# Brown County OneMap:

# Hydrography, Wetlands and Land Cover Mapping

Saint Mary's University
GEOSPATIAL SERVICES

Wetland Mapping Consortium
Fall Meeting
September, 2025

# GeoSpatial Services

## Who We Are

*And integration of academic apprenticeship with focused professional development applying spatial technologies*


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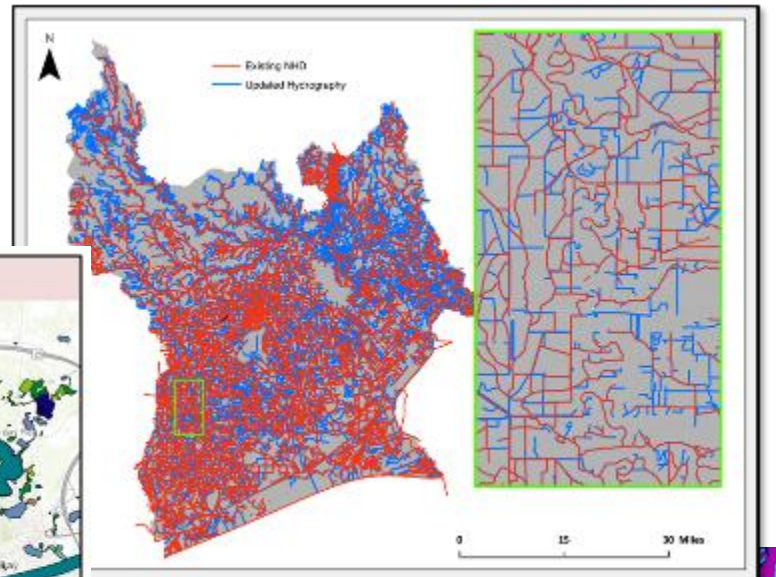
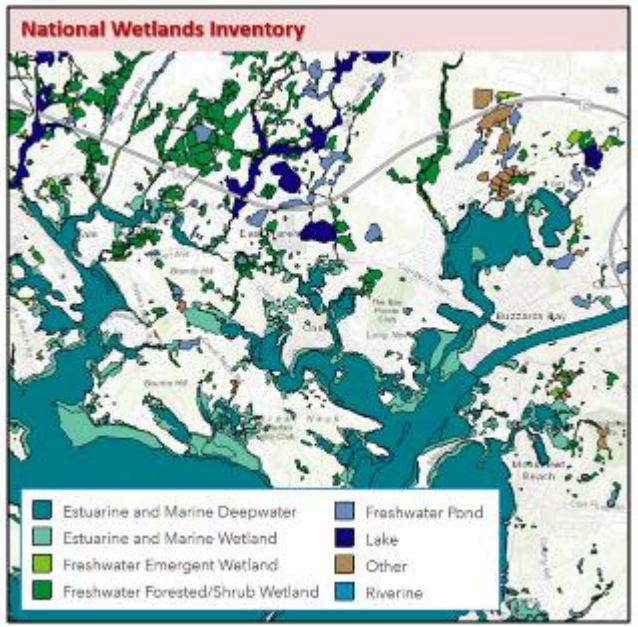
# So, What is “One Map”

Leveraging Existing Federal Mapping Programs to Achieve Efficiencies

- 3DEP Program – 3DHP Hydrography
- C-CAP Landcover Level 2
- National Wetland Inventory
- C-CAP Landcover Level 3
- FEMA D-Firm Maps



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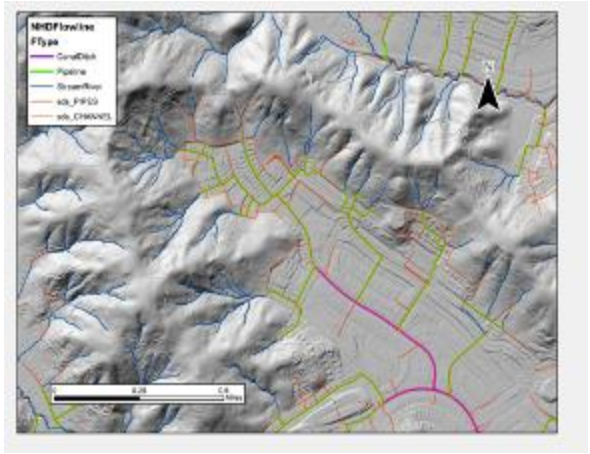
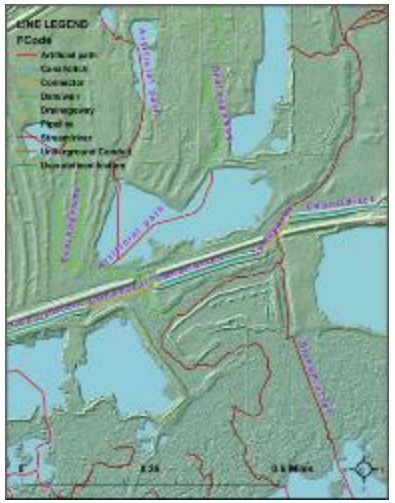
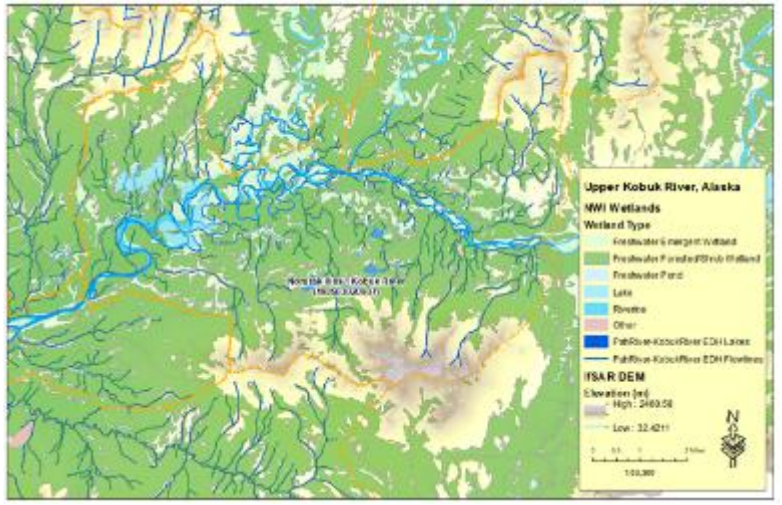
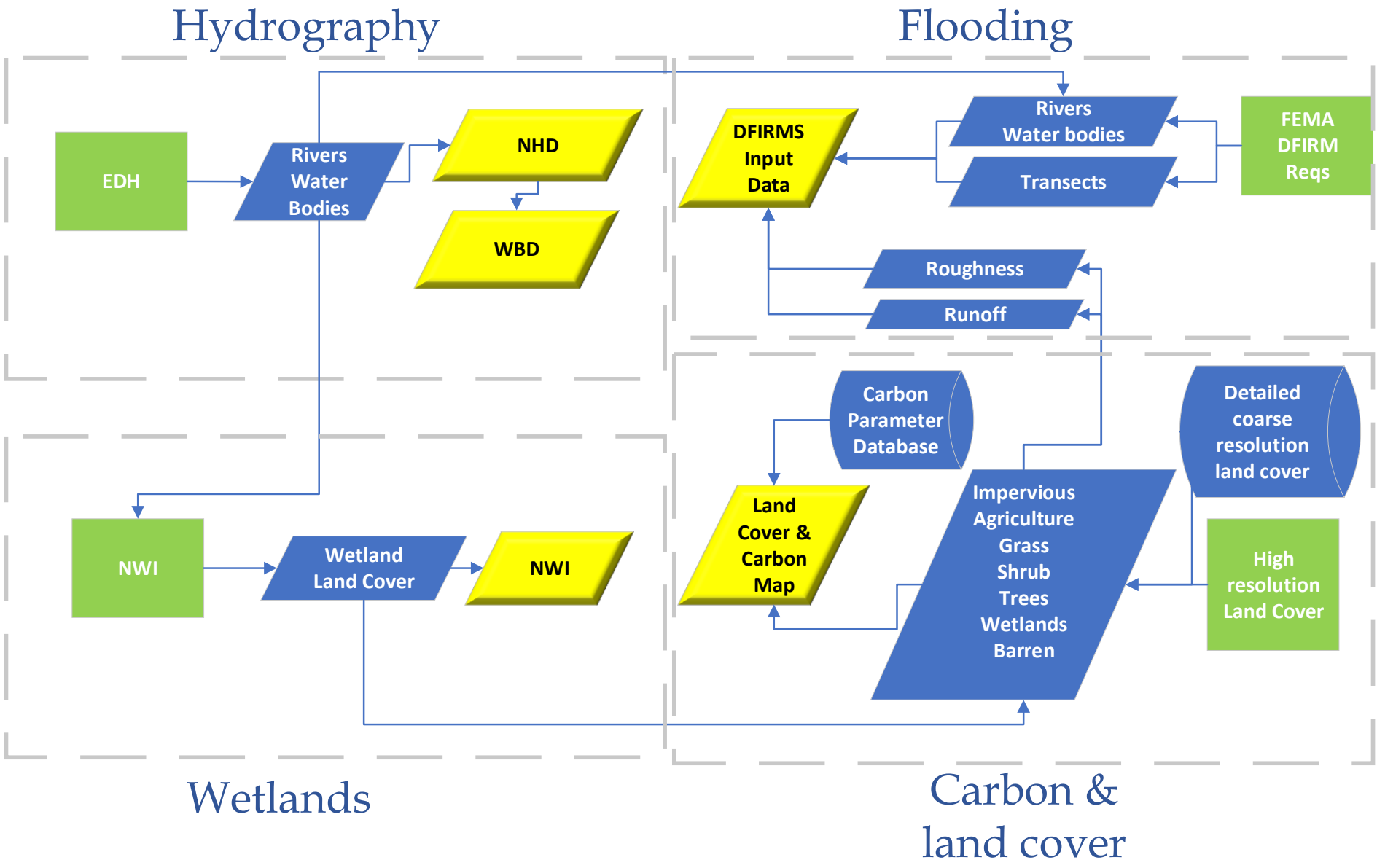
# So, Why Now?

- **Historically** datasets were created from different data sources and at different scales
- Conducting any type of analysis from these data required **significant effort**
  - Inconsistent boundaries
  - Inconsistent definition of classes
  - Data used at a scale not designed for
  - Lowest resolution used
- Develop all these datasets off the **same scale source data** (imagery and lidar)
- **Operational** decision making scale
- **Nationwide** Federal efforts
- **Reduced cost** of producing data together
- **Increased utility** of consistent data
- Massive need to address **climate modification**

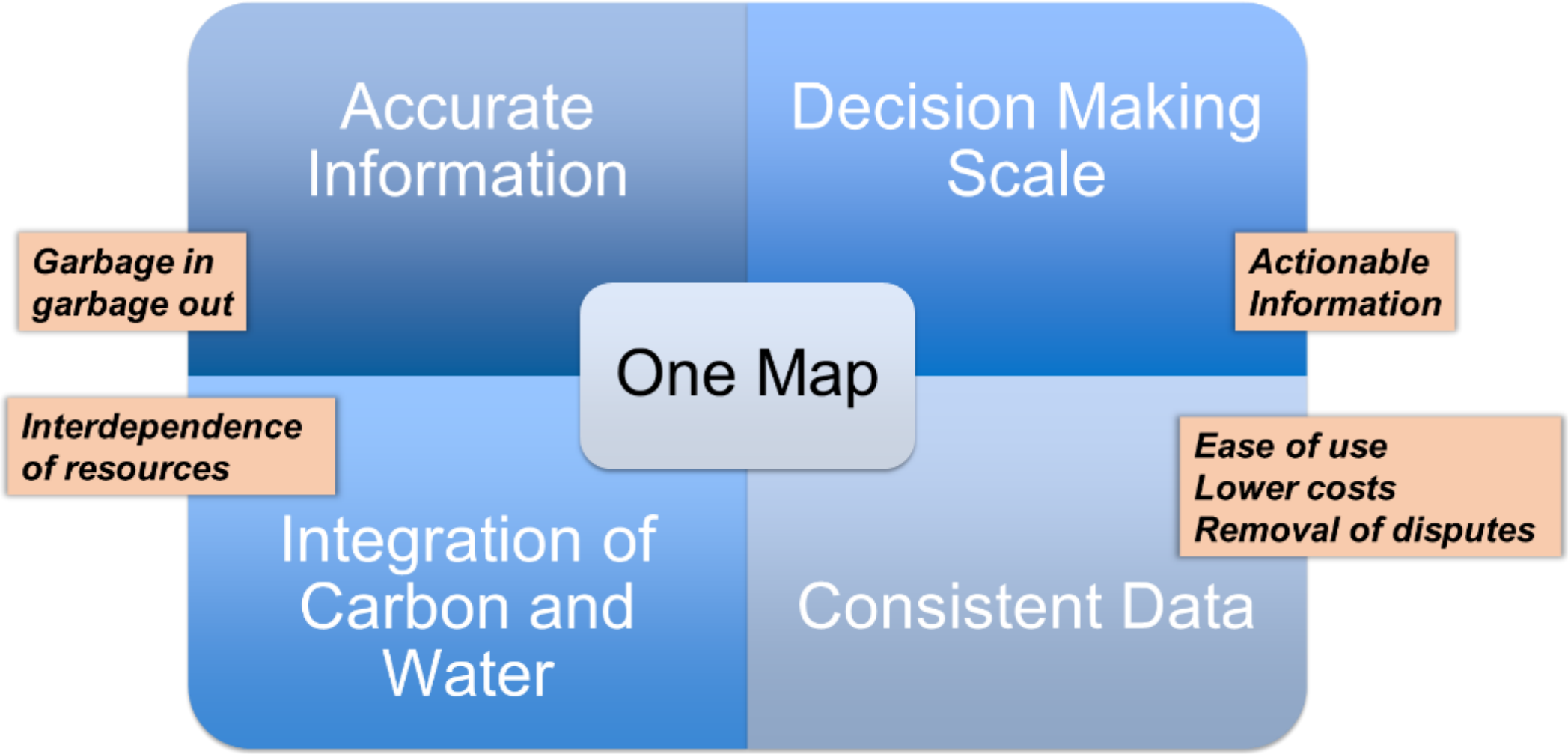







Hydrography
Flooding
EDH
Rivers Water Bodies
NHD
WBD
DFIRMS Input Data
Rivers Water bodies
Transects
FEMA DFIRM Reqs
Roughness
Runoff
NWI
Wetland Land Cover
NWI
Carbon Parameter Database
Land Cover & Carbon Map
Impervious
Agriculture
Grass
Shrub
Trees
Wetlands
Barren
Detailed coarse resolution land cover
High resolution Land Cover
Wetlands
Carbon & land cover

# Management Depends On…

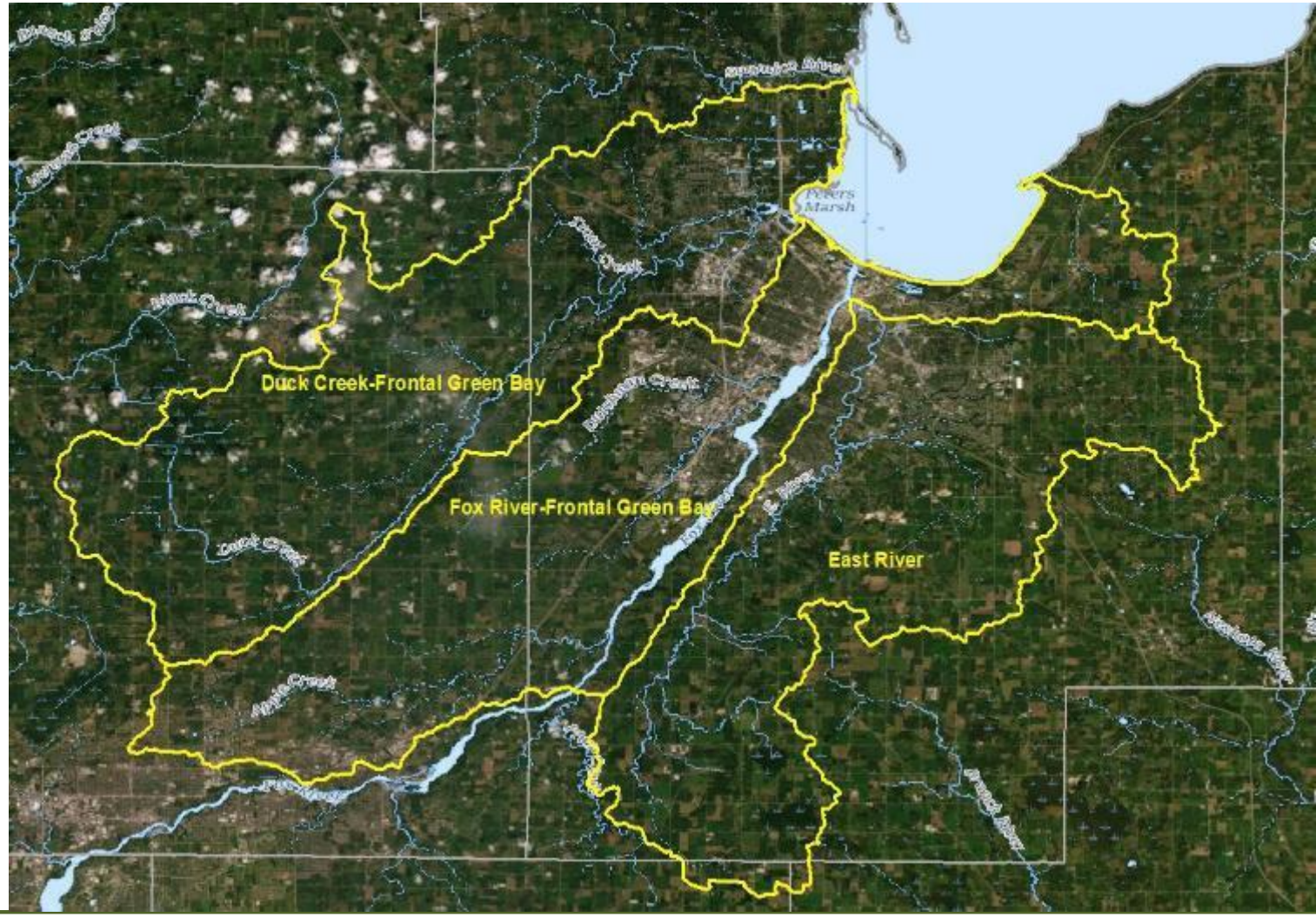


# Project Study Area

| HU10 | Name | Area (acres) |
|---|---|---|
| 0403020401 | Duck Creek-Frontal Green Bay | 105,747 |
| 0403020404 | Fox River-Frontal Green Bay | 106,294 |
| 0403020403 | East River | 94,381 |
| | Total | 306,422 |

The purpose of this Project is to use 3DEP LiDAR and high resolution imagery to create a suite of integrated datasets.

- 3DHP – Hydrography
- CCAP Level 2 – General Land Cover
- NWI – Wetlands
- 3D Level 3 – Detailed Land Cover with Canopy Height

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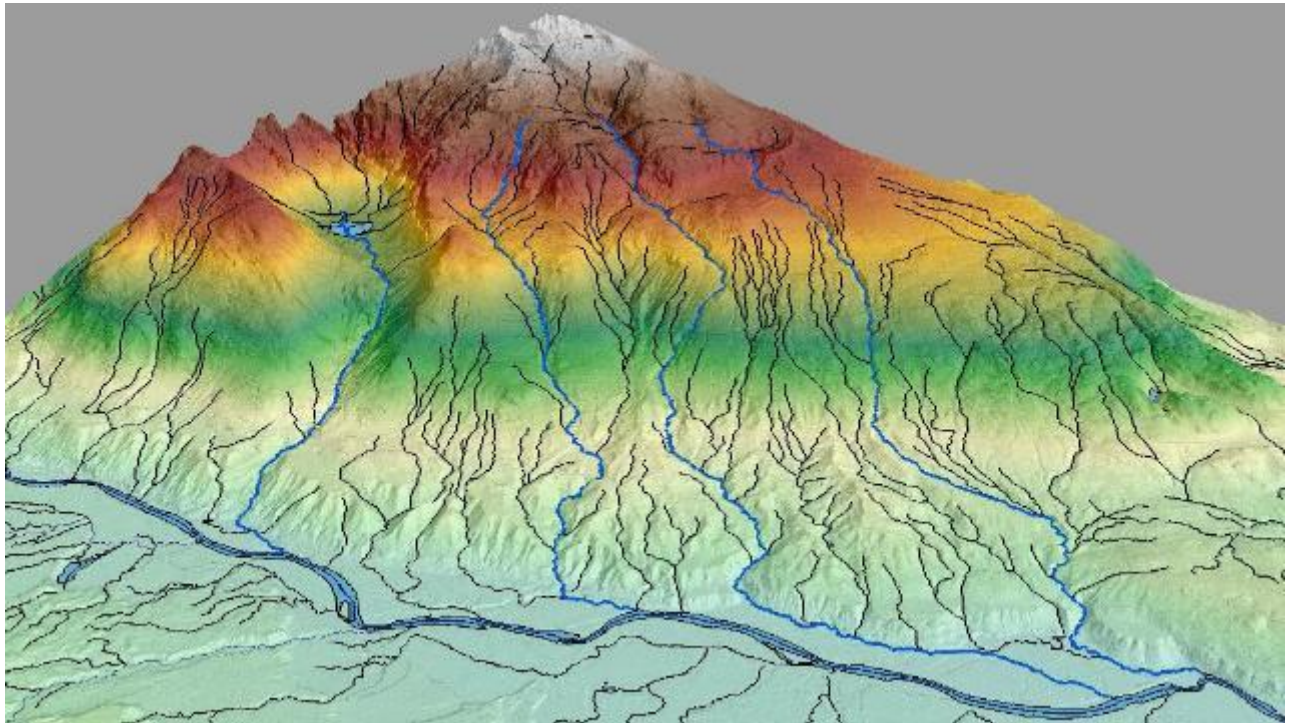
# 3DHP Delivery Specifications

Delivered Data

- Projection/Datum: NAD83 (2011) Conus Albers, NAVD88, Meters, Geoid 18, EPSG: 6350
- USGS-provided feature attribute templates: 3DHP Schema Template (CONUS_EDH1_2_withFCodeDomains – 2/24/2023) - Contains the network
- Drainage boundaries for each stream segment
- Hydro-enforced DEM (1 m)
- Culvert dataset



Report detailing:

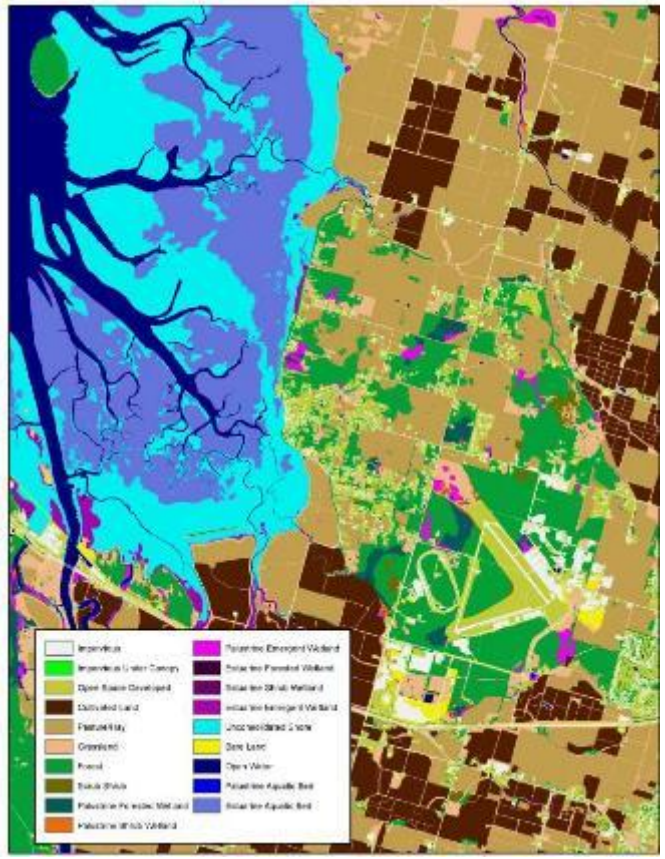
- A list of all data sources
- Processing steps used
- Issues encountered
- Procedures for analysis, accuracy assessment,
- validation of project data
- Excluded NHD features

# C-CAP Level 2 Delivery Specifications

Delivered Data

- Projection/Datum: NAD83 (2011) Conus Albers, NAVD88, Meters, Geoid 18, EPSG: 6350
- Raster Land Cover based off NAIP 2021
- Spatial resolution (1 m)
- Raster delivered in tiff format

| Table 1. Land Cover Classification System | |
|---|---|
| **Class** | **Description** |
| 1 | Impervious |
| 2 | Impervious, Covered by Tree Canopy |
| 3 | Open Space Developed |
| 4 | Cultivated |
| 5 | Pasture / Hay |
| 6 | Grassland |
| 7 | Trees / Forest |
| 8 | Scrub / Shrub |
| 9 | Palustrine Forested Wetlands |
| 10 | Palustrine Scrub / Shrub Wetlands |
| 11 | Palustrine Emergent Wetlands |
| 12 | Unconsolidated Shore |
| 13 | Bare Land |
| 14 | Open Water |
| 15 | Palustrine Aquatic Bed |
| | |



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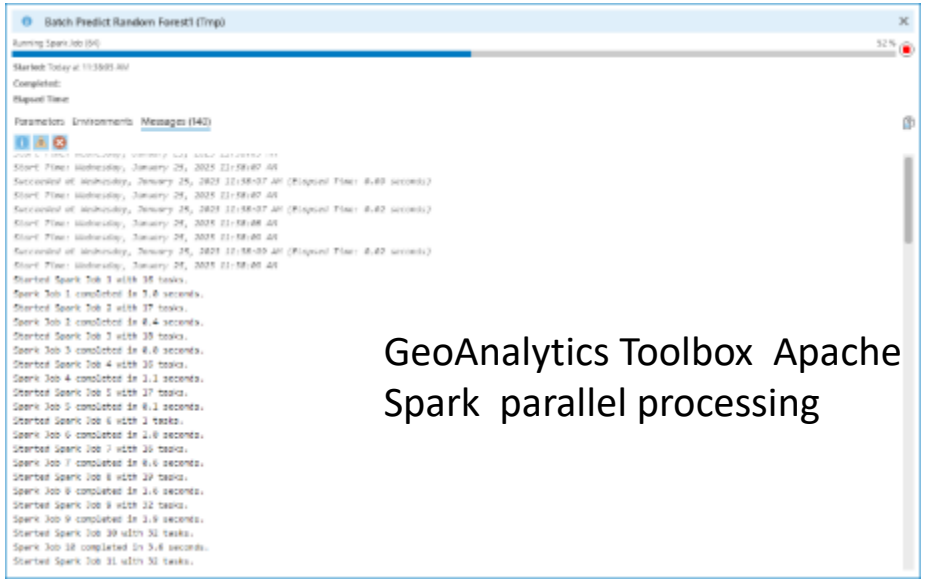
NATIONAL ASSOCIATION OF WETLAND MANAGERS

# C-CAP Minimum Mapping Units

| Feature | |
|---|---|
| Buildings | 200 $ft^2$ |
| Roads | 8 ft wide, 100 ft length |
| Other paved surfaces | 400 ft with consideration given to connectivity |
| Open Space Developed, Emergent Wetlands | 5,000 $ft^2$ |
| Grassland | 0.25 acres |
| Agriculture (Cultivated & Pasture/Hay) | 0.5 acres |
| Forest, Scrub Shrub | 5,000 $ft^2$ |
| Barren Land | 5,000 $ft^2$ |
| Railroad features | 100 ft length |
| Water | 5,000 $ft^2$ |
| River features | 10 ft wide, clearly visible |
| Unconsolidated Shore | 5,000 $ft^2$ , 20 ft wide |
| Aquatic Bed | 5,000 $ft^2$ , 20 ft wide |

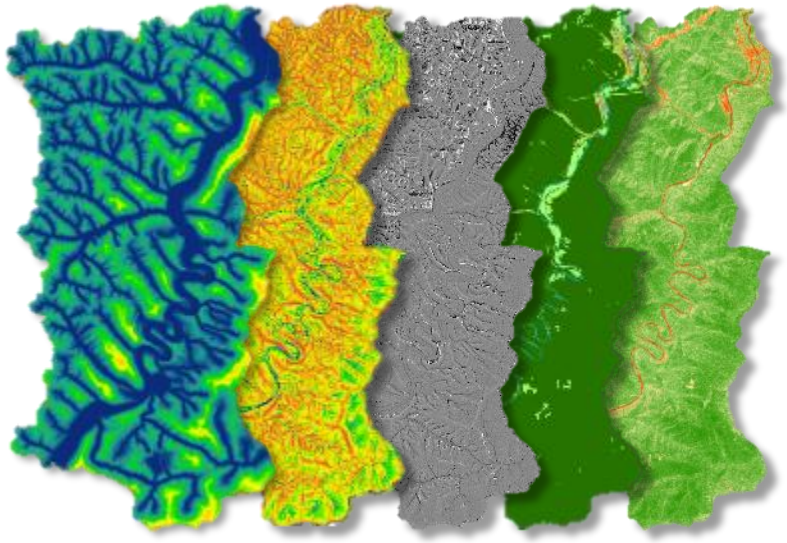
# Potential Wetland Landscape Modeling

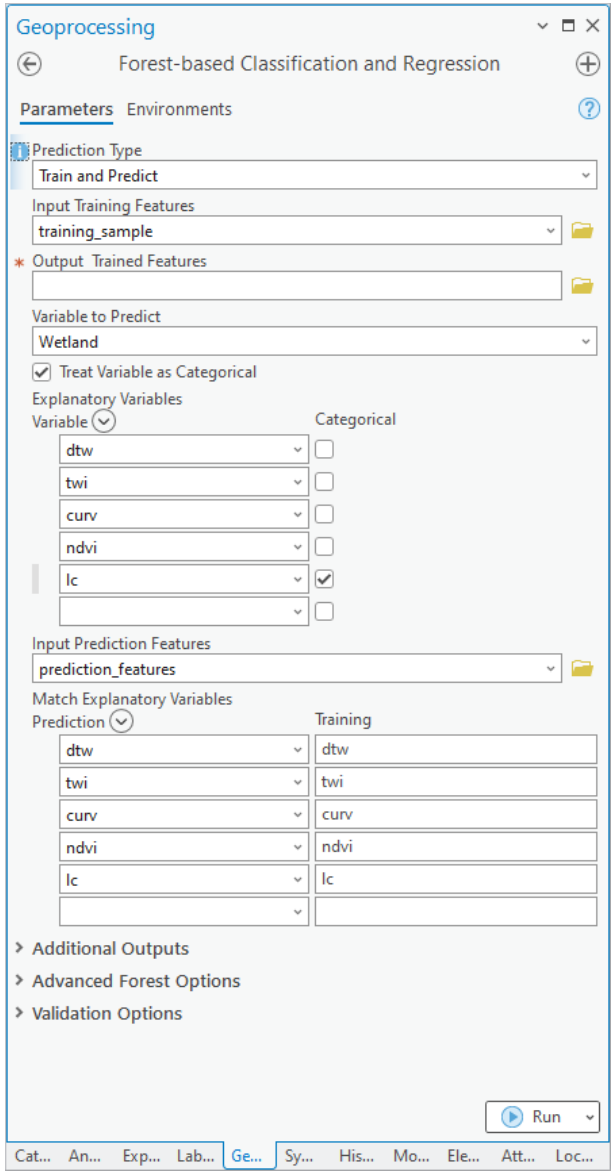
- Machine learning Random Trees algorithm using lidar derived predictor variables, NDVI and high resolution landcover.
- Based on Wetland Identification Model (WIM) processing methods in Arc Hydro – Gina O'Neil
- Modified WIM process to iteratively process multiple HUC12s for larger geographic areas and to overcome processing limitations.
- Experimented with other predictor variables such as SSURGO, local land cover etc.
- Less accurate in agricultural and developed areas where hydrography has been modified.




GeoAnalytics Toolbox Apache Spark parallel processing

DTW TWI CURV LC NDVI



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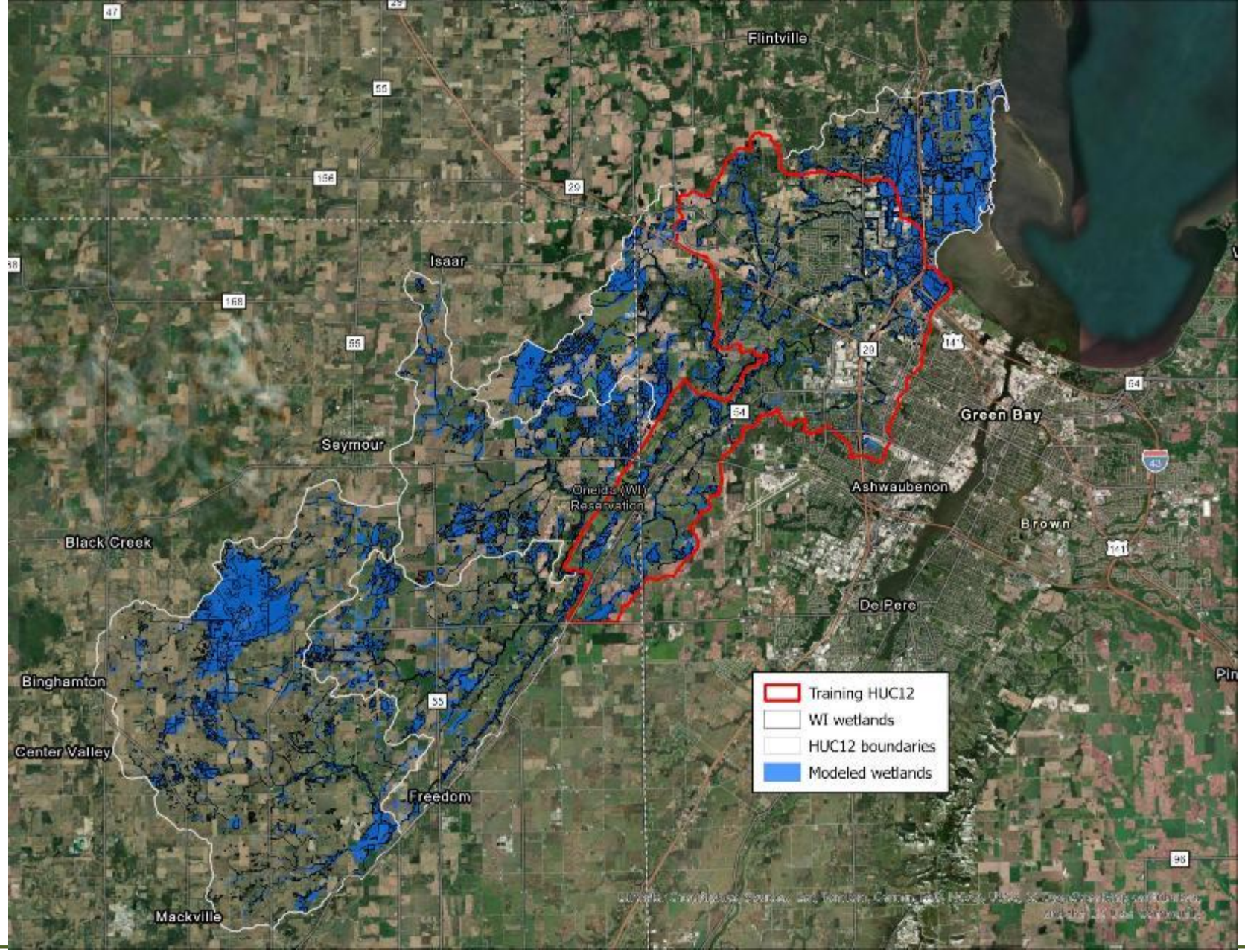


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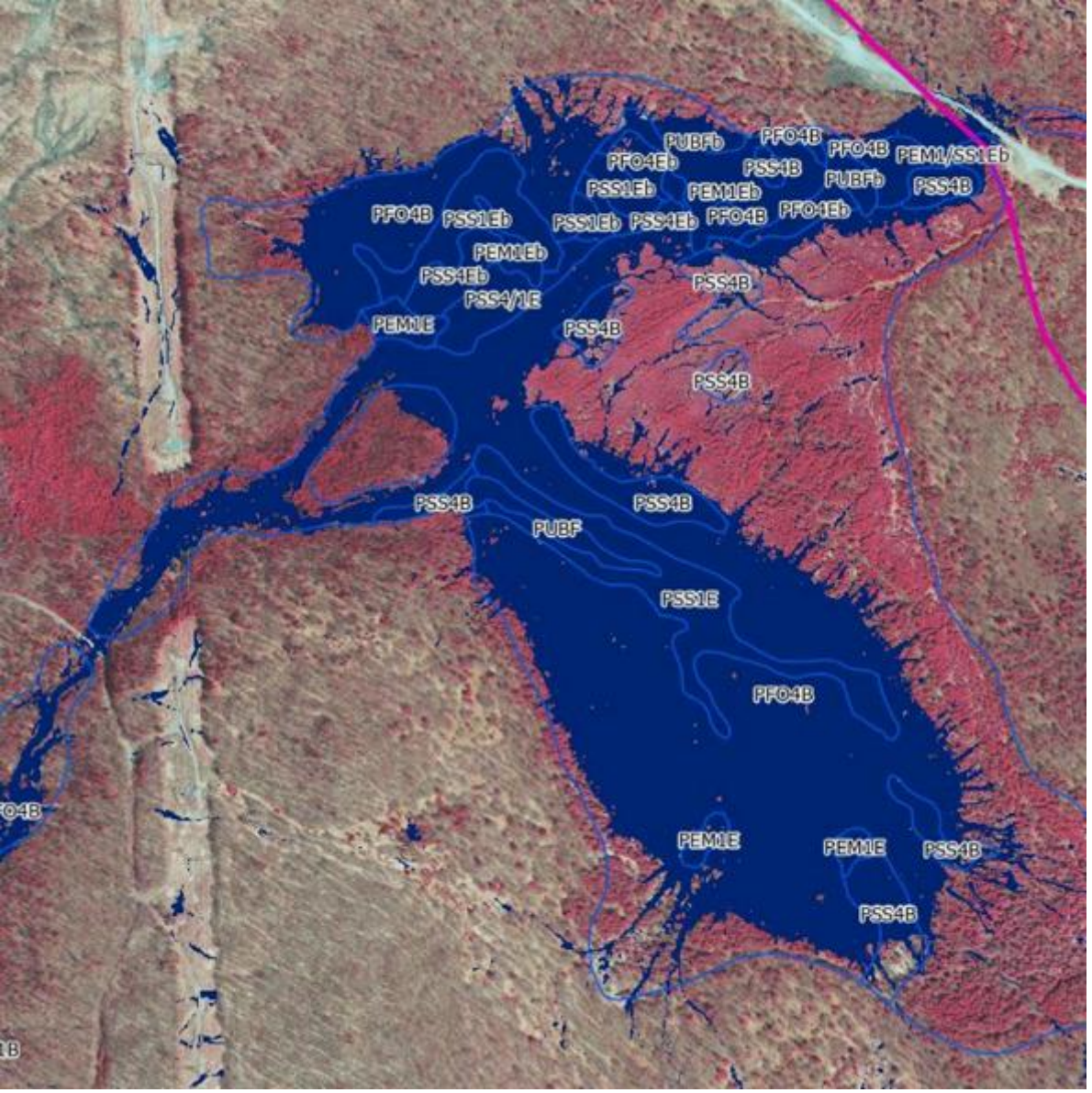
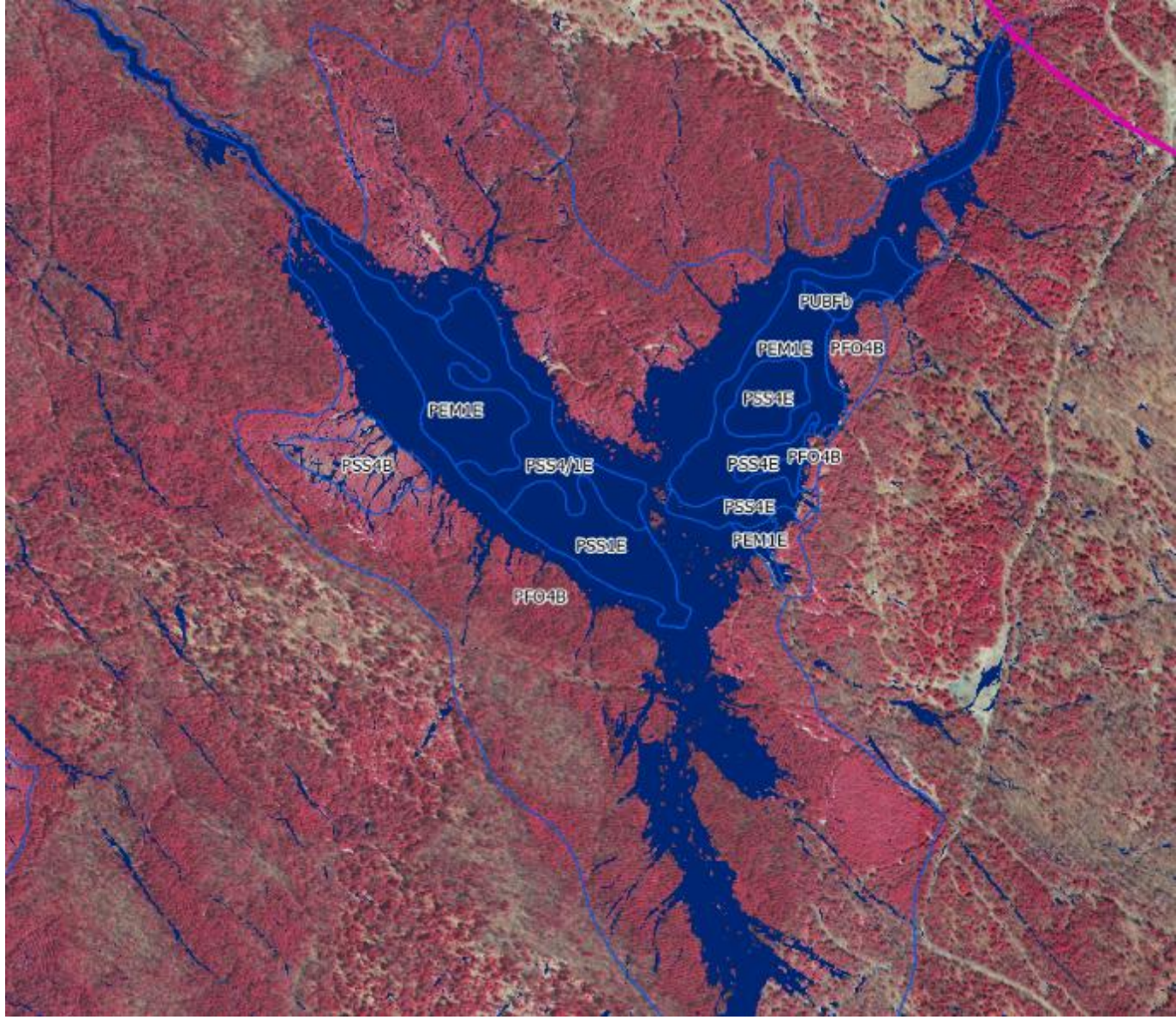
# Potential Wetland Landscape Modeling

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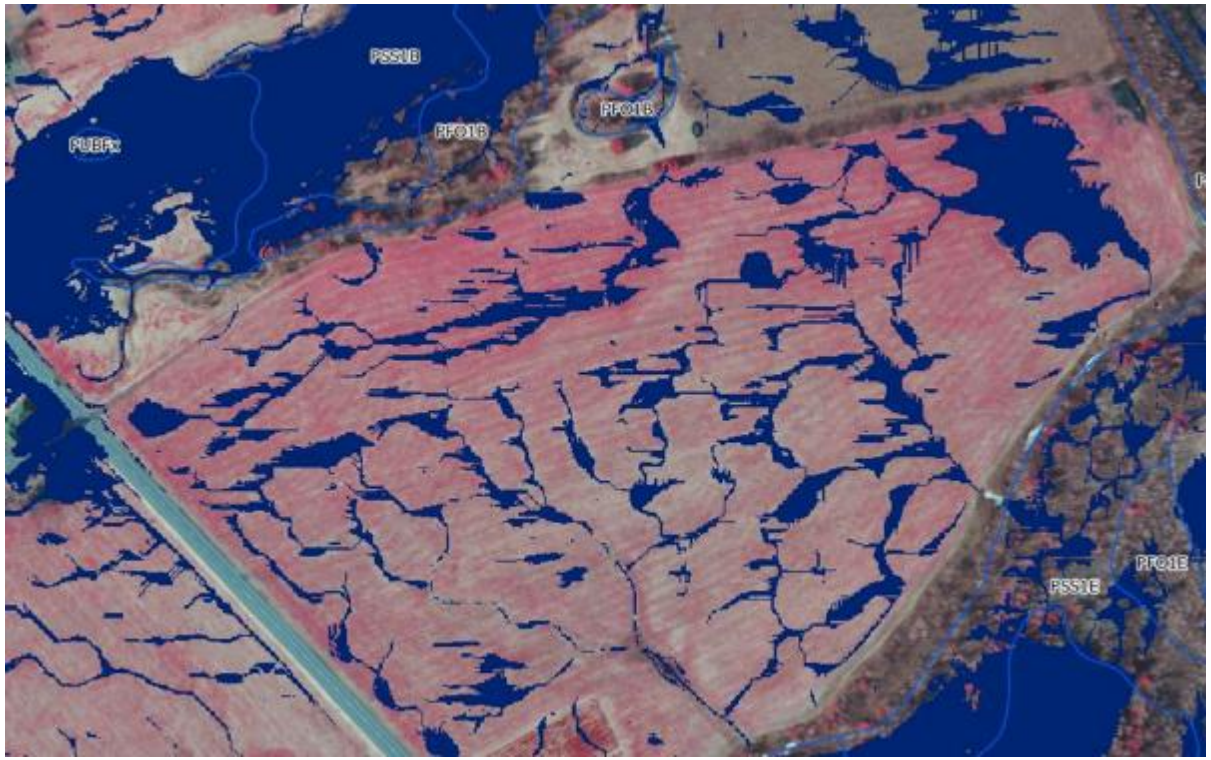





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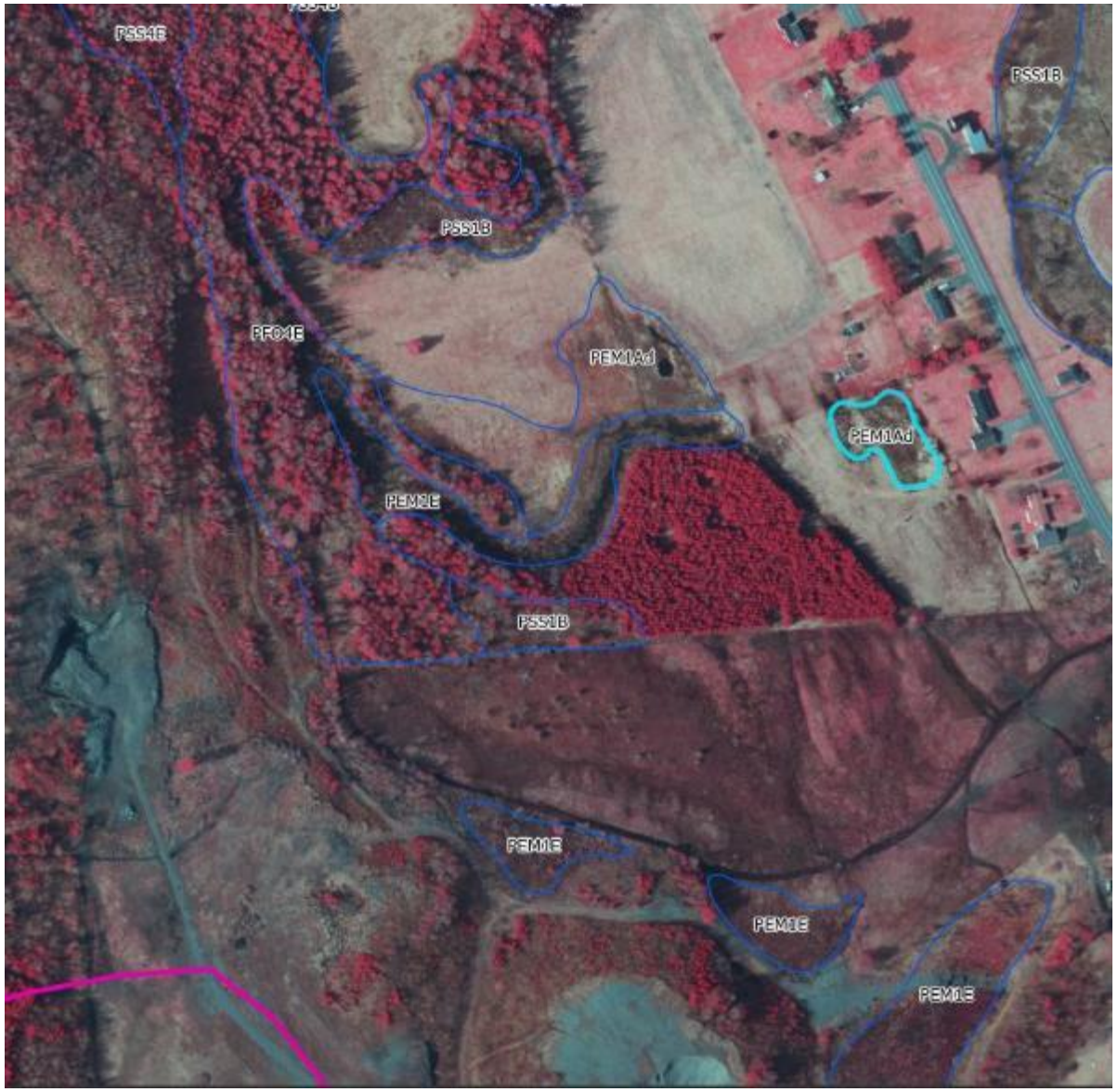


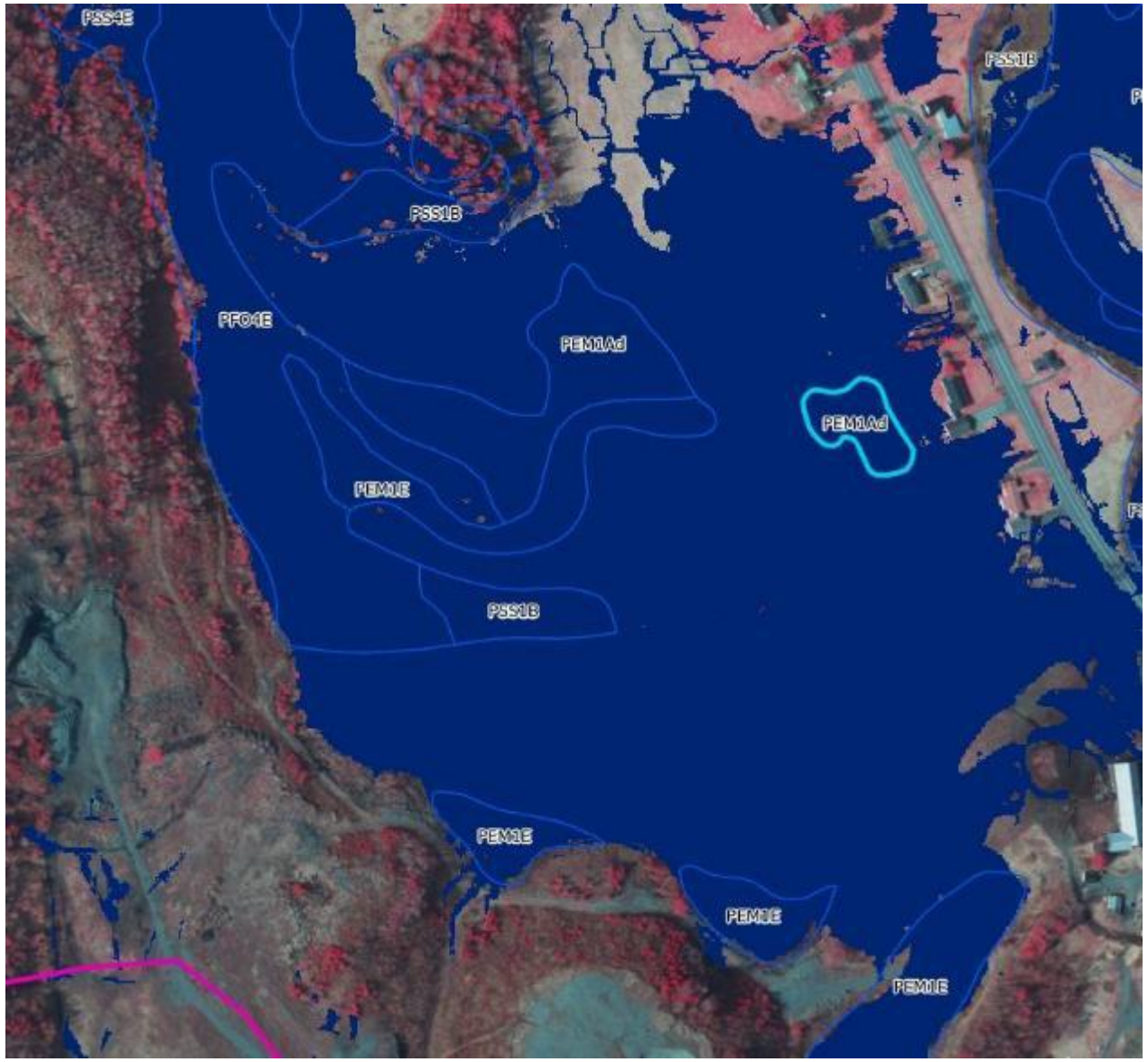


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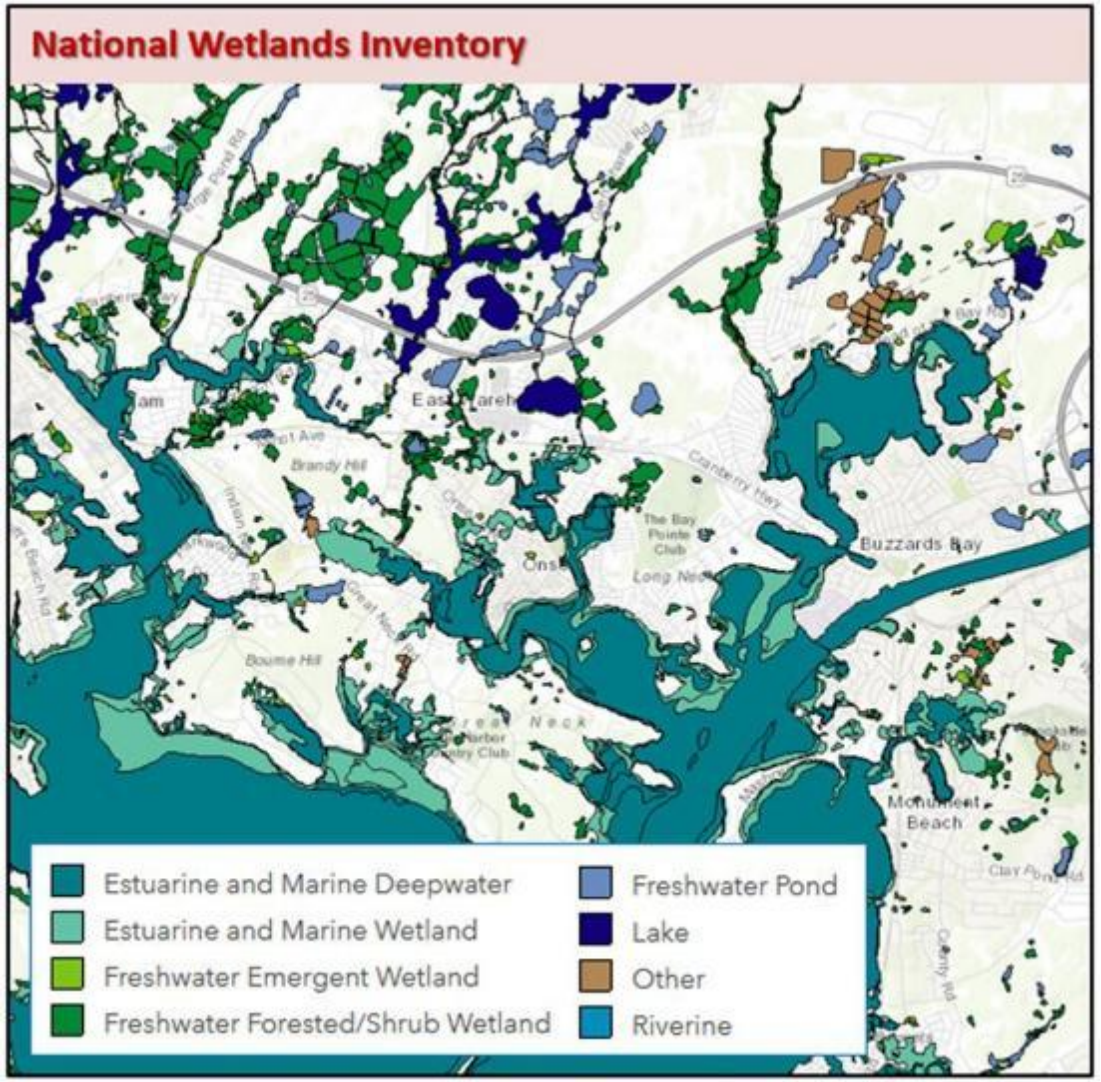
# Potential Wetland Landscape Modeling

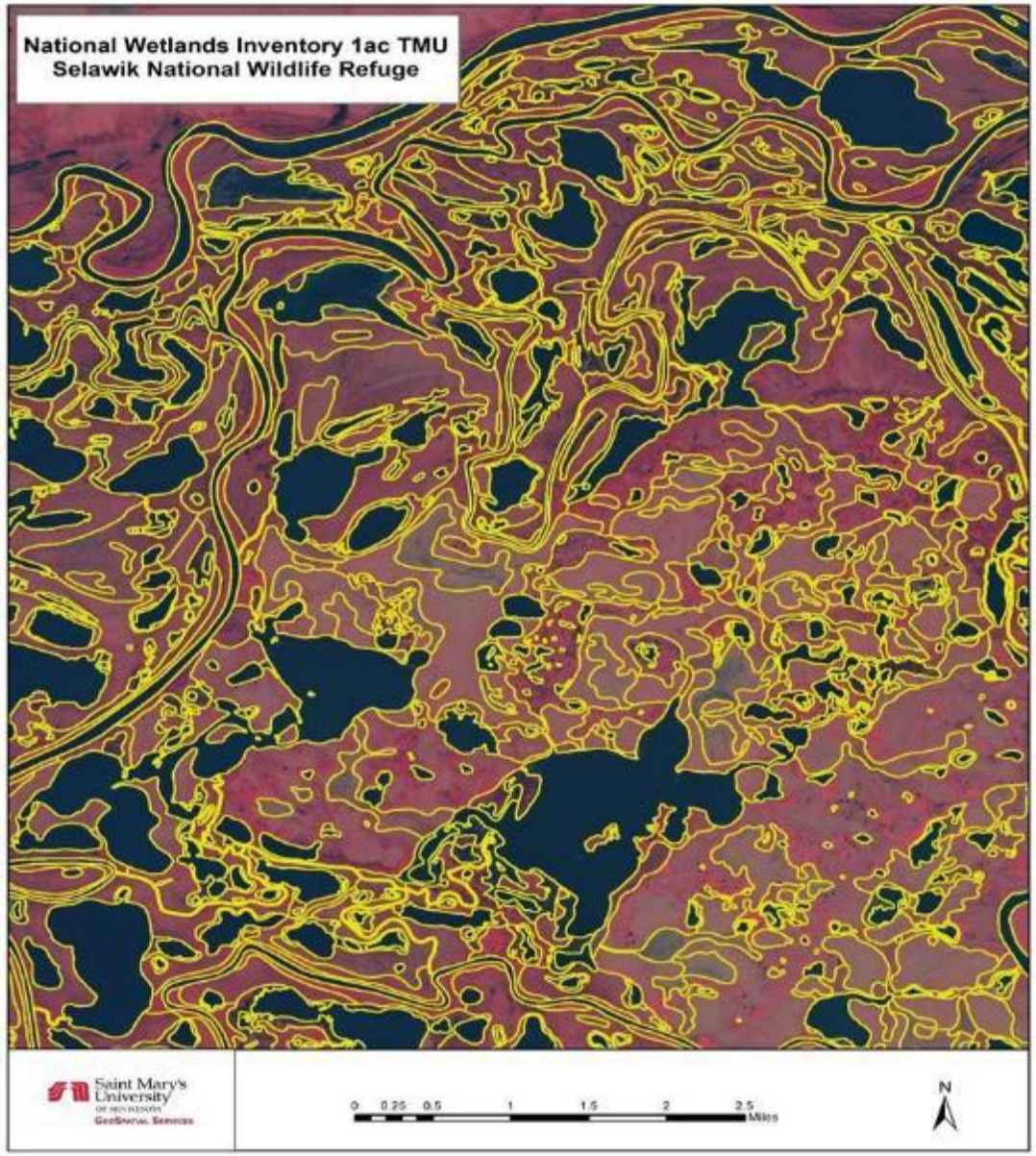
# National Wetlands Inventory

- National Wetlands Inventory is the federal program tasked with mapping wetland habitats using the approved FGDC  Wetland Classification Schema
- NWI data development relies on human interpretation
- Traditionally not linked to USGS NHD data production
- 3DHP data development process provides the opportunity for data production synergies – recognized by USGS and FWS
- 3DHP outputs as NWI inputs:
  - Open waters
  - Hydro-modified DEM and nDSM
  - Narrow linear habitats
  - NDVI and Geomorphons
  - Derived surfaces – CTI, TPI, DTW



# NWI Workflow

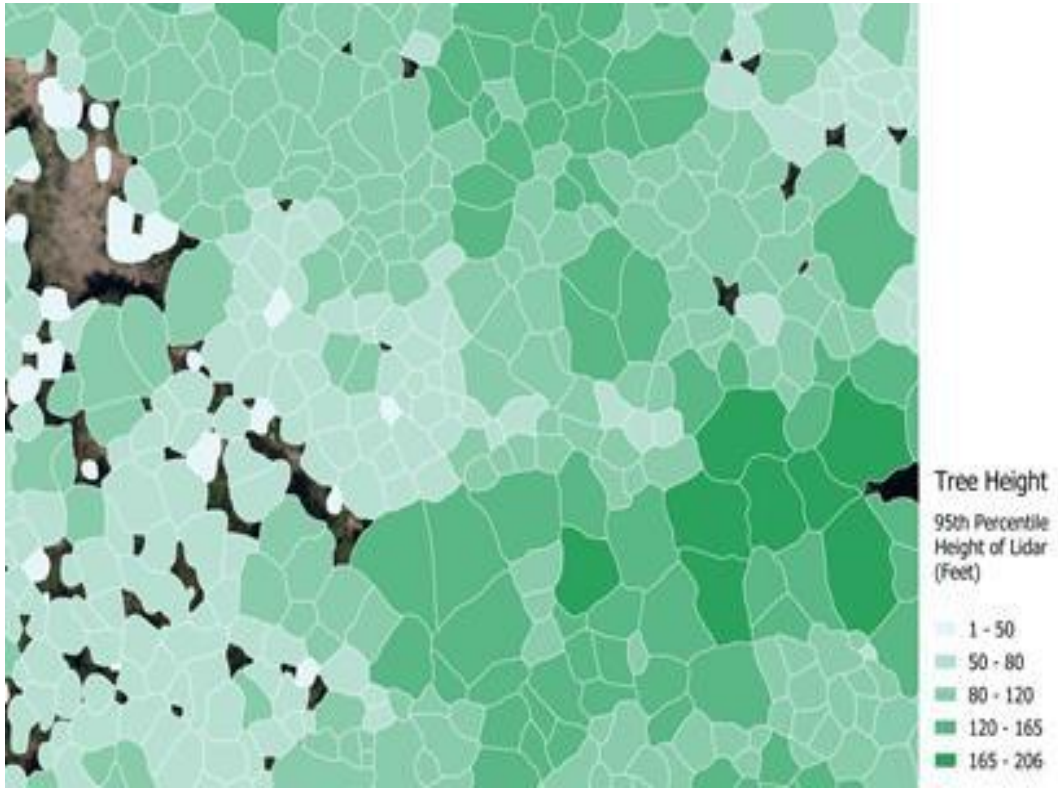
- Outputs for 3DHP and CCAP Land Use provide inputs to NWI
- NWI data development relies on human interpretation
  - Aerial of satellite imagery
  - Potential wetland landscapes model
  - Derived Elevation Surfaces
  - Land cover and open water bodies
  - Field data collection and conventions
- Wetland data polygons build around open water features classification using Cowardin System
- Schema validated using USFWS NWI QA/QC Tools
- Output vector database



# Level 3 Landcover Specifications

Delivered Data

- Projection/Datum: NAD83 (2011) Conus Albers, NAVD88, Meters, Geoid 18, EPSG: 6350
- Land Cover based off NAIP 2021
- MMUs as defined by CCAP
- Leverage existing 30 m datasets and ancillary data
  - Wiscland 2.0
  - USFS Big Map
  - NVCS
  - Ag data
- New dataset – so look and feel to be worked out with Brown County



# Draft Level 3 Land Cover

| | Level 1 | Level 2 | Level 3 | Size Class | MMU | CCAP Class Level 2 |
|---|---|---|---|---|---|---|
| | Life Forms | Enhanced Lifeforms | Major Associations | | | |
| 1000 | Impervious | Impervious | Impervious | NA | 1,000 square feet | Impervious |
| 2000 | Agriculture | Rotational Crop | Cash Grain | NA | 0.25 acres | Cultivated |
| | | | Corn | NA | 0.25 acres | |
| | | | Dairy Rotation | NA | 0.25 acres | |
| | | | Cranberries | NA | 0.25 acres | |
| 3000 | Grassland | Pasture | Permanent Pasture | NA | 0.25 acres | Pasture/Hay |
| | | | Rotational Pasture | NA | 0.25 acres | |
| | | Turfgrass | | NA | 1,000 square feet | Developed Open Space |
| | | Grassland | | NA | 0.25 acres | Grassland |
| 4000 | Upland Woody Vegetation | Urban trees | | Height Class | 1,000 square feet | Developed Open Space |
| | | Shrubland | Early Successional Forest | Height Class | 0.25 acres | Scrub Shrub |
| | | | Oak | Height Class | 0.25 acres | |
| | | | Central Hardwoods | Height Class | 0.25 acres | |
| | | | Northern Hardwoods | Height Class | 0.25 acres | |

| | Level 1 | Level 2 | Level 3 | Size Class | MMU | CCAP Class Level 2 |
|---|---|---|---|---|---|---|
| | Life Forms | Enhanced Lifeforms | Major Associations | | | |
| | | Deciduous | Aspen/Birch | Height Class | 0.25 acres | Deciduous Forests |
| | | | Red Maple | Height Class | 0.25 acres | |
| | | | Oak | Height Class | 0.25 acres | |
| | | | Central Hardwoods | Height Class | 0.25 acres | |
| | | | Northern Hardwoods | Height Class | 0.25 acres | |
| | | | Mixed Deciduous/Coniferous Forest | Height Class | 0.25 acres | Mixed Forest |
| | Water | Water | Water | | 0.25 acres | Water |
| | Wetlands | Floating Aquatic | | | 0.25 acres | Palustrine Aquatic Bed |
| | | Emergent | Cattails | | 0.25 acres | Palustrine Emergent |
| | | | Reed Canary Grass | | 0.25 acres | |
| | | | Other | | 0.25 acres | |
| | | Lowland Scrub/Shrub | Broadleaf deciduous | | 0.25 acres | Palustrine Scrub/Shrub |
| | | | Broadleaf evergreen | | 0.25 acres | |
| | | | Needle leaf | | 0.25 acres | |
| | | Forested | Conifer Forested | Height Class | 0.25 acres | Palustrine Forest |
| | | | Aspen Forested Wetland | Height Class | 0.25 acres | |
| | | | Bottomland Hardwood | Height Class | 0.25 acres | |
| | | | Swamp Hardwoods | Height Class | 0.25 acres | |
| | | | Mixed Deciduous/Coniferous Wetlands | Height Class | 0.25 acres | |
| 7000 | | Barren | | | 0.25 acres | Bare Land |

# Example: Good Agreement

# Example: Medium Agreement

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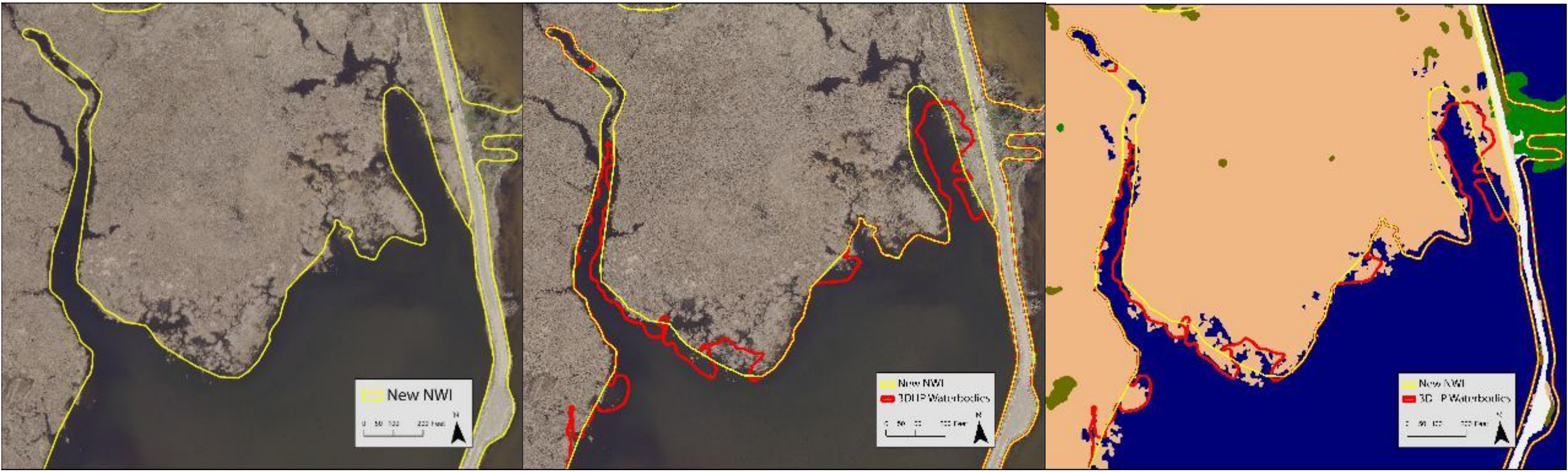
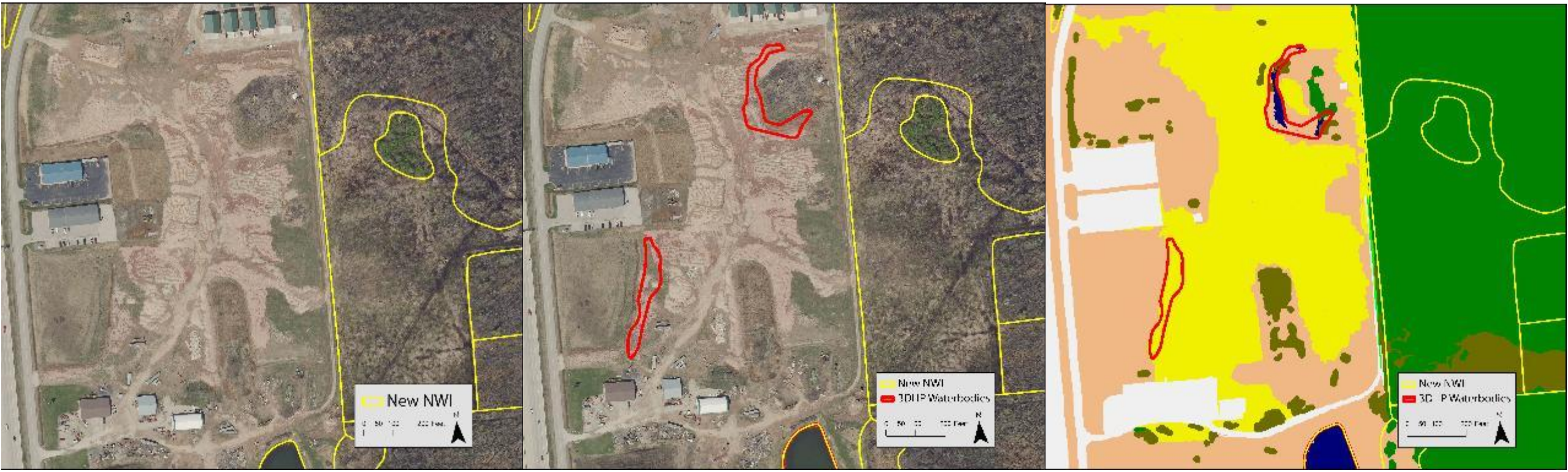


# Example: Poor Agreement



# Lessons Learned

Three elements we know conflict are source data, vintage, and feature representation

- Source data
  - 3DHP: Lidar: 3DEP Vintage 2015, 2018, 2020
  - NWI: Imagery: Latest Vintage 2023
  - CCAP: Imagery: NAIP Vintage 20/21
- Water bodies
  - 3DHP: MMU 0.25 acres (vector – semi-automated)
  - NWI: MMU 0.25 acres – vegetated;
    0.1 acres – water (vector – manual)
  - CCAP: MMU 0.25 acres (1 m pixels – semi-automated)
- Rivers
  - 3DHP: Min width (15 m)
  - NWI: Min width (15 ft)
  - CCAP: (3 pixels of open water 3 m, not a rule)

# Lessons Learned

Logical Consistency Between Datasets

- Watersheds (WBD)
  - Process revised boundaries early
  - Eliminate time revisiting extents - NWI and CCAP
- EDH and NWI
  - Source data requirements
  - EDH lines contained within NWI polygons
  - Flowlines forming the edges of wetland features
  - Conduct full hydro-enforcement as an initial step
  - Cost savings of up to 20% in NWI data production
- NWI and C-CAP Consistency
  - Enforce vegetation breaks from NWI in C-CAP
  - Utilize NWI wetlands as C-CAP wetlands

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