Green Infrastructure Mapping Project

Stormwater Coalition of Albany County
Albany County MS4 Mapping Project
University at Albany SUNY -Student Intern Projects
NYSDEC WQIP Grant Contract C00081GG
May 14, 2018 Project Presentation

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Presentation Outline

I. Project Concept

II. Identifying Green Infrastructure Using Remote Sensing Technology
- Selecting Imagery
- Selecting Software
- Software Processing Methods
- Conducting The Analysis
- Limitations & Errors

III. Prioritizing Green Infrastructure
- Ranking Survey/Grouping & Prioritizing Again
- Forests Where? Prioritizing Again - All Buffers/Slope Layer-Intersection
- Forests Where? Prioritizing Again – Watershed Imperviousness

IV. Green Infrastructure Assets – Maintaining System Performance
- Will the Forest infrastructure be here in 30 years?
- Planner's Perspective – 30 Years
- Scoring Likelihood of Change

I. Project Concept

Green Infrastructure is an asset which should be managed like other water related assets.

What is Green Infrastructure?

From Wikipedia (5/2018)

Green Infrastructure or blue-green infrastructure is a network providing the "ingredients" for solving urban and climatic challenges by building with nature.

[1] The **main components** of this approach include:
stormwater management
climate adaptation
less heat stress
more biodiversity
food production
better air quality
sustainable energy production
clean water
healthy soils
increased quality of life…

MANY GOALS

From NYSDEC Stormwater Design Manual (2015)

Green Infrastructure – In the context of stormwater management, the term green infrastructure includes a wide array of practices at multiple scales to manage and treat stormwater, maintain and restore natural hydrology and ecological function by infiltration, evapotranspiration, capture and reuse of stormwater, and establishment of natural vegetative features.

On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains and wetlands, coupled with policies such as infill and redevelopment that reduce overall imperviousness in a watershed or ecoregion.

On the local scale green infrastructure consists of site- and neighborhood-specific practices and runoff reduction techniques. Examples: green roofs, trees/tree boxes, pervious pavement, rain gardens, vegetated swales, planters, reforestation, and protection and enhancement of riparian buffers and floodplains.

PRIMARY GOAL: From Clean Water Act
Restore/maintain Nation's waters

For this project… the green infrastructure purpose is to restore/maintain Nation's waters

From NYSDEC Stormwater Design Manual (2015)

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Green Infrastructure of Interest:

All scales:

- **natural vegetation**
- **forests**
- **flood plains**
- **wetlands**
- **riparian buffers**

How are water assets managed in New York State?

Albany Pool Communities CSO Long Term Control Plan
Status Report Second Term, 2017 (7/1 to 12/31)

APW-05
Asset Management Plans
Albany Water Board, Cohoes, Watervliet, Green Island

Project Description:
Provides each community with assistance in developing asset management plans to improve long term management of capital investments for operation and maintenance of their collection systems. Scope to be further developed within the established budget based upon the goals and needs of each community.

Purpose:

Allows for prioritization of rehabilitative measures based upon condition and criticality of infrastructure. Helps to reduce the risk of failure of critical infrastructure and improves reliability of the collection system to convey wastewater to the WWTP for treatment during dry and wet weather conditions.

Consent Order Milestones	Date Milestone Met
Task Start Date: 4/1/16	4/1/16
Task Completion Date: 12/1/17	12/1/17

SPEDES Permit #s	NY 002 5747, 003 1046, 003 0899, 003 3031
LTCP Projected Project Cost (Millions)	$0.35 (aggregate)
Total Cost (minus in-kind)	TBD
Owned By	N/A
CSO Outfall No.	N/A
Grant Funding or other sources	WQIP for a portion of the mapping work accomplished by the Stormwater Coalition of Albany County

Contact Information:
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CDRPC
518-453-0850
mdaley@cdrpc.org

Project Status:

1/08/15: Awaiting asset management plan guidance from DEC, which will be helpful for this task. 2/12: Troy and Rensselaer will be meeting with DEC at the end of the month to discuss these plans. We anticipate these final plans to drive development and co
side communities.

4/9/15: Under discussion for several months, plans on the east side cont
and negotiated with DEC. West side communities awaiting approved pla
communities prior to developing their own. **(continued next page)**

d plans to DEC for consideration.
C Asset Management Plan Pilot
intenance, and Inspection Plans
Asset management program. The
the DEC pilot program.
g their Asset management plan,
d consistency. Albany has begun
e AMP, maps, and reports.
ment and senior staff from the
ns who will comprise the Asset
ngths, weaknesses and gaps in asset
lentify asset management elements
M GAP framework. The AMP will
he NYS DEC Asset Management
M Support Group International
s of the AMP will include formal
vice, asset inventory, valuation, risk
pair and replacement strategies,
programs to support elements of
existing Geographic Information
ent Information Model (LGIM), and
luding very large diameter
hrough an Albany County
d inventorying their MS4 and CSO
Asset Management Plans. Cohoes

adis and CHA to author the plan.
ny Plan.
on November 1, 2017. The City of
nitted their final AMPs to DEC on

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

MUNICIPAL SEWAGE SYSTEM ASSET MANAGEMENT GUIDE

November 2015

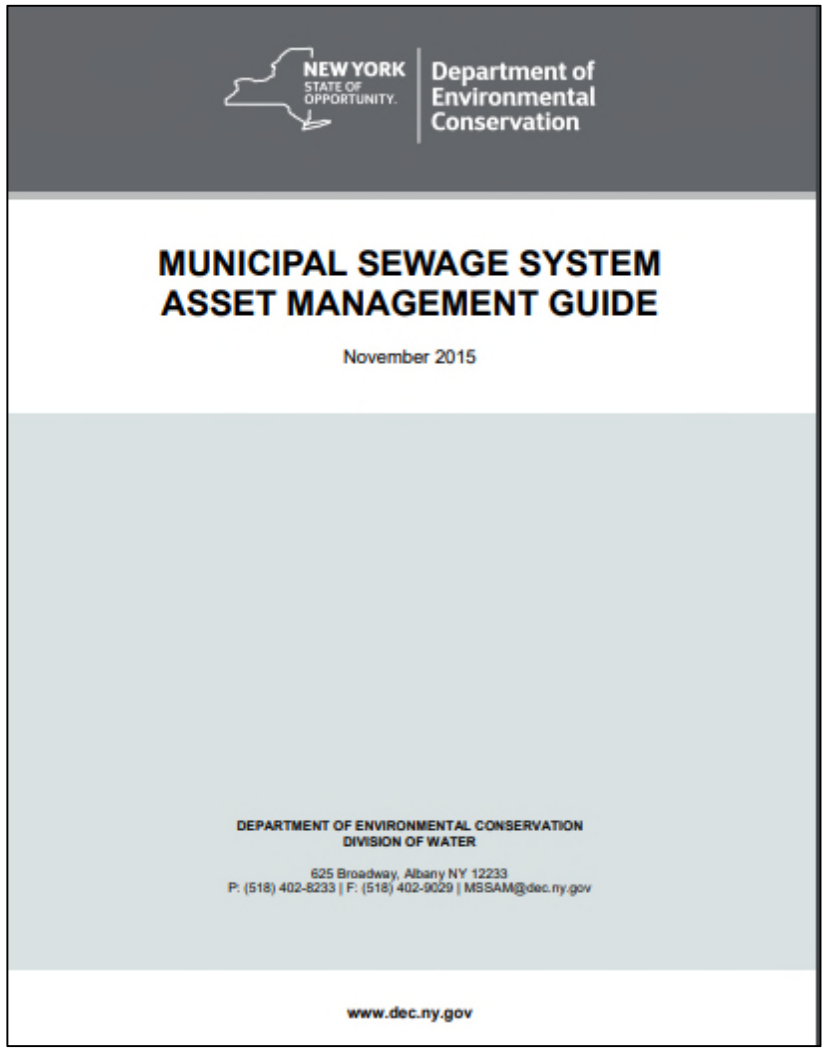
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF WATER

625 Broadway, Albany NY 12233
P: (518) 402-8233 | F: (518) 402-9029 | MSSAM@dec.ny.gov

Municipal sewage asset management plans incorporate…

- detailed asset inventories
- prioritization of critical assets for the capital improvement program
- financial planning to maintain system performance

In this guide, green infrastructure practices not mentioned …concept of recognizing green infrastructure is evolving



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www.dec.ny.gov

Assets that may be inventoried and assessed include the following:

Wastewater treatment plant assets may include the following:

- Primary, secondary, and tertiary treatment units
- Disinfection equipment
- Pumps
- Blowers
- Buildings
- Electronic components (including control systems)
- Equipment and materials (including gates and valves) which may be required for maintenance, health and safety, and upkeep

Sewage collection and conveyance system assets may include the following:

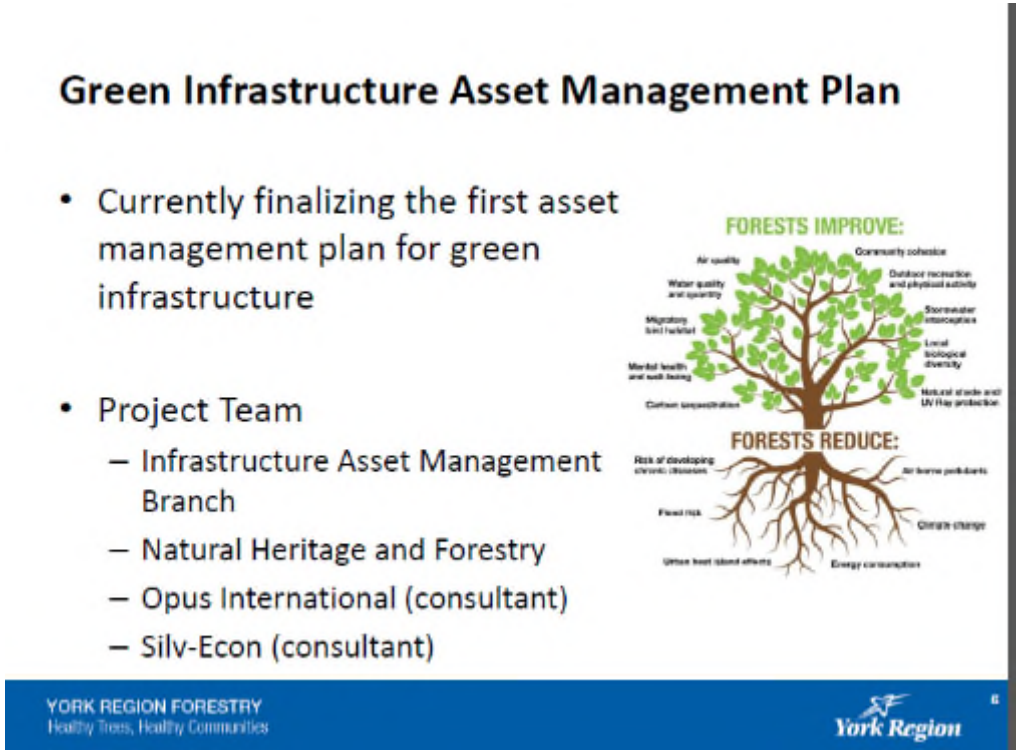
- Piping
- Pump stations
- Catch basins
- Manholes
- Portable pumps and generators
- Rodding and other collection system maintenance equipment

Such map(s) should include, at a minimum, the following:

- ☐ All sanitary and combined sewer lines and related manholes, catch basins, and CSO regulators
- ☐ Coding of pipe size and materials
- ☐ All known or suspected connections between the sanitary or combined sewer and storm drain systems
- ☐ All SPDES permitted outfalls, including the treatment plant outfall(s), combined sewer outfall(s), and remote treatment facility (RTF) outfall(s)
- ☐ All pump stations and force mains
- ☐ Wastewater treatment facilities, including all treatment processes
- ☐ All surface waters and wetlands within the service area
- ☐ 100 year and 500 year floodplains and aquifer recharge areas
- ☐ Disaster preparedness measures and equipment (e.g. floodwalls), and other major appurtenances such as siphons and air release valves
- ☐ Scale and north arrow

Another place

Regional Municipality of York, Ontario, Canada.
October 11, 2017



Stormwater Coalition of Albany County
Project Description (at the beginning…)

Project #2 GREEN INFRASTRUCTURE ASSETS-Identification/Characterization.

1. Map and characterize green infrastructure assets in Albany County, to include the identification of existing assets using multiple sources, such as aerial imagery, remote sensing data, tax parcel data and local knowledge.
2. Develop criteria which describes the degree and type of long term protection of these assets.

Repackaging of Project

- Identification Green Infrastructure (Use Land Cover Data)
- Prioritizing Green Infrastructure (Prioritization of Critical Assets)
- Maintaining System Performance (Will the GI Asset Be Here in 30 yrs?)

II. Identifying Green Infrastructure

Using Remote Sensing Technology

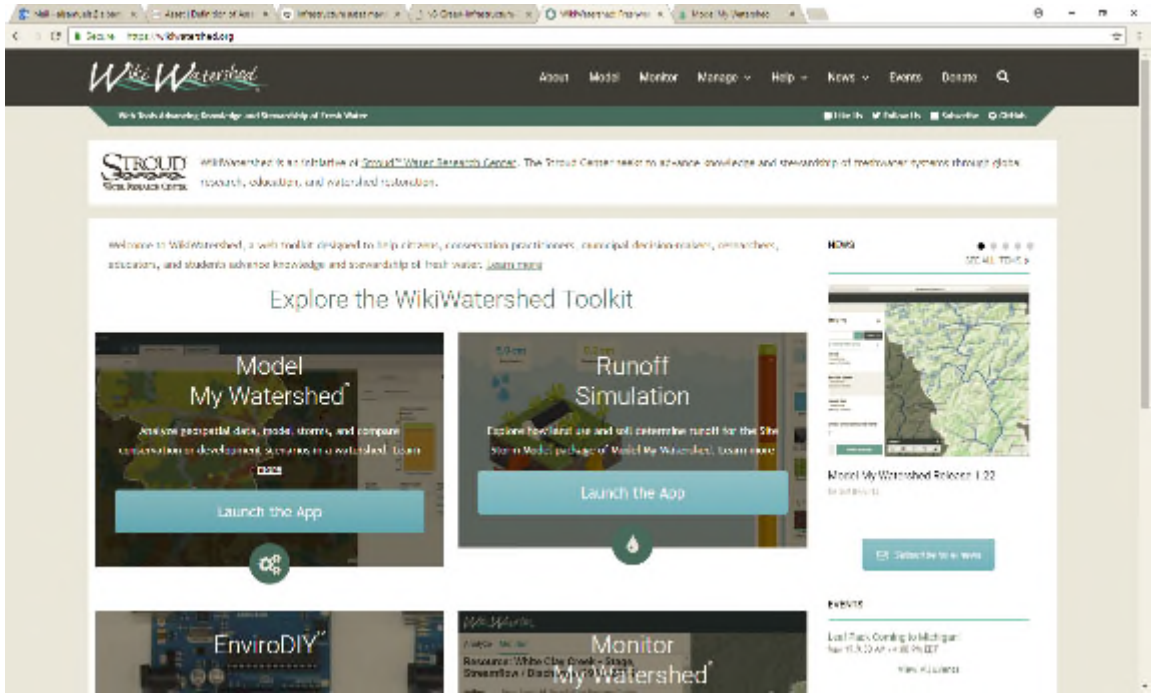
First…Get to Know Green Infrastructure

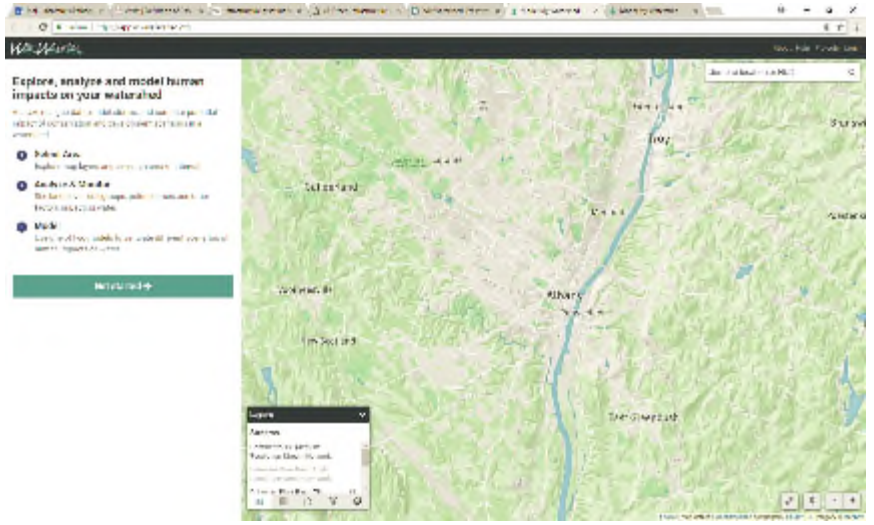
- **Readings**
  - Evaluating and Conserving Green Infrastructure Across the landscape- New York Guide by Karen Firehock- May 2013
  - NYS DEC Stormwater Design Manual – January 2015
  - Biodiversity Assessment Manual for the Hudson River Estuary Corridor by Hudsonia Ltd. 2001
- **Outdoors/ Training**
  - **Habitat and water resources assessment short course (October 21-23, 2017)**
  - Learned how to interpret soil, topography and aerial imagery and match it to a real place.
  - The focus was habitat protection, if we protect habitat we protect water

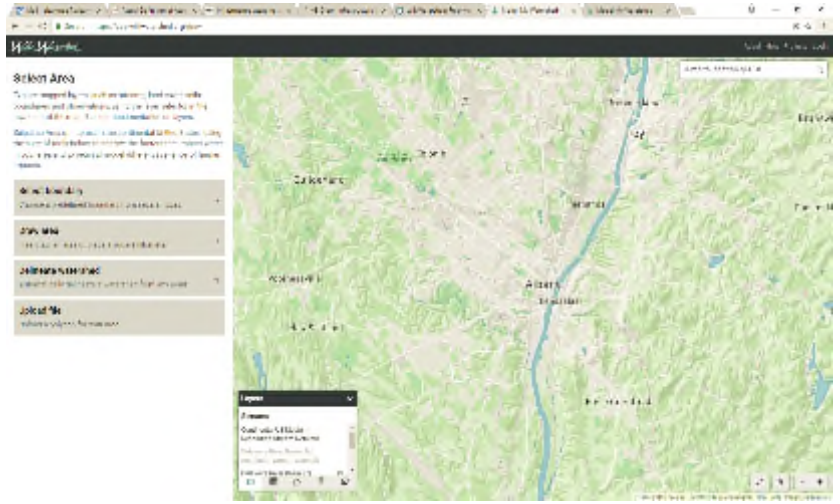
Researching The Imagery - Choices

Discovered Wiki Watershed

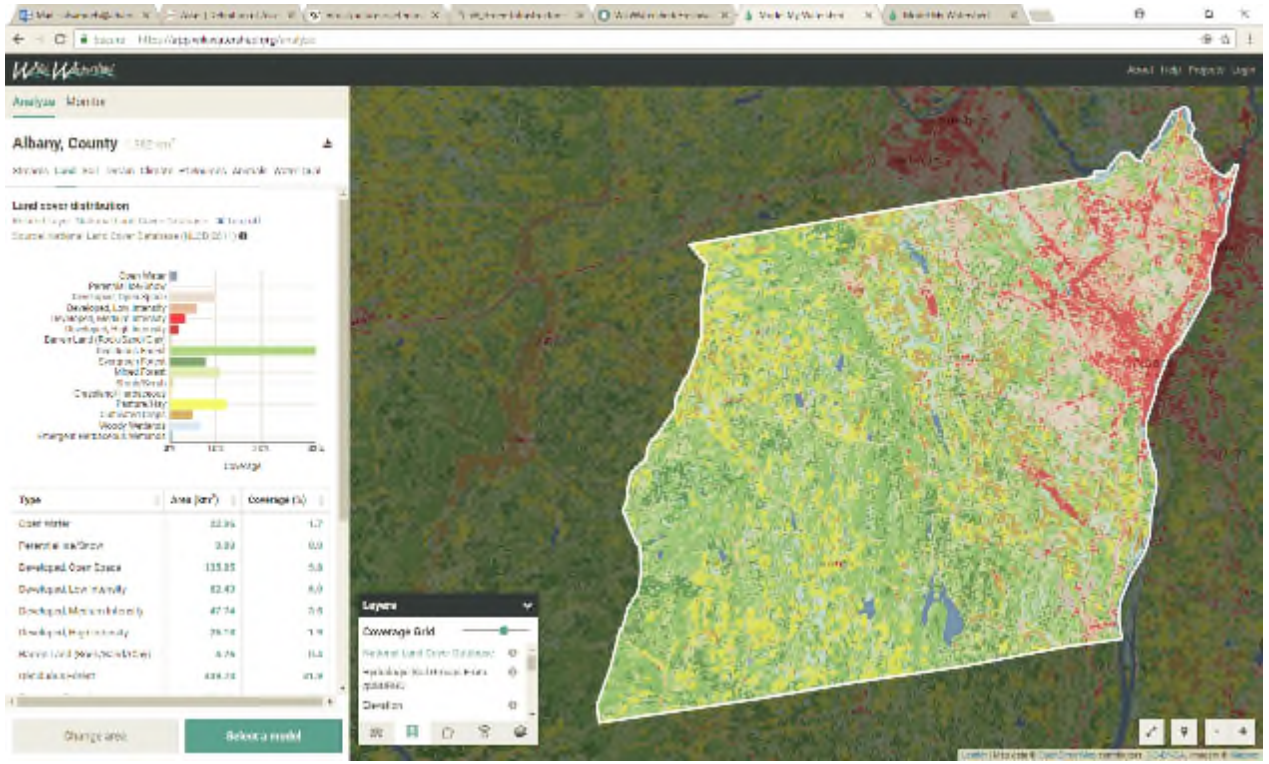
- https://app.wikiwatershed.org/

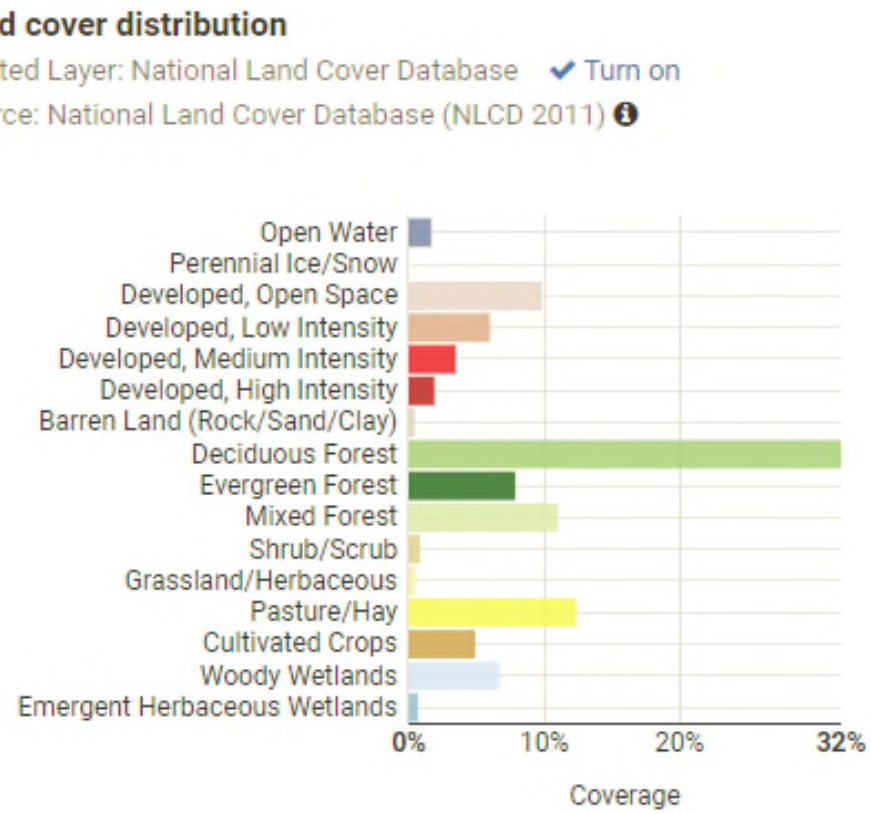






Results

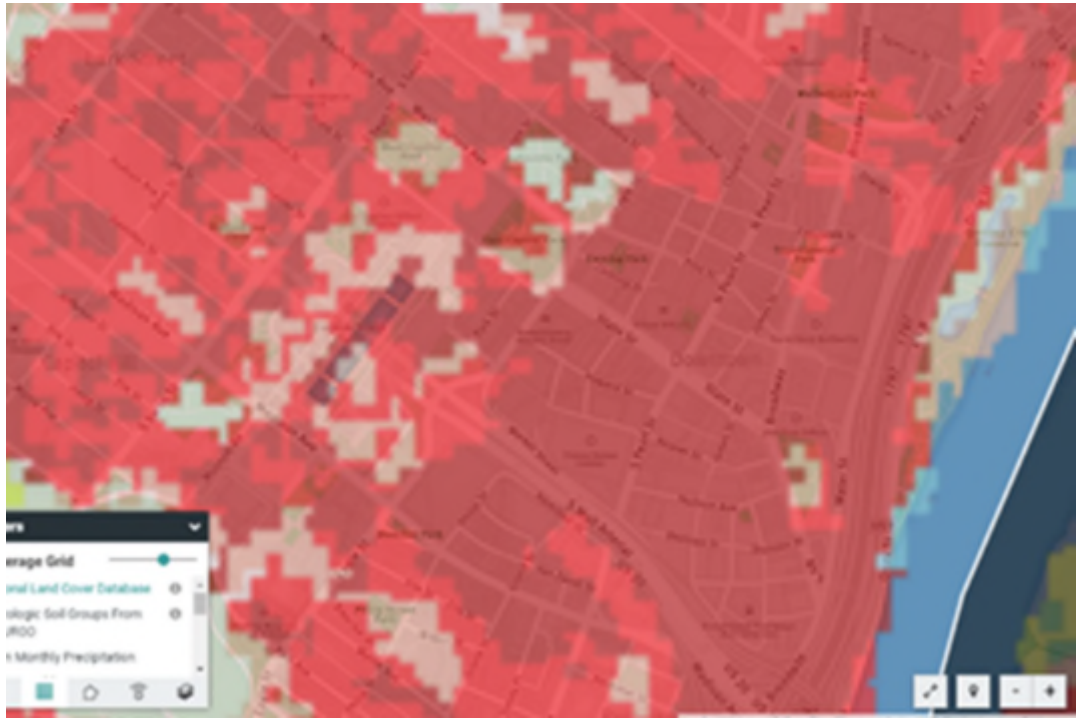




Land cover analysis automatically classified by WikiWatershed (using USGS data)

Why Not Use WikiWatershed?

- **30m resolution**
- 1 pixel represents 30 meters of the ground
  - There is potentially more that 1 land cover in 30 meter area therefore some land covers get lost
- Difficult to map urban forests

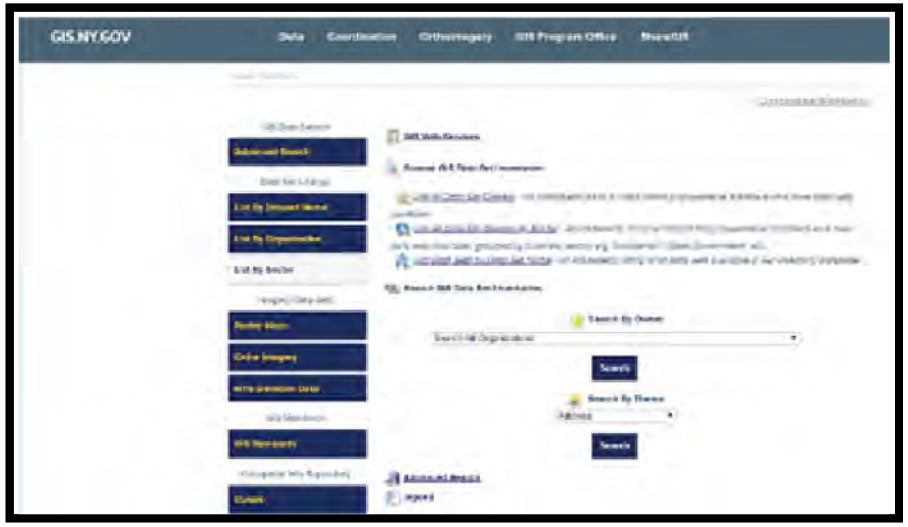


Decided to do it ourselves

Imagery Selection

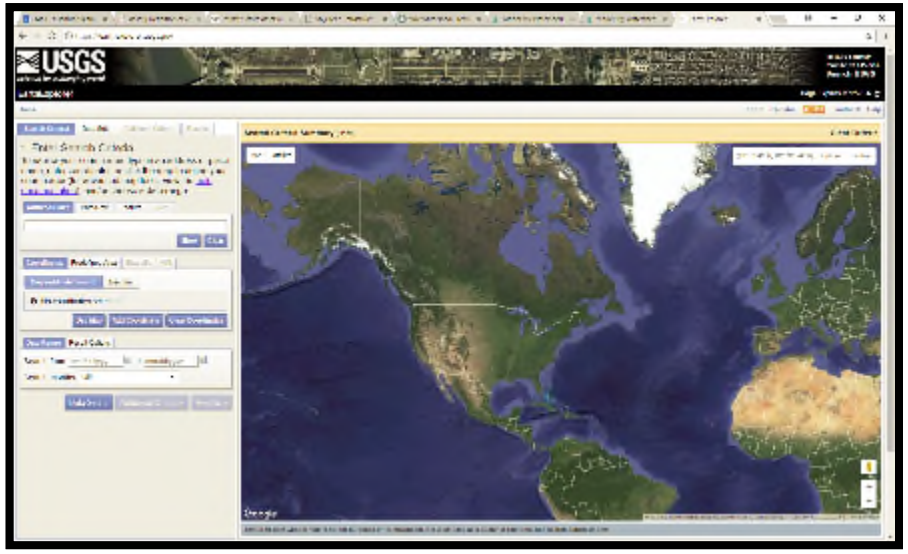
Imagery Options

1) NYS GIS Clearing house (2017 Aerial ortho-imagery at, 1-ft resolution)



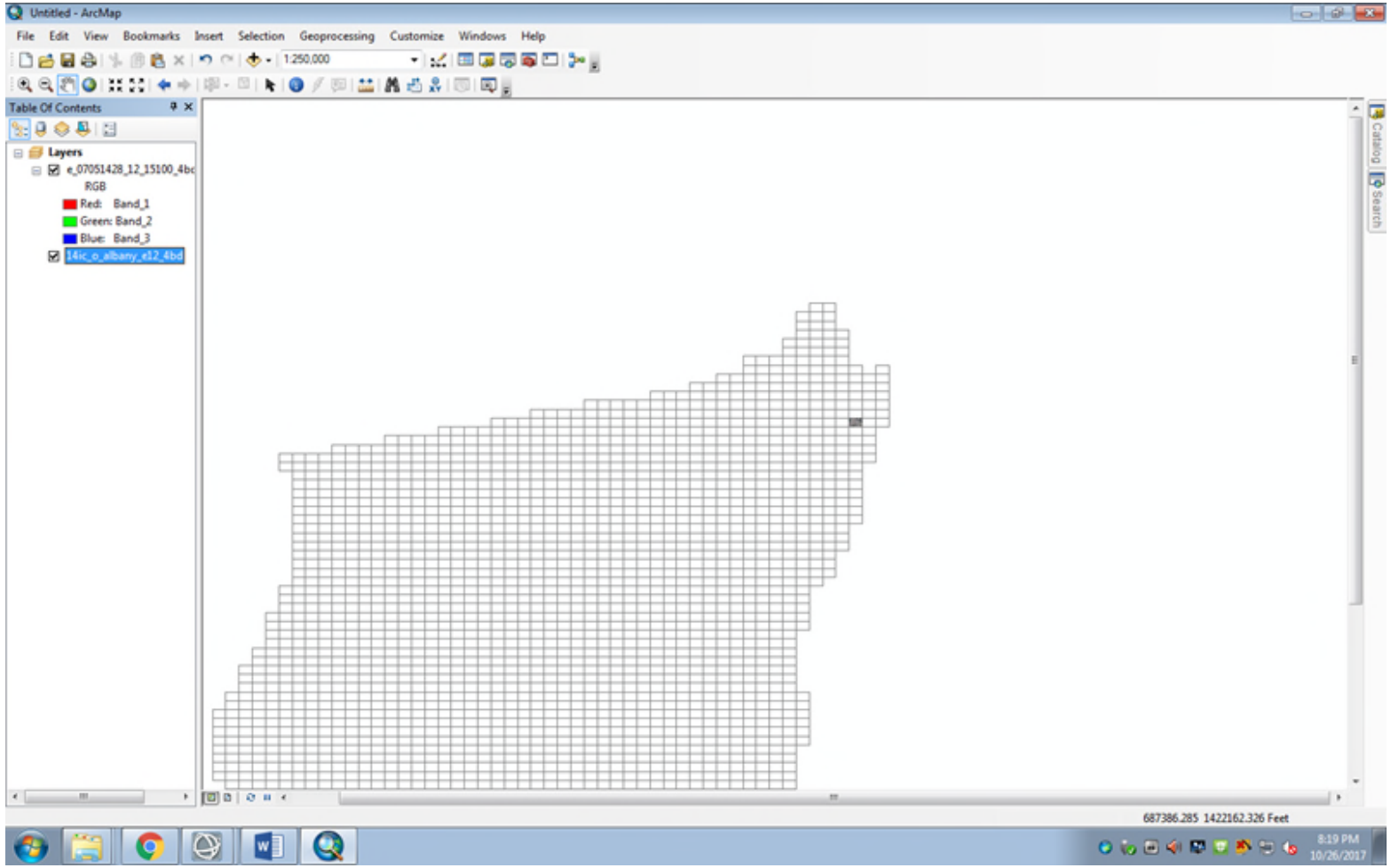
2) USGS

- **DOQ Images** (1994 data at, 1-meter resolution)
- **Landsat Imagery** (2012 data at, 1-meter resolution)



NYS GIS Clearing house (2017 data at, 1-ft resolution)

- Over 1000 tiles
- Each tile = over 8 hrs. processing
- Very High Resolution (1-ft ground resolution)



Landsat (2012 data at, 1-meter resolution)

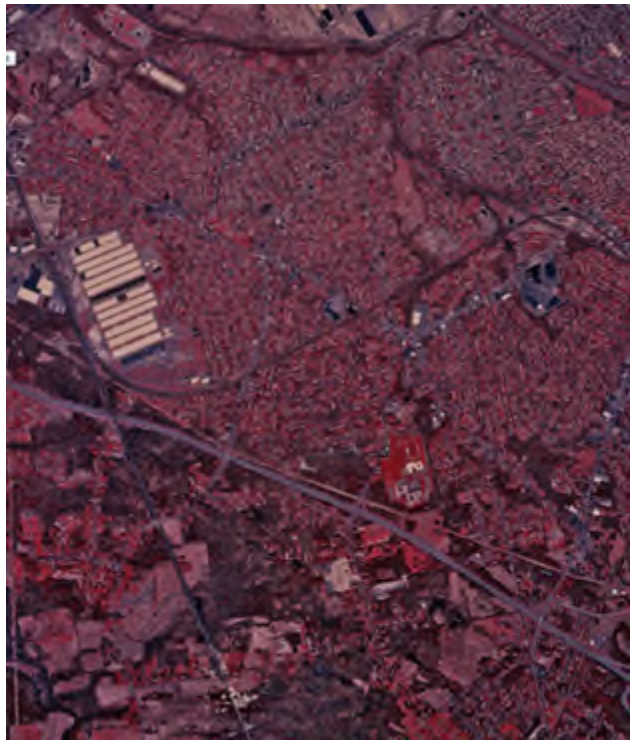
- Single tile covering study area
- Difficult to differentiate between land covers
- High resolution
- Details not visible for training area selection

USGS DOQ Images (1994 data at, 1-m resolution)

- High resolution
- 1994 data
- Land cover visible and easier to select training areas
- 4 band imagery (red, blue , green and CIR)
- 56 tiles covered Albany County

What we selected and why?

- **Imagery: DOQ Images**
  - High resolution
  - Easy to select training areas
  - 4 bands (CIR- Color infrared) necessary for remote sensing in Envi)



- DOQs in native format are cast to the Universal Transverse Mercator (UTM) projection and referenced to either the North American Datum (NAD) of 1927 (NAD27) or the NAD of 1983 (NAD83).

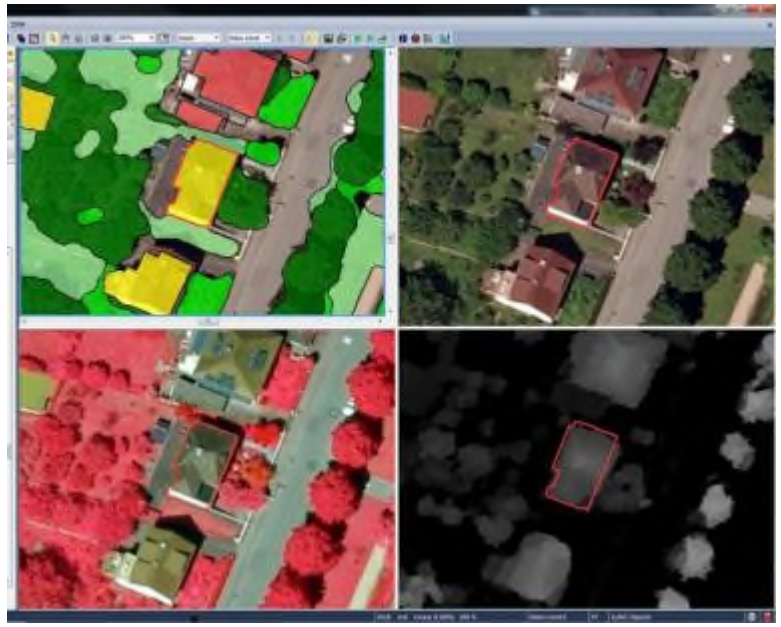
- The file size of a single color image file is generally between 140-150 megabytes.

We ordered and downloaded 56 tiles/images which covered the entire Albany County

Selecting the Software

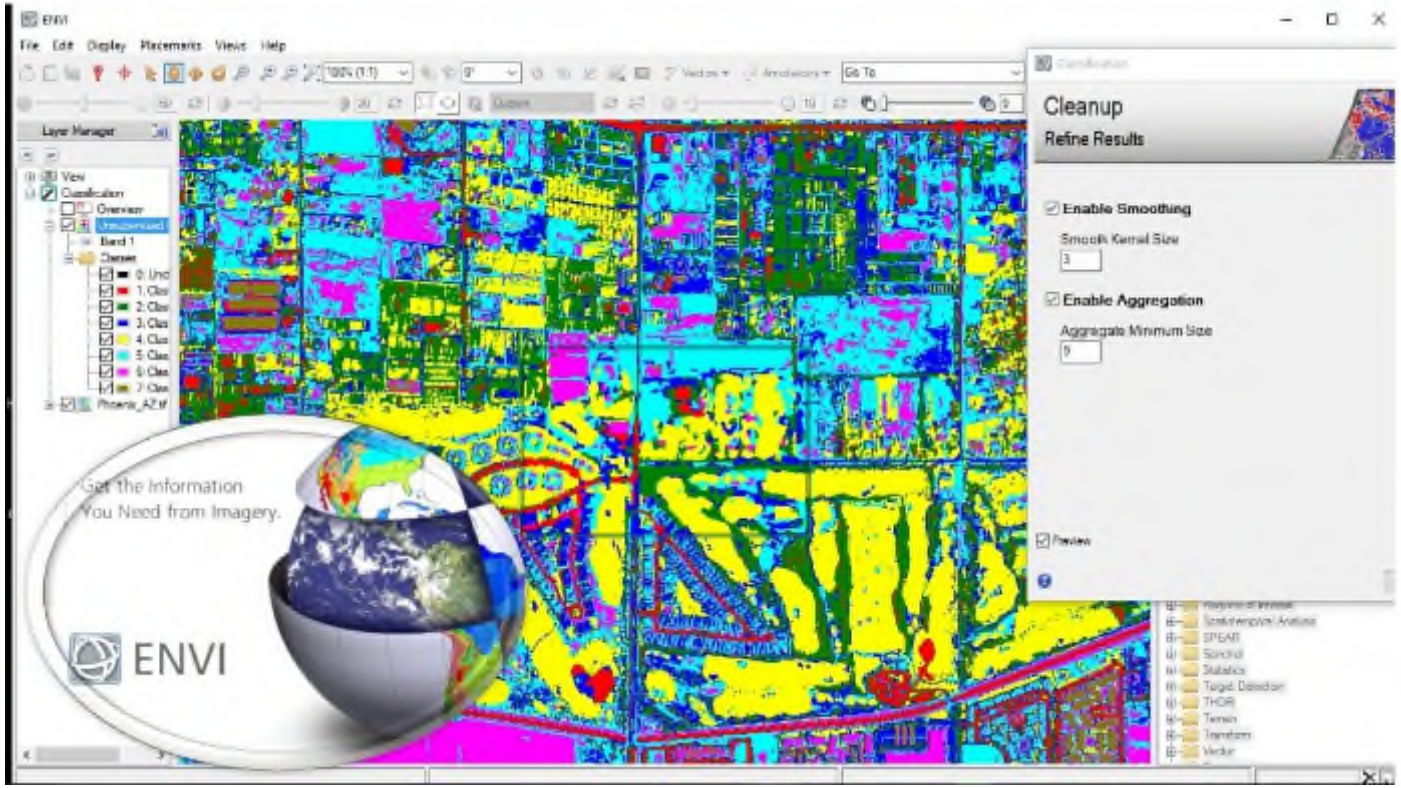
Software Options

- **Envi-**
  - "Environment for Visualizing Images" is a software application used to process and analyze geospatial imagery. It is commonly used by remote sensing professionals and image analysts.
- **eCognition-**
  - is the original object-based image analysis software. eCognition is the most advanced image analysis tool available today.



What we selected and why?

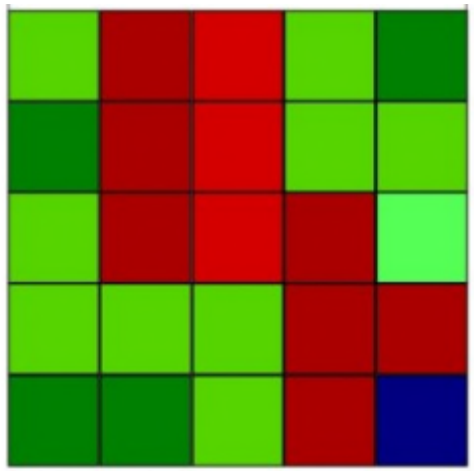
- **Software: Envi**
  - Knowledge of the software
  - eCognition training was not yet available and limited hardware for processing was available



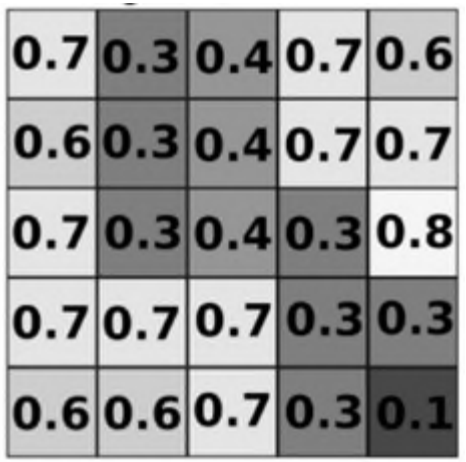
Software Processing Methods

What is software processing

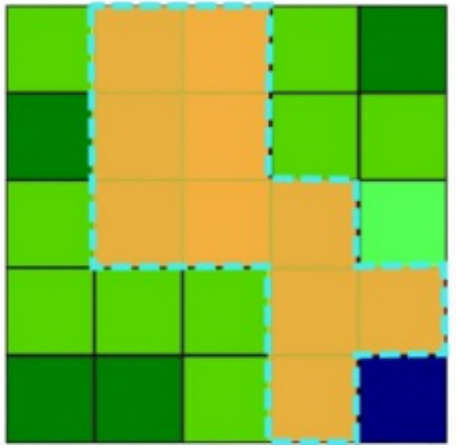
- pixels/areas of similar reflectance are grouped and each group is assigned a class.
- May be supervised or unsupervised



Image



Reflectance value



Grouping

Groups-assigned class (e.g. developed lands)

Source: http://semiautomaticclassificationmanual-v5.readthedocs.io/pt/latest/remote_sensing.html

Conducting The Analysis

Steps in ENVI

1. Unzipped and extracted 56 files to get them ready to used in ENVI

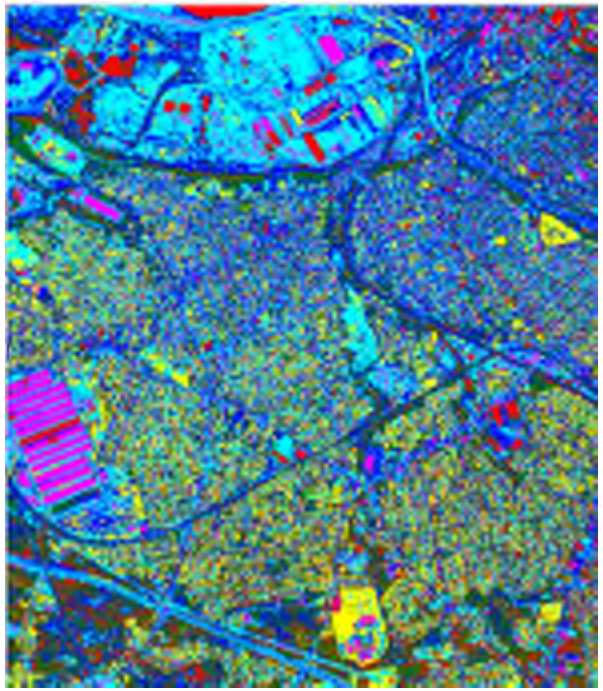
2. Used the Annotation tool to select training areas (Each class has 20 training areas)

3. ‘Preview” to check the result

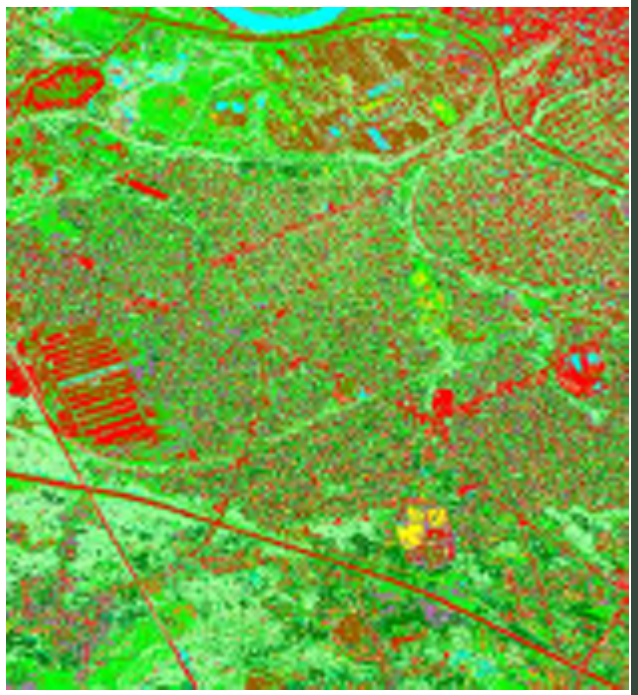
4. Changed colors and names

5. Export Classification Image and gave Envi 5 to 10 mins to run and save.

4 weeks of work



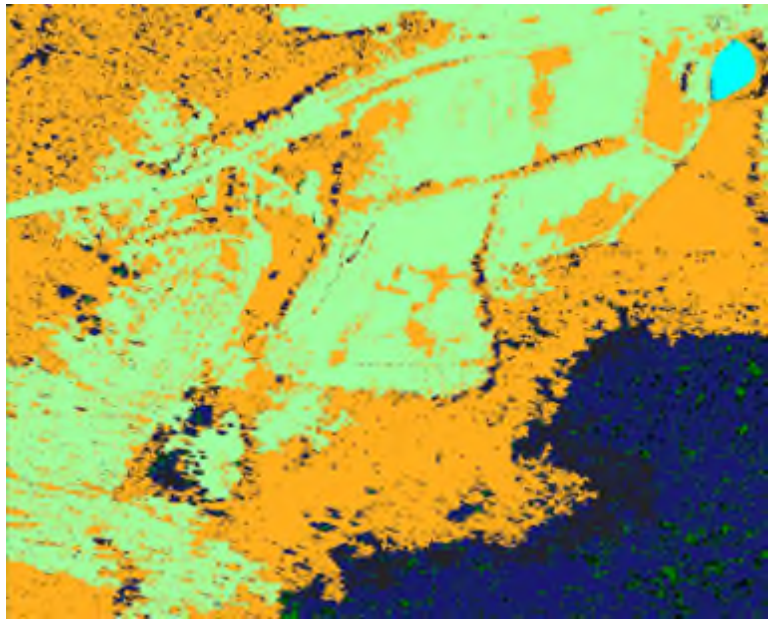
Preview



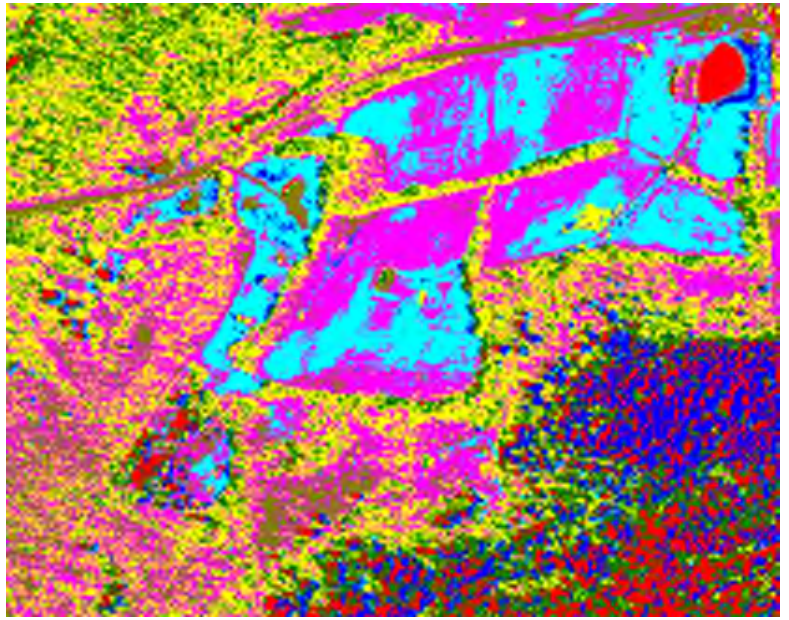
Assigning new colors

Unsupervised Classification

- This is where the outcomes (groupings of pixels with common characteristics) are based on the software analysis of an image without the user providing sample classes.
- We explored using 6, 12 and 24 classes



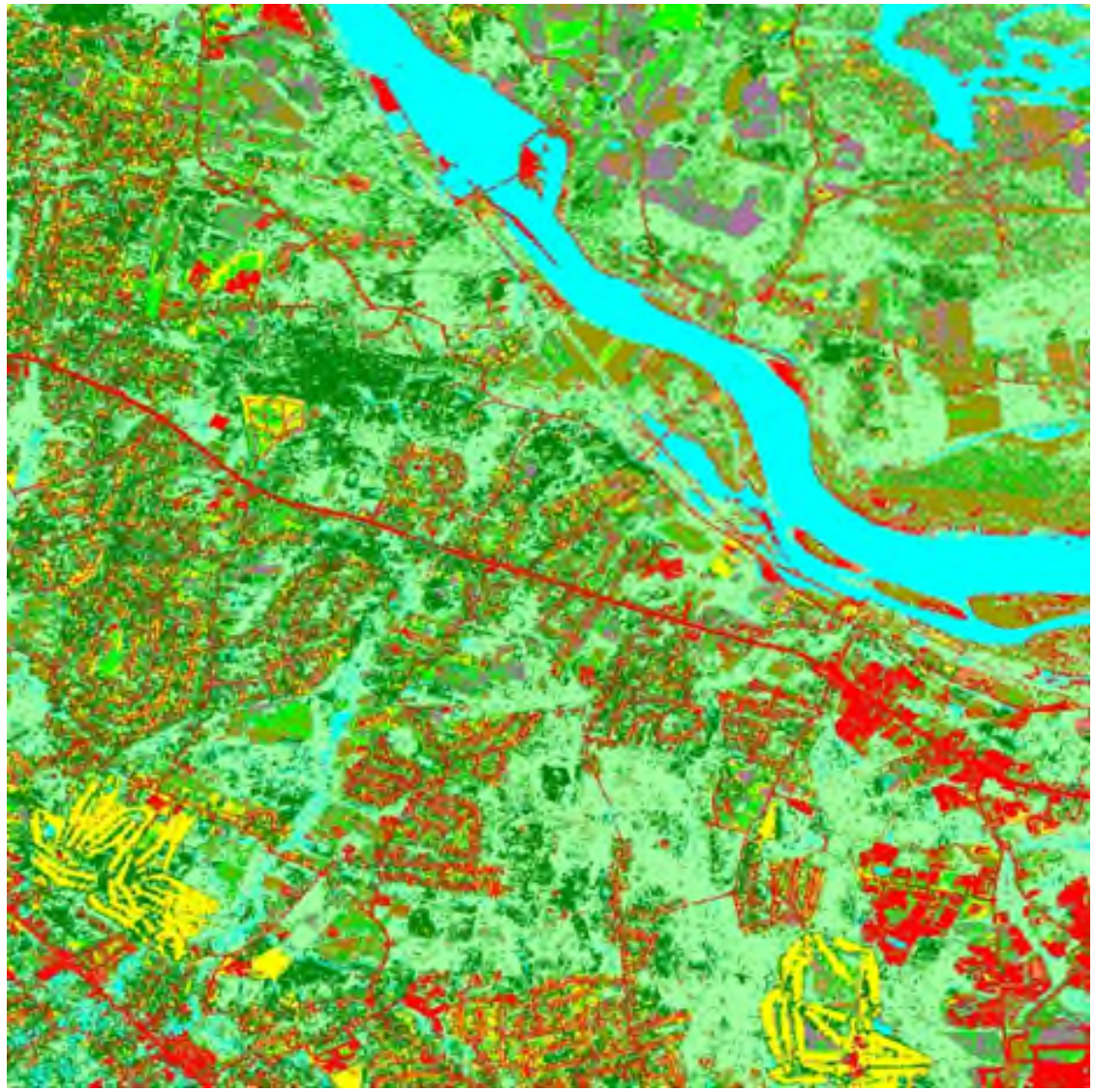
Using 6 Classes



Using 24 classes

Supervised Classification

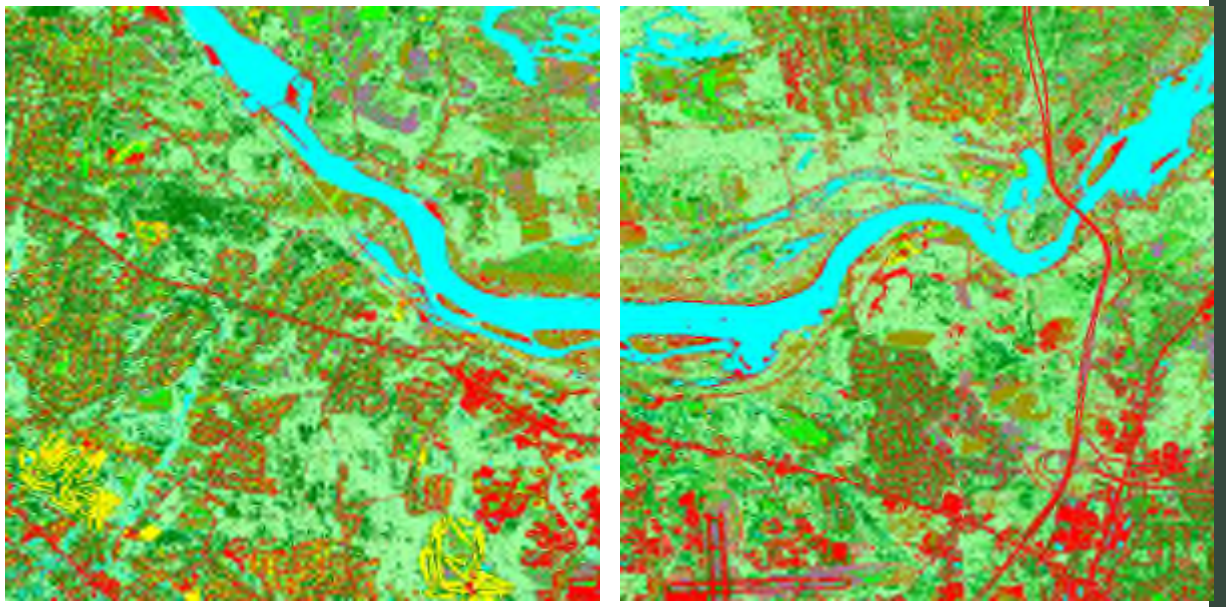
- Supervised classification- is when the image processing software is guided by the user to specify the land cover classes of interest.
  - We explored using 6 and 12 classes



Using 12 classes

The Decision- Supervised Classification using 12 Classes

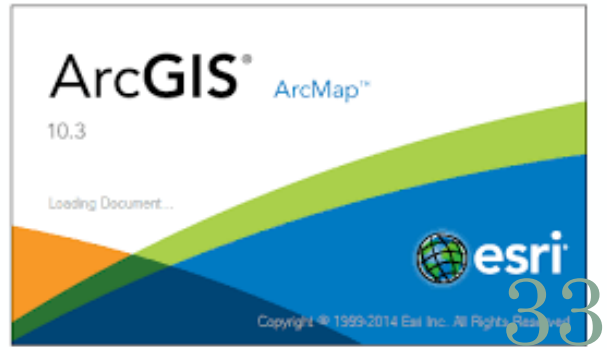
- 12 Land Cover classes:
  1. Evergreen Forest
  2. Mixed Forest
  3. Deciduous Forest
  4. Grassland and shrub
  5. Cultivated Crops
  6. Wetlands
  7. Open Water
  8. Barren Land (Rock/Sand/Clay)
  9. Developed- Open Space (golf courses, parks, and cemeteries)
  10. Developed- Low Intensity
  11. Developed-Medium Intensity
  12. Developed-High Intensity



National Land Cover Database 2011 (NLCD2011)

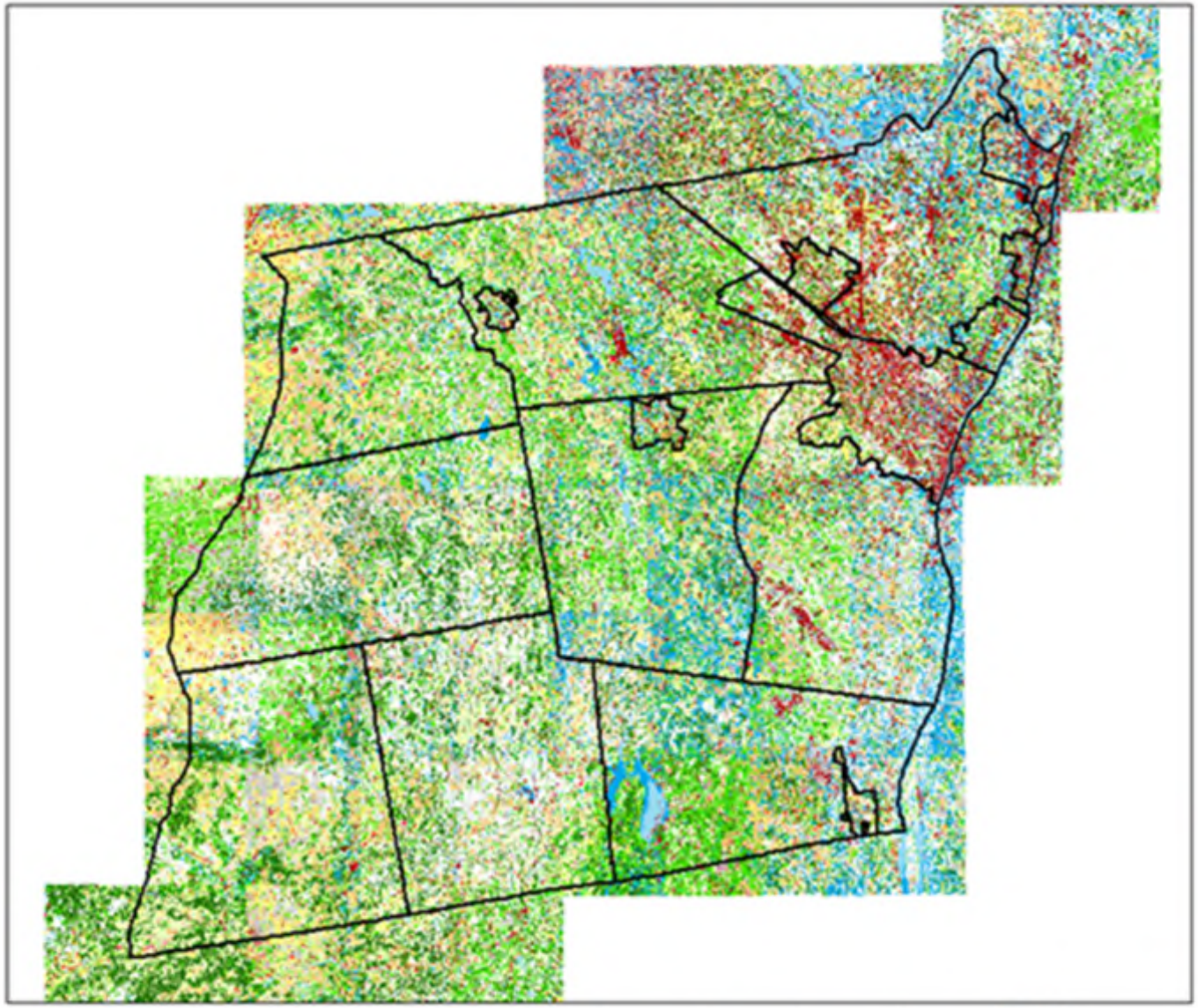
Converting tiff.files to shapefiles

- ENVI produced new tiff.files however, the files created were not grouped according to classes over the entire area but instead to classes on each mosaic or single tiff.file.
- **Merged all tiles**
  - These files were imported into ArcMap then merged using the geoprocessing tool. After they were merged the entire dataset became a single layer containing all 12 classes.
- **Expanding attribute table to export each class/ land cover**
  - This single layer was then broken down into 12 layers based on their respective classes. The produced 12 individual layers that are compatible with other G.I.S Datasets.



Drumroll Please!!

Land Cover Map of Albany County – 1994 DOQ Imagery



Did the land cover classification match local landscapes?

2017 Aerial Imagery

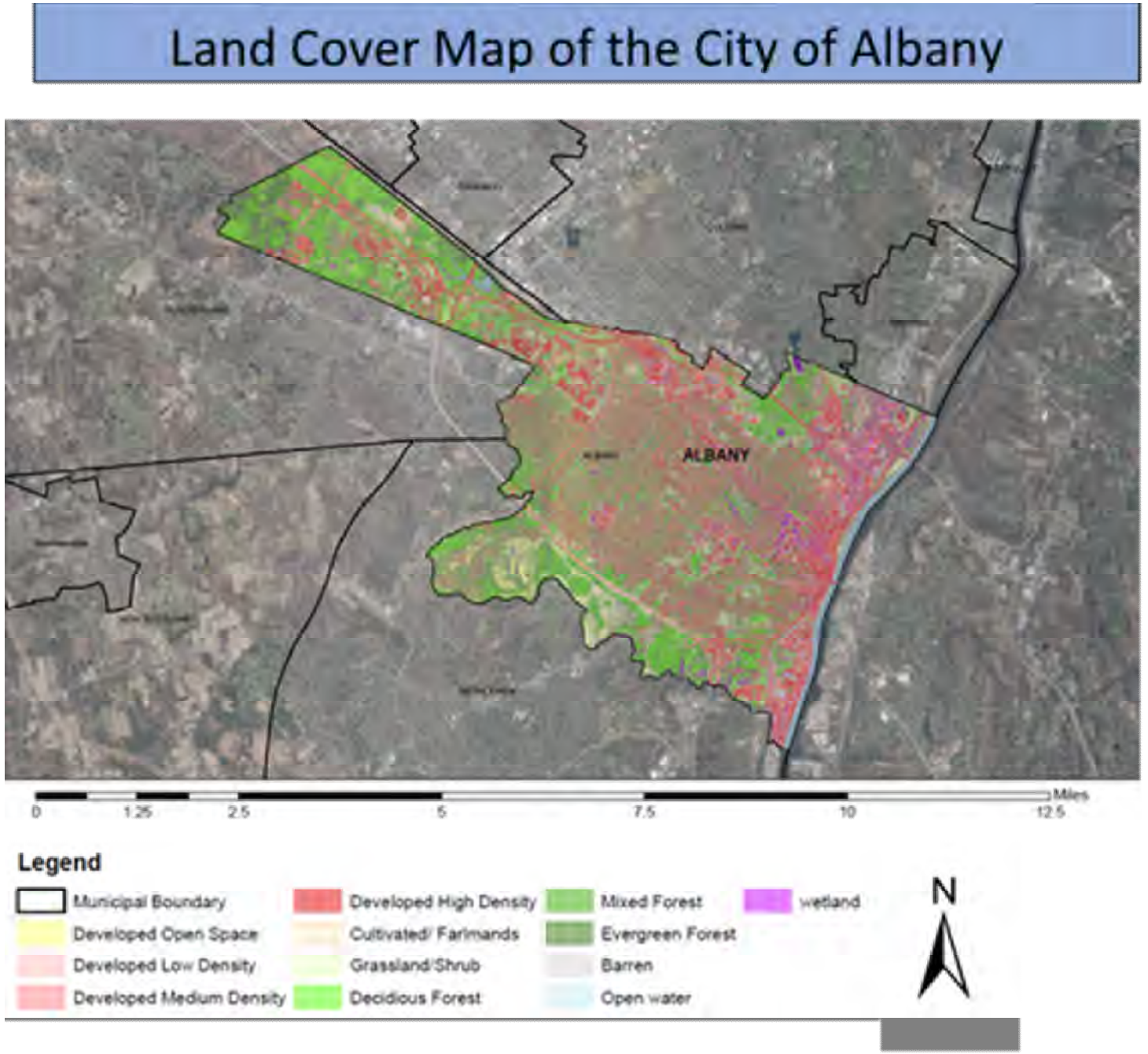
DOQ Supervised Classification of 1994 Imagery

(Lark street to Swan Street, along Livingston Avenue)- The City of Albany

If we had used WikiWatershed !!!!

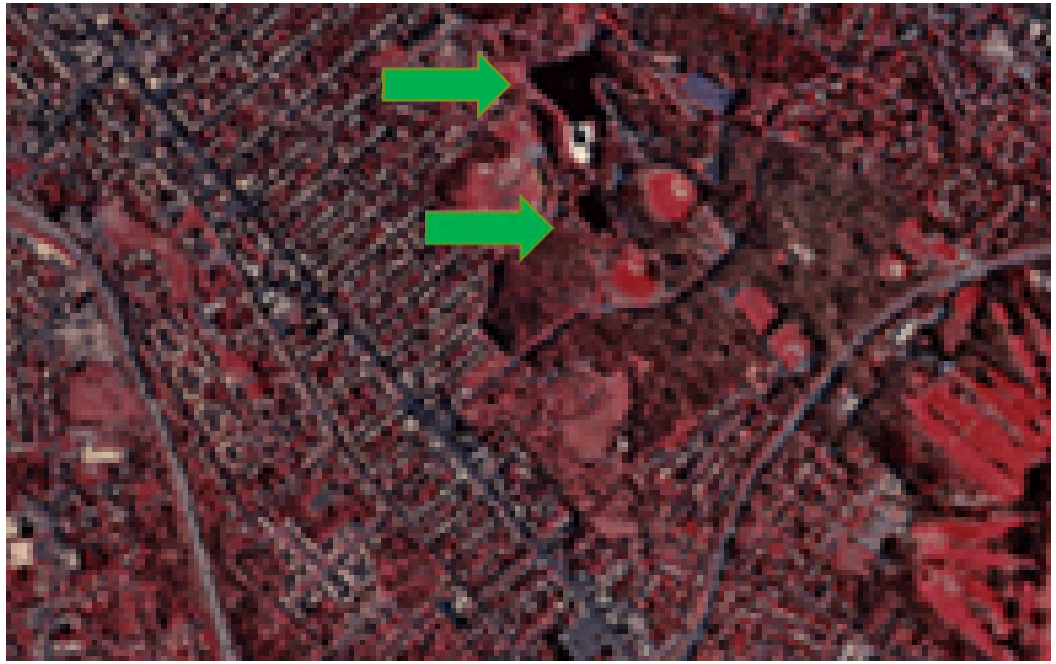
Land Cover- the City of Albany

1994 DOQ Imagery



Limitations

1. Training Area Selection

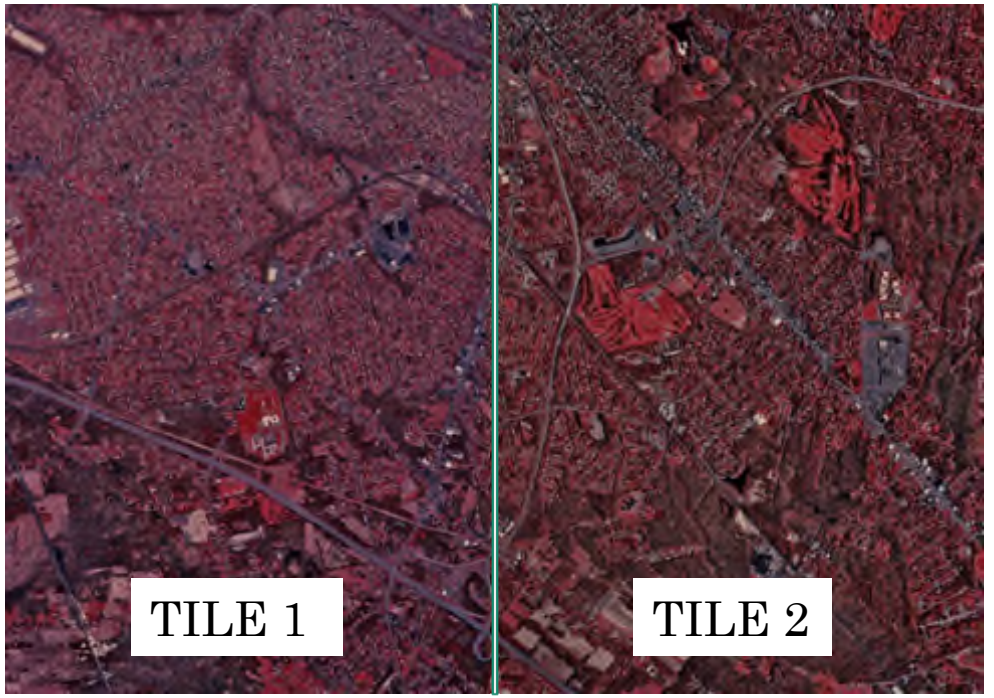


Wetland or Water?

Grassland or Farmland?

2. Color Difference

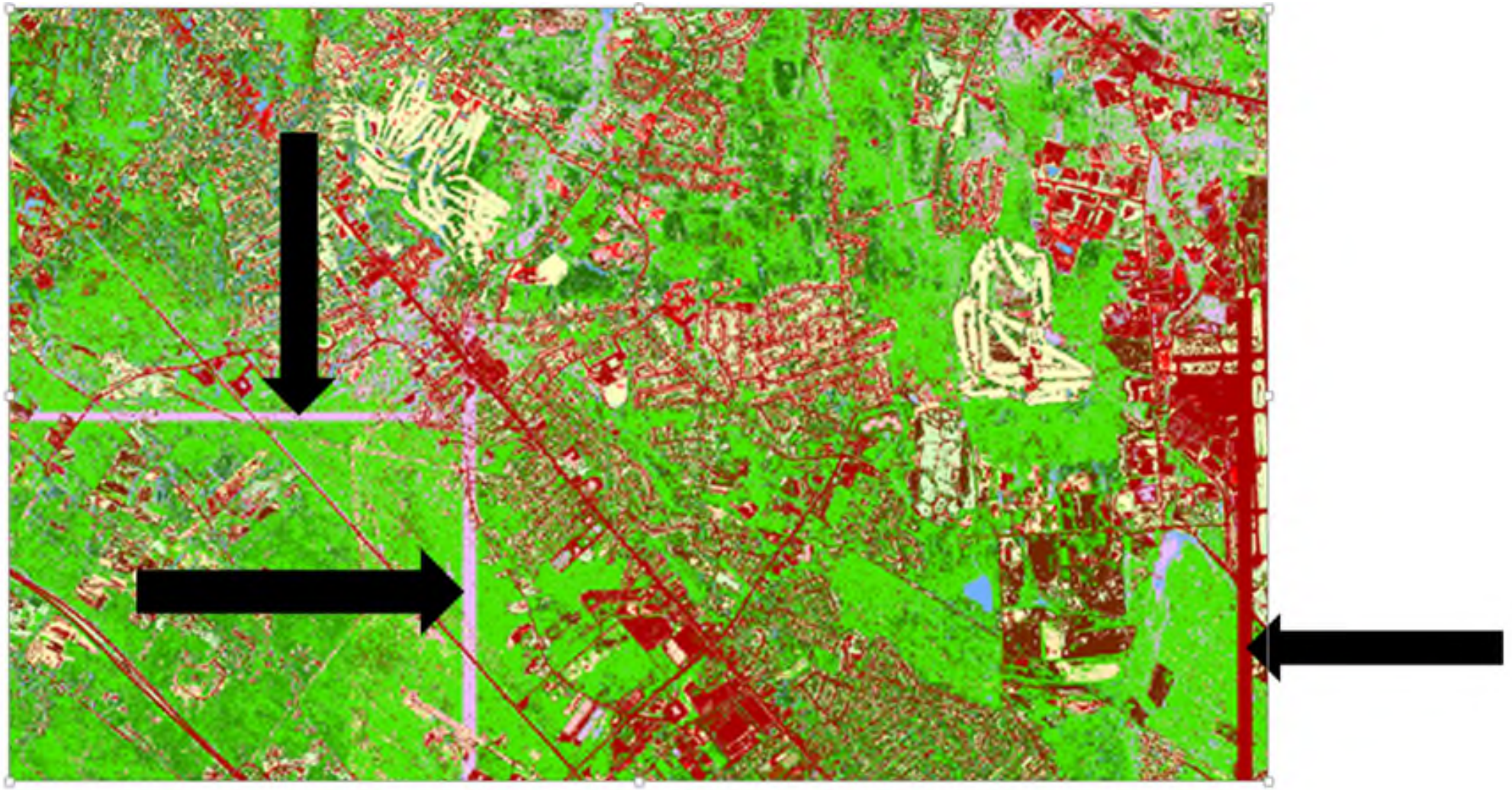
- There were color difference between some tiles because the original DOQ images had subtle color/reflectance differences since they were captured at different times of a day.



TILES – After Supervised Classification

3. Overlapping

Why are these distinct lines here?



Error Analysis

How well did we distinguish one land cover from another?

- **We conducted an Error Matrix on the classification data**

  - (Jeffries-Matusita, Transformed Divergence Method)
  - This is a measurement of how distinctly different one classification is from another this method computes the spectral separability between selected classes
  - Values range from 0-2
  - Values =/>1 is excellent classification
  - Values <1 it is recommended that these classes are grouped
  -

```
farmlands and evergreen forest - 1.89945724
wetlands and evergreen forest - 1.90632050
water and developed low intensity - 1.90674907
barren and mixed forest - 1.91984291
barren and evergreen forest - 1.94537805
wetlands and grassland - 1.95132915
developed high intensity and mixed forest - 1.95258836
wetlands and decidious forest - 1.95563159
developed medium intensity and developed open space - 1.95837754
barren and decidious forest - 1.96658714
developed high intensity and barren - 1.96742200
developed high intensity and decidious forest - 1.96877005
wetlands and developed high intensity - 1.96976038
developed high intensity and evergreen forest - 1.97356487
developed high intensity and grassland - 1.97779922
developed open space and evergreen forest - 1.98173061
water and developed high intensity - 1.99009377
developed open space and barren - 1.99431812
developed open space and mixed forest - 1.99517782
developed high intensity and farmlands - 1.99647713
water and barren - 1.99827950
wetlands and barren - 1.99876038
grassland and developed open space - 1.99899023
water and farmlands - 1.99979934
developed open space and decidious forest - 1.99997462
wetlands and farmlands - 1.99997720
developed open space and farmlands - 1.99999408
water and developed open space - 1.99999408
developed high intensity and developed open space - 1.99999929
wetlands and developed open space - 1.99999987
```

Least and most Pair separation

Most Pair Separation
Over 1.9 excellent values

```
Pair Separation (least to most);

developed medium intensity and developed low intensity - 0.10949072
evergreen forest and mixed forest - 0.29492134
grassland and mixed forest - 0.68446737
decidious forest and mixed forest - 0.75583887
decidious forest and evergreen forest - 0.96292874
grassland and evergreen forest - 0.97463137
grassland and farmlands - 0.97752200
developed medium intensity and mixed forest - 1.05704032
```

Least Pair separation
Under 1.0 consider grouping

Grouping based on Error Matrix Report

1

Forest (Mixed, evergreen and deciduous)and Grassland and farmland

2

Developed (medium and low intensity)

III. Prioritizing green infrastructure

Ranking Survey

Prioritization 1

Assumptions

1. Not all land cover categories are equally effective at protecting water quality – some are more valuable as a green infrastructure asset than others

e.g. Some have more vegetation than others; some have more impervious cover than others

2. Land Cover classes can be ranked as more or less of a green infrastructure asset

3. Ask knowledgeable stormwater practitioners and environmental students how they would rank land cover

Ranking Land Cover Types – Opinion?

			1 = High Value GI Asset 12= Low Value GI Asset (Rank the 12 NLCD categories)			OTHER NATURAL FEATURES	
			GI Rank'g You	GI Rank'g Others	GI Rank'g Others	ADD green infrastructure value	DECREASE green infrastructure value
#	NLCD* Themes 'Categories'	*Examples*					
1	Open Waters						
2	Developed - Open Space	*Golf courses, parks, cemeteries*					
3	Developed - Low Intensity (20 to 49% impervious)	*Large lot residential development*					
4	Developed - Medium Intensity (50 to 79% impervious)	*Older section of town on smaller lots; higher density in cluster subdivision*					
5	Developed - High Intensity (80 to 100% impervious)	*Retail, commercial strip, urban residential, parking lots, streets*					
6	Barren Land	*Rock/Sand/Clay*					
7	Deciduous Forest						
8	Evergreen Forest						
9	Mixed Forest						
10	Grassland and shrub						
11	Cultivated Crops						
12	Wetlands						

- **18 Respondents – In the field of Environmental Management**

* National Land Cover Dataset

Land Cover	Ranking most important to least important 1 to 12																							
	1		2		3		4		5		6		7		8		9		10		11		12	
	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%	# OF RESP.	%
Open water	1.0	7.7	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	**3.0**	**23.1**	1.0	7.7	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	**6.0**	**46.2**
Developed Open Space	0.0	0.0	2.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0	2.0	15.4	**4.0**	**30.8**	2.0	15.4	**3.0**	**23.1**	0.0	0.0	0.0	0.0	0.0	0.0
Developed Low intensity	0.0	0.0	0.0	0.0	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.7	1.0	7.7	**5.0**	**38.5**	**5.0**	**38.5**	0.0	0.0	0.0	0.0
Developed Med. intensity	0.0	0.0	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.7	**5.0**	**38.5**	**6.0**	**46.2**	0.0	0.0
Developed High Intensity	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.7	**5.0**	**38.5**	**6.0**	**46.2**
Barren	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.7	0.0	0.0	0.0	0.0	**2.0**	**15.4**	**4.0**	**30.8**	**2.0**	**15.4**	**2.0**	**15.4**	1.0	7.7	1.0	7.7
Decidous Forest	1.0	7.7	1.0	7.7	**3.0**	**23.1**	**3.0**	**23.1**	**4.0**	**30.8**	0.0	0.0	0.0	0.0	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	2.0	15.4	**4.0**	**30.8**	**3.0**	**23.1**	1.0	7.7	1.0	7.7	0.0	0.0	2.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Forest	2.0	15.4	2.0	15.4	**3.0**	**23.1**	**4.0**	**30.8**	0.0	0.0	2.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grassland/ shrub	0.0	0.0	1.0	7.7	1.0	7.7	1.0	7.7	**7.0**	**53.8**	**2.0**	**15.4**	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cultivated Crops	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.7	0.0	0.0	**4.0**	**30.8**	2.0	15.4	**4.0**	**30.8**	2.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0
wetland	**6.0**	**46.2**	1.0	7.7	**2.0**	**15.4**	**2.0**	**15.4**	1.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.7	0.0	0.0
sample size	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0	13.0	100.0

** Figures in bold represent the rankings that are most frequent for their respective land cover

Scenarios	A			B			C			
Land Cover	%	NO. OF RESPONDENTS	Rankings	%	NO. OF RESPONDENTS	Rankings	NO. OF RESPODENTS	%		Rankings
Open water	23.1	6		23.1	6		46.2	12	TRUE	
Developed Open Space	23.1	9		23.1	9		30.8	7		
Developed Low intensity	38.5	10		38.5	10		38.5	9		
Developed Med. intensity	46.2	11		46.2	11		38.5	10		
Developed High Intensity	46.2	12		46.2	12		38.5	11		
Barren	15.4	7		15.4	7		30.8	8	TRUE	
Decidous Forest	23.1	3	Ranked 1, 2, or 3?	23.1	3		23.1	3		
Evergreen Forest	30.8	2	Ranked 2 (30.8% highest % in Rank 2)	30.8	2		30.8	2	TRUE	
Mixed Forest	30.8	4		30.8	4		30.8	4	TRUE	
Grassland/ shrub	53.8	5		53.8	5		53.8	5		
Cultivated Crops	30.8	8		30.8	8		30.8	6		
wetland	46.2	1	Ranked 1 (46% highest % in Rank 1)	46.2	1	Ranked 1	46.2	1	TRUE	Ranked 1

A Scenario- most favorable as it takes into consideration NLCD and also breaks down urban into two groups, instead of a single group as seen on NLCD
B Scenario- corresponds with National land Cover Databas hybrid classification 1992/2001 (https://www.mrlc.gov/nlcdrlc_leg.php)
C scenario is grouping the land covers in categories based on vegatative cover

TRUE : THIS REPRESENTS GROUPINGS THAT ARE CONSISTENT ACROSS SCENARIOS

CONCLUSION: Some patterns, but very small sample size. Groupings around forests and vegetation showed higher ranking – better at protecting water quality & more important green infrastructure asset. Medium and high density land cover – not as effective in protecting water quality. Confusing, which is better open space or wetlands? Comments: need to consider how large a forest; soils, slopes, etc. Not scientific!

Grouping & Prioritizing Again

Prioritization 2

Decided to reduce the number of land cover categories from 12 to 5 by grouping

-Concept supported by Error Matrix Report

-Fewer categories – FASTER computer processing

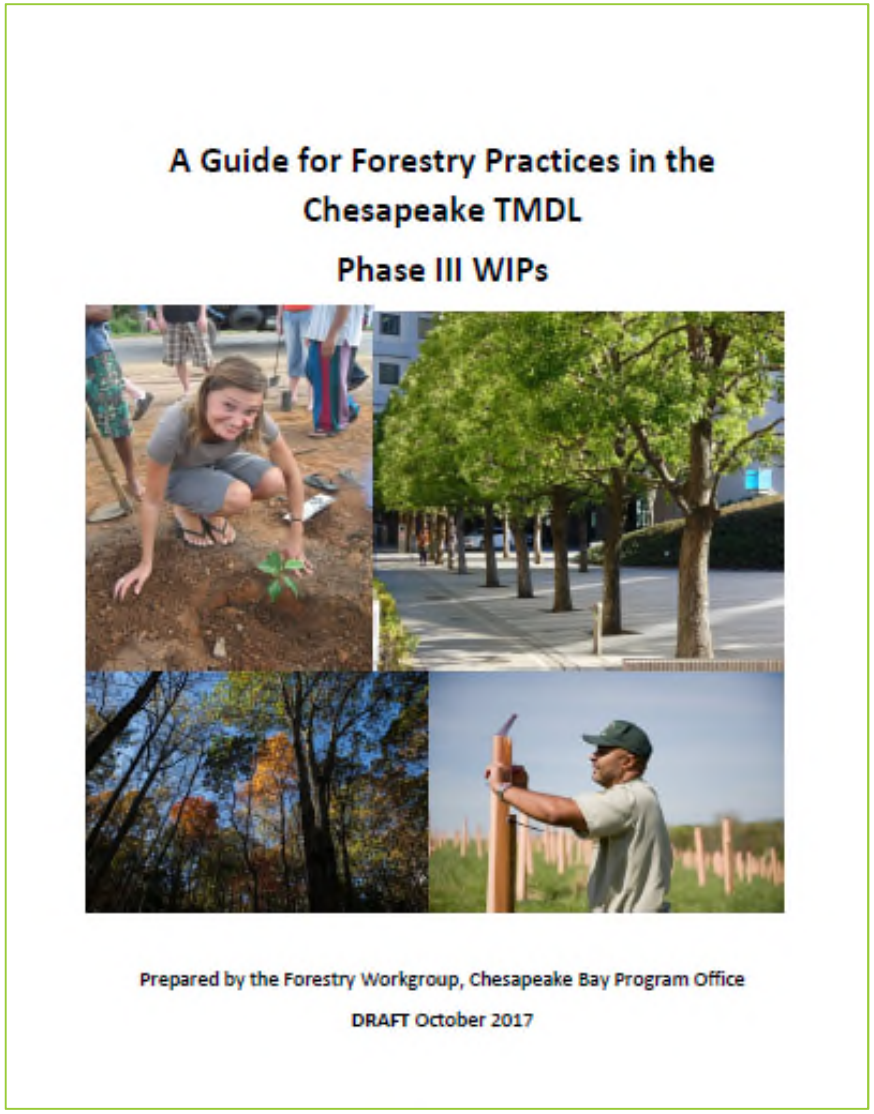
Five Categories

- **Forest** (deciduous, mixed and evergreen forest)
- **Developed** (developed low, medium and high intensity)
- **Barren** (bare soil including mining areas)
- **Water and wetlands**
- **Other vegetation** (developed open space, farmlands, grassland and shrub)

Which of these land cover types most effective at protecting water quality:

- Forests
- Developed
- Barren
- Water and Wetlands
- Other Vegetation

Considered Curve Number tables – used to estimate amount of runoff based on type of vegetation and soils. Too complicated! Much research – no time!



DRAFT OCTOBER, 2017
WIPs "Watershed Implementation Plans

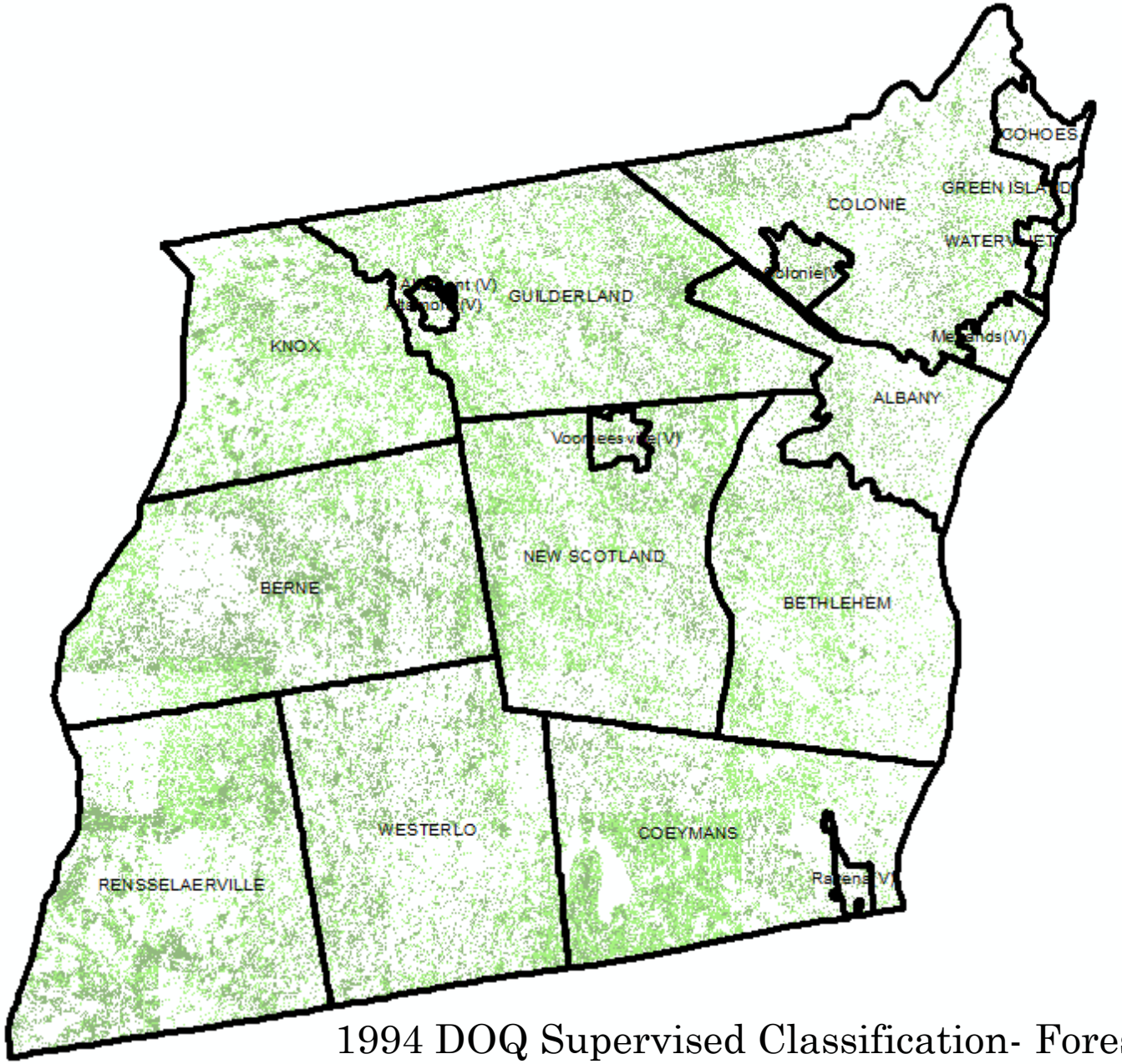
"Compared to developed areas and farm land, forests are a less intensive land use and <u>well known to be the best for protecting water quality</u> (EPA 2017)."

- By absorbing and processing water from rainfall and floodplains, forests reduce erosion, excess nutrients and sediments, other pollutants, and flooding risks."

Forest Land Cover Map for Albany County

Includes: mixed, evergreen, and deciduous forest all grouped

Polygons range in size – smallest "forest" 10 sq. meters



1994 DOQ Supervised Classification- Forests

Forests: Where? Prioritizing Again

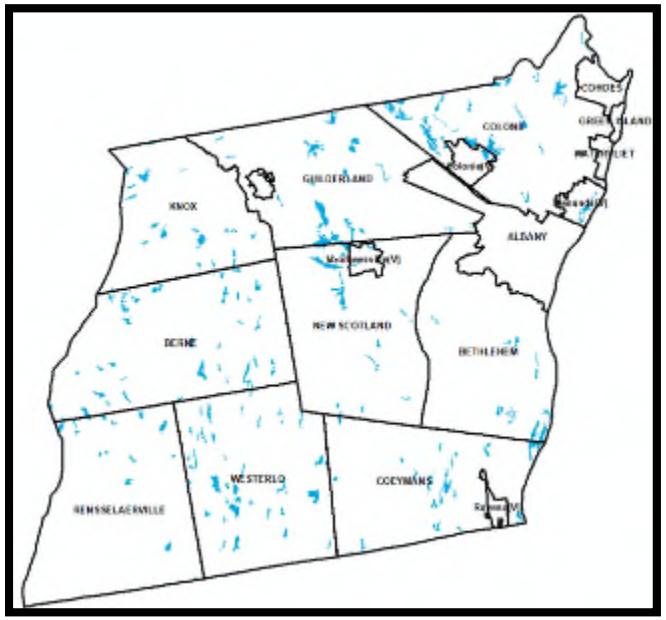
All Buffers Layer - Steep Slopes; Forest Intersection

Prioritization 3

From Forest Land Cover Map – forests everywhere…are they equally valuable as green infrastructure assets?

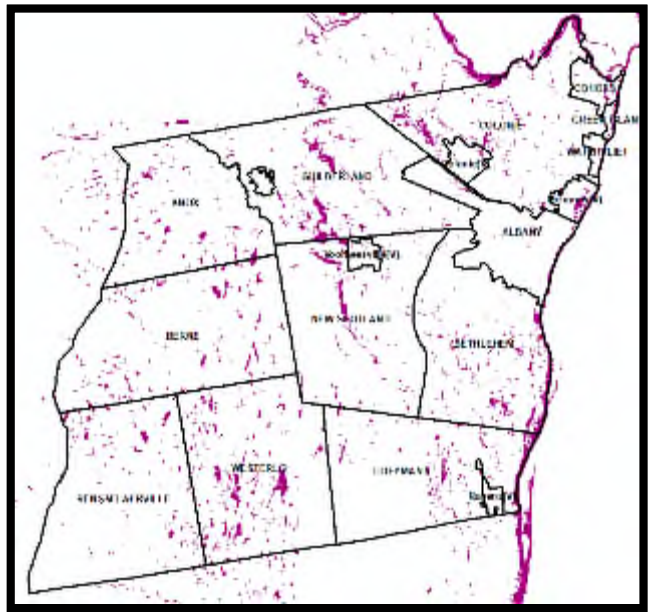
Forests located on a stream corridor, near a wetland, on a steep slope, or in a flood plain assumed to be more valuable than forests elsewhere.

All Buffers Layer and Buffer Sizes



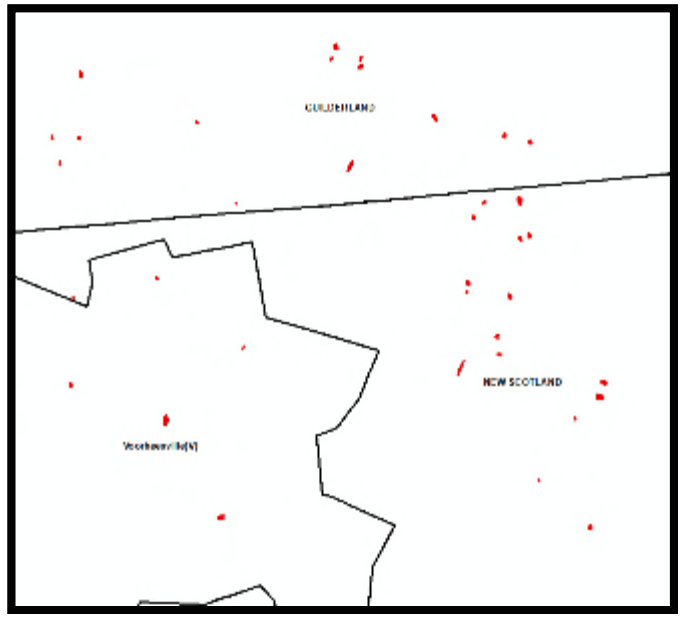
DEC Wetlands
=/> 12.4 acres

75ft buffer



NWI Wetlands > .5 acre

75ft buffer



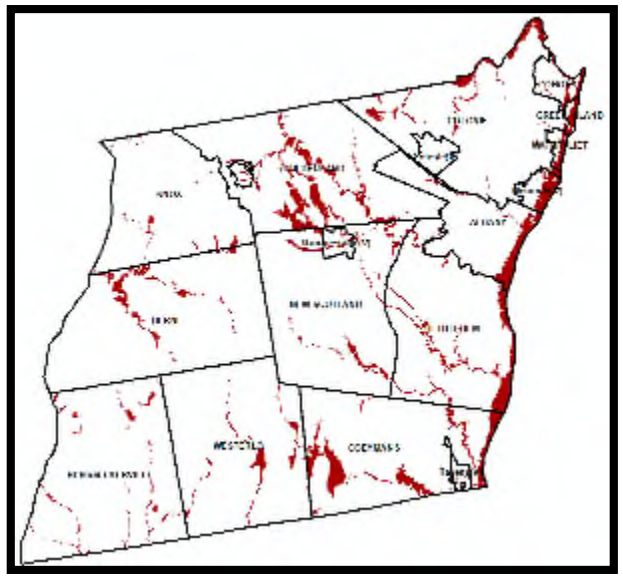
NWI Wetlands = /< .5 acre

50ft buffer

Map Layers for Buffering (cont'd)

Waterbodies (NHD Streams, lakes, reservoirs, estuaries and large streams)

300ft. buffer



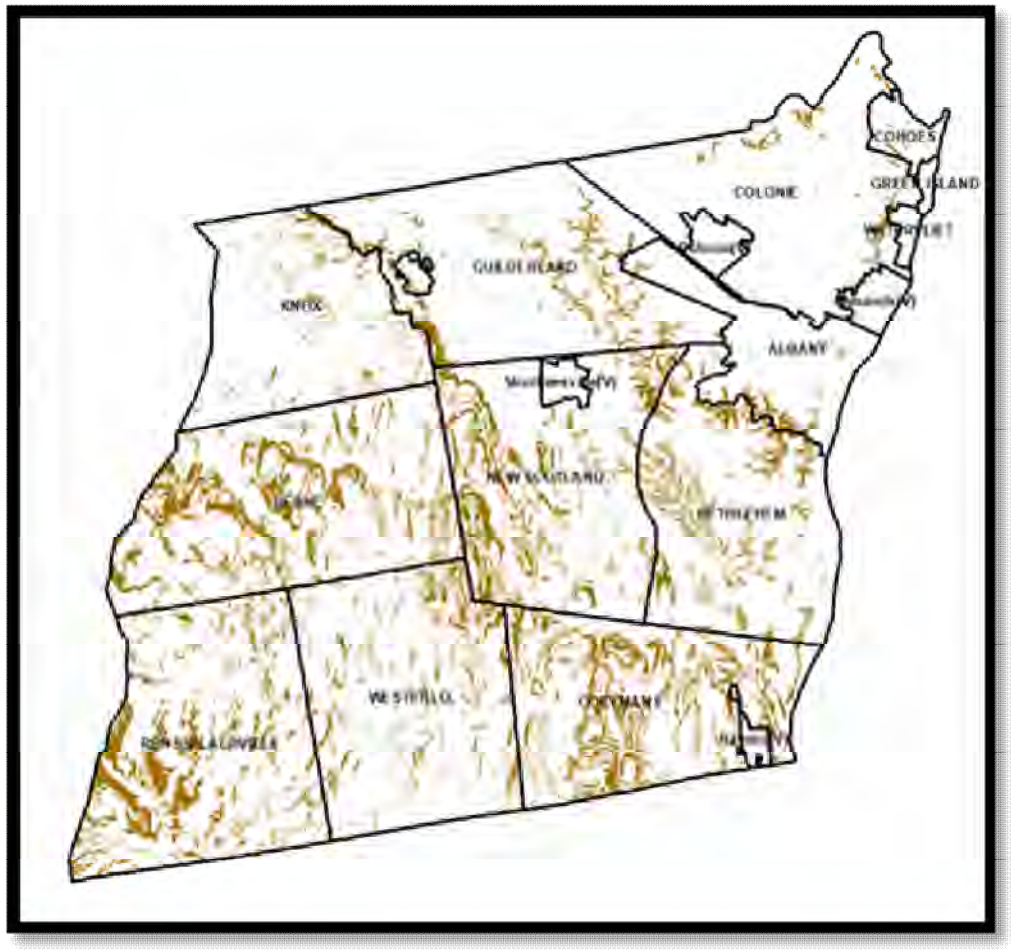
FEMA Flood Plain 1% annual chance of flood

300 ft. buffer

Buffer Criteria Sources

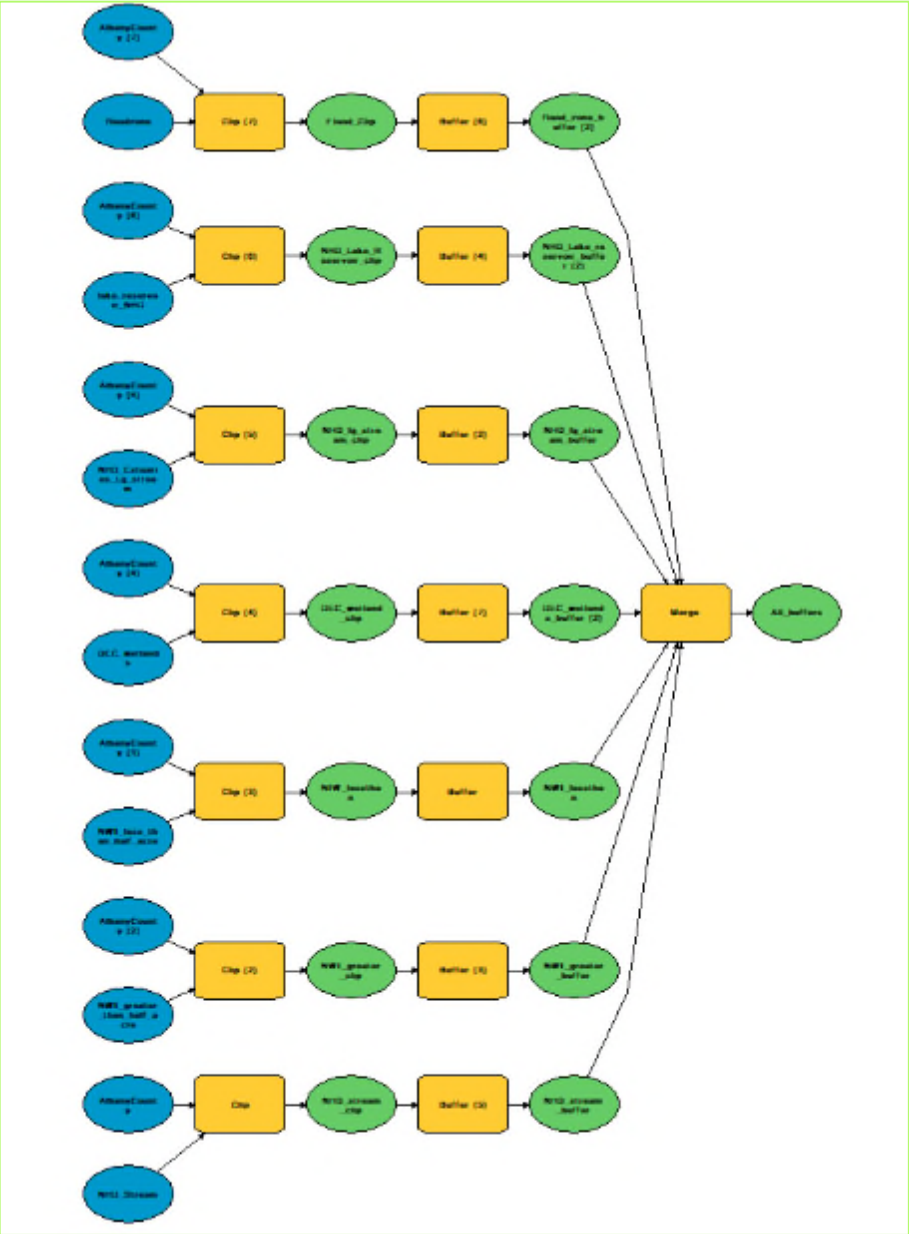
Parameter	Findings	Source
Waterbody Buffer	Include 100yr flood+ 300 ft. buffer	Stormwater Design Manual (SWDM) Yale School of Forestry and Environmental Studies
Flood Plains	Include 100yr flood+ 300 ft. buffer	Stormwater Design Manual (SWDM) Yale School of Forestry and Environmental Studies
Steep Slopes	USDA Soil Slope Phase E and F Slopes greater than 25%	NYSDEC- Construction Activity General Permit
wetland	(> 0.5-75ft Buffer) (</= 0.5 acre- 50 ft. buffer).	Environmental Law Institute – National Wetlands Newsletter

Other Map Layers- Steep Slope Phases E and F



No Buffer

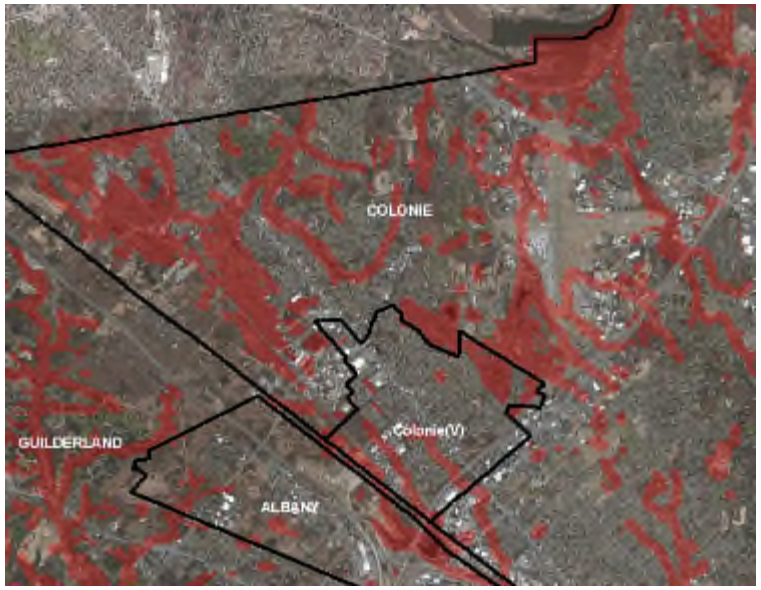
Just included in areas to protect

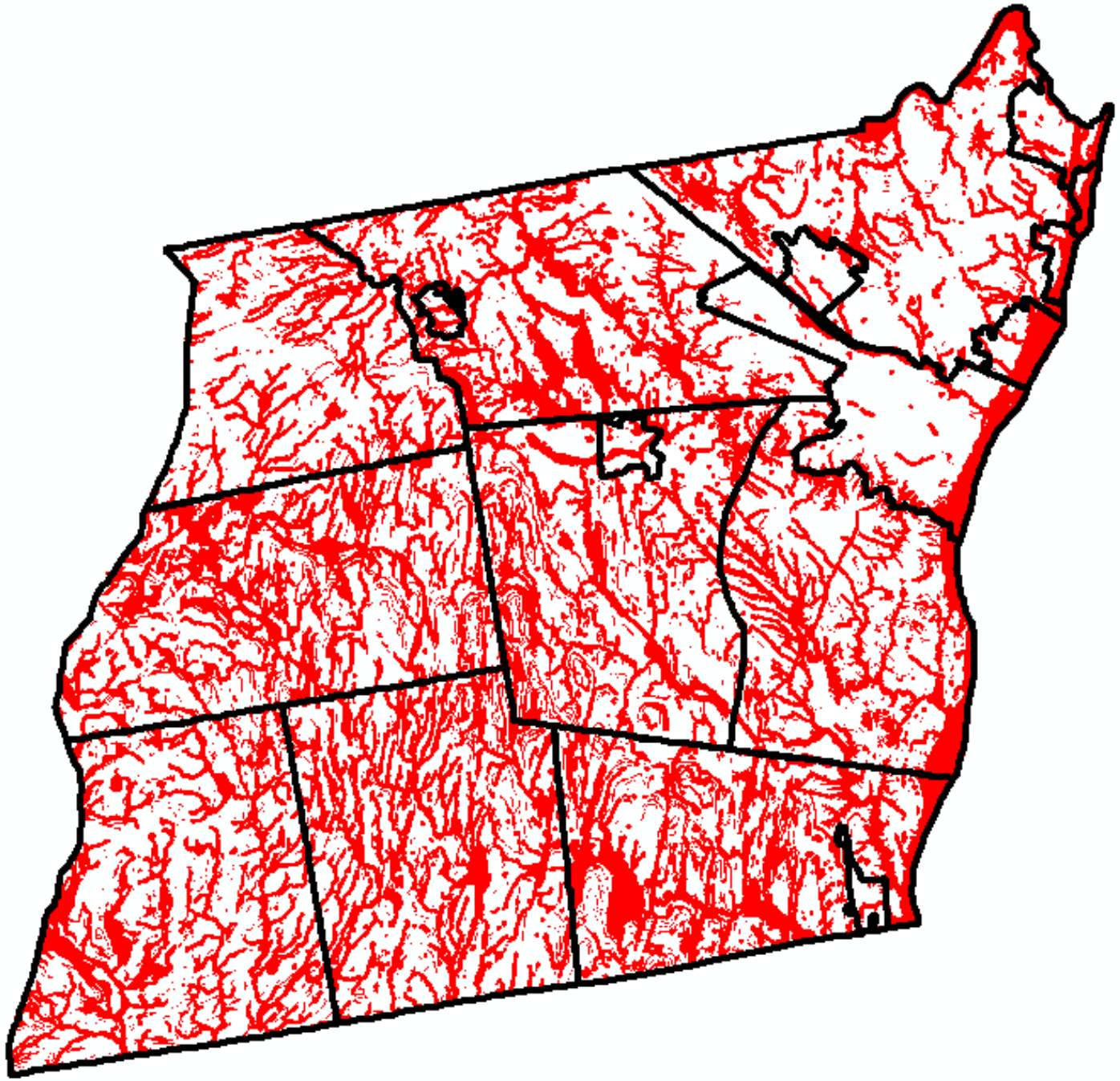


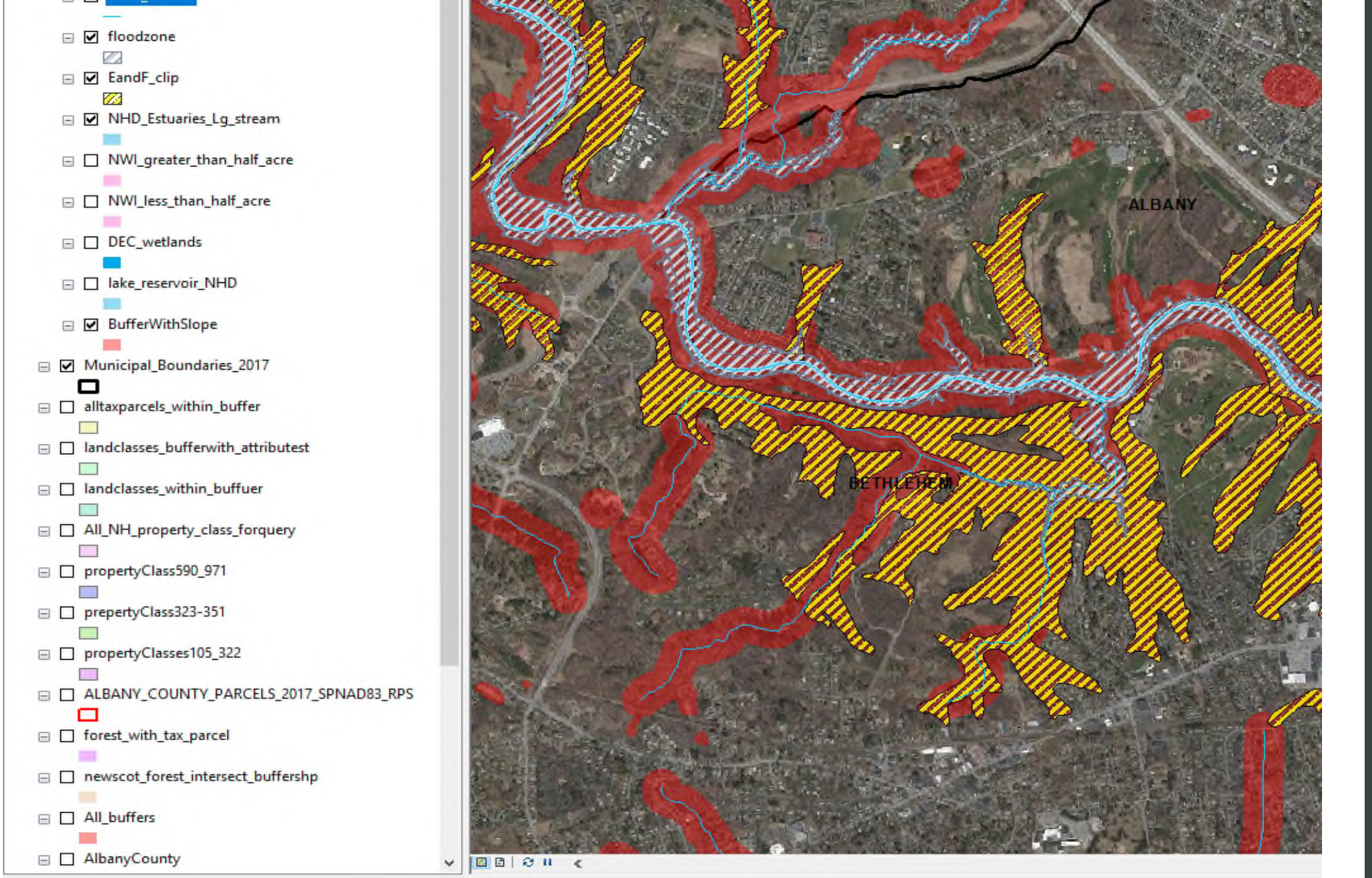
Creating Buffer Layer Model Builder Tool

Tool in ArcMap used to automatically create buffers based on buffer criteria

All Buffers and Steep Slope



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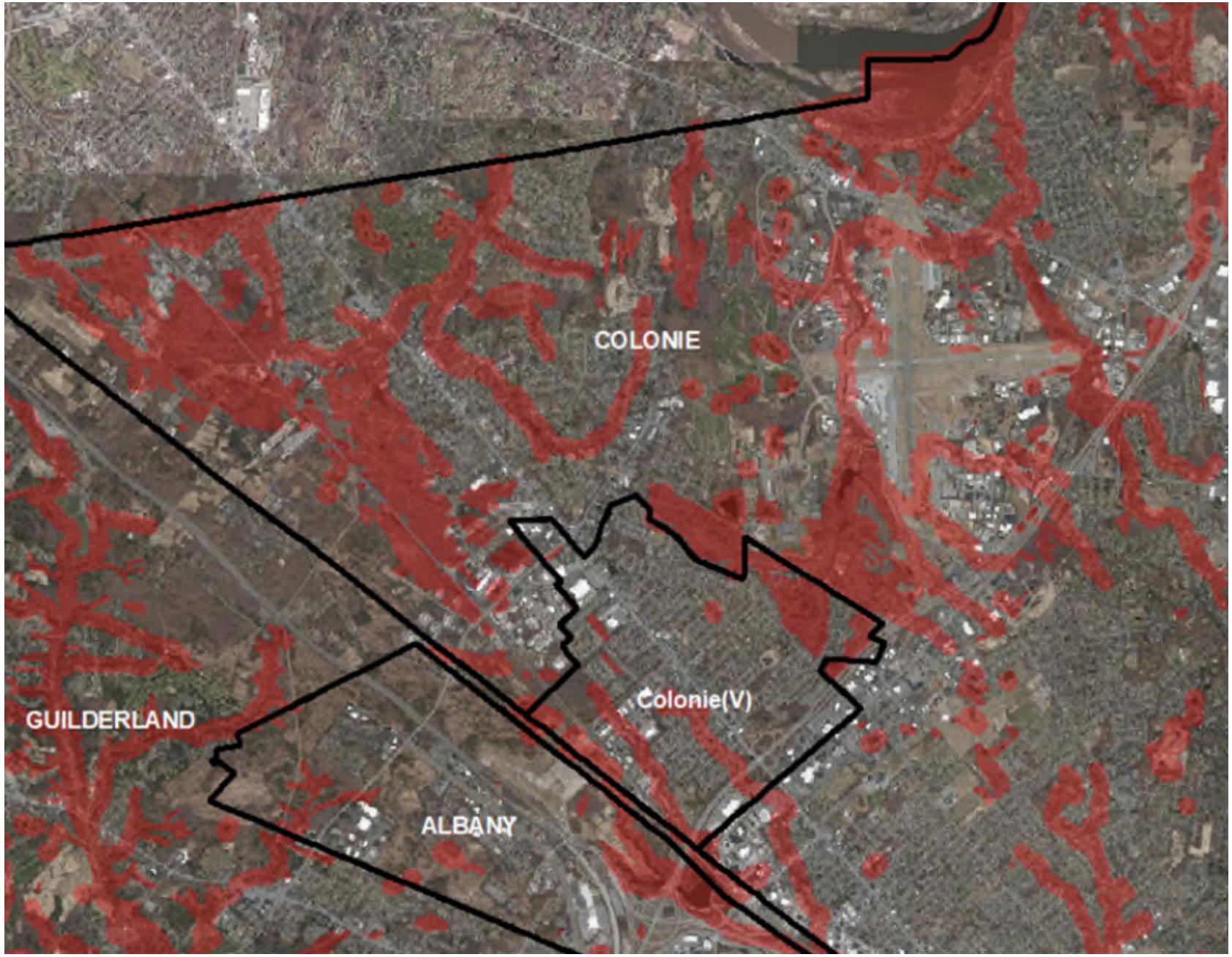
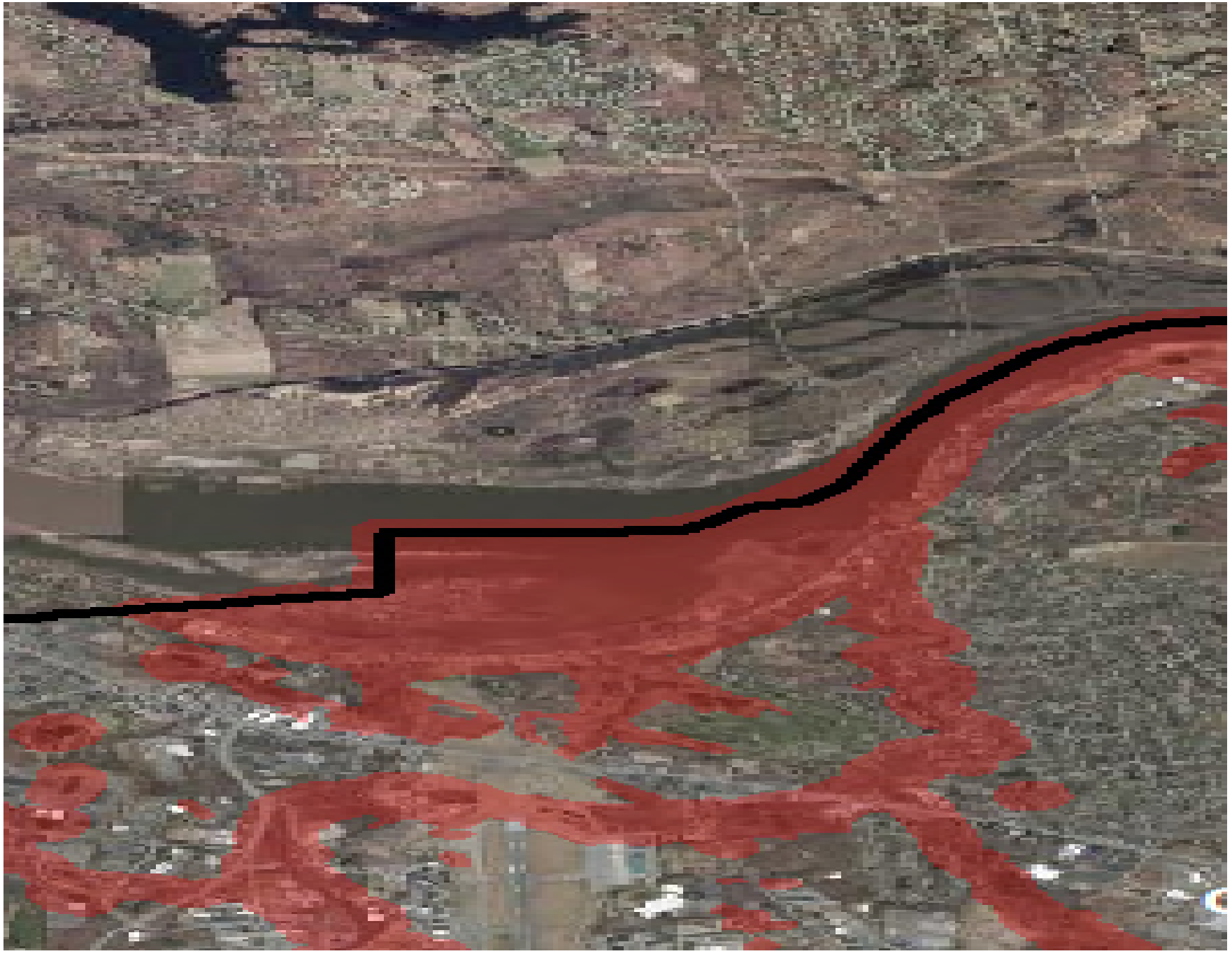
ALBANY
BETHLEHEM



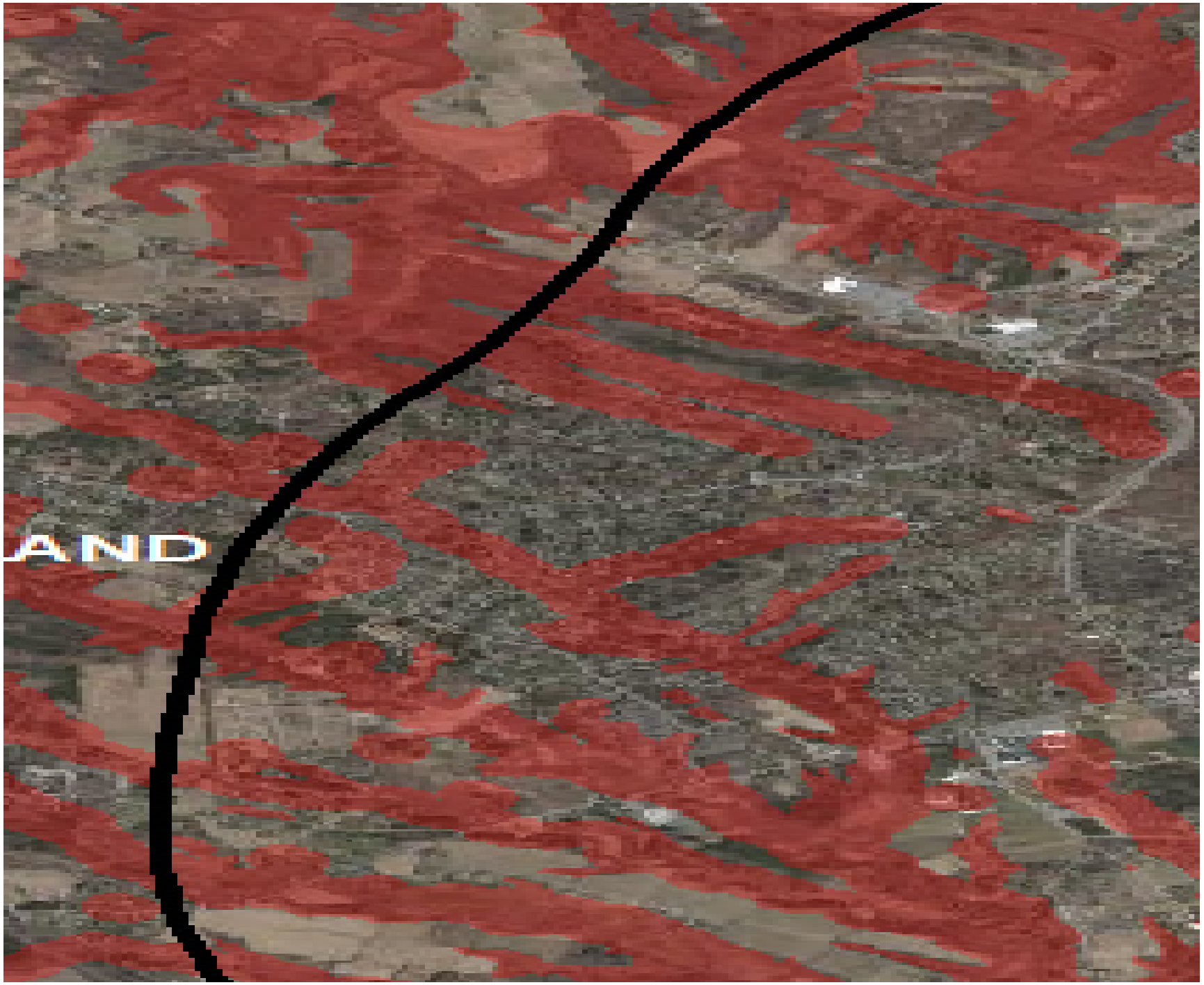
The Village of Colonie and a section of The Town of Colonie



Northern Colonie and City of Cohoes

The Village of Green Island, City Watervliet Town of Colonie, and Village of Menands

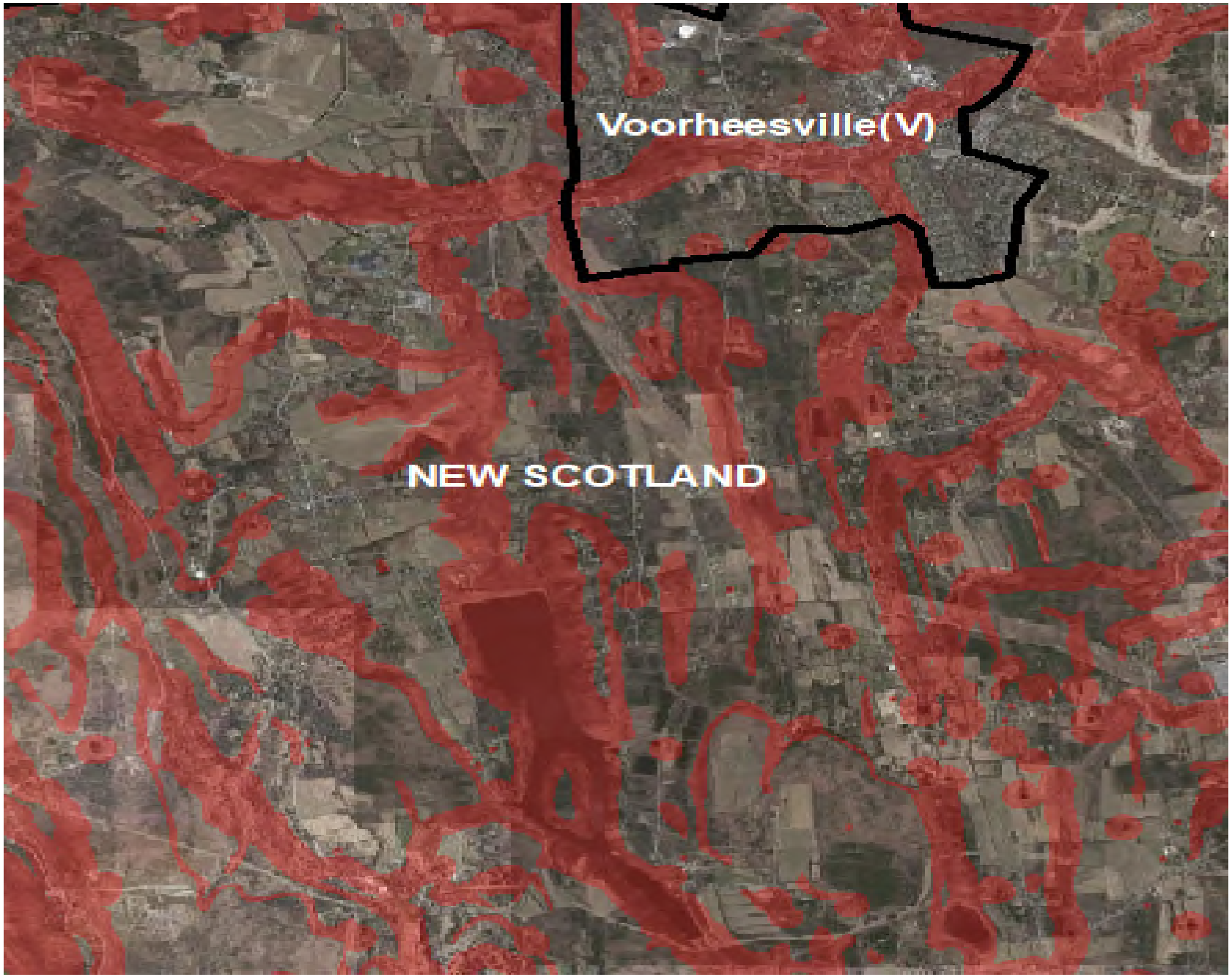
The City of Albany



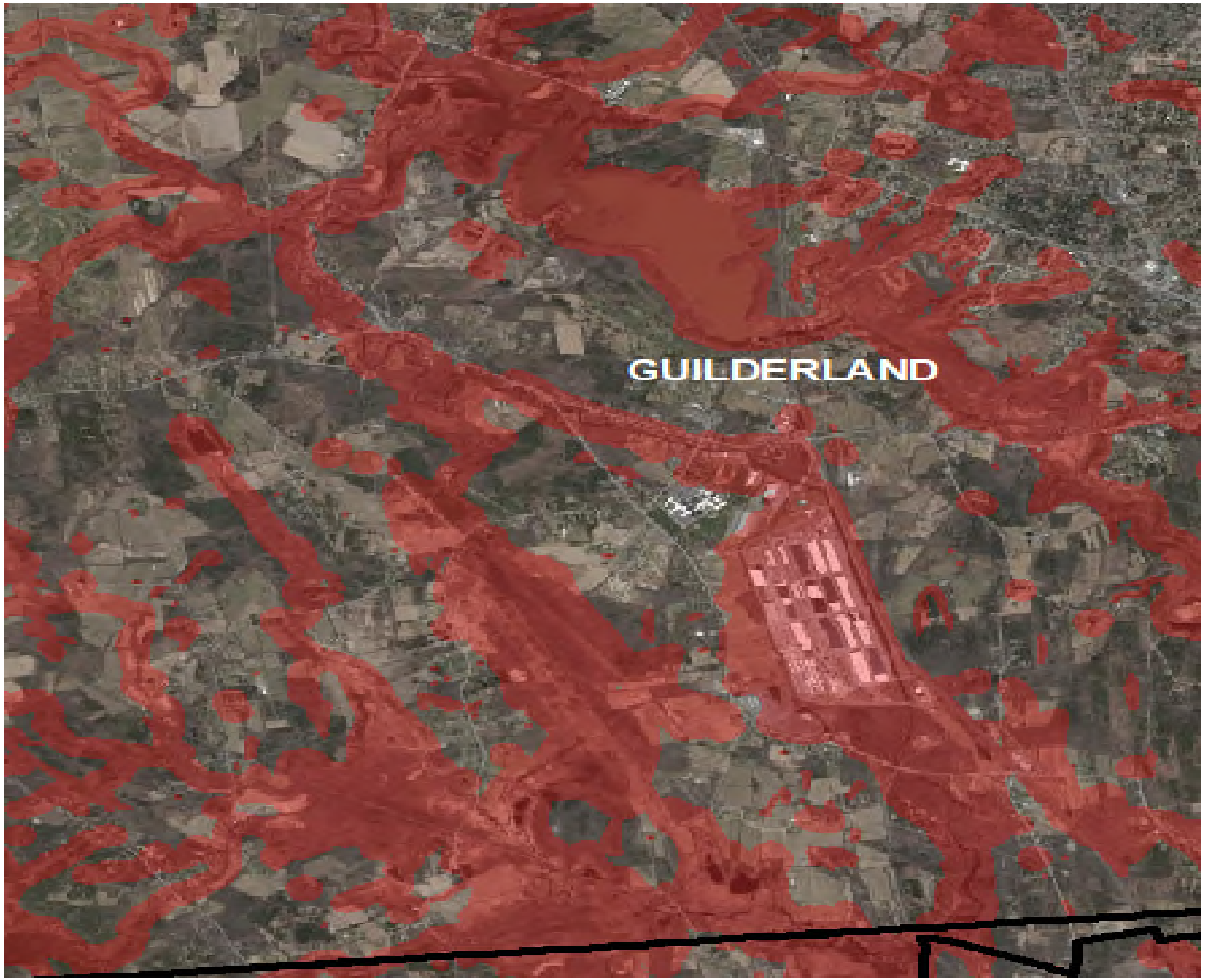
Northern Section of Town of Bethlehem

Southern Section of Town of Bethlehem

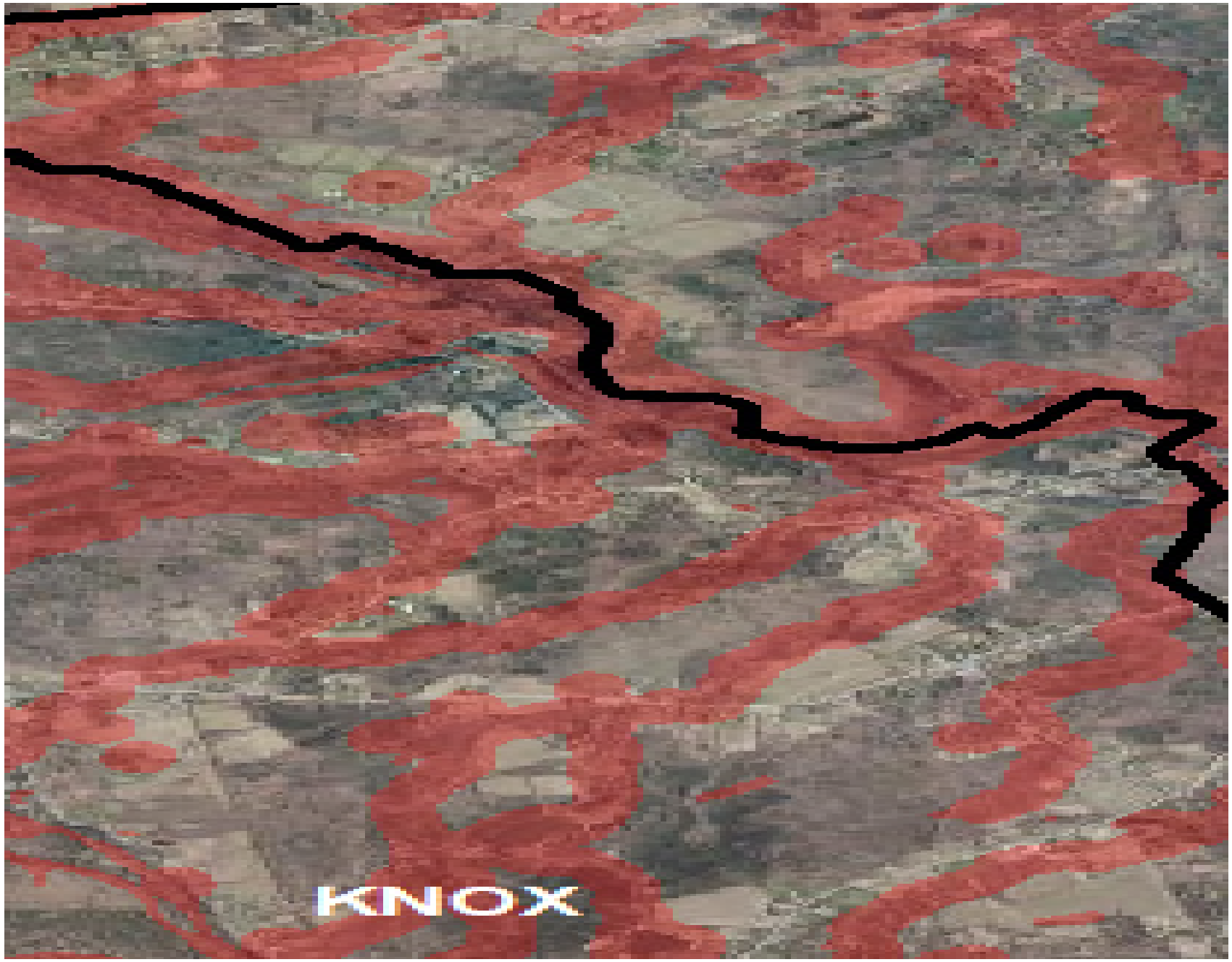
Southern section of Town of New Scotland



Northern Section of Town of New Scotland



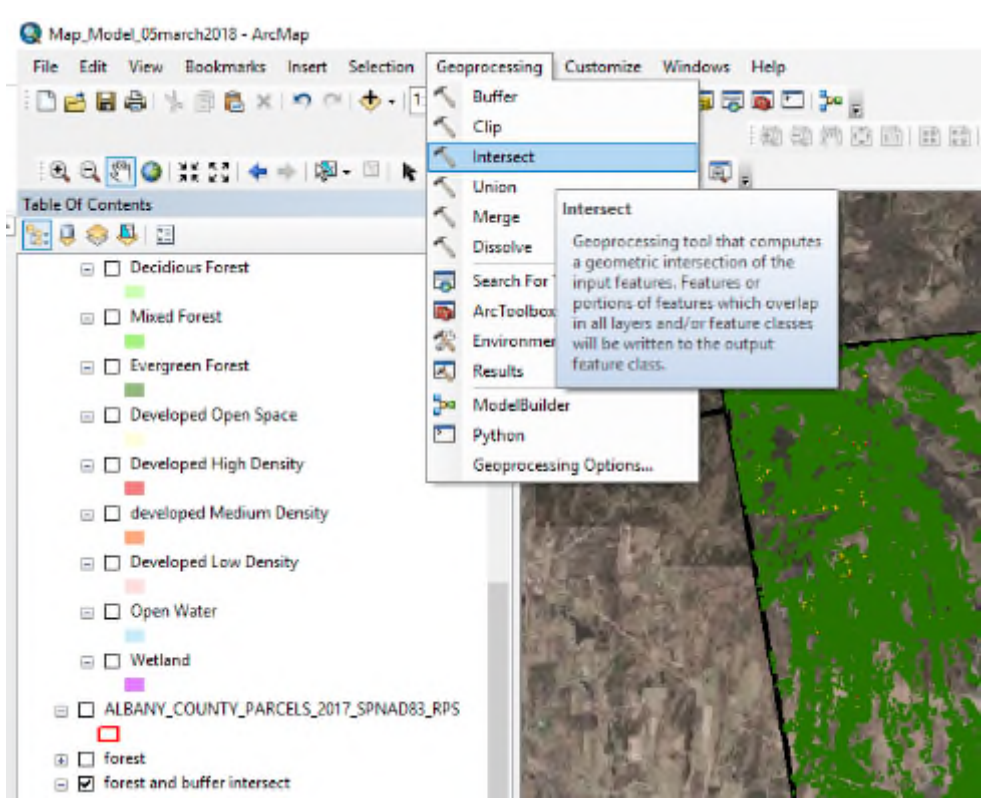
Town of Guilderland

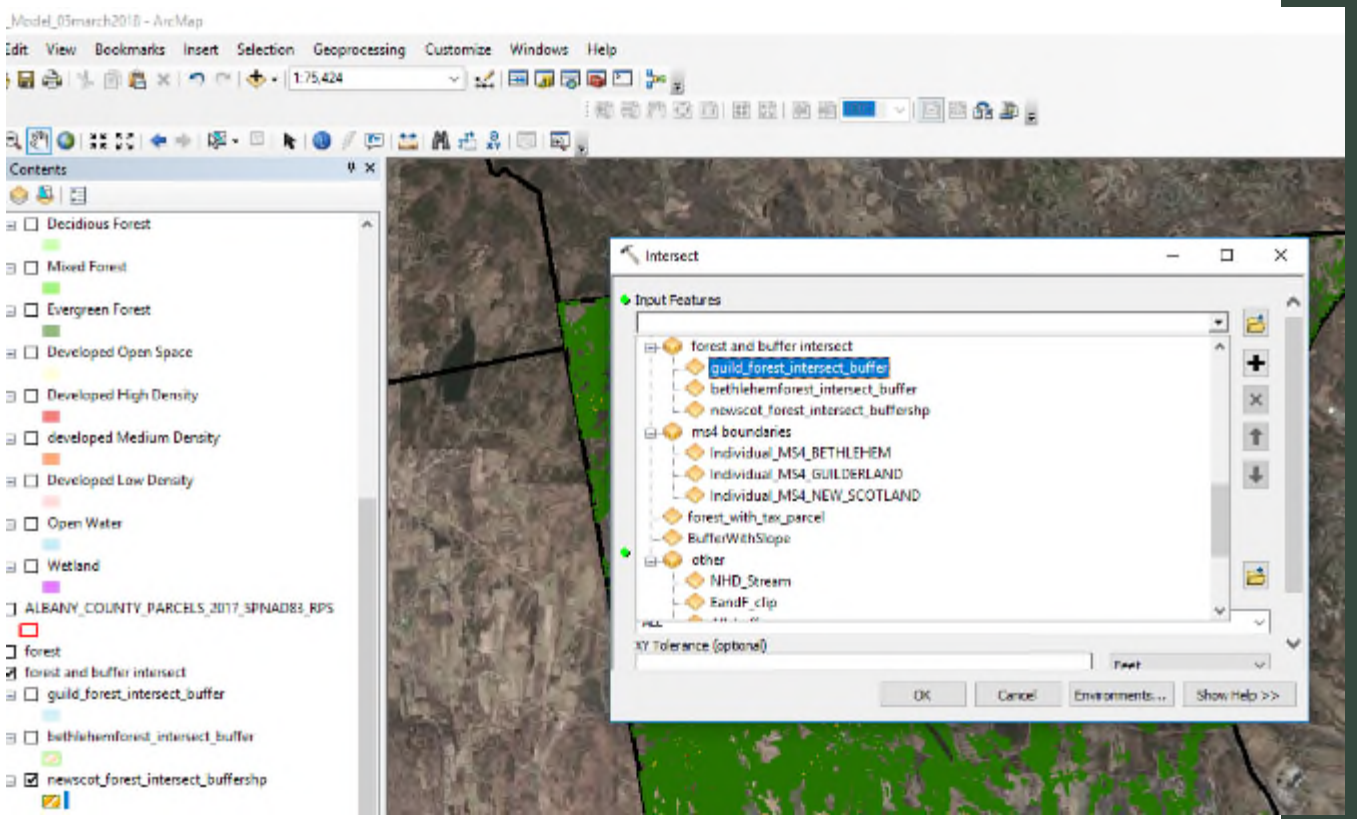


Town of Guilderland

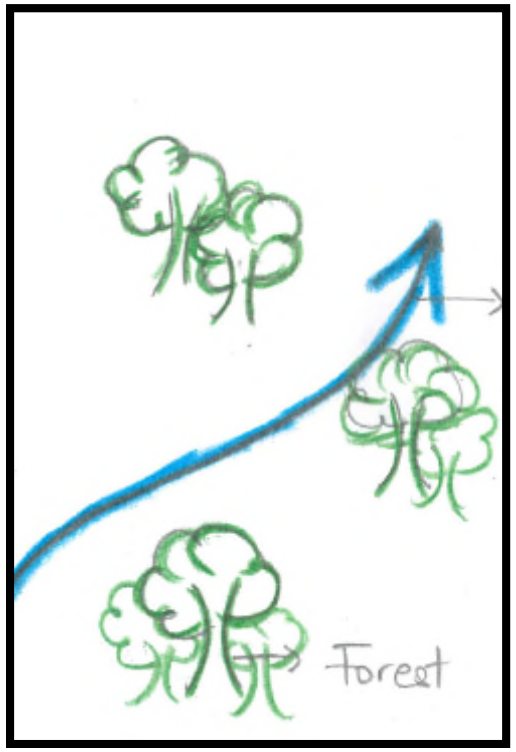
Prioritizing Forests Associated with Buffers

Forest Layer Intersects All Buffers- Steep Slopes Layer

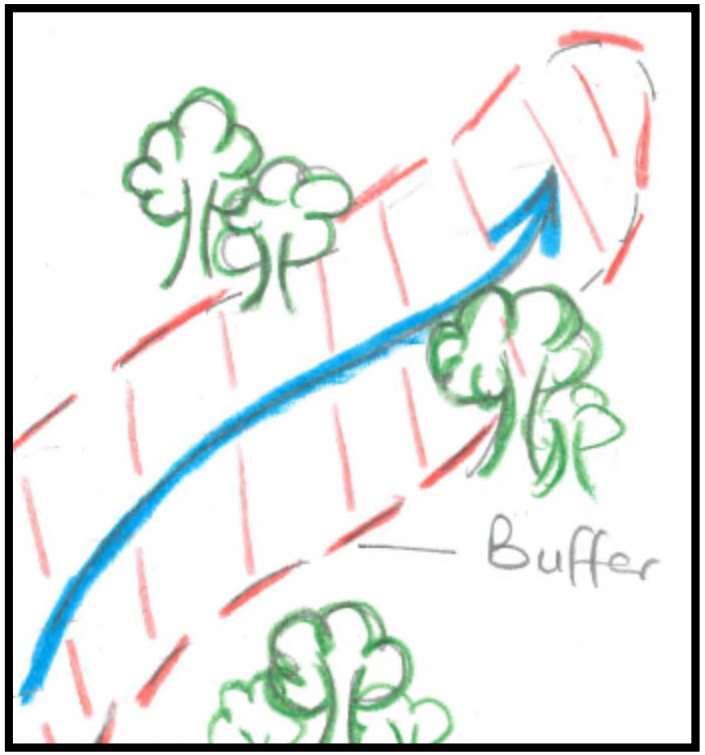




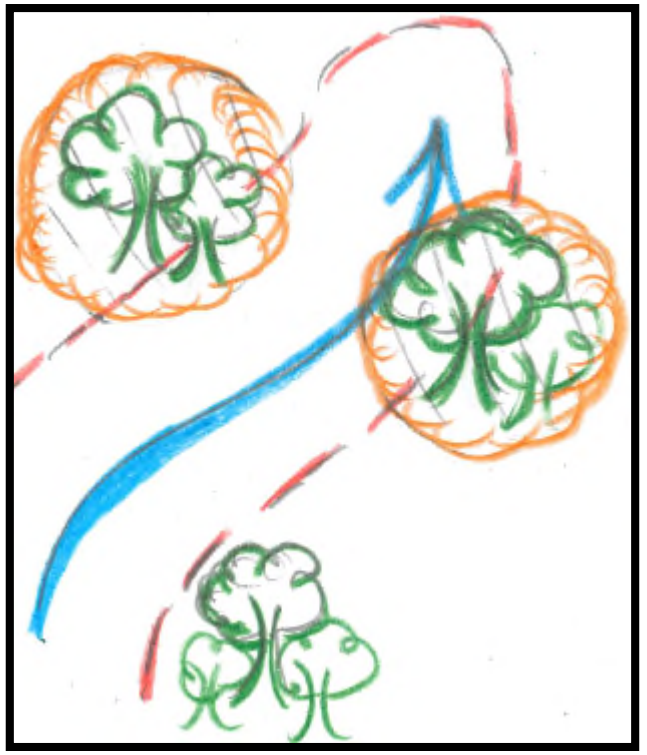
What is happening behind the scenes?



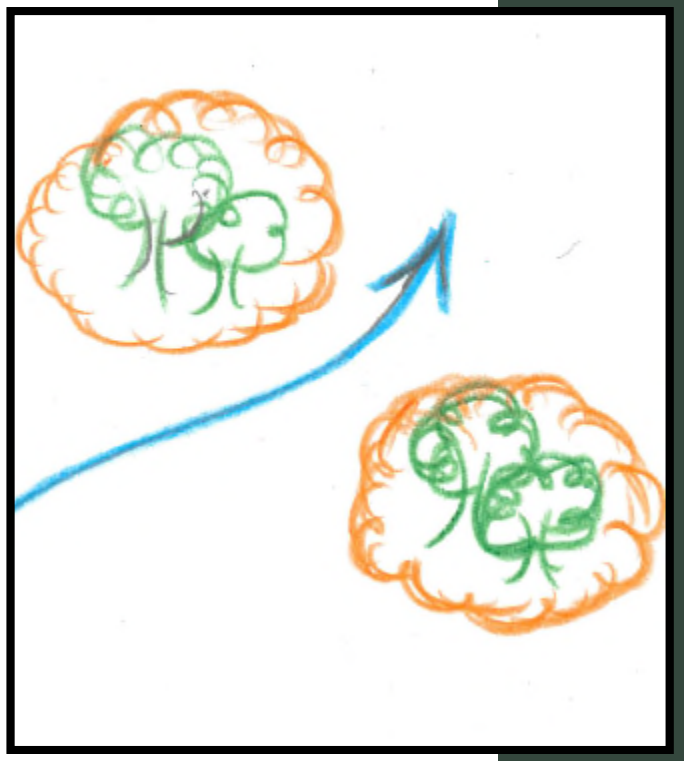
1
Natural forests and waterways



2
Slopes and buffers from waterways



3
Intersection between buffers and forests



4
The end product
Forest that intersect buffers

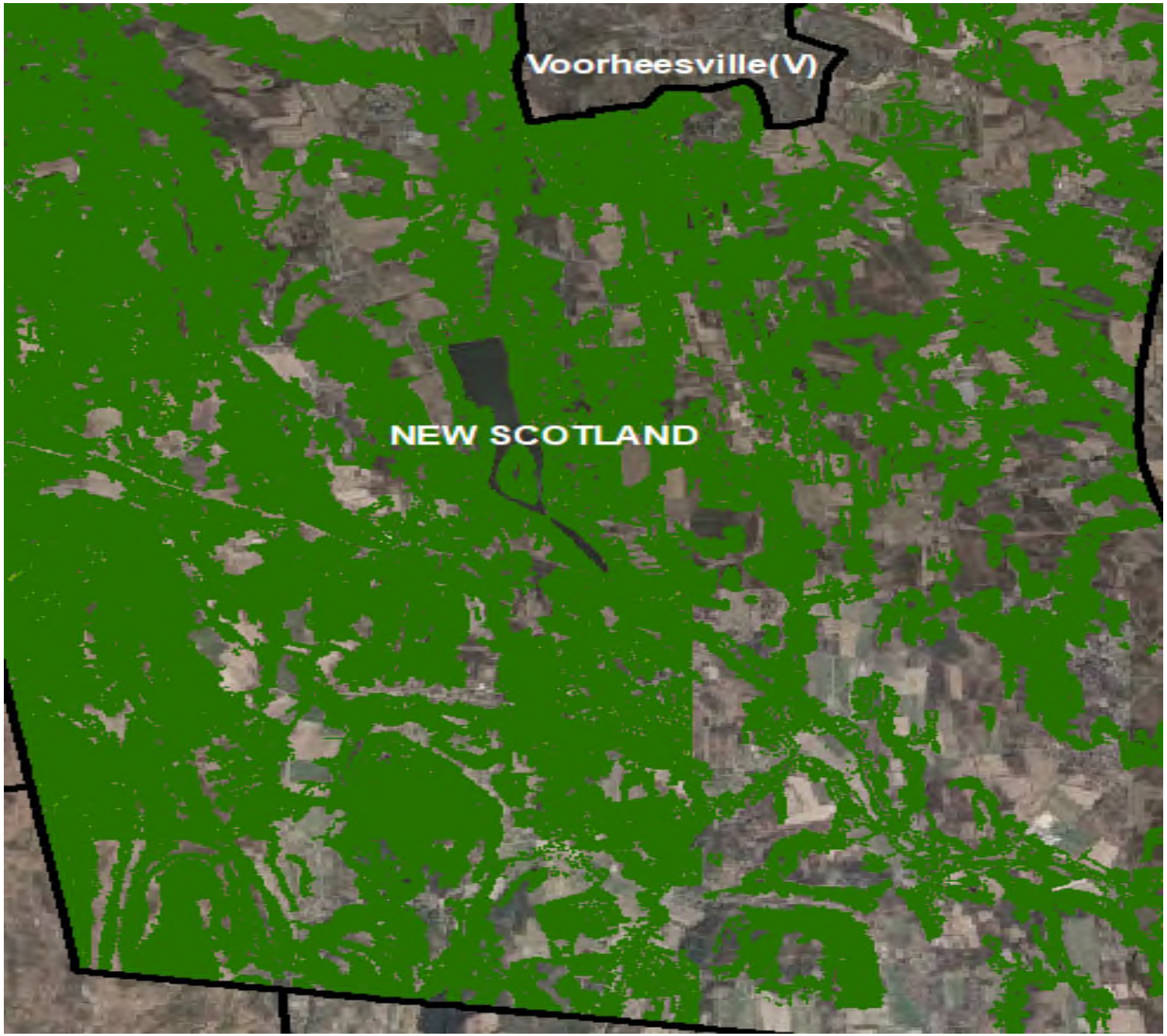
Example: Town of New Scotland

Intersection Layer Demo

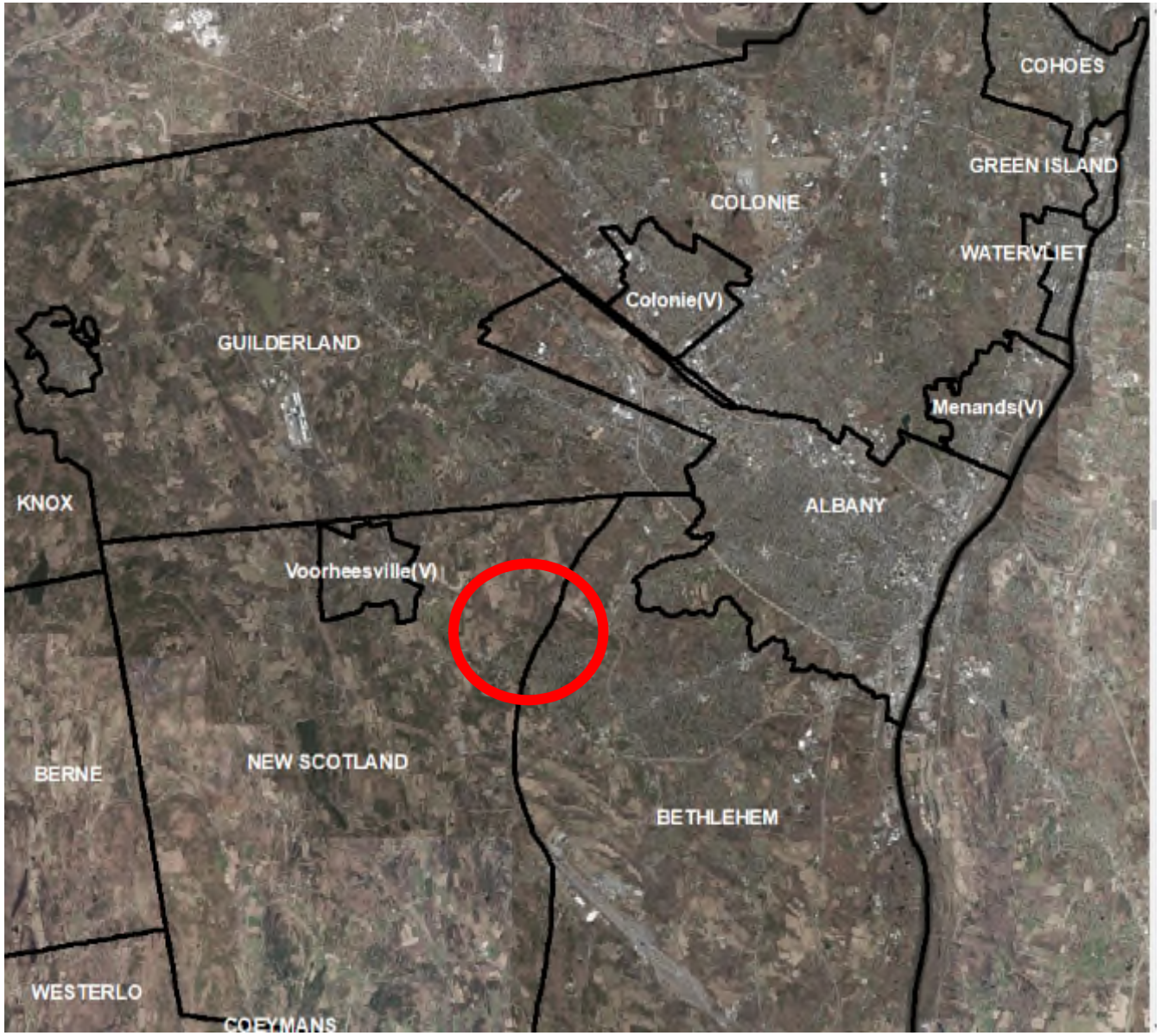
Town of New Scotland Forested Areas Which Intersect With Buffers

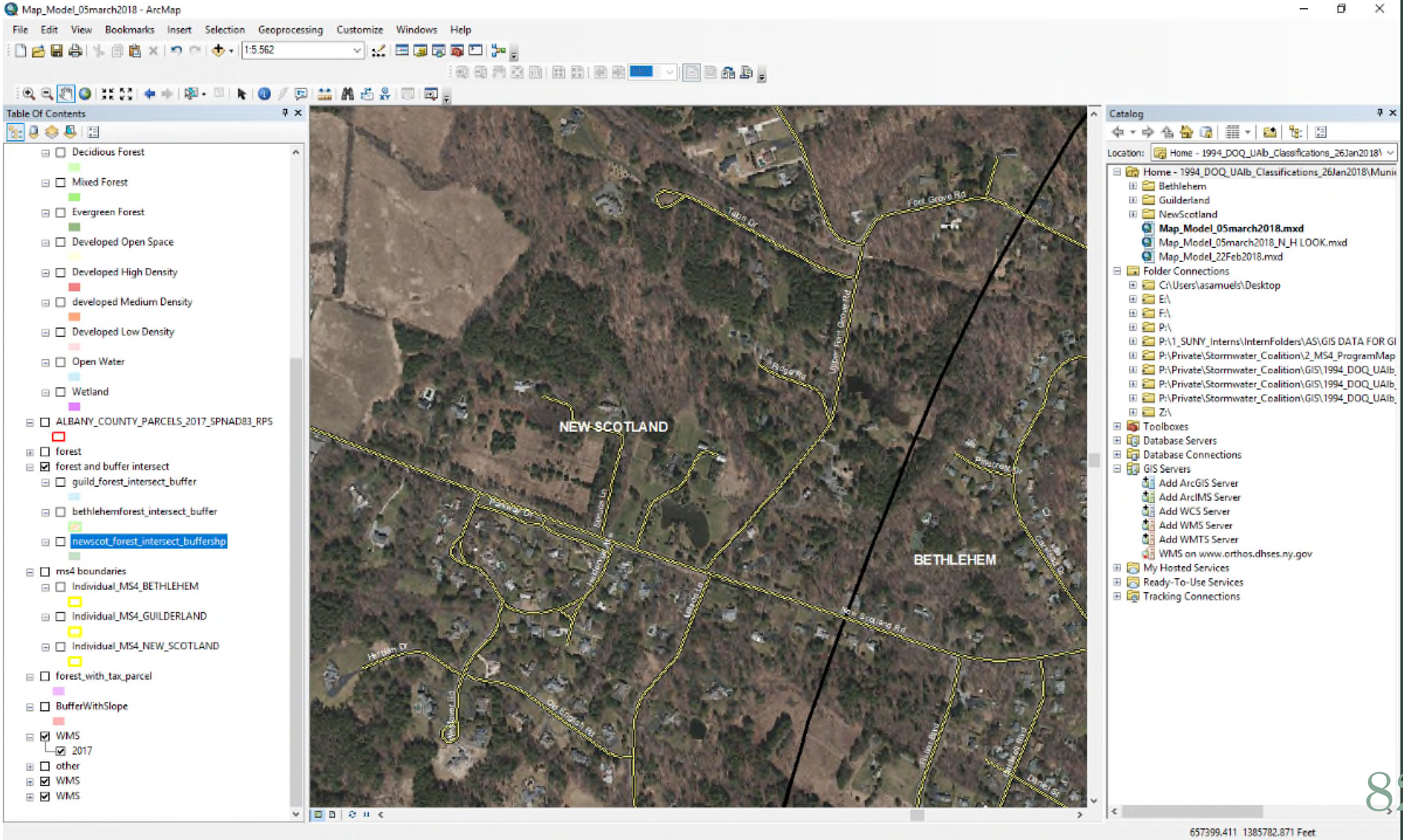
Intersect Analysis:

Completed for Town of New Scotland; Town of Guilderland; Town of Bethlehem



Area within the Town of New Scotland

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File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
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Developed High Density
developed Medium Density
Developed Low Density
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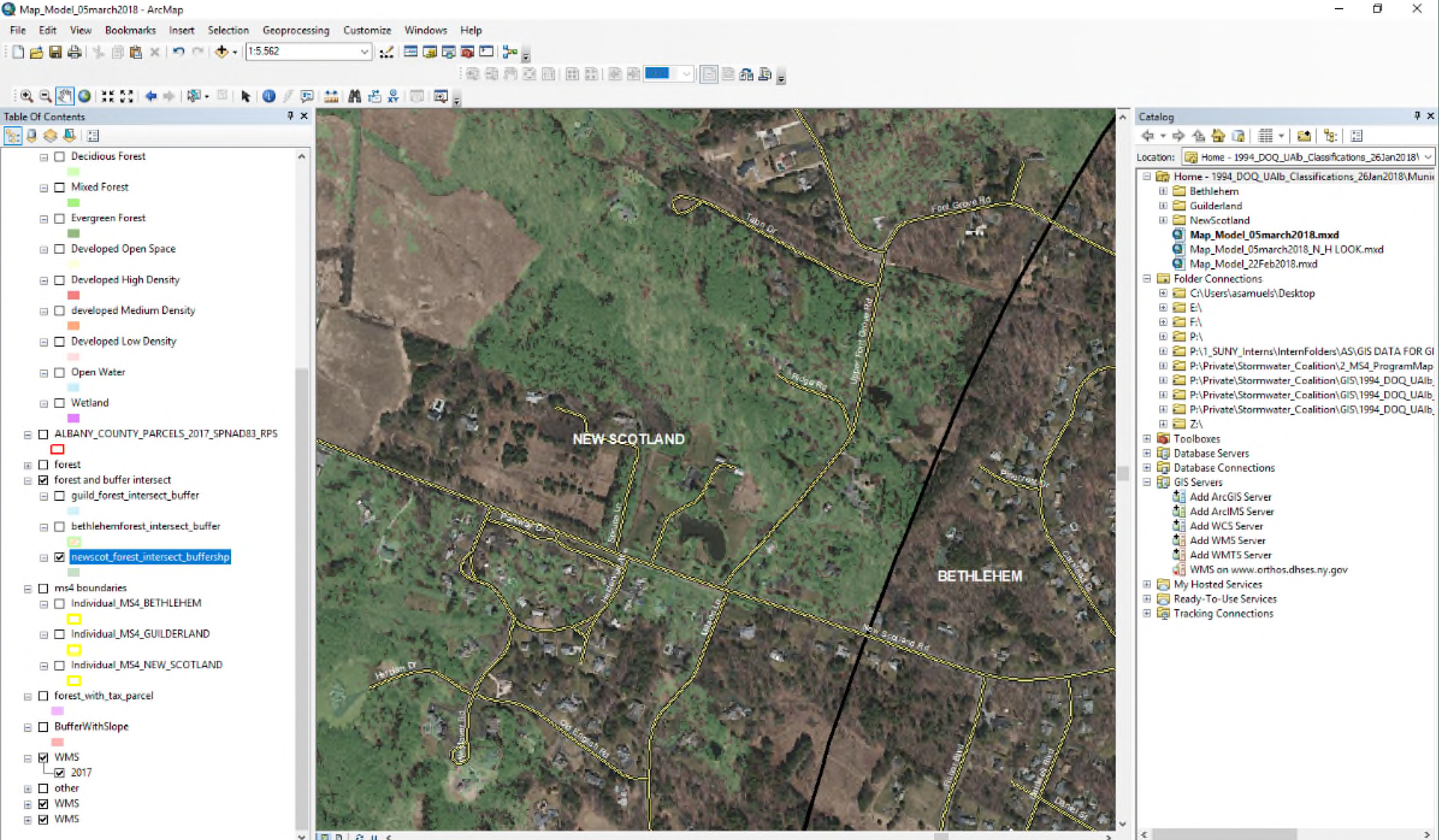
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bethlehemforest_intersect_buffer
newscot_forest_intersect_buffershp
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Individual_MS4_GUILDERLAND
Individual_MS4_NEW_SCOTLAND
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other
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NEW SCOTLAND
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New Scotland Rd
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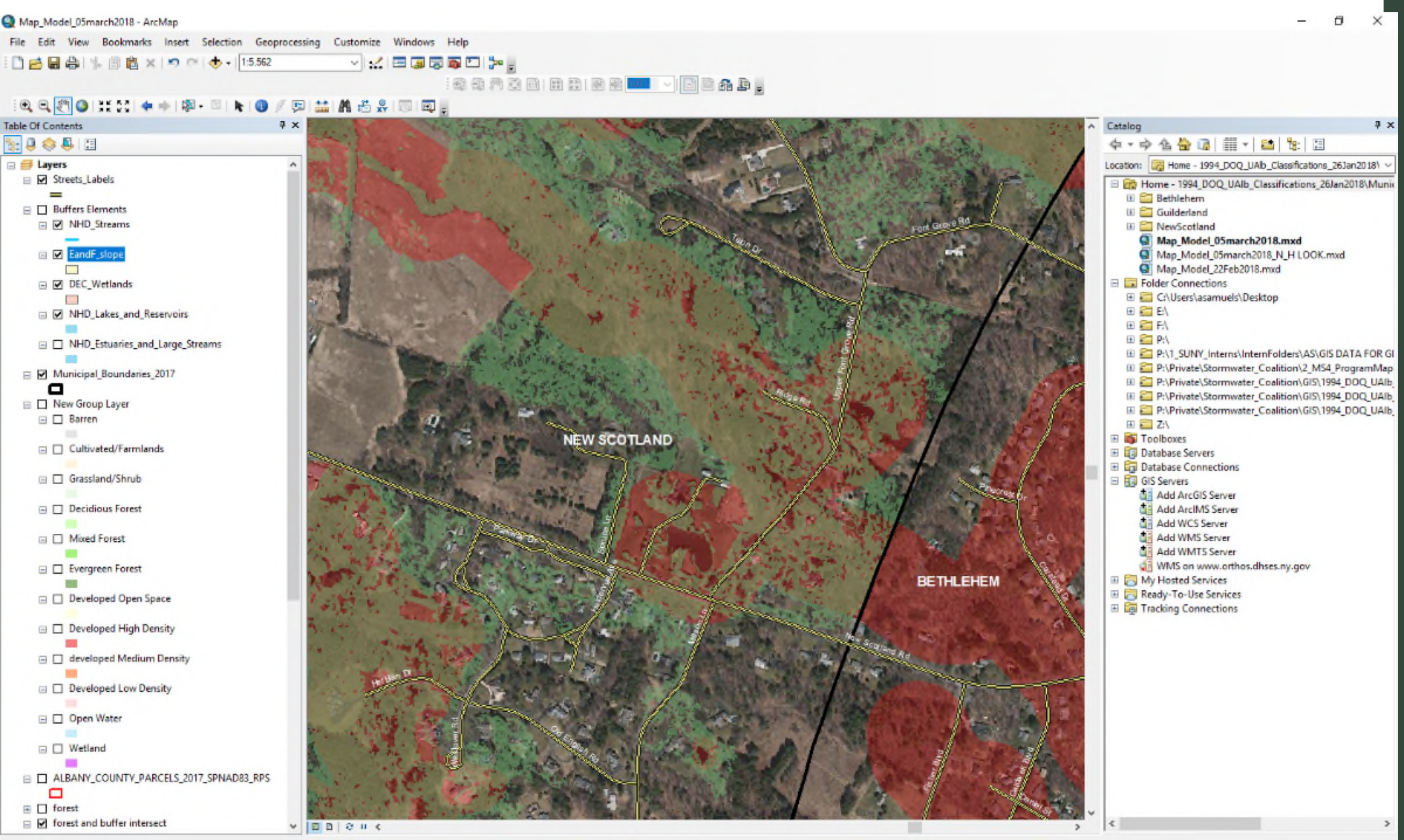
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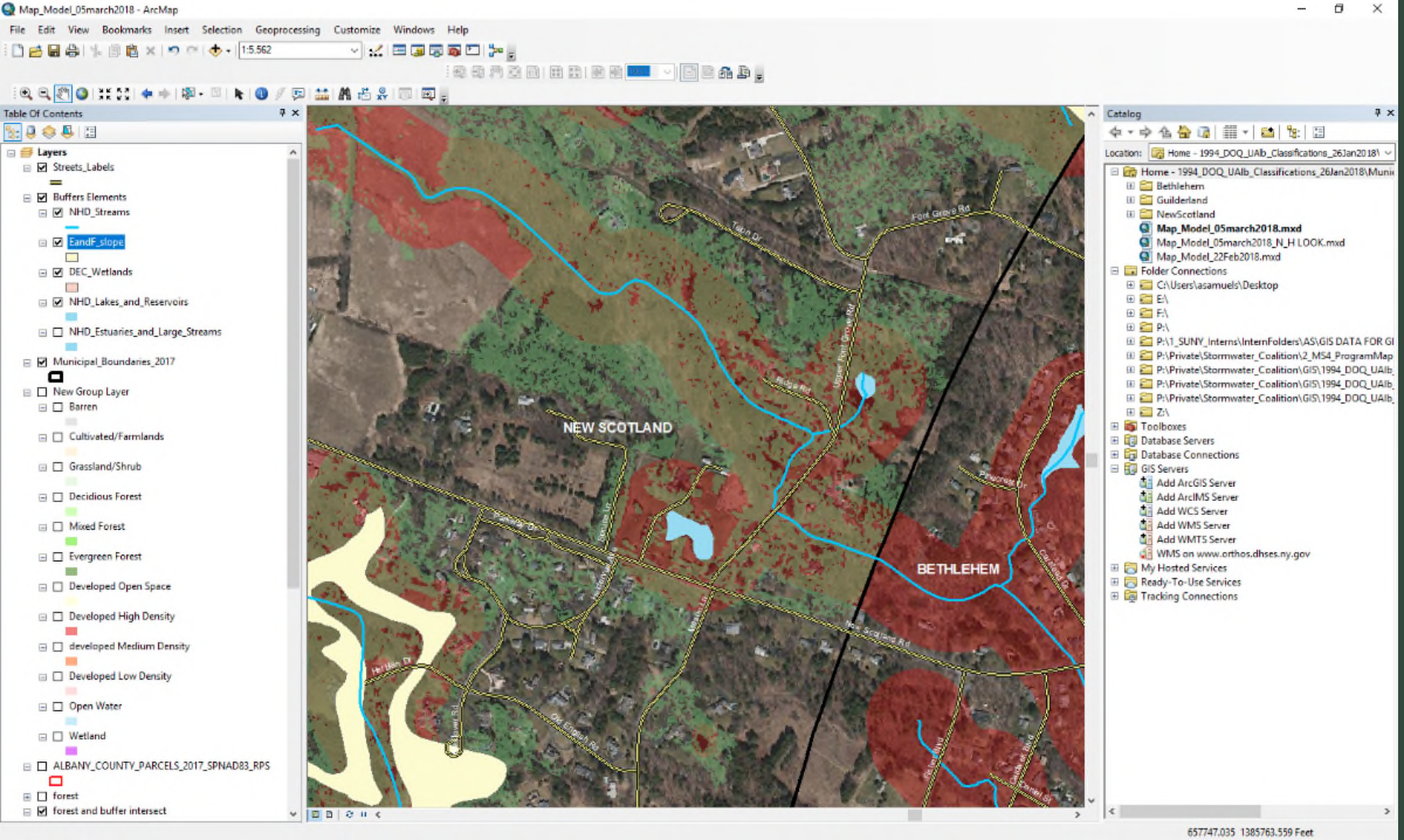
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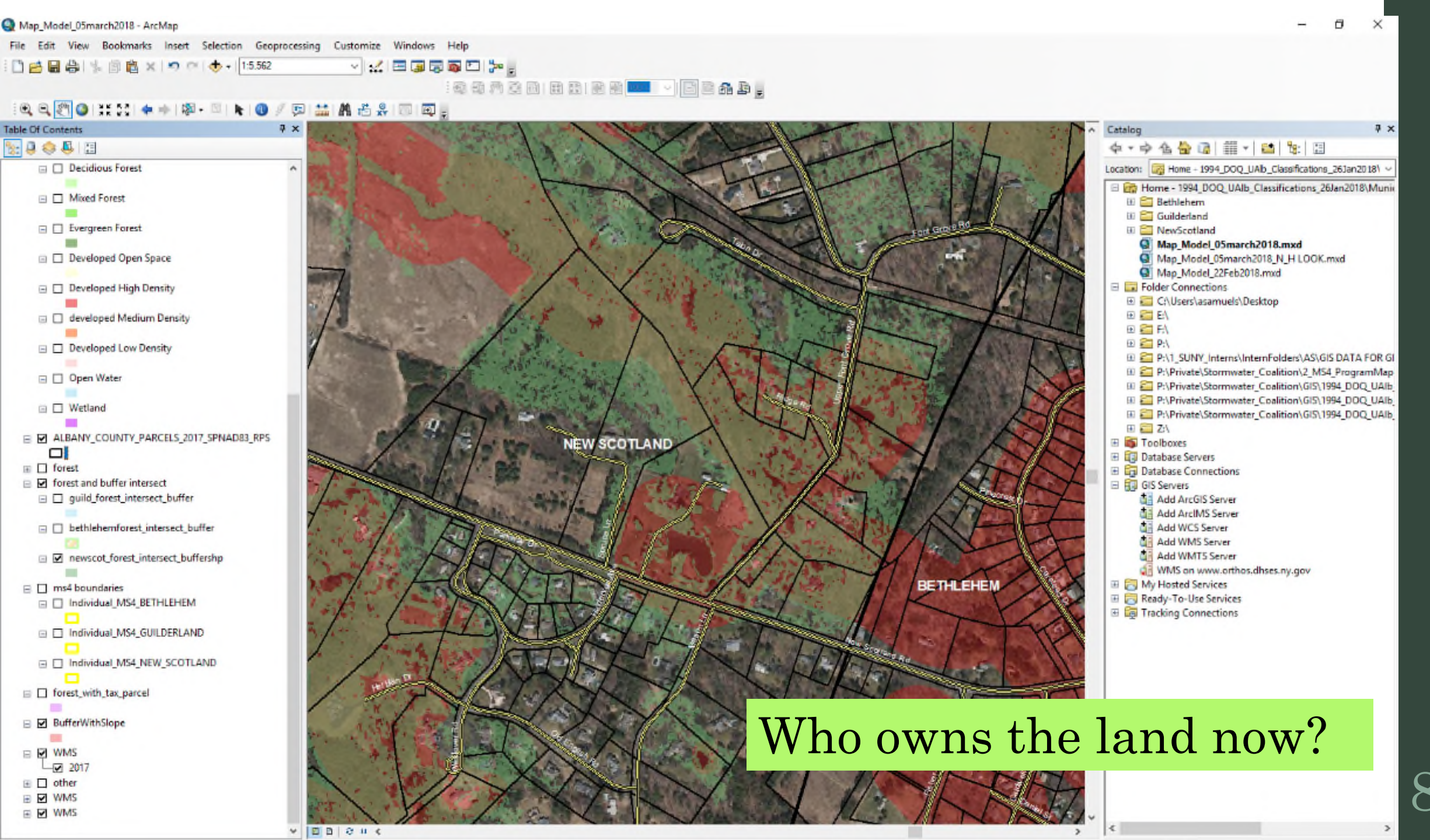
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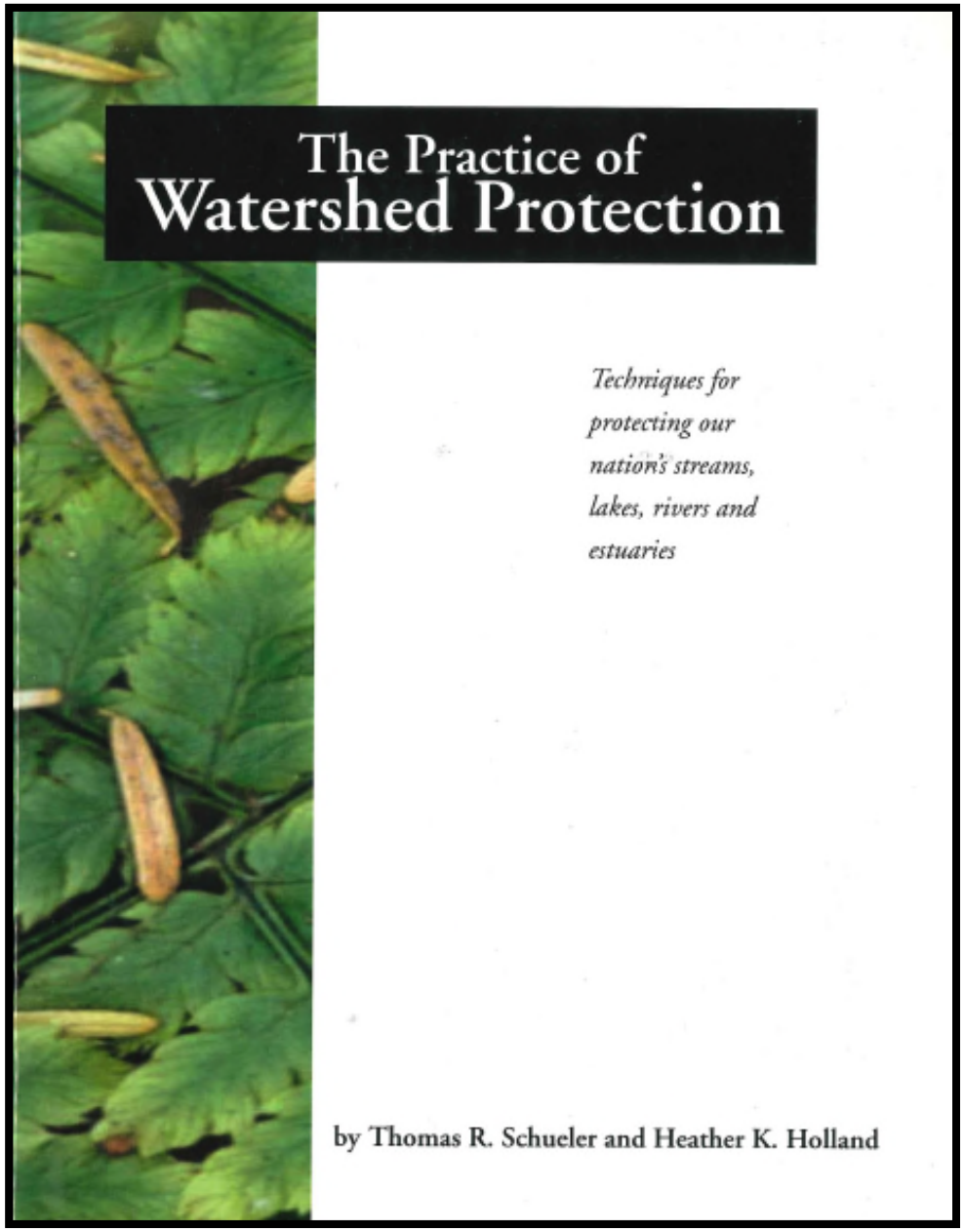
Who owns the land now?

Forests Where? Prioritizing Again

Watershed Imperviousness

Prioritization 4



Article 1- The Importance of Imperviousness

Feature article from Watershed Protection Techniques. 1 (3): 100-111

"Extremely difficult to maintain predevelopment stream quality when watershed development exceeds 10-15% impervious cover"

Assumption: Removal of forest may increase the % impervious cover and adversely affect water quality

Estimating Amount of Imperviousness Using 1994 Land Cover Data

RESEARCH: In rural areas, impervious cover may only be 1 or 2 percent. In residential areas, coverage increases from about "10 percent in low-density subdivisions to over 50 percent in multi-family communities. In industrial and commercial areas, coverage rises above 70 percent. In regional shopping centers and dense urban areas, it is over 90 percent".

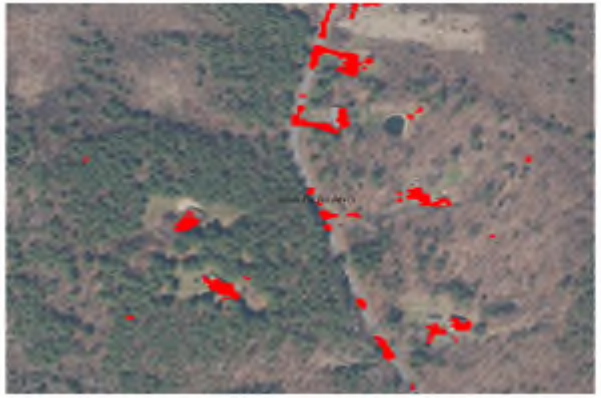
- (Source: Schueler, Thomas R. "The Importance of Imperviousness." Archived 2009-02-27 at the Wayback Machine. Reprinted in *The Practice of Watershed Protection.* Archived 2008-12-23 at the Wayback Machine. 2000. Center for Watershed Protection.

DECISION: To determine the percent imperviousness for the watersheds the total land cover for Low, Medium, and High intensity was multiplied by the respective percentages below:

- Low Intensity: 15% Impervious Surface Cover (ISC)
- Medium Intensity: 60% ISC
- High Intensity: 95% ISC

Calculating Imperviousness

Low Intensity
Training Area



15% of area is impervious

Medium Intensity
Training Area

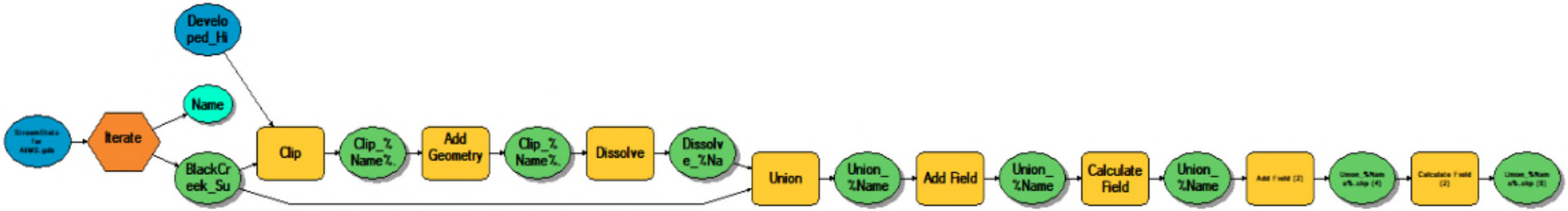
60% of area is impervious

High Intensity
Training Area

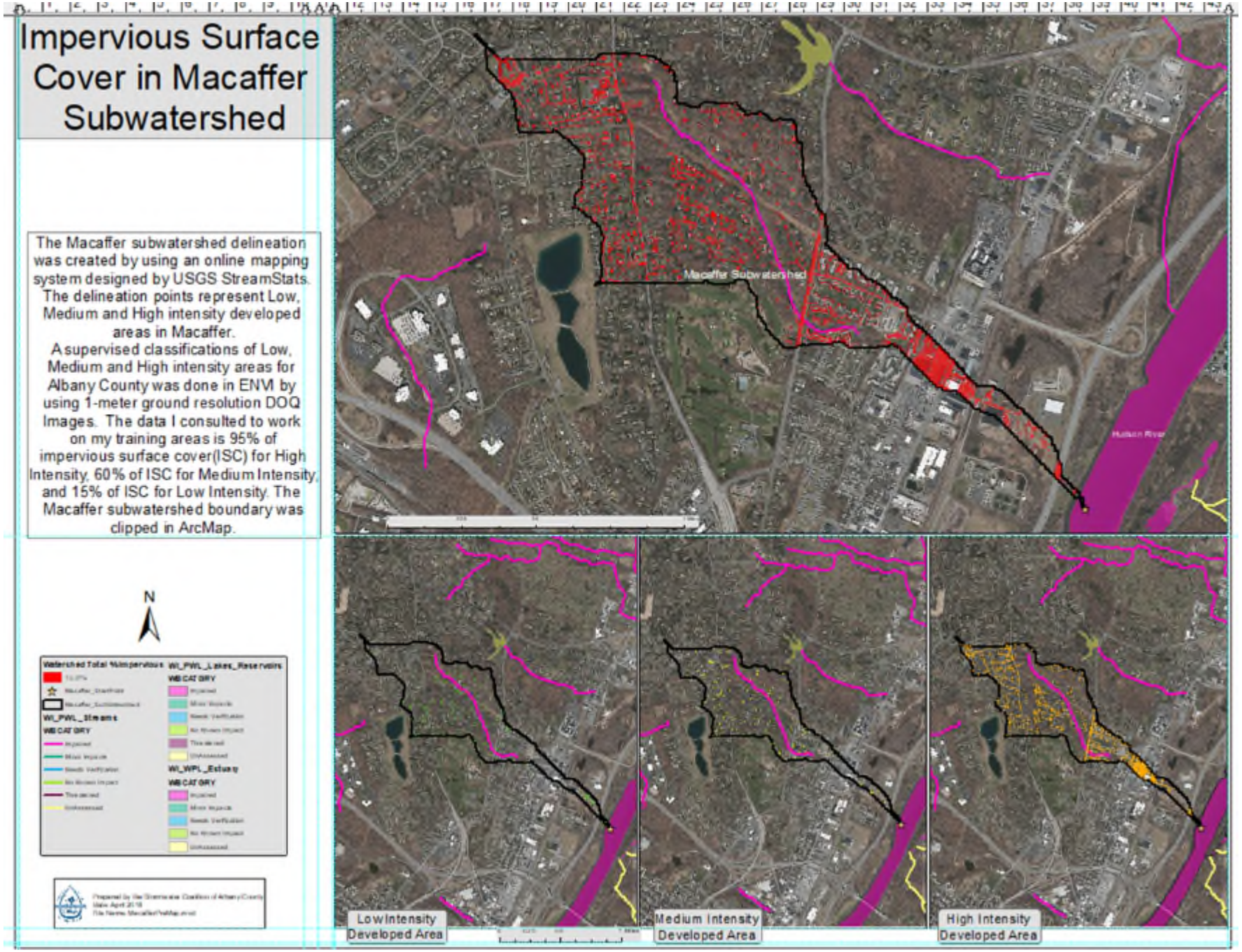
95% of area is impervious

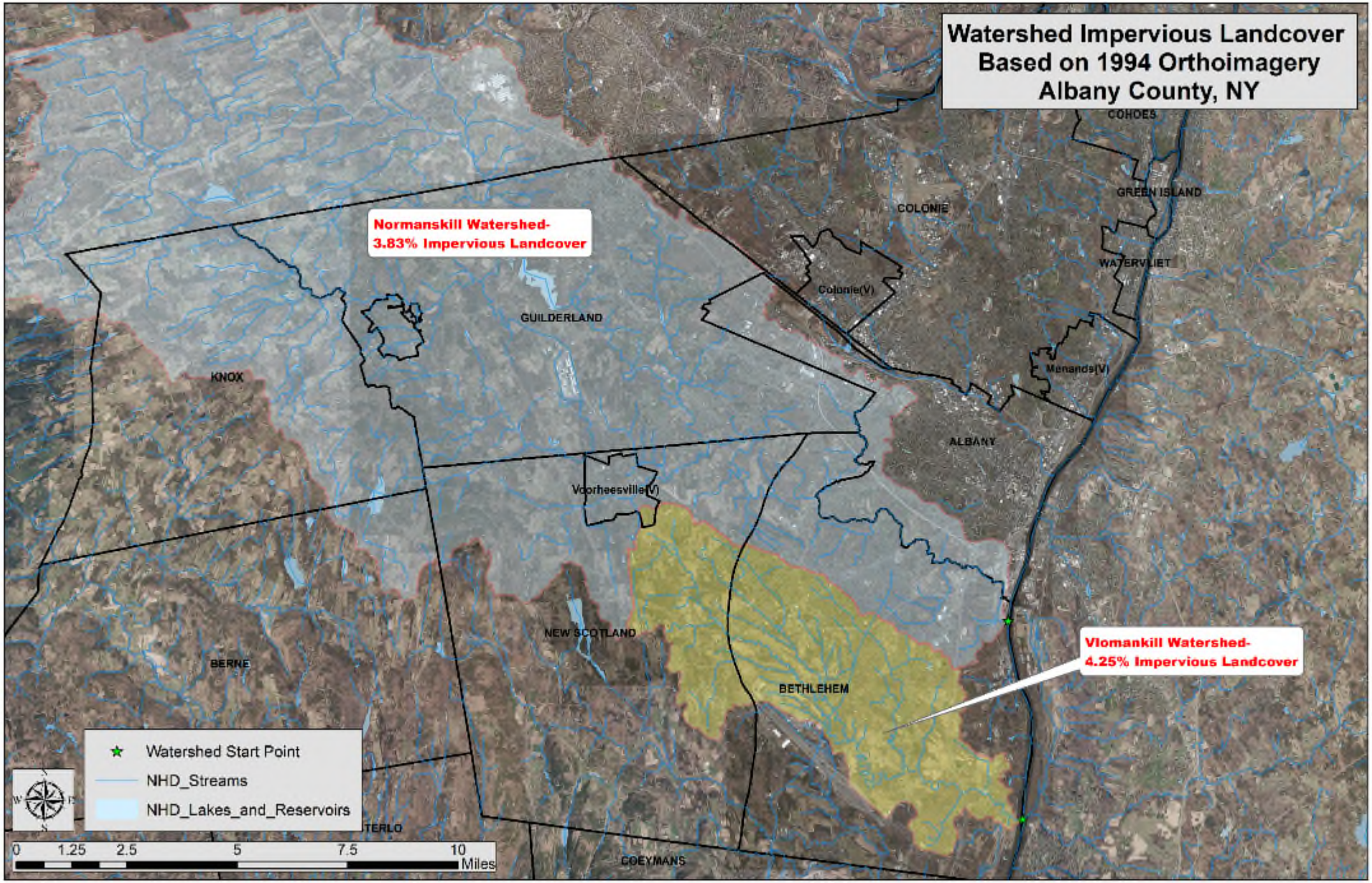
Calculated the Impervious Surface Cover in Albany County Watersheds – ESRI Using Model Builder Tool

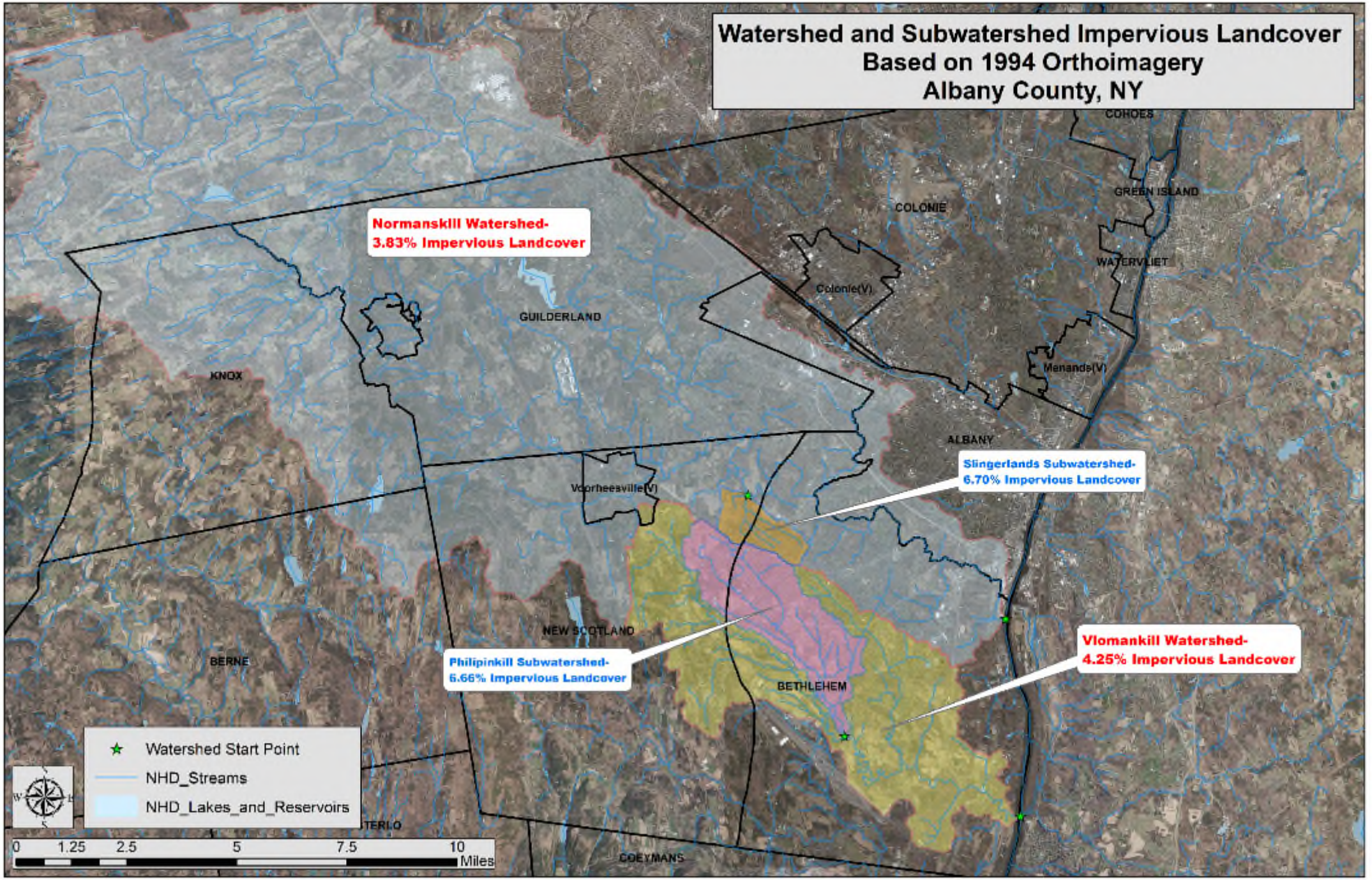
- 1.Set my workspace to the **geodatabase** with the watersheds
- 2.**Clip**: cut the developed areas with the boundaries of watersheds
- 3.**Add geometry Attributes**: selected AREA as Geometry Properties, and selected Square Miles-US as its unit
- 4.**Dissolve**: selected POLY-AREA as Field in Statistics Section
- 5.**Union**: computes a geometric union of the input features. All features and their attributes will be added to the output feature class.
- 6.**Add field + Calculated field** : add PCT_IMP in attribute table; expressed as SUM_POLY_AREA/A. It can get the % of High developed area to the whole watershed area.
- 7. **Add field + Calculated field** : add Cal_PCT, expressed as PCT_IMP*0.95. It can get the area of Imperious High Developed.
- 8. **Add field + Calculated field** : add H_IMP, expressed as Cal_PCT/A. It gets the % of High Developed Imperious areas.

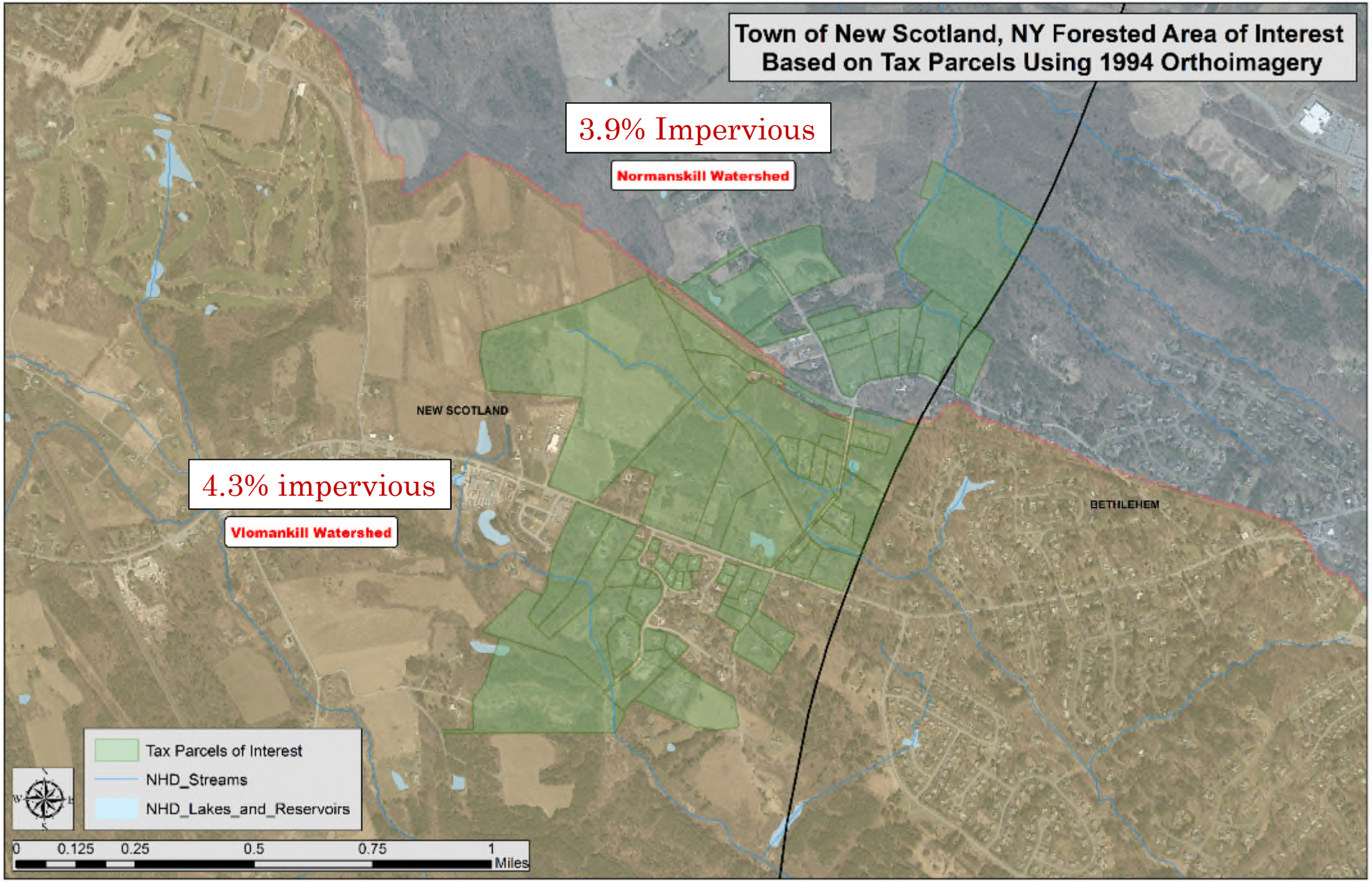


Macaffer Watershed - % Impervious Surface




Watershed Impervious Landcover
Based on 1994 Orthoimagery
Albany County, NY
Normanskill Watershed-
3.83% Impervious Landcover
Vlomankill Watershed-
4.25% Impervious Landcover
COHOES
GREEN ISLAND
COLONIE
WATERVLIET
Colonie(V)
GUILDERLAND
KNOX
Menands(V)
ALBANY
Voorheesville(V)
NEW SCOTLAND
BERNE
BETHLEHEM
COEYMANS
Watershed Start Point
NHD_Streams
NHD_Lakes_and_Reservoirs
0 1.25 2.5 5 7.5 10
Miles

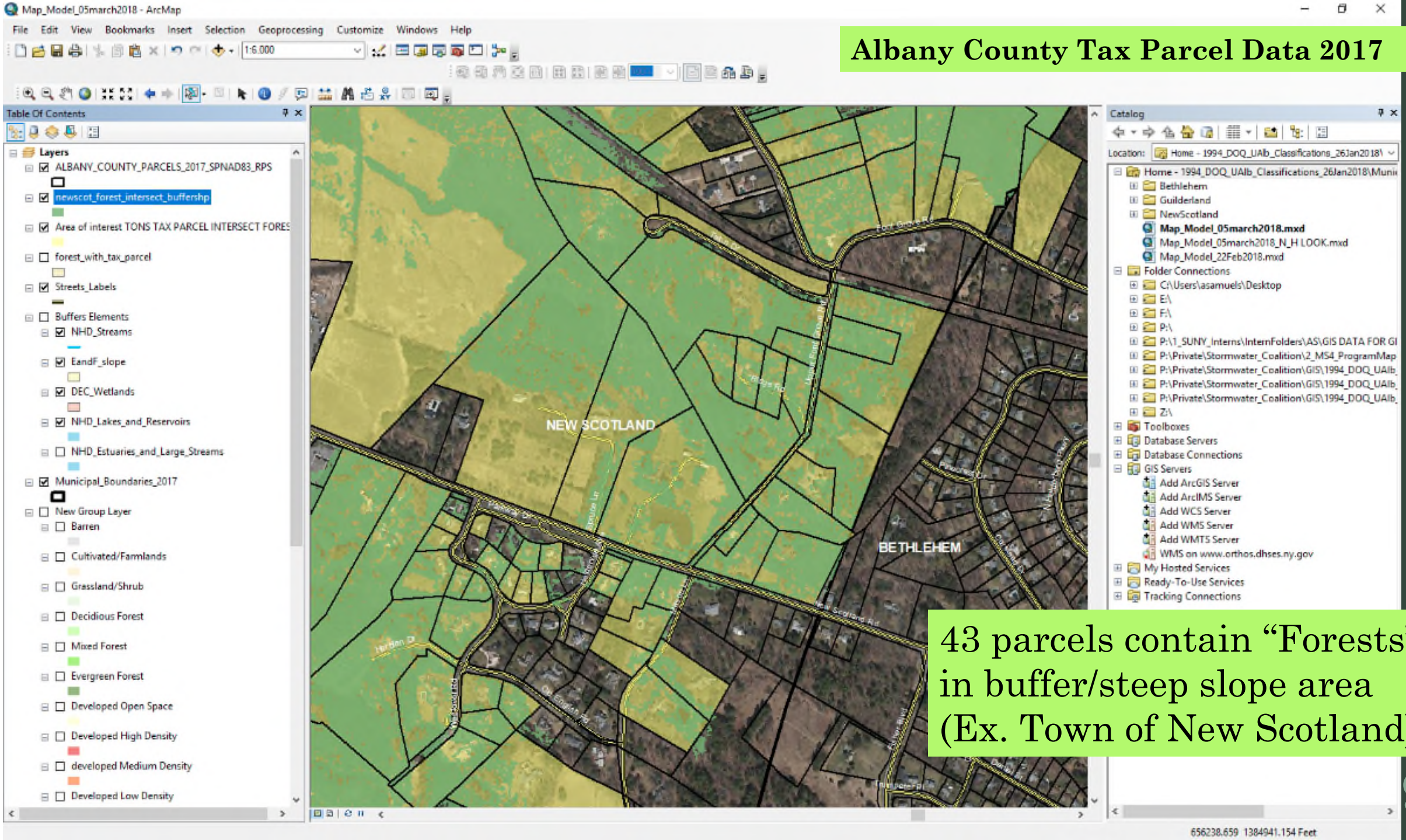

Watershed and Subwatershed Impervious Landcover
Based on 1994 Orthoimagery
Albany County, NY
Normanskill Watershed-
3.83% Impervious Landcover
Slingerlands Subwatershed-
6.70% Impervious Landcover
Philipinkill Subwatershed-
6.66% Impervious Landcover
Vlomankill Watershed-
4.25% Impervious Landcover
COHOES
GREEN ISLAND
COLONIE
WATERVLIET
Colonie(V)
Menands(V)
GUILDERLAND
KNOX
ALBANY
Voorheesville(V)
NEW SCOTLAND
BERNE
BETHLEHEM
COEYMANS
Watershed Start Point
NHD_Streams
NHD_Lakes_and_Reservoirs
0 1.25 2.5 5 7.5 10
Miles


Town of New Scotland, NY Forested Area of Interest
Based on Tax Parcels Using 1994 Orthoimagery
3.9% Impervious
Normanskill Watershed
NEW SCOTLAND
4.3% impervious
Vlomankill Watershed
BETHLEHEM
Tax Parcels of Interest
NHD_Streams
NHD_Lakes_and_Reservoirs
0
0.125
0.25
0.5
0.75
1
Miles

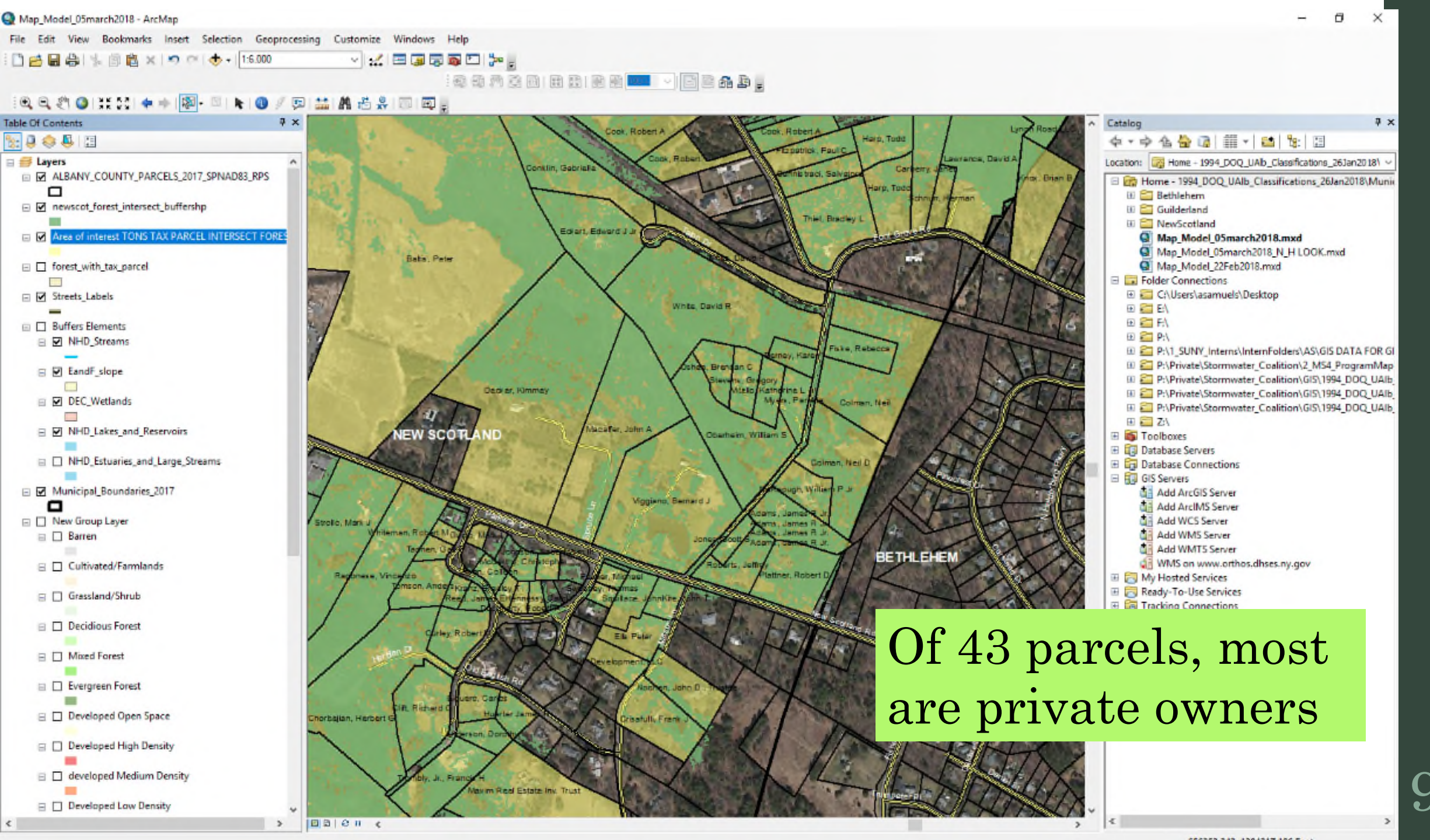
Maintaining System Performance

Will the “Forest” green infrastructure be here in 30 years?

Albany County Tax Parcel Data 2017



43 parcels contain “Forests” in buffer/steep slope area (Ex. Town of New Scotland)



Of 43 parcels, most are private owners

Five parcels suggest other types of ownership.
What does the tax parcel data tell us?

OwnrName	PrclStreet	PrclMuni	YrBuilt	PropClsite	SchCode	LandAssess	TotAssess	Zone Code	SaleDate	SalePrice	Acres	PriorLndAV	PriorTotAV
DF Development, LLC	Mason Ln	New Scotland	0	311	012206			MDR			1.36		
Lynch Road LLC	Font Grove Rd	New Scotland	0	322	012206			R2			33.9		
Noonan, John D., Trustee	Mason Ln	Slingerlands	1988	210	012206			MDR	2014/12/12		2.6		
Maxim Real Estate Inv. Trust	Toby Ln	New Scotland	1979	210	012206			RA	2017/05/02		11.51		
Creekside New Scotland LLC	Miller Rd	New Scotland	0	322	013403			RA	2016/10/04		30		

Owner Name: LLC's – Developers own property?
Noonan, John D Trustee (Trustee of estate? Inheritance scenario, ripe for purchase?)

YrBuilt and Property Class Code: No buildings and vacant land; "greenfield" cheaper to develop

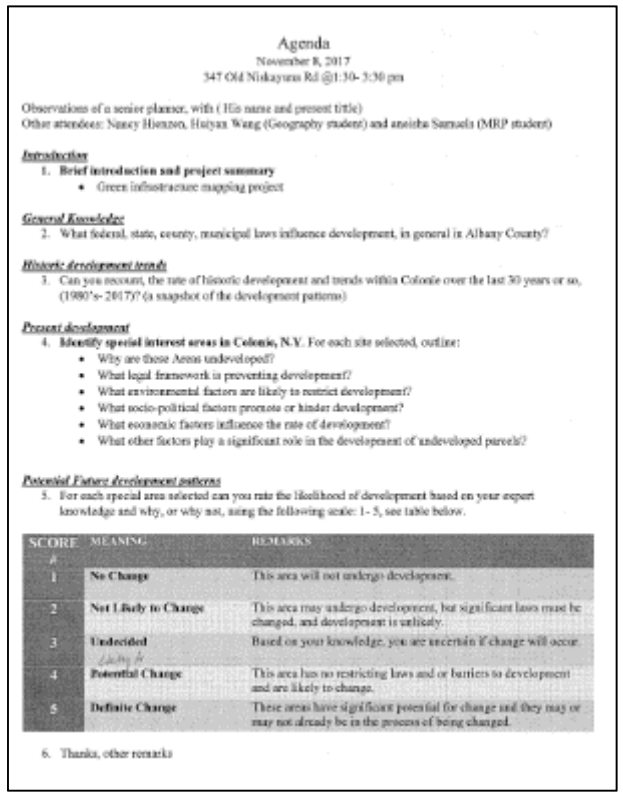
School Code: Bethlehem Central School District-Voorheesville Central School District (high ranking)

TotAssess & Acres: Tax burden and assessed value of land (price per acre-proxy. Land too expensive? Cheap? What is the return on investment for developer?

Will these properties be here in 30 years?

A Planner's Perspective Town of Colonie

30 Years of Professional Experience



Agenda
November 8, 2017
347 Old Niskayuna Rd @1:30- 3:30 pm

Observations of a senior planner, with (His name and present title)
Other attendees: Nancy Hiruzo, Haiyan Wang (Geography student) and aneitha Samuels (MRP student)

Introduction

1. **Brief introduction and project summary**
   - Green infrastructure mapping project

General Knowledge

2. What federal, state, county, municipal laws influence development, in general in Albany County?

Historic development trends

3. Can you recount, the rate of historic development and trends within Colonie over the last 30 years or so, (1980's- 2017)? (a snapshot of the development patterns)

Present development

4. **Identify special interest areas in Colonie, N.Y.** For each site selected, outline:
   - Why are these Areas undeveloped?
   - What legal framework is preventing development?
   - What environmental factors are likely to restrict development?
   - What socio-political factors promote or hinder development?
   - What economic factors influence the rate of development?
   - What other factors play a significant role in the development of undeveloped parcels?

Potential Future development patterns

5. For each special area selected can you rate the likelihood of development based on your expert knowledge and why, or why not, using the following scale: 1- 5, see table below.

SCORE #	MEANING	REMARKS
1	**No Change**	This area will not undergo development.
2	**Not Likely to Change**	This area may undergo development, but significant laws must be changed, and development is unlikely.
3	**Undecided**	Based on your knowledge, you are uncertain if change will occur.
4	**Potential Change**	This area has no restricting laws and or barriers to development and are likely to change.
5	**Definite Change**	These areas have significant potential for change and they may or may not already be in the process of being changed.

6. Thanks, other remarks

Questions for Mike Lyons, Senior Planner Town of Colonie

November 8 & 15, 2017 Sessions

Retired January, 2018. [2011 to 2013 Stormwater Coalition Green Infrastructure Local Law Committee]

1. What Federal, State, and Local Laws influence development (in Town of Colonie or generally)

2. Describe the rate of historic development and trends within the Town of Colonie over the past 30 years

3. Identify special interest areas in Colonie, N.Y.
   - Why are these Areas undeveloped?
   - What legal framework is preventing development?
   - What environmental factors are likely to restrict development?
   - What socio-political factors promote or hinder development?
   - What economic factors influence the rate of development?
   - What other factors play a significant role in the development of undeveloped parcels?

Town of Colonie
Areas of Interest
M. Lyons Nov, 2017

Take away's from Mike Lyons sessions

1. Undeveloped parcels have a long history

a. Who owns it now, who used to own it. Many stories. Why property not sold? Family attached to land, still some income, unclear when it might be developed. Family decisions, very personal.

b. Some parcels – constrained lands, can't be developed

c. Availability of water and sewer key – important to seller and buyer-projects sit for a long time (appear to be undeveloped), just a matter of time for infrastructure issues to be addressed

Observations

2. Local planning tools important, along with Fed & State laws

a. Conservation overlays worked
   -educating landowners and developer's important
   -overlay law needs to be in place, accepted and support before rapid development occurs

b. Pine Bush Commission – important partner

c. Stream corridor protection –important

d. Support for green infrastructure needs to be widespread w/in municipality and developer community – takes effort

e. Land trusts important – durable land protection – T/Col parcel, now MHLC inventory. Need well managed, well funded Land Trust.

Observations

3. Exercise in Town of Colonie – valuable. Parcel by parcel look-one way to assess likelihood of change. Scorecard reviewed by Mike. Parcel by parcel analysis, no scores for Town of Colonie. No time.

SCORE #	MEANING	REMARKS
1	**No Change**	This area will not undergo development.
2	**Not Likely to Change**	This area may undergo development, but significant laws must be changed, and development is unlikely.
3	**Undecided**	Based on your knowledge, you are uncertain if change will occur.
4	**Likely to Change**	This area has no restricting laws and or barriers to development and are likely to change.
5	**Definite Change**	These areas have significant potential for change and they may or may not already be in the process of being changed.

How would you score these properties?

OwnrName	PrclStreet	PrclMuni	YrBuilt	PropClsite	SchCode	LandAsse ss	TotAssess	Zone Code	SaleDat e	SalePri ce	Acres	PriorLnd AV	PriorTot AV	SCORE
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Creekside New Scotland LLC	Miller Rd	New Scotland	0	322	013403			RA	2016/10/ 04		30			5?

SCORE #	MEANING
1	No Change
2	Not Likely to Change
3	Undecided
4	Likely to Change
5	Definite Change

Will these properties be here in 30 years?

Given water quality goals, what is the future of these prioritized “Forests”?

What is the future of “Forests” where 10% imperviousness threshold of watershed is changing?

Are “Forests” really considered green infrastructure assets to be “maintained for performance” similar to other water infrastructure?

Lessons Learned

- Working knowledge of applied G.I.S. and Remote Sensing
- The realities of working with large datasets
- The extent of green infrastructure
- The value of local knowledge (municipal experience)

Acknowledgments

Alexander Buyantuev
Assistant Professor
Geography and Planning
University at Albany SUNY

Mike Lyons
Senior Planner
Department of Planning
Town of Colonie

Thank You