



Is this a trout stream?

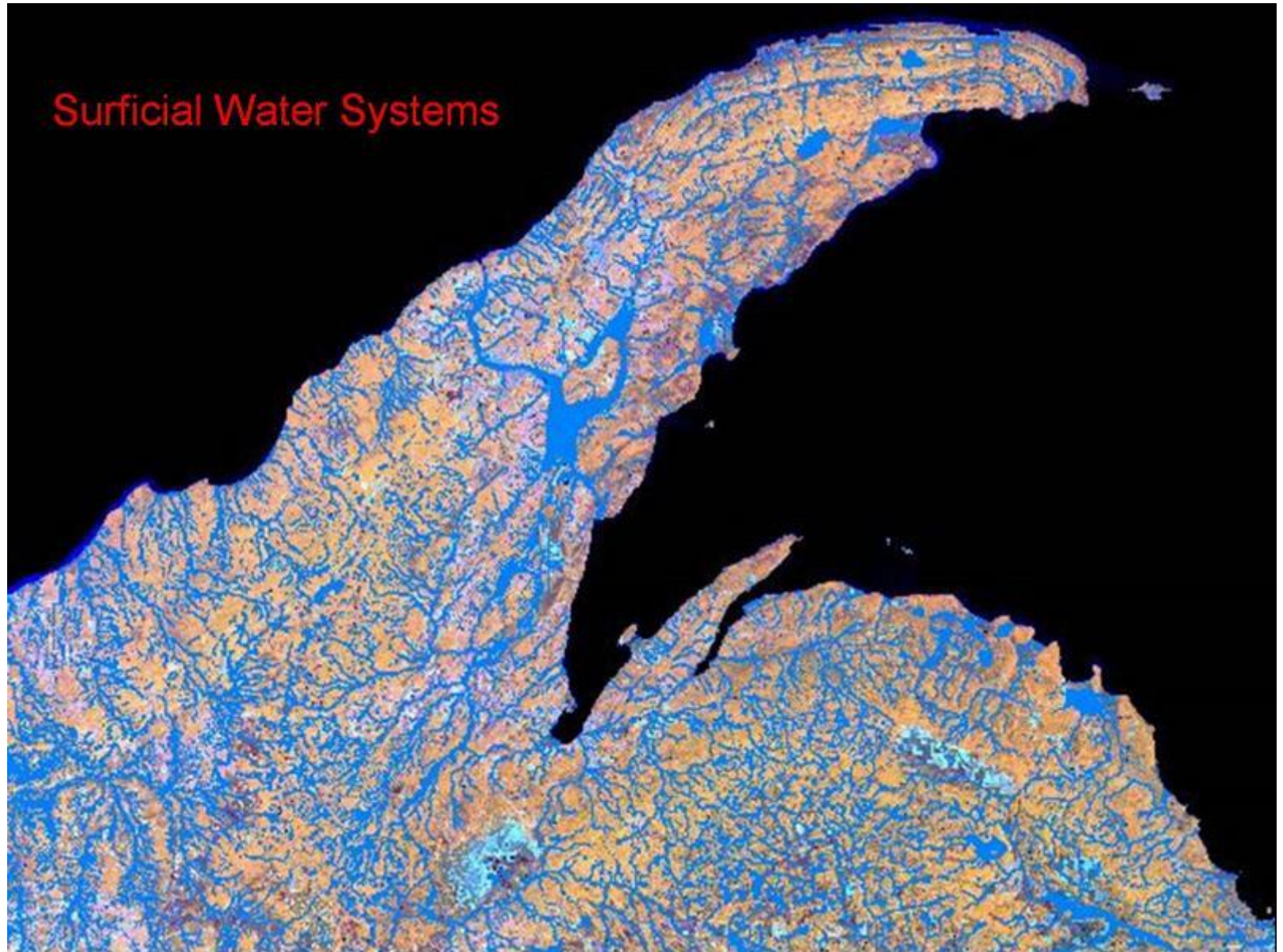


Or...is this a trout stream?



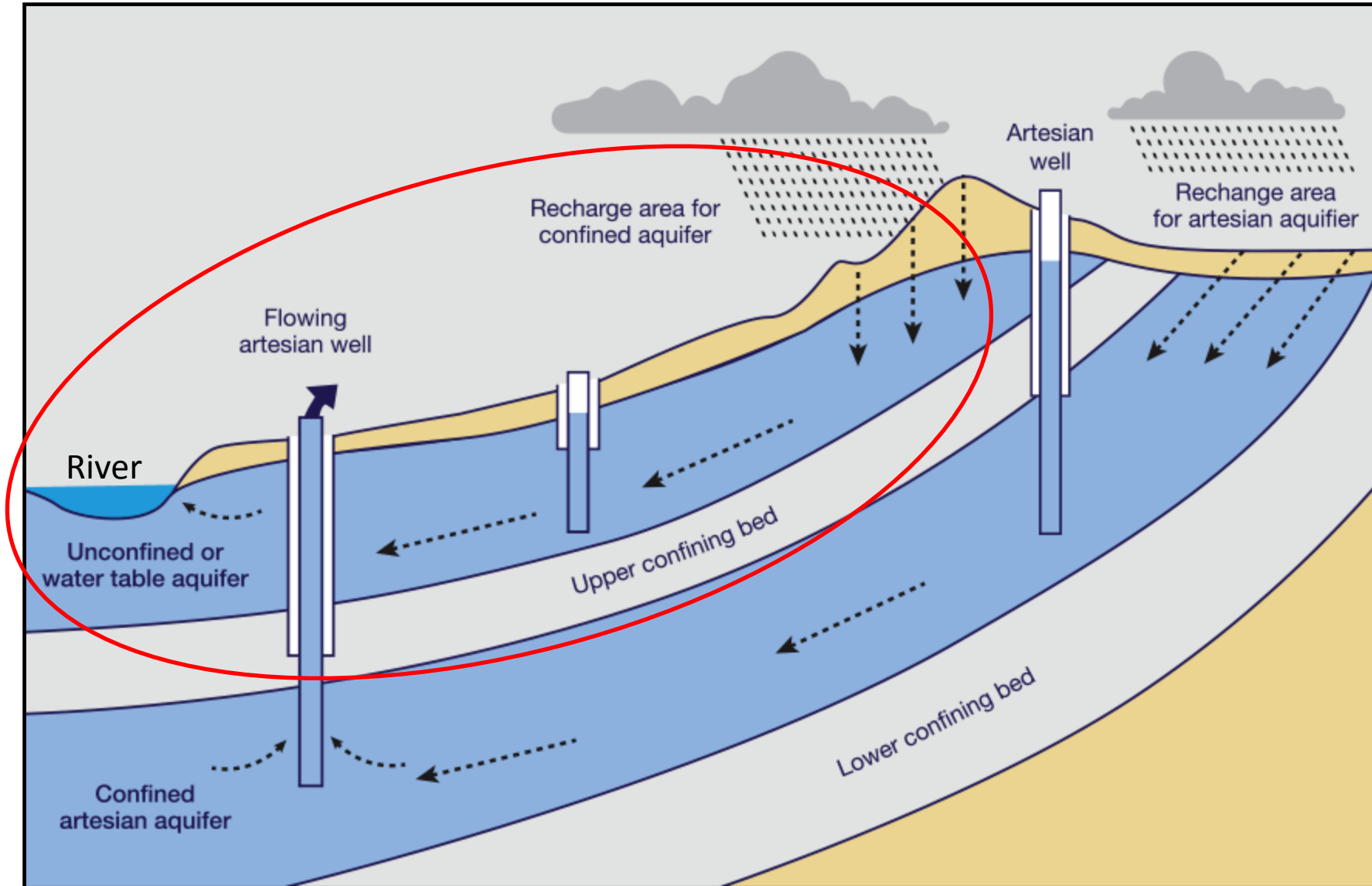


Information about surface water is readily available.





However, information about sub-surface water is **not** readily available. Particularly sub-surface aquifers that supply cold contributions to rivers and streams.





This presentation will.....

Give you a tool to identify high quality coldwater resources (trout streams) before you head out into the field.

Which may help you decide appropriate vegetation management goals for your landscape planning.

Aspen management in riparian zones, when conducted without appropriate buffers, can foster beaver activity, thereby degrading coldwater trout fisheries.



Photo; DNR archives

Creative riparian zone forestry practices give land managers the opportunity to create top quality waterfowl and furbearer habitat.





Darcy's law

From Wikipedia

Darcy's law is an equation that describes the flow of a fluid through a porous medium.

The law was formulated by Henry Darcy based on the results of experiments on the flow of water through beds of sand forming the basis of hydrogeology.

in 1856, a French hydraulic engineer named Henry Darcy published an equation for flow through a porous medium that today bears his name.



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- Weekly Fishing Report
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- Ice Fishing Safety / Tips

Angler Tools

- Fish ID
- Master Angler & State Record Plan
- Plan the perfect boat fishing trip with our Trip! Trip! tool
- Report a Michigan or Tagged Fish
- Michigan Fishing is Catching On - informational booklet
- Family Friendly Fishing Waiver

Angler Alerts

- 2017 Black Lake sturgeon season information
- The 2017 lake sturgeon fishing season on Black Lake (Cheboygan County) will begin at 8 a.m. on Saturday, Feb. 4. All anglers must register to participate in the lake sturgeon season.

Featured Items

2017 Winter Free Fishing Weekend February 18 & 19

#MIFreeFishingWeekend

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With the help of MDNR Forest Resources Division, we've developed a GIS groundwater link at the Michigan DNR map data website

http://gis.midnr.opendata.arcgis.com/datasets?q=darcy+groundwater+version+2+dataset&sort_by=relevance

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Welcome to the Department of Natural Resources' Maps and Data landing page for all things GIS geographic information system. Here you can search a listing of all geospatial data and available maps. The DNR is actively developing, managing, and distributing GIS data and information. This includes data collection and analysis required for resource investigations along with the support of making sound natural resource land management decisions. The DNR delivers data in various formats to decision makers and the general public. We also provide GIS support and training to all DNR divisions and other State of Michigan agencies.

- Maps
- Open Data
- Aerial Imagery Archive

Aerial Imagery



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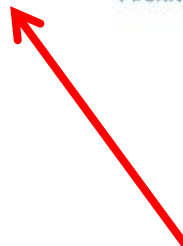
Maps



[Open Data](#)



Aerial Imagery Archive





DNR Open Data

Michigan Department of Natural Resources

Type in "Darcy"

Darcy

My Activity

MI DNR Open Data

Here the Michigan DNR provides accessible, high-quality information and analysis to drive informed decision-making. Our goal is to provide Michigan DNR data that is essential and unbiased to be used by all. Please browse, search, preview, and download datasets. Browse by category or enter key words in the search box to locate a dataset of interest. There are several ways to access the data within. The data can be downloaded as shapefiles or KML for GIS applications and as CSV for tabular analysis. Additionally, data from this site can be easily embedded in other applications using the GeoService or GeoJSON links. Explore the ESRI Javascript API documentation to get started. We intend to continually build this content collection as data becomes available.



DNR Land Ownership Data



Recreation Data



Motorized Trail Data



Non-Motorized Trail Data



Forestry Data





DNR Open Data

Michigan Department of Natural Resources

darcy

SEARCH WITHIN MAP

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Open Data file

1-1 of 1 results

Relevance

Share



Darcy Groundwater Version 2 Dataset (from Michigan DNR Open Data)
Shared by MichiganDNR
Darcy's Law was used to create the GIS Raster Data set. Darcy's Law describes how rate of flow of groundwater is related to the variables for velocity, hydraulic gradient and hydraulic conductivity. The rate at which groundwater flows is equal to the product of the hvdraulic conductivity multiplied by the hvdraulic arradient.

Document Link | www.midnr.com | ☆

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click ☆ on any dataset to add to your favorites



Open Instruction File

WinZip - Darcy_v2.zip

File Actions View Jobs Options Help

New Open Favorites Add Extract Encrypt View CheckOut Wizard View Style

Name	Type	Modified	Size	Ratio	Packed	Path
arc.dir	DIR File	04/29/2009 9:37 AM	1,140	79%	235	Darcy_v2\info\
arc0000.dat	DAT File	04/29/2009 9:36 AM	80	63%	30	Darcy_v2\info\
arc0000.nit	NIT File	04/29/2009 9:36 AM	576	82%	101	Darcy_v2\info\
arc0001.dat	DAT File	04/29/2009 9:36 AM	80	66%	27	Darcy_v2\info\
arc0001.nit	NIT File	04/29/2009 9:36 AM	576	85%	88	Darcy_v2\info\
arc0002.dat	DAT File	04/29/2009 9:37 AM	80	66%	27	Darcy_v2\info\
arc0002.nit	NIT File	04/29/2009 9:37 AM	288	80%	58	Darcy_v2\info\
arc0002r.001	001 File	04/29/2009 9:37 AM	215,040	43%	121,508	Darcy_v2\info\
mi_darcy_v2.aux	AUX File	04/29/2009 9:37 AM	6,142	80%	1,200	Darcy_v2\
mi_darcy_v2.grid.aux	AUX File	03/02/2009 4:02 PM	5,060	77%	1,160	Darcy_v2\
mi_darcy_v2.htm	HTML Docu...	04/29/2009 8:18 AM	49,174	75%	12,336	Darcy_v2\
mi_darcy_v2.vat.T675182KFN12.17780.11908.sr.lock			0	0%	0	Darcy_v2\
dblbnd.adf			32	0%	32	Darcy_v2\mi_darcy_v2\
hdr.adf	ADF File	04/29/2009 9:14 AM	308	82%	56	Darcy_v2\mi_darcy_v2\
log	File	04/29/2009 9:14 AM	222	39%	136	Darcy_v2\mi_darcy_v2\
metadata.xml	XML Docu...	04/29/2009 9:37 AM	39,340	68%	12,524	Darcy_v2\mi_darcy_v2\
sta.adf	ADF File	04/29/2009 9:36 AM	32	3%	31	Darcy_v2\mi_darcy_v2\
vat.adf	ADF File	04/29/2009 9:37 AM	210,192	59%	85,707	Darcy_v2\mi_darcy_v2\
w001001.adf	ADF File	04/29/2009 9:36 AM	306,340...	25%	230,27...	Darcy_v2\mi_darcy_v2\
w001001x.adf	ADF File	04/29/2009 9:36 AM	3,829,388	64%	1,360,...	Darcy_v2\mi_darcy_v2\
Instructions for opening Darcy Groundwater dataset.pdf	Adobe Acro...	02/24/2017 8:14 AM	9,460	39%	5,731	

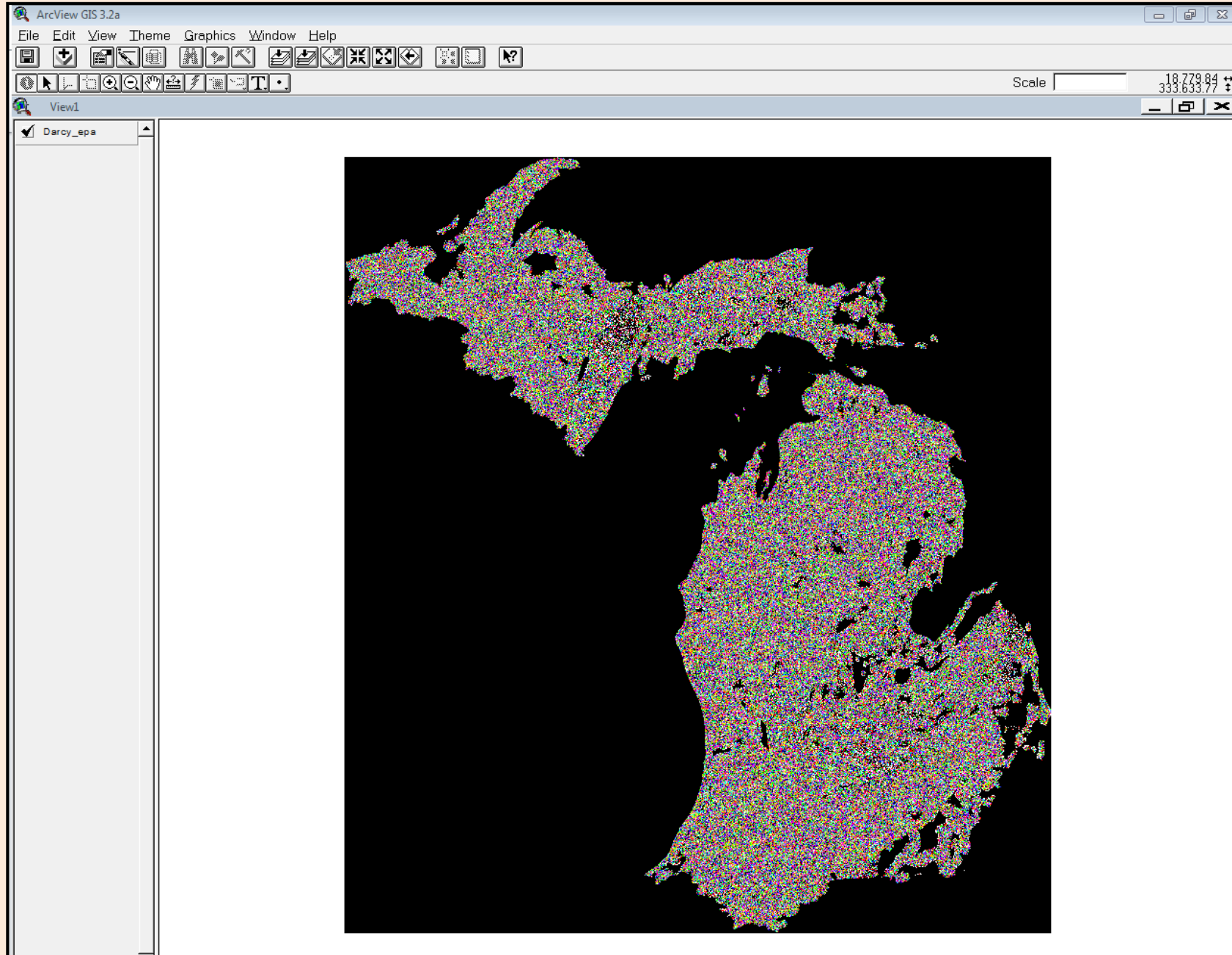
Open instruction file



Open Data File in Your GIS Program

A screenshot of the ArcView GIS 3.2a interface. The main window is titled "ArcView GIS 3.2a" and contains a menu bar (File, Edit, View, Theme, Graphics, Window, Help) and a toolbar with various GIS tools. A "View1" window is open, showing a map area. Overlaid on this is the "Add Theme" dialog box. The dialog box has a "Directory:" field containing the path "tuff\fixed files\gis\o's & e's\darcy epa\darcy_epa". Below this is a list of files and folders. The file "darcy_epa" is selected and highlighted with a red oval, and a red arrow points to it from the left. To the right of the file list is another list of folders, with "darcy_epa" also highlighted with a red oval. At the bottom of the dialog, there are "Data Source Types:" and "Drives:" dropdown menus. The "Data Source Types:" menu is set to "Image Data Source". The "Drives:" menu is set to "NR\BAR\HOME\MADISO!". On the right side of the dialog, there are "OK" and "Cancel" buttons, and radio buttons for "Directories" (selected) and "Libraries".

You will see pixilated imagery that needs to be reset.



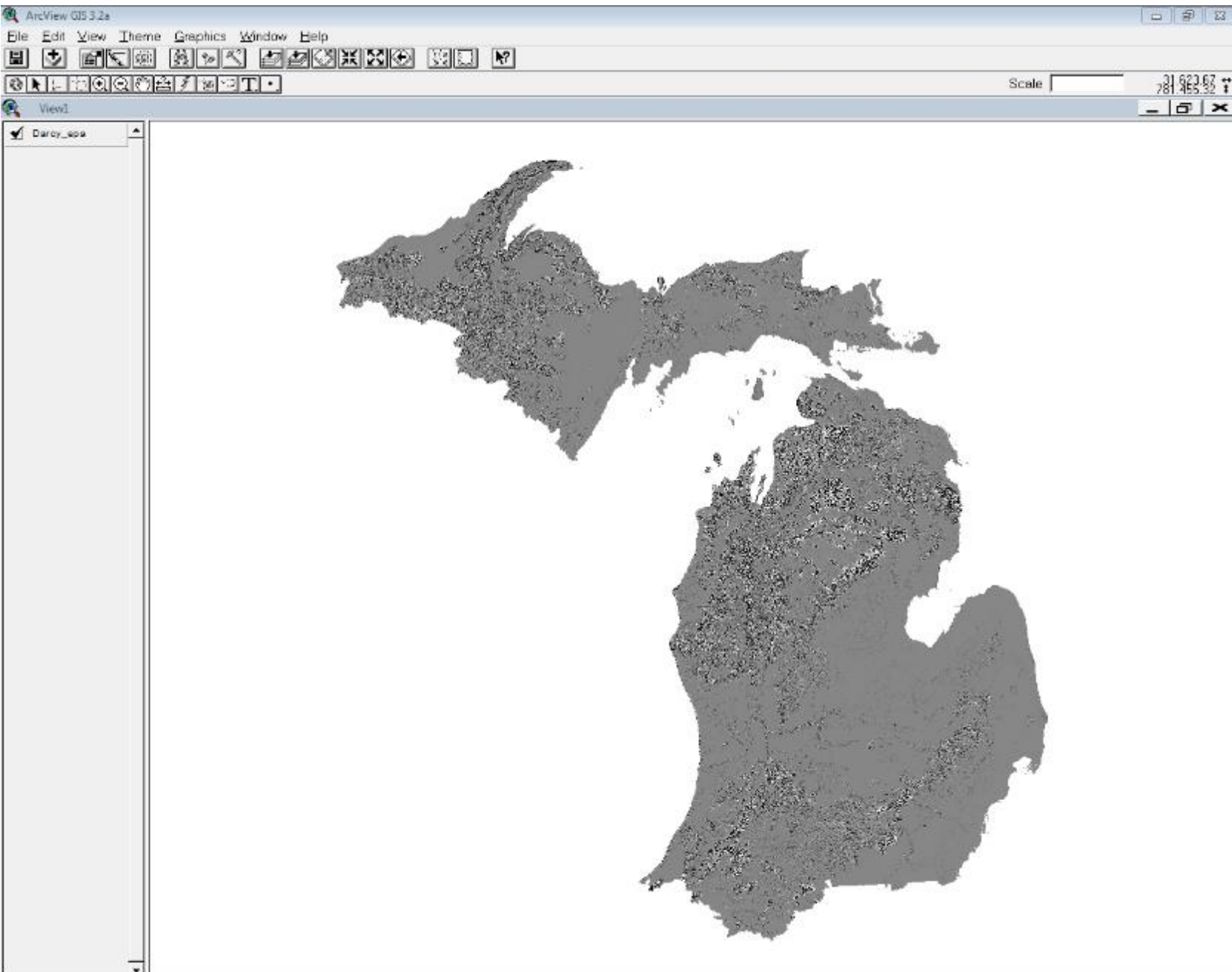


Follow The Instructions To Set The Image View

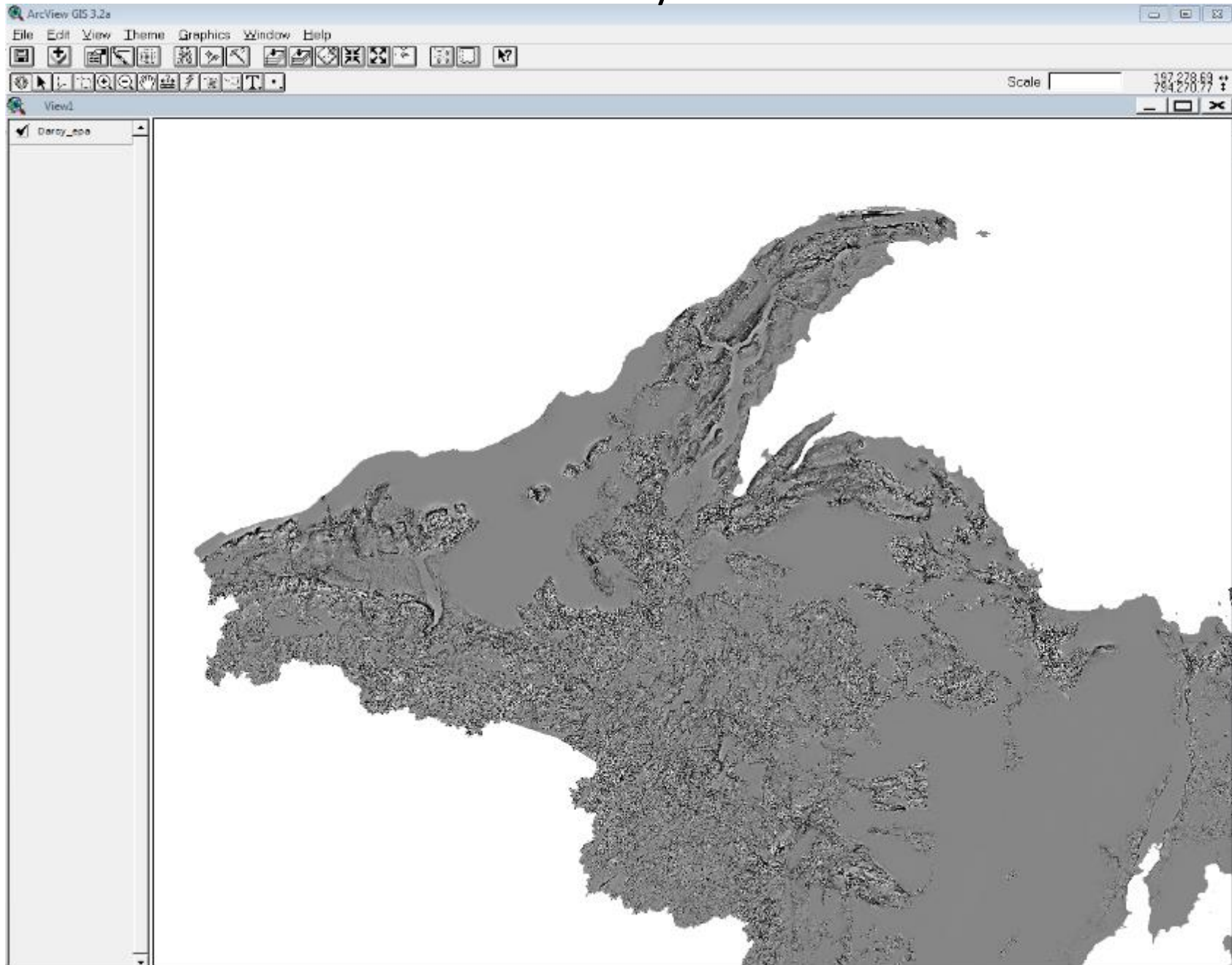
1. Extract all of the files w/in the zip file to a new folder somewhere on your hard drive or server (I named mine Darcy_EPA)
2. In ArcView, select add theme. Navigate to where you saved the folder with all of the Darcy files. There should be a folder inside named "darcy_epa". Double-click this folder.
3. Change the "Data Source Types" drop-down in the lower left hand corner of the add theme dialogue box to "Image Data Source". You should now see a file named "darcy_epa" with a blue and green square next to it. Highlight it and click OK.
4. Click the check box next to the theme name. The image that shows up will look really weird.
5. Double-click the theme name to open the image legend editor. Click Linear, Apply, and then close the window. You should be back in the image legend editor. Next, click Colormap, then Gray, then Ramp. In the left-hand side of the window with the numbers and black boxes, scroll all the way down to the bottom and double-click the black box next to NO DATA. In the window that appears, select the white box with the X in it at the upper left hand corner, and then close the window. Click apply, and the image on your screen should look like a black and white version of what we had on the screen in Marquette. When you zoom in to a particular region of the state, the really active groundwater areas will really stand out.



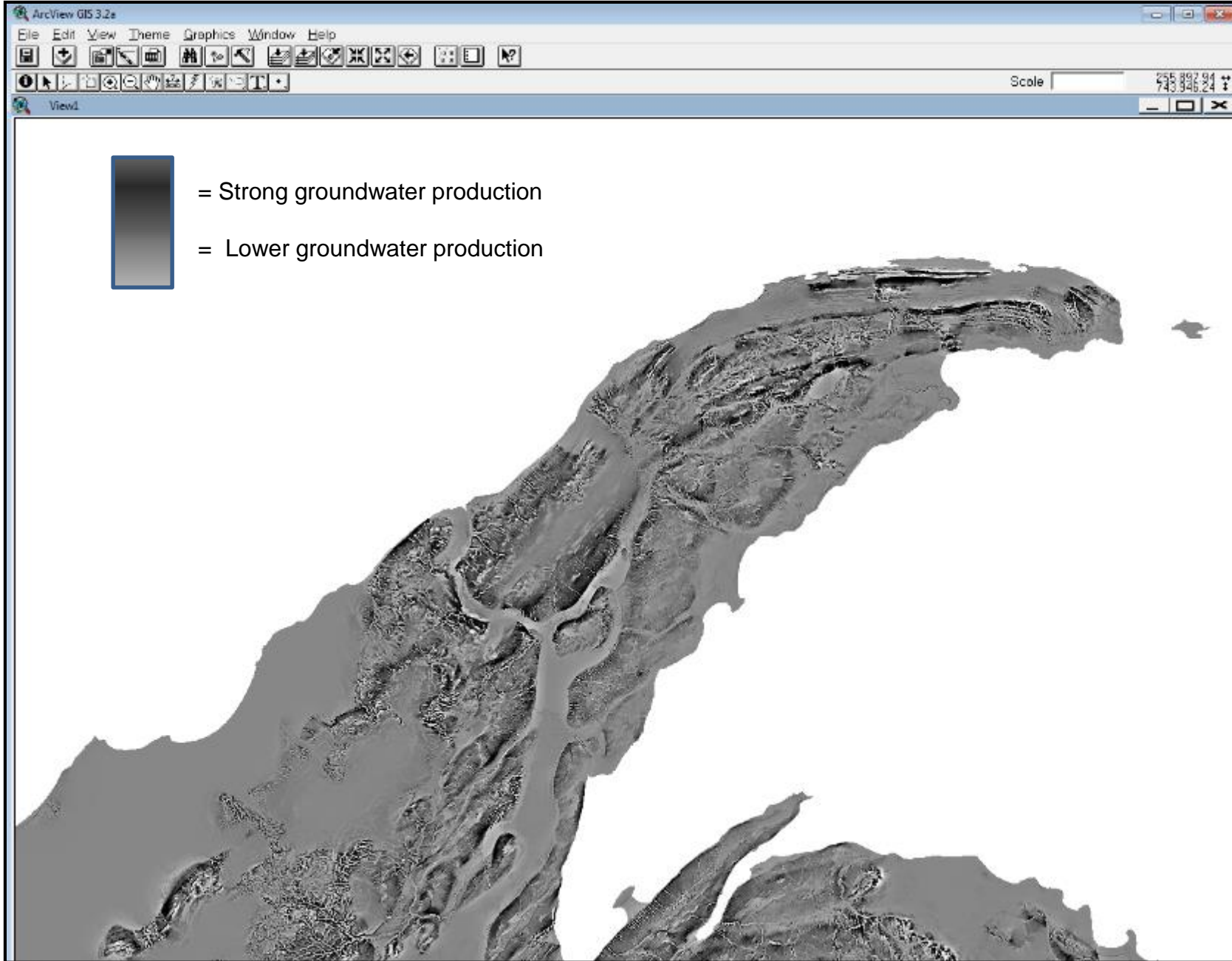
You will begin to see the gradation of groundwater production.



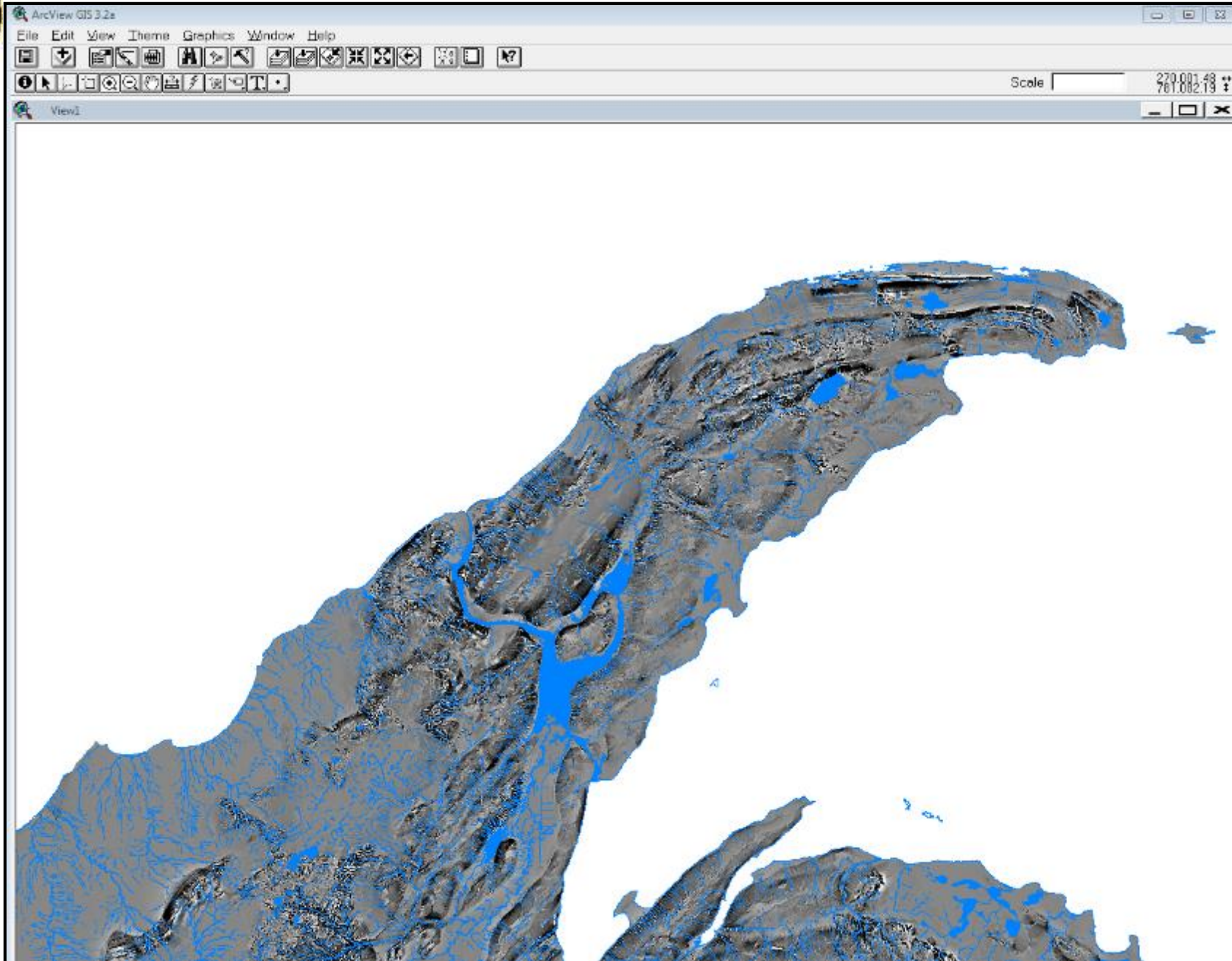
Zoom in to the area of your interest.



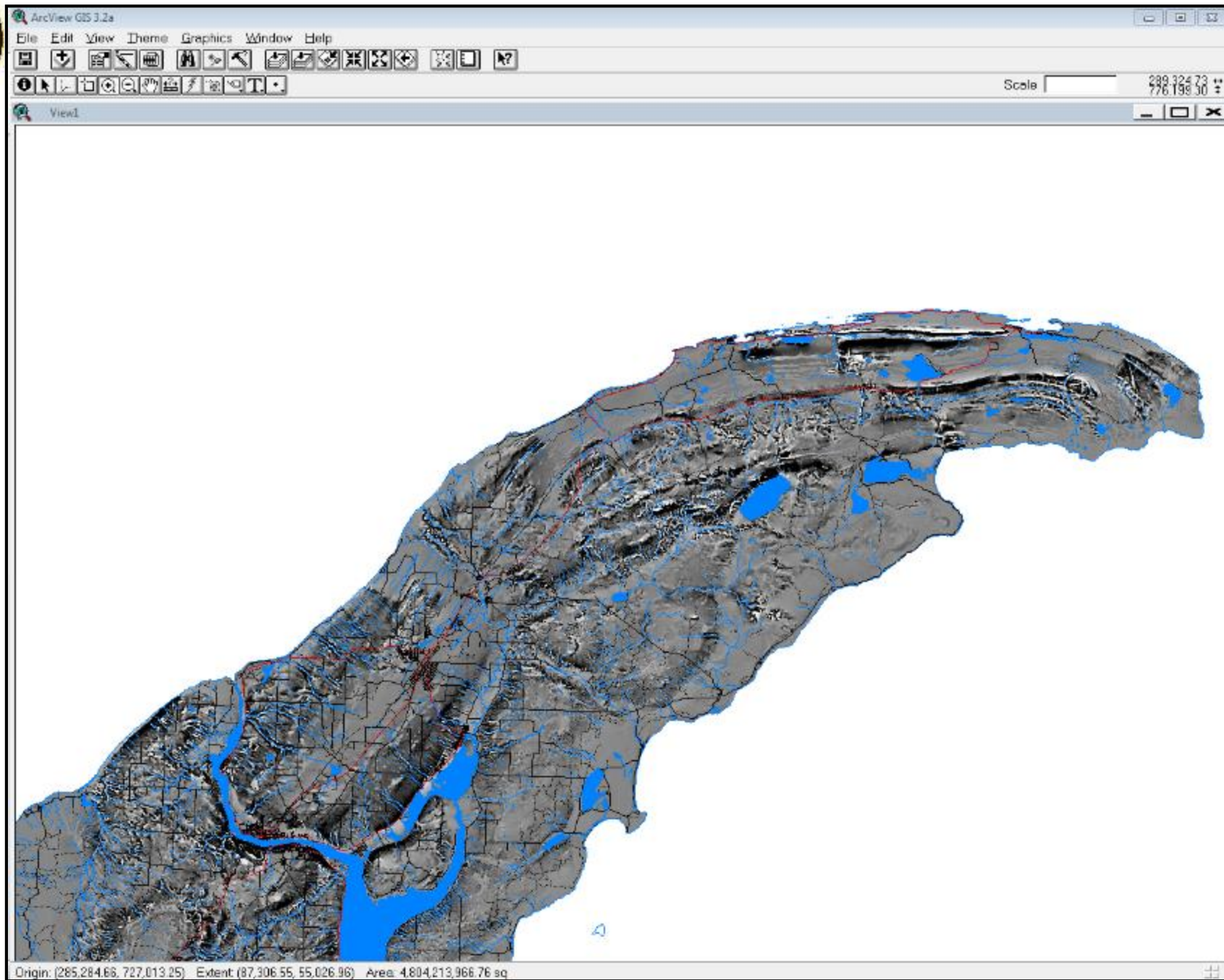
Darker colors indicate stronger groundwater movement.



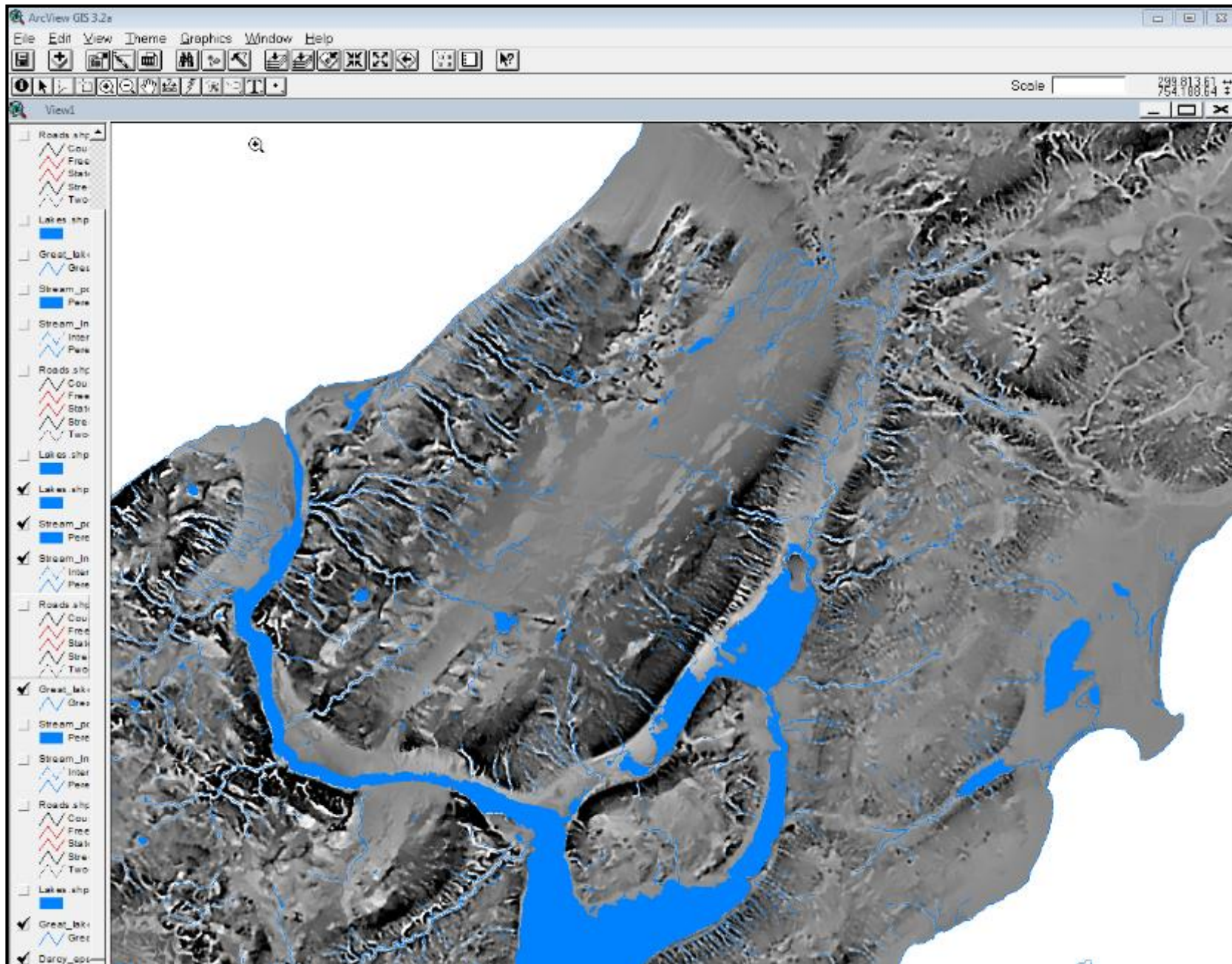
You can overlay surficial waters (lakes and rivers).



Add your road layer.

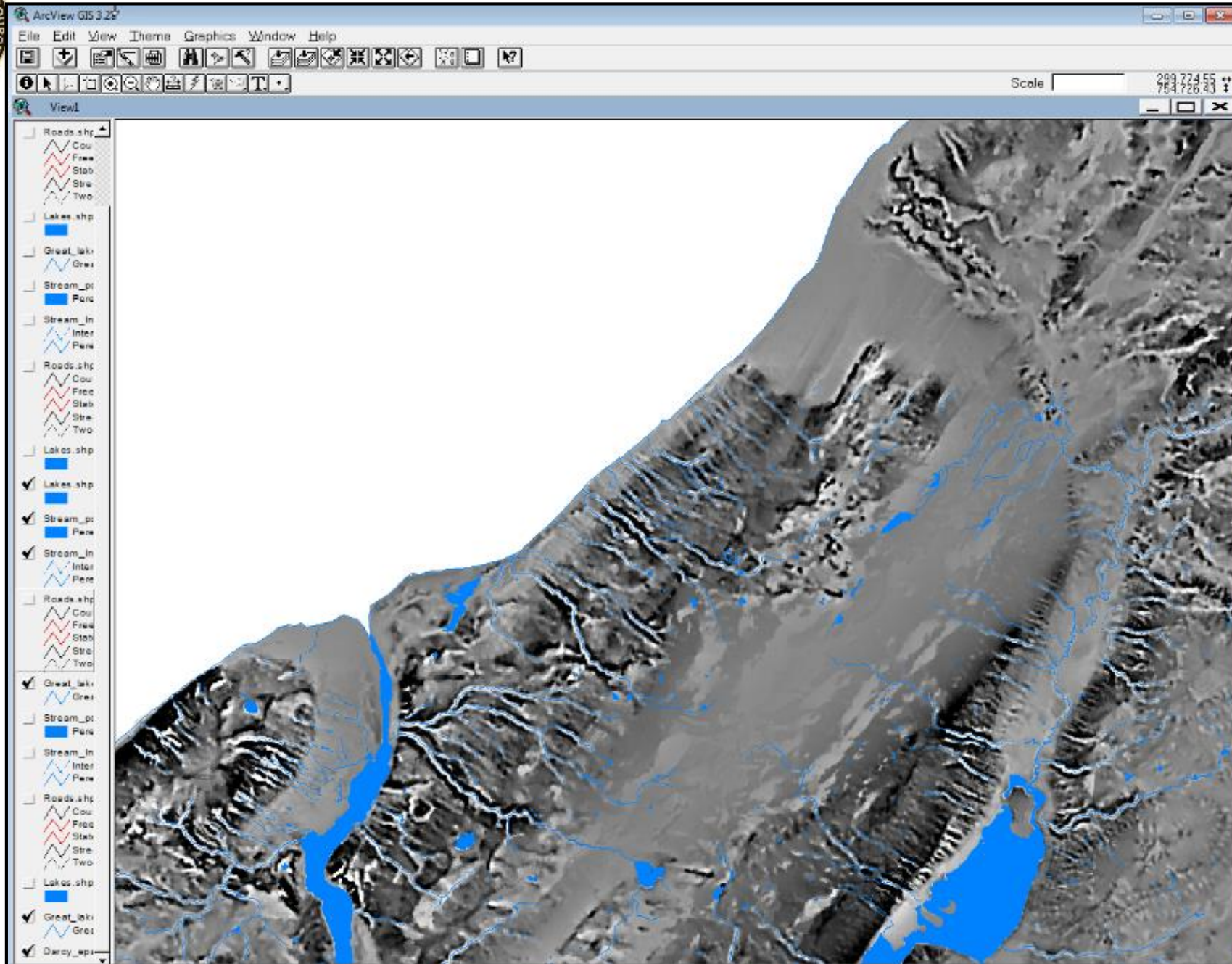


Zooming in will define a smaller landscape scale.



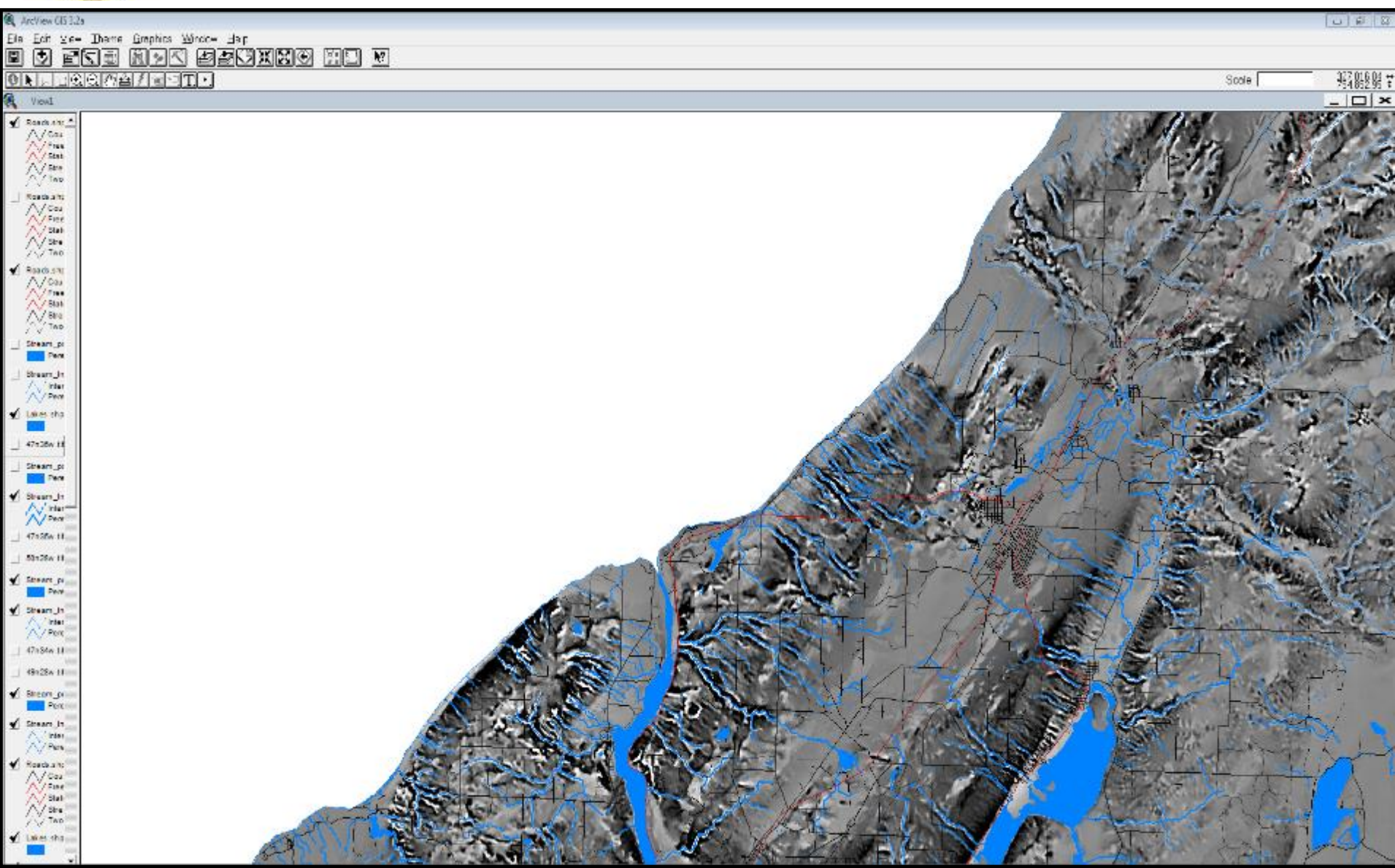


Even further.



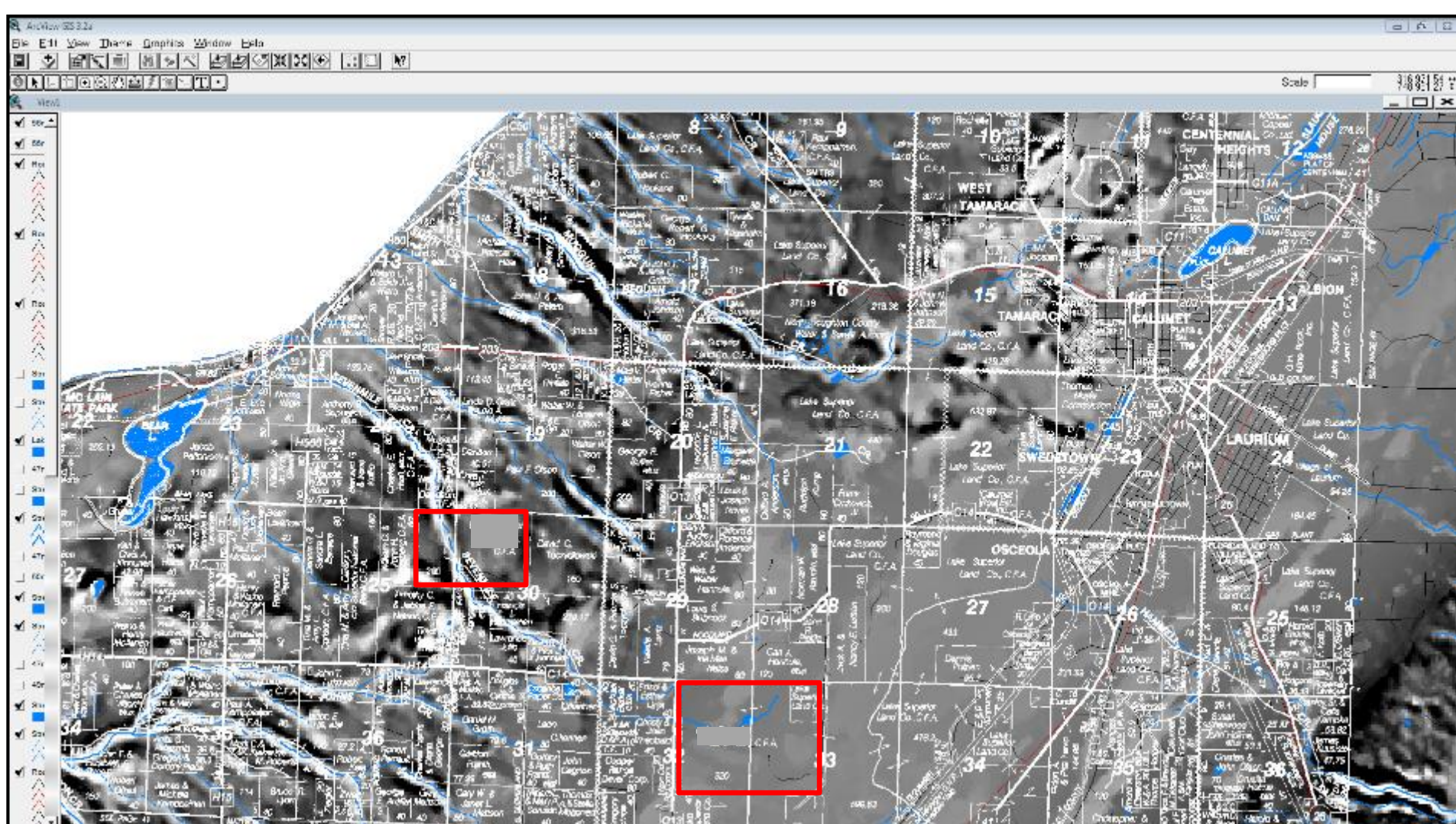


Add your road layer again.



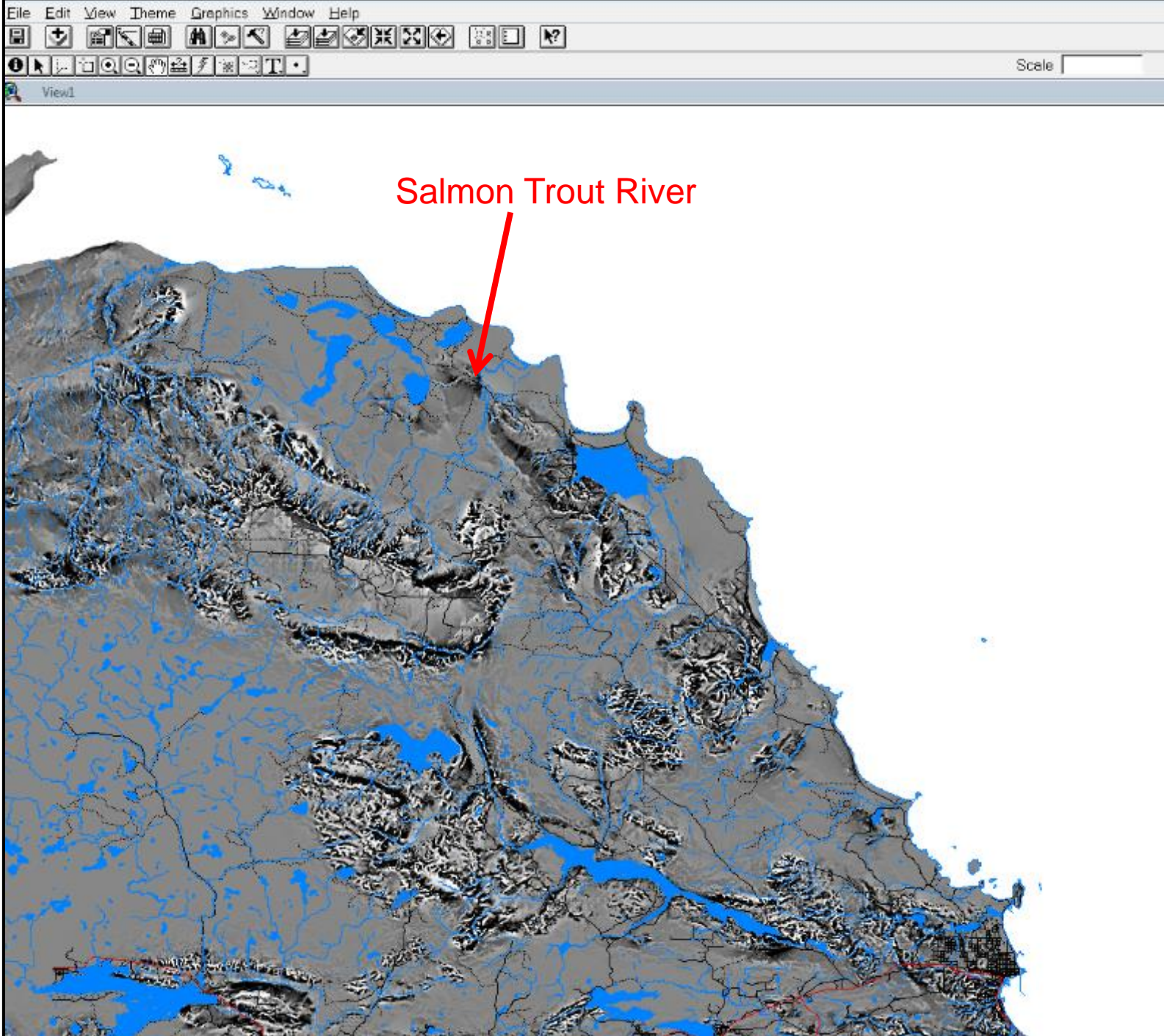


Locate and assess groundwater inputs in your project area.





Yes... This is this a trout stream!



Salmon Trout River

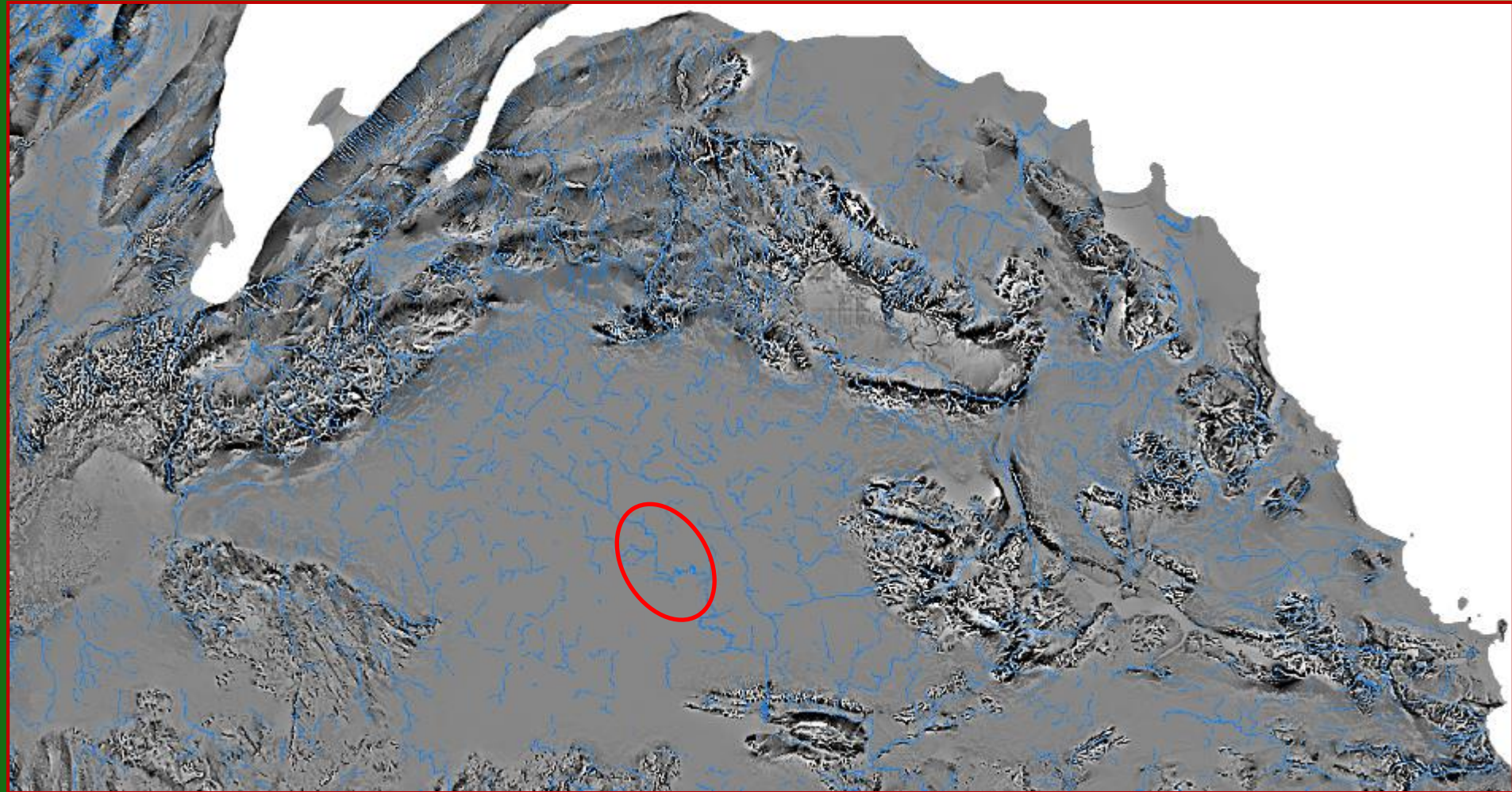


This river...well...this is this is a mediocre trout stream.
Aspen management here will not degrade the fishery.





Peshekee Highlands





Special Thanks To..... Matt Tonello

Michigan DNR Forest Resources Division, Resource Assessment Section





Please take an instruction handout home with you, or visit the website where the instructions will be posted.

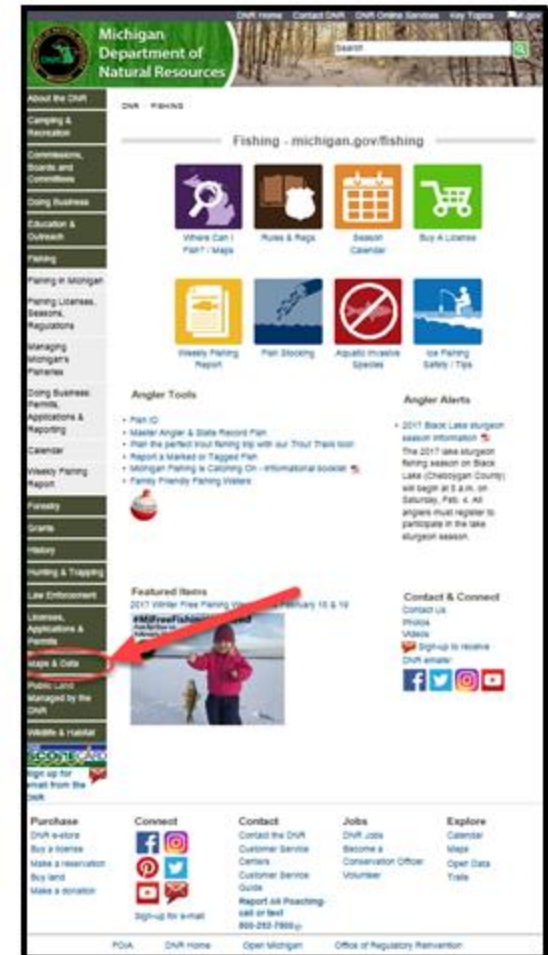
Instructions for opening Darcy Groundwater dataset

Go to....Link at Michigan DNR Michigan DNR map data website

<http://gis.midnr.opendata.arcgis.com/datasets?q=darcy+groundwater+version+2+datas&t&sort+by=relevance>

Or go to.... DNR website, Maps & Data tab;

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Case Study

Here is an example of when aspen management enhanced a lake system



Herman Lake, Schoolcraft County



As we zoom in to look at Herman Lake, we can see the character of the lake outlet.



Beaver Dam Construction Site



Dam site.





Thank You!





Factoid



World's largest beaver dam (2,800 feet long and still growing) on the southern edge of Wood Buffalo National Park, Canada.





degree of warming for lake superior



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Study: Lake Superior is one of the fastest-warming lakes in the world ...

<https://www.mprnews.org/story/2016/01/14/climate-cast-lake-superior-warming>

Jan 14, 2016 - **Superior** is **warming** at a rate of **2 degrees** Fahrenheit per decade, Huttner said, which is three times the global average. "Project that out 50 years, and you've got a **Lake Superior** that's **10 degrees warmer**. ... A second factor contributing to **Lake Superior's** increased **warming** is the presence of ice — or the lack thereof.

Warming waters: Lake Superior nearly breaks water temperature ...

<https://www.mprnews.org/story/2016/09/09/lake-superior-water-temperature>

Sep 9, 2016 - **Another warm summer water year for Lake Superior** is consistent with ... surface water temperature for the entire lake hit 68 and a half **degrees**.

Lake Superior Facts - Minnesota Sea Grant - University of Minnesota

www.seagrants.umn.edu/superior/facts

About the distance between **Lake Superior** and Duluth's hilltop; Maximum Depth: ... over the **warmer** surface of **Lake Superior** soaking up water like a sponge. ... **Lake Superior's** climate reflects its position on the planet and, to a smaller **degree**, ...

Global Warming and the Great Lakes - National Wildlife Federation

www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/.../Great-Lakes.aspx

Learn about global **warming's** impacts on the **Great Lakes**. ... and **increases in water temperature 2-12 degrees F** (or 1-7 **degrees C**) at surface, up to 14 **degrees** ...

Researchers say Lake Superior water temperature on the rise – Twin ...

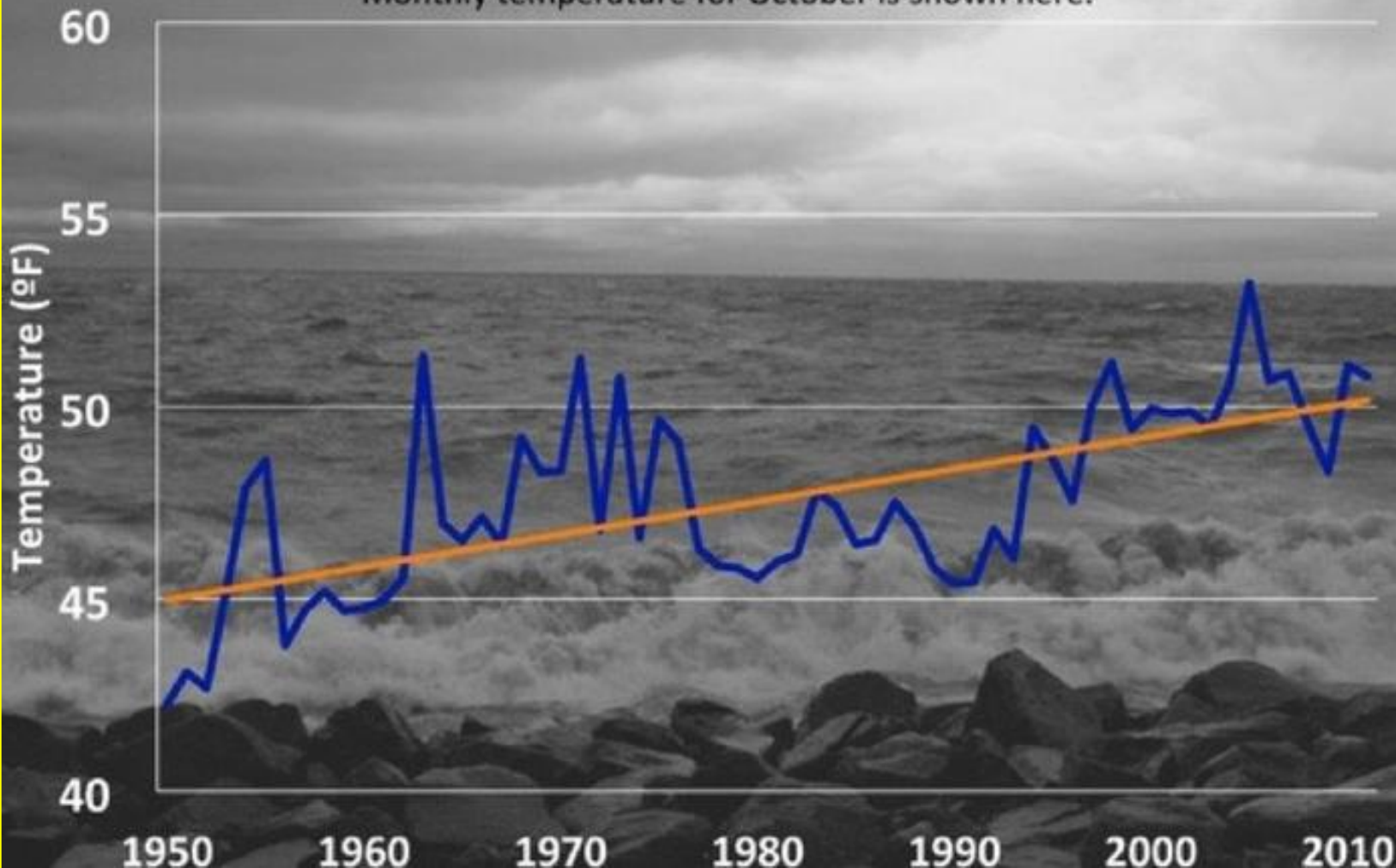
www.twincities.com/.../researchers-say-lake-superior-water-temperature-on-the-rise/

Sep 11, 2016 - **A warmer Lake Superior** could improve the chances of catching salmon ... water temperature for the entire lake hit 68.5 **degrees** Fahrenheit.



Not-so chilly Lake Superior

Aggregated NOAA data points to a warming lake.
Monthly temperature for October is shown here.





As Smallmouth Bass Move In, Walleye In Ontario Lakes At Risk

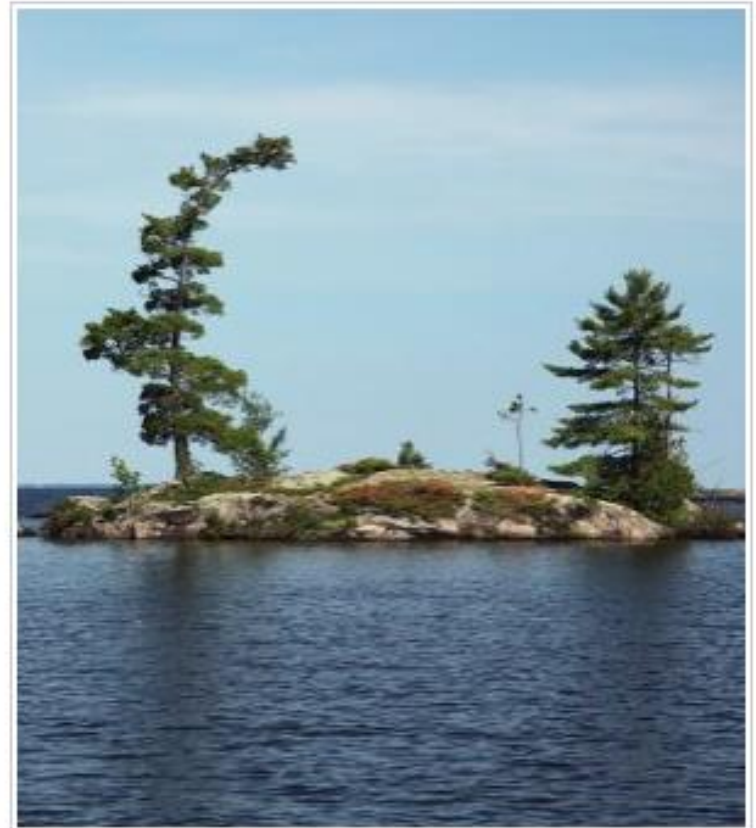
By Daniel Kelly on November 10, 2016

Researchers at York University have found that **native walleye in Ontario lakes are at the risk of disappearing with the rise of smallmouth bass.**

Populations of walleye are diminishing as warmer waters allow the bass to push into more northern lakes.

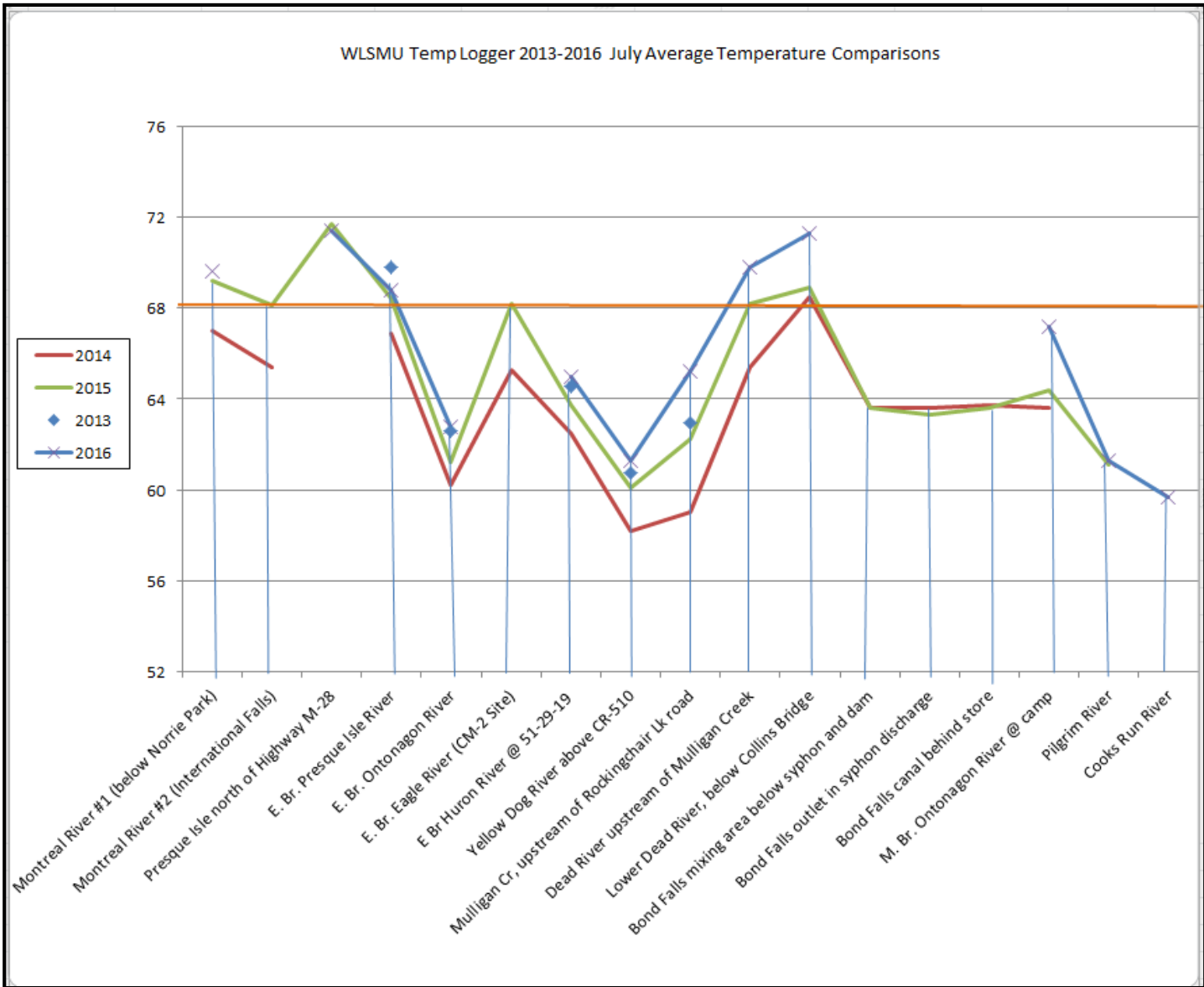
Encroaching smallmouth bass mean more competition for food resources in Ontario's lakes. Adult bass will also chow down on younger and smaller walleye, affecting development of the fish's stocks in the future.

In the past, cold and northern water bodies had served to deter bass from edging in. But that is changing, scientists say, as temperatures are getting warmer. **Similar impacts from warming have been noted in lakes in Wisconsin,** a U.S. state that sits just south of the Canadian province.

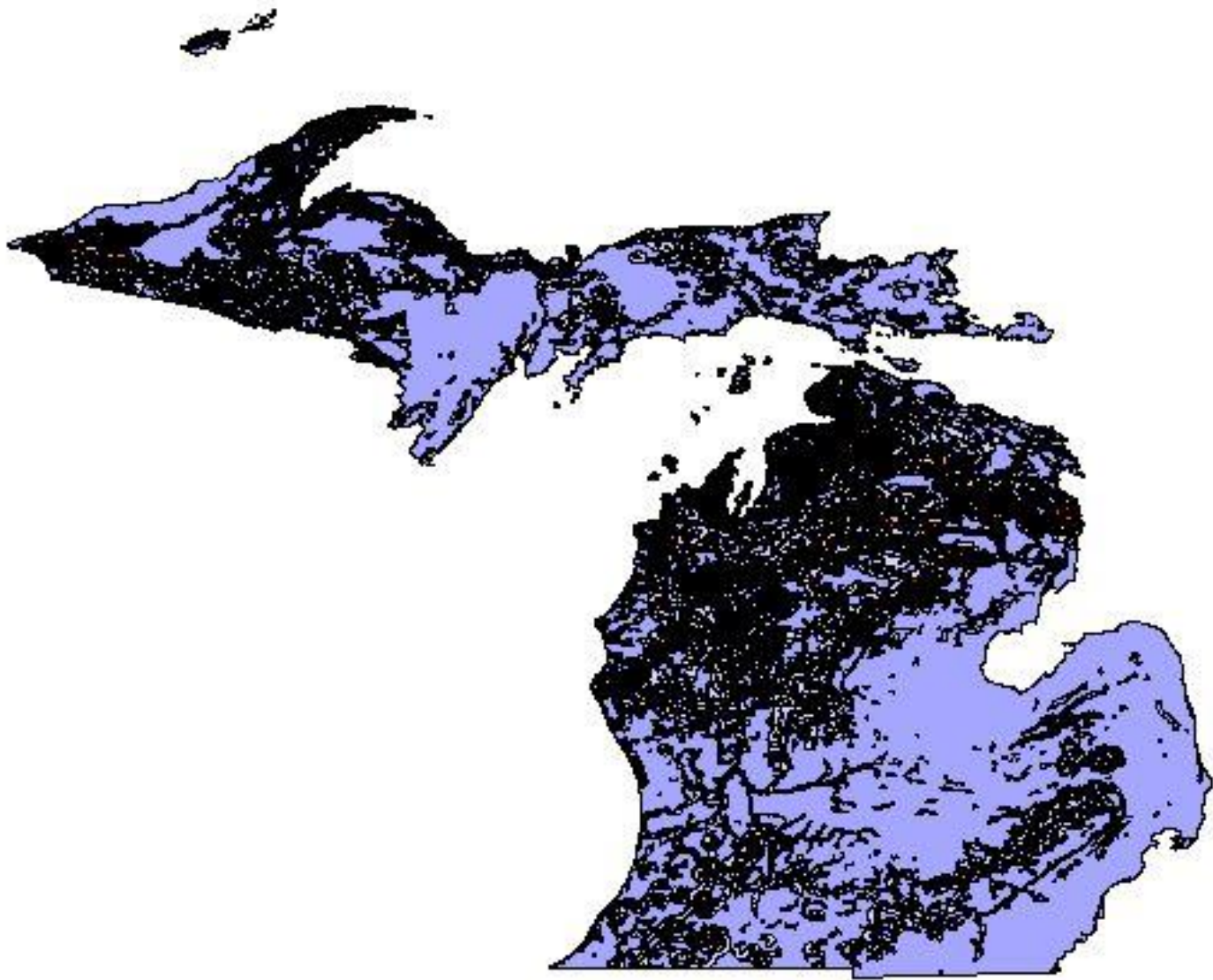


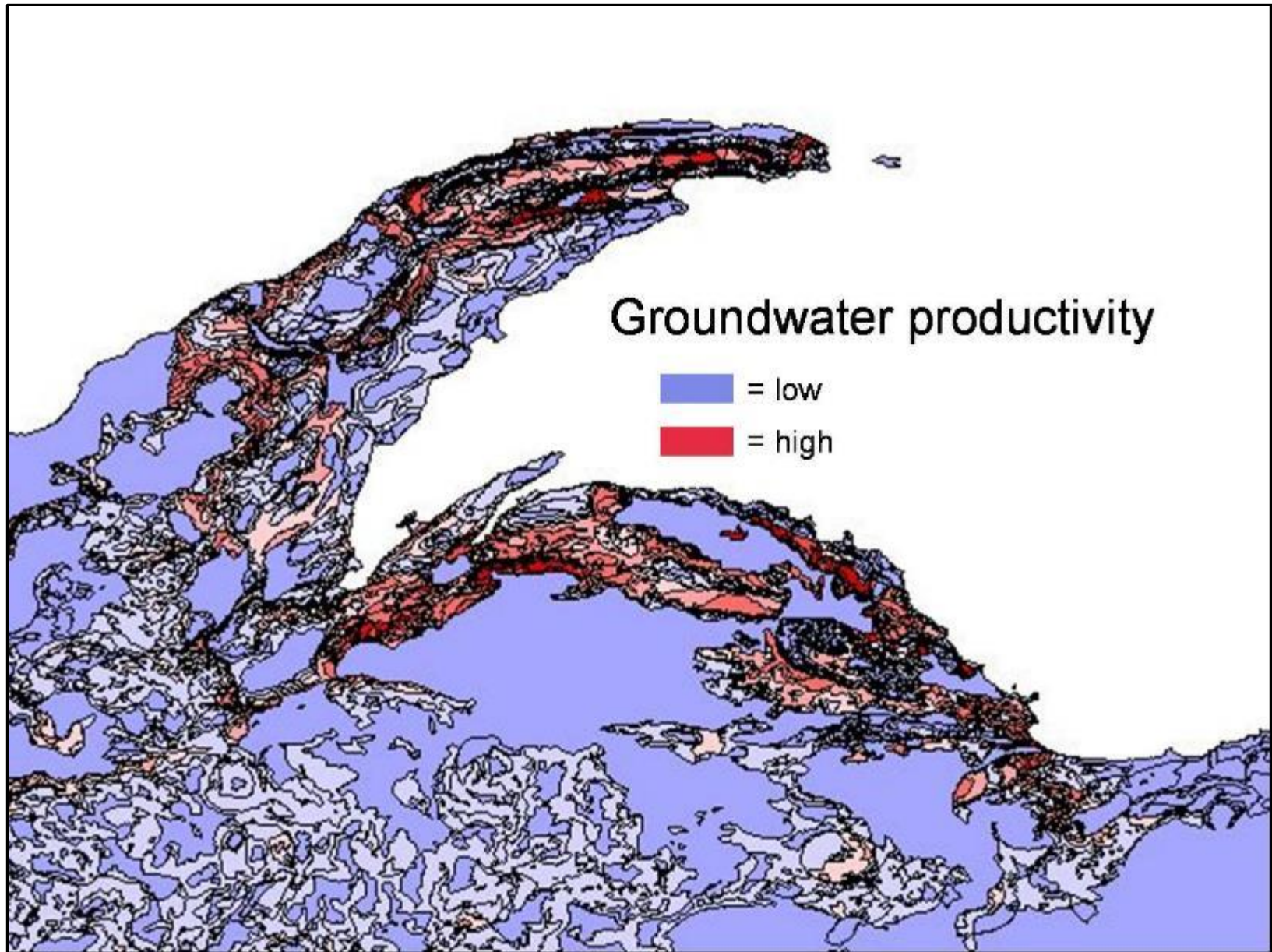


WLSMU Temp Logger 2013-2016 July Average Temperature Comparisons










Groundwater productivity

 = low

 = high