

Report for 2005MI59B: Publicizing, Facilitating the Access, and the Interpretation of the Michigan Groundwater Inventory and Mapping Project with Outreach Education

Publications

- There are no reported publications resulting from this project.

Report Follows

Synopsis

Project Number: 2005MI59B

FY 2005 Federal Funds: \$15,000 **FY 2005 Non-Federal Funds:** \$30,777

Start Date: 03/01/05 **End Date:** 02/28/06

Title: Publicizing, Facilitating the Access, and the Interpretation of the Michigan Groundwater Inventory and Mapping Project with Outreach Education

Project type: Research

Principal Investigator: William J. Northcott, Asst. Professor, Dept. Ag Engineering

Focus Categories: Water Quantity, Water Use, Education

Congressional District: Eighth

Key Words: Hydrology, Water Use Conflicts, GIS, Groundwater

Publicizing, Facilitating the Access, and the Interpretation of the
Michigan Groundwater Inventory and Mapping Project with Outreach Education

Problem and Research Objectives

The state of Michigan recently enacted Public Acts 148 and 177, which focuses on water use. Public Act 148 outlines a strategy to assess the water resources of the State utilizing existing data. The second public act, 177, establishes the mechanism to resolve disputes among groundwater users and allows the government to intercede if large water withdrawals are threatening the water resource. Educational outreach is not a component that has been included in any of the legislative initiatives. The general public needs to be informed of the published map series as well as the end users. The value-data base compiled into a map series of hydrogeologic parameters will need to be comprehensible to the public and their respective policy makers at all levels of government to aid in the understanding of these map presentations as well implementing the strategies stated in Public Act 177. Also, an explanation of what the scope of use for the map series needs to be disseminated with an outreach educational goal of interpretation and the limits applied to each map. This year the legislature has proposed legislation to require the permitting and regulation of large water withdrawals entitled the Water Legacy Act. The proposed measures would fulfill part of the Great Lakes Charter, an agreement between the eight states and two Canadian provinces bordering the Great Lakes, by regulating bulk withdrawals from the Great Lakes, inland lakes, rivers, and aquifers. Michigan is the only partner in the charter that has not committed to legislation of regulating and limiting the large water withdrawals from the surface or ground water resources or preventing the diversion of the Great Lakes. The media coverage of the Great Lakes and ultimately our water resources are being debated throughout the state by various mediums including the opinion pages, newspaper articles, meetings and briefs sponsored by special interest groups and policy makers seeking scientific conclusions and constituent's views. Michigan citizens and their legislators are a receptive audience to our proposed efforts to publicize, facilitate the access and to interpret the map series of the groundwater inventory.

Methodology, Principal Findings, Significance

The highly publicized court case in West-Central Michigan concerning a citizen's group alleging that large water withdrawals by a bottling plant is negatively impacting the surrounding water resources. Also, mining operations in the Southeast Michigan have resulted in lowering the

water levels in the area affecting neighboring wells. In East-Central Michigan, irrigation is being charged with lowering the water levels in the nearby domestic wells and influencing the upward intrusion of saltwater from a bedrock aquifer. Thus, the public's perception of an unlimited water supply and sustainable water resources is being altered by these published events of conflicting water uses. Recent environmental legislation enacted by Michigan addresses the need for an inventory of hydrogeologic data, and adopting strategies for water use conflicts, Public Act 148 and 177 respectively. Currently, proposed legislation, entitled the Water Legacy Act, has been submitted in the Michigan House and Senate subcommittees. This proposed legislation would fulfill part of the Great Lakes Charter, an agreement between the eight states and two Canadian provinces bordering the Great Lakes, by regulating bulk withdrawals from the Great Lakes, inland lakes, rivers, and aquifers. Michigan is the only partner in the charter that has not committed to legislation of regulating and limiting the large water withdrawals from the surface or ground water resources or preventing the diversion of the Great Lakes. The problem with the current and proposed legislative initiatives is the fundamental component of outreach education is overlooked. The groundwater inventory and map series will be available on a web site as directed by the statutes; but, the majority of the public sector will not be aware of the available data inventory and lack the background knowledge to understand or interpret the presented information.

Statement of results or benefits

The U.S. Geological Survey (USGS) and Michigan State University (MSU) will aid the Michigan Department of Environmental Quality (MIDEQ) in completing the requirements of section 32802 of Public Act 148 by the summer of 2005. The following requisite components to complete the inventory and a map series are:

- Location and water yielding capabilities of aquifers in the state
- Aquifer recharge rates in the state
- Static water levels of groundwater in the state
- Base flow of rivers and streams in the state
- Conflict areas in the state
- Surface waters, including designated trout lakes and streams, and groundwater dependent natural resources that are identified on the natural features inventory
- Location and pumping capacity of specific facilities
- Aggregate agricultural water use and consumptive use, by township
- Groundwater inventory and map available to the general public

The inventory and mapping project extracts, analyzes, and maps data from well record records stored in the Wellogic data base. Base flow and aquifer recharge is derived from USGS studies. Water use data and information on water use conflicts are provided by MIDEQ. The groundwater inventory mapping project will provide the tools for environmental planning. If outreach materials are developed to present a scientific framework of Michigan's water resources, the majority of the consumers, water resource managers, and policy makers will be more receptive to accept voluntary and legislative to protect and manage their water resources.

Nature, Scope, and Objectives of The Project, Including a Timeline of Activities

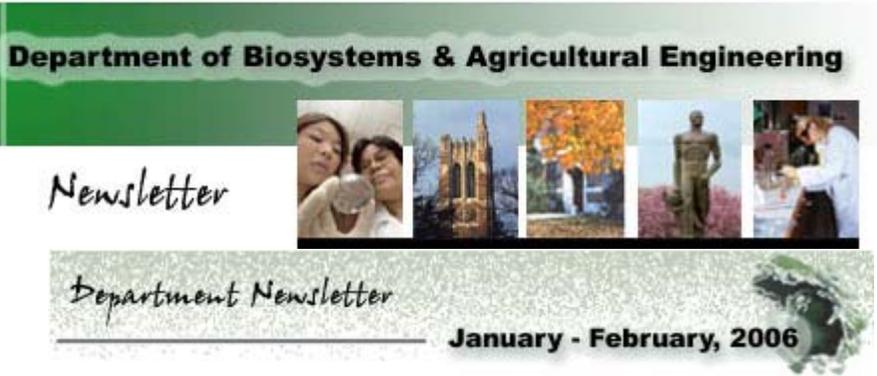
The delivery of outreach education is evolving due to computer technology available to the mainstream public. Even though data is available on web sites, the applicable explanations are

often not rationalized or clarified. When metadata is accounted for, most users are not able to comprehend the descriptive information into laymen's terms. Thus, the main objective of this outreach proposal is to summarize the groundwater inventory and map for the non-scientific sector as an aid in understanding the fundamental concepts of Michigan's water resources by a variety of methods. Networking with agencies such as the MSU extension staff and Michigan Department of Agriculture, outreach educational deficiencies and needs have been identified and will continue to be noted to the IWR.

The delivery of outreach education was accomplished by the following initiatives:

- A project overview and appraisal meeting was held March 1, 2005 at the Kellogg Center on the campus of MSU. Representatives from an array of stakeholder groups were invited including water supply consultants, well drilling contractors, academic hydrogeologists, local environmental health and the DEQ technical advisory group. Preliminary copies of the Glacial Aquifer and Bedrock Aquifers Yield maps were displayed at the March 15, 2005 annual meeting of the Michigan Groundwater Association. About fifty people viewed the maps and twelve made written comments concerning groundwater conditions in their various service areas.
- The Department of Biosystems and Agricultural Engineering Newsletter featured an article the Michigan Groundwater Inventory and Mapping Project. (article attached)
- Three meetings with Extension Coordinator, Dean Solomon, to discuss deliverables for Extension personnel and publications. (brochure attached)
- The 26th annual Ag Expo, Michigan's largest and most inclusive farm equipment and trade show, took place July 19-21 on the campus of Michigan State University. This event draws nearly 15,000 farmers and members of farm-related groups and their families annually. Our booth featured IWR's products including online demonstrations for the GW Mapping Project at <http://gwmap.rsgis.msu.edu/> and Understanding your Watershed at <http://www.iwr.msu.edu/>. (posters attached)
- In our educational tent at the Ag Expo, a GW Mapping Project "feature presentation" was delivered on July 20, 2005 to the attendees.
- Presented at the Water Quality Area Of Expertise Summer Retreat, Monday and Tuesday, August 22 and 23, 2005, (agenda attached)
- Attended 2005 Water Resources Conference, Use of Long-Term Research for Enhancing Water Quality in the Great Lakes Region, Regional Water Quality Meeting September 8 and 9, 2005 University Place Conference Center at IUPUI Indianapolis, Indiana. Attendees included those with interest in water quality research, extension, and urban water resource activities as well as those interested in using water quality data in a decision making process. Sponsors included USDA-CSREES through the Great Lakes Regional Water Quality Leadership Team, Indiana Water Resources Research Center (IWRRC), and the Center for Earth and Environmental Science (CEES) at IUPUI.
- MSU's Role in Water Use Policy Meeting to discuss how our presence (MSU) can be made known to the legislature and to determine how we can bring science based information to decision makers, November 22, 2005
- Groundwater Mapping Training session, February 14, 2006 (agenda and brochure attached)

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 Text too small or large?
 > Best viewed in Internet Explorer 5, Netscape 6 or higher.

THE MICHIGAN GROUNDWATER INVENTORY AND MAPPING PROJECT

*By: Steve Miller, BAE
 Dave Lusch, RSGIS
 Pam Hunt, IWR*

Printable pdf

In response to growing concerns about groundwater use conflicts, in 2003 Michigan Public Act 148 of 2003 was enacted. The act required the Department of Environmental Quality (DEQ) to create a "groundwater inventory and map" that includes eight specific map components, a general requirement for a groundwater inventory, and a directive to make the map and inventory available to the public. DEQ established a collaborative research team involving groundwater and mapping experts from the U.S. Geological Survey (USGS) and Michigan State University (MSU). The project team designed an interactive web site to make the mandated products available to the public to aid in understanding and evaluating the groundwater resources in Michigan .

The interactive web site's home page (<http://gwmap.rsgis.msu.edu/>) links to the following components for the Groundwater Mapping Project.

- **Interactive Map Viewer** - access the spatial map layers as well as query databases. The mandated map components are:
 - Location and water yielding capabilities of aquifers in the state - glacial yield, glacial transmissivity, glacial draw down, bedrock yield, bedrock transmissivity, and bedrock draw down
 - Aquifer recharge rates in the state
 - Base flow of rivers and streams in the state
 - Water levels of groundwater in the state
 - Surface waters, including designated trout

Groundwater Inventory and Mapping Project

What is the Groundwater Inventory and Mapping Project?

Michigan Public Act 148 of 2003 required the Department of Environmental Quality (DEQ) to create a “groundwater inventory and map” that includes eight specific map components, a general requirement for a groundwater inventory, and a directive to make the map and inventory available to the public. DEQ created a cooperative research team involving groundwater and mapping experts from the U.S. Geological Survey (USGS) and Michigan State University (MSU). This project team designed an interactive web site to make the mandated products available to the public. The site can be used to answer questions of groundwater availability in Michigan. Some examples are featured in this fact sheet.

The web site's home page (on the right) links to the completed products for the Groundwater Mapping Project.

<http://gwmap.rsgis.msu.edu>

- Interactive Map Viewer (specific map components & wells summary)
- Groundwater Information Database (query publications & bibliography)
- Project Reports
- Web Resources
- Recent Changes
- Documents

Interactive Map Viewer	Project Reports	Documents
<p>The online interactive map viewer was created by MSU Remote Sensing & GIS Research and Outreach Services (RS&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>Start the Viewer</p> <p>Viewer Tutorial</p> <p>Browser Help</p>	<p>Executive Summary (8-18-05) Print Quality: 17.1 MB Draft Quality: 2.8 MB</p> <p>Get Adobe Reader</p>	<p>PowerPoint Presentation: Intro and Overview of Project</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>Groundwater Information Database</p> <p>USGS and RS&GIS collaborated on the searchable groundwater database.</p> <p>Search the Database</p> <p>Bibliography</p> <p>Database Tutorial</p> <p>Copyright Information</p> <p>Database last updated: August 17, 2005</p>	<p>Web Resources</p> <p>Groundwater Tutorial</p> <p>Groundwater Glossary</p> <p>Groundwater Stewardship Manual</p> <p>Aquifer Basics</p> <p>Glossary of Hydrologic Terms</p> <p>Groundwater Atlas of the United States</p> <p>The Water Cycle</p>	<p>Recent Changes</p> <p>8-19-05</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>

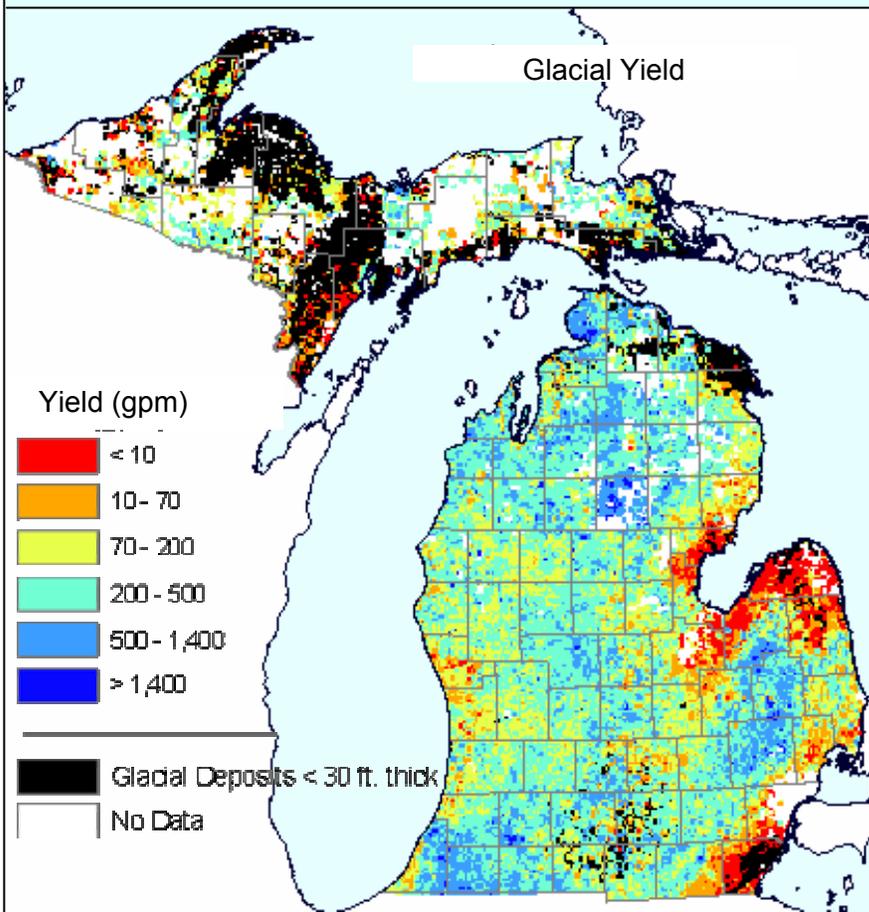
What are the specific map components?

The Interactive Map Viewer features the requisite map components:

- Location and water yielding capabilities of aquifers in the state
glacial yield, glacial transmissivity, glacial drawdown, bedrock yield, bedrock transmissivity, and bedrock drawdown
- Aquifer recharge rates in the state
- Static water levels of groundwater in the state
- Base flow of rivers and streams in the state
- Conflict areas in the state
- Surface waters, including designated trout lakes and streams, and groundwater dependent natural resources that are identified on the natural features inventory
- Location and pumping capacity of specific facilities
- Aggregate agricultural water use and consumptive use, by township
- Supplemental maps: Glacial Land systems, Wells Summary database, Wells-Complete database, Wells-Hydrologic Properties database

Each of these maps contain layer information and metadata

How abundant is groundwater in the glacial deposits?

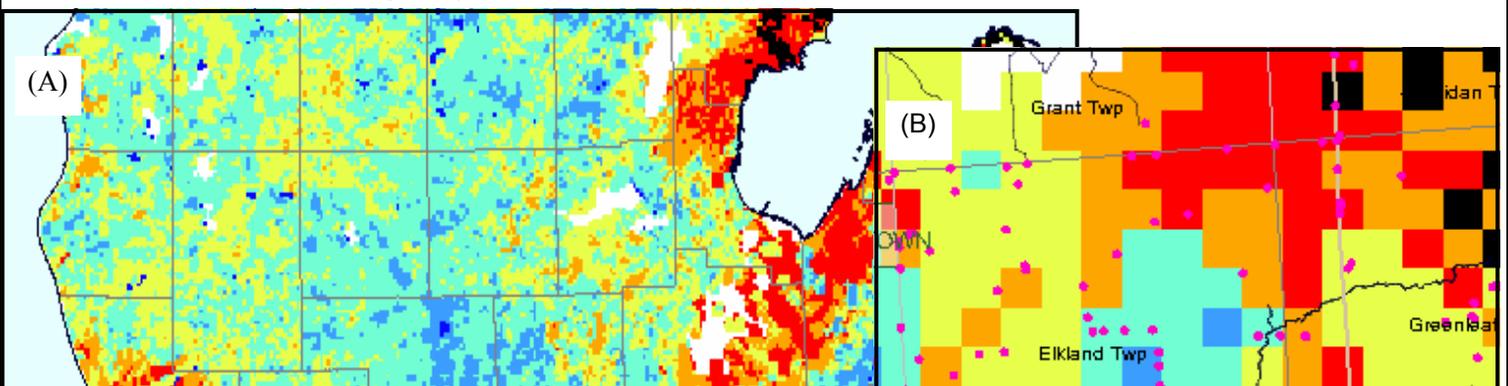


The industry-standard minimum well yield for a small residential home is 10-15 gpm. The 70 gpm yield level is the current definition of a high capacity well.

Several regions of minimal yield, <10 gallons per minute (gpm), are obvious on the Glacial Yield map on the left, most notably in the areas northwest, south, and southeast of Saginaw Bay, the tip of the “thumb”, and southeastern most Lower Michigan. Many areas in Delta and Menominee counties in the Upper Peninsula also exhibit poor yields. Note that in these areas, some homeowners have wells in glacial deposits that yield sufficient water. Local-scale heterogeneity (lithologic variations within 10-1000 meters) is very difficult to quantify and display on a statewide map. As such, site-specific investigation is always prudent when planning high-capacity groundwater withdrawals.

High capacity wells are routinely possible throughout much of Lower Michigan (excluding the areas shown in red and orange). Zones of very high yield potential are located in southwestern and south-central Lower Michigan, in the core of the “thumb” (Oakland, Lapeer and southeastern Tuscola counties), in the Houghton-Higgins lakes district of northern Lower Michigan and across the “tip of the mitt.”

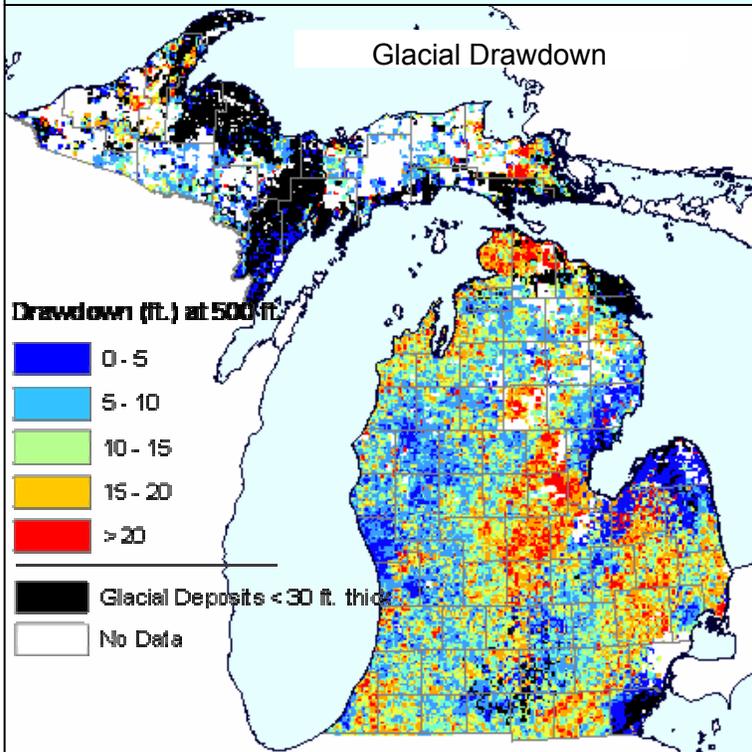
The “Full Extent” view as shown above for the Glacial Yield Map is primarily useful to observe the gross, statewide patterns of the theme and navigating to a closer view. In most cases, the inherent detail of the theme cannot be observed at this small presentation scale. Zooming in on about a third of the state (A) makes the individual 1 km² grid cells of this theme just visible and heterogeneous areas (many different colors side by side) become more obvious. Zooming in until the vertical dimension of the viewer window encompasses a few townships (B) makes the individual grid cells very obvious. At this and larger presentation scales, the water well point file (“Wells Summary DB”) can be displayed and gives the map reader a better appreciation of the “control” that exists for the interpolation of the data (note that many cells do not contain a data point).



WELLS SUMMARY

WELLID	IMPORT_ID	COUNTY	TOWNSHIP	TOWN_RANGE	SECTION	OWNER_NAME	WELL_ADDR	WELL_DEPTH	WELL_TYPE	
33000008374	Lith Info	33040224002	Ingham	Lansing	04N 02W	24	MSU POULTRY RESEARCH	3606 E MT. HOPE RD.	352	*U

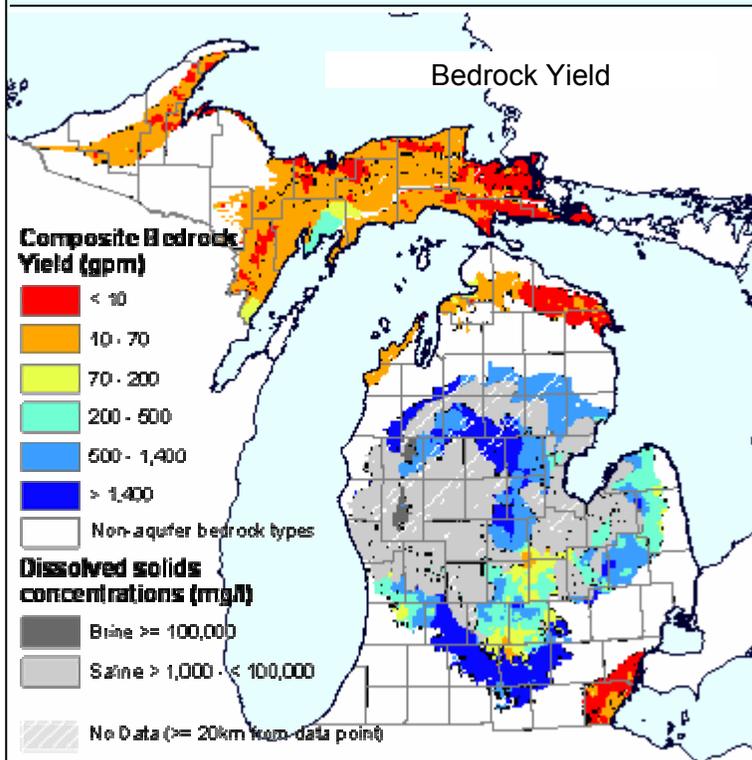
What is the probability that a high capacity well will adversely impact a small capacity well in the glacial deposits?



The estimated drawdown map for pumping from glacial deposits follows the general patterns noted for the yield map (shown on left hand page) with one interesting exception. Areas of low estimated drawdown (less than 5 ft) occur both where the estimated yield is moderate (70-200 gpm) and where it is low (<10 gpm). In the low-yield areas, the small estimated drawdown results from the inability of the water-bearing materials to provide enough groundwater to impact a well 500 feet away.

In areas of moderate yield, the available drawdown and transmissivity of the glacial deposits are such that the estimated yield can be obtained without significantly lowering the groundwater level 500 feet away. In these areas, a high capacity well capable of pumping at a rate larger than the estimated yield might be possible (for example, by drilling a well much deeper than the typical wells in the area) and such a well could impact groundwater levels 500 feet away.

How abundant is groundwater in the bedrock deposits?



The bedrock aquifer map depicts those areas of the state where groundwater is readily available from the bedrock. The highest estimated yields from bedrock aquifers occur in the central and southern portions of the Lower Peninsula especially in Jackson, Calhoun and Barry counties where high yields are associated with a productive sandstone unit (Marshall Formation).

Lower yields are typical from bedrock aquifers in the Upper Peninsula, the northern swath of the Lower Peninsula and the southeast corner of the state. These aquifers are generally comprised of sandstone and carbonate units in the Upper Peninsula and predominately carbonate strata in the Lower Peninsula.

In the Lower Peninsula, the white areas are generally characterized by shale bedrock units that normally do not serve as aquifers, such as the Coldwater Shale that underlies much of southwestern and southeastern Lower Michigan and an arcuate swath from Mason to Alcona counties in the northern Lower Peninsula. Much of the western Upper Peninsula is dominated by hard-rock units that only produce groundwater along

localized fracture traces. Nevertheless, there are residential wells in these areas of the State that derive water from fractures in the upper part of these "non-aquifer" units.

How can I search the available information that describes groundwater characteristics in Michigan?

The project team searched the available literature for relevant theses, journal articles, abstracts, conference presentations/papers, and government documents describing groundwater characteristics in Michigan. The bibliography contains 464 citations with over 220 digitally scanned documents.

Several search options are available on the Groundwater Information Database. Click on the link, [Search the Database](#), the picture on your right shows all of the available search options.

A hydrogeological summary is available for each county. The county summary describes the site location within the State and the watersheds located within the county. The glacial and bedrock deposits are described for the county. A search for county data will access type of wells, range of transmissivity and storativity, and amount of water used for each county.

Reports cited in the summaries can be accessed by location, author, watershed name or by a hydrologic unit code.

Aquifer data for wells listed in reports can be searched by county, type of aquifer, and type of test.

A list of reports that contain water quality data can be generated.

Find county summaries. Find a written summary of the hydrogeologic characteristics for each county.	<input type="text" value="Alcona"/>	<input type="button" value="Search"/>
Find county data. Find the type of wells, range of transmissivity and storativity, and amount of water used for each county.		<input type="button" value="Search"/>
Find reports. Find reports pertaining to the groundwater resources in Michigan by location, author, watershed name or code.		
Location:	<input type="text" value="Statewide"/>	<input type="button" value="Search"/>
Author:	<input type="text" value="Aichele, S., Hill-Rowley, R., and Malone, M."/>	<input type="button" value="Search"/>
Watershed name:	<input type="text" value="Au Gres-Rifle"/>	<input type="button" value="Search"/>
8-digit Hydrologic Unit Code:	<input type="text" value="04010302"/>	<input type="button" value="Search"/>
Find aquifer data. Find aquifer data for wells listed in reports sorted by county, type of aquifer, and/or type of test.		
County:	<input type="text" value="Arenac"/>	
Type of aquifer: glacial (D) or bedrock (R)	<input type="text" value="ALL"/>	
Type of test:	<input type="text" value="ALL"/>	<input type="button" value="Search"/>
Find any water quality data. Generate a list of reports that contain water quality data.		<input type="button" value="Search"/>
Find nutrient water quality data. Find reports that specifically list or discuss nutrient water quality data.		<input type="button" value="Search"/>

[Pringle, G.H., 1937, Geology of Arenac County. Michigan Geological Survey Division, Progress Report 3, 31 p.](#)

[Radfar, Shahbaz. 1979. Determination of recharge areas from ground-water quality data, Ingham County, Michigan \(M.S. thesis\): East Lansing, Michigan State University.](#)

[Reed, J.E., Deutsch, Morris, and Wittala, S.W., 1966, Induced recharge of an artesian glacial-drift aquifer at Kalamazoo, Michigan. U.S. Geological Survey Water-Supply Paper 1594-D, 62 p.](#)

The full bibliography is also available on the Groundwater Information Database, excerpt shown at left.

The inventory and map products are available to end-users in three ways.

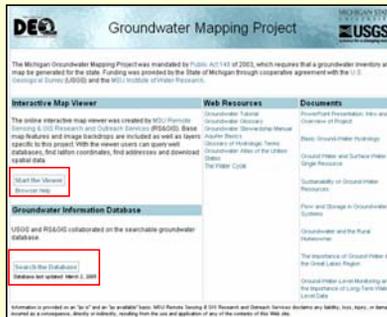
- (1.) Web-based mapping site hosted by MSU (gwmap.rsgis.msu.edu). The digital data are also available for download from this site.
- (2.) Digital data provided on compact disc for use with the Map Image Viewer software, an easy-to-use GIS software package for viewing and analyzing spatial data. MSU provides this mechanism. There is a charge for this service for users other than local health departments and the DEQ.
- (3.) The digital data will also be available for download through the State of Michigan, Center for Geographic Information (www.michigan.gov/cgi).

Groundwater Mapping Project

Groundwater inventory and maps available at: <http://gwmap.rsgis.msu.edu/>

- Aquifer recharge rates
- Base flow of rivers & streams
- Location and water yielding capabilities of aquifers
- Static water levels of groundwater
- Conflict areas in the state

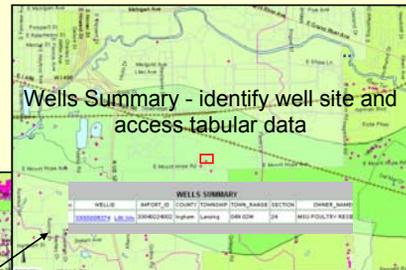
- Surface waters, including designated trout lakes and streams, and groundwater dependent natural resources identified by natural features inventory
- Location and pumping capacity of specific facilities
- Aggregate agricultural water use & consumptive use, by townships



Interactive Map Viewer



legend



Wells Summary - identify well site and access tabular data

zoom in to locate site area

Base map features and image backdrops are included to use with the specific layers

of the Groundwater Mapping Project. With the viewer, users can query well databases, find latitude/longitude coordinates, find addresses, & download spatial data.

Click on the link, [Search the Database](#). Several search options are available in this groundwater database. A county summary is available for each county as well as county data describing hydrogeological parameters. Publications cited in the summaries can be accessed and downloaded. Publications that contain aquifer data and water quality data can be searched as well.

Groundwater Information Database



A Sense of Place in Michigan's Watersheds



What is a Watershed? A watershed is the area of land that drains into a body of water such as a river, lake, stream or bay. It is separated from other systems by high points in the area such as hills or slopes. It includes not only the waterway itself but also the entire land area that drains to it. For example, the watershed of a lake would include not only the streams entering the lake but also the land area that drains into those streams and eventually the lake. Drainage basins generally refer to large watersheds that encompass many smaller watersheds. Each of these areas is considered to be a watershed at a certain scale and may be referred to as catchments, sub basins, sub watershed, or watersheds. Understanding how you impact a watershed is the first step toward protecting water quality. By being informed you can learn the simple things you can do as a homeowner or business owner to help improve water quality.



This diagram shows the larger watersheds or drainage basins in Michigan's lower peninsula. The Lansing, East Lansing, and Jackson areas are located within the Upper Grand Watershed, which eventually flows into the Lower Grand Watershed and then into Lake Michigan. Michigan is unique in that it is almost entirely contained within the Great Lakes Basin. Because of this there are many activities and projects at the IWR and all around Michigan which focus on improving the water quality in the Great Lakes Basin and its watersheds.

The Upper Grand watershed is a 572,376-acre watershed in parts of Hillsdale, Jackson, Eaton, Washtenaw, and Ingham Counties. Land uses within this watershed are about 6% agriculture, 20% urban, and 20% forestry. The Upper Grand River was once heavily polluted. The water quality has since been improved by decreasing point source and non point source pollutants. This has enhanced the fish and aquatic invertebrate community composition. Several portions of the Upper Grand River still fail to meet water quality standards. However, with proper surface and groundwater protection, land use, and watershed management planning, we can improve the water quality in the Upper Grand as well as other watersheds in Michigan.



The Red Cedar River is the main flow of surface water in the Red Cedar Watershed in which MSU's campus is located. The Red Cedar River arises in Cedar Lake in the south-central Lower peninsula of Michigan and flows about 45 miles to its confluence with the Grand River in the city of Lansing. It has 12 tributaries and drains a total area of about 472 square miles. The river provides mid-Michigan residents with numerous recreational opportunities which include angling, canoeing, kayaking, photography and bird watching. The river also serves as a source of water for the irrigation of crops throughout the watershed.



Upper Grand Watershed

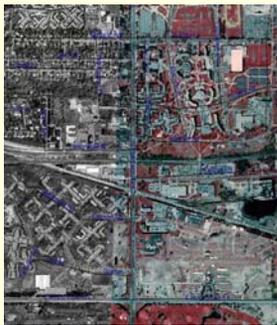
These pictures show several scales of the Red Cedar Watershed in which we are currently located. You can obtain pictures and display various features of your watershed by visiting the IWR website, <http://www.iwr.msu.edu/>, and clicking on "Tools and Data" then "Watershed Mapping".



1 : 57,700



1 : 28,850



1 : 14,425



1 : 7,212

Agenda

Water Quality AOE Summer Retreat
Monday and Tuesday, August 22 and 23, 2005
Kettunen Center
14901 4H Drive
Tustin, MI 49688

Monday

9:30 AM – AOE Business meeting

Noon – Lunch in dining room

1:00 – 5:00 PM – Watershed and limnological investigation using Center Lake,
Osceola County
Howard Wandell, Lois Wolfson and Jane Herbert

6:00 PM Dinner in courtyard – evening free for boating, swimming, hiking,
relaxing

Tuesday

7:30 AM Breakfast in dining room – check out of rooms

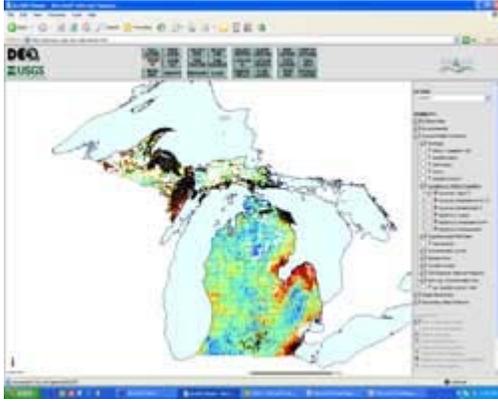
8:30 AM New MSU Groundwater mapping tool (PA 148) – overview and in-
service training

Dave Lusch, Steve Miller, and Pam Hunt

11:30 – Lunch in dining room

12:30 – 3:30 PM Meet with Jerry Lindquist, Osceola County ANR Educator, and
then leave for MAEAP/CAFO visit

3:30 PM Return to Center or leave for home directly from farm



**Groundwater mapping
project web site training
Tuesday, February 14, 2006
Geography Building
Michigan State University**

The Michigan Groundwater Mapping Project was mandated by Public Act 148 of 2003, which required that a groundwater inventory and map be generated for the state. The resulting web site, developed by the MSU Remote Sensing & Geographic Information Science Research and Outreach Services (RS&GIS) in cooperation with the MSU Institute of Water Research (IWR), USGS and MDEQ, includes a wealth of useful information and tools for agriculture and natural resources professionals, local leaders and landowners.

The Groundwater Mapping Project web site can help you:

- find specific information about wells in your community
- learn about groundwater use and availability in your community
- access past groundwater reports and studies
- access aerial photographs and map features
- predict drawdown from wells
- locate groundwater-dependent resources such as trout lakes and streams, and certain wetland types

Join us for this special in-service training to help MSU Extension and Michigan Groundwater Stewardship Program staff members learn about the features of this systems and how to use the tools in their communities.

Resource people will be Dave Lusch (RS&GIS and IWR), Steve Miller (MSU Biosystems and Agricultural Engineering and IWR) and Pam Hunt (IWR).

Agenda

9:30 am - noon	Introduction to the Groundwater Mapping Project and web site <ul style="list-style-type: none"> • Project background • Web site overview • Features and data resources • Example applications and limitations
noon - 1:15 pm	Lunch on your own
1:15 - 4:00 pm	A hands-on session at computers for those who intend to extensively use the tool in their community.
4:00 p.m.	Adjourn

You may attend just the morning overview session or the whole day.

How to register

There is no fee for this program, but pre-registration on this web site is required.

Registration deadline is Tuesday, February 7. Registration is limited, so sign up early!

[Registration form](#)

Directions and parking

[Directions to the Geography Building.](#) Parking passes will be mailed to you if you register before February 3. Otherwise, permits will be available at the program registration desk.

For additional information, contact [Dean Solomon](#), phone 269-671-2412 x221.

The Michigan Groundwater Inventory and Mapping Project

What is the Michigan Groundwater Inventory and Mapping Project?

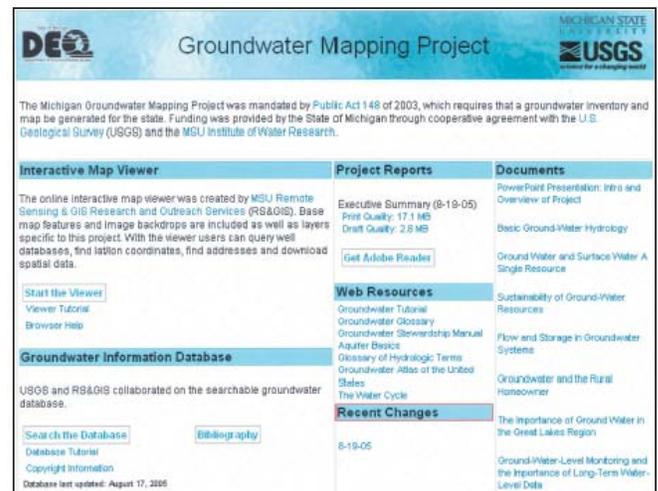
The Michigan Groundwater Inventory and Mapping Project is a project to aid in understanding and evaluating the groundwater resources in Michigan and fulfills the mandates of Michigan Public Act 148 of 2003. The act required the Department of Environmental Quality (DEQ) to create a “groundwater inventory and map” that includes eight specific map components, a general requirement for a groundwater inventory and a directive to make the map and inventory available to the public. DEQ established a collaborative research team involving groundwater and mapping experts from the U. S. Geological Survey (USGS) and Michigan State University (MSU). The project team designed an interactive web site to make the mandated products available to the public.

The interactive website’s home page (gwmap.rsgis.msu.edu) links to the following components for the Groundwater Mapping Project.

- **Interactive Map Viewer**—access the spatial map layers as well as query databases. The mandated map components are:
 - Location and water yielding capabilities of aquifers in the state—glacial yield, glacial transmissivity, glacial drawdown, bedrock yield, bedrock transmissivity and bedrock drawdown.
 - Aquifer recharge rates in the state.
 - Base flow of rivers and streams in the state.
 - Water levels of groundwater in the state.
 - Surface waters, including designated trout lakes and streams, and groundwater dependent natural resources that are identified on the natural features inventory.
 - Location and pumping capacity of specific facilities.
 - Aggregate agricultural water use and consumptive use, by township.
 - Conflict areas in the state.
 - Supplemental maps: Glacial Landsystems, Wells Summary database, Wells-Complete database, Wells-Hydrologic Properties database.

Additional map layers, including political boundaries, roads, aerial photos, topography, satellite imagery, land use, environmental sites and many more are available.

- **Groundwater Information Database**—access more than 220 articles digitally scanned and a bibliography with more than 480 groundwater relevant citations.
- **Project reports**—the Executive Summary contains a synopsis of the statewide conditions for each of the map components and inventory.
- **Web resources**—links to primers on groundwater and water resources.
- **Documents**—online documents concerning water resources.
- **Online tutorials**—for the Interactive Map Viewer and Groundwater Information Database.



Who can use this site and why?

Anyone with internet access can make use of this interactive website. The Michigan Groundwater Mapping Project website is targeted for a wide audience, for example, planners, watershed groups, policy makers, scientists, educators and citizens. This site can be used to investigate and evaluate areas of interest regarding the groundwater resources of Michigan.

What kind of questions can be answered by the Michigan Groundwater Inventory and Mapping Project website?

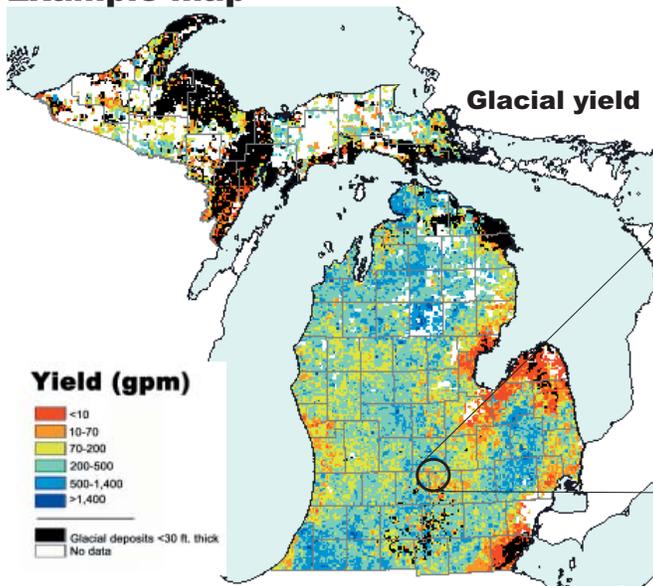
- How abundant is groundwater in the glacial and bedrock deposits?
- What is the probability that a high capacity well will adversely impact a small capacity well in the glacial deposits?
- Where and what type of water wells exist in my vicinity?
- Where are the groundwater dependent features, for example, trout streams and lakes, and Michigan Natural Features Inventory identified wetlands, located?
- What type of water use is in my area and how much groundwater is being withdrawn?
- What are the hydrogeologic characteristics of my county or watershed?
- Are there any publications with water quality data for groundwater in my area?

How can I obtain components of the inventory and map products?

The inventory and map products are available to end-users in three ways:

- Web-based mapping site hosted by MSU (gwmap.rsgis.msu.edu). The digital data and publications are available for download from this site.
- The digital data are available for download through the State of Michigan, Center for Geographic Information (www.michigan.gov/cgi) for use in a GIS mapping software.
- Digital data provided on compact disc for use with the Map Image Viewer software, an easy-to-use GIS software package for viewing and analyzing spatial data. MSU provides this mechanism. There is a charge for this service for users other than local health departments and the DEQ.

Example map



Well data

WELLS SUMMARY									
WELLID	IMPORT_ID	COUNTY	TOWNSHIP	TOWNSHIP_RANGE	SECTION	OWNER_NAME	WELL_ADDR	WELL_DEPTH	WELL_TYPE
33000000374	Lib Inv	33040224002	Ingham	Lansing	04N 02W	24	MSU POULTRY RESEARCH 3808 E MT. HOPE RD.	352	"U

Zoom view



This example glacial yield map highlights some of the interactive map viewer features. The zoom feature allows viewing of smaller geographic areas. At this scale, water well point data can be displayed and queried.

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