Lidar Data Acquisition

FY23 BUDGET ADJUSTMENT ACT

Senate Committee on Appropriations

January 17th 2023

John E. Adams

Director, Vermont Center for Geographic Information

VERMONT

AGENCY OF DIGITAL SERVICES

Overview

Requesting $1,734,000 to collect and process statewide Quality Level 1 lidar data in the Spring of 2023.

1. What is Lidar?
2. Current Status & Needs
3. Acquisition Plan

VERMONT
AGENCY OF DIGITAL SERVICES

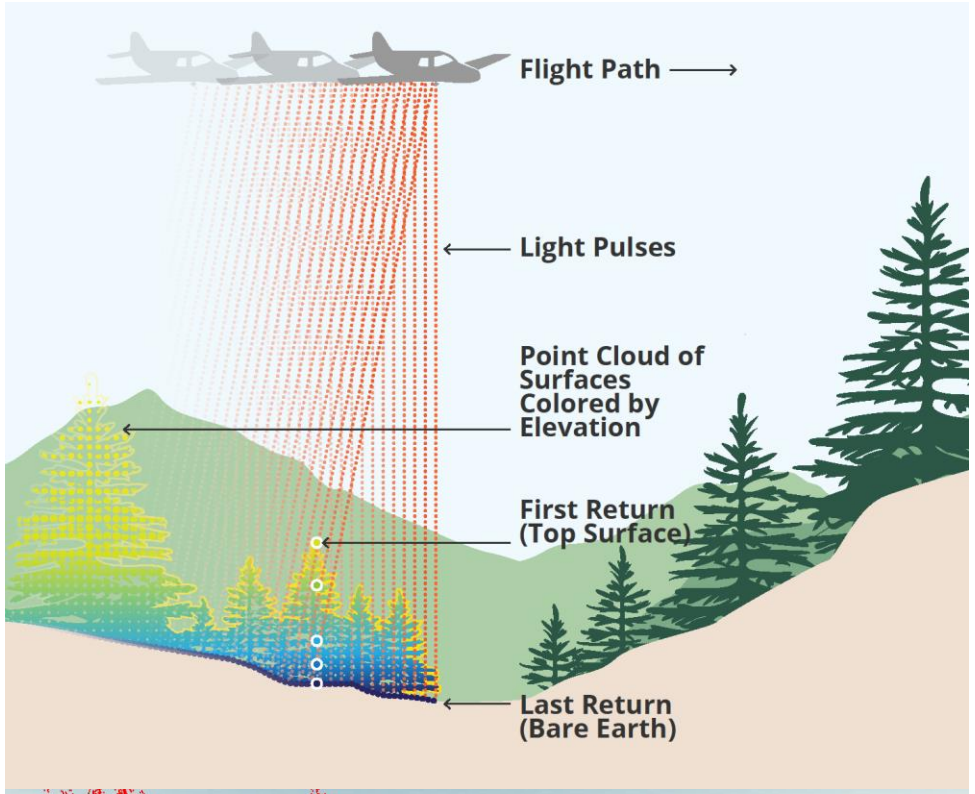
What is Lidar?

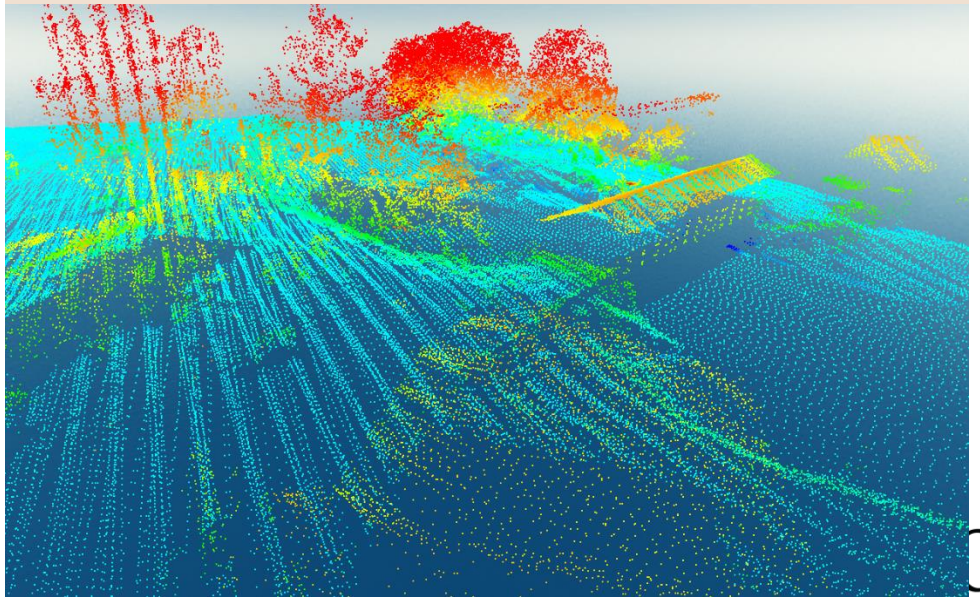
Point clouds
Derivatives
Uses

VERMONT
AGENCY OF DIGITAL SERVICES

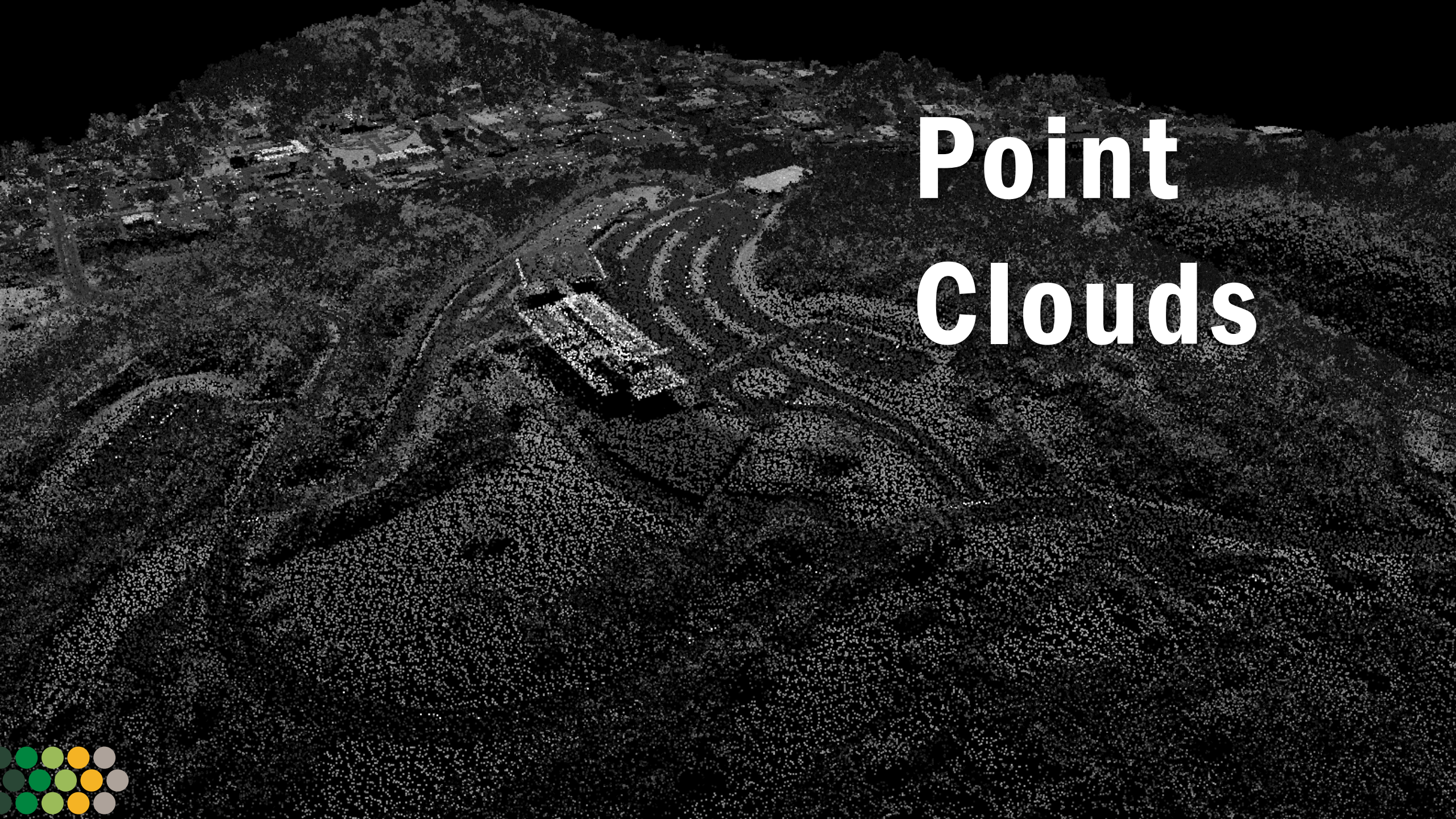
What is lidar?

Light Detection and Ranging (lidar) is a technology used to create high-resolution models of ground and surface elevation. Lidar data are collected from aircraft using sensors that detect the reflections of a pulsed laser beam. The reflections are recorded as billions of individual points, which are processed into digital three-dimensional models of Vermont in formats readily accessible for use by state agencies, partners, and the public.



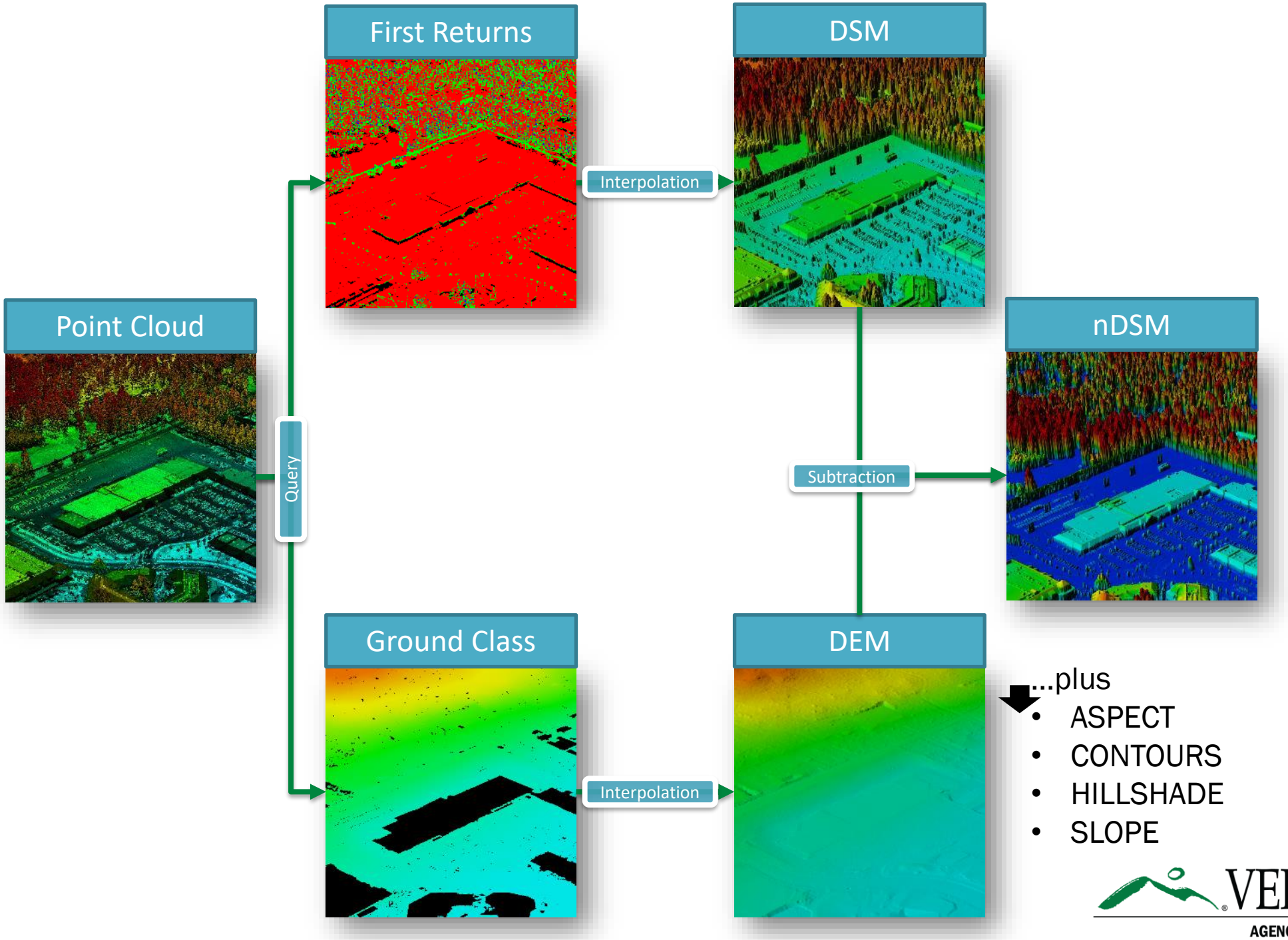


AGENCY OF DIGITAL SERVICES



Point Clouds

Lidar Derivatives

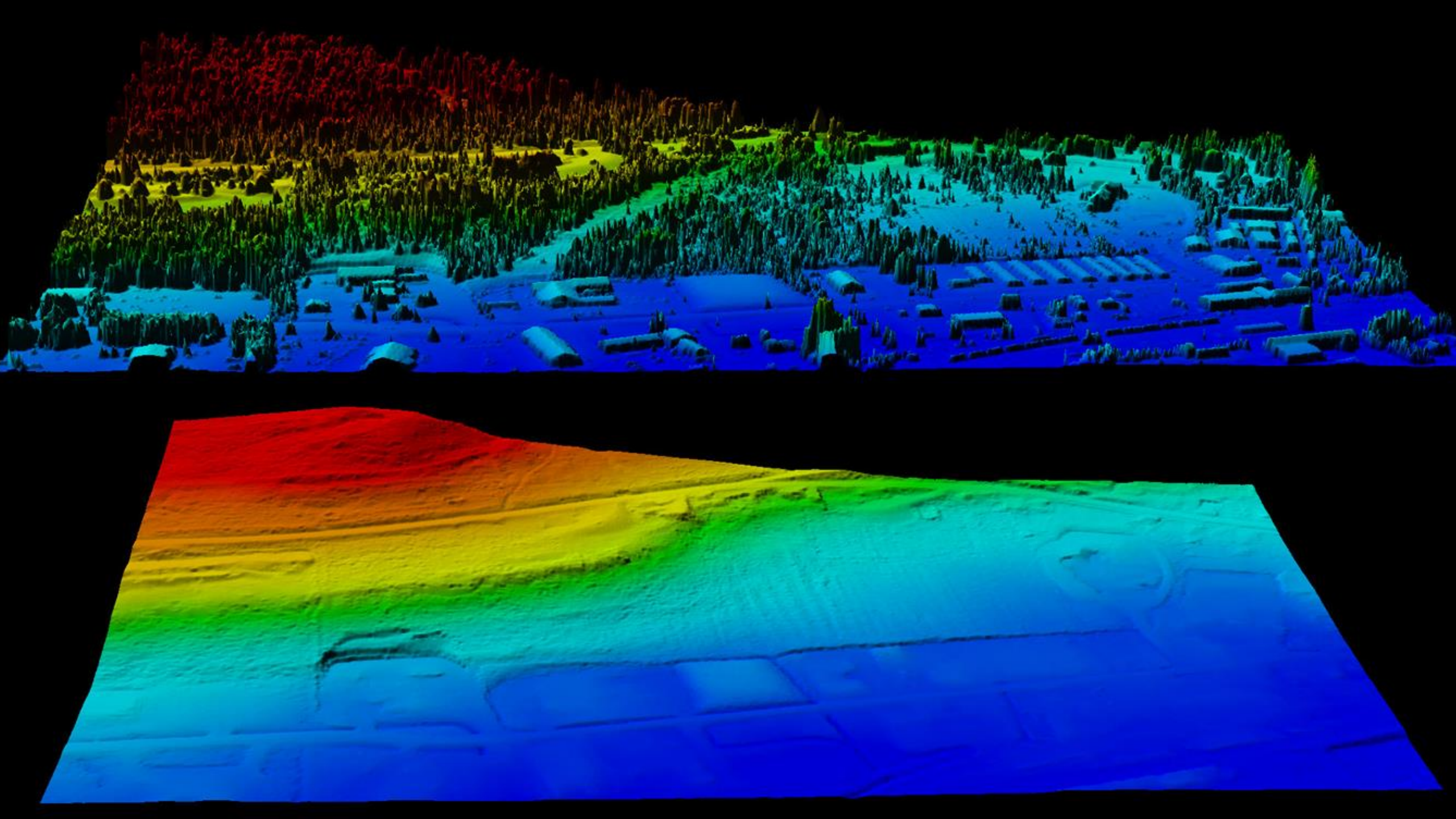


...plus

- ASPECT
- CONTOURS
- HILLSHADE
- SLOPE

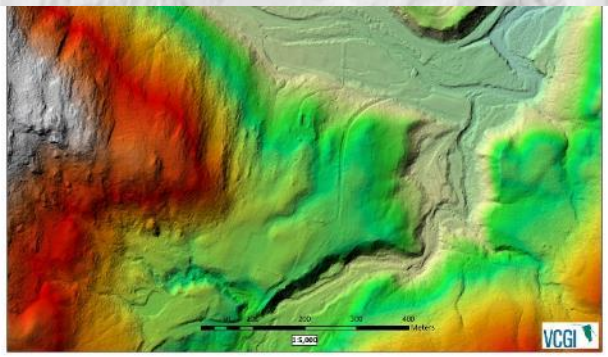
Credit: UVM Spatial Analysis Lab

VERMONT
AGENCY OF DIGITAL SERVICES

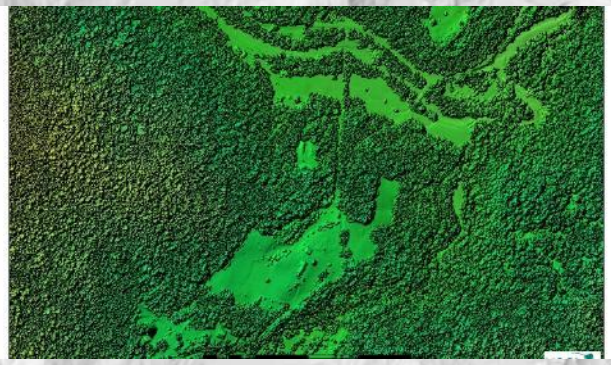


Example Derivative Products

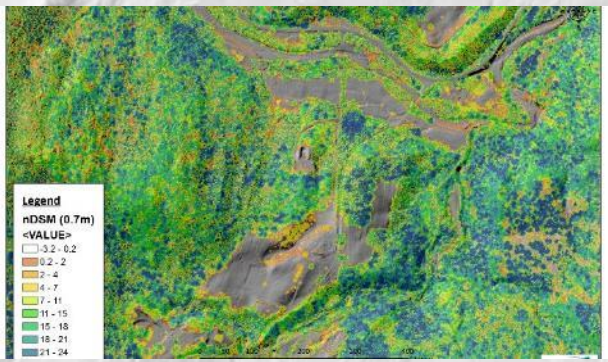
MARLBORO, VT



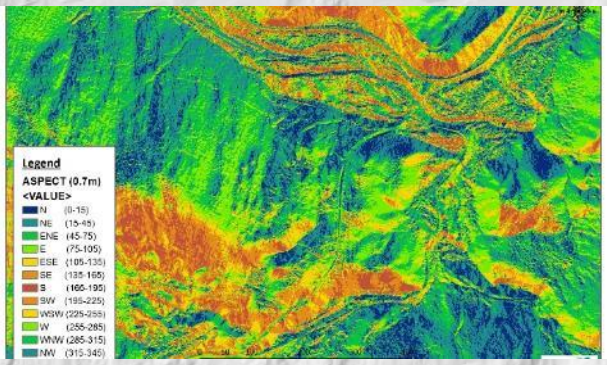
DIGITAL ELEVATION MODEL (DEM)



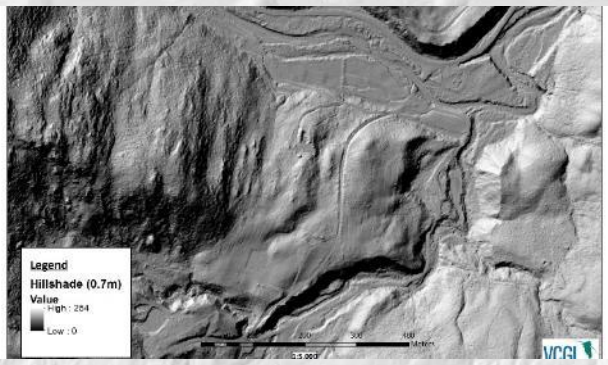
DIGITAL SURFACE MODEL (DSM)



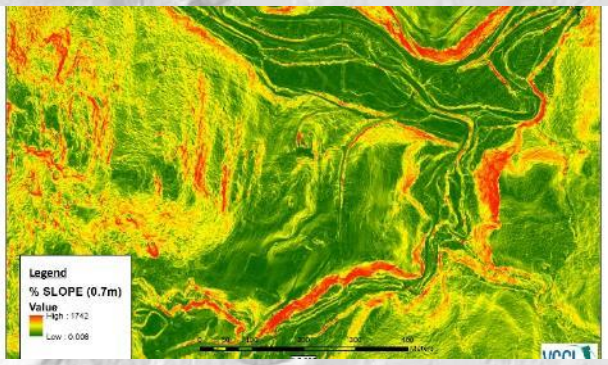
NORMALIZED DSM (nDSM)



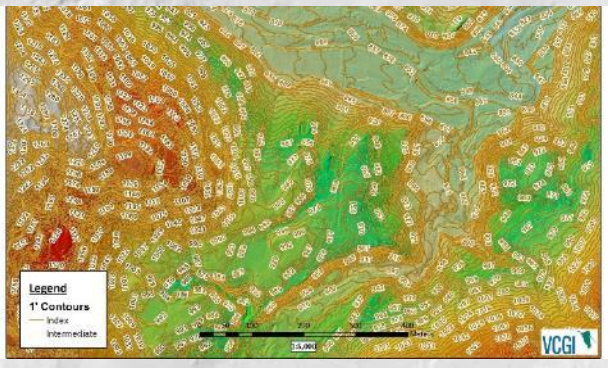
ASPECT (AZIMUTH)



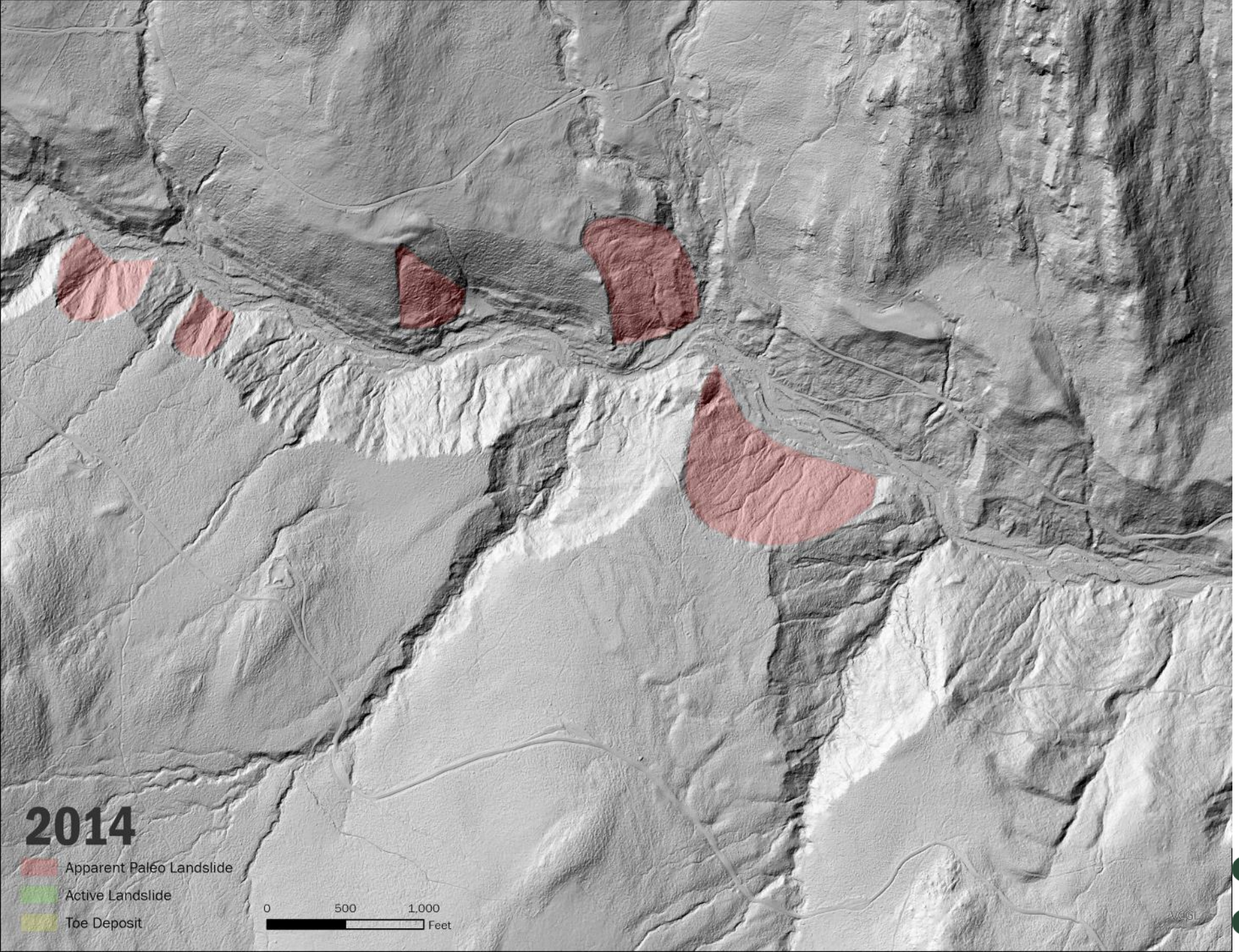
“BARE EARTH” HILLSHADE

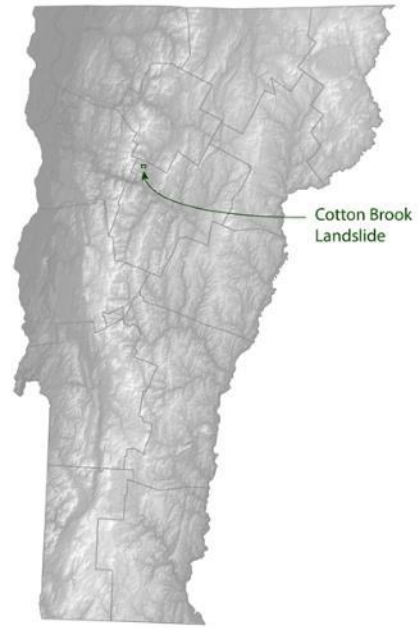


SLOPE



1 FOOT CONTOURS





Changing With Time

2014 Inset Area

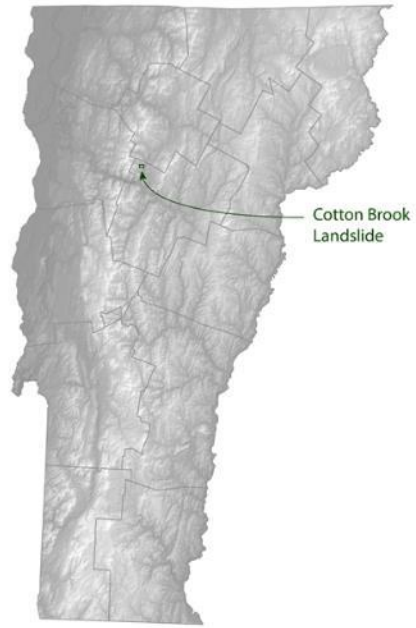
2021

Apparent Paleo Landslide

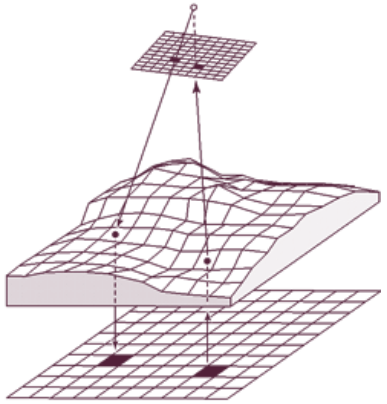
Active Landslide

Toe Deposit

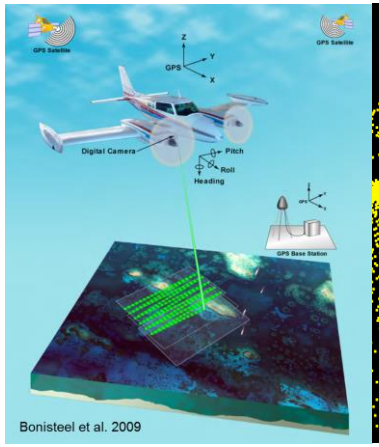
0 500 1,000 Feet

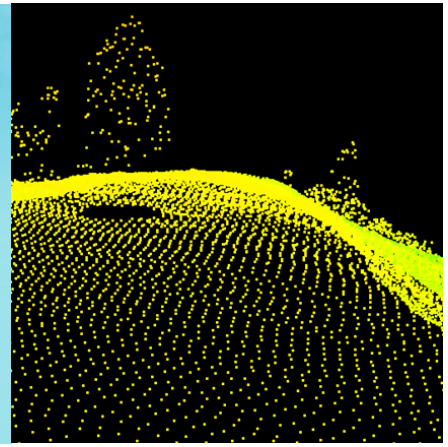


Changing With Time

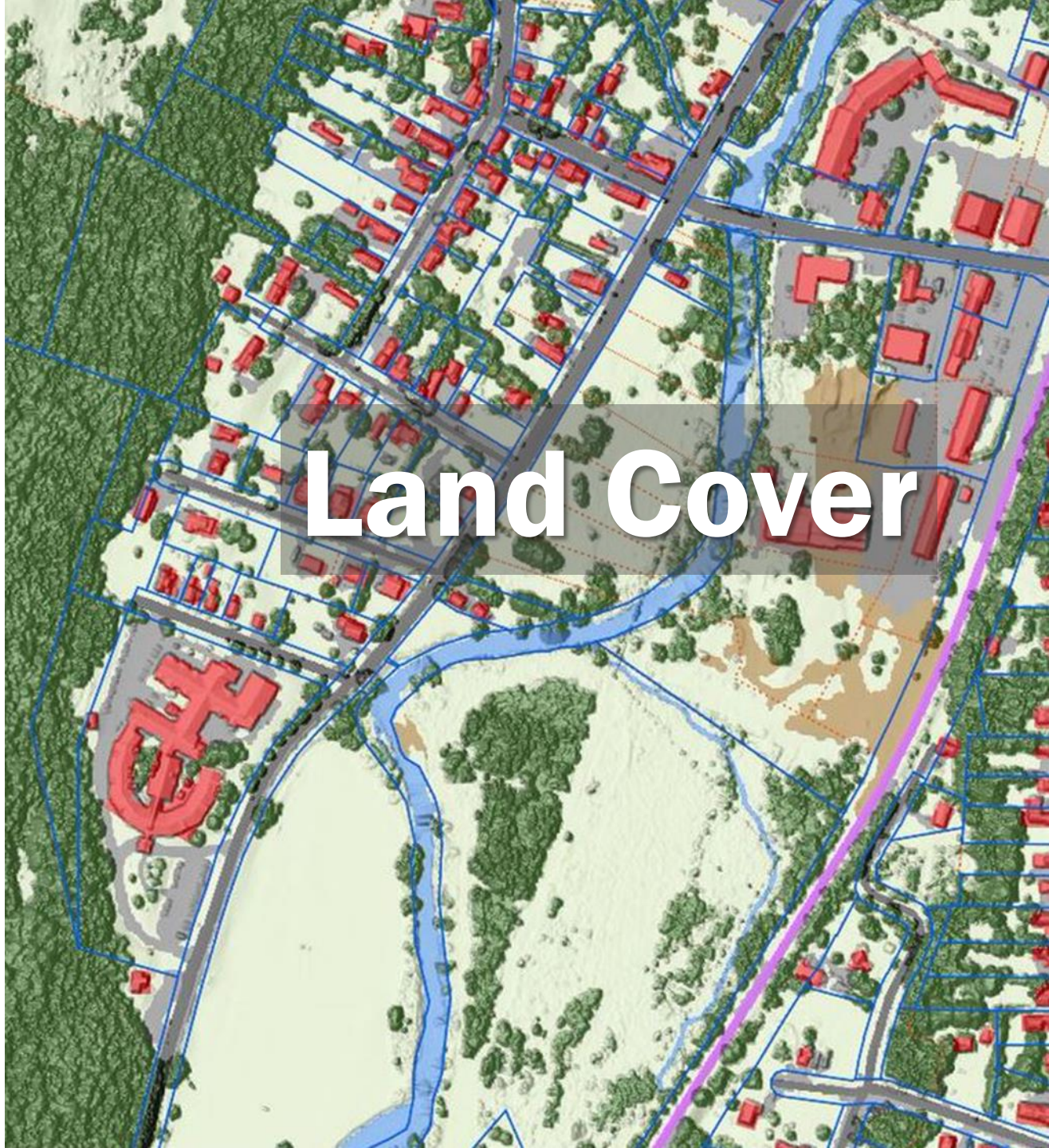


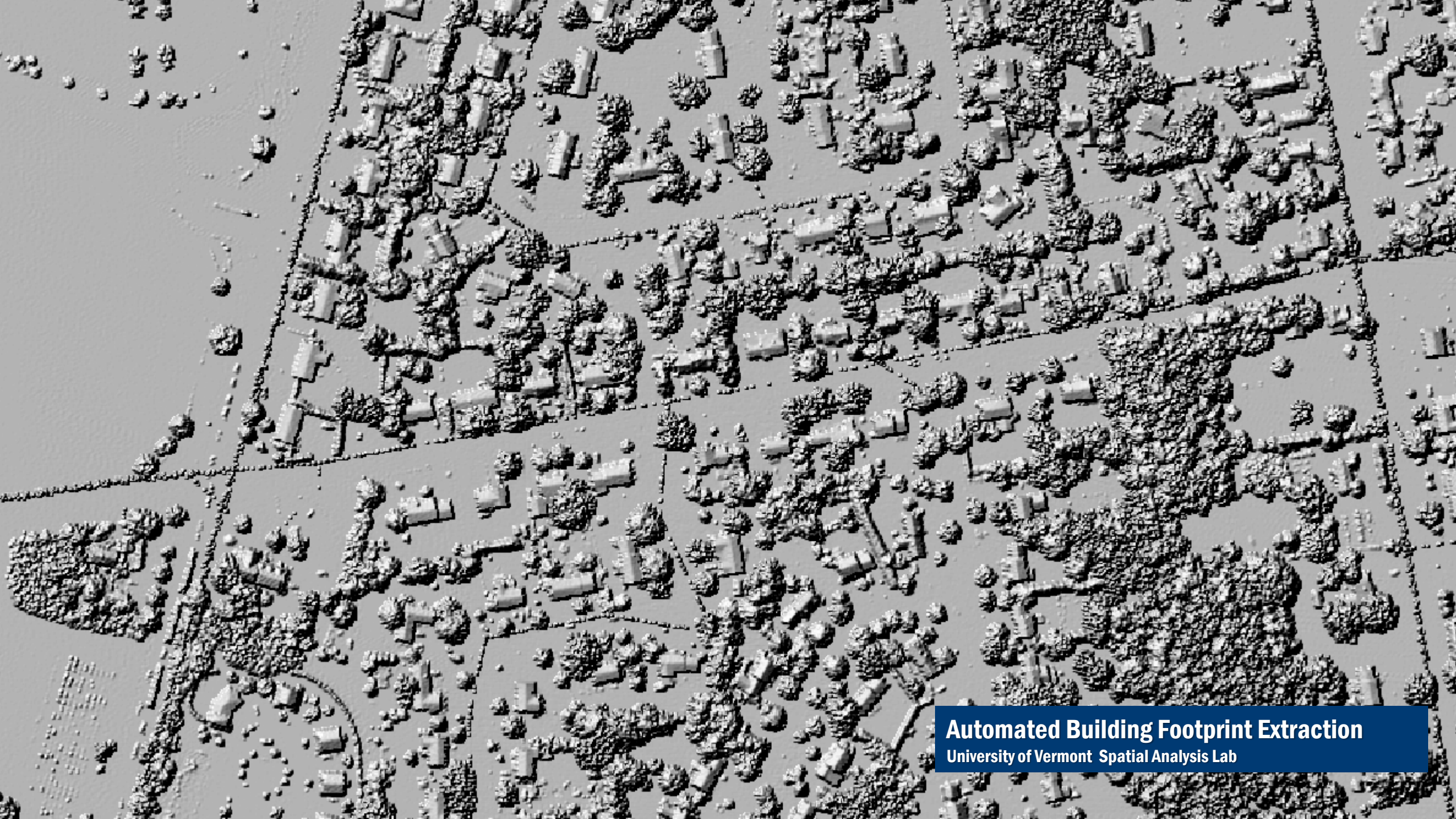
ORTHOIMAGERY





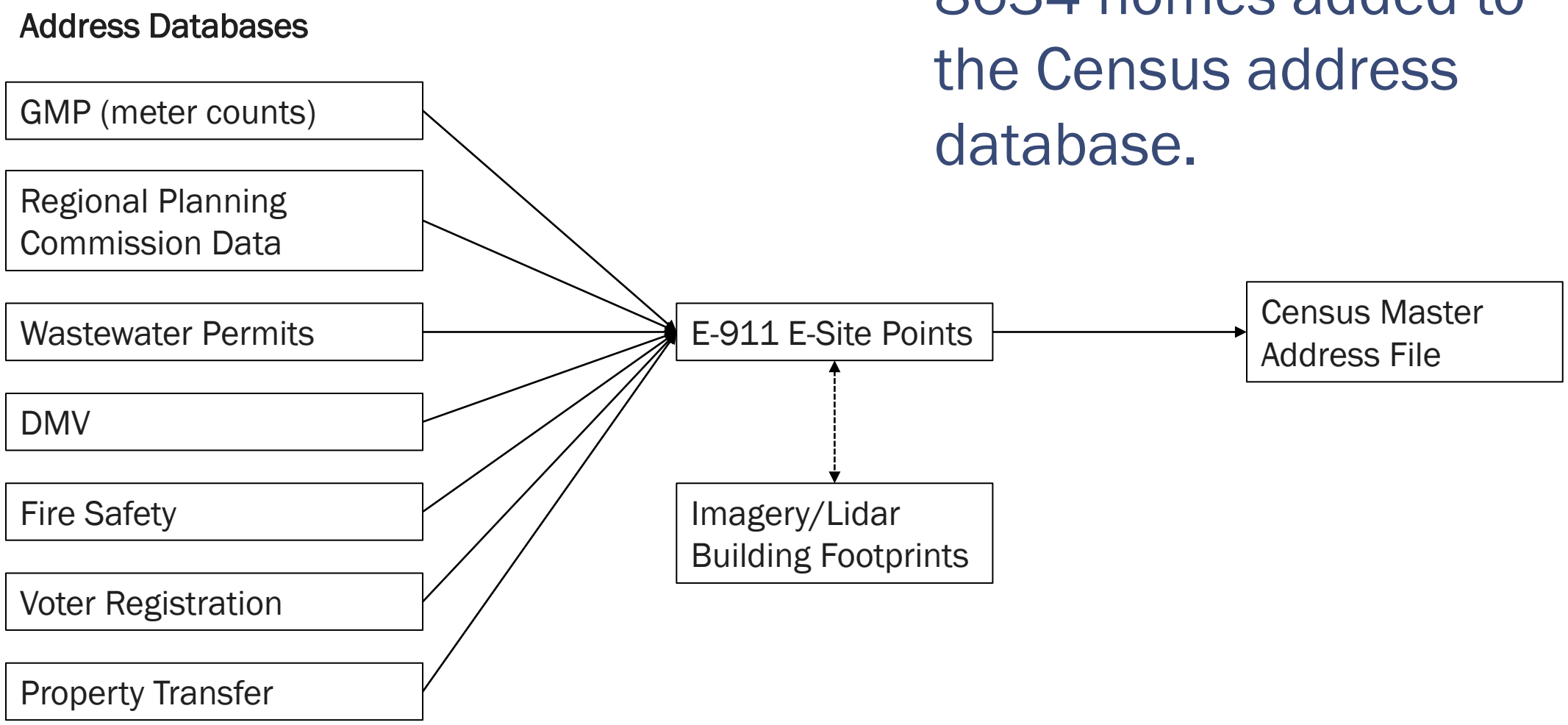
LIDAR




Automated Building Footprint Extraction
University of Vermont Spatial Analysis Lab

Identification of Missing E911 Points

8634 homes added to the Census address database.



VERMONT
AGENCY OF DIGITAL SERVICES

Estimated difference in federal Medicaid funds to Vermont resulting from the 8634 homes added to the census address database:

$318 million dollars over ten years.

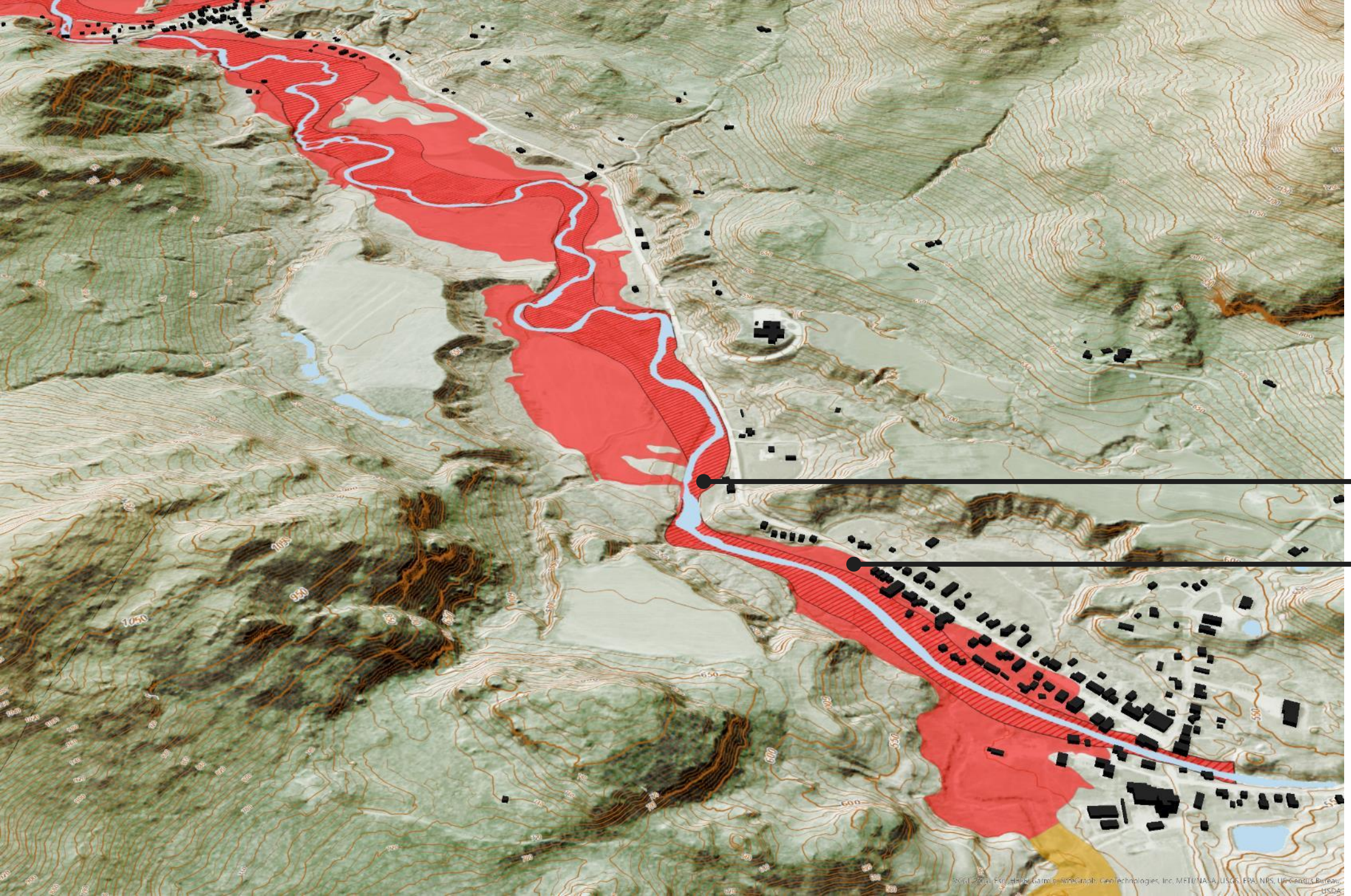
Read more here: https://maps.vcgi.vermont.gov/HighCostLowCount

VERMONT
AGENCY OF DIGITAL SERVICES

FLOODING:
Managing Risk
Exposure

VERMONT
AGENCY OF DIGITAL SERVICES

FLOODING:
Managing Risk
Exposure



FLOODING:
Managing Risk
Exposure

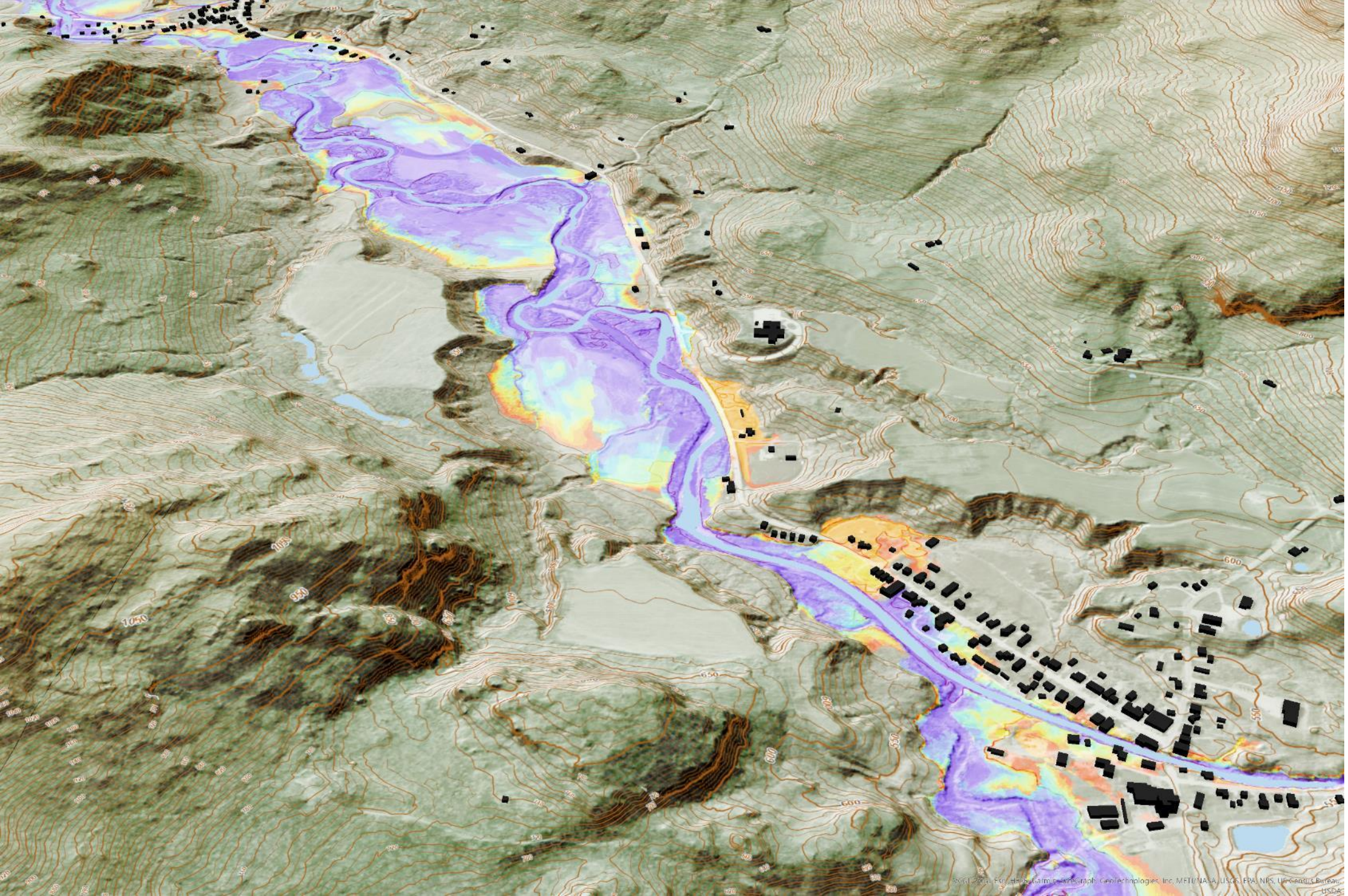
FEMA's
NFHL (DFIRM's)

Regulatory
Floodway Zone AE

1% Annual Chance
Flood - Zone AE

0.2% Annual
Chance Flood -
Zone X
(not shown)

VCGI



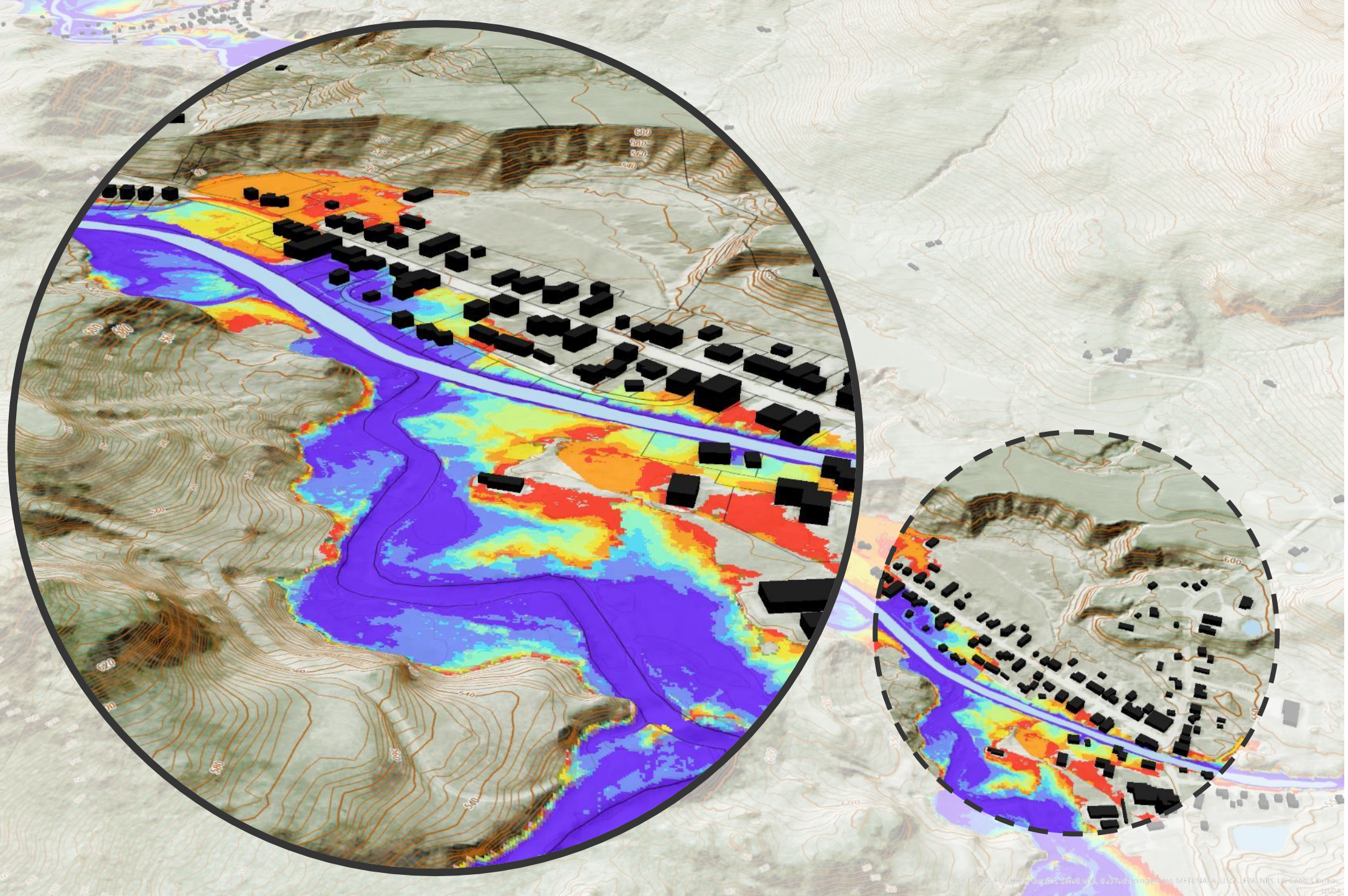
FLOODING: Managing Risk Exposure

UVM's Lidar-aided Flood Inundation Layer (2022)

- 2-year flood zone (50% annual exceedance)
- 5-year flood zone (20% annual exceedance)
- 10-year flood zone (10% annual exceedance)
- 25-year flood zone (4% annual exceedance)
- 50-year flood zone (2% annual exceedance)
- 100-year flood zone (1% annual exceedance)
- 200-year flood zone (.05% annual exceedance)
- 500-year flood zone (.02% annual exceedance)

VCGI

FLOODING: Managing Risk Exposure



UVM's Lidar-aided Flood Inundation Layer (2022)

- 2-year flood zone (50% annual exceedance)
- 5-year flood zone (20% annual exceedance)
- 10-year flood zone (10% annual exceedance)
- 25-year flood zone (4% annual exceedance)
- 50-year flood zone (2% annual exceedance)
- 100-year flood zone (1% annual exceedance)
- 200-year flood zone (.05% annual exceedance)
- 500-year flood zone (.02% annual exceedance)

VCGI

Archaeology

Solar Assessment

Wetlands Assessment

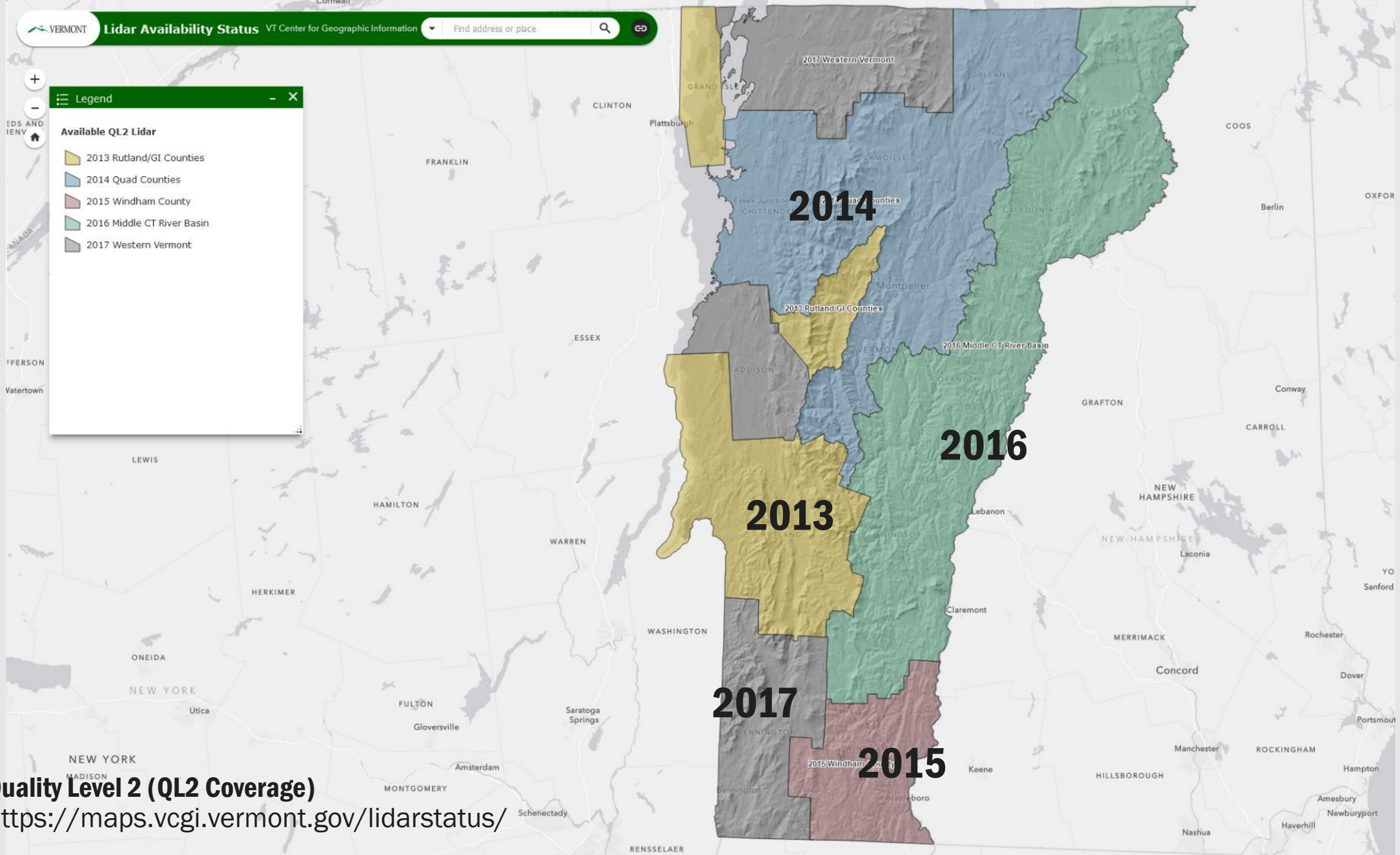
Site Suitability

Lidar supports activities across all sectors of the [Statewide Strategic Plan]

VERMONT
AGENCY OF DIGITAL SERVICES

Current Status & Needs

VERMONT
AGENCY OF DIGITAL SERVICES

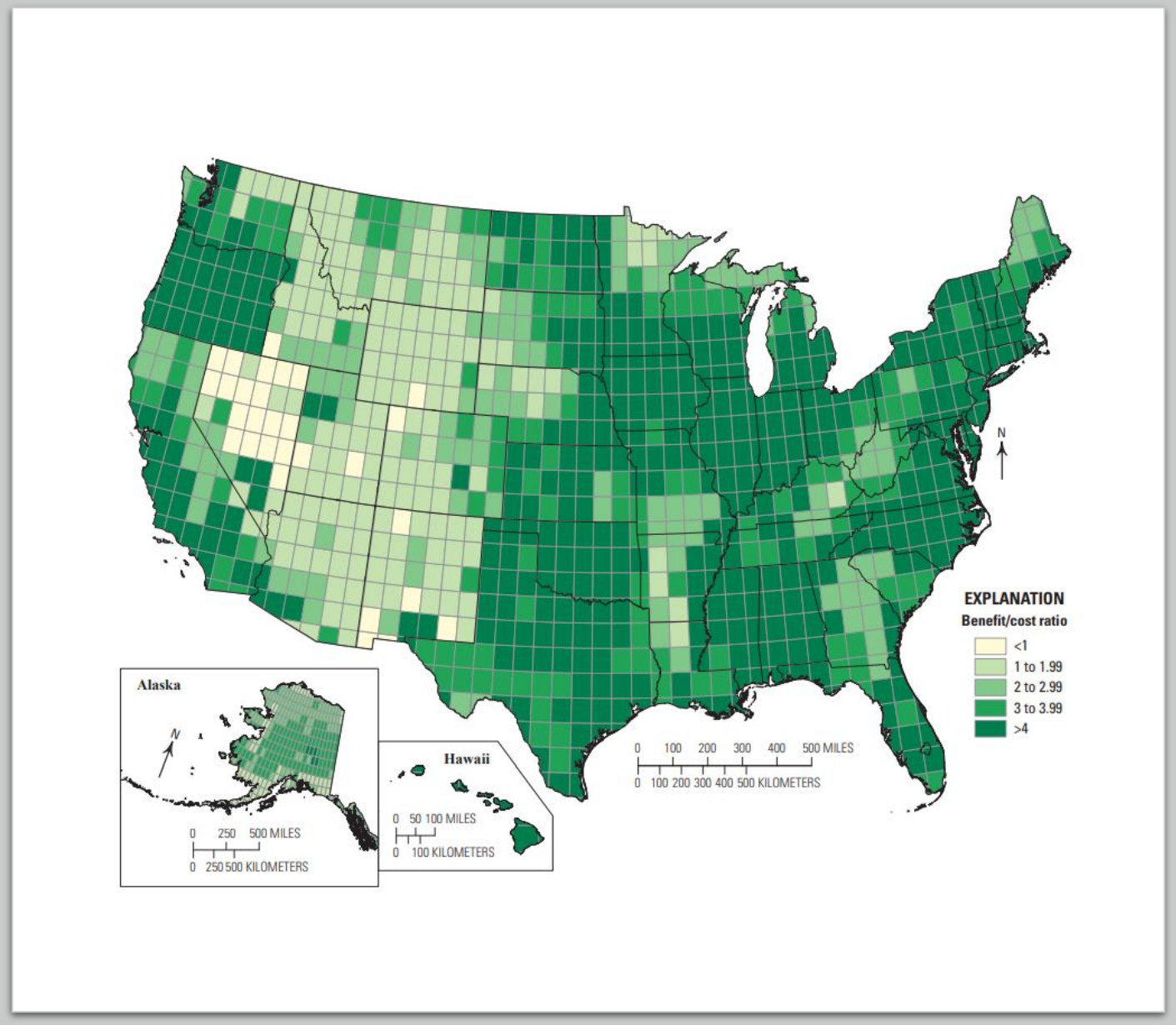


Quality Level 2 (QL2 Coverage)
https://maps.vcgi.vermont.gov/lidarstatus/

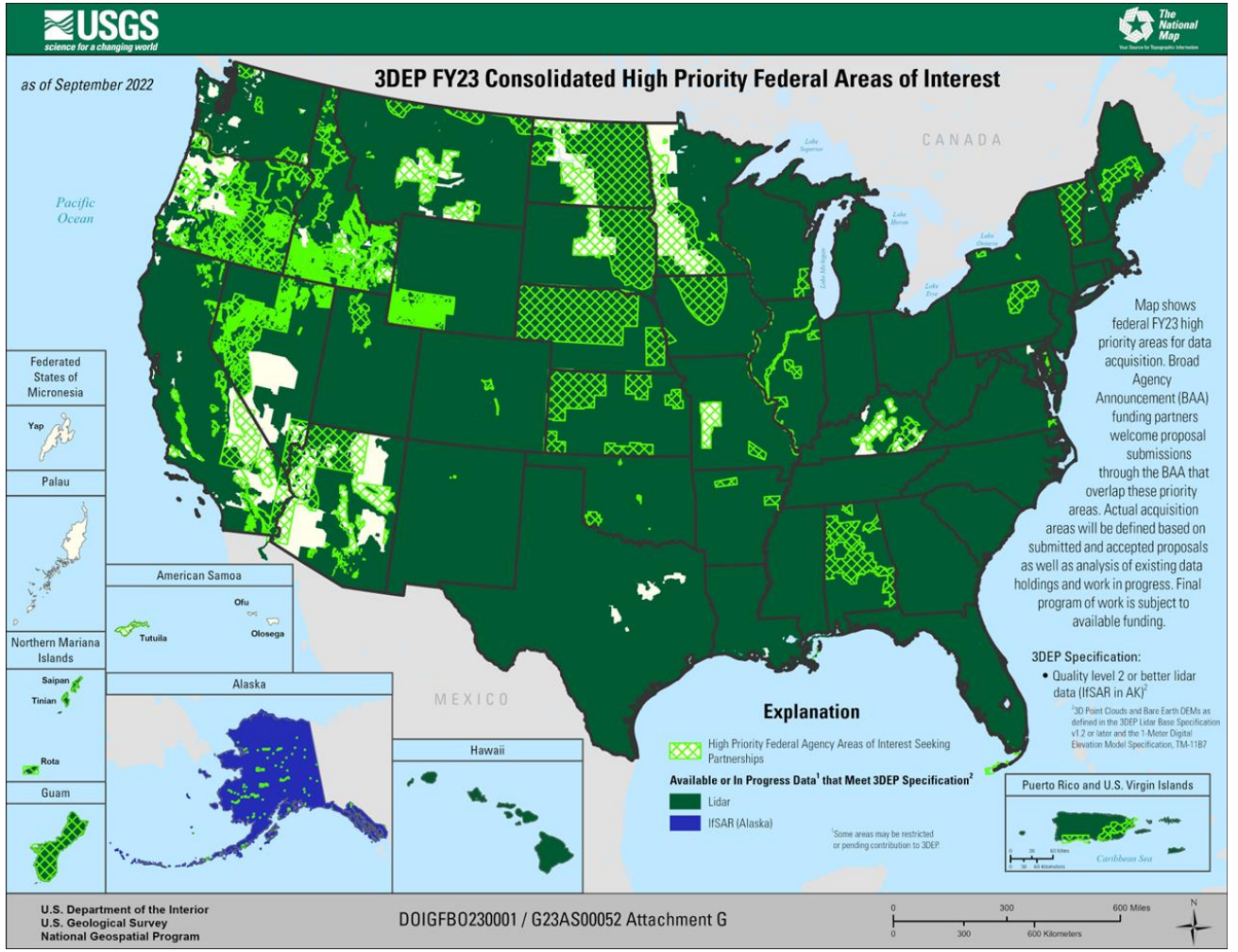
Return on Investment Study

“Nearly 5:1 return on investment, informing critical decisions that are made across our Nation every day that depend on elevation data, ranging from immediate safety of life, property, and environment to long term planning for infrastructure projects.”- United States Geological Survey

Priority: 8 years or older.



The average age of lidar data in Vermont is now >8 years old, qualifying the state as a high priority area.



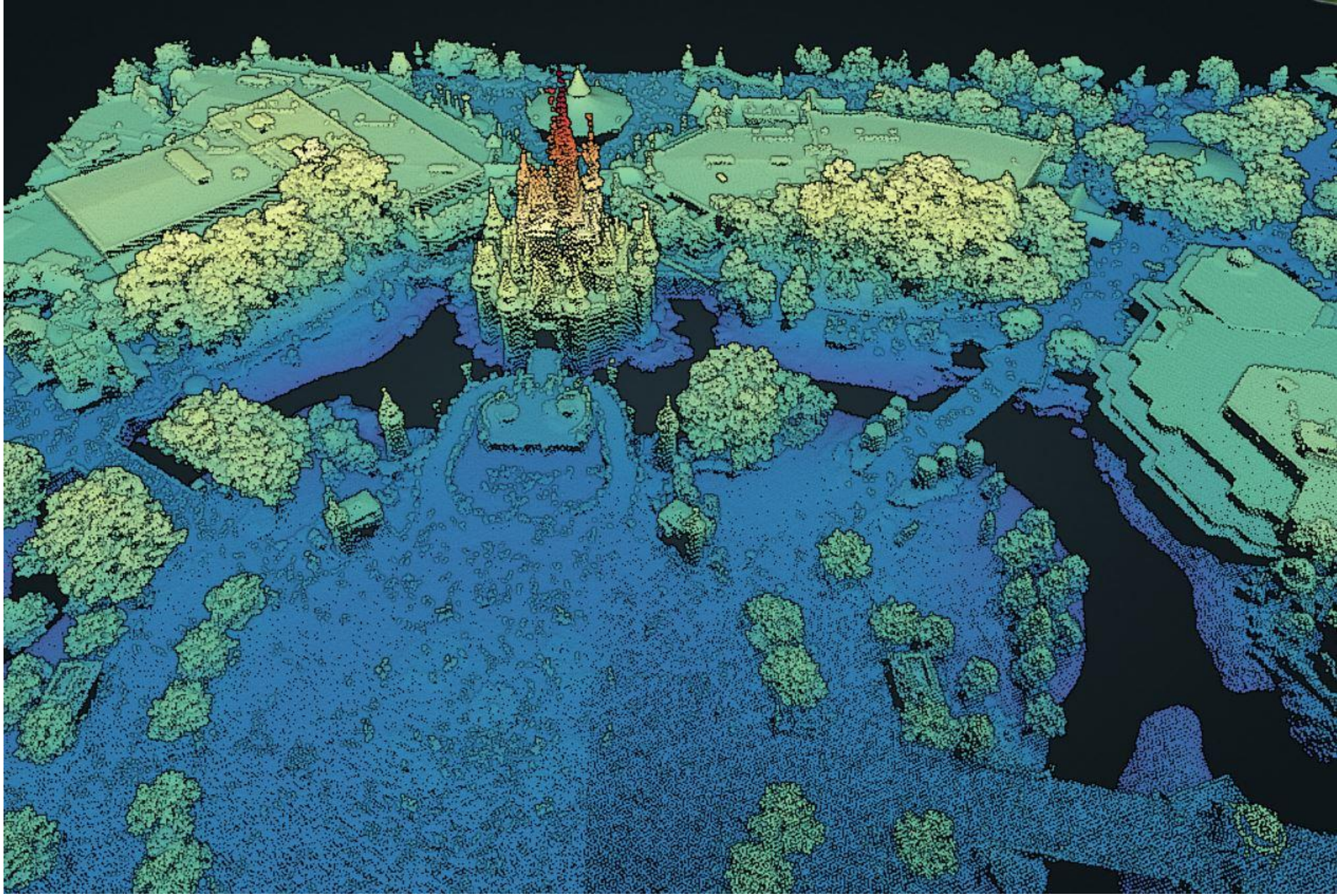
Quality Level 1 (QL1)

"Consistently, we found that in order to support the work stakeholders wished to conduct, **quality level 1(QL1) data with a minimum aggregate density of 8 pulses per square meter (ppsm) is required.** Without this level of density, the bare earth under even moderate vegetation cannot be accurately characterized.

For other applications, such as development and resource planning, a QL1 lidar dataset is needed as a baseline for future work, and ultimately QL1 data provides the opportunity to serve a much wider range of applications."

Quality Level 1 Point Cloud Courtesy of Daniel Coe Washington Geological Survey

Example of Quality Level 1 Data in Florida



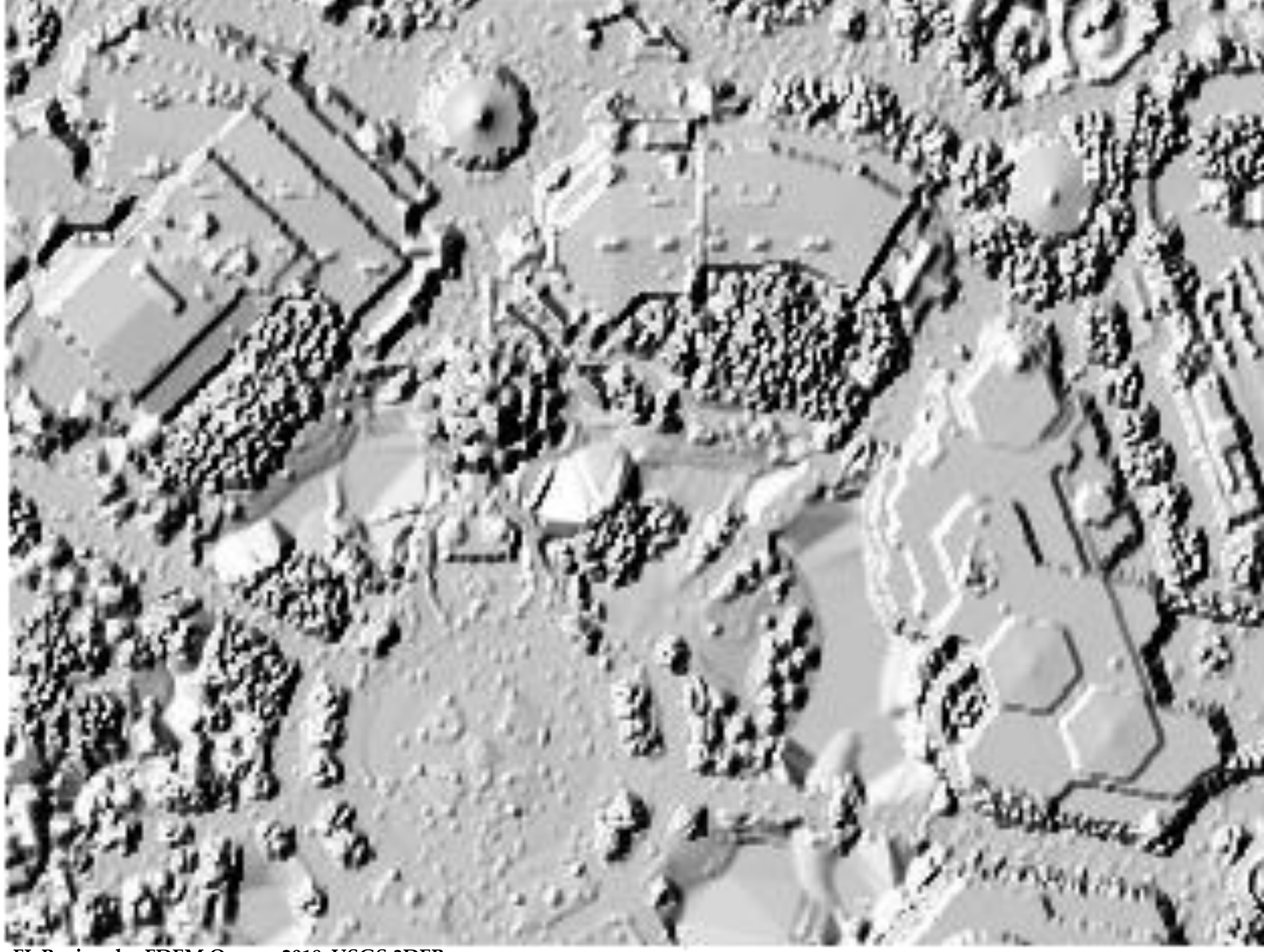
FL Peninsular FDEM Orange 2018, USGS 3DEP
Distributed by Open Topography

VERMONT
AGENCY OF DIGITAL SERVICES

Orthoimagery for context

VERMONT
AGENCY OF DIGITAL SERVICES

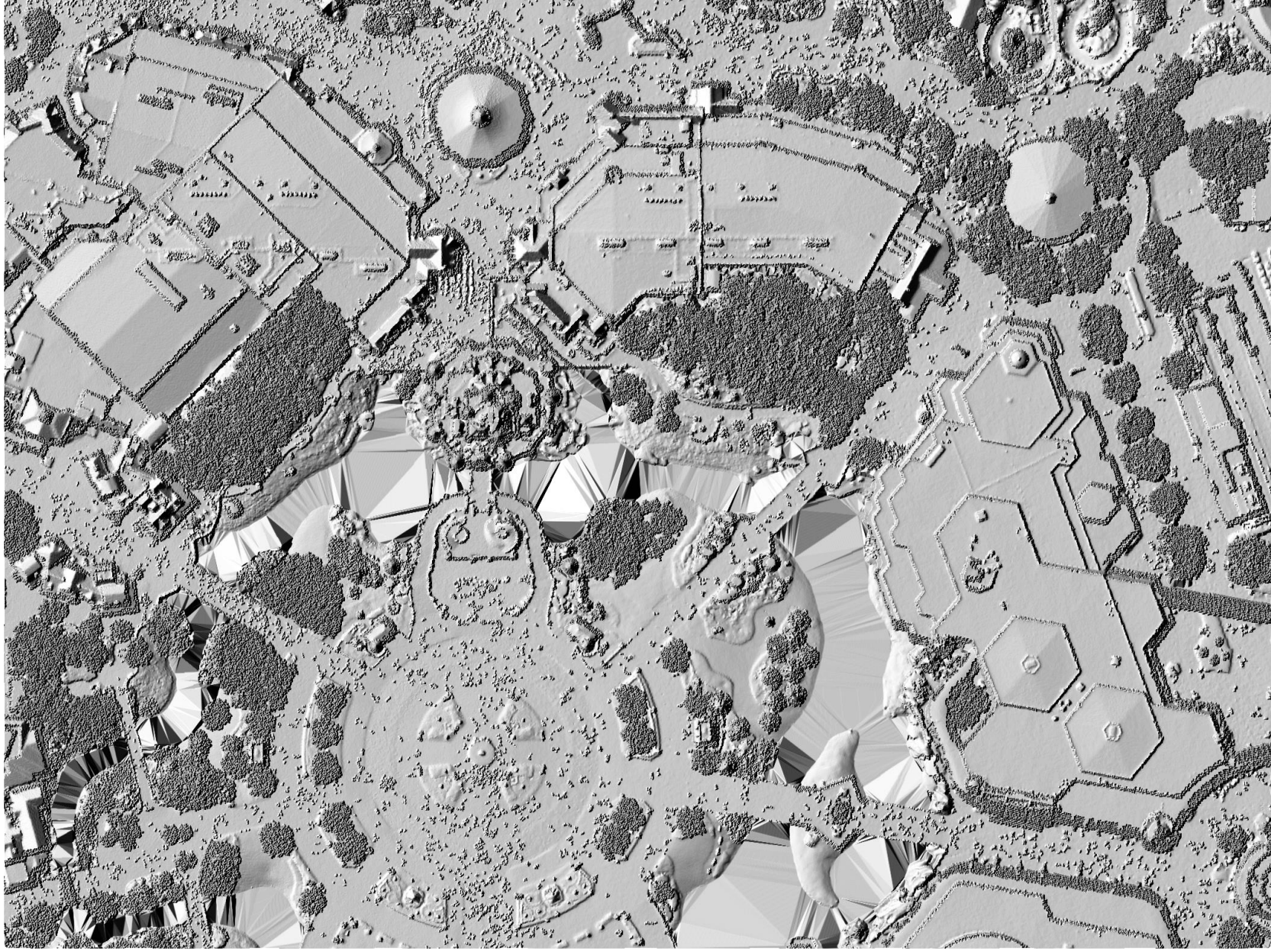
Elevation Model Downsampled to Quality Level 2
2 pts per square meter



FL Peninsular FDEM Orange 2018, USGS 3DEP
Distributed by Open Topography (1M DSM)

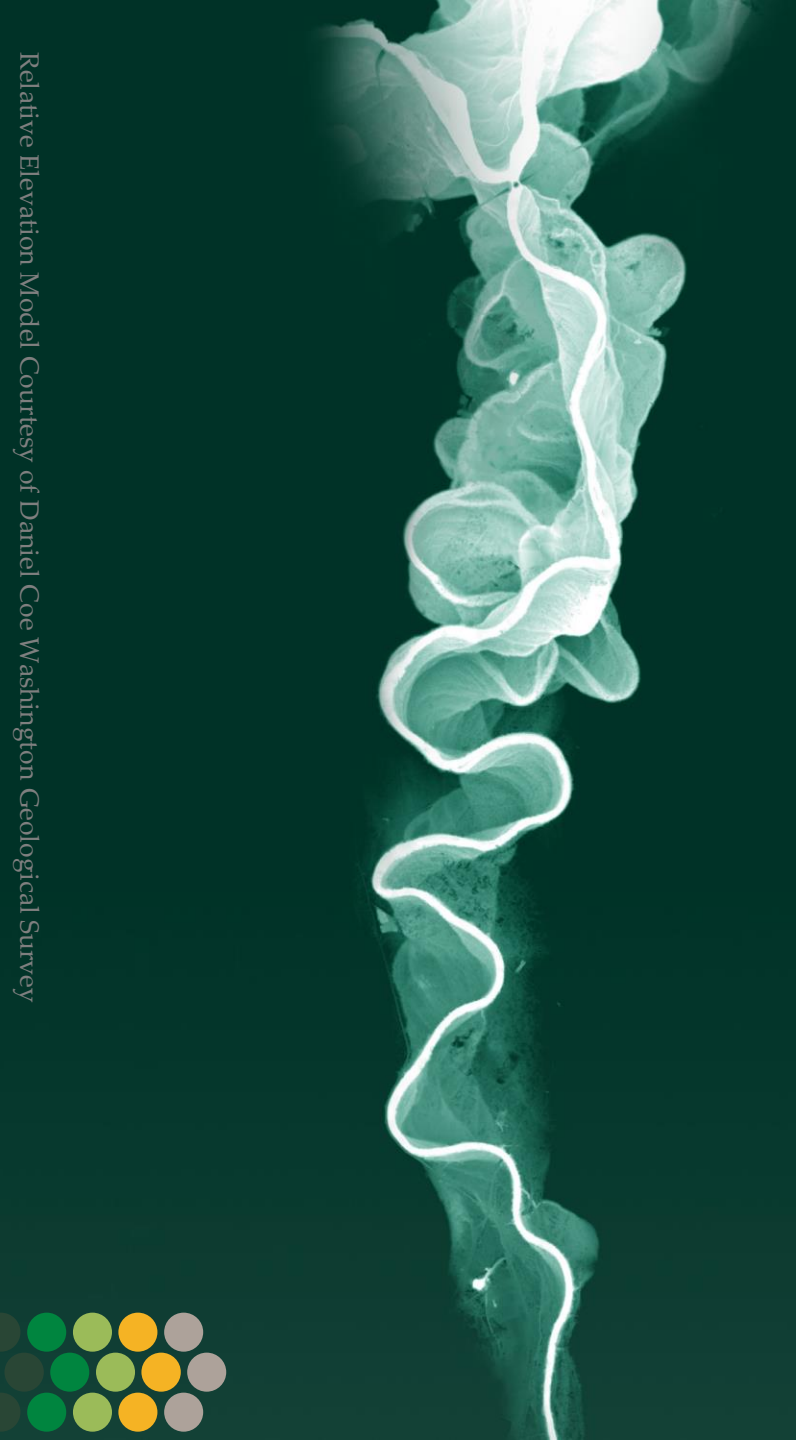
VERMONT
AGENCY OF DIGITAL SERVICES

Elevation Model
Quality Level 1
> 8 pts per square meter



FL Peninsular FDEM Orange 2018, USGS 3DEP
Distributed by Open Topography (15cm DSM)

VERMONT
AGENCY OF DIGITAL SERVICES


Relative Elevation Model Courtesy of Daniel Coe Washington Geological Survey

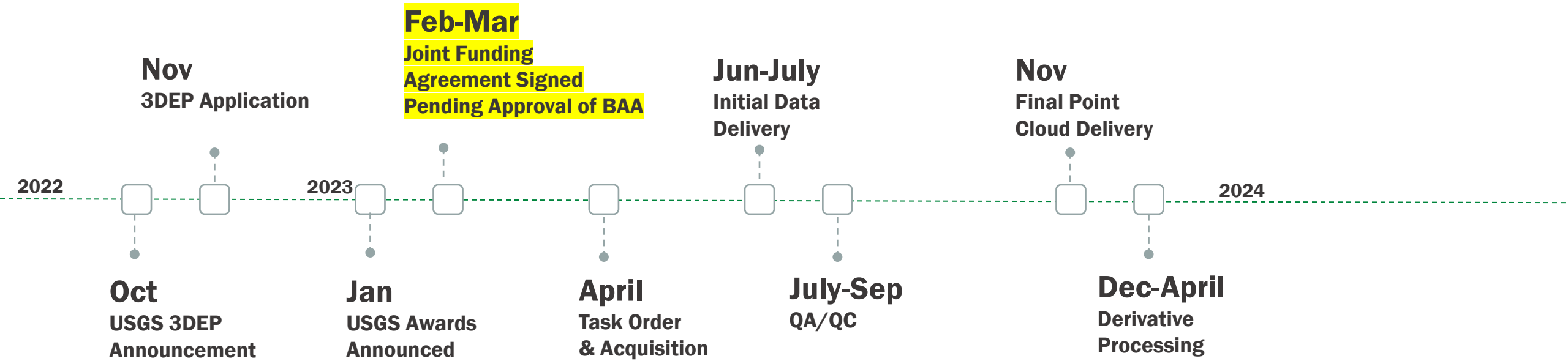
Partner Needs

1) Vermont needs updated topographic data, which is now on average 8 years old and older than 10 years in parts of the state
2) Higher resolution data QL1 is needed to meet the most use cases
3) A consistent single year collection would simplify use of the data and leverage economies of scale.

VERMONT
AGENCY OF DIGITAL SERVICES

Acquisition Plan

Quality Level 1 lidar data collected statewide in the Spring of 2023 during leaf-off conditions



VERMONT
AGENCY OF DIGITAL SERVICES

Steering Committee

Pam Brangan – Chittenden County Regional Planning Commission

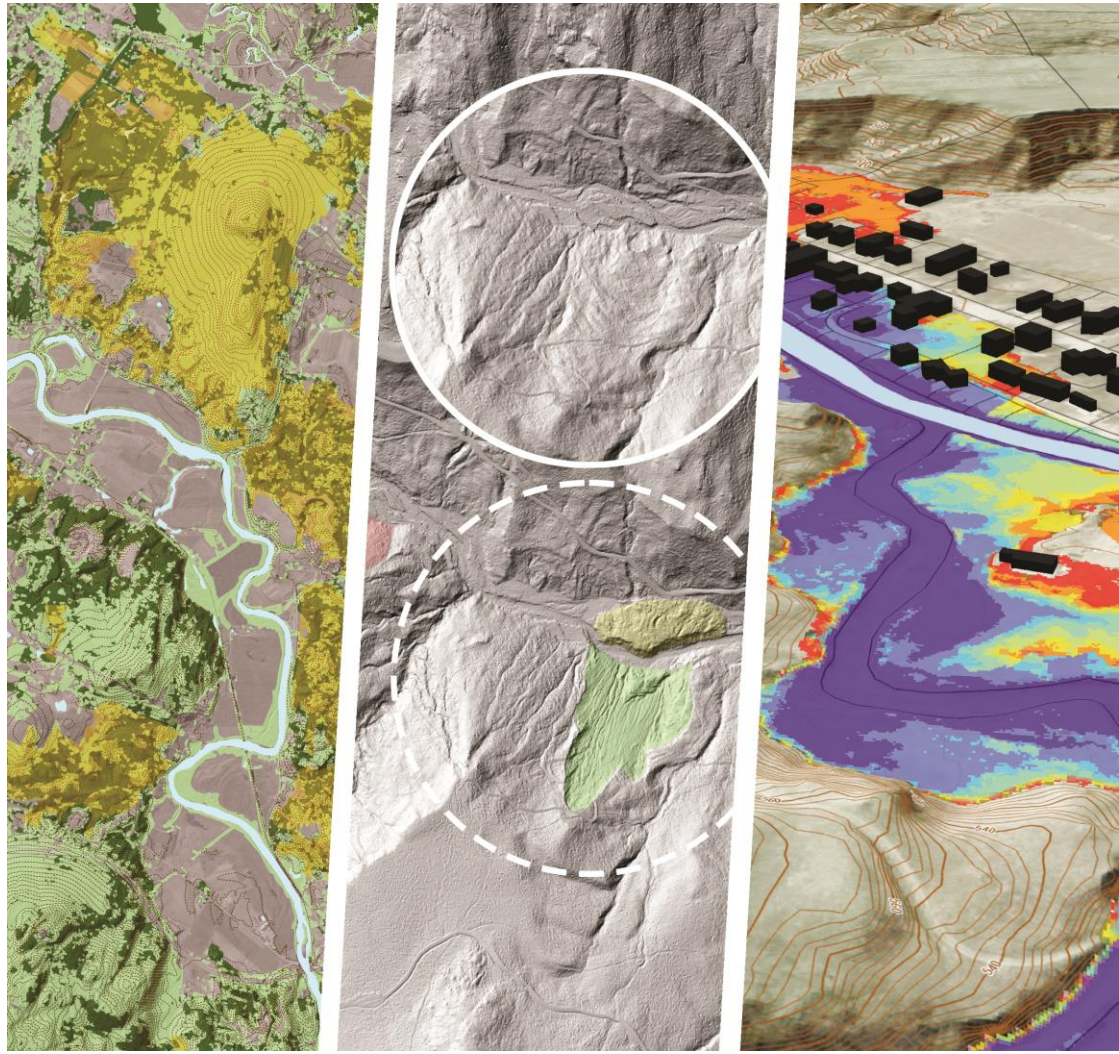
Johnathan Croft – AOT Mapping Section Chief

Ben DeJong, PhD – State Geologist

Jess Robinson, PhD – State Archeologist

John Van Hoesen, PhD - USDA Natural Resources Conservation Service

Brian Voight, PhD – Central Vermont Regional Planning Commission



VERMONT
AGENCY OF DIGITAL SERVICES

Resources

- Vermont Lidar Program
- Lidar FAQ's
- VT Interactive Map Viewer
- ANR Natural Resources Atlas
- Beneath the Trees App
- What's My Elevation App
- VT Open Geodata Portal Elevation Page (Raw Data Access)
- VT Lidar Status App
- VT Lidar Finder App
- VCGI News and Announcements (e.g., new data release notice)
- Learning Resources (for going further on your own)

Elevation

Imagery

Parcels