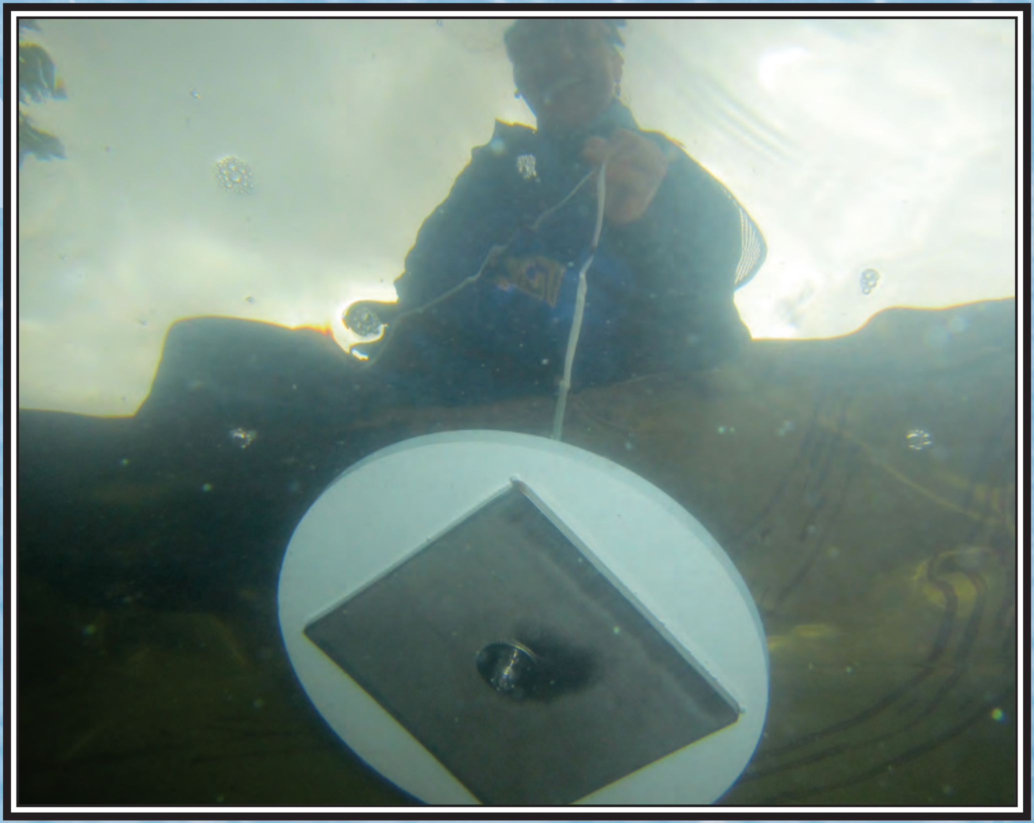
Wisconsin Citizen Lake Monitoring Training Manual

(Secchi Disk Procedures)



3rd Edition

Written by
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and Patricia J. Howard

Revised by
Sandy Wickman and Laura Herman

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Mention of trade names and commercial products do not constitute endorsement of their use.

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Acknowledgements

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CITIZEN LAKE MONITORING NETWORK

www.dnr.wi.gov/lakes/CLMN

- Log in to Enter Data
- Find Lake Summary Reports
- Graphs and Data
- Data Sheets
- Remote Sensing Schedule
- Your Satellite Path
- Awards
- Quality Assurance Project Plan

CITIZEN LAKE MONITORING NETWORK

www.uwsp.edu/uwexlakes

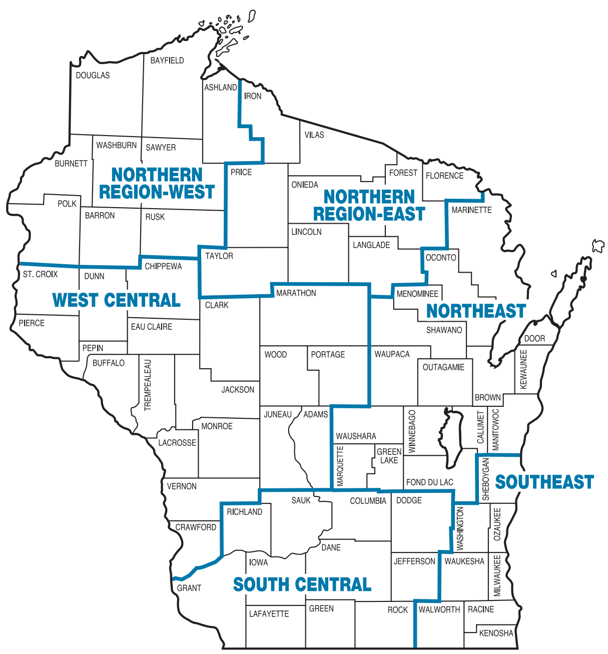
- Manuals
- Data Sheets
- How-to Videos for Water Clarity and Water Chemistry
- CLMN Newsletter
- Links to Other UWEX-Lakes Resources
    * Lake Tides
    * Lake Convention
    - Lake Leaders
    - Healthy Lakes Initiative

Need Answers to Your Questions?

When questions arise please contact the appropriate Citizen Lake Monitoring Network numbers listed below. There are two websites that may help you with questions: **www.dnr.wi.gov/lakes/CLMN** or **www.uwsp.edu/uwexlakes**.

If you are interested in becoming a citizen lake monitoring volunteer, or have questions about training, refresher courses, or other monitoring opportunities, please contact Paul Skawinski, Citizen Lake Monitoring Network Educator, at (715) 346-4853 or by email **Paul.Skawinski@uwsp.edu**.

For questions about the database, reporting data, or annual reports please contact the WDNR Citizen Lake Monitoring Network support team by email **DNRLakeb@wisconsin.gov**.



For questions about equipment, sampling procedures, or interpreting your water quality data, please contact your regional coordinator. You can visit **www.dnr.wi.gov/lakes/CLMN/** for a current listing of Citizen Lake Monitoring Network coordinators or call the number below.

Location	**Phone Number**
Northern Region-West	(715) 661-8175
Northern Region-East	(715) 365-8951
Northeast Region	(920) 360-3167
West Central Region	(715) 491-4131
Southeast Region & South Central Region	(414) 507-1413

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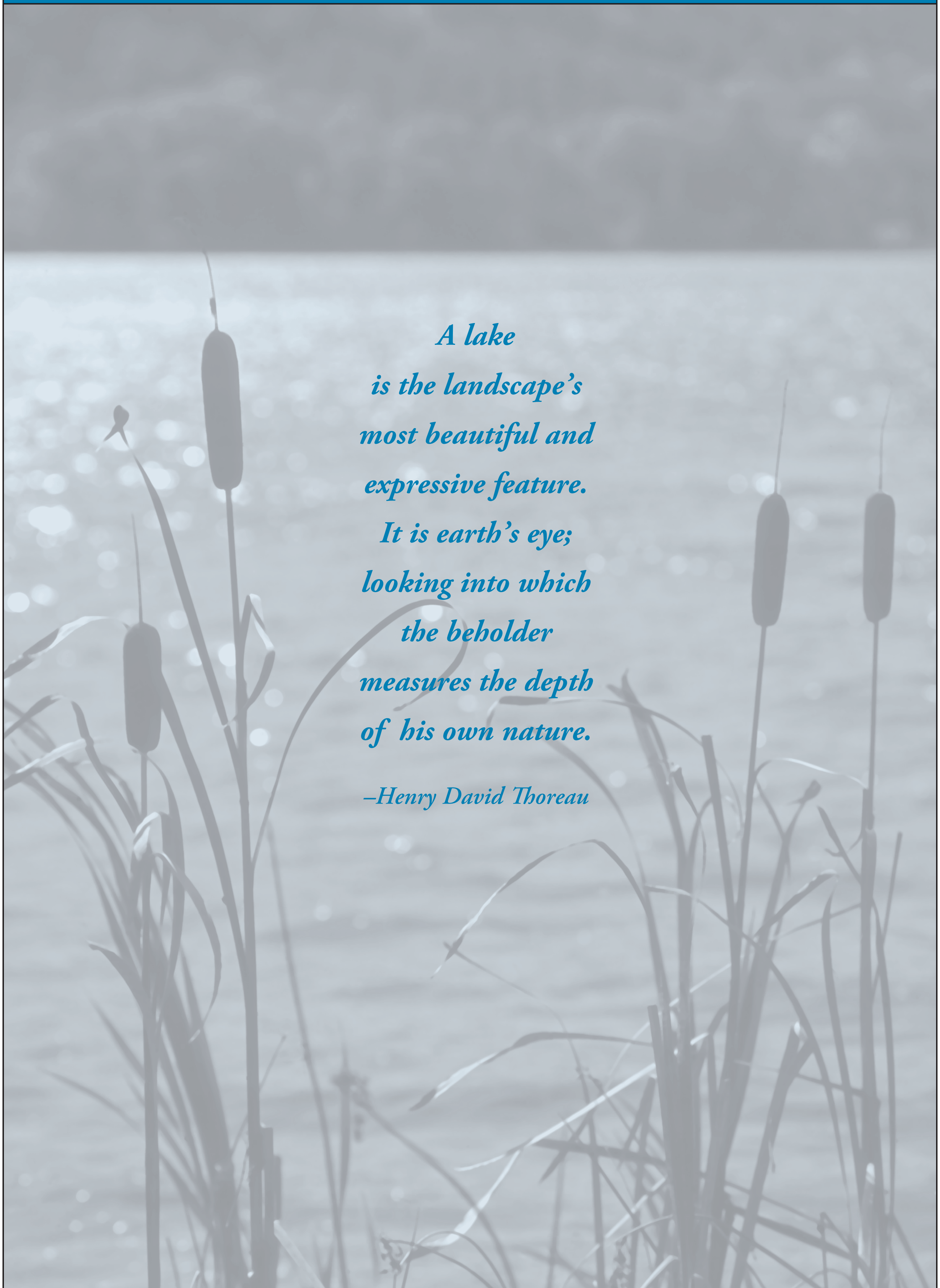


A lake
is the landscape's
most beautiful and
expressive feature.
It is earth's eye;
looking into which
the beholder
measures the depth
of his own nature.

–Henry David Thoreau

Introduction

THANK YOU for joining the Citizen Lake Monitoring Network (CLMN or Network). You are one of over a thousand citizen volunteers currently monitoring Wisconsin's lakes. Over one million acres of Wisconsin is covered by water. Wisconsin's 15,000 lakes contribute significantly to the economy of individual communities and the state. In addition, these lakes offer diverse recreational opportunities and provide important habitat for fish, waterfowl, and other wildlife. The volunteer monitoring network provides an opportunity for citizens to take an active role in monitoring and maintaining water quality. Through this volunteer network, you can learn about your lake and help the Wisconsin Lakes Partnership gain a better understanding of our state's lakes. More importantly, you can share your knowledge and the information you gather with your **lake association** and other lake residents.

The partnering of concerned citizens and the Wisconsin Department of Natural Resources (Wisconsin DNR) was initiated in 1986. In the Network's first year, volunteers throughout the state monitored 129 lakes. Since then, the Network has grown to include over 1,200 volunteers monitoring more than 900 lakes statewide! Some volunteers monitor more than one lake and some larger lakes are monitored at more than one location. Many volunteers share monitoring responsibilities with a friend or a group of friends.

Since 1986, the partnership has grown to include volunteers, the Wisconsin DNR, Extension Lakes, and Wisconsin Lakes. CLMN offers volunteers the opportunity to collect many types of data. The types of data you collect will depend on your concerns and interests, as well as the amount of time you wish to spend monitoring. **Secchi disk** monitoring is the backbone of CLMN and is the most common type of monitoring. Secchi volunteers collect water clarity information on their lakes throughout the open water season. After collecting Secchi data for one or more years, some volunteers choose to get involved in other types of monitoring. Secchi volunteers may be asked by their Lakes Coordinator to collect chemistry data on their lake. Chemistry volunteers collect **phosphorus** and

A full glossary of highlighted terms is provided on page 43 of this manual.

LAKE ASSOCIATION • *A voluntary organization with a membership generally comprised of those who own land on or near a lake. The goals of lake associations usually include maintaining, protecting, and improving the quality of a lake, its fisheries, and its watershed.*

SECCHI DISK • *A 20-cm (8-inch) diameter disk painted white and black in alternating quadrants. It is used to measure light transparency in lakes.*

PHOSPHORUS • *The major nutrient influencing plant and algal growth in more than 80% of Wisconsin lakes. Soluble reactive phosphorus refers to the amount of phosphorus in solution that is available to plants and algae. Total phosphorus refers to the amount of phosphorus in solution (reactive) and in particulate forms (non-reactive).*

CHLOROPHYLL • *Green pigment present in all plant life and necessary for photosynthesis. The amount of chlorophyll present in lake water depends on the amount of algae and is used as a common indicator of water quality.*

chlorophyll samples four times a year *in addition to* collecting Secchi data. This more extensive volunteer monitoring allows Wisconsin DNR lake managers to assess the nutrient enrichment state for their lakes. In addition, some volunteers also collect temperature and **dissolved oxygen** (DO) data for their lakes. Other types of monitoring activities include aquatic invasive species monitoring and native aquatic plant monitoring. Ideally, all volunteers will be able to find a level of involvement that suits their interests and abilities.

The partnership between the volunteer monitors and the Wisconsin DNR has resulted in an extensive volunteer monitoring database. Data collected by volunteers has been published in numerous reports and is frequently used by limnologists (scientists who study lakes) and water resource planners for a variety of purposes. In addition, volunteer data is reported to the U.S. Environmental Protection Agency (EPA) on a regular basis.

What is Expected of Me?

What we need most from you is your time and your keen powers of observation! As a Secchi volunteer, you will determine how the water clarity of your lake compares to similar lakes statewide and watch for long-term changes. The Network will provide all of the equipment that you will need to collect your data. You may be asked to participate in refresher sessions. These sessions provide an opportunity to meet other volunteers and to ask Wisconsin DNR staff questions about monitoring and lake issues as well as ensuring that all volunteers are following CLMN monitoring protocols.

There are some things that may influence your enjoyment when participating as a citizen volunteer: the type of boat you use, and whether or not you have a sampling partner. A fishing-type boat or pontoon boat is ideal for sampling work and will be safer and more comfortable than a canoe. A sampling partner will make your job safer, easier, and faster as one person can record data while the other collects samples.

DISSOLVED OXYGEN • *A measure of the amount of oxygen gas dissolved in water and available for use by micro-organisms and fish. Dissolved oxygen is produced by aquatic plants and algae as part of photosynthesis.*

LAKE CLASSIFICATION • *A way of placing lakes into categories with management strategies best suited to the types of lakes found in each category. For example, lakes can be classified to apply varying shoreland development standards. They can be grouped based on hydrology, average depth, surface area, shoreline configuration, as well as, sensitivity to pollutants and recreational use.*

Children of a culture born in a water-rich environment, we have never really learned how important water is to us. We understand it, but we do not respect it.

–William Ashworth

HOW IS CLMN DATA USED?

All citizen volunteers receive an annual data summary report, electronically or by mail, for their lake as well as periodic statewide reports. Most volunteers share this information with other lake residents who are interested in learning more about lake water quality. Lake groups, DNR, and county land conservation offices use CLMN data to support water quality projects such as shoreland restoration, lake classification, shoreland zoning, and nutrient diversion projects. All lake data is available to the public at www.dnr.wi.gov/lakes/CLMN.

Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that do not meet water quality standards. CLMN data is used in the Impaired Waters listing process.

We estimate that citizen collected data has a value of $4.08 million since 1986!

Fish biologists and lake managers use volunteer data to

- support general lake management decisions,
- support lake planning and protection grants,
- craft aquatic invasive species management decisions,
- determine lake health,
- look at winterkill or summer anoxic conditions,
- supplement statewide long-term trend data to analyze trends and issues and climate change, and
- establish "baseline" data to look at water quality changes and trends through time.

CLMN data is used to research water quality trends, to assist with remote sensing research, to investigate climate change and to further wildlife research.

Volunteer data is provided to other organizations, the state legislature, and federal, tribal, and local agencies that in turn may use this data to help determine funding for invasive species grants and programs. Citizen generated data is used every two years to report trends in Wisconsin lakes and to identify needs to the Federal government.

Volunteer data is also used by Earth Echo Water Challenge™, an international education and outreach program that builds public awareness and involvement in protecting water resources around the world by engaging citizens to conduct basic monitoring of their local water bodies.

Volunteer data is incorporated into the Secchi Dip-In. The Secchi Dip-In is a demonstration of the potential of volunteer monitors to gather environmentally important information on our lakes, rivers, and estuaries. Volunteers have been submitting information during the annual Dip In since 1994. It's an international effort to track changes in water quality. nalms.org/secchidipin

WHAT IS THE REMOTE SENSING PROGRAM?

The development of capabilities for the remote sensing of water quality in Wisconsin started in 1999 when Citizen Lake Monitoring Network (CLMN) volunteers assisted in a collaborative research effort with the University of Wisconsin-Madison Environmental Remote Sensing Center (ERSC) to develop a model for the retrieval of water clarity data from satellite images. CLMN volunteers collected on-the-ground Secchi depth data when the satellites were overhead to calibrate this model for each satellite image and water clarity data was retrieved for over 8,000 lakes statewide between 1999 and 2001. This research effort provided the foundation for the operational remote sensing of water clarity at the Wisconsin DNR in subsequent years. Today remote sensing data from the NASA/USGS Landsat Program are used by the Wisconsin DNR to provide satellite retrieved Secchi depth data for thousands of lakes annually with the support of CLMN volunteers. Different weather conditions and atmospheric effects on satellite images and challenges in the atmospheric correction of satellite images mean on-the-ground Secchi depth data is still needed to calibrate this model for each satellite image. Your CLMN volunteer coordinator will send you a list of Landsat 7 ETM+ and Landsat 8 OLI-TIRS image acquisition dates for your lake if you are one of our Secchi volunteers and want to support our operational efforts. The satellite image specific algorithms will translate your data to data for hundreds of lakes within the same satellite image if you collect it on a clear satellite image acquisition date for your lake! Find out more about remote sensing at http://dnr.wi.gov/lakes/CLMN/remotesensing/.

Sample Schedule

A typical year of volunteer monitoring may look something like this:

February

All current volunteers receive an annual report summarizing last year's lake data. Volunteers can print out their own lake summary report from the CLMN website. Volunteers who do not have access to the Internet will receive a paper copy of last year's lake summary report in the mail. At this time, volunteers receive awards for their service, including awards for monitoring milestones such as years of service or number of secchi readings taken.

March

Spring monitoring supplies are mailed out to volunteers. Volunteers with Internet access can print off their own data sheets and find their remote sensing schedule. The annual Wisconsin Lakes Convention is held in March or April.

April

Volunteers begin monitoring as soon as the ice is off the lake. Secchi volunteers continue taking readings every 10 to 14 days throughout the open water season.

May

New volunteers are trained.

June

Invasive Species Awareness Month.

CLMN Quality Assurance Project.

July

Secchi readings are taken in conjunction with satellite dates.

Secchi Dip-In.

CLMN Quality Assurance Project.

August

Secchi readings taken in conjunction with satellite dates.

September

Secchi readings taken in conjunction with satellite dates.

October

Volunteers wrap up Secchi monitoring for the season.

November

Volunteers ensure that all data has been submitted. If data has been entered into SWIMS you do not need to submit a paper copy.

December

Volunteers send any comments or needs (such as repair needs) to their regional coordinator.

THE CITIZEN LAKE MONITORING NETWORK PARTNERSHIP

Volunteer citizen lake monitoring is a team effort with many players including citizen volunteers, Wisconsin DNR, UWEX and Wisconsin Lakes.

The citizen volunteer is the most important player in the lake monitoring network.

You know your lake on a day-to-day basis. You know the best spots to fish and what birds visit or nest on the lake. You know when the lake freezes over, when the ice goes out, and you know your neighbors and friends who love and use the lake. You volunteer to participate because of your genuine concern for the lake and your desire to learn more about it. Collecting water quality data is a step in the right direction to gaining a better understanding of your lake.

We depend on volunteers to share the information that they learn about their lakes with their Lake Association, Lake District, or other residents on the lake. You have the best access to your neighbors. Many volunteers share their lake status report every year at annual meetings. Your lake summary report, graphs, and narrative will help you to prepare this report. Your CLMN regional coordinator or Wisconsin DNR lakes coordinator are available to assist you if you need help providing this information to your lake group.

Another member of the partnership is the Wisconsin DNR CLMN Regional Coordinator and local staff.

Local staff is located in several Wisconsin DNR regional offices around the state. As a citizen volunteer, you may already know them or have worked with them in the past. If you have any questions about your lake and your monitoring duties, these are the first people you should contact to help answer your questions.

Wisconsin DNR CLMN staff located in Madison.

Staff help maintain and analyze the volunteer data, keep track of awards, produce reports, and logistically keep the Network running smoothly.

By the conclusion of the sampling season you will receive an email reminding you that reports about your lake are available online at the Wisconsin DNR website. The reports summarize previous years' data collected on your lake and include text and graphs that help you understand how the data you collected in the past year relates to your lake.

Extension Lakes staff.

Extension Lakes staff ensure that trainers (Wisconsin DNR regional staff, and outside agency trainers) follow the Network's protocols when volunteers are trained. This ensures statewide consistency in data collected. Extension Lakes staff help with monitoring protocols and outreach.

Citizen volunteers receive *Lake Tides*, a quarterly newsletter published by the Wisconsin Lakes Partnership. The newsletter can also be viewed online at Extension Lakes web page.

Lake Leaders Institute was established to assist citizens in developing and enhancing their technical skills to preserve and protect Wisconsin Waters. To learn more, visit https://www.uwsp.edu/uwexlakes/ and click on Lake Leaders

THE CLMN LAKE MONITORING NETWORK HAS TEN PRIMARY GOALS

1. Quality and Accessible Data.
   Following collection protocols will enable you to collect quality data on your lake. Recording your Secchi disk readings and water chemistry data carefully, regularly and according to procedures, will provide valuable information about your lake. When you report your data to the Network, it is readily available through a database on the Internet. The Wisconsin DNR relies on your data. Without your help, very few lakes would be monitored.

2. Document Water Quality Changes Over Time.
   The Network's aim is to document water quality changes over time by summarizing the data that you collect and sharing that data with other volunteers and organizations. This is particularly important for those lakes where little or no data exists. You will be collecting baseline data that cannot be captured again in the future; and that will be used for decades to come. You will be able to compare your lake to hundreds of others using the statewide Summary Report. After several years of monitoring, your regional coordinator can work with you or your Lake Association to determine whether or not your lake should receive more intensive monitoring or management attention.

3. Educated and Informed Citizen Monitors.
   The Network's goal is to help you learn more about basic limnology. By collecting, summarizing, and reviewing your data, you will increase your understanding of your lake's overall water quality and will be able to share this information with your Lake Association or other lake residents. The information you collect can be used to help make decisions about your lake (e.g., use restrictions, watershed management decisions, aquatic plant management, etc.).

4. Greater Number and Frequency of Lakes Monitored.
   The Wisconsin DNR relies on citizen volunteers for most of its data. In a given year, Wisconsin DNR staff can only get out to a limited number of lakes, and often only get to these lakes once a year or once every five years. Your help allows many more lakes to be monitored on a much more frequent basis.

5. Enhanced Participation in Statewide Network of Volunteer Monitors.
   The Network is a partner in a statewide network with other Wisconsin monitoring groups, such as, LoonWatch, Water Action Volunteer Stream Monitoring, and others.

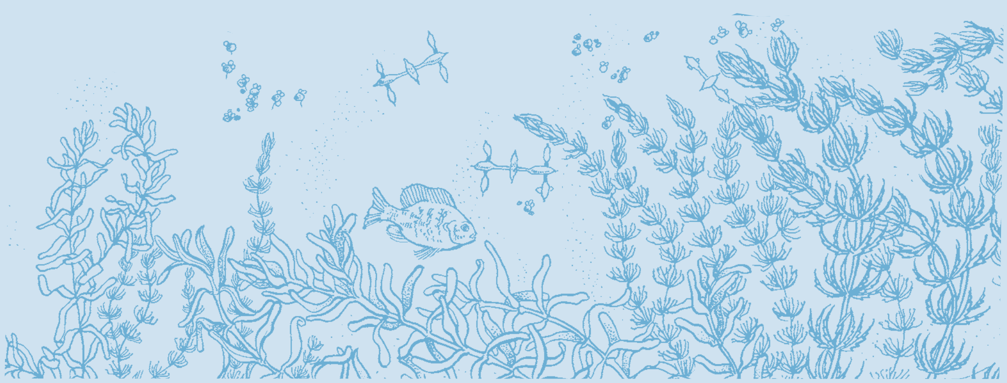
6. Quality Support.
   Support staff, located in Madison and Stevens Point, are available to help you with database or data reporting questions and awards. Each region of the state has a regional coordinator who trains volunteers and answers questions about equipment and sampling procedures, and annual reports.

7. Reduced Administrative Overhead (state, community, and citizen).
   Volunteer help reduces the Wisconsin DNR's operating costs and helps streamline workflow. By having volunteers sample lakes that need to be monitored, the Wisconsin DNR saves time and money involved in having staff travel to those lakes to collect the data. Those staff can in turn concentrate their efforts on other lakes. It is the Network's goal to keep monitoring and data reporting as simple and efficient as possible for the citizen volunteer.

8. Engage Others in Support of the Network.
   The Network is supported through a partnership, not just the Wisconsin DNR. Extension Lakes, and private entities are engaged in providing support and services to the statewide network. Volunteers often serve as mentors or trainers for other volunteers.

9. Tie-in to National Lake Research and Monitoring.
   Data is often used for lake research. For example, volunteer data has been used to successfully derive water clarity data on thousands of lakes from satellite imagery. You can see the results of this effort and learn more about satellite imagery and water clarity at www.lakesat.org. Volunteers are also annual participants in the "Secchi Dip-in," an international effort to monitor lakes. Visit www.secchidipin@nalms.org.

10. Recognize and Appreciate Citizen Involvement.
    At the end of each monitoring season, the Network provides length of service awards. Volunteers who have taken 100 or 500 Secchi readings on their lake receive recognition as well!



CAROL WATKINS, UW-EXTENSION, ENVIRONMENTAL RESOURCES CENTER

LIMNOLOGY • *The study of inland lakes and waters. The study of the interactions of the biological, chemical, and physical parameters of lakes and rivers.*

WATERSHED • *The area of land draining into a specific stream, river, lake or other body of water.*

What Types of Monitoring Can I Participate in?

If you have an interest in any of the following monitoring activities, please contact your regional coordinator.

Secchi

Father Pietro Angelo Secchi was an Italian astrophysicist and the scientific advisor to the Pope. In 1865, he was asked by the head of the Papal Navy to develop a way to measure transparency in the Mediterranean Sea. Secchi used white disks to measure the clarity of water. The Secchi disk was adopted for use by limnologists as a way to measure water clarity and to set a numerical value to water quality. Secchi disks come in various sizes and colors.

A Secchi depth reading is intended to give a general picture of your lake's water clarity. The sampling is easy to do and does not require sophisticated, high-maintenance equipment nor demand a background in science, chemistry, or engineering. One Secchi reading will not tell you a great deal about your lake but Secchi disk readings taken over a period of time will tell a story about your lake – is your water clarity improving, declining, or remaining the same?

Wisconsin CLMN uses a Secchi disk that is 8 inches in diameter. It is black and white and weighted with a stainless steel plate. CLMN protocols must be followed closely so that the data that you collect can be compared to other lakes. The Secchi disk is lowered into the water on a marked rope until it just disappears from view, that point is marked with a clothespin at the water's surface. Volunteers then lower the disk a couple of feet further into the water. They then slowly raise the disk until they can see it again. That point is also marked with a clothespin. The average of these two measurements is recorded. Doing the two measurements using the "clothespin method" allows the volunteer's eyes to acclimate to looking in the water and gives a more accurate reading. Measuring the water clarity or transparency of lakes over time provides a "pulse" on the health of these lakes, and is a crucial record for long-range planning.

Water Chemistry

After one year of water clarity monitoring, you may be eligible to participate in water chemistry monitoring. Chemistry volunteers, in addition to measuring water clarity and temperature, collect water samples for analysis for phosphorus and chlorophyll levels four times a year. Volunteer collected samples are sent to the **State Laboratory of Hygiene (WSLH)** for analysis. The information volunteers collect when monitoring both Secchi and water chemistry is used to determine the **trophic state** of the lake. Training and equipment for chemistry monitoring are provided by the Wisconsin DNR. Secchi volunteers who have participated in the Network for at least one sampling season and are interested in becoming a chemistry volunteer should contact their CLMN regional coordinator. The number of chemistry lakes that are added each year is limited due to the cost of equipment and the cost of sample analysis by WSLH. Because of budget limitations lakes are prioritized according to the need for information.

Temperature and Dissolved Oxygen

Water temperature impacts many organisms living in the lake. Reproduction, metabolic rate, and survival of fish and other aquatic animals; plant and algal growth and biomass; and nutrient cycling are all driven by water temperature. Long term data is needed to understand temperature trends.

DNR Fisheries Biologists and Lake Coordinators may ask you to collect a dissolved oxygen profile. Temperature and dissolved oxygen profiles are collected at three-foot intervals at the deep hole.

A Van Dorn water sample bottle is used to collect the water sample from the various depths for dissolved oxygen testing The collection profile will be determined by your regional coordinator. Winkler titration kits are available through CLMN.

Dissolved oxygen meters are not available through CLMN but your CLMN Coordinator may know of meters that are available to the public.

Native Aquatic Plant Monitoring

Aquatic plants are a good indicator of lake health. Over time, the type of vegetation and size of plant beds may change and/or move in response to changes in water quality, invasives, and human activity. Aquatic plant monitoring is tailored each volunteer's ability, interest, and time commitment and can vary from lake to lake. Some volunteers choose to identify and map plant beds on the lake, keeping track of beds based on whether the plants are submergent, emergent, or floating.

Other volunteers wish to have a more comprehensive list of the aquatic plants that are present on their lake. They identify, collect, and press their lake's aquatic plants and map the plants' location. All plants collected by volunteers are verified.

Aquatic Invasive Species (AIS) Monitoring

Citizen volunteer monitoring protocols for AIS can be found at the Extension Lakes website. Information on invasive species can be found on the DNR website.

If you think you have found an invasive, please contact your local CLMN coordinator so they can verify the specimen. The DNR website lists the lakes that are known to contain invasive species.

AQUATIC INVASIVE SPECIES (AIS) • *Refers to species of plant or animal that are not native to a particular region into which they have moved or invaded. Wisconsin law prohibits launching or transporting a boat if aquatic plants or animals are attached to the boat.*

PUBLIC PERCEPTION OF WATER QUALITY

As part of your Secchi data collection, the Network is interested in your opinion of the lake's water quality when you are sampling. Using these observations, a public opinion assessment of water clarity can be made. This information will help determine water quality standards for lakes. There is no right or wrong answer to these questions and your answer can change throughout the summer or in subsequent years. Specifically, citizen volunteers will be asked to note the algal content of the water. Is there so much algae that you want to shower after swimming? Do you not want to go swimming? In addition to the Secchi disk readings that you measure, the Network is concerned with your opinion of what constitutes good or poor water quality.

The Network predicts that the public opinion question will reveal that people living in one area of the state will have similar perceptions of what they consider to be acceptable water clarity. The Network hopes to share this information with other states in anticipation of creating a regional map of public perceptions of water clarity.

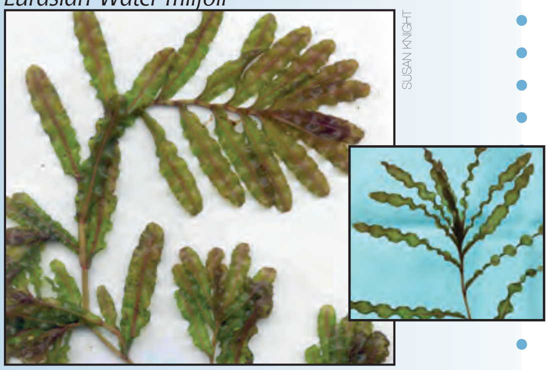
STATE LABORATORY OF HYGIENE (WSLH) • *The state of Wisconsin's public health and environmental laboratory.*

TROPHIC STATE • *The extent to which the process of eutrophication has occurred is reflected in a lake's trophic classification or state. The three major trophic states are oligotrophic, mesotrophic, and eutrophic.*

pH • *The measure of acidity or alkalinity of a solution. Neutral solutions are defined as having a pH of 7.0. Solutions which are known as acidic have a pH lower than 7. Solutions which are known as basic have a pH greater than 7.*

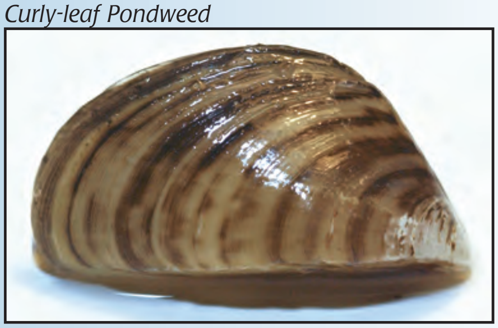
DNR PHOTO

Eurasian Water-milfoil



SUSAN KNIGHT

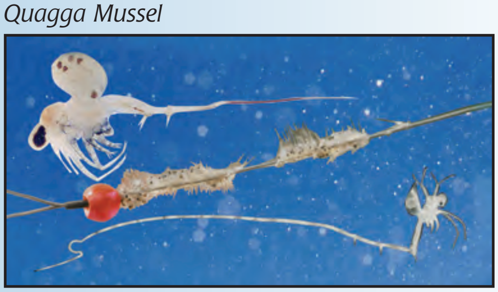
Curly-leaf Pondweed



Zebra Mussel

BOB KORTH

Quagga Mussel



DOUGLAS A. JENSEN

Spiny Waterflea

Eurasian Water-milfoil (EWM) Watch

All volunteers are encouraged to monitor their lake for Eurasian water-milfoil (*Myriophyllum spicatum*). EWM is an aquatic plant that is not native to the United States and continues to populate many lakes throughout Wisconsin.

Curly-leaf Pondweed Watch

In Wisconsin, curly-leaf pondweed (*Potamogeton crispus*) usually completes its life cycle by June or July. Volunteers are asked to check plant beds on calm, clear days from ice off until mid-July.

Zebra and Quagga Mussel Watch

The zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena rostriformis bugensis*) are two non-native mussel species that can spread rapidly and change food webs.

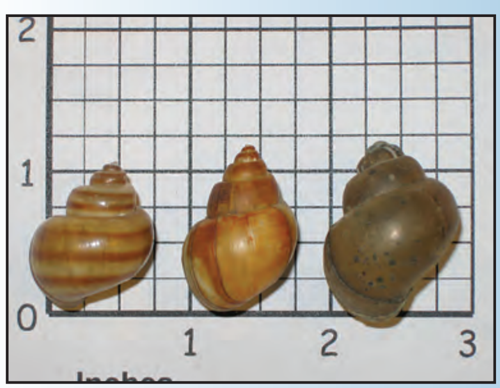
Spiny Waterflea Watch

Spiny waterfleas (*Bythotrephes spp.*) and fish hook waterfleas (*Cercopagis pengoi*) are small crustaceans distantly related to shrimp. Both species of waterflea entered the Great Lakes in ship ballast water from Europe. One or both of the species are now found in all of the Great Lakes. Spiny waterfleas are found in some inland lakes in Wisconsin.

Both species tend to gather in masses on fishing lines so anglers may be the first to discover a new infestation.

Chinese and Banded Mystery Snail Monitoring

There are three species of mystery snails in Wisconsin. Only one of these species, the brown mystery snail (*Campeloma decisum*) is native to Wisconsin. The Chinese mystery snail (*Bellamya chinensis*) is native to Asia. The banded mystery snail (*Viviparus georgianus*) is native to



LAURA HERMAN

Banded Mystery Snail (left), Brown Mystery Snail which is native to Wisconsin (center), and Chinese Mystery Snail (right).

Volunteer Monitoring

in and Around Wisconsin Waters

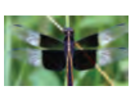
Welcome to the Citizen Lake Monitoring Network — a volunteer network with over 1,000 citizens collecting water quality data on Wisconsin's lakes! ***We welcome you to check out these additional volunteer monitoring opportunities in and around Wisconsin waters!***

Clean Boats, Clean Waters Watercraft Inspectors
Volunteers can also help stop the spread of invasive species by organizing and conducting watercraft inspections at boat landings in their communities. Trained volunteers then educate boaters on how and where invasive species are most likely to hitch a ride into water bodies. For more information, contact Erin McFarlane, Aquatic Invasive Species Volunteer Coordinator, at erin.mcfarlane@uwsp.edu.

Water Action Volunteers
Water Action Volunteers (WAV) has three levels of stream monitoring to accommodate citizens' time availability and interests; volunteers begin by learning to monitor six aspects of water quality their first year. After a monitoring season, citizens can move to the next level to monitor stream health using the same methods as DNR biologists or can conduct intensive monitoring that addresses a specific issue about local stream quality. For more information, contact WAV@extension.wisc.edu .

Project RED
Project RED (Riverine Early Detectors) allows volunteers to identify, report, and control invasive species in and along Wisconsin's rivers and streams. Volunteers are trained to monitor rivers and streams by canoe, kayak, or on foot for 16 species of concern. Contact info@wisconsinrivers.org

Mussel Monitoring Program of Wisconsin
Over half of Wisconsin's 51 native mussel species (also known as clams) are listed as species of greatest "conservation need"; we need information on where they currently occur. The Mussel Monitoring Program of Wisconsin would like your help in finding out what mussels occur in your area. Contact wiatri.net/inventory/mussels .



Odonata Survey
The goal of the Wisconsin Odonata Survey is to gain more knowledge about the distribution and habitat requirements of our 160+ species of dragonflies and damselflies (Order Odonata). The Odonata Survey uses volunteers to document populations of dragonflies and damselflies by identifying adults, larvae, and exuviae (cast skins left behind near shore when the larva transforms into the adult). Contact wiatri.net/inventory/odonata .

LoonWatch
LoonWatch promotes the preservation, understanding, and enjoyment of common loons and their aquatic habitats in the Lake Superior region. Volunteers record when loons arrive, if they nested, how many chicks were produced, and any potential threats to the nest site. For more information, contact the *LoonWatch* Coordinator at (715) 682-1220 or email loonwatch@northland.edu.

Wisconsin Bat Program

In general, bat populations are susceptible to decline because of low reproductive rates, and many species congregate at a limited number of locations during critical stages of their natural history cycle (i.e., hibernacula and maternity colonies). Volunteers can conduct acoustic surveys or can participate in bat house monitoring. For more information, contact the Wisconsin Bat Program at wiatri.net/inventory/bats .

Wisconsin Turtle Conservation Program

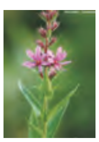
The Wisconsin Turtle Conservation Program (WTCP) records turtle species' distributions using the help of Wisconsin citizens. The program is looking for volunteers to document high turtle mortality locations along roads in order to promote effective management and conservation of Wisconsin's 11 turtle species. For more information, wiatri.net/inventory/witurtles .

Wisconsin Frog and Toad Survey

The Wisconsin Frog and Toad Survey (WFTS) is a citizen-based monitoring program intended to determine the status, distribution, and long-term population trends of Wisconsin's frog and toad species. WFTS includes approximately 150 permanent roadside routes throughout the state where volunteers monitor frog populations through calling surveys. For more information, wiatri.net/inventory/frogtoadsurvey.

Wisconsin Marshbird Survey

Secretive marshbirds such as rails, bitterns, coots, and grebes are among the most poorly monitored bird groups in North America. Volunteers are needed to conduct surveys of a predetermined route during in May and June to help experts learn more about species' abundance, population trends, and habitat associations. For more information on marshbird surveys or additional bird monitoring opportunities, contact wiatri.net/projects/birdroutes .



Purple Loosestrife Biocontrol Project

There are a number of methods to control purple loosestrife; however, biocontrol may be the most viable long-term control method. The Purple Loosestrife Biocontrol Program offers cooperative support, including free equipment and starter beetles, to all Wisconsin citizens who wish to use these insects to reduce their local purple loosestrife. For more information, contact program coordinator jeannes.scherer@wisconsin.gov.

For more information, please visit the Wisconsin Citizen-based Monitoring Network at:

www.wiatri.net/cbm/

Factors that Affect Water Clarity

Water clarity is a measure of the amount of particles in the water, or the extent to which light can travel through the water. There are many ways to express water clarity, including Secchi disk depth, turbidity, color, suspended solids, or light extinction. Chlorophyll-a, collected by water chemistry volunteers, is a measurement of the amount of **algae** that is in the water.

Water clarity is important for a number of reasons. It affects the depth to which aquatic plants can grow, dissolved oxygen content, and water temperature. Fish and loons and other wildlife depend on good water clarity to find food. Water clarity is often used as a measure of trophic status, or an indicator of ecosystem health. Water clarity is important aesthetically and can affect property values and recreational use of a water body (Tim Asplund, March 2000).

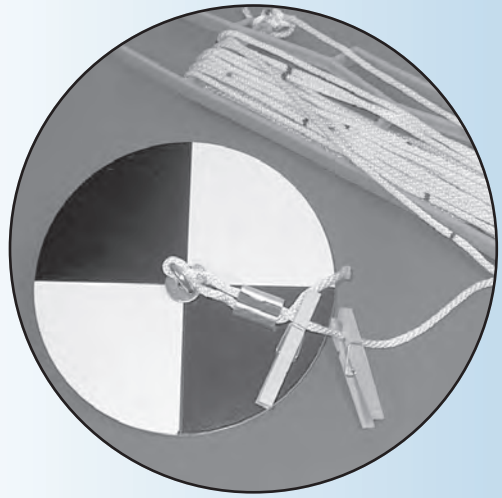
Suspended sediments, algal growth, runoff, shoreline erosion, wind mixing of the lake bottom, and tannic and humic acids from wetlands can all affect water clarity. Water clarity often fluctuates seasonally and can be affected by storms, wind, normal cycles in food webs, and rough fish such as carp, suckers, and bullheads.

Suspended Sediments

Sediment may enter the lake from a river or stream. Sediment may also come from land use activities in the **watershed** including erosion from cropland and **runoff** from barnyards, construction sites, and city streets. In a shallow lake, sediment from the lake bottom can be suspended throughout the water column during heavy winds. Additionally, certain fish species (e.g., carp) may stir up bottom sediments and make the lake appear muddy. A lake with a lot of suspended sediment will appear cloudy, muddy, or brown. As a result, the Secchi disk may disappear from view within a few feet of the water's surface.

Algae

Phytoplankton (a type of free-floating algae) is a vital part of the food chain in aquatic systems. They provide the food base for **zooplankton** (microscopic animals)



Secchi disk

ALGAE • *Small aquatic plants containing chlorophyll and without roots that occur as single cell or multi-celled colonies. Algae form the base of the food chain in an aquatic environment.*

WATERSHED • *The area of land draining into a specific stream, river, lake, or other body of water.*

RUNOFF • *Water from rain, snow melt, or irrigation that flows over the ground surface and into streams or lakes.*

PHYTOPLANKTON • *Very small free-floating aquatic plants, such as one-celled algae. Their abundance, as measured by the amount of chlorophyll a in a water sample, is commonly used to classify the trophic status of a lake.*

ZOOPLANKTON • *Plankton that is made up of microscopic animals, for example, protozoa, that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. For many fish and crustaceans, they are the primary source* that eventually are eaten by fish, ducks, and other animals. Too much phytoplankton can disrupt the natural balance of a lake ecosystem, make the lake unsightly, and make swimming and other activities less enjoyable.

Blue-green algae, also known as Cyanobacteria can grow very quickly in number if conditions are just right. Concerns associated with blue-green algae include discolored water, reduced light penetration, taste and odor problems, dissolved oxygen depletions during die-off, and toxin production. If your lake has little turbidity due to sediment, the Secchi disk data you provide will give a relative estimate of how much algae is present in your lake. It will not reveal what types of algae are present.

Water Color

Some lakes, especially those near acidic wetlands such as bogs, may be stained brown like tea. This is an indication that the water contains tannic acid that leached from the surrounding vegetation. Since light does not penetrate as well through dark-colored water, Secchi depth may be low although algae may be less abundant. Plant densities may be lower in stained lakes since sunlight is not able to penetrate very deep into the water column. You may also notice a change in water color over the sampling season. Seasonal color changes most likely reflect changes in algae productivity. If your lake turns unusually green, brown, or orange for a few weeks during the summer months, the change is probably the result of an algal bloom. To fully understand variations in Secchi depth, water color observations over time must be recorded.

Mixing and Stratification

A lake's water quality and ability to support fish are affected by the extent to which the water mixes. Mixing will also impact your Secchi disk reading. The depth, size, and shape of a lake are the most important factors influencing mixing; although climate, lakeshore topography, inflow from streams, and vegetation also play a role (Shaw et al. 2000).

Water density peaks at 39°F. It is lighter at both warmer and colder temperatures. Variations in water density caused by different temperatures can prevent

STRATIFICATION • *The layering of water due to differences in temperature and density.*

EPILIMNION • *The uppermost circulating layer of warm water that occurs in stratified lakes in summer because of the differences in water density. Water's greatest density occurs at 39°F. In lakes that stratify, as water warms during the summer, it remains near the surface while the colder water remains near the bottom. The depth of the epilimnion is determined by wind and usually extends about 20 feet below the surface.*

THERMOCLINE • *Sometimes referred to as the metalimnion. The narrow transition zone between the epilimnion and the hypolimnion that occurs in stratified lakes.*

METALIMNION • *Sometimes referred to as the thermocline. The narrow transition zone between the epilimnion and the hypolimnion that occurs in stratified lakes.*

HYPOLIMNION • *The cold, deepest layer of a lake that is removed from surface influences.*

warm and cold water from mixing (Shaw et al. 2000). When lake ice melts in early spring, the temperature and density of lake water will be similar from top to bottom. This uniform water density allows the lake to mix completely, recharging the bottom water with oxygen and bringing nutrients to the surface (Shaw et al. 2000). This mixing process is called spring overturn. As surface water warms in the spring, it loses density. Due to physics, wind and waves can only circulate the warmed water 20 to 30 feet deep, so deeper areas are not mixed. If the lake is shallow (less than 20 feet), however, the water may stay completely mixed all summer (Shaw et al. 2000).

During the summer, lakes more than 20 feet deep usually experience a layering called **stratification**. Depending on their shape, small lakes can stratify even if they are less than 20 feet deep. In larger lakes, the wind may continuously mix the water to a depth of 30 feet or more. Lake shallows do not form layers, though deeper areas may stratify. Summer stratification, as pictured in Figure 1, divides a lake into three zones: **epilimnion** (warm surface layer), **thermocline** or **metalimnion** (transition zone between warm and cold water), and **hypolimnion** (cold bottom water). Stratification traps nutrients released from the bottom sediments in the hypolimnion (Shaw et al. 2000).

In the fall, the surface cools until the water temperature evens out from top to bottom, which again allows mixing (fall overturn). A fall algae bloom often appears when nutrients mix and rise to the surface. Winter stratification, with a temperature difference of only 7°F (39°F on the lake bottom versus 32°F right below the ice), remains stable because the ice cover prevents wind and waves from mixing the water (Shaw et al. 2000).

The lake's orientation to prevailing winds

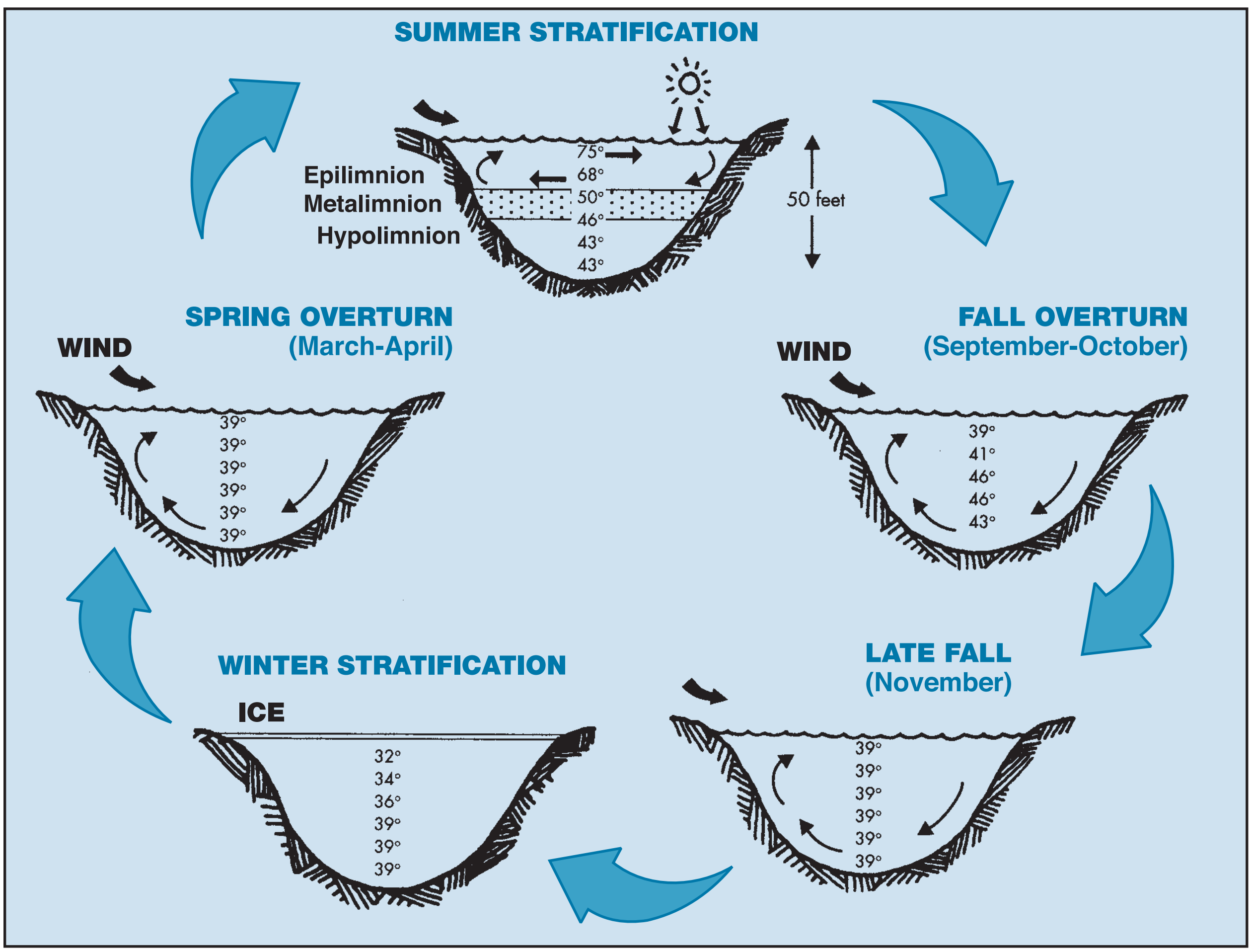


Figure 1. *Seasonal Stratification of Lakes. (Taken from Shaw et al. 2000 "Understanding Lake Data")*

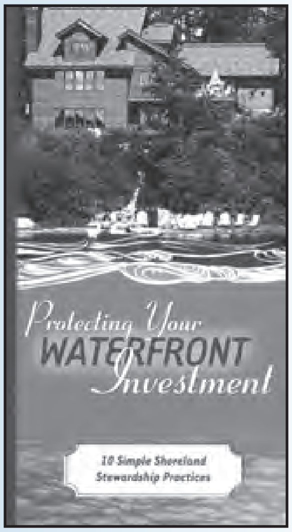
can affect the amount of mixing that occurs. Some small, deep lakes may not undergo complete mixing in the spring or fall if there is not enough wind action. The mixing that takes place in the bays of a large lake will more closely resemble that of a small lake because the irregular shoreline blocks the wind (Shaw et al. 2000). Because mixing distributes oxygen throughout a lake, lakes that don't mix may have low oxygen levels in the hypolimnion, which can harm fish. Some fish species require lake stratification. The cold water in the hypolimnion can hold more oxygen than the warmer water in the epilimnion and thus provide a summer refuge for cold water fish (e.g., trout). If the lake produces too much algae that falls onto the lake bottom to decay, oxygen in this part of the lake will become depleted since the steep temperature gradient in the metalimnion will prevent any surface water with dissolved oxygen from reaching the bottom (Shaw et al. 2000).

Water Levels

Lake water levels naturally fluctuate over time on approximately a 13 year cycle. Many factors influence water levels on lakes:

- Natural variability due to weather
- Decadal climate cycles (dry and wet periods)
- Climate change
- Dams
- Human use (water withdrawals)
- Lake morphology and hydrology.
    - o Lakes with gradual sloping shorelines will have more lake bed exposed during drought than lakes with steep shorelines
    - o Seepage lakes respond more dramatically to drought than drainage lakes

Natural lake level fluctuations can be important for maintaining healthy riparian plants and habitat. At extreme low and high lake levels, there can be negative impacts to both lake health and recreation. As water levels decline, critical littoral habitat for fish and aquatic life is stranded above water in lakes. The loss of this habitat can lower diversity and decrease productivity, particularly for slow-growing aquatic plants that may not be able to retreat as quickly as the water retreats. In some lakes, low water levels have left piers hundreds of feet from shore and rendered boat landings unusable.



Protecting Your Waterfront Investment

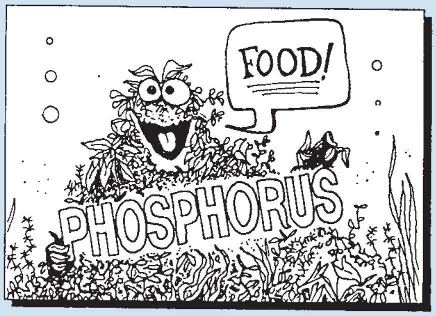
Protecting Your Waterfront Investment is a handy booklet designed to provide you with 10 simple shoreland stewardship practices you can do to protect your watershed and lake.

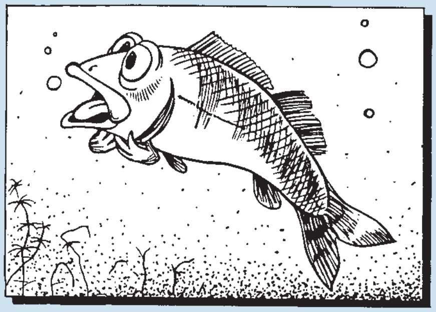
Free with a small handling fee from UWEX-Lakes

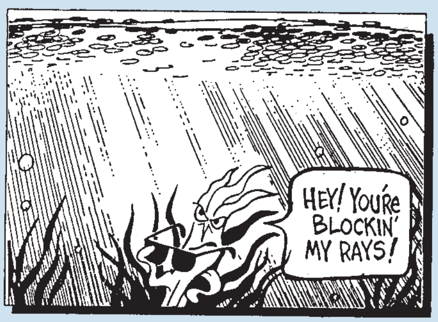
SEEPAGE LAKES • *Lakes without a significant inlet or outlet, fed by rainfall and groundwater.*

ALGAL BLOOM • *A heavy growth of algae in and on a body of water as a result of high nutrient concentrations.*

FAMILIAR SIGNS OF RUNOFF POLLUTION





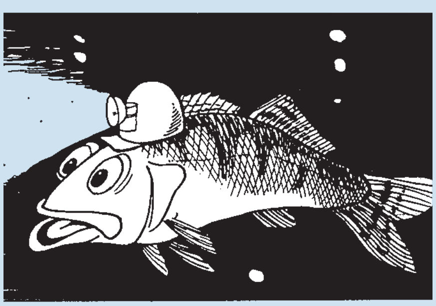


ALGAE

Nutrients, such as phosphorus and nitrogen, come from sediments, manure, pet wastes, improperly maintained septic systems, and misapplication of fertilizers on lawns or farm fields. Phosphorus contributes to the eutrophication (over-fertilization) of lakes. This leads to an increase in aquatic macrophyte and algae growth. Excess aquatic macrophytes and algae are harmful to fish and make a lake less attractive for swimming, boating, and other activities (UW Extension 2001).

When algae and aquatic weeds die they are broken down by bacteria. Bacteria consume oxygen during decomposition and make it difficult for fish and other aquatic life to survive. Excess aquatic macrophytes also contribute to winter fish kills in shallow lakes (UW Extension 2001).

Excess algae can reduce populations of bottom-rooted plants by blocking sunlight. Bottom-rooted plants provide food and habitat for fish and waterfowl (UW Extension 2001).



SEDIMENT

Sediments can cause water to become cloudy, or "turbid", making it difficult for fish to see and feed properly. Sediments can also damage fish gills and impair the feeding and breathing processes in aquatic insects (UW Extension 2001).

Sediments cloud the water and cover plant leaves, reducing sunlight penetration and inhibiting photosynthesis. Without photosynthesis, desirable plant populations are reduced, leaving fewer habitats for fish and small organisms (UW Extension 2001).

EUTROPHICATION • *The process by which lakes and streams are enriched by nutrients causing an increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients (mostly nitrates and phosphates) from natural erosion and runoff from the surrounding land basin. The extent this process occurs is reflected in a lake's trophic classification. Lakes can be classified as being oligotrophic (nutrient poor), mesotrophic (moderately productive), or eutrophic (very productive and fertile).*

NITROGEN • *One of the major nutrients required for the growth of aquatic plants and algae. Various forms of nitrogen can be found in water: organic nitrogen, most of which eventually decomposes to ammonia; ammonia, produced from organic decay by bacteria and fungi; nitrite, produced from ammonia by nitrite bacteria; and nitrate, the form which is most readily available for use by plants. Nitrate is produced from nitrous oxide by nitrate bacteria. In some ecosystems, nitrogen is the nutrient that limits algae growth.*

Conversely, high water levels can lead to shoreline erosion, increased nutrient inputs, and flooding of piers, homes, and boat landings. Slow no wake boating ordinances may be introduced to protect lake shorelines during the high-water period.

Water level monitoring has been added to CLMN to monitor statewide lake-levels over time to address growing concern for health of aquatic life due to drought, changing climate, and groundwater withdrawals. Although long-term water level records exist, current monitoring efforts are disjointed and do not cover all areas of the state.

Professionals (e.g., county surveyors) survey and install staff gages to lakes shortly after ice-out in spring and then survey and remove staff gages in late fall. Citizen volunteers record and report lake levels preferably weekly, but at least monthly. Seventeen lakes began monitoring water levels in summer 2015 as a pilot and WDNR plans to expand the program. All staff gages are surveyed to at least three reference marks and tied to a datum. This ensures that the data record may continue long into the future even if all reference marks are lost.

Wind-generated Waves, Sun Position, and Cloud Cover

Wind-generated waves and boat wakes stir up sediments in shallow water areas. Unprotected shorelines can erode and contribute suspended particles to the water. These shoreline and shallow water impacts contribute to turbidity and can block out sunlight and affect photosynthesis.

A 1998 study conducted by Larson and Buktenica found that when the lake surface was calm and skies were clear or had high haze, differences between descending and ascending Secchi observations decreased slightly with increased disk depth. Waves from tour boats, drops of water from the research vessel, and wind generated ripples and chop decreased disk readings as much as 5 meters relative to readings recorded when the lake surface was calm. Furthermore, documenting the variation caused by slightly disturbed lake surface conditions relative to calm surface conditions and among trained observers ensures consistent interpretation of the long-term data (Larson and Buktenica 1998).

The distance of the observer from the water surface, weather conditions, waves, the height of the sun on the horizon, and glare at the water's surface all affect your Secchi disk reading. CLMN monitoring protocols are set up to make sure that lake data is comparable and to eliminate as many extenuating circumstances as possible.

Motor Boat Activity

Propellers of boats may disturb the lake or river bottom directly, or indirectly through the wash or turbulence they produce, especially in shallow water. This may affect water clarity by increasing the amount of sediment particles in the water or may cause nutrients, such as phosphorus, that are stored in the sediments, such as phosphorus, to become available for algal growth. Waves created

HELP STOP THE SPREAD OF INVASIVE SPECIES

Wisconsin law requires that you:

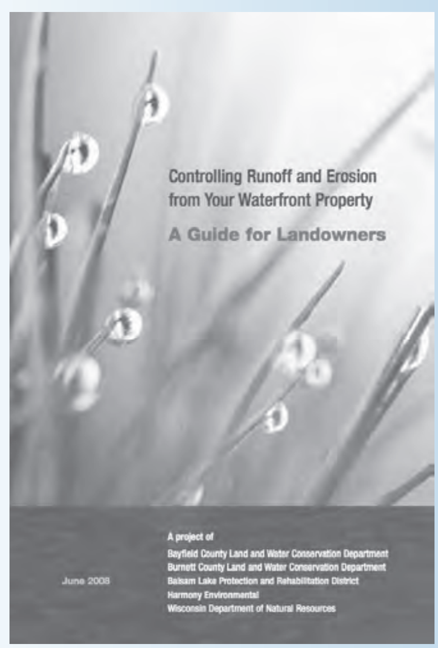
- ☑ Inspect your boat, trailer and equipment.
- ☑ Remove any attached aquatic plants or animals (before launching, after loading and before transporting on a public highway).
- ☑ Drain all water from boats, motors and all equipment
- ☑ Don't move live fish away from a waterbody.
- ☑ Buy minnows from a Wisconsin bait dealer and **USE** leftover minnows only under certain conditions* (See **fishingwisconsin.org** for more information).

In addition you can:

- ☑ Rinse boat and equipment with hot or high pressure water and dry for at least five days.
- ☑ Learn to easily recognize Eurasian water-milfoil. Monitor boat landings, marinas, and inlets on a regular basis for the first sign of an invasion. Report new sightings to your nearest Wisconsin DNR office.
- ☑ Work with your local lake association to develop an aquatic plant management program for your lake including contingency plans in case Eurasian water-milfoil is found in the lake.
- ☑ Dispose of unwanted live bait in the trash.

by watercraft may contribute to shoreline erosion, which can cloud the water. Boats have been shown to affect water clarity and can be a source of nutrients and algal growth in aquatic ecosystems. Shallow lakes, shallow parts of lakes and rivers, and channels connecting lakes are the most susceptible to impacts. Depth of impact varies depending upon many factors including boat size, engine size, speed, and substrate type. Few impacts have been noted at depths greater than 10 feet (Asplund 2000).

The secchdisk visibility world record of 262 feet was set in the eastern Weddell Sea, Antarctica in 1986. Even the clearest of lakes in Wisconsin have a maximum water clarity of 25-55 feet. These include the aptly named Crystal Lake in Sheboygan County with a water clarity of 32.5 feet in March 2012, Maiden Lake in Oconto County with a water clarity reading of 47.5 feet in May 2009 and Black Oak Lake in Vilas County with a water clarity of 53.5 feet in June 2012. These lakes stand in stark contrast to some of the more turbid lakes we find in Wisconsin. Lake Wissota in Chippewa County had a Secchi reading of 0.25 feet in June 2012 and Lake Winnebago with a clarity reading of 0 to 0.25 feet in July 2012.



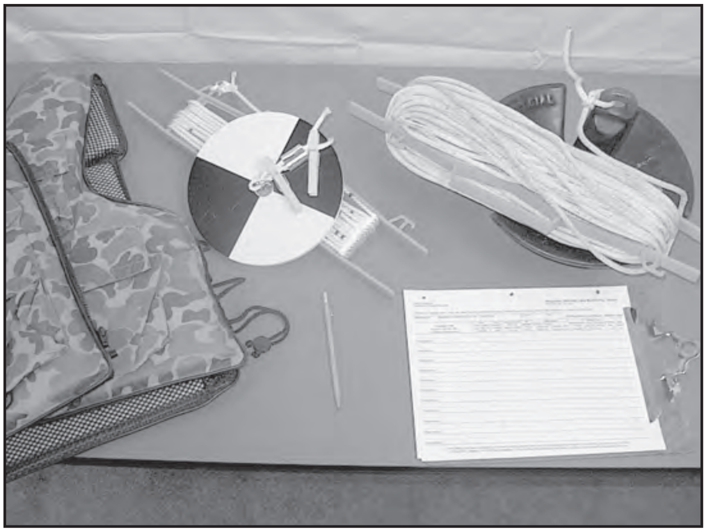
NOTES

A How-to Video is Available for both Water Clarity and Water Chemistry. Find both of these Videos on the UW–Lakes Website.

Want to know what water clarity monitoring entails? Haven't used your Secchi disc in awhile and want to refresh your memory?
Check out this great how-to video!

1. SECCHI (Water Clarity)

Before you start sampling, be sure to read the following pages to familiarize yourself with the equipment and the procedures that you will be using. *All of the procedures that you will follow in sampling your lake are done for specific reasons. It is very important that you follow the sampling procedures exactly as they are laid out in the following pages to ensure good, consistent, high quality data. The following pages will provide you with sufficient background on the design of the equipment and proper procedures to use.*



DNR PHOTO

After sampling, it is very important to rinse and air dry thoroughly all of the equipment that you used.

What Equipment Will You Need?

At your training session, your CLMN regional coordinator will outline and provide all of the equipment that you will need to successfully monitor your lake.

- ☑ Secchi disk (with rope and holder)
- ☑ Two clothespins
- ☑ Lake map with sampling site marked
- ☑ Life jackets (you provide)
- ☑ Anchor and rope (you provide)
- ☑ Boat (you provide)
- ☑ Field data sheets
- ☑ Pencil

SHOULD I COLLECT SECCHI DATA IN THE WINTER?

Secchi measurements taken through the ice are highly variable depending on the amount of snow on the ice and ice clarity (i.e. did it freeze fast or was there slush on the lake that froze and created "cloudy" ice). These are the main factors that determine the amount of light that can get through the ice which allows you to take accurate measurements. Since algae production is at a minimum under the ice, this data has no real value for Network use.

Waterbody # or WBIC (Waterbody Identification Code) • *A unique identification number the Wisconsin DNR uses to identify each waterbody in the state. Every one of the 15,000 lakes in Wisconsin has a unique WBIC.*

Station # • *A number assigned to sampling locations on a waterbody. The station identification number makes it easy to track secchi and chemistry data. Each sampling site on a lake will have a separate station identification number.*

How Do You Prepare to Sample?

The Day You Sample

On the day you plan to sample, complete the top portion of your field data sheet by filling in the waterbody # (or WBIC) and "Station #", sections. Enter the name of each volunteer who will be sampling. If you do not know these numbers, contact your CLMN regional coordinator. Before you launch your boat, make sure you have your Secchi disk, an anchor, and personal flotation devices (life jackets) in your boat before proceeding to your sampling site.

Sampling Overview

When to Take Your Secchi Readings

The weather can affect the depth at which you can no longer see the Secchi disk. Wind-generated waves, sun position, and cloud cover are major weather factors that can affect the accuracy of your readings.

- Secchi readings should be taken every 10 to 14 days.
- Secchi readings should be taken on clear, calm days between 10 am and 4 pm.
- Anchor the boat.
- Secchi disk readings are taken on the shady side of the boat.
- Kneel or sit so you are close to the surface of the water.
- Remove your sun glasses – sun glasses can increase the depth that you can see your Secchi disk. For consistency and so we can compare data from one lake to another, please remove your sun glasses.
- Use clothespin method to determine accurate reading.
- For color and clear/murky determination, hold Secchi disk one foot below the surface of the water.

To make sampling regular and convenient, try to make it a part of your weekly routine. You can include it as part of your weekend fishing trip or family outing on the lake. The most important time to collect your Secchi data is in July and August. These are the prime months for lake recreation and the time when algae is the most prevalent. Secchi analysis statewide relies on information for these months and will appear in your statewide summary. Averages of Secchi data recorded during July and August will appear in your statewide summary report. Due to seasonal variation, the entire years' Secchi disk data cannot be averaged.

The Secchi readings you take in the spring and fall will tell a story about your lake. These readings can tell you when spring runoff occurs in your lake or when there are algal blooms. For this reason, many Secchi volunteers may start collecting data in April and continue through November.

If you are unable to sample during your normally scheduled sampling time, do not worry about it! Just try to sample as soon as possible after that time. However, if you think that you will not be able to continue monitoring your lake due to illness, schedule conflicts, or other problems, please contact your CLMN regional coordinator as soon as you can.

Remote Sensing Project

Today remote sensing data from the NASA/USGS Landsat Program are used by the Wisconsin DNR to provide satellite retrieved Secchi depth data for thousands of lakes annually with the support of CLMN volunteers. Different weather conditions and atmospheric effects on satellite images and challenges in the atmospheric correction of satellite images mean on-the-ground Secchi depth data is still needed to calibrate this model for each satellite image. Your CLMN volunteer coordinator will send you a list of Landsat 7 ETM+ and Landsat 8 OLI-TIRS image acquisition dates for your lake if you are one of our Secchi volunteers and want to support our operational efforts. The satellite image specific algorithms will translate your data to data for hundreds of lakes within the same satellite image if you collect it on a clear satellite image acquisition date for your lake! Find out more about remote sensing at **http://dnr.wi.gov/lakes/CLMN/remotesensing/.**

WHAT IS THE SATELLITE RETRIEVED WATER CLARITY DATA USED FOR?

The operational annual satellite retrieval of the water clarity for thousands of lakes across Wisconsin from Landsat 7 ETM+ and Landsat 8 OLI-TIRS data assists the Wisconsin DNR in trophic state assessments for the State of Wisconsin. The results are shared within the Wisconsin DNR for the Wisconsin Water Quality Reports to Congress in compliance with Section 305(b) of the Clean Water Act and with state and local water quality managers, lake organizations, and the public. Summer water clarity maps are shared through the Wisconsin Lakes & Aquatic Invasive Species Mapping Tool and GIS data portal. Check out the latest summer water clarity maps at **https://dnr.wi.gov/lakes/viewer/**.

WHAT ARE CURRENT AND FUTURE REMOTE SENSING ACTIVITIES?

Current and future remote sensing activities at the Wisconsin DNR include the transition of image processing efforts from a desktop to cloud environment, the collection of field and satellite match-up data for waterbodies across Wisconsin to support algorithm development and validation efforts by external partners, and the development of strategies for the integration of satellite data products into our water quality monitoring program. Recently started algorithm development and validation efforts include a comparison of several state of the art algorithms for the satellite retrieval of total suspended solid (TSS) and chlorophyll-a (Chla) concentrations in partnership with NASA. This study presents the first step towards the operational annual satellite retrieval of TSS and Chla for thousands of lakes across Wisconsin from Landsat 8 OLI-TIRS, Sentinel-2 MSI, and Sentinel-3 OLCI data.

CAROL WATKINS, UW-EXTENSION, ENVIRONMENTAL RESOURCES CENTER

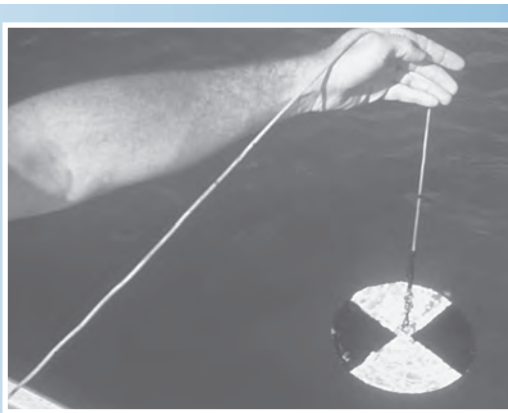
ON LAKE PROCEDURES

STEP 1. Before going out to take your Secchi disk readings, be sure the conditions are right for sampling. Ideal weather conditions include sunny or partly sunny/cloudy skies; wind-calm to breezy (there should be no whitecaps on the lake). Collect Secchi measurements between 10 am and 4 pm. If possible, try to collect Secchi readings when the satellite is overhead.

STEP 2. Your CLMN regional coordinator will provide you with a lake map with the sampling site marked. Be sure you have a station id number for each site you are monitoring.

STEP 3. Anchor your boat at your sampling site to prevent drifting. Be careful not to disturb the sediments on the lake bottom when anchoring since this could cloud the water. ***Remove your sun glasses***. Wearing sun glasses will give you an unnatural reading. Unwind the Secchi disk rope from the holder.

STEP 4. Lean over the shady side of the boat and slowly lower the Secchi disk into the water until you can no longer see it. If you are sampling in a pontoon boat, be sure to kneel down on the floor of the boat when you take your readings so you are closer to the surface of the water. Be as close to the surface of the water as you can safely be. Secchi disk readings are taken on the shady side of the boat to reduce glare.



STEP 5. When the Secchi disk barely disappears from your view, mark the rope at the surface of the water with a clothespin.

- Secchi values vary by about 6% due to change in sun's angle in midsummer.
- 5″ waves can decrease Secchi reading by 10%.

DNR PHOTOS

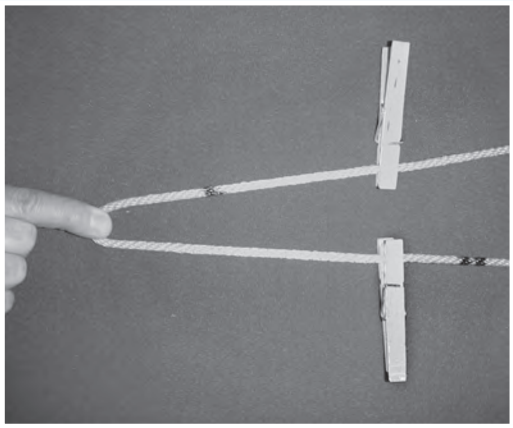
ON LAKE PROCEDURES

STEP 6. After you have marked this spot with the clothespin, lower the disk a few more feet into the water. Slowly raise the disk. When the Secchi disk reappears, mark the rope at the surface of the water with the second clothespin. The clothespin marks may be at the same spot, several inches or even several feet apart. The purpose of lowering the Secchi disk and raising it back into view is so your eyes become accustomed to looking into the water. The average of the two readings will be a more accurate result.

DNR PHOTO

STEP 7. Bring the Secchi disk back into the boat.

STEP 8. Average your two Secchi disk readings by forming a loop between the two clothespins. Slide one clothespin into the center of the loop to mark it. Remove the other clothespin. The remaining clothespin mark will be your Secchi reading.



JIM KLOSIEWSKI

STEP 9. Your rope is marked in foot increments. The red lines indicate five, fifteen, and twenty-five feet. The double black lines indicate ten, twenty, and thirty feet. Carefully measure the number of feet from the disk until you reach your clothespin mark. Round off to the nearest quarter foot.

STEP 10. Record this measurement on your data sheet and then fill out the rest of your data sheet.

(continued on next page)

ON LAKE PROCEDURES

STEP 11. Record your perception of water color and water appearance. Hold the Secchi disk one foot under the surface of the water to determine color and appearance. Record perception. This is your perception of the amount of algae that is in the water at the deep hole.

Perception Numbers

1 - Beautiful, could not be any nicer.

2 - Very minor aesthetic problems, excellent for swimming and boating.

3 - Swimming and aesthetic enjoyment of lake slightly impaired.

4 - Desire to swim and level of enjoyment of lake substantially reduced because of algae (would not swim, but boating is okay).

5 - Swimming and aesthetic enjoyment of the lake substantially reduced because of algal level.

STEP 12. If you are taking Secchi readings at more than one site or lake, proceed to your next location and repeat steps 1 through 10 above (step 11, perception, is recorded at the deep hole only.)

STEP 13. Report your data. Data can be submitted electronically at the CLMN web site. Instructions for entering data are in Appendix 2 of this manual. If you enter data online, you do not need to submit data sheets by mail.

For those without Internet access – data sheets can be mailed to your CLMN regional coordinator to be entered into the database.

Taking Care of Data

Once you are back on shore, transfer all your data to the data form. This form will make it easier for you to enter your data online. After entering your data into the DNR database, fill in the column labeled "*Date Entered*" on your data form. This will allow you to keep track of what data you have already entered.

Online

The web address to enter your data online is **apps.dnr.wi.gov/swims**. You will need a user name and password to enter data. Instructions for obtaining a user name and password are found at the CLMN website. If you enter your data online, there is no need to mail in a paper copy.

All data for the year should be entered online by November 1st to guarantee that it will be included in reports and analyses done in the winter and spring. If you find data that has not been entered after this date you can still enter your data online or you can mail your data sheets to your CLMN Coordinator. Your coordinator will make sure your data gets entered.

Your lake summary report will show the dates you sampled, and your Secchi disk readings measured in feet and meters. Always check your annual report with a copy of your original data sheet to verify your data.

CLMN lake summary reports are part of Wisconsin Water Explorer (WEx). You can access your summary report at the DNR CLMN web site at **dnr.wisconsin.gov/topic/lakes/clmn.**

WEx is a new DNR tool that can be used to analyze and display surface water quality data. Several new tools are available to the public to help you learn more about your lake.

The Wisconsin Water Explorer (WEx)

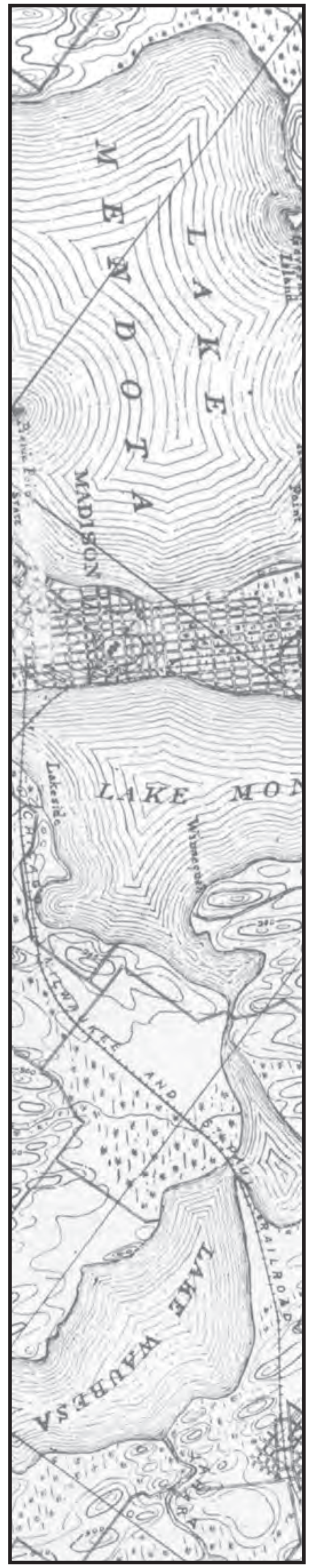
Use this tool to explore watershed characteristics like land use, geology, and soils. You may also view conditions and trends in lake water quality and run nutrient loading models for lakes and streams. WEx can be accessed at To access WEx, go directly to **https://dnr.wisconsin.gov/topic/SurfaceWater/WEx.html** or get redirected to WEx by looking up water quality data on a lake of interest identified on the DNR Lakes Pages. WEx is also listed on the Surface Water Quality homepage under the "Water Quality Tools" menu.

The Shoreland Habitat Disturbance Viewer

Use this tool to view the condition of habitat along lake shorelines. You may view the overall condition of lakeshore habitat at the scale of the entire lake or individual parcels. The tool also recommends actions for protecting and restoring habitat based on the lake's or parcel's condition. You may access the tool by clicking the "Lake Shoreland Habitat" icon on the DNR Lakes Pages.

Lake Level Monitoring in Wisconsin

Use this tool to observe lake level data through time on select Wisconsin lakes. To access this tool, go to this webpage or click the Lake Levels icon on the DNR Lakes Pages.



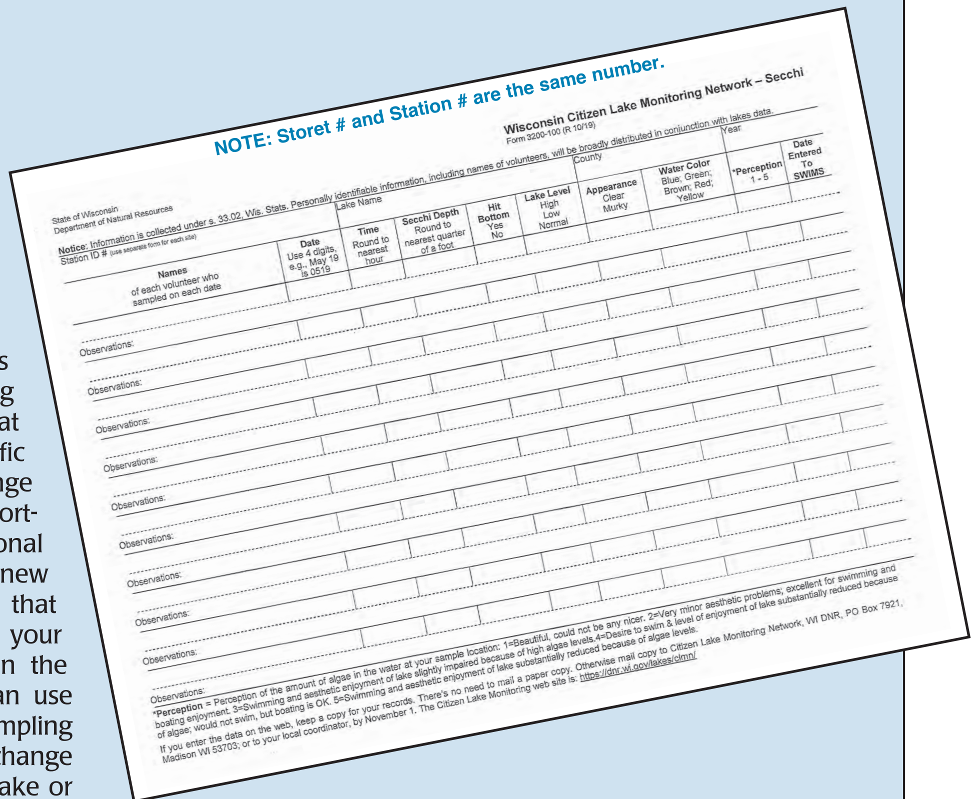
DNR PHOTO

HOW TO FILL OUT YOUR FIELD DATA SHEET

During your training session, you should have received:

- A waterbody identification code (WBIC)
- Station #

The WBIC is a number assigned to your lake and allows the Citizen Lake Monitoring Network to know exactly which lake you are monitoring. The Station # is assigned to the specific monitoring site on your lake and the data that you collect is tied to that specific number. If you decide to change your sampling site, it is very important that you contact your regional coordinator right away so a new Station # can be assigned for that site. While you are sampling on your lake, record all of your data on the white "Field Data Form". You can use this same form for repeated sampling days until it is filled up. If you change sampling site locations within a lake or change lakes, you must use a new form!


NOTE: Storet # and Station # are the same number.

State of Wisconsin
Department of Natural Resources

Wisconsin Citizen Lake Monitoring Network – Secchi
Form 3200-100 (R 10/19)

Notice: Information is collected under s. 33.02, Wis. Stats. Personally identifiable information, including names of volunteers, will be broadly distributed in conjunction with lakes data.

Station ID # (use separate form for each site) | Lake Name | County | Year

Names of each volunteer who sampled on each date	Date Use 4 digits, e.g., May 19 is 0519	Time Round to nearest hour	Secchi Depth Round to nearest quarter of a foot	Hit Bottom Yes No	Lake Level High Low Normal	Appearance Clear Murky	Water Color Blue; Green; Brown; Red; Yellow	*Perception 1 - 5	Date Entered To SWIMS

Observations:

Observations:

Observations:

Observations:

Observations:

Observations:

Observations:

Observations:

Observations:

Observations:

***Perception** = Perception of the amount of algae in the water at your sample location: 1=Beautiful, could not be any nicer. 2=Very minor aesthetic problems; excellent for swimming and boating enjoyment. 3=Swimming and aesthetic enjoyment of lake slightly impaired because of high algae levels.4=Desire to swim & level of enjoyment of lake substantially reduced because of algae; would not swim, but boating is OK. 5=Swimming and aesthetic enjoyment of lake substantially reduced because of algae levels.

If you enter the data on the web, keep a copy for your records. There's no need to mail a paper copy. Otherwise mail copy to Citizen Lake Monitoring Network, WI DNR, PO Box 7921, Madison WI 53703; or to your local coordinator, by November 1. The Citizen Lake Monitoring web site is: https://dnr.wi.gov/lakes/clmn/

The following descriptions represent the portions of your data sheet that can be filled out while you are on the shoreline or before you get into your boat. Data sheets can be found online at the CLMN web site.

Date

When recording the date it is only necessary to use 4 digits. For example, if you sampled on May 19th, you would record this on your data form as "0519"; July 6th would be "0706", etc. You do not need to include the year since your data is submitted annually.

Time

Record the time you started your sampling. You can record your "civilian" time as you normally would by using A.M. and P.M.

Lake Level

Record the water level on your lake. It helps to use the shoreline or your pier as a guide to indicate whether your lake level is high, low, or normal. If you are able to determine the water level using a staff gauge on the lake, indicate this on the data sheet and record the numerical value in the space provided.

The following descriptions should be filled out while you are on the water at your sampling site so the observations are fresh in your mind.

Secchi Depth

When recording your Secchi disk reading, round off to the nearest quarter foot. Record fractions of a foot as a decimal since this is how it will be entered online. For example, 12 ¼ feet is 12.25 feet. It is possible that the Secchi disk will be visible even when it is resting on the bottom of the lake. If this is the case, record the depth as you always would, but make sure you record a "1" in the "Hit Bottom" field of your data sheet.

Appearance

To determine if the water appearance is clear or murky, hold your Secchi disk one foot under the surface of the water and observe how the white part of the disk appears.

Water Color

The water color is determined at your site using the Secchi disk as a guide. After lowering the disk about a foot into the water, ask yourself the question, "Does the white part of the Secchi disk look white, or does it appear green or brown?" If it appears white, then the water color is "blue." If it appears green, then the water color is "green" and so on. The online data entry form will only accept one color. If the water appears "bluish-green," you will have to select the one color (blue or green) that best describes your water color.

Perceptions

Indicate your perception of the water quality for your lake at the deep hole. Refer only to the condition of the water itself. You can record information on aquatic plants around the shoreline or other problems you perceive in the observation section of the data sheet. On a scale of 1 to 5 (1 being the best and 5 being the worst), your perception of the water should reflect how much algae is in the water.

1 - Beautiful, could not be any nicer

2 - Very minor aesthetic problems; excellent for swimming and boating enjoyment

3 - Swimming and aesthetic enjoyment of lake slightly impaired because of high algae levels

4 - Desire to swim and level of enjoyment of lake substantially reduced because of algae (would not swim, but boating is OK)

5 - Swimming and aesthetic enjoyment of lake substantially reduced because of algae levels

Observations

In the observation section of the data sheet, you can include any comments about the weather, water conditions, wildlife sightings, plant densities, or other information you want to include that you think will help to better understand your lake. If you need more data sheets, have questions or problems, you may also include those comments in this section. Feel free to attach additional observations on a separate sheet of paper. You can enter as much information as you'd like. The database is capable of holding a very long entry.

HOW TO REPORT ICE ON/OFF INFORMATION

You can report your ice observations online through SWIMS. After you log in, choose the Ice Observations project for your lake.

ROBERT QUEEN

Understanding Your Data

Please review your annual monitoring report. Compare your report to your original records. If you find an error, please let your Coordinator know.

Your report has plots summarizing the trophic status and clarity of your lake over time and trand over time in water clarity.

Knowing your lake type and lake georegions will help you to better understand your lake data.

Lake Types

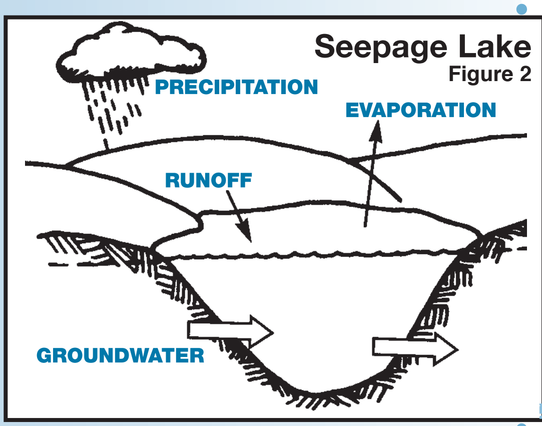
The physical characteristics of a lake can greatly influence its water quality. Two factors are especially important: the primary source of the lake's water along with its flushing rate and whether or not the lake is stratified in the summer.

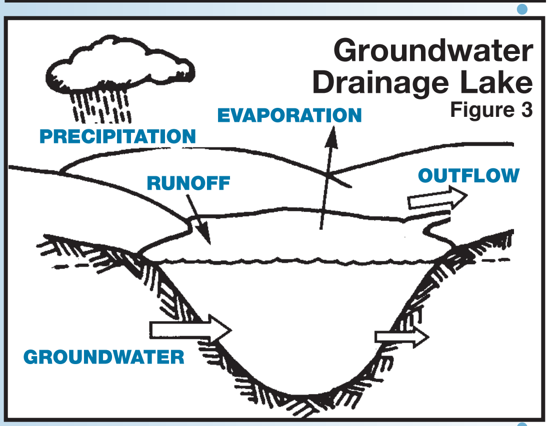
Seepage lakes are fed mainly by precipitation and runoff, supplemented by groundwater from the immediate drainage area. These lakes do not have an inlet or permanent outlet. Seepage lakes are the most common lake type in Wisconsin. Many seepage lakes are low in nutrients, acidic, and susceptible to acid rain. These lakes usually have small watersheds (Figure 2).

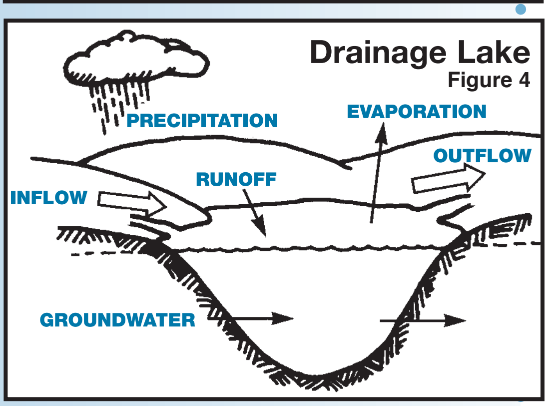
Groundwater drainage lakes, often referred to as spring-fed lakes, are fed by groundwater, precipitation, and limited runoff. Spring-fed lakes have a permanent outlet, but no inlet. The primary source of water for spring-fed lakes is groundwater flowing into the bottom of the lake from inside and outside the immediate surface drainage area. Spring-fed lakes are located at the headwaters of many streams and are a fairly common type of lake in northern Wisconsin. These lakes are usually well buffered against acid rain and contain low to moderate amounts of nutrients. These lakes have small watersheds (Figure 3).

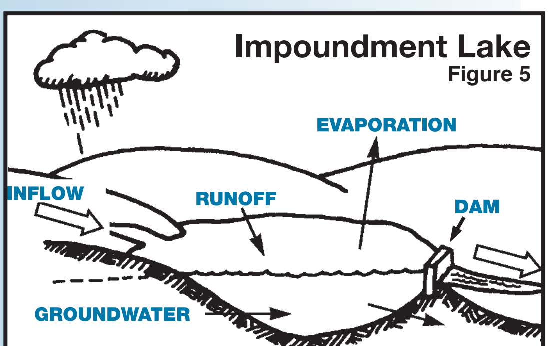
Drainage lakes are fed by streams, groundwater, precipitation, and runoff. These lakes have an inlet and an outlet, and the main water source is stream drainage. Most major rivers in Wisconsin have drainage lakes along their course. Water quality in

Figures 2-5. ***Lake Types.*** *Major water inputs and outflows of different lake types. Large arrows indicate heavy water flow. (Taken from Shaw et al 2000 "Understanding Lake Data")*









drainage lakes can be highly variable. These lakes often have large watersheds (Figure 4).

Impoundments are man-made lakes or reservoirs made by damming a stream or river. An impoundment is drained by a stream or river. Because of nutrient and soil loss from upstream land use practices, impoundments typically have higher nutrient concentrations and faster sedimentation rates than natural lakes (Figure 5).

Lake Georegions

Wisconsin's lake georegions first originated from a grouping of lakes made in the early 1980s by Wisconsin DNR senior limnologists. These first groupings were based on the best professional judgment of the scientists most familiar with Wisconsin's lake resources. The georegions roughly reflect "hydro-chemical lake regions" which are based on the state's bedrock geology, glacial geology, and soil type; and more recently described ecoregions which are based on geological characteristics and dominant vegetation (Figure 6).

The ***northwest georegion*** is lake-rich. Most of the lakes found here are relatively small (i.e., less than 100 acres). They are usually natural lakes and many have extensive wetlands. Many "stained" lakes are found in this georegion. In general, the lakes in this georegion have low phosphorus levels and are moderately free of sediment. However, lakes in Polk, St. Croix, and Barron counties tend to be shallow and more eutrophic. For this reason, chlorophyll concentrations and water clarity both vary considerably in northwest georegion lakes.

Thirty seven percent of Wisconsin's lakes are found in the ***northeast georegion***. Many are natural "stained" lakes and tend to be clustered with extensive wetlands. Lake size varies considerably. Lakes in the northeast georegion tend to be deeper than lakes in other georegions. As a group, northeastern lakes have low phosphorus and chlorophyll levels and tend to have the greatest water clarity when compared to lakes in the other four georegions.

The ***central georegion*** forms a distinct lake group in Wisconsin. In a large part of this georegion, lakes are scarce due to the nature of the underlying soil and bedrock. Most central georegion lakes are small (i.e., less than 100 acres) and tend to have small watersheds. Most

GEOREGION • *Wisconsin's lake "georegions" originated from a grouping of lakes made in the early 1980s by Wisconsin DNR senior limnologists. These groupings are based on the best professional judgment of the scientists most familiar with Wisconsin's lake resources. The georegions roughly reflect "hydro-chemical lake regions" which are based on the state's bedrock geology, glacial geology and soil type, and the more recently described "ecoregions" which are based on geological characteristics as well as the dominant vegetation.*

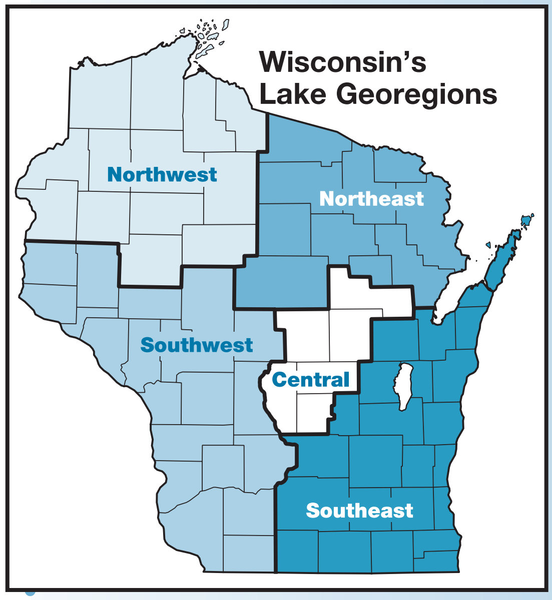


Figure 6. *Wisconsin's lake georegions.*

Average summer TSI values for different lake georegions. *Averages were calculated from Secchi measurements recorded in June, July, and August 2004.*

Lake Georegion	TSI Value
Northwest	45
Northeast	43
Central	44
Southwest	58
Southeast	49

WATER SOURCE

The source of a lake's water supply is very important in determining its water quality and in choosing management practices to protect that quality. If precipitation is a major water source, (e.g., a seepage lake) the lake will be acidic, low in nutrients, and susceptible to acid rain (Shaw et al. 2000).

If groundwater is the major water source, the lake is usually well buffered against acid rain and contains low to moderate amounts of nutrients. Local septic systems or other groundwater contamination could cause problems. Water exchange is fairly slow creating long residence times for nutrients. (Shaw et al. 2000).

If streams are the major source of lake water, nutrient levels are often high and water exchange takes place more rapidly. These lakes have the most variable water quality depending on the amount of runoff and human activity in the watershed (Shaw et al. 2000).

Managing the watershed to control the amount of nutrients and soil that enter a lake is essential to protecting water quality. Controlling runoff (water that runs from the land's surface into the lake) is important for drainage lakes and impoundments, and some seepage and groundwater lakes. Protecting groundwater quality is particularly important for seepage and groundwater drainage lakes (Shaw et al. 2000).

Watershed management becomes especially critical in impoundment lakes. If a stream is dammed the natural movement of water will be restricted, causing soil and nutrients to collect in the impoundment (Shaw et al. 2000).

Lake managers will measure the inflow and outflow of a lake to determine its water budget. As shown in the formula below, a water budget consists of several elements. The average precipitation in Wisconsin is 30 inches per year. Evaporation depends on the type of summer weather, but is usually about 21 inches. Groundwater flow is more difficult to measure, but can be estimated (Shaw et al. 2000).

The water budget can be expressed in percent or volume. A typical water budget for a drainage lake may look something like this:

Groundwater inflow (30%)
+ Precipitation (10%)
+ Surface runoff (60%)
= Groundwater outflow (5%)
+ Evaporation (11%)
+ Stream outlet (84%).

have low phosphorus, low chlorophyll concentrations, and high water clarity.

Large, shallow, eutrophic lakes and impoundments are found in the ***southwest georegion***. Natural lakes are scarce because of the topography and geological history since much of this georegion lies in the driftless area (a highly eroded and unglaciated landscape). Most lakes in this georegion are shallow and do not stratify in the summer. Lakes in the southwestern georegion tend to have high phosphorus and chlorophyll levels, and as a result, low water clarity.

Lakes and bogs are common in the ***southeast georegion***. This georegion has more large lakes (i.e., greater than 1000 acres) than the other four georegions and also has many shallow lakes. Lakes in the southeastern georegion tend to exhibit high phosphorus and chlorophyll levels along with low water clarity.

What Do My Secchi Readings Mean?

On a statewide level, a Secchi reading of greater than 20 feet is considered excellent water clarity. A reading of less than 3 feet is considered poor. The water clarity that can be expected of a lake varies widely depending on the location, lake type, and historical conditions.

Average summer Secchi values for different lake georegions. *Averages were calculated from Secchi measurements recorded in July and August 2004.*

Georegion	Average Secchi depth (ft.) for mixed lakes	Average Secchi depth (ft.) for stratified lakes
Northwest	6.5	10.7
Northeast	7.4	12.8
Central	8.1	10.8
Southwest	3.4	4.7
Southeast	3.6	4.7

What Can I Learn From the Variation in My Secchi Readings?

Was your lake clearest in the spring and gradually became murky as the summer progressed? This trend might suggest that the lake is receiving a constant supply of nutrients, either from the watershed or from the lake sediments. This nutrient supply could be what is fueling the algal growth you are seeing throughout the summer.

If your lake water became clearer as the monitoring season went on, nutrients might be coming into the lake mainly in the spring with snowmelt. But as the summer progresses, there is no nutrient supply and algal growth is slowed.

If you see a sharp increase in your lakes water clarity in May or June, it may be that tiny grazing animals, called zooplankton, are eating the algae. When zooplankton are abundant, they can actually be seen as tiny dark dots swimming over the white part of the Secchi disk when it is submerged. These animals help decrease the amount of algae in the water, but are grazed on by minnows and other fish (e.g., bluegills, perch, crappie, etc.). If fish species that eat zooplankton become too abundant, often due to over-fishing of predator fish (i.e. bass), then the zooplankton population can decrease and the algae can become more abundant. The reason why zooplankton are more abundant in the spring is because fish that feed on them are not as active in the cooler water.

What is Trophic State?

Taking just one Secchi disk reading may not have much value since it measures the water clarity of the lake only on that one occasion. The time you sampled might have been during an algae bloom or it could have been after a heavy rainfall; both of which do not represent typical conditions. Secchi data collected regularly over time at or near the same location will provide the most accurate picture of your lake. Your data should vary over time because a lake is an ever-changing system. By taking regular measurements during the ice-free period you can determine the normal seasonal variations for your lake and its overall condition.

Your Secchi depth results, along with phosphorus and chlorophyll data (if available), allow a determination of the level of nutrient enrichment of the lake (i.e., trophic status). The Trophic State Index (TSI) is a continuum scale of 0 to 100, corresponding with the clearest and most nutrient poor lake possible, to the least clear and most nutrient rich lake (Table 1, page 34). Lakes can be divided into three main levels of nutrient enrichment categories. Oligotrophic, or nutrient poor lakes, are characterized by very high Secchi depths, plenty of oxygen in deep water, and may have cold-water fish species living in them. Mesotrophic lakes fall in the middle of the continuum from nutrient-poor to nutrient-rich. They have moderately clear water, and may experience low to no oxygen concentrations in bottom waters. Nutrient-rich lakes are called eutrophic. They have decreased Secchi disk readings and experience low to no oxygen in the bottom waters during the summer. These lakes would only be habitable for warm water fish. They may also experience blue-green algae blooms. Lakes that are super-enriched fall into an additional fourth category termed hypereutrophic. These lakes experience heavy algae blooms throughout the summer, and may even experience fish kills. Rough fish dominate in hypereutrophic lake systems.

TABLE 1. ***The Trophic State Index (TSI) continuum.***

TSI less than 30
Classic oligotrophic lake characterized by clear water, many algal species, oxygen throughout the year in bottom water, and cold water oxygen-sensitive fish species in deep lakes. Excellent water quality.

TSI 30-40
Deeper lakes will still be oligotrophic, but the bottom waters of some shallower lakes may become oxygen-depleted during the summer.

TSI 40-50
Classic mesotrophic lake. characterized by moderately clear water, but increasing chance of low dissolved oxygen in deep water during the summer.

TSI 50-60
Lake becoming eutrophic characterized by decreased clarity, fewer algal species, and oxygen-depleted bottom waters during the summer. Plant overgrowth evident, supporting only warm-water fisheries.

TSI 60-70
Becoming very eutrophic. Blue-green algae may become dominant with possible algal scums. Extensive plant overgrowth problems likely.

TSI 70-80
Lake becoming hypereutrophic characterized by heavy algal blooms throughout summer, dense plant beds limited by light penetration.

TSI > 80
Hypereutrophic lake with very poor water quality, algal scums, summer fish kills, and few plants.

OLIGOTROPHIC • *Lakes characterized by low nutrient inputs and low productivity. They are generally deep with high water clarity.*

MESOTROPHIC • *Lakes characterized by their moderately fertile nutrient levels. Falls in between the oligotrophic and eutrophic levels of nutrient enrichment.*

EUTROPHIC • *Lakes characterized by high nutrient inputs, high productivity, often experiencing algal blooms and abundant weed growth. This term can also refer to a nutrient-rich lake, as large amounts of algae and weeds characterize a eutrophic lake.*

After a few years of collecting Secchi data, you will be able to answer two major questions about your lake.

1. *What is the trophic state of my lake based on water clarity data alone? (Is my lake generally more* ***eutrophic****,* ***mesotrophic****, or more* ***oligotrophic****?)*

2. *Is the water quality of my lake improving, declining, or remaining the same over time?*

Lake enrichment levels for Wisconsin lakes can range from being oligotrophic (i.e., lakes that experience low levels of productivity) to eutrophic (i.e., lakes that are highly productive). A natural aging process occurs in all lakes, causing them to change from oligotrophic to eutrophic over time, and eventually filling in (Figure 7). Human activity can accelerate this aging process. "Cultural eutrophication" is a term coined by ecologists to define human activity impacts on a lake's trophic state.

Although trophic states are labeled for the purposes of discussion, keep in mind that in nature, the categories make smooth transitions into each other. Data from one date may show your lake as being eutrophic, and the next date as being mesotrophic.

If your lake has many rooted aquatic plants and relatively clear water, the TSI could be a mischaracterization of the true nutrient status of your lake. Lakes dominated by aquatic plants tend to have high amounts of phosphorus in the bottom sediments and relatively low amounts phosphorus in the water column. On the other hand, lakes that grow mostly algae have high amounts of phosphorus in the water column. The TSI only measures the portion of nutrients that are found in the water column, as evidenced by the amount of algae. So if most of the nutrients are held in the sediments and the lake is loaded with aquatic plants, the true total nutrient status would not be accurately measured using the TSI.

THE NATURAL AGING OF LAKES

Lakes can be divided into three categories based on trophic state: eutrophic, mesotrophic, and oligotrophic. Eutrophic lakes (very productive or fertile lakes) contain an overabundance of algae and may appear green in color. The water clarity of a eutrophic lake is low, meaning the Secchi disk disappears when submerged only a few feet. A eutrophic lake is not necessarily an unhealthy lake, but often has abundant plant growth or algae. Eutrophic lakes often support large fish populations but can be susceptible to oxygen depletion.

In contrast, a less productive lake is referred to as oligotrophic. In oligotrophic lakes, the Secchi disk may be visible to great depths, indicating high water clarity. Oligotrophic lakes generally contain little algae, fewer plants, and often have low fish densities. Mesotrophic lakes categorize the state between the oligotrophic and eutrophic stages. Mesotrophic lakes often have low dissolved oxygen levels in late summer. The hypolimnion (cold, bottom water) in these lakes limits coldwater fish populations and causes phosphorus cycling from the sediments.

A natural aging process occurs in all lakes, causing them to change from oligotrophic to eutrophic over time, and eventually filling in (Figure 7). However, human activity can accelerate this aging process. The term "cultural eutrophication," coined by ecologists, defines the human activity impact on a lake's trophic state.

By examining Secchi data over time, general lake productivity can be estimated. But in order to estimate the trophic state of your lake, you must have enough data collected over several years; particularly in the summer months when algal blooms are most prevalent.

Figure 7. *(Taken from Shaw et al. 2000 "Understanding Lake Data")*

CULTURAL EUTROPHICATION • *Accelerated eutrophication of a lake that occurs as a result of human activities in the watershed. These activities increase nutrient loads in runoff water that drains into lakes.*

LAKE SUMMARY REPORT SAMPLE

Citizen Lake Monitoring Report

MIDDLE LAKE - DEEPEST POINT

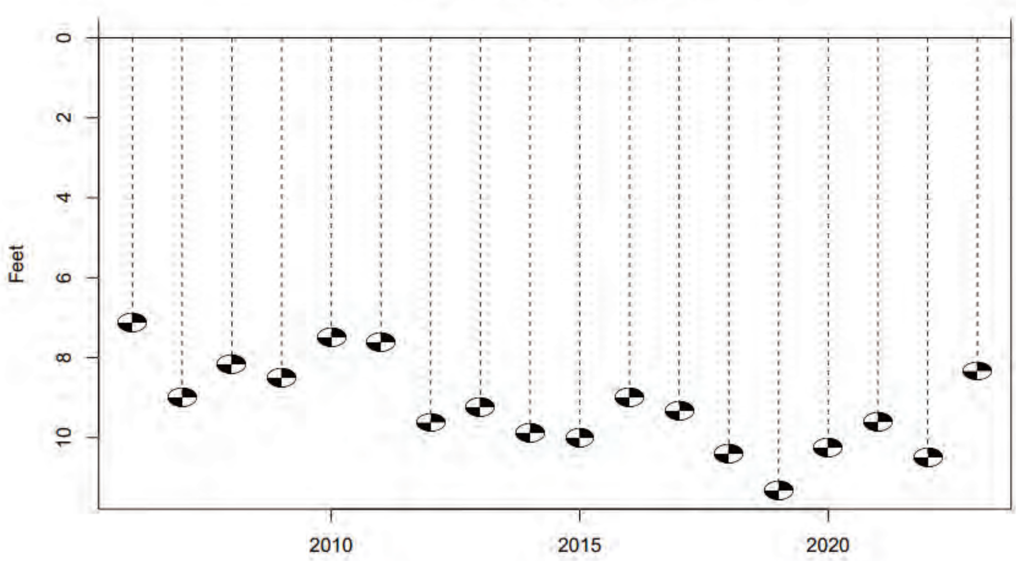
Report Year: 2023
Waterbody Name: Middle Lake
WBIC: 755700
County: Walworth County
Station ID: 653124

About this report
This report contains information that summarizes data routinely collected by the Citizen Lake Monitoring Network.

p. 2–3: Plots summarizing the trophic status and clarity of this lake over time.
p. 4–6: Trends over time in water clarity, total phosphorus, and chlorophyll–a
p. 7+: Tables of observations made during the selected report year, and temperature and dissolved oxygen profiles.

MIDDLE LAKE – DEEPEST POINT – 653124

Average July & August Secchi depths

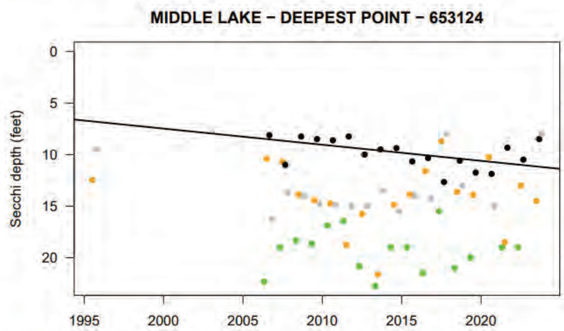


Average Secchi depths calculated from all July and August readings. Low Secchi depths indicate low water clarity, which can be caused by nutrients fueling the growth of algae, by particles suspended in the water, or from dark staining by dissolved tannins (naturally occurring compounds in leaves).

LAKE SUMMARY REPORT SAMPLE (part 2)

Secchi Depth

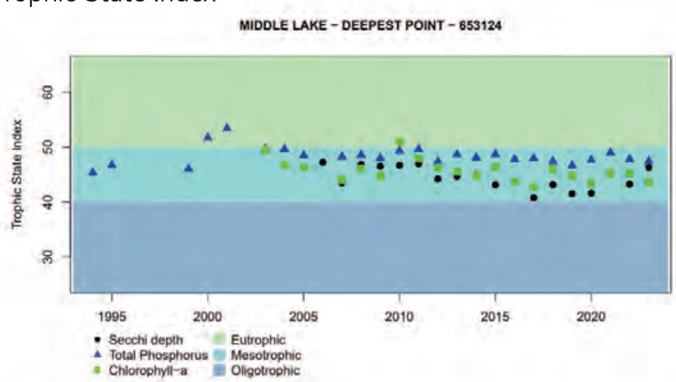
Trends over time



spring (before May 15)
early summer (May 15 – Jul 14)
late summer (Jul 15 – Sep 14)
fall (after Sep 15)
solid lines appear if there is a trend over time
points represent seasonal averages

Secchi depth is increasing over time in late summer. Secchi depth exhibits no trend over time in spring, early summer, and fall.

Trophic State Index

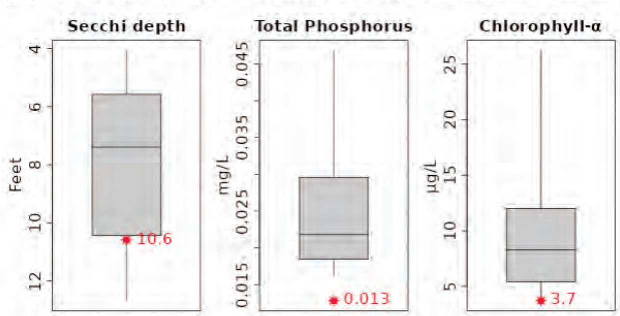


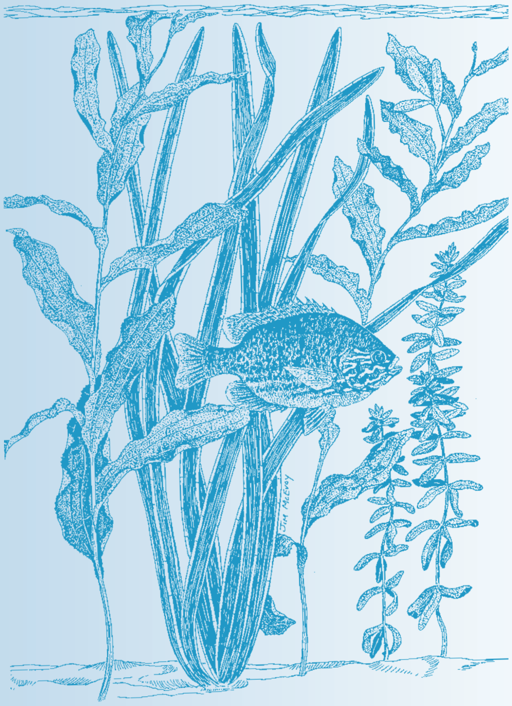
Trophic status indices (TSI) indicate the amount of nutrients in the lake. The TSI equations use late summer (July 15 - September 15) averages of Secchi depth, total phosphorus, and chlorophyll-α.

Eutrophic: excess nutrients, lower clarity, and greater risk of harmful algal blooms and hypoxia (low oxygen)
Mesotrophic: moderate levels of nutrients, moderate clarity
Oligotrophic: low levels of nutrients, high clarity, lower risk of hypoxia
Black circles indicate secchidepth

Trophic Status Compared to Similar Lakes

Late summer trophic indicator averages (red) from the last 10 years compared to other **DEEP LOWLAND** lakes (gray box and whiskers). If red dots are absent, not enough recent data exists to calculate an average.





DID YOU KNOW?

Usually, light can penetrate the surface of a lake to about 1.7 times the recorded Secchi depth. This light penetrating zone is called the photic zone. In this zone, plants and algae produce oxygen. Aquatic plants provide good habitat for fish and invertebrates. This zone also provides good habitat for fish and other vertebrates, because the light enables them to see better under water when searching for prey.

PHOTIC ZONE • *The surface and underwater lighted zone in a lake that usually has a depth around 1.7 times the Secchi reading.*

PHOTOSYNTHESIS • *Process by which green plants convert carbon dioxide (CO_2) dissolved in water to sugar and oxygen using sunlight for energy.*

DECOMPOSITION • *The act of breaking down organic matter from a complex form to a simpler form, mainly through the action of fungi and bacteria.*

Secchi Reading and Light Penetration

Secchi disk measurements can indicate the depth at which your lake contains enough oxygen to support fish and other aquatic life. In general, sunlight can penetrate to a depth 1.7 times greater than your recorded Secchi depth. For example, if your Secchi disk reading is 12 feet deep, that means the sunlight can actually penetrate 20 feet deep (1.7 times 12). The depth at which sunlight can penetrate is called the **photic zone**. It is within this zone that **photosynthesis** occurs and oxygen is produced by algae and other aquatic plants. Plant life is important to provide necessary habitat for fish and invertebrates. In deep, productive lakes, oxygen may become depleted below the photic zone as a result of bacterial **decomposition** of dead plants and animals. Without oxygen, phosphorus and other nutrients may be released from the lake sediments and during the lake's mixing periods be circulated to the surface water. This internal cycling of nutrients can trigger algae blooms, aquatic plant growth, and odor problems.

How Does My Lake Compare to Others?

To examine how your lake quality compares to others around the state, use the summary reports generated by CLMN. These reports contain graphs that chart the Secchi TSIs for each lake type in each georegion. You can find these reports online.

What if Your Data is Better Than Average

If your Secchi readings are better than average for your lake type and georegion, you will want to work to protect your lake and keep it the way it is. One way to help protect your lake is through a Lake Protection Grant. Qualified lake associations, lake districts, as well as, counties, towns, cities, or villages are eligible to receive lake planning and protection grant funding. Through these grants, money is available for lake and watershed data collection, development of local lake management plans, land acquisition, and other lake protection activities. For more information on lake grants, contact your CLMN regional coordinator or a Extension Lakes specialist. The Wisconsin DNR also has excellent information on lake grants online.

What if Your Data is Worse Than Average

If your Secchi readings are lower than average for your lake type and georegion, the first step is to try to figure out what is causing the low readings. If your water appears clear and brown, chances are your lake is a "stained" lake. This staining is natural and not an indication of a water quality problem. With this kind of lake, you may want to get involved in chemistry monitoring which can give you more information about the trophic status of your lake.

If your water appears murky and brown, the problem may be sediment. In this case, you will want to investigate where the problem is coming from. Sediment in the water can be due to erosion along the lake shore, or erosion coming from streams that flow into lakes. Sediment in your lake could also be a result of carp or boat traffic stirring up the bottom.

Clear and green, or murky and green water may suggest that algae are impacting your Secchi readings. In this case, working with people that live and work around your lake to reduce nutrient inputs is one thing you can do.

GET TO THE ROOT OF THE PROBLEM

Suppose that your lake is not as clear as others in the area, and that there is some indication of clay turbidity in the spring and after rainstorms. However, the color of your lake is green indicating that algae, not clay, is affecting water clarity. What do you do now?

First, do some detective work.

Your data have given you some clues as to the sources and cycles of nutrients and erosion materials. Drive through the watershed, preferably after a recent rain and observe the condition of the streams entering your lake. Are some more turbid than others? Look upstream and try to track down the sources of turbidity. You may find a point source (e.g., pipes) or a specific location such as a field or housing development that is the source of the problem. Or, you may find that there are numerous contributors to stream turbidity. Are there any sewage treatment plants discharging into the river or are houses in the watershed using septic tanks? Sewage in any form is high in nutrients and septic systems sometimes fail or are deliberately by-passed. By the time you have done several of these surveys you might have a better idea of the sources of your lake's problems. It might even be necessary to obtain a detailed map that includes the watershed and start mapping problem streams and sources.

Second, take more Secchi measurements in your lake.

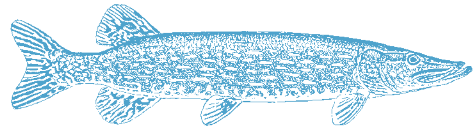
Even though the Network requires you to collect data every other week, you can sample more often if you think it is important. Make a point to sample your lake after rainstorms to see if there is any relationship between rainfall and your lake's turbidity. You may also want to sample more sites on your lake, preferably near the mouths of streams that you think may be causing turbidity. To make these new sites "official" contact your regional coordinator. If you think weekend watercraft use may be affecting your water clarity, try sampling the lake during the week and again on the weekend (Don't forget to make a note of this on your data sheet!). Volunteers have even used their Secchi data to detect the consequences of leaking septic systems by monitoring decreases in transparency near houses. Be sure to write down all of your observations and report your data to the Network. We really do want to know more about your lake, too!

A recent study of over 1,000 waterfront properties in Minnesota found that when all other factors were equal, properties on lakes with clearer water commanded significantly higher property prices (Krysel, 2003).

What you and your neighbors do to maintain or improve water quality will improve resale potential.

Here are some things that you can do to improve water quality.

- Agricultural producers should apply best management practices to reduce the amount of nutrient runoff to lakes. Your local Land Conservation Office can offer assistance.
- A healthy, diverse aquatic plant community stabilizes a shoreline and reduces erosion and provides habitat for fish and wildlife.
- Protect or restore your shoreland buffer.
- Plant native trees and shrubs or protect your wooded areas.
- Capture and cleanse pollutant and sediment-carrying runoff before it reaches the waterway – with shoreland buffers, rain barrels or rain gardens.
- Try to maintain as much woody habitat as possible. Fish use submerged trees to spawn on and they provide cover to young and old alike.
- Declines in submerged tree habitats have been linked to reduced abundance of young smallmouth bass and yellow perch.
- Inspect and maintain your septic system and well regularly
- Reduce the hard surfaces and driveways on your property. Pervious pavers are an option for areas that do not have heavy traffic. To reduce runoff, diversion practices such as rock infiltration can be installed.
- Monitor your lake for aquatic invasive species
- Assess your property and participate in Healthy Lakes and Rivers Wisconsin. The goal is to protect and improve the health of our lakes and rivers by increasing shoreland property owner participation in habitat restoration and runoff and erosion control projects. Check out the Healthy Lakes Wisconsin web site at https://healthylakeswi.com.
- If your lake does not have a lake association or lake district, consider forming one. Dealing with a broad range of issues (aquatic invasive species, water quality) can be overwhelming for one person. Working as an organized group that shares a common goal can make even the most difficult problems easier to tackle.
- Plan a lake fair or event. A lake fair is an educational and social event that blends a sense of discovery and entertainment. These evens provide an opportunity for participants to get hands-on experience, talk with lakes experts in an informal setting, meet lake neighbors and build relationships.
- Become a Lake Leader. Lake Leaders is designed to stretch the mind by exploring new ideas about lake management and the human use of lakes. Graduates of this program develop a network to share experiences and learn from each other.
- The Lakes and Rivers Convention is an annual event that gives educators, lake lovers, and professionals a chance to get together and discuss lake issues.



PHOTOS: JUNE KONOS

Record-Keeping

Keeping a "Lake Log"

As a CLMN volunteer, you are a record-keeper of your lake's overall health. The Secchi clarity data, water chemistry information, and observations that you supply help with current management activities and also provide a basis for future management. The information that you collect in the field, as well as, the summary results presented in CLMN reports, can be used to create a "lake log" (i.e. a long-term record of your lake's overall history and health).

The field data sheet copies of your water clarity and chemistry information can be used as basic information for starting your lake log. Eventually you can add graphs, news clippings, lake history, maps, wildlife sightings, land use records, etc., to make your log complete. The sky's the limit! But don't take on this responsibility alone. You can share record-keeping responsibilities by enlisting the help of lakeshore residents, lake association members, and youth or school groups to help collect and compile information. For a *basic* lake log, the following items are recommended: a lake map, copies of your field data sheets and notes, and your annual data summary sheets. In addition to the items listed above, if you would like to compile a more comprehensive lake log the following items are recommended.

- ☑ Graphs of your results
- ☑ General lake ecology information (e.g., CLMN reports, *Understanding Lake Data*, etc.)
- ☑ Planning and protection grant information
- ☑ Precipitation and other weather information
- ☑ Ice-on and ice-off dates
- ☑ Wildlife sightings
- ☑ Illustrations and photographs
- ☑ Aquatic plant information
- ☑ Lake history notes from interviews with long-time residents
- ☑ Historical maps showing watershed development
- ☑ Video or photos of shoreline development runoff, plants, algal blooms, etc.
- ☑ Any other data or information collected about your lake

Assembling the Basics

The Wisconsin DNR has maps for many lakes in Wisconsin available online. When you sample, make careful observations. Your initial observations are important since they can help you remember (and others understand) what is happening in and around your lake. In addition, taking careful field notes can provide a better understanding of the water quality and ecosystem conditions on your lake.

Glossary

Algae. Small aquatic plants containing chlorophyll and without roots that occur as a single cell or multi-celled colonies. Algae form the base of the food chain in an aquatic environment.

Algal bloom. A heavy growth of algae in and on a body of water as a result of high nutrient concentrations.

Aquatic Invasive Species (AIS). Refers to species of plant or animal that are not native to a particular region into which they have moved or invaded. Zebra mussels and Eurasian water-milfoil are examples of AIS. Wisconsin has laws preventing the spread on boats and trailers.

Bathymetric map. A map showing depth contours in a water body. Bottom contours are usually presented as lines of equal depth, in meters or feet. Often called a hydrographic map.

Chlorophyll. Green pigment present in all plant life and necessary for photosynthesis. The amount of chlorophyll present in lake water depends on the amount of algae and is used as a common indicator of water quality.

Cultural eutrophication. Accelerated eutrophication of a lake that occurs as a result of human activities in the watershed. These activities increase nutrient loads in runoff water that drains into lakes.

Decomposition. The act of breaking down organic matter from a complex form to a simpler form, mainly through the action of fungi and bacteria.

Deionized water. Water that has been passed through a column or membrane to remove ions present.

Distilled water. Water that is boiled in a still and the condensate collected and distributed. Distillation removes both ionic and nonionic organic contaminants.

Dissolved oxygen. A measure of the amount of oxygen gas dissolved in water and available for use by microorganisms and fish. Dissolved oxygen is produced by aquatic plants and algae as part of photosynthesis.

Drainage lake. Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

Epilimnion. The uppermost circulating layer of warm water that occurs in stratified lakes in summer because of the differences in water density.

Euphotic zone. That part of a water body where light penetration is sufficient to maintain photosynthesis.

Eutrophic. Lakes characterized by high nutrient inputs, high productivity, often experiencing algal blooms and abundant weed growth. This term can also refer to a nutrient-rich lake, as large amounts of algae and weeds characterize a eutrophic lake.

Eutrophication. The process by which lakes and streams are enriched by nutrients causing an increase in plant and algae growth.

Georegion. Wisconsin's lake "georegions" originated from a grouping of lakes made in the early 1980s by Wisconsin DNR senior limnologists. These groupings are based on the best professional judgment of the scientists most familiar with Wisconsin's lake resources. The georegions roughly reflect "hydro-chemical lake regions" which are based on the state's bedrock geology, glacial geology and soil type, and the more recently described "ecoregions" which are based on geological characteristics as well as the dominant vegetation.

Hypolimnion. The cold, deepest layer of a lake that is removed from surface influences.

Lake association. A voluntary organization with a membership generally comprised of those who own land on or near a lake. The goals of lake associations usually include maintaining, protecting, and improving the quality of a lake, its fisheries, and its watershed.

Lake classification. A way of placing lakes into categories with management strategies best suited to the types of lakes found in each category. For example, lakes can be classified to apply varying shoreland development standards. They can be grouped based on hydrology, average depth, surface area, shoreline configuration, as well as, sensitivity to pollutants and recreational use.

Lake district. A special purpose unit of government with the cause of maintaining, protecting, and improving the quality of a lake and its watershed for the mutual good of the members and the lake environment.

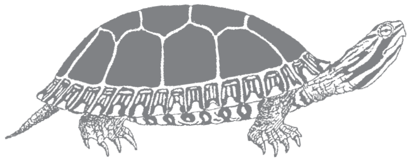
Limnology. The study of inland lakes and waters. The study of the interactions of the biological, chemical, and physical parameters of lakes and rivers.

Macrophyte. Large, rooted or floating aquatic plants that may bear flowers and seeds.

Meniscus. The curved upper surface of a still liquid in a tube caused by surface tension.

Mesotrophic. Lakes characterized by their moderately fertile nutrient levels. Falls in between the oligotrophic and eutrophic levels of nutrient enrichment.

Metalimnion. Sometimes referred to as the thermocline. The narrow transition zone between the epilimnion and the hypolimnion that occurs in stratified lakes.



Nitrogen. One of the major nutrients required for the growth of aquatic plants and algae.

Oligotrophic. Lakes characterized by low nutrient inputs and low productivity. They are generally deep with high water clarity.

Parts per million (ppm). An expression of concentration indicating weight of a substance in a volume of one liter. Milligrams per liter (mg/l) is an equivalent unit.

pH. The measure of the acidity or alkalinity of a solution. Neutral solutions are defined as having a pH of 7.0. Solutions which are known as acidic have a pH lower than 7. Solutions which are known as basic have a pH greater than 7.

Phosphorus. The major nutrient influencing plant and algal growth in more than 80% of Wisconsin lakes. Soluble reactive phosphorus refers to the amount of phosphorus in solution that is available to plants and algae. Total phosphorus refers to the amount of phosphorus in solution (reactive) and in particulate forms (non-reactive.)

Photic zone. The surface and underwater lighted zone in a lake that usually has a depth around 1.7 times the Secchi reading.

Photosynthesis. Process by which green plants convert carbon dioxide (CO_2) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base and is an important source of oxygen for many lakes.

Phytoplankton. Very small free-floating aquatic plants, such as one-celled algae. Their abundance, as measured by the amount of chlorophyll a in a water sample, is commonly used to classify the trophic status of a lake.

Qualified Lake Association. To be eligible for state lake planning, protection and recreational boating facilities grants, a lake association must meet certain standards set out in section 281.68 of the Wisconsin statutes.

(Glossary continued on next page)

Respiration. The reverse reaction of photosynthesis. The complex process that occurs in the cells of plants and animals in which nutrient organic molecules, such as glucose, combine with oxygen to produce carbon dioxide, water, and energy. Respiration consumes oxygen and releases carbon dioxide. This process also takes place during decomposition as bacterial respiration increases.

Runoff. Water from rain, snow melt, or irrigation that flows over the ground surface and into streams or lakes.

Secchi disk. A 20-cm (8-inch) diameter disk painted white and black in alternating quadrants. It is used to measure light transparency in lakes.

Seepage lakes. Lakes without a significant inlet or outlet, fed by rainfall and groundwater.

Spring lakes. Lakes that have no inlet, but have an outlet. The primary source of water for spring lakes is groundwater flowing into the bottom of the lake from inside and outside the immediate surface drainage area. Spring lakes are found at the headwaters of many streams and are a fairly common type of lake in northern Wisconsin.

State Laboratory of Hygiene. The state of Wisconsin's public health and environmental laboratory.

Station #. A number assigned to sampling locations on a waterbody. The Station # makes it easy to track secchi and chemistry data. Each sampling site on a lake will have a separate Station #.

Stratification. The layering of water due to differences in temperature and density.

SWIMS. Surface Water Integrated Monitoring System. The database where all CLMN data and other water quality data is stored.

Tannins. Natural pigments found in organic matter such as leaves and bark.

Thermocline. Sometimes referred to as the metalimnion. The narrow transition zone between the epilimnion and the hypolimnion that occurs in stratified lakes.

Trophic state. The extent to which the process of eutrophication has occurred is reflected in a lake's trophic classification or state. The three major trophic states are oligotrophic, mesotrophic, and eutrophic.

µg/L. micrograms per liter is an expression of concentration indicating weight of a substance in a volume of one liter. Parts per billion (ppb) is an equivalent unit.

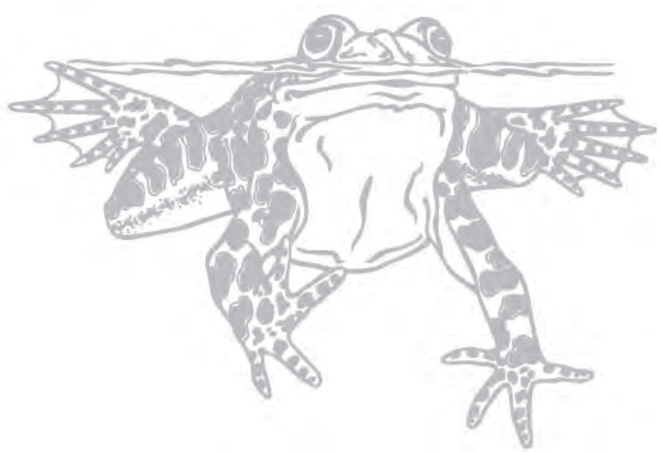
Waterbody # or WBIC (Waterbody Identification Code).
A unique identification number the Wisconsin DNR uses to identify each waterbody in the state. Every one of the 15,000 lakes in Wisconsin has a unique WBIC.

Watershed. The area of land draining into a specific stream, river, lake, or other body of water.

Zebra mussel. A tiny bottom dwelling mollusk native to Europe.

Zooplankton. Plankton that is made up of microscopic animals, for example, protozoa, that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. For many fish and crustaceans, they are the primary source of food.

NOTES



Appendix 1 Secchi Collection Summary Sheet

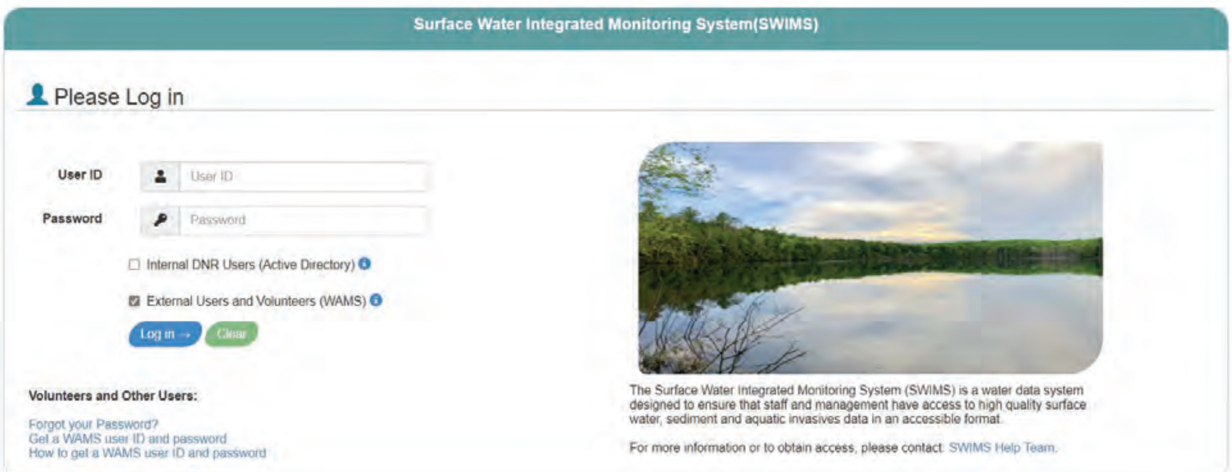
1. Contact your Citizen Lake Monitoring Network coordinator for waterbody # or WBIC (Waterbody Identification Code) and Station #. The Station # identifies the sample site on the lake, usually the deepest part of the lake (the deep hole).
2. Before going out to collect Secchi reading, be sure that conditions are right and safe for sampling.
   - Sunny to partly sunny/cloudy skies
   - Wind calm to breezy – there should be no white caps on the lake
   - Between 10:00 am and 4:00 pm
3. Gather your reporting form, lake map with the sample site marked, PFD and Secchi disk. Motor to the deep hole or other designated sampling site. Anchor boat.
4. Mark time and date on your data sheet.
5. Remove sunglasses. Secchi reading is taken from the shady side of the boat.
6. Unwind the Secchi disk rope from the holder. Lean over the shady side of the boat and slowly lower the Secchi disk into the water until you can no longer see it. You should be as close to the surface of the water as is safe. If you are sampling from a pontoon boat, kneel down on the floor of the boat.
7. When the Secchi disk barely disappears from view, mark the rope at the water level with a clothes pin.
8. Lower the Secchi disk a few more feet into the water. Slowly raise the disk. When the Secchi disk reappears, mark the rope at the water level with the second clothespin. The clothespin may be at the same spot or there may be several inches to several feet difference.
9. Bring the Secchi disk back into the boat. Average the two Secchi readings by forming a loop between the two clothespins. Slide one clothespin into the center of the loop to mark it. Remove the other clothespin. The remaining clothespin will be your Secchi reading.
10. Count the number of feet from the disk until you reach your clothespin. Round off to the nearest quarter foot and record that number on your data sheet.
11. Complete water aesthetics survey on your worksheet. Water level should be recorded using the ordinary high water mark as the norm.
12. To determine if the water appearance is clear or murky, hold your Secchi disk **one foot** under the surface of the water and observe how the white part of the disk appears.
13. To determine water color, hold your Secchi disk **one foot** under the surface of the water and observe the water against the white of the disk. Clear water should be recorded as "blue."
14. Indicate your perception of the water quality **at the deep hole**. On a scale of 1 to 5 (1 being the best and 5 being the worst) record your perception of the amount of algae in the water.
15. Record weather and other observations.

Appendix 2 How to Report Data Online

Citizen Lake Monitoring
How to Report Data

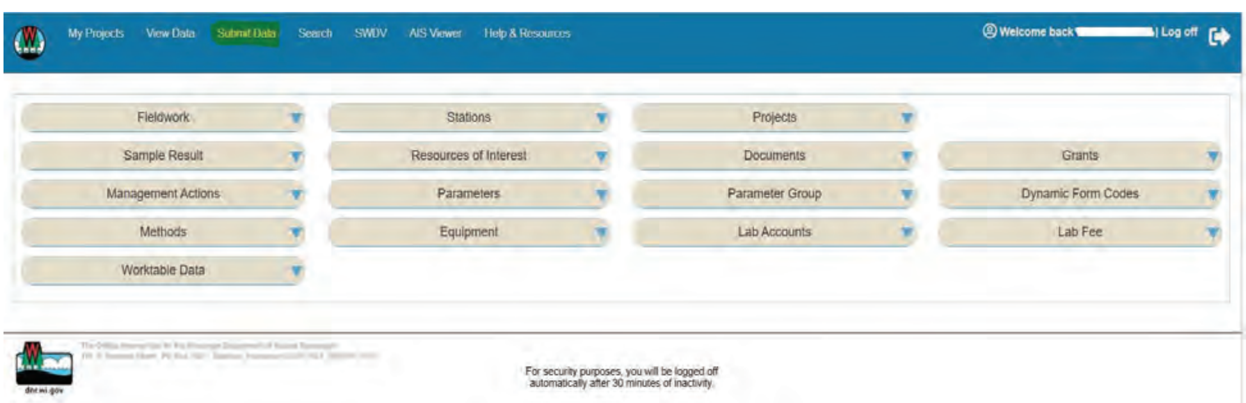
How to Enter Data

1. Log in at https://apps.dnr.wi.gov/swims/Account/LoginSWIMS

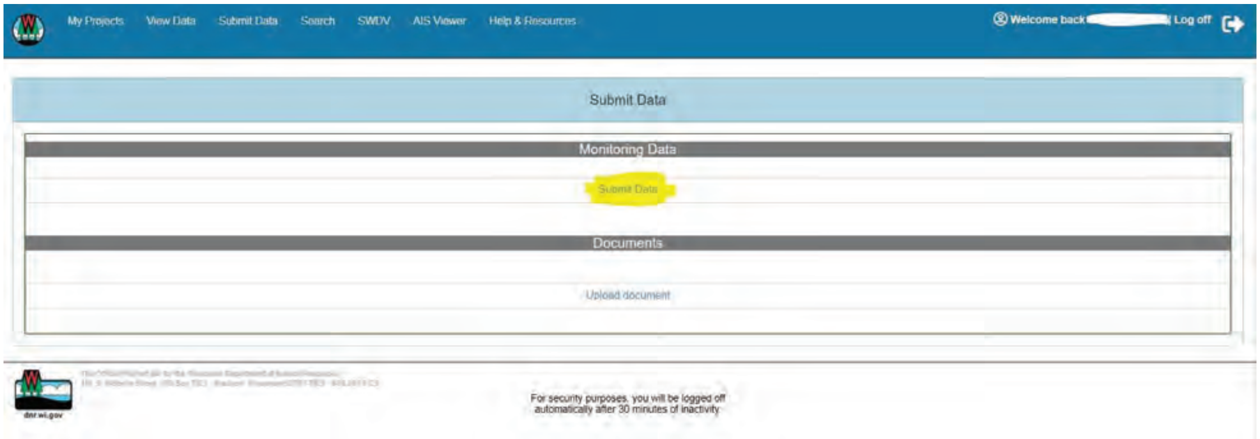


Tip/hint: Click the External Users and Volunteers (WAMS) box, as login page will default to internal DNR users.

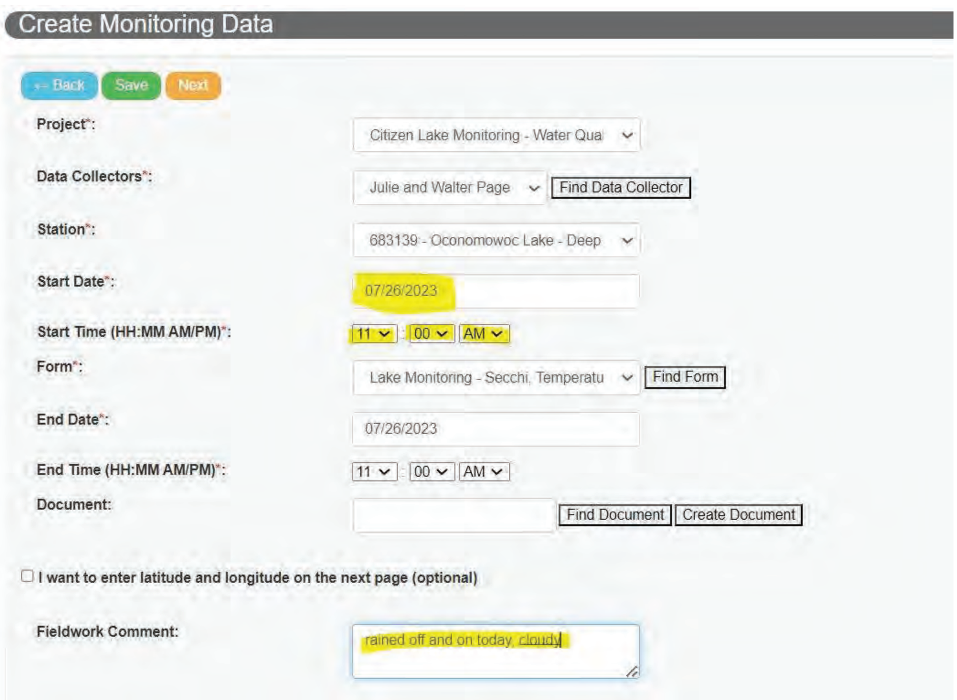
2. Click on Submit Data tab along top of page



3. Under Monitoring Data, hit **Submit Data** link



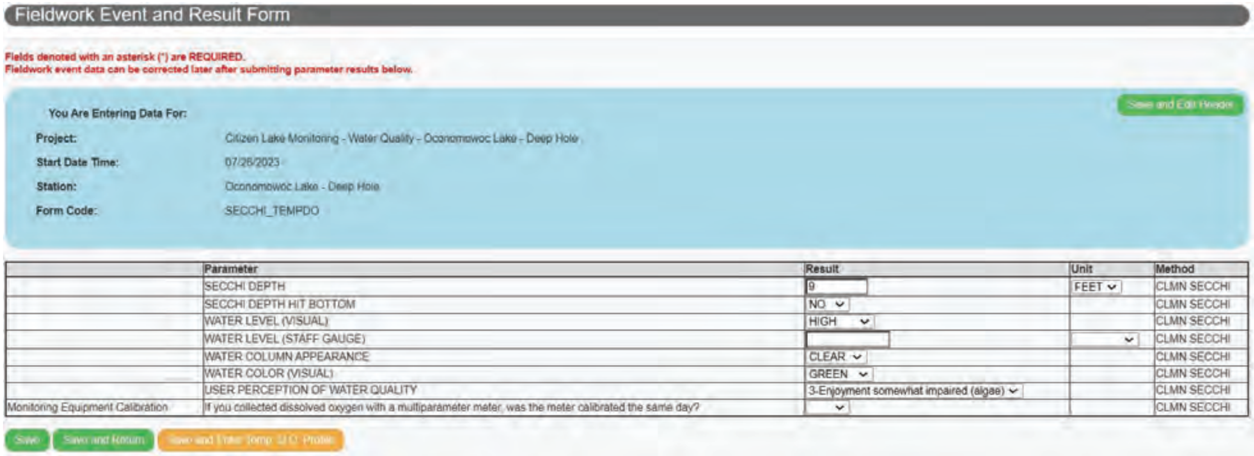
4. Then, select the data collector/s and monitoring station (they should be prefilled with your information).
5. Enter the date and time you monitored.
6. Enter your written observations in the fieldwork comments box (ie Weather, Wildlife, etc..)
7. Click **Next** button at top



Tip/hint: Use drop down menus and calendars to prevent more errors from occurring.

Also if you monitor multiple sites you may have a drop down menu under the project line. Make sure to check the project if you cannot find your station.

8. Fill in your results. To enter a Temperature and or Dissolved Oxygen profile, click on the **Save and Enter Temp D.O. Profile** button. If you are done, click on the Save and Return button.



Fieldwork Event and Result Form

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

Save and Edit Header

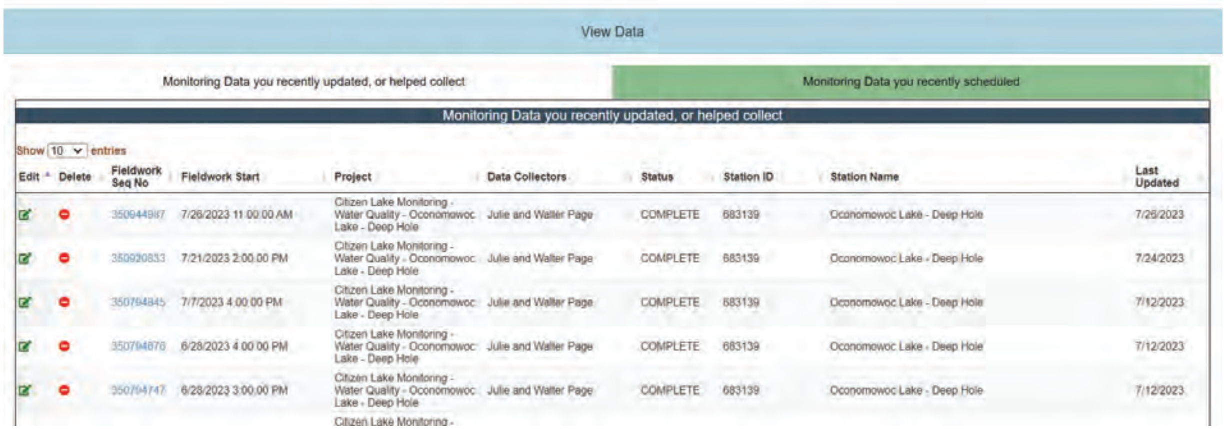
You Are Entering Data For:

Project:	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole
Start Date Time:	07/26/2023
Station:	Oconomowoc Lake - Deep Hole
Form Code:	SECCHI_TEMPDO

	Parameter	Result	Unit	Method
	SECCHI DEPTH	9	FEET	CLMN SECCHI
	SECCHI DEPTH HIT BOTTOM	NO		CLMN SECCHI
	WATER LEVEL (VISUAL)	HIGH		CLMN SECCHI
	WATER LEVEL (STAFF GAUGE)			CLMN SECCHI
	WATER COLUMN APPEARANCE	CLEAR		CLMN SECCHI
	WATER COLOR (VISUAL)	GREEN		CLMN SECCHI
	USER PERCEPTION OF WATER QUALITY	3-Enjoyment somewhat impaired (algae)		CLMN SECCHI
Monitoring Equipment Calibration	If you collected dissolved oxygen with a multiparameter meter, was the meter calibrated the same day?			CLMN SECCHI

Save | Save and Return | Save and Enter Temp D.O. Profile

9. When you hit Save and Return you will see a list of data you have recently entered or helped collect.



View Data

Monitoring Data you recently updated, or helped collect | Monitoring Data you recently scheduled

Monitoring Data you recently updated, or helped collect

Show 10 entries

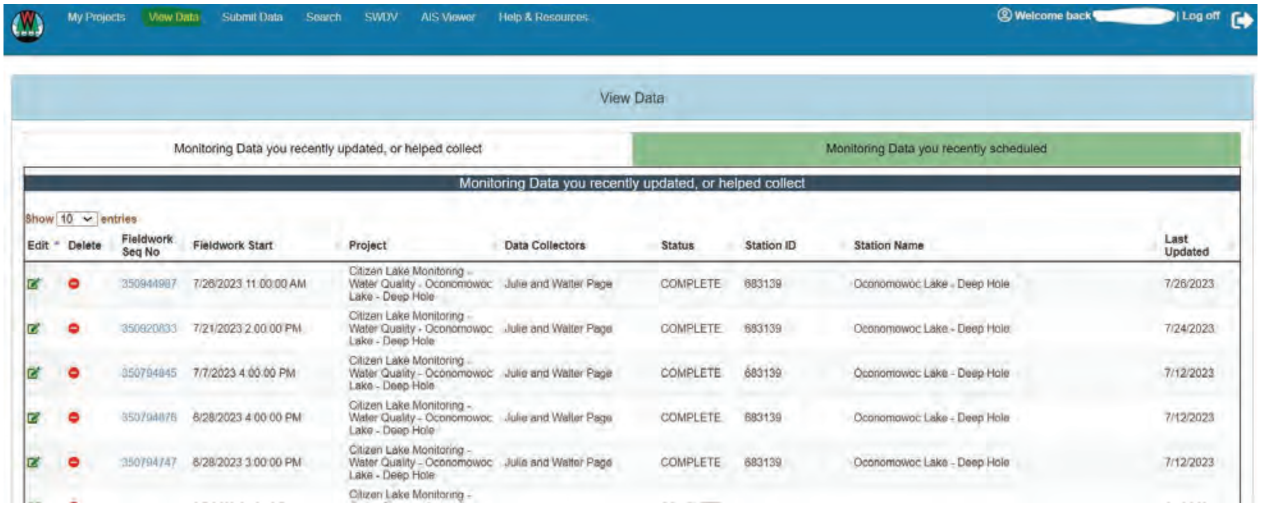
Edit	Delete	Fieldwork Seq No	Fieldwork Start	Project	Data Collectors	Status	Station ID	Station Name	Last Updated
		350944987	7/26/2023 11:00:00 AM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/26/2023
		350920833	7/21/2023 2:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/24/2023
		350794845	7/7/2023 4:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/12/2023
		350794870	6/28/2023 4:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/12/2023
		350794747	6/28/2023 3:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/12/2023
				Citizen Lake Monitoring -					

10. Repeat steps above if you have more than one date and/or station to enter data for.

How to Edit Existing Data

You can edit data you have entered during the current monitoring season. Here's how:

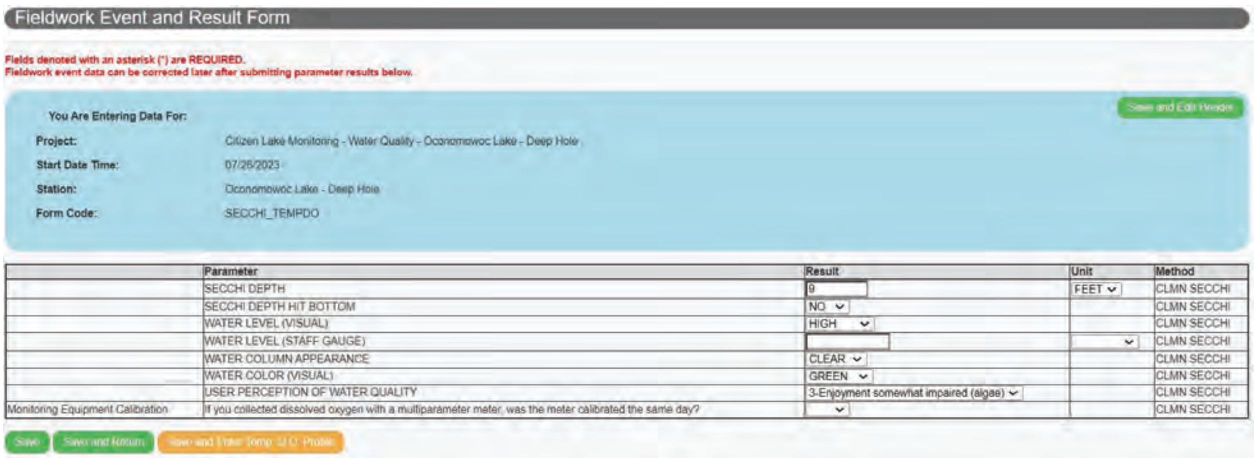
1. Log into SWIMs at https://apps.dnr.wi.gov/swims/Account/LoginSWIMS
2. Click on View Data at top of page. This will show all the data you recently entered.



3. Click on the Green Edit Button next to the data you would like to edit. This button is located on the left side of the webpage.

4. You can edit any box that is not greyed out. When you have completed the editing of this page you can hit Update . If you need to edit any of the secchi data hit Next .

5. You can Edit your results here. To edit the temperature and or Dissolved Oxygen profile, click on the **Save and Enter Temp D.O. Profile** button. If you are done, click on the Save and Return button


Fieldwork Event and Result Form

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

Save and Edit Header

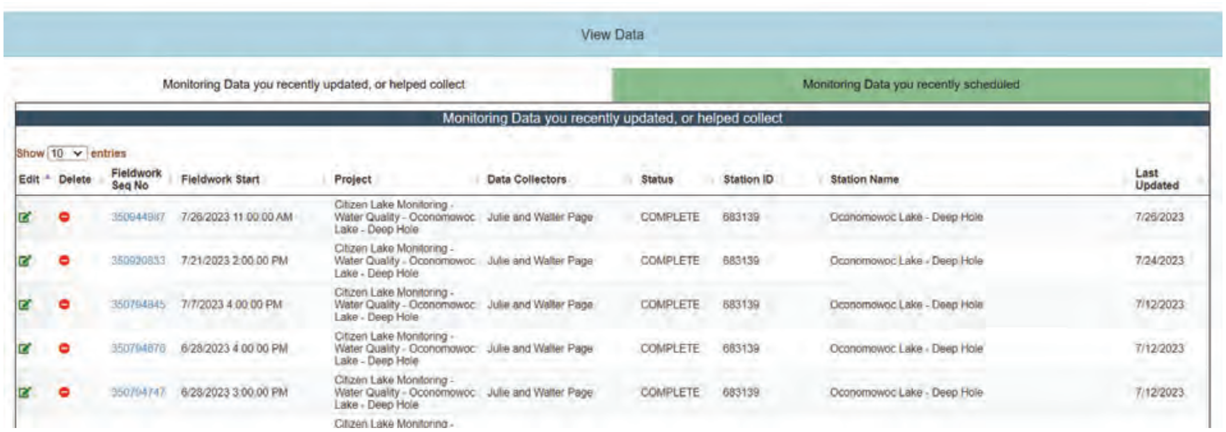
You Are Entering Data For:

Project:	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole
Start Date Time:	07/26/2023
Station:	Oconomowoc Lake - Deep Hole
Form Code:	SECCHI_TEMPDO

	Parameter	Result	Unit	Method
	SECCHI DEPTH	9	FEET	CLMN SECCHI
	SECCHI DEPTH HIT BOTTOM	NO		CLMN SECCHI
	WATER LEVEL (VISUAL)	HIGH		CLMN SECCHI
	WATER LEVEL (STAFF GAUGE)			CLMN SECCHI
	WATER COLUMN APPEARANCE	CLEAR		CLMN SECCHI
	WATER COLOR (VISUAL)	GREEN		CLMN SECCHI
	USER PERCEPTION OF WATER QUALITY	3-Enjoyment somewhat impaired (algae)		CLMN SECCHI
Monitoring Equipment Calibration	If you collected dissolved oxygen with a multiparameter meter, was the meter calibrated the same day?			CLMN SECCHI

Save | Save and Return | Save and Enter Temp D.O. Profile

6. When you hit Save and Return you will see a list of data you have recently entered or helped collect.


View Data

Monitoring Data you recently updated, or helped collect | Monitoring Data you recently scheduled

Monitoring Data you recently updated, or helped collect

Show 10 entries

Edit	Delete	Fieldwork Seq No	Fieldwork Start	Project	Data Collectors	Status	Station ID	Station Name	Last Updated
		350944987	7/26/2023 11:00:00 AM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/26/2023
		350920833	7/21/2023 2:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/24/2023
		350794845	7/7/2023 4:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/12/2023
		350794876	6/28/2023 4:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/12/2023
		350794747	6/28/2023 3:00:00 PM	Citizen Lake Monitoring - Water Quality - Oconomowoc Lake - Deep Hole	Julie and Walter Page	COMPLETE	683139	Oconomowoc Lake - Deep Hole	7/12/2023
				Citizen Lake Monitoring -					

Appendix 3 Forms

Secchi Datasheet

Ice Observation Report

Aquatic Invasives Presence/Absence Report

(see next 3 pages)

PLEASE NOTE: You can find the most current version of the forms online.

State of Wisconsin
Department of Natural Resources

Wisconsin Citizen Lake Monitoring Network – Secchi

Form 3200-100 (R 10/19)

Notice: Information is collected under s. 33.02, Wis. Stats. Personally identifiable information, including names of volunteers, will be broadly distributed in conjunction with lakes data.

Station ID # (use separate form for each site)	Lake Name	County	Year

Names of each volunteer who sampled on each date	**Date** Use 4 digits, e.g., May 19 is 0519	**Time** Round to nearest hour	**Secchi Depth** Round to nearest quarter of a foot	**Hit Bottom** Yes No	**Lake Level** High Low Normal	**Appearance** Clear Murky	**Water Color** Blue; Green; Brown; Red; Yellow	***Perception** 1 - 5	**Date Entered To SWIMS**
Observations:									
Observations:									
Observations:									
Observations:									
Observations:									
Observations:									
Observations:									
Observations:									
Observations:									
Observations:									

***Perception** = Perception of the amount of algae in the water at your sample location: 1=Beautiful, could not be any nicer. 2=Very minor aesthetic problems; excellent for swimming and boating enjoyment. 3=Swimming and aesthetic enjoyment of lake slightly impaired because of high algae levels.4=Desire to swim & level of enjoyment of lake substantially reduced because of algae; would not swim, but boating is OK. 5=Swimming and aesthetic enjoyment of lake substantially reduced because of algae levels.

If you enter the data on the web, keep a copy for your records. There's no need to mail a paper copy. Otherwise mail copy to Citizen Lake Monitoring Network, WI DNR, PO Box 7921, Madison WI 53703; or to your local coordinator, by November 1. The Citizen Lake Monitoring web site is: https://dnr.wi.gov/lakes/clmn/

State of Wisconsin
Department of Natural Resources
Wisconsin Lakes Partnership

Ice Observation Report

Form 3200-131 (R 02/08)

Personally identifiable information collected on this form will be incorporated into the DNR lakes database. It is not intended to be used for any other purposes, but may be made available to requesters under Wisconsin's Open Records laws, s. 19.32 - 19.39, Wis. Stats.

Primary Data Collector

Name	Phone Number	Email

Additional Data Collector Names

Monitoring Location

Waterbody Name	Township Name	County

Describe your observation point

Describe portion of waterbody you can see from your observation point

Date and Time of Monitoring

Start Date	Start Time	End Date	End Time

Start Date = Date you began making ice observations for the winter season. End Date = Date you finished making ice observations in the spring

Monitoring Results

"Ice On" = A lake is considered ice covered when the deepest part of the lake is ice covered.

"Ice Off" = The lake is considered thawed when it is possible to boat from any shore to the deepest part of the lake without encountering ice.

If you or past observers on your lake have always used another method to judge ice-on and ice-off, please describe the method

Date of First "Ice On" (When lake was first observed to be closed in the fall)

Date First "Ice Off" (When lake was first observed to be open in the spring)

Ice Duration (Total number of days frozen) [provide only if lake was observed daily]

Comments

State of Wisconsin
Department of Natural Resources
Wisconsin Lakes Partnership

Aquatic Invasives Surveillance Monitoring
End of Season Report

Form 3200-133 (02/10) (formerly Form 3200-124)

This monitoring is designed to help detect new invasive species on your lake, so DNR can be alerted and lake residents and/or professionals can respond appropriately. The purpose of the DNR collecting this data is to let us know what methods trained citizens and professionals use when actively looking for aquatic invasive species. You are often the ones to alert us of new invasives in our waters. Remember for surveillance monitoring, a report of "no invasive" at a location is just as important as finding an invasive. One cannot confidently state that the invasive is not present in an area if no one has looked and reported their findings. Knowing where invasives are not, as well as where they are, is extremely important in being able to track and understand their spread. Knowing how often monitors are looking for species and what they are finding is very important information.

Notice: Information on this voluntary form is collected under ss. 33.02 and 281.11, Wis. Stats. Personally identifiable information collected on this form will be incorporated into the DNR Surface Water Integrated Monitoring System (SWIMS) Database. It is not intended to be used for any other purposes, but may be made available to requesters under Wisconsin's Open Records laws, ss. 19.32 - 19.39, Wis. Stats.

Data Collectors		
Primary Data Collector Name	Phone Number	Email
Additional Data Collector Names		
Total Paid Hours Spent (# people x # hours each)	Total Volunteer Hours Spent (# people x # hours each)	

Monitoring Location			
Waterbody Name	Township Name	County	Boat Landing (if you only monitor at a boat landing)

Dates Monitored	
Start Date (when you first monitored this season)	End Date (when you last monitored this season)
Did at least some data collectors monitor in... May? June? July? August? (circle all that apply)	

Did you monitor...	**Did you...**
All Beaches and Boat Landings? Frequently Some of the Time Not Often/Never	Walk along the shoreline? Frequently Some of the Time Not Often/Never
Perimeter of whole lake? Frequently Some of the Time Not Often/Never	Observe entire shallow water area (up to 3 feet deep)? Frequently Some of the Time Not Often/Never
Docks or piers? Frequently Some of the Time Not Often/Never	Use rake to extract plant samples? Frequently Some of the Time Not Often/Never
Other: ______________	Check underwater solid surfaces (boat hulls, dock legs, rocks)? Frequently Some of the Time Not Often/Never
	Other: ______________

Did you find...(even if not a new finding for the lake or stream)			
Banded Mystery Snail?	Yes No Did not look for	Hydrilla?	Yes No Did not look for
Chinese Mystery Snail?	Yes No Did not look for	Purple Loosestrife?	Yes No Did not look for
Curly-Leaf Pondweed?	Yes No Did not look for	Rusty Crayfish?	Yes No Did not look for
Eurasian Water Milfoil?	Yes No Did not look for	Spiny Waterfleas?	Yes No Did not look for
Fishhook Waterfleas?	Yes No Did not look for	Zebra Mussels?	Yes No Did not look for
Freshwater Jellyfish?	Yes No Did not look for	Other?: ________	

If you find an aquatic invasive
If you find an aquatic invasive and it is not listed at http://dnr.wi.gov/lakes/AIS fill out an incident report for the species. Then bring the form, a voucher specimen if possible, and a map showing where you found it to your regional DNR Citizen Lake Monitoring or AIS Coordinator as soon as possible (to facilitate control if control is an option).

If you don't find an aquatic invasive
If you submit your data online, that is all you need to do. Otherwise, please mail a copy to your regional DNR Citizen Lake Monitoring Coordinator. http://dnr.wi.gov/lakes/contacts

Additional Resources

CLMN Web Site: www.dnr.wi.gov/lakes/CLMN and www.uwsp.edu/uwexlakes
CBCW Web Site: www.uwsp.edu/uwexlakes
Extension Lakes Web Site: www.uwsp.edu/uwexlakes

The following resources and many other limnology related books can be found on the web or at your local or University library. Used text books often can be found at college bookstores for a reduced price.

Understanding Lake Data
This booklet will help you understand how lakes work and what your data means for your lake. The CLMN web site can also provide links to other lake information.

Wisconsin Lakes [PUBL-FM-800 91]
This book published by the Wisconsin DNR lists Wisconsin's lakes, their area, depth, if they have public access, and what fish species they support.

Through the Looking Glass... A Field Guide to Aquatic Plants
This book was written by Susan Borman, Robert Korth and Jo Temte and published in 1997 by the University of Wisconsin. It is available from University of Wisconsin Extension Lakes Partnership, College of Natural Resources, University of Wisconsin Stevens Point.

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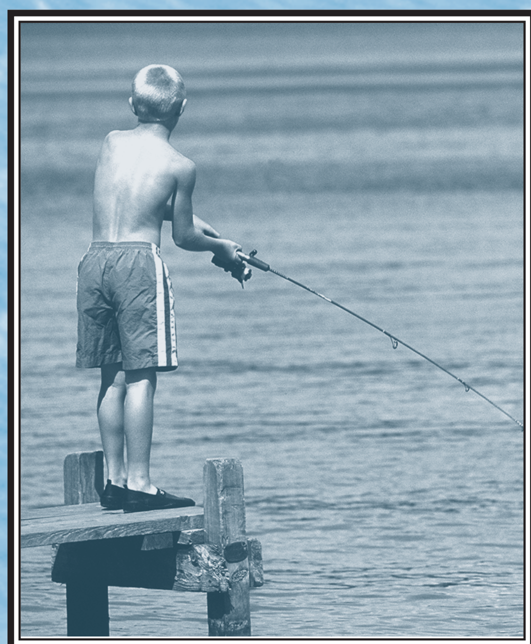

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