

# The Water Withdrawal Assessment Tool

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# The Water Withdrawal Assessment Process

- Water Withdrawal Assessment Tool - WWAT
  - Develop methods, criteria, and definitions for establishing 'adverse resource impacts' for streams and lakes.
  - Make recommendations on the policy aspects of the model

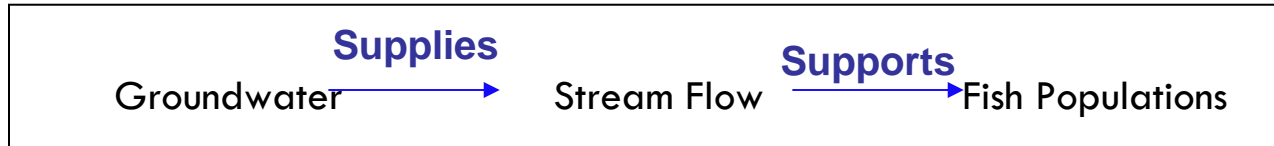
Groundwater → Stream Flow → Fish Populations

**Adverse Resource Impact Means:** Decreasing that part of the flow such that the streams ability to support Characteristic Fish Populations is Functionally Impaired.

# The Philosophy behind the Approach

- Integrated, science-based approach
- National Scientific Peer Review Panel
- Base the approach on Michigan data
  - Science team: USGS, MDEQ, MDNR, UM, MSU
- Process was inclusive
  - Council & guests (across all sectors)
    - Technical and Legal and Mitigation Subcommittees
  - MDA, MDEQ & MDNR on Council

# The Water Withdrawal Assessment Process



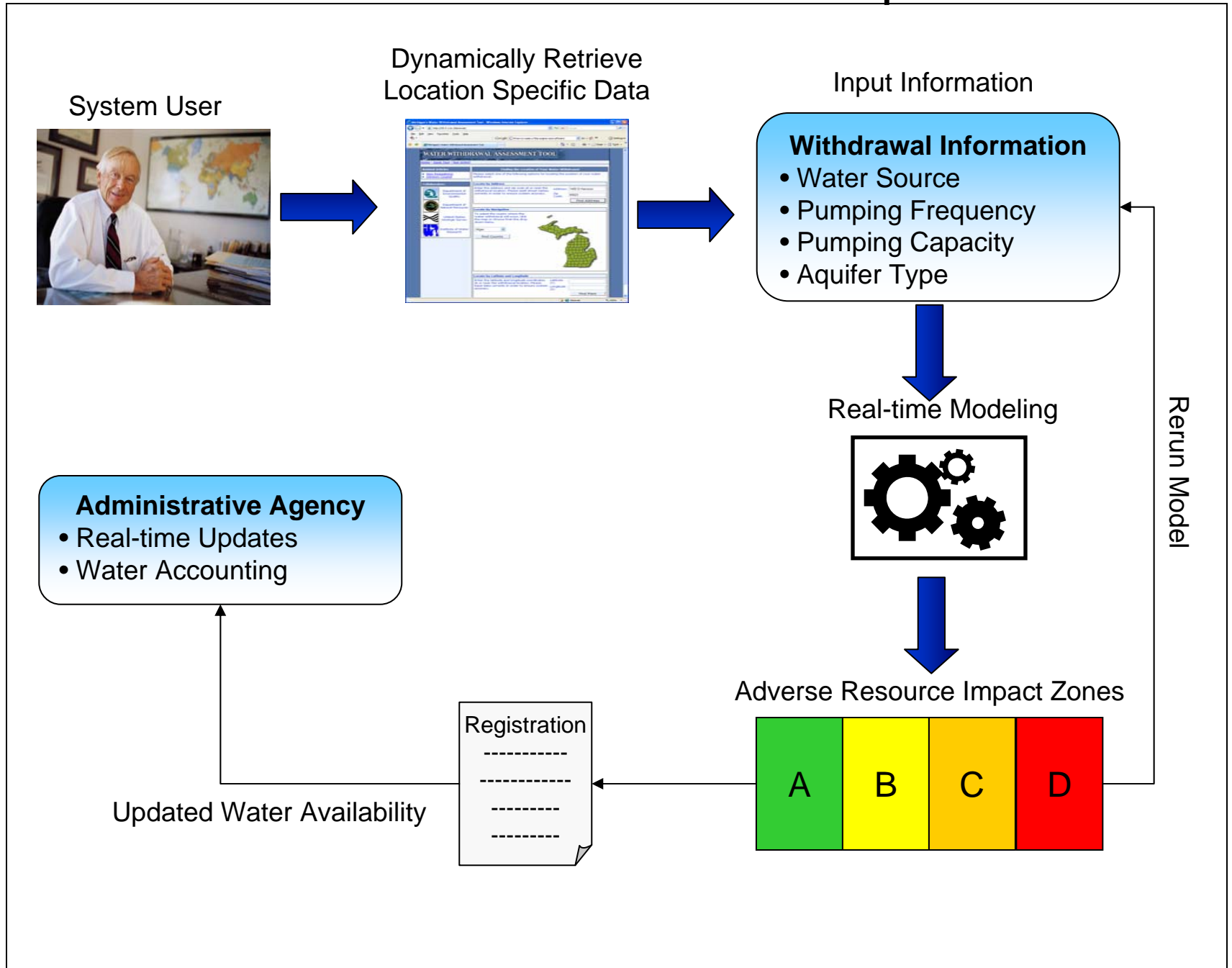
## ➤ Three Models Interact within the impact assessment model

Withdrawal Model - How much water is in the aquifer, is being withdrawn, and from where and how it will affect stream flow

Streamflow Model - How much water is flowing in the stream during summer low flow periods

Fish Impact Model - What fish are in the stream and what is the likely effect of removing water on those groups of fish

# Water Withdrawal Assessment Tool Conceptual Model



# WATER WITHDRAWAL ASSESSMENT TOOL

[Home](#) | [Quick Tour](#) | [Run WWAT](#)

### Related Articles

- [New Regulations](#)

### Collaborators

-  Department of Environmental Quality
-  Department of Natural Resources
-  United States Geologic Survey
-  Institute of Water Research

### WWAT Information


- [Recent Updates](#)

## Finding the Location of Your Water Withdrawal

Please select one of the following options for locating the position of your water withdrawal.

### Locate by

Enter the address of your water withdrawal correctly in the following field.

 **IMPORTANT INFORMATION** ✕

In order to operate the assessment tool properly, you will need to disable your pop up blocker.

[Learn How..](#)

Find Address

### Locate by Navigation

To select your water withdrawal location, click on the map or choose from the drop down menu.

Mackinac

Note: there may be many pop-up blockers active



## Related Articles

- [New Regulations](#)

## Collaborators



Department of Environmental Quality



Department of Natural Resources



United States Geologic Survey



Institute of Water Research

## WWAT Information

- [Recent Updates](#)

# Locate your site

### Locate by Address

Enter the address and zip code at or near the withdrawal location. Please spell street names correctly in order to ensure system accuracy.

Address:

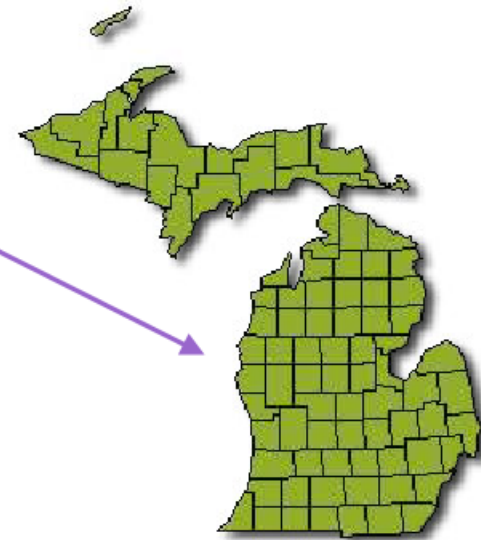
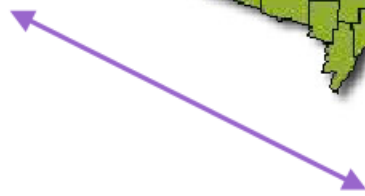
Zip Code:



### Locate by Navigation

To select the county where the water withdrawal will occur, click the map or choose from the drop down menu.

Houghton



### Locate by Latitude and Longitude

Enter the latitude and longitude coordinates at or near the withdrawal location. Please input data correctly in order to ensure system accuracy.

Latitude (Y):

Longitude (X):





# WATER WITHDRAWAL ASSESSMENT TOOL

[Home](#) | [Quick Tour](#) | [Run WWAT](#)

- Related Articles**
- [New Regulations](#)
  - [Advisory Council](#)

**Collaborators**

-  Department of Environmental Quality
-  Department of Natural Resources
-  United States Geologic Survey
-  Institute of Water Research

**Finding the Location of Your Water Withdrawal**

Please select one of the following options for locating the position of your water withdrawal.

**Locate by Address**


Enter the address and zip code at or near the withdrawal location. Please spell street names correctly in order to ensure system accuracy.

Address:

Zip Code:

**Locate by Navigation**

To select the county where the water withdrawal will occur, click the map or choose from the drop down menu.



**Locate by Latitude and Longitude**

Enter the latitude and longitude coordinates at or near the withdrawal location. Please input data correctly in order to ensure system accuracy.

Latitude (Y):

Longitude (X):



# WATER WITHDRAWAL ASSESSMENT TOOL

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## Related Articles

- [New Regulations](#)
- [Advisory Council](#)

## Collaborators



Department of Environmental Quality



Department of Natural Resources



United States Geologic Survey



Institute of Water Research

## Finding the Location of Your Water Withdrawal

Please select one of the following options for locating the position of your water withdrawal.

### Locate by Address

Enter the address and zipcode at or near the withdrawal location. Please spell street names correctly in order to ensure system accuracy.

Address:

Zip Code:

Please select from the following addresses.

[1405 S Harrison Rd 48823](#)

[1405 N Harrison Rd 48823](#)

### Locate by Navigation

To select the county where the water withdrawal will occur, click the map or choose from the drop down menu.

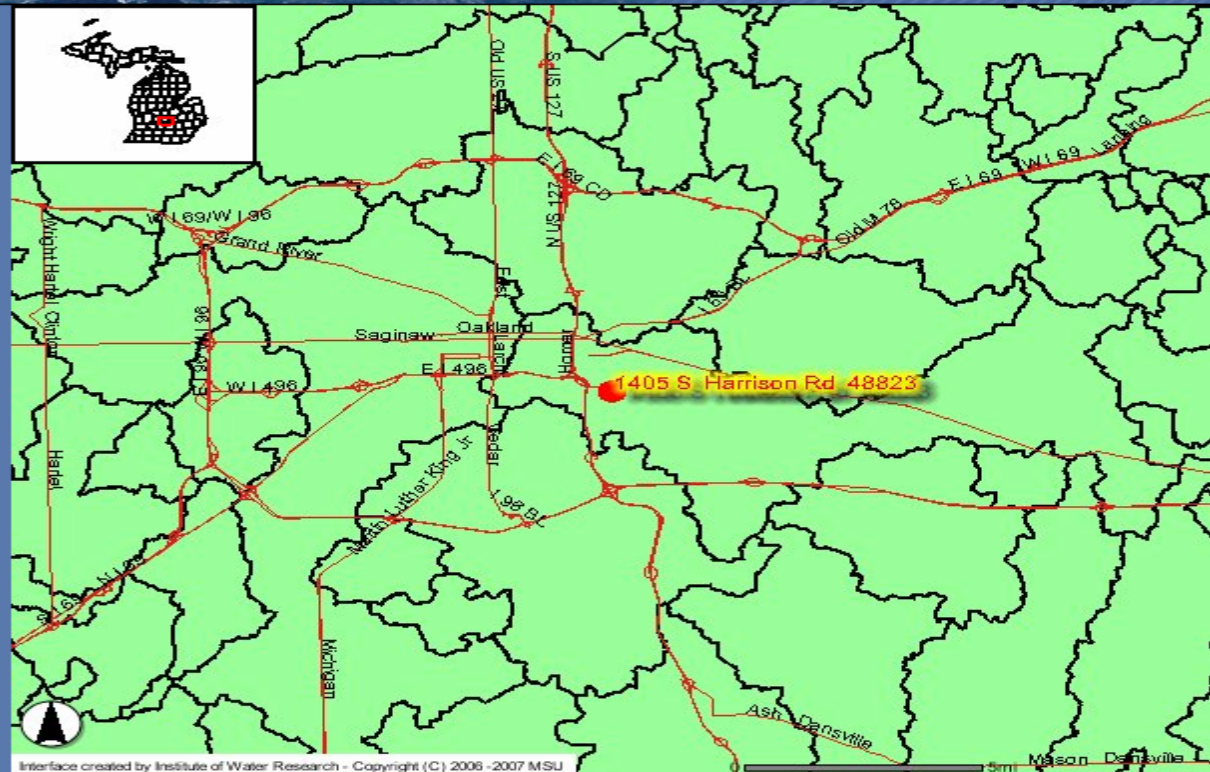
Alcona



# WATER WITHDRAWAL ASSESSMENT TOOL

## GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	



Interface created by Institute of Water Research - Copyright (C) 2006 -2007 MSU

## Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

Refresh Map

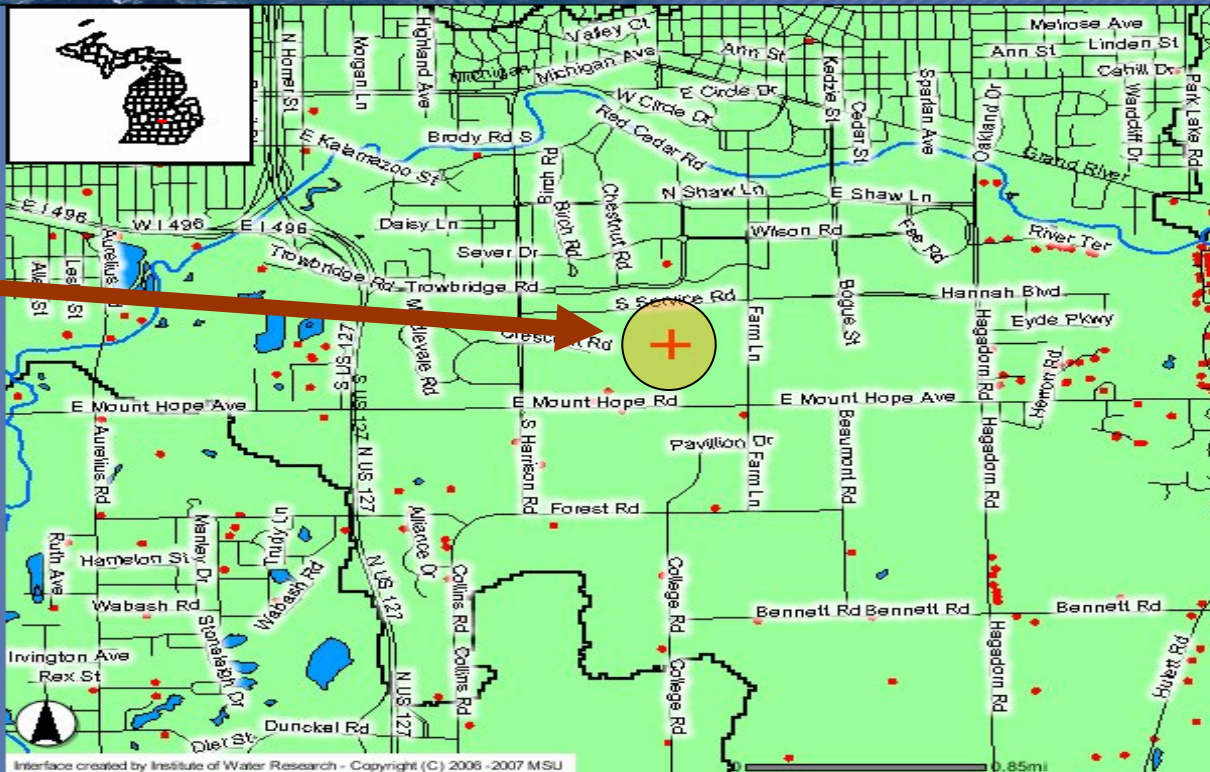
Auto Refresh

Data Layer Help?

# WATER WITHDRAWAL ASSESSMENT TOOL

### GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	



### Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

### Refresh Map

Auto Refresh

Data Layer Help?

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### Watersheds

Hyperlink to <http://35.9.116.206/wwat/getflow.asp?trans=1378&shore=0&bdrkt=1&bdrkt=999999&aline=1130.690&bline=1809.100&dline=2826.710&dphzoned=93&estdphbdrk=79&-84.483425&y=42.716036&mapx=624054.9997418431&mapy=241736.95975327538>

### ENTER WITHDRAWAL CHARACTERISTICS

#### Pumping Source and Frequency

Withdrawal Source:  Surface Water (from stream)  Ground Water  
Pumping Frequency:  Continuous  Intermittent

#### Pumping Parameters

Pumping Capacity (GPM):   
Coordinates (X,Y):   
Well Depth (FT):   
Aquifer Type:  Bedrock  Glacial

#### Current Stats at Location

-Depth to Bedrock (FT): 79  
-Average Well Depth (FT): 93  
-Percent Wells in Glacial: 2  
-Percent Wells in Bedrock: 93

#### Intermittent Pumping Schedule

Pumping Hours/Day:  Pumping Days/Week:   
Months Pumping: 

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug

(hold Ctrl to select multiple months)

Send to Model

# Water Withdrawal Screening Results

**WARNING:** For demonstration purpose only..

## Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI).

The proposed withdrawal has passed in Zone A.

## Screening Results - PASSED

### Instructions:

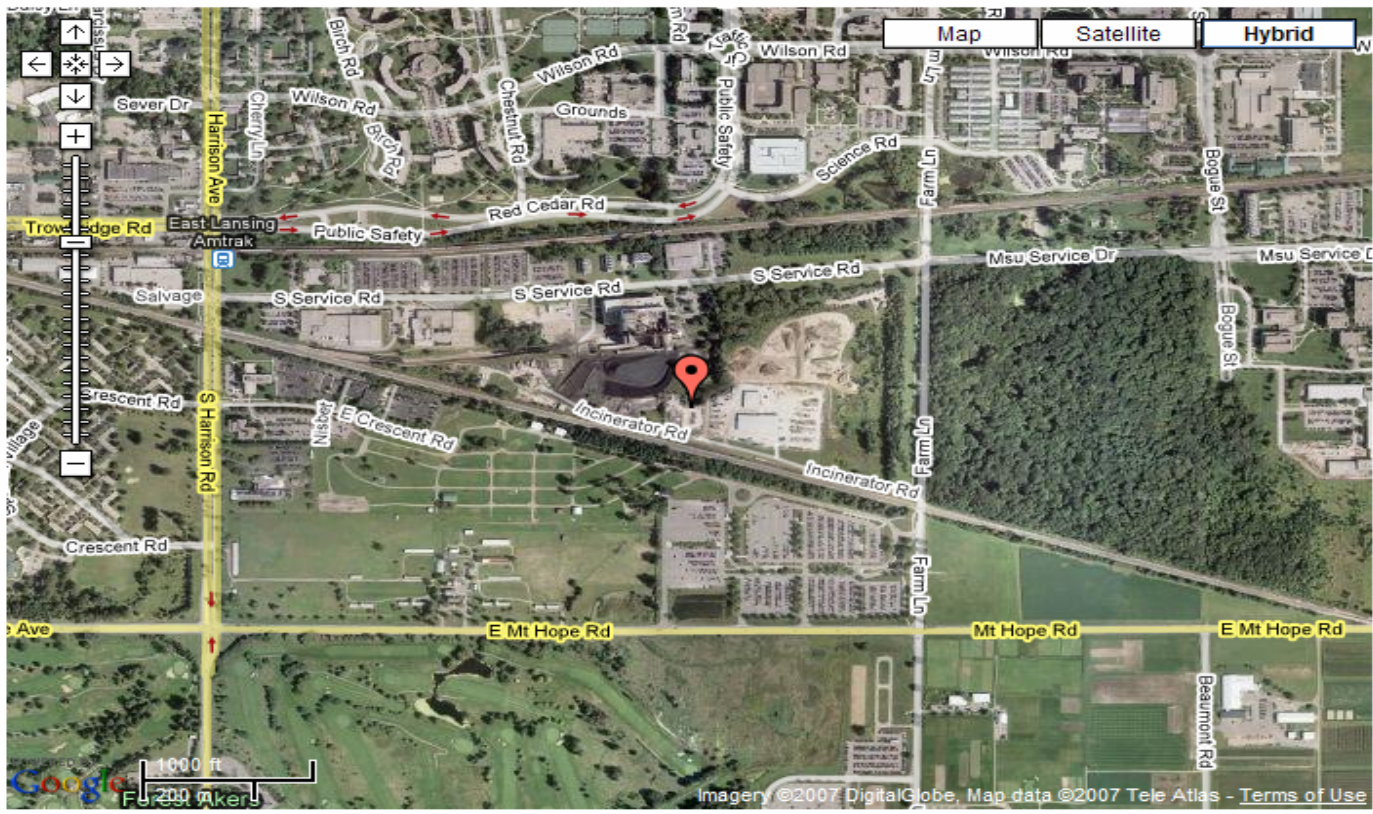
The proposed withdrawal has passed the screening process.

This withdrawal lies within 'Zone A' and is unlikely to have an adverse resource impact. Water withdrawals with a capacity of over 70 gpm are required to register with the Michigan Department of Environmental Quality before beginning the withdrawal, and report the actual water use every year. If you would like to register now press continue.

### Actions:

- [Help](#)
- [Rerun](#)
- [Register Now](#)
- [Feedback](#)
- [View Google Map](#)
- [Print Report](#)
- [Exit](#)

# WATER WITHDRAWAL ASSESSMENT TOOL



## Related Articles

- [New Regulations](#)

## Collaborators



Department of Environmental Quality



Department of Natural Resources



United States Geologic Survey



Institute of Water Research

## WWAT Information

- [Recent Updates](#)

# Locate your site

### Locate by Address

Enter the address and zip code at or near the withdrawal location. Please spell street names correctly in order to ensure system accuracy.

Address:

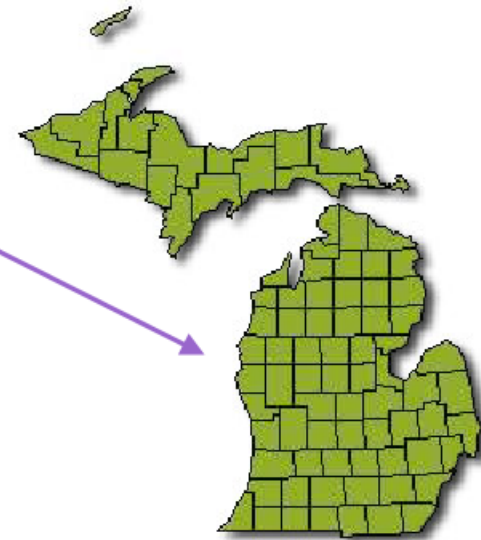
Zip Code:



### Locate by Navigation

To select the county where the water withdrawal will occur, click the map or down menu **Select County**

Houghton



### Locate by Latitude and Longitude

Enter the latitude and longitude coordinates at or near the withdrawal location. Please input data correctly in order to ensure system accuracy.

Latitude (Y):

Longitude (X):



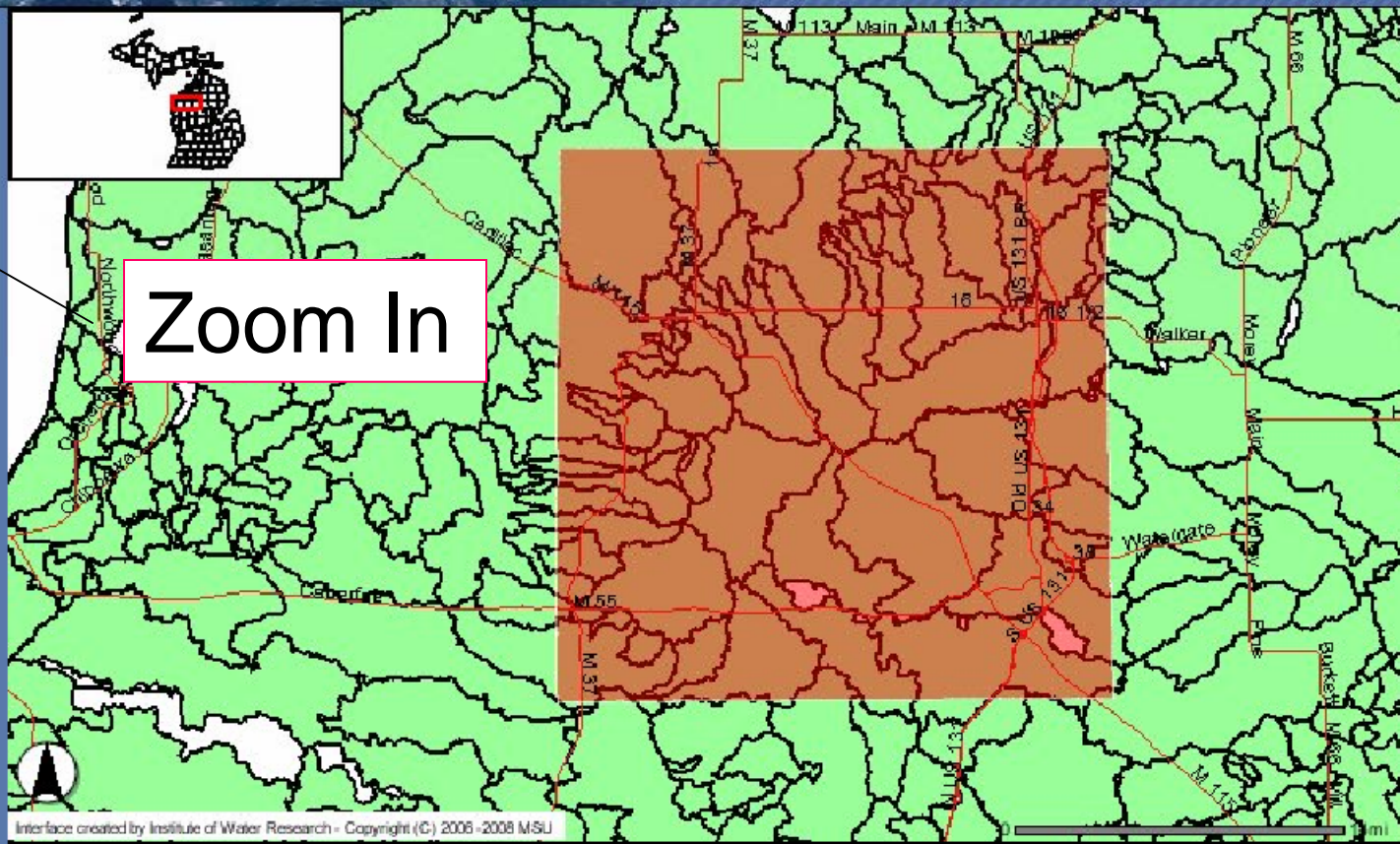
# WATER WITHDRAWAL ASSESSMENT TOOL

### GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	



Zoom In



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### Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

Refresh Map

Auto Refresh

Data Layer Help?



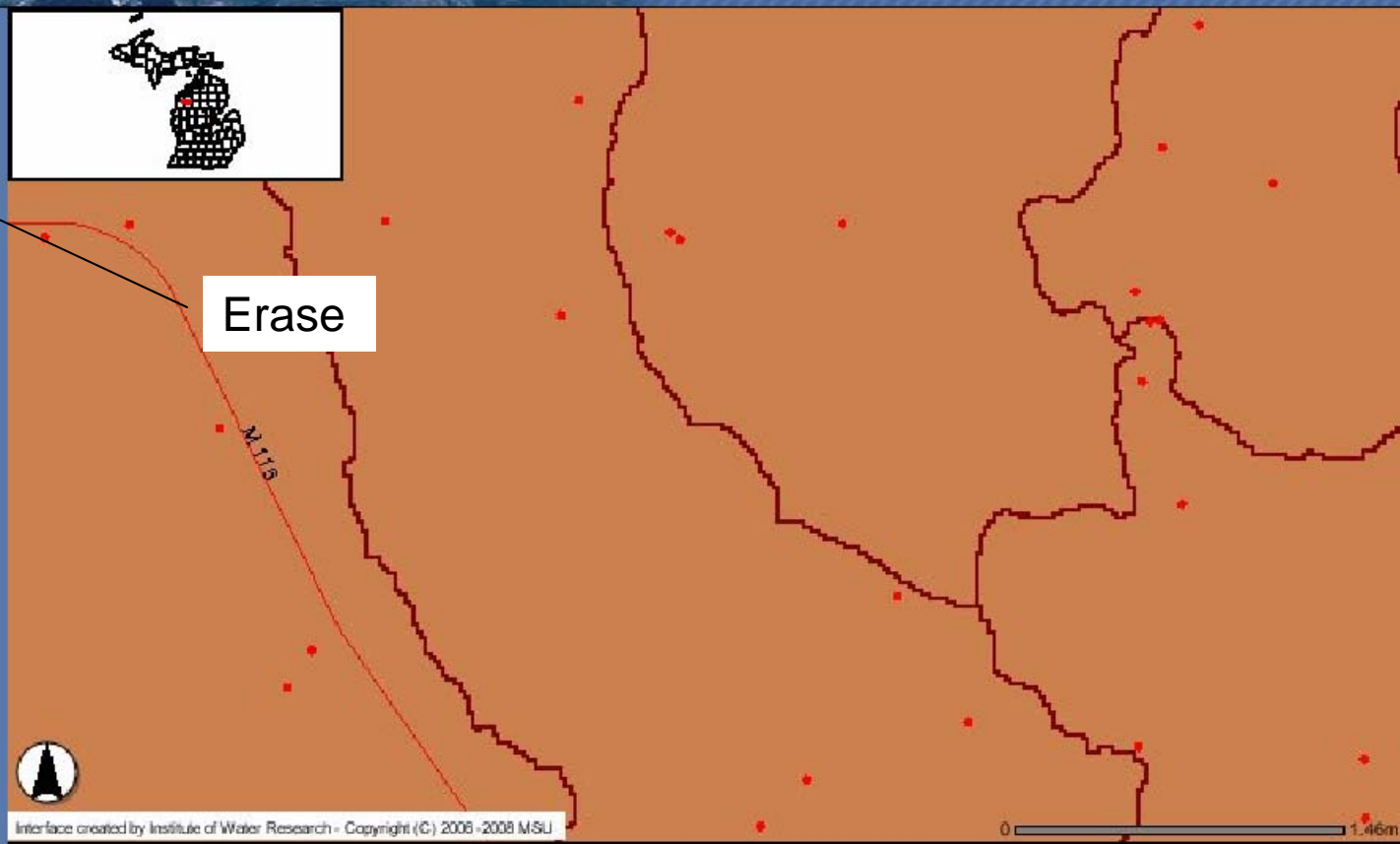
# WATER WITHDRAWAL ASSESSMENT TOOL

## GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	



Erase



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0 1.46m

## Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

Refresh Map

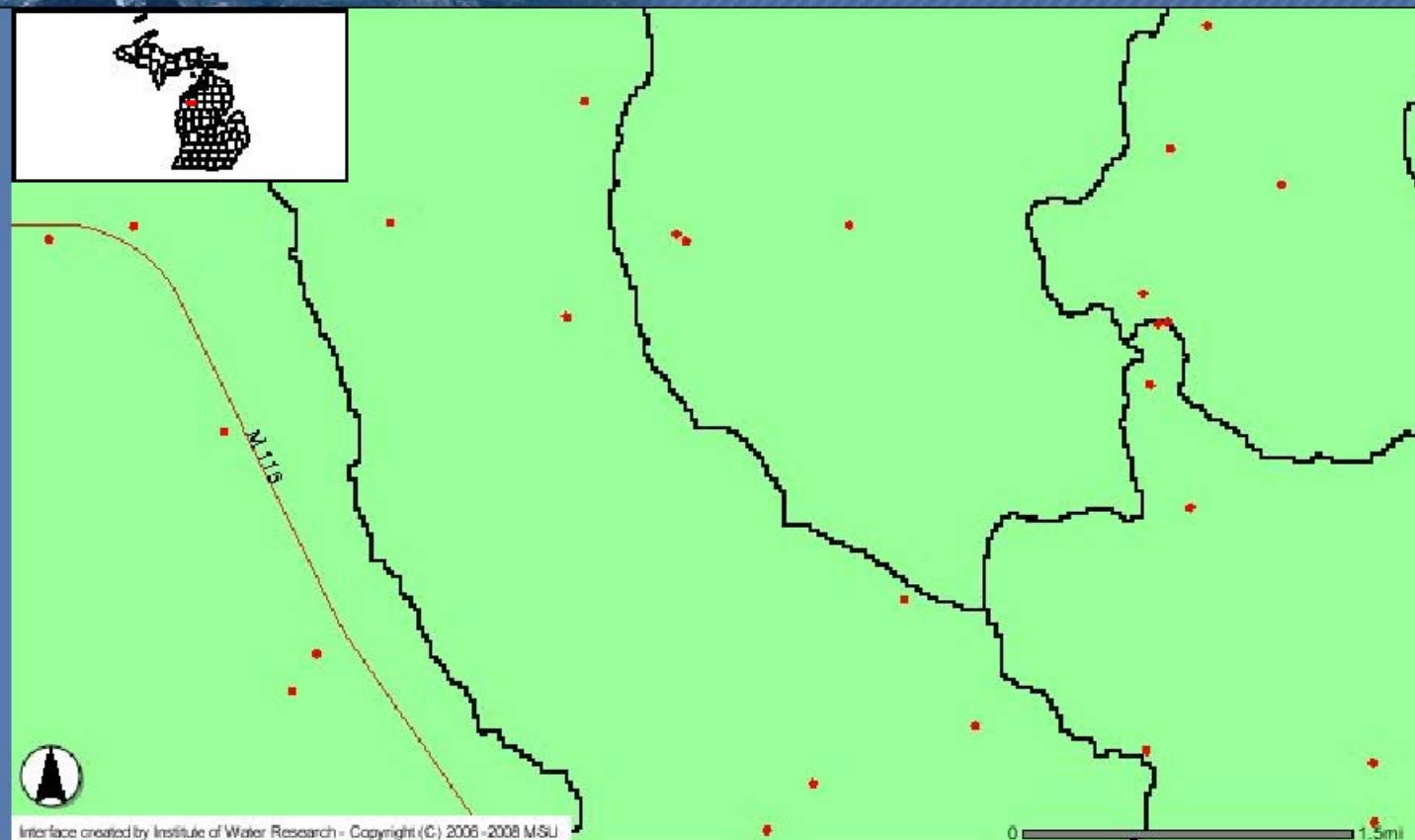
Auto Refresh

Data Layer Help?

# WATER WITHDRAWAL ASSESSMENT TOOL

## GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	



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## Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

**Refresh Map**

Auto Refresh

Data Layer Help?

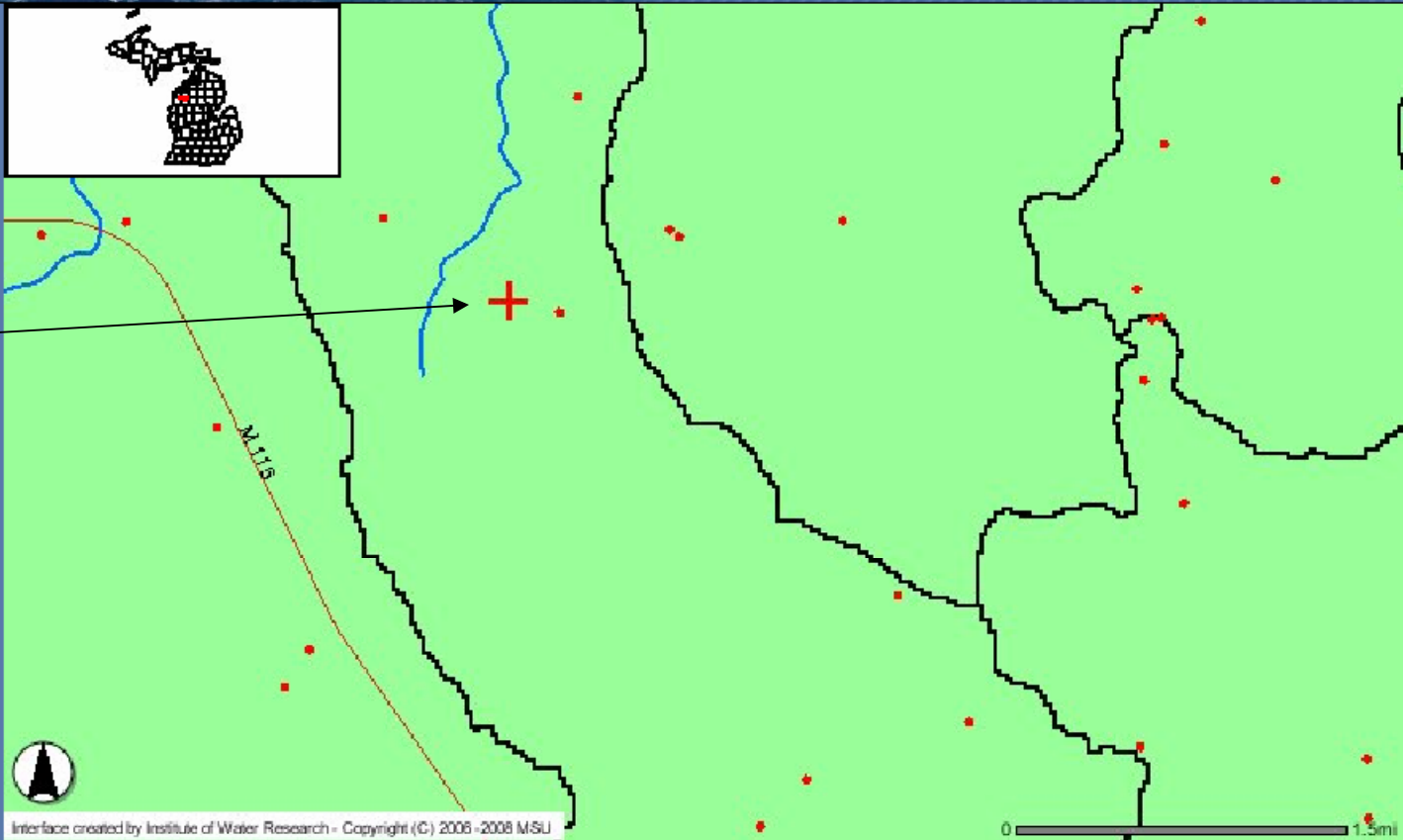
### County

Selection cleared.

# WATER WITHDRAWAL ASSESSMENT TOOL

## GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview map	Print
<b>New Withdrawal</b>	



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## Watersheds

Hyperlink to <http://35.9.116.206/wwat/getflow.asp?trans=6549&shore=0&bdrkf=-1&bdrkt=999999&aline=294.219&bline=294.429&cline=525.390&dphzoned=155&estdphbdrk=646&pctdrift=94&pctrock=0&kw=154.044&x=-85.595885&y=44.375951&mapx=532035.853531105&mapy=425015.04495285474>

## Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

Refresh Map

Auto Refresh

Data Layer Help?

# WATER WITHDRAWAL ASSESSMENT TOOL

## GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	

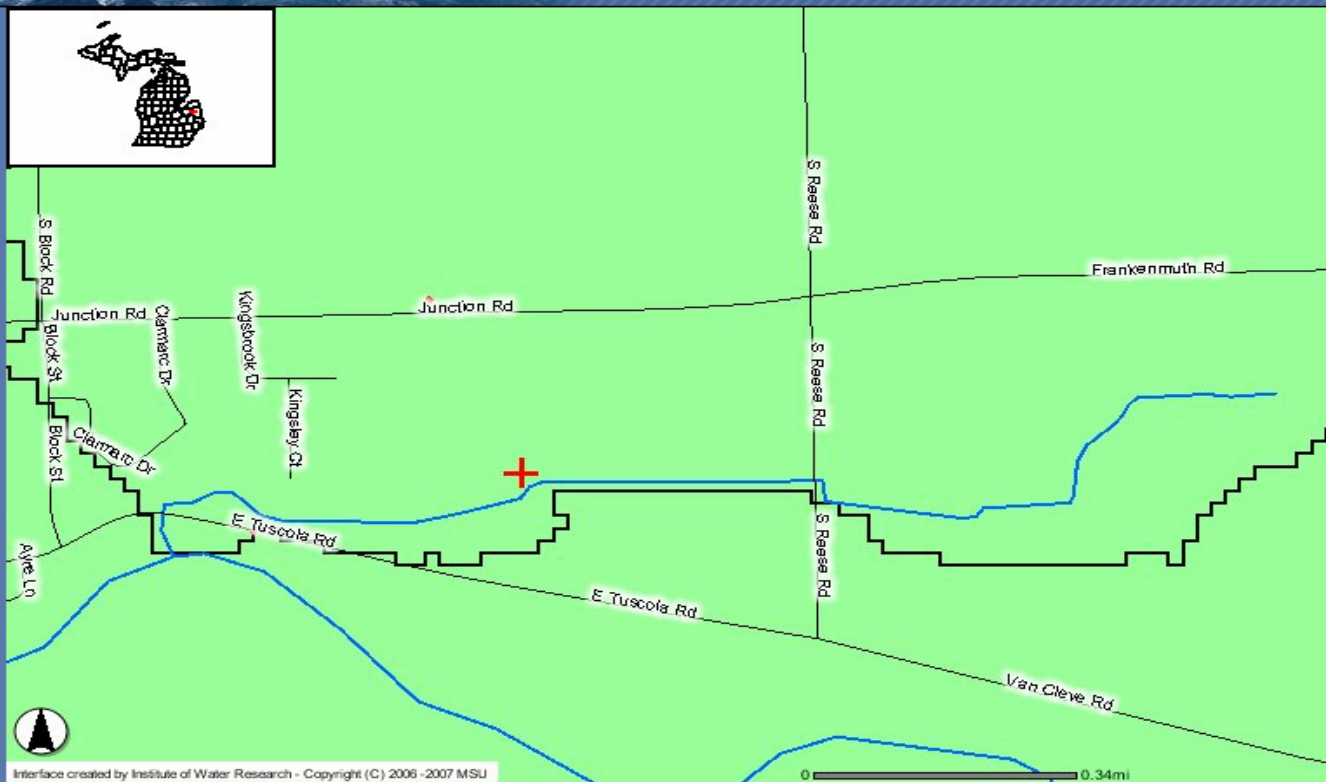
## Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

Refresh Map

Auto Refresh

Data Layer Help?



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## Watersheds

Hyperlink to <http://35.9.116.206/wwat/getflow.asp?trans=0&shore=0&bdrkf=-1&bdrkt=99999&aline=1.186&bline=2.727&cline=4.031&dphzoned=88&estdphbdrk=92&pctdrift=0&pctrock=100&kw=0.100&x=-83.705917&y=43.332214&mapx=885813.4368945792&mapy=311604.34534970834>

### ENTER WITHDRAWAL INFORMATION

#### Pumping Source and Frequency

Withdrawal Source:  Surface Water (from stream)  Ground Water  
Pumping Frequency:  Continuous  Intermittent

#### Pumping Parameters

Pumping Capacity (GPM):   
Coordinates (X,Y):    
Well Depth (FT):   
Aquifer Type:  Bedrock  Glacial

#### Current Stats at Location

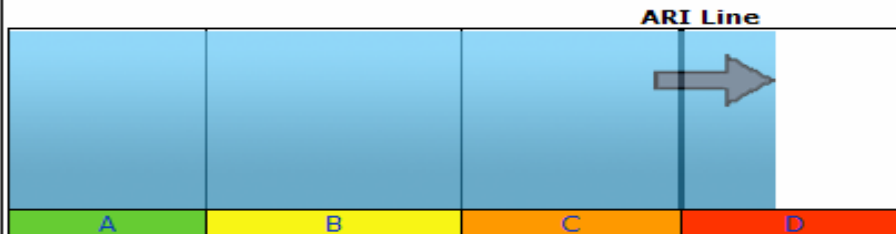
-Depth to Bedrock (FT): 291  
-Average Well Depth (FT): 137  
-Percent Wells in Glacial: 88  
-Percent Wells in Bedrock: 7

**send to model**

# Water Withdrawal Screening Results

**WARNING:** For demonstration purpose only..

## Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI). Estimated 51 GPM

The proposed withdrawal has failed in Zone D, and is likely to have an adverse resource impact.

## Screening Results - FAILED

### Instructions:

The proposed withdrawal lies within 'Zone D' and is likely to cause an adverse resource impact. By reducing the flow taken from a nearby stream, you may be able to avoid these impacts and pass the screening process. Here are several examples of what you could do to help avoid adverse resource impacts:

- Increase Distance From Nearby Streams
- Increase Well Depth
- Reduce Pumping Rate

To modify withdrawal characteristics and rerun the screen press 'Rerun'.

This proposed withdrawal cannot proceed unless approved by the Michigan Department of Environmental Quality through a site specific evaluation. A site specific analysis improves the estimate of how much water is available in a stream and may demonstrate additional water is available at this location. Please contact the Michigan Department of Environmental Quality for more information.

### Actions:

- Help
- Rerun
- Register Now
- Feedback
- View Google Map
- Print Report
- Exit



### ENTER WITHDRAWAL INFORMATION

#### Pumping Source and Frequency

Withdrawal Source:  Surface Water (from stream)  Ground Water  
Pumping Frequency:  Continuous  Intermittent

#### Pumping Parameters

Pumping Capacity (GPM):   
Coordinates (X,Y):  ,   
Well Depth (FT):   
Aquifer Type:  Bedrock  Glacial

#### Current Stats at Location

-Depth to Bedrock (FT): 291  
-Average Well Depth (FT): 137  
-Percent Wells in Glacial: 88  
-Percent Wells in Bedrock: 7

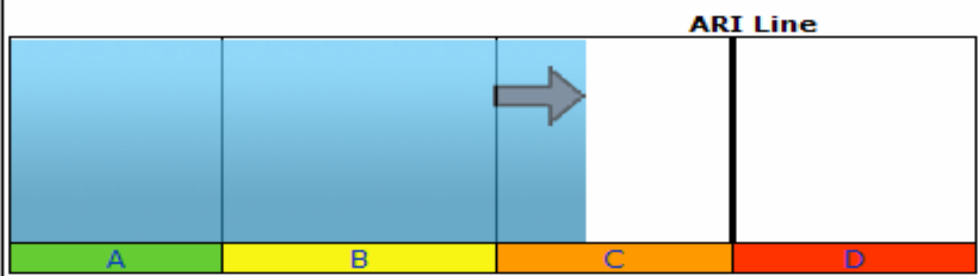
**send to model**

Reduce Pumping Rate from 100 GPM to 70 GPM

# Water Withdrawal Screening Results

**WARNING:** For demonstration purpose only..

## Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI). Estimated 36 GPM

The proposed withdrawal is in Zone C and is approaching the ARI line.

## Screening Results - PASSED

### Instructions:

The proposed withdrawal lies within 'Zone C' and is approaching the Adverse Resource Impact line. Please be aware that as proposed withdrawals approach this line, there is an increased likelihood of an adverse resource impact as new water uses begin in the watershed.

Water withdrawals with a capacity of over 70 gpm are required to register with the Michigan Department of Environmental Quality before beginning the withdrawal, and report the actual water use every year.

Additional considerations may apply to a withdrawal in Zone C. Actions necessary to begin a withdrawal in Zone C will be determined after final legislative action.

### Actions:

- [Help](#)
- [Rerun](#)
- [Register Now](#)
- [Feedback](#)
- [View Google Map](#)
- [Print Report](#)
- [Exit](#)

**DISCLAIMER:**



# WATER WITHDRAWAL ASSESSMENT TOOL

### GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
New Withdrawal	

### Data Layers

- All Layers
- Roads
- State Roads
- Existing Wells
- Streams
- Lakes
- Watersheds
- Reach Watershed
- County

Refresh Map

Auto Refresh

Data Layer Help?



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**Watersheds**

Hyperlink to <http://35.9.116.206/wwat/getflow.asp?trans=0&shore=0&bdrkf=-1&bdrkt=99999&aline=1.186&bline=2.727&cline=4.031&dphzoned=88&estdphbdrk=92&pctdrift=0&pctrock=100&kw=0.100&x=-83.705917&y=43.332214&mapx=885813.4368945792&mapy=311604.34534970834>

### ENTER WITHDRAWAL INFORMATION

#### Pumping Source and Frequency

Withdrawal Source:  Surface Water (from stream)  Ground Water  
Pumping Frequency:  Continuous  Intermittent

#### Pumping Parameters

Pumping Capacity (GPM):   
Coordinates (X,Y): ,   
Well Depth (FT):   
Aquifer Type:  Bedrock  Glacial

#### Current Stats at Location

-Depth to Bedrock (FT): 291  
-Average Well Depth (FT): 137  
-Percent Wells in Glacial: 88  
-Percent Wells in Bedrock: 7

**send to model**

Keep Original Pumping Rate..

# Water Withdrawal Screening Results

**WARNING:** For demonstration purpose only..

## Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI). Estimated 10 GPM

The proposed withdrawal has passed in Zone A.

## Screening Results - PASSED

### Instructions:

The proposed withdrawal has passed the screening process.

This withdrawal lies within 'Zone A' and is unlikely to have an adverse resource impact. Water withdrawals with a capacity of over 70 gpm are required to register with the Michigan Department of Environmental Quality before beginning the withdrawal, and report the actual water use every year.

### Actions:

- [Help](#)
- [Rerun](#)
- [Register Now](#)
- [Feedback](#)
- [View Google Map](#)
- [Print Report](#)
- [Exit](#)

**DISCLAIMER:**

### ENTER WITHDRAWAL INFORMATION

#### Pumping Source and Frequency

Withdrawal Source:  Surface Water (from stream)  Ground Water  
Pumping Frequency:  Continuous  Intermittent

#### Pumping Parameters

Pumping Capacity (GPM):   
Coordinates (X,Y):    
Well Depth (FT):   
Aquifer Type:  Bedrock  Glacial

#### Current Stats at Location

-Depth to Bedrock (FT): 291  
-Average Well Depth (FT): 137  
-Percent Wells in Glacial: 88  
-Percent Wells in Bedrock: 7

#### Intermittent Pumping Schedule

Pumping Hours/Day:  Pumping Days/Week:   
Months Pumping: 

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug

(hold Ctrl to select multiple months)

**send to model**

Change to Intermittent Pumping Schedule..

# Water Withdrawal Screening Results

**WARNING:** For demonstration purpose only..

## Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI). Estimated 12 GPM

The proposed withdrawal has passed in Zone A.

## Screening Results - PASSED

### Instructions:

The proposed withdrawal has passed the screening process.

This withdrawal lies within 'Zone A' and is unlikely to have an adverse resource impact. Water withdrawals with a capacity of over 70 gpm are required to register with the Michigan Department of Environmental Quality before beginning the withdrawal, and report the actual water use every year.

### Actions:

- [Help](#)
- [Rerun](#)
- [Register Now](#)
- [Feedback](#)
- [View Google Map](#)
- [Print Report](#)
- [Exit](#)

**DISCLAIMER:**

### ENTER WITHDRAWAL INFORMATION

#### Pumping Source and Frequency

Withdrawal Source:  Surface Water (from stream)  Ground Water  
Pumping Frequency:  Continuous  Intermittent

#### Pumping Parameters

Pumping Capacity (GPM):   
Coordinates (X,Y):  ,   
Well Depth (FT):   
Aquifer Type:  Bedrock  Glacial

#### Current Stats at Location

-Depth to Bedrock (FT): 291  
-Average Well Depth (FT): 137  
-Percent Wells in Glacial: 88  
-Percent Wells in Bedrock: 7

**send to model**

Increase the depth of the well from 137 ft to 300 ft, and move from glacial aquifer to bedrock aquifer..

# Water Withdrawal Screening Results

**WARNING:** For demonstration purpose only..

## Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI). Estimated 100 GPM

The proposed withdrawal has passed in Zone A.

## Screening Results - PASSED

### Instructions:

The proposed withdrawal has passed the screening process.

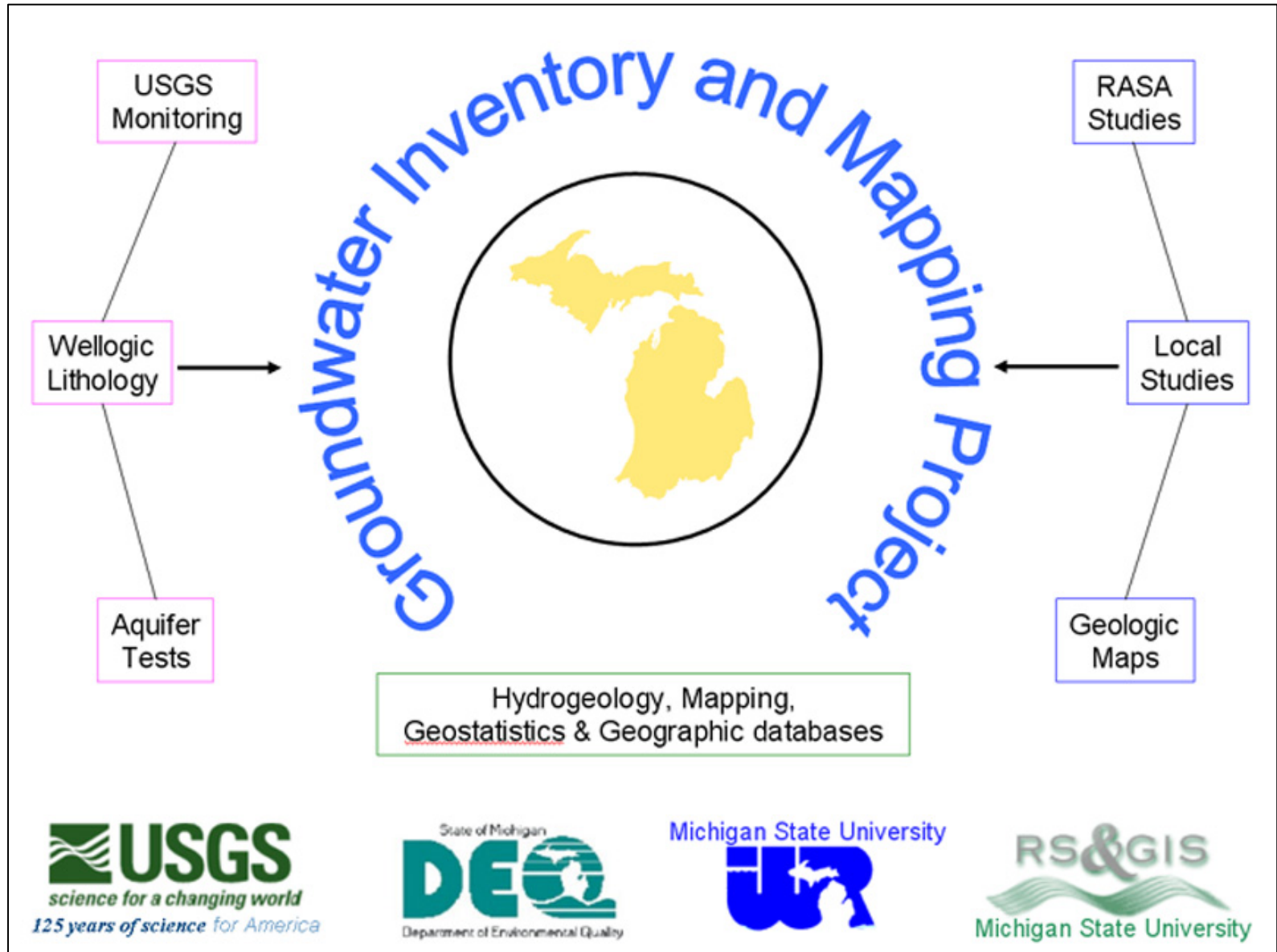
This withdrawal lies within 'Zone A' and is unlikely to have an adverse resource impact. Water withdrawals with a capacity of over 70 gpm are required to register with the Michigan Department of Environmental Quality before beginning the withdrawal, and report the actual water use every year. If you would like to register now press continue.

### Actions:

- [Help](#)
- [Rerun](#)
- [Register Now](#)
- [Feedback](#)
- [View Google Map](#)
- [Print Report](#)
- [Exit](#)

**DISCLAIMER:**

# Public Act 148: Groundwater Inventory and Map Project

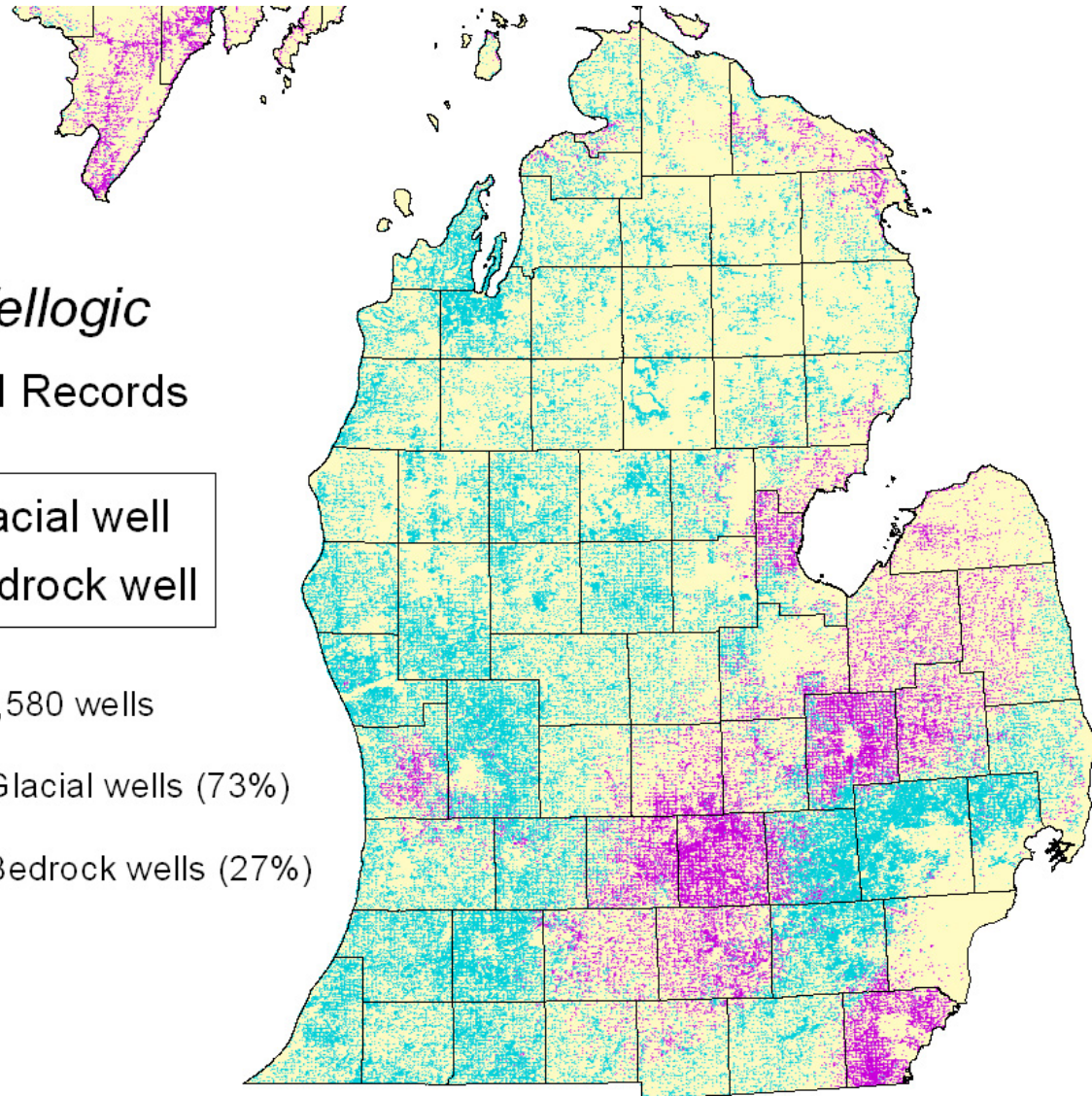




# Aquifers

- Any geologic material that stores and transmits groundwater.
- In Michigan, there are two types:
  - **Bedrock** Aquifers
  - **Glacial** Aquifers

# Aquifers



*Welllogic*

Well Records

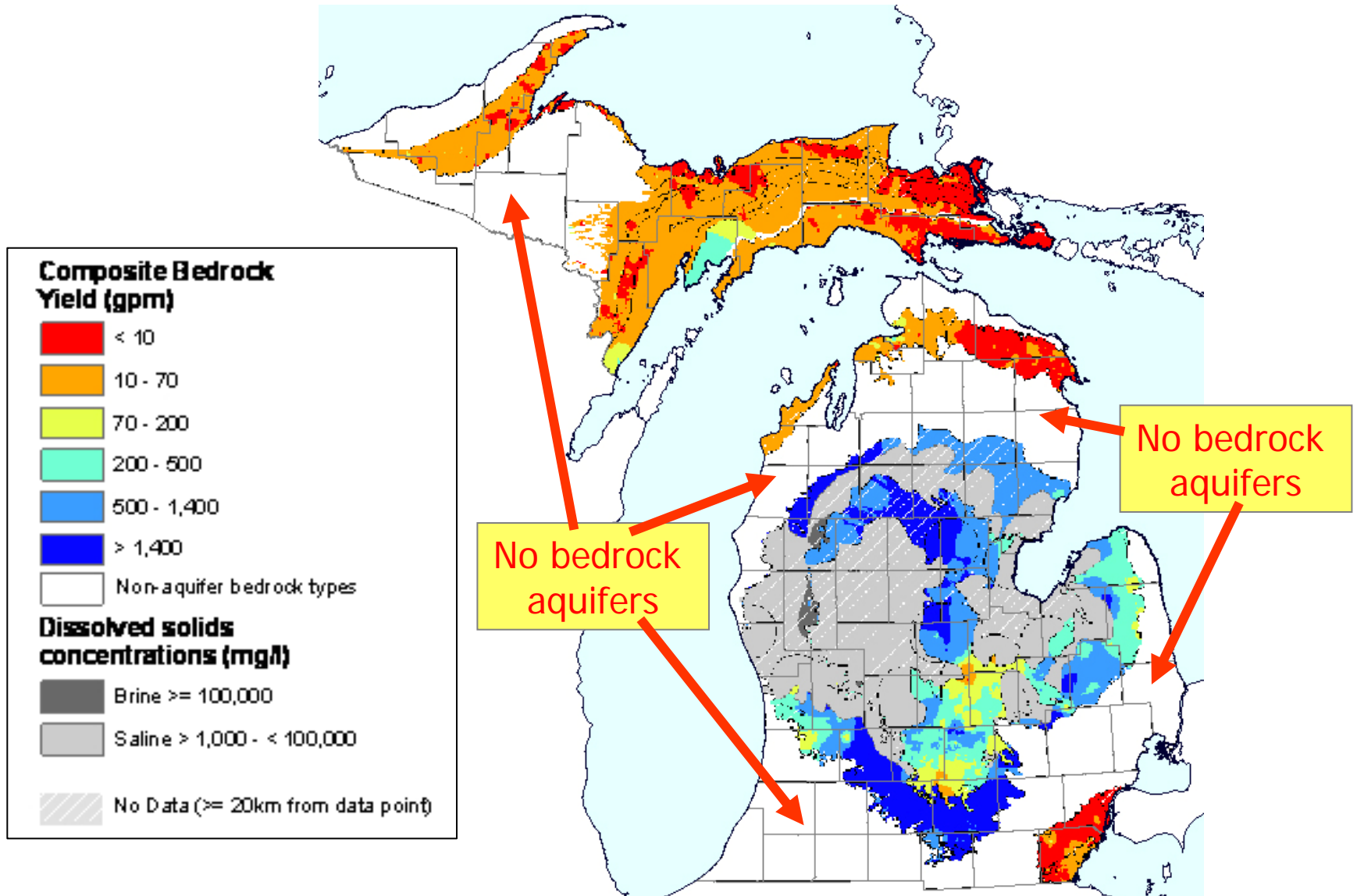
- Glacial well
- Bedrock well

312,580 wells

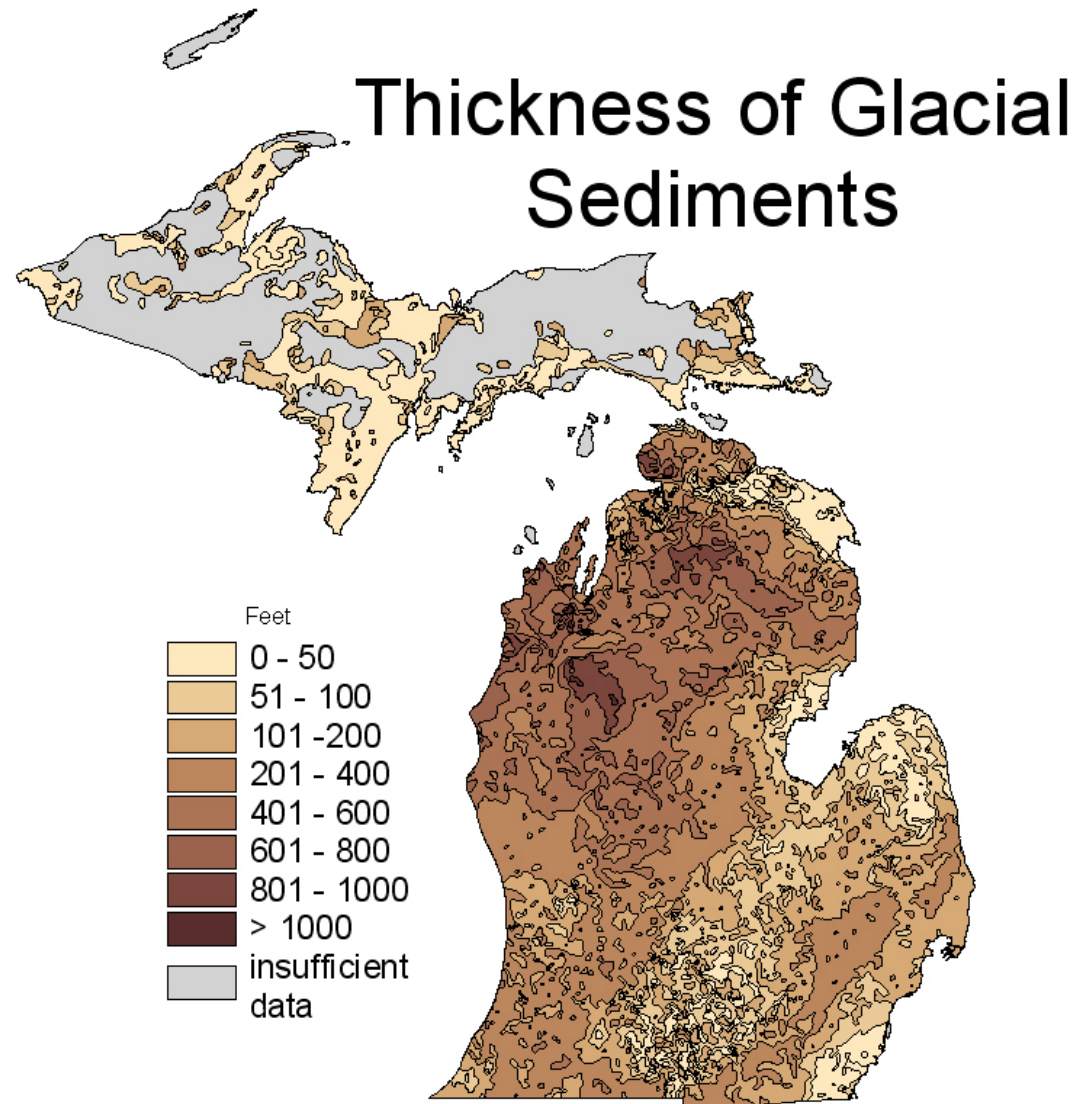
229,256 Glacial wells (73%)

83,324 Bedrock wells (27%)

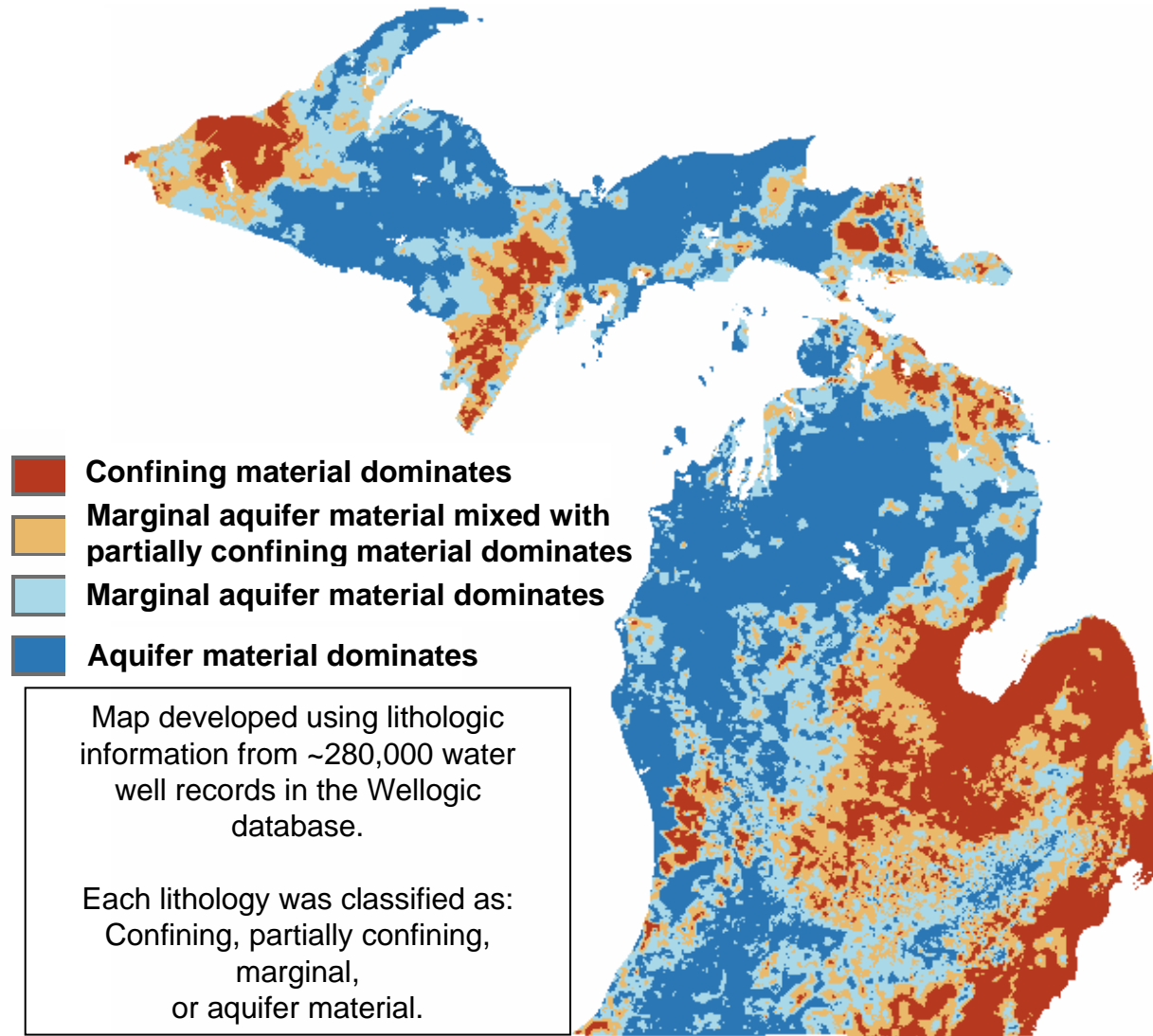
# Yield from Bedrock Aquifers



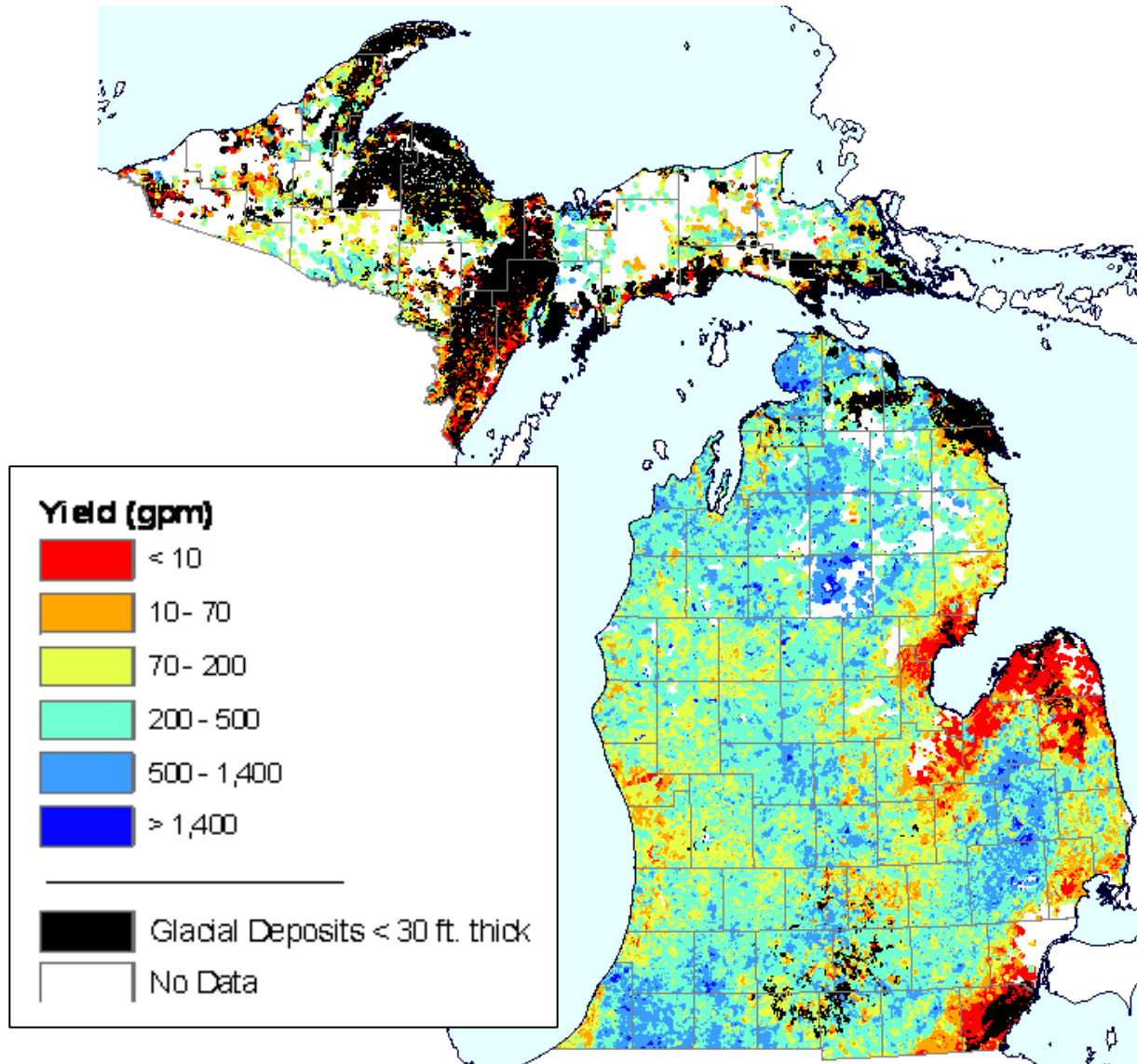
# Depth to Bedrock Constraint



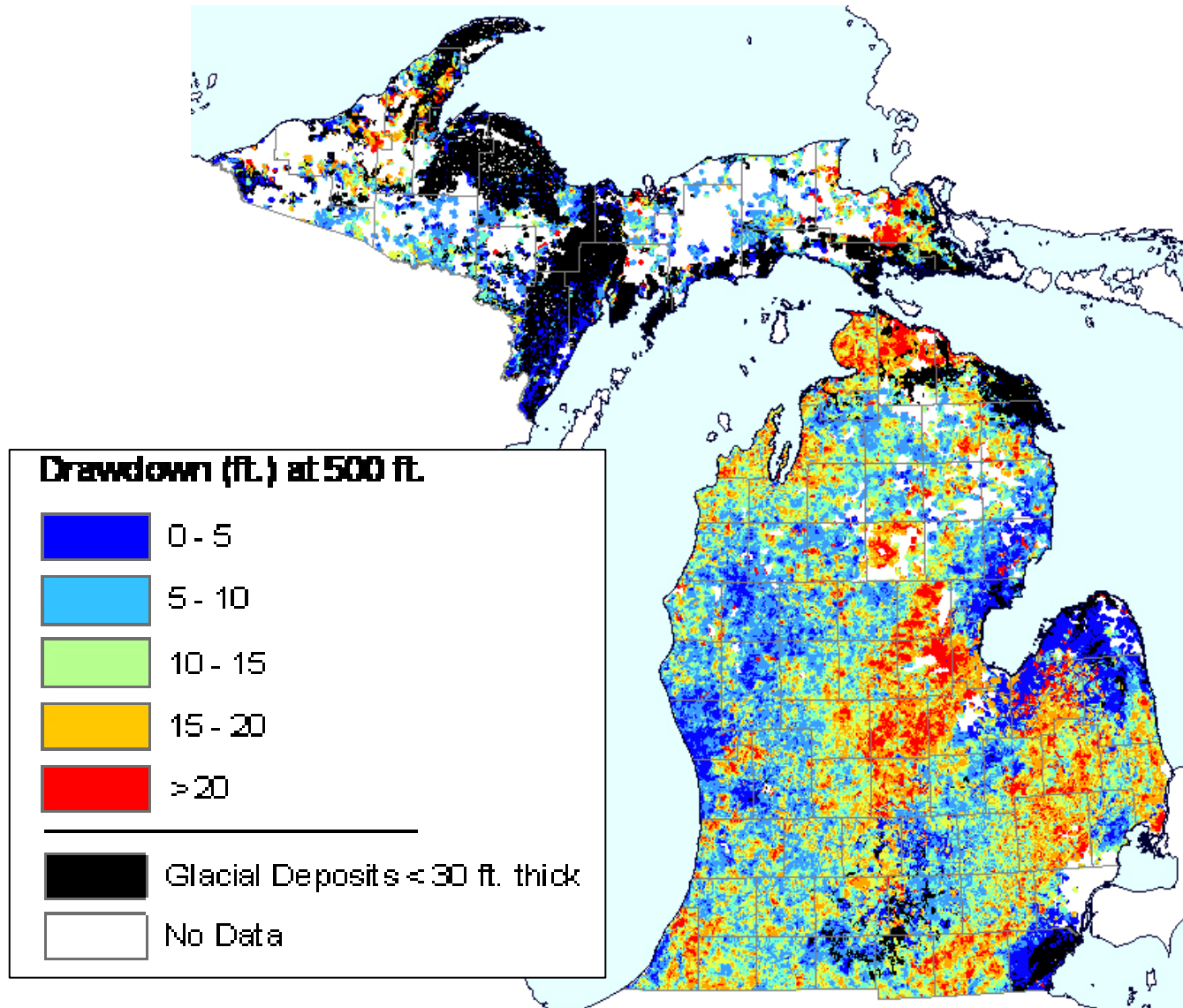
# Glacial Aquifer Characterization






# Yield from Glacial Aquifers



# Drawdown from Glacial Aquifers



# Groundwater Mapping Web Site



## Groundwater Mapping Project

# http://gwwmap.rsgis.msu.edu

<h3>Interactive Map Viewer</h3> <p>The online interactive map viewer was created by MSU Remote Sensing &amp; GIS Research and Outreach Services (RS&amp;GIS). Base map features and image backdrops are included as well as layers specific to this project. With the viewer users can query well databases, find lat/lon coordinates, find addresses and download spatial data.</p> <p><a href="#">Start the Viewer</a></p> <p><a href="#">Viewer Tutorial</a></p> <p><a href="#">Browser Help</a></p> <h3>Groundwater Information Database</h3> <p>USGS and RS&amp;GIS collaborated on the searchable groundwater database.</p> <p><a href="#">Search the Database</a></p> <p><a href="#">Bibliography</a></p> <p><a href="#">Database Tutorial</a></p> <p><a href="#">Copyright Information</a></p> <p>Database last updated: August 17, 2005</p>	<h3>Project Reports</h3> <p>Executive Summary (8-18-05) Print Quality: 17.1 MB Draft Quality: 2.8 MB</p> <p>Technical Report (3-6-06) Full Technical Report: 23.5 MB Technical Report by Chapter: 1 2 3 4 5 6 7 8</p> <p><a href="#">Get Adobe Reader</a></p> <h3>Web Resources</h3> <p>Groundwater Tutorial Groundwater Glossary Groundwater Stewardship Manual Aquifer Basics Glossary of Hydrologic Terms Groundwater Atlas of the United States The Water Cycle</p> <h3>Recent Changes</h3> <p>3-6-06 8-19-05</p>	<h3>Documents</h3> <p>PowerPoint Presentation: Groundwater in Michigan</p> <p>Basic Ground-Water Hydrology</p> <p>Ground Water and Surface Water A Single Resource</p> <p>Sustainability of Ground-Water Resources</p> <p>Flow and Storage in Groundwater Systems</p> <p>Groundwater and the Rural Homeowner</p> <p>The Importance of Ground Water in the Great Lakes Region</p> <p>Ground-Water-Level Monitoring and the Importance of Long-Term Water-Level Data</p>
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# Public Act 148: Groundwater Inventory and Map Project

## Public Act 148: Groundwater Inventory and Map Project

Executive Summary



Michigan Department of Environmental Quality

August 18, 2005

# Public Act 148: Groundwater Inventory and Map Project

## gwwmap.rsgis.msu.edu



FULL EXTENT	PREV ZOOM	SELECT BOX	SELECT LINE	SELECT BUFFER	QUERY FEATURE	MAP LEGEND	DISPLAY OPTIONS
ZOOM IN	ZOOM OUT	FIND FEATURE	FIND ADDRESS	LAT/LON ID	LAT/LON SEARCH	TOPO LEGEND	TOOL HELP
MOVE MAP	IDENTIFY	MEASURE	CLEAR	OBSERV. WELLS	FLOW GAGES	PRINT MAP	EXTRACT LAYERS



ACTIVE:  
COUNTY

- VISIBILITY:
- Base Map
  - Environmental
  - Ground Water Inventory
  - Image Backdrops
  - Secondary Map Features

- LAYER HELP:
- Click to open/close group.
  - Click to show group/layer.
  - Click to hide layer.
  - Scale-dependent layer
  - Click to show entire group.
  - Click for layer information.
  - Click for raster identify.

Auto Refresh  
**Refresh Map**

[Back to start page](#)  
[Contact information](#)

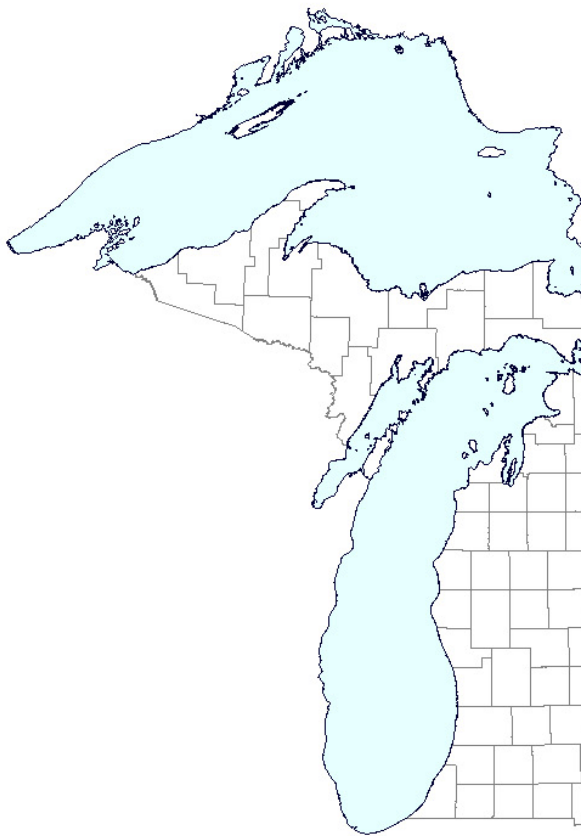


# Public Act 148: Groundwater Inventory and Map Project

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FULL EXTENT	PREV ZOOM
ZOOM IN	ZOOM OUT
MOVE MAP	IDENTIFY



Ground Water Inventory

- Geology
  - QUATERNARY GEOLOGY
  - GLACIAL LAND SYSTEMS
- WELLS SUMMARY DB
- WATERSHEDS
- WETLANDS
- SOILS
- WATER QUALITY
- Location & Yield of Aquifers
  - GLACIAL YIELD ⓘ
  - GLACIAL TRANSMISSIVITY ⓘ
  - GLACIAL DRAWDOWN ⓘ
  - BEDROCK YIELD
  - BEDROCK TRANSMISSIVITY
  - BEDROCK DRAWDOWN
- Supplemental Well Data
  - WELLS COMPLETE DB
  - WELLS HYDRO. PROP. DB
  - GLACIAL AQUIFER INDEX
- RECHARGE
- Groundwater Levels
  - WATER TABLE DEPTH ⓘ
  - OBSERV. WELLS
- Stream Flow
  - BASE FLOW
  - STREAM GAGES
- Conflict Areas
  - CONFLICT POINTS
  - CONFLICT POLYS
- GW-Depend. Natural Features
  - GW-DEPEND. WETLANDS
  - TROUT LAKES
  - TROUT STREAMS
- Non-Ag. Groundwater Use
  - INDUSTRIAL
  - NON-AG. IRRIGATION
  - POWER GENERATION
- Public Water Supply
  - USE BY SYSTEM
  - CAPACITY BY WELL
- AG. WATER USE BY TWP

DISPLAY OPTIONS
TOOL HELP
EXTRACT LAYERS

ACTIVE: COUNTY

VISIBILITY:

- Base Map
- Environmental
- Ground Water Inventory
- Geology
- WELLS SUMMARY DB
- WATERSHEDS
- WETLANDS
- SOILS
- WATER QUALITY
- Location & Yield of Aquifers
- Supplemental Well Data
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Back to start page  
Contact information

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ACTIVE: COUNTY

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Auto Refresh

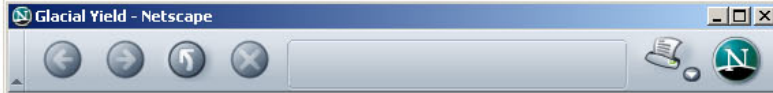
**Refresh Map**

Back to start page  
Contact information

# Glacial Deposits – Estimated Yield



FULL EXTENT	PREV ZOOM	SELECT BOX	SELECT LINE	SELECT BUFFER	QUERY FEATURE	MAP LEGEND	DISPLAY OPTIONS
ZOOM IN	ZOOM OUT	FIND FEATURE	FIND ADDRESS	LAT/LON ID	LAT/LON SEARCH	TOPO LEGEND	TOOL HELP
MOVE MAP	IDENTIFY	MEASURE	CLEAR	OBSERV. WELLS	FLOW GAGES	PRINT MAP	EXTRACT LAYERS



## Glacial Deposits-Estimated Yield

### Yield (gpm)



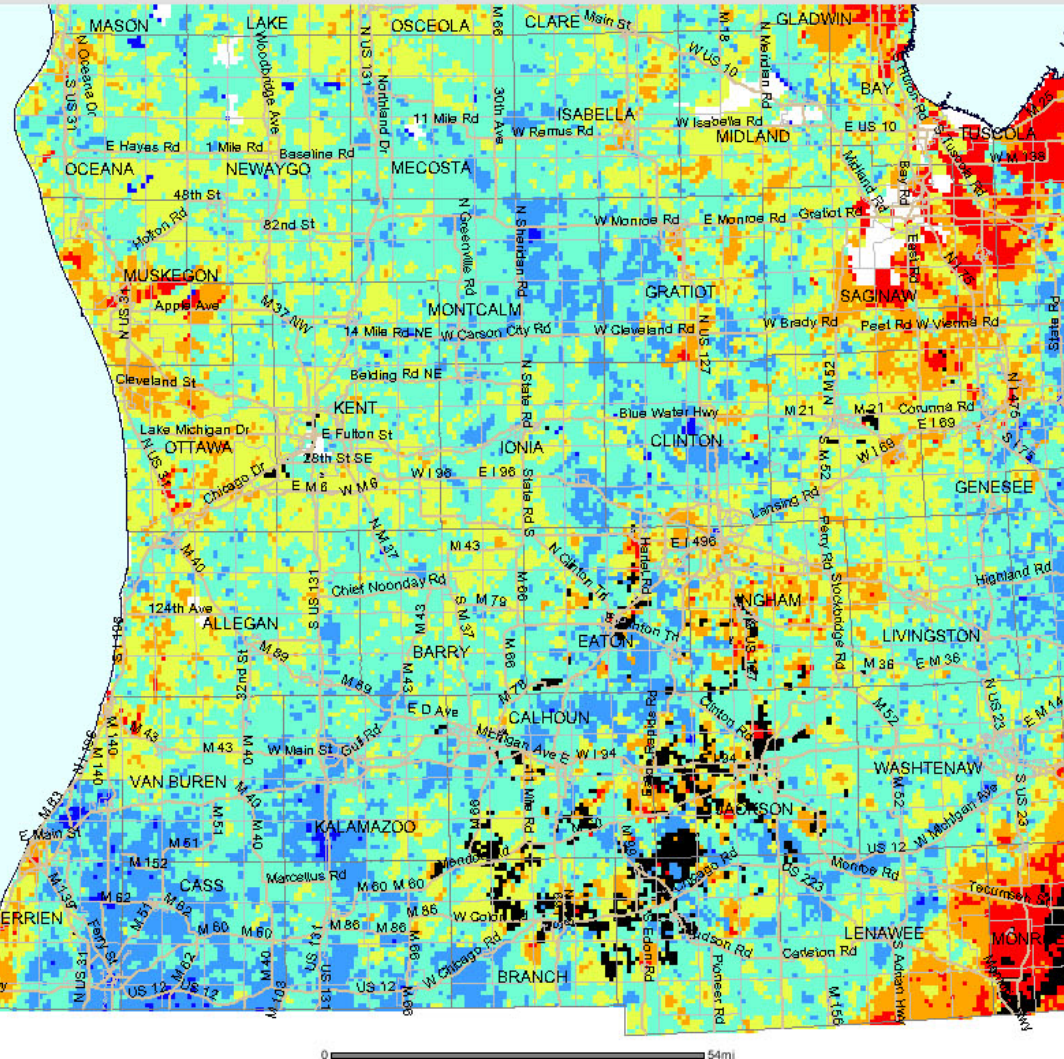
- Glacial Deposits < 30 ft. thick
- No Data

Note: Yield is defined as the pumping rate necessary to produce an estimated 50% decrease in water level at a well, for the used thickness of the glacial deposits as derived from Wellogic well records.

Yield from a local area in the commonly-used portion of the glacial deposits was mapped as the estimated pumping rate (gallons per minute) that would cause a fifty-percent decrease in the water level in the pumping well (sometimes referred to as available drawdown). This fifty-percent threshold value accounts for the generally accepted manner that high-capacity water wells operate (i.e. well efficiency). The estimated yield was calculated using a simple analytical equation to combine transmissivity, the saturated thickness and a storativity value of 0.0016, which is typical of a leaky-confined aquifer.

**The yield map should not be viewed as a guarantee of yield from a well at a specific location.**

Areas of thin glacial deposits (<30 feet thick) are shown because legally-constructed water wells screened in the glacial deposits of these areas are unlikely. The no-data areas on the map are zones more than 2000 meters away from a well record in Wellogic. This 2000-meter buffer zone balances the desire to note areas that lack data in Wellogic with the need for a statewide estimate.



# Groundwater Mapping Project

## Glacial Deposits-Estimated Yield

### Yield (gpm)



- Glacial Deposits < 30 ft. thick
- No Data

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This fifty-per generally ac wells operat was calcula combine tra storativity va leaky-confir

**Raster Info - Netscape**

Glacial Drawdown = 20 ft

Glacial Yield: Max. Discharge = 1420 gpm

The yield ma of yield from a well at a specific location.

Areas of thin glacial deposits (<30 feet thick) are shown because legally-constructed water wells screened in the glacial deposits of these areas are unlikely. The no-data areas on the map are zones more than 2000 meters away from a well record in Wellogic. This 2000-meter buffer zone balances the desire to note areas that lack data in Wellogic with the need for a statewide estimate.

ACTIVE:

COUNTY

VISIBILITY:

Full Screen Map

Inventory

PRIMARY GEOLOGY

LANDSYSTEMS

PRIMARY DB

WATER RESOURCES

WETLANDS

SOILS

WATER QUALITY

Location & Yield of Artifiers

GLACIAL YIELD

GLACIAL TRANSMISSIVITY

GLACIAL DRAWDOWN

BEDROCK YIELD

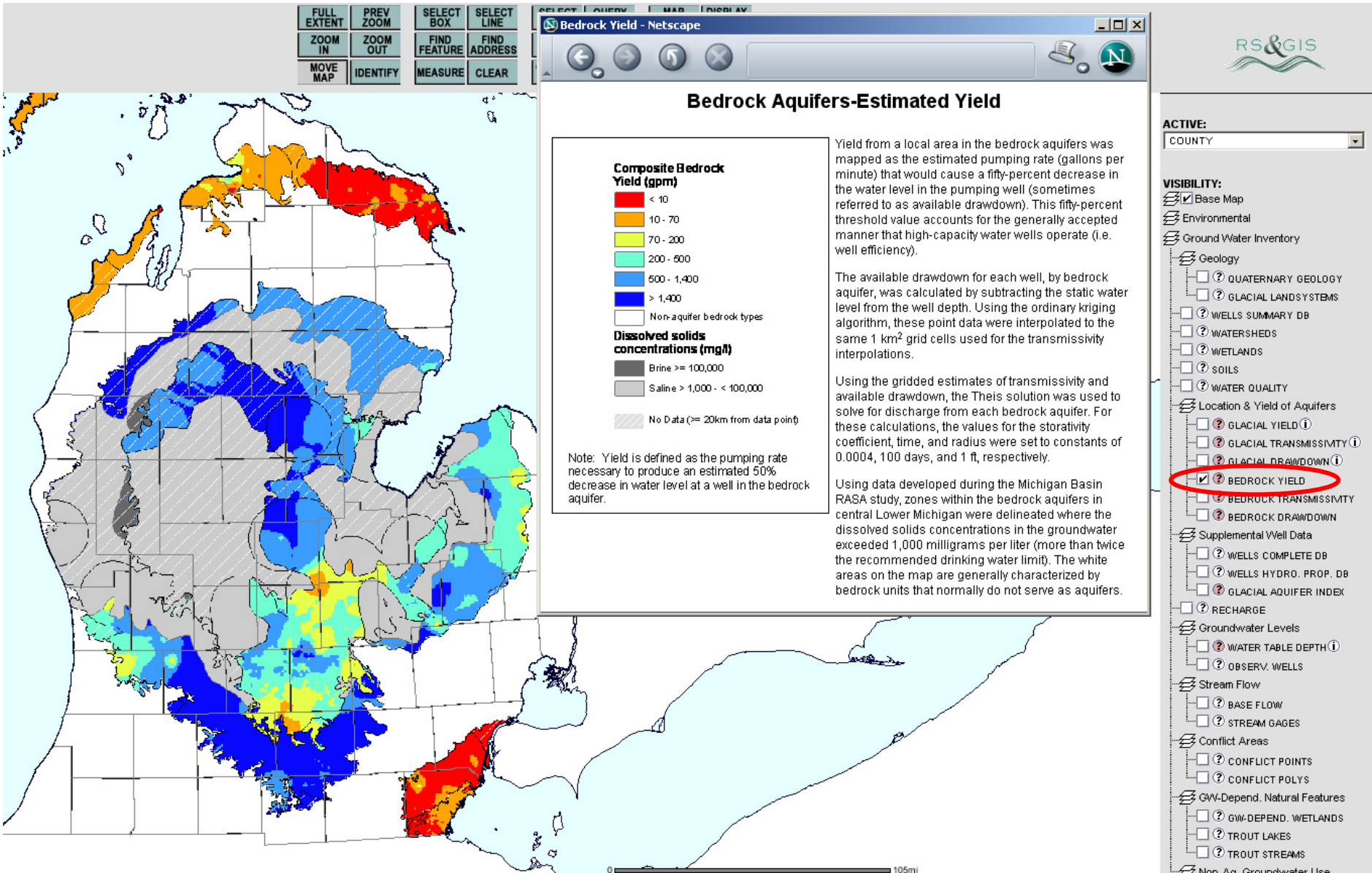
BEDROCK TRANSMISSIVITY

BEDROCK DRAWDOWN

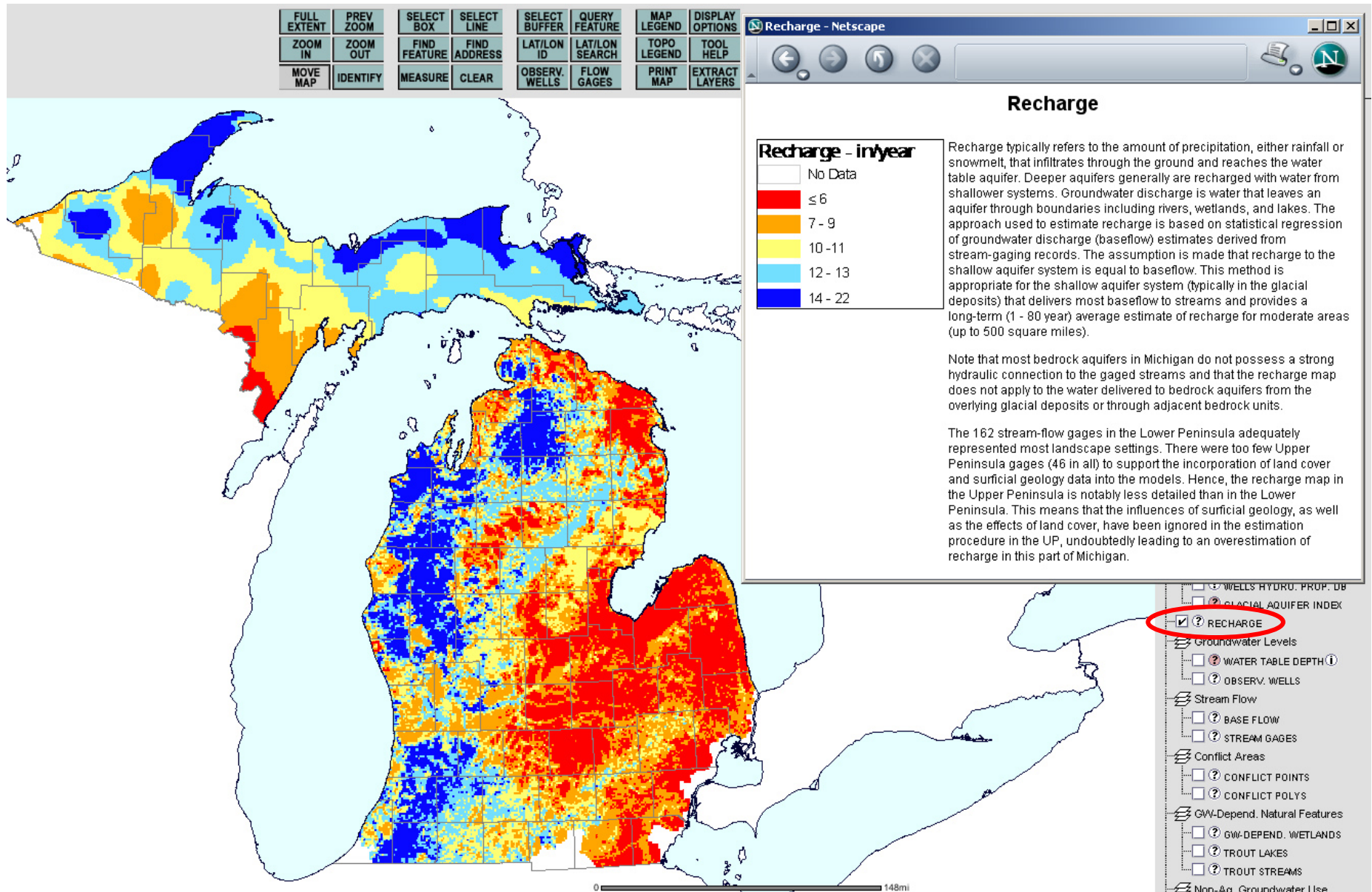
Supplemental Well Data

WELLS COMPLETE DB

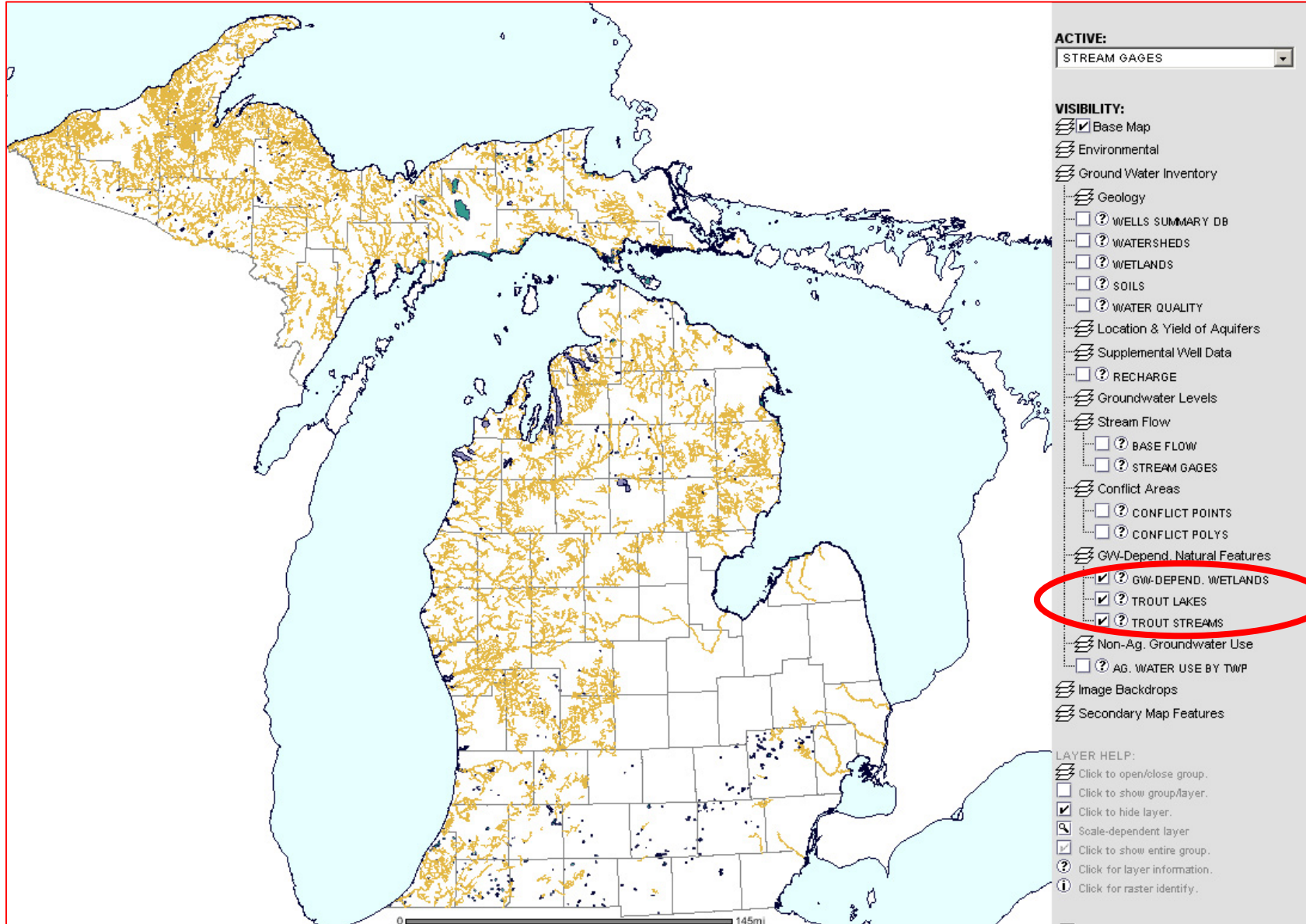
# Bedrock Aquifers – Estimated Yield



# Estimated Recharge To Glacial Aquifers



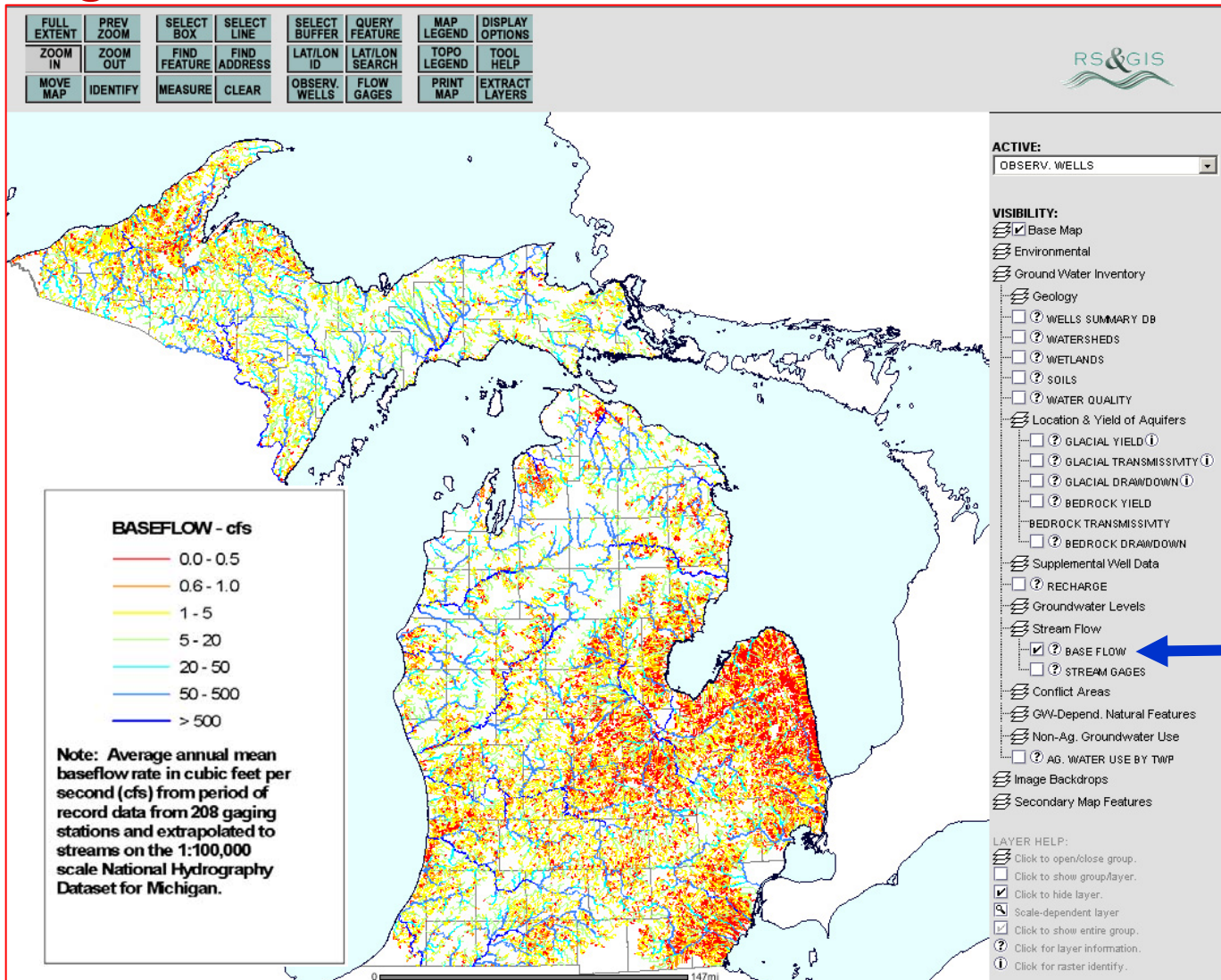
# Groundwater Dependent Resources from MNFI





# Estimated Baseflow of Rivers

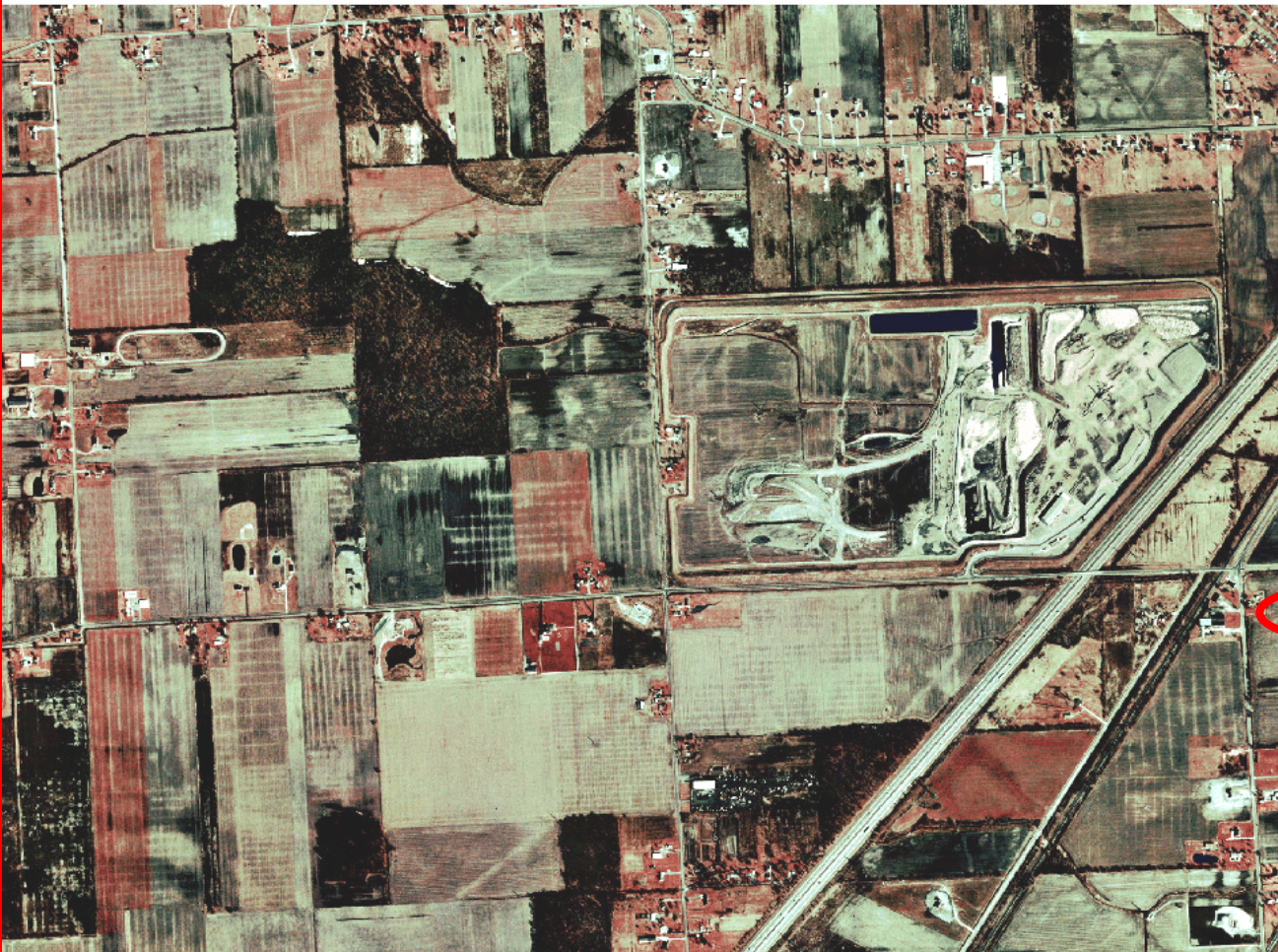
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# Public Act 148: Groundwater Inventory and Map Project

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RS&GIS

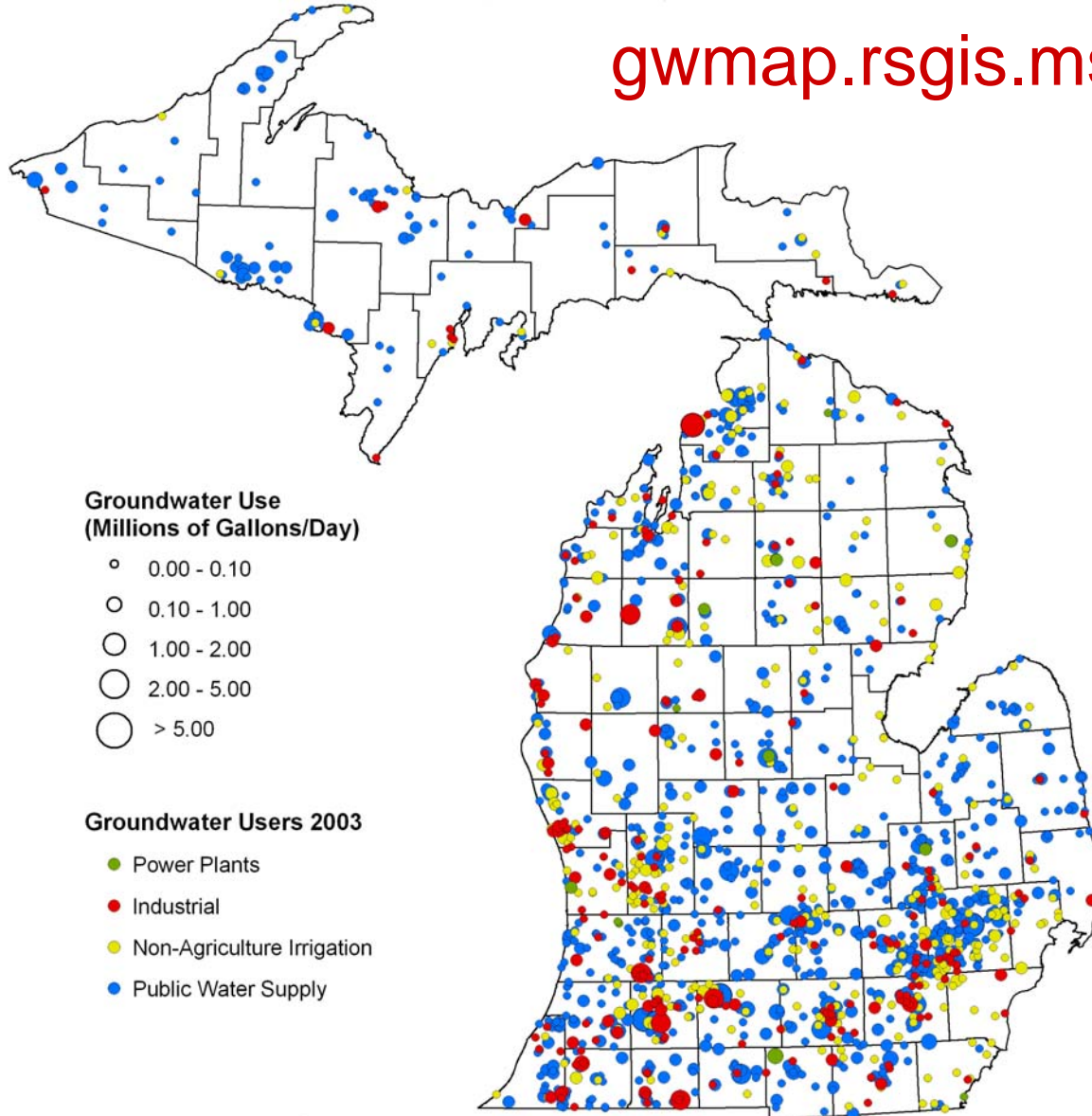
**ACTIVE:**  
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  - Non-Ag. Groundwater Use
    - AGR. WATER USE BY TWP
  - Image Backdrops
    - AERIAL
    - SATELLITE
    - TOPO MAP
    - LANDUSE
- Secondary Map Features
  - MINOR CIVL DIVISIONS
  - SURVEY SECTIONS
  - QQ SECTION GRID
  - GREAT LAKES
  - PIPELINE
  - POINTS OF INTEREST
  - POPULATED PLACES
  - UTILITY
  - TOPO INDEX

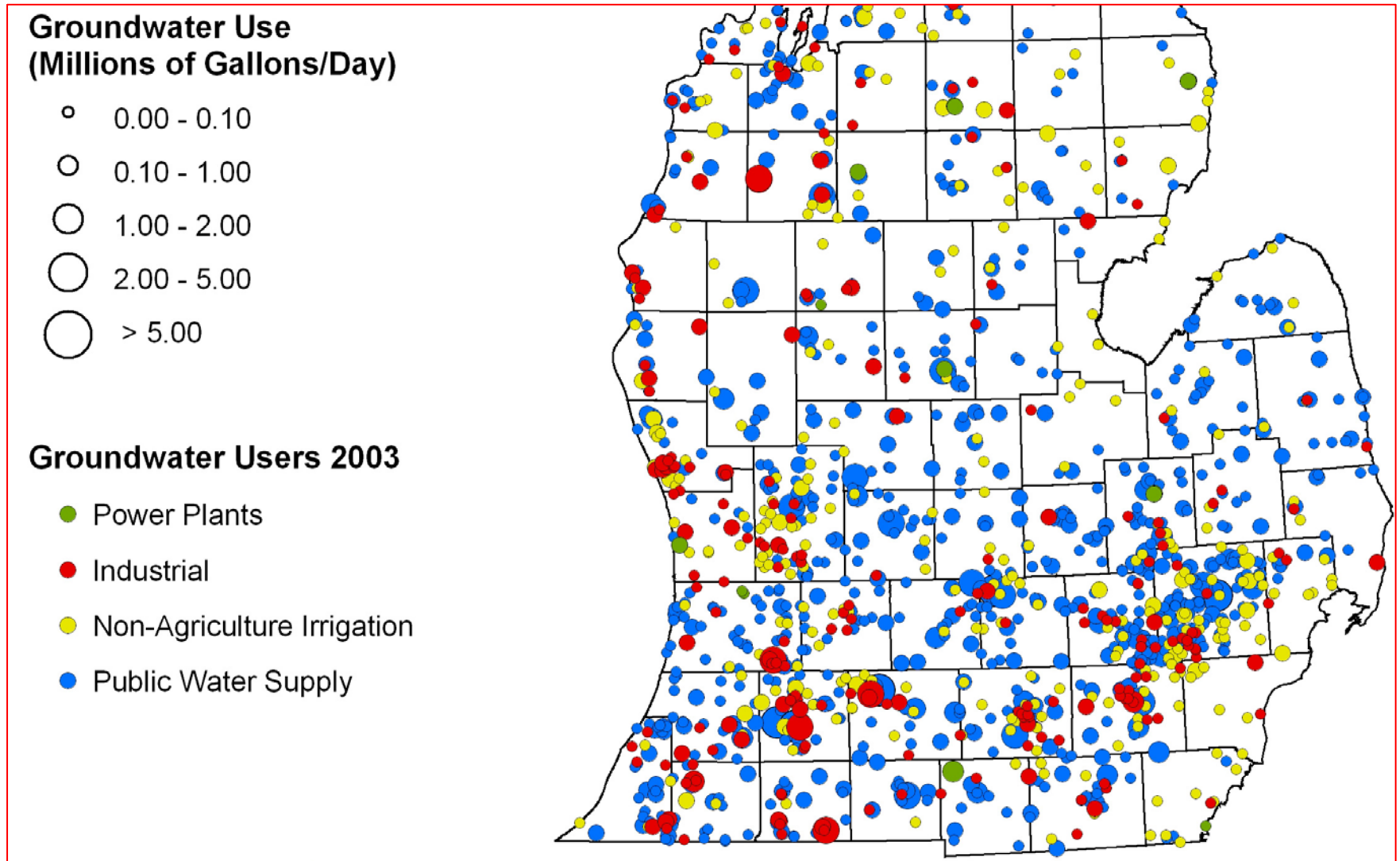
# Non-Agricultural Groundwater Use

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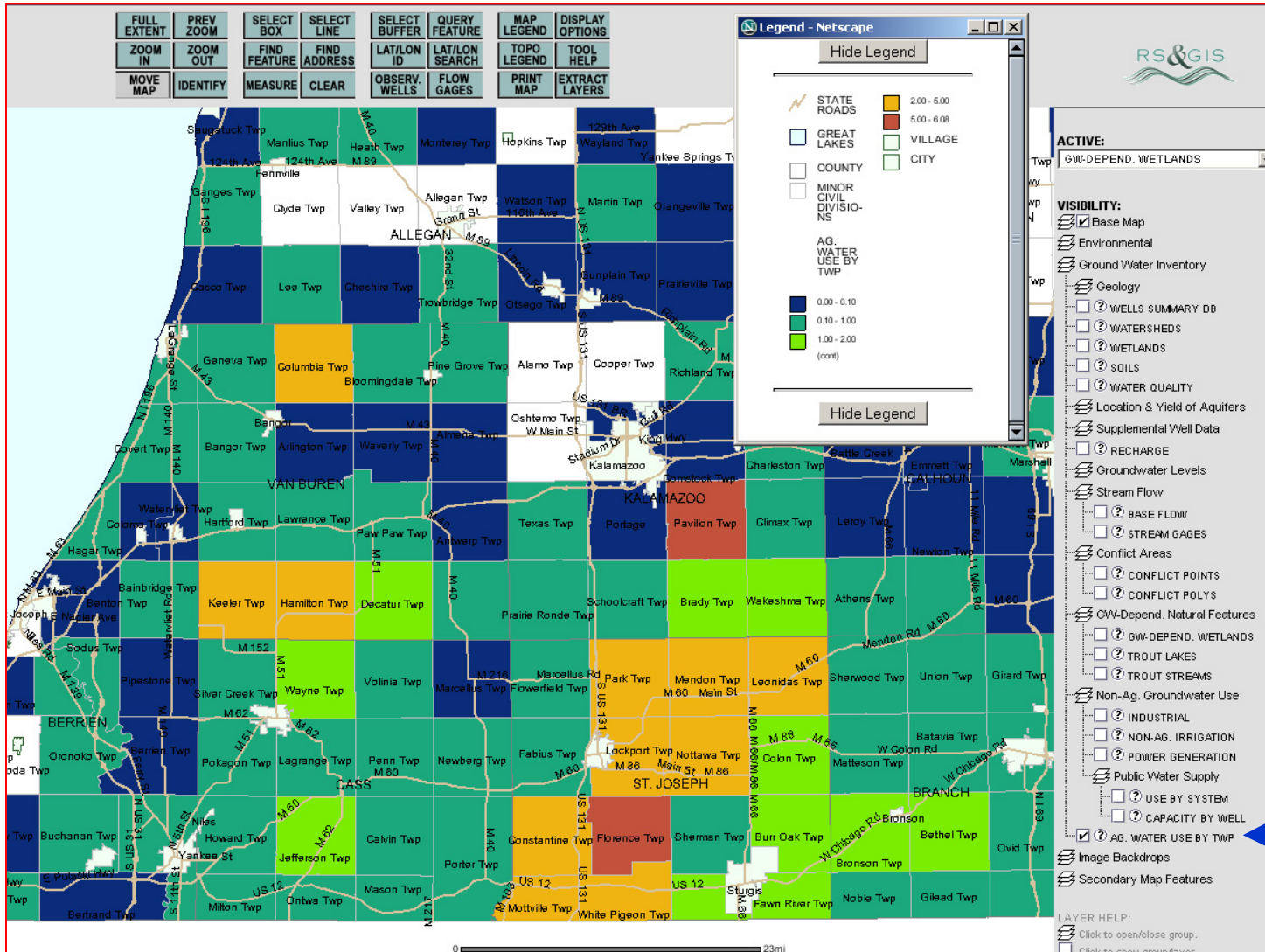
# Non-Agricultural Groundwater Use

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# Agricultural Water Use

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## New Water Use Regulations

### Regulations

## Introduction

The Michigan Senate and House enacted new legislation to manage large water withdrawals in the state using science as the basis for policy development, including a water withdrawal assessment process for high capacity wells. A group of eight bills were approved by the Legislature and signed into law by the Governor, filed with the Secretary of State, and assigned a Public Act number. These Public Acts become part of Michigan Compiled Laws and amended Part 327 (Great Lakes Preservation) of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994 and the Safe Drinking Water Act (SDWA), PA 399 of 1976.

The amended portion of Part 327 of the Natural Resources and Environmental Protection Act 451 of 1994, follows.

• **Natural Resources and Environmental Protection Act (EXCERPT)  
Act 451 of 1994 PART 327 Great Lakes Preservation** [PDF](#)

An analysis of the public acts, prepared by nonpartisan Senate Staff, is available below.

• **Water Resources Compact Analysis** [PDF](#)

The following sections are amended in The SAFE DRINKING WATER ACT (EXCERPT) Act 399 of 1976

• **325.1004 Includes in the amendment: water works systems,  
use of assessment tool and determination of zone C withdrawal** [PDF](#)

• **325.1017 Bottled drinking water** [PDF](#)

Department of  
Environmental Quality



United States  
Geologic Survey



MICHIGAN STATE  
UNIVERSITY  
EXTENSION

Department of  
Natural Resources



Institute of  
Water Research





## Department of Environmental Quality



The Official State of Michigan Website

Michigan.gov Home | DEQ\_Home | Online\_Services | Permits | Programs | Site\_Map | Contact\_DEQ

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### Water Use Program

Michigan and the other states and provinces in the Great Lakes region have each enacted laws that require major water users to report water withdrawals made within the Great Lakes Basin. This information provides an environmental baseline for managing water resources in a more integrated manner, and strengthens the legal basis for opposing unwarranted diversions of Great Lakes water. The Water Use Program is responsible for registering large quantity withdrawals, collecting annual water use data, making determinations on the potential impacts to water resources as a result of a proposed withdrawal, and issuing water withdrawal permits.

### Information

- [Water Use Program Staff](#)
- [Water Use Conservation Measures](#)

### Laws & Rules

- [Water Withdrawal Legislation](#) PDF
- [The Great Lakes Charter](#) PDF
- [The Great Lakes Charter Annex](#) PDF

### Forms

- [Water Use Registration Form - for new registrants](#) PDF
- [Water Use Reporting Form - for current registrants](#) PDF

### Related Links

- [Agricultural Water Use Reporting Program](#)
- [Find Latitude/Longitude Coordinates](#)
- [Pay water use reporting fee online via e-Check](#)
- [Water Withdrawal Reports, Data](#)

### Permits

- [Water Withdrawal Permit Application](#) PDF

### Water Management

- Dam Safety
- Floodplain Management/National Flood Insurance
- Hydrologic Data Collection & Analysis
- Michigan's Stream Team
- Subdivision Floodplain Transportation Review
- Water Use Program**
- Water Quality Monitoring
- Wetlands Protection
- Campgrounds and Pools
- On Site Wastewater

### Departments/Agencies

### Online Services

### Surveys

### RSS Feeds

### DEQ Quick Links

- DEQ Calendar
- DEQ Military Salute
- DEQ Who Does What List PDF
- DEQ Publications
- DEQ Acronyms PDF
- DEQ Laws and Rules
- DEQ Shortcuts PDF
- Public Comment Opportunities
- DEQ Staff Spotlight
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Surface Water Information Management System