

# Tools for Understanding Groundwater and Lake Interactions

**Wisconsin Lakes Convention 2008**

# ***TOOLS***

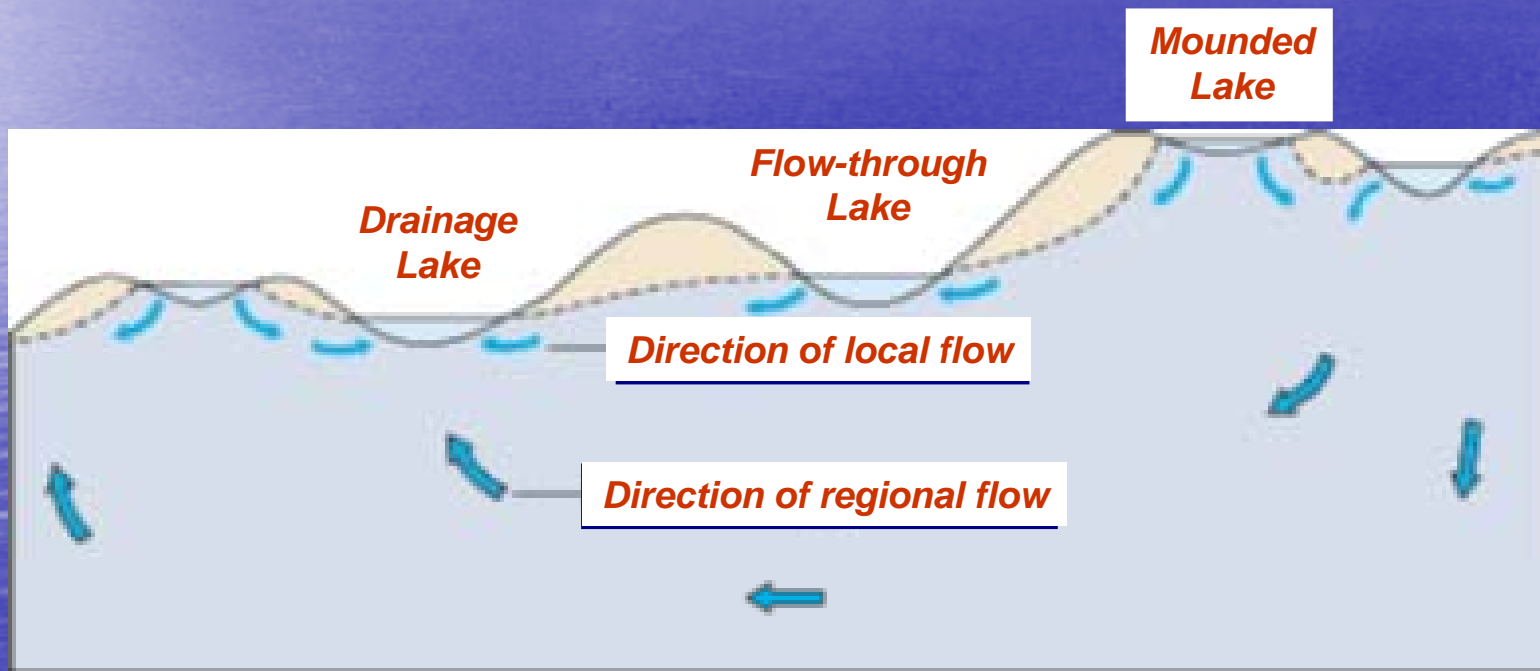
- **RESIDENT WORK (with a little help)**
- **EXPANDED WATERSHED STUDY**
- **MULTI-WATERSHED STUDY**
- **TECHNICAL ASSISTANCE**
- **GRANTS**



***RESIDENT WORK***  
***(WITH A LITTLE HELP)***

- IDENTIFY THE TYPE OF LAKE

# LAKE TYPE



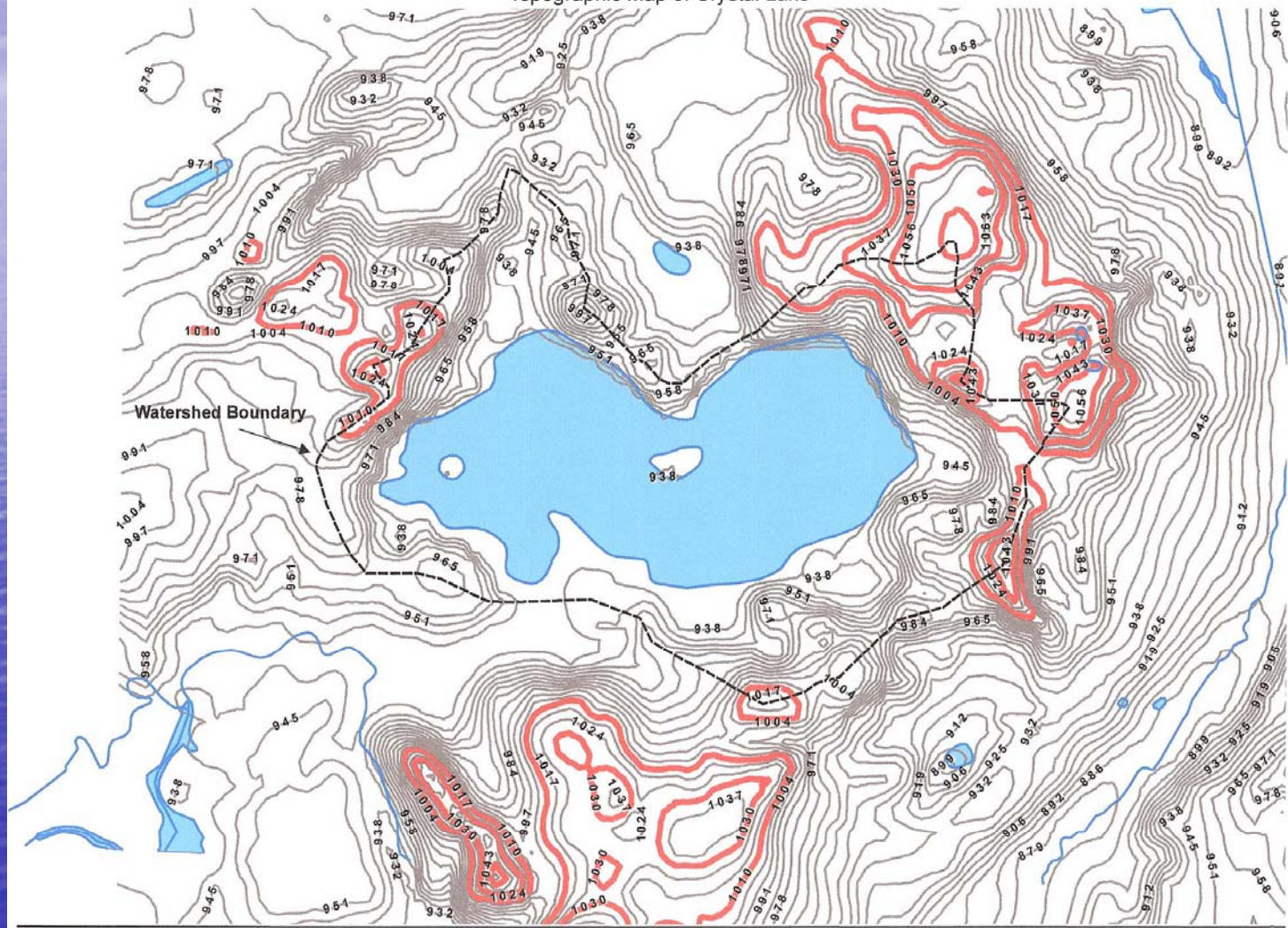
# ***RESIDENT WORK***

## ***(WITH A LITTLE HELP)***

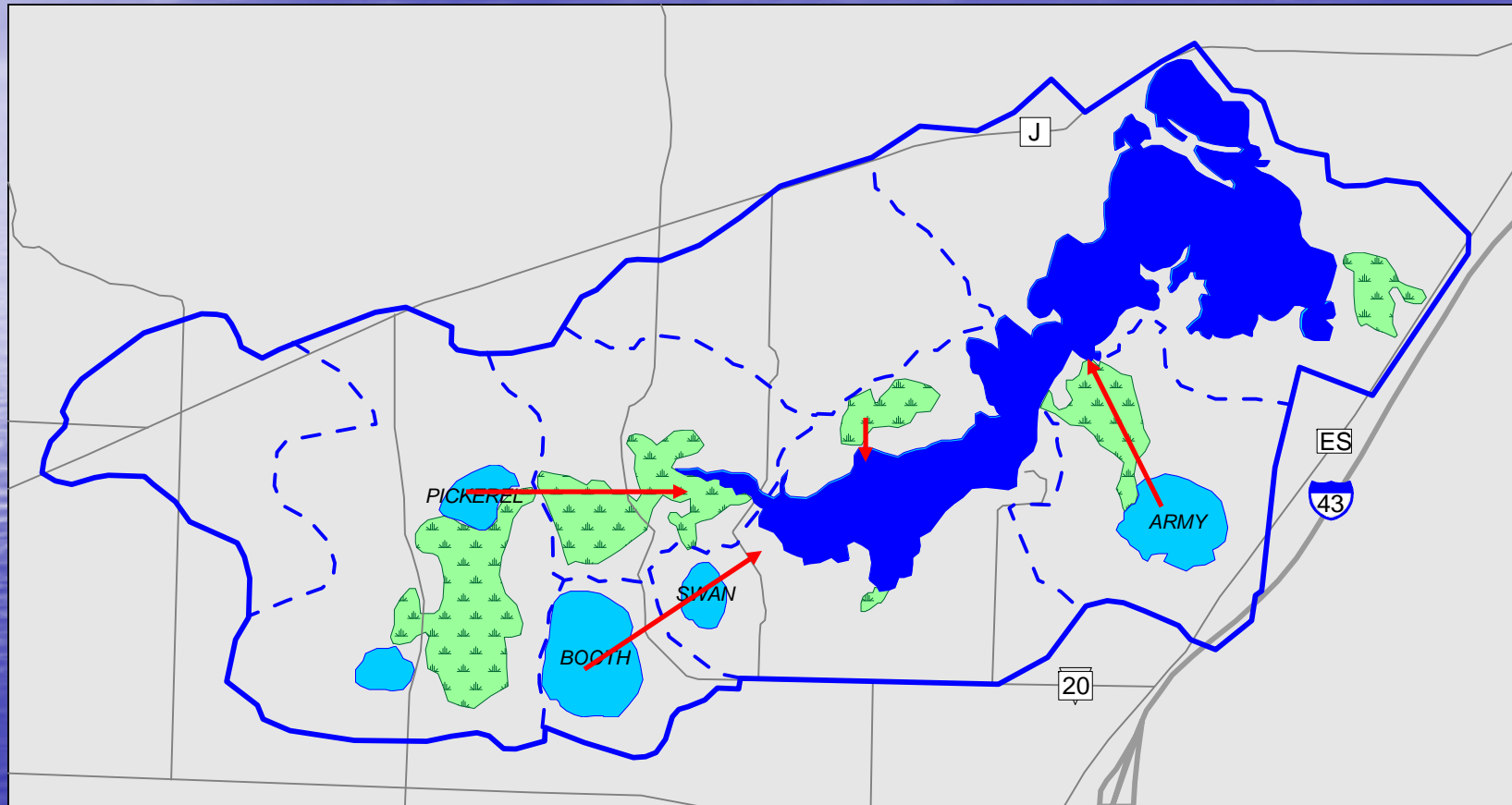
- **IDENTIFY THE TYPE OF LAKE**
- **MAP THE WATERSHED**

# MAP THE WATERSHED

Figure 2.1  
Topographic Map of Crystal Lake



# MAP THE WATERSHED



# ***RESIDENT WORK***

## ***(WITH A LITTLE HELP)***

- IDENTIFY THE TYPE OF LAKE
- MAP THE WATERSHED
- MAP SITES OF INTEREST IN THE WATERSHED



# *MAP SITES OF INTEREST*



# ***RESIDENT WORK***

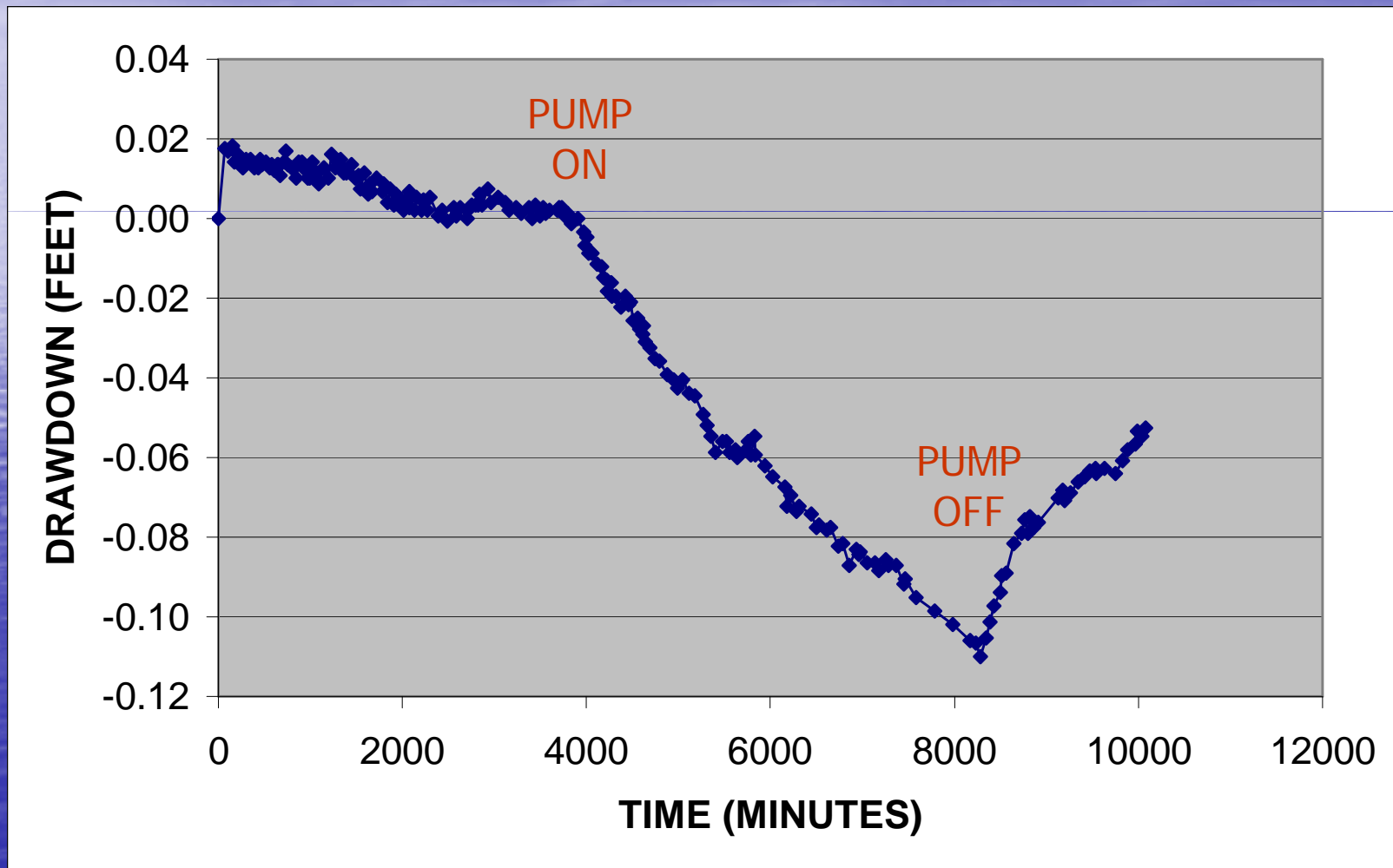
## ***(WITH A LITTLE HELP)***

- IDENTIFY THE TYPE OF LAKE
- MAP THE WATERSHED
- MAP SITES OF INTEREST IN THE WATERSHED
- WATER LEVEL MONITORING

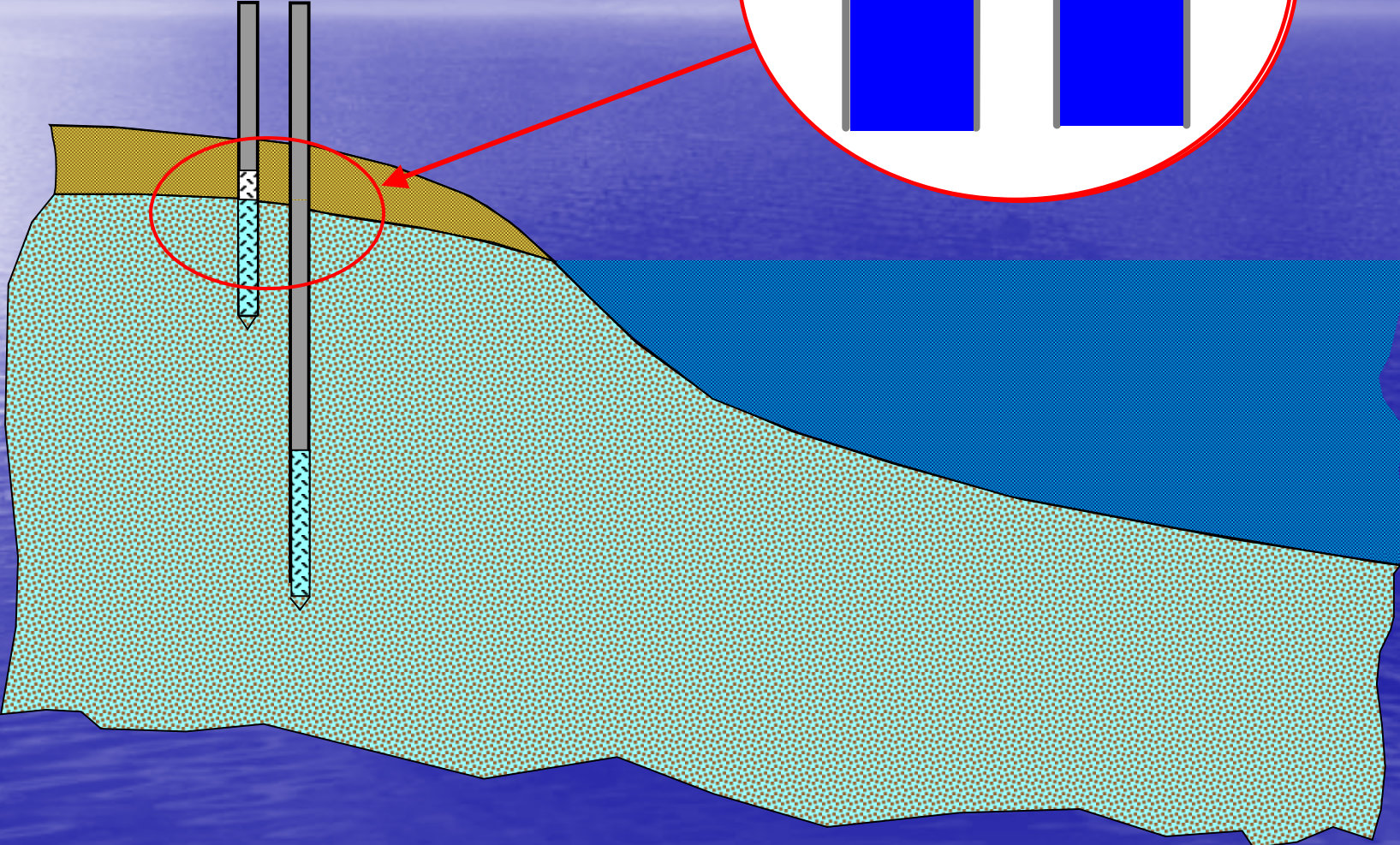
# *MONITOR GROUNDWATER LEVELS*



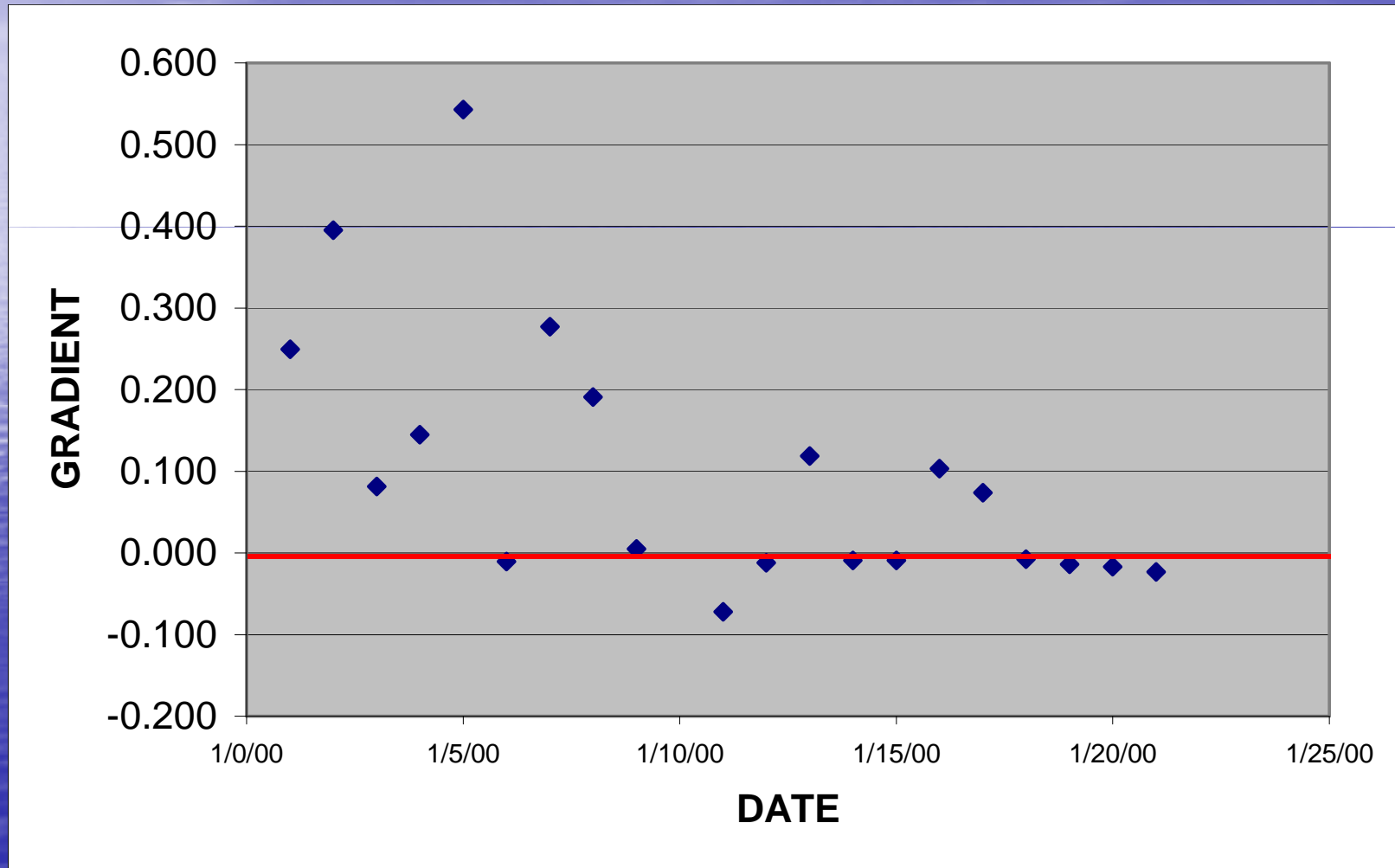
# *MONITOR GROUNDWATER LEVELS*



*MONITOR  
GROUNDWATER  
LEVELS - GRADIENTS*



# *MONITOR GROUNDWATER LEVELS*



# ***RESIDENT WORK***

## ***(WITH A LITTLE HELP)***

- **IDENTIFY THE TYPE OF LAKE**
- **MAP THE WATERSHED**
- **MAP SITES OF INTEREST IN THE WATERSHED**
- **WATER QUALITY MONITORING**

# MONITOR WATER QUALITY

Citizen Lake Monitoring Network - WDNR - Windows Internet Explorer

http://dnr.wi.gov/lakes/CLMN/

Citizen Lake Monitoring Network - WDNR

Search Site... Search

Program Search

Wisconsin Department of Natural Resources

Home About Topics Contact Us

## Citizen Lake Monitoring

### Monitoring Results

Reports and Data

### For Volunteers

Enter Data  
How to Submit Data on the Web  
Manuals  
Datasheets and Forms  
Invasives Lists and Maps  
Frequently Asked Questions

### Special Projects

Remote Sensing  
Secchi Dip-In

### How to Get Involved

Volunteer Opportunities (UWEX)  
Training Sessions (UWEX)

## Citizen Lake Monitoring Network

### Features

### Volunteer Participation Reaches an All-Time High

Thanks to all volunteers, participation in 2007 reached an all-time high. In 2007, 846 monitoring stations & 962 volunteers were active. In 2006, there were 798 stations & 832 volunteers active. The Citizen Lake Monitoring Network is growing!



[Learn More](#)

Last Revised:

Internet 100%

start R5VB08's Buddy List ... Citizen Lake Monitorin... The Stephanie Miller ... 9:50 AM



# ***EXPANDED WATERSHED STUDY***

- **PROFESSIONAL ASSISTANCE**

- **USGS**

- **DNR**

- **WGNHS**

- **CONSULTANTS**

# ***EXPANDED WATERSHED STUDY***

- **PROFESSIONAL ASSISTANCE**
- **STREAM FLOW MONITORING**

# ***STREAM FLOW MONITORING***



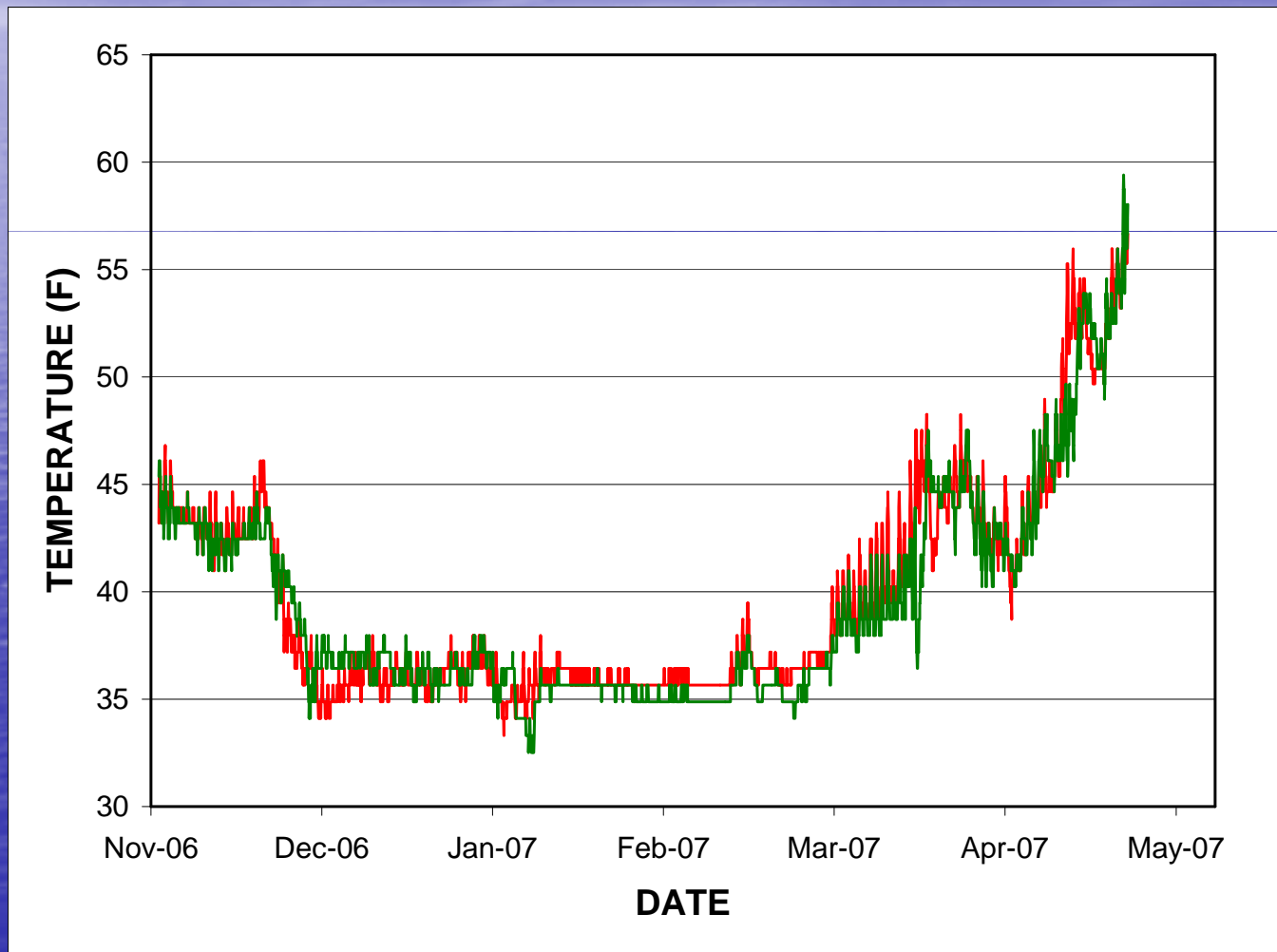
# *GROUNDWATER MONITORING*



# ***EXPANDED WATERSHED STUDY***

- **PROFESSIONAL ASSISTANCE**
- **STREAM FLOW MONITORING**
- **LAKEBED TEMPERATURE MONITORING**

# *LAKEBED TEMPERATURE MONITORING*

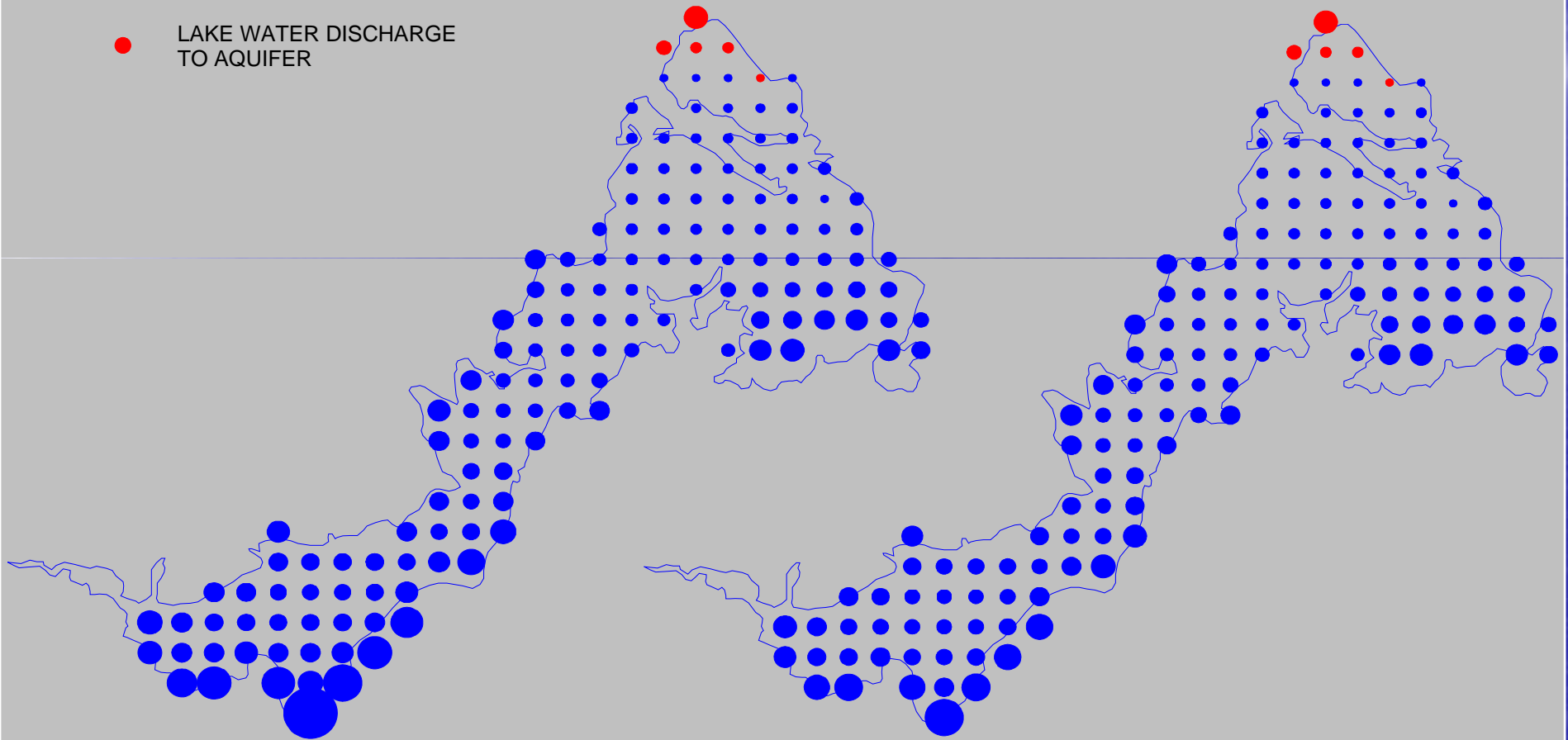


# ***EXPANDED WATERSHED STUDY***

- **PROFESSIONAL ASSISTANCE**
- **STREAM FLOW MONITORING**
- **LAKEBED TEMPERATURE MONITORING**
- **GROUNDWATER MODELING**

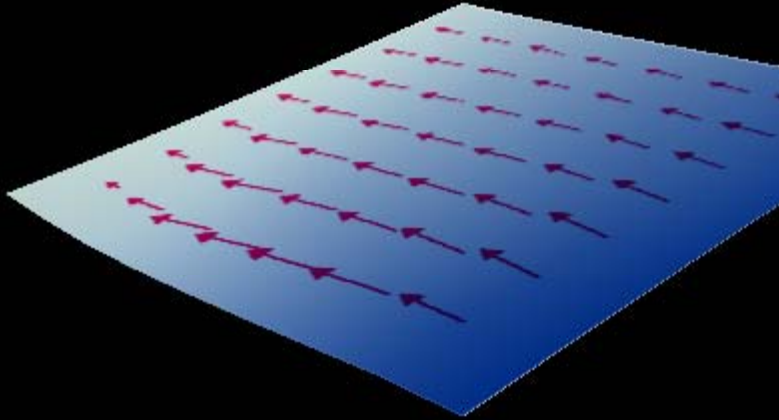
# *GROUNDWATER MODELING*

- GROUNDWATER DISCHARGE TO LAKE
- LAKE WATER DISCHARGE TO AQUIFER

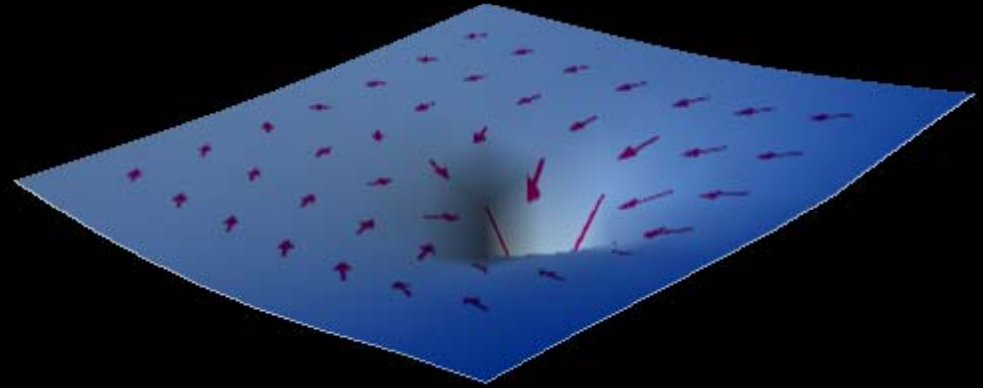




# ***GROUNDWATER MODELING***



***WATER LEVELS AT  
DEPTH OF  
WELL SCREEN –  
NO PUMPING***



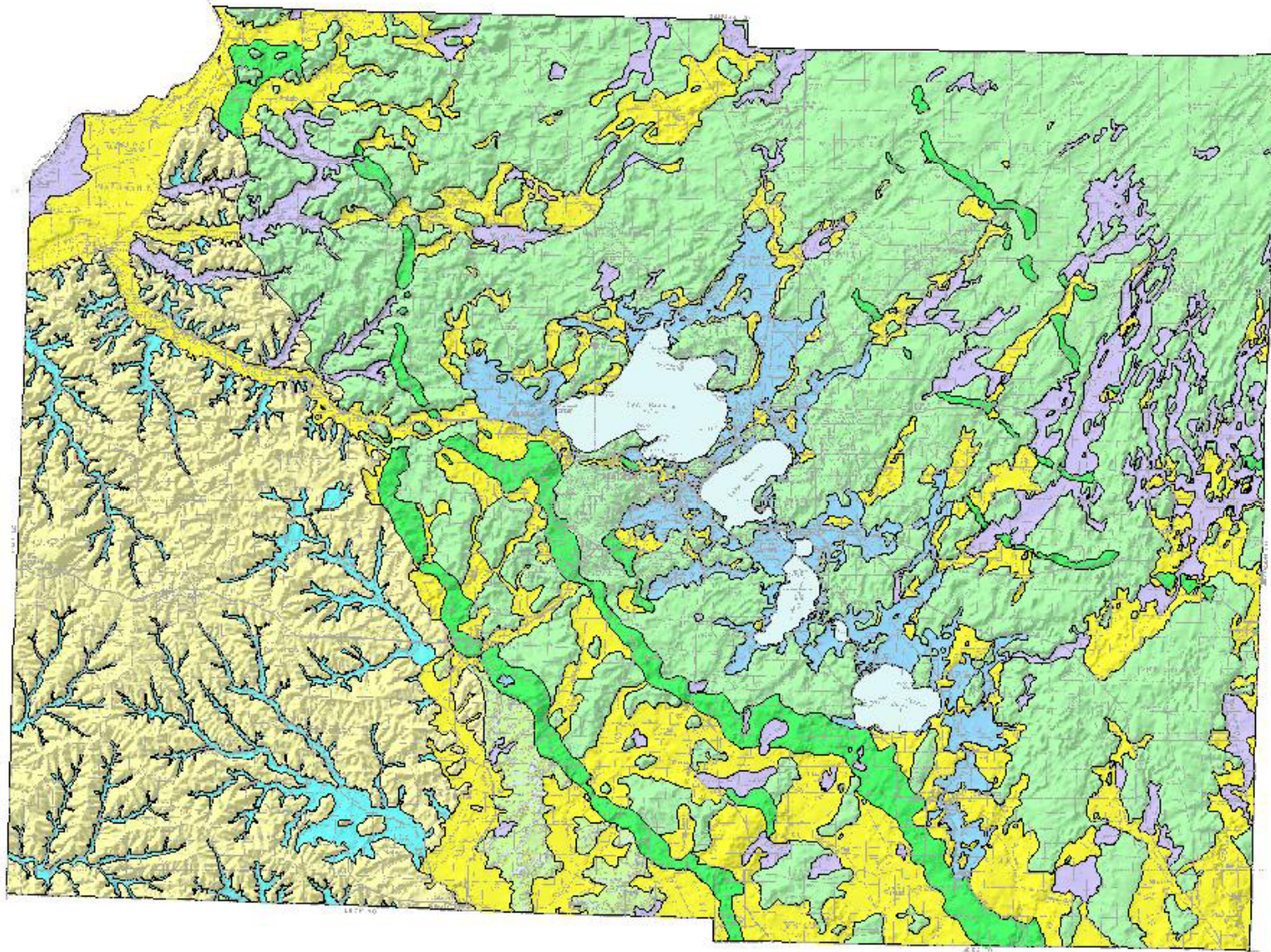
***WATER LEVELS AT  
DEPTH OF  
WELL SCREEN –  
333 GPM***

# Multi-watershed studies

**Chuck Dunning, USGS**

**Wisconsin Lakes Convention 2008**

# Dane County surface geology



# Technical Assistance

**Chuck Dunning and Herb Garn, USGS**

**Wisconsin Lakes Convention 2008**

# Public Data



[USGS Home](#)  
[Contact USGS](#)  
[Search USGS](#)

## Wisconsin Water Science Center

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### Water Data

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[Protecting Wisconsin's Groundwater through Comprehensive Planning](#) **NEW**

[Real-Time Data for Wisconsin](#)

[Real-Time Streamflow Data for Wisconsin](#)

[Ground-Water Observation Network](#)

[USGS Ground-Water Networks](#) - includes Active-Water Level, Climate Response Network, Real-Time Ground-Water Level Network **NEW**

[Waterwatch](#) - Current water resources conditions

[Historical Instantaneous Flow Data](#)

### NWIS Web

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**More data and improved access to real-time and historic data.**

[NWISWeb](#)

[Daily Streamflow Conditions \(map\)](#)

[Current Streamflow and stage data \(table\)](#)

[Daily Streamflow and stage data for the past 18 months](#)

[Historical Streamflow data](#)

[Other Streamflow data](#)

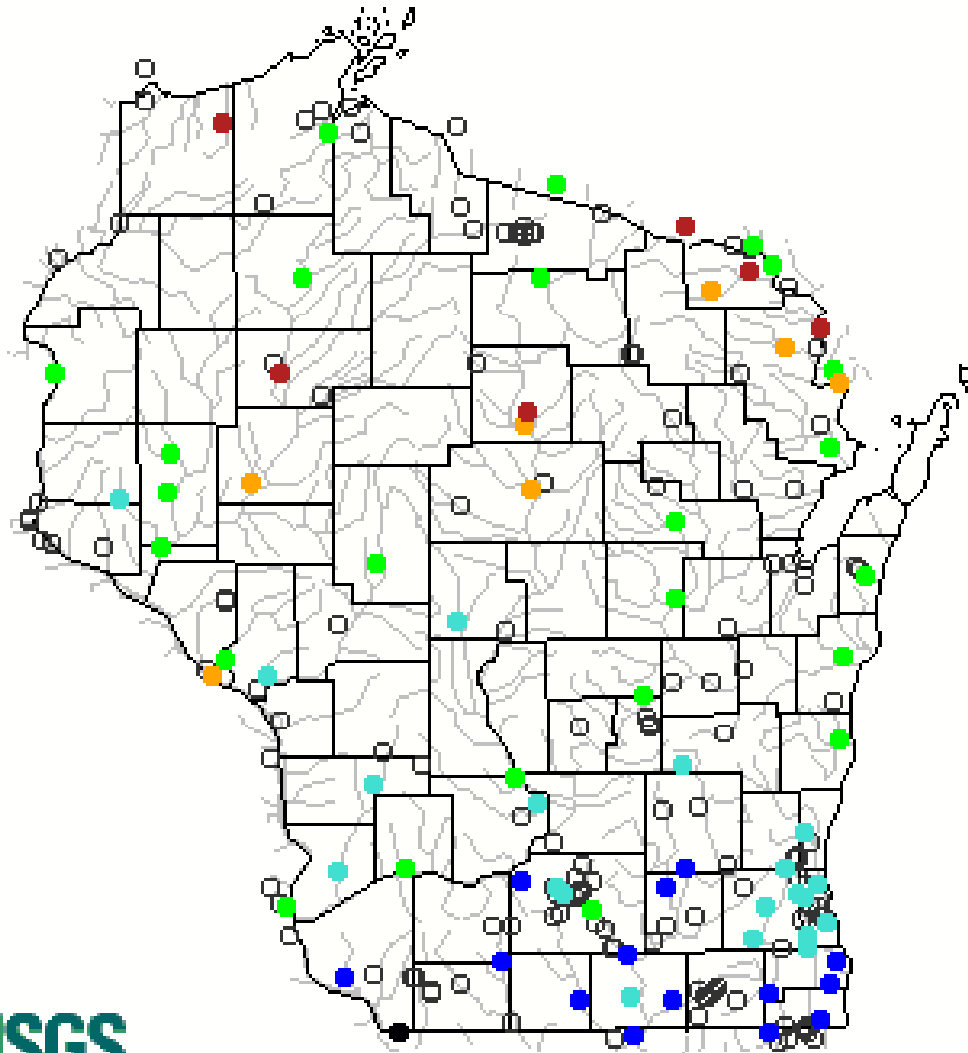
[Ground water levels](#)

[Water quality data](#)

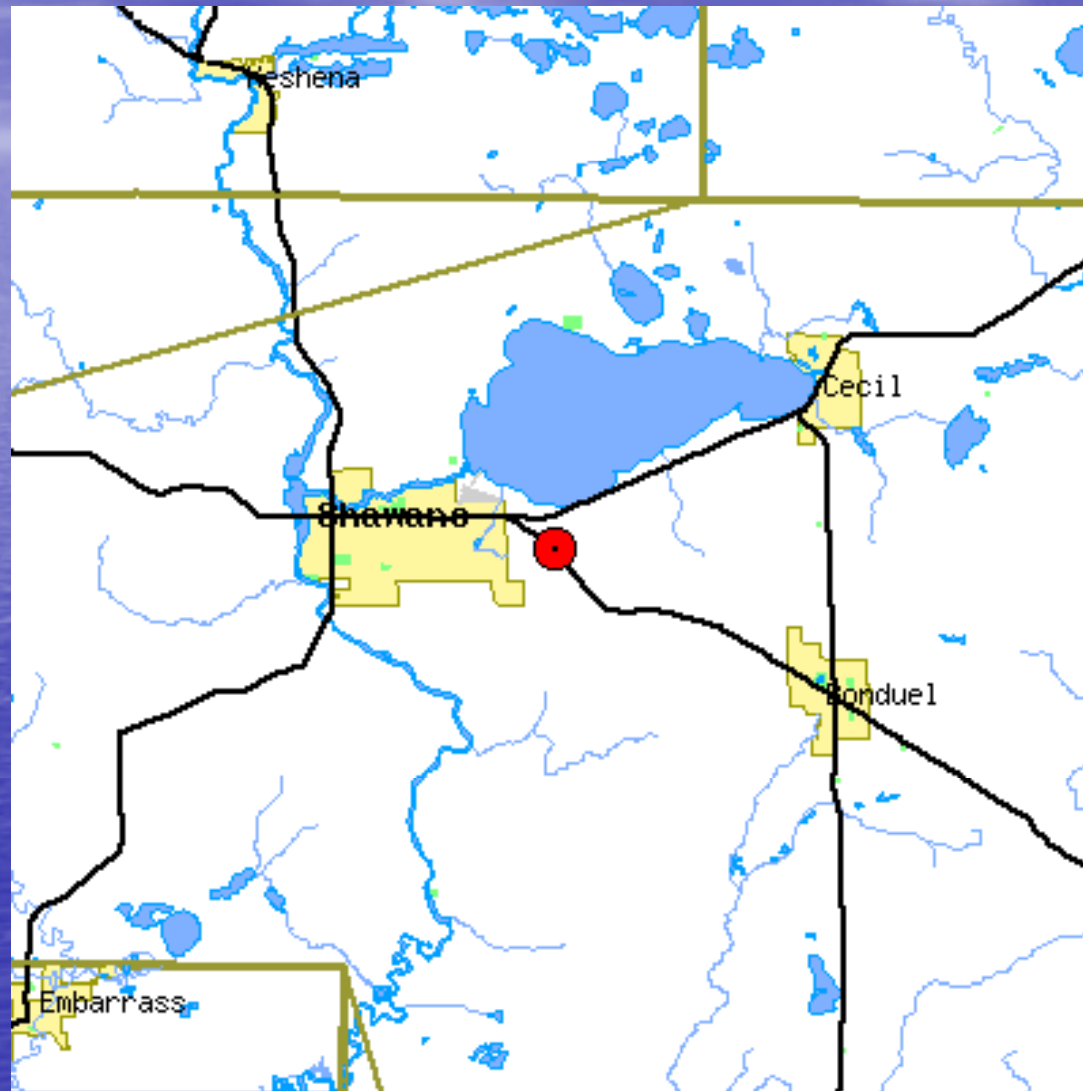
[Site information](#)

# Streamflow Data

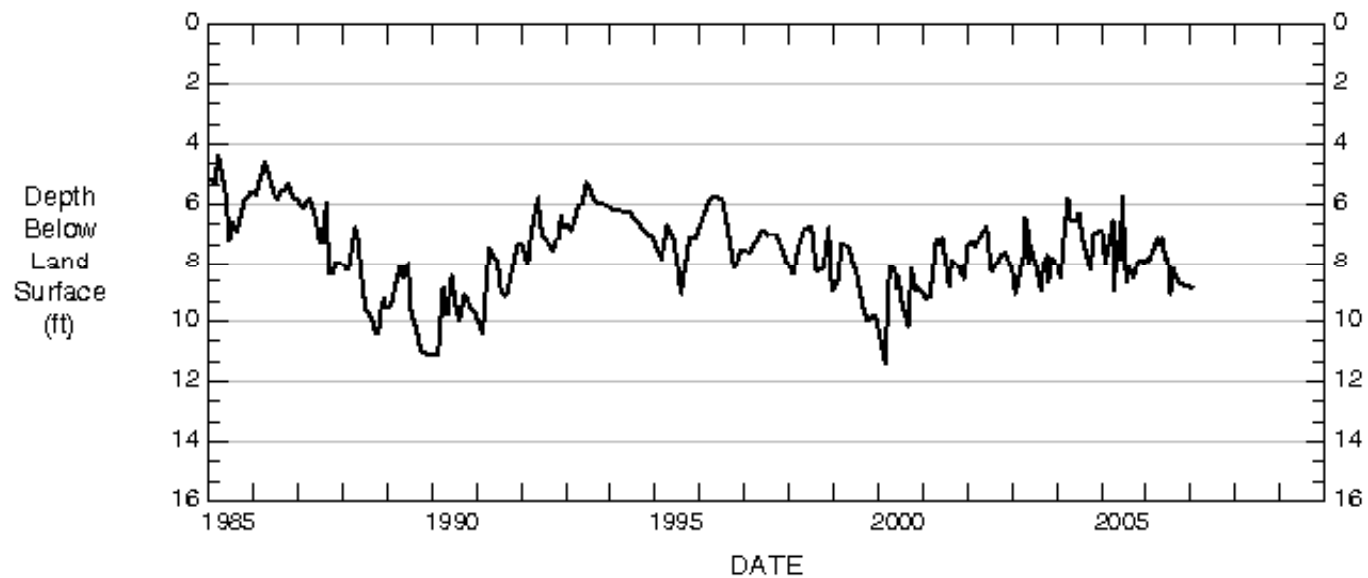
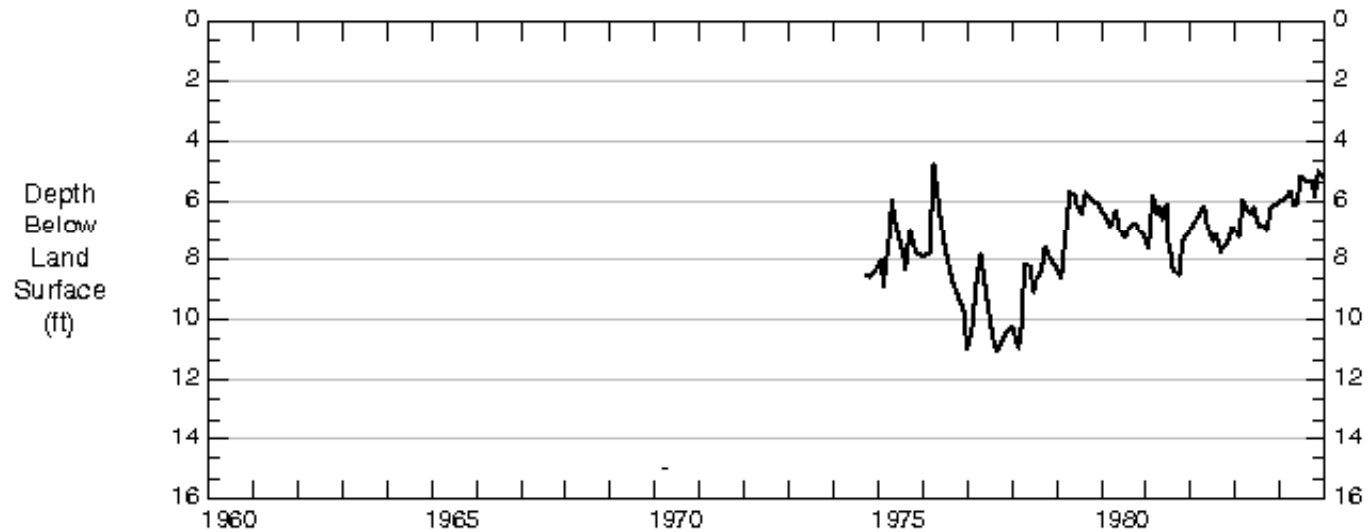
Friday, April 04, 2008 14:30ET



# Ground-Water-Level Data



# Ground-Water-Level Data





# Groundwater Flow Models

- Darcy's Law - Water flows downhill
- Continuity – Mass Balance;  $IN=OUT$
- Numerical equations representing streams, wetlands, wells, etc.
- Extensive data requirements - "GI/GO"
- Quantifies system / Predictions
- Highlights areas where more and what type of data are needed

# Model Development

- “Take your best guess” - Interpretation of hydrologic data
- “Draw a picture” - Conceptual model development
- “Keep it as simple as possible” - one layer?, multiple layers?
- “Build the machine” - Model development
- “Constrain the arm waving” - Calibration and sensitivity analysis



## Protecting Wisconsin's Groundwater Through Comprehensive Planning

*The drinking water in over 95% of Wisconsin's communities is groundwater. Public health and strong local economies depend on wise local decisions regarding groundwater.*

*This web site will help you learn about groundwater, find groundwater data and polices, and plan to protect groundwater in your area.*

LEARN MORE ABOUT GROUNDWATER

INTEGRATE GROUNDWATER INTO YOUR PLAN

FIND DATA AND POLICIES IN YOUR AREA

BROWSE ADDITIONAL RESOURCES

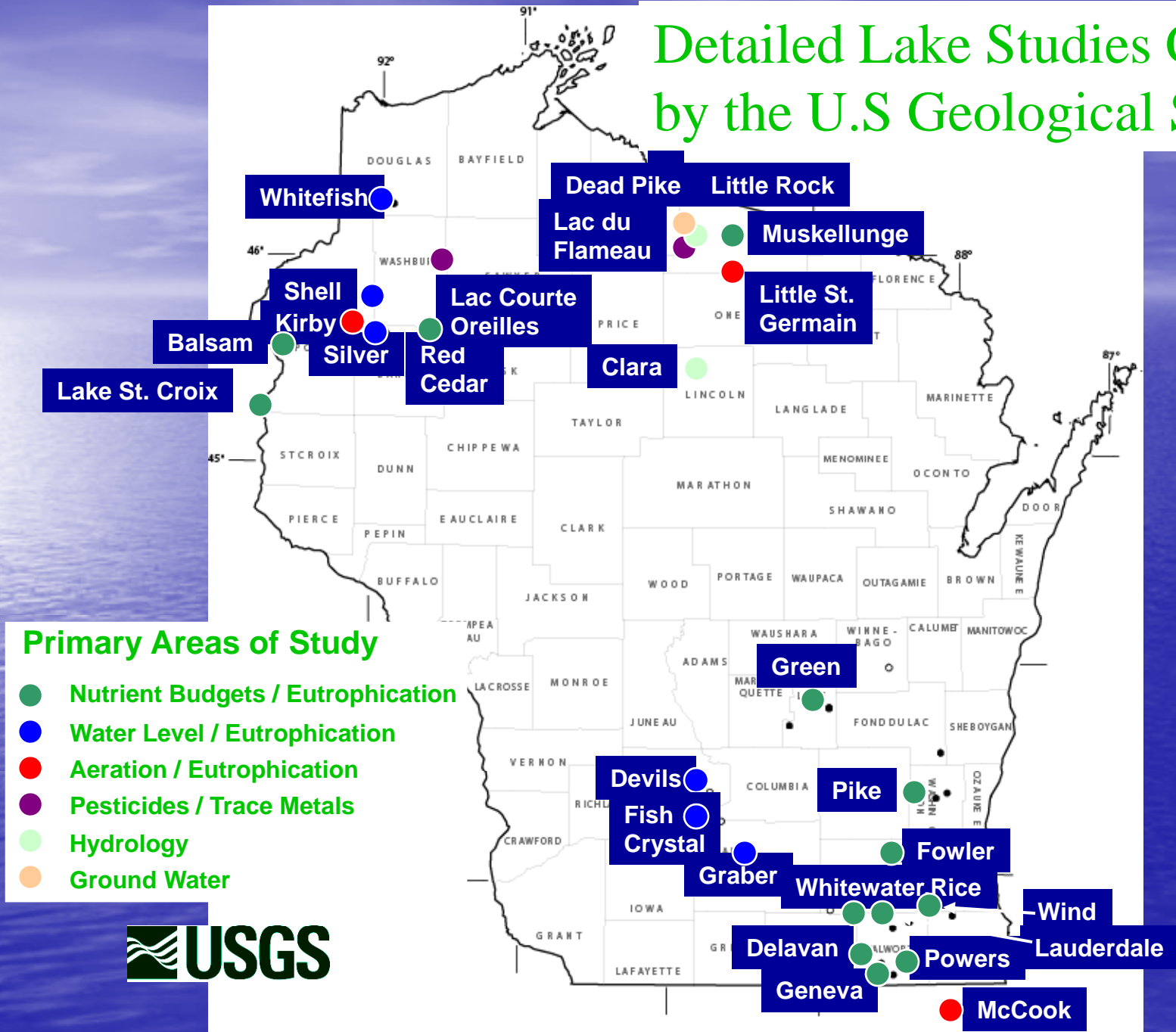
For more information about this web site, its contributors, and the data contained herein, [click here](#).

# U.S. Geological Survey Wisconsin Water Science Center Lake Studies Program

Mission: To provide hydrologic, water-quality, and other scientific information to:

1. Describe current characteristics and conditions of lakes,
2. Identify and understand water-quality problems,
3. Provide an understanding of in-lake processes, and
4. Determine effective management actions to protect or restore lakes.

# Detailed Lake Studies Conducted by the U.S Geological Survey



Location of detailed lake studies conducted by the USGS

# Lake Data

## Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 2006



U.S. GEOLOGICAL SURVEY  
Open-File Report 2007-1173

*Prepared in cooperation with the  
State of Wisconsin and local agencies*



 **USGS**  
*science for a changing world*

## Funding for Lake Studies

- Lake Planning Grants (WDNR)
- Lake Protection Grants (WDNR)
- Local Communities/agencies
- USGS Cooperative Funding