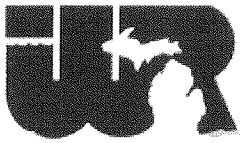
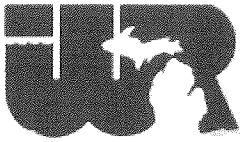


Digital Watershed



address entry | map entry | site info

Please Type in Your Address :

Street Address:

City:

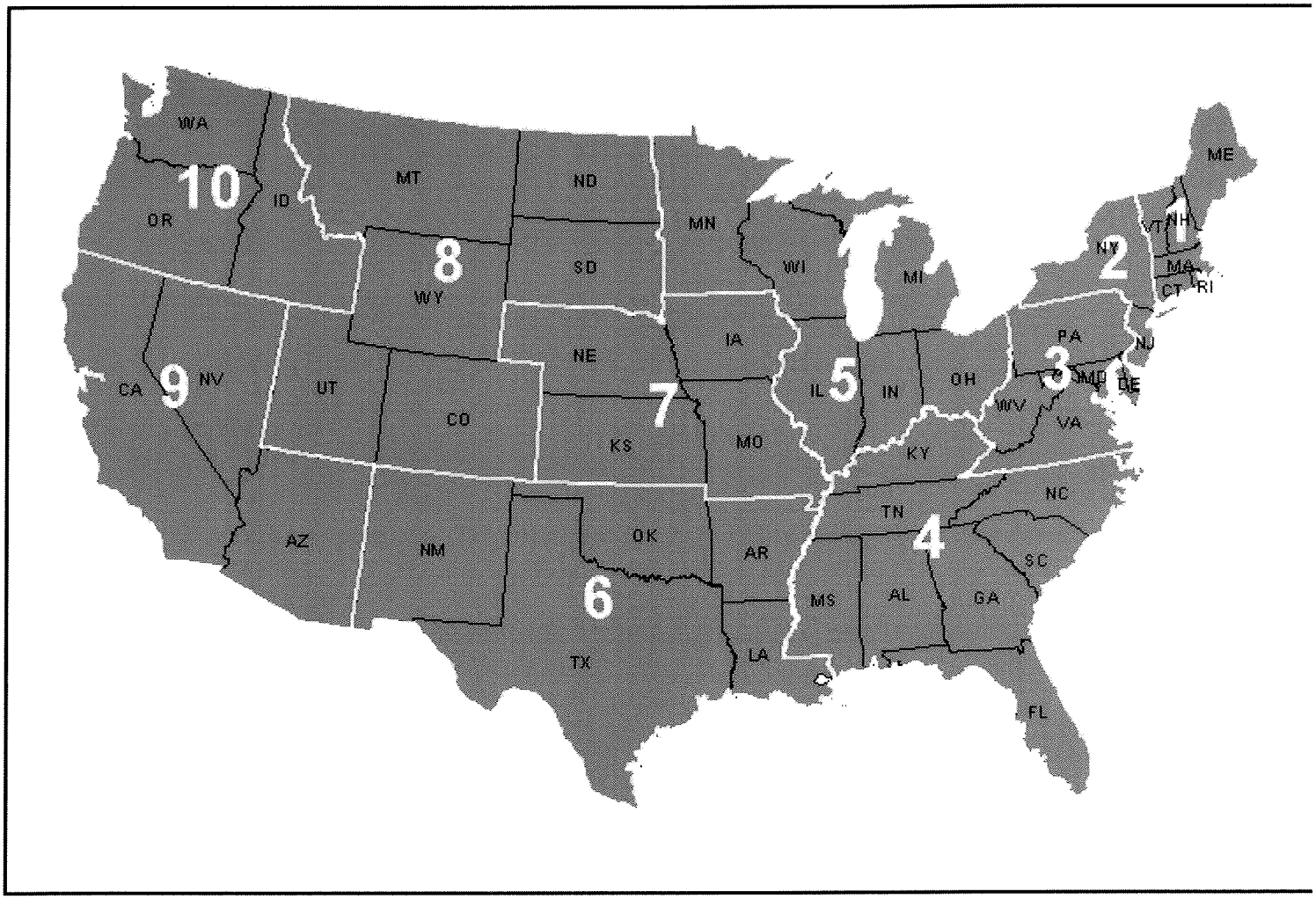
State:

Zip Code:

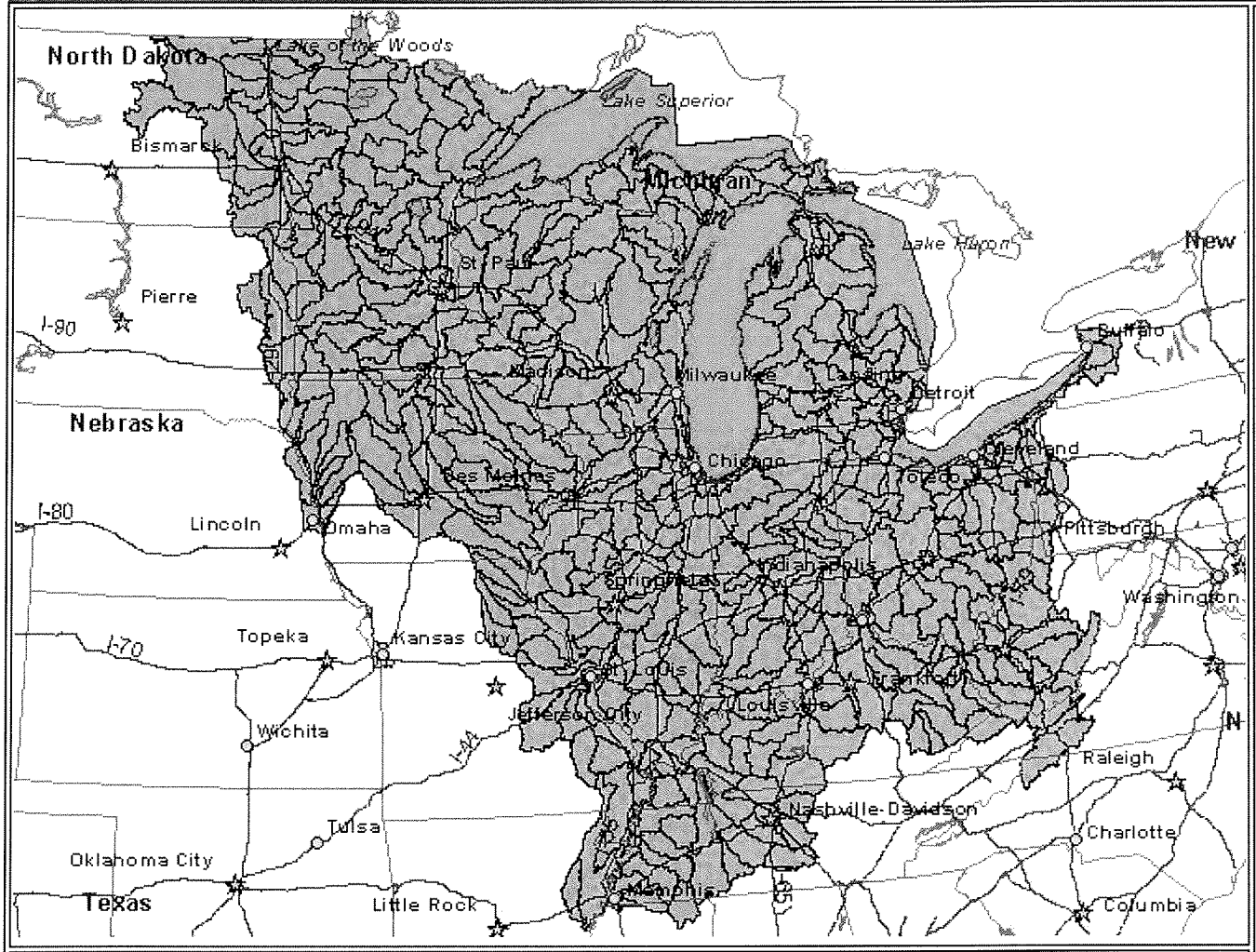
Get Map | Clear

Digital Watershed

address entry | map entry | site info



Locating a Watershed



8 digit level watershed

Click on the map t select a watershe

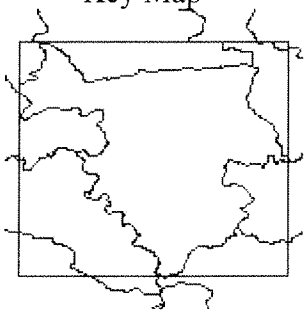
SCIENCE-BASED Watershed Management

Map Information

GIS Tools

Zoom Factor: 2

Key Map



Legend

Watershed Boundary

StreetMap USA
- Airport
- Highway
- Primary road
- Secondary and conne
- Water body
- Park
- State

Permit Compliance System

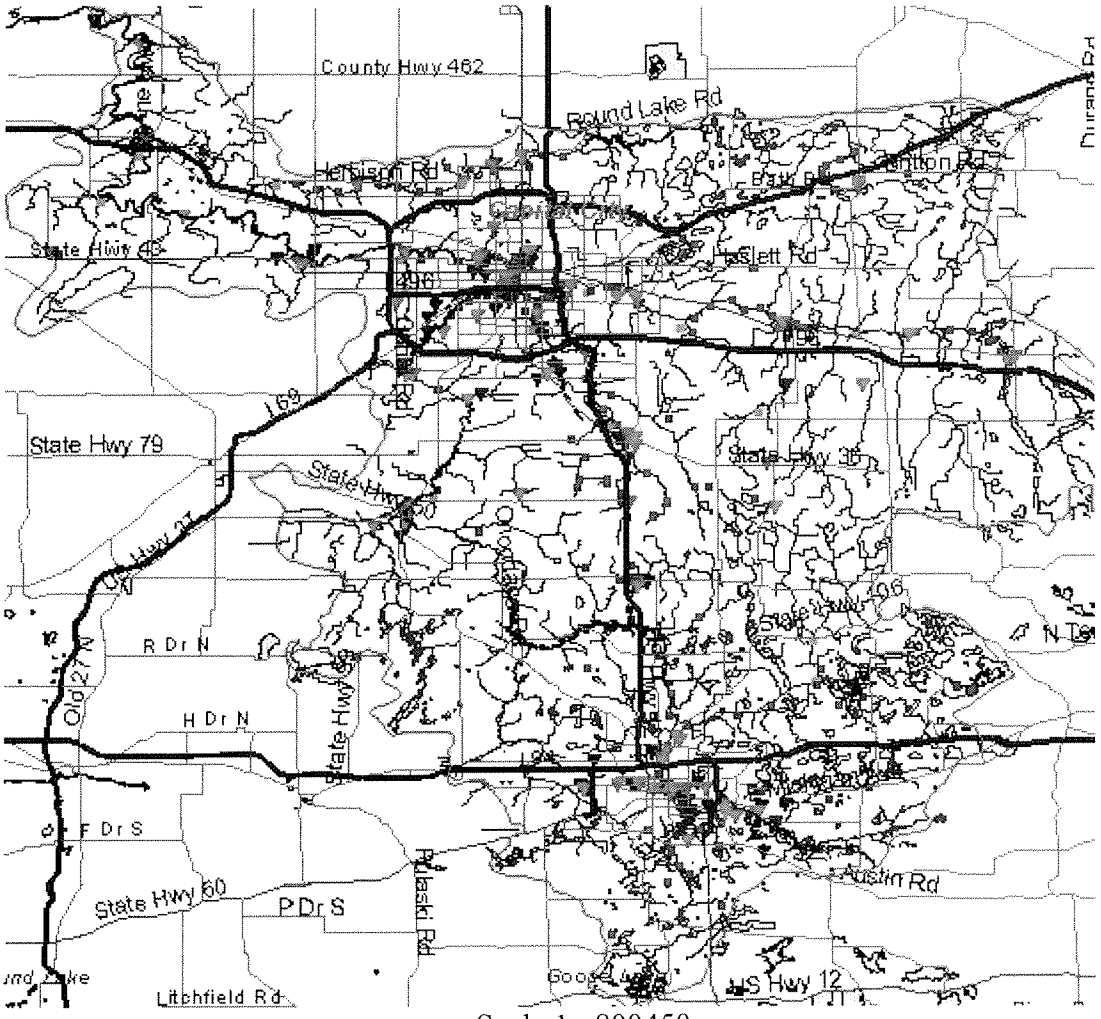
Industrial Facilities Discharge

Toxic Release Inventory

Water Quality Stations

USGS Gage Stations

River



Scale 1 : 800450

Comments and Suggestions

Developed by
Institute of Water Research
Michigan State University

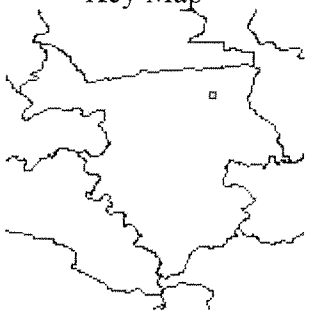
SCIENCE-BASED Watershed Management

Map Information

GIS Tools

Zoom Factor: 2

Key Map



Legend

Watershed Boundary

StreetMap USA
- Airport
- Hospital
- Highway
- Primary road
- Secondary and connec
- Local road
- Access road
- Water body
- Park
- State

River

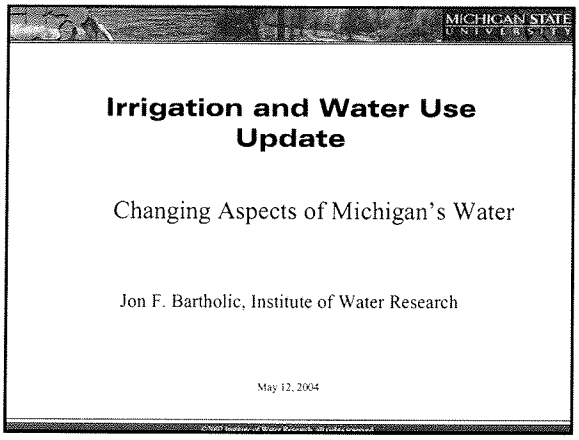
Photo

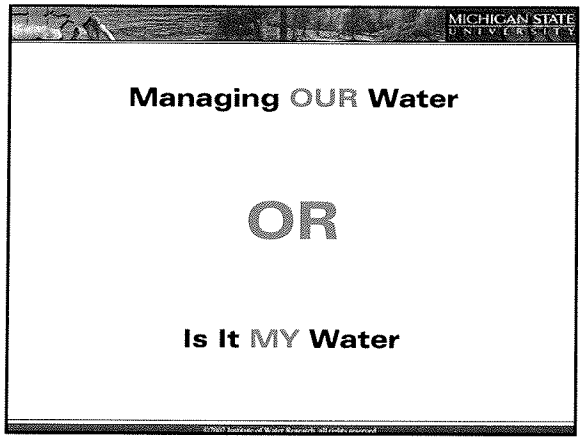
Cataloging Unit Boundaries

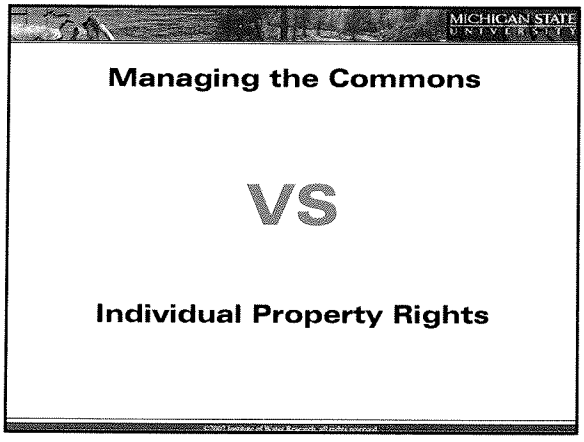
Scale 1 : 25014.1

Comments and Suggestions

Developed by
Institute of Water Research
Michigan State University


MICHIGAN STATE UNIVERSITY
Irrigation and Water Use Update
Changing Aspects of Michigan's Water
Jon F. Bartholic, Institute of Water Research
May 12, 2004


MICHIGAN STATE UNIVERSITY
Managing OUR Water
OR
Is It MY Water


MICHIGAN STATE UNIVERSITY
Managing the Commons
VS
Individual Property Rights

Managing the Commons

VS

While Respecting

LAW

- Riparian Rights
- Reasonable Use Doctrine

Balancing

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Reasonable

- Sustaining the Aquifer
- Maintaining EcoSystem Services

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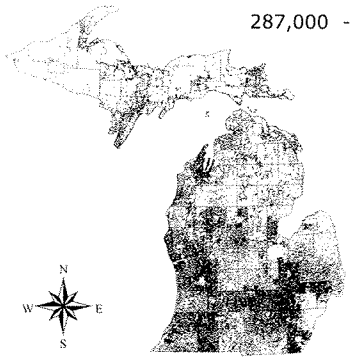
287,000 - MI Wells



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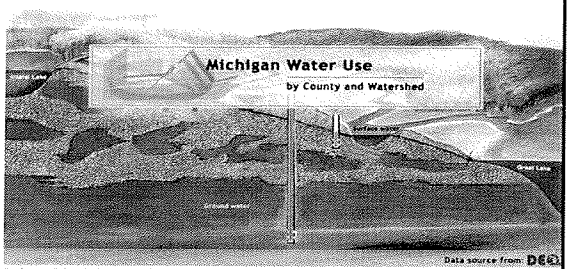
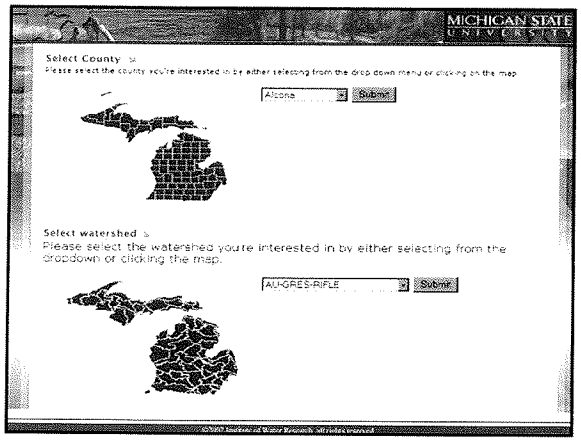
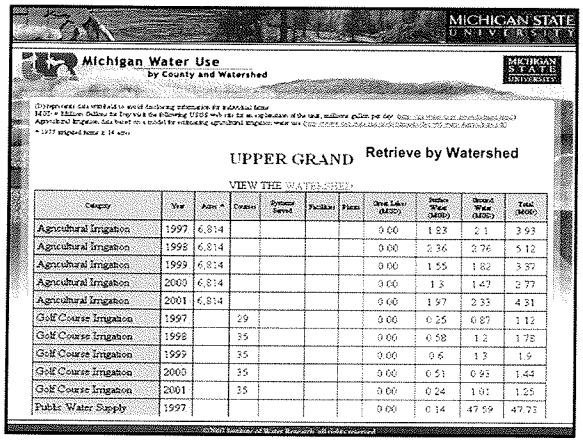
MSU Institute of Water Research

Water withdrawal data can be retrieved by county and watershed for water years 1997-2001 for the five major sectors of water withdrawal: Thermoelectric Power Generation, Public Water Supply, Self-Supplied Industrial, Agricultural Irrigation, and Golf Course Irrigation.

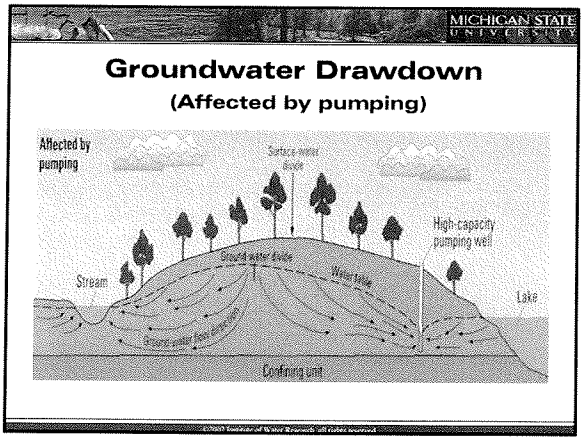


Disclaimer: This web site is a compilation of water use data from the Michigan Water Use Reporting Program, Department of Environmental Quality. For a program overview and reporting requirements, please visit the following web site,



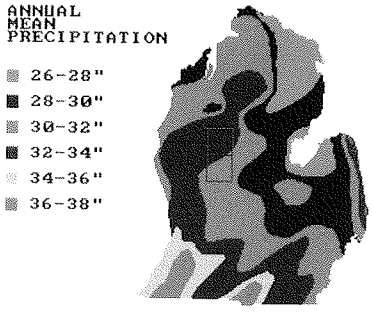


Category	Year	Acres *	Owners	Systems Served	Facilities	Plants	Great Lakes (MGD)	Surface Water (MGD)	Ground Water (MGD)	Total (MGD)
Agricultural Irrigation	1997	6,814					0.00	1.83	2.1	3.93
Agricultural Irrigation	1998	6,814					0.00	2.36	2.76	5.12
Agricultural Irrigation	1999	6,814					0.00	1.55	1.82	3.37
Agricultural Irrigation	2000	6,814					0.00	1.3	1.47	2.77
Agricultural Irrigation	2001	6,814					0.00	1.97	2.33	4.31
Golf Course Irrigation	1997		29				0.00	0.25	0.87	1.12
Golf Course Irrigation	1998		35				0.00	0.58	1.2	1.78
Golf Course Irrigation	1999		35				0.00	0.6	1.3	1.9
Golf Course Irrigation	2000		35				0.00	0.51	0.93	1.44
Golf Course Irrigation	2001		35				0.00	0.24	1.01	1.25
Public Water Supply	1997						0.00	0.14	47.59	47.73



Magnitude of Water Cycle Components

Rainfall Yearly Average

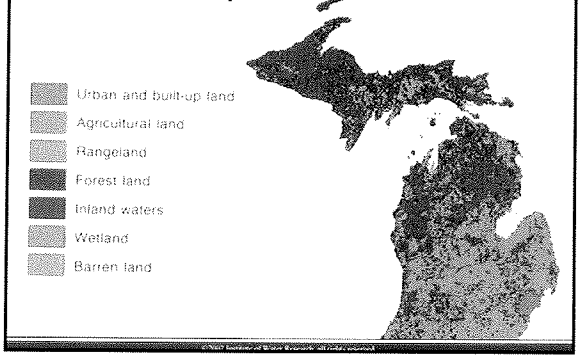


Annual Rainfall
30" - 34"
Assume 33"

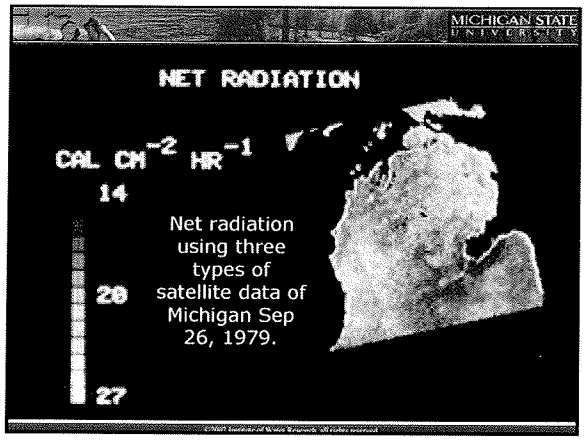
Evaporation

- 22" with deep rooted Perennials
- 20" with cold season grasses

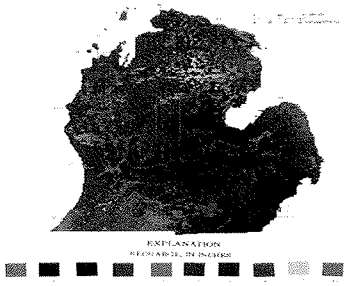
Land Use/Land Cover in MI



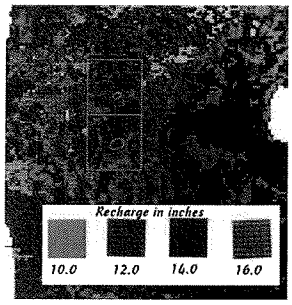
NET RADIATION



USGS Recharge Map



USGS Recharge Map



Hierarchical groundwater modeling: the Saginaw County groundwater conflict

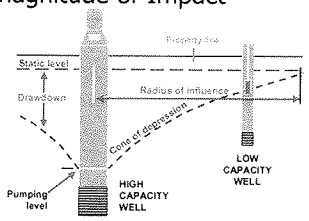
By: Andreanne Simard and Dr. Li,
Civil and Environmental Engineering

Saginaw GW conflict background

- Agriculture in many areas in Michigan relies on large amounts of groundwater withdrawals for irrigation.
- Residential wells in several areas of Saginaw County, Michigan, recently went dry after the beginning of the irrigation season.
- The relationship between the water-level declines in residential wells and ground-water withdrawals from irrigation wells has been the subject of many local investigations in the past.

THE PROBLEM

- Residential Wells in Drift and Bedrock Experienced Problems
- The magnitude of Impact



Solution

New tool to address groundwater conflict

- Hierarchical modeling
  - definition

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Why Hierarchical modeling?

- The traditional method of modeling is inadequate to model large areas.
- The modeling of large areas is infeasible and too expensive
- The traditional method is inadequate for simulating the more detailed local and site flow dynamics at individual well fields

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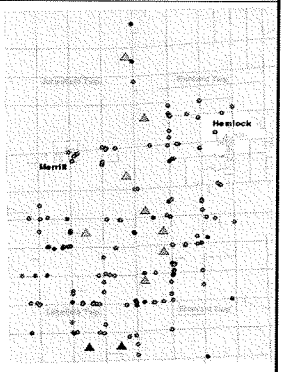
Distribution of Well Complaints and Irrigation Wells in Study Area

Well complaints and aquifer type
- Drift (102 wells)
- Rock (36 wells)

Irrigation wells and aquifer type
- Drift
- Bedrock
- Drift & Bedrock

0 1 5 Miles



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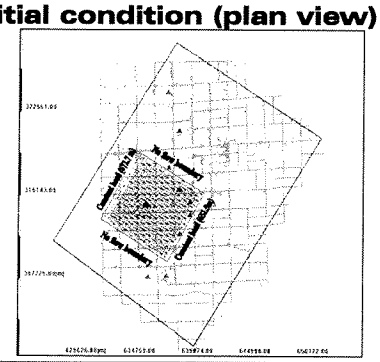
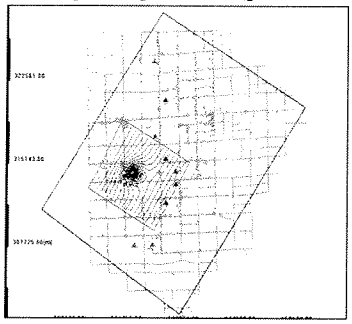
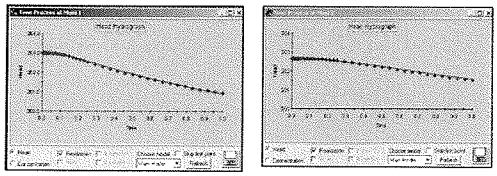
Initial condition (plan view)



24 hour pump test (plan view)

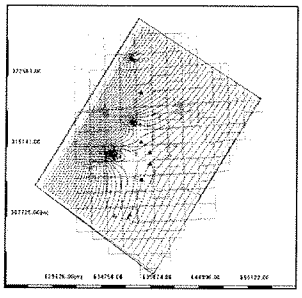


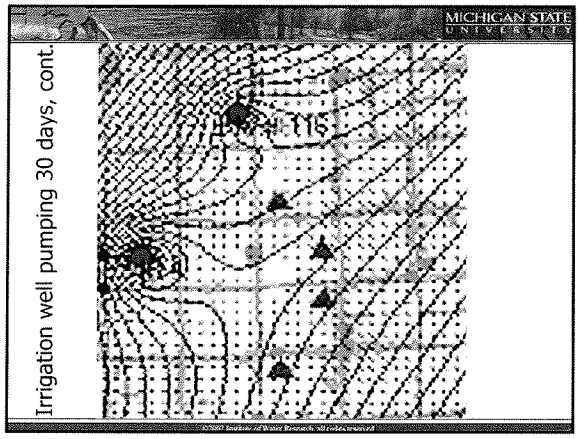
2. Model calibration



3. Model applications

Irrigation well interaction:

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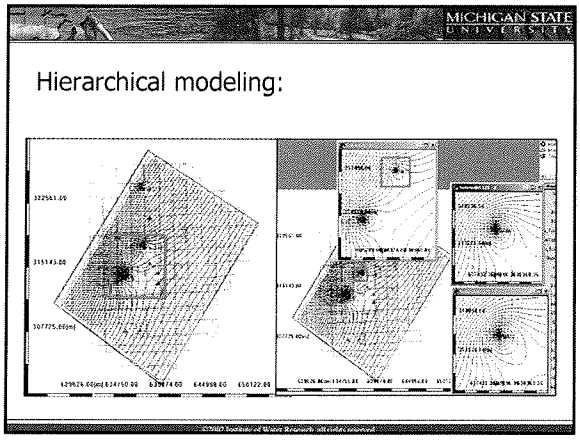
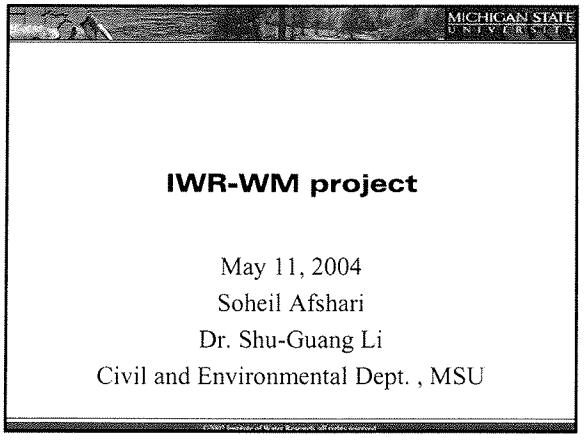
Irrigation well pumping 30 days, cont.


MICHIGAN STATE UNIVERSITY
Hierarchical modeling: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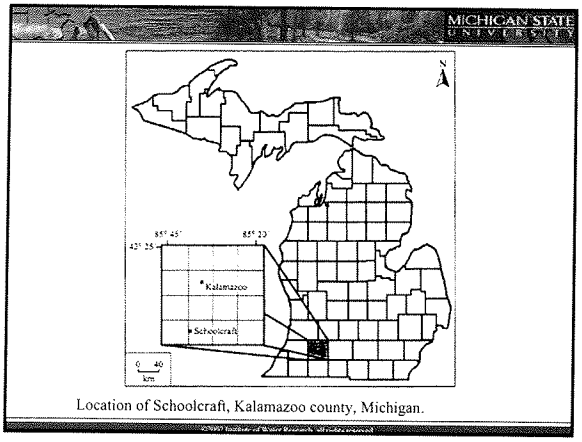
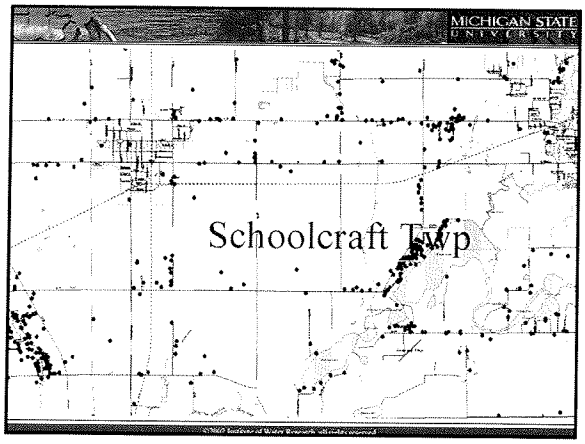
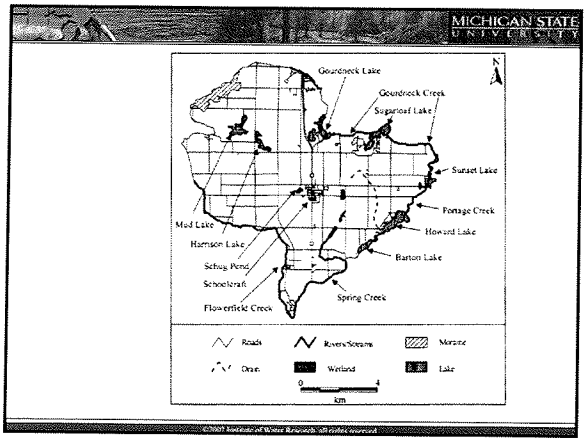
IWR-WM project
May 11, 2004
Soheil Afshari
Dr. Shu-Guang Li
Civil and Environmental Dept. , MSU



Location of Schoolcraft, Kalamazoo county, Michigan.





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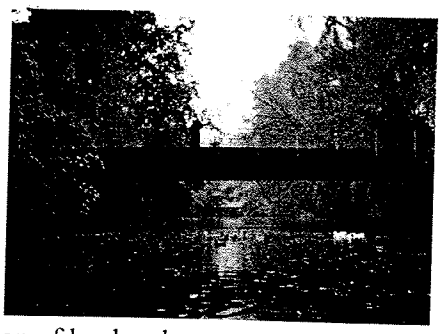


Who We Are

The Institute of Water Research at Michigan State University is responsible for coordinating research and educational programs on surface water and groundwater quality and quantity. Established in 1961, the institute addresses multi-disciplinary issues arising from the dynamic interaction of land and water resources and strengthens MSU's commitment to finding effective solutions to contemporary water resource problems.

Our Goal

The Institute's goal is to provide the most accurate and complete information on contemporary land and water issues to citizens, stakeholders, government agencies, and resource managers. To achieve this goal, the Institute consistently collaborates and forges partnerships with other research and resource conservation organizations. The result of these collaborations is the development of science-based information for use by decision makers faced with complex land and water issues. The increasing use of information technologies and geographical information systems (GIS) for better decisionmaking is a fundamental part of the Institute's mission in the 21st century.

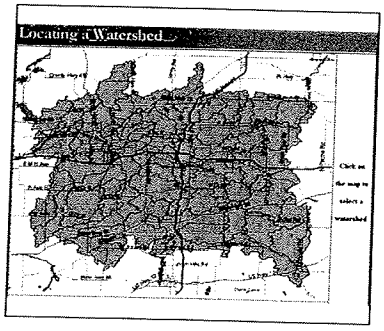
Range of Activities in Research, Education and Training

The Institute supports a variety of research projects and educational and training programs that address critical state concerns in water related issues. Examples of projects include:

- Classification of Michigan lakes by integrating fish assemblages, landscape features and water quality. Some of the variables include watershed area, lake area, ecoregion, water inputs, total phosphorus, chlorophyll, secchi depth, alkalinity, and lake connectivity to streams.

- Development of several computerized decision support systems to facilitate making decisions about water-related issues such as wetland functions, risk modeling, and ecological processes including the first online soil erosion assessment tool using the Revised Universal Soil Loss Equation (RUSLE) which allows users to estimate soil erosion for a specific site based on site data and information.

- Development of an interactive watershed information system that can be used over the internet. This system, "Understanding Your Watershed: An Interactive Mapping Program to Explore Michigan Watersheds," is designed for use as a convenient and versatile tool that provides access to data sets, maps, and reports. Through the use of this tool, planners have unique opportunities to visualize and understand the complexity of land-water interrelationships critical to the development of effective watershed plans.



- Development of an internet-based professional certificate program in watershed management. Four courses are offered and are designed to address the need for a multi-disciplinary approach to watershed management that includes an understanding of issues and solutions in the areas of engineering, biology, hydrology, and chemistry, and problem-solving in the areas of law, policy, community development, and economics.

- Production of a guidebook, in collaboration with the Michigan Department of Environmental Quality, that details the watershed planning process and provides a step by step approach for developing a watershed management plan. The booklet also provides the necessary steps for obtaining state funding for implementing plans.

Contact Information

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email: waterres@msue.msu.edu
web: www.iwr.msu.edu

Institute of Water Research
Michigan State University

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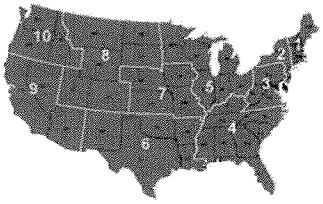
- The ***digital watershed website*** is designed to provide both a centralized information repository and an online computing center for watersheds in the United States. One can access the watershed information system at http://www.iwr.msu.edu/dw.
- The Institute of Water Research and Northwestern Michigan College (NMC) Water Studies Institute (WSI) are partnering on the development of a joint watershed education program. The WSI and IWR are working collaboratively to adapt IWR's existing VU watershed education program (with over 200 students/year) to include a "localized" experiential education course, which may encompass learning and participation in watershed management projects or research in the Traverse City region.



- Ez-Mapper Site Locator
  This site was created to assist farmers, citizens, and planners in developing digital maps that can be used in a variety documents, including, Comprehensive Nutrient Management Plans (CNMP). By typing an address, city, and zip code or using a locator map, users can retrieve a map containing, aerial photos, streets, streams, and soils information. http://www.iwr.msu.edu/cnmp/
- The Institute is assisting in the coordination of MSU-WATER, a comprehensive watershed management initiative that will strive to protect the water that runs through Michigan State University's East Lansing campus, and also generate new solutions for water resources problems that can be adopted by other communities across the state, nation and world. Led by faculty, staff and students within the University, MSU-WATER will assess physical, chemical, biological and human factors in order to identify the most pressing water-related issues and research opportunities.
- A 3-D modeling program developed by Dr. Shu-Guang Li called Interactive and Hierarchical Modeling of Groundwater Systems is being utilized to study the effects of pumping irrigation wells in Western Saginaw County. The purpose and scope of this project is to model a pilot study involving the effects of pumping irrigation wells on yields of residential wells in a section of Saginaw County. This model will be a preliminary 3-D representation of the groundwater flow in Saginaw County. The longer-term objective for Dr. Li and his research team is to extend the pilot project to a full implementation of a statewide groundwater model of Michigan.
- IWR is designing an information system to assist nine National Park units in Michigan (Sleeping Bear Dunes, Pictured Rocks, and Isle Royale), Wisconsin (Apostle Islands and St. Croix National Scenic River), Minnesota (Voyageurs National Park, Mississippi National River Recreation Area, and Grand Portage National Monument), and the Indiana Dunes in planning and implementing a long-term ecological monitoring program. The system will include data layers on climate, water and air resources, human population growth, and land use.

Contact Information
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email: waterres@msue.msu.edu , web: www.iwr.msu.edu

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