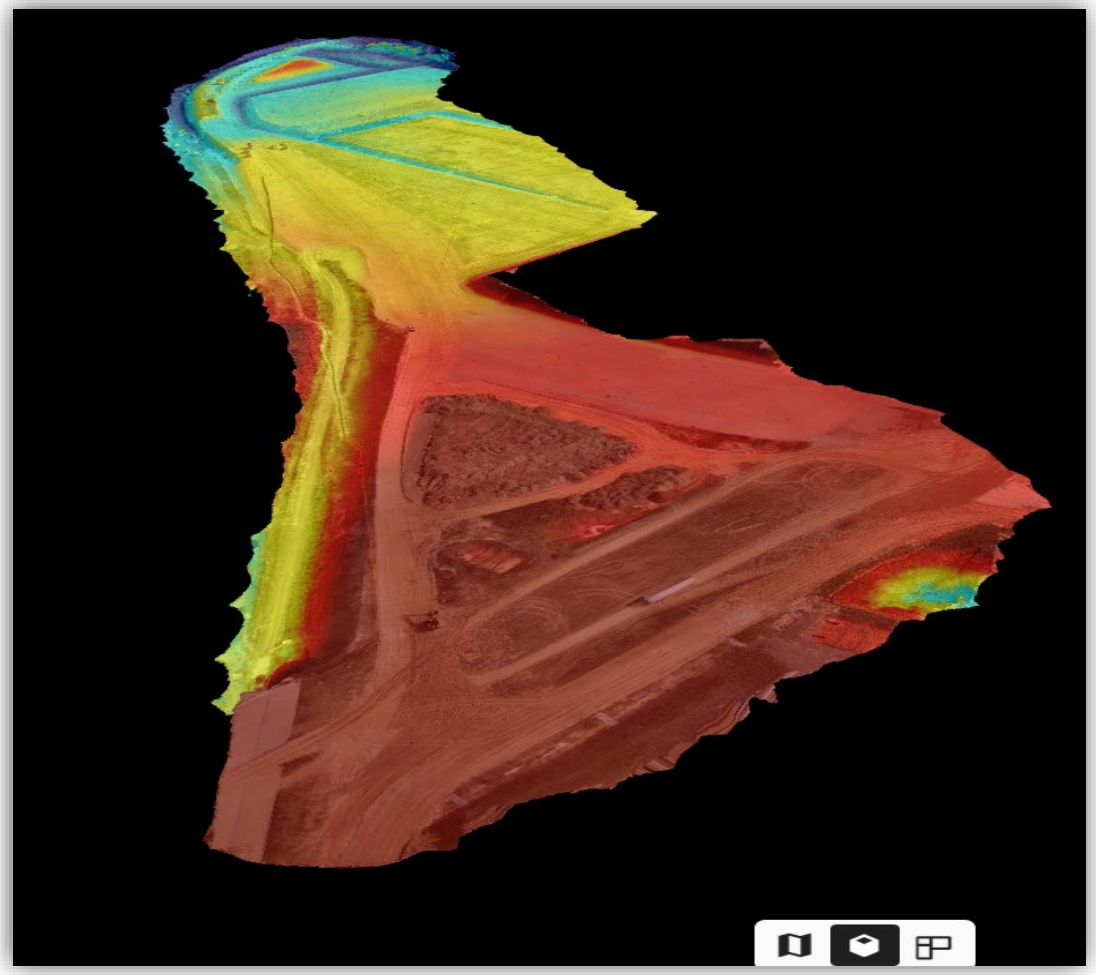
Project Highlight

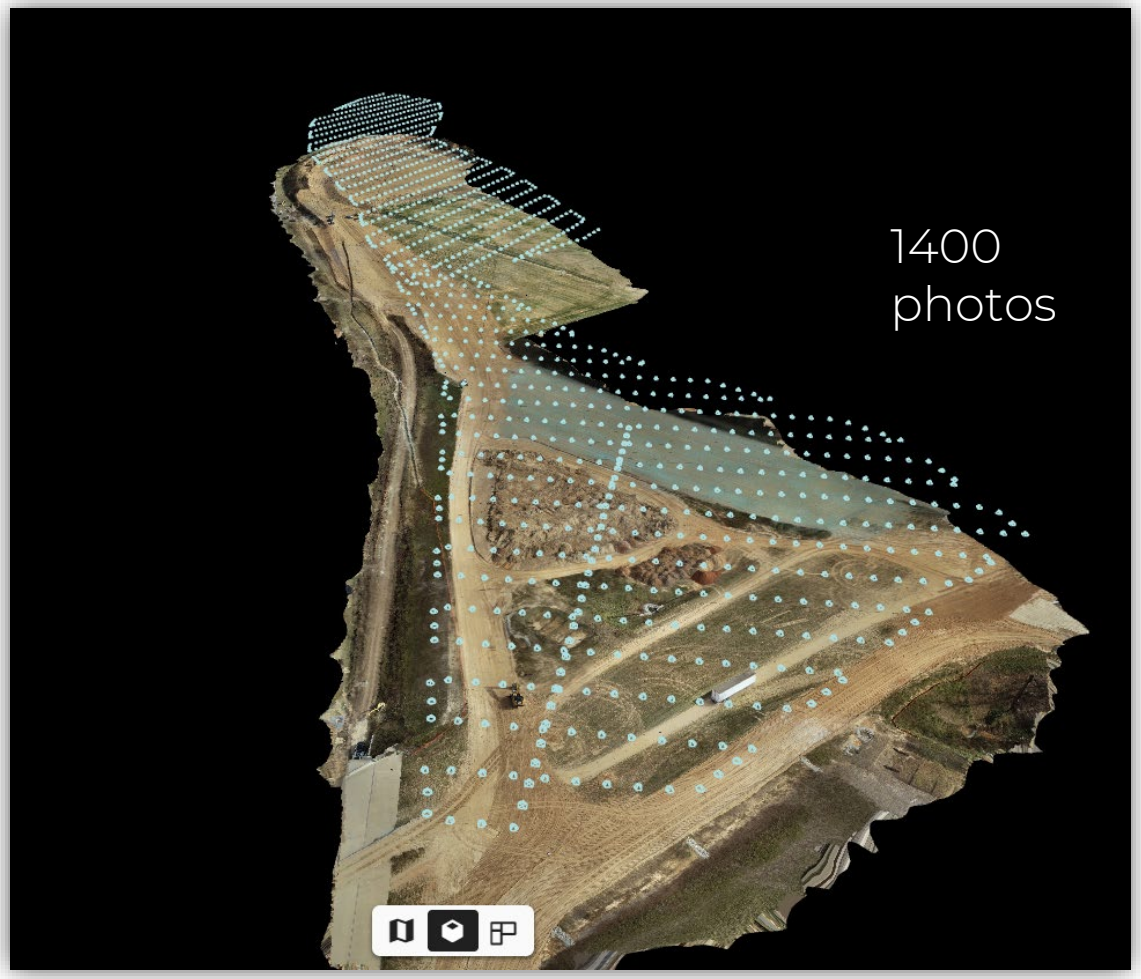
BOOM Supersonic Survey

Project Highlight

BOOM Supersonic Survey



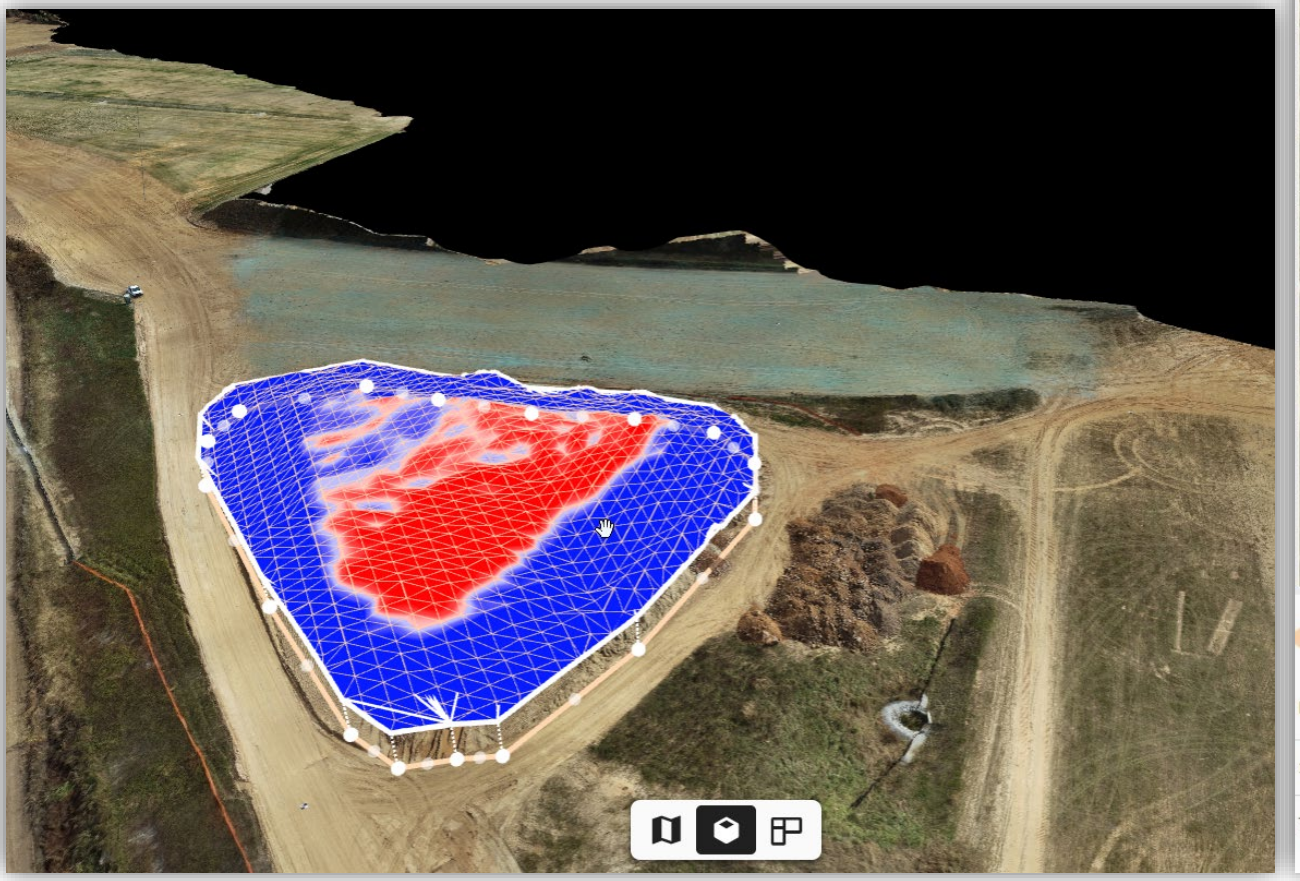
Elevation Heat Map



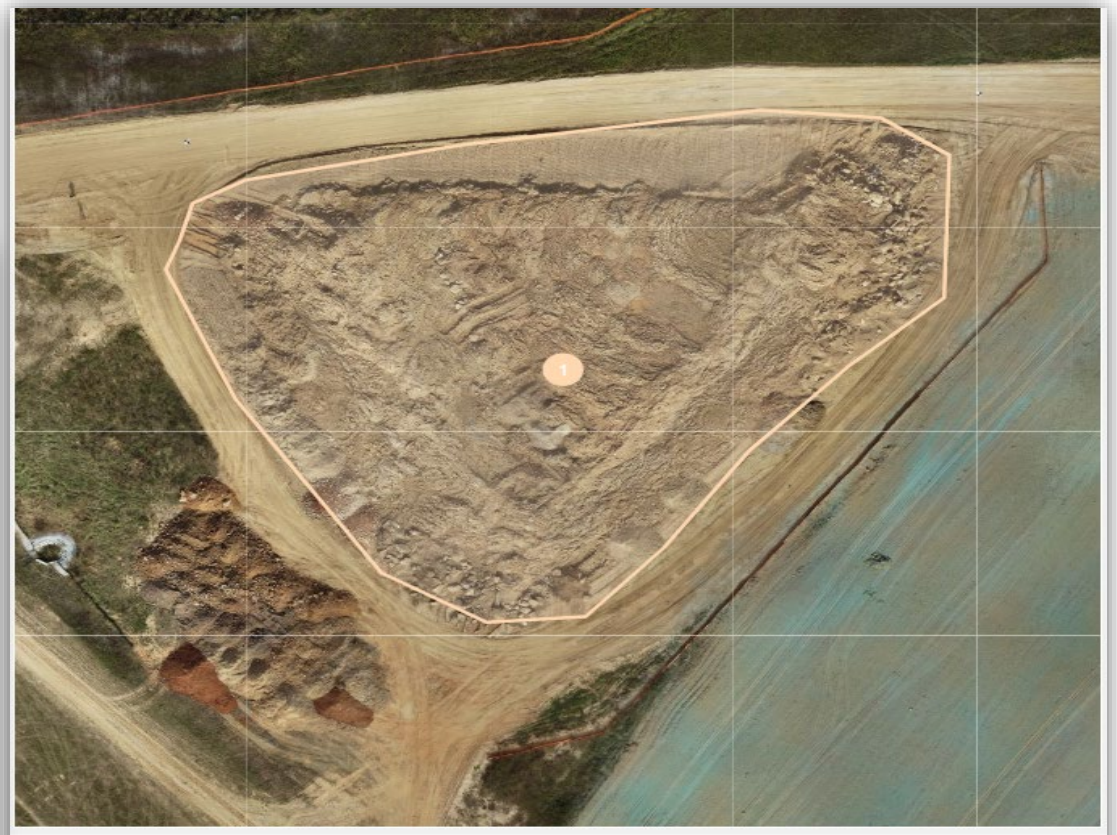
Digital Orthomosaic

Project Highlight

Stockpile Analysis



BOOM Supersonic Survey

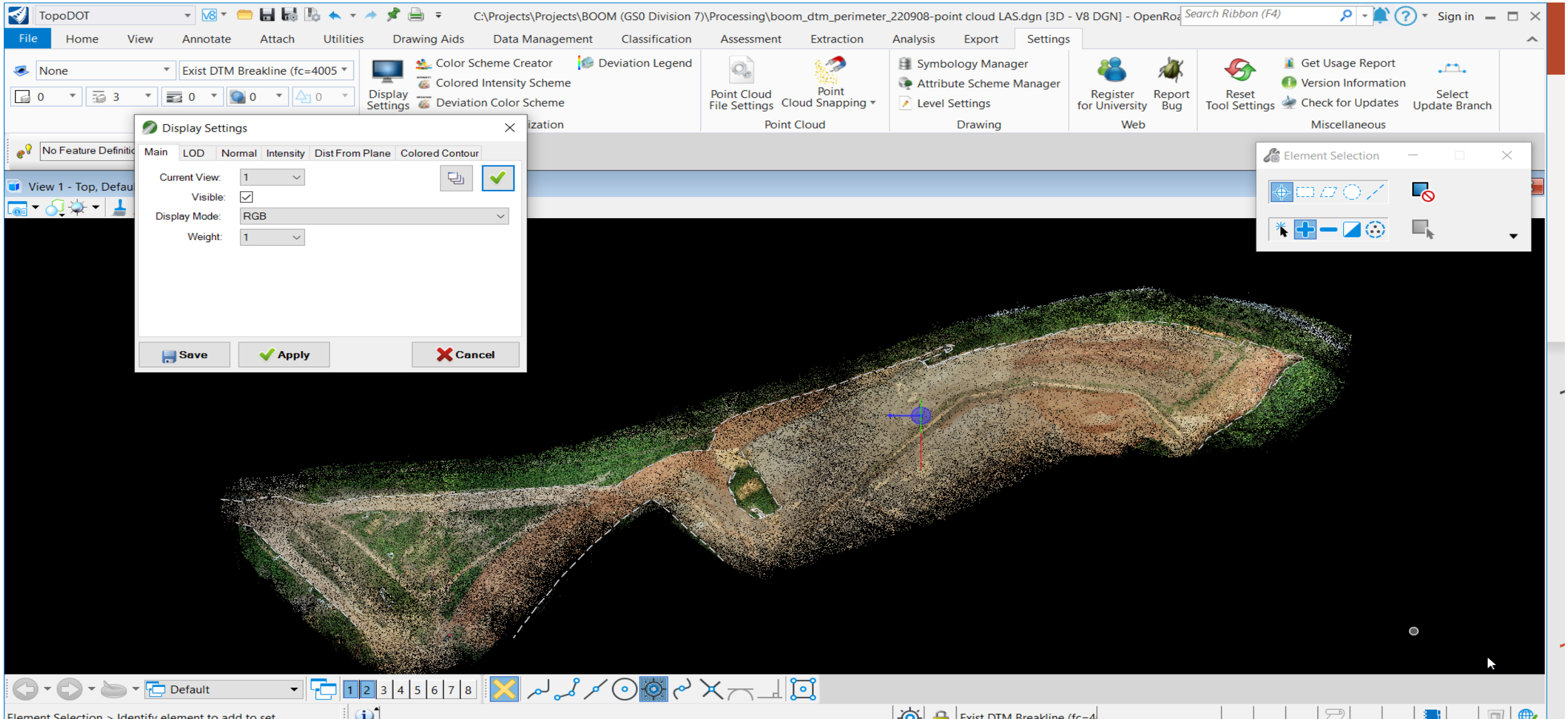


Top Soil

Label	Title	Material Volume	Cut	Fill
1	Stockpile - Area 1	16532.91 y³	16532.91 y³	16.03 y³
Total:		16532.91 y³	16532.91 y³	16.03 y³

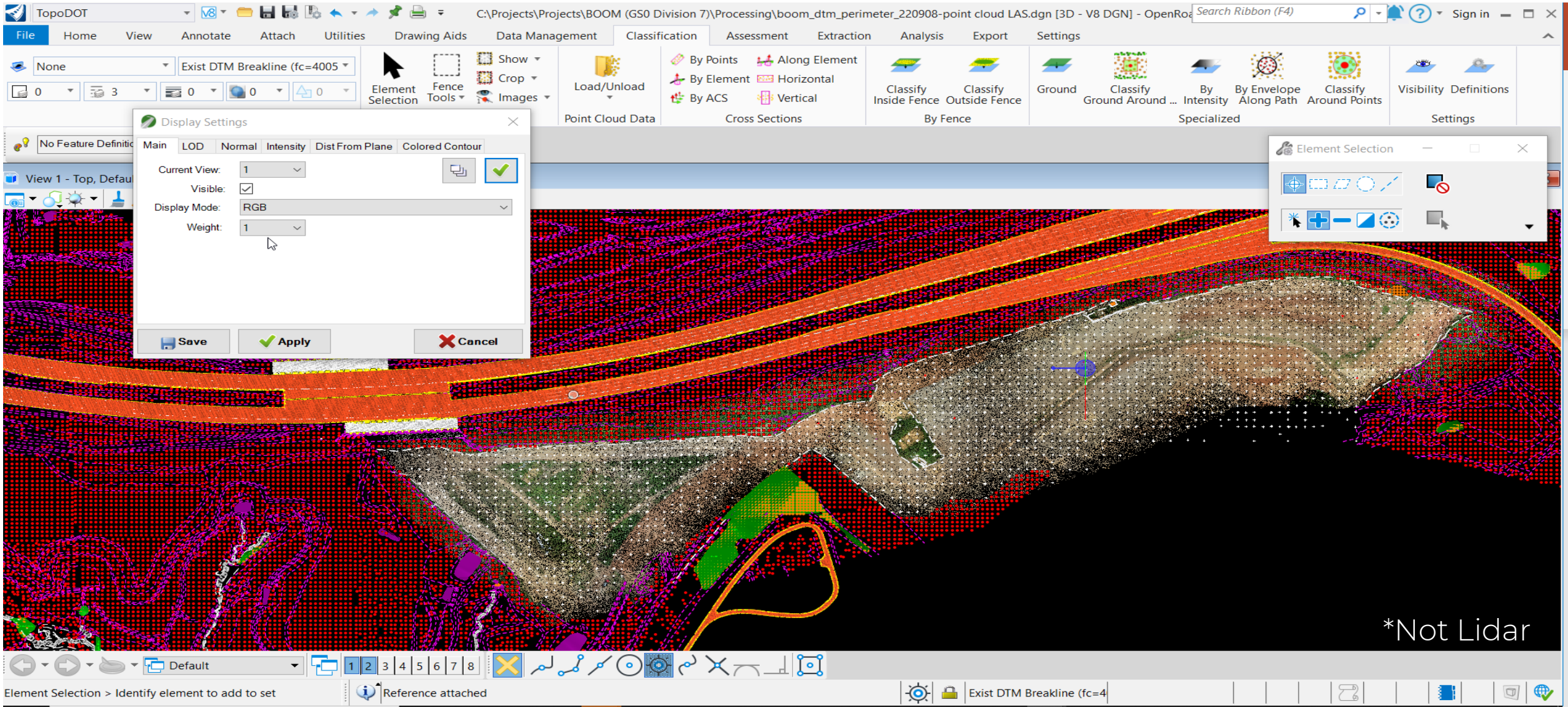
Project Highlight

BOOM Supersonic Survey



Project Highlight

BOOM Supersonic Survey



Project Highlight

Howard Gap Road Rockslide

Project Highlight

Howard Gap Road Rockslide

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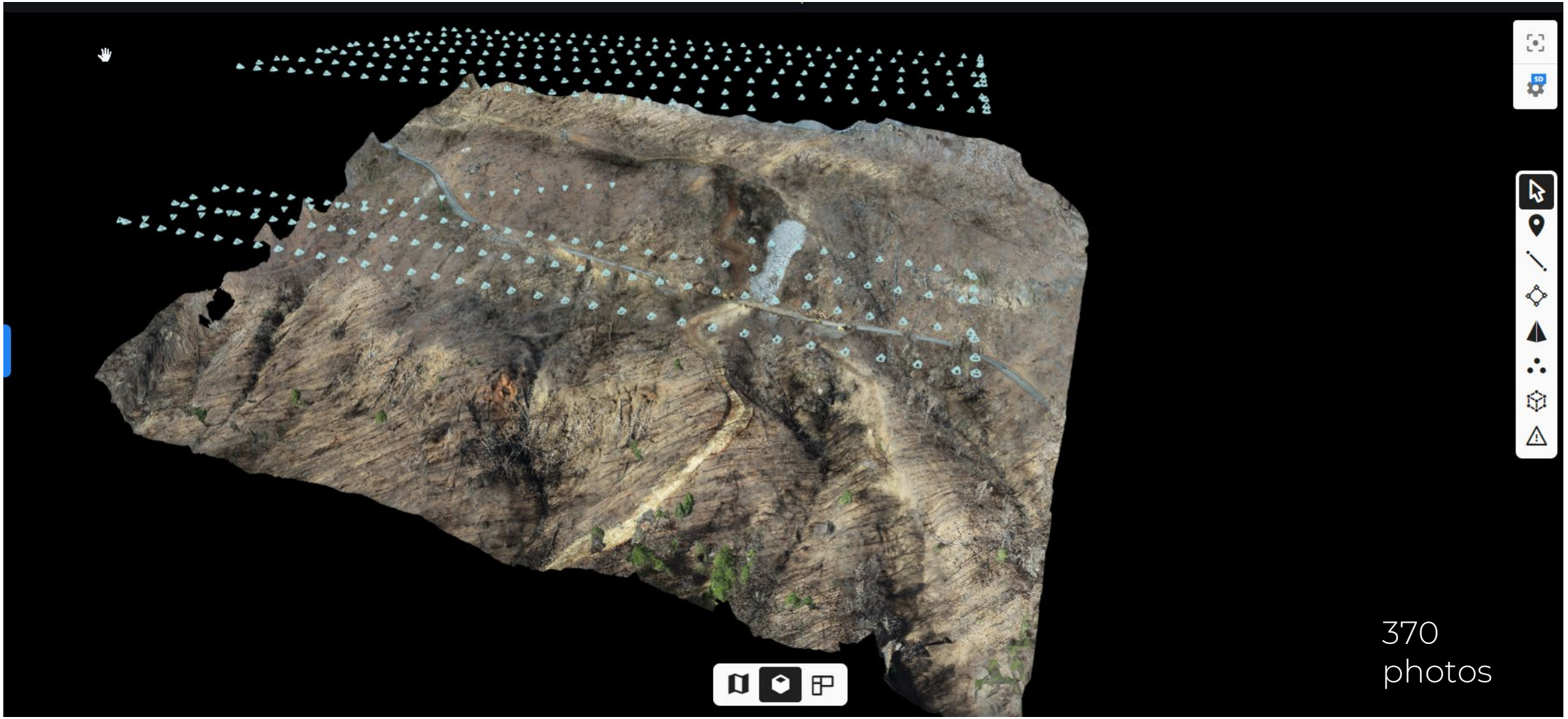
Howard Gap Road Rockslide



Project Highlight

Howard Gap Road Rockslide

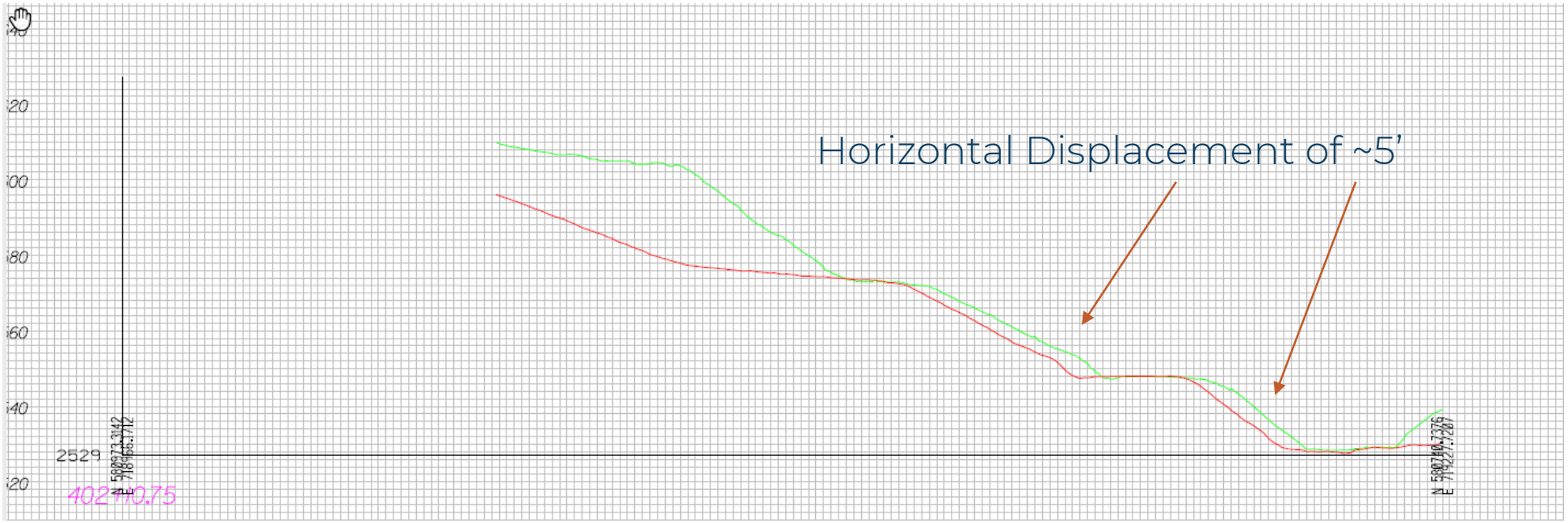
Slide is causing horizontal pavement displacement.

Project Highlight

Cowee Mountain Rockslide

Project Highlight

Cowee Mountain Rockslide

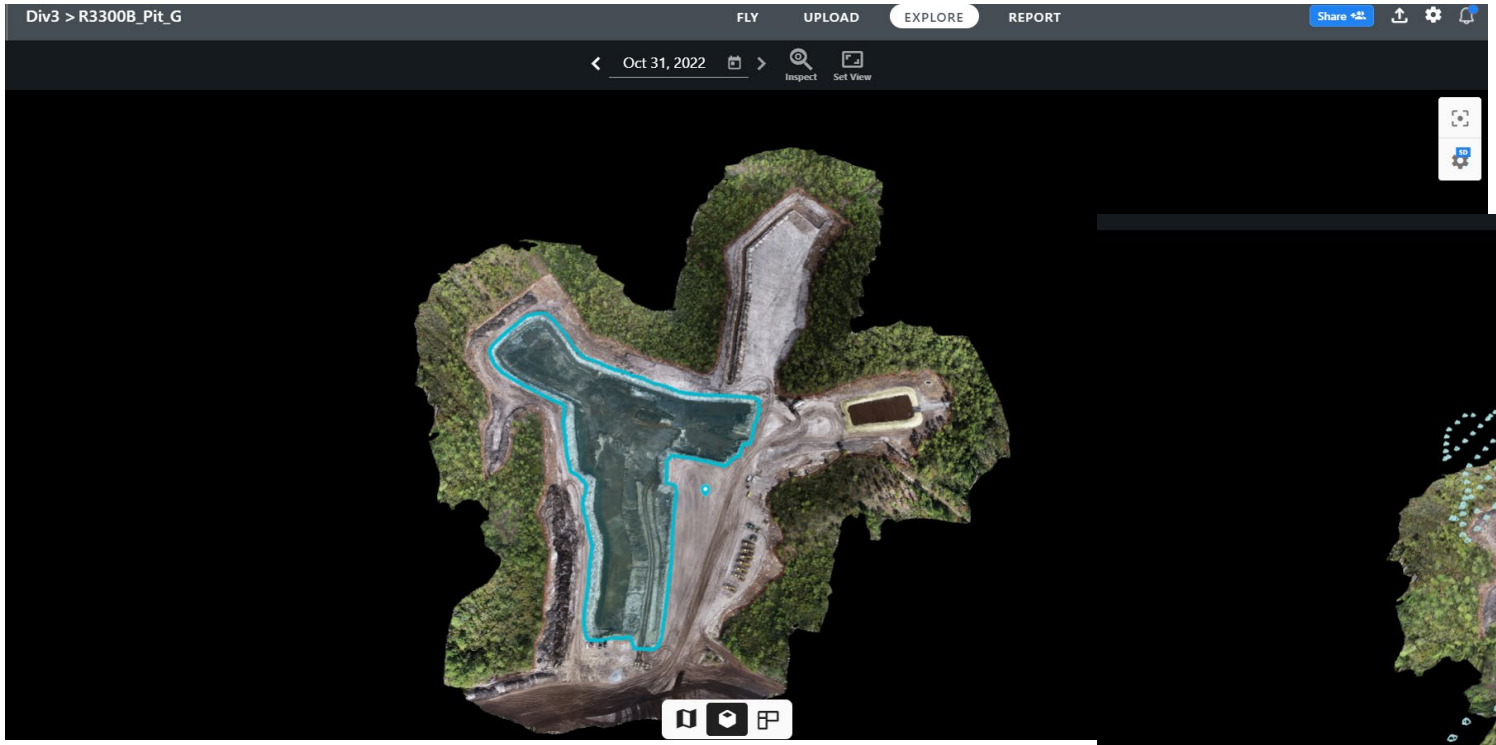


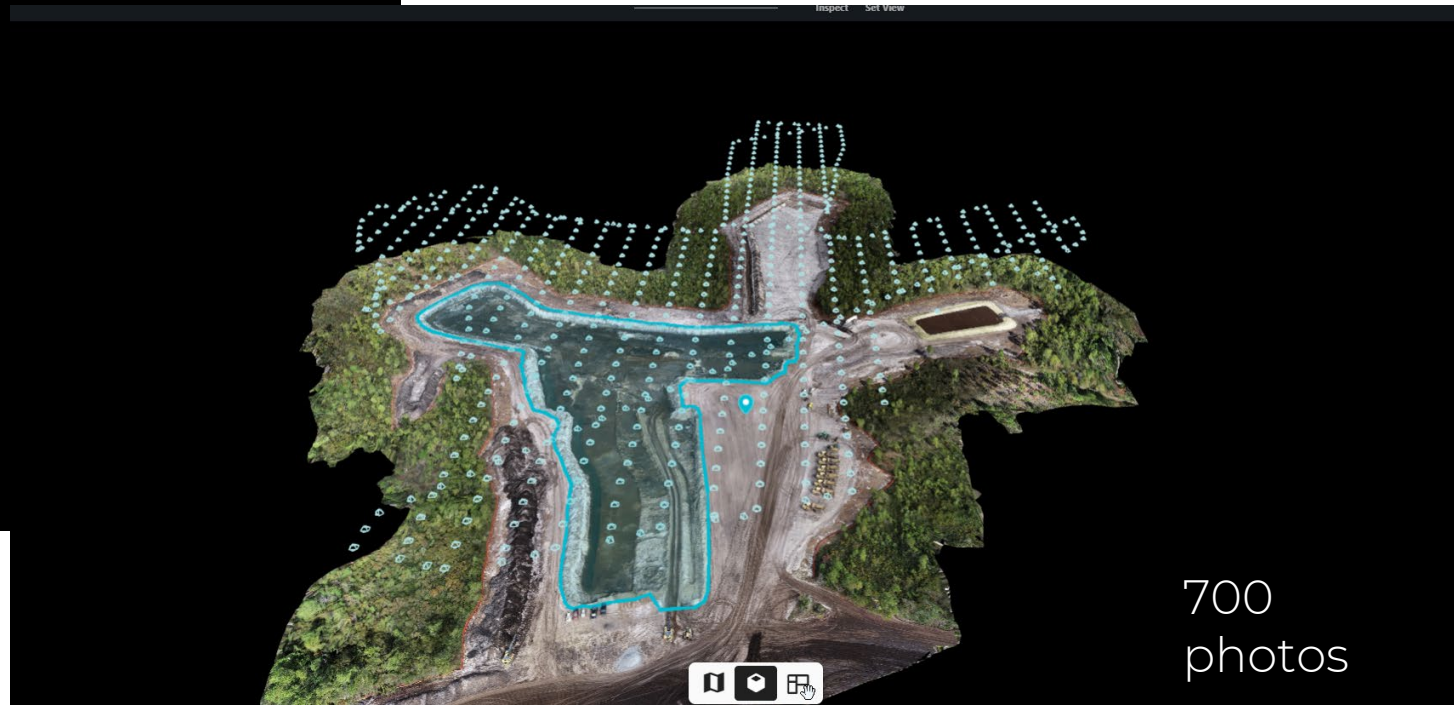
- Red line is 2018 QL1 LiDAR
- Green line in 2022 UAS Data

Project Highlight

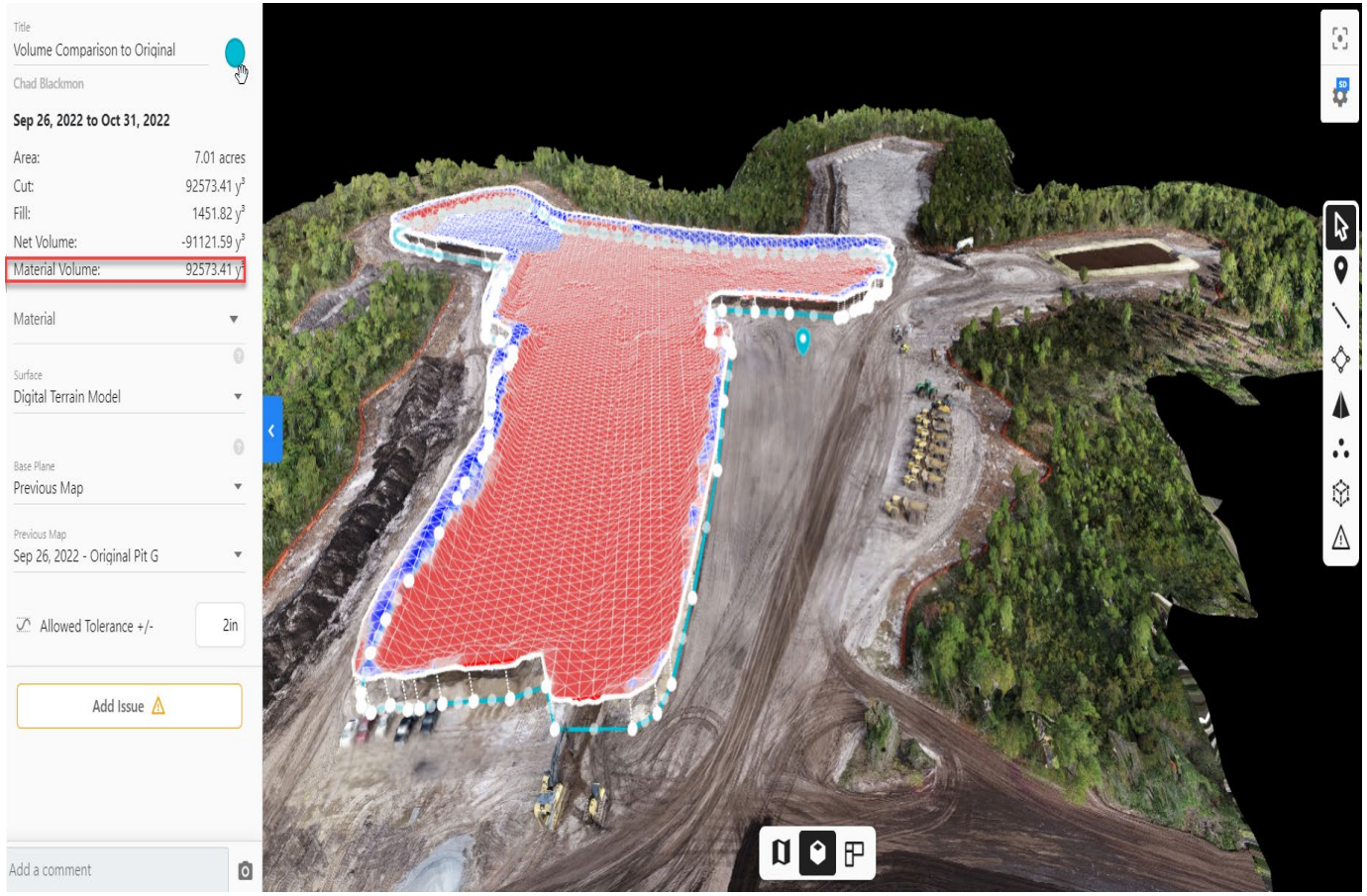
Hampstead Bypass
R-3300B (Pit G)

Volumetric Analysis
(post excavation)



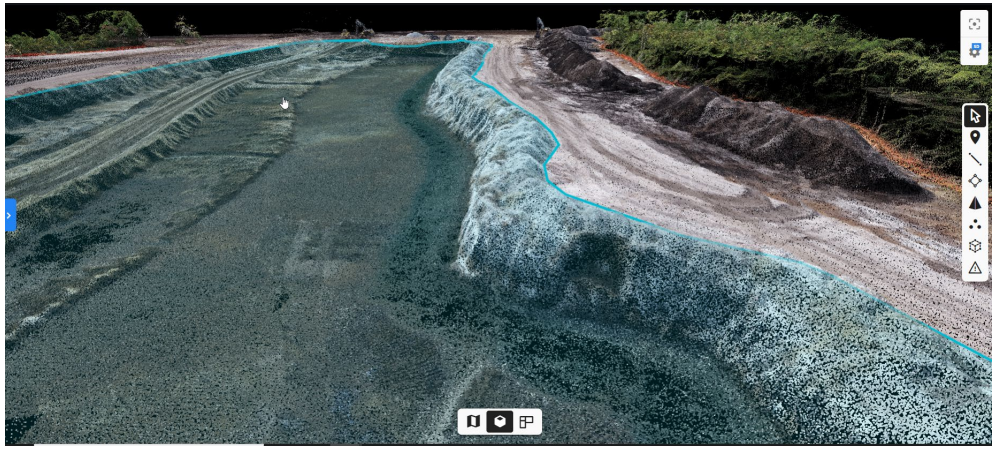


Project Highlight



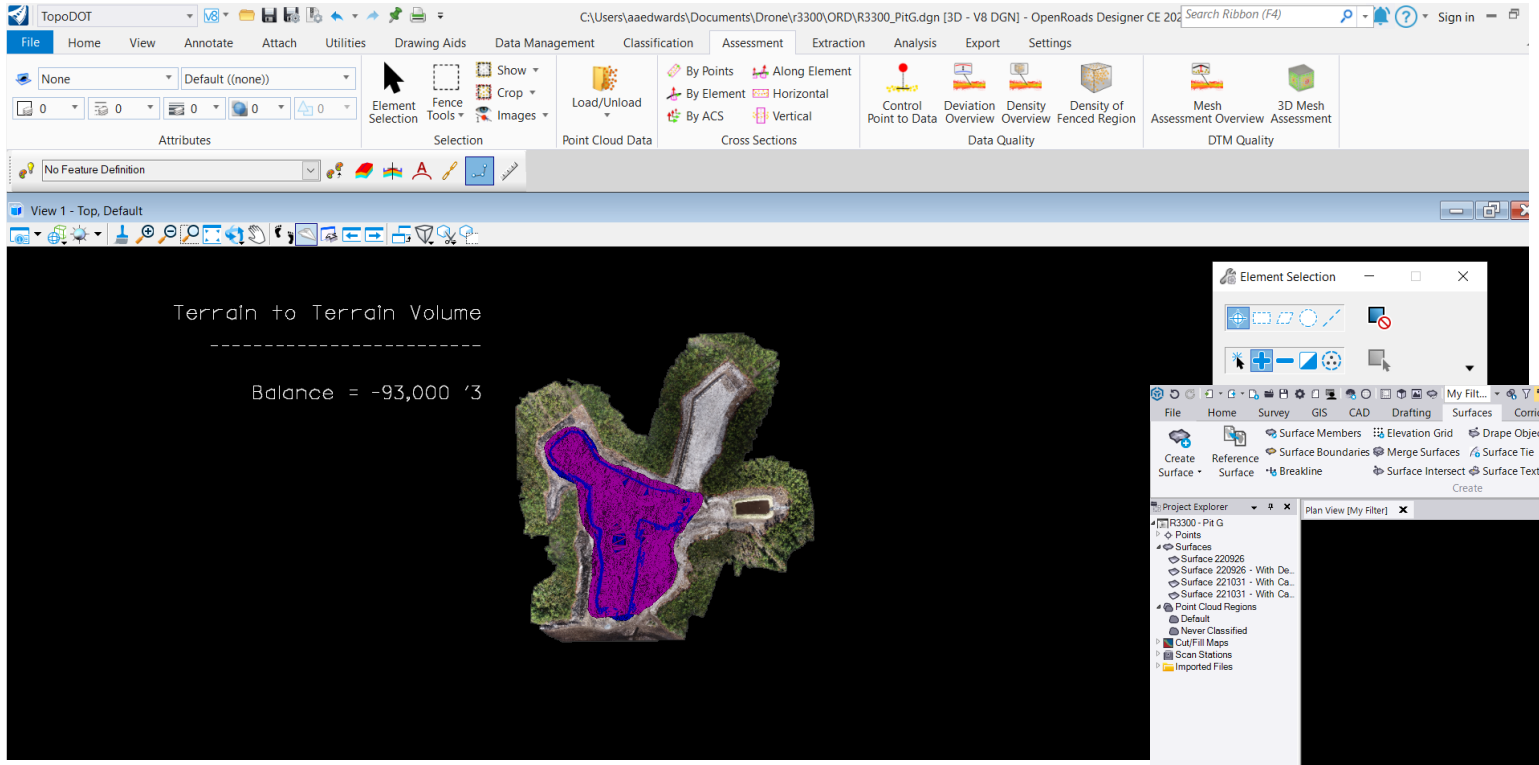
Volumetric Analysis
(post excavation)

Hampstead Bypass
R-3300B (Pit G)



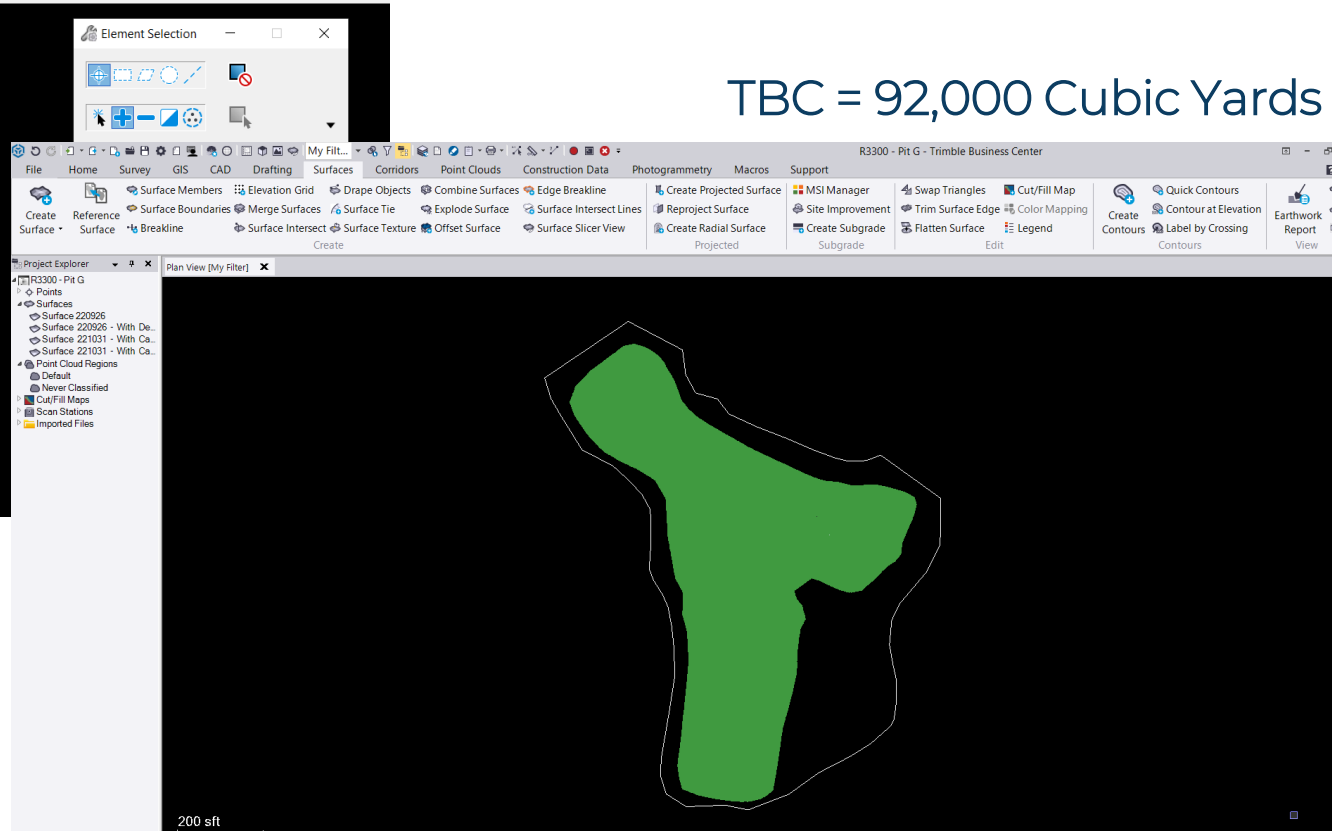
Project Highlight

Hampstead Bypass R-3300B (Pit G)



Volumetric Analysis (post excavation)

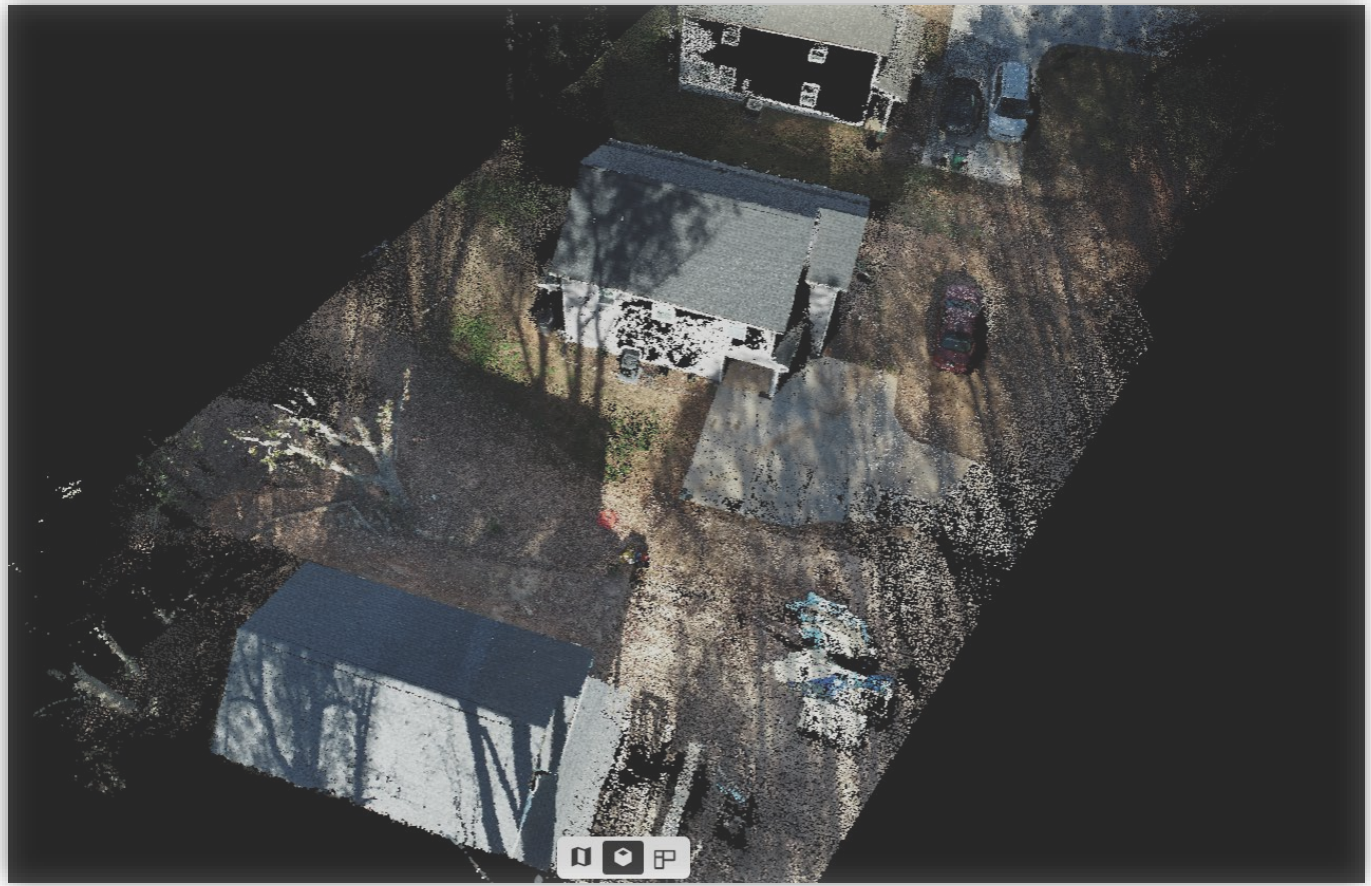
TBC = 92,000 Cubic Yards



ORD – 93000 Cubic Yards

Project Highlight

HL-0025



2D Feature Data Extraction
(New Home Construction)

Project Highlight

U-5808

2D Feature Data Extraction
(Utility Poles)

- Future Uses

Subsurface Utility Engineering

Future Use(s)

2D Feature Data Extraction(Subsurface Utility Engineering)

Subsurface Utility Engineering

Traffic Analysis

Future Use(s)

Traffic Analysis (Independence Blvd. – on ramp)

L&S Continued & Future Uses

- Supplement Crewed Photogrammetry data with UAS data.
- Construction erosion control analysis and documentation after large rain events on Construction projects.
- Intermediate volumes on small Borrow pits and earth work projects.
- Small project updates / Secondary roads and intersection surveys.
- Location and Surveys is looking for new and innovative ways to use this new technology to help in our mission to collect data and produce mapping for NCDOT projects.

L&S Continued & Future Uses

Lessons learned.

- A tool within the toolbox.
- Front End Preparation / Back End Processing
- FAA & Regulatory Agencies

Where are we headed?

- Drone w/ LIDAR capabilities (accuracy - speed – canopy penetration)
- Ongoing development of Unit SOP / Checklist (mission specific)
- Continued training throughout the Unit and increased Part 107 remote pilot licensure.
- Recruitment of new staff. (Local high schools / Colleges)
- Discovering new use cases daily through innovative requests and scenarios.

Thank you!

Contact Us

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