LiDAR

What is it | Why should I Care | How do I get my hands on it

NETC | 21 March 2024

Christopher Eddy

HALEY ALDRICH

Agenda

1. Introduction
2. What is LiDAR
3. How is LiDAR Employed
4. What Do We Get From LiDAR
5. LiDAR and GAM

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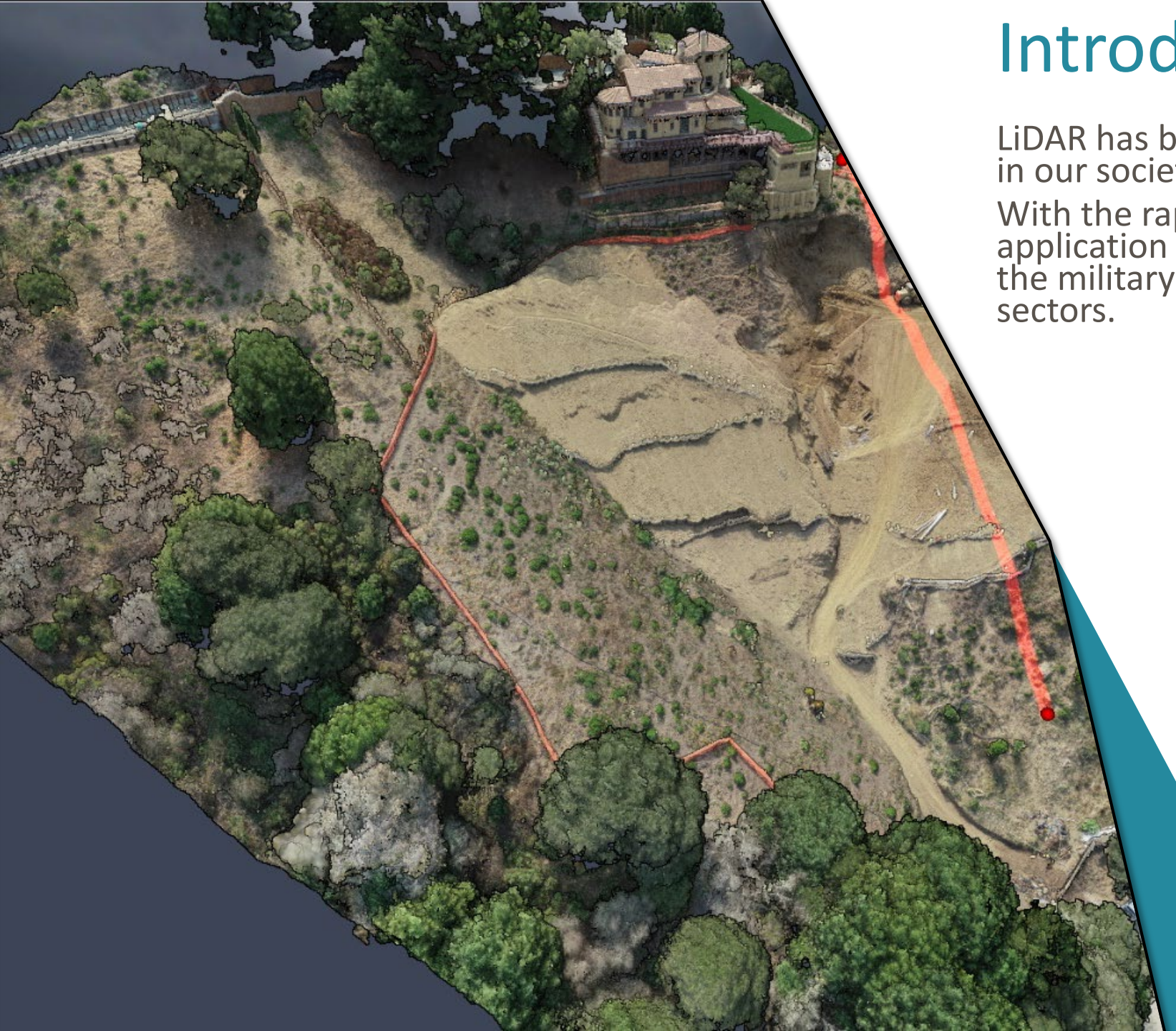

Introduction

LiDAR has become a common place term used in our society, and certainly for good reason.

With the rapid increase in GPS technology the application of LiDAR has moved from NASA and the military into state agencies and commercial sectors.

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What is LiDAR – Light Detection And Ranging

- LiDAR can be akin to RADAR or even sonar.
- LiDAR scanners measure the time traveled by light (laser) emitted from the scanner, scattered off a surface, and received back to the scanner, giving us a distance.
- The scanner emits and collects millions if not billions of points, and with that we get very high-resolution data, sub-mm in some cases, representing the object scanned.
- The scanner is linked to a GPS unit, or tied into survey points, which give spatial relevance to the points collected.

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How is LiDAR Employed

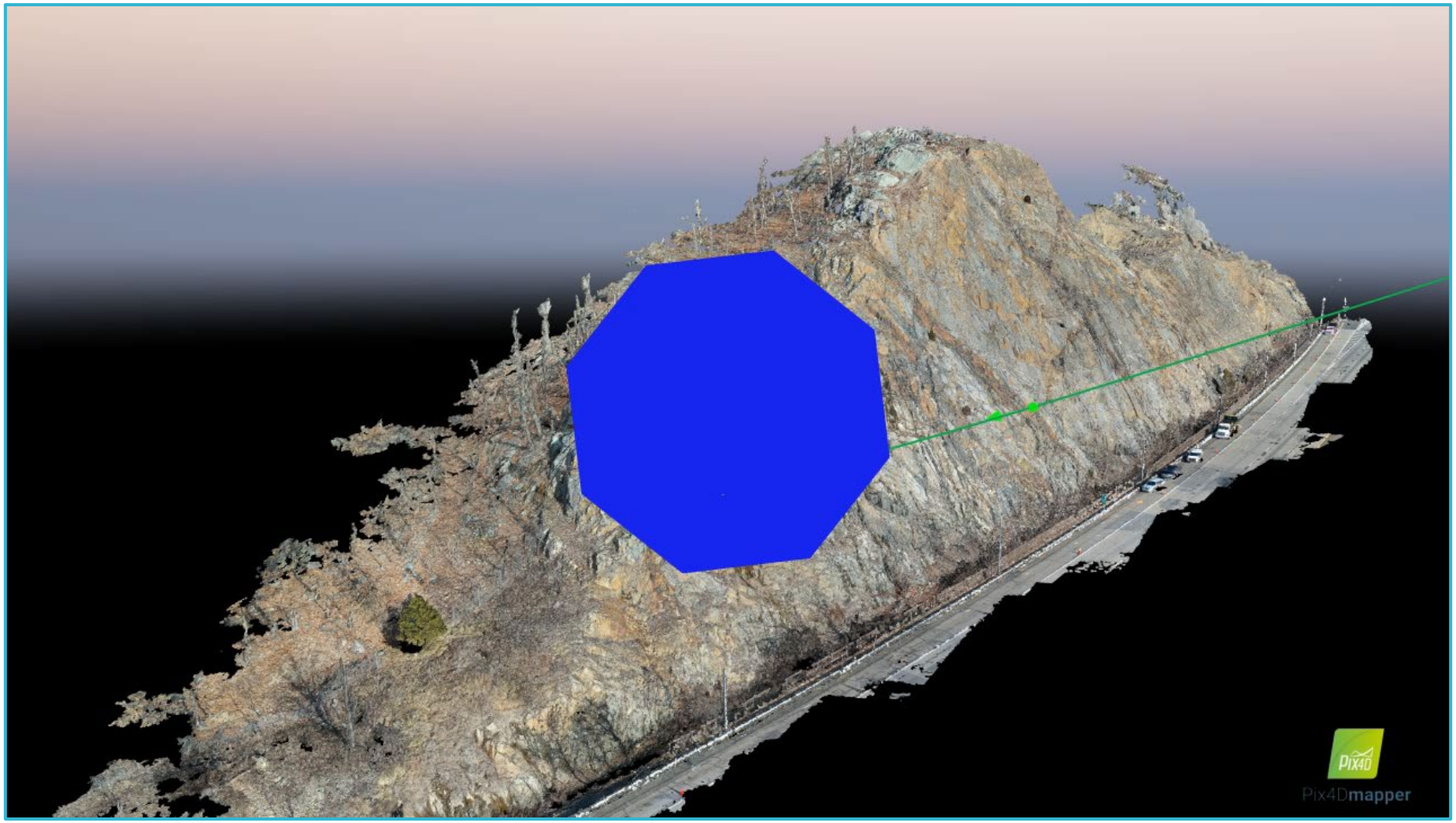
- Terrestrial – this is a unit similar to a total scanner that has extremely high resolution, the limitations when thinking about rock slopes is that they are fixed, usually at the base of a slope, and as such cannot always collect data from slopes of great height.

- Aerial – this is a fixed wing mounted unit aimed at collecting surface data. Not really useful for what we do, but QL2 data collected from fixed wing LiDAR generates very high-resolution topo maps.

- UAS – Drones are here to stay, and their utility is evident everywhere we look. High resolution photos from vantage points otherwise unattainable, to LiDAR payloads. FAA and local filght restrictions sometimes make this work difficult.

What do we get from LiDAR

- Digital Twin



What do we get from LiDAR Digital Twins

- Topographic Maps
  - Photogrammetry: inch-scale
  - LiDAR: centimeter-scale

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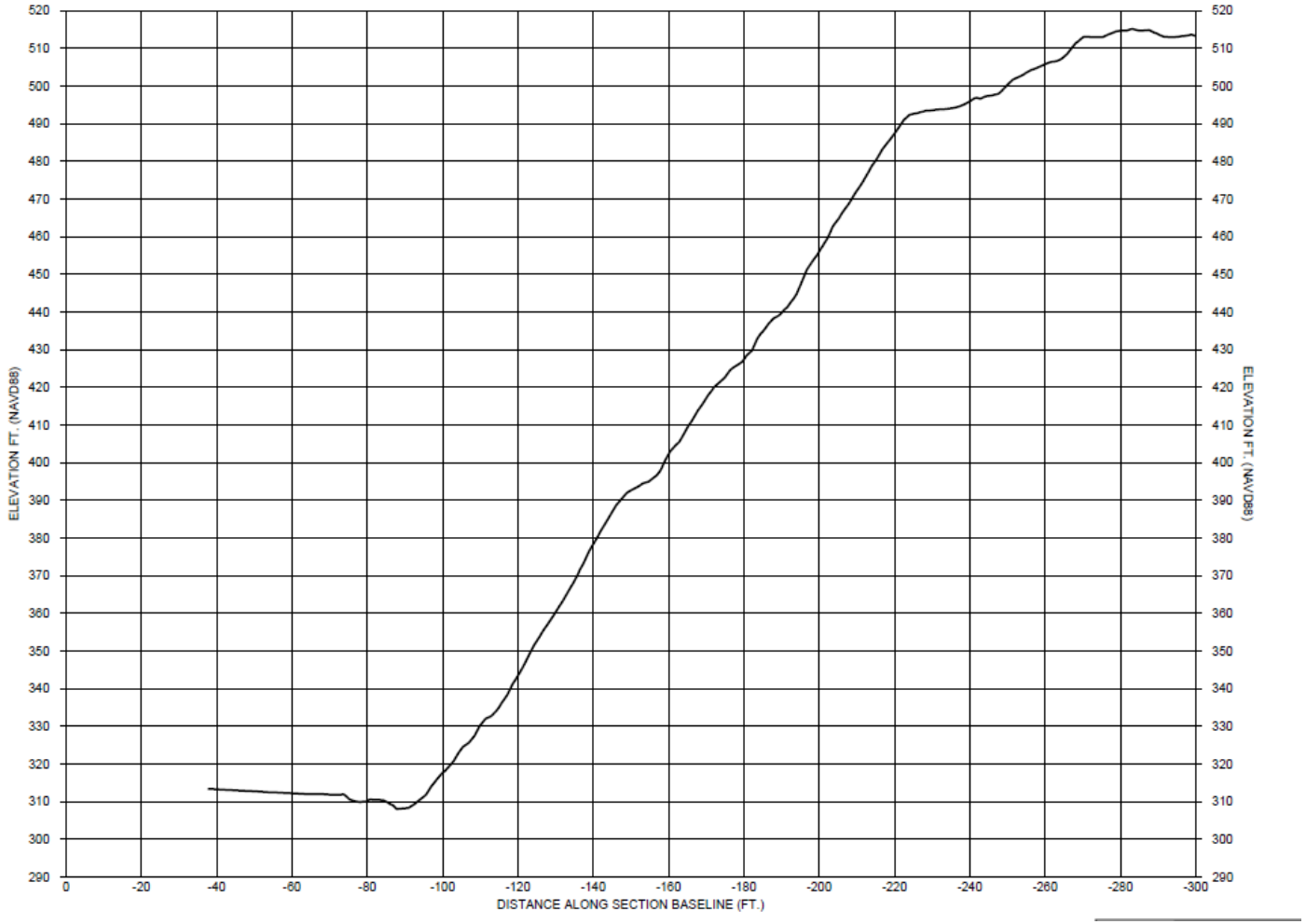
- Topographic Maps



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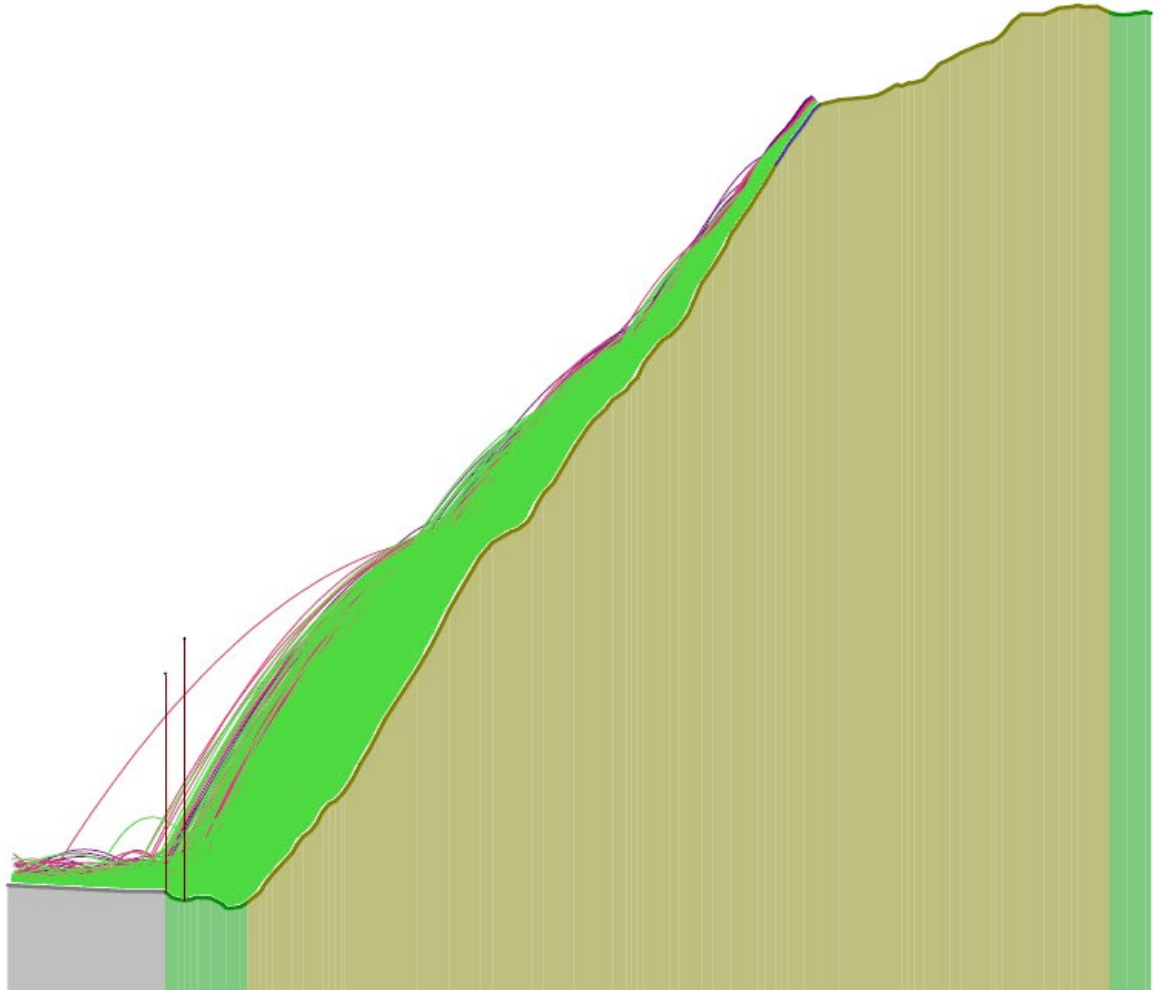

What do we get from LiDAR Digital Twins

- 3D Models
  - Volumetric calculations for stockpiles, debris chutes, removal/fill of rock or sediment

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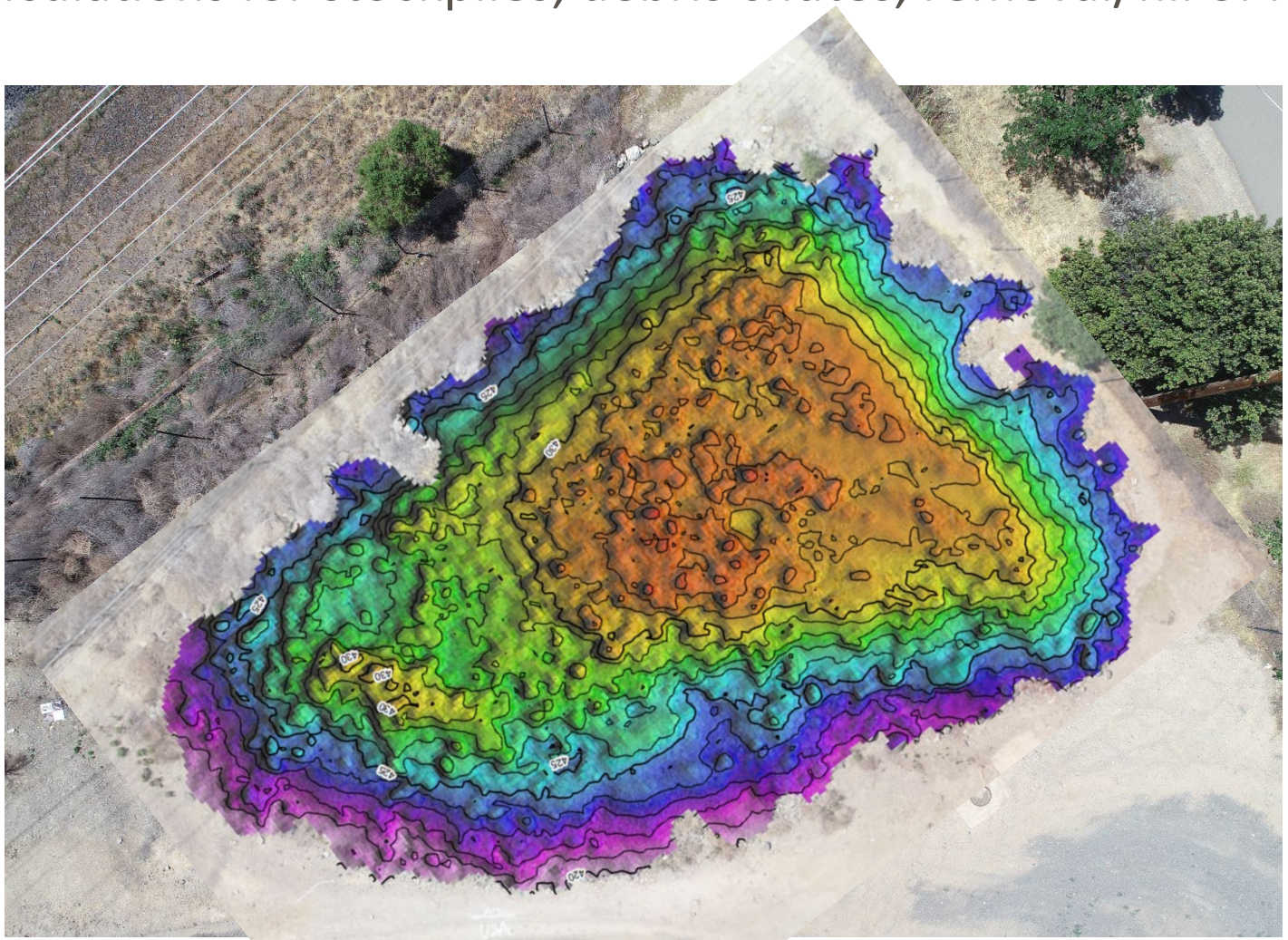
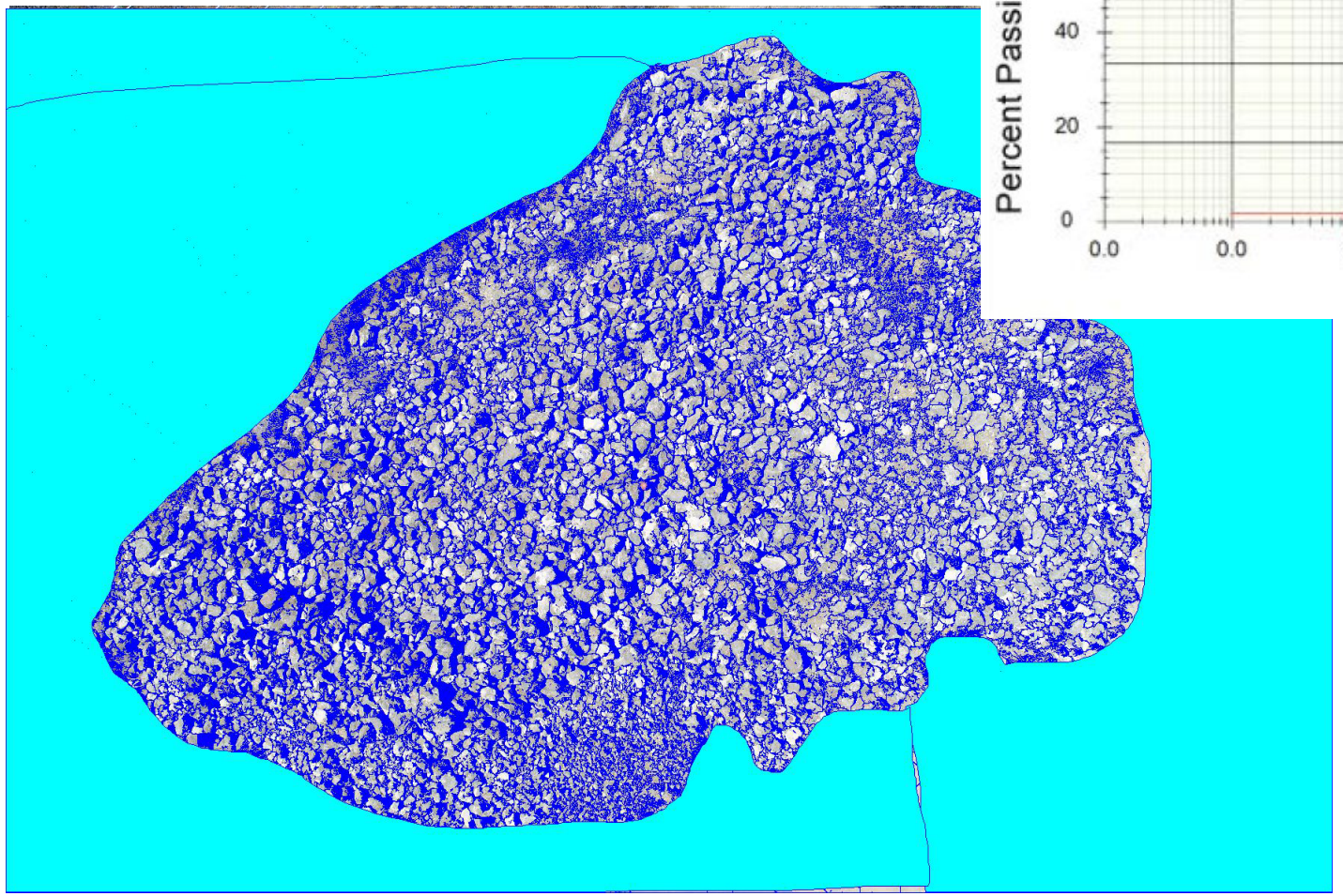
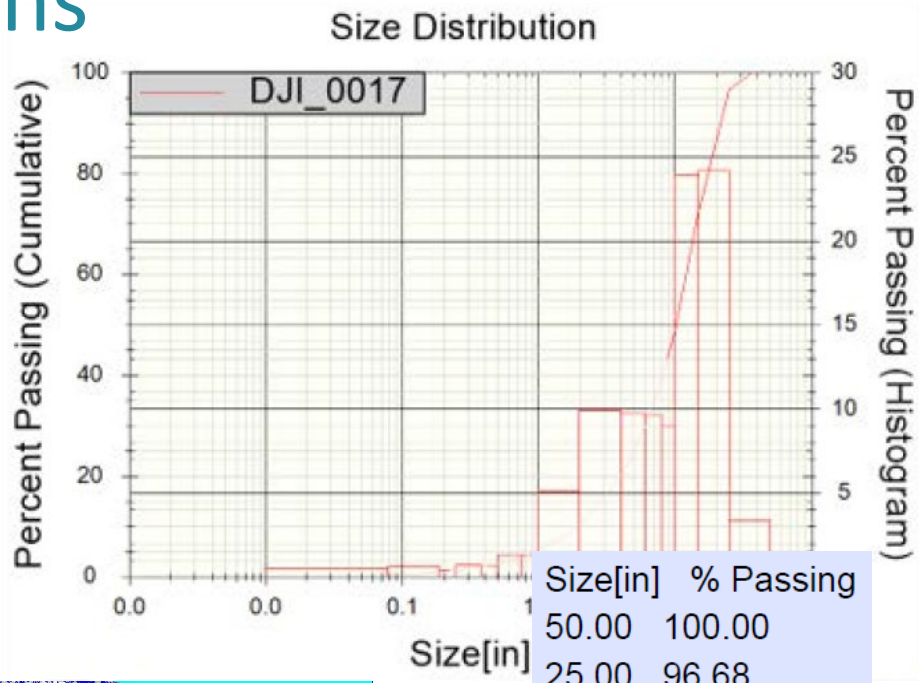


What do we get from LiDAR Digital Twins

- 3D Models
  - Particle size distribution



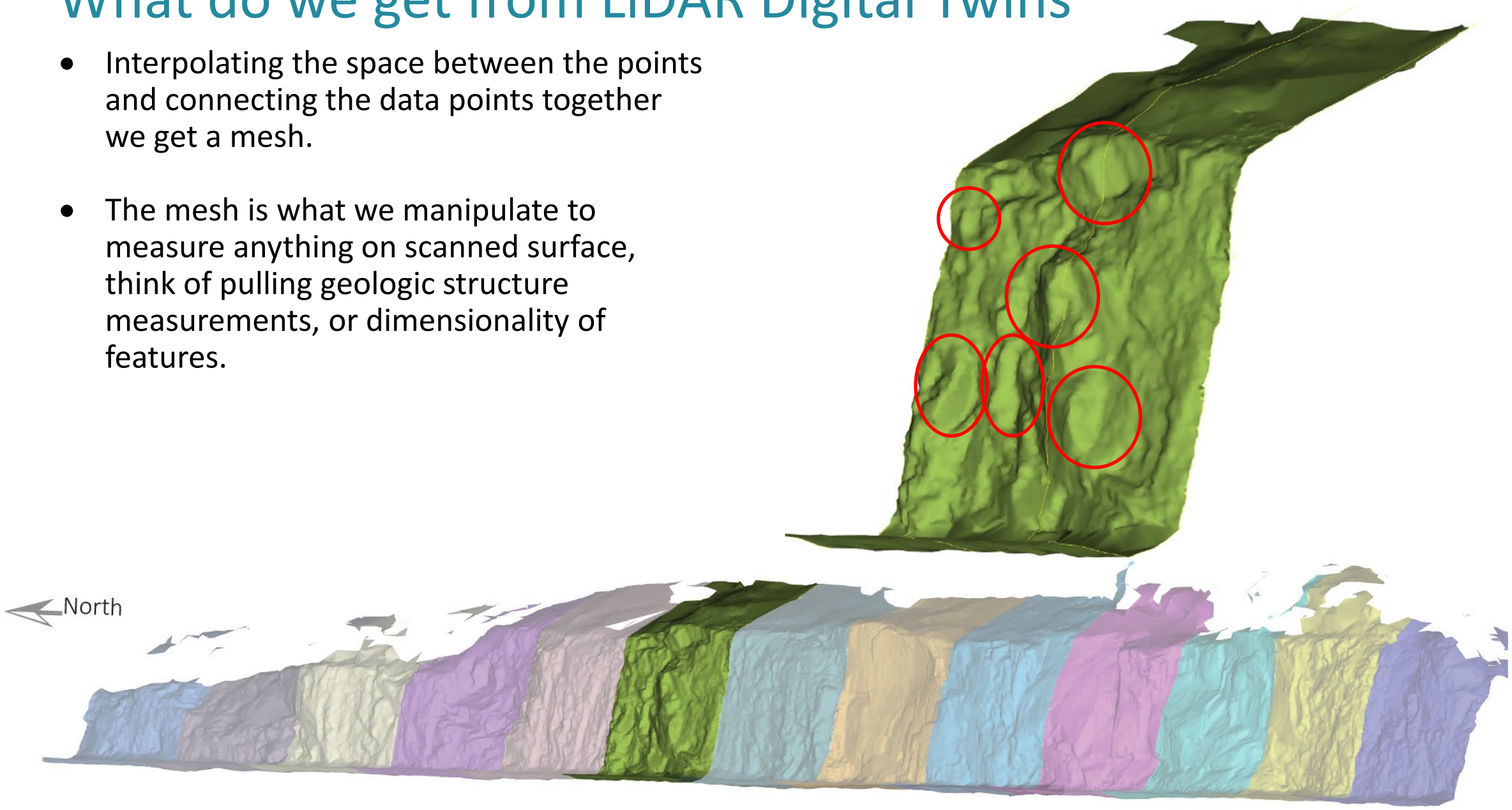


Size[in]	% Passing
50.00	100.00
25.00	96.68
15.00	72.52
10.00	48.61
8.00	39.65
6.00	30.05
4.00	20.33
2.00	10.42
1.00	5.34
0.75	4.05
0.50	2.74
0.38	2.08
0.25	1.40
0.19	1.06
0.08	0.46

What do we get from LiDAR Digital Twins

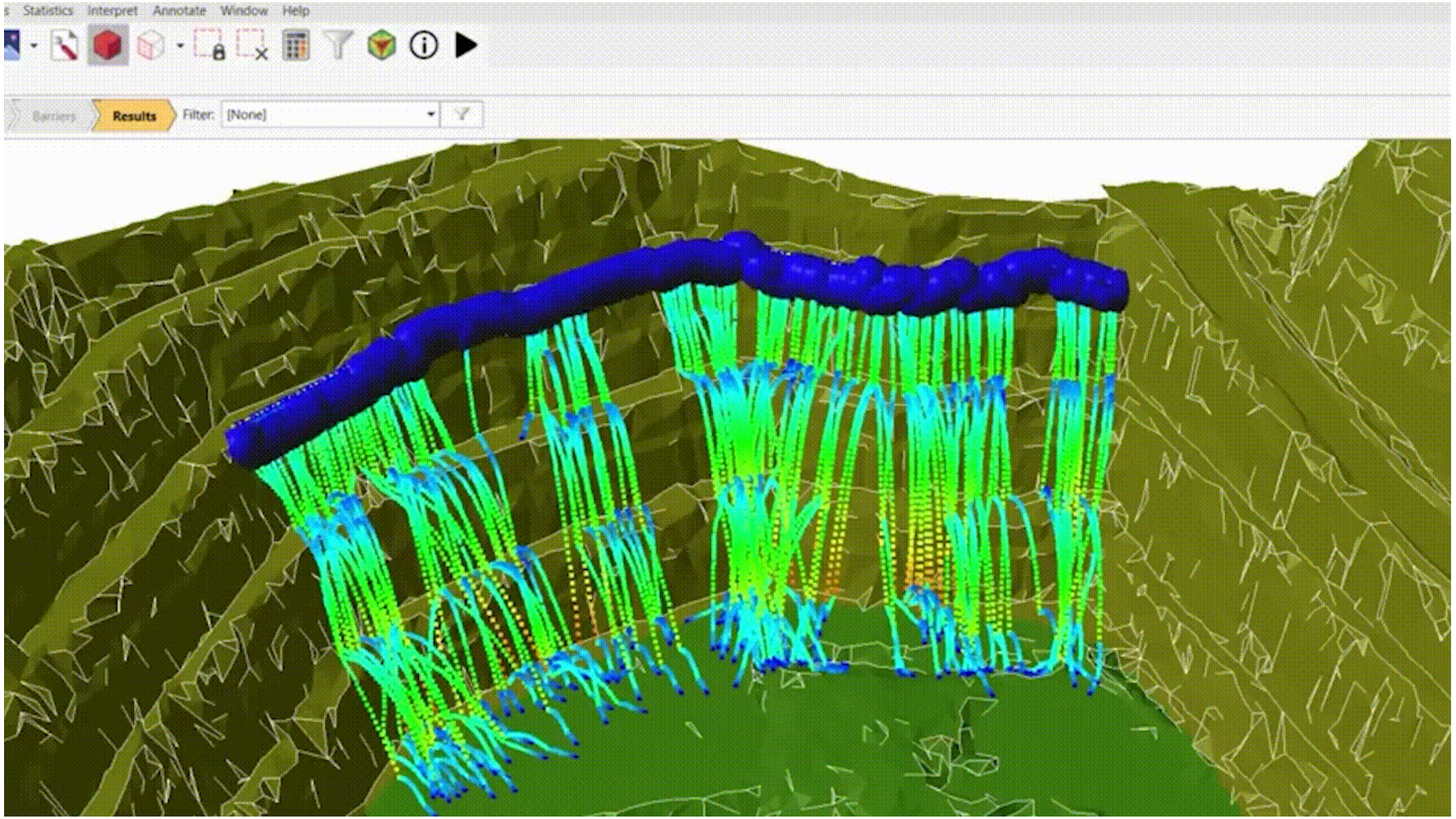
- Interpolating the space between the points and connecting the data points together we get a mesh.

- The mesh is what we manipulate to measure anything on scanned surface, think of pulling geologic structure measurements, or dimensionality of features.



What do we get from LiDAR Digital Twins

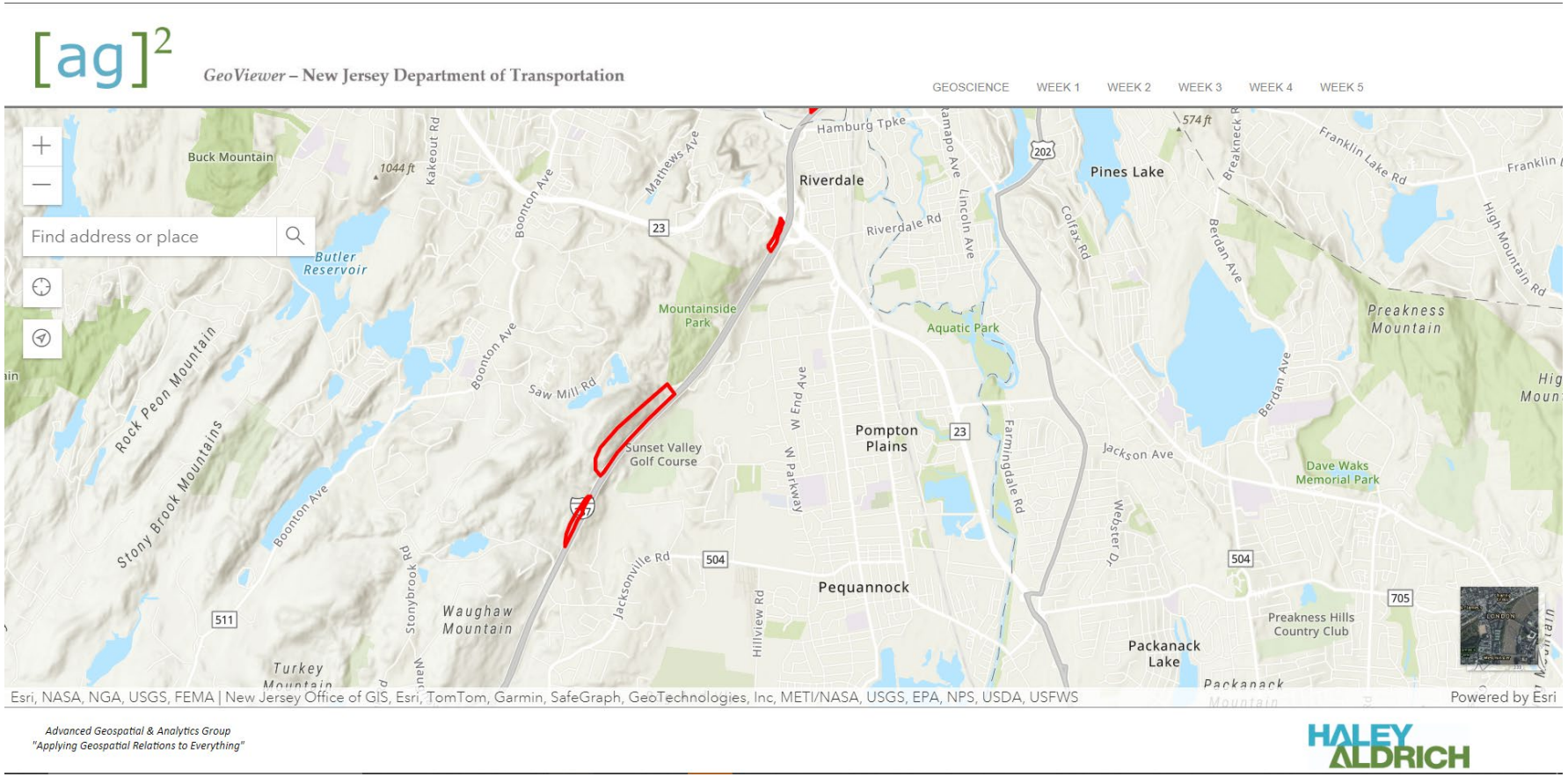
- Additional 3D Model Applications
  - 3D rockfall model simulations



Model Credit: Rocfall 3 by RocScience

What do we get from LiDAR

- LiDAR & GIS



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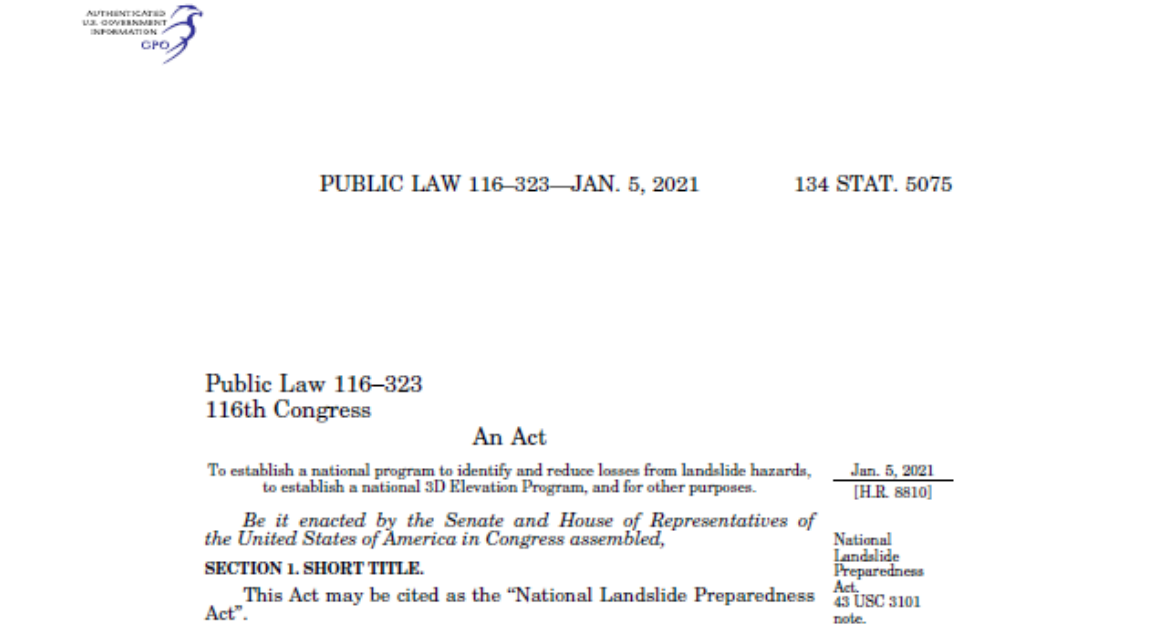
LiDAR and Geotechnical Asset Management

- *"This bill directs the U.S. Geological Survey (USGS) to establish a National Landslide Hazards Reduction Program to identify and understand landslide hazards and risks, reduce losses from landslides, protect communities at risk of landslide hazards, and help improve communication and emergency preparedness."*



PUBLIC LAW 116–323—JAN. 5, 2021 134 STAT. 5075

Public Law 116–323
116th Congress

An Act

To establish a national program to identify and reduce losses from landslide hazards, to establish a national 3D Elevation Program, and for other purposes.

Jan. 5, 2021
[H.R. 8810]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Landslide Preparedness Act".

National Landslide Preparedness Act.
43 USC 3101 note.

Special Thanks

- Vermont Agency of Transportation, VTrans Geology & Geotech
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- Steven Pepe, H&A
  - Technical Specialist - Geology

HALEY ALDRICH

Contact

- Questions?
  - ceddy@haleyaldrich.com