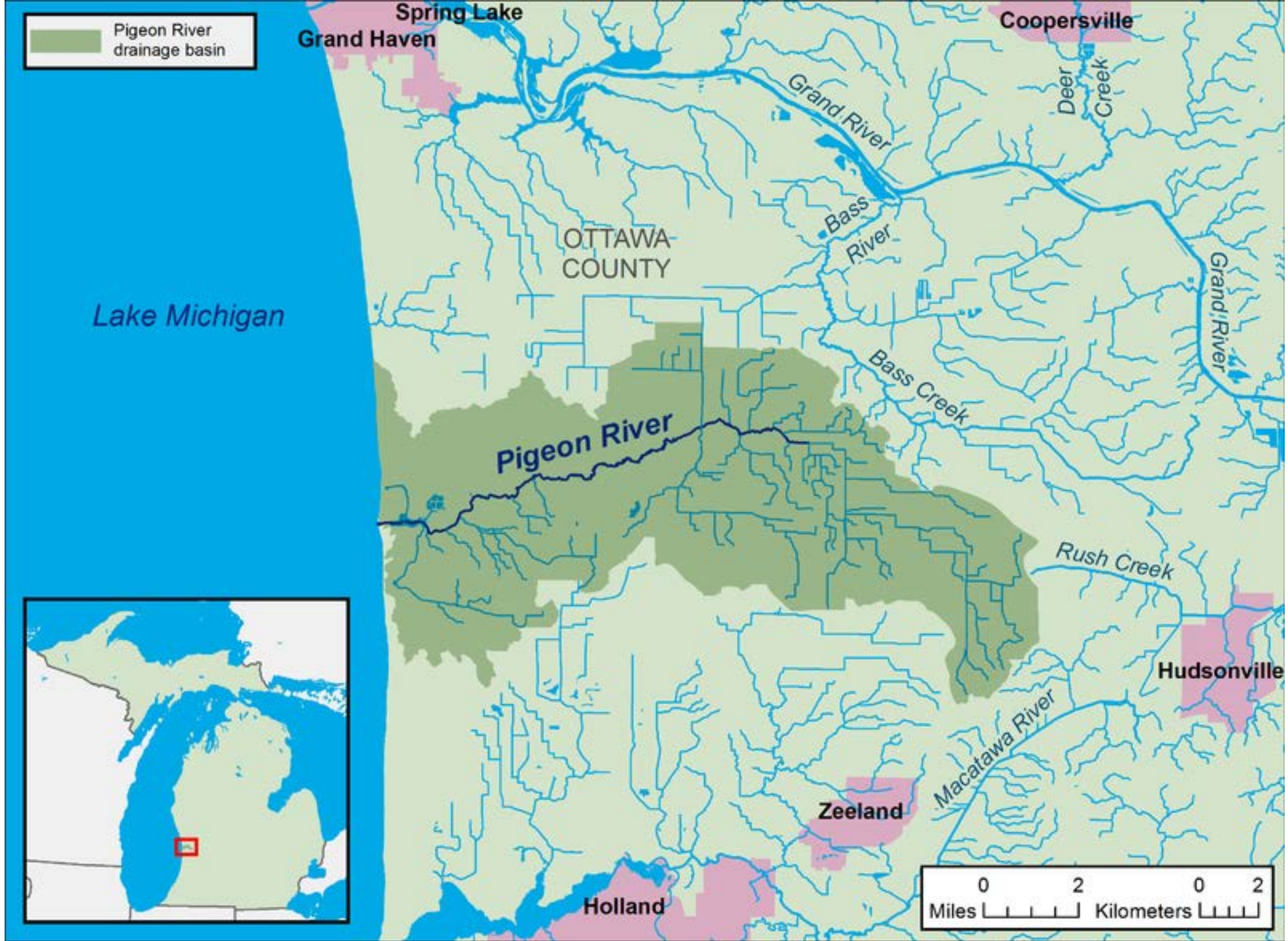
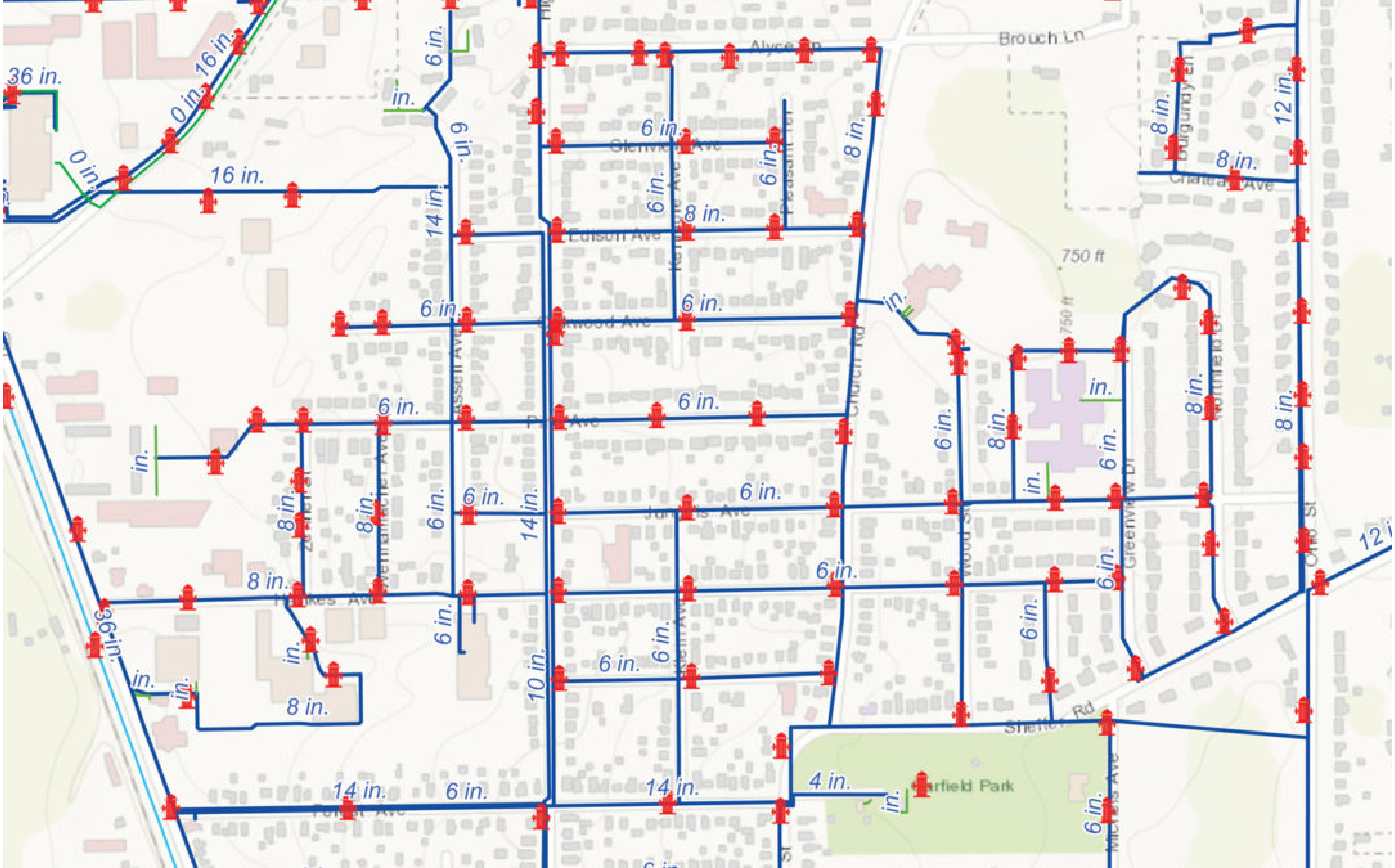
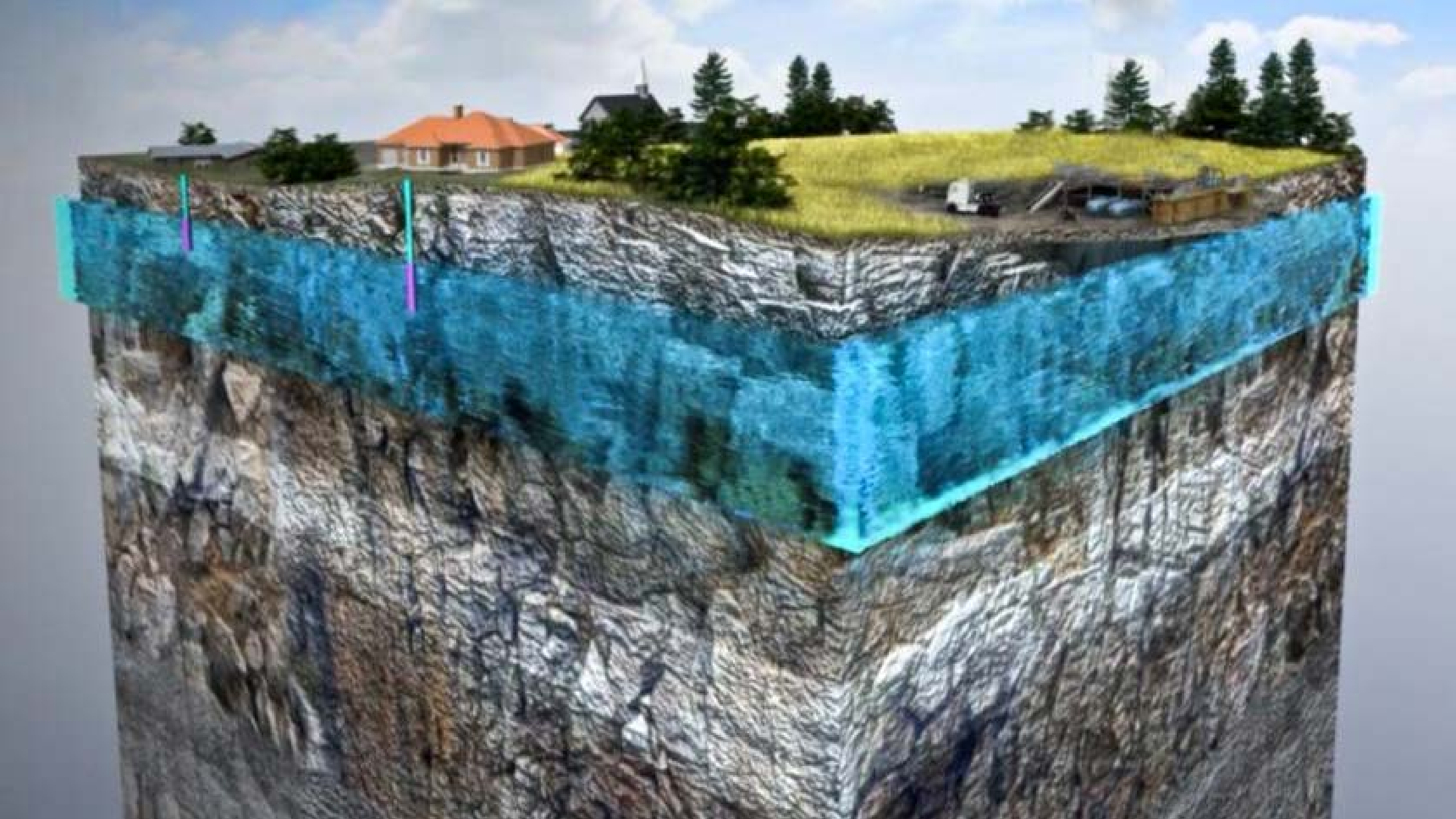
OTTAWA COUNTY
GROUNDWATER

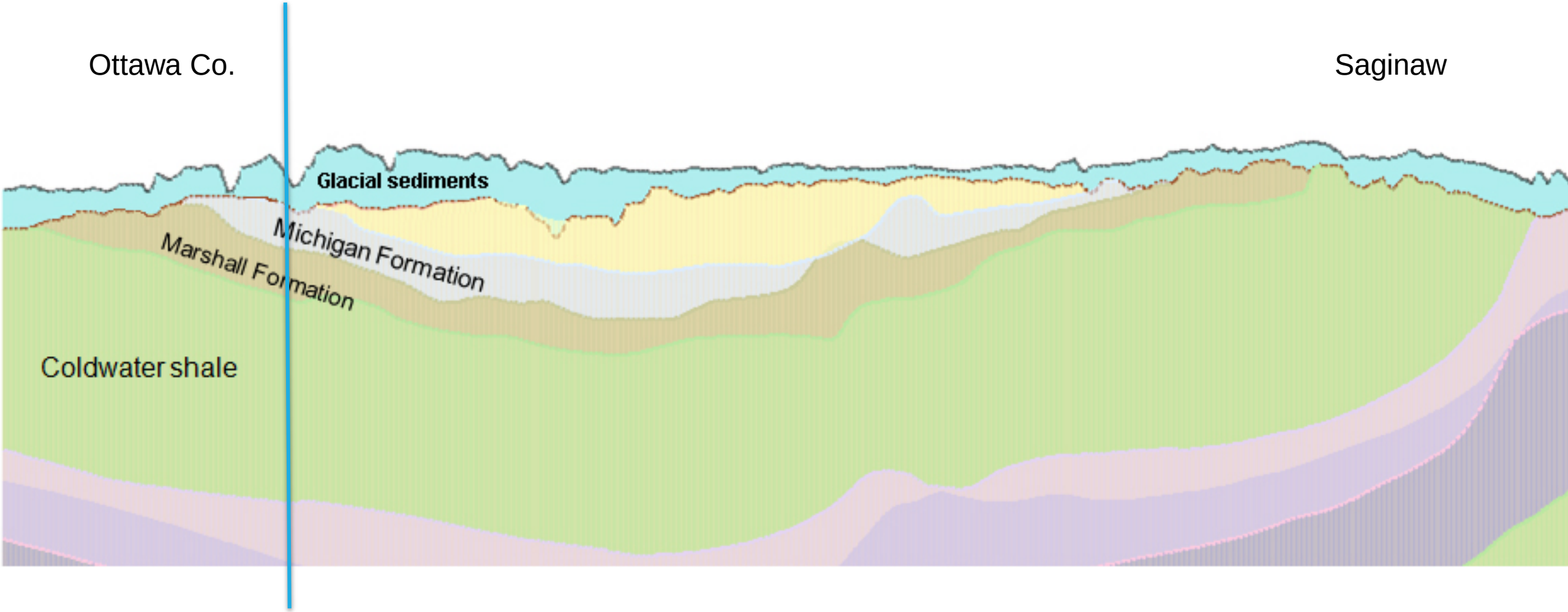
A Study Update for the 12th Annual Water Quality Forum
November 30, 2017


Pigeon River drainage basin
Spring Lake
Grand Haven
Coopersville
Grand River
Deer Creek
Bass River
OTTAWA COUNTY
Grand River
Lake Michigan
Bass Creek
Pigeon River
Rush Creek
Hudsonville
Macatawa River
Zeeland
Holland
0 2
Miles
0 2
Kilometers

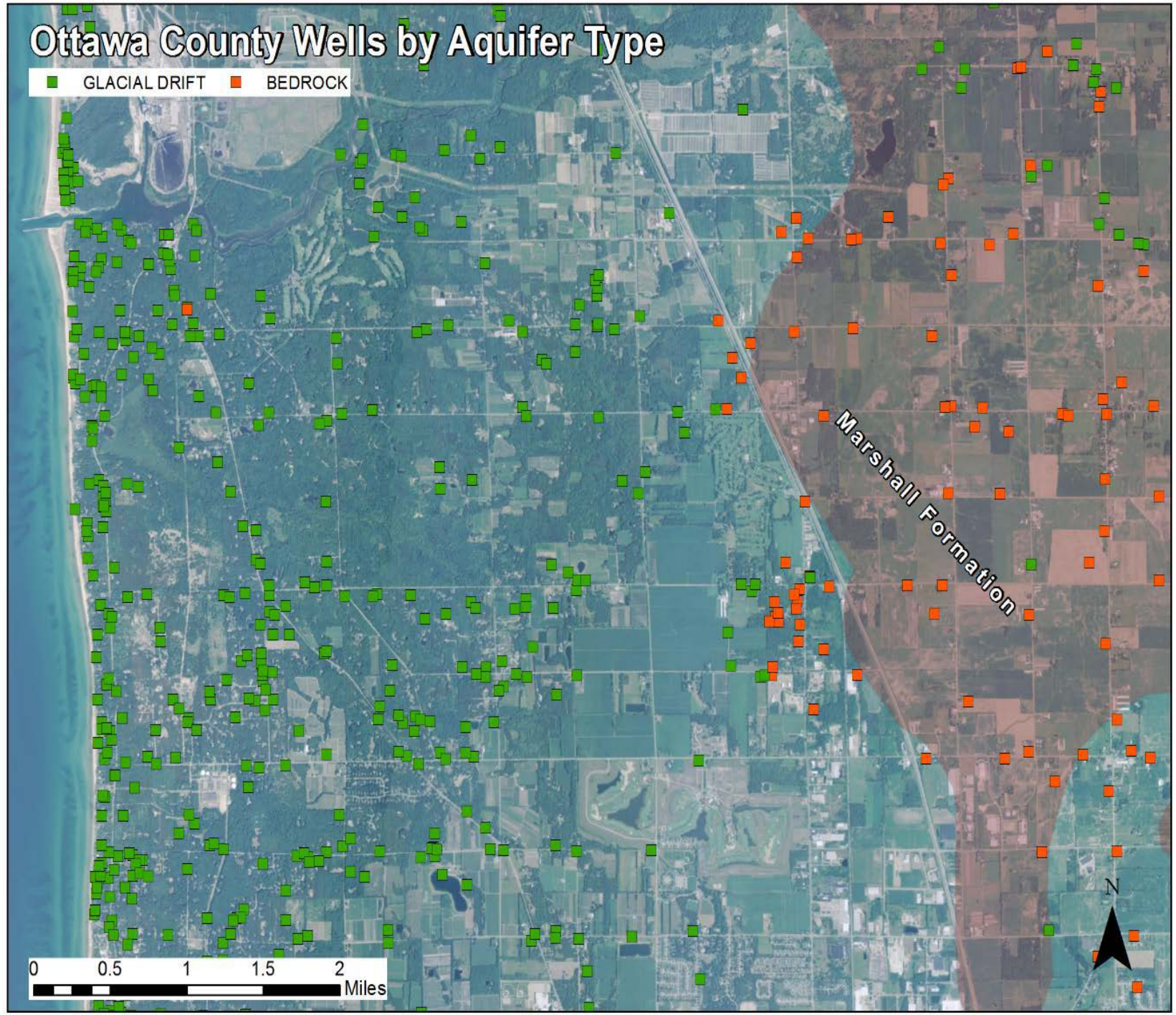

SUNBELT RENTALS

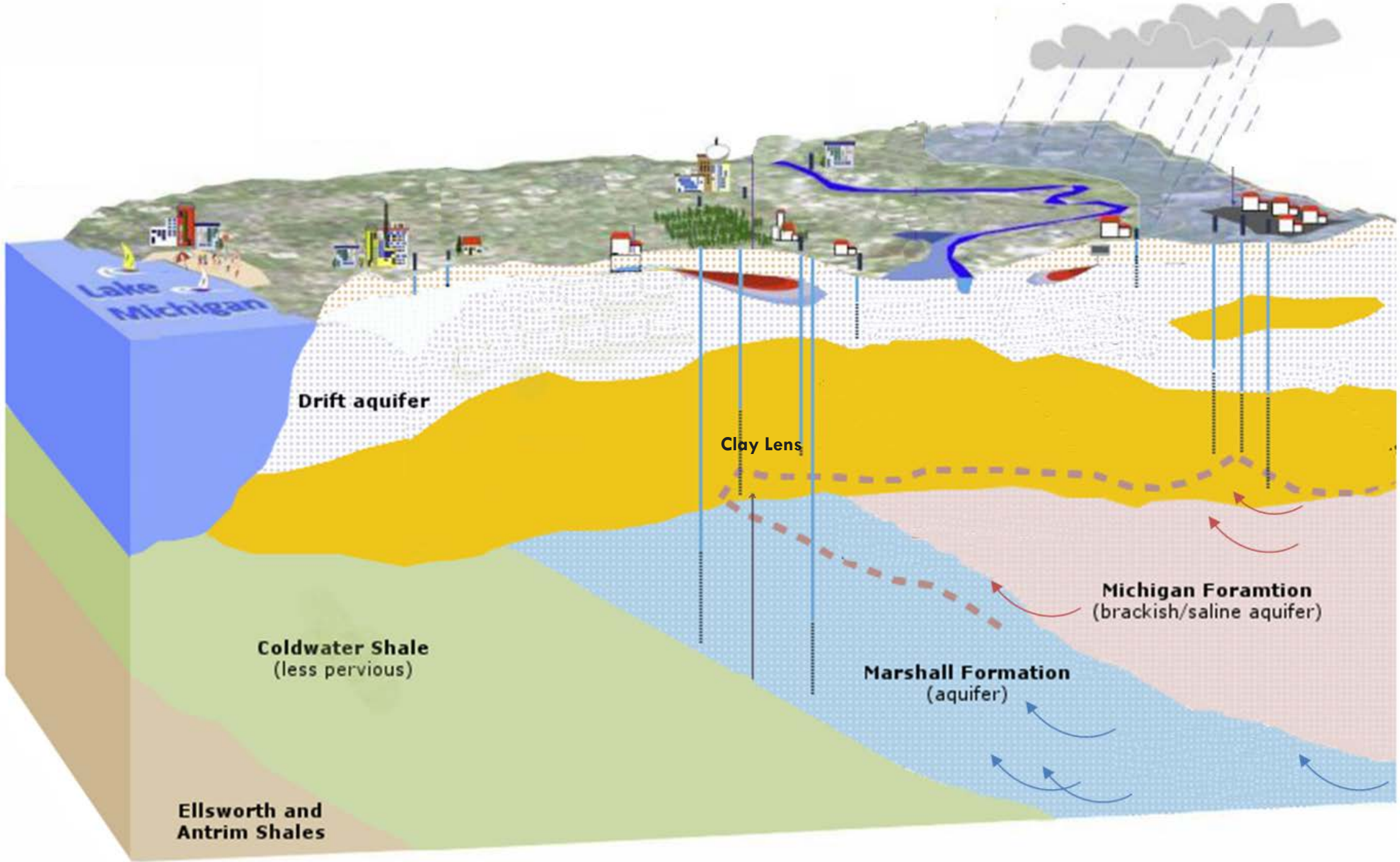

Brouch Ln
Alyce Ln
Edison Ave
Church Rd
Wood St
Greenview Dr
Chateau Ave
Ohio St
750 ft
36 in.
16 in.
14 in.
12 in.
10 in.
8 in.
6 in.
4 in.



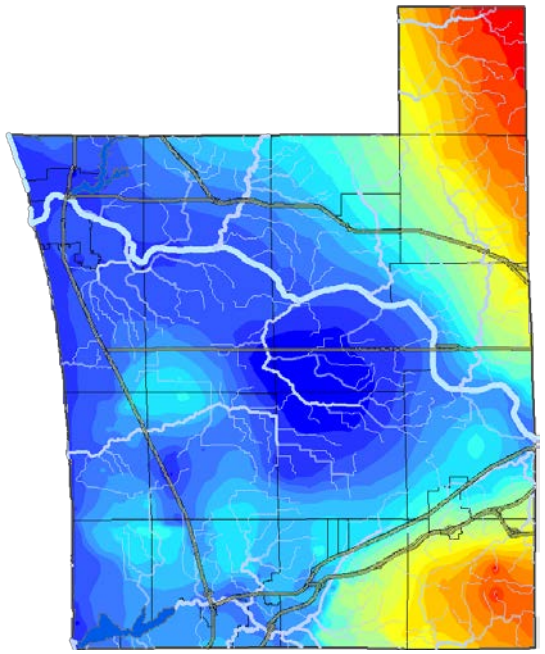


Statewide East-West cross-section

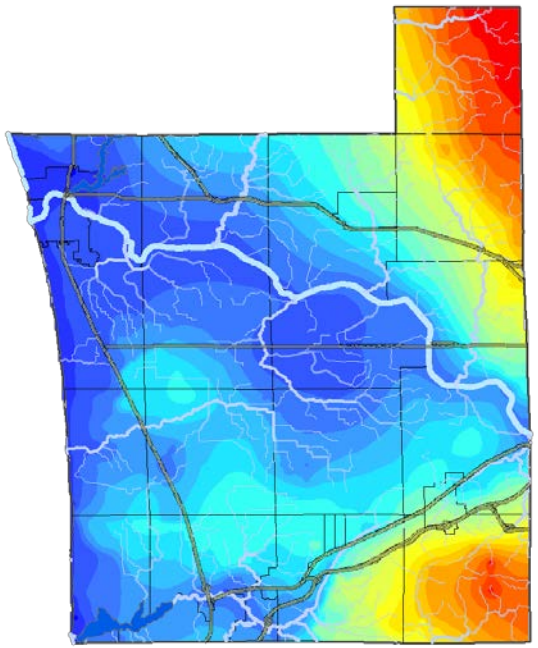

Ottawa County Wells by Aquifer Type
GLACIAL DRIFT
BEDROCK
Marshall Formation
0
0.5
1
1.5
2
Miles
N


Lake Michigan
Drift aquifer
Clay Lens
Michigan Foramtion
(brackish/saline aquifer)
Coldwater Shale
(less pervious)
Marshall Formation
(aquifer)
Ellsworth and
Antrim Shales

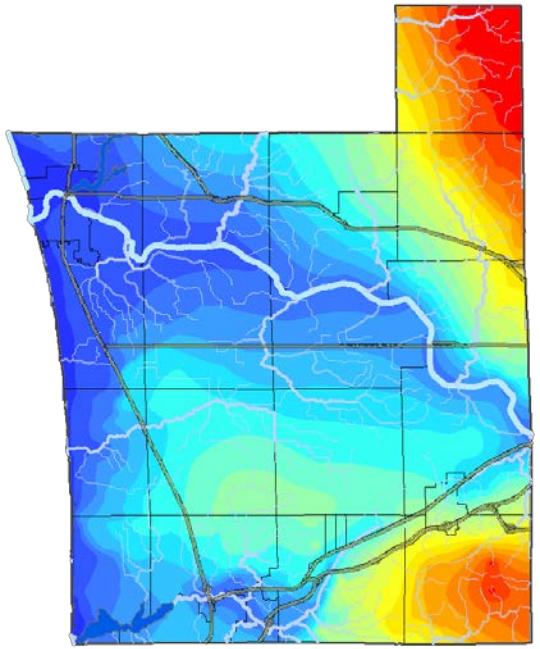
- Declining *static water levels*



1970



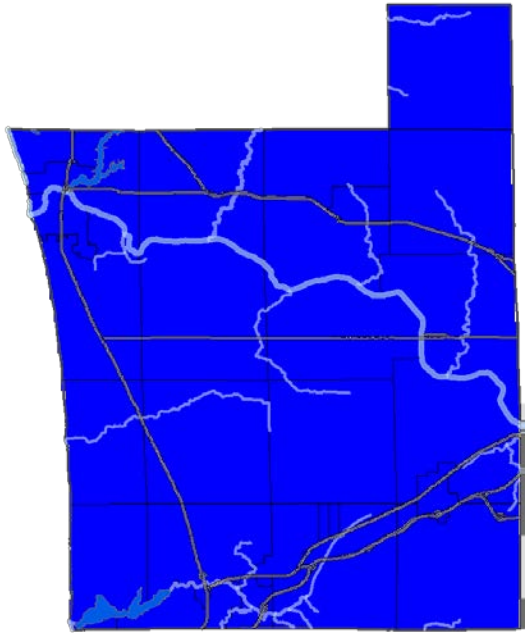
2000



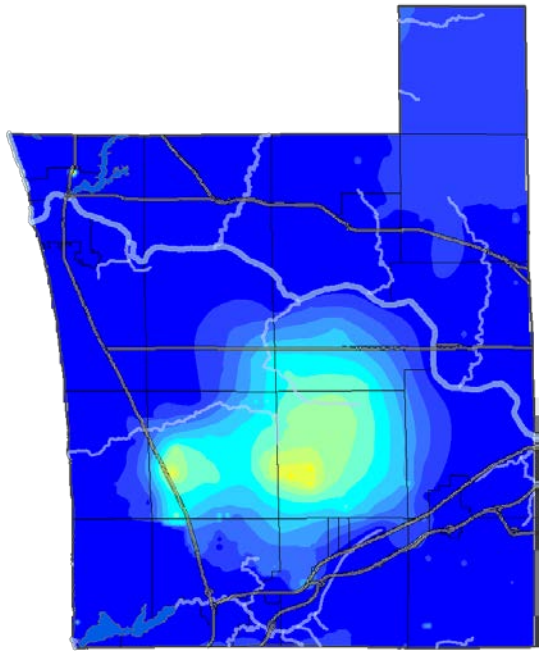
2015

MICHIGAN STATE UNIVERSITY

- Increased *drawdown* in Central Ottawa County



1970



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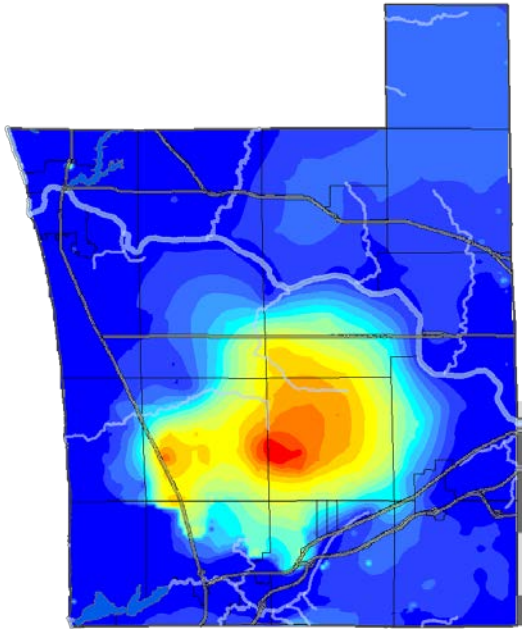
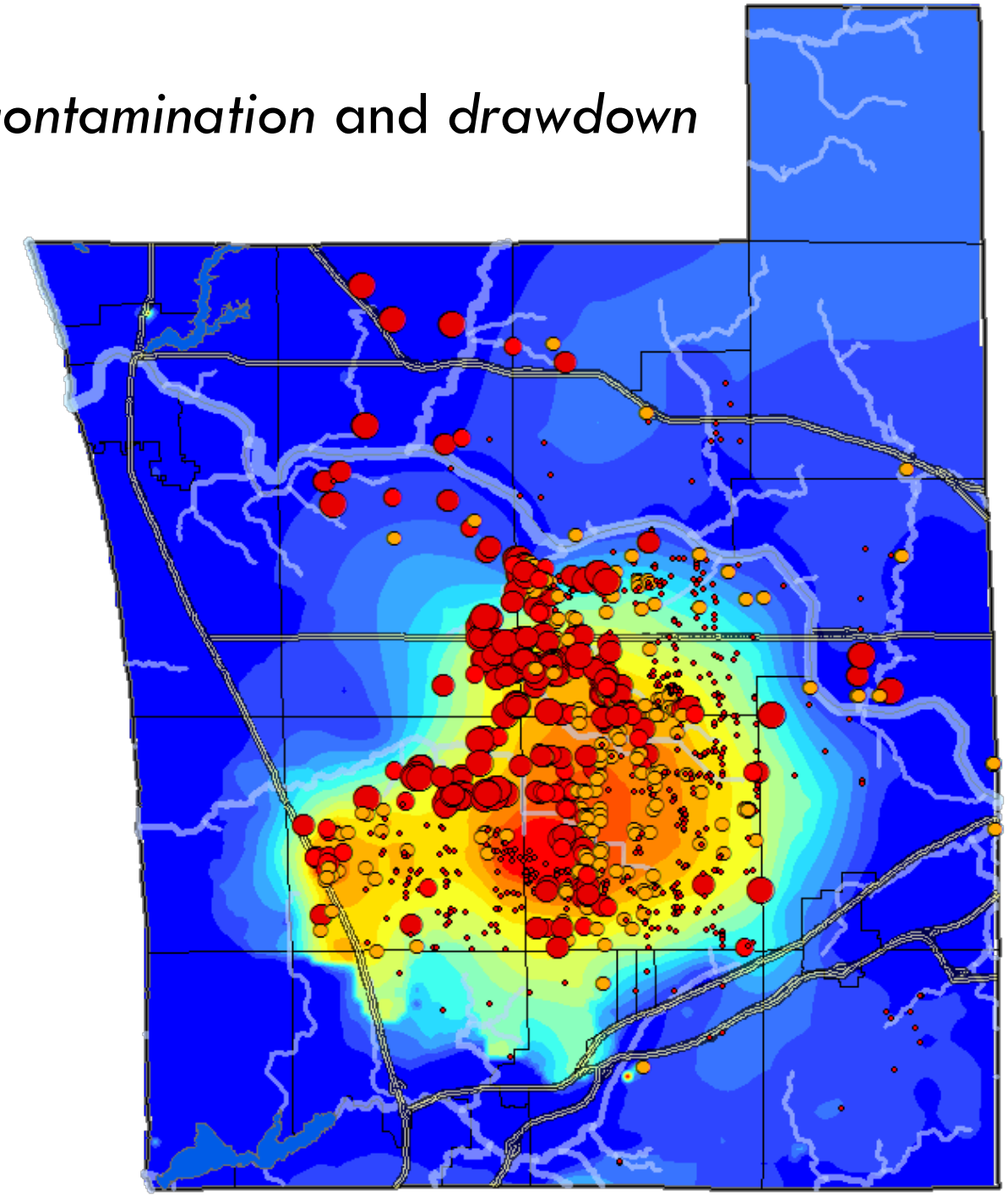


2015

MICHIGAN STATE UNIVERSITY

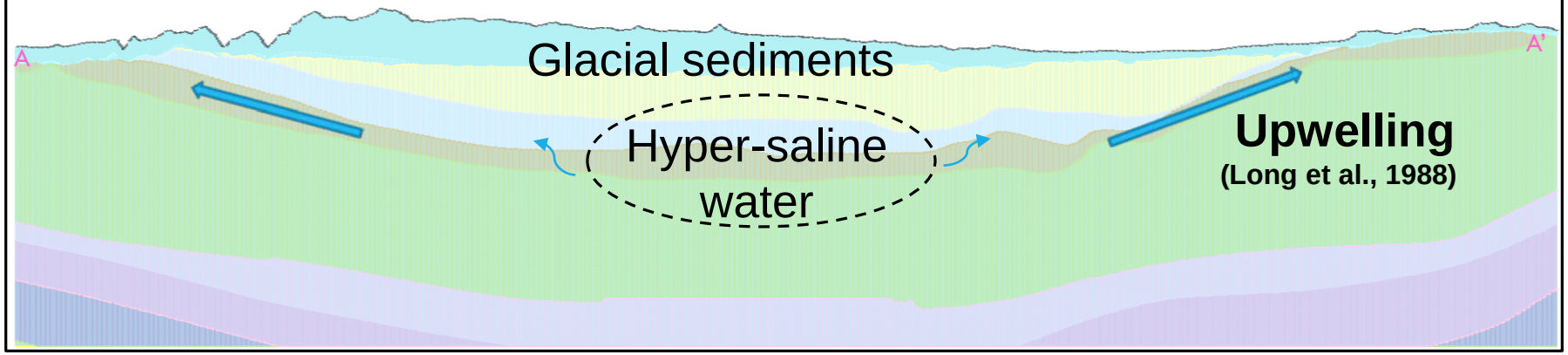
- Correlation between *chloride contamination* and *drawdown*



MICHIGAN STATE UNIVERSITY

Bedrock Formation

- Saginaw (productive)
- Michigan (not productive)
- **Marshall Formation**
- Coldwater Shale (not productive)



MODELING FUTURE WELL-DEPENDENT STRUCTURES

GIS BUILD-OUT MODELING

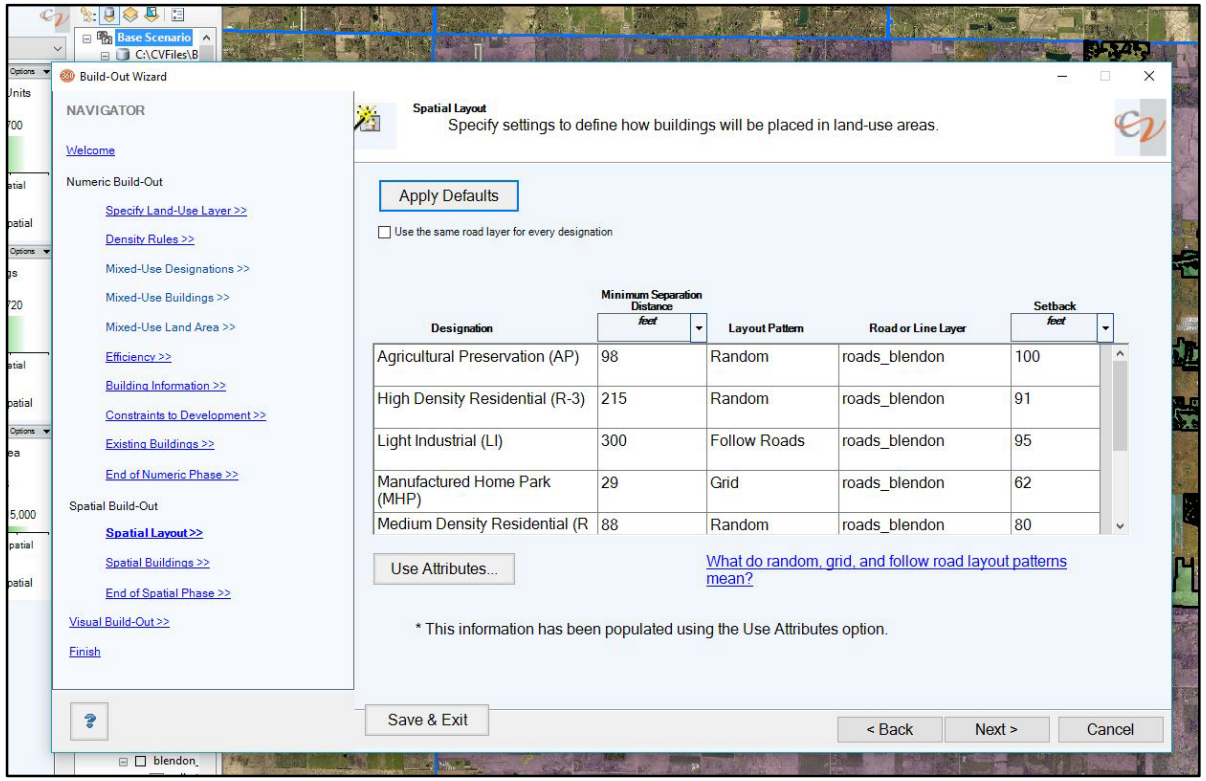
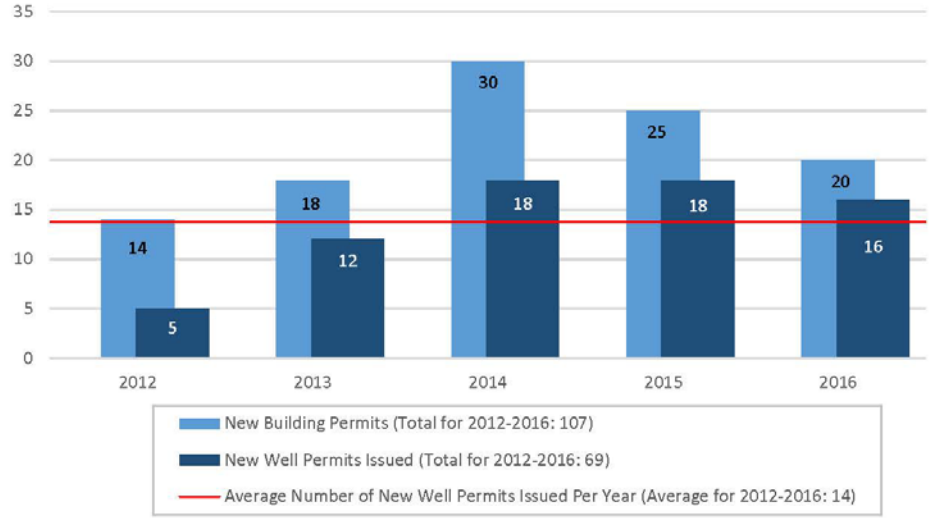


Exhibit 1
Well and Building Permits Issued in Olive Township for New Buildings (2012-2016)



Source: Ottawa County Public Health, Environmental Health Division; Olive Township

Exhibit 2
Buildout Results: New Groundwater Dependent Buildings by Zoning Classification

Zoning Classification	2016-2020	2021-2025	2026-2035	Total
Agricultural (AG)	1	2	1	4
Low Density Residential (LDR)	1	2	5	8
Medium Density Res. (MDR)	49	35	78	162
Rural Residential (RR)	18	31	54	103
Multi-Family Residential (MFR)	0	0	0	0
Commercial (COM)	1	0	2	3
Heavy Ind (HI)	0	0	0	0
Light Industrial (LI)	0	0	0	0
Mobile Home Park (MHP)	0	0	0	0
Total	**70**	**70**	**140**	**280**

Legend:

New Groundwater Dependent Single Family Residential Buildings

New Groundwater Dependent Multi-Family Residential Buildings

New Groundwater Dependent Non-Residential Buildings (Commercial or Industrial)

Olive Township Buildout: 2016-2025

Legend

Existing Water Mains

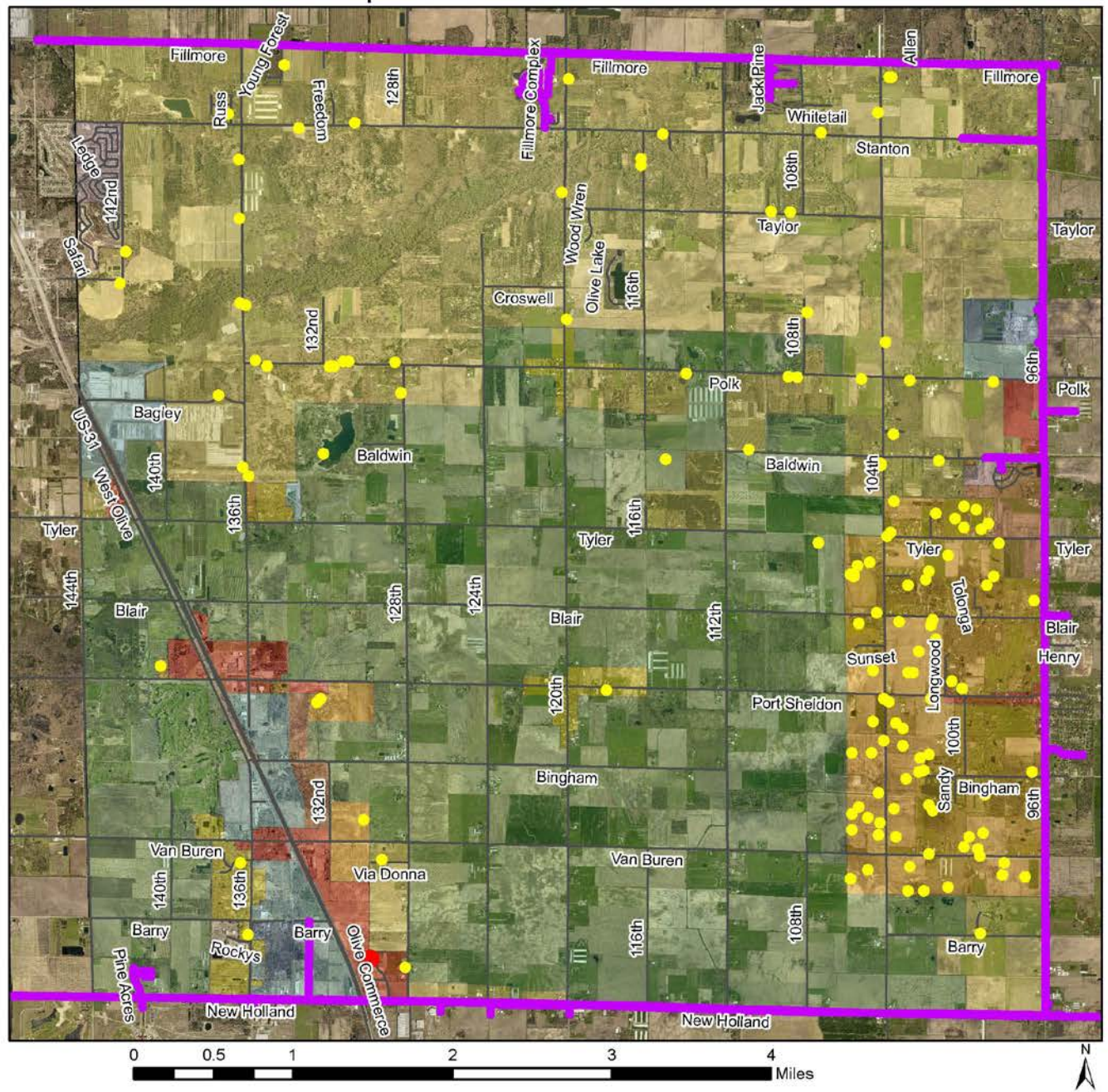
Zoning Districts

- Agricultural (AG)
- Commercial (COM)
- Heavy Ind (HI)
- Light Industrial (LI)
- Low Density Residential (LDR)
- Medium Density Res. (MDR)
- Mobile Home Park (MHP)
- Multi-Family Residential (MFR)
- Rural Residential (RR)

Projected New Buildings

(well-dependent only)

	2016-2025
Single Family Residential	139
Multi-Family Residential	0
Commercial / Industrial	1
Total	**140**

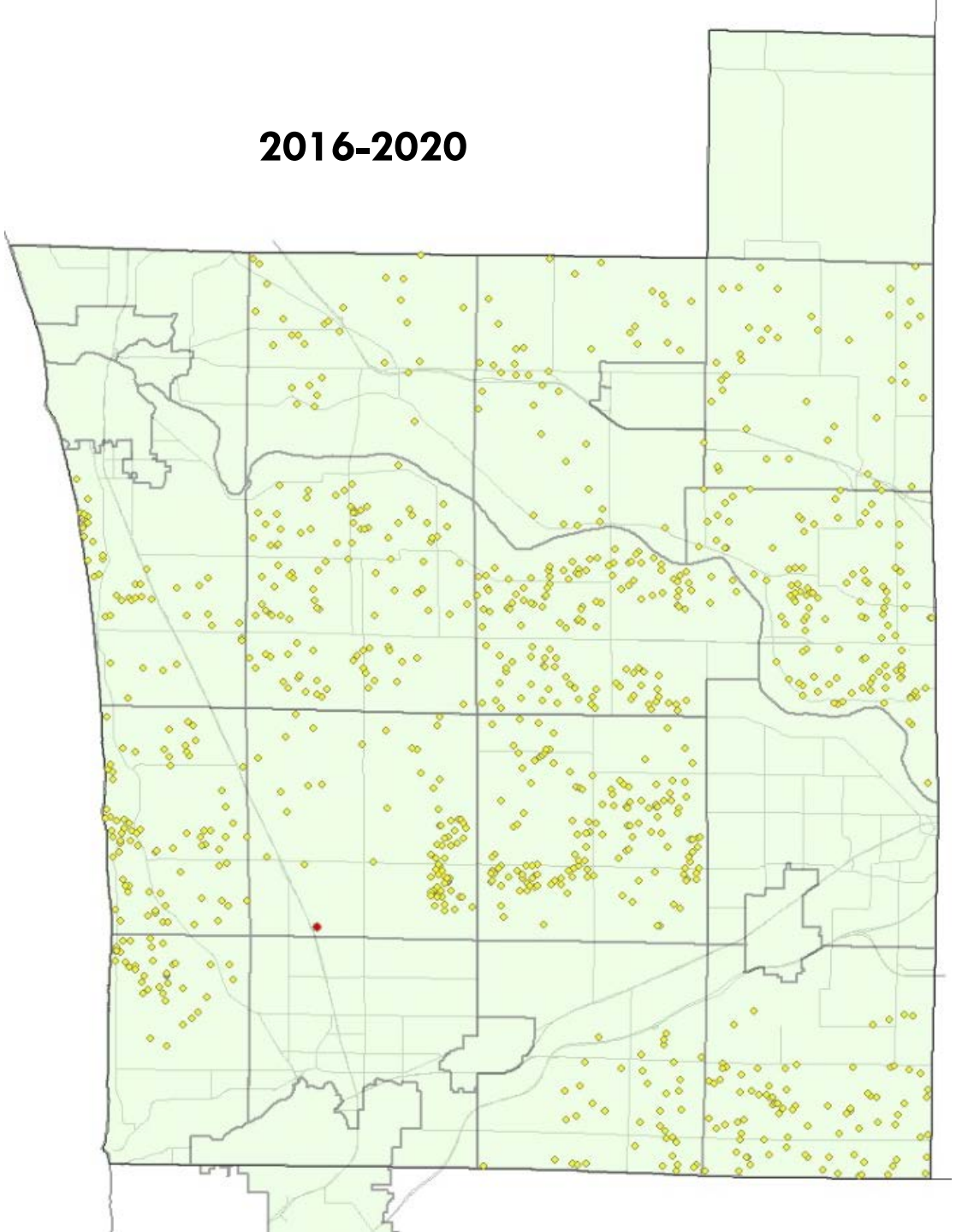


Created by the
Ottawa County Planning &
Performance Improvement
Department
March 2017

2016-2020

Projected Well-Dependent Buildings

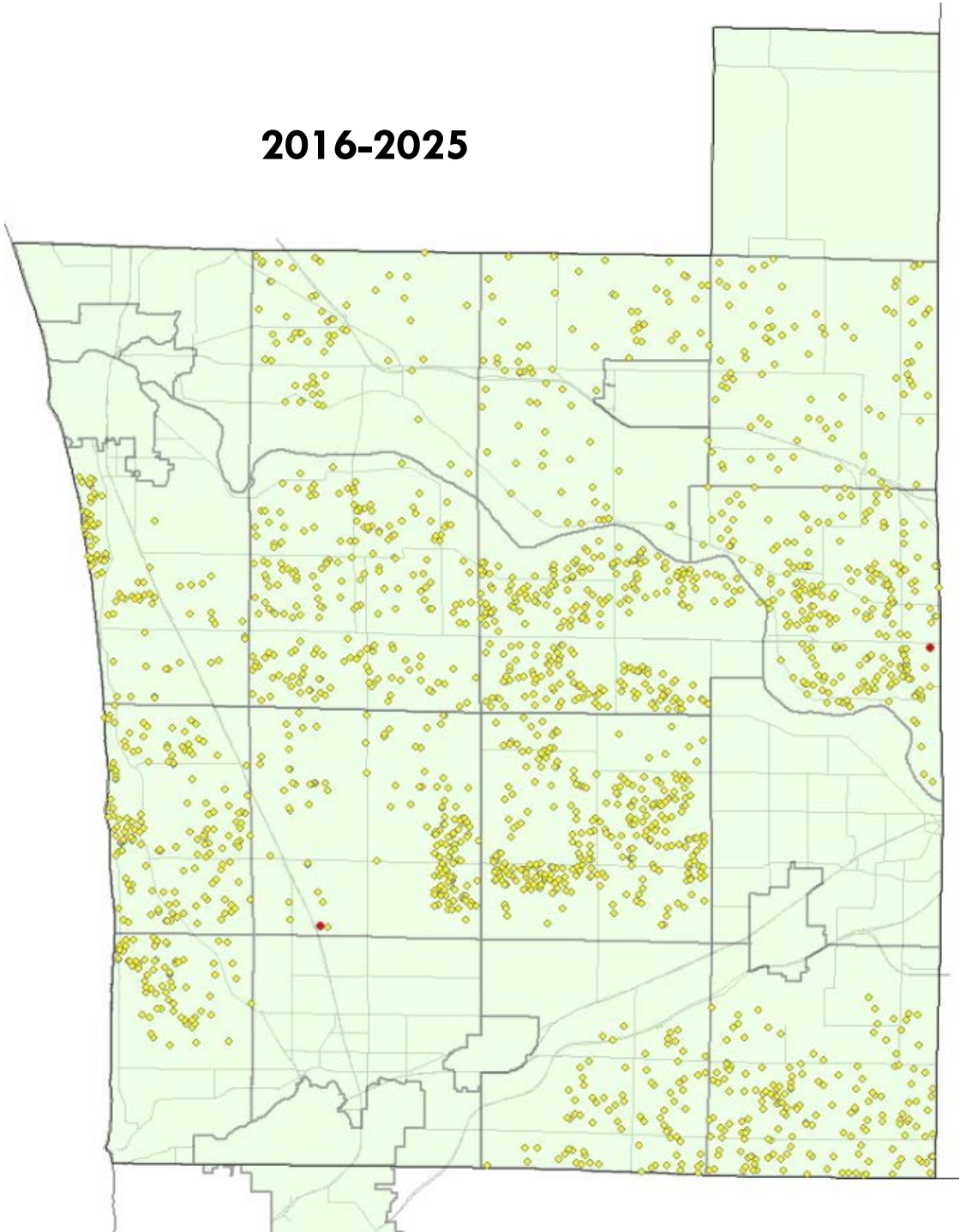
Commercial	1
Industrial	0
Multi Fam. Res	0
Single Fam. Res.	1,034



2016-2025

Projected Well-Dependent Buildings

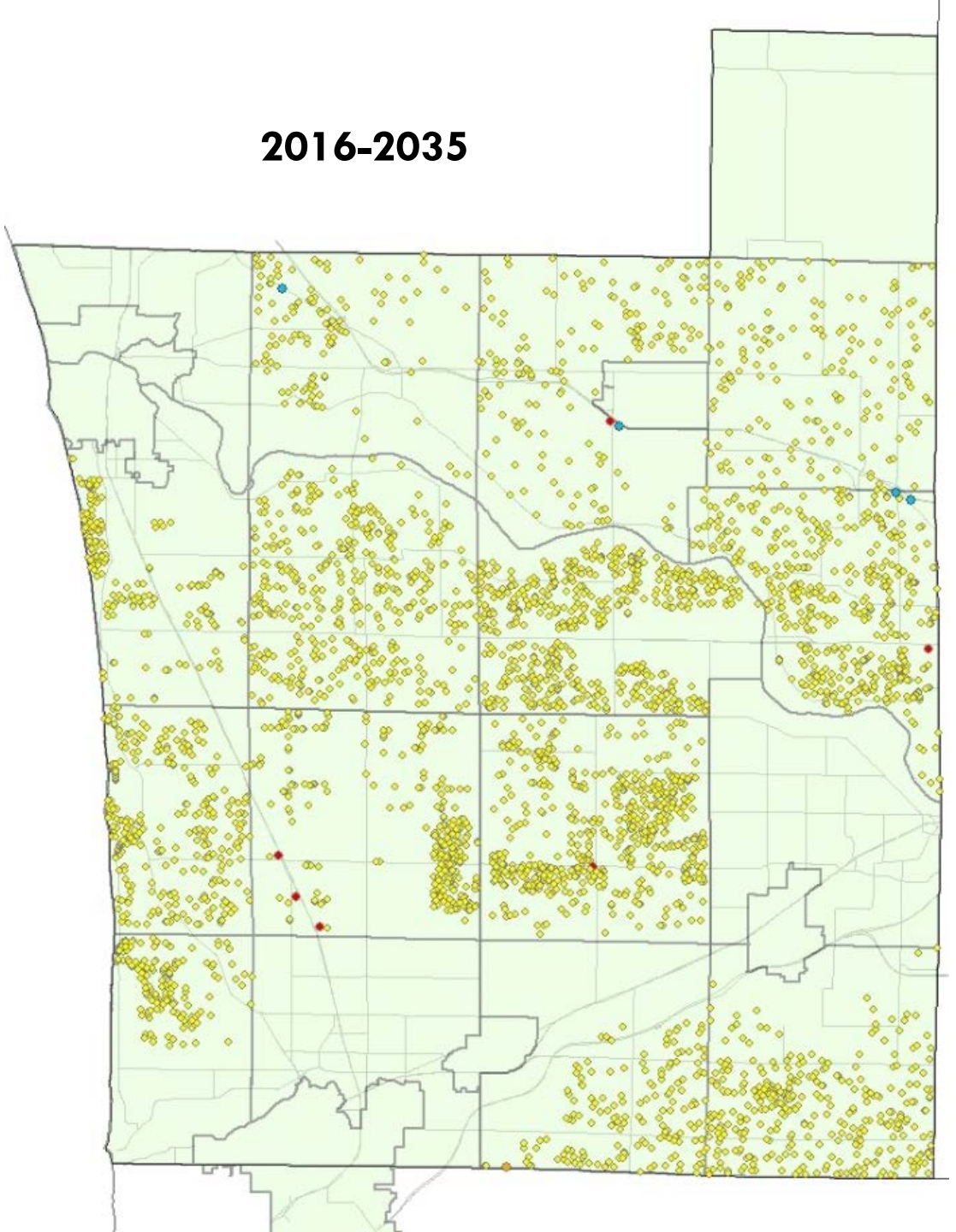
Commercial	2
Industrial	0
Multi Fam. Res	0
Single Fam. Res.	2,068



2016-2035

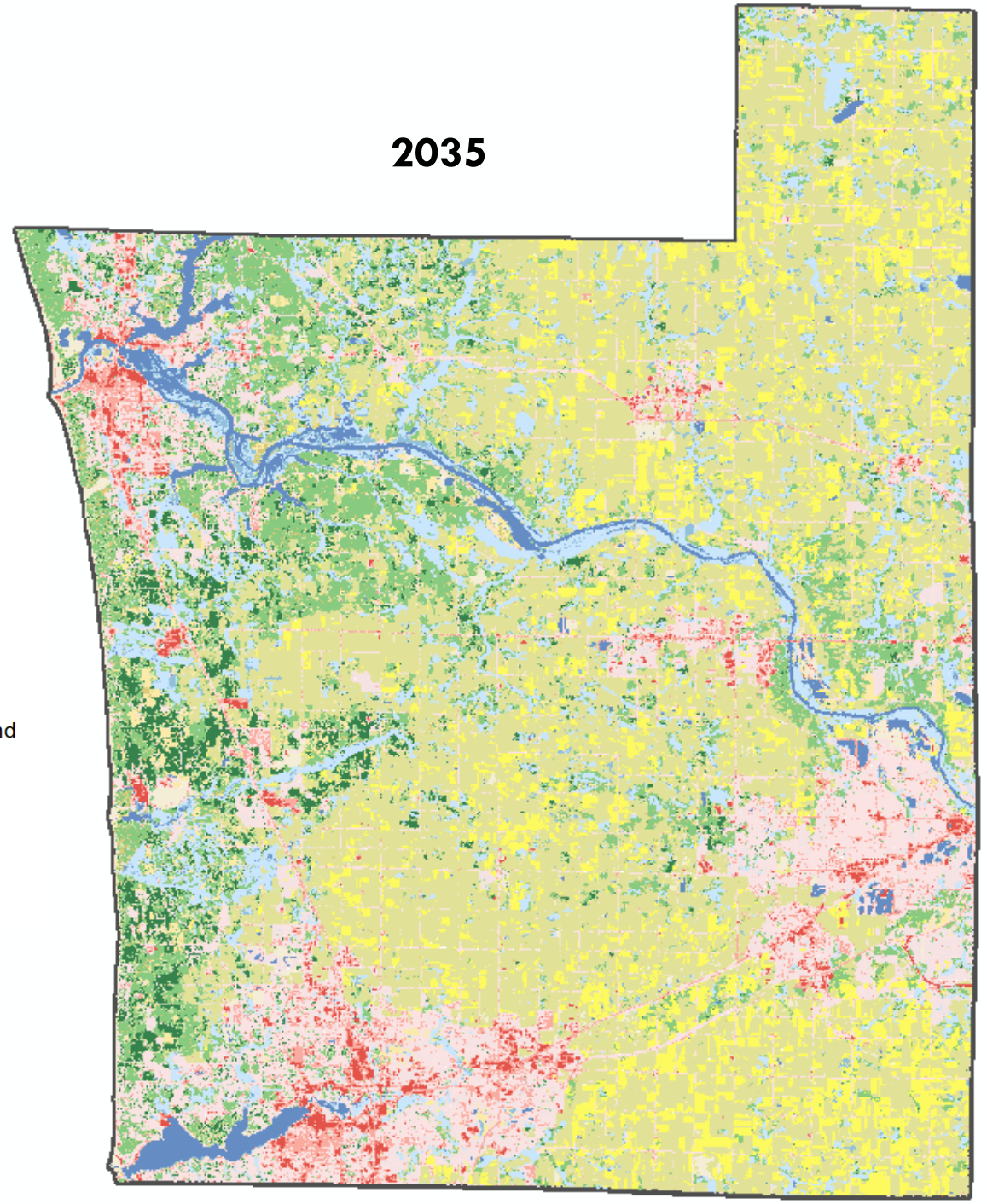
Projected Well-Dependent Buildings

Commercial	6
Industrial	4
Multi Fam. Res	1
Single Fam. Res.	4,129



LAND COVER CHANGE MODELING

2035



Legend

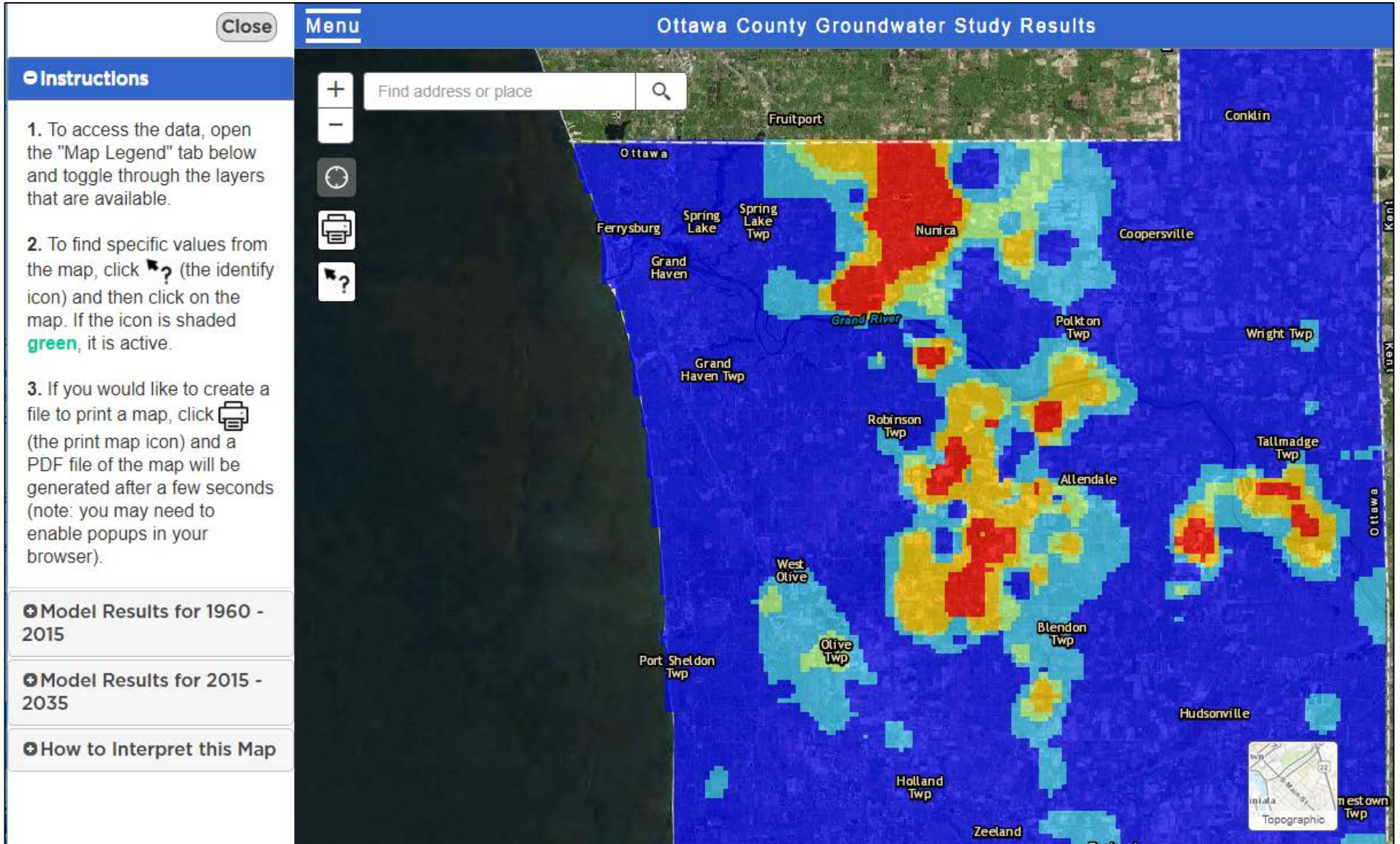
Land Cover Categories

- Bare Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Evergreen Forest
- Grassland/Herbaceous
- Mixed Forest
- Open Water
- Palustrine Aquatic Bed
- Palustrine Emergent Wetland
- Palustrine Forested Wetland
- Palustrine Scrub/Shrub Wetland
- Pasture/Hay
- Scrub/Shrub
- Unconsolidated Shore

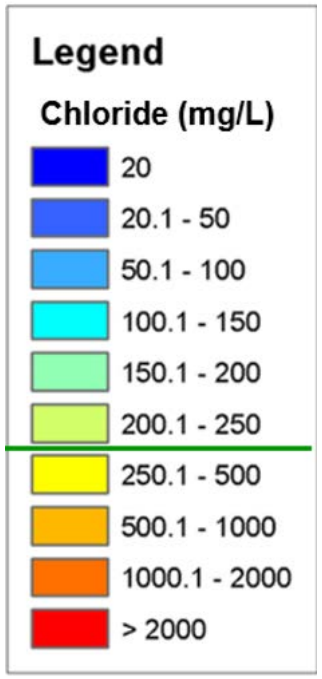
MODELING PROJECTED FUTURE GROUNDWATER USAGE

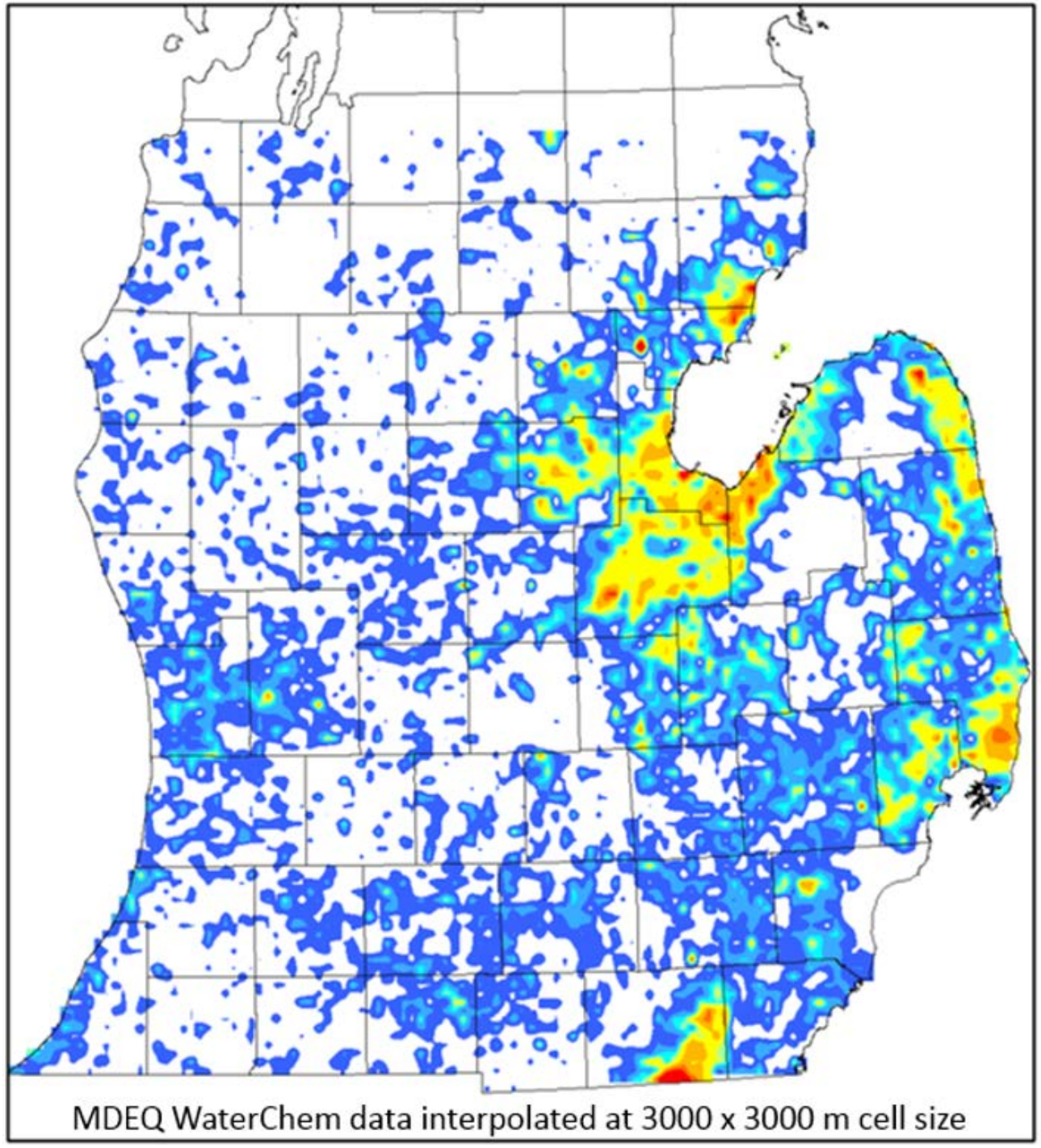

CONTROL DATA | 6400
SYSTEM PROCESSING...

INTERACTIVE WEB-BASED STUDY RESULTS



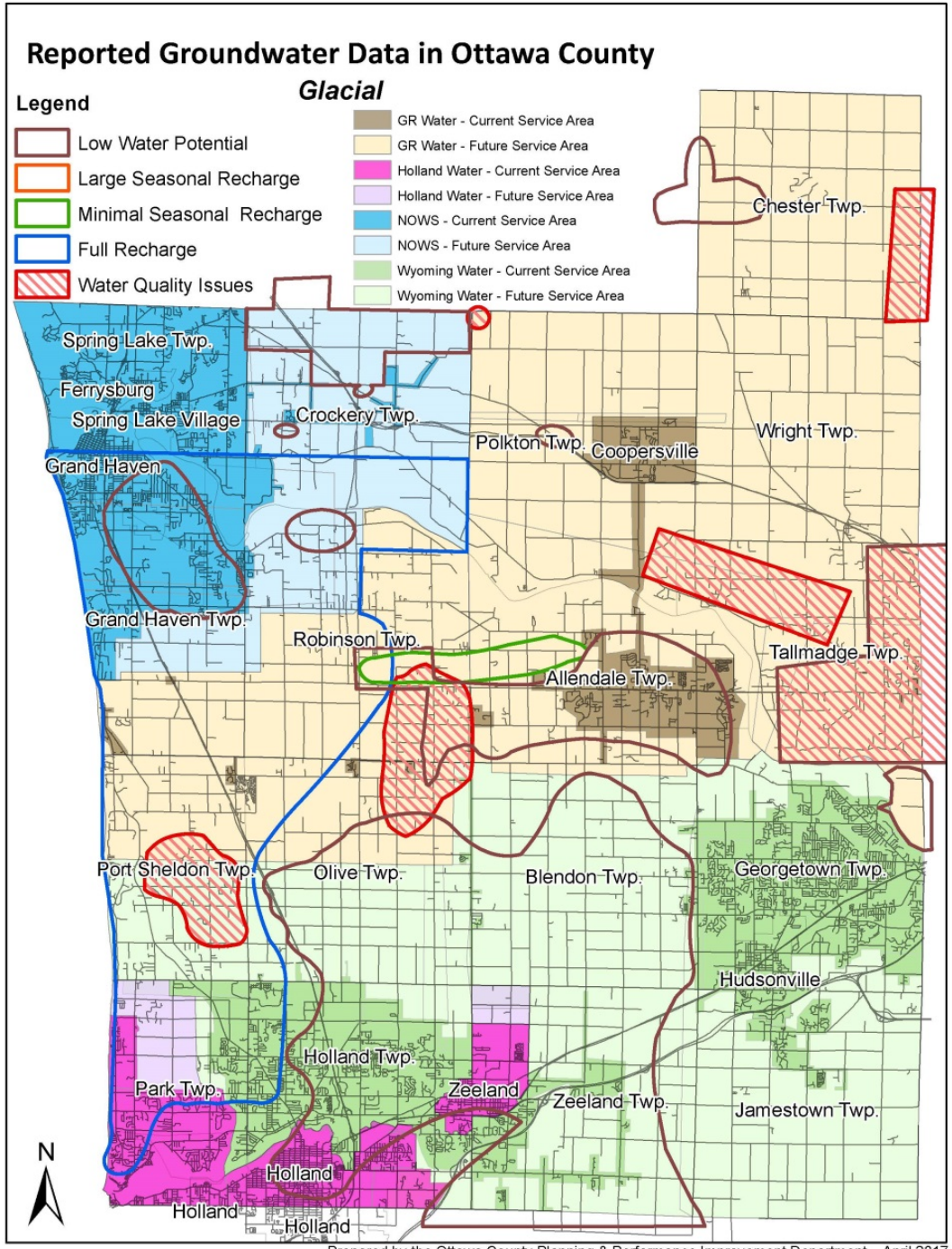
STATE LOWLANDS STUDY

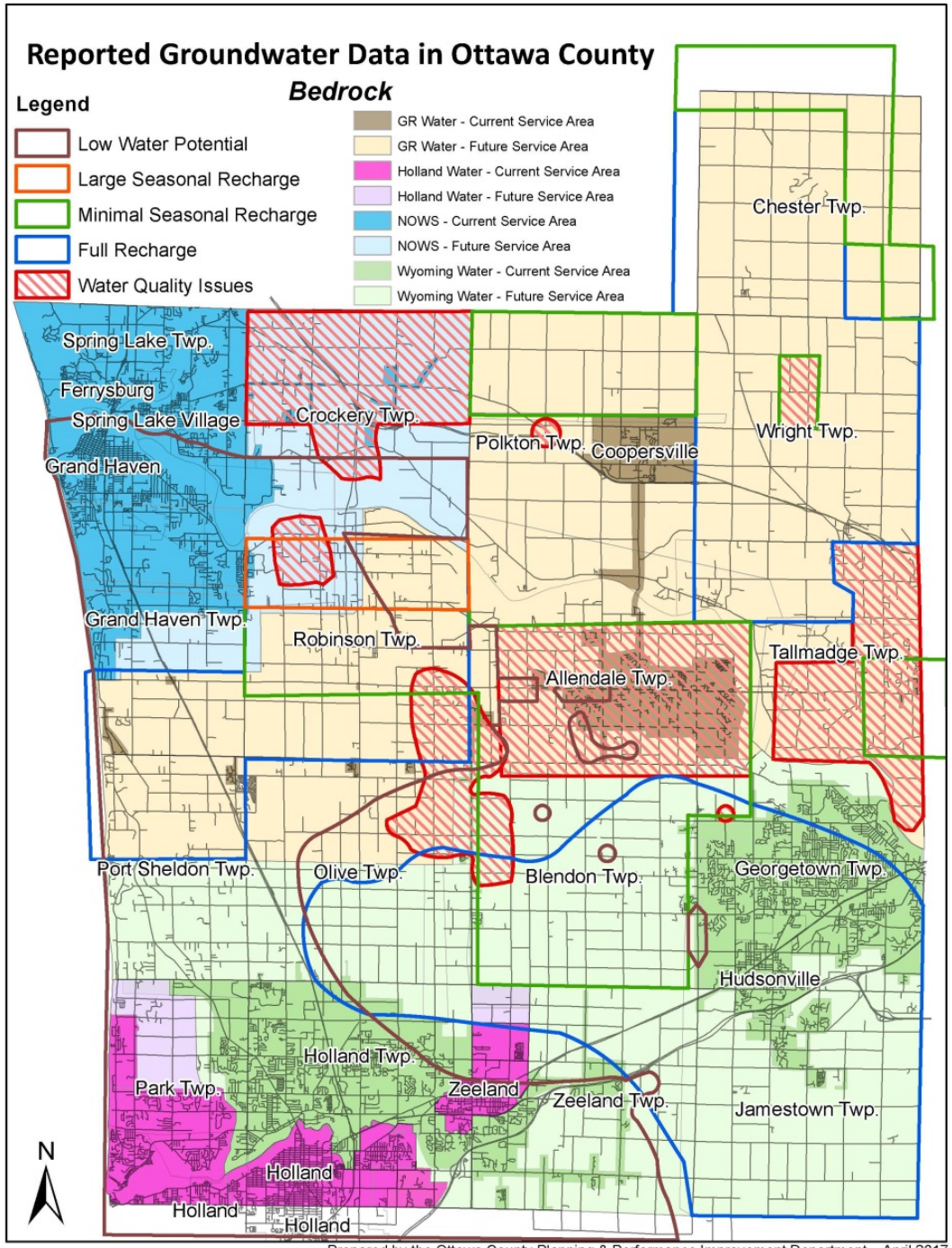




MICHIGAN STATE
UNIVERSITY

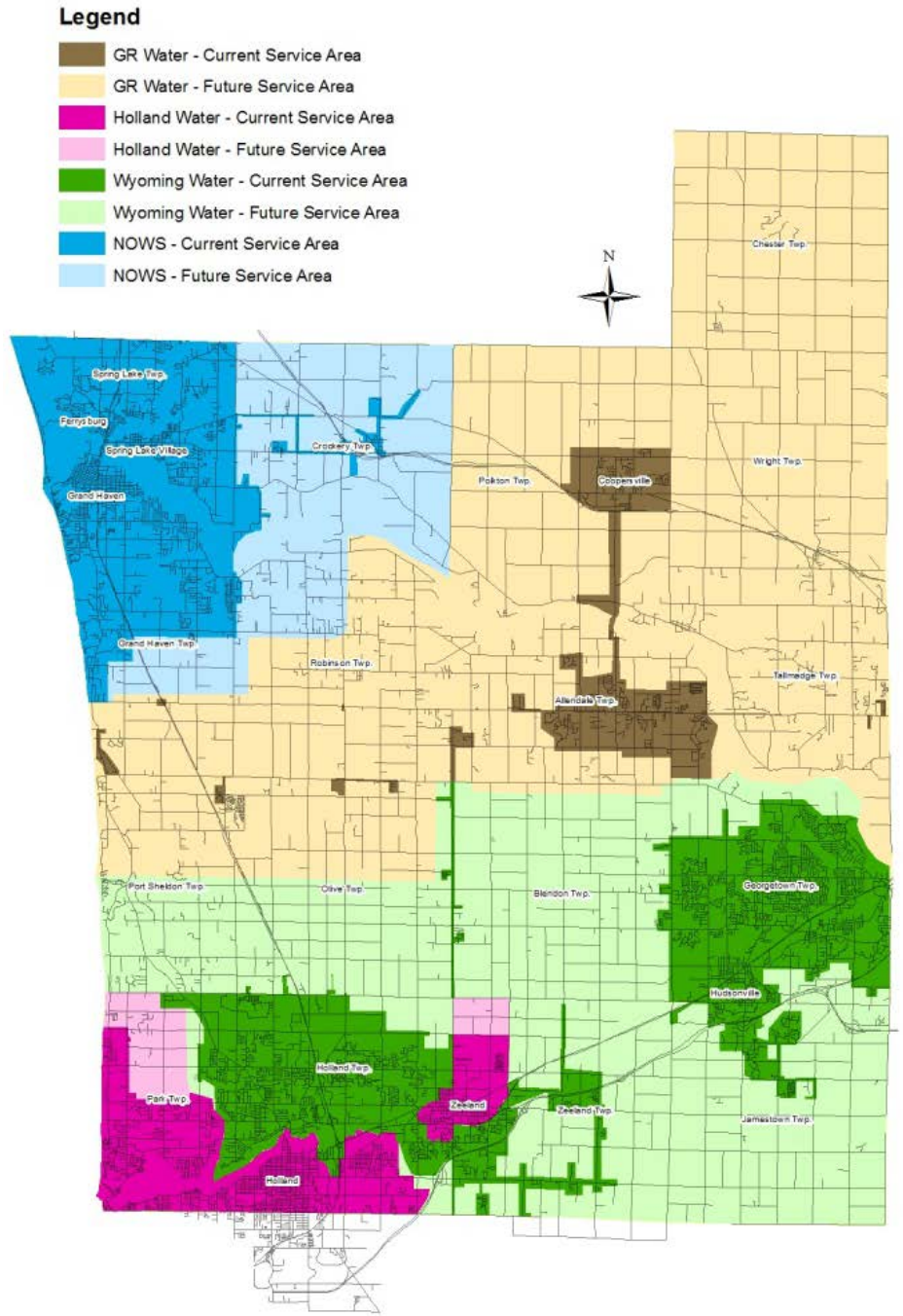
PLANNING FOR GROUNDWATER SUSTAINABILITY


Reported Groundwater Data in Ottawa County
Glacial
Legend
Low Water Potential
Large Seasonal Recharge
Minimal Seasonal Recharge
Full Recharge
Water Quality Issues
GR Water - Current Service Area
GR Water - Future Service Area
Holland Water - Current Service Area
Holland Water - Future Service Area
NOWS - Current Service Area
NOWS - Future Service Area
Wyoming Water - Current Service Area
Wyoming Water - Future Service Area
Chester Twp.
Spring Lake Twp.
Ferrysburg
Spring Lake Village
Crockery Twp.
Polkton Twp.
Coopersville
Wright Twp.
Grand Haven
Grand Haven Twp.
Robinson Twp.
Allendale Twp.
Tallmadge Twp.
Port Sheldon Twp.
Olive Twp.
Blendon Twp.
Georgetown Twp.
Hudsonville
Holland Twp.
Park Twp.
Zeeland
Zeeland Twp.
Jamestown Twp.
Holland
Holland
Holland
N
Prepared by the Ottawa County Planning & Performance Improvement Department April 2017

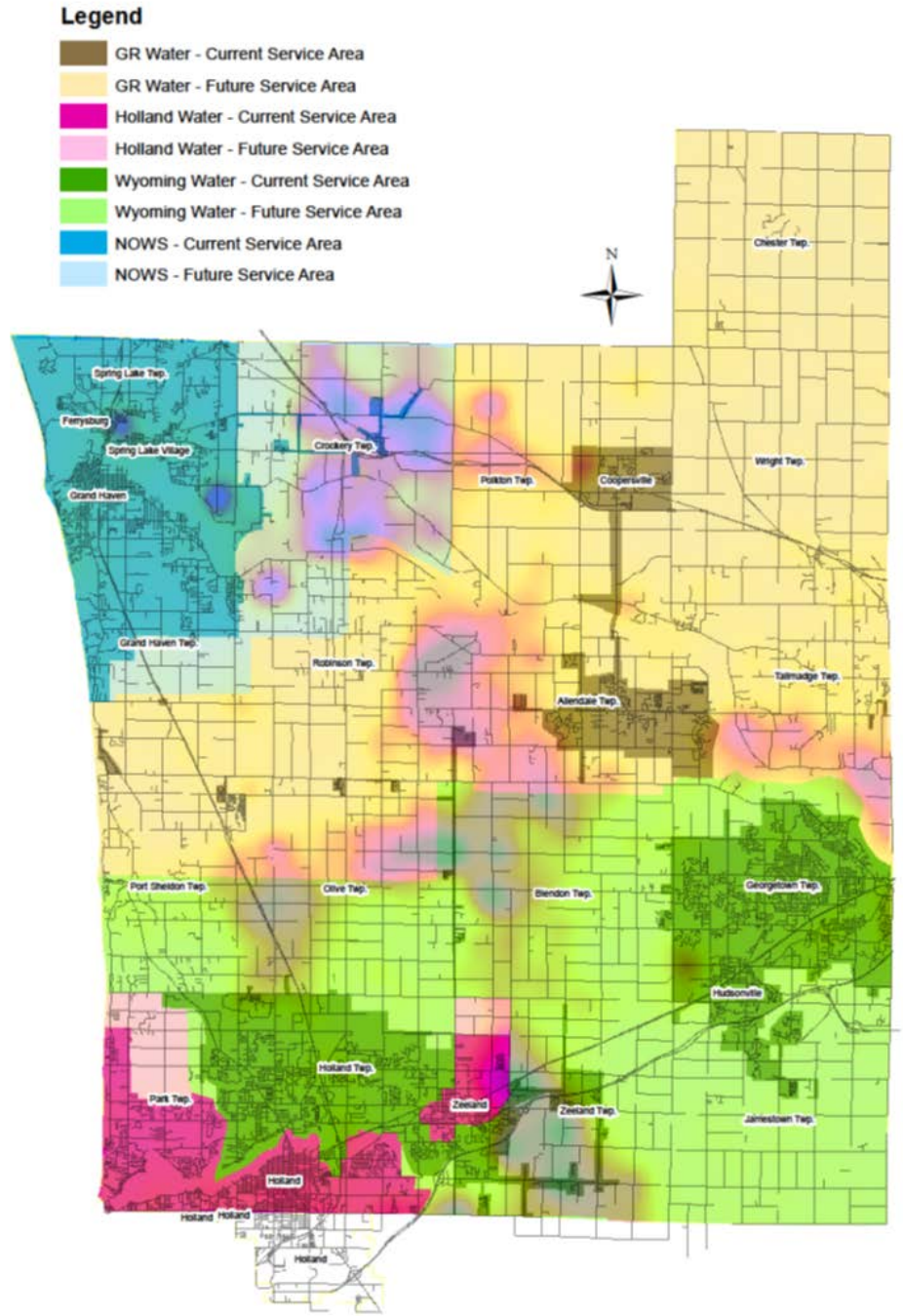

Reported Groundwater Data in Ottawa County
Bedrock
Legend
Low Water Potential
Large Seasonal Recharge
Minimal Seasonal Recharge
Full Recharge
Water Quality Issues
GR Water - Current Service Area
GR Water - Future Service Area
Holland Water - Current Service Area
Holland Water - Future Service Area
NOWS - Current Service Area
NOWS - Future Service Area
Wyoming Water - Current Service Area
Wyoming Water - Future Service Area
Chester Twp.
Spring Lake Twp.
Ferrysburg
Spring Lake Village
Crockery Twp.
Polkton Twp.
Coopersville
Wright Twp.
Grand Haven
Grand Haven Twp.
Robinson Twp.
Allendale Twp.
Tallmadge Twp.
Port Sheldon Twp.
Olive Twp.
Blendon Twp.
Georgetown Twp.
Hudsonville
Holland Twp.
Park Twp.
Zeeland
Zeeland Twp.
Jamestown Twp.
Holland
Holland
Holland
N
Prepared by the Ottawa County Planning & Performance Improvement Department April 2017


EXIT

Water Service Areas

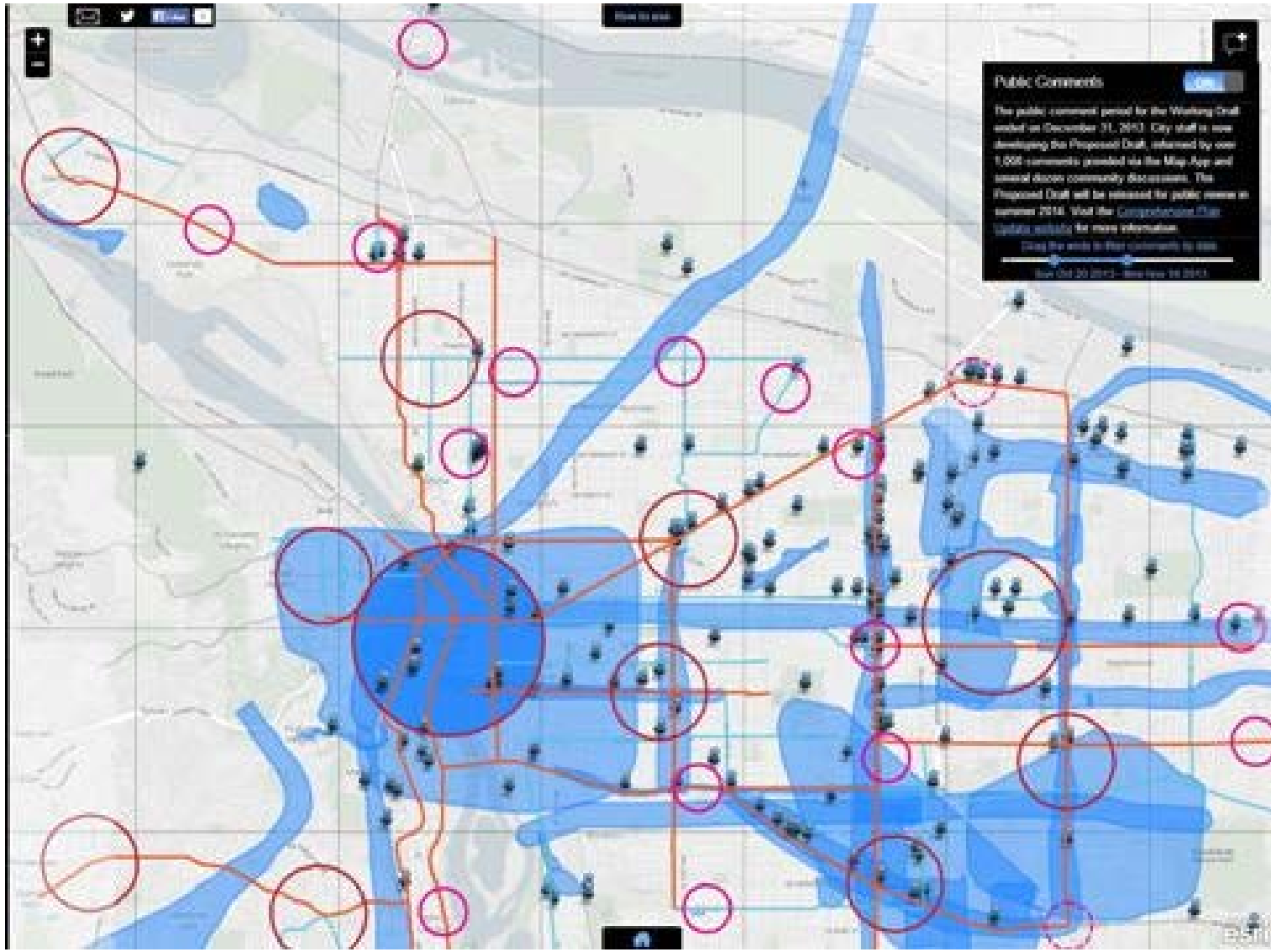


Water Service Areas



OTTAWA COUNTY ROAD COMMISSION

miOttawa Department of Public Health



Comprehensive Water Resources Study

Ottawa County

Groundwater Task Force


Manage
Groundwater

NEXT STEPS/MOVING FORWARD

- Complete MSU Study – March 2018

- Create "Plan" for Groundwater Use, Conservation, and Education

  - Define high priority groundwater areas
  - Identify solutions (e.g. techniques, technologies, policies, education, etc.)
  - Prioritize actions, secure stakeholders, activate "teams"
  - Commence with implementation (short and long-term)


QUESTIONS?