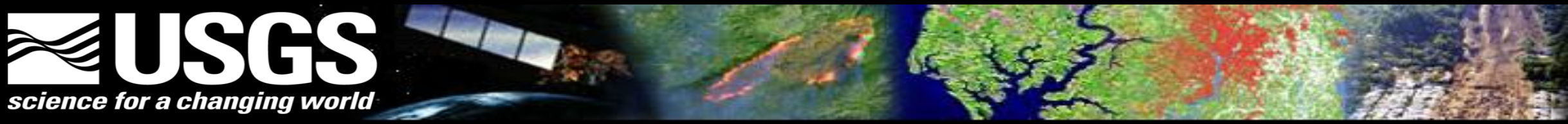

Land Use for Phase 7: present and future

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1 Lower Mississippi-Gulf Water Science Center, U.S. Geological Survey, Annapolis, MD 21403

Land Use Workgroup
October 7, 2021

U.S. Department of the Interior
U.S. Geological Survey

One-meter Resolution Land Use Products for Chesapeake Bay Counties

Land Use: 2013/14, 2017/18, and 2021/22; 60+ classes; accurate change over time.

2017-18 data highlights: addition of lakes/ponds, solar fields, and orchards/vineyards; improved mapping of tidal and non-tidal wetlands

Planned public release date: February 2022

2021-22 data highlights: addition of open channel, tree canopy over channel, and animal operations.

Planned public release date: December 2023

Hydrography: 2-D raster (discontinuous), 1-D polyline (continuous)

Features: streams, rills/gullies, agricultural ditches, roadside ditches, floodplains (from FACET), floodplain depressions, detention features, headwater wetlands, other.

Attributes: width, bank height, flow permanence, stream order, drainage area

Planned public release date: June 2024 (draft products will be available in 2022-23)

Phase 7 Full Land Use/Cover Classification (60 classes, final version)

1. Water (9)

- 1.1 Lentic
  - 1.1.1 Estuary (tidal)
  - 1.1.2 Lakes & Ponds (non wetlands)
- 1.2 Lotic
  - 1.2.1 Channels (TBD)
    - 1.2.1.1 Open Channel
    - 1.2.1.2 Tree Canopy over Channel
    - 1.2.1.3 Culverted
  - 1.2.2.Ditches (TBD)
    - 1.2.2.1 Open Ditch
    - 1.2.2.2 Tree Canopy over Ditch
    - 1.2.2.3 Culverted
- 1.3 Other Water

2. Developed (12)

- 2.1 Impervious
  - 2.1.1 Roads
  - 2.1.2 Structures
  - 2.1.3 Other Impervious (Parking lots, driveways)
  - 2.1.4 Tree Canopy (TC) over Impervious
    - 2.1.4.1 TC over Roads
    - 2.1.4.2 TC over Structures
    - 2.1.4.3 TC over Other Impervious
- 2.2 Pervious
  - 2.2.1 Turf Grass
  - 2.2.2 Bare Developed
  - 2.2.3 Suspended Succession (rights-of-way)
    - 2.2.3.1 Barren
    - 2.2.3.2 Herbaceous
    - 2.2.3.3 Scrub-shrub
  - 2.2.4 Tree Canopy over Turf Grass

3. Forest (7)

- 3.1 Forest (>= 1 acre, 240-ft width)
- 3.2 Other Tree Canopy
- 3.3 Harvested Forest (<= 3 years)
  - 3.3.1 Barren
  - 3.3.2 Herbaceous
- 3.4 Natural Succession (> 3 years)
  - 3.4.1 Barren
  - 3.4.2 Herbaceous
  - 3.4.3 Scrub-shrub

4. Production (16)

- 4.1 Agriculture
  - 4.1.1 Cropland
    - 4.1.1.1 Barren
    - 4.1.1.2 Herbaceous
  - 4.1.2 Pasture
    - 4.1.2.1 Barren
    - 4.1.2.2 Herbaceous
  - 4.1.3 Orchard/vineyard
    - 4.1.3.1 Barren
    - 4.1.3.2 Herbaceous
    - 4.1.3.3 Scrub-shrub
  - 4.1.4 Animal Operations (TBD)
    - 4.1.4.1 Impervious
    - 4.1.4.2 Barren
    - 4.1.4.3 Herbaceous
- 4.2 Solar fields
  - 4.2.1 Impervious
  - 4.2.2 Pervious
    - 4.2.2.1 Barren
    - 4.2.2.2 Herbaceous
    - 4.2.2.3 Scrub-shrub
- 4.3 Extractive (active mines)
  - 4.3.1 Barren
  - 4.3.2 Impervious

5. Wetlands and Water Margins (16)

- 5.1 Tidal
  - 5.1.1 Barren
  - 5.1.2 Herbaceous
  - 5.1.3 Scrub-shrub
  - 5.1.4 Tree Canopy
  - 5.1.5 Forest
- 5.2 Riverine (Non-tidal)
  - 5.2.1. Barren
  - 5.2.2 Herbaceous
  - 5.2.3 Scrub-shrub
  - 5.2.4 Tree Canopy
  - 5.2.5 Forest
  - 5.2.6 Ponds
- 5.3 Terrene/Isolated (Non-tidal)
  - 5.3.1 Barren
  - 5.3.2 Herbaceous
  - 5.3.3 Scrub-shrub
  - 5.3.4 Tree Canopy
  - 5.3.5 Forest
  - 5.3.6 Ponds
- 5.4 Bare shore

Generalized Phase 7 Land Use/Cover Classes

1. **Impervious Roads**
   - 2.1 Impervious
     - 2.1.1 Roads

2. **Impervious Non-Roads**
   - 2.1 Impervious
     - 2.1.2 Structures
     - 2.1.3 Other Impervious
   - 4.2 Solar fields
     - 4.2.1 Impervious
   - 4.3 Extractive (active mines)
     - 4.3.2 Impervious

3. **Tree Canopy Over Impervious**
   - 2.1 Impervious
     - 2.1.4 Tree Canopy over Impervious

4. **Turf Grass**
   - 2.2 Pervious, Developed
     - 2.2.1 Turf Grass

5. **Tree Canopy over Turf Grass**
   - 2.2 Pervious. Developed
     - 2.2.4 Tree Canopy over Turf Grass

6. **Construction**
   - 2.2 Pervious. Developed
     - 2.2.2 Bare Developed

7. **Stream Beds and Banks (?)**

8. **Suspended Succession**
   - 2.2 Pervious. Developed
     - 2.2.2 Bare Developed
   - 4.2 Solar fields
     - 4.2.2 Pervious

9. **Forest**
   - 3.1 Forest (>= 1 acre, 240-ft width)
   - 3.2 Tree Canopy in Agriculture

10. **Harvested Forest**
    - 3.3 Harvested Forest (<= 3 years)

11. **Natural Succession**
    - 3.4 Natural Succession (> 3 years)
    - 5.4 Bare shore, Water Margins

12. **Wetlands, Tidal (?)**
    - 5.1 Tidal Wetlands

13. **Wetlands, Floodplain**
    - 5.2 Riverine Wetlands

14. **Wetlands, Other**
    - 5.3 Terrene/Isolated Wetlands

15. **Water**
    - 1.1 Lentic
      - 1.1.1 Estuary (tidal)
      - 1.1.2 Lakes & Ponds
    - 1.2 Lotic
      - 1.2.1 Channels
      - 1.2.2 Ditches

16. **Cropland**
    - 4.1 Agriculture
      - 4.1.1 Cropland
      - 4.1.3 Orchard/vineyard

17. **Pasture**
    - 4.1 Agriculture
      - 4.1.2 Pasture

18. **Animal Operations**
    - 4.1.4 Animal Operations

19. **Extractive**
    - 4.3 Extractive (active mines)
      - 4.3.1 Barren

Land Use Change Viewer

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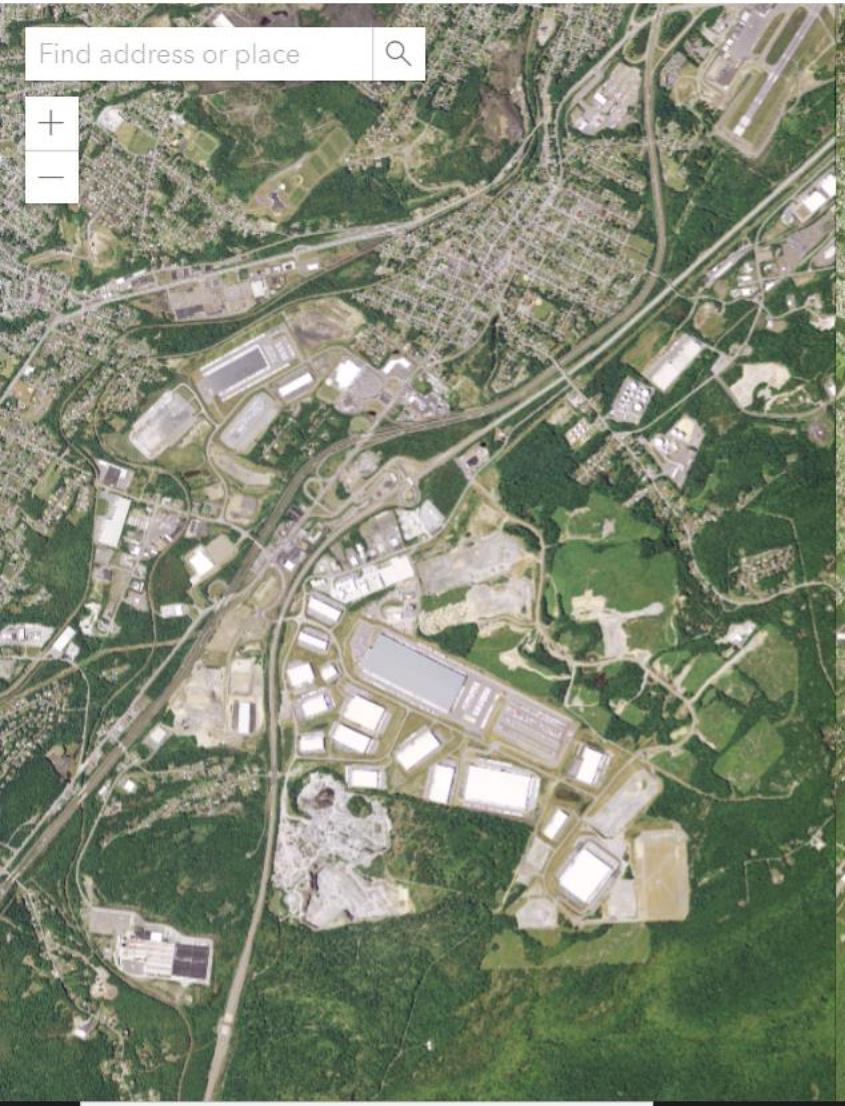
NAIP 2013/2014

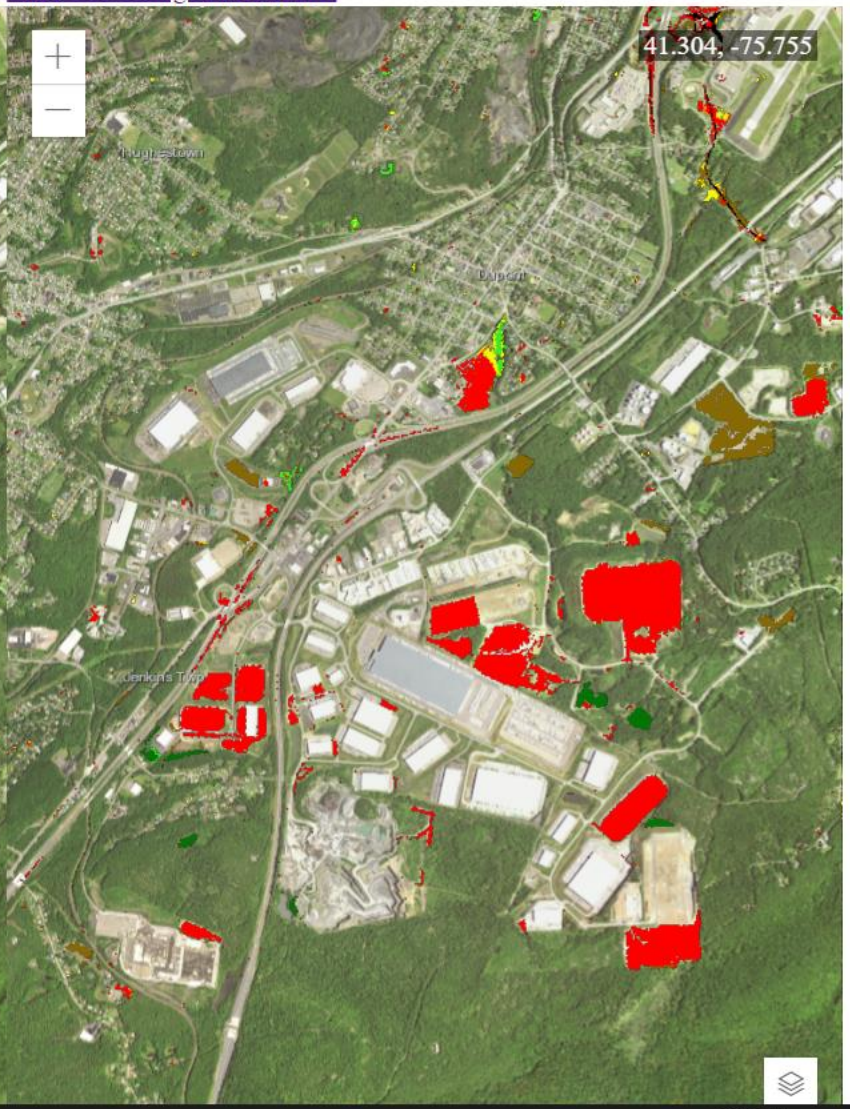
NAIP 2017/2018

Version 1 Land Use Change

NAIP 2017/2018

Land Use Change Pivot Tables





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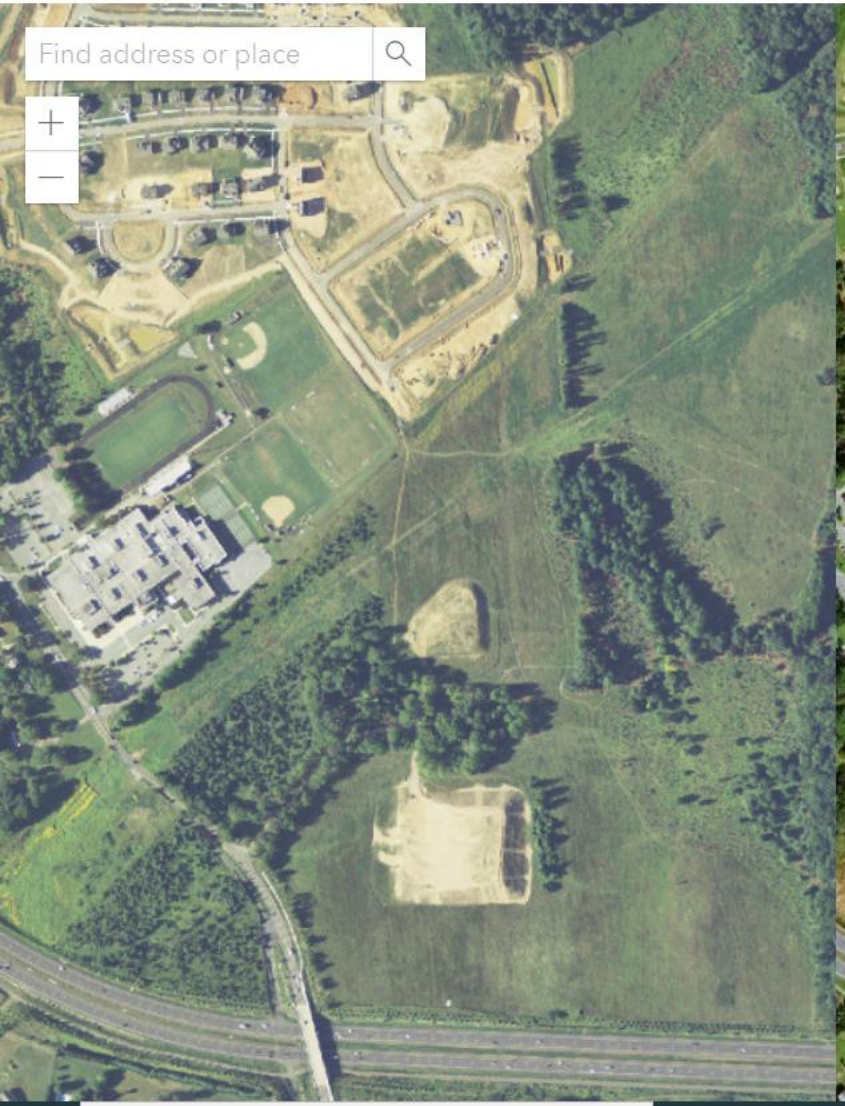
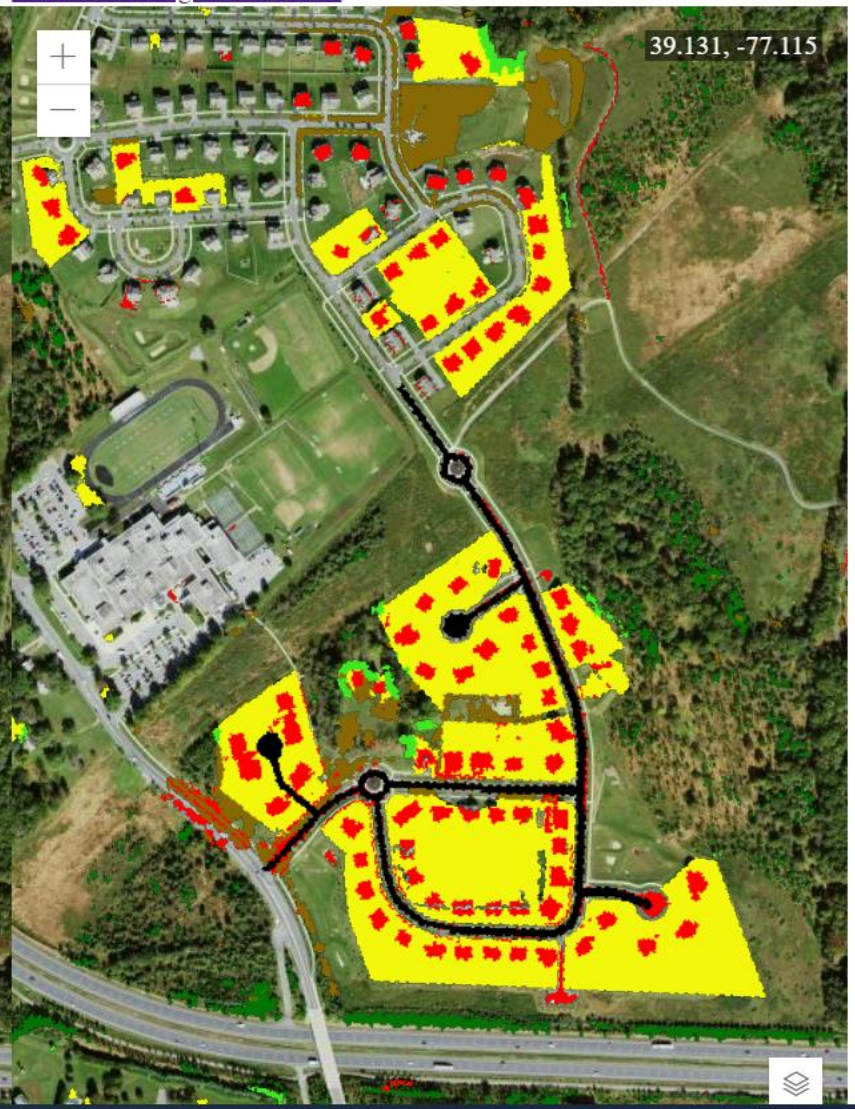
NAIP 2017/2018

Land Use Change Pivot Tables





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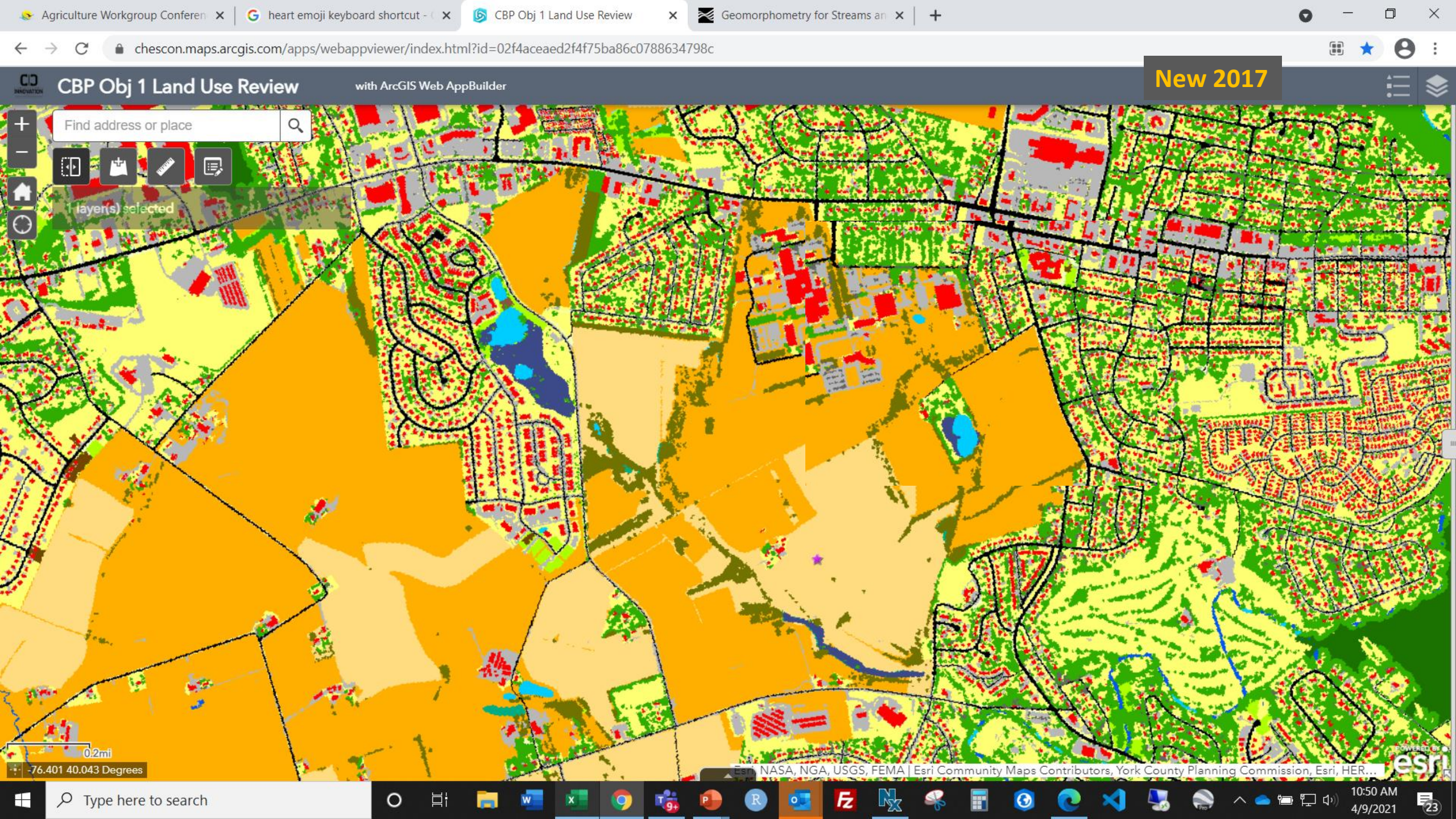
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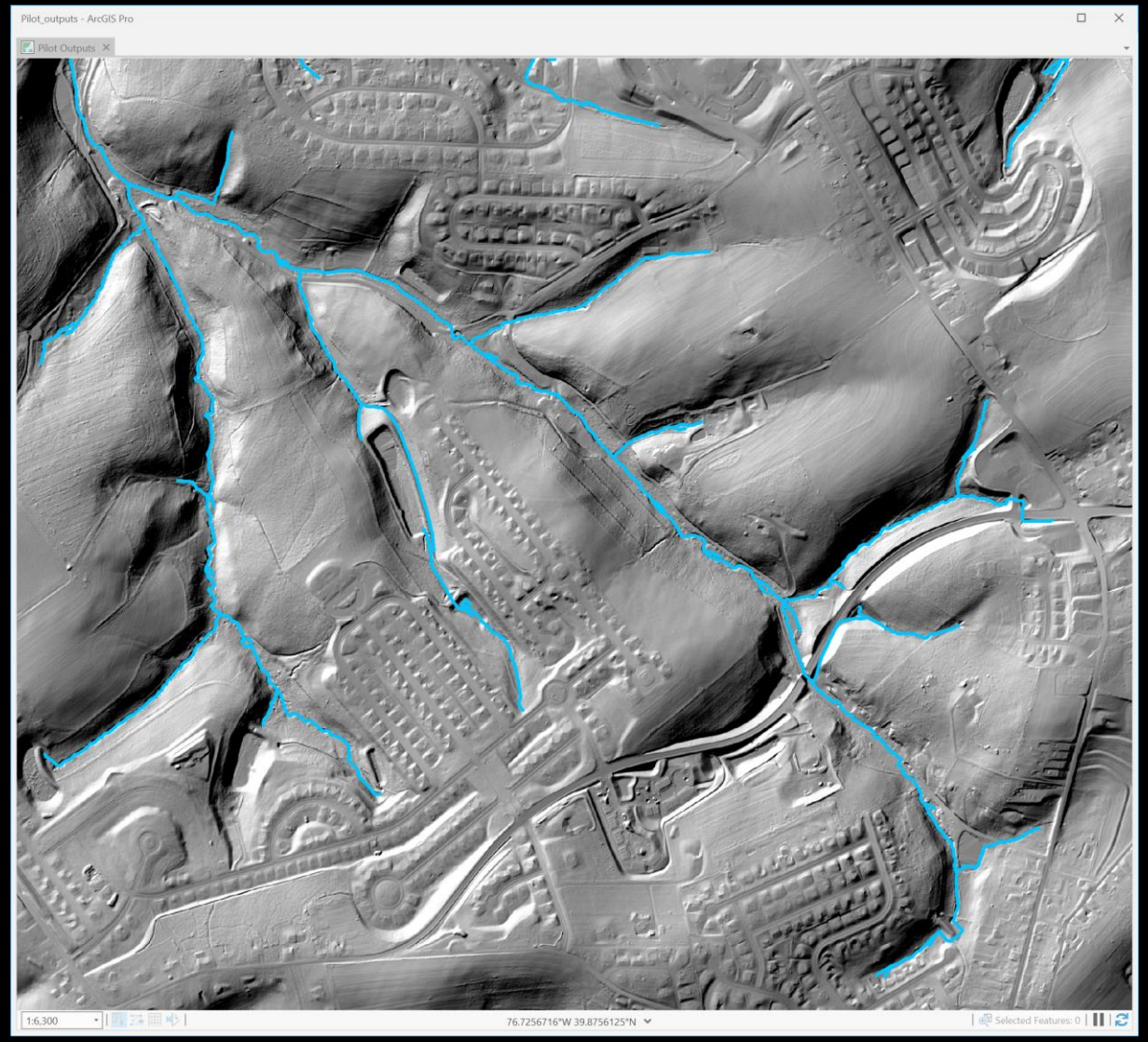
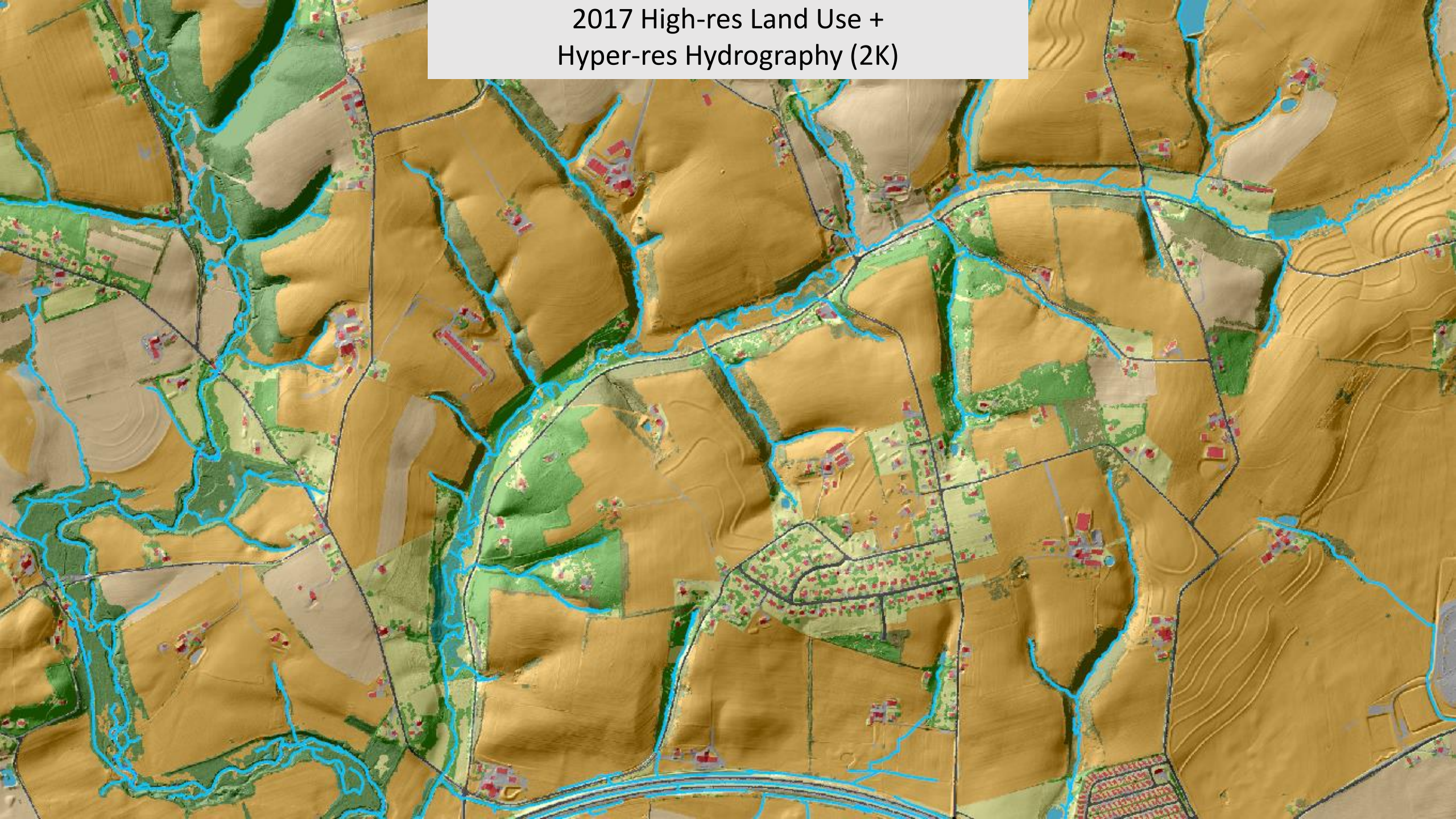
Hyper-Resolution* Hydrography

1. Lidar elevation
2. Valley-scale geomorphons
3. Channel-scale geomorphons
4. Extract valley network
5. Extract channels using valley network
6. QAQC channel skeleton
7. Connect stream network

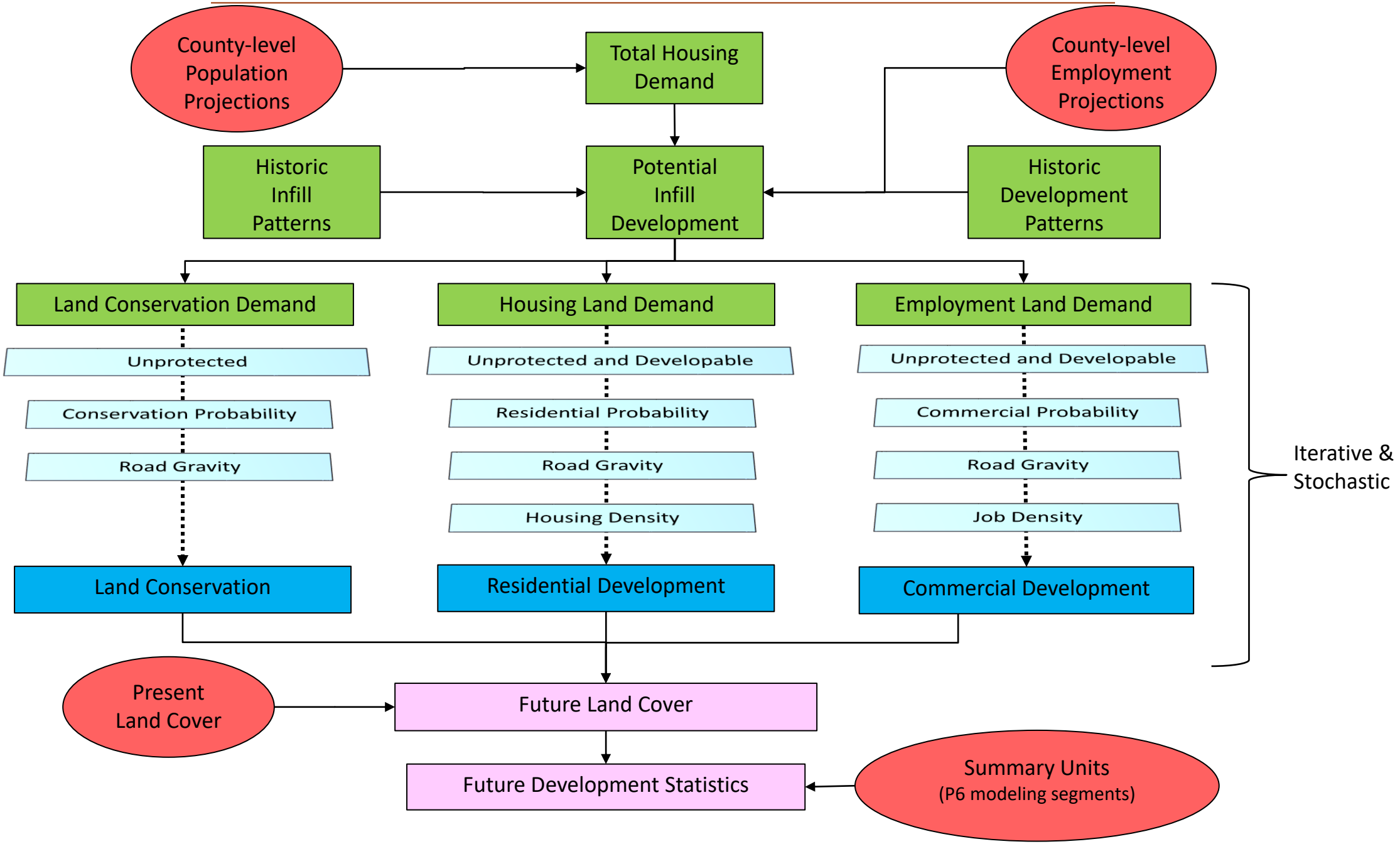
Attributed with bank-height ratio, channel width, floodplain width, entrenchment ratio



* 1-meter raster, 1:2000 scale


2017 High-res Land Use +
Hyper-res Hydrography (2K)

Forecasting Future Changes in Land Use: Chesapeake Bay Land Change Model v5



Forecasting Future Changes in Land Use

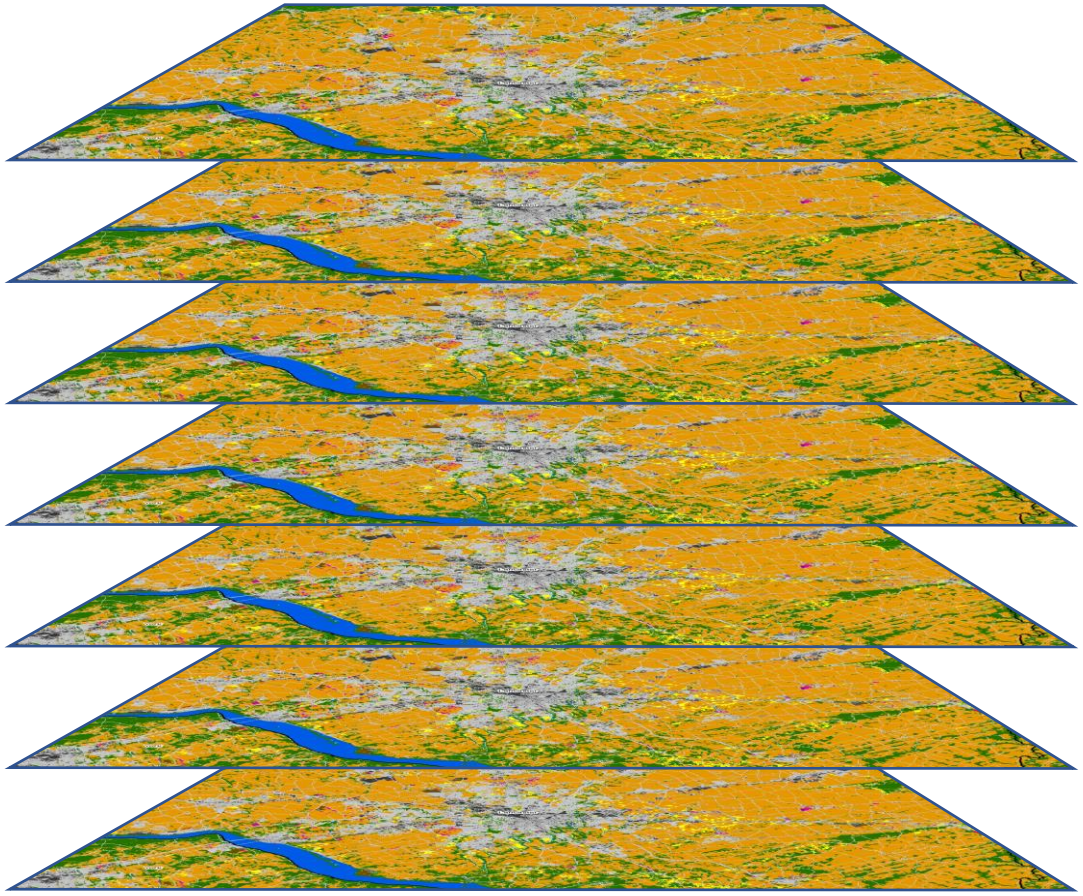
CBLCM v5 (current version)

- Simulates residential, commercial, and mixed-use development and forest and farmland conservation.
- Simulates change in patches of cells
- Estimates infill/redevelopment by county
- Relies on Capiella and Brown (2001) impervious surface coefficients
- Derives commercial and residential densities from Decennial Census and NLCD.
- Parameterized using 30-meter resolution NLCD: 2001-2011

CBLCM v6 (Phase 7)

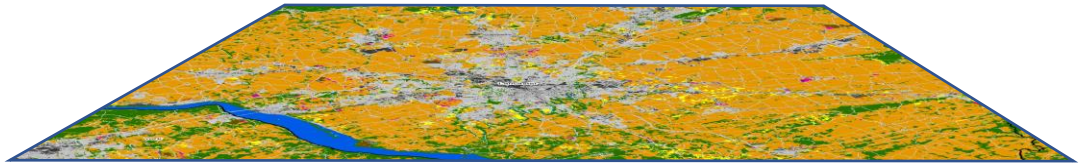
- Same + different types of housing and commercial development, timber harvest, agricultural land in production.
- Simulates change in tax parcels or patches of cells
- Simulates infill/redevelopment by parcel
- Derives impervious surface coefficients from parcel and high-res land use data.
- Derives commercial and residential densities from parcel data.
- Parameterized using 1-meter resolution land use: 2013-2021 and 30-years of annual 30-meter resolution land use (LCMAP)
- Tracks development capacity and age of housing stock and trees

Multiple Stochastic Iterations



Every county is simulated 101 times for each scenario and target year, i.e., 2025.

Average of simulations by summary unit = future development

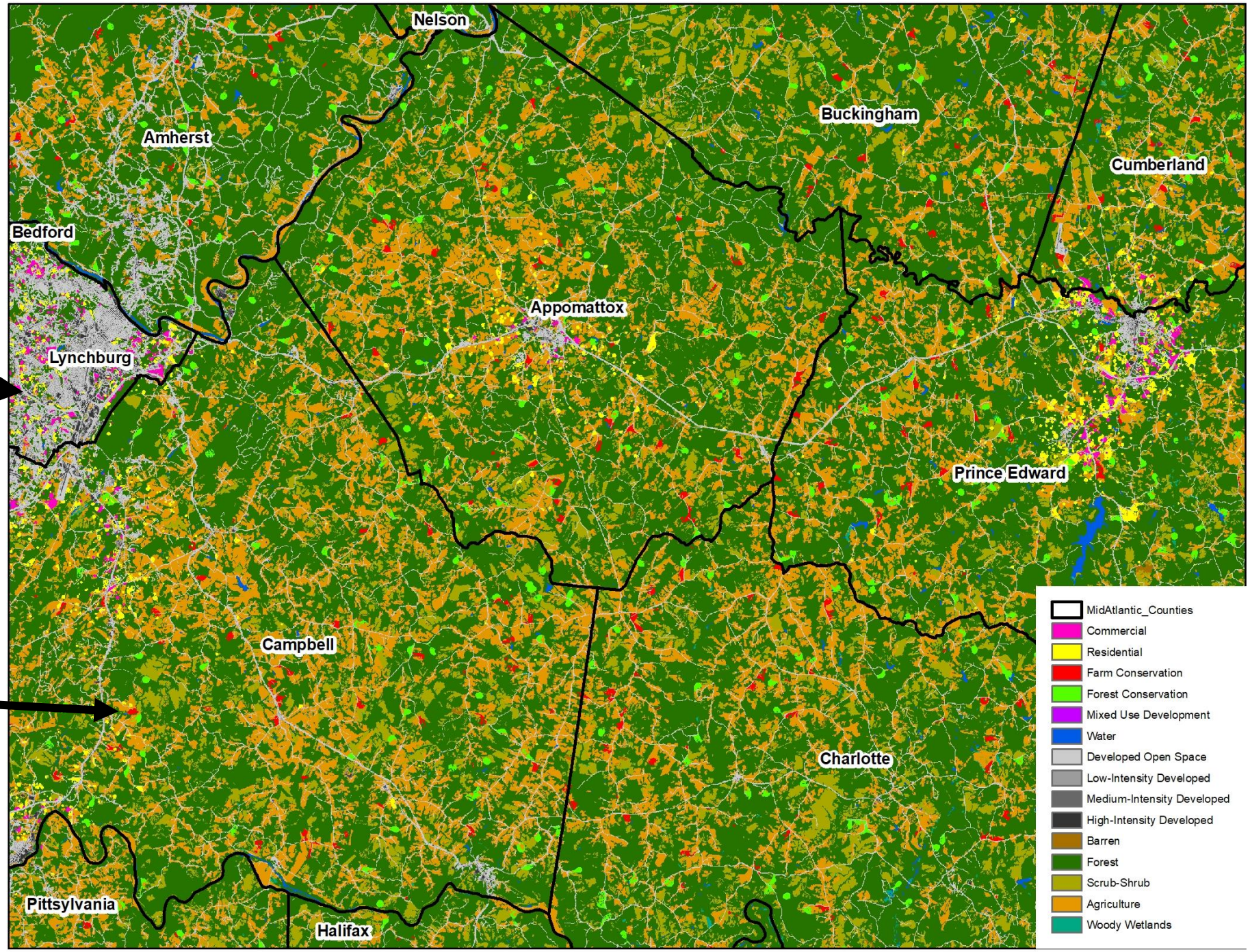


Relative Standard Deviation = estimate of uncertainty

Land Change Model Outputs

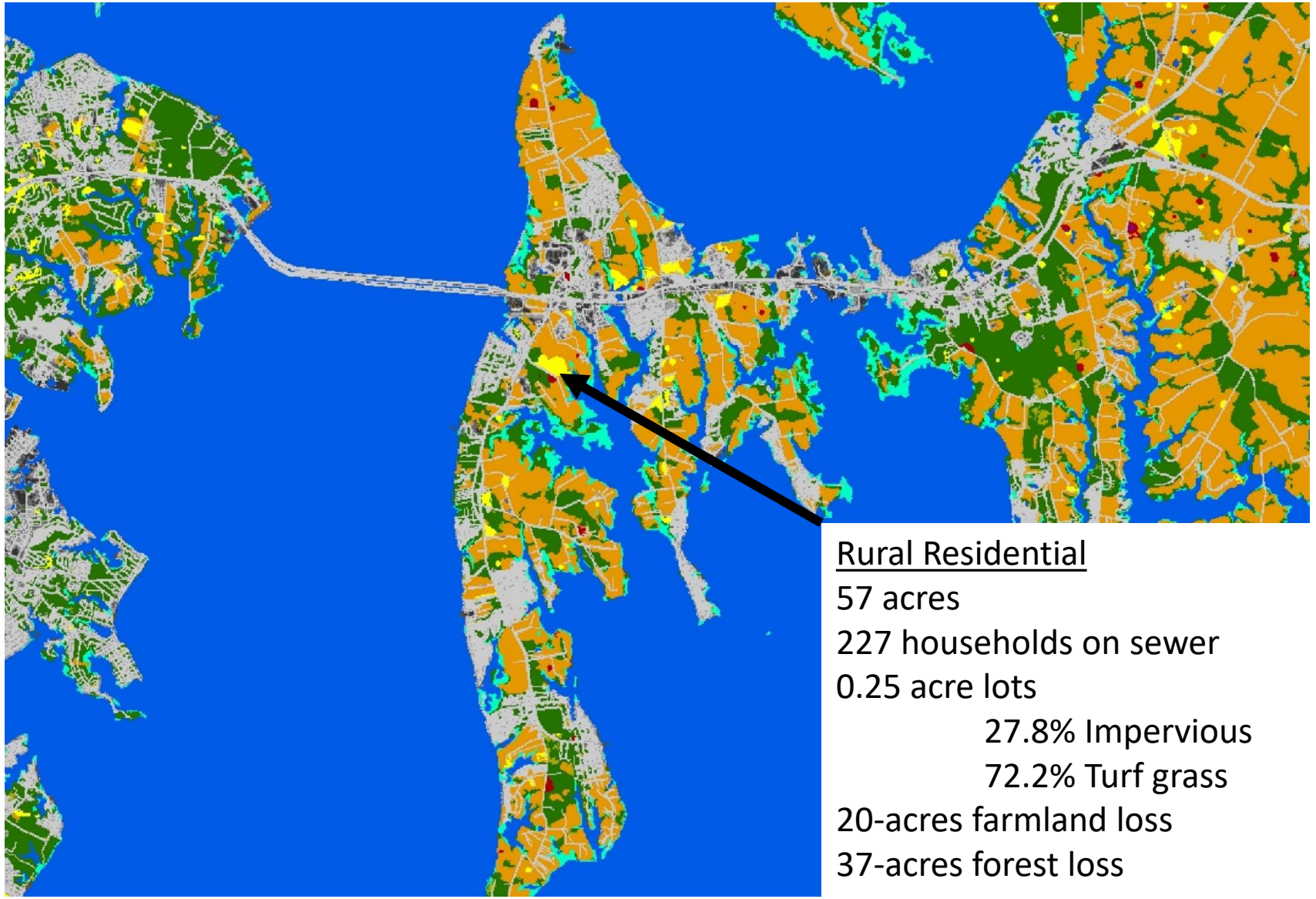
Commercial and Residential Growth

Farmland and Forest Conservation



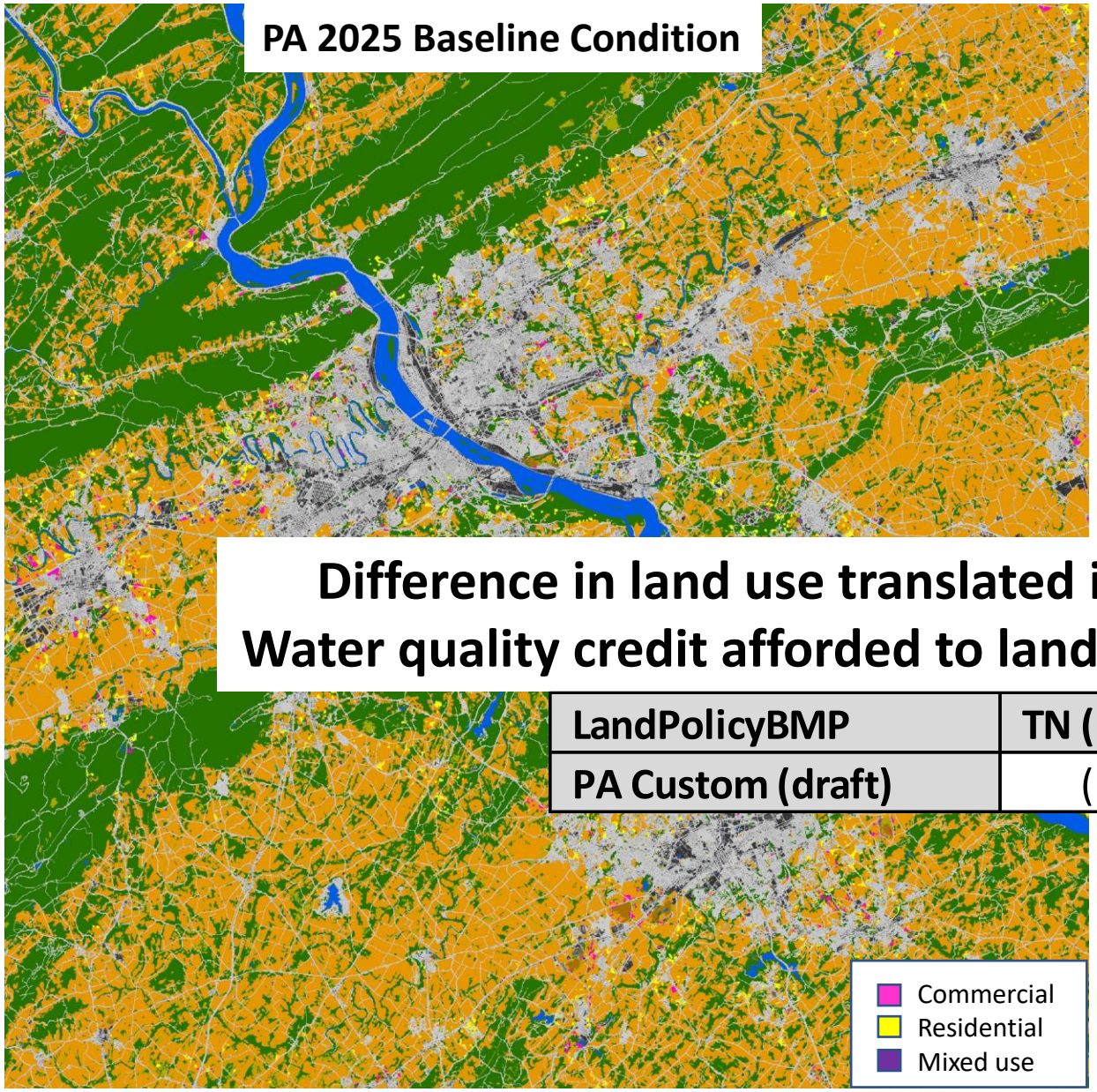
Land Change Model Outputs: Summary Statistics

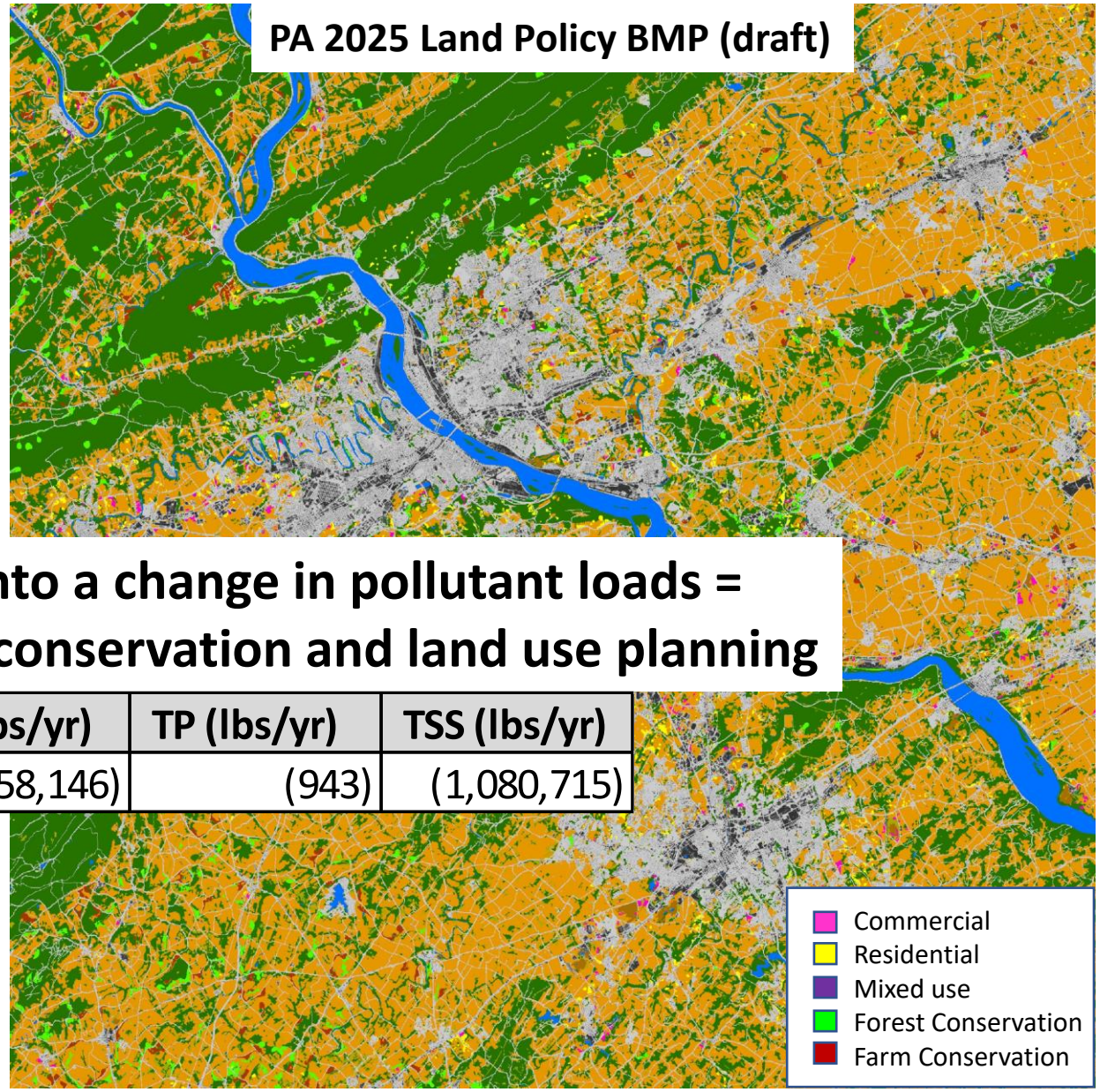
- Impervious surface and turf grass expansion
- Forest conversion to development
- Farmland conversion to development
- Future population on sewer and septic



<u>Rural Residential</u>
57 acres
227 households on sewer
0.25 acre lots
27.8% Impervious
72.2% Turf grass
20-acres farmland loss
37-acres forest loss

Crediting Land Conservation and Planning towards Water Quality Improvement





Difference in land use translated into a change in pollutant loads = Water quality credit afforded to land conservation and land use planning

LandPolicyBMP	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)
PA Custom (draft)	(158,146)	(943)	(1,080,715)


USGS
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