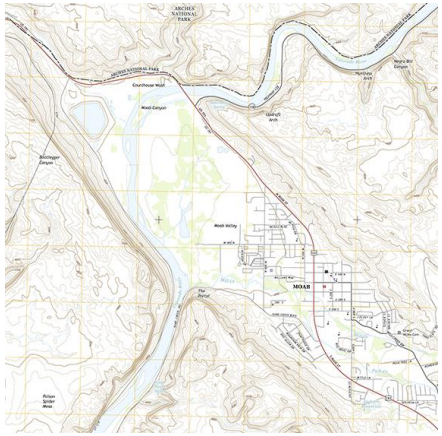
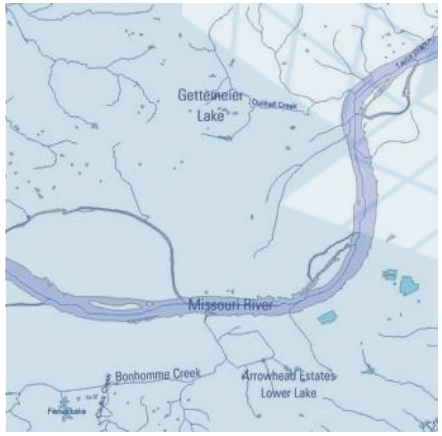
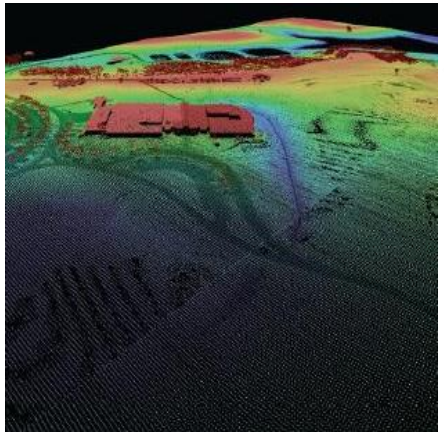
LiDAR Project Life Cycles at Government Agencies: a Federal Perspective on 3DEP in New York







Craig A. Neidig
USGS National Geospatial Program
National Map Liaison (NY-PA-VA-WV)

NYGeoCON 2017
October 18, 2017

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National Geospatial Program (NGP)

What we do …

- Primary civilian geospatial data-production agency for the Nation
  - https://nationalmap.gov/index.html
- Provide coordination and support to other Federal, state, local, and tribal government geospatial activities
- Support mission-critical activities and applications, focusing on:
  - Elevation (3D Elevation Program – 3DEP)
  - Water (National Hydrographic Dataset - NHD, NHDPlus)
  - Hazards (natural, manmade) – Emergency Response
  - USGS and DOI science
  - "Communities of Use" – water, natural resources, hazards
- Reston (HQ), Rolla (NGTOC), Denver (NGTOC), science centers, and the National Map liaison network
- Liaison housed at USGS VA-WV Water Science Center (Charleston, WV)
- Associate Liaison (Doug Freehafer) at NY WSC (Troy, NY)

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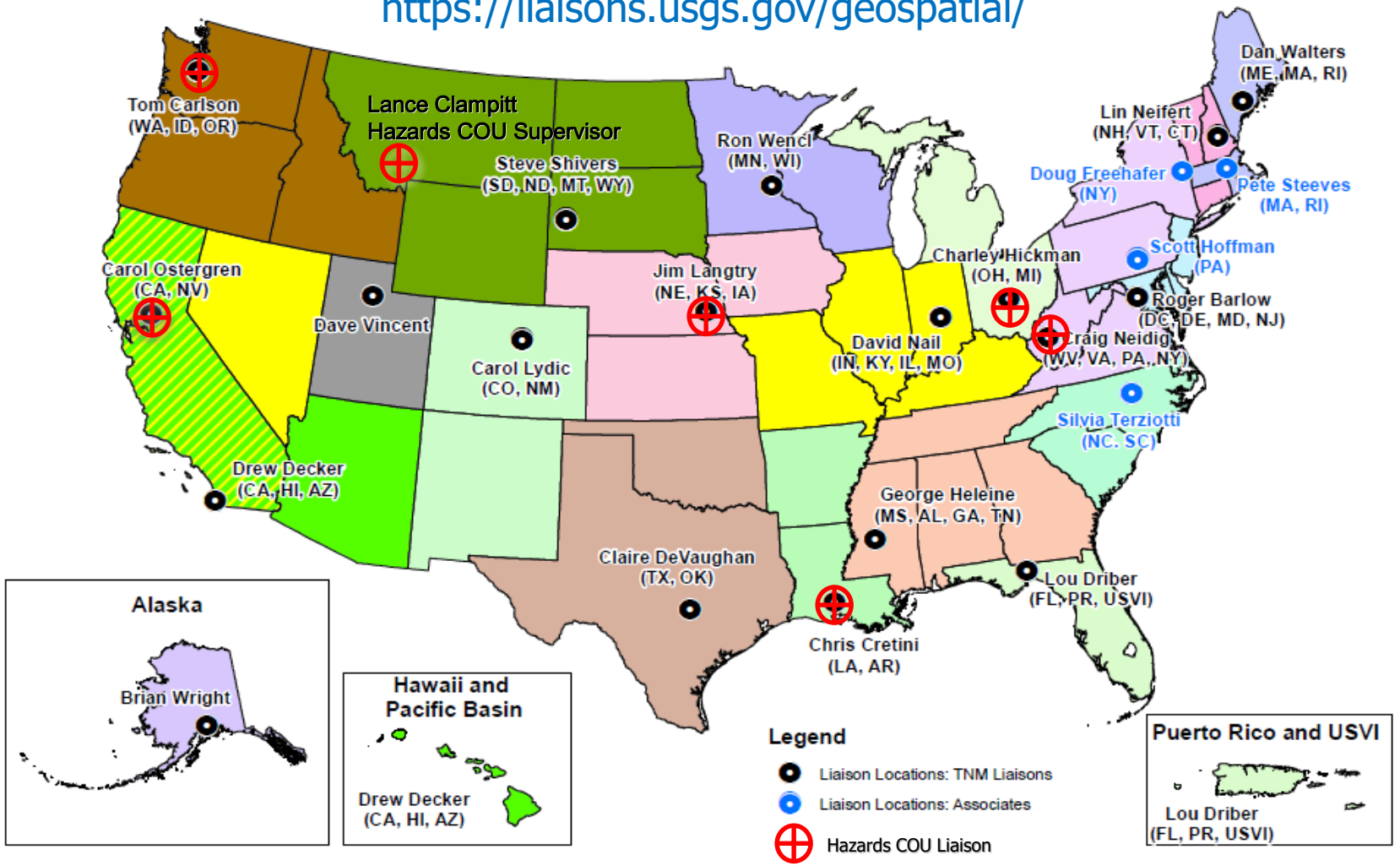
The National Map Liaisons and Associate Liaisons

State Points of Contact

as of February 9, 2017

https://liaisons.usgs.gov/geospatial/



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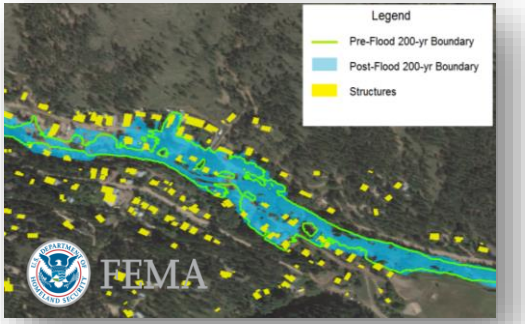
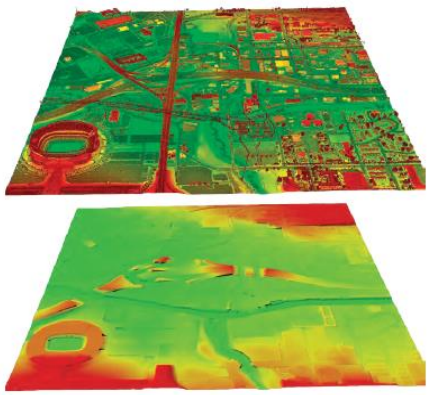
NEEA Benefits Study (2011) – Top Business Uses

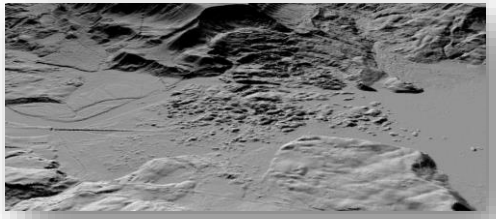
Rank	Business Use	Annual Benefits	
		Conservative	Potential
1	Flood Risk Management	$295M	$502M
2	Infrastructure and Construction Management	$206M	$942M
3	Natural Resources Conservation	$159M	$335M
4	Agriculture and Precision Farming	$122M	$2,011M
5	Water Supply and Quality	$85M	$156M
6	Wildfire Management, Planning and Response	$76M	$159M
7	Geologic Resource Assessment and Hazard Mitigation	$52M	$1,067M
8	Forest Resources Management	$44M	$62M
9	River and Stream Resource Management	$38M	$87M
10	Aviation Navigation and Safety	$35M	$56M
:			
20	Land Navigation and Safety	$0.2M	$7,125M
	Total for all Business Uses (1 – 27)	**$1.2B**	**$13B**



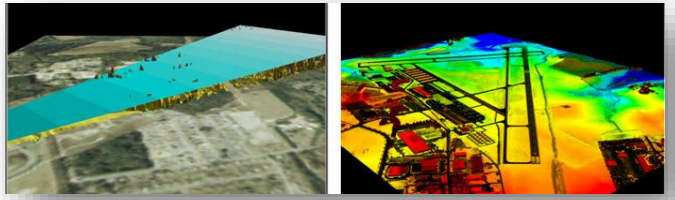
Flood Risk Management



Infrastructure



Geologic Hazards



Aviation Safety

NEEA2 Update planned for FY18

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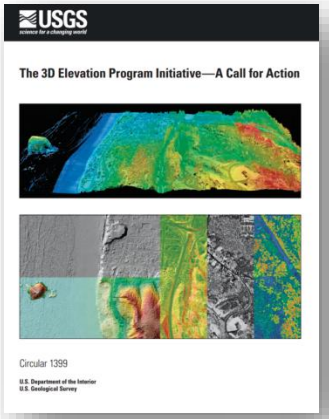
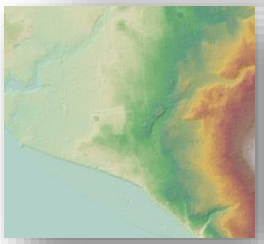
3D Elevation Program (3DEP)

A new national elevation program

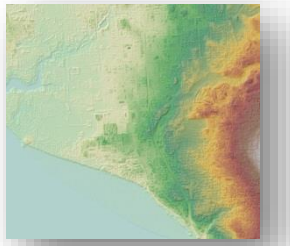
- Published plan for action based on extensive stakeholder input (2013)
- Proposed 8-year collection cycle over CONUS
- Issued the first Broad Agency Announcement in 2014, in partnership with FEMA and NRCS
- Geospatial Products and Services Contracts (GPSC3) being established to address increased data volume
- Revised the base lidar specification to include 3DEP quality levels (QL1 – QL5)
- Investigating new collection technologies (Geiger mode, Single-Photon, green laser, etc.)
- New products and services made available through *The National Map*



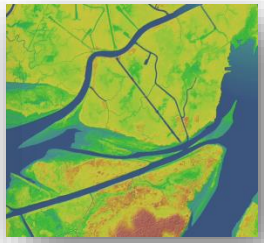


5 meter Alaska DEMs

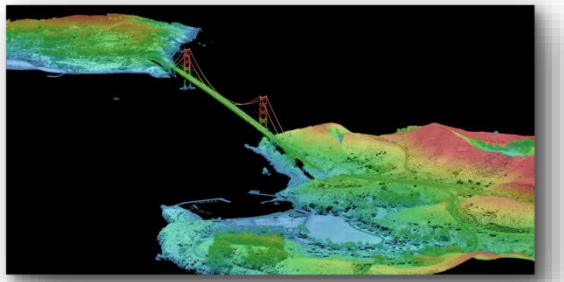
Alaska Ifsar ORIs



Alaska Ifsar DSMs



1 meter DEMs



Lidar Point Cloud

3DEP is a Partnership Program

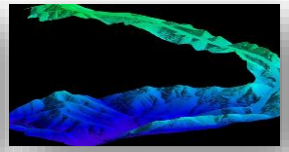
- Goal of National lidar coverage, including with IfSAR in Alaska, every 8 years
- Address the mission-critical requirements of 34 Federal agencies, 50 states, and other organizations documented in the National Enhanced Elevation Assessment (NEEA 2011)
- Identified 602 Mission critical activities that need significantly better data than are currently available
- Est. Return on investment 5:1, designed to conservatively provide new benefits of $690 million/year with the potential to generate $13 billion/year in new benefits through applications that span the economy
- Leverage the capability and capacity of private industry mapping firms
- Achieve a 25% cost efficiency gain by collecting data in larger projects
- Completely refresh national elevation data holdings with new lidar and IfSAR elevation data products and services, on a cyclical 8-year basis


Natural Resource Conservation


Infrastructure Management


Flood Risk Mitigation


Precision Farming


Land Navigation and Safety


Geologic Resources and Hazards Mitigation

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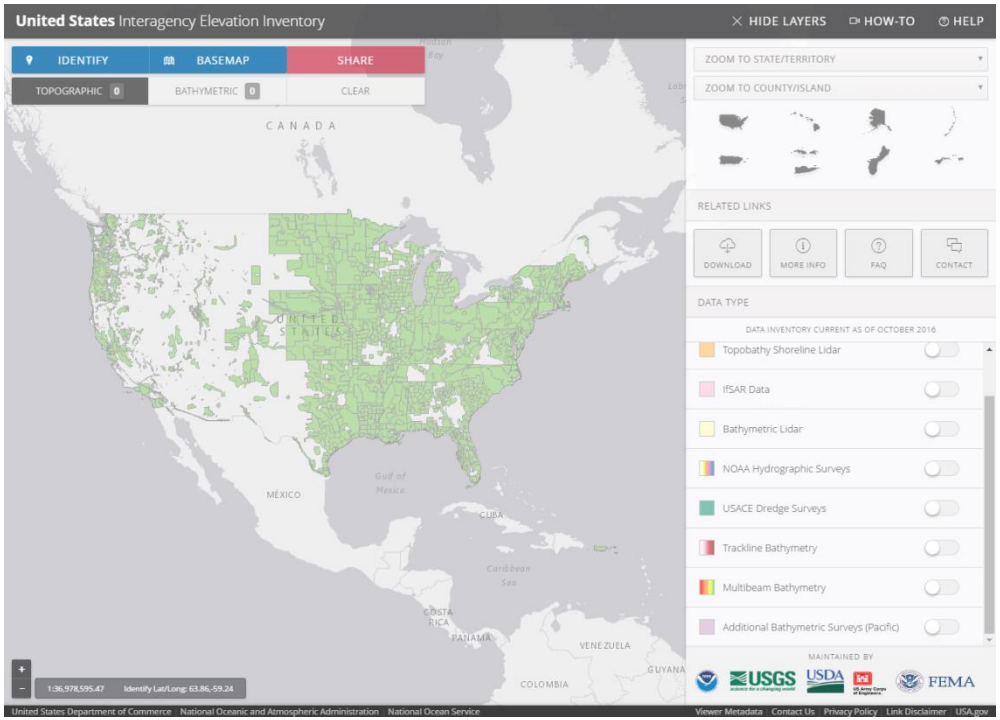
U.S. Interagency Elevation Inventory

Where has lidar data been collected?

- Interagency Collaboration
  - USGS leads the topographic component
  - NOAA leads the bathymetric component
  - CoNED – joint USGS/NOAA topo-bathy
  - FEMA, NRCS, USACE, USFS, NPS
  - States / regional partners
- Critical to assessing progress toward 3DEP goals
- Updated twice annually by the USGS National Map liaison network and NGTOC staff



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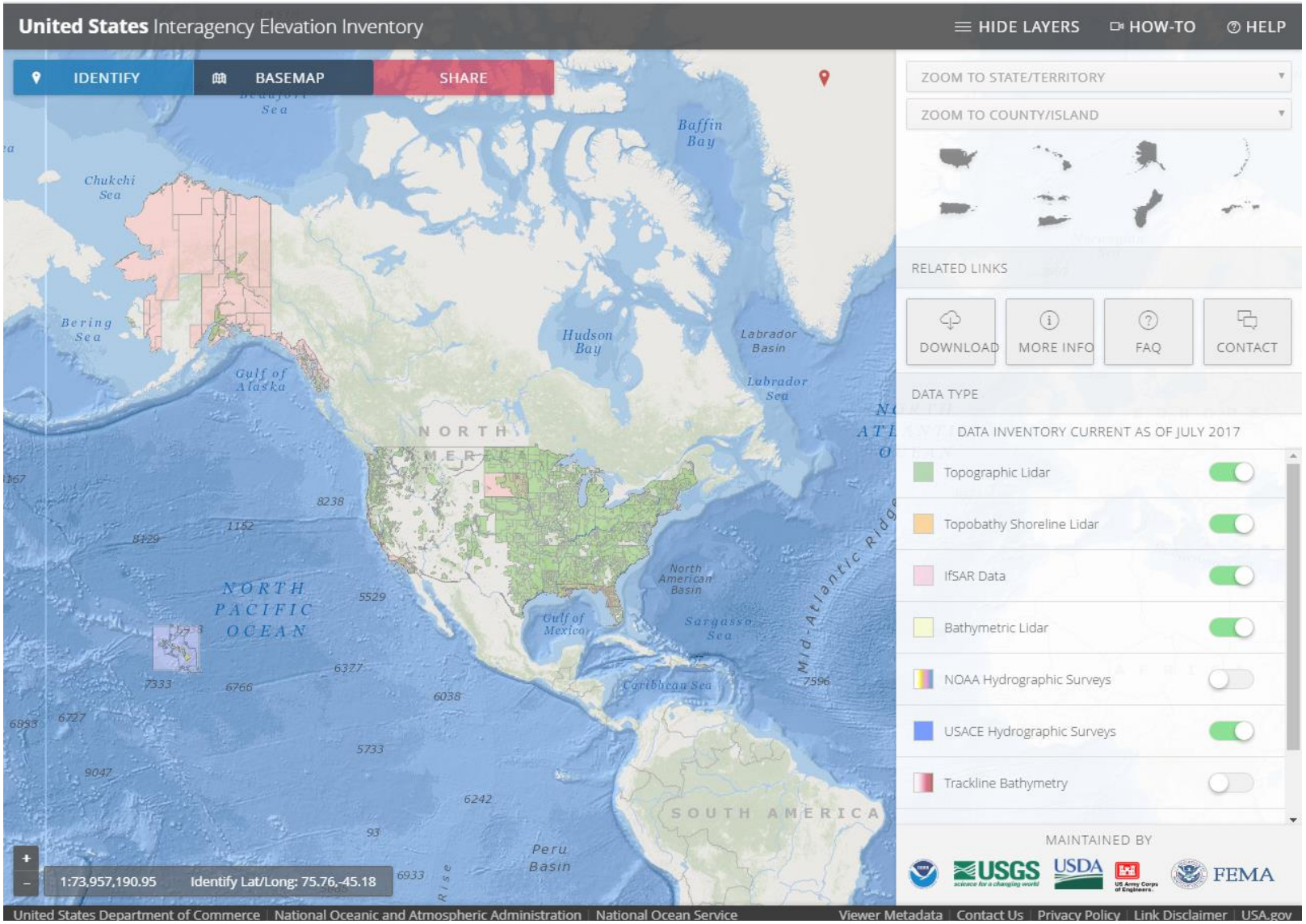
U.S. Interagency Elevation Inventory



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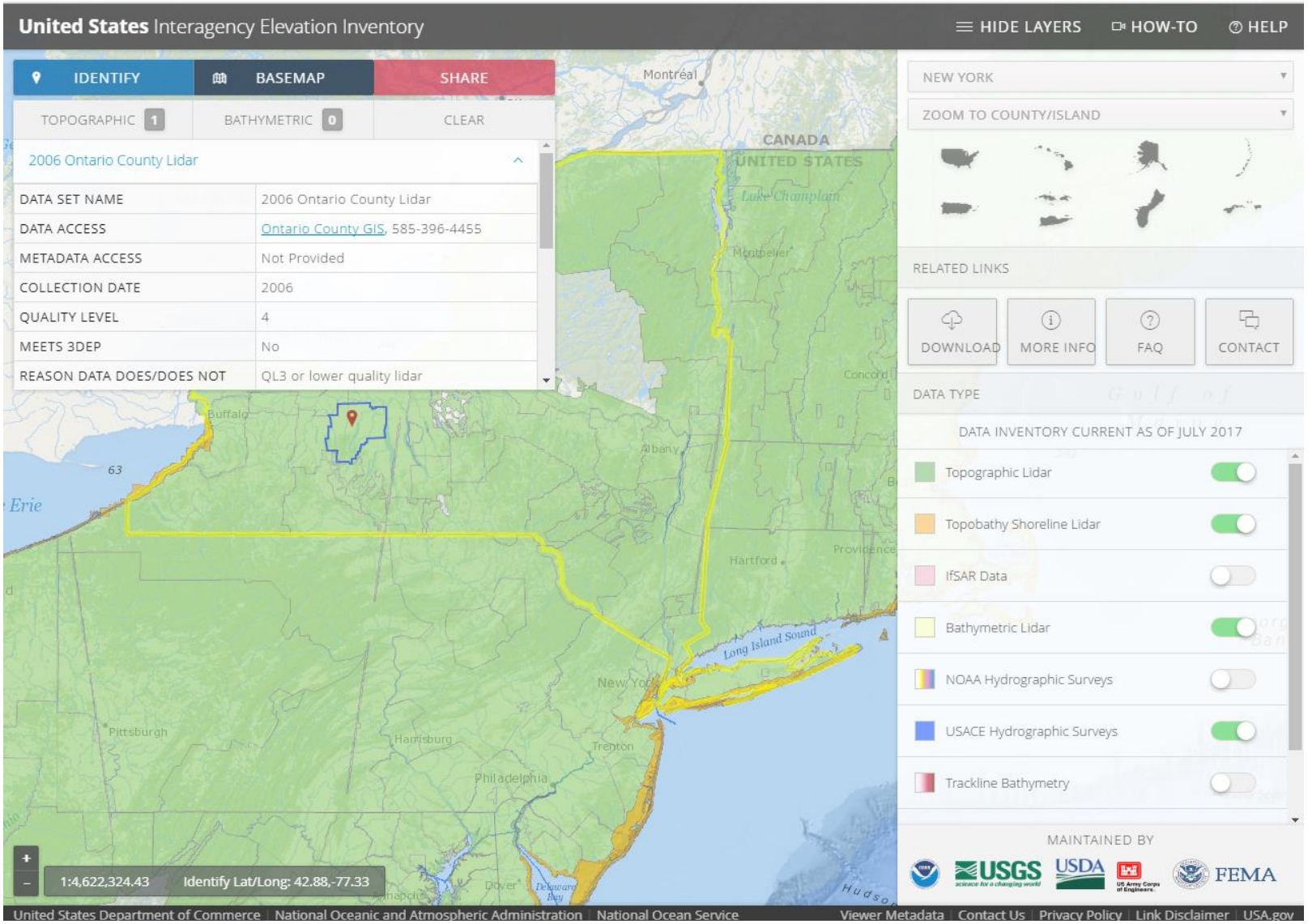
https://coast.noaa.gov/inventory/

Interagency Elevation Inventory (NOAA)



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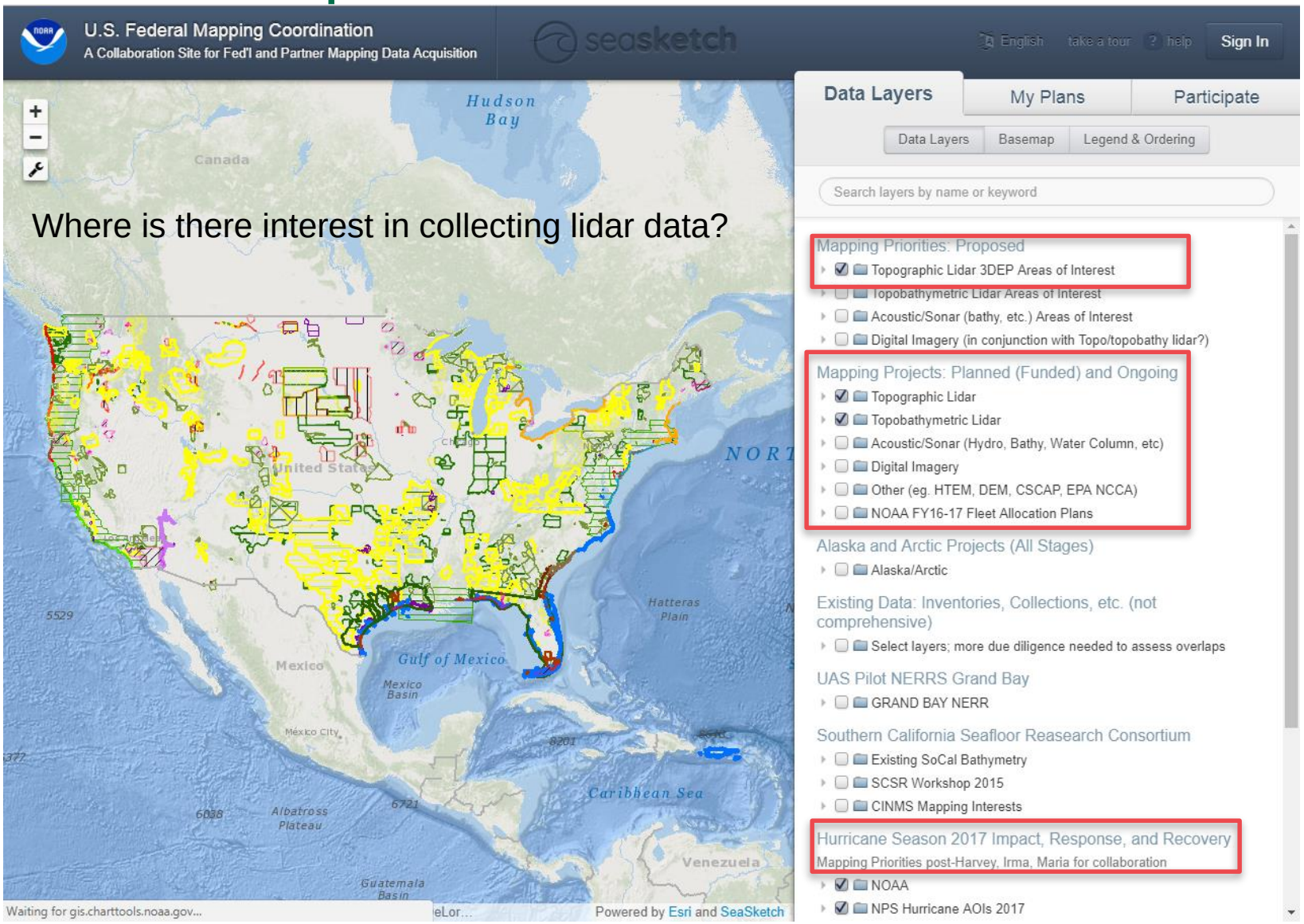
https://coast.noaa.gov/inventory

+ Data Requirements - Seasketch



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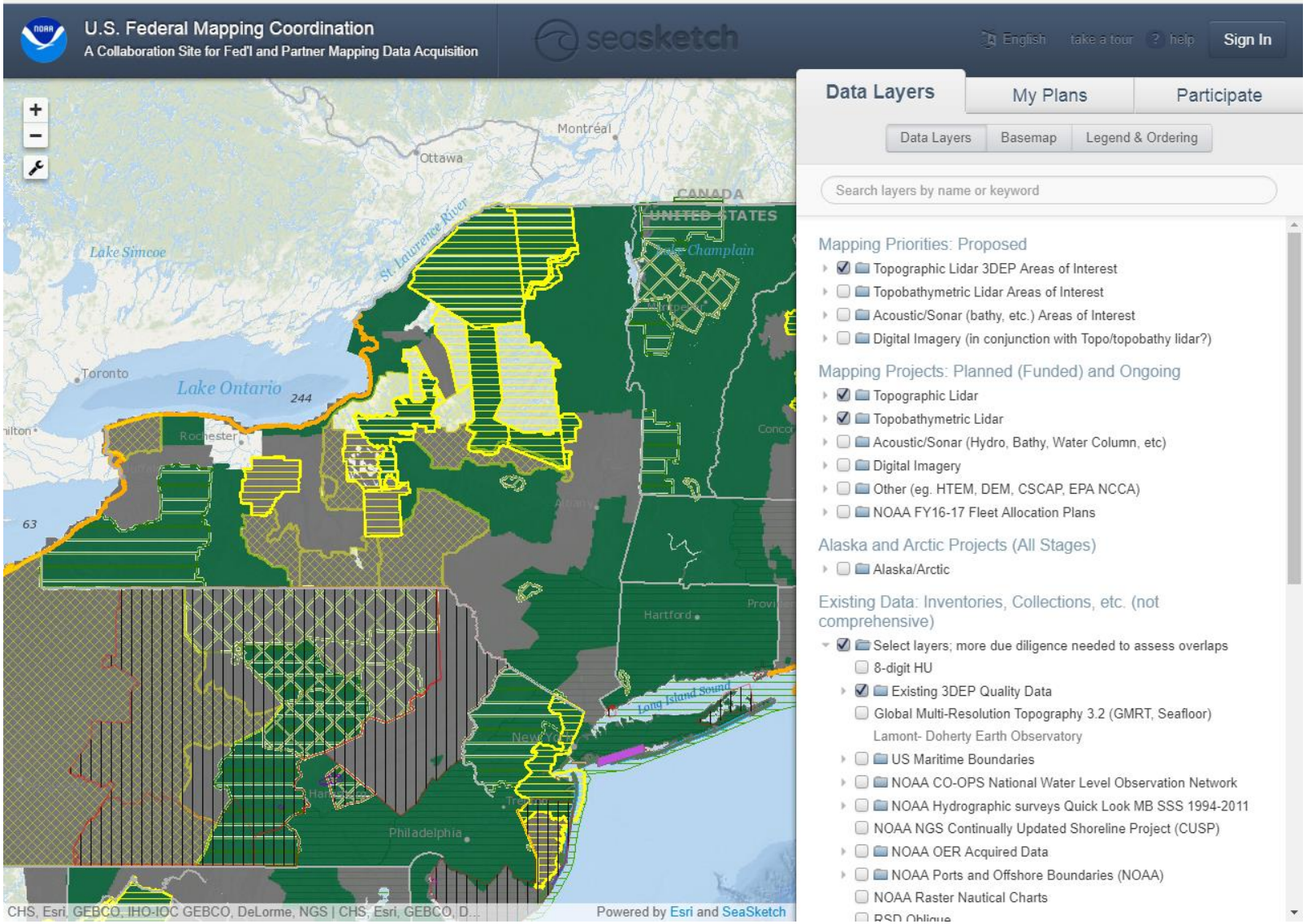
https://www.seasketch.org

Seasketch Tool – Mapping Requirements



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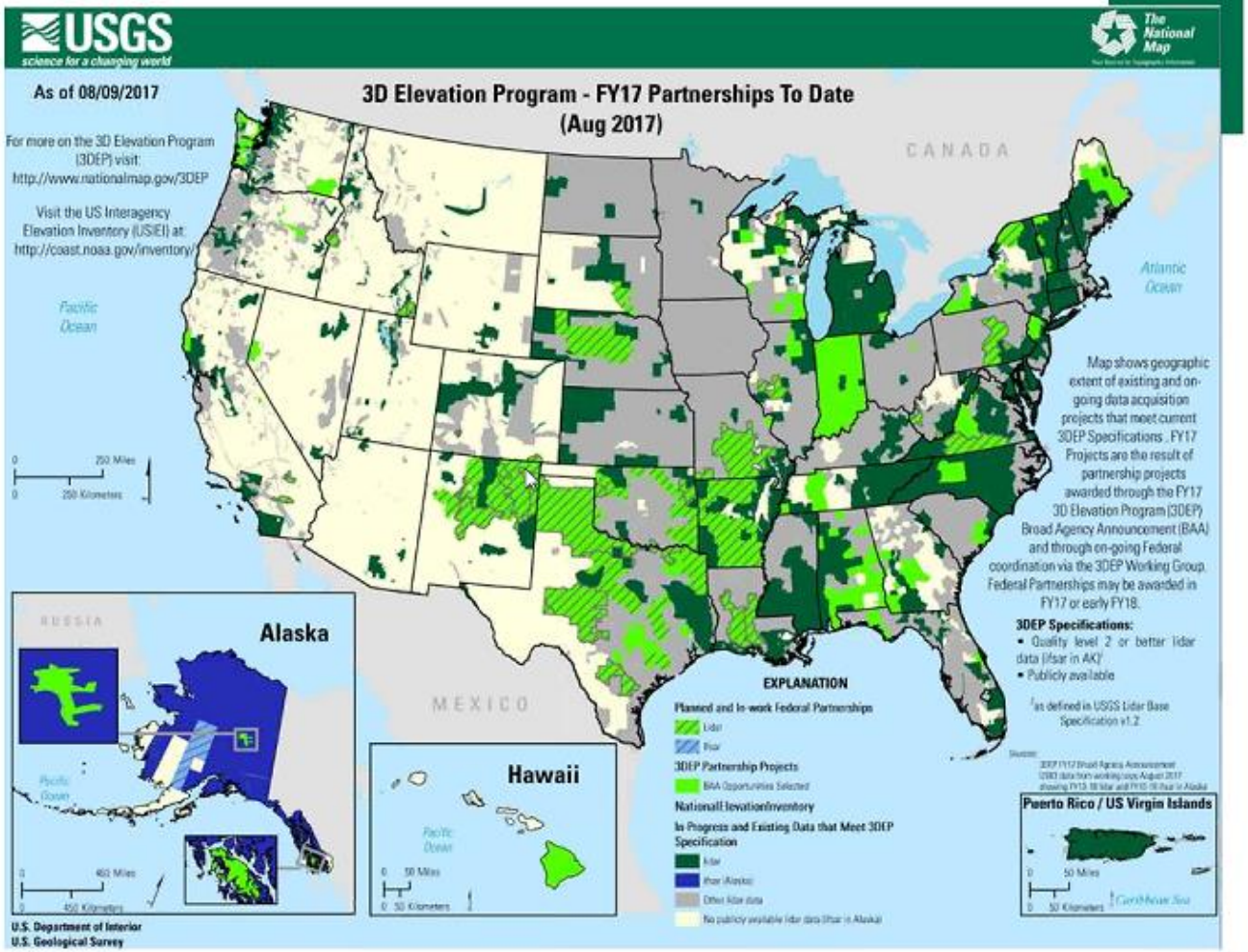
https://www.seasketch.org/

Summary of FY 2017 3DEP Partnerships

BAA + Additional Federal Investments

- BAA supported 33 projects in 24 states
- For BAA projects - USGS, FEMA HQ and NRCS NCGE committed $10M, regional federal offices, state and local agencies contributed $22M for total BAA project value of $32M
- BAA project awards ranged from $14K to $1MK, average award was $315K
- Average BAA award covered 31% of the cost of the project
- Average project size 4348 square miles



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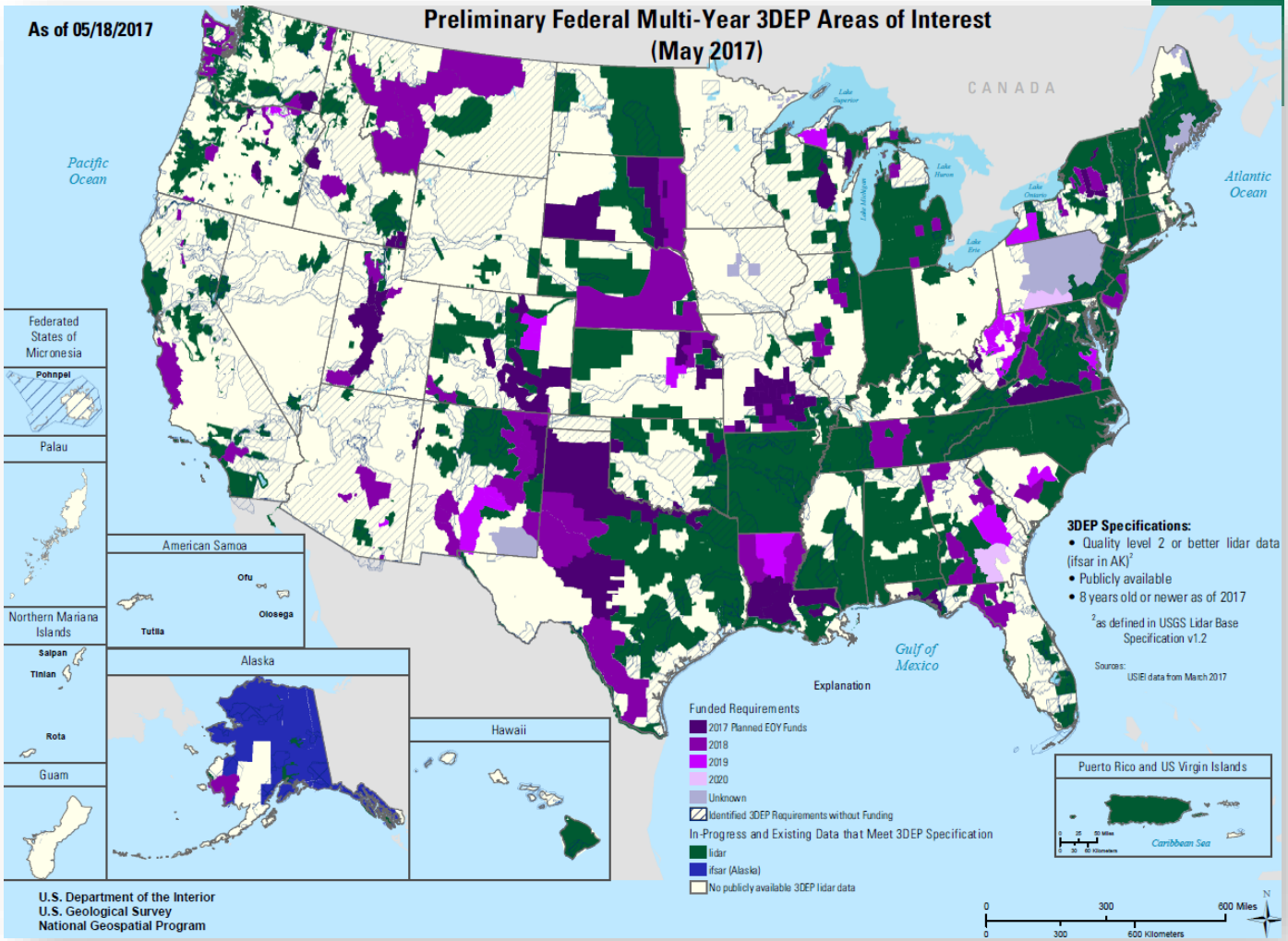
Results available at http://nationalmap.gov/3dep

3DEP Multi-Year Planning (FY18 – FY20)

Preliminary Inputs

- Based on input from 3DEP WG Federal agencies
- Assumes a level budget
- Identifies projects with a minimum/ partial planned funding
- Will be adjusted based on the availability of funding
- Annual adjustment to reflect updated priorities



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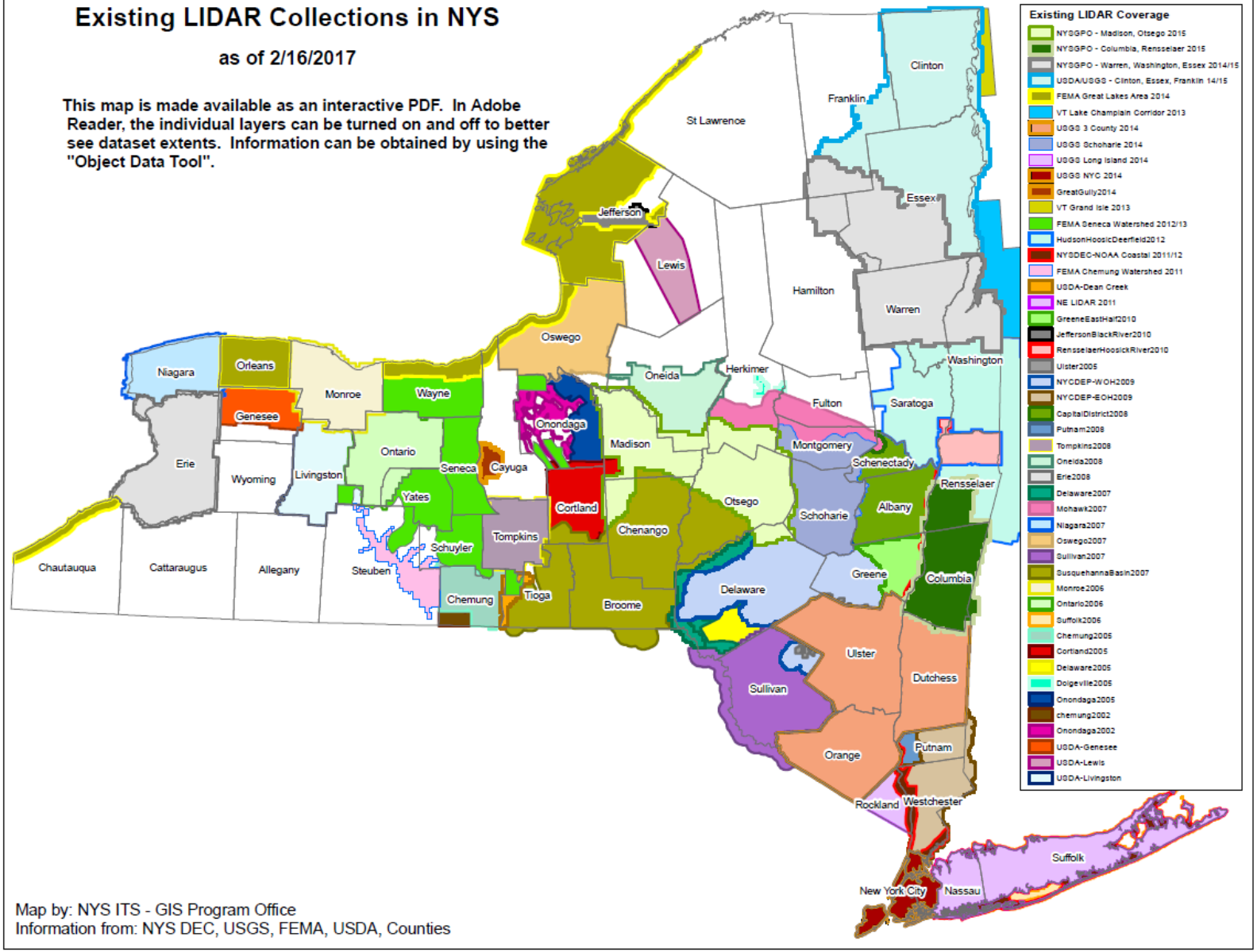
Existing LIDAR Collections in NYS

as of 2/16/2017

This map is made available as an interactive PDF. In Adobe Reader, the individual layers can be turned on and off to better see dataset extents. Information can be obtained by using the "Object Data Tool".



Map by: NYS ITS - GIS Program Office
Information from: NYS DEC, USGS, FEMA, USDA, Counties

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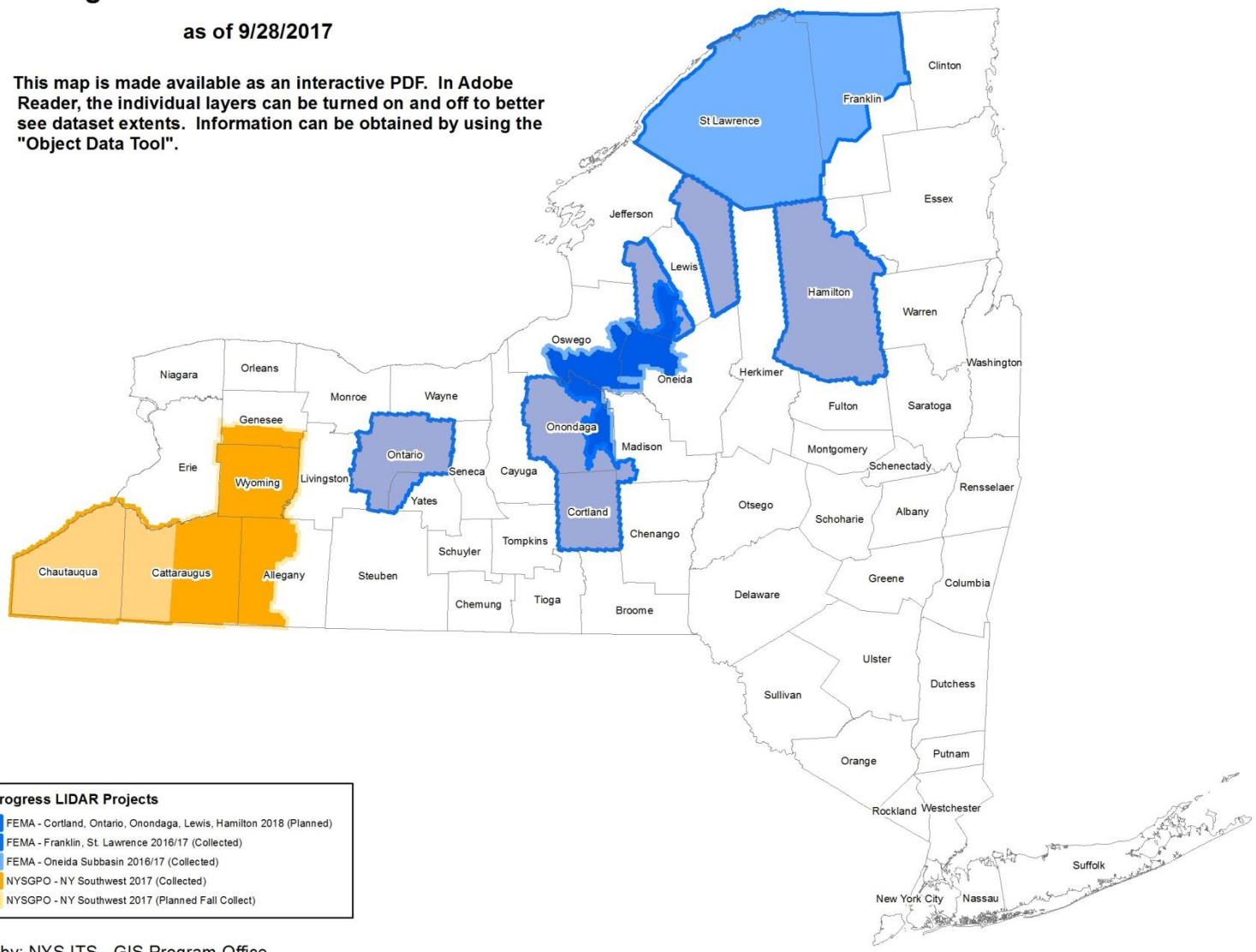
In-Progress LIDAR Collections in NYS

as of 9/28/2017

This map is made available as an interactive PDF. In Adobe Reader, the individual layers can be turned on and off to better see dataset extents. Information can be obtained by using the "Object Data Tool".



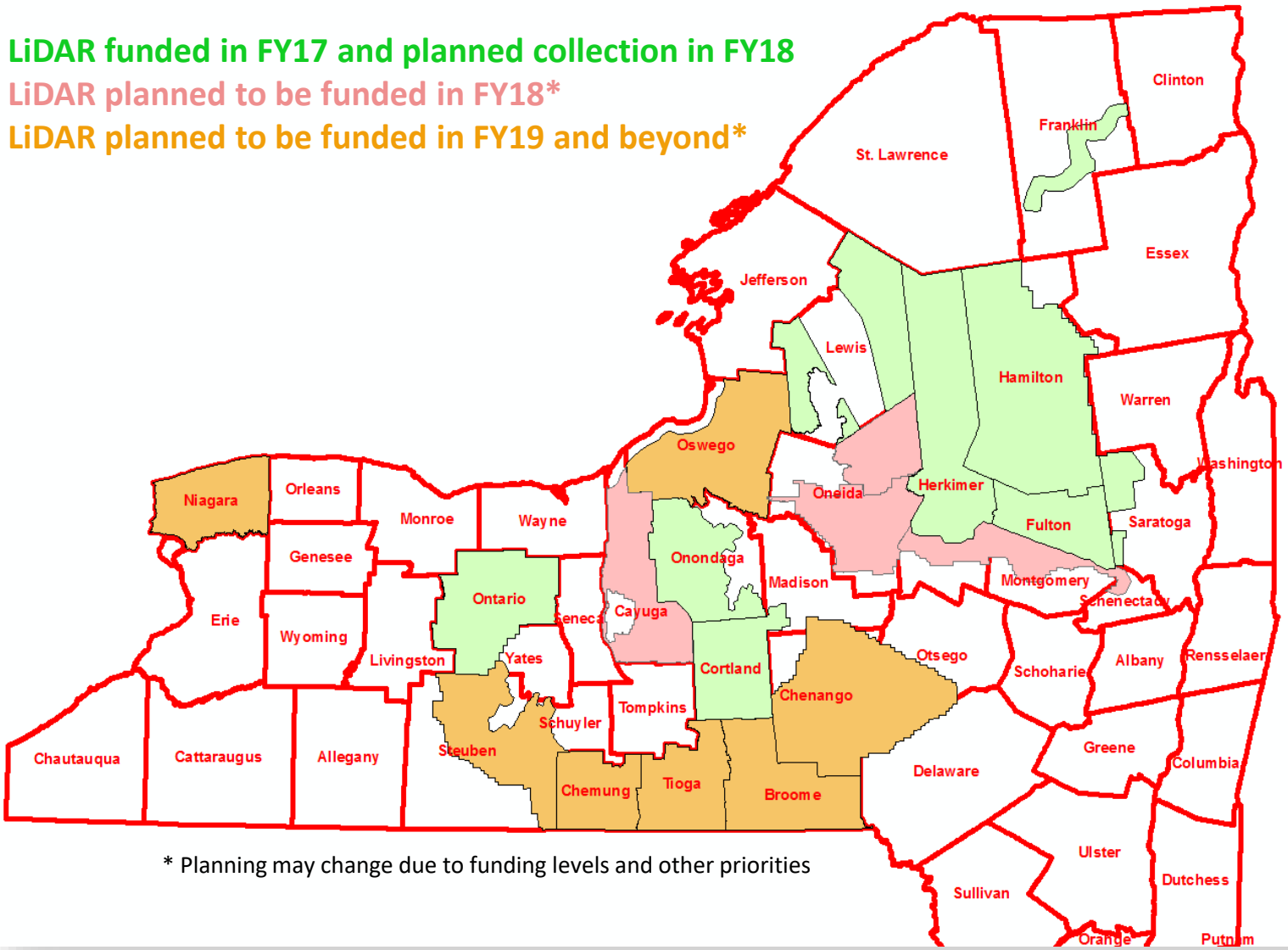
In-Progress LIDAR Projects

- FEMA - Cortland, Ontario, Onondaga, Lewis, Hamilton 2018 (Planned)
- FEMA - Franklin, St. Lawrence 2016/17 (Collected)
- FEMA - Oneida Subbasin 2016/17 (Collected)
- NYSGPO - NY Southwest 2017 (Collected)
- NYSGPO - NY Southwest 2017 (Planned Fall Collect)

Map by: NYS ITS - GIS Program Office
Information from: NYS DEC, USGS, FEMA, USDA, Counties

FEMA Region 2 Planning (FY17 – FY19)

LiDAR funded in FY17 and planned collection in FY18
LiDAR planned to be funded in FY18*
LiDAR planned to be funded in FY19 and beyond*



* Planning may change due to funding levels and other priorities

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NY USDA-NRCS

- NRCS state office in Syracuse, 3 regional offices, 43 field offices
- provide technical expertise and conservation planning to forest landowners, ranchers and farmers
- NRCS benefits of using lidar:
  - Conservation Planning
    - Improves spatial accuracy (and credibility) of landowner conservation plan maps
    - shows precise elevation changes for slope analysis;
    - more accurate drainage erosion potential determinations
  - Engineering project work: preliminary investigations with LIDAR aids in better planning and management of field survey crews
  - NRCS Soil Survey (SURGO) Updates:
    - Lidar increases efficiency and saves time in evaluation of detailed landscape analysis that aids in identifying and predicting locations of specific soil characteristics, allowing the Soil Scientist more field time dedicated to focusing on “challenge areas”.
- NRCS Cost benefit analysis of 3DEP:
  - NRCS dollars only (no partnership):
    - ca. 1,500 sq. mi. averaging **$0.57/acre** (total $547,000)
  - NRCS dollars leveraged with other Federal, State and Local agency dollars
    - ca. 6,500 sq. mi. averaging **$0.08/acre** (total $332, 800)
  - **= 7x cost savings ! – value of leveraging partners !**

Acknowledgements

- Doug Freehafer - USGS NY WSC
- Alan Springett, Robert Schaefer, Brian Shumon, Juan Arevalo, Curtis Smith - FEMA Region 2
- Cathy Crotty - USDA-NRCS
- Tim Ruhren, Jeff Langella - NYS-ITS GIS Program
- Tim Daly – NYS-DEC
- Andrew Kozlowski, NY State Museum
- Dan O'Brien, NYSES-OEM

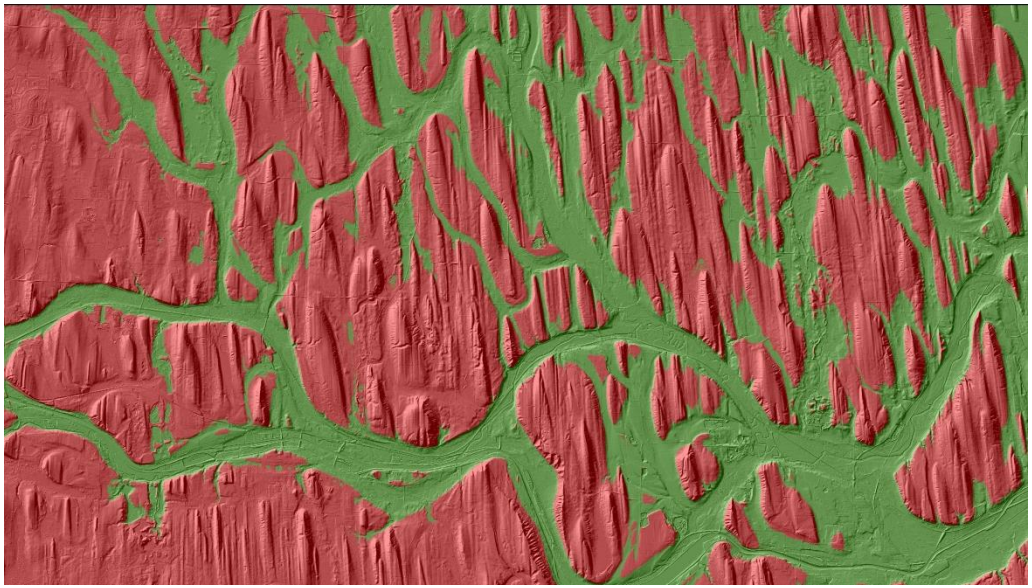

Image showing location of the Fairport-Lyons channel and inter-drumlin outwash channels revealed by lidar in southern Wayne County, New York, courtesy Doug Freehafer, USGS

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Craig A. Neidig
cneidig@usgs.gov
https://nationalmap.gov/

Thank you !

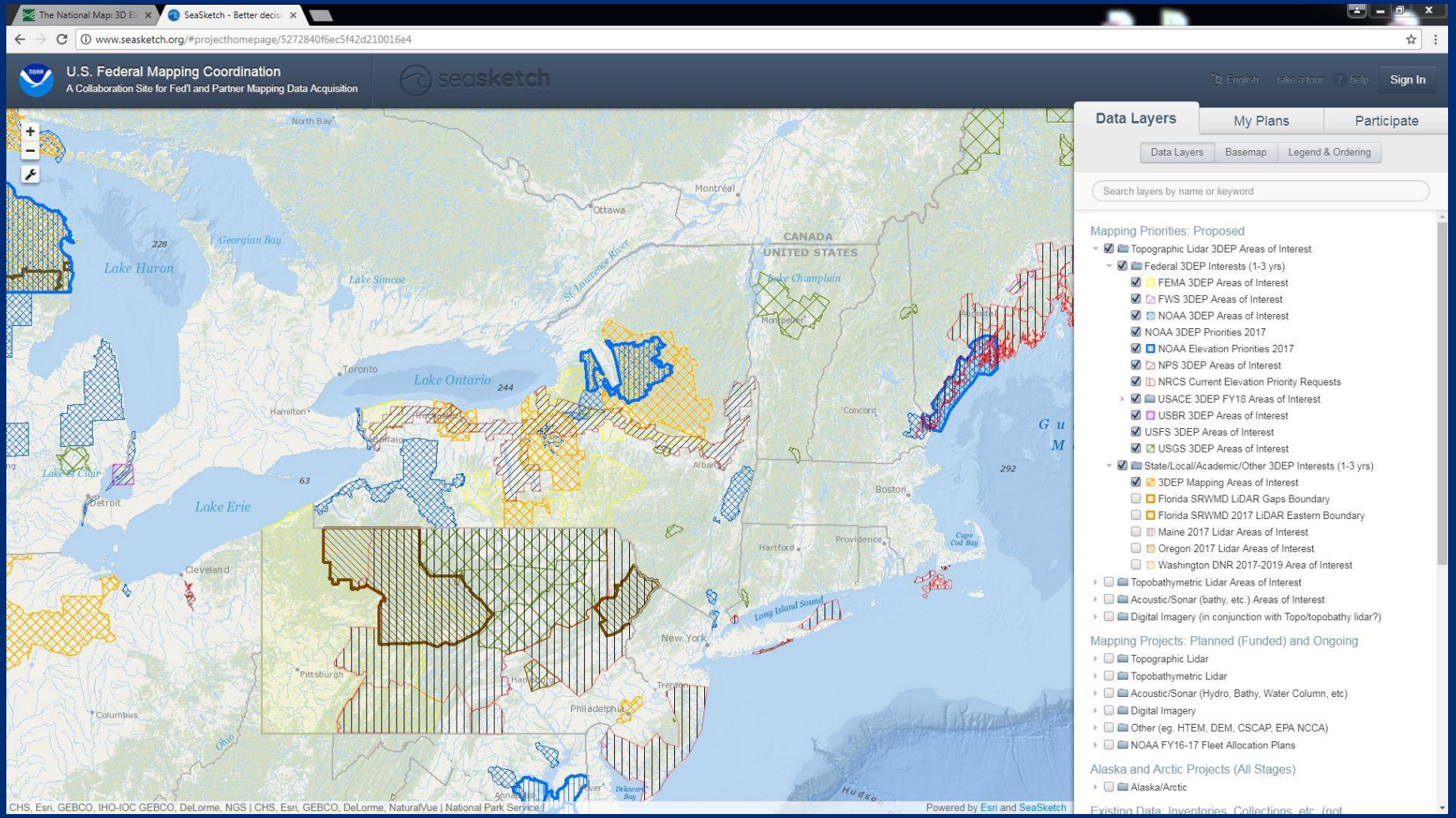
NEW YORK STATE OF OPPORTUNITY. | Office of Information Technology Services

LIDAR Project Life Cycles in Government Agencies

Jeff Langella – NYS GIS Program Office

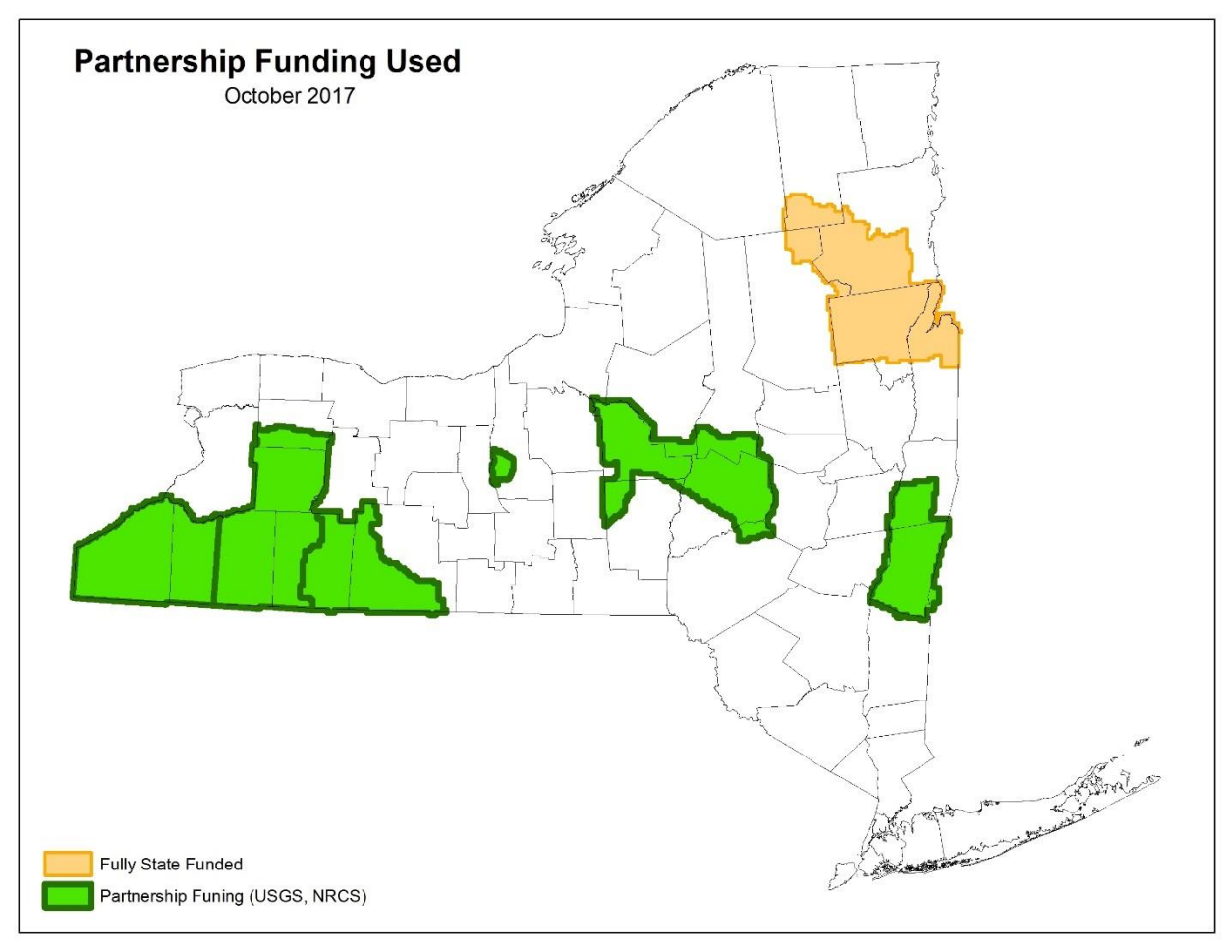
- October 22, 2017

Coordination of State Priorities with Federal and Local Priorities

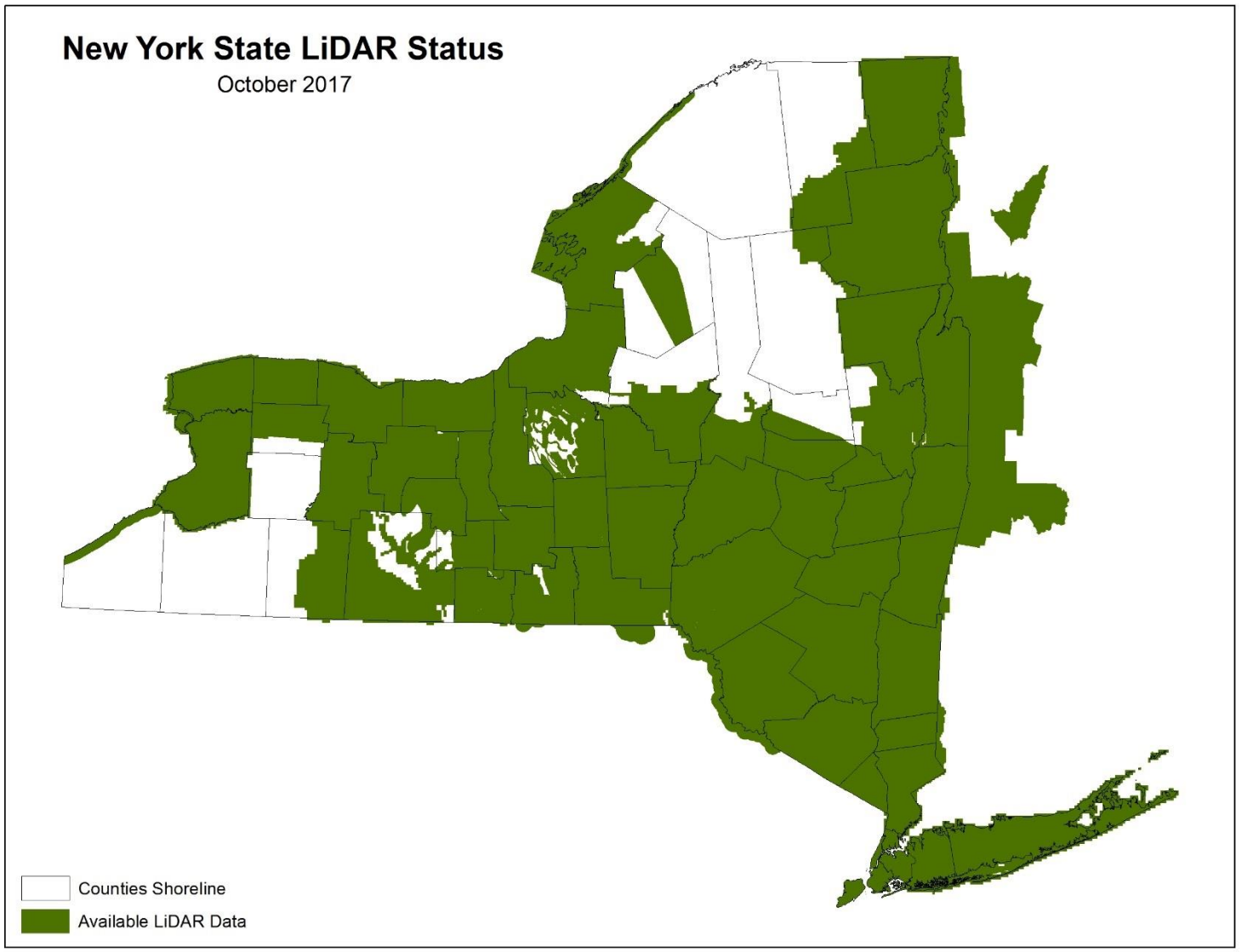


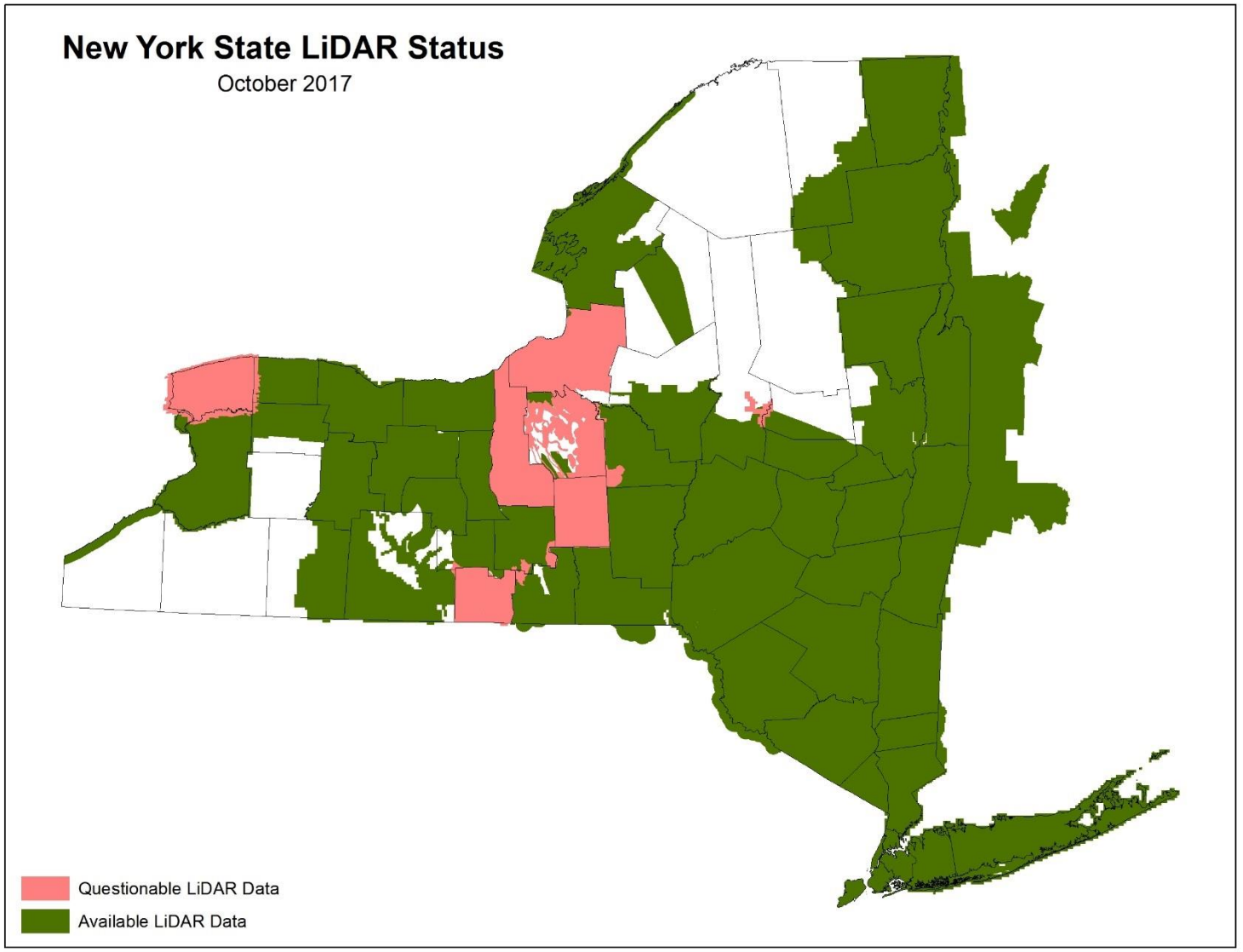
NEW YORK STATE OF OPPORTUNITY. Office of Information Technology Services

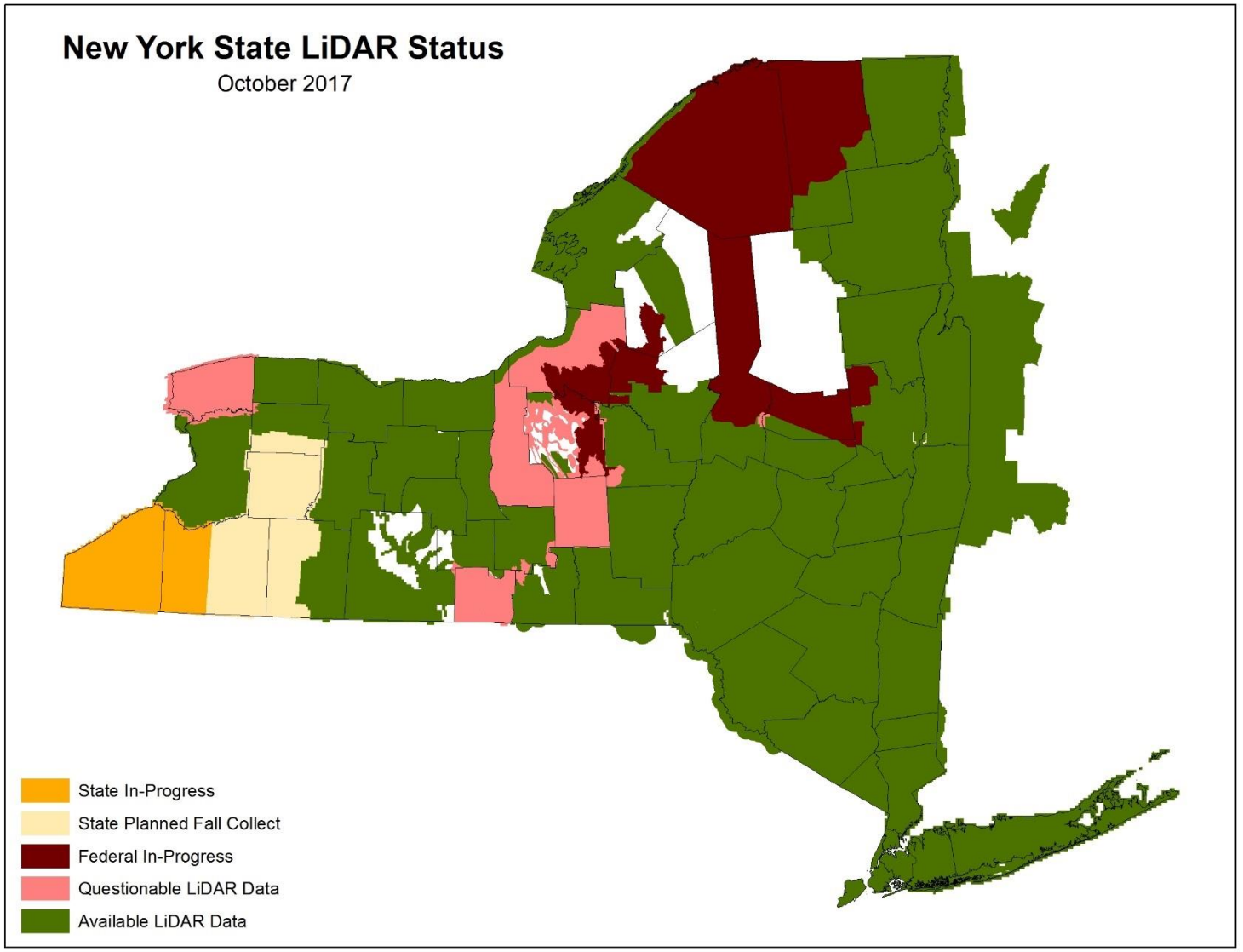
Partnership funding used through NYS Contract

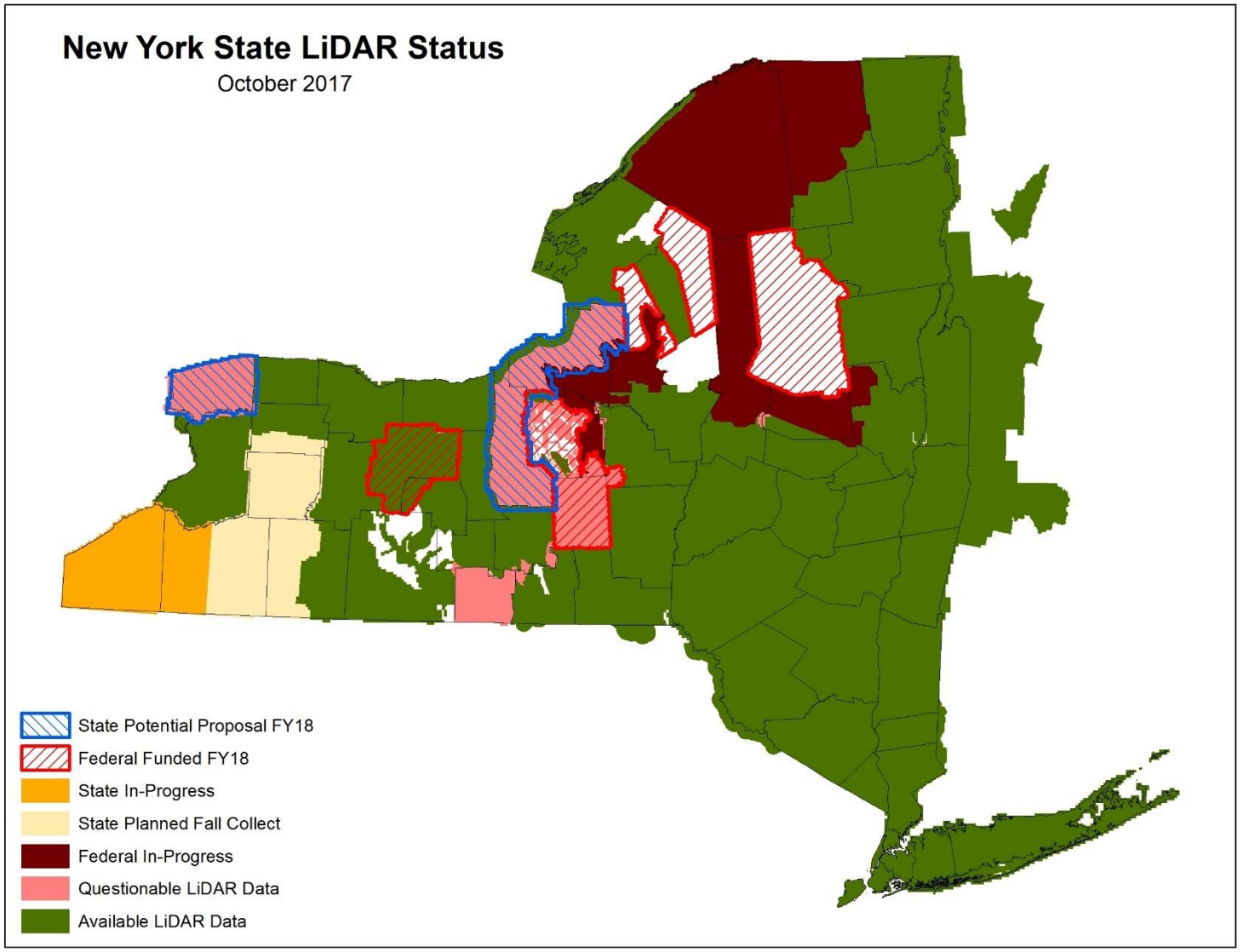


Project Management - Planning

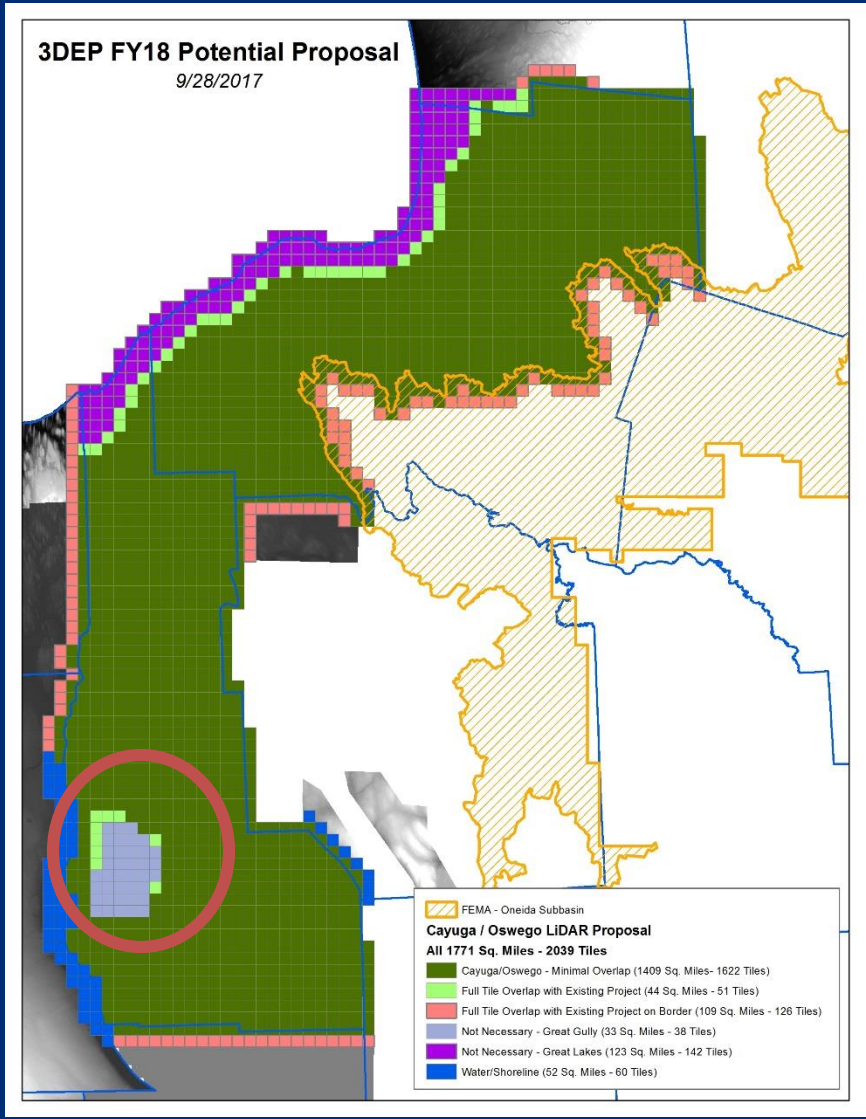

New York State LiDAR Status
October 2017
Counties Shoreline
Available LiDAR Data


New York State LiDAR Status
October 2017
Questionable LiDAR Data
Available LiDAR Data

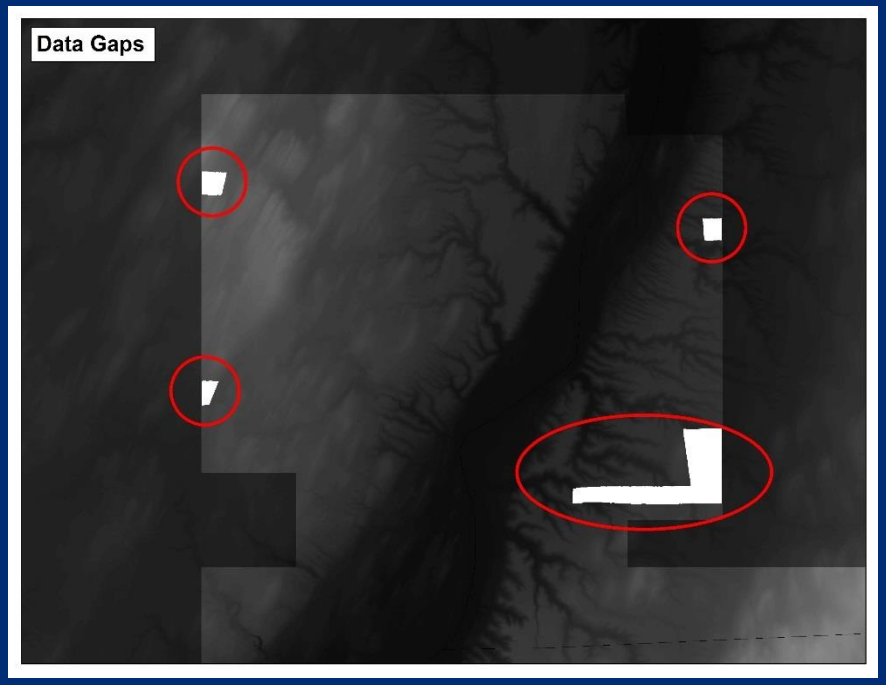

New York State LiDAR Status
October 2017
State In-Progress
State Planned Fall Collect
Federal In-Progress
Questionable LiDAR Data
Available LiDAR Data

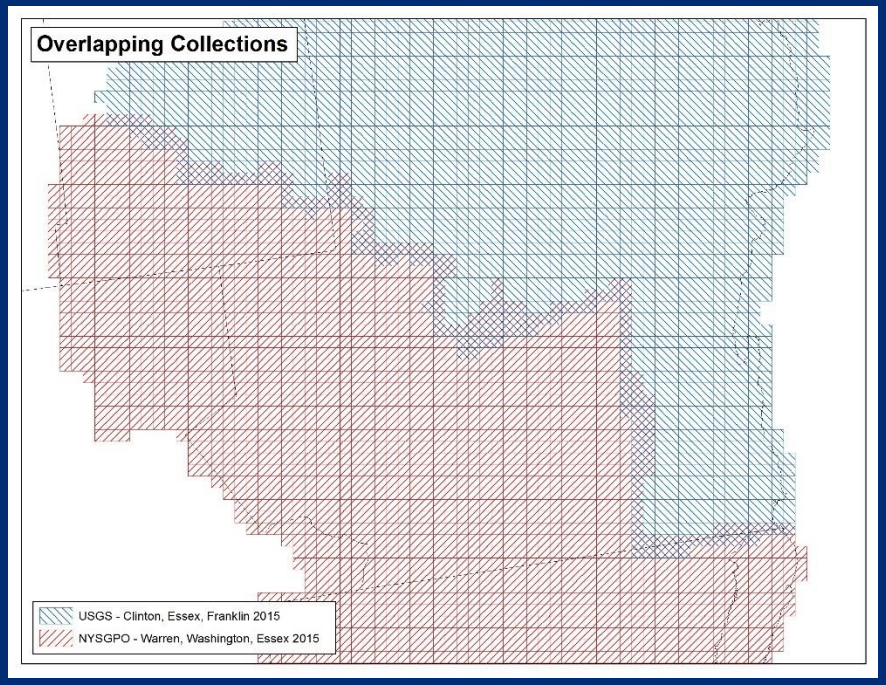

New York State LiDAR Status
October 2017
State Potential Proposal FY18
Federal Funded FY18
State In-Progress
State Planned Fall Collect
Federal In-Progress
Questionable LiDAR Data
Available LiDAR Data

Be Mindful of Bordering Projects' Age

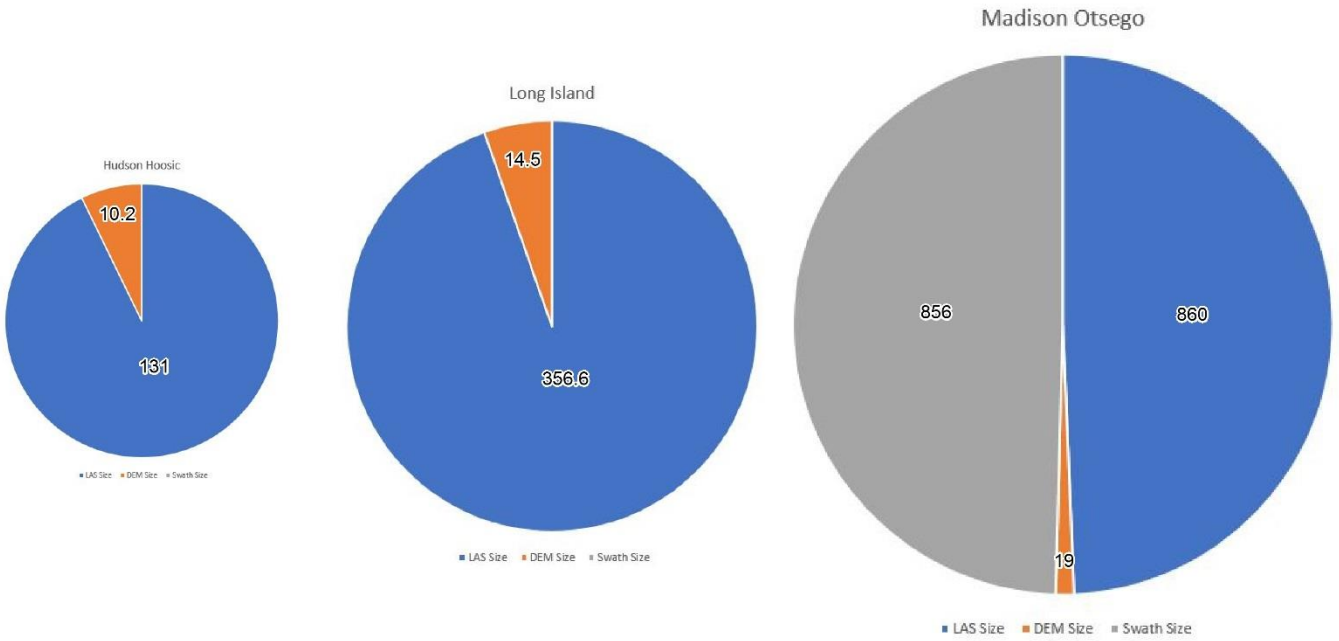


Avoid the Gap, Overlap





	Year	Quality Level	Square Miles	Total Size (GB)
Hudson Hoosic	2012	3	3370	141.2
Long Island	2014	2	1750	271.1
Madison Otsego	2015	2	1844	1735



Point Cloud & DEM Review

Expected Tile Count:	1001					
Review Process / Step	**Reviewer**	**Date Start**	**Date Finish**	**Accepted**	**Location**	**Filename**
Inventory Tiled LAS Delivery (tile count, size ranges)	JL	8/29/2017	8/29/2017	JL	T:\GpoDot\lidar\Southwest_2017\las	SouthWest_EastBlock_082817.lasd
Point File Info (Improved)	SO	8/29/2017	8/29/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\pfi	Southwest_EastBlock_PFIimp_082917.shp
Point File Info (Summarize by Class Code)	SO	8/29/2017	8/29/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\pfi	Southwest_EastBlock_PFIsum_082917.shp
Extent	SO	8/29/2017	8/29/2017			
LAS Dataset	SO	8/28/2017	8/29/2017		T:\GpoDot\lidar\Southwest_2017\las	SouthWest_EastBlock_082817.lasd
File Format 1.4	JL	8/28/2017	8/29/2017	Yes	T:\GpoDot\lidar\Southwest_2017\review\East_block\las_info	Southwest17_LASINFO.xlsx
General Classifications						
(Proper classes included, extents of classes are sensible)	JL	8/29/2017	8/29/2017	NO	T:\GpoDot\lidar\Southwest_2017\review\East_block\classification	Southwest17_LASINFO.xlsx | SW_EastBlock_ErrPoly.shp
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Horizontal Check GPO - Check Points						
Horizontal Check DOT - DOT Projects						
Vertical Check GPO - Check Points	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar\Southwest_2017\review\East_block\vertical	AXIS_Checkpoints_East_Block_Subset_08302017.shp RMSE_AXIS_Checkpoints_East_083017.xlsx
Vertical Check DOT - DOT Projects						
Vertical Check DOT - Truck Data	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar\Southwest_2017\review\East_block\vertical	DOT_Truck_Data_East_Block_Subset_08302017.shp RMSE_DOT_Truck_Data_East_08032017.xlsx
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Classification - water	JL	9/8/2017				
Classification - Bare Earth	SO	9/19/2017	9/21/2017			
Classification - Class 10						
Hydrobreakline Review						
Bare Earth Slope Creation	SO	8/29/2017	8/29/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\bare_earth_slope	SW_EastBlock_BE_1mSLOPE.tif
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Spot check Profiles						
Spot check creating contours						
LiDAR Metadata						
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Water Slope Polygons	SO	8/30/2017	8/30/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\water_slope	sw_eastblock_water_polysAGG.shp

Expected Tile Count:	1001					
Review Process / Step	**Reviewer**	**Date Start**	**Date Finish**	**Accepted**	**Location**	**Filename**
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LAS Dataset	SO	8/28/2017	8/29/2017		T:\GpoDot\lidar	
File Format 1.4	JL	8/28/2017	8/29/2017	Yes	T:\GpoDot\lidar	
General Classifications						
(Proper classes included, extents of classes are sensible)	JL	8/29/2017	8/29/2017	NO	T:\GpoDot\lidar	
Intensity	SO	8/29/2017	8/30/2017		T:\GpoDot\lidar	
Horizontal Check GPO - Digitized Roads	SO	8/31/2017	8/31/2017		T:\GpoDot\lidar	
Horizontal Check GPO - Check Points						
Horizontal Check DOT - DOT Projects						
Vertical Check GPO - Check Points	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar	
Vertical Check DOT - DOT Projects						
Vertical Check DOT - Truck Data	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar	
Classification - Bridges	SO	8/31/2017	9/15/2017		T:\GpoDot\lidar	
Classification - water	JL	9/8/2017				
Classification - Bare Earth	SO	9/19/2017	9/21/2017			
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Hydrobreakline Review						
Bare Earth Slope Creation	SO	8/29/2017	8/29/2017		T:\GpoDot\lidar	
High Noise/Low Noise	SO	8/30/2017	8/30/2017		T:\GpoDot\lidar	
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Point Density - Bare Earth	SO	9/19/2017	9/19/2017		T:\GpoDot\lidar	
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Void Analysis	Raj	9/11/2017	9/14/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\void	SW_EastBlock_Void_reviw.mxd
Slope Analysis						
Spot check Profiles						
Spot check creating contours						
LiDAR Metadata						
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Deliverables Reviewed

- LAS Swath
- Classified LAS
- Hydro Breaklines
- Bare Earth DEM
- Metadata

Expected Tile Count:	1001					
Review Process / Step	**Reviewer**	**Date Start**	**Date Finish**	**Accepted**	**Location**	**Filename**
Inventory Tiled LAS Delivery (tile count, size ranges)	JL	8/29/2017	8/29/2017	JL	T:\GpoDot\lidar\Southwest_2017\las	SouthWest_EastBlock_082817.lasd
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File Format 1.4	JL	8/28/2017	8/29/2017	Yes	T:\GpoDot\lidar	
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(Proper classes included, extents of classes are sensible)	JL	8/29/2017	8/29/2017	NO	T:\GpoDot\lidar	
Intensity	SO	8/29/2017	8/30/2017		T:\GpoDot\lidar	
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Horizontal Check DOT - DOT Projects						
Vertical Check GPO - Check Points	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar	
Vertical Check DOT - DOT Projects						
Vertical Check DOT - Truck Data	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar	
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Classification - water	JL	9/8/2017				
Classification - Bare Earth	SO	9/19/2017	9/21/2017			
Classification - Class 10						
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Spot check creating contours						
LiDAR Metadata						
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Water Slope Raster	SO	8/30/2017	8/30/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\water_slope	SW_EastBlock_Water_5mSLOPE_083017.tif
Water Slope Polygons	SO	8/30/2017	8/30/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\water_slope	sw_eastblock_water_polysAGG.shp

Deliverables Reviewed
- LAS Swath
- Classified LAS
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- Bare Earth DEM
- Metadata

35 + Review Steps for Classified LAS tiles

Expected Tile Count:	1001					
Review Process / Step	**Reviewer**	**Date Start**	**Date Finish**	**Accepted**	**Location**	**Filename**
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(Proper classes included, extents of classes are sensible)	JL	8/29/2017	8/29/2017	NO	T:\GpoDot\lidar	
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Horizontal Check GPO - Check Points						
Horizontal Check DOT - DOT Projects						
Vertical Check GPO - Check Points	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar	
Vertical Check DOT - DOT Projects						
Vertical Check DOT - Truck Data	JL	8/30/2017	8/30/2017	Yes	T:\GpoDot\lidar	
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Classification - water	JL	9/8/2017				
Classification - Bare Earth	SO	9/19/2017	9/21/2017			
Classification - Class 10						
Hydrobreakline Review						
Bare Earth Slope Creation	SO	8/29/2017	8/29/2017		T:\GpoDot\lidar	
High Noise/Low Noise	SO	8/30/2017	8/30/2017		T:\GpoDot\lidar	
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LiDAR Metadata						
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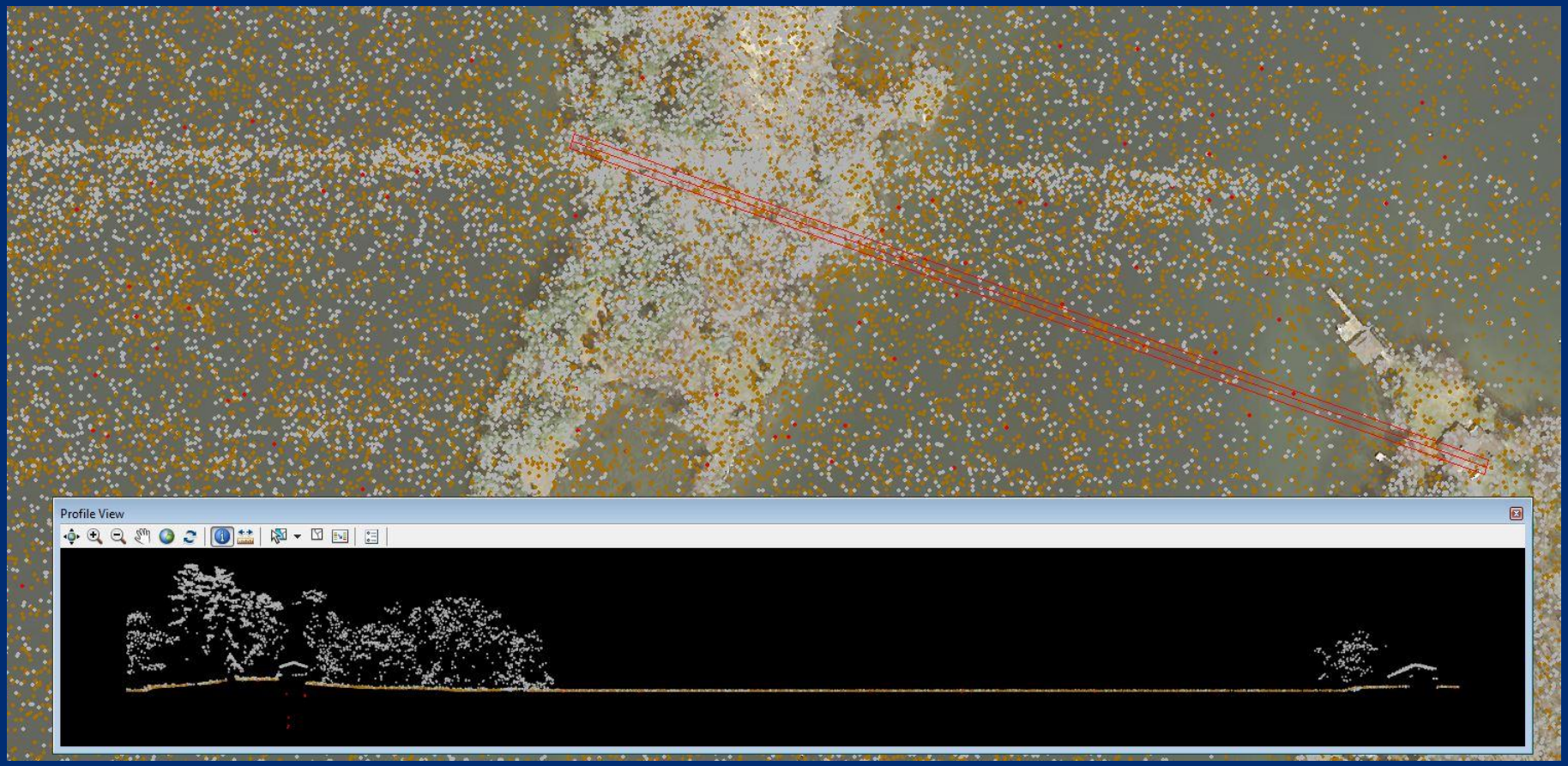
Water Slope Polygons	SO	8/30/2017	8/30/2017		T:\GpoDot\lidar\Southwest_2017\review\East_block\water_slope	sw_eastblock_water_polysAGG.shp

Deliverables Reviewed
- LAS Swath
- Classified LAS
- Hydro Breaklines
- Bare Earth DEM
- Metadata

35 + Review Steps for Classified LAS tiles

Common GIS Tools (ESRI, Global Mapper, Rapid Lasso LAS Tools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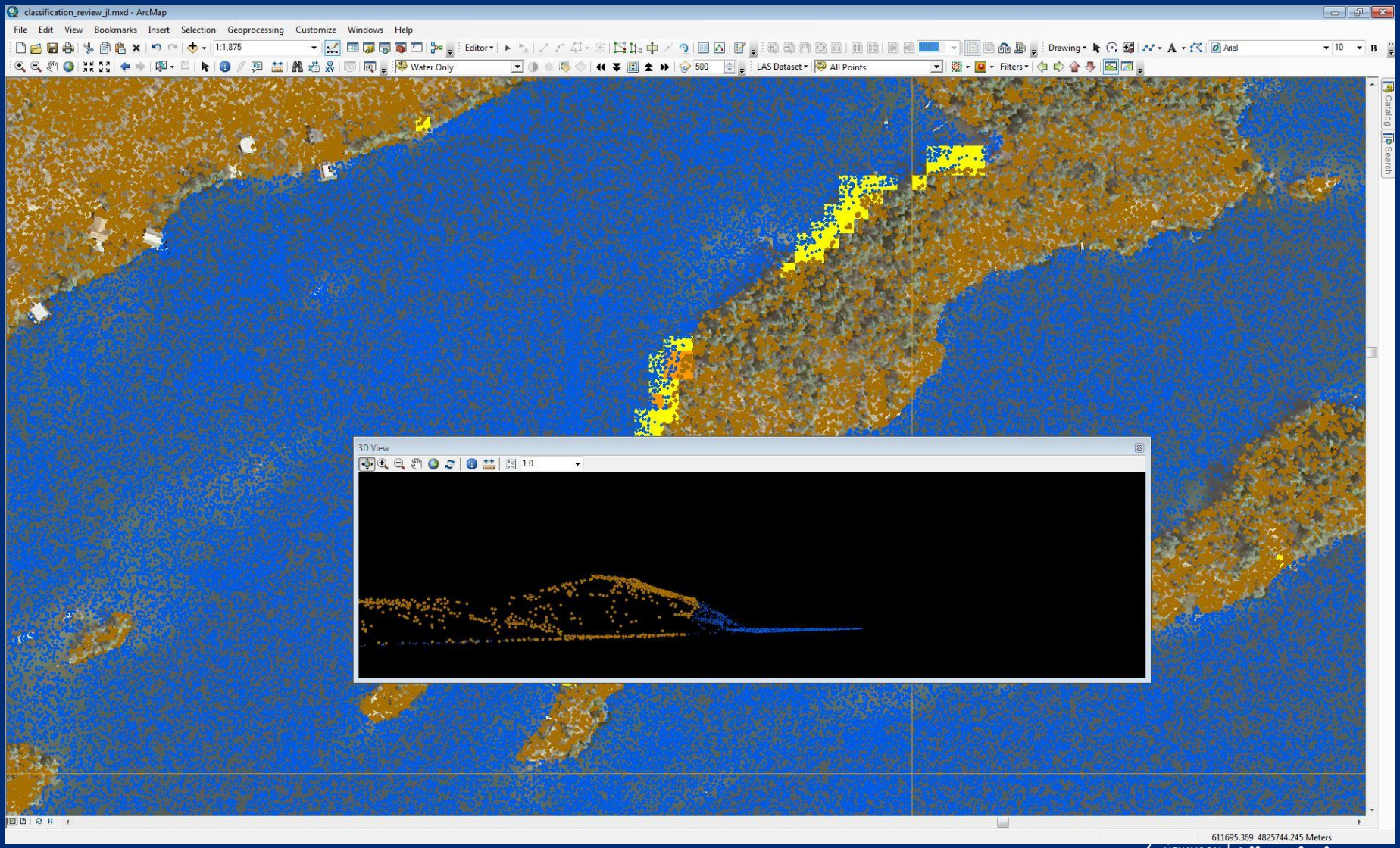
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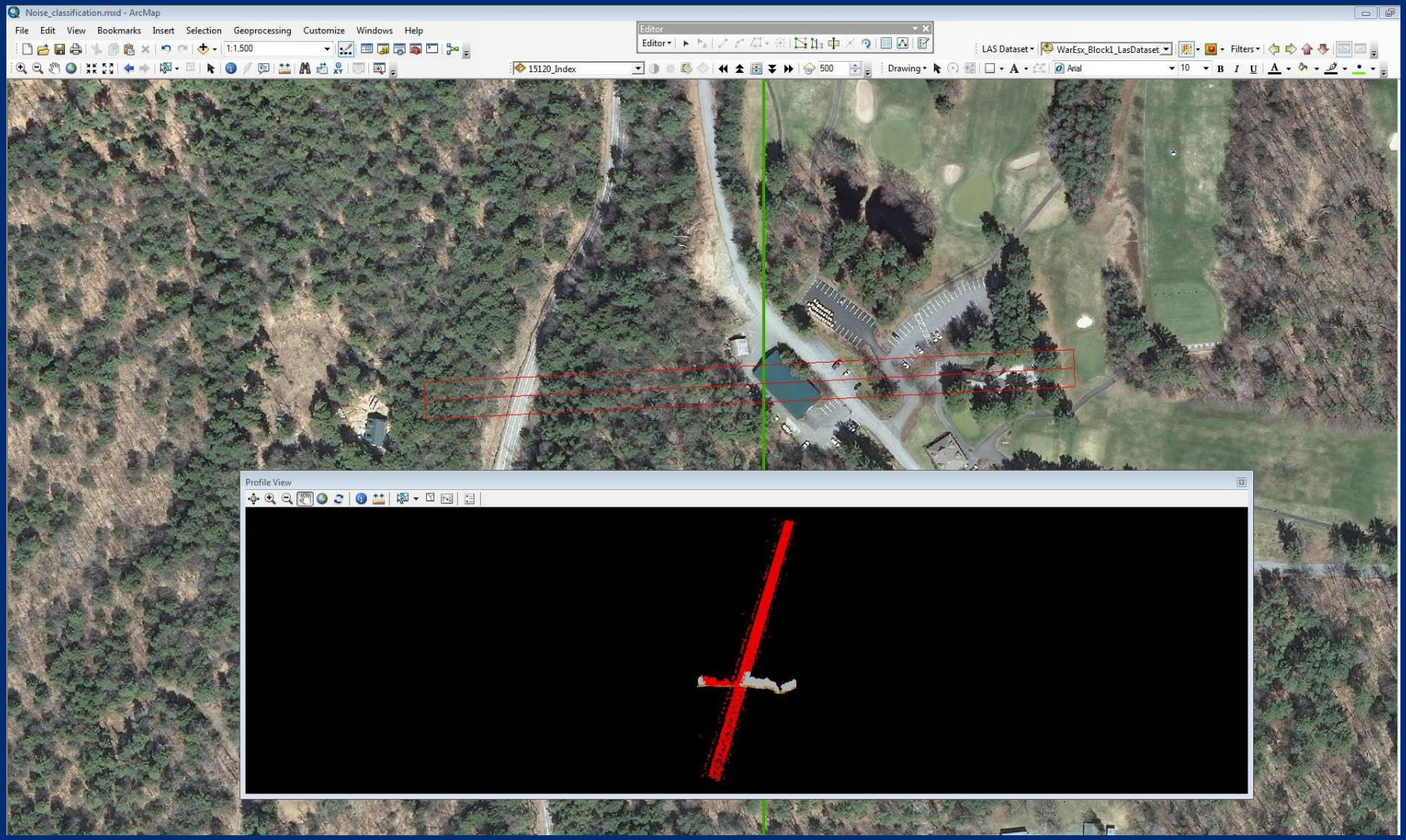
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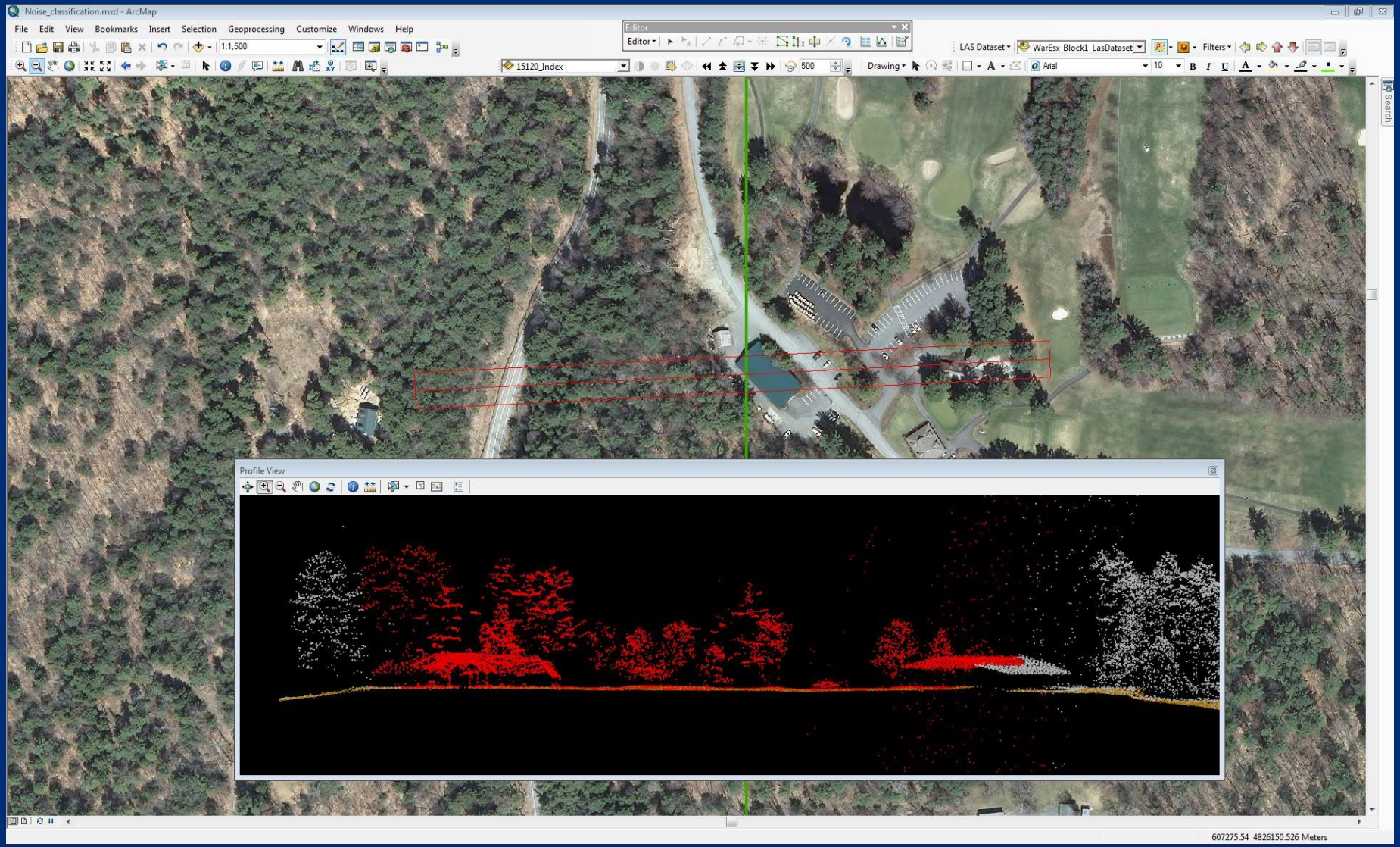
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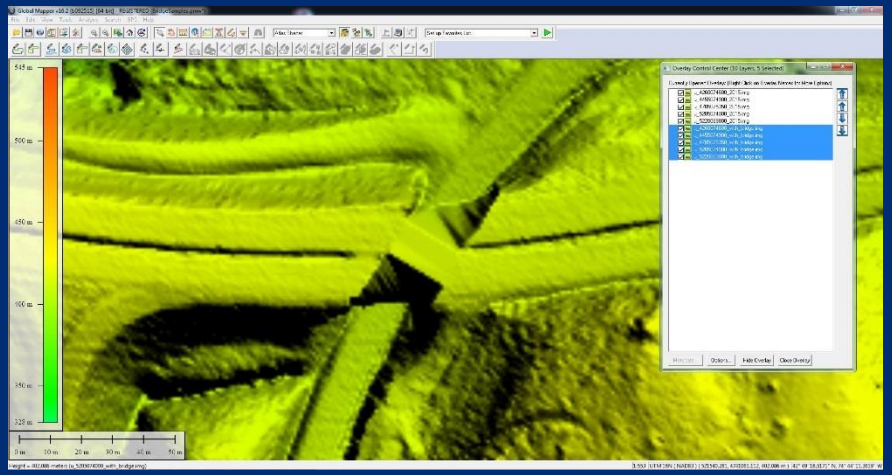
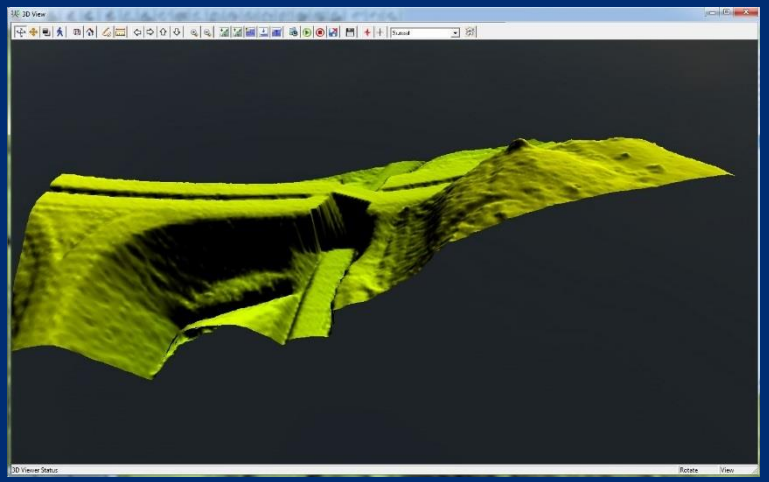
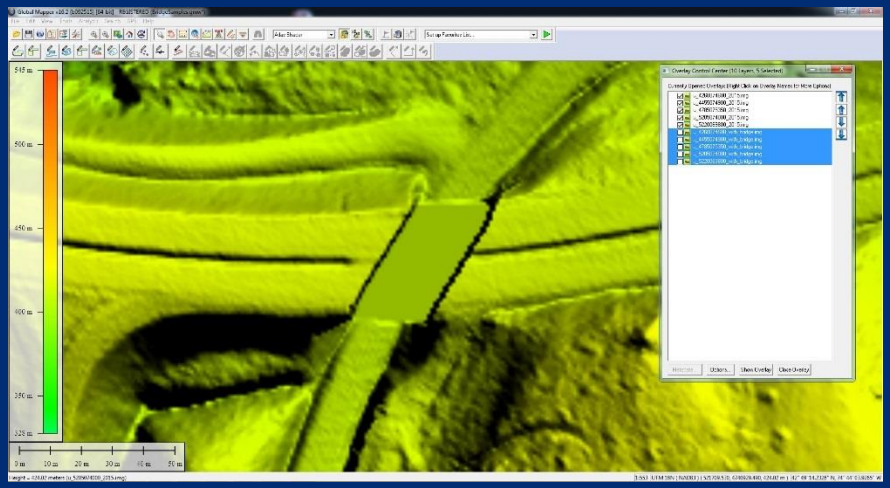
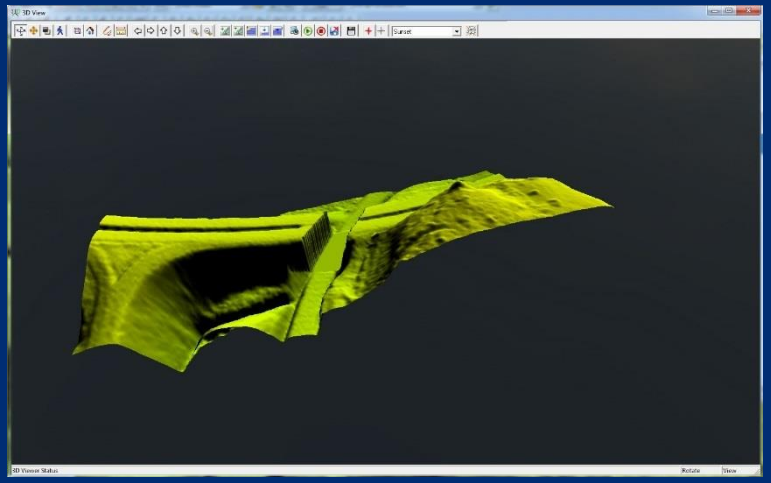
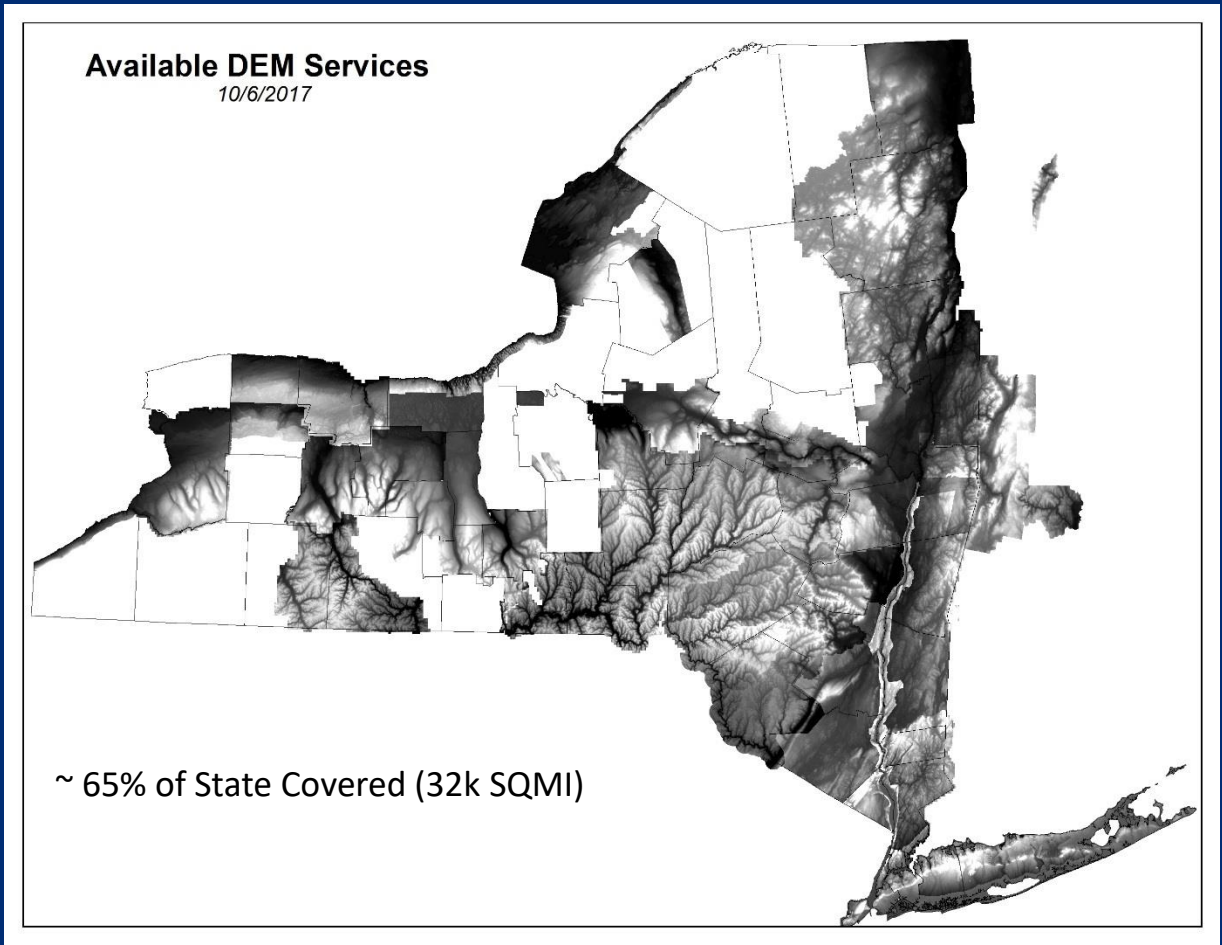




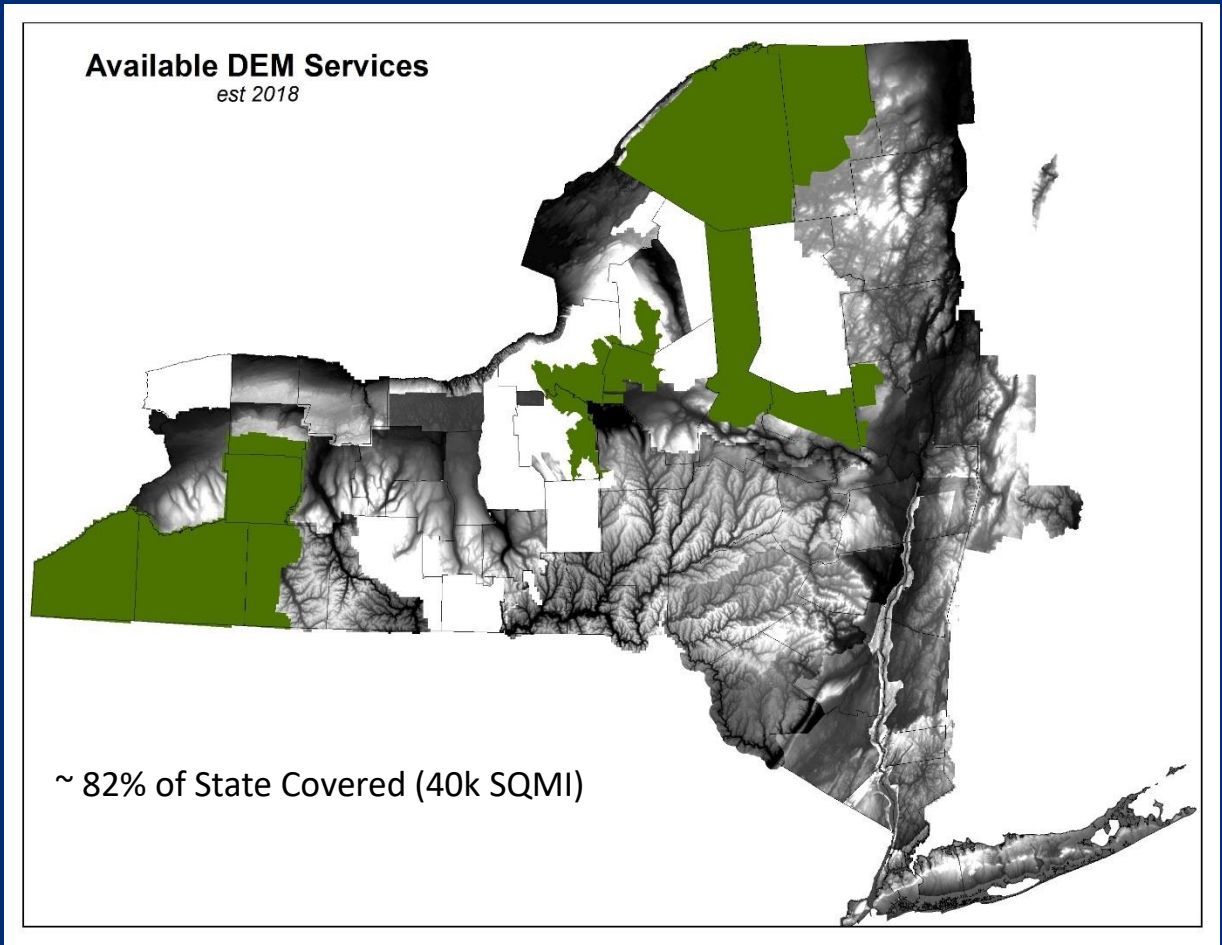




Distribution of DEM



Distribution of DEM



DEM Web Service

Visualize
- No need to download

Display
- Elevation
- Slope
- Hillshade
- Aspect

Analyze
- Run Geoprocessing Tools
- Generate Contours
- Run in Models

Other Benefits
- Saves Space
- Immediate updates
- Download Blocks of Data

LIDAR PANEL: PROJECT LIFECYCLES IN COUNTY GOVERNMENT

2017 NYS GeoCon
Sheri Norton, GISP
Ontario County

EXISTING LIDAR

Total County investment: $141,000

- **2006 capture – Pictometry hired ($108,000 County cost)**
- **Included portion of Yates County in Canandaigua watershed**

Typical Flying Altitude	Average Combined Spot Spacing	NSSDA – Vertical Accuracy 95% Confidence	Horizontal Accuracy
5000’	4.1’ (1.23 m)	1.2’ (36.6 cm)	1/3000th the flying height

2008 processing ($33,000) by IAGT to provide:

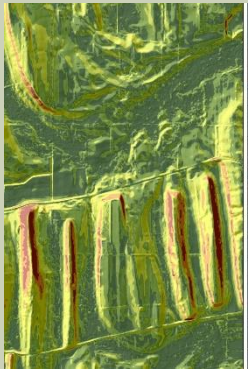
- **Shapefiles of point collections, 2-foot contours**
- **Bare Earth DEM and Terrain (5-meter)**
- **Hydrologic features**
- **Building footprints**

MAJOR APPLICATIONS

- **Updated Soil Survey** - ong project with USDA Natural Resource Conservation Service (NRCS), the Ontario County Soil & Water Conservation District(SWCD), and County Planning
- **Emergency Radio Communications System** – planning and environmental review
- **Watershed Analyses** – ongoing by Public Works (averaging 40-50 per year).
- **Building Footprints** – base layer of features extracted

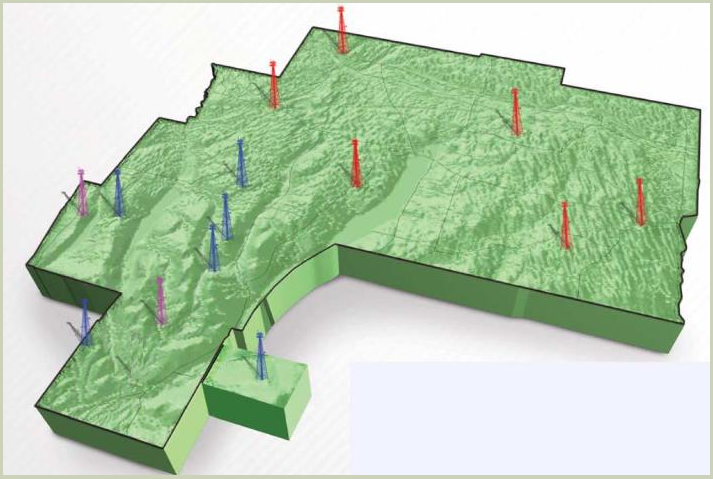
SOIL SURVEY UPDATE

- Ontario County went from having one of the oldest soil surveys (c. 1946) to one of the most current and accurate in New York State
- Partnership with Ontario County Soil and Water Conservation District and the County Planning Department: Investment of $150,000
- Soil types no longer in the NRCS Soil Classification System were resampled in the field over several years (soil boring and analysis)
- LiDAR enabled soil scientists at NRCS to accurately map soil types according to slope categorical breakdowns



EMERGENCY RADIO COMMUNICATIONS SYSTEM

- **Planning and environmental review**
- **Tower site location (topographic data important)**
  - **County close proximity to Canada**
  - **FFC rules governing use of 700 and 800 MHz radio spectrum**
    - Limited to power output of radios, including at fixed sites on towers (Base Stations)
    - Limited signal strength leaving our jurisdiction
  - **Assess viewshed of towers to gauge environmental impact**

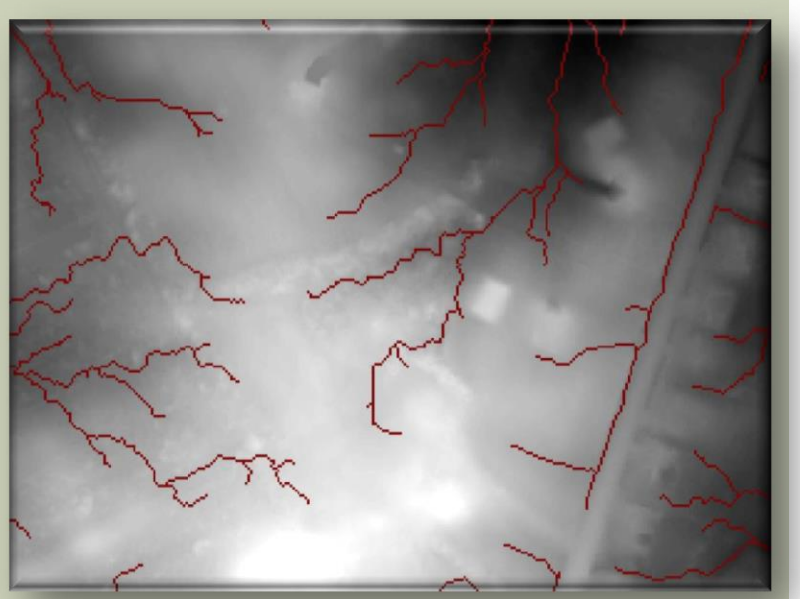


WATERSHED ANALYSES

- **Determine culvert size and placement -** Our goal is to see *how much water ultimately flows into a specific culvert*
  - Evaluate **whether** a specific culvert or ditch is able to handle the associated water that could potentially be flowing through it during a significant rain event
  - Determine what size and style culverts are needed in order to properly design culverts for bid purposes and to appropriate funds for culvert replacement projects

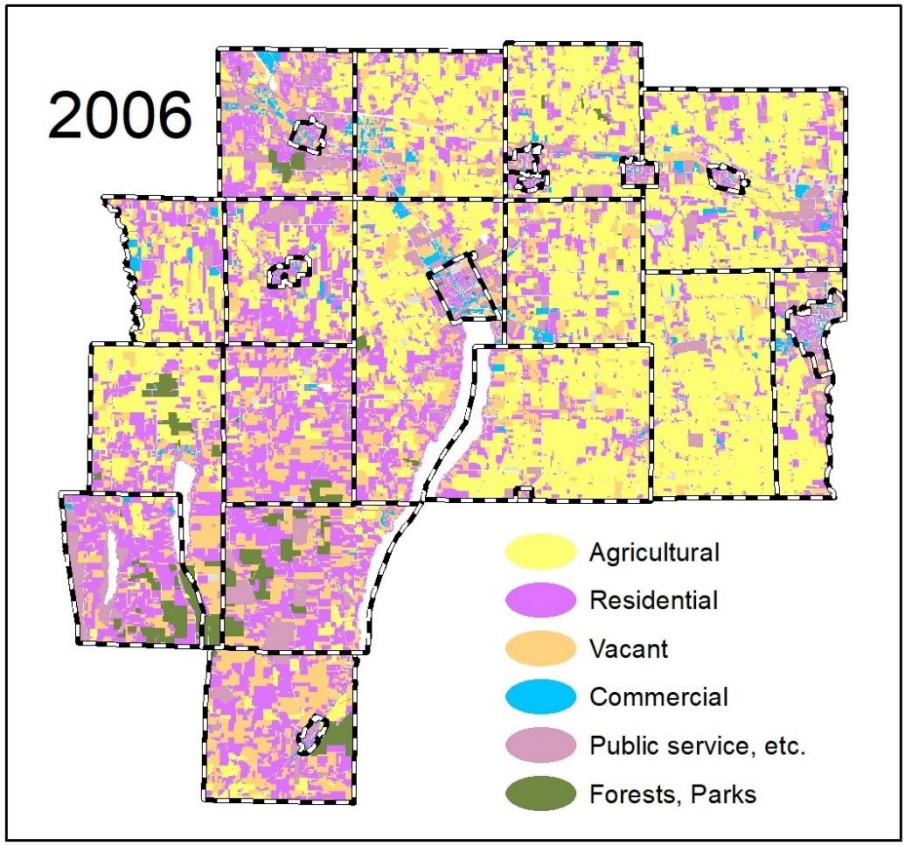
- **40-50 analyses per year for various size watersheds**

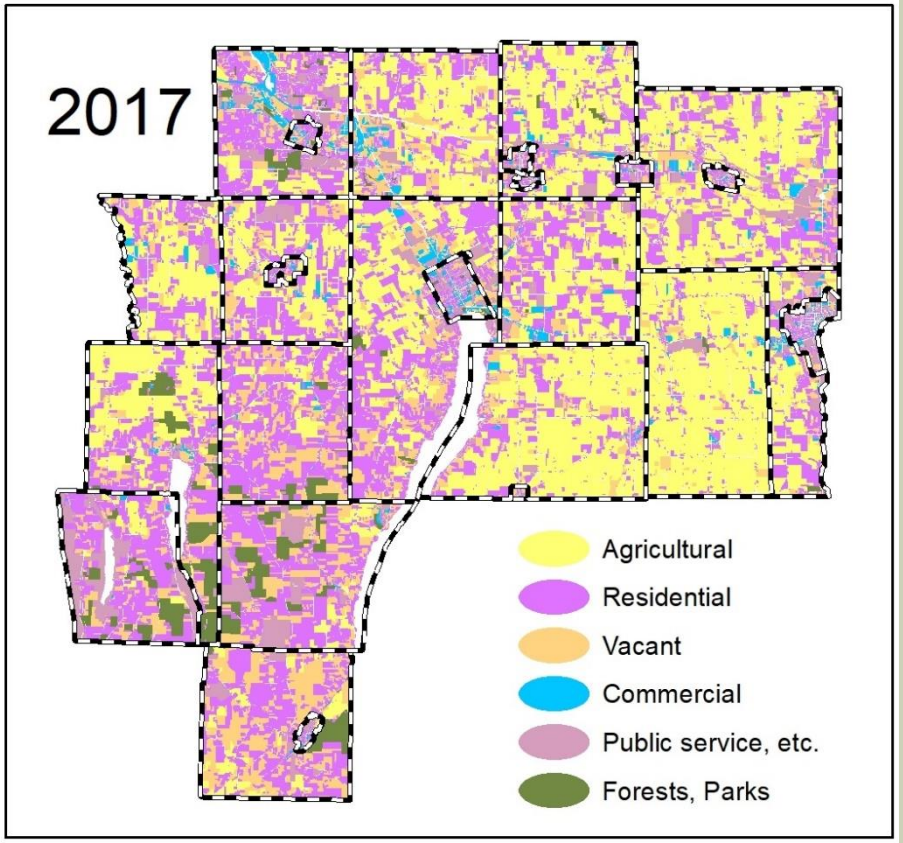
- **Process uses the 5-meter DEM (watershed creation), 2-foot contours and bare earth data (discharge analysis)**



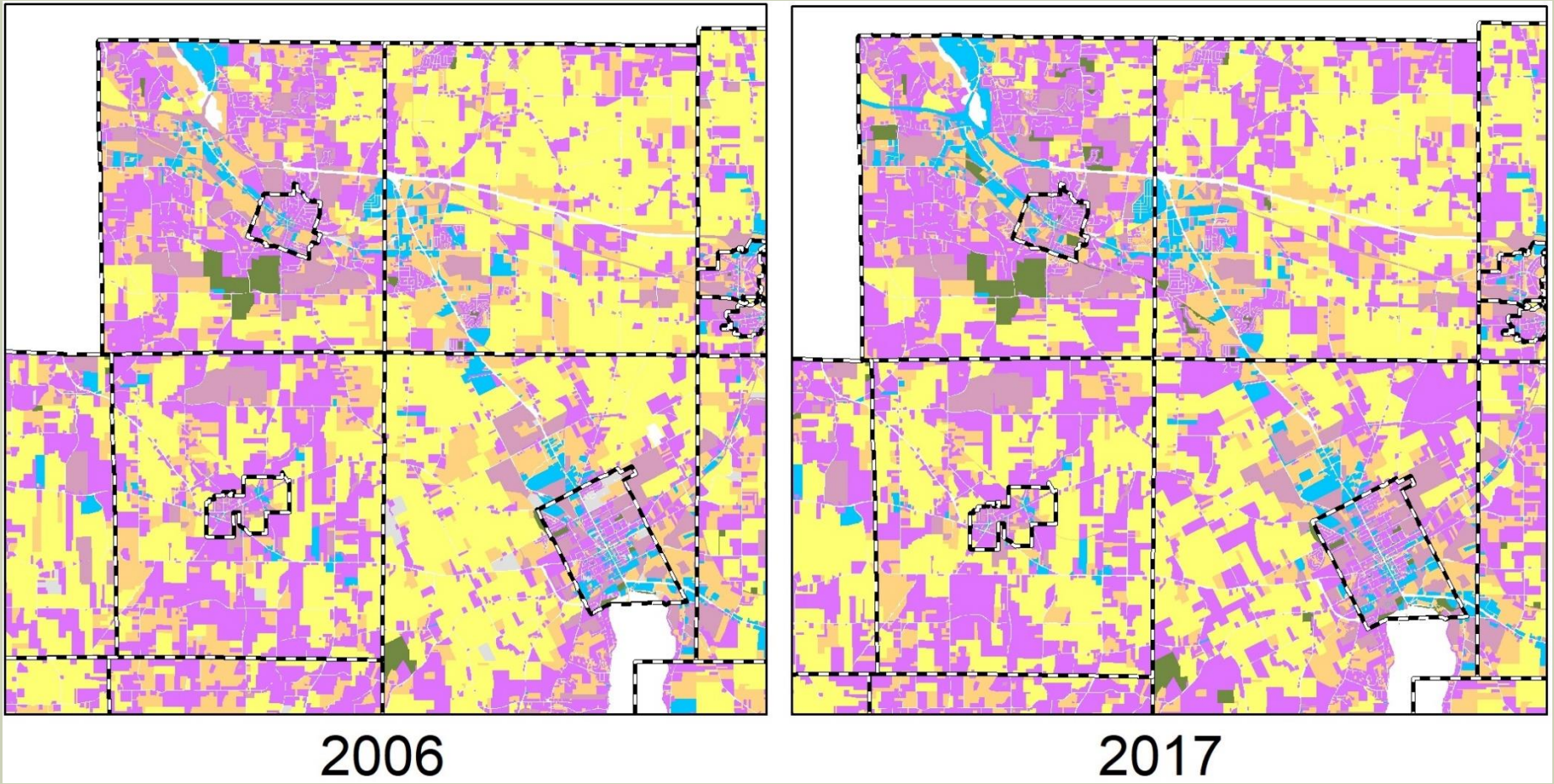
Flow accumulation determined

CHANGE IN LAND USE 2006 - 2017





CHANGE IN LAND USE 2006 - 2017



High growth northwest section – residential and commercial development

UPDATED LIDAR

- Deliverables Desired
  - DEM
  - Hydrology
  - Contours
  - Network of highly accurate control points
    - Increase accuracy of survey quality for projects
    - Serve the County Real Property's long-standing desire to require surveyors to tie their surveys back to these control points (Monroe County has done that for years). Benefits:
      - Increase accuracy of the surveys filed with the County Clerk
      - Easier to overlay the surveys in GIS for tax map editing
- Updated terrain reflecting current state of developed lands
  - Difficulties with accuracy in some areas due to extensive development
    - Does not include new drainage structures/systems that can drastically alter how the hydrology tools function

State

Elevation Webpage: http://gis.ny.gov/elevation/

DEM Services: https://elevation.its.ny.gov/arcgis/rest/services/

Ontario County

http://www.co.ontario.ny.us/456/Geographic-Information-Systems-GIS

Federal

USGS National Map: https://nationalmap.gov/index.html

USGS 3DEP info: https://nationalmap.gov/3DEP/index.html

USDA-NRCS Geospatial Gateway: https://datagateway.nrcs.usda.gov/

Federal Geoplatform: https://www.geoplatform.gov/