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Objectives

Why is the Water Wonderland regulating water withdrawals?

Brief review of Michigan Water Law.

► Water Use Legislation of 2006 & 2008.

Some key terms & concepts.

Review the environmental criteria now used to assess "adverse resource impacts."



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Objectives

Introduction to the Water Withdrawal Assessment Tool.

Overview of Michigan's groundwater resources and an example of the river classification from west-central Lower Michigan.



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- Why does Michigan, the "water wonderland", regulate water withdrawals?
- One main reason



- Diversions of water from the Great Lakes Basin
 - Commerce Clause of the U.S. Constitution
 - Great Lakes Compact



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- A diversion is any transfer of water across watershed boundaries through a pipeline or canal.
- Existing diversions of Great Lakes water provide municipal drinking water, support irrigation and industry, are used for hydroelectric power production and also support shipping and recreational boating.



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Source: "Protection of the Waters of the Great Lakes," International Joint Commission Interim Report, 1999.



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- Commerce Clause
 - Article 1, Section 8, Clause 3 of the United States Constitution, states that Congress has the power

"to regulate commerce with foreign nations, and among the several states, and with the Indian tribes;"

- States may not subject **inter**state water transfers (*i.e.*, diversions) to a higher standard than **intra**state ones.



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Great Lakes Basin Water Resources Compact

- A binding agreement which specifies that each of the eight States and two Provinces in the Great Lakes Basin will manage and regulate new or increased withdrawals within their jurisdictions.
- The Compact took effect on Oct 3, 2008 when it became federal law.



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Michigan Water Rights

- A "bundle of legal rights" may be transferred with property from seller to buyer. These rights may include sporting rights, mineral rights, development rights, air rights, and water rights, to name a few.
- Water rights in Michigan, and in the eastern U.S. in general, are subject to the *reasonable use doctrine* and the *correlative rights rule*.



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• Reasonable use doctrine

- Permits a landowner to make use of water on, adjacent to, or under their property, so long as such use does not
 - unreasonably interfere with the rights of adjacent or neighboring landowners to the reasonable use of water from their property,



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• Reasonable use doctrine

- Permits a landowner to make use of water on, adjacent to, or under their property, so long as such use does not
 - decrease the value of the adjacent or neighboring land for legitimate uses, and
 - 3) unreasonably impair the quality of the water leaving their property.



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- Michigan Water Rights
 - The correlative rights rule holds that in addition to being reasonable, water use must also be prorated among all users during times of shortage.



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Michigan Water Rights

- So, water rights in Michigan are not absolute; rather they are qualified rights, subject to
 - the *reasonable use doctrine* and
 - the *correlative rights rule*.



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Michigan Water Rights

- State of Michigan Court of Appeals ruling of November 29, 2005 in the case of Michigan Citizens for Water Conservation, R. and B. Doyle, and J. and S. SAPP v Nestle Waters North America Inc.
- "... in order to recognize the interconnected nature of water sources and fully integrate the law applicable to water disputes, we adopt the *reasonable use balancing test* first stated in *Dumont v Kellogg*, 29 Mich 420 (1874) as the law applicable to disputes between riparian (*i.e.*, surface water) and groundwater users".



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Michigan Water Rights

- State of Michigan Court of Appeals ruling of November 29, 2005 in the case of Michigan Citizens for Water Conservation, R. and B. Doyle, and J. and S. SAPP v Nestle Waters North America Inc.
- "... defendant's water use [*i.e.*, bottled water]
 is not inherently unreasonable."
- "While we have determined that defendant's proposed withdrawal rate of 400 gpm would be unreasonable in light of the factors analyzed, this does not necessarily mean defendant should be completely enjoined from making use of its wells."



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Michigan Water Rights

- State of Michigan Court of Appeals ruling of November 29, 2005 in the case of Michigan Citizens for Water Conservation, R. and B. Doyle, and J. and S. SAPP v Nestle Waters North America Inc.
- "On the contrary ... defendant is entitled to make reasonable use of the available water resources, and plaintiffs may properly be compelled to endure some measure of loss, as long as an adequate supply of water remains for their own water uses."



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Water use reporting and registration has been required by statute since 1995 (part 327, PA 451 of 1994; amd. May 24, 1995).



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- Water use legislation in 2006
 - PAs 33 37
 - see the handout for details



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• Act 33, PA of 2006

- Adverse resource impact means either
 - Decreasing the flow of a stream by part of the index flow such that the stream's ability to support characteristic fish populations is functionally impaired, or
 - Decreasing the level of a body of surface water such that its ability to support characteristic fish populations is functionally impaired.



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• Act 33, PA of 2006

- A person shall not make a new or increased large quantity withdrawal that causes an adverse resource impact.
- This section does not apply to the baseline capacity of a large quantity withdrawal that existed on February 28, 2006.
- A person who developed the capacity to make a new or increased large quantity withdrawal on or after February 28, 2006 and prior to February 1, 2009 is subject to the definition of adverse resource impact that existed on February 28, 2006.



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• Act 33, PA of 2006

- Except as authorized by the public health code (1978 PA 368, MCL 333.1101 to 333.25211), a local unit of government shall not enact or enforce an ordinance that regulates a large quantity withdrawal.
 - This section is not intended to diminish or create any existing authority of municipalities to require persons to connect to municipal water supply systems as authorized by law.



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- Withdrawal
 - The removal of water from its source for any purpose, other than for hydroelectric generation at sites certified, licensed, or permitted by the federal energy regulatory commission.



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Large quantity withdrawal

- 1 or more cumulative total withdrawals of over 100,000 gallons of water per day average in any consecutive 30-day period that supply a common distribution system.
- -100,000 gpd = 70 gpm pumping capacity



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 New or increased large quantity withdrawal

– a new water withdrawal of over 100,000 gpd average in any consecutive 30-day period or an increase of over 100,000 gpd average in any consecutive 30-day period beyond the baseline capacity of a withdrawal.



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- Baseline capacity means either:
 - (A) The withdrawal capacity as reported in the April 1, 2007 annual report or water use conservation plan
 - For a community supply, the total designed withdrawal capacity for the community supply under the SDWA, 1976 PA 399.
 - For a quarry or mine the discharge volume stated in an authorization to discharge under part 31.



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Baseline capacity also means:

• The system capacity used or developed to make a withdrawal on July 9, 2008, if the system capacity and a description of the system capacity are included in an annual report that is submitted under this part.



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- Baseline capacity also means:
 - (B) The highest annual amount of water withdrawn as reported under this part for calendar year 2002, 2003, 2004, or 2005, if the person making the withdrawal does not report under subparagraph (A)



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- Adverse Resource Impact
 - Until February 1, 2009, "adverse resource impact" means decreasing the flow of a river or stream by part of the index flow so that its ability to support characteristic fish populations is functionally impaired.
 - A qualitative standard.



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- Sources of Water in Rivers
 - -Overland Flow
 - Interflow
 - -Baseflow (groundwater discharge)
 - Direct precipitation in channel



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Sources of Water in Rivers





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- The baseflow of a river is the amount of groundwater that discharges from an aquifer into the watercourse.
 - Baseflow occurs year-round, but fluctuates seasonally depending on the level of the water-table aquifer.
 - The baseflow of a river is supplemented by direct runoff during and immediately after precipitation or snowmelt events.



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Runoff dominated river – very little baseflow: "flashy" and warm

Intermediate river – baseflow + runoff: warm/cool, but fewer extremes

Baseflow dominated river – very little runoff – cold/cold transitional



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• Index Flow - the flow that is met or exceeded 50% of the time for the lowest summer flow month of the flow regime, determined over the period of record or extrapolated from USGS flow gauges in Michigan.





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- Water use legislation in 2008
 - 12 new statutes: PAs 179 190
 - see handout for details



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- Water use legislation in 2008
 - Added Part 342 to NREPA
 - -Created the Great Lakes-St. Lawrence River Basin Water Resources Council.
 - Prohibits all new or increased diversions, subject to exceptions for straddling communities and some intra-Basin transfers.



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- Water use legislation in 2008
 Added Part 342 to NREPA
 - -Requires each state to create a program for the management and regulation of new or increased withdrawals and consumptive uses, including threshold levels for their regulation.



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Water use legislation in 2008

- Amended Part 327 of NREPA
 - Revised several definitions used in the part, including the definition of adverse resource impact.
 - Revised requirements for a property owner to register with the DEQ before making a LQW, and revised water withdrawal permit requirements.



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- Water use legislation in 2008
 - Amended Part 327 of NREPA
 - -Created a **rebuttable presumption** that a proposed withdrawal will not cause an adverse resource impact, under certain circumstances.



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- Water use legislation in 2008
 - Amended Part 327 of NREPA
 - Required the DEQ to make available for testing and evaluation an internet-based water withdrawal assessment tool that can determine if a proposed withdrawal is likely to cause an adverse resource impact on October 1, 2008.
 - Required the DEQ to implement the assessment tool on July 9, 2009.



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- Water use legislation in 2008
 - LQW management provisions
 - ARI Standard Re-defined
 - Zone Concept Introduced
 - Water Withdrawal Assessment Process Established
 - Provides for Site-Specific Reviews



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- Water use legislation in 2008
 - Adverse Resource Impact (beginning Feb 1, 2009)
 - For streams and rivers, any withdrawal resulting in a specified % decrease in either *Thriving Fish Populations* or *Characteristic Fish Populations*, as the result of a reduction in the Index Flow
 - Irrespective of fish populations, decreasing the Index Flow by more than 25%
 - % reduction in the Index Flow as specified by the statute



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Fish Biology

 If you sampled the fish populations of various stretches of rivers and streams, how could you determine the species that are characteristic of that place in the system, versus those that are really thriving in that location or those which are "outside of their comfort zone"?



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Fish Biology

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-Biologic niche concept





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Fish Biology

-Characteristic Fish Populations

• Fish species, including thriving fish, that are typically **found at high densities**

- Thriving Fish Population

- Fish species that are expected to flourish
- Typically found at very high densities



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Modeling Species Distribution

- –MDNR Fisheries Biologists have determined that variations in species abundance in rivers are most closely associated with:
 - Catchment area
 - July mean water temperature
 - Baseflow yield (baseflow per unit area)



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Fish Species Distribution



Modeling Species Distribution

- The huge variety of stream segments in terms of catchment area and mean July temperature had to be simplified to create a practical classification system to support riverine resource management.
 - Three catchment sizes
 - -Four temperature regimes



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River Systems by Size

- Stream:

- flowing body of water
- drainage area < 80 sq. miles
 - flows range from 0.02 to 46,600 gpm

– Small River

River with a drainage area < 300 sq. miles
 Flows range from 3,878 to 90,343 gpm

– Large River

- River with a drainage area \geq 300 sq. miles
 - flows range from 19,484 to 694,858 gpm



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• River Systems by Temperature

- Cold
 - Streams and small rivers **no large rivers**
 - Summer water temp sustains cold-water fish
 - Average annual water temperature < 19° C
 - Small increase in temp \rightarrow no change in fish
- Cold-transitional
 - Streams, small rivers and large rivers
 - Summer water temp sustains cold-water fish
 - Small increase in temp → decline in cold-water fish



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River Systems by Temperature

- Cool
 - Streams, small rivers and large rivers
 - Summer water temp sustains warm-, cool- and cold-water fish
 - Average annual water temperature $19^{\circ} < 22^{\circ}$ C
- Warm
 - Streams, small rivers and large rivers
 - Summer water temp sustains warm-water fish
 - Average annual water temperature $\geq 22^{\circ} C$



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Withdrawal Impacts on Rivers

-Reduced flow

-Altered water temperatures



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• Withdrawal Impacts on Rivers





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Withdrawal Impacts on Fish



Withdrawal Impacts on Fish



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• Impact criteria – one size does NOT fit all!



• Impact criteria – Zones A, B, C or D

Temp	Size	Zone A (% Index Flow)	Zone B (% Index Flow)	Zone C (% Index Flow)	Zone D (% Index Flow)
Cold	Stream	Reduction < 14	None	$14 \leq \text{Reduction} < 20$	Reduction ≥ 20
	Small R.	Reduction < 10.5	None	$10.5 \leq \text{Reduction} < 21$	Reduction \geq 21
Cold Trans	Stream	None	Reduction < 4	None	Reduction \ge 4
	Small R.	None	Reduction < 2	None	Reduction ≥ 2
	Large R.	None	Reduction < 3	None	Reduction \geq 3
Cool	Stream	Reduction < 6	$6 \leq$ Reduction < 15	$15 \leq \text{Reduction} < 25$	Reduction \geq 25
	Small R.	Reduction < 15	$15 \leq \text{Reduction} < 19$	19 ≤ Reduction < 25	Reduction ≥ 25
	Large R.	Reduction < 14	$14 \leq \text{Reduction} < 19$	$19 \leq \text{Reduction} < 25$	Reduction \geq 25
Warm	Stream	Reduction < 10	$10 \leq \text{Reduction} < 18$	$18 \leq \text{Reduction} < 24$	Reduction ≥ 24
	Small R.	Reduction < 8	$8 \leq$ Reduction < 13	$13 \leq \text{Reduction} < 17$	Reduction \geq 17
	Large R.	Reduction < 10	$10 \leq \text{Reduction} < 16$	$16 \le \text{Reduction} < 22$	Reduction \geq 22



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- What do we need to know to assess withdrawal impacts on rivers?
 - -Which stream segments will be impacted by a proposed withdrawal (distance matters)?
 - -Index flow of the affected streams.
 - -Temp- and size-class of the affected streams.
 - Estimate of how much the proposed withdrawal reduces the index flows in the affected streams.



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 How in the hec am I supposed to figure all that out?







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Water Withdrawal Assessment Tool

- Oct 1, 2008
 - WWAT available for testing and evaluation
 - DEQ shall begin accounting of cumulative withdrawals affecting the same stream reach
- February 1, 2009
 - DEQ shall adjust the water withdrawal account for any stream reach whose zone classification changed due to cumulative water withdrawals
- July 9, 2009
 - DEQ shall implement the assessment tool
 - LQWs shall use the assessment tool (or request site-specific review)



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Water Withdrawal Assessment Tool

- Flow-based safety factor
 - A protective measure of the assessment tool that reduces the portion of the index flow that is available for a withdrawal to ½ of the index flow for the purpose of minimizing the risk of adverse resource impacts caused by statistical uncertainty.



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http://www.miwwat.org/

The Water Withdrawal Assessment Tool (Assessment Tool) is designed to estimate the likely impact of a proposed water withdrawal on nearby streams and rivers. This is a test version. It is provided for the public to evaluate the Assessment Tool before it becomes effective on July 9, 2009.

You may use this Assessment Tool test site to register a new or increased large quantity withdrawal. The results page provides a quick link to submitting a registration. A registration is valid for 18 months; the withdrawal capacity must be installed within that 18 months or the registration becomes void.

Michigan's Water Withdrawal Assessment Tool 🭝 Information Window About the Tool Educational Material Run the Tool



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Date	FEB 28, 2006	FEB 28, <mark>2008</mark>	JUL 9, 2008	FEB 1, 2009	JUL 9, 2009
ARI Standard	Narrative: Shall not functionally impair the ability of a stream or lake to support characteristic fish populations.	Narrative: Shall not functionally impair the ability of a stream or lake to support characteristic fish populations.	Narrative: Decreasing the flow of a stream by part of the index flow such that the stream's ability to support characteristic fish populations is functionally impaired. Or, decreasing the level of a lake ≥ 5 acres in size, through a direct withdrawal, in a manner that would impair/destroy the uses made of the lake or functionally impair the ability of the lake to support characteristic fish populations.	Quantitative: Withdrawals limited to % reduction of index flows in streams as specified for each of the 11 stream types. Never more than 25% reduction in index flow. Or, decreasing the level of a lake \geq 5 acres in size, through a direct withdrawal, in a manner that would impair/destroy the uses made of the lake or functionally impair the ability of the lake to support characteristic fish populations.	Quantitative: Withdrawals limited to % reduction of index flows in streams as specified for each of the 11 stream types. Never more than 25% reduction in index flow. Or, decreasing the level of a lake \geq 5 acres in size, through a direct withdrawal, in a manner that would impair/destroy the uses made of the lake or functionally impair the ability of the lake to support characteristic fish populations.
Applies to	Designated trout streams	All streams	All streams	All streams	All streams
Presumption criteria	At least 1320 ft from banks of a designated trout stream. OR Well depth at least 150 ft.	At least 1320 ft from banks of a designated trout stream. OR Well depth at least 150 ft.	At least 1320 ft from banks of the affected stream. OR Well depth at least 150 ft.	At least 1320 ft from banks of the affected stream. OR Well depth at least 150 ft.	Zone A or B in the screening tool OR MDEQ site-specific review



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Presumption

- Beginning July 9, 2009, the rebuttable presumption is not valid if the capacity to make the withdrawal is not developed within 18 months after the withdrawal is registered.
- A presumption under this section may be rebutted by a preponderance of evidence that a new or increased large quantity withdrawal from the waters of the state has caused or is likely to cause an adverse resource impact.



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Civil Action

- Effective Oct. 7, 2008, the MDEQ may request the AG to commence a civil action for a violation under this part, including **falsifying a record** submitted under this part.
- The court of jurisdiction may restrain the violation and require compliance. It may also impose a civil fine:
 - For a person who **knowingly causes an ARI with a LQW**, a civil fine of not more than **\$10,000.00 per day of violation**.
 - For all other violations of this part, a civil fine of not more than \$1,000.00.
 - In addition, the AG may file suit to recover the full value of the costs of surveillance and enforcement by the state resulting from the violation.



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- Review the prototype *Water Withdrawal* **Assessment Tool**.
- Overview of Michigan's groundwater resources and an example of the river classification from west-central Lower Michigan.



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Aquifers

- Any geologic material that stores and transmits groundwater
- Two basic types:
 - Bedrock Aquifers
 - Glacial Aquifers



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Bedrock Aquifers



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Groundwater Inventory & Mapping



Groundwater Mapping Project



http://gwmap.rsgis.msu.edu

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



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Bedrock Aquifers





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Wells in Bedrock Aquifers





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Yield from Bedrock Aquifers





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Drawdown from Bedrock Aquifers





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Glacial Sediment Thickness





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Glacial Aquifer Characterization

Confining material dominates Marginal aquifer material mixed with partially confining material dominates Marginal aquifer material dominates

Aquifer material dominates

Map developed using lithologic information from ~280,000 water well records in the Wellogic database.

Each lithology was classified as: Confining, partially confining, marginal, or aquifer material.



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Wells in Glacial Aquifers





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Yield from Glacial Aquifers





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Drawdown from Glacial Aquifers





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Depth to First Water





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First Water Surface





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Recharge to Shallow Aquifers





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Cold Transitional Streams





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Cool streams





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Warm streams





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Warm large rivers





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The End www.miwwat.org

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