

Lidar Data Acquisition

FY23 BUDGET ADJUSTMENT ACT

House Committee on Appropriations
January 10th 2023

John E. Adams
Director, Vermont Center for Geographic Information



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





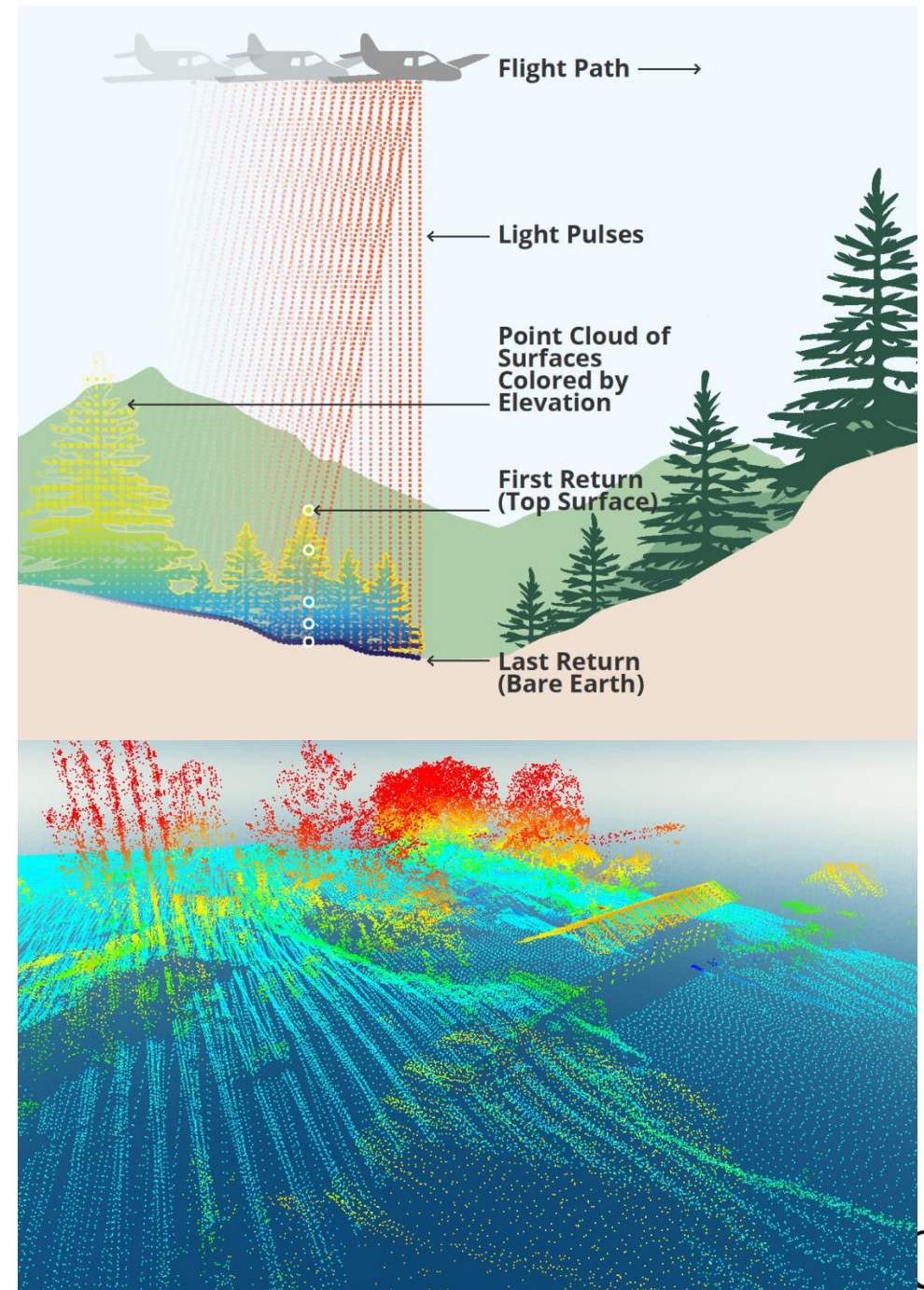
What is Lidar?

Point clouds
Derivatives
Uses

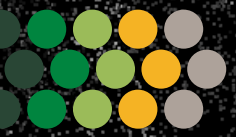


What is lidar?

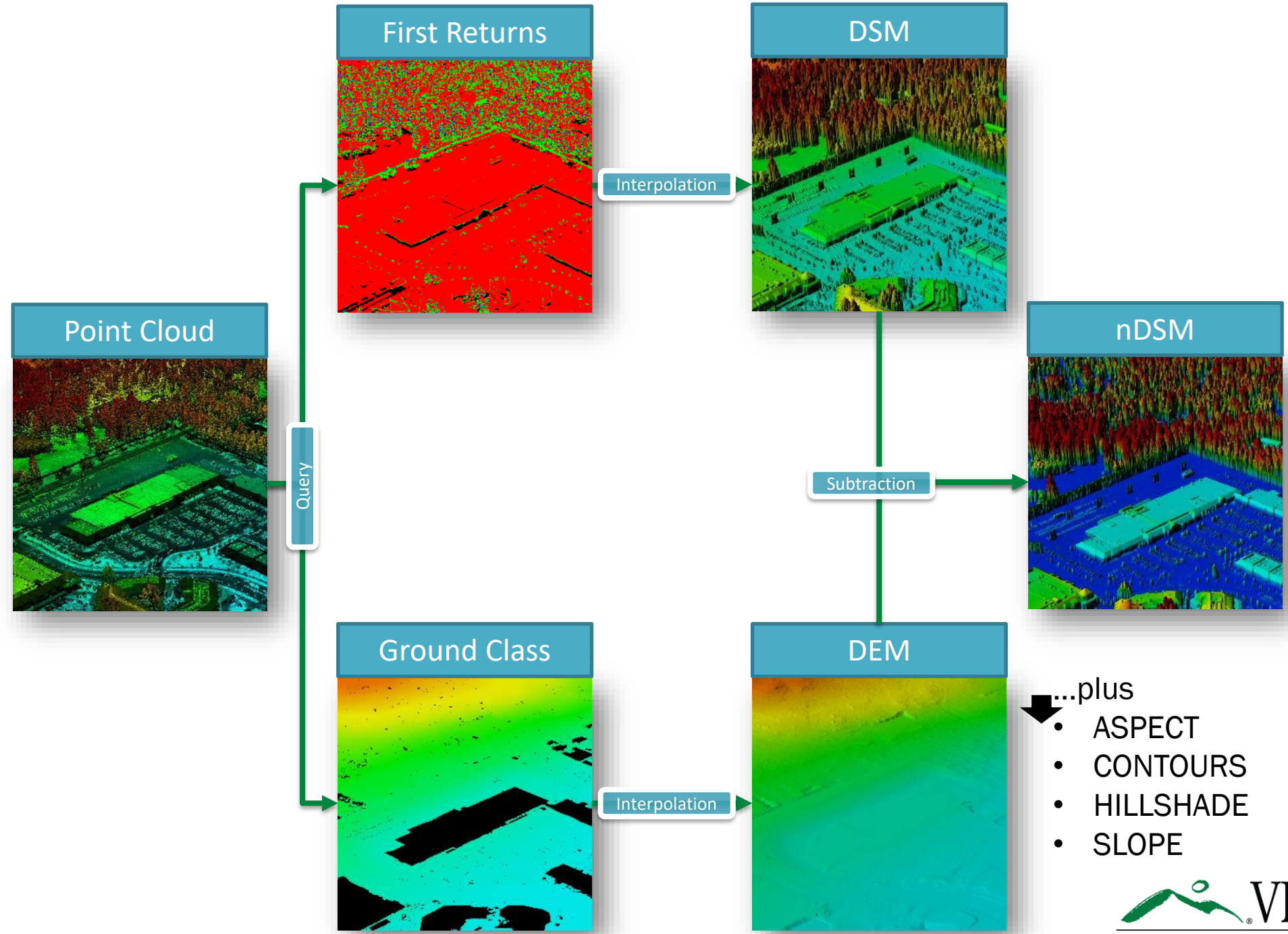
Light Detection and Ranging (lidar) is a technology used to create high-resolution models of ground and surface elevation. Lidar data are collected from aircraft using sensors that detect the reflections of a pulsed laser beam. The reflections are recorded as billions of individual points, which are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



Point Clouds

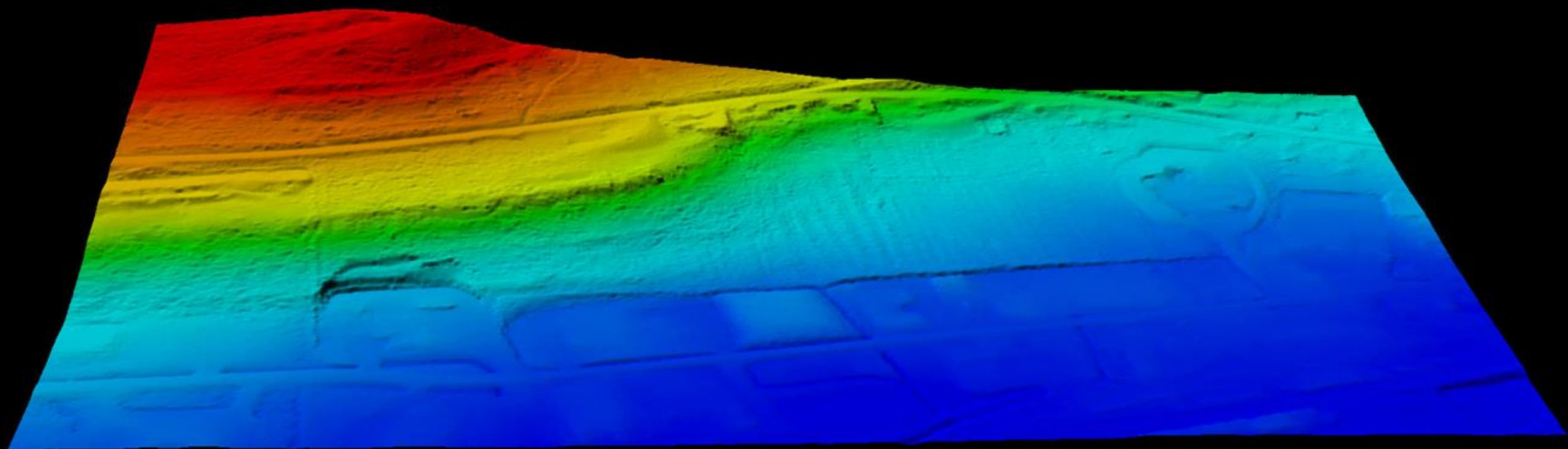
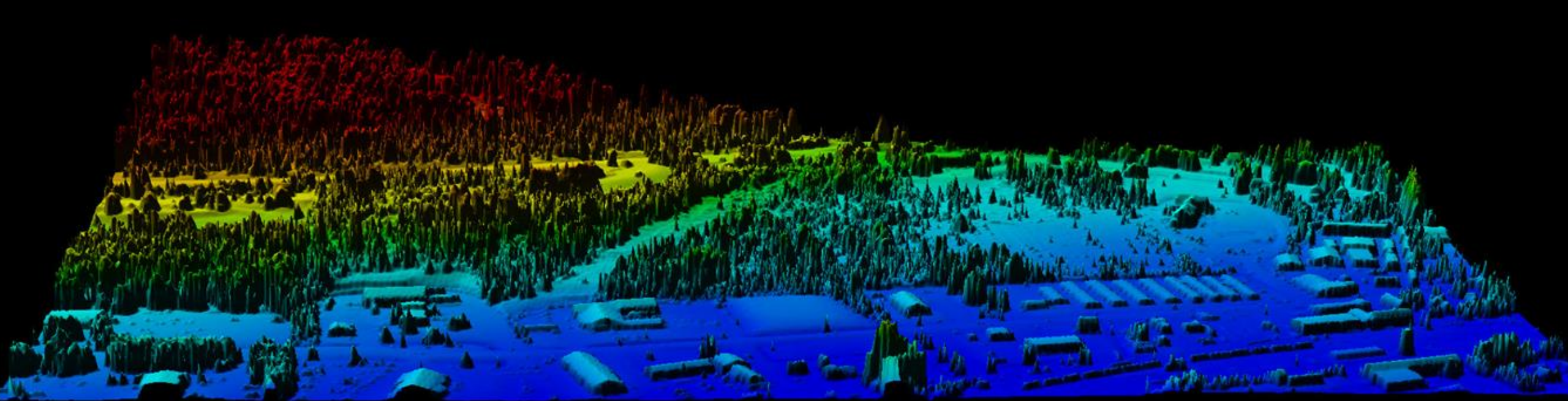


Lidar Derivatives



Credit: UVM Spatial Analysis Lab

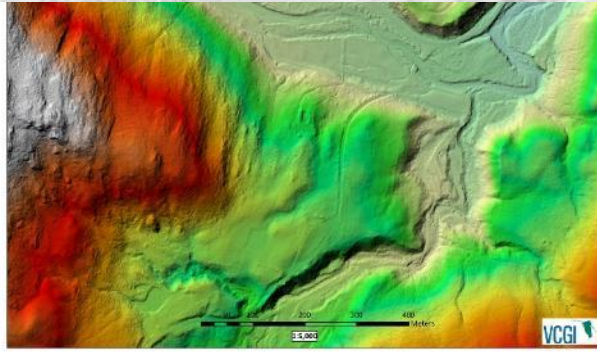




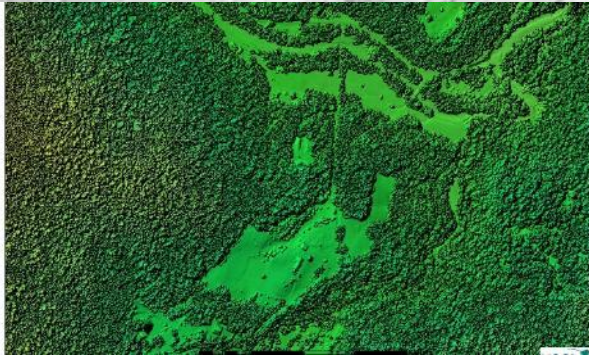
Example Derivative Products



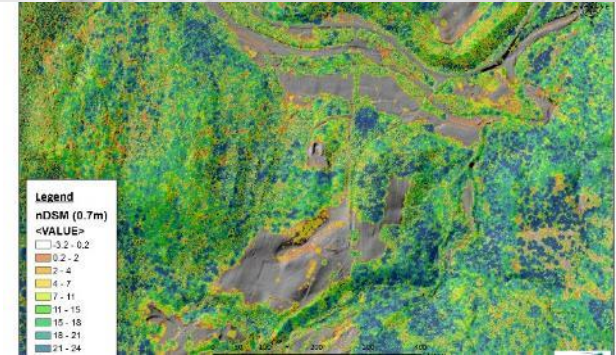
MARLBORO, VT



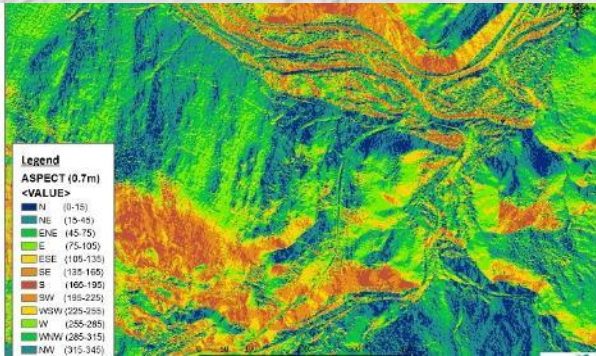
DIGITAL ELEVATION MODEL (DEM)



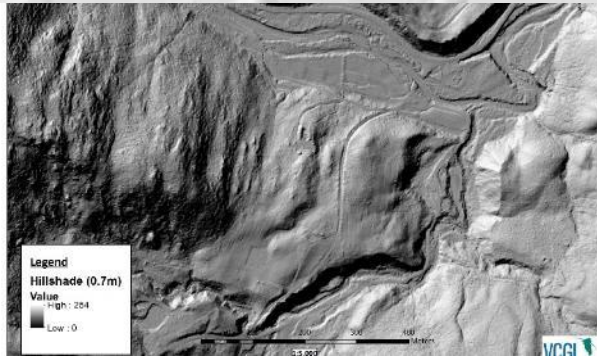
DIGITAL SURFACE MODEL (DSM)



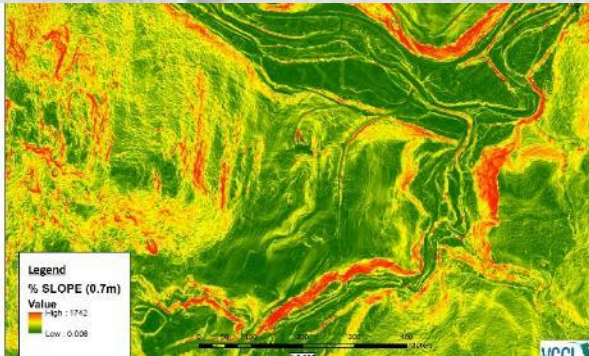
NORMALIZED DSM (nDSM)



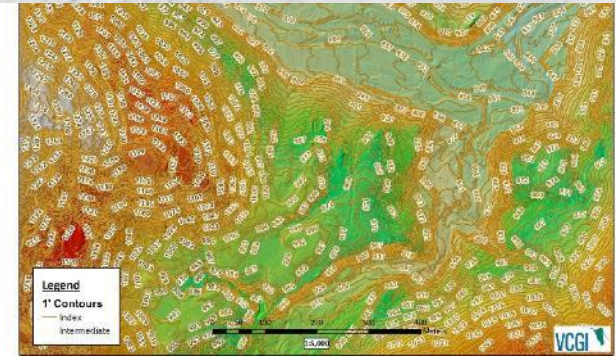
ASPECT (AZIMUTH)



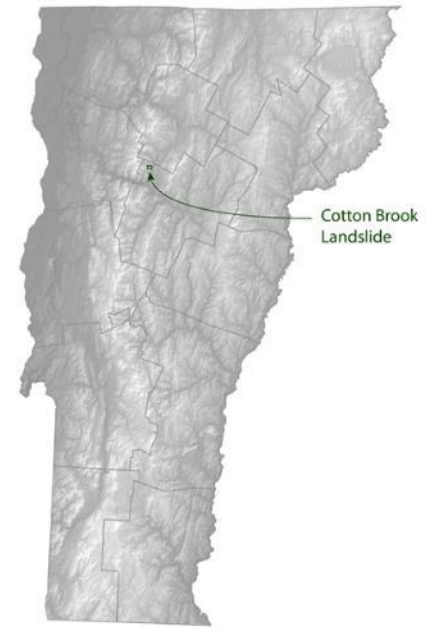
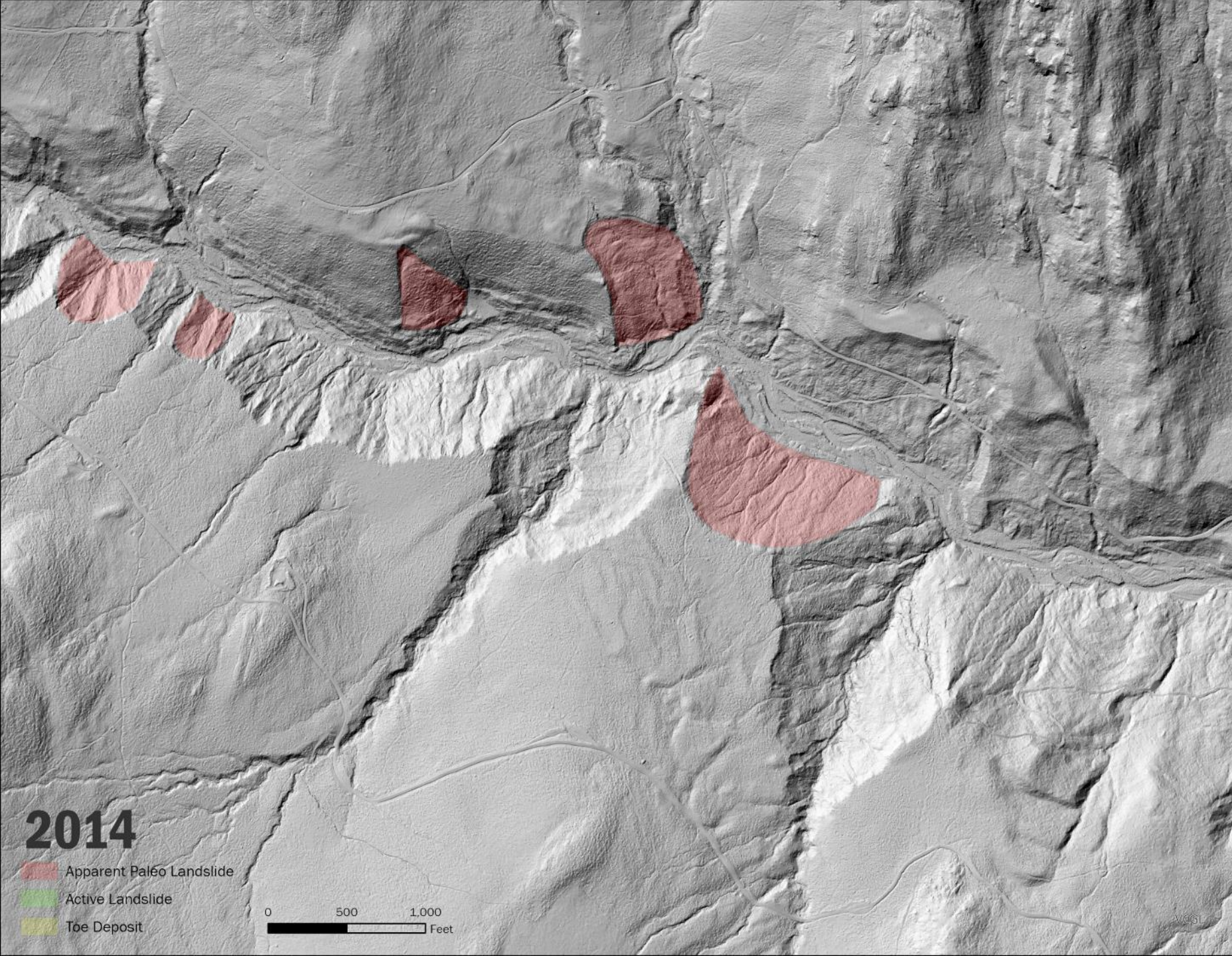
“BARE EARTH” HILLSHADE



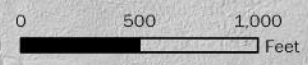
SLOPE



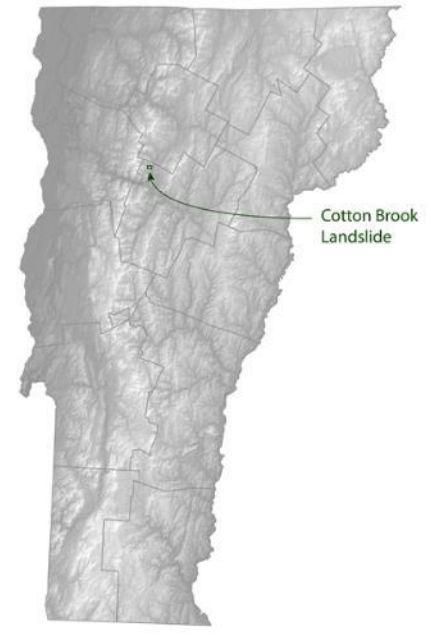
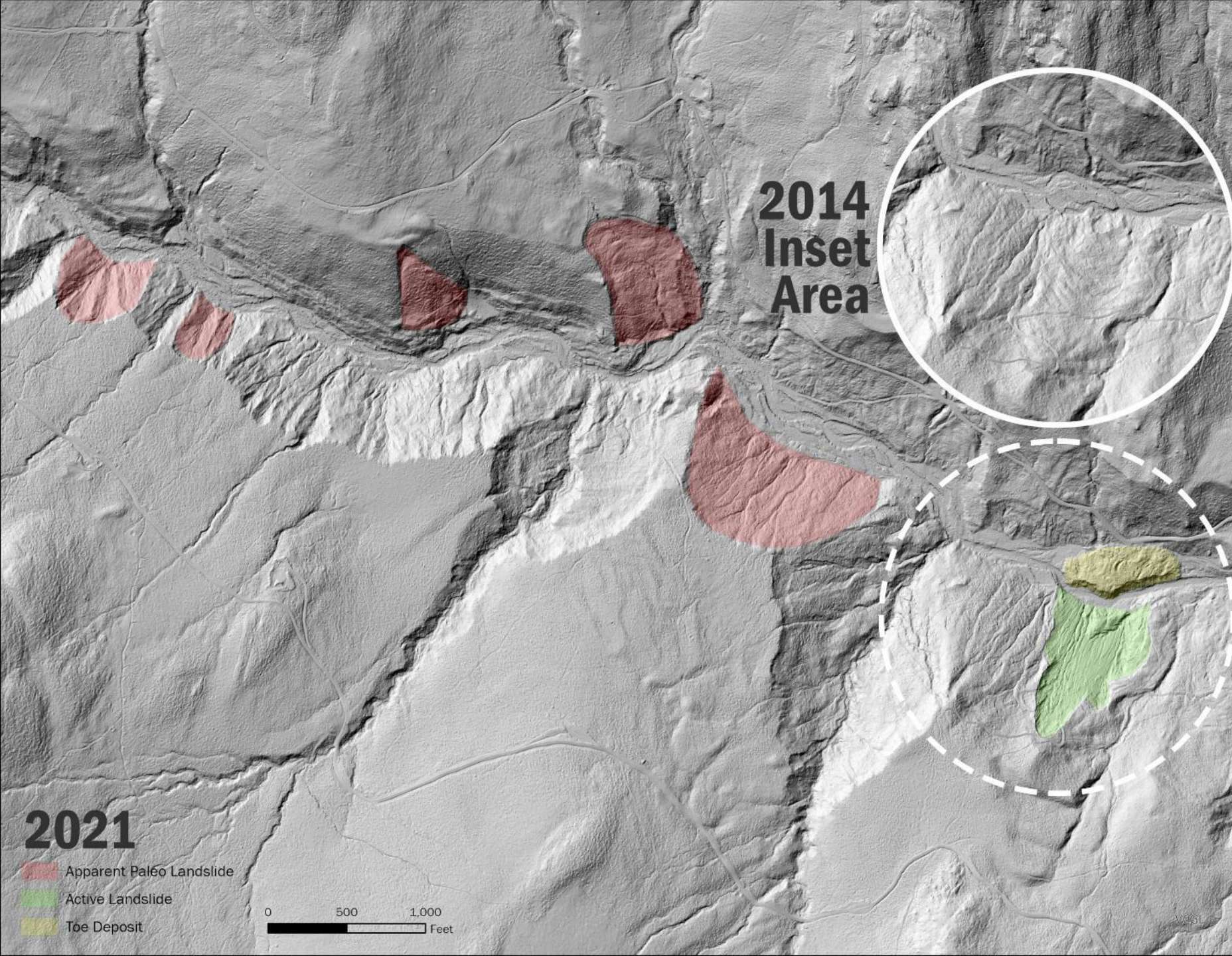
1 FOOT CONTOURS



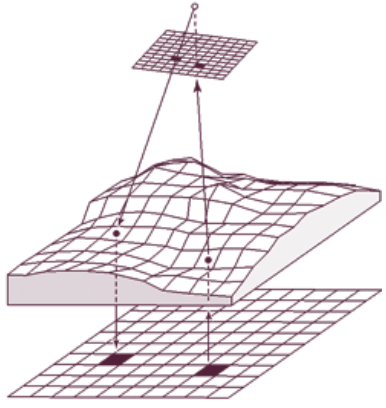
- 2014**
- Apparent Paleo Landslide
 - Active Landslide
 - Toe Deposit



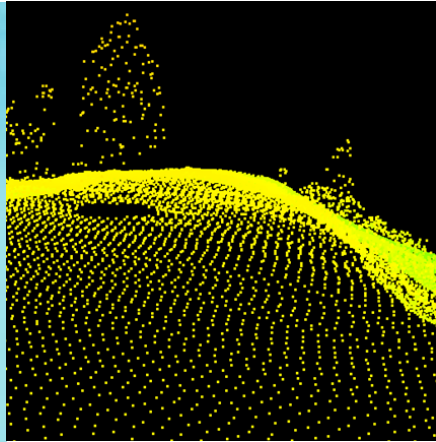
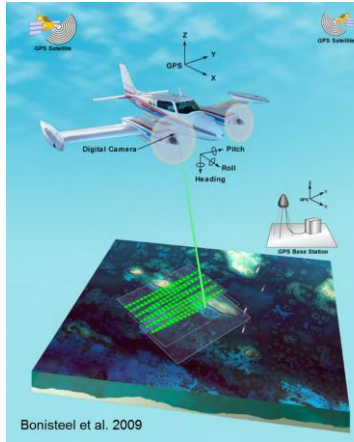
Changing With Time



Changing With Time

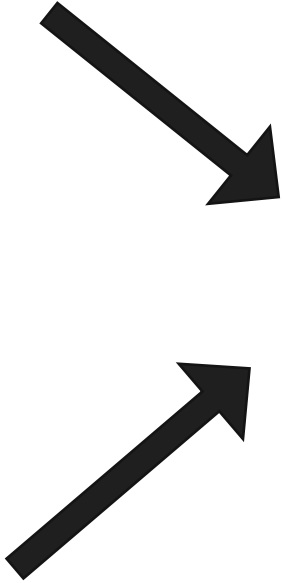


ORTHOIMAGERY

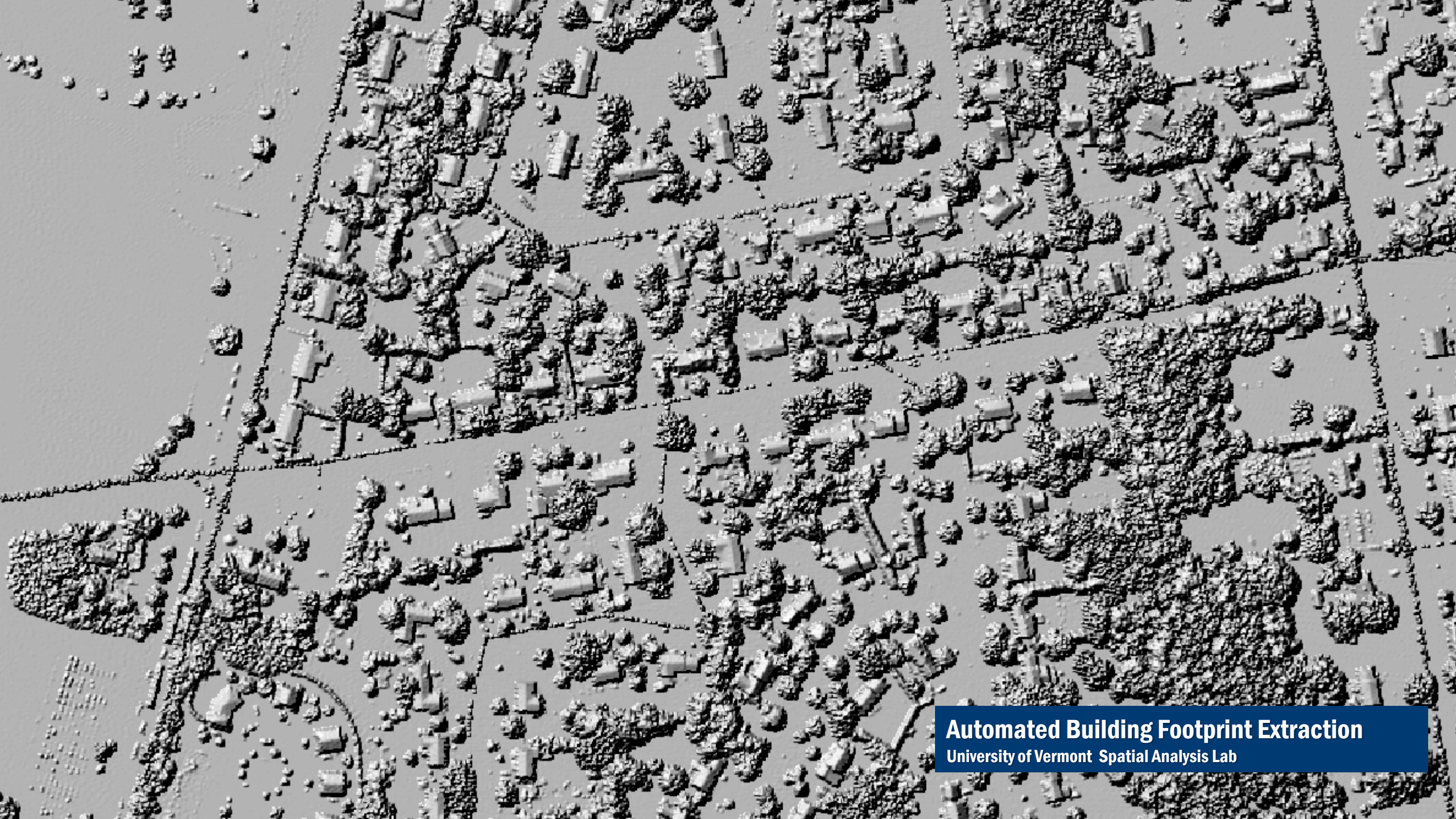


Bonisteel et al. 2009

LIDAR



Land Cover



Automated Building Footprint Extraction
University of Vermont Spatial Analysis Lab

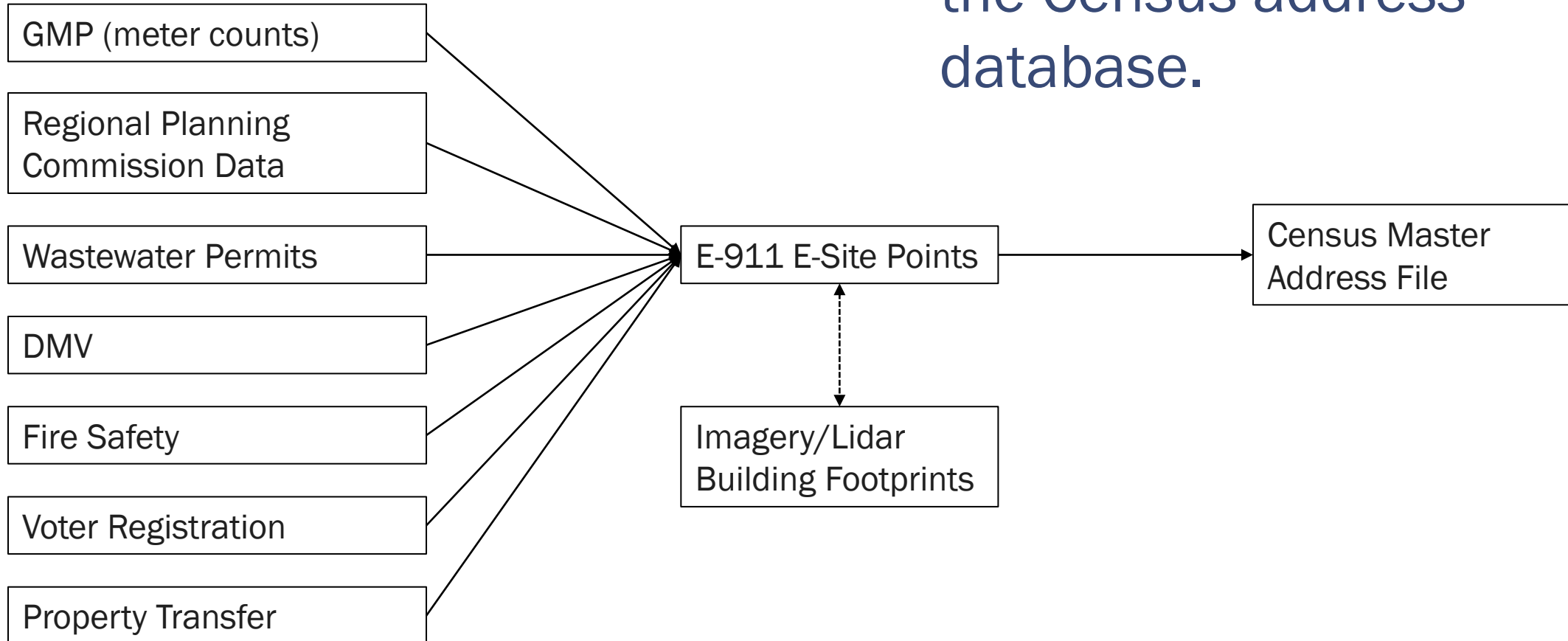




**Identification of
Missing E911
Points**

8634 homes added to the Census address database.

Address Databases



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>

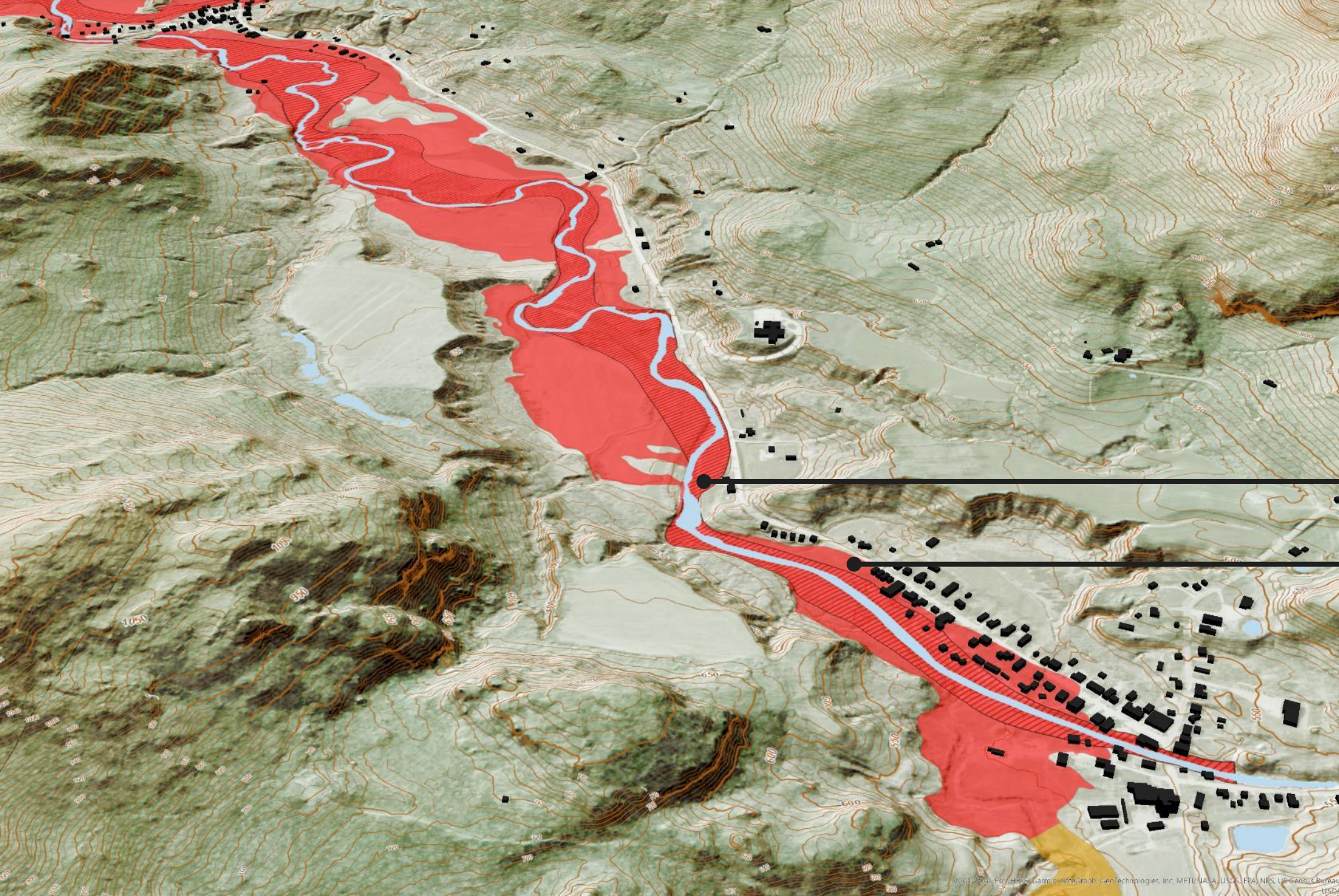


FLOODING:
Managing Risk
Exposure



FLOODING:
Managing Risk
Exposure





FLOODING:
Managing Risk
Exposure

FEMA's
NFHL (DFIRM's)

Regulatory
Floodway Zone AE

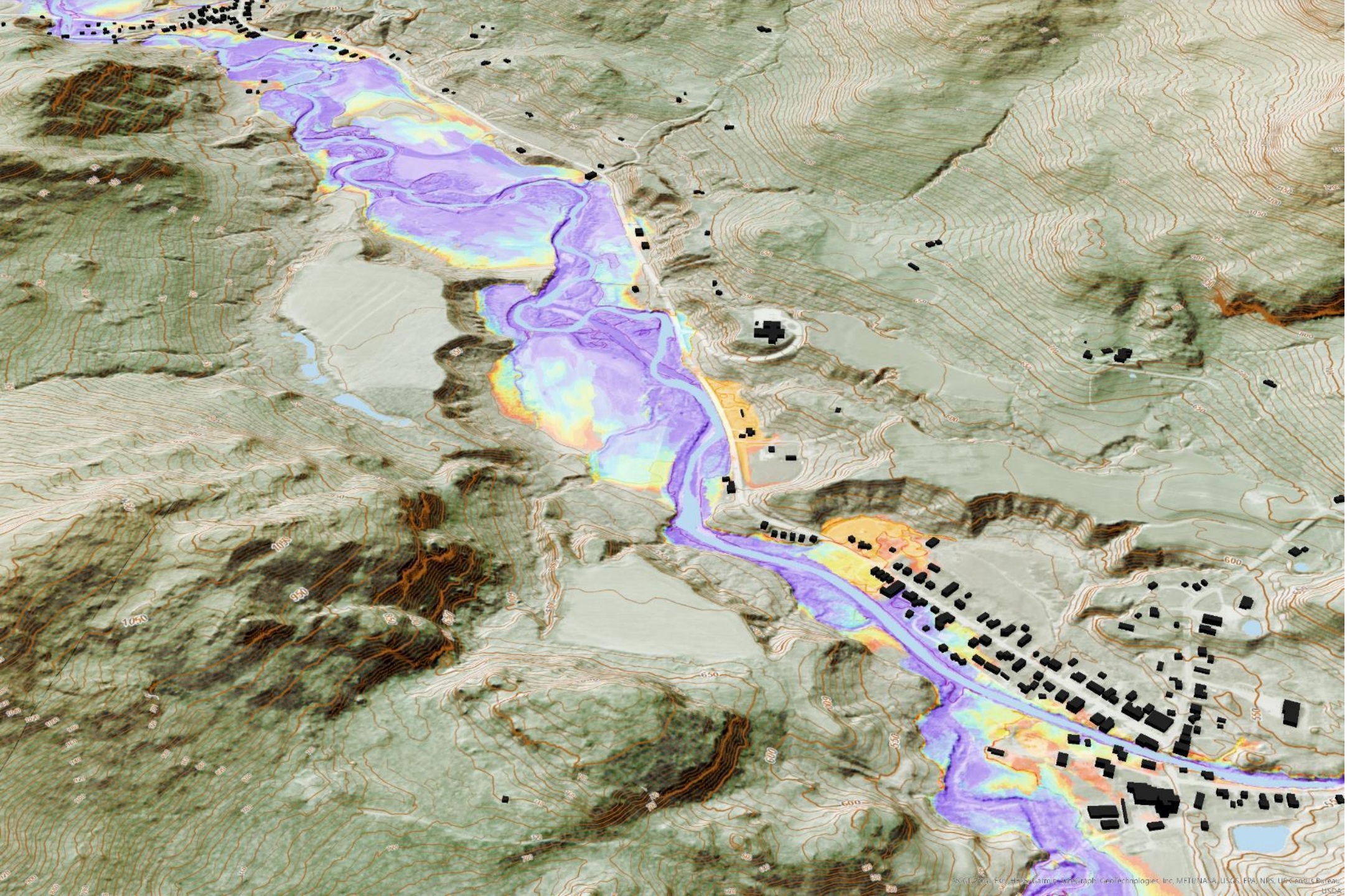
1% Annual Chance
Flood - Zone AE

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

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)



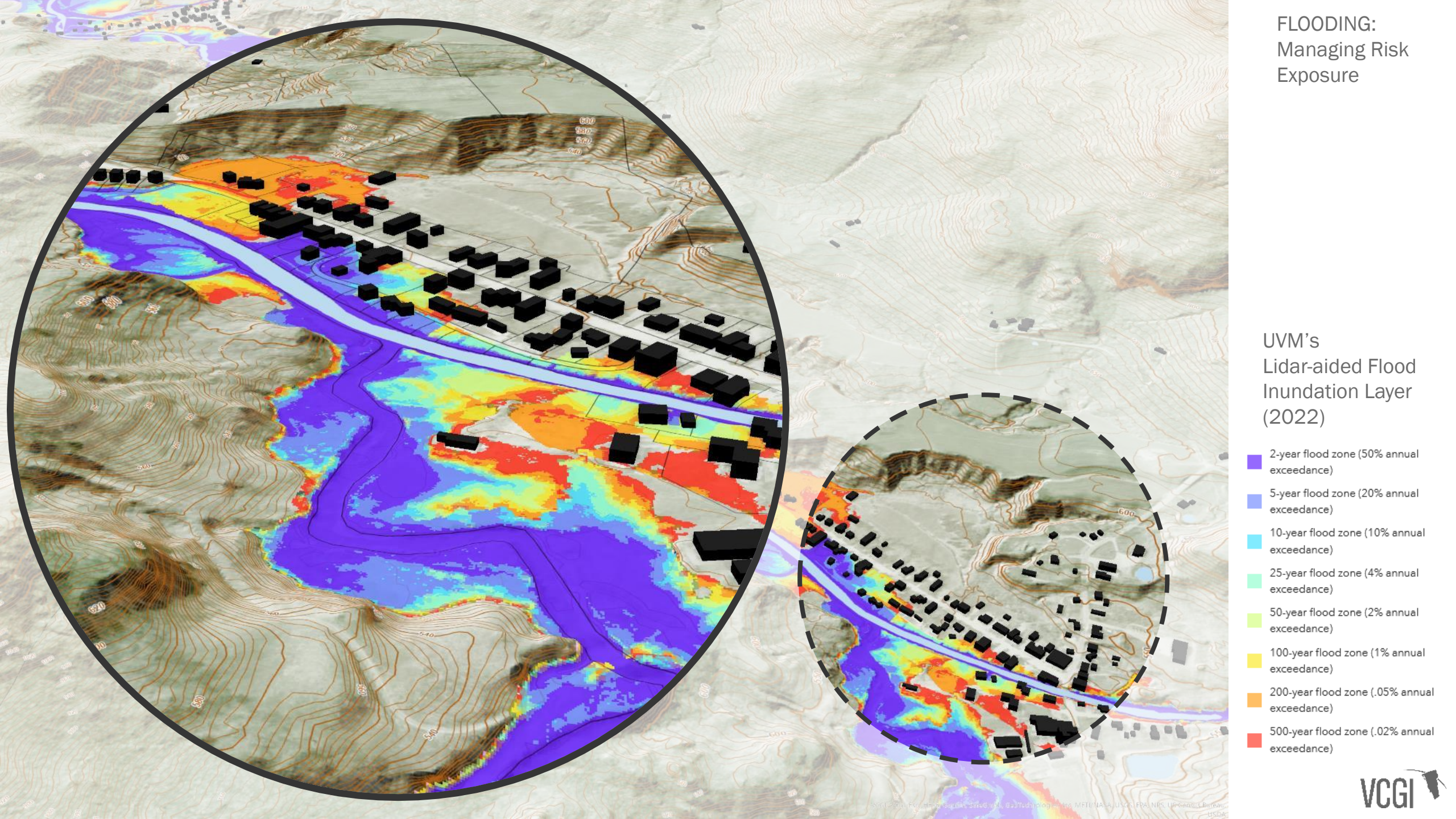
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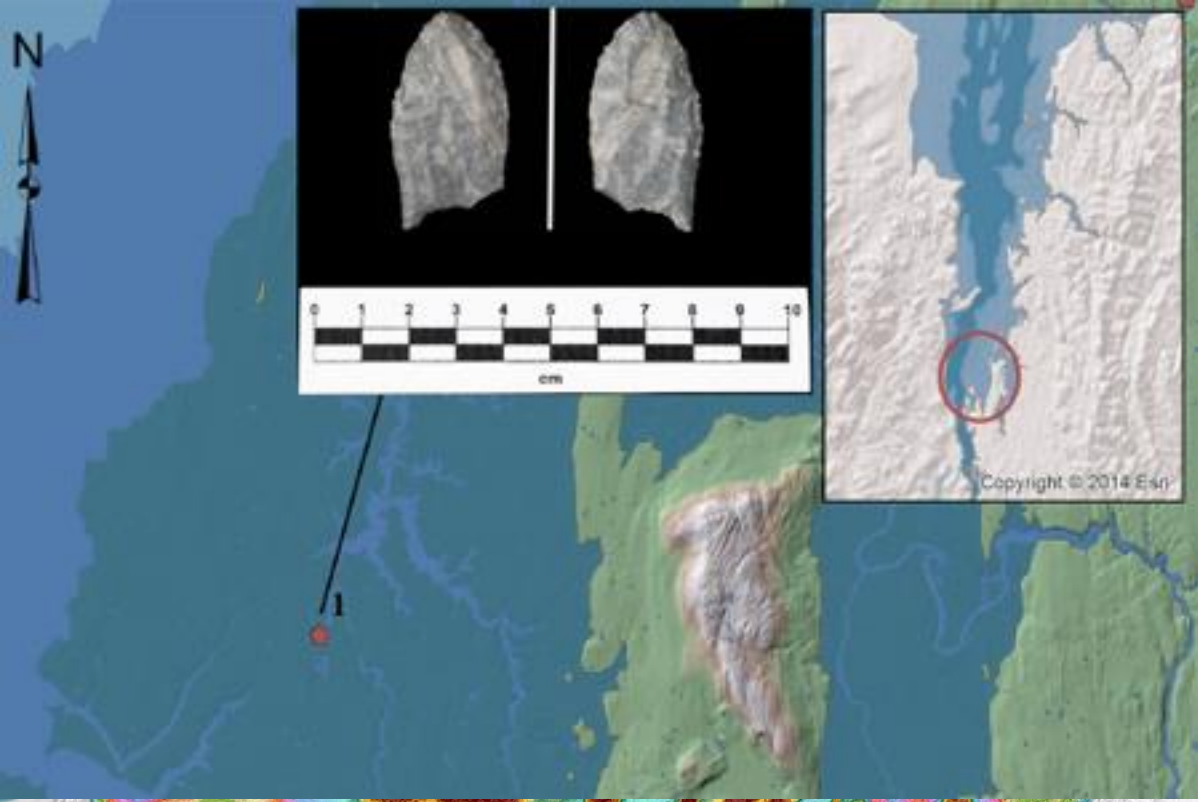


FLOODING: Managing Risk Exposure

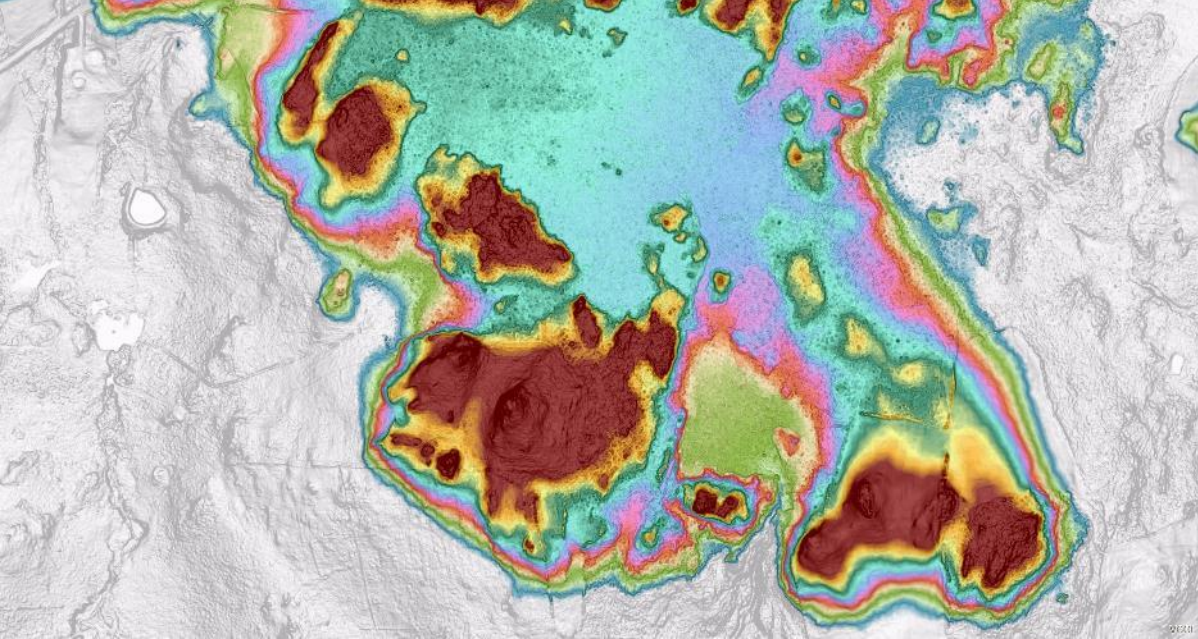
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Archaeology



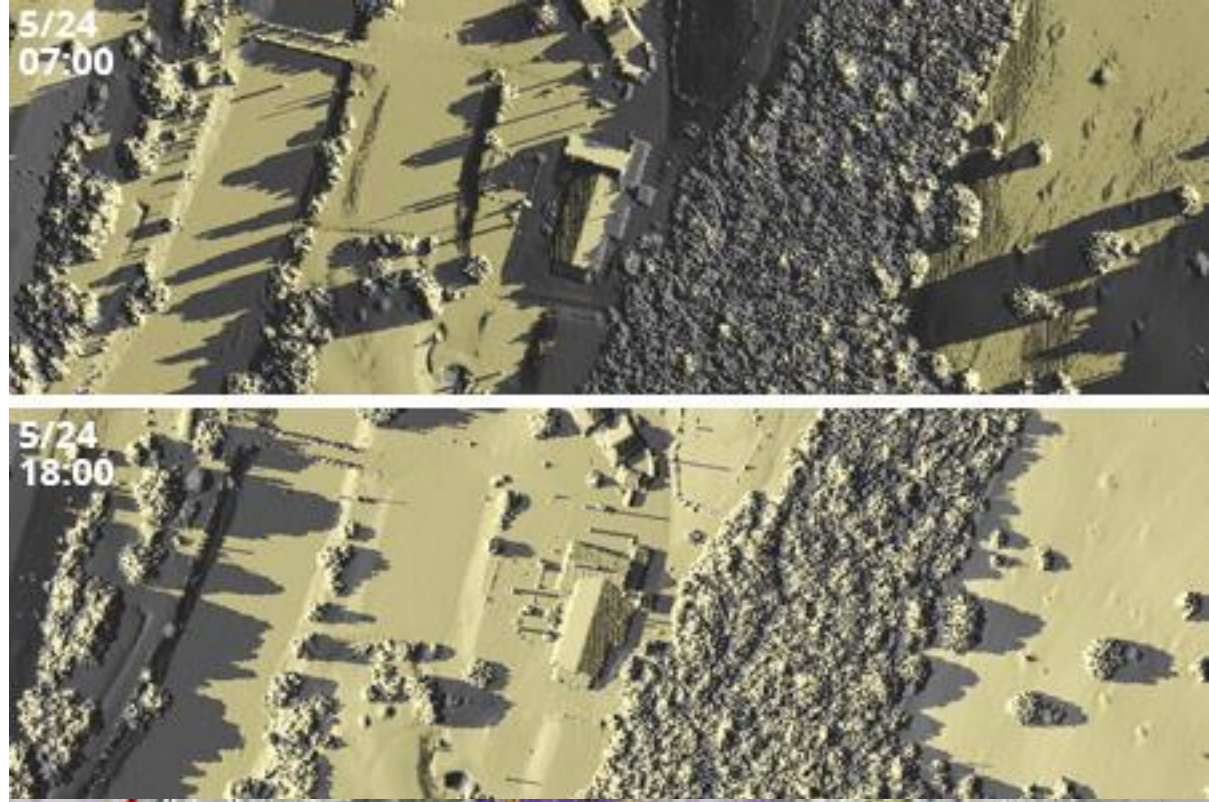
Wetlands Assessment

Site Suitability



Site Suitability

Solar Assessment



Solar Assessment

Lidar supports
activities across
all sectors of the
Statewide Strategic Plan



ECONOMY

Forest Management
Broadband
Outdoor Recreation
Renewable Energy

VULNERABILITY

Flood Hazards
Emergency Response
Water Quality
Landslide & Ice Jams



AFFORDABILITY

Real Estate Development
Medicare/FMAP
Infrastructure
Small Business

MODERNIZATION

Streamline Permitting
Reduced Field Work
Machine Learning
Process Automation





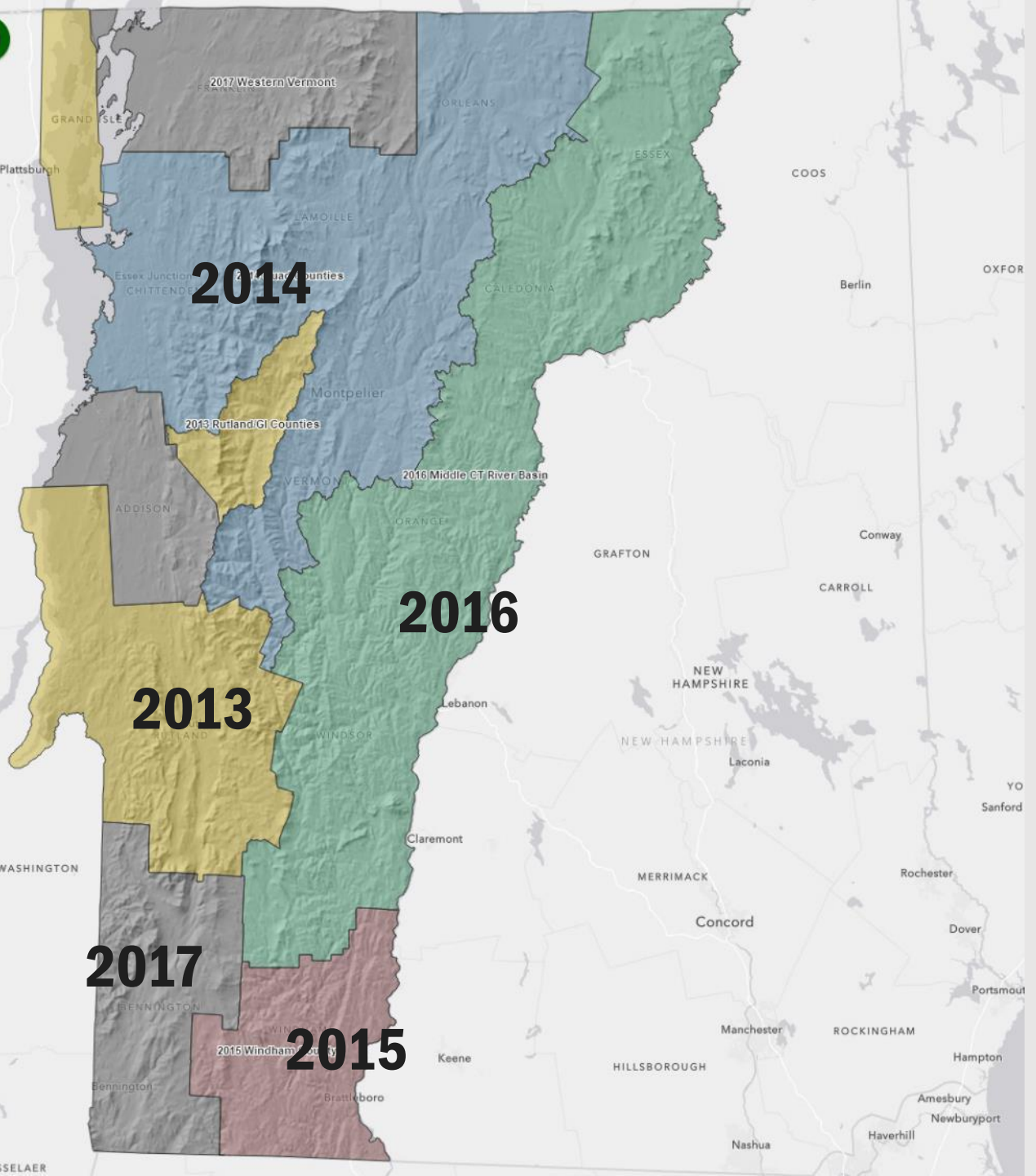
Current Status & Needs



Legend

Available QL2 Lidar

- 2013 Rutland/GI Counties
- 2014 Quad Counties
- 2015 Windham County
- 2016 Middle CT River Basin
- 2017 Western Vermont

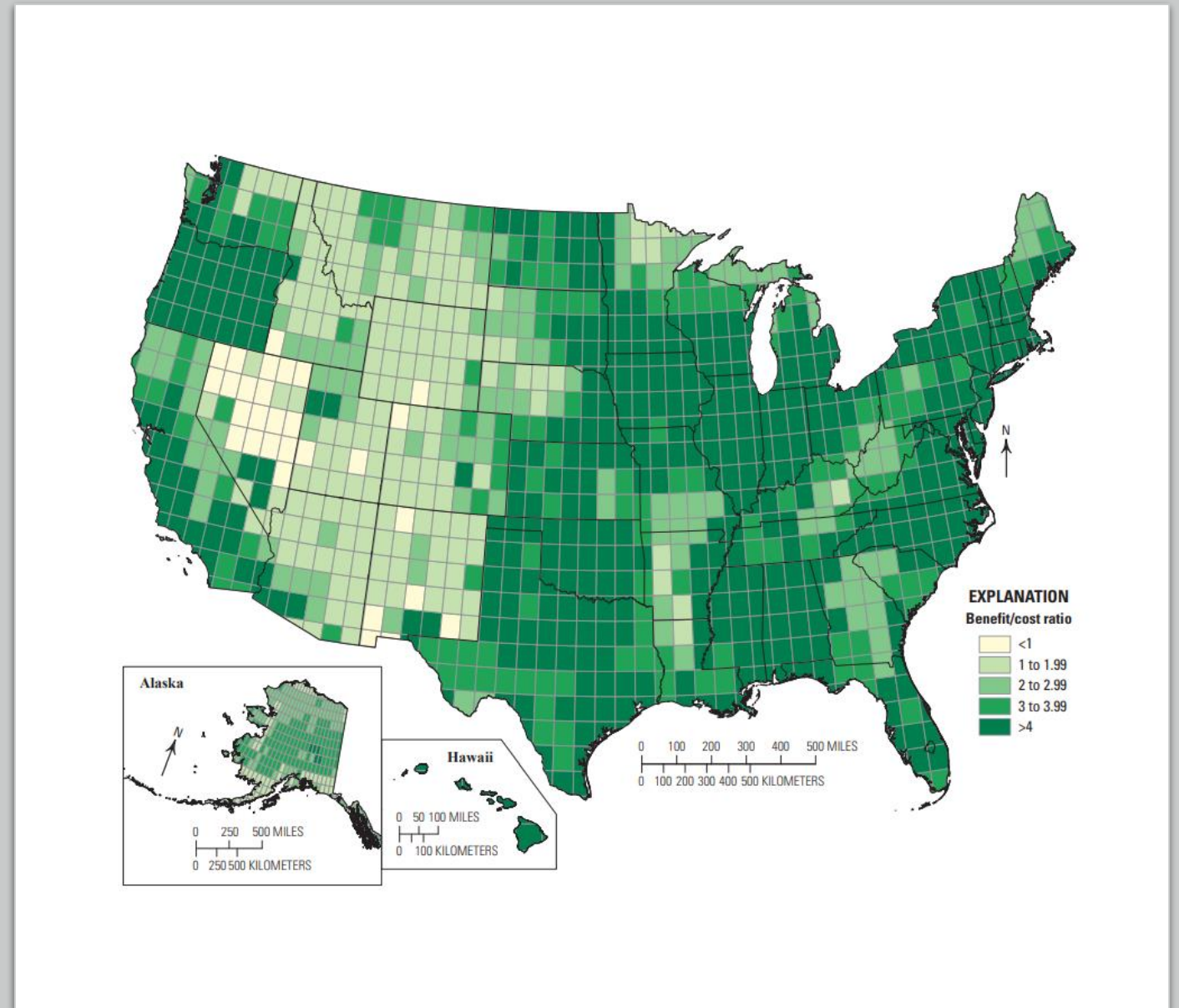


Quality Level 2 (QL2 Coverage)
<https://maps.vcgi.vermont.gov/lidarstatus/>

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.





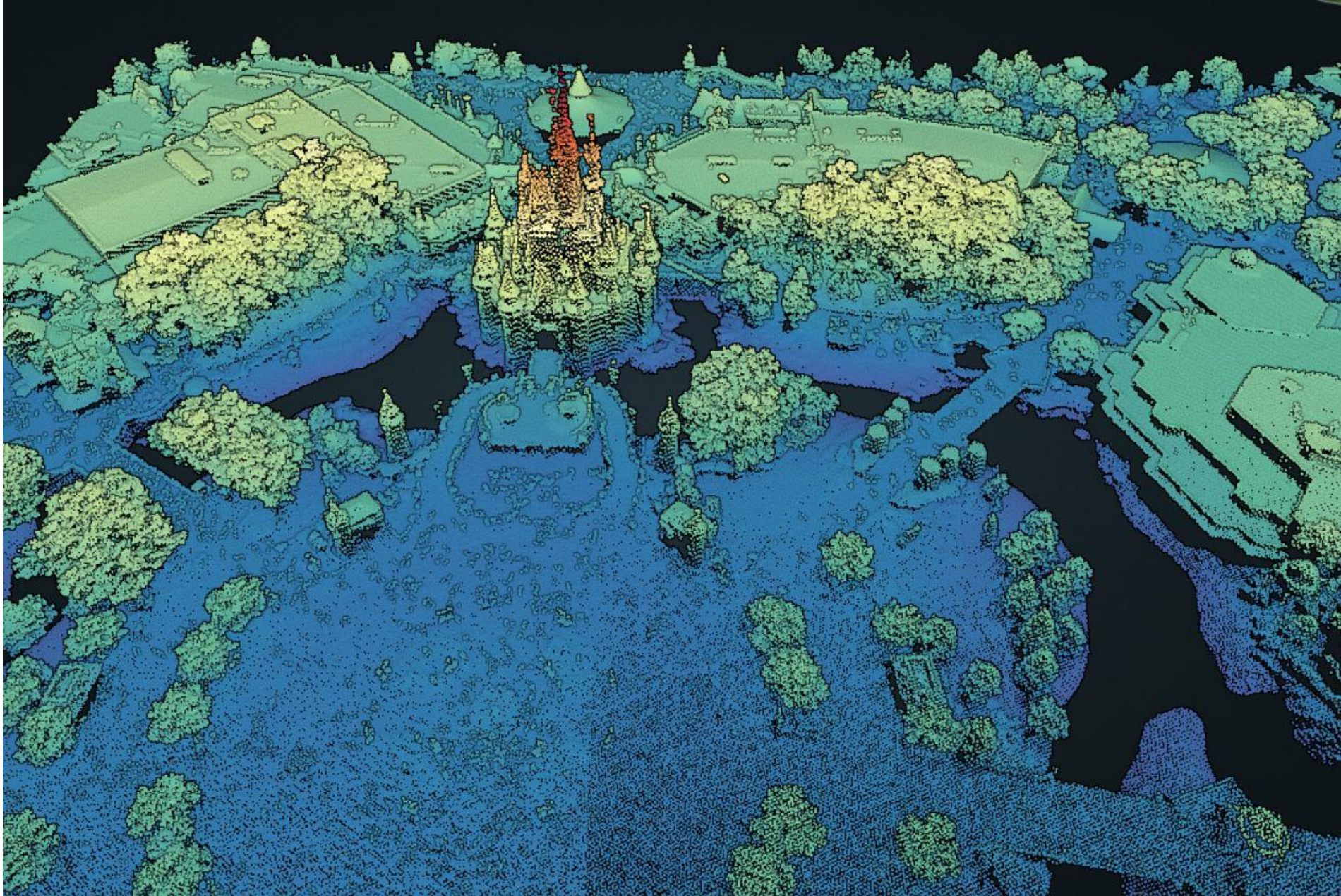
Quality Level 1 (QL1)

“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.”



Example
of Quality
Level 1
Data in
Florida



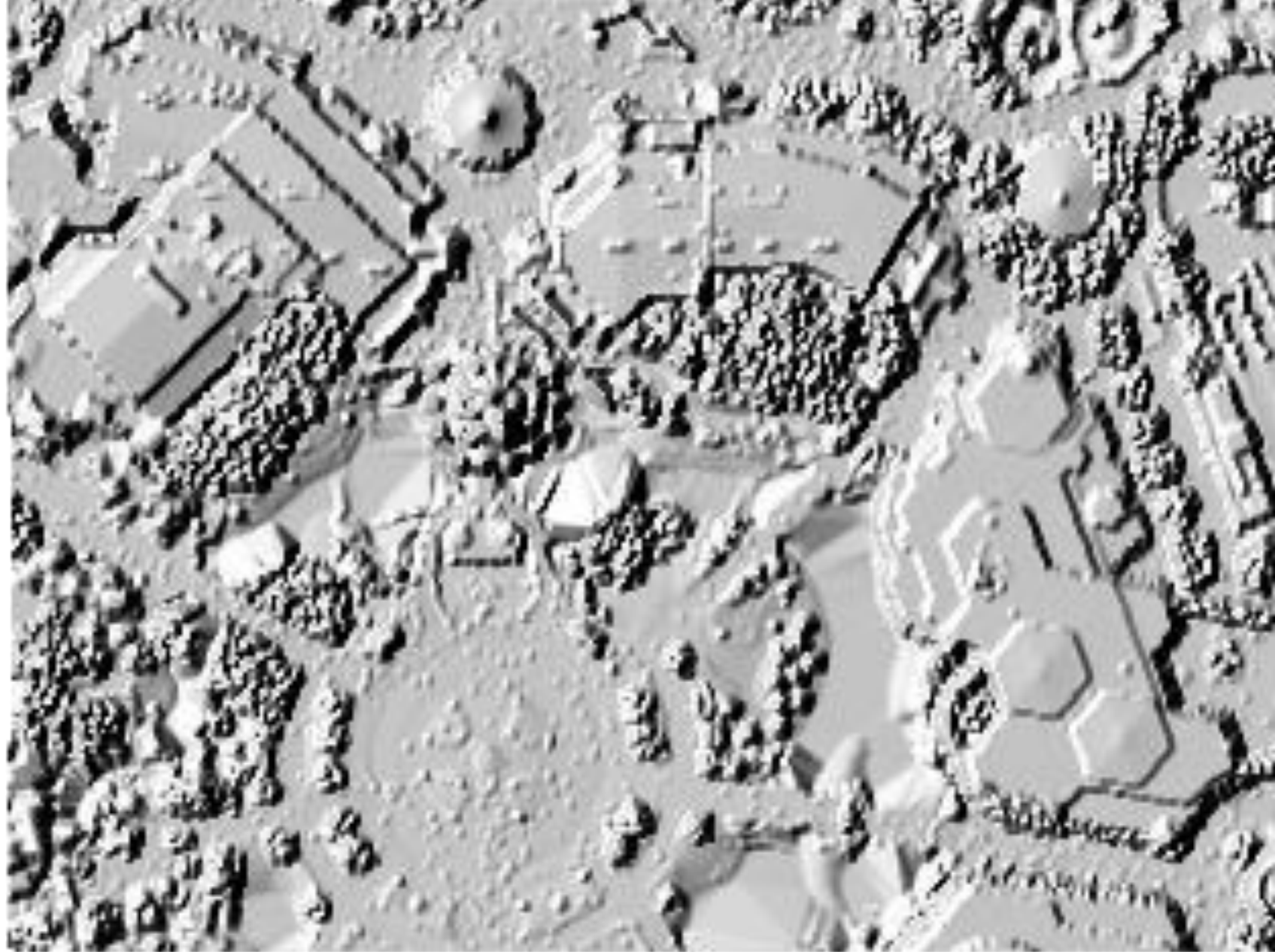
FL Peninsular FDEM Orange 2018, USGS 3DEP
Distributed by Open Topography



Orthoimagery for context



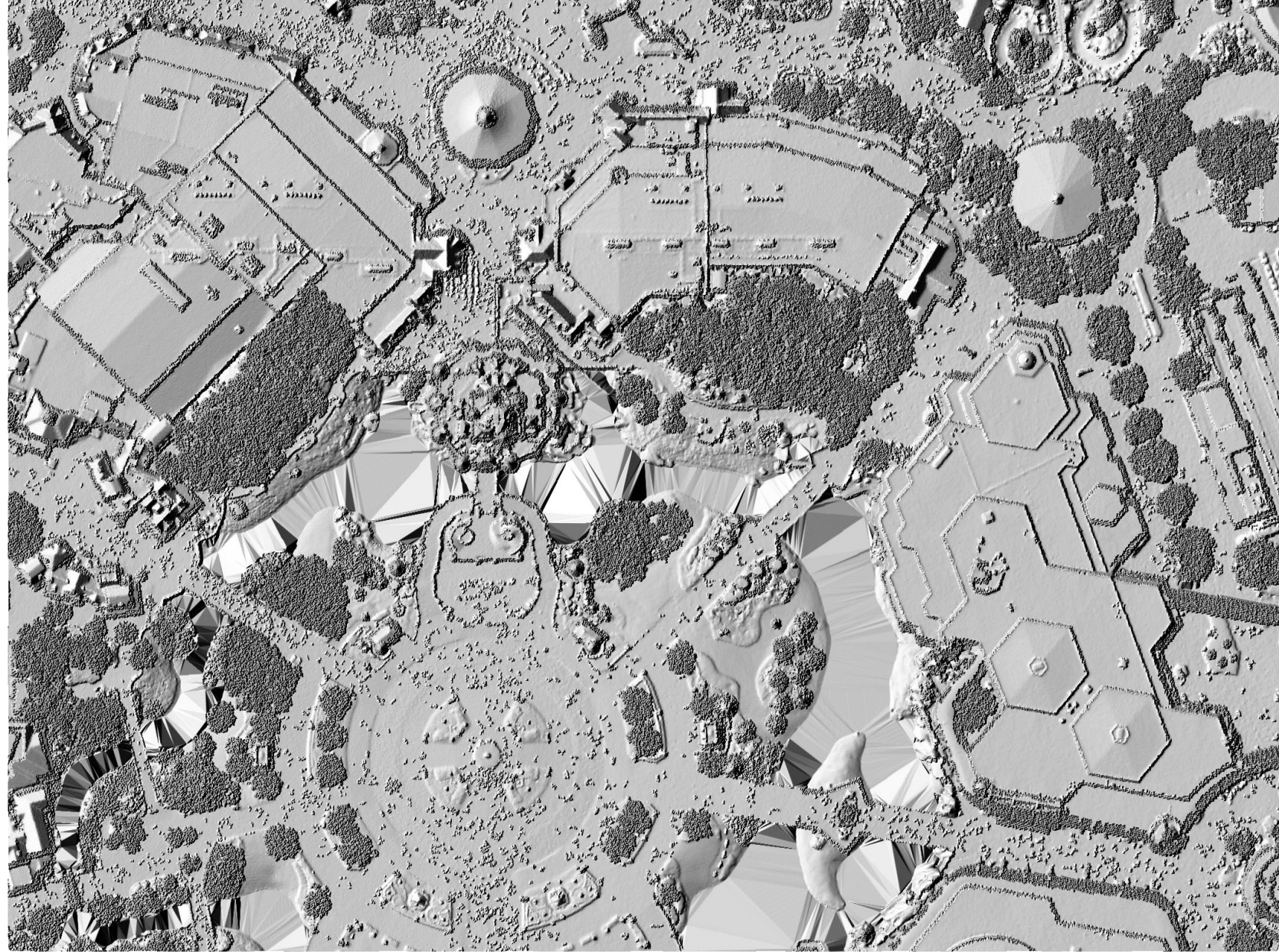
Elevation Model
Downsampled to
Quality Level 2
2 pts per square
meter



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



Elevation Model
Quality Level 1
> 8 pts per square meter



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



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.

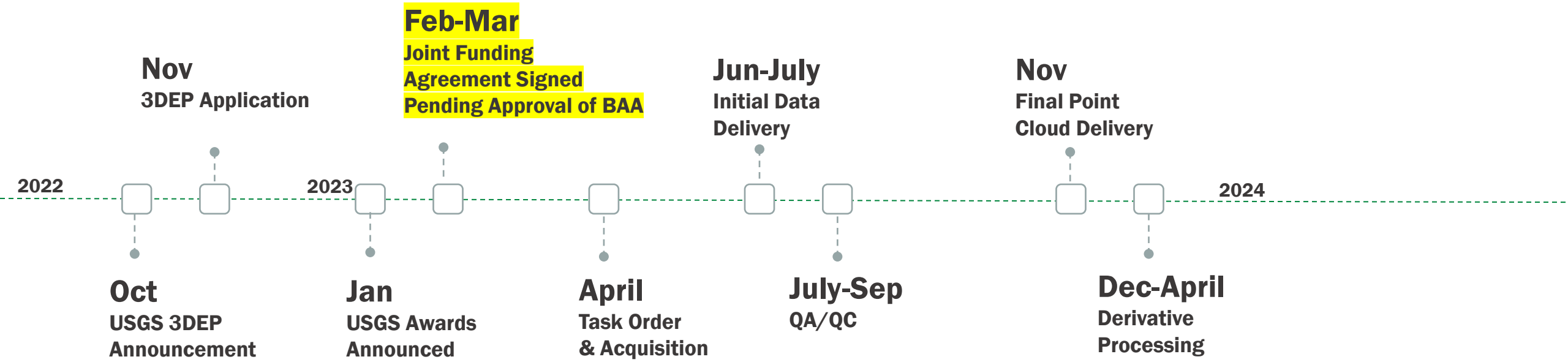




Acquisition Plan

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





Steering Committee

Pam Brangan - Chittenden County Regional Planning Commission

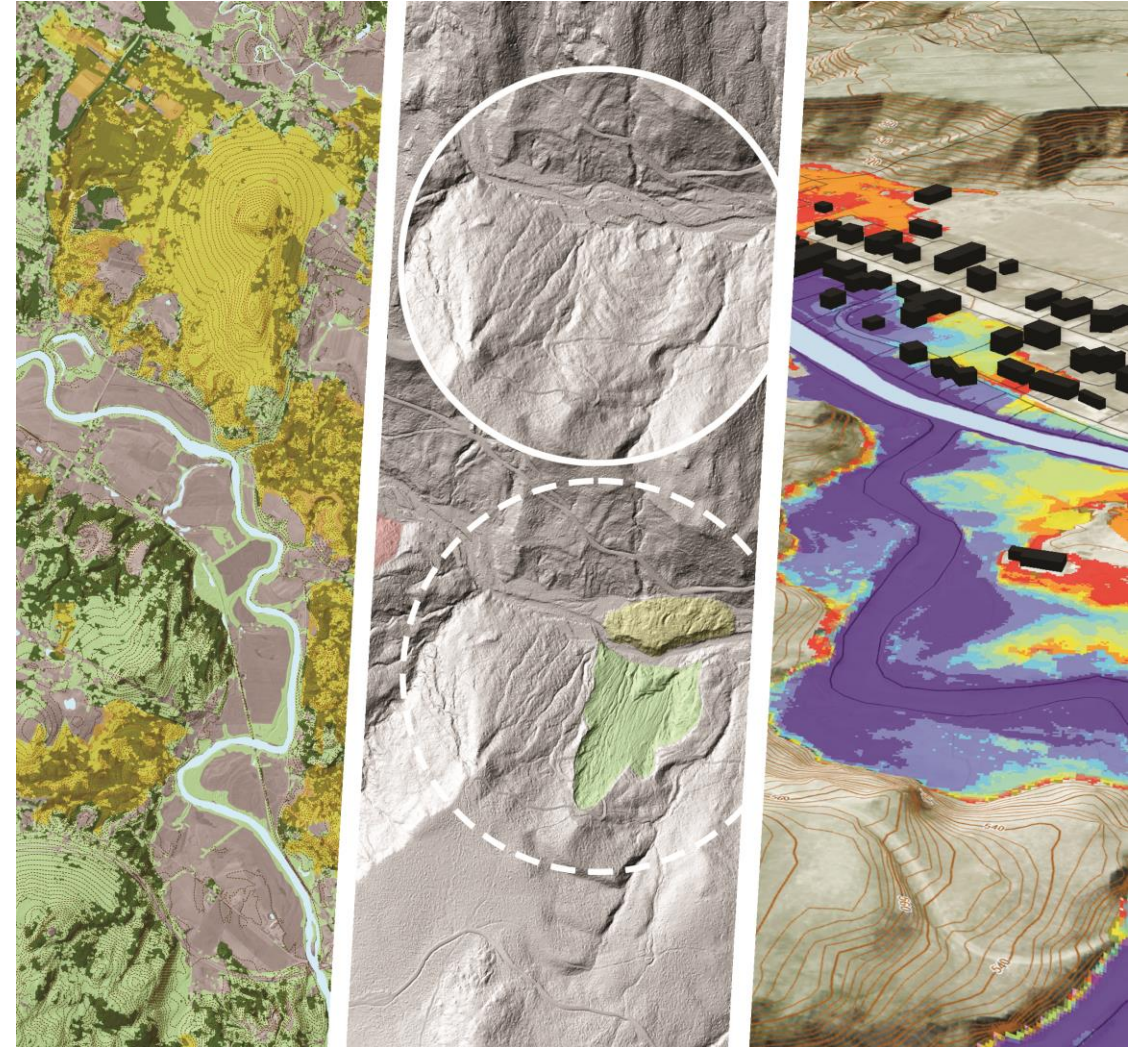
Johnathan Croft - AOT Mapping Section Chief

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



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

