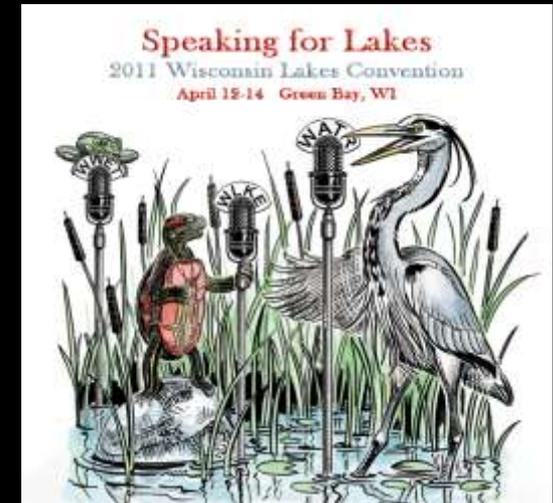


# Adding Lake Levels to the Citizen Lake Monitoring Network

## Outline

- Why Water Level Matters
- Adapting to Changes in Water Level
- How to Monitor Lake Levels
- BREAK
- How to Monitor Lake Levels (cont)
- Citizen Lake Monitoring Network Plan



# OK, SO NOW WHAT?

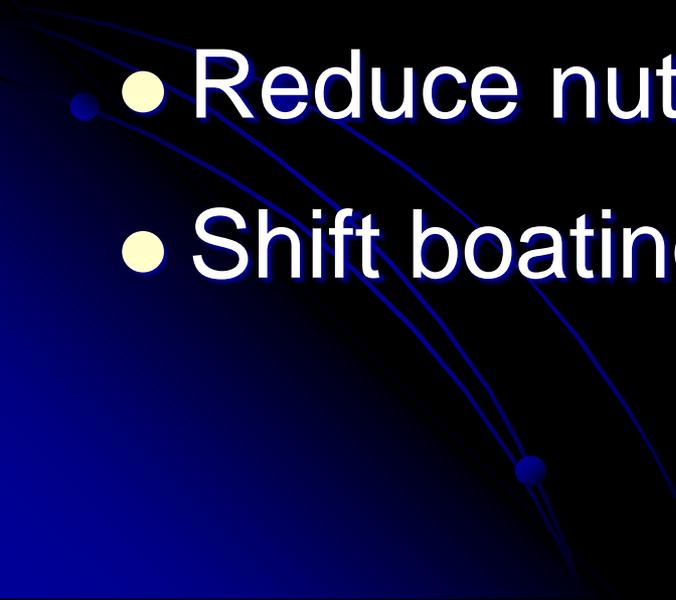
- Understand your water resources (lakes, streams, groundwater – how do individual water bodies interact?)
- Careful use of water and energy
- Thoughtful planning
- Mitigation/Adaptation



# Mitigating low lake levels

- Water level modification – caution!
- Pumping water into lakes – caution!
- Decrease inefficient water use (lawn watering, car washing, etc)
- Increase infiltration (redirect downspouts, raingardens, eliminate surfaces that can increase evaporation loss)

# Adapting to low lake levels

- Understand that lake levels fluctuate
  - Careful use of lakes and lakeshores
  - Protect habitat – fragile ecosystems
  - Reduce nutrient inputs
  - Shift boating behavior – go deep!
- 

# Adaptation strategies during times of low water (lakes)

Does your lake experience natural water level fluctuations? Such lakes:

## may have these problems

aquatic invasive plant species that are adaptable to water level increases or decreases

damage to unique habitats by human use during low water periods

sensitivity to changes in groundwater recharge

a large area less than 8 feet deep during some parts of the year

winter fish kills

removal of woody material, leading to loss of potential habitat for fish during periods of high water

## and may benefit from

✓ looking for and removing exotic aquatic invasive plants during low water periods

✓ establishing barriers to prevent vehicle access to the dry lake bed during low water periods

✓ use of swales and rain gardens to encourage infiltration of rainwater and snowmelt

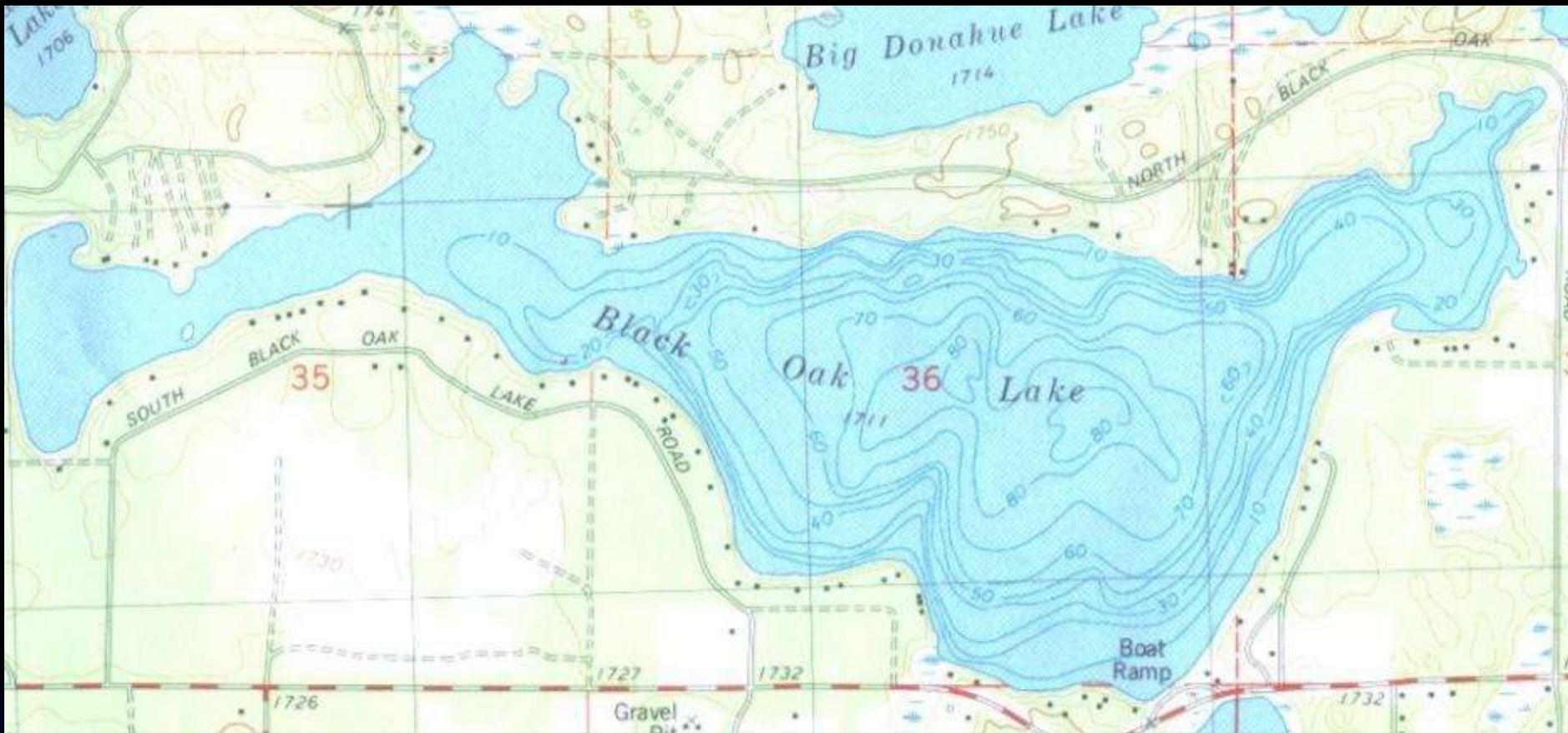
✓ no-wake speeds or electric-motor-only zoning

✓ adding oxygen when necessary by mechanical aeration or by plowing snow off the lake surface to encourage plant growth

✓ leaving fallen trees, logs, or branches in place or adding them to the exposed lake bed during low water periods

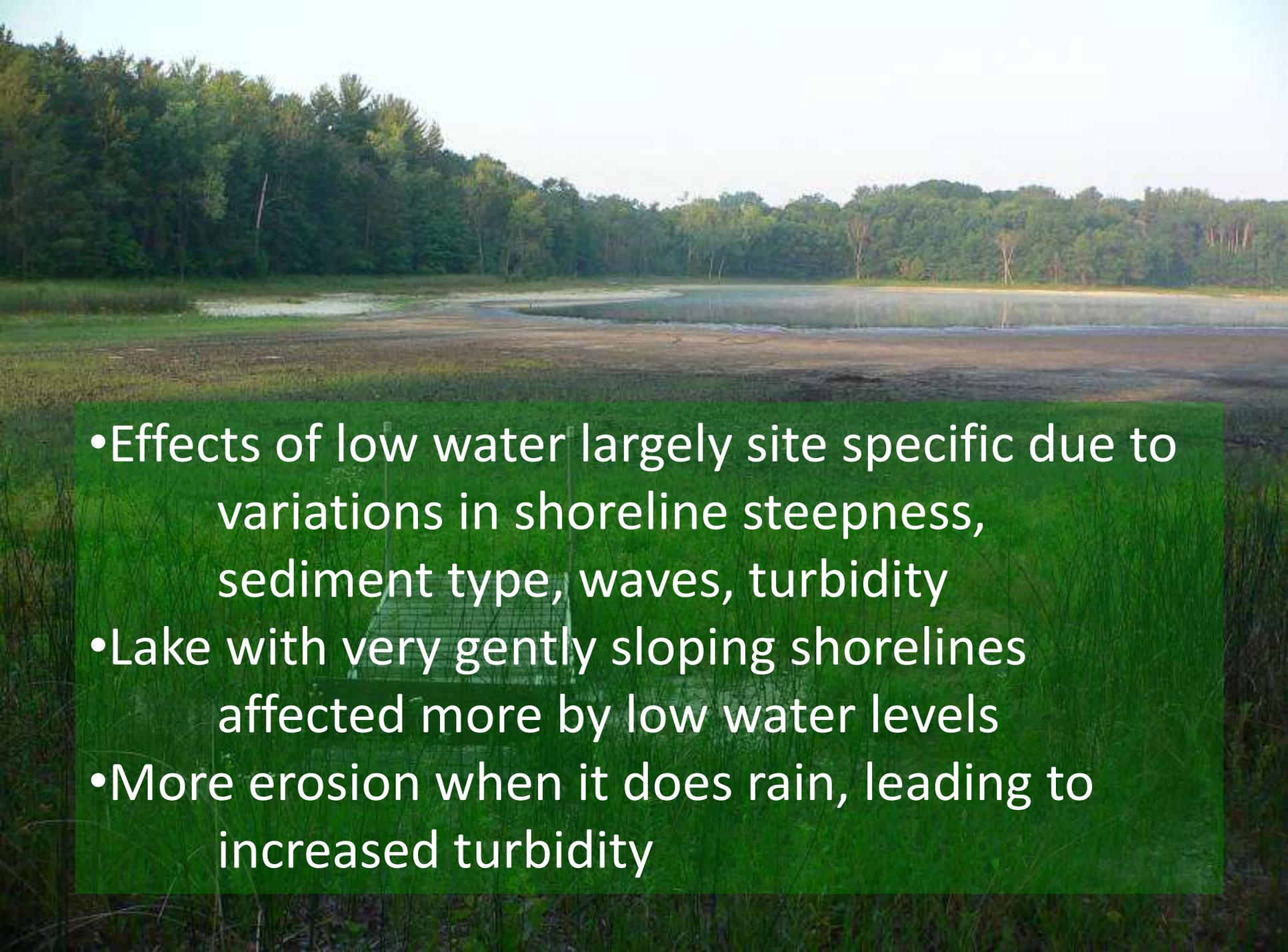
[http://www.uwsp.edu/cnr/watersheds/Reports\\_Publications/Reports/lakemanagementmenu.pdf](http://www.uwsp.edu/cnr/watersheds/Reports_Publications/Reports/lakemanagementmenu.pdf)

Shaw and others, 2009



Parts of the lake will be vulnerable to declining water levels. Others will be less affected.

Black Oak Lake, Vilas County

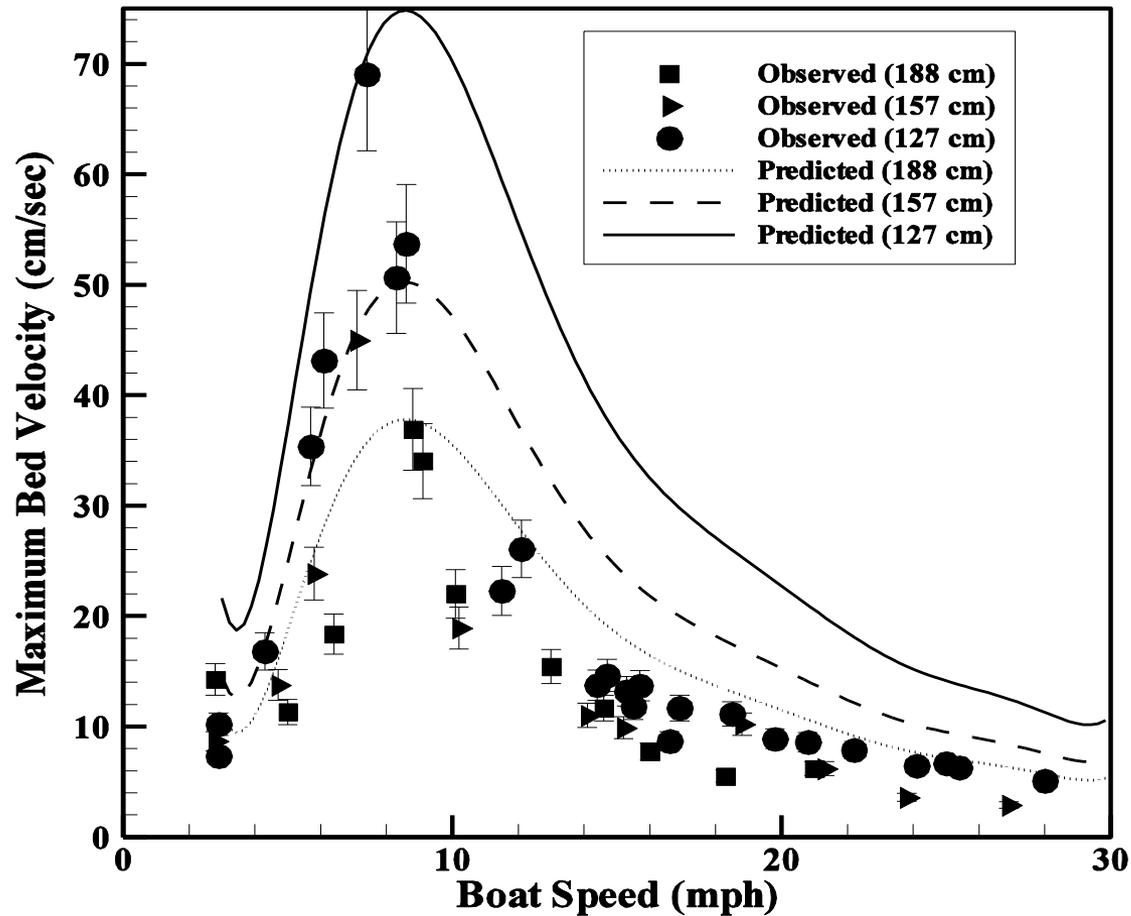
- 
- A landscape photograph showing a wide, sandy beach in the foreground, leading to a calm body of water. The background is filled with a dense forest of green trees under a clear sky. The water reflects the sky and the surrounding greenery.
- Effects of low water largely site specific due to variations in shoreline steepness, sediment type, waves, turbidity
  - Lake with very gently sloping shorelines affected more by low water levels
  - More erosion when it does rain, leading to increased turbidity



**Low water can lead to navigational issues and disturbance to lake beds**



# Boat speed and water depth affect sediment disturbance



(From Beachler and Hill, 2003)

No-wake  
zones  
protect  
plants from  
disturbance  
Long Lake  
Fond du Lac  
Co.

1998



Buoys  
moved  
toward  
shore

1997



Buoys in  
place

1995



Pre-study

MOTOR WATERCRAFT  
PROHIBITED AREA  
NO PERSON SHALL OPERATE  
A MOTOR BOAT  
AS DEFINED IN WIS STATE  
STATUTES 30.50 (6)  
THAT IS PROPELLED BY  
INTERNAL COMBUSTION  
ENGINE OR ENGINES ON  
THE WATERS OF KANGAROO  
LAKE NORTH OF THE CAUSE-  
WAY ELECTRIC MOTORS  
ONLY ARE PERMITTED  
ON SAID WATERS

**GILBERT LAKE**  
TOWN OF SPRINGWATER

- SLOW-NO-WAKE 5:00 P.M. TO 10:00 A.M.
- ANY MOTORIZED WATERCRAFT TRAVELING FASTER THAN SLOW-NO-WAKE MUST TRAVEL IN A COUNTER-CLOCKWISE DIRECTION
- NO OVERNIGHT CAMPING
- NO BUILDING OF FIRES
- NO-WAKE AREAS
- PUBLIC ACCESSES
- BOAT LANDING
- MOTORBOATS PROHIBITED IN MILFOIL AREAS
- STATE & LOCAL BOATING LAWS ENFORCED



**PLEASE STOP**  
Remove All Aquatic Plants and Grass Water From Boat and Trailer

**State Species Advisory**  
This Advisory Concerns The Following Species: ...

**Emergency Alert!**  
Eurasian watermilfoil has been found in area lakes.  
Help us protect our lakes from this and other invasive species.

- **Remove all vegetation** from your boat and trailer before launching and when leaving.
- **Dispose** of unwanted bait on shore. Do not release any fish into the lake nor harvest from this lake.
- **Drain** water from live wells.

Town of Barnes  
EWM Project





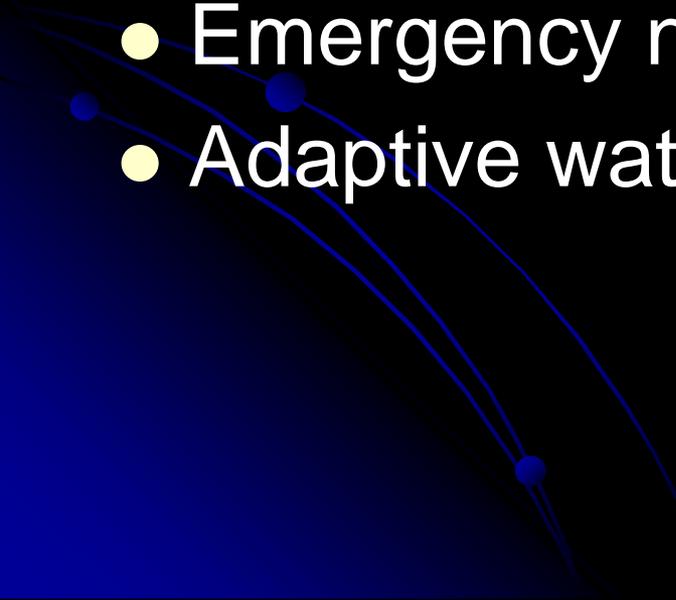
**Welcome to Pleasant Lake**

Please Note the Following Boating Regulations

- **Maximum Watercraft Speed -Slow No Wake-** Except from the hours of 11:00 AM to 3:00 PM
- **Counter Clockwise Traffic Pattern** for All Motorized Watercraft is Required From the Hours of 11:00 AM to 3:00 PM
- It is Unlawful to Operate Any Motorized Watercraft Within 100 Feet of any Dock, Pier, Boat or Buoyed Restricted Area at Speeds in Excess of Slow No Wake.
- All Plant Material Must Be Removed From All Watercraft and Trailers Before Entering the Lake to Prevent Eurasian Water Milfoil Contamination
- Proper Flotation Devices are Required When Operating All Watercraft, Water Skiing, etc.

*Excerpts From Town of Coloma Ordinance -1983-1E Wisconsin State Laws*

# High Water Adaptation

- Pumping/diversions (Devil's Lake, Fish Lake, Shell Lake)
  - Infiltration further up in watershed
  - Relocate infrastructure, homes
  - Emergency no-wake zones
  - Adaptive water level management
- 

# Clear Lake, Rock County, November 26, 2008





# WISCONSIN'S CHANGING CLIMATE:

*IMPACTS AND ADAPTATION*

The first report of the Wisconsin Initiative on Climate Change Impacts

2011

## WICCI's First Adaptive Assessment Report - released Feb 2011

30+ Authors

10 Editorial Team Members

22 Science Council Members

22 Chairs/Co-Chairs of 15  
Working Groups

220 Working Group Members

<http://wicci.wisc.edu>

# Potential Adaptation Strategies

**Strategy:** Response to changes in water levels due to variable precipitation, recharge, increased evaporation

- Enhance and restore shoreline habitat to withstand variations in water levels.
- Enhance infiltration by reducing impervious surfaces in urban/riparian areas and changing land management practices
- Build flexibility into planning and zoning for lakeshore and riparian development to account for changes in water levels
- Adjust and modify expectations – variability is the norm!



Photo – S. Ebben, Rhinelander, WI



Photo - WDNR



Photo – Janesville Gazette

# Potential Adaptation Strategies

## Strategy: Response to increasing groundwater extraction and demand for water

- Encourage large water users to locate in areas with adequate (sustainable) water sources (e.g. large rivers/Great Lakes).
- Encourage water conservation (rural and urban) through incentives and regulation
- Promote Integrated Water Management: Planning water use based on long term projections of supply and demand

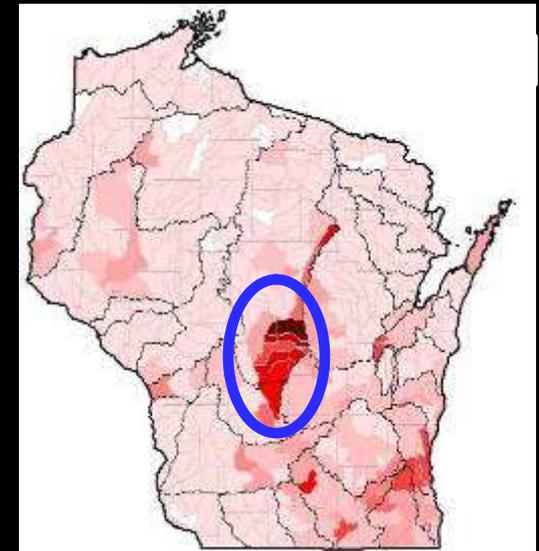
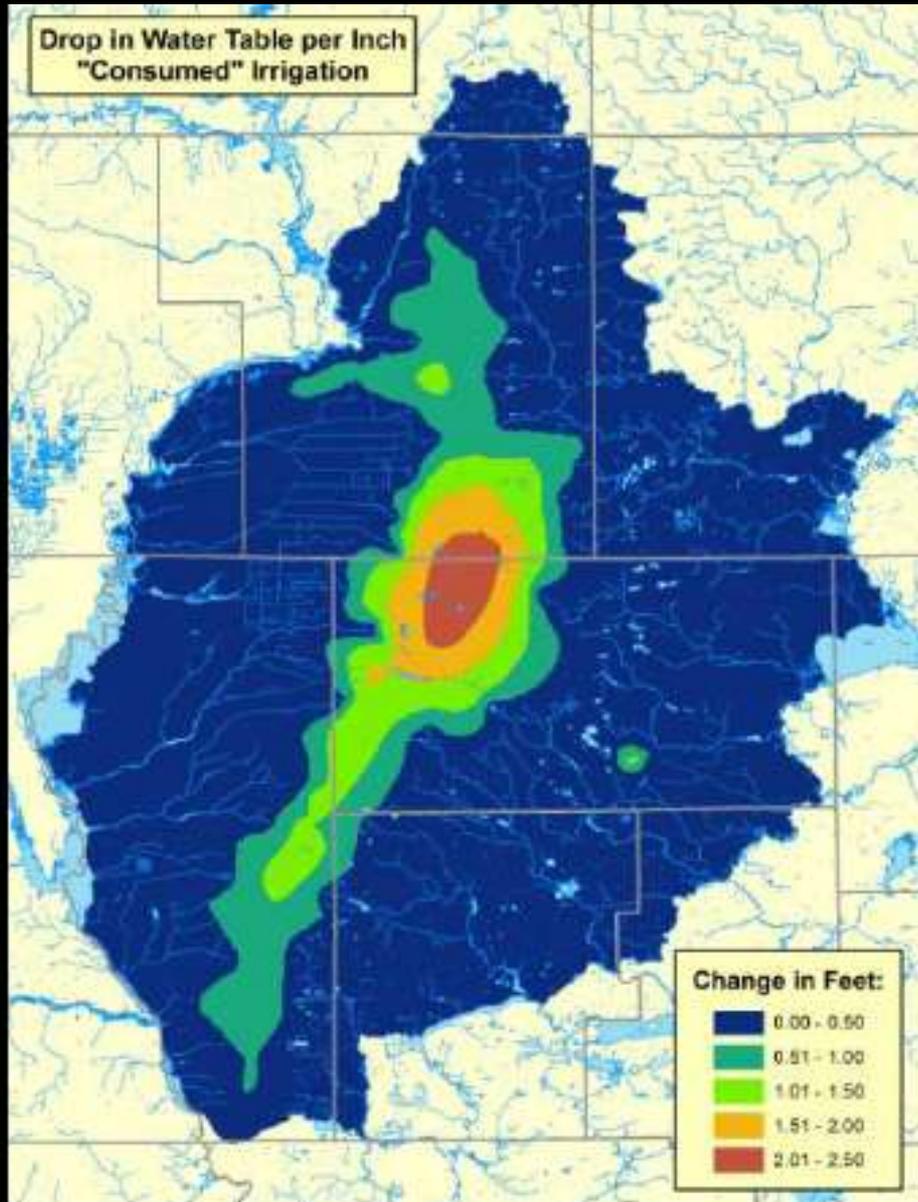


Photo - Mark Rozin/Capital Press



Quentin LaFond

# Groundwater Management Areas!



Kraft & Mechenich, 2010

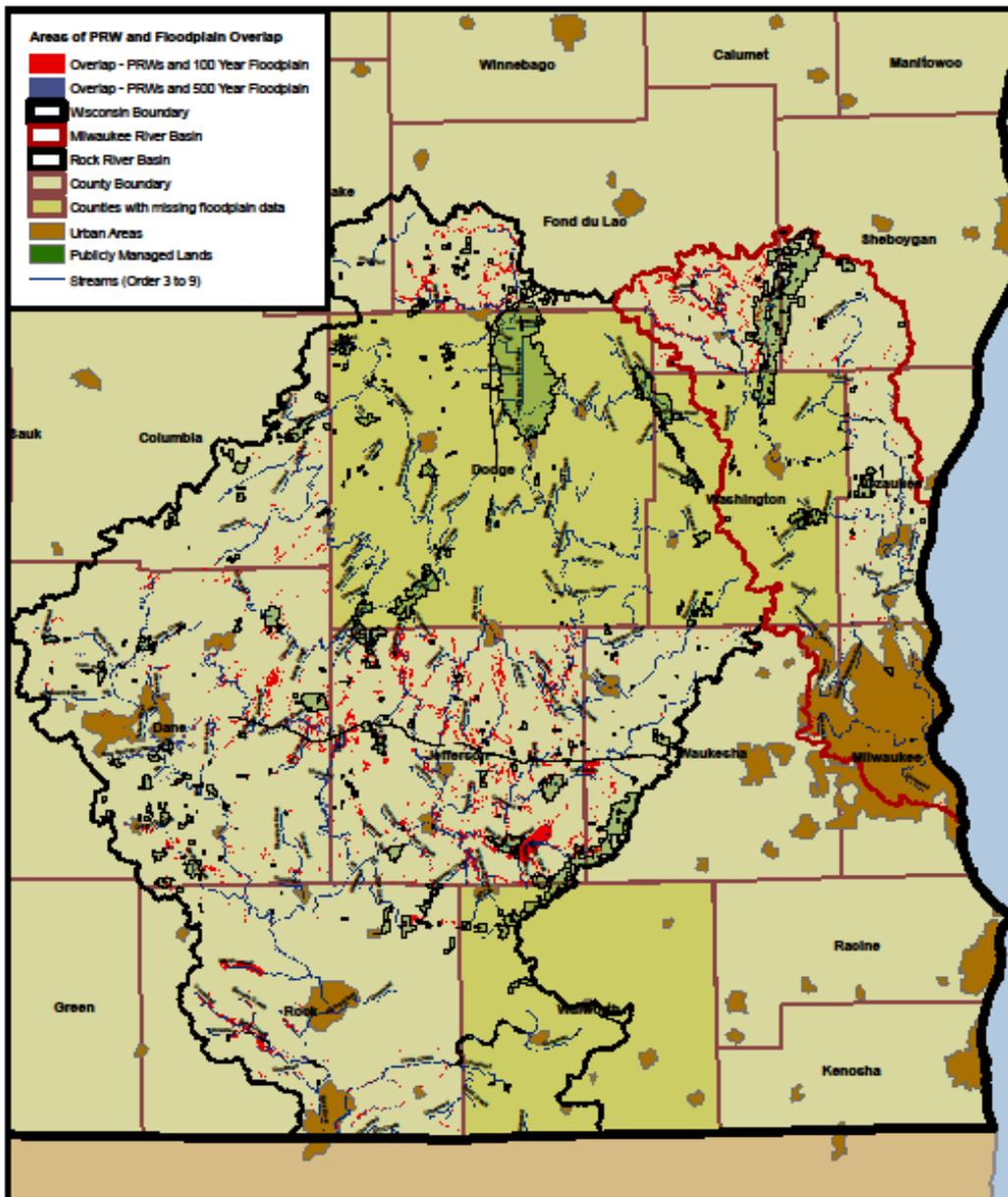
# Potential Adaptation Strategies

**Strategy:** Respond to increased flooding and impacts to infrastructure and agricultural land

- Identify and map and prioritize Potentially Restorable Wetlands (PRW's) in floodplain areas
- Restore prior-converted wetlands in upland areas to provide storage and filtration
- Resize manure storage lagoons, wastewater facilities, storm sewers, etc to accommodate increased storm flows
- Inspect, reinforce or remove dams, water control structures



Photos - WDNR



Areas in red show overlap between PRWs and 100 year floodplain

Note: floodplain delineations not complete for some counties.

# What can Lake Residents do?

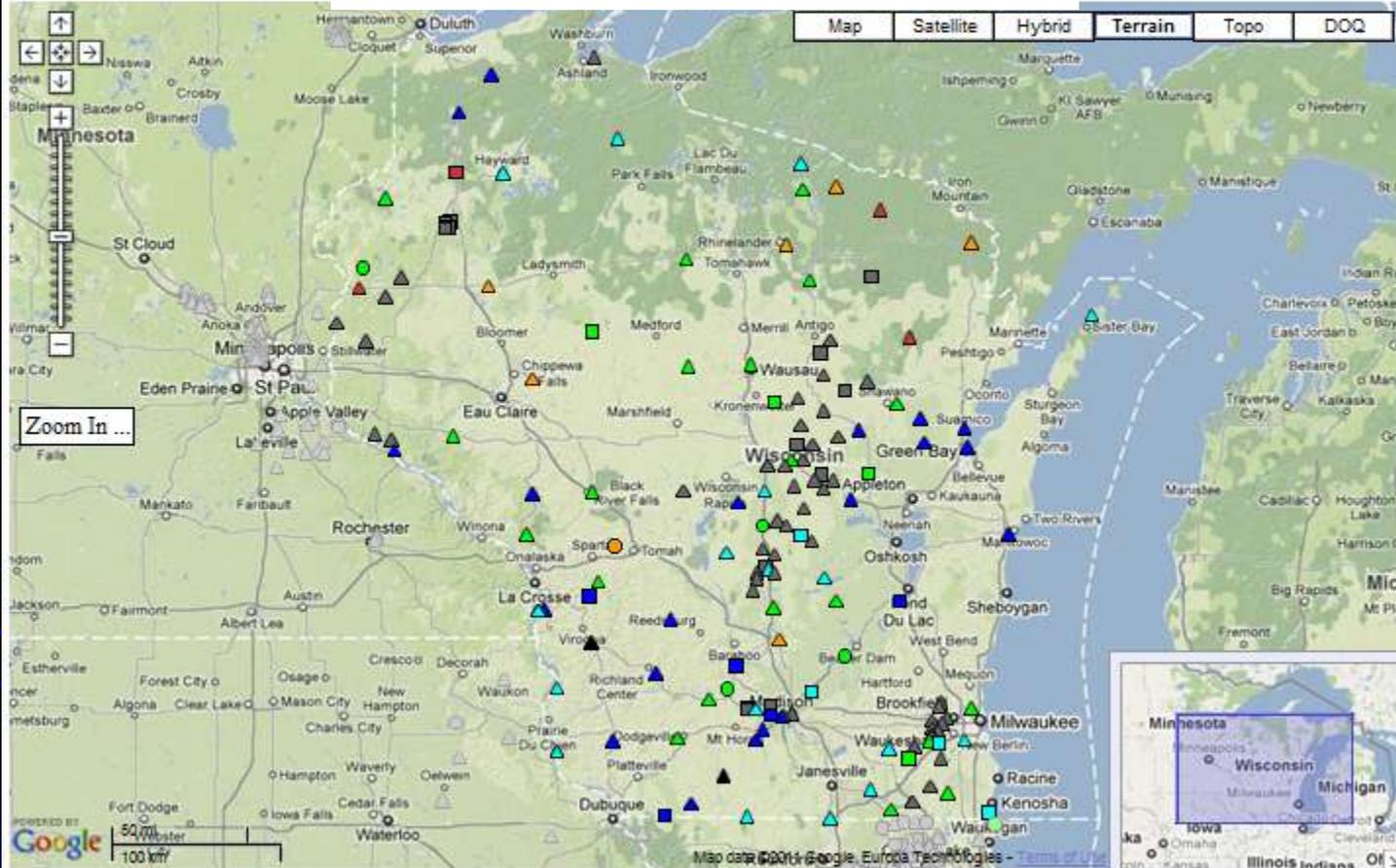
- Understand your lake and watershed
  - Natural cycles are normal; expect it
  - Climate trends are a new concern; adapt
- Look for opportunities to mitigate impacts / apply adaptation strategies  
(land and water management, zoning)
- Support groundwater, lake level, and streamflow monitoring



Wisconsin Active Water Level Network

March 1, 2011

<http://groundwaterwatch.usgs.gov>



Symbols with low color intensity indicate active wells located in adjacent states

Explanation - Percentile classes (symbol color based on most recent measurement)							
	●	●	●	●	●	●	●
	<10	10-24	25-75	76-90	>90	High	Not Ranked
Low	Much Below Normal	Below Normal	Normal	Above Normal	Much Above Normal		
						○ Real Time	□ Continuous
							△ Periodic Measurements

# Index Lake Network

Whitefish  
(Bardon)

Silver

Anvil

Boot

Berry

Huron

Long

Silver

Beaver

North

# Lake Tides

The newsletter for people interested in Wisconsin Lakes

Volume 35, No. 3; Summer 2010

## Long-term Lake-level Monitoring in Wisconsin

**T**he summer 2010 USGS Strategic Planning and Implementation project established a long-term monitoring network of large lakes located in major regions of Wisconsin. The goal of the project, which is being partially funded by the USGS through the Great Lakes Monitoring Initiative (GLMI), was to track regional changes in climate and hydrology, provide early warning of climate change, and provide a framework and priority for continuing lake-level monitoring by other volunteers throughout the state.



Large lakes have the potential to provide early warning of climate change.

Lake water level fluctuations are dependent on lake and water drainage, drainage property owners, development, and lake users. Lake levels change from year to year, and extreme high or low levels can present problems by restricting access to water and hampering navigation. Flooding threatens property and damages shoreline and structures, and changing near-shore vegetation. In addition, decadal-scale fluctuations in lake and stream-levels, climate change are known to occur over large areas and longer periods of time, but only locally according to geology, topography, type of water body, and human use. To respond appropriately, we need to understand why and how lake levels are changing.

Why there is no consistent long-term lake-level monitoring network in Wisconsin. Many drainage basins still depend on unrecorded and less long records of continuous data, but these records are not as useful for evaluating natural changes in water levels because drainage basins have varied streamflow that can moderate extreme levels. Deep-water lakes, which lack an outlet stream, exhibit large fluctuations in stage because water-level increases are caused by the cumulative effect of climatic fluctuations year or decade. These factors make ongoing lake-level for long-term lake-level monitoring.

### Approach

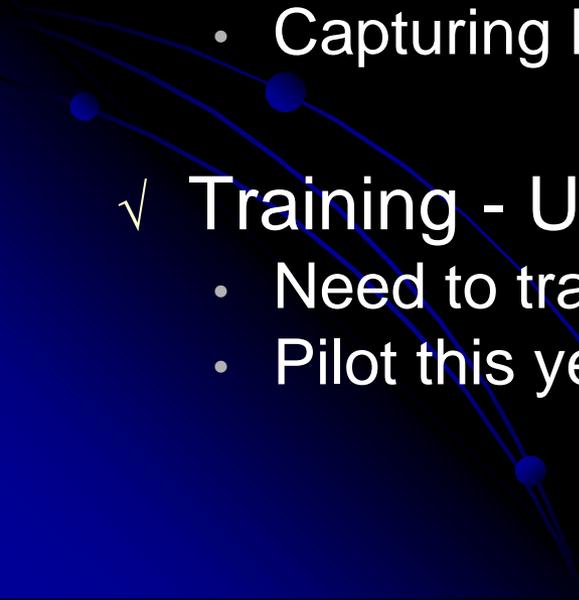
A series of 10 lakes was chosen from a list of candidate large lakes and selected by the USGS and Wisconsin Department of Natural Resources. Many of these lakes were proposed because they were recorded in the past and have relatively long periods of record. Additional monitoring criteria, such as geographic hydrologic status, water quality data, and active volunteer involvement, among other criteria, were also considered.

All lake monitoring sites that are part of the long-term monitoring network will be monitored for a minimum of 20 years each year by USGS staff. Water levels for these lakes will be read during open water by a local observer at about a weekly interval. USGS personnel will measure stage 2-4 times annually on an opportunistic basis when they are working near the vicinity of the lake. All lake level observations will be uploaded to the USGS website for public access. In addition, a network will be developed to track this information between the USGS and DNR websites. As a future option, a subset of the lakes could be read and with continuous records and the real-time data generated on the USGS website to provide access to a greater audience.

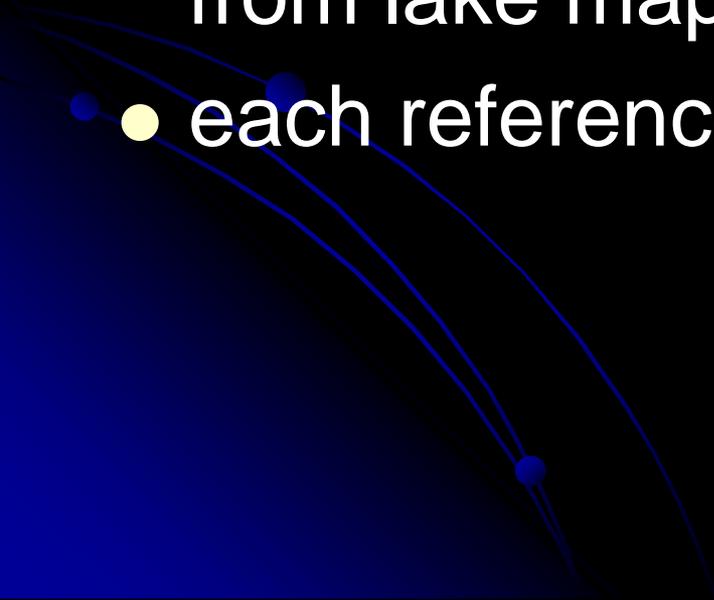
Lake Tides 2010



# CLMN Lake Level Monitoring

- √ Standard Protocol and Methods - USGS
    - Establishing benchmarks and reference points
    - Maintaining datum from year to year
  
  - √ Database development - WDNR
    - Setting up stations and interface for entering data
    - Capturing historical information
  
  - √ Training - UWEX
    - Need to train the trainers!
    - Pilot this year, expand in 2012
- 

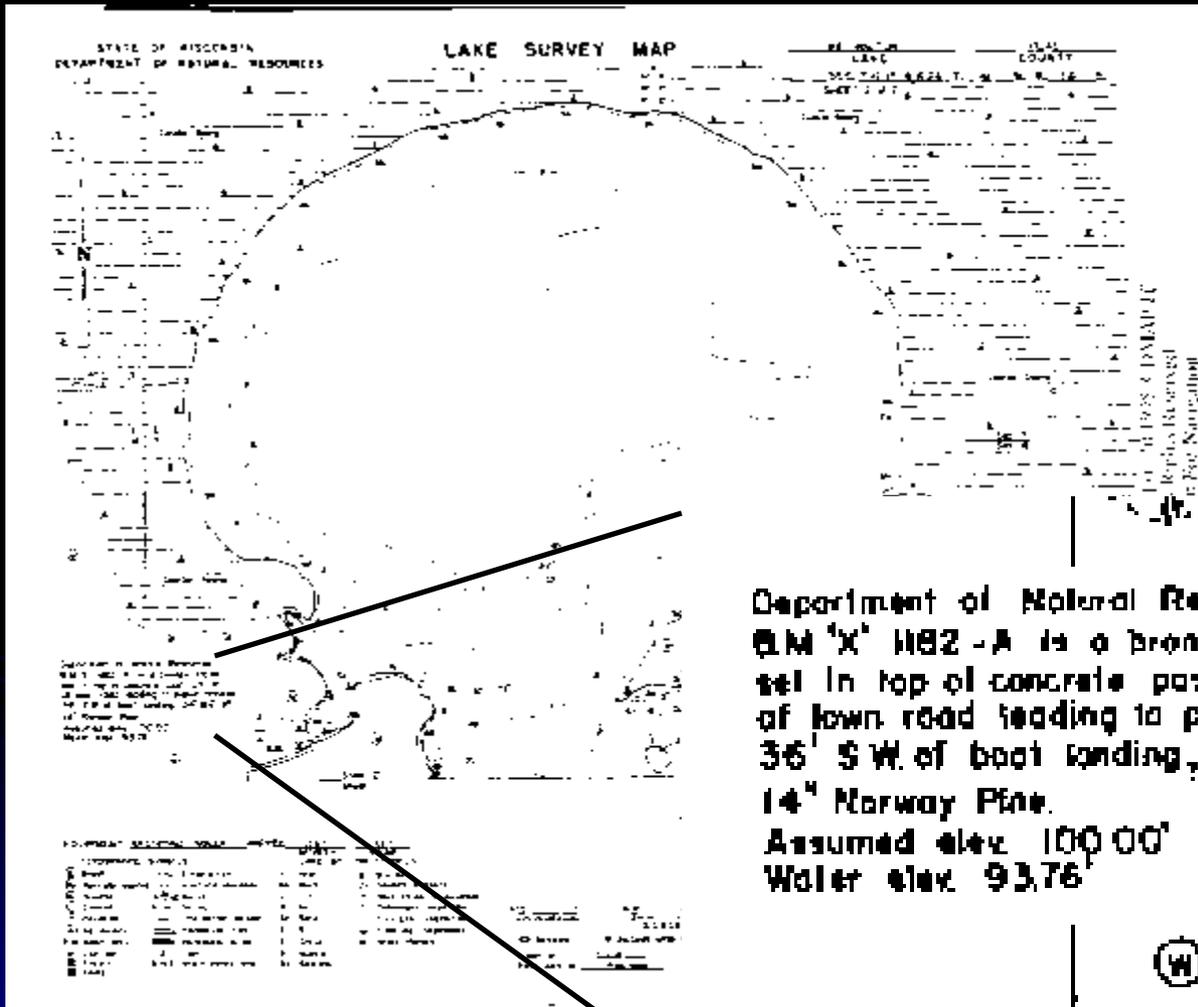
# For each lake, we'll set up monitoring stations for:

- the reference point (the observation point - for either beach width monitoring, or staff gage).
  - the benchmark (either use existing one from lake map, or need to set a new one)
  - each reference mark (may be several)
- 

# Common Bench Marks



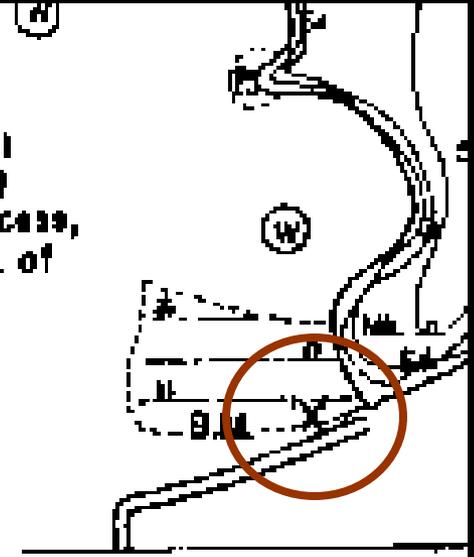
# Historical Benchmarks



Ike Walton Lake  
Vilas County

Map created in 1967

Department of Natural Resources  
BM 'X' 1192 -A is a bronze tablet  
set in top of concrete post, 59' N  
of town road leading to public access,  
36' S W. of boat landing, 34' N E. of  
14" Norway Pine.  
Assumed elev. 100.00'  
Water elev. 93.76'



Are they still there?

### Surface Water Integrated Monitoring System (SWIMS)

Projects Find Data Submit Data Stations Forms Reports, Maps, and Documents Manage Data

Home -> Fieldwork Event and Result Form

Fields denoted with an asterisk (\*) are REQUIRED.  
Fieldwork event data can be corrected later after submitting parameter results below.

You Are Entering Data For:

**Project:** Project Riverine Early Detectors (Project RED)  
**Start Date Time:** 01/02/2011  
**Station:** 10033438 - Location Specified On Next Page

Save and Edit Header

Project Riverine Early Detection

	Parameter	Result	Units	Method
Location Monitored	Waterbody Name (*)	Wingra Creek		PROJECT_RED_2011
	Start Latitude (ex. 43.074747)	44.1234		PROJECT_RED_2011
	Start Longitude (ex. -89.384625)	-89.4567		PROJECT_RED_2011
	Start Location Description (*)	Fish Hatchery Road, Madison		PROJECT_RED_2011
	End Latitude (ex. 43.074747)	44.3456		PROJECT_RED_2011
	End Longitude (ex. -89.384625)	-89.5678		PROJECT_RED_2011
	End Location Description	John Nolen Drive, Madison		PROJECT_RED_2011
Species Looked For	Japanese Knotweed	<input type="checkbox"/>		PROJECT_RED_2011
	Purple Loosestrife	<input type="checkbox"/>		PROJECT_RED_2011
	Phragmites	<input type="checkbox"/>		PROJECT_RED_2011
	Japanese Hops	<input type="checkbox"/>		PROJECT_RED_2011
	Flowering Rush	<input type="checkbox"/>		PROJECT_RED_2011
	Hydrilla	<input type="checkbox"/>		PROJECT_RED_2011
	Brazilian Waterweed	<input type="checkbox"/>		PROJECT_RED_2011
	Eurasian Water-Milfoil	<input type="checkbox"/>		PROJECT_RED_2011
	Curly-Leaf Pondweed	<input type="checkbox"/>		PROJECT_RED_2011
	Yellow Floating Heart	<input type="checkbox"/>		PROJECT_RED_2011
	Didymo	<input type="checkbox"/>		PROJECT_RED_2011
	Zebra Mussels	<input type="checkbox"/>		PROJECT_RED_2011
	Quagga Mussels	<input type="checkbox"/>		PROJECT_RED_2011

# Reference Points and staff gauges



gauges





### Surface Water Integrated Monitoring System (SWIMS)

Welcome FILBERT, JENNIFER M | Updates | Help | Log Off

- My Projects
- Find Data
- Submit Data
- Stations
- Forms
- Reports, Maps, and Documents
- Manage Data

#### Enter Monitoring Data

Fields denoted with an asterisk (\*) are REQUIRED.

Project \* Citizen Lake Monitoring - Water Quality - Lake Wingra; Deep Hole

Data Collectors \* Carry Lupulina

Station \* 133320, Lake Wingra - Deep Hole [Show Map](#)

Start Date \* 6/1/2011 [Select Date](#)

Time 3 : 00 PM

Form \* Lake Monitoring - Secchi, Temperature and D.O.

Selected Project: Citizen Lake Monitoring - Water Quality - Lake Win

Selected Collectors: Carry Lupulina

Selected Station: Lake Wingra - Deep Hole

**Optional Fields**

I want to enter latitude and longitude on the next page (optional)

End Date 6/1/2011 [Select Date](#)

Time 4 : 00 PM

Comments  
Sunny day, winds NW 5 mph.

Fill in the weather here, lake or streamside observations, wildlife spotted, names of additional helpers etc...

[Next](#)

**Currently, you are logged in.**  
For security purposes, you will be logged off automatically after 15 minutes of inactivity, or you can log out now.





### Surface Water Integrated Monitoring System (SWIMS)

Welcome FILBERT, JENNIFER M | Updates | Help | Log Off

My Projects Find Data Submit Data Stations Forms Reports, Maps, and Documents Manage Data

Home -> Fieldwork Event and Result Form

Fields denoted with an asterisk (\*) are REQUIRED.  
Fieldwork event data can be corrected later after submitting parameter results below.

You Are Entering Data For: Project: Citizen Lake Monitoring - Water Quality - Lake Wingra; Deep Hole  
Start Date Time: 01/01/2011 01:00 PM  
Station: 133320 - Lake Wingra - Deep Hole

Save and Edit Header

Lake Monitoring - Secchi, Temperature and D.O.

Parameter	Result	Units	Method
SECCHI DEPTH - FEET	3	FEET	CLMN SECCHI
SECCHI DEPTH HIT BOTTOM	NO	Y/N	CLMN SECCHI
WATER LEVEL (STAFF GAUGE)		FEET	CLMN SECCHI
WATER LEVEL (VISUAL)	HIGH		CLMN SECCHI
WATER COLUMN APPEARANCE	CLEAR		CLMN SECCHI
WATER COLOR (VISUAL)	BROWN		CLMN SECCHI
USER PERCEPTION OF WATER QUALITY			CLMN SECCHI

Next Date Next Station Save and Return to List Save and Enter Temp. D.O. Profile

After entering your data, please retain the original (blue) copy for your records. There is no need to mail in a copy.

Currently, you are logged in.  
For security purposes, you will be logged off automatically after 15 minutes of inactivity, or you can log out now.



The Official Internet site for the Wisconsin Department of Natural Resources  
101 S. Webster Street - PO Box 7921 - Madison, Wisconsin 53707-7921 - 608.266.2621

dnr.wi.gov



- Wisconsin Lakes
- Lake Maps
- Lake Information
  - A to Z Lake List
  - Search Lakes
  - Lake Trails
- Popular Topics
  - Aquatic Invasive Species
  - Aquatic Invasives - Lists and Maps
  - Aquatic Plants
  - Beaches
  - Blue-Green Algae
  - Boat Landings
  - Citizen Lake Monitoring
  - Clean Boats, Clean Waters
  - Critical Habitat Designations
  - Fishing
  - Grants
  - Maps, Lake Bathymetry
  - Wetlands
  - More...
- All Topics, A to Z

[Find A Lake](#) > [Iron County](#) > [Fox Lake](#)

## Fox Lake

Iron County

44 Acres

Fox Lake is a 44 acre lake located in Iron County. It has a maximum depth of 23 FEET. Fish in the lake include Panfish, Largemouth Bass, Northern Pike. The lake's water clarity is Low.

### Fish

- Panfish (Common)
- Largemouth Bass (Present)
- Northern Pike (Present)

### Typical Conditions

Typical Water Clarity: Low

Typical Water Temperature: | May: 72 F | June: 55 F |

### Before You Go

[Fish Consumption Advisories](#)

[State Fishing Regulations](#)



DNR Photo

- Overview
- Lake Health
  - Invasive Species
  - Water Level
  - Water Quality
- Local Efforts
  - Grants
  - etc.

### Kentuck Lake

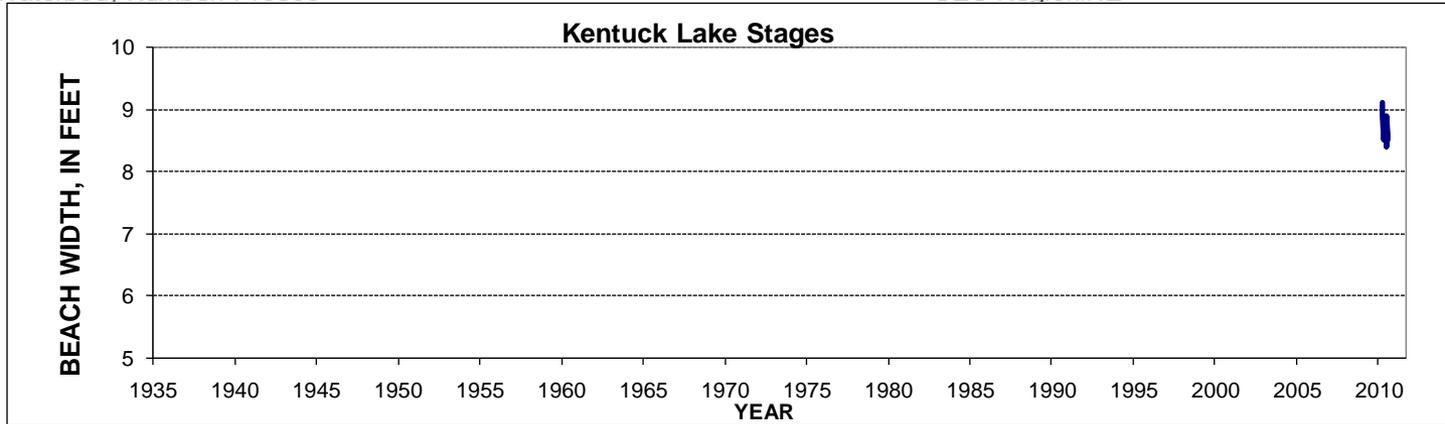
Vilas County

Waterbody Number: 716800

Lake Type: DRAINAGE

DNR Region: NO

GEO Region: NE



### Anvil Lake

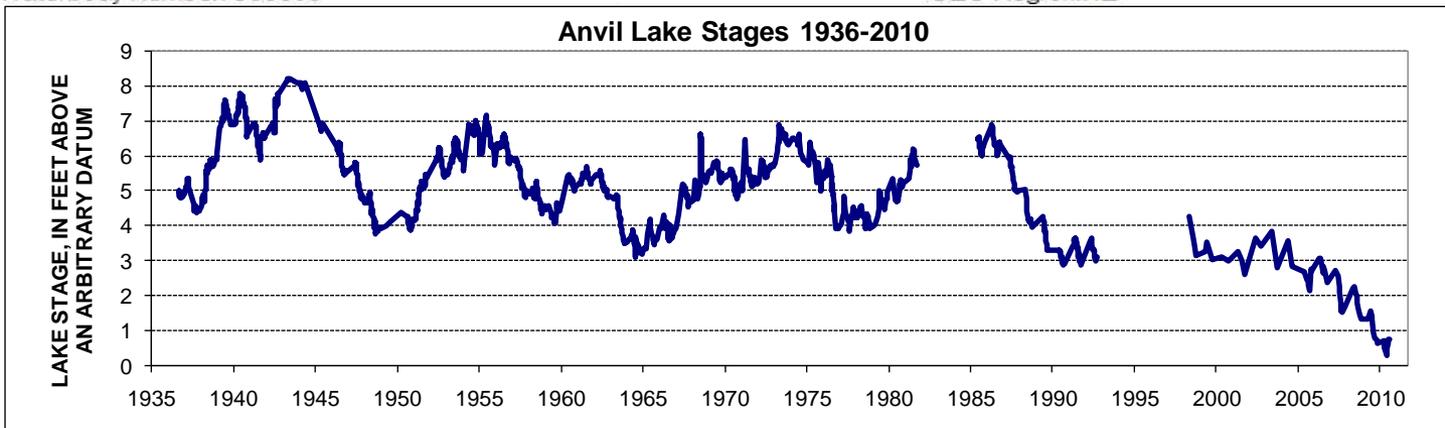
Vilas County

Waterbody Number: 968800

Lake Type: SEEPAGE

DNR Region: NO

GEO Region: NE



Past water level in feet above arbitrary datum

# Next Steps

- May – June: -- A “Train-the-Specialists” workshop will be held during which professionals and citizens that are interested in helping lake groups implement water level monitoring through the CLMN program will be trained
- June – November: -- Continued assistance will be provided to “Area Specialists” by WDNR, with support from USGS
- Spring 2012: Expanded training opportunities

# Sign-up sheets

- 1) Are you already collecting water level data and wish to enter it online?
- 2) Do you have an interest in collecting water level and/or beach width data in the future?
- 3) Are you interested in being trained in water level measuring protocols and then help groups in your area to perform many of these tasks?