

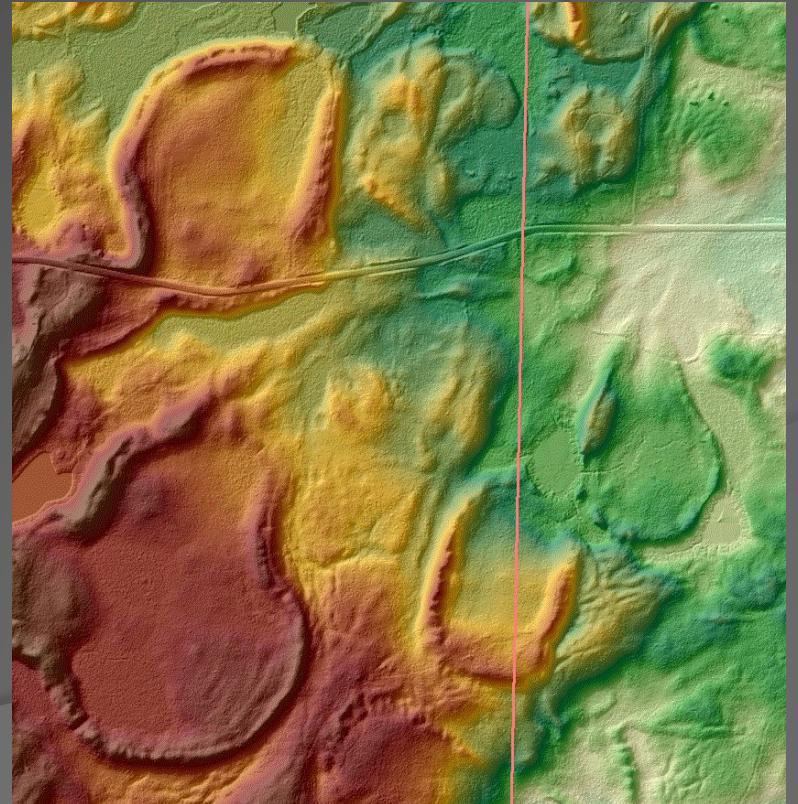
LiDAR in MN

Joel Nelson

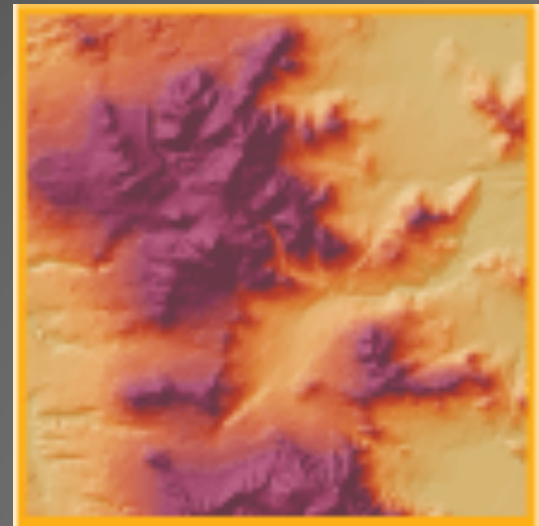
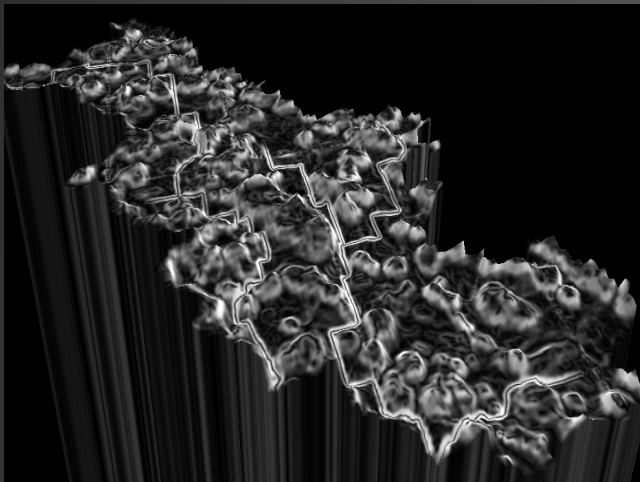
U. of MN, Dept of Soil,
Water, and Climate

Where We Are,

How We Got Here



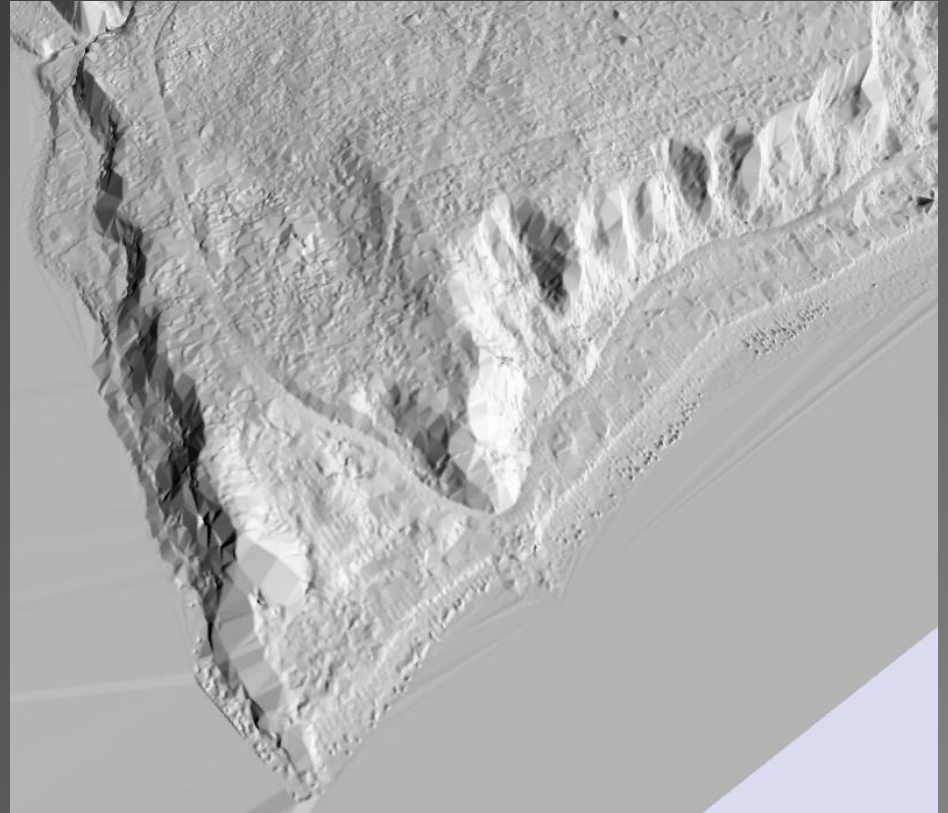
What is LiDAR?



LiDAR

What is LiDAR?

- Light Detection And Ranging – a remote sensing system used to collect topographic data
- Produces high-resolution, accurate, land-elevation information

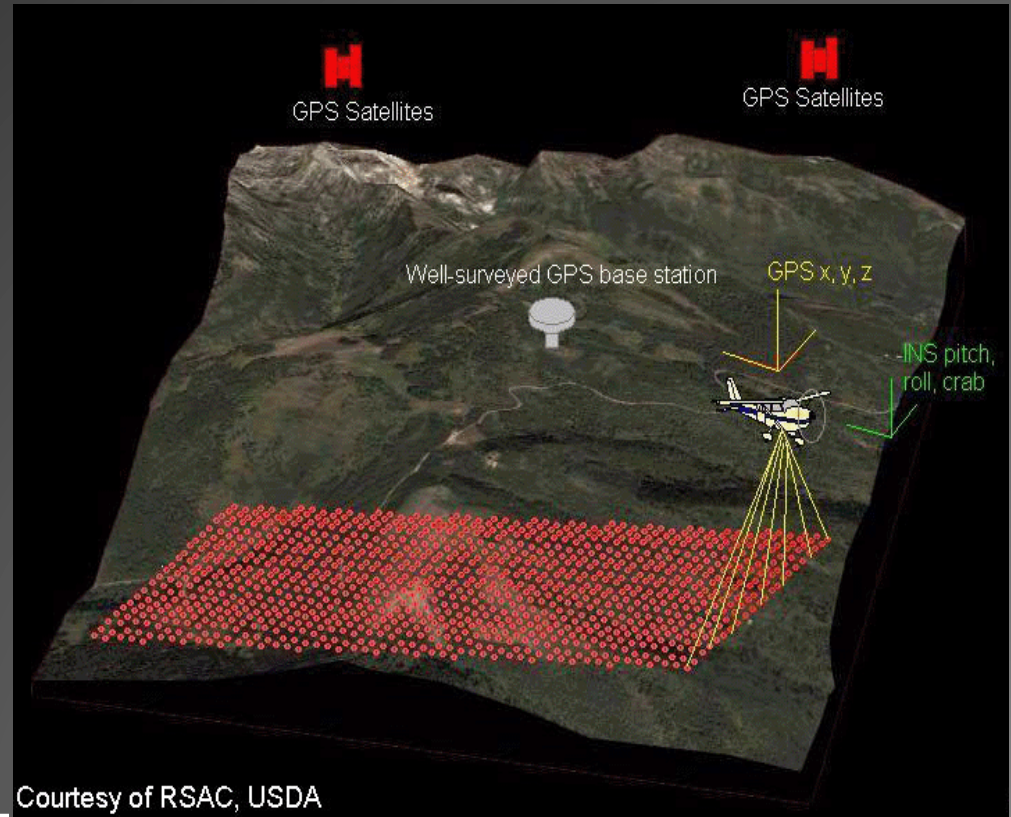


LiDAR

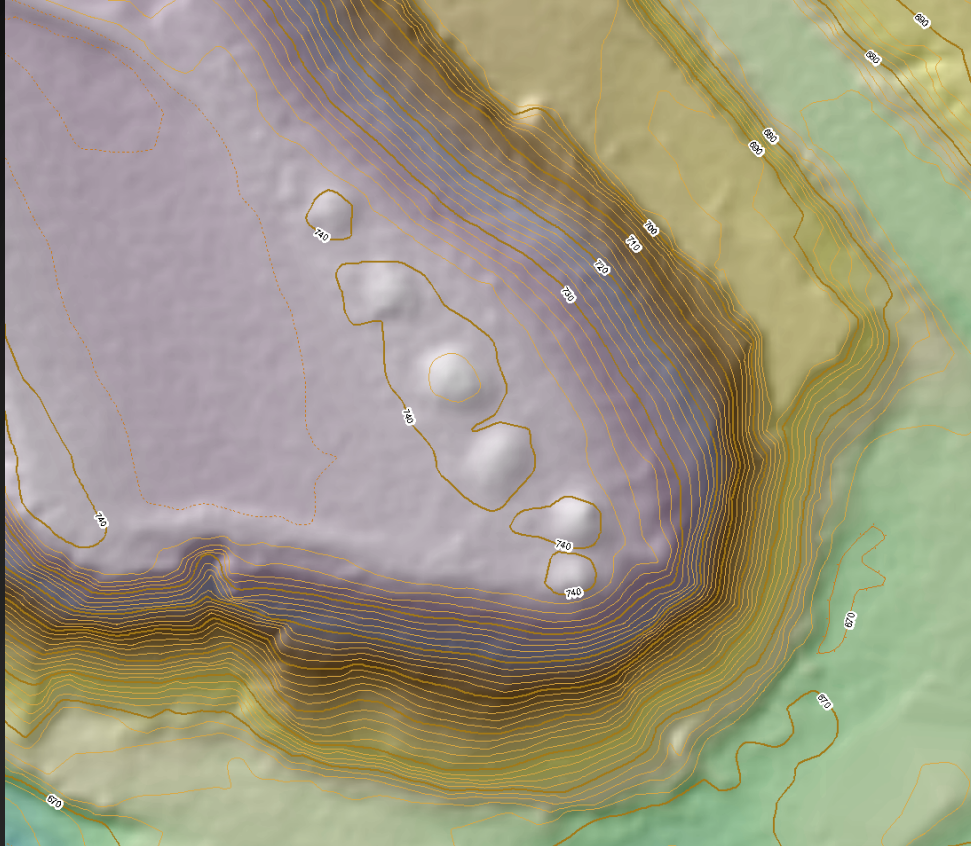
How is LiDAR data collected?

Airborne survey:

- Covers the surface with multiple discrete laser pulses
 - Up to 150,000 per second
- Collects the returns
 - Time = distance + GPS = Location



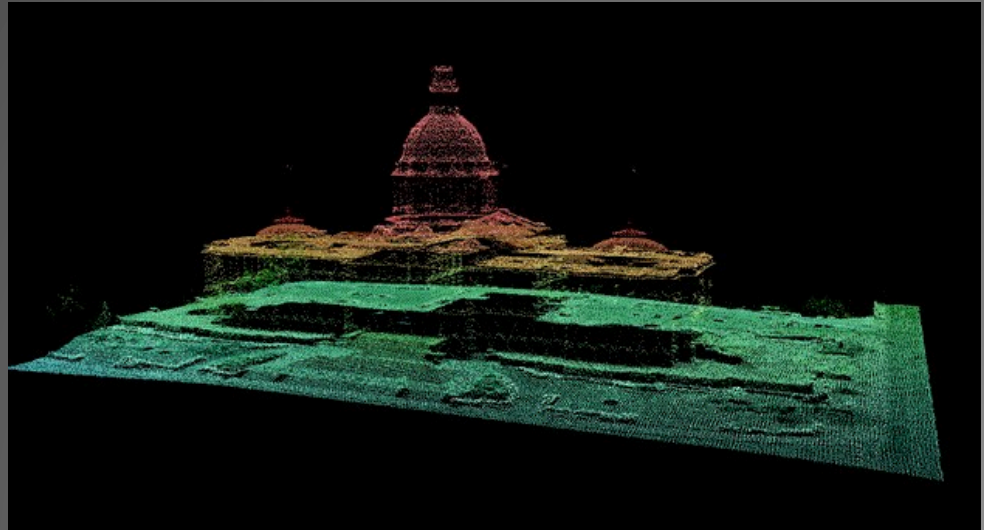
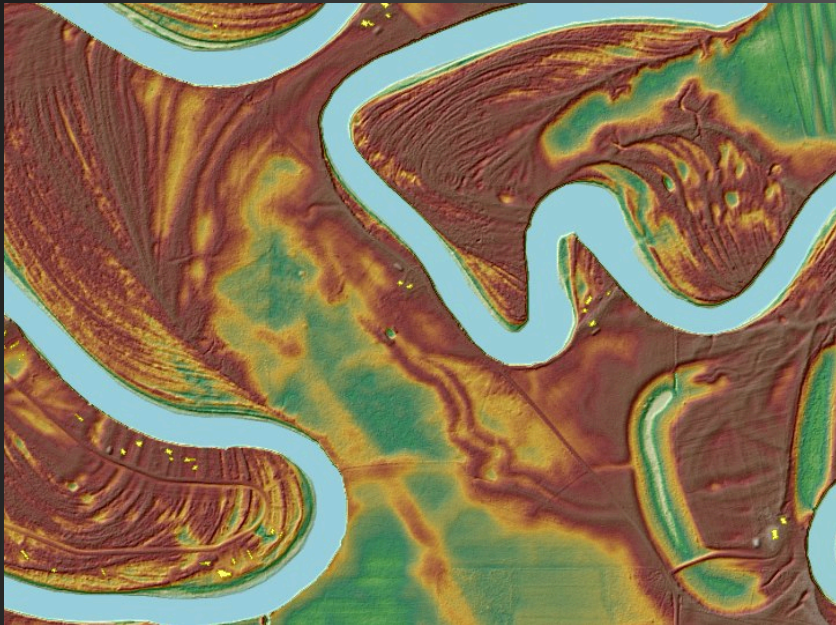
LiDAR Products

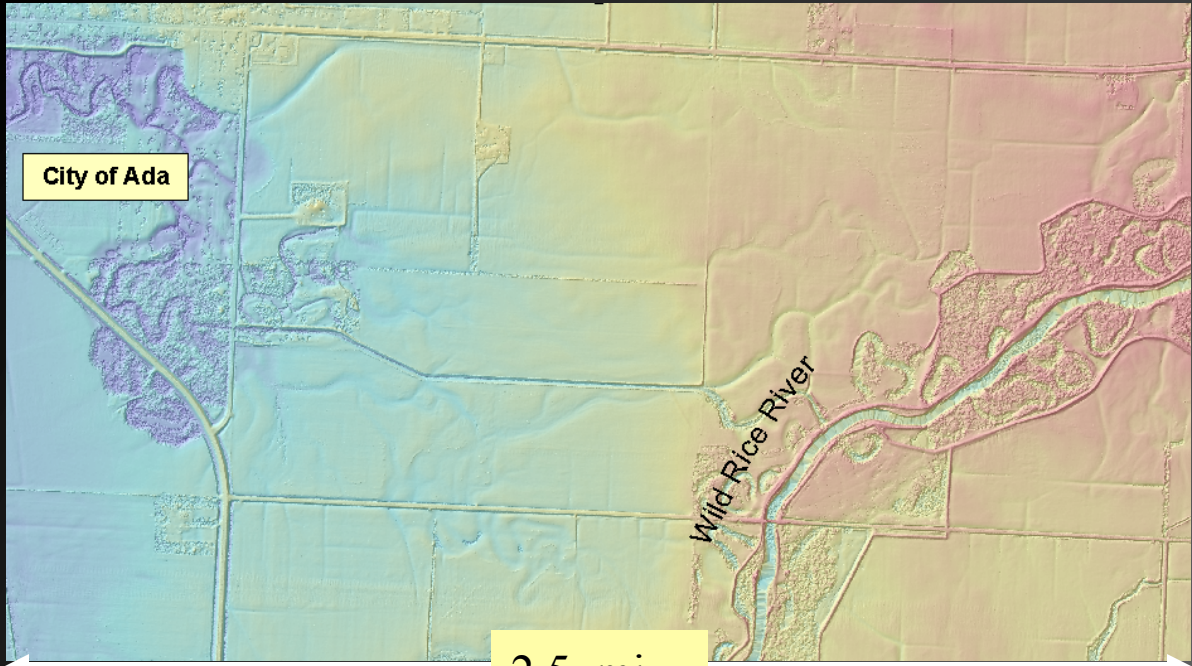


- End-product is accurate, with geographically registered longitude, latitude, and elevation (x,y,z) for every data point
- Several file types and derivative products available to end-users

LiDAR Benefits

- Aerial Survey
- Large (county-sized) or small areas
- Large areas processing-intensive
- Provides multiple formats and data-types from original data
- Very precise – not as precise as Survey

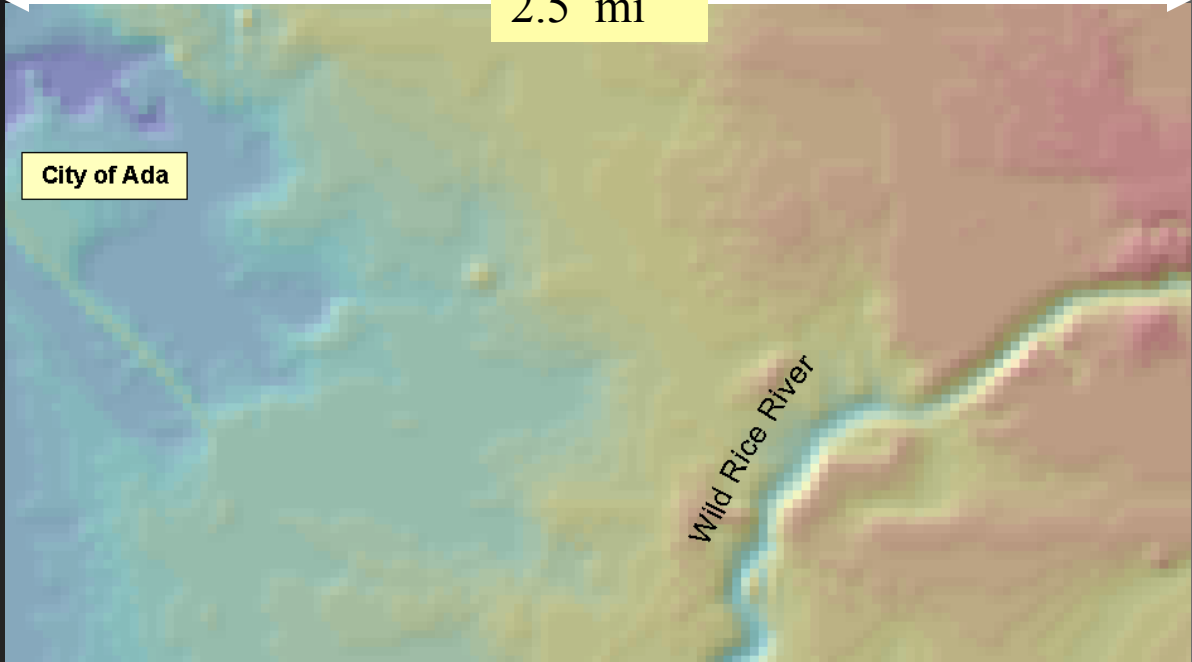




LiDAR Derived DEM

Cell Size: 1 meter sq
Vertical Error: 15 cm¹

1.5 mil points / sq mile

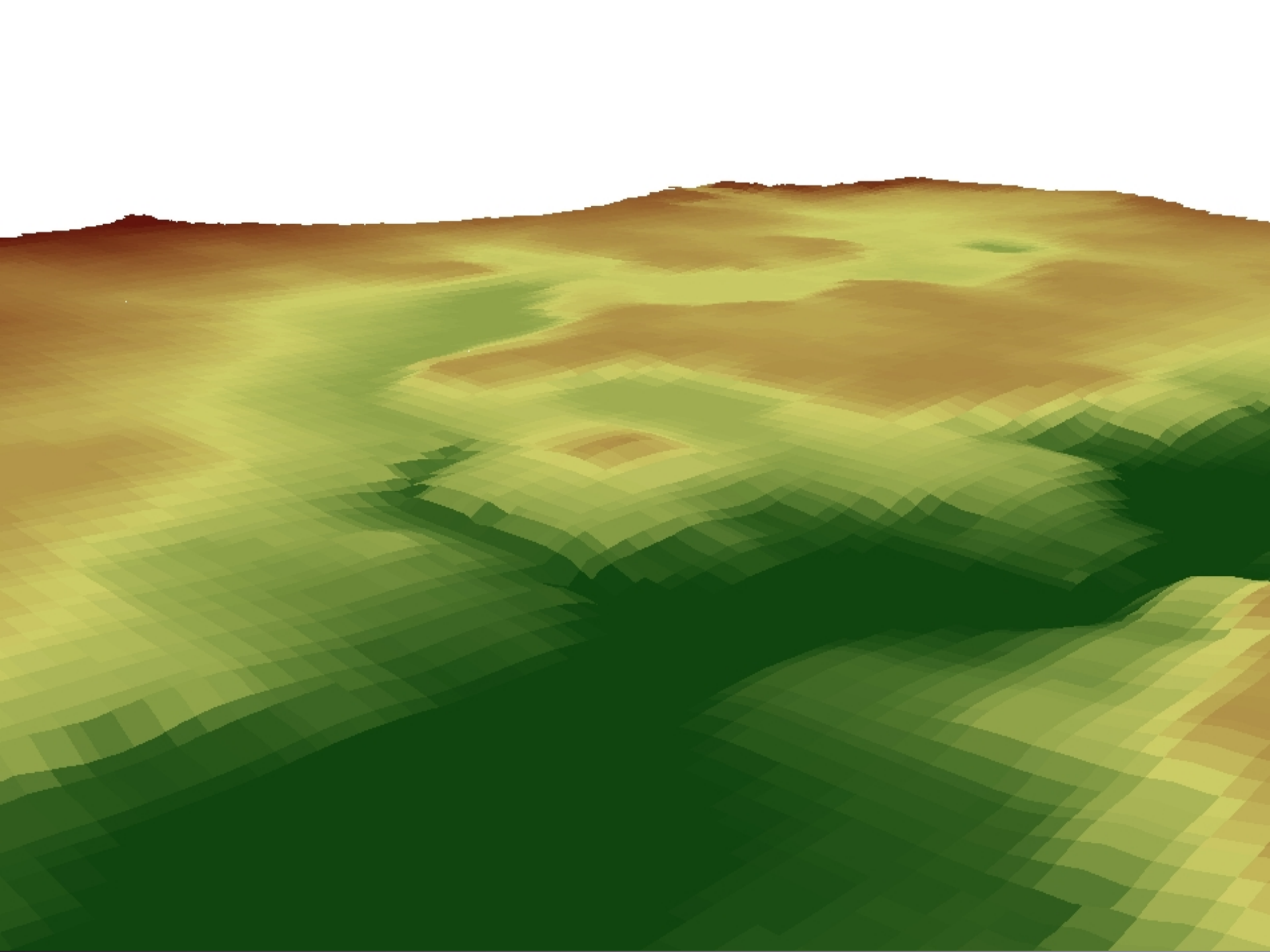


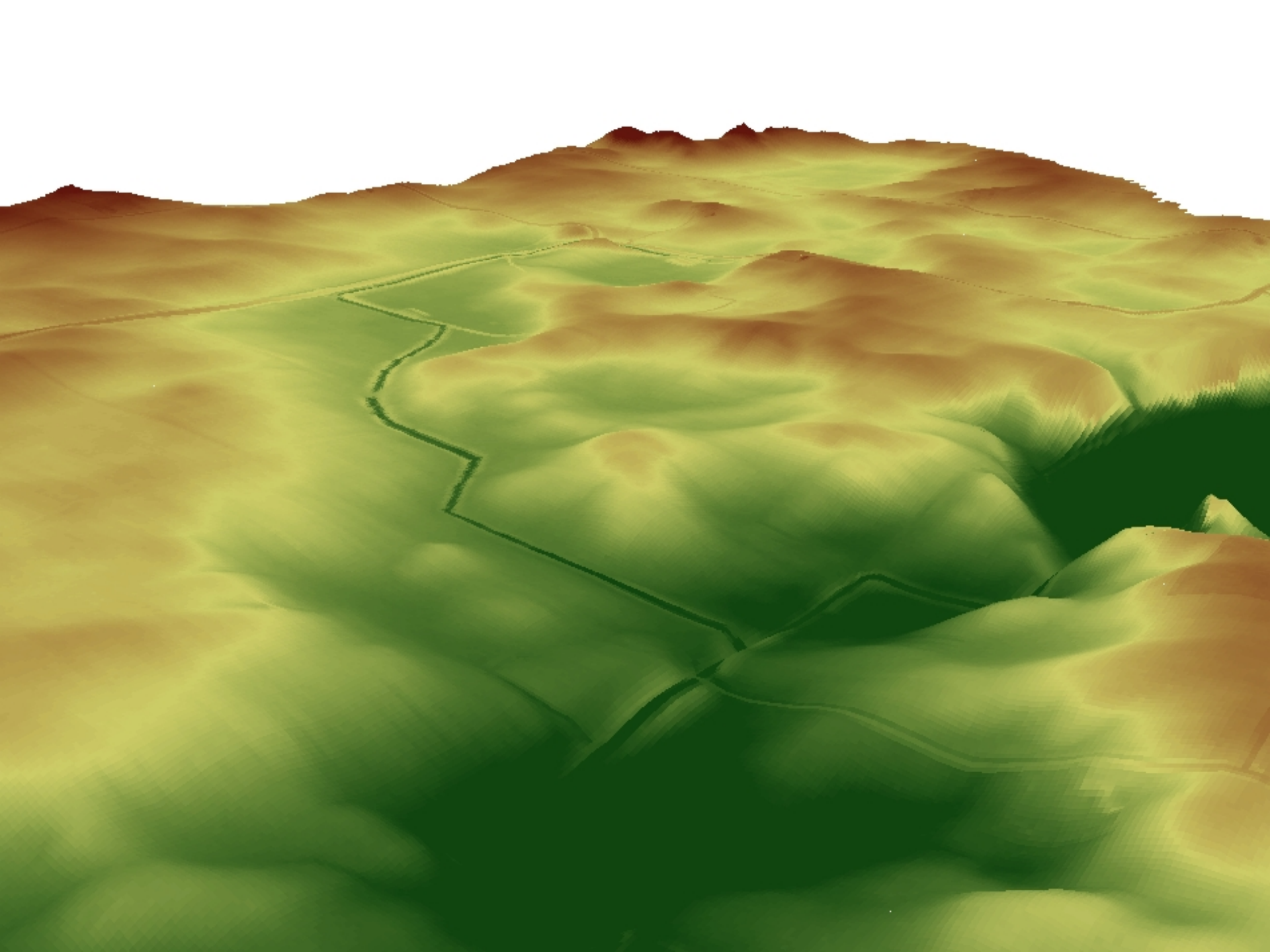
USGS Standard DEM

Cell Size: 30 meter sq
Vertical Error: "Equal to or better than 15 m."²

1600 points / sq mile

¹ Varies based on project specifications
² <http://edc.usgs.gov/guides/dem.html>





MN LiDAR Collect

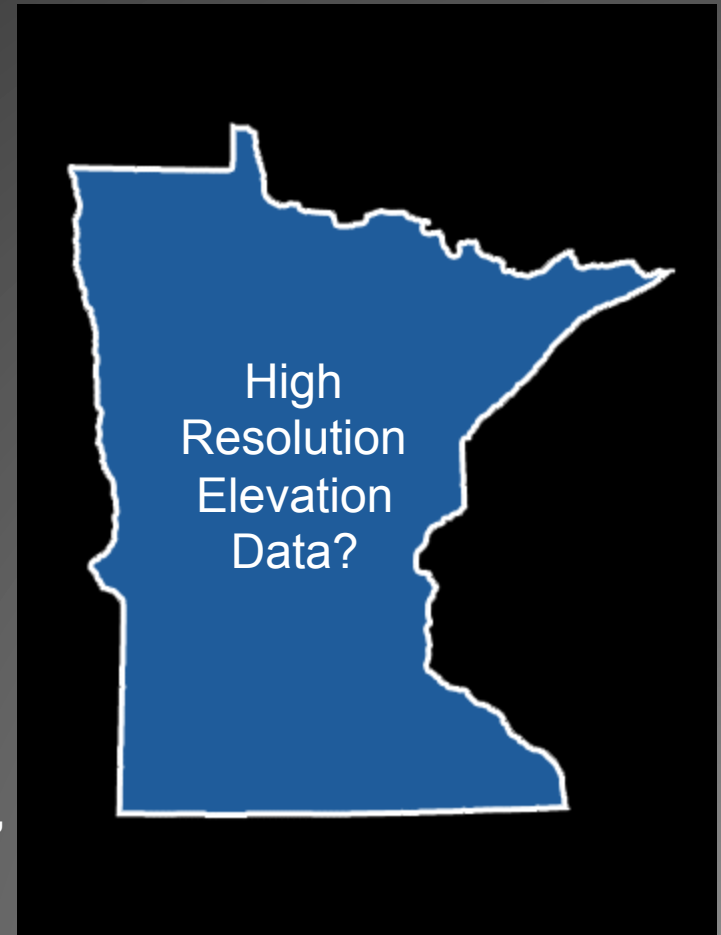
Minnesota Mapping Initiative

In the beginning.....

- Red River Collect – 2006
- Obi Sium – DNR Waters/FEMA
- Technical Group to develop standards

Governor's Council on Geographic Information

- Digital Elevation Committee
 - Working to achieve publicly available, high accuracy elevation data statewide
 - Federal, State and County representatives



Minnesota Mapping Initiative

Several unsuccessful attempts to secure funding at the state level

Worked with counties to ensure consistent data

- Technical advice and assistance
- Standards and accuracy

Minnesota Mapping Initiative



Clean Water Fund of the Legacy Amendment

- Citizens of the state have invested in Water Quality
- High Resolution Elevation data can be used for all future water quality projects

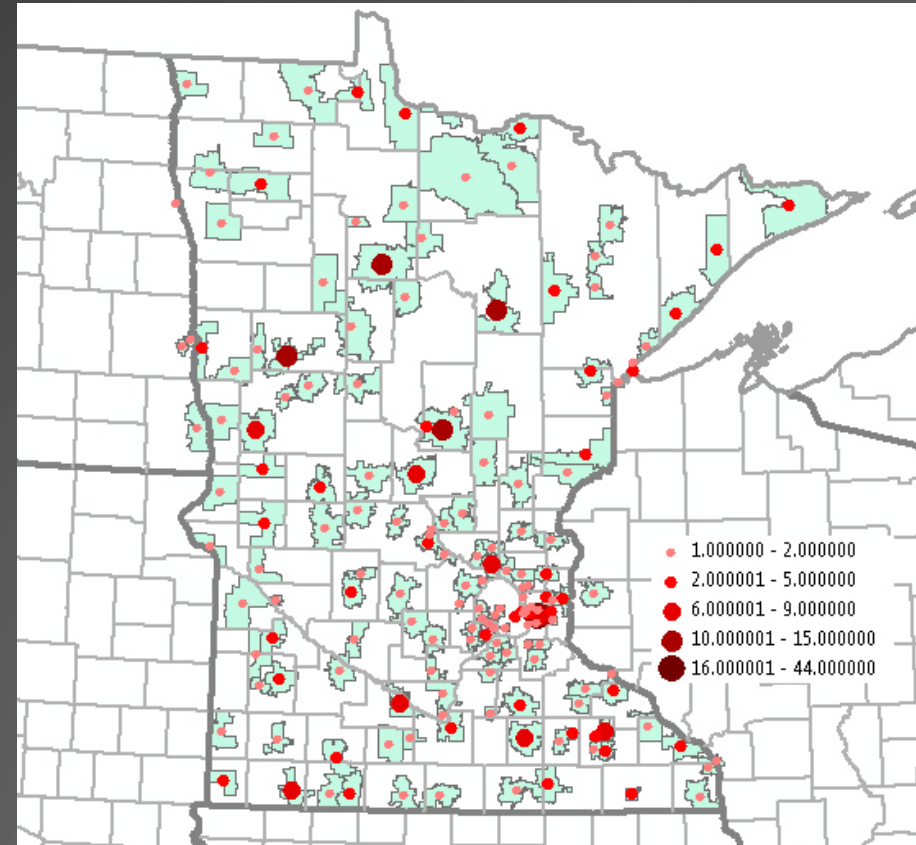
Secured \$5.6 million in funding

- Funds in Division of Ecological Resources/Waters
- Project led by Management Resources/MIS

LiDAR Use Surveys

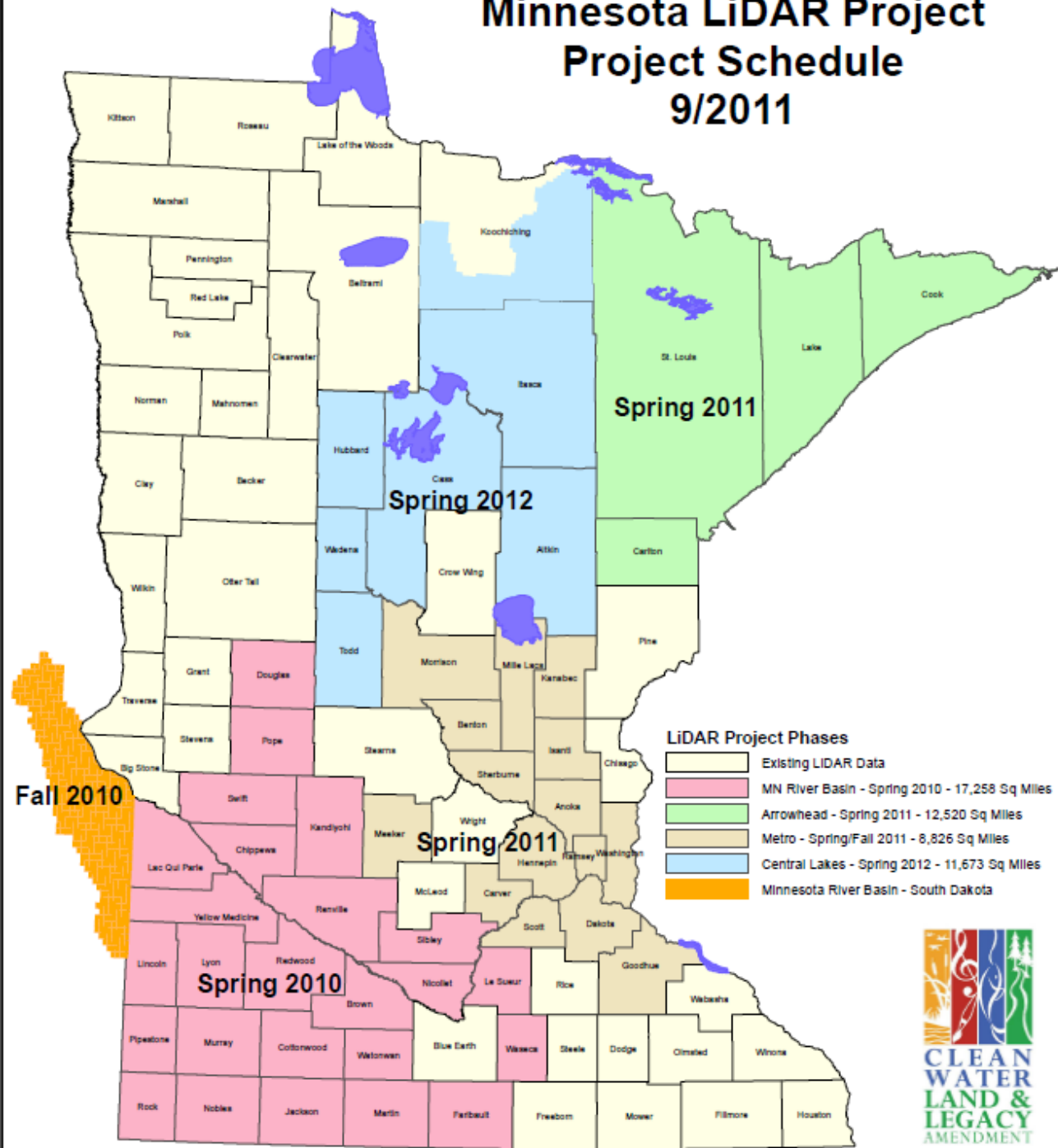
LiDAR Use Surveys

- Spring 2011
 - LiDAR very important
 - Third – Third - Third
- Spring 2012
 - Data types, delivery



LiDAR Acquisition 2010 - 2012

Minnesota LiDAR Project Project Schedule 9/2011

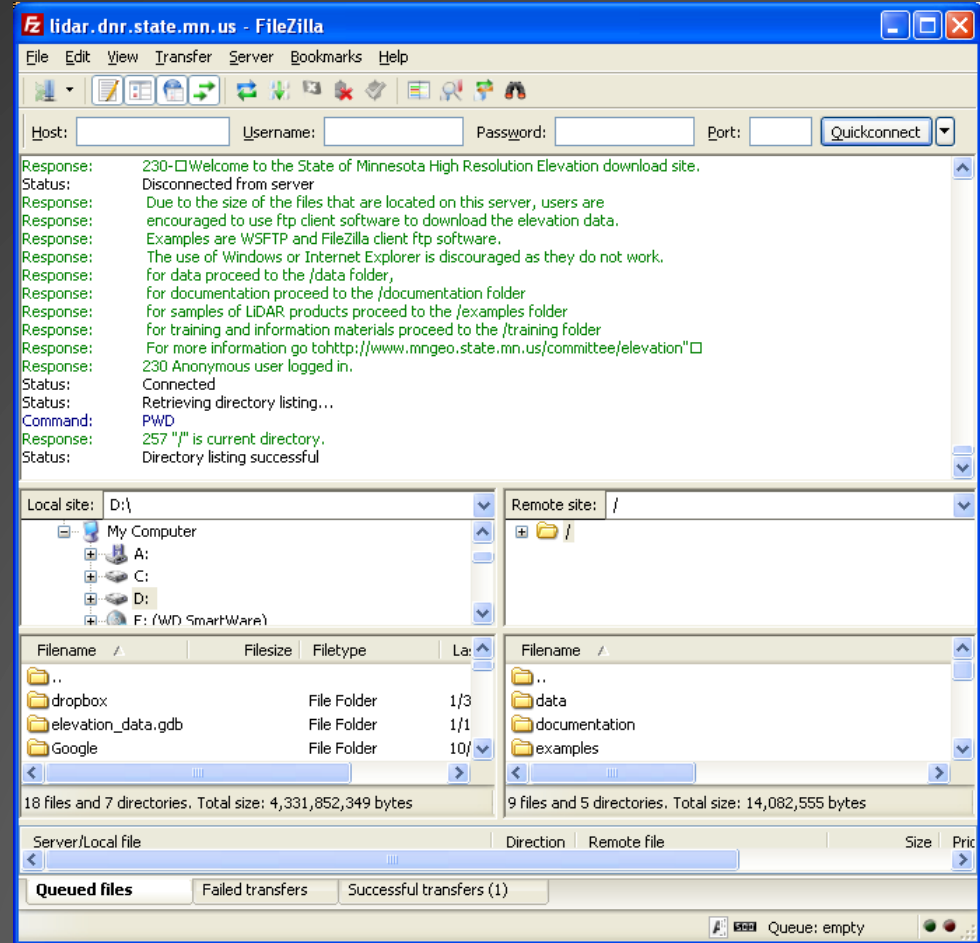


LiDAR in MN – Data Delivery

MN LiDAR FTP Data Delivery Format

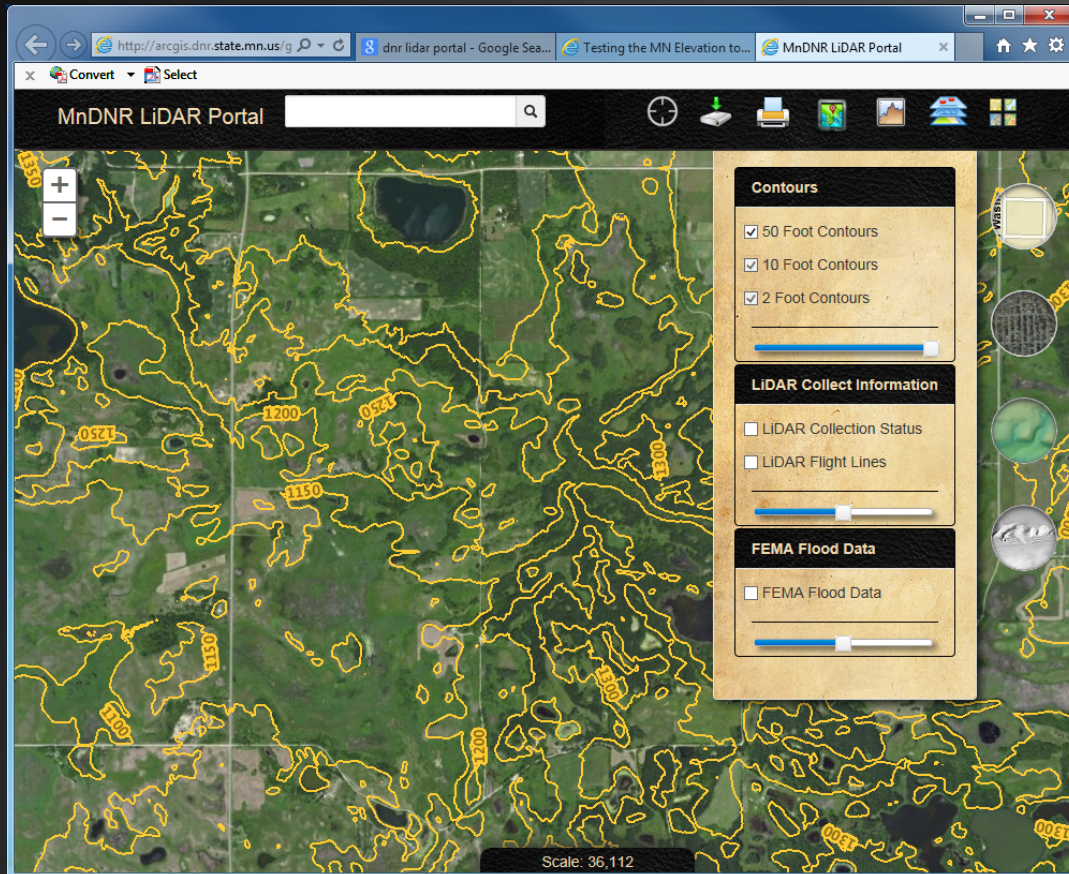
Things to know...

- Use third party FTP Software - Filezilla
- Know what you want before you download
- Interactive web download page coming in near future
- RTM – Read the Manual!
 - Several helpful Readme's



MN LiDAR Interactive Data Delivery Format - NEW

MN DNR Interactive
Download and Viewer



- Multi-view
 - Air Photos
 - Streets
 - Terrain
- AOI Download
- Mobile App?

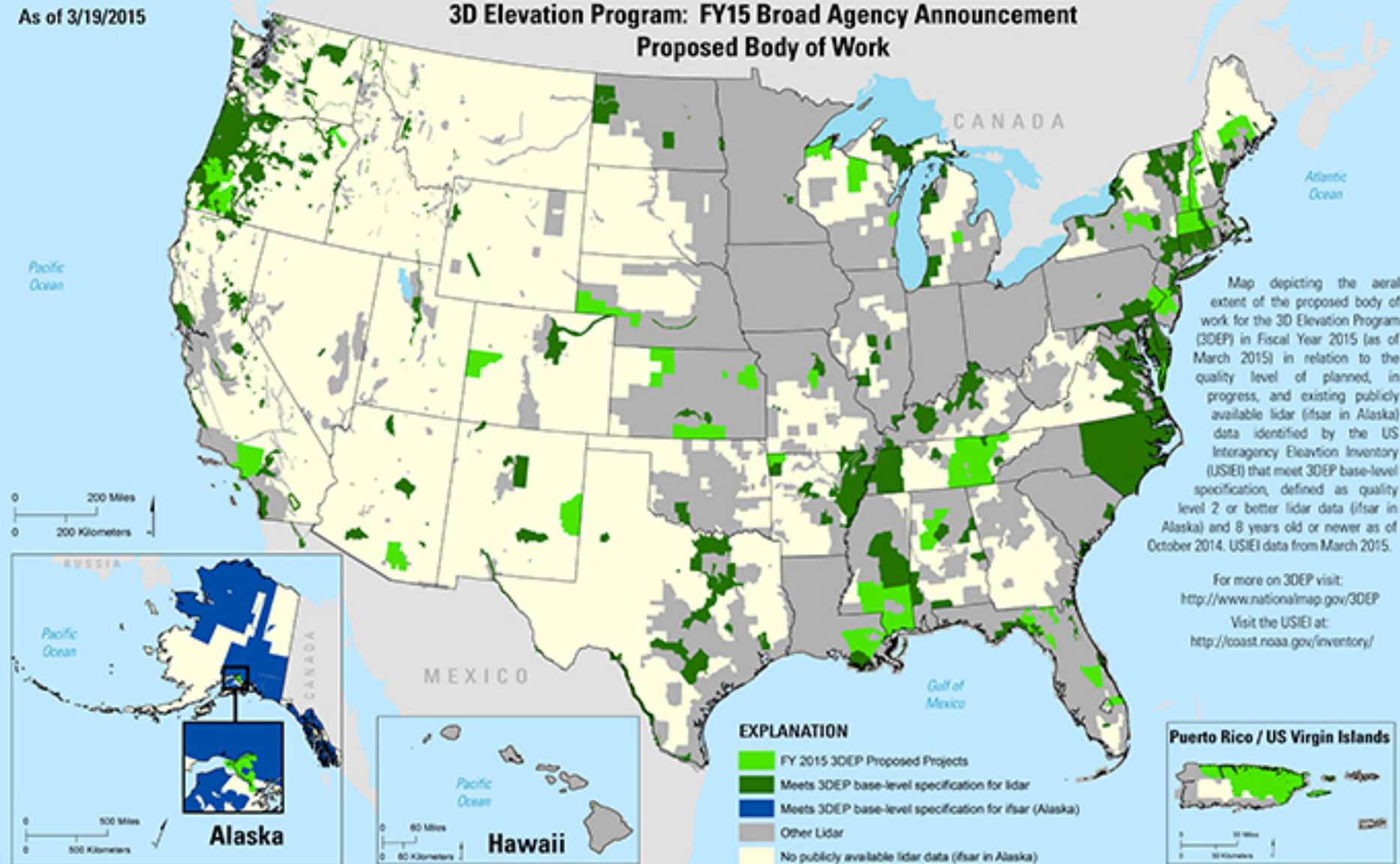
MN Topo



<http://arcgis.dnr.state.mn.us/maps/mntopo/>

As of 3/19/2015

3D Elevation Program: FY15 Broad Agency Announcement Proposed Body of Work



LiDAR in MN – What's Available?

LiDAR Representations

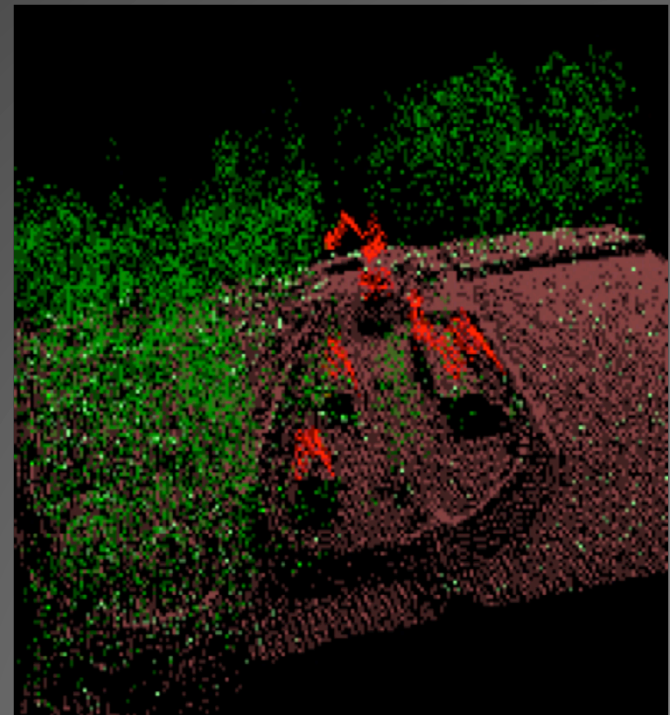
Point Cloud/LAS

Raster – DEM

Vector – Contours

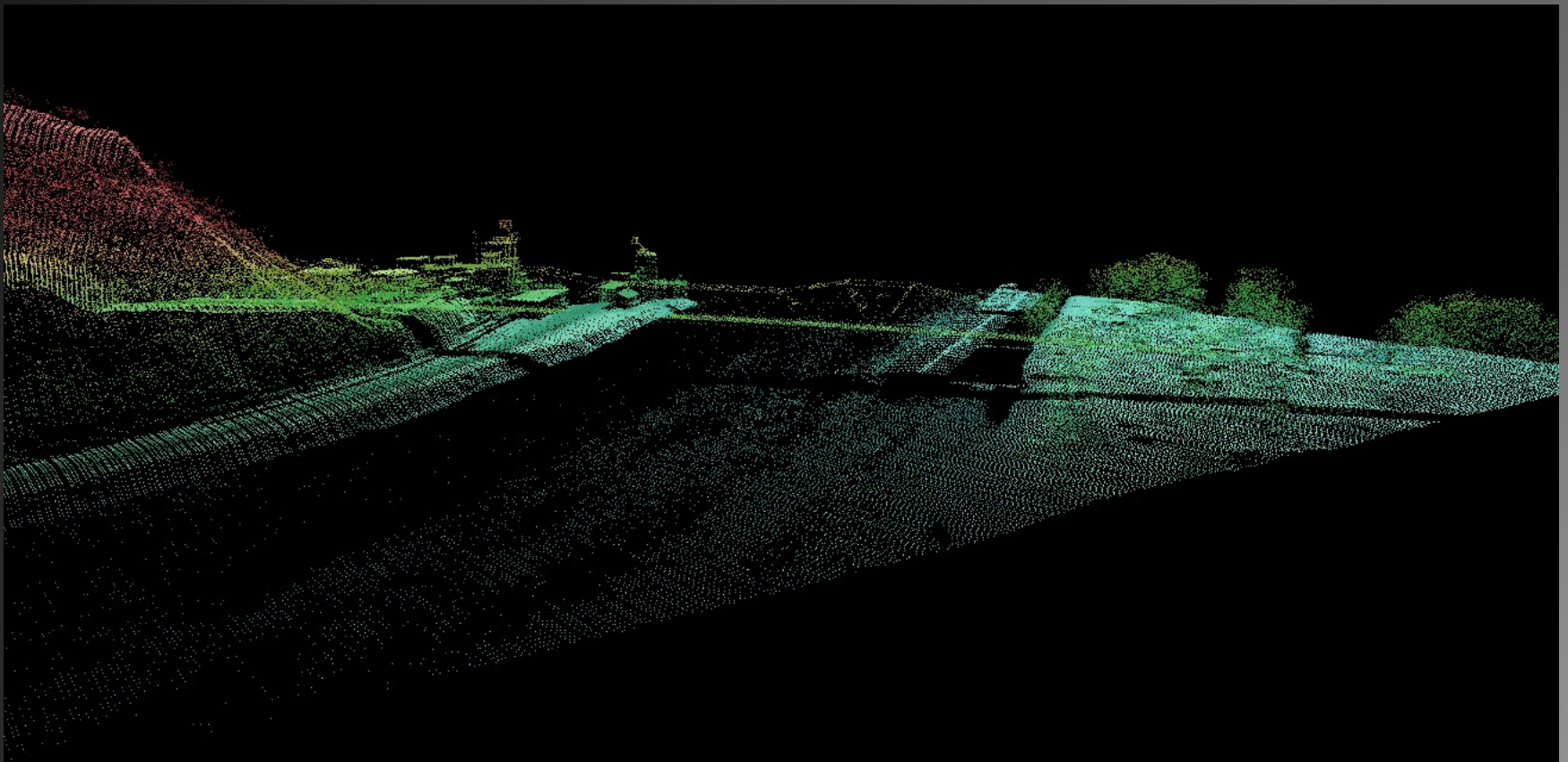
**Triangulated Irregular
Network (TIN)**

Terrain



LAS Files

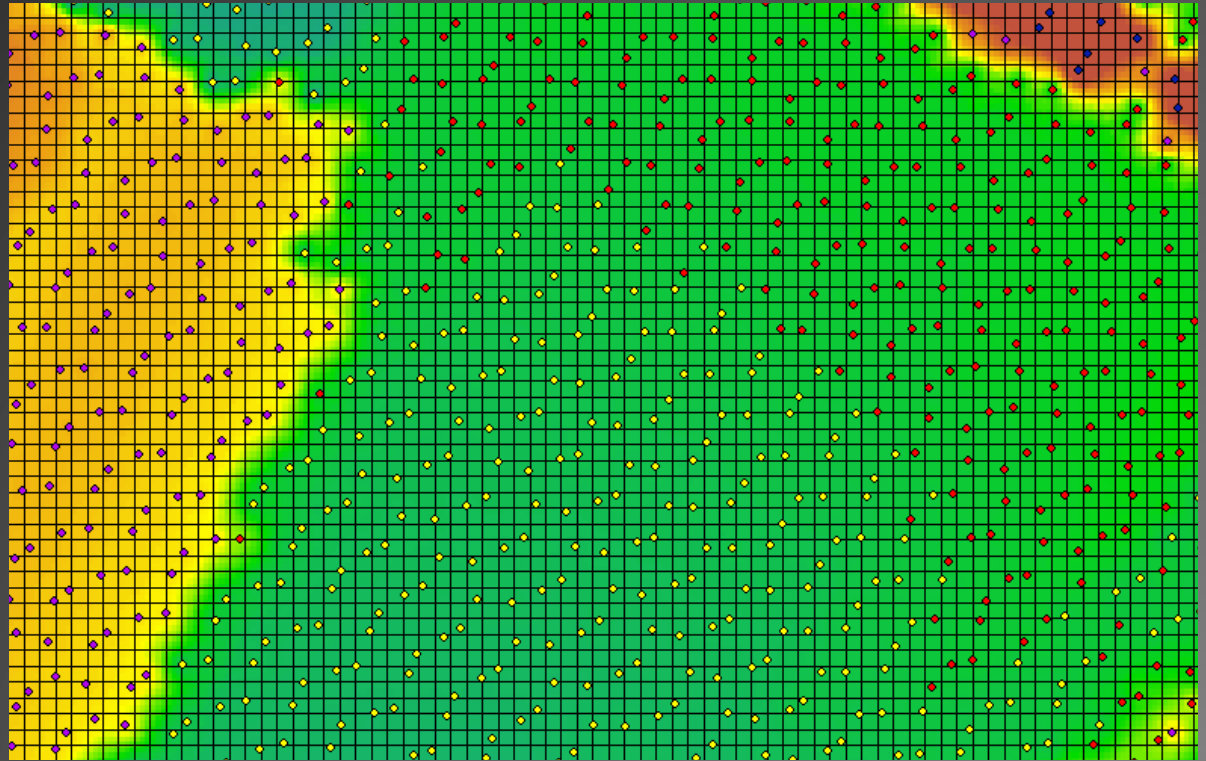
- Source data for other products
- Can be manipulated to represent elevation as well



Digital Elevation Model

DEM Creation

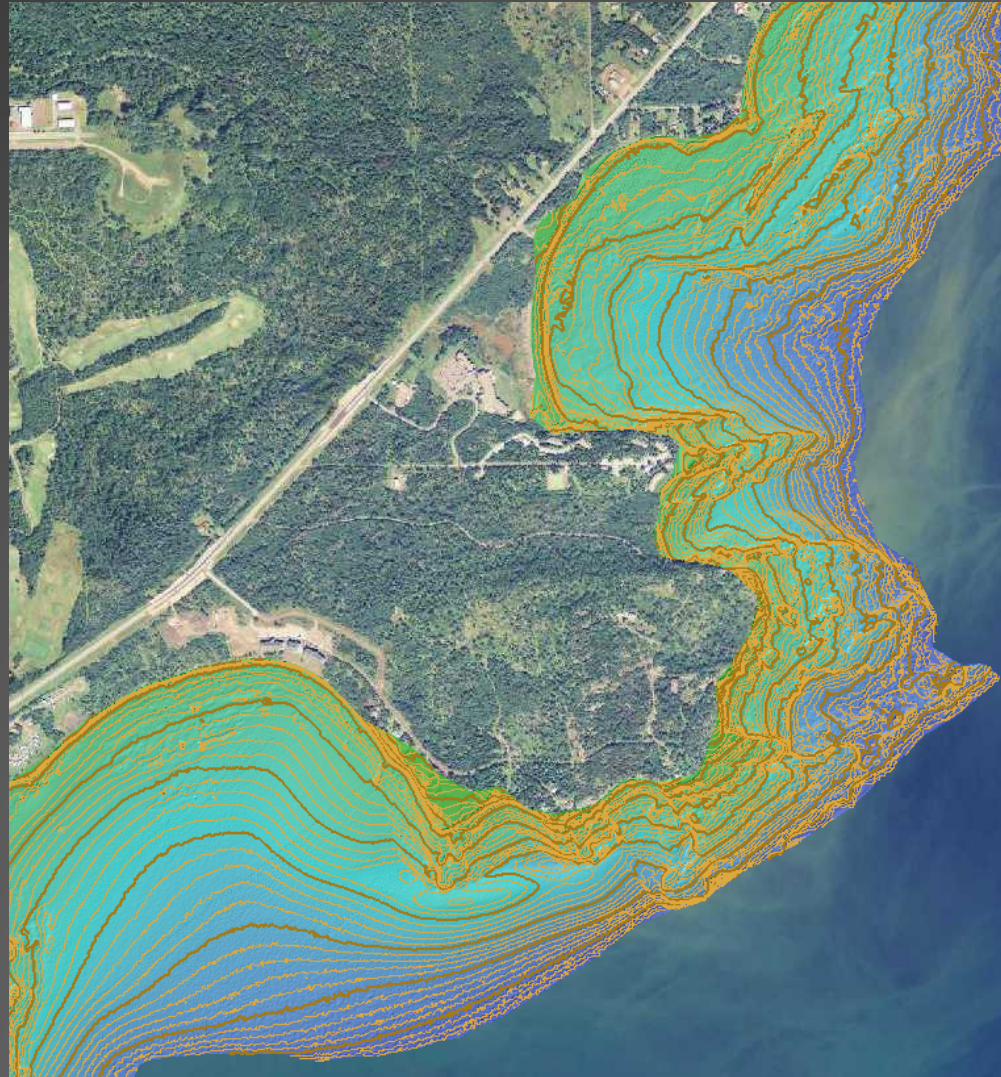
- Interpolation process
- Derived from source files (LAS)



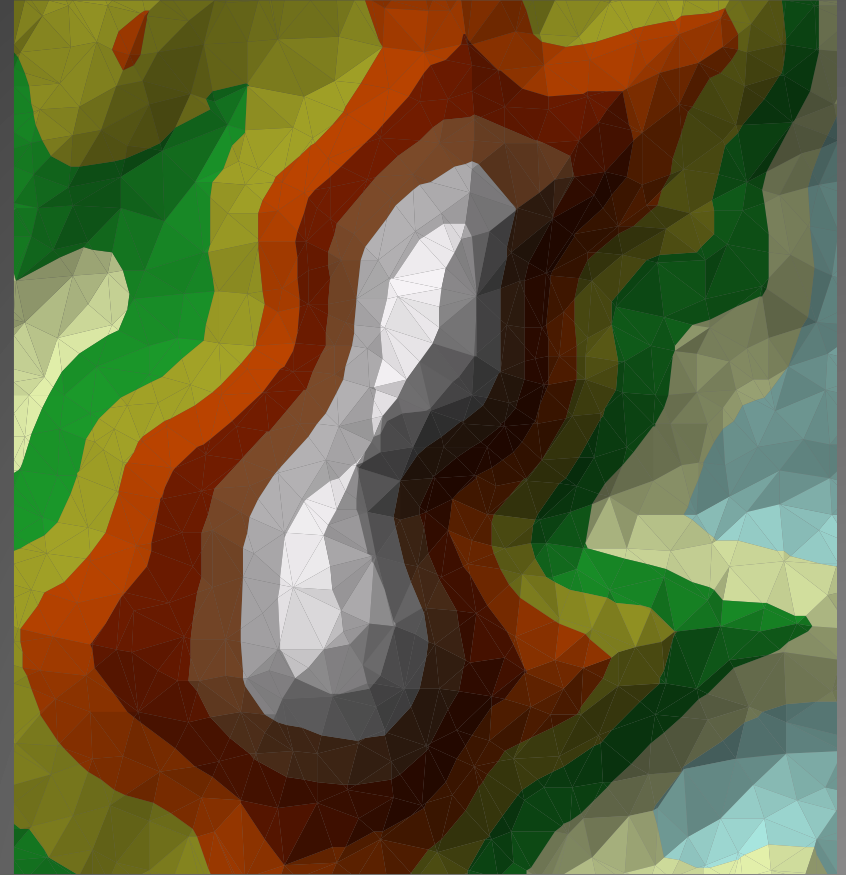
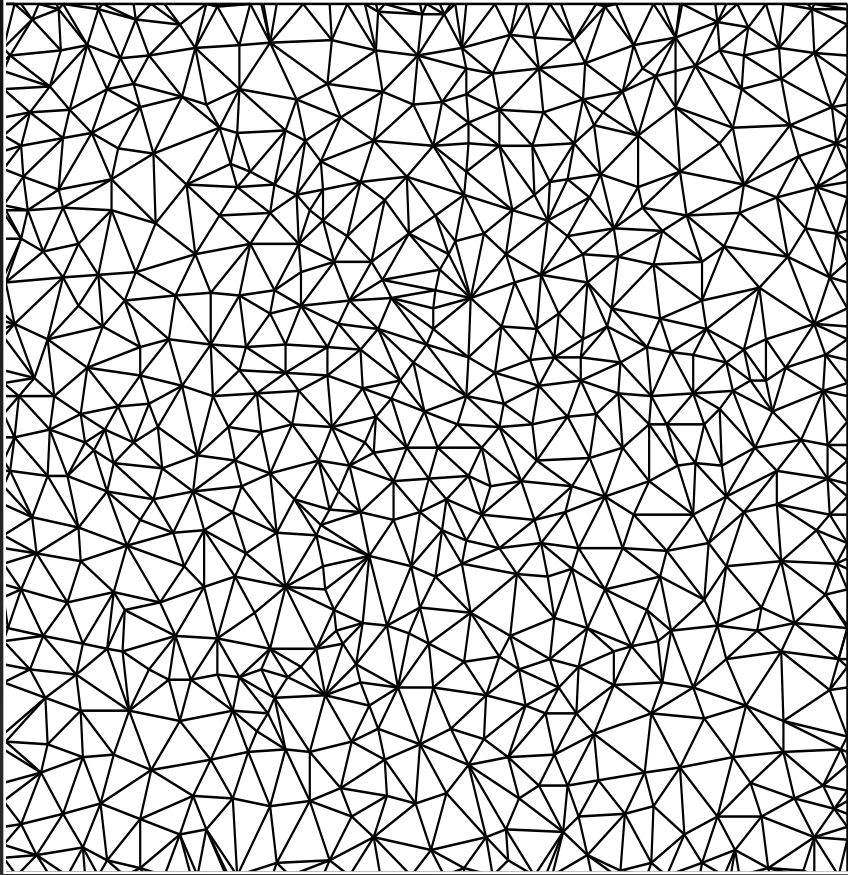
Vector Contours

Contour Creation

- Interpolation process
- Derived from source files (LAS)

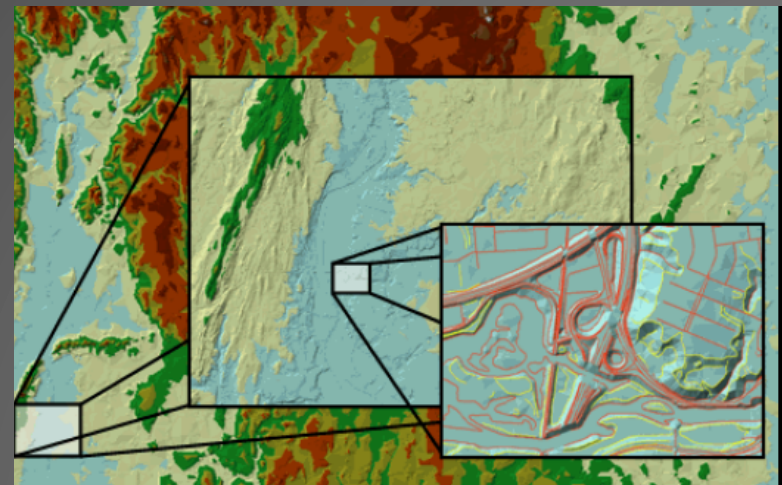


TIN Triangles Hillshaded and Colored by Elevation

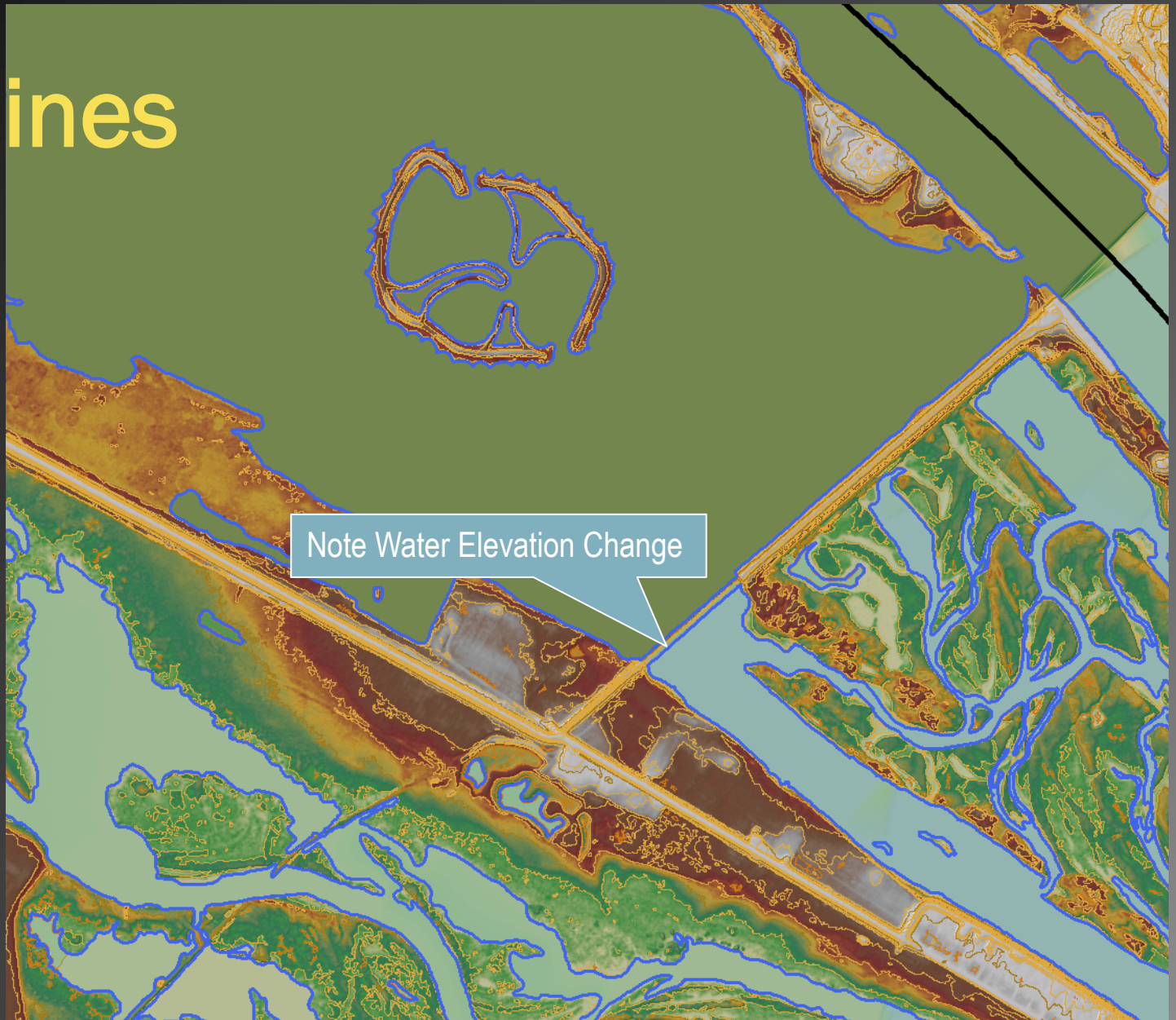


Terrain Data Structure

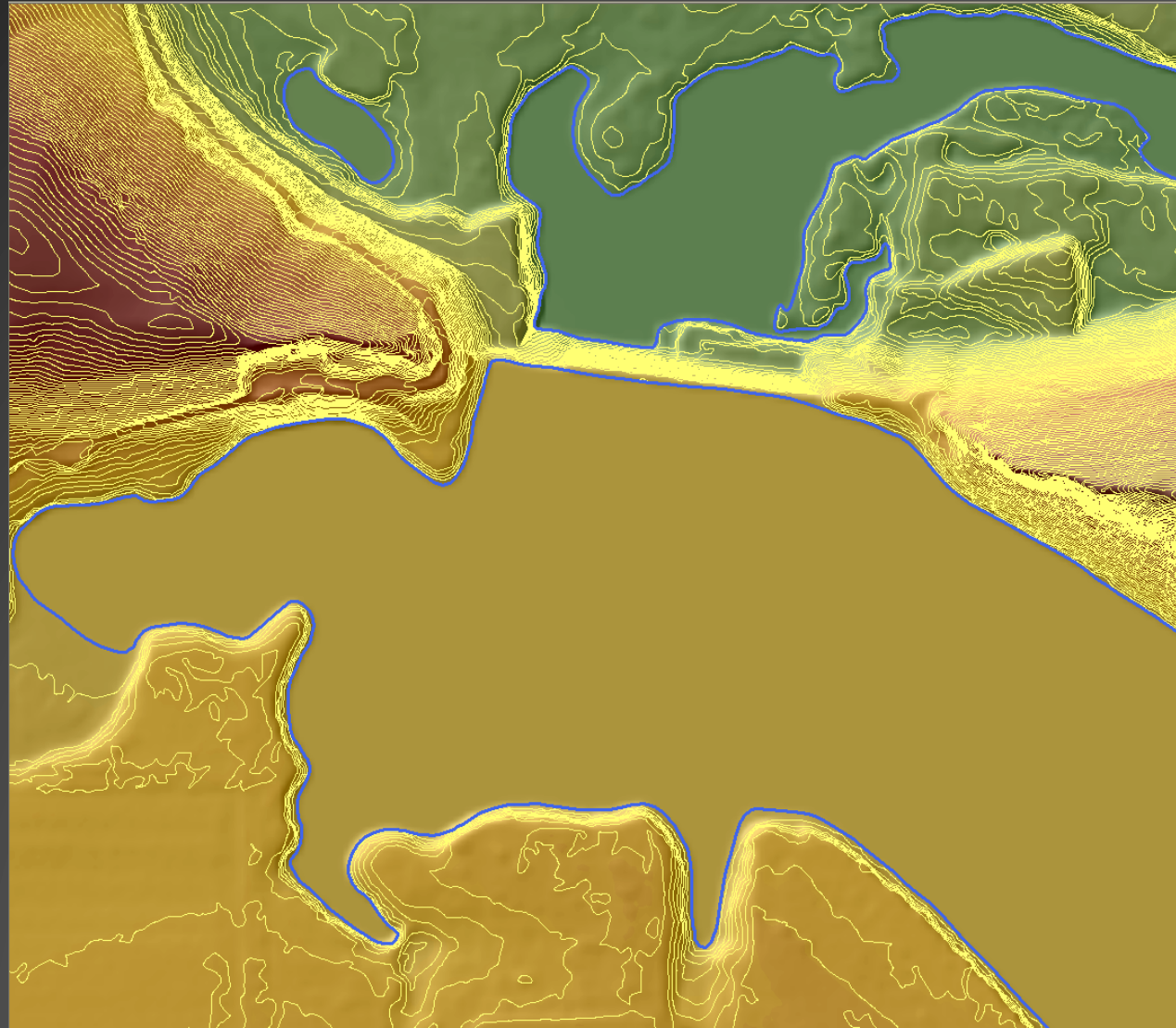
- Data structure specific to elevation data
- TIN model represents surfaces
- Terrains use pyramids to represent multiple levels of resolution
- Data Inputs
 - Mass Points – TIN
 - Breaklines
- Data Outputs
 - TINs
 - Rasters



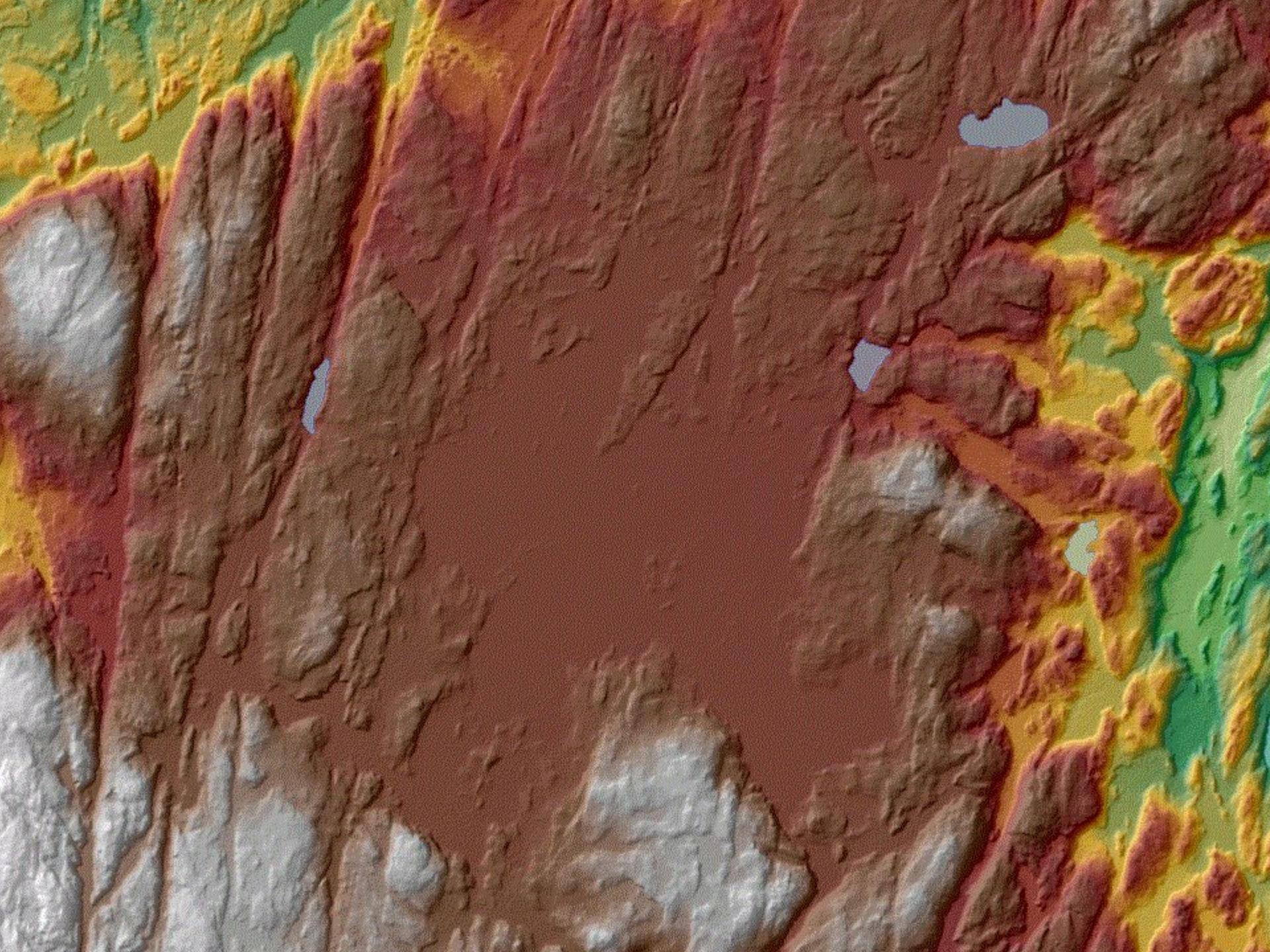
Breaklines



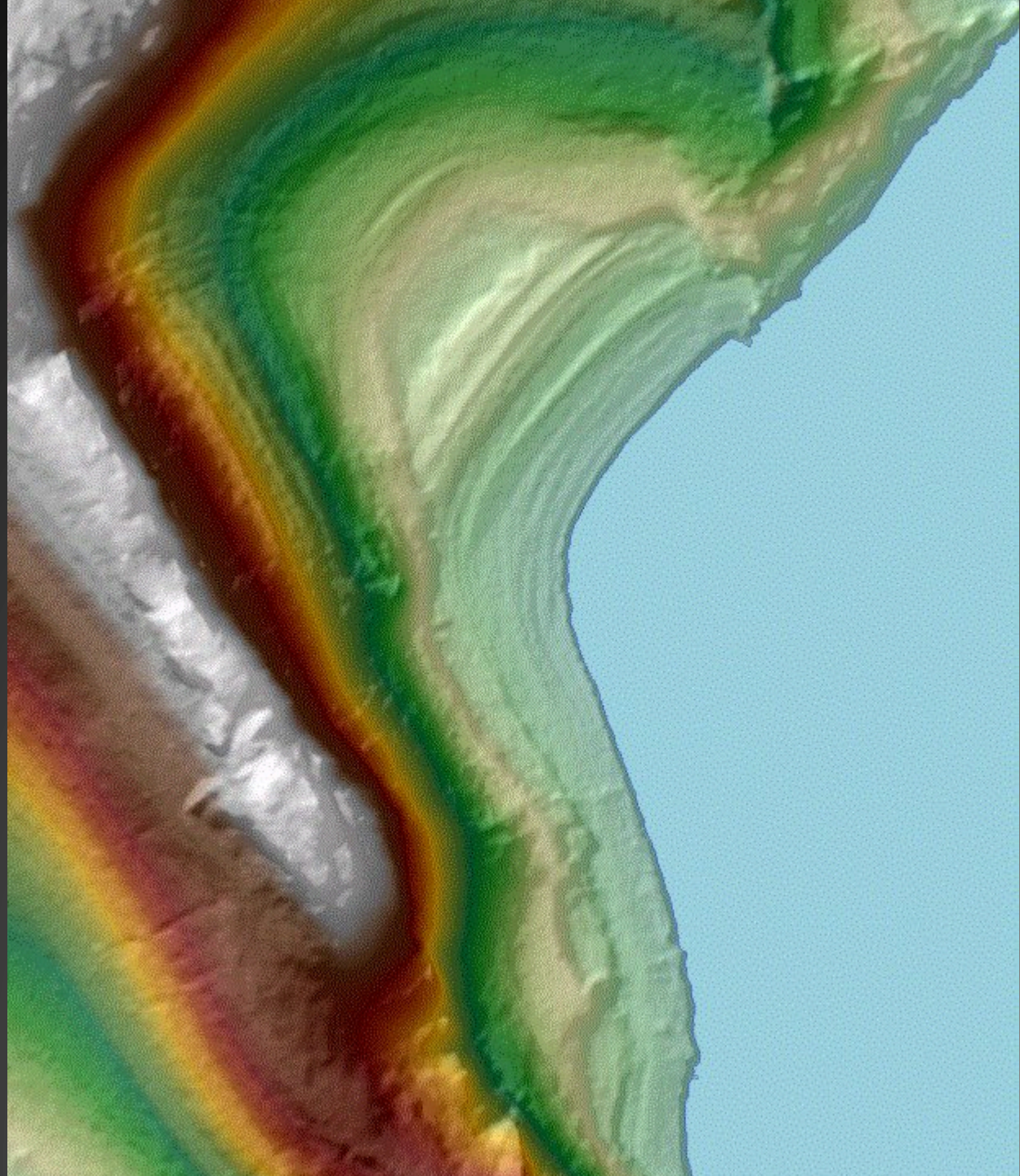
Breaklines



Data Examples









Credits/Acknowledgements

- Tim Loesch – MN Dept. of Natural Resources
- Sean Vaughn – MN Dept. of Natural Resources
- Steve Kloiber – MN Dept. of Natural Resources
- Dr. Adam Birr – MN Dept. of Agriculture
- Jake Galzki – University of Minnesota
- Dr. Jay Bell – University of Minnesota
- Ann Lewandowski – University of Minnesota
- Les Everett – University of Minnesota