

Water Quantity & Quality Research Programs

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State Extension and AgBioResearch Council

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Growing Demand for Water

- World's population is expected to expand from 7 to 9 billion by 2050
- Agriculture and industry are growing annually and have implications for future water demand considerations
- Broad water quantity and quality impacts

Holistic Water Management Using Information Technology

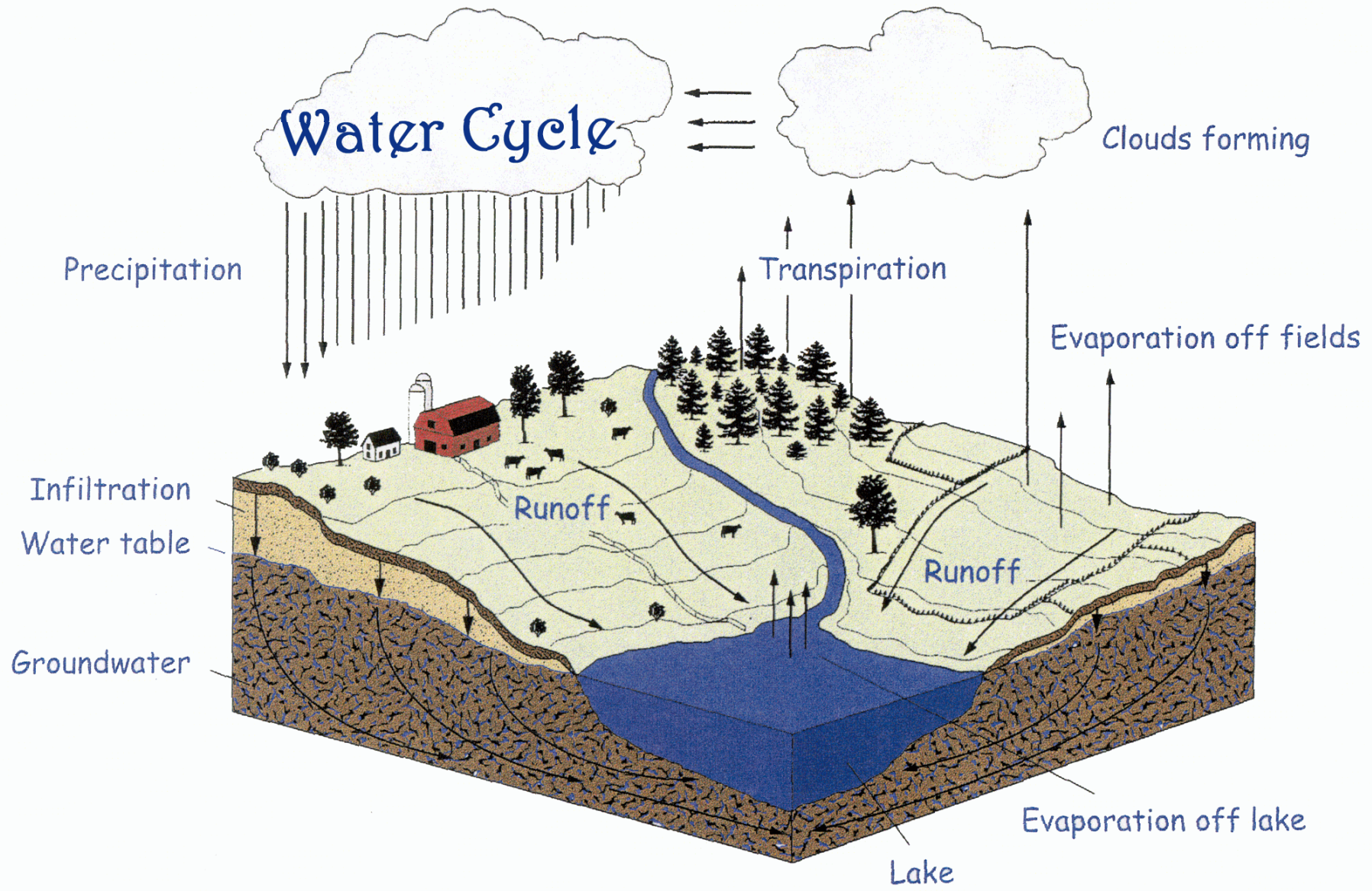


Holistic Water Management Using Information Technology

- We can work together to provide a system that is fair, equitable and ***assures sustainable water resources***
- Sustainable water management is within the best interests of both **water users** and the **public**
- New approaches using information technologies are within our reach. What would a **statewide spatial decision support system** look like?

Water Quantity Considerations

Water Cycle



Clouds forming

Precipitation

Transpiration

Evaporation off fields

Infiltration

Water table

Groundwater

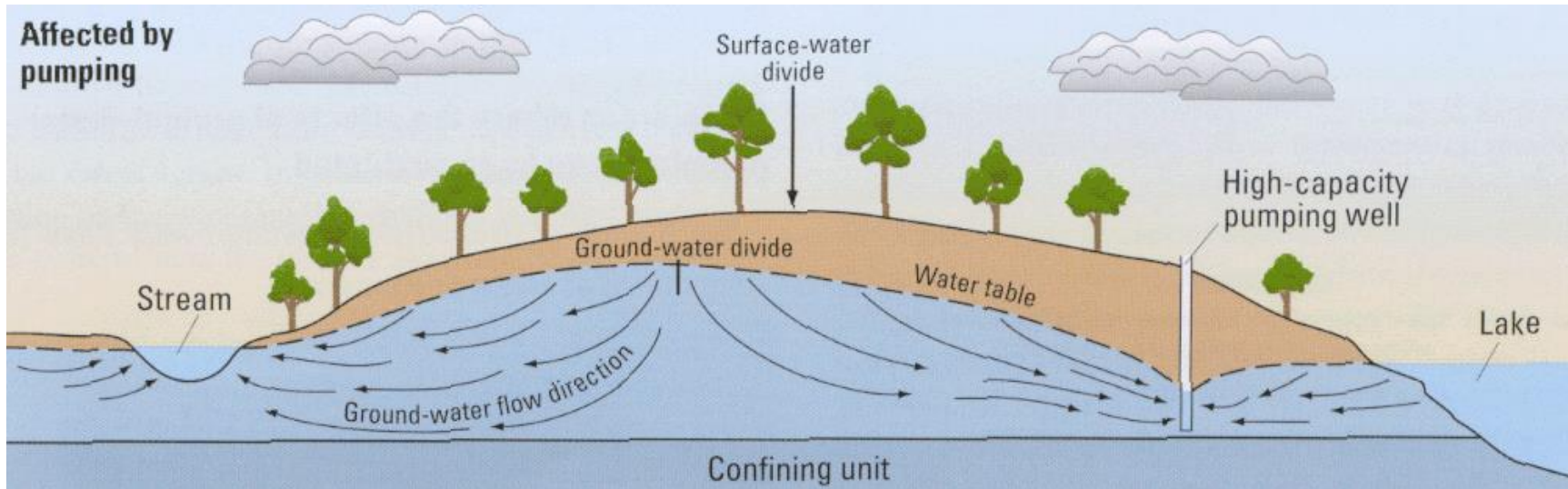
Runoff

Runoff

Lake

Evaporation off lake

Affected by pumping



Policy Basis of Regulatory Framework

- Great Lakes Compact → **Water Withdrawal Assessment Process (WWAP) and Tool (WWAT)**
- **WWAT** used to determine how much water can be pumped before having an **Adverse Resource Impact (ARI)** on fish populations
- Over **3,500 registrations** since 2009 (90% irrigation)
- May convene local **Water Users Committee** to determine how resources will be shared among users when watersheds are fully subscribed.



Choosing a new or existing registration

If you are assessing a new withdrawal or proposing to register a new withdrawal for the first time, choose "New Withdrawal" below.

If you are modifying an existing registration you have made through the water withdrawal assessment tool, choose "Modify Existing Registration" below.

Note: Modifying an existing registration is required when the actual withdrawal construction deviates from what was proposed during the initial registration. This includes modifications such as: changing your location, well casing depth, capacity, etc.

**Assess a
New Withdrawal**

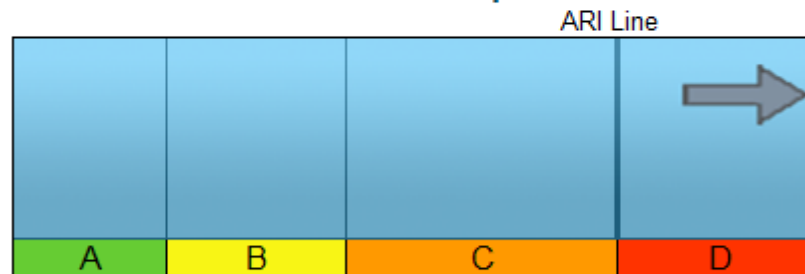
**Modify or Cancel
a Registration**

**Replace an
Existing
Withdrawal**

Assessment Zones

Water withdrawal screening results

ARI Zone Graph



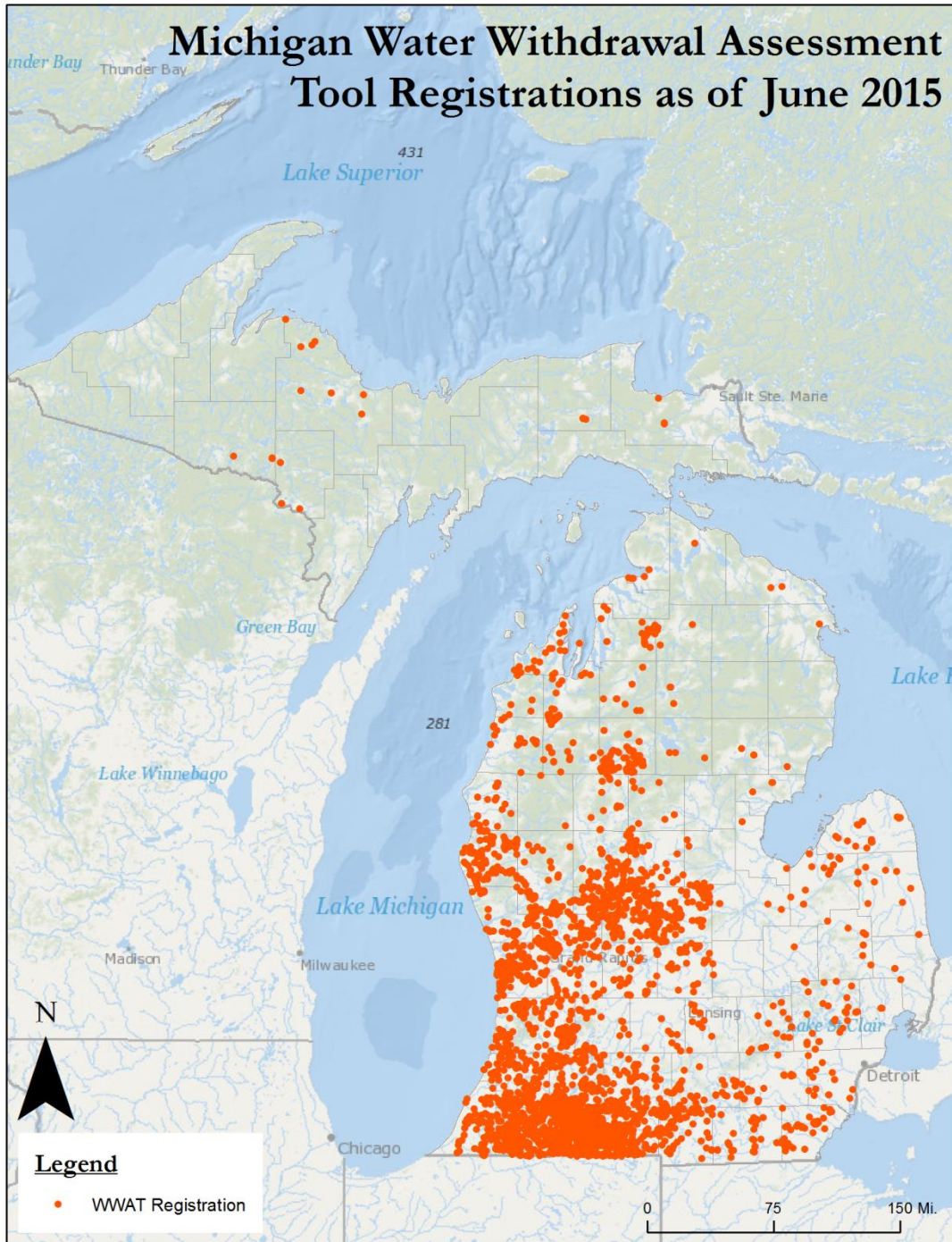
Result: Zone D

The proposed withdrawal has failed the screening process.

You must request a site specific review below in order to begin using this withdrawal.

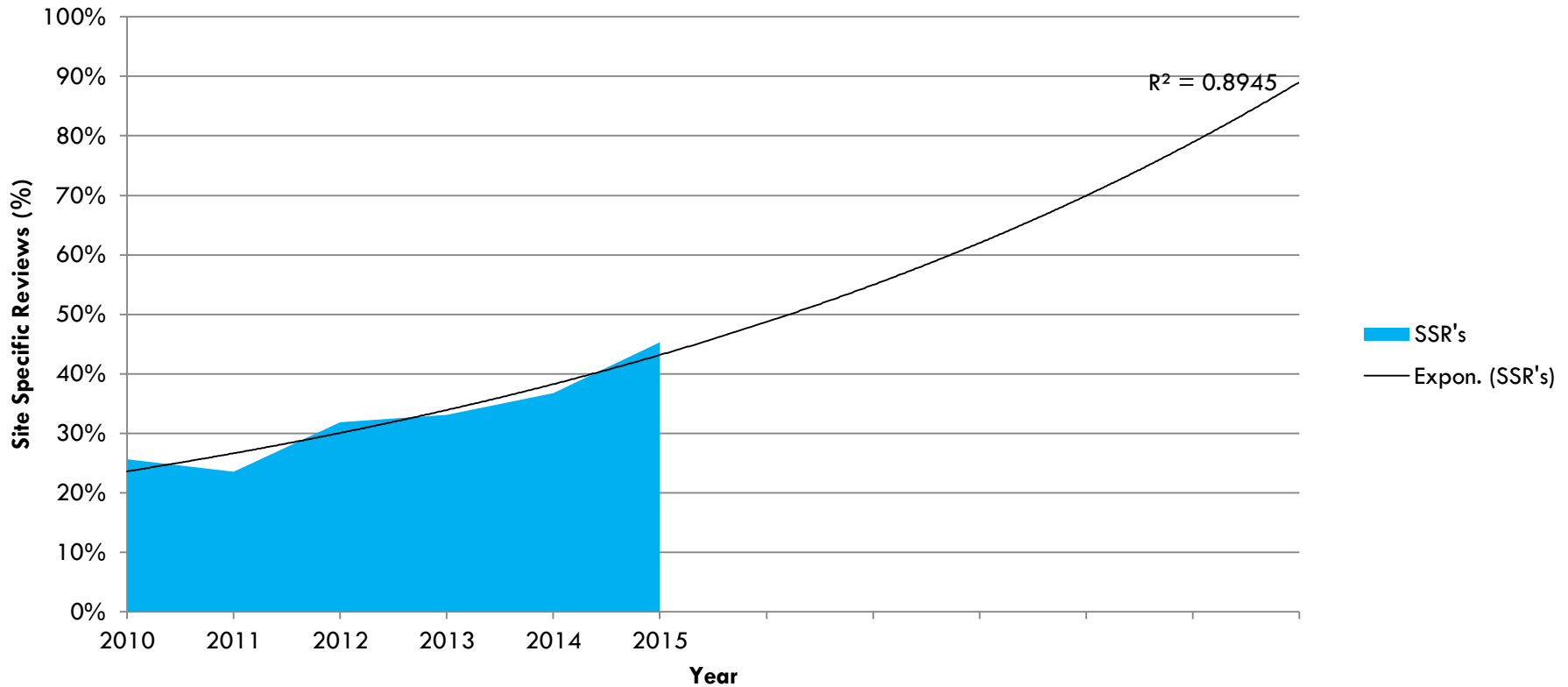
The graph above illustrates the estimated impact of the proposed withdrawal on the affected stream, and its potential for causing an adverse resource impact (ARI).

Michigan Water Withdrawal Assessment Tool Registrations as of June 2015



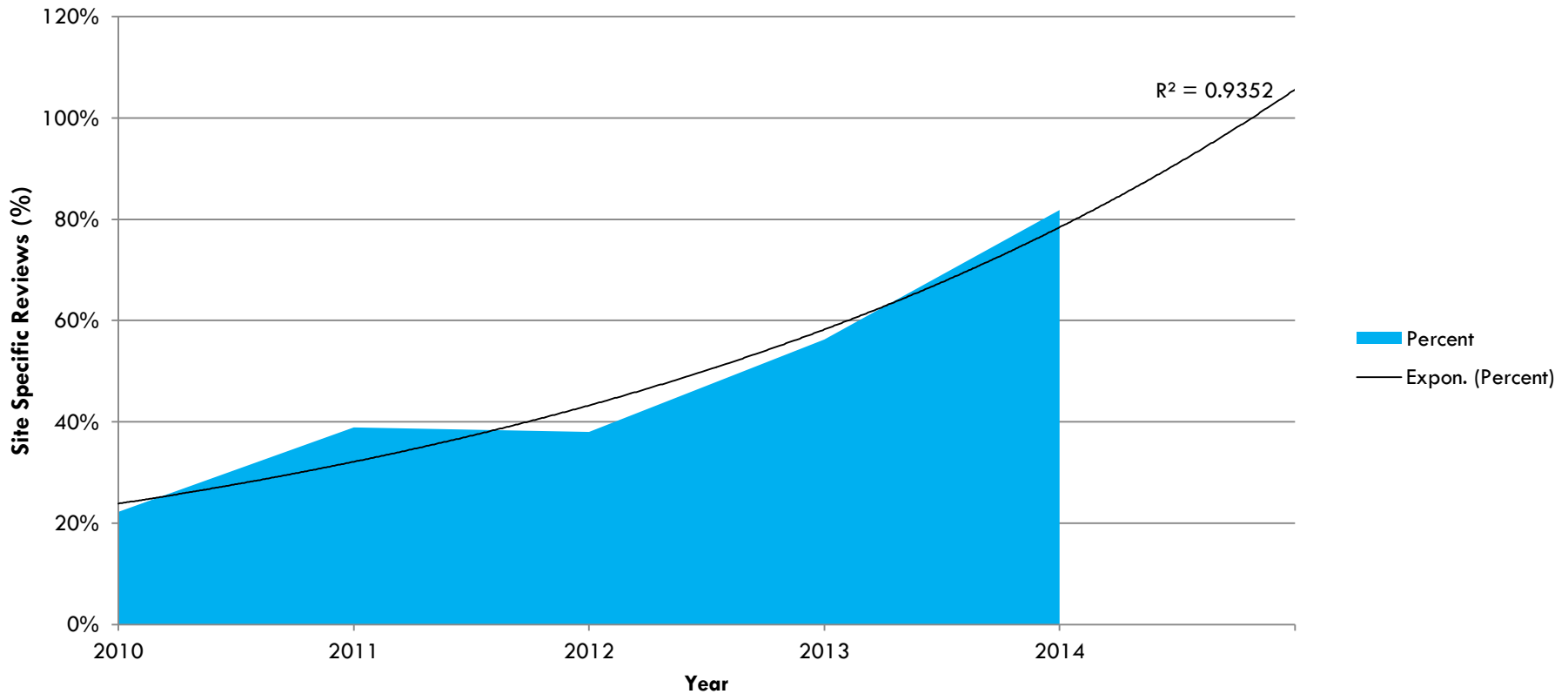
Working with Limited Water Resources

Projected Percent of Registrations Requiring a Site Specific Review



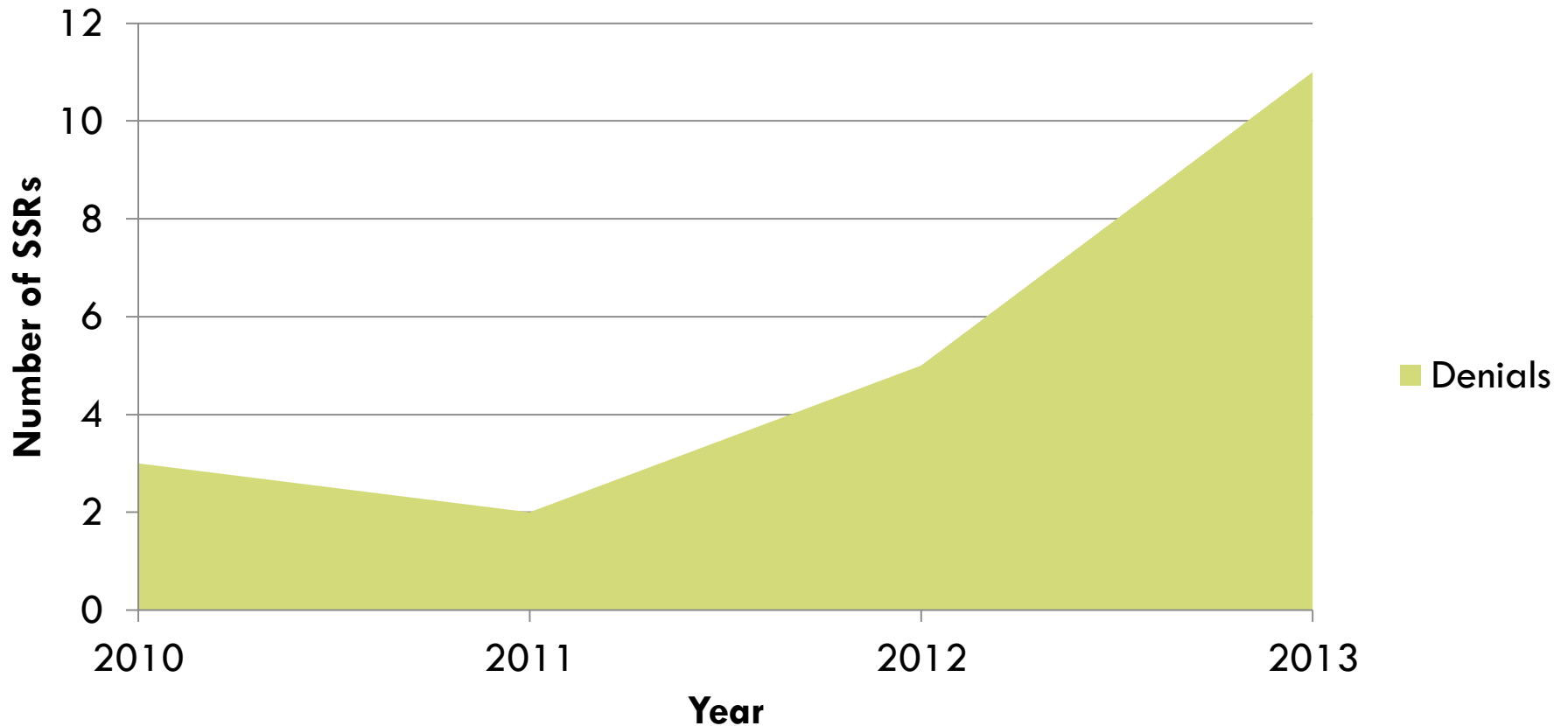
Working with Limited Water Resources

Percentage of Registrations Requiring a Site Specific Review in the Prairie River Watershed



Working with Limited Water Resources

Zone D Result After Site Specific Review (Denials)




Moving forward in the WWAP

- Water user committees form to discuss how to use less water
- New system to offer water offsets through landscape changes, new technologies, recycling



Recharge Calculator

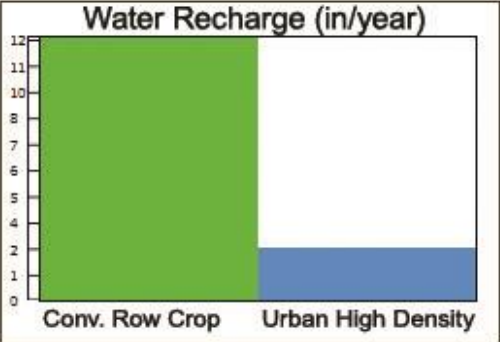
The Nature Conservancy  Paw Paw River Watershed Recharge Calculator and Map

Size of Parcel: 34 acres
Current Land Use/Cover: Conventional Row Crop
Proposed Land Use/Cover: Urban High-density
Soil Type: B

Decrease in Recharge	-9.72 in/yr
Offset Equivalent Pumping	-17.08 gal/min (continuous)
Total Gallons	-8,978,019 gallons

Calculate

Water Recharge (in/year)



Land Use/Cover	Water Recharge (in/year)
Conv. Row Crop	11.8
Urban High Density	2.1

Map interface showing an aerial view of a parcel (highlighted in green) with navigation controls (2D, 3D, Road, Aerial, Bird's eye, Labels) and buttons (Go To, Data Layers, Create New Parcel). The map shows E Napier Ave and S Benton Center Rd.

Expanding Use of Agricultural Tile Drainage



Water Quality Considerations

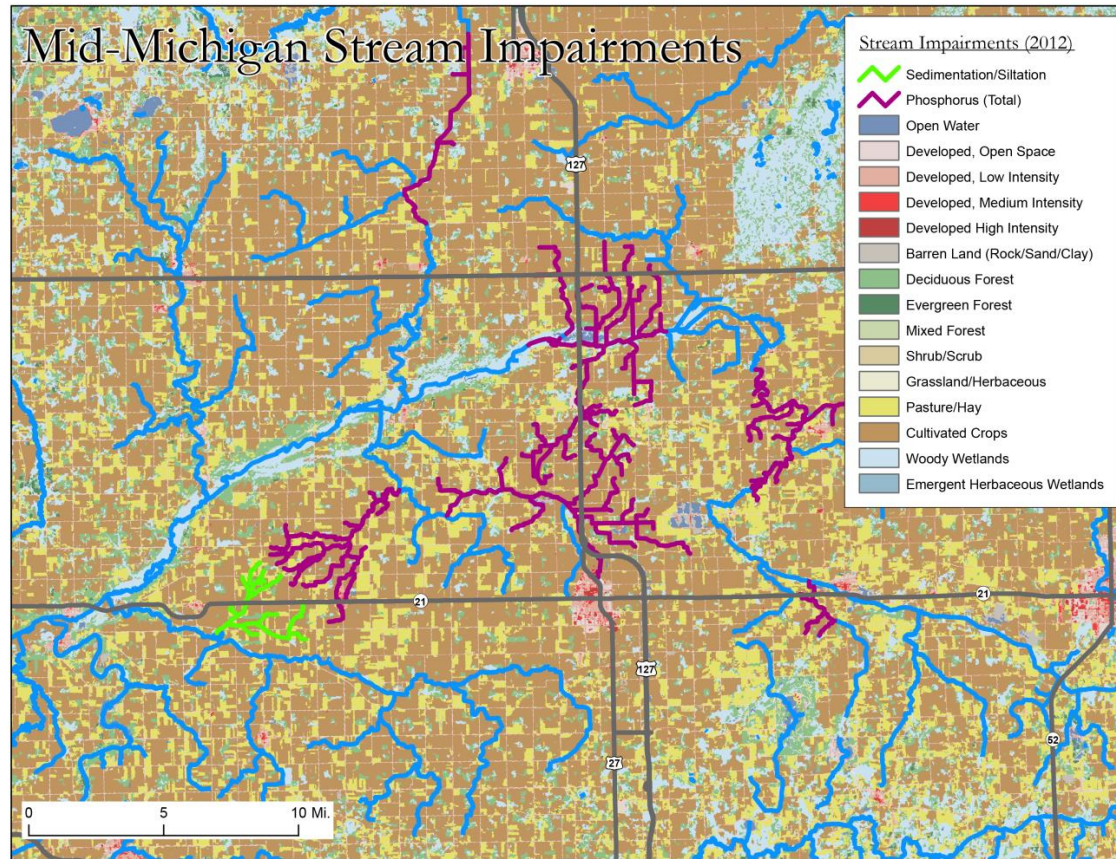
Water Quality: Lake Erie



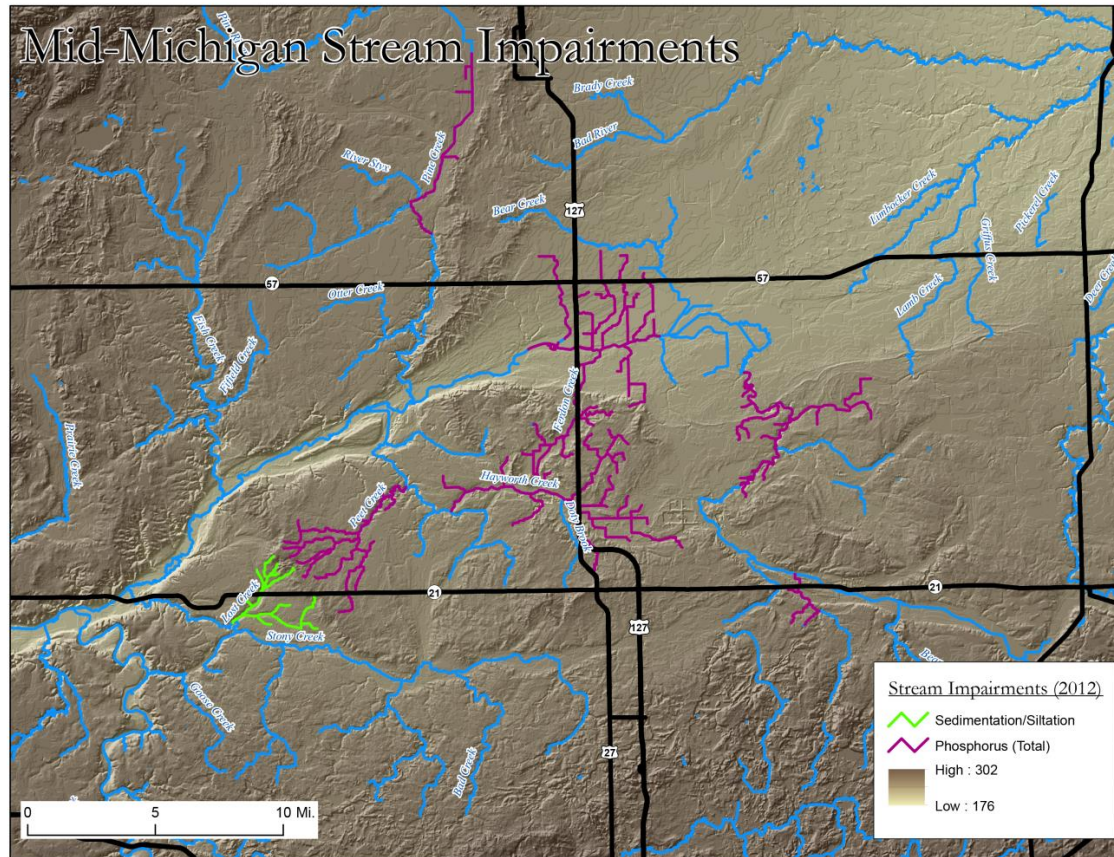
Water Quality: Saginaw Bay



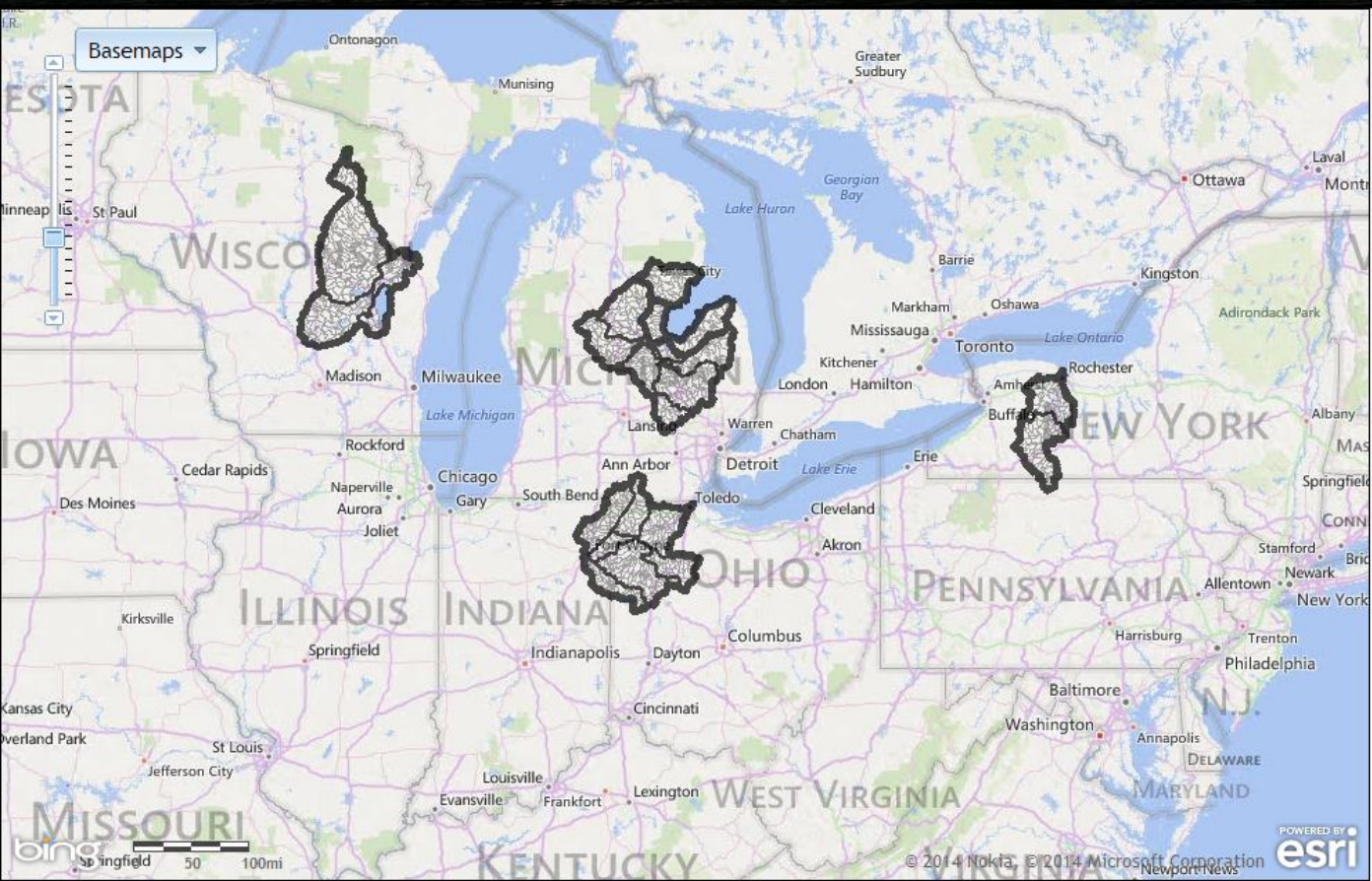
Water Quality Impairments in Michigan



Water Quality Impairments in Michigan



On the Fly Modeling



Introduction

The Great Lakes Watershed Management System (GLWMS) is an on-line tool that allows users to evaluate non-point source (NPS) pollution model estimates at watershed and field scales. The system links two water quality models, [High Impact Targeting \(HIT\)](#) from the [Institute of Water Research at Michigan State University](#), and the [Long Term Hydrologic Impact Assessment \(L-THIA\)](#) from [Purdue University's Department of Agricultural and Biological Engineering](#). HIT estimates sediment loading from agricultural lands to nearby streams; L-THIA estimates run-off volumes and pollutant loads.

The GLWMS allows users to view HIT and L-THIA estimates at watershed scales, and conduct field scale scenario evaluations of land cover changes or best management practices (BMPs).

The system is currently available for the priority basins of the [EPA's Great Lakes Restoration Initiative](#) - the Fox River Basin of Wisconsin, the

Navigation

- Map Layers
- Legend
- Analysis
- About the Models
- About the Tool

Watershed Scale Prioritization

Basemaps

Introduction
Navigation
Map Layers

Watershed-scale Analysis

Select watersheds to analyze Selected watersheds and data HIT analysis L-THIA analysis

Apply a Map Legend

Shade the selected watersheds by a numeric attribute in the 'Selected Watersheds and Data' tab.

Attributes:
Acres
Sediment loading (t/ac/yr)

Number of classes: 4

quantiles equal intervals

Watershed Legend:
Low
↓
High

Apply Legend

About the Tool

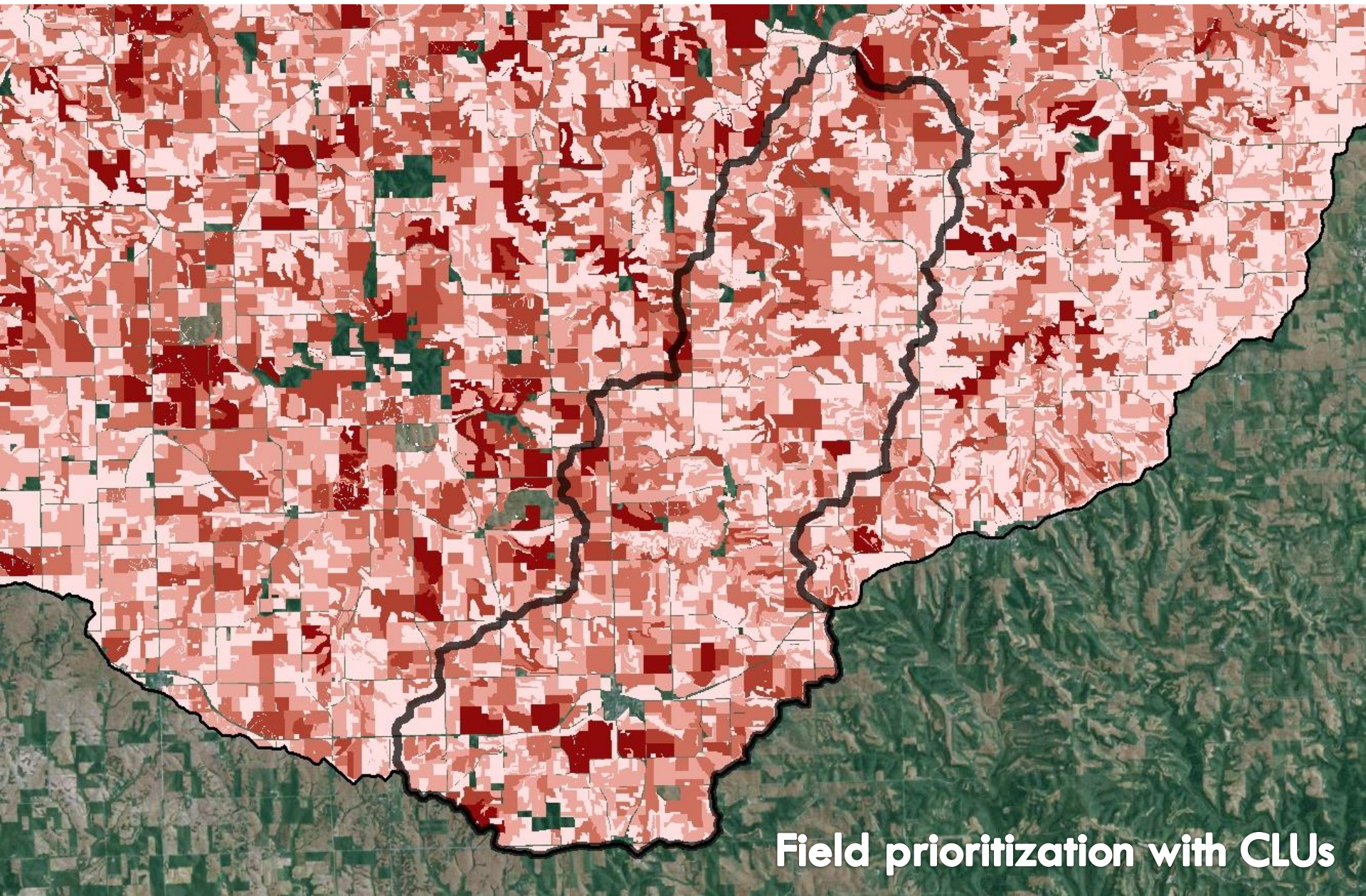
© 2014 Nokia, © 2014 Microsoft Corporation **esri**

Active Map Tool: [Identify features on-click](#)

-82.78600468, 42.55940627

Banner photograph credit: [Andrew L. Jansen-Mohr](#)

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Field prioritization with CLUs

Field-Scale Prioritization



Introduction

Navigation

Map Layers

Legend

Analysis

To analyze data at the field level, or run land-cover change scenario models click on 'Field-scale Analysis'.

To analyze sediment and nutrient loading at watershed scales click on 'Watershed-scale Analysis'.

[Field-scale Analysis](#)

[Watershed-scale Analysis](#)

[My Projects](#)

[Reports](#)

About the Models

About the Tool

Active Map Tool: [Identify features on-click](#)




Banner photograph credit: [Andrea L. Jaeger Mohr](#)

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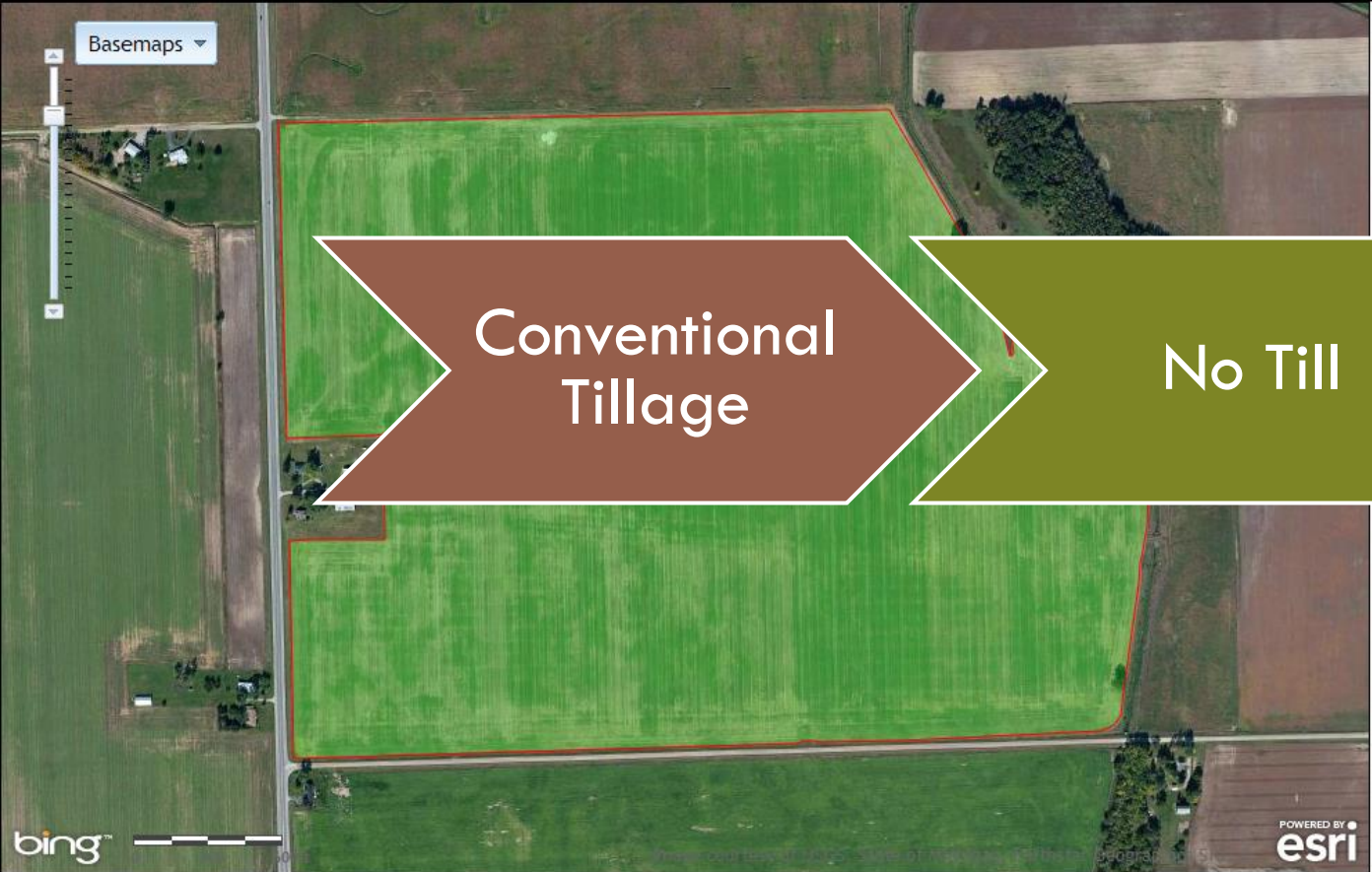
-83.07066471, 43.39735135

Field-Scale Analysis

Great Lakes Watershed Management System [login/logout](#)
(logged in as: laura)

   The Nature Conservancy
Protecting nature. Preserving life.

Basemaps



Conventional Tillage

No Till

Introduction

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Map Layers

Legend

Analysis

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Field-scale Analysis

Watershed-scale Analysis

My Projects

Reports

About the Models

About the Tool

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POWERED BY esri

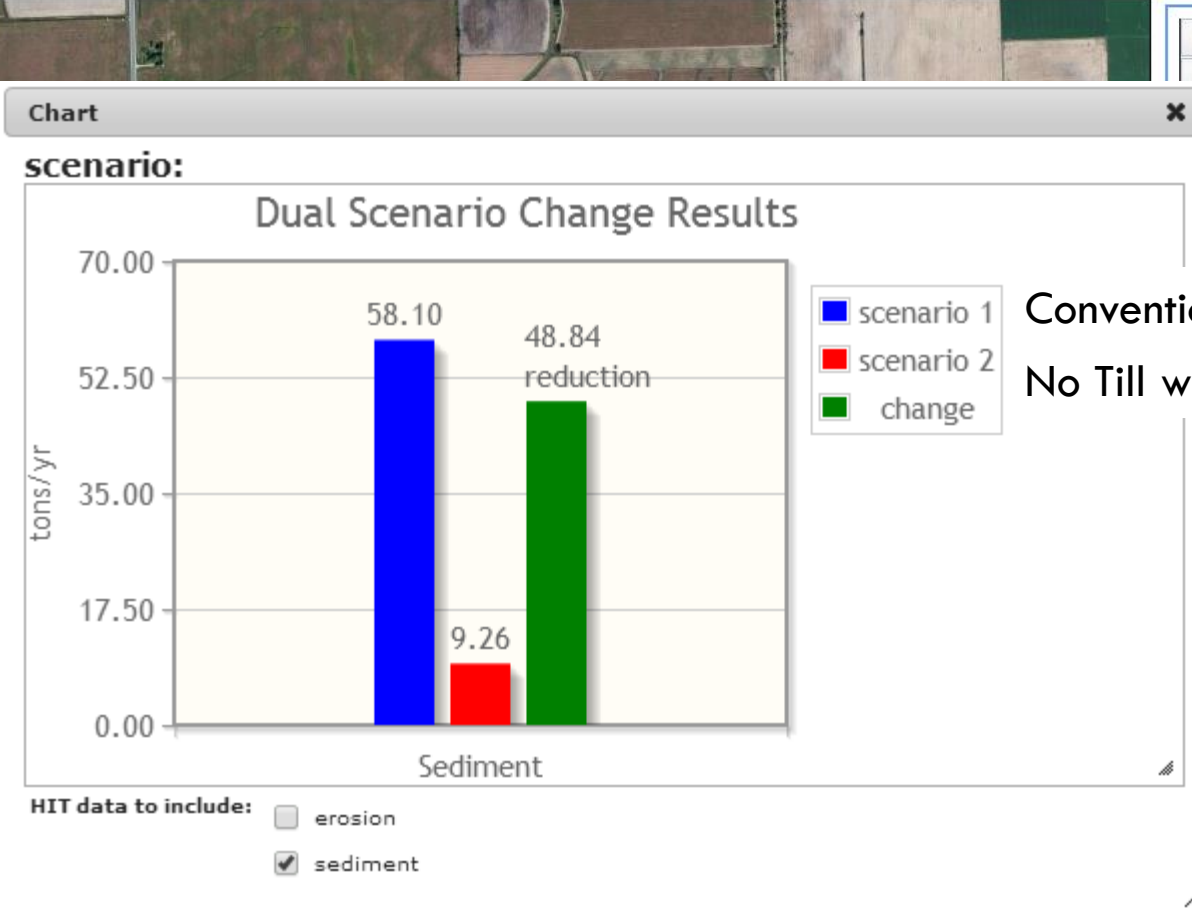
Active Map Tool: **Identify features on-click**

Banner photograph credit: [Lukas L. Jener Medley](#)

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-83.07223112, 43.39814650

Field-Scale Analysis



Introduction

Navigation

Change Compare 2 Scenarios

[HIT uncertainty](#)
[L-THIA uncertainty](#)

Conventional Tillage
No Till with Cover Crop

8e2	274.15
yr	60.86
yr	213.29
sc (r):	58.1
sc (r):	9.26
sc (r):	48.84

as chart

About the Models

About the Tool

Water Resource Study

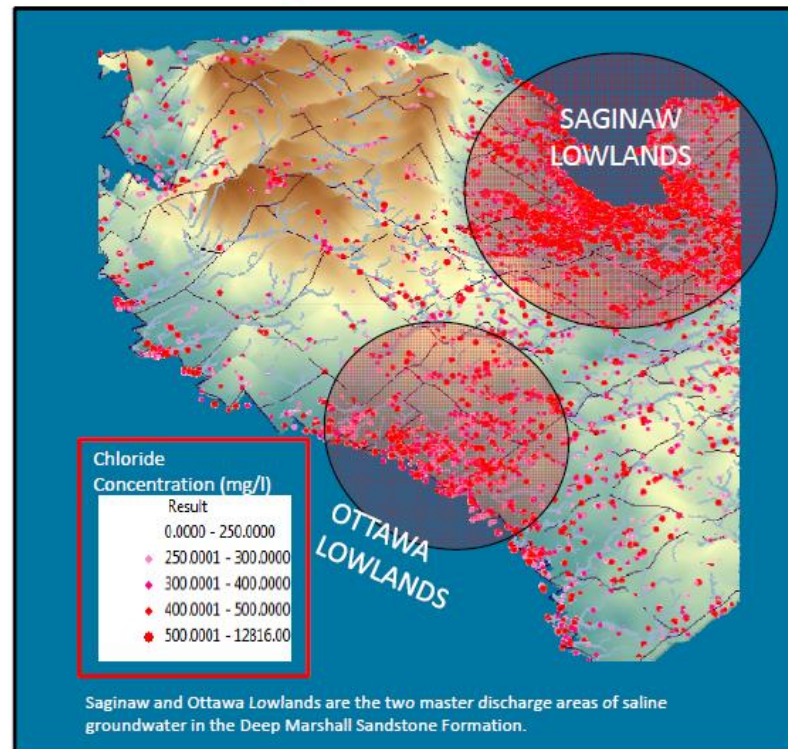
Chloride Contamination in the Saginaw and Ottawa Lowlands

In this slide we visualize Ottawa Lowlands and Saginaw Lowlands in 3D and compare side by side their chloride concentration distribution. The red dots represent wells with chloride concentrations higher than the drinking water standard.

The results clearly show that the two master groundwater discharge areas of deep geological formations stand out in elevated chloride concentrations.

The Saginaw and Ottawa lowlands share the following common characteristics:

- Coastal areas at low elevations in Michigan.
- Master discharge areas of deep geological formations.
- Presence of an extensive surficial clay layer limiting natural recharge to the deep bedrock aquifer.



Water Resource Study

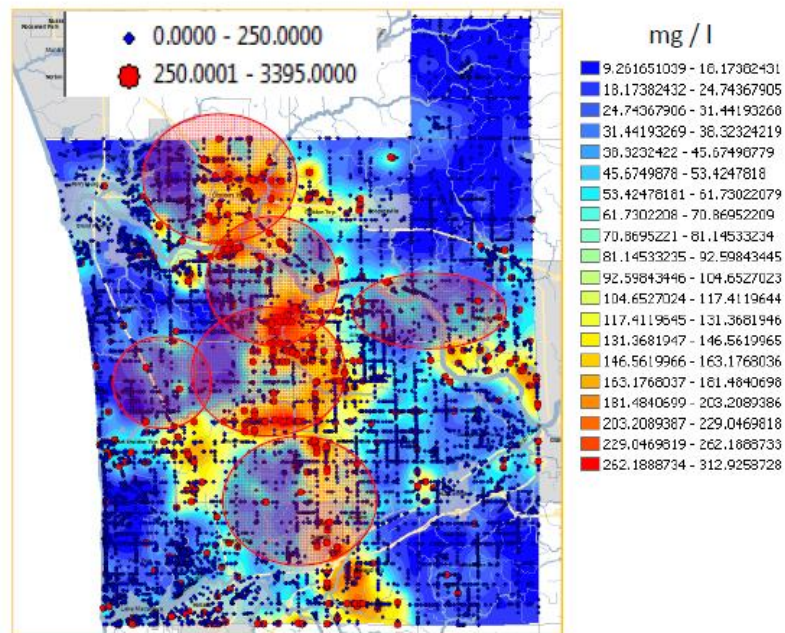
Areas with Significantly Elevated Chloride Concentrations in Groundwater

This slide shows an overlay of scattered chloride concentration values (point symbols) and their moving window average (continuous color backdrop).

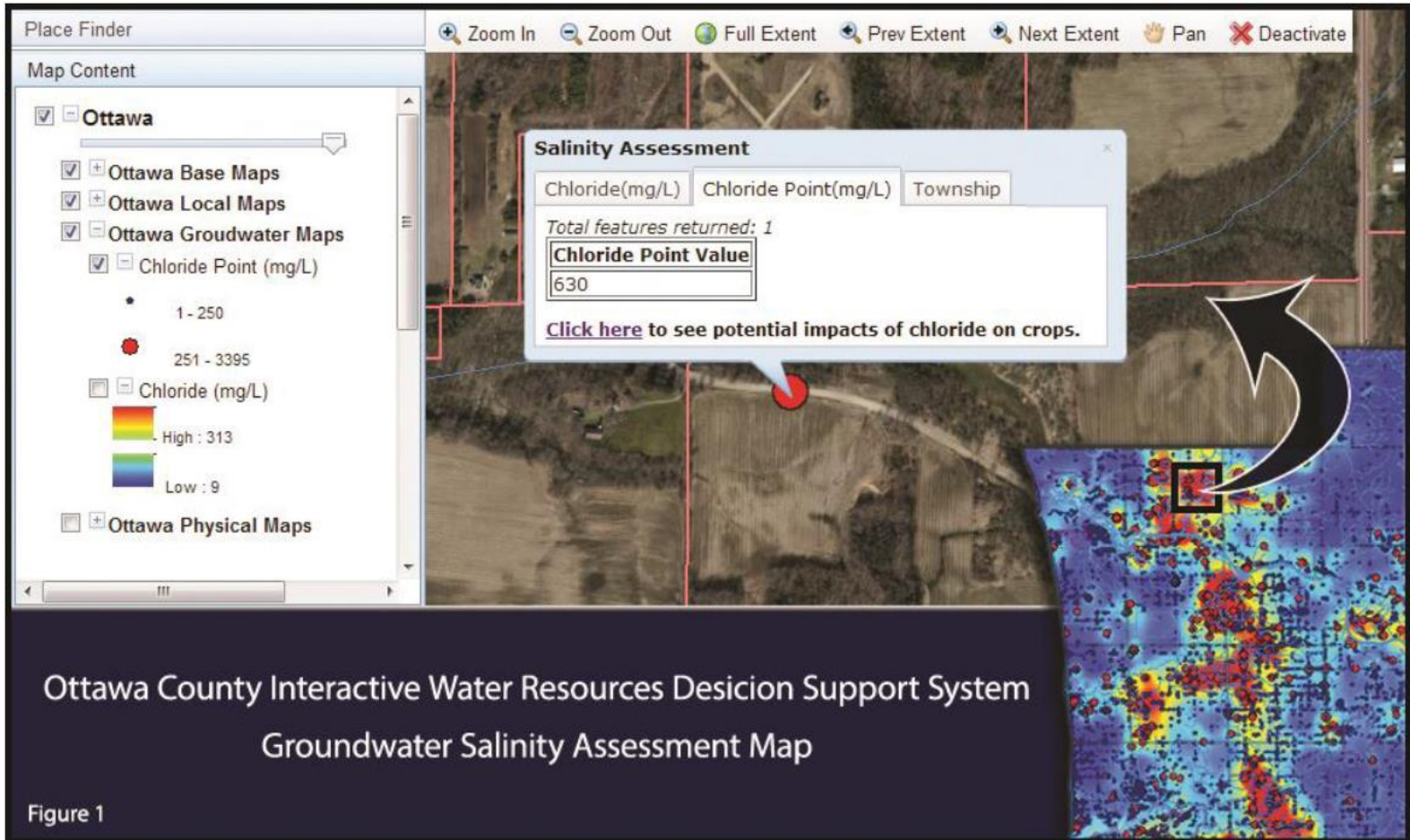
This map is useful in identifying the broad trends and patterns in the spatial distribution of chloride concentrations.

Note the chloride concentrations in the following areas are significantly elevated (>100 mg/L):

1. Crockery Township and Northern End of Robinson Township
2. West Allendale Township and East Robinson Twp.
3. Northern part of Blendon Township
4. Northeastern Corner of Olive Township
5. South of Zeeland, especially near the border with Allegan County
6. South of Tallmadge Township (north side of the Grand River Corridor).



Water Resource Study - eWatershed



New Possibilities

CrowdHydrology



What's the water height today? Text us.

1

Find the ruler!



2



What's the height measurement at water surface?

3

Send to:
608-514-1889

Text "W1009"
and the height
from step 2



What to do:

1. Look around for a ruler mounted in the water.
2. Read the measurement at the water's surface.
3. Text that number and "W1009" to 608-514-1889.

Visit www.crowdhydrology.org to see your measurement. (It will take a few minutes to load your point.)

CrowdHydrology collects water data using social media and citizen science. When you text us today's water height, we use your measurement to create a historical record of this lake or stream. If enough people send data, we can help predict floods and droughts.

State and local agencies can't put scientific monitoring equipment on every water body, but **CrowdHydrology** provides a way for local communities to track any lake or stream that's important to them. Help support **CrowdHydrology** by sending a measurement every time you visit this area.

CrowdHydrology
POWERED BY
social water



Great Lakes Clean Communities Network



Great Lakes
Clean Communities Network

Connect To Protect

Home About ▾ GLCCN Actions ▾ My Profile Contact Log Out

Great Lakes Clean Communities Network

A network for discovering solutions to
protect and restore the Great Lakes



Featured Story

January 23, 2015 By The Rockford Squire This week, Cannon Township enacted three new Ordinance amendments...



Connect

Connect with others in the network



Share

Share ideas, tools, and calculators with peers



Tools

Find innovative tools and calculators



EcoScore

Calculate and Track your EcoScore

MICHIGAN STATE
UNIVERSITY

Great Lakes
Protection Fund

SCHOOL OF INFORMATION
UNIVERSITY OF MICHIGAN

Institute of Water Research
Michigan State University



Sign-up for an invitation at www.iwr.msu.edu/glccn

Holistic Water Management Using Information Technology

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- Sustainable water management is within the best interests of both **water users** and the **public**
- New approaches using information technologies are within our reach. What would a **statewide spatial decision support system** look like?

Connections, Guidance and Inputs



Questions

www.iwr.msu.edu

iwr@msu.edu

