

PROCEDURES

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.

*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



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!

The Secchi disk 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 to 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 reading of 53.5 feet in June 2012

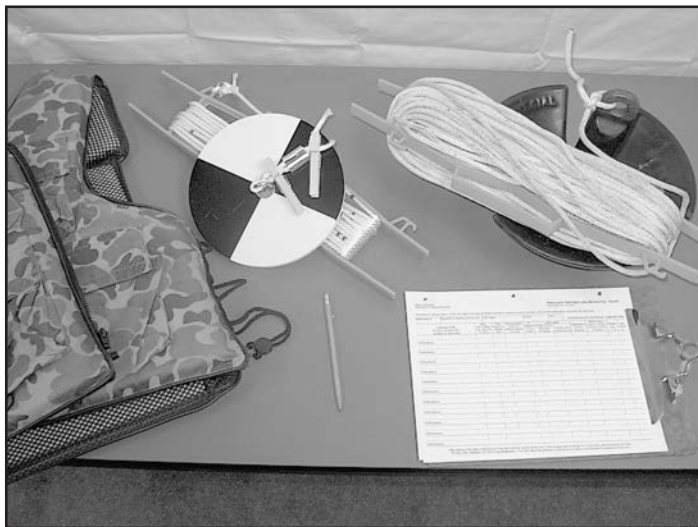
These lakes stand in stark contrast to some of the more turbid lakes we find in Wisconsin. Lake Wissota in Chippewa County had a Secchi reading of 0.25 feet in June 2012 and Lake Winnebago with a clarity reading of 0 to 0.25 feet in July 2012.



Want to know more about water chemistry monitoring? Want a little refresher after the winter months to make sure you collect and report accurate data? Check out this great how-to video!

1. SECCHI (Water Clarity) MONITORING

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.



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

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 #**”. 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. But for a variety of reasons other volunteers may choose to start in June and only continue sampling through September.

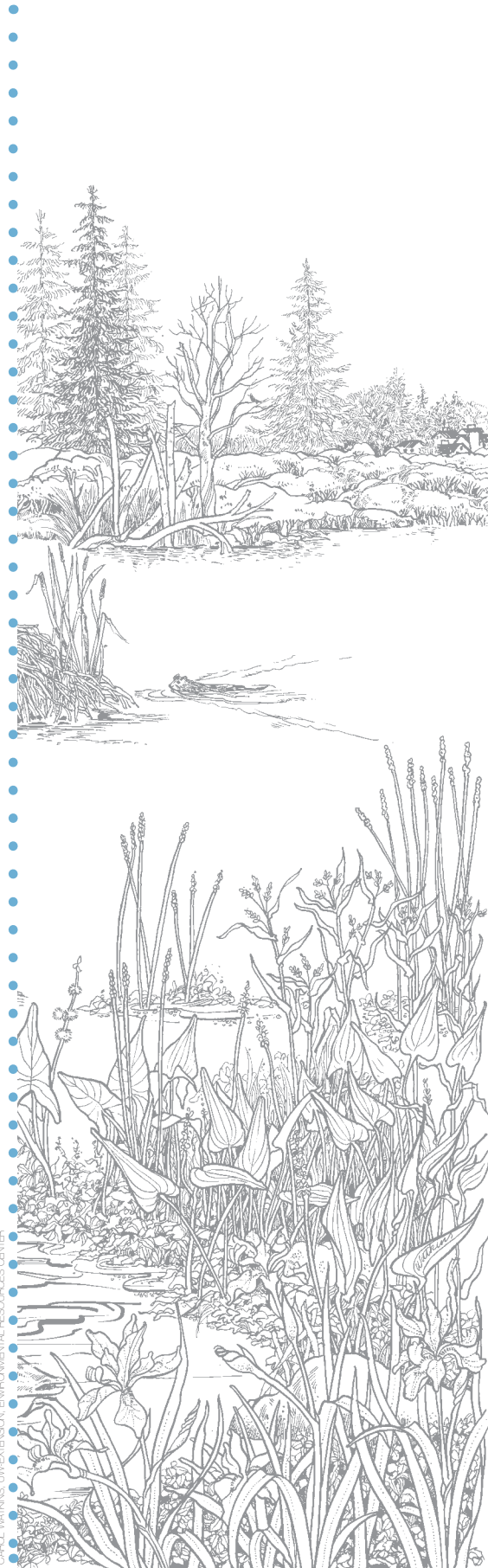
If you are unable to sample during your normally scheduled sampling time, do not worry about it! Just try to sample as soon as possible after that time. However, if you think that you will not be able to continue monitoring your lake due to illness, schedule conflicts, or other problems, please contact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

Some states collect Secchi readings differently than Wisconsin volunteers do. Some use different sized and colored disks or unmarked ropes. Some monitor on the sunny side of the boat. The most important thing is that Wisconsin CLMN volunteers remain consistent in monitoring protocols so we can continue to compare Wisconsin lakes to one another.

Remote Sensing Project

In recent years, the WDNR has implemented a satellite water clarity program. This program originated in 1999 as a UW–Madison research project that has now transitioned into a WDNR operational program that estimates water clarity on approximately 8000 lakes annually across Wisconsin. The WDNR depends on citizen-based monitoring (CBM) for field measurements needed in satellite calibration. This powerful management tool that helps the agency monitor a large number of lakes in a cost-effective manner (less than \$1 a lake). The large database supplied by this effort can assist managers is looking at the “big picture” with respect to Wisconsin’s changing lake conditions, i.e. how are lakes changing in different regions of the state, different lake classes, different size lakes? In the near future, we hope to start examining how lakes are responding to past and future climatic conditions and landuse changes.

Each lake is assigned a path number. This path number will let you know the dates when the satellite will be overhead. Go out on any of these days you can and sample your lake as you normally would, preferably on clear, calm sunny days. There is no need to let us know that you sampled for the satellite experiment, just report your data as you normally do. For paths and sampling dates please visit www.dnr.wi.gov/lakes/CLMN.



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ON LAKE PROCEDURES

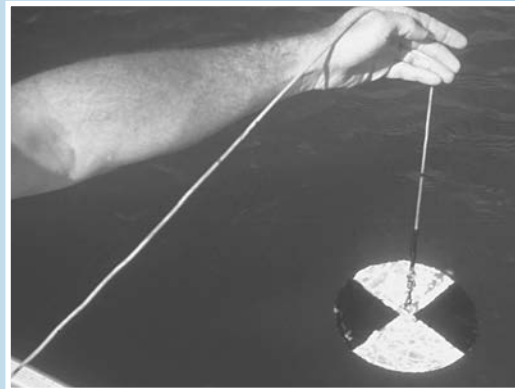
How to Use the Secchi Disk

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

How to Use the Secchi Disk (continued)

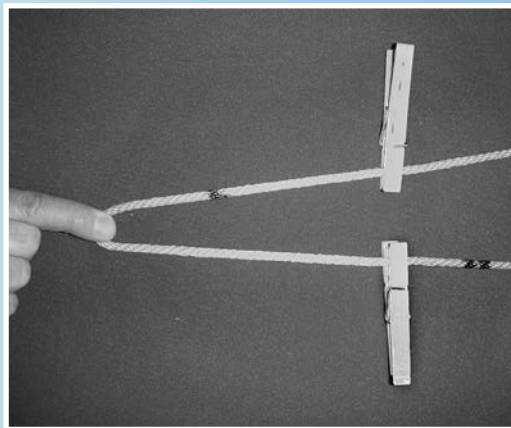
STEP 6. After you have marked this spot with the clothespin, lower the disk a few more feet into the water. Slowly raise the disk. When the Secchi disk reappears, mark the rope at the surface of the water with the second clothespin. The clothespin marks may be at the same spot, several inches or even 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 KLOSEVSKI

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

How to Use the Secchi Disk (continued)

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 or mailed to the central office in Madison:

Department of Natural Resources, Lakes WT/4

101 S. Webster St.
P.O. Box 7921
Madison, WI 53791-9087

2. TEMPERATURE MONITORING:

Using a Digital Meter

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.



After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used. Be sure to unplug your meter and store out of direct sunlight.

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.
- Manual
- Lake map with sampling site marked
- Digital temperature meter and probe
- Lifejackets (you provide)
- Anchor and rope (you provide)
- Field data sheets
- Pencil

DNR PHOTO

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 #. If you do not know these numbers, contact your regional coordinator. Check your monitoring equipment to make sure it is good working condition. If you have an electronic temperature meter, make sure the 9-volt battery is working. Before you launch your boat, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Sampling Overview

Temperature Readings

Some limnologists believe that lake temperature profile data are very important to document the effects of climate change. Keep this in mind, as the accuracy of the data you collect is critical. Temperature readings are easy to take. When using a digital temperature meter, a measured cable with a probe is lowered into the water and a hand-held digital meter records the temperature. The cable is marked in one foot increments. Your regional coordinator will give you the depths at which the temperature should be recorded for your particular lake.

Your temperature profile will also tell you if your lake stratifies. You will be able to determine the depth of the epilimnion and where the thermocline is. Temperature profiles will also help determine if a fish kill is a possibility on your lake.

ON LAKE PROCEDURES

Temperature Monitoring

Temperature Probe Method

STEP 1. Your regional coordinator will assign the depths at which you should sample the temperature of your lake. List these pre-determined depths on your field data sheet.

STEP 2. Plug cable into unit.

STEP 3. Lower the probe to your assigned depths and note the corresponding temperatures from the meter onto your data sheet.



DNR PHOTO

STEP 4. Once you are finished, raise probe and unplug the cable from unit to conserve the battery. Be sure to store the digital meter out of direct sunlight.

3. TEMPERATURE MONITORING:

Using a Van Dorn Sampling Bottle with a Thermometer

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.

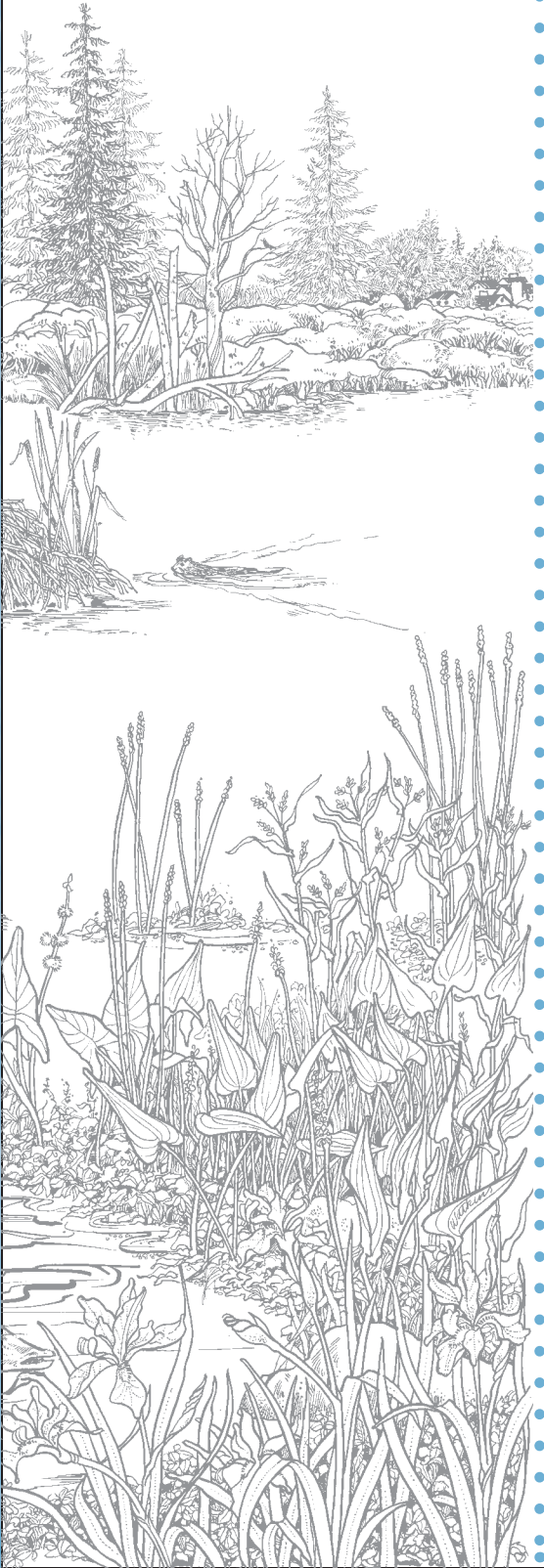


After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used.

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.

- Manual
- Lake map with sampling site marked
- Van Dorn sampling bottle with thermometer
- Lifejackets (you provide)
- Anchor and rope (you provide)
- Field data sheets
- Pencil



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How Do You Prepare to Sample?

The Day You Sample

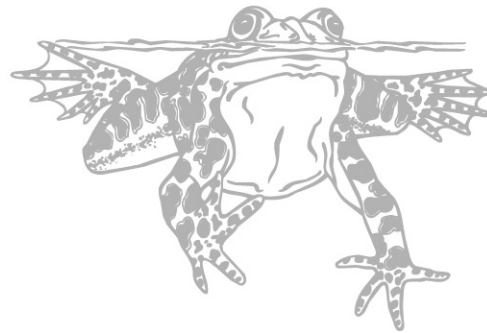
On the day you plan to sample, complete the top portion of your field data sheet by filling in the Waterbody # (or WBIC) and Station #. Before you launch your boat, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Measure the rope on your Van Dorn sampling bottle before the season starts to make sure it is accurate. Check your Van Dorn sampling bottle before each sample period to make sure it is working. If it is not working properly return it to your CLMN coordinator for repair or replacement.

Sampling Overview

Temperature Readings

Some limnologists believe that lake temperature profile data are very important to document the effects of climate change. Keep this in mind, as the accuracy of the data you collect is critical. Temperature readings are easy to take. Your regional coordinator will give you the depths at which the temperature should be recorded for your particular lake. When using this method you will use a regular thermometer in the Van Dorn sampling bottle to record the temperature of the water.



ON LAKE PROCEDURES

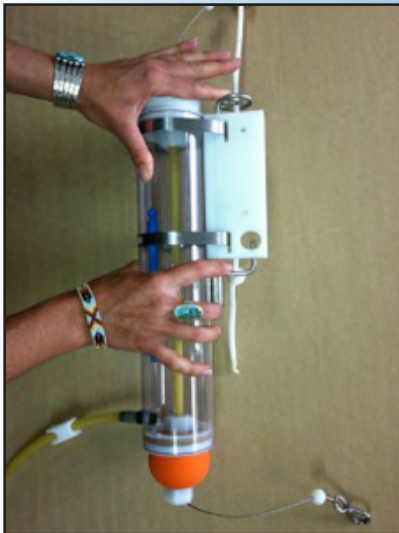
How to Collect Water Samples

The following instructions are for the vertical messenger release sampler. Please contact your regional coordinator if you need instruction on using other models or if your sampler fails to work properly.

- Anchor your boat before collecting water sample(s). If the boat is drifting, the release mechanism may not work properly.
- Always secure the end of the sampler to a floating object to avoid accidental loss of sampler.
- Try to keep sampler out of direct sunlight for extended periods of time. UV light breaks down plastics, particularly latex.
- Store your sampler dry.
- The latex internal closure can be adjusted to increase tension between sealing caps. If there is too little tension, the unit will not seal properly.
- The “how to” video on the UWEX Lakes web site shows you how to deploy this type of water sampler.



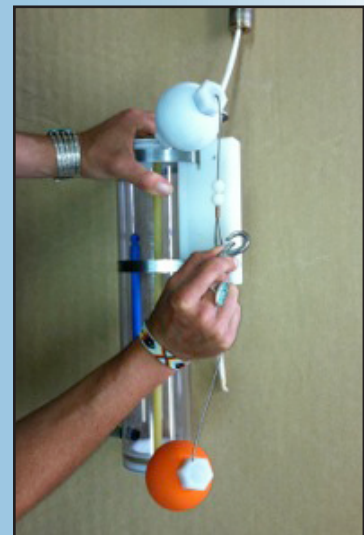
STEP 1. Lay sampler on its side with the rope side of the cable clamp positioned downward (figure 1 ▼).



STEP 2. Start with the top seal (the rubber ball with the lanyard coming out of the top). Use your index finger to pull the arming rod of the release mechanism downward. Pull the top ball seal out of the sampler cylinder using the lanyard loop (figure 2 ▼).



STEP 3. Insert the lanyard “loop” inside the hole in the closing mechanism. Release the arming pin to hook the loop (figures 3 ▼).



STEP 4. Release the arming pin to hook the loop (figure 4▶).



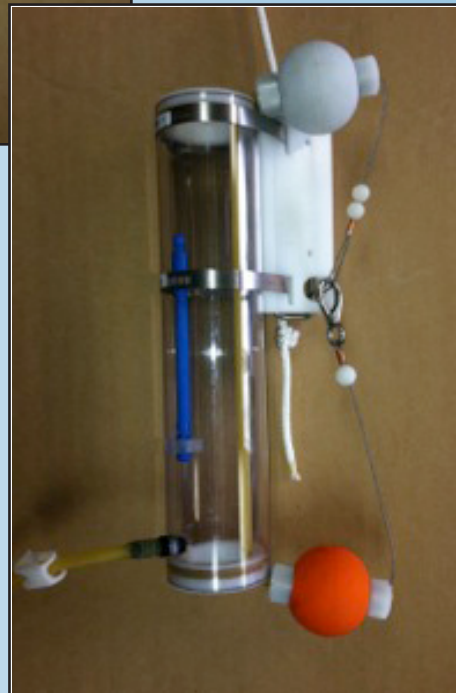
STEP 5. Arm the bottom seal (the rubber ball) using the same procedure as above and clip the stainless steel clip around both strands of the loop lanyard (figure 5▶).

The sampler is now ready for deployment.

STEP 6. Lower the sampler to the desired depth. Release the messenger to activate the closing mechanism. You can generally feel the sampler close at depth through the line.

STEP 7. Bring the now closed sampler to the surface. Open the clamp to release a small amount of water through the drain tube. You can cock the rubber ball seal to increase the flow out of the drain tube.

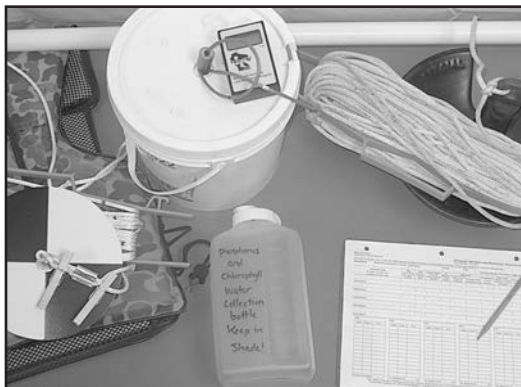
STEP 8. After sampling, thoroughly rinse your sampler with distilled water. Place pencils in either end so the sampler will dry out. Open up or remove the hose clamp so the hose will air dry as well. When the sampler is dry, remove pencils so the rubber tubing does not stretch and wear out.



4. CHEMISTRY MONITORING:

Phosphorus and Chlorophyll

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.



Please remember to keep all sampling equipment and chemicals out of the reach of children. Many of the chemicals you will be using are hazardous (see Appendix 1). After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used.

What Equipment Will You Need?

At your training session, your CLMN regional coordinator will outline and provide the equipment that you will need to successfully monitor your lake. If you are participating in the CLMN as a chemistry volunteer you will receive the same equipment that a Secchi volunteer uses to determine water clarity. In addition, you will also receive equipment and chemicals for your water chemistry (phosphorus and chlorophyll) analysis. This list includes everything that you will need while you are on and off the lake.

- Manual
 - Lake map with sampling site marked
 - Integrated water sampler
 - A large plastic tub containing: 1000 ml flask, filter cup, pump and tube, squirt bottle (to be filled with distilled water that you provide), water collection bottle, filter membrane, 250 ml graduated cylinder, sulfuric acid vial, "acid added" stickers, safety goggles and gloves, and mailing tape.
 - Life jacket (you provide)
 - Anchor and rope (you provide)
 - Field data sheets
 - Pencil
 - 3 trays of ice cubes (you provide)
- The following supplies will be provided to you by the CLMN to send your collected water samples to the State Laboratory of Hygiene for analysis:
- Styrofoam® mailer
 - 250 ml bottle for the phosphorus sample
 - Zip-lock bag for phosphorus bottles
 - Chlorophyll tube and baggies for ice cubes
 - Data forms
 - Chlorophyll sample stickers
 - Phosphorus sample stickers
 - State Laboratory of Hygiene lab slip
 - Merchandise return labels for mailers
 - Priority mail stickers

How Do You Prepare to Sample?

The Day Before You Sample

The day before you are planning to sample your lake, you should always check to see that your equipment is in good condition. Make sure you have three trays of ice cubes available and your squirt bottle is filled with distilled water. Distilled water can be purchased at your local grocery store but be sure it is labeled “*distilled water*” **not** “*drinking water*” or “*pure water*”. **Sampling early in the week (e.g., Monday through Wednesday) is advised as it allows your samples to arrive at the State Laboratory of Hygiene (WSLH) when someone is at the lab to process them.**

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 #. Before you launch your boat, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Sampling Overview

Water Sampling

To collect water samples for phosphorus and chlorophyll analysis, you will use one of two types of water samplers—either an integrated water sampler or a Van Dorn sampling bottle. Your lake needs to be at least 10-feet deep in order to use the integrated water sampler. Shallow lakes less than 10 feet in depth will usually be assigned a Van Dorn sampling bottle.

The integrated water sampler is a six and a half-foot PVC pipe that serves as a collection tube. At the bottom of the tube is a PVC ball that acts as a water-locking mechanism. To take your sample, slowly lower the tube vertically into the water to the tape mark (a depth of six feet), using the rope to lower and raise your integrated sample will help to avoid contamination. After lifting the tube, you will have collected an *integrated* sample that is a *mix* of water from the surface to six feet deep in the water column (0-6 feet). The water in the integrated sampler will be released when the integrated sampler is placed on top of the water collection bottle. The ball will be displaced by the bar on the neck of the water collection bottle, releasing the water. Contamination can occur if you touch the end of the integrated sampler or

if it lies in the bottom of your boat and touches oil or gas. Please keep your integrated water sampler clean. The collection end should be rinsed with distilled water prior to storing. The water sample in the water collection bottle will be used to fill your WSLH phosphorus sample bottle. The remainder of the water in the water collection bottle will be used for your chlorophyll analysis. When the sampler is not in use, it is very important to store the sampler upside down to dry; this will prevent the growth of algae and bacteria which could contaminate future samples.

Some volunteers collect the water sample for phosphorus and chlorophyll analysis at a depth of three feet with the Van Dorn sampling bottle. The Van Dorn sampling bottle is different type of sampler than the integrated sampler. The Van Dorn sampling bottle is a plastic collection bottle with rubber stoppers at each end. This type of sampler is able to collect water at a specific depth—not a mix of water from multiple depths like the integrated sampler. When the Van Dorn sampling bottle is lowered into the lake, water will enter the plastic bottle. Once the sampler is at the appropriate depth, a brass “messenger” is dropped down the line to snap the sampler closed with the water sample inside.

Phosphorus Sampling

As discussed above, the water you collect for your phosphorus sample will be analyzed by WSLH. Since phosphorus can be measured in very small amounts, it is important that “clean” sampling techniques be used. *Be careful not to touch the inside of the WSLH sample bottles or caps or the water as it is being drained from the sampler into the bottle as your fingers may have phosphorus residue on them.* Phosphorus contamination can come from a variety of sources, including soap, dishwashing detergents, or lawn fertilizers. To further reduce possible contamination, make sure the sample bottle caps rest upside down as you fill the bottles.

Before mailing your phosphorus sample to WSLH for analysis, it must be preserved (or “fixed”) by adding sulfuric acid. Once the acid is added, the sample is stabilized. Remember to always wear your safety goggles and gloves when handling sulfuric acid to prevent injury to your hands or eyes. Long pants and shoes will protect your legs and feet. Flush any spilled acid with water (see Appendix 6 for further detail on sulfuric acid).

Chlorophyll Sampling

Your chlorophyll samples should be collected once during the last two weeks of June, July, and August. Since there is little algal growth in early spring, there is no need to sample chlorophyll until June. The integrated water sampler will collect a sample from 0-6 feet of the water column. This depth contains algae that are representative of species that live in the upper layers of the water column. After collecting your sample, transfer the water to your water collection bottle. Algae will continue to grow in sunlight so be sure to place the water collection bottle in a cool, shady spot after collection. Process your samples on shore and out of direct sunlight.

The amount of water that you will filter is dependent on your Secchi reading the day you collect the water samples. The Secchi depth is one way to estimate the concentration of algae in the water. The deeper you can see the Secchi disk, the greater the likelihood of fewer algae in the water. The shallower the Secchi disk reading, the more algae is present. An exception are lakes with turbid or naturally stained water. Since there is a proportional relationship between Secchi depth and the amount of chlorophyll present, the deeper the Secchi reading, the more water you will have to filter to collect enough algae to measure (see table on page 46). Once you have determined the volume of water that you will need to filter, pour that volume from the water collection bottle into your graduated cylinder for a precise measurement.

The upper cup of the filtering apparatus should not be used to measure the volume of water you need to filter. Do not touch the filter paper with your fingers. The oil on your skin may degrade the chlorophyll in the samples. Use the tweezers provided to place the filter on and to remove the filter paper from the filtering device. After the water has been filtered to extract the algae, the filtered water may be discarded. Only the residue on the filter paper will be analyzed. After you are done filtering, the filter paper sample must be kept in the freezer until you send it to the WSLH to be analyzed.

Phosphorus sample collected with 2 weeks of ice off. Phosphorus and chlorophyll sample collected the last 2 weeks of June, last 2 weeks of July and the last 2 weeks of August.



ON LAKE PROCEDURES

How to Collect Water Samples

Integrated Water Sampler

The integrated water sampler is used to collect the water sample for phosphorus and chlorophyll analysis on lakes that are deeper than ten feet. Chemistry volunteers collecting water samples on lakes less than ten feet in depth will use a Van Dorn sampling bottle.

STEP 1. Before using the integrated sampler rinse with lake water three times. Fill the sampler with lake water and empty the water out of the top of the sampler. This will clean out any dirt or dust that may have gotten in the sampler.



STEP 2. Rinse the water collection bottle and cap with lake water three times. Always place the cap top side down to prevent contamination of the inside of the cap.

STEP 3. While holding onto the rope, lower the collection end (bottom) of the sampler tube vertically into the water column until the water level reaches the six-foot mark on the sampler. Raise the sampler out of the water.



STEP 4. Drain the integrated water sampler by touching the collection end of the sampler to the rod in the neck of the water collection bottle. Water will drain from the integrated water sampler tube into the water collection bottle.

STEP 5. Keep your water sample in a cool place and out of direct sunlight until you return to shore. A cooler is an ideal place to keep it. Algae in the lake water will continue to grow if the bottle remains in the sun.

STEP 6. Rinse your integrated sampler with distilled water after use and stored topside down. This will prevent algal growth between the ball and the collection end of the sampler.

Do not handle any food, drink, sunscreen or insect repellent until after samples have been collected!



DNR PHOTOS

Before you start processing the sample(s), 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.

ON SHORE PROCEDURES

Before you begin processing your water samples and preparing them for the State Laboratory of Hygiene, here is a quick checklist to make sure that you have everything you will need.

- Manual
- Field Data Sheets
- State Laboratory of Hygiene slip for your phosphorus and chlorophyll samples
- Pencil
- Safety gloves
- Safety goggles
- Phosphorus sample sticker
- Chlorophyll sample sticker
- "Acid added" stickers (optional)
- Three trays of ice cubes (you provide)
- Styrofoam® mailer kit
- Ziploc® bags
- Packaging tape
- Merchandise return label and priority mail stickers
- Magnetic Filter Funnel (2 pieces)
- Chlorophyll tube
- Hand pump with plastic tubing
- 500 or 1000 ml plastic flask
- 250 or 500 ml graduated cylinder
- Membrane filters
- Test tubes
- 1 Filter forceps and 1 regular forceps
- Paper towels (you provide)
- Squeeze bottle filled with distilled water (you provide distilled water)
- Acid vial
- Phosphorus sample
- Water sample in the 2-quart water collection bottle



ON SHORE PROCEDURES

Phosphorus Sample Preparation

Be sure to wear long pants and shoes while processing samples to avoid getting acid on yourself and be sure to put on your gloves and safety goggles before beginning your phosphorus sample preparation!

STEP 1. To prepare your phosphorus sample, remove the cap from your 250 ml State Laboratory of Hygiene bottle. Place cap topside down to prevent contamination. Gently mix the water in the water collection bottle and pour the water from the water collection bottle into the 250 ml bottle. Fill to the neck. Avoid touching the mouth of the water collection bottle and the phosphorus bottle lip to prevent contamination.

STEP 2. Remove the sulfuric acid vial from your kit.

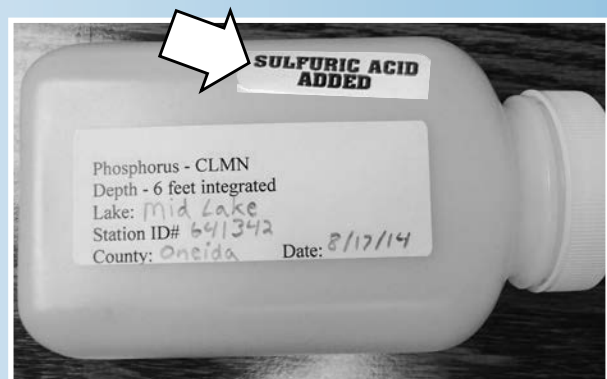
STEP 3. Uncap your phosphorus bottle and empty contents of one acid vial into your phosphorus sample. Preservation by acid inhibits bacterial growth for a limited period of time.

Always place the cap topside down to prevent contamination.



STEP 4. Replace lid on acid vial and the cap on your phosphorus sample. Mix your sample by inverting the bottle several times.

Attach a completed label with the name of your lake, station id number, county, and date. Don't forget to mark on your bottle that it is preserved with H_2SO_4 (sulfuric acid), or as an option, attach the acid-added sticker to your bottle.



DNR PHOTOS

STEP 5. When you are done adding the sulfuric acid, rinse and dispose of the used vials in the garbage. Store unused vials out of the reach of children!

STEP 6. Refrigerate phosphorus sample until ready to mail.

ON SHORE PROCEDURES

Chlorophyll Sample Preparation

Since light can cause the algae to grow and alter your sample, this on shore procedure for preparing your chlorophyll sample should be conducted in the shade and out of direct sunlight.

STEP 1. Place all the parts of your chlorophyll filtering equipment at your work area.

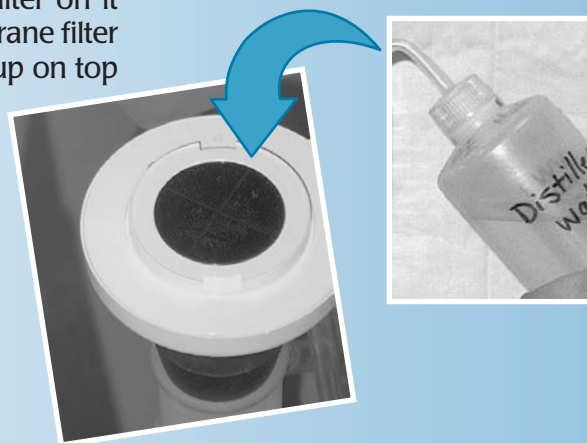


STEP 2. Attach the plastic tubing of the hand pump to the spout of the 500 or 1000 ml plastic flask.

STEP 3. Insert the stopper of the filtering cup into the flask. You may want to moisten the stopper first to ensure a good seal.

STEP 4.

Squirt a small amount of distilled water on the black filter base **before** placing the membrane filter on it (see Step 5). This will help to hold the membrane filter in place until you can place the magnetic cup on top of it (see Step 6).



DNR PHOTOS

ON SHORE PROCEDURES

Chlorophyll Sample Preparation (continued)

STEP 5. Use the tweezers to pick up one membrane filter and place it on the center of the filter cup base (i.e. the black screen). Note that filters are white and the divider sheets are blue. Make sure you use a white filter and not a blue divider sheet!

Note: Never touch the filter with your fingers! Always use tweezers when removing it from the Ziploc® bag or when placing it on the black screen.



DNR PHOTOS

STEP 6. Carefully place the magnetic cup on top of the filter base. Be sure that the filter does not move! If the filter moves, wrinkles, or tears, remove the filter cup and discard the torn/wrinkled filter. Repeat steps 4 and 5 with a new filter.



DNR PHOTO

STEP 7. Using the table on the right, look up the Secchi depth you measured earlier in the day. Use this to determine the volume of water that you need to filter to obtain your chlorophyll sample. Please be aware that this amount may change each time you sample. In general, the better the water clarity (i.e. deep Secchi depth), the fewer algae there are in the water, and the more water you need to filter in order to collect enough algae for analysis.

Volume of water to filter as determined by Secchi depth.

Secchi Depth (ft)	Volume of Water to Filter (ml)
Less than 1	50
1 to 1.5	100
Greater than 1.5	200

ON SHORE PROCEDURES

Chlorophyll Sample Preparation (continued)

STEP 8. Take out the plastic water collection bottle filled with water for your chlorophyll sample, and gently mix the water in the bottle. Fill your 250 ml graduated cylinder with the appropriate volume of water needed to filter your sample (Refer to step 7). *Note that although the upper cup of the filtering apparatus can be used to measure water volume, it is not an accurate measuring device and should **not** be used to measure the volume of water you need to filter.*

STEP 9. To begin filtering, pour some of the measured water from the graduated cylinder into the filter apparatus. You don't want to pour the full amount into the filter cup all at once. If your lake contains lots of algae or sediment, the filter will become clogged and you will not be able to empty the filter cup easily.

If the filter becomes clogged, try to filter the remaining water from the filter cup. You should remove the used filter using the filter forceps and place it in the chlorophyll tube provided by the WSLH. Put a new filter on the magnetic filter cup apparatus, replace the cup and continue to filter. You can send more than one filter successfully. **OR:** Try to filter as much water from the cup as possible and record only the amount of water you were able to filter.

STEP 10. Squeeze the hand pump to move the water through the filter. Once all the water has been filtered, wash down the sides of the graduated cylinder and filter cup with distilled water to ensure that all of the algae are washed onto the filter paper.

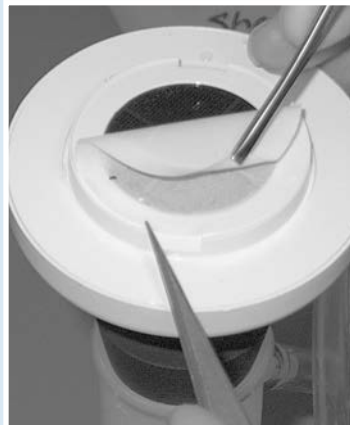
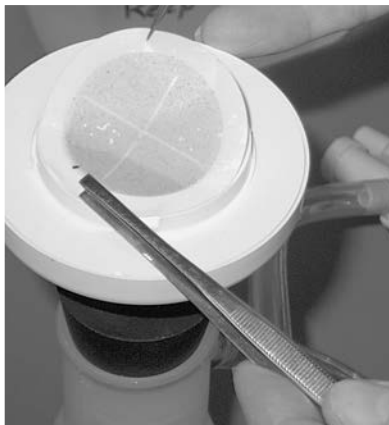
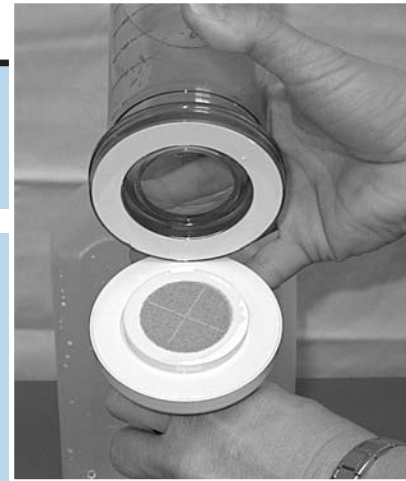


ON SHORE PROCEDURES

Chlorophyll Sample Preparation (continued)

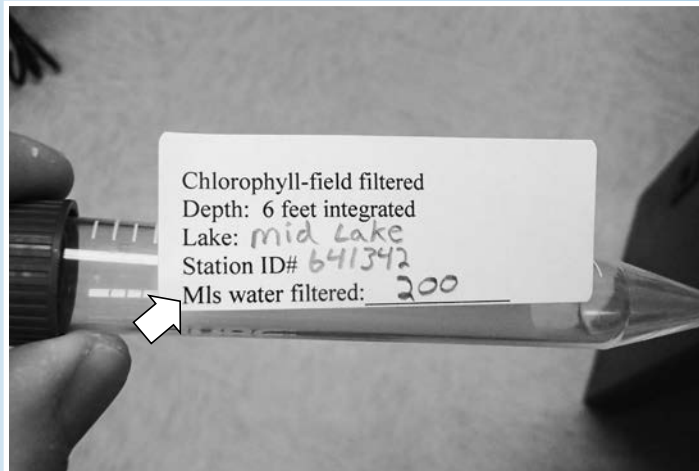
STEP 11. After you have filtered the appropriate volume of water, separate the filter apparatus by removing the top cup from the filter base.

STEP 12. Using tweezers, place the filter into the chlorophyll tube that came in the mailer from the WSLH. If the filter tears while you are removing it, it is okay to place it in the tube. Make sure that the algae that is on the filter does not get lost during transfer to the tube.



STEP 13. Fill out the chlorophyll label and place it on the tube containing your chlorophyll sample. Be sure to include the volume filtered (mls) on the label. Your station id number should be written on the label.

STEP 14. Don't forget to write the volume of water that you filtered for your chlorophyll sample on your lab slip.



IT IS BEST TO MAIL YOUR SAMPLE ON THE DAY YOU COLLECT IT. But, if it has to be mailed the next day, place your chlorophyll sample in the freezer until you're ready to mail it!

How to Fill Out Your Lab Sheet

When filling out your lab sheet, please make sure the following information listed is completed.

- Date**
- Time**
- Collected By Name**
- Telephone**
- Email Address**
- Depth of Sample**
(3 feet or 0-6 feet)
- Chlorophyll - a mls of water filtered**

Mailing Your Samples

For the lab to get an accurate analysis of the phosphorus and chlorophyll in your lake, your

samples must be handled and shipped properly. Try to collect your samples early in the week so that you are able to put them in the mail on a Monday, Tuesday, or Wednesday. You want your samples to reach the WSLH by Friday so they do not sit in the post office over the weekend. If you collect your samples on a Friday, Saturday, or Sunday put your chlorophyll sample in the freezer and keep your phosphorus sample in the refrigerator until you are able to mail them on Monday. **Do not put your phosphorus sample in the freezer!** Keep in mind that the sooner the lab is able to analyze your samples, the more accurate your results will be. The following steps are an efficient way to make sure that your samples are packaged properly and prepared to ship to the State Laboratory of Hygiene safely.

MAILING YOUR SAMPLES

STEP 1. Complete the laboratory data sheet for your phosphorus and chlorophyll samples. All information must be complete for the lab to analyze the samples.

STEP 2. Gather all the materials you will need to mail your samples: Styrofoam[®] mailer, completed lab sheet, merchandise return label (mailing label), three trays of ice cubes, one sandwich-size Ziploc[®] bag, 2 one-gallon Ziploc[®] bags, and Priority Mail[®] stickers.

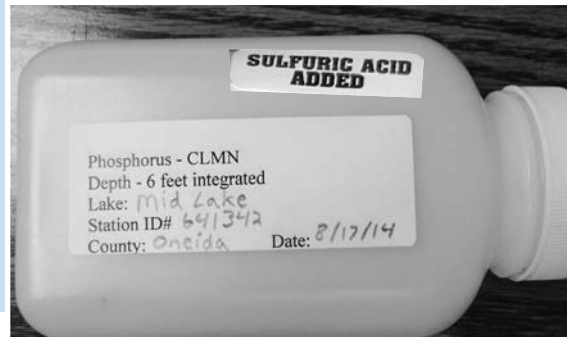
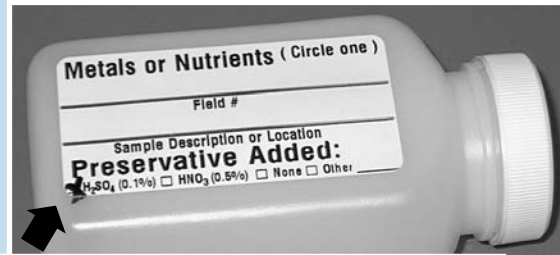


DNR PHOTOS

STEP 3. Prepare to mail your chlorophyll sample by making sure that the chlorophyll sticker is filled out completely and attached to the tube. Don't forget to include the volume of water that you filtered! Put your chlorophyll filter tube in the gallon Ziploc[®] bag.

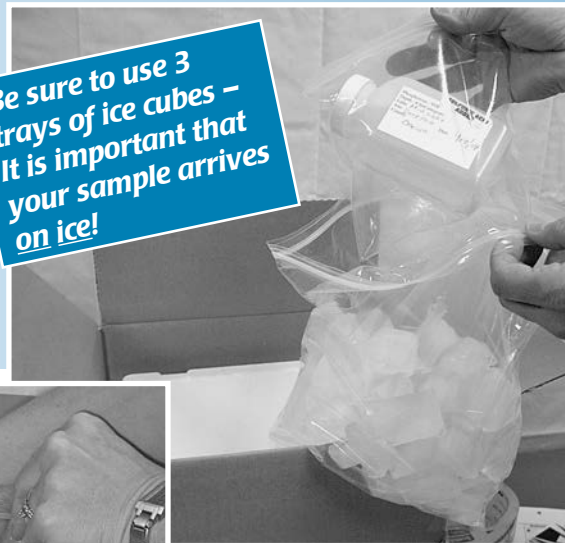
MAILING YOUR SAMPLES (continued)

STEP 4. Prepare to mail your phosphorus sample by making sure that your sample was preserved with sulfuric acid. Attach the completed label with the name of your lake, station id#, county, and date. Don't forget to mark on your bottle that it is preserved with H₂SO₄ (sulfuric acid), or as an option, attach the acid-added sticker to your bottle.



STEP 5. Place your phosphorus sample in the sandwich-size Ziploc® bag, seal the bag, and then put it in a one-gallon Ziploc® bag with three trays of ice cubes. Make sure this bag is sealed tightly or it will leak. If this bag leaks during mailing, the Post Office will not deliver it to the lab and your sample will be ruined.

Be sure to use 3 trays of ice cubes – It is important that your sample arrives on ice!



STEP 6. Put your completed lab sheet in the one-gallon Ziploc® bag with your chlorophyll tube. Seal the bag.



NOTE: Always mail the lab slip with your samples!

DNR PHOTOS

MAILING YOUR SAMPLES (continued)

STEP 7. Place your bagged phosphorus sample containing the ice in the Styrofoam® mailer. Then place the bagged lab sheet with your chlorophyll sample and tube in the inside of the Styrofoam® mailer. Make sure that the chlorophyll sample is against the ice in the bag with your phosphorus sample!



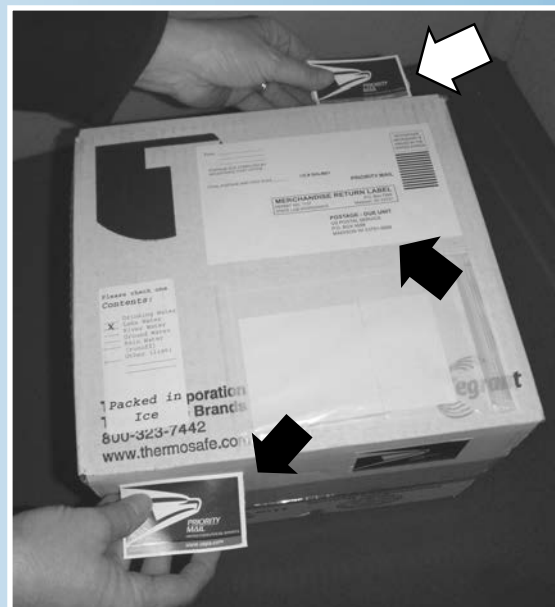
STEP 8. Gently fold the bagged lab sheet over the ice, close the Styrofoam® lid, and tape the cardboard mailing box shut.



STEP 9. Tape once around the cardboard sleeve. Attach the 4 inch x 6 inch white merchandise return label to the top of the mailer. Attach *one* priority mail sticker to the top of the package and *one* to the bottom. The mailer card should have your postal address on one side. The other side should be **BLANK**. You want the blank side facing out when the sample is sent to the WSLH.

STEP 10. Put your samples in the mail with your regular outgoing mail or at the post office. The mailing label is postage paid, so you will not need any stamps.

STEP 11. Once the WSLH has received your samples, they will send you a new mailer to use for your next collection of samples.



DNR PHOTOS

Quality Assurance Sampling Protocol

In 2007, the Citizen Lake Monitoring Network implemented procedures to document the accuracy and precision of the field data collected by volunteers. These procedures are a way to look at natural variability and sampling error. The protocol that was designed mimicked the Quality Assurance/Quality Control (QA/QC) methods used by the Wisconsin Department of Natural Resources (Wisconsin DNR) water quality staff.

Approximately ten percent of the total phosphorus (TP) and chlorophyll stations are randomly selected each year to participate in collection of QA/QC samples. The Wisconsin DNR asks volunteers who are chosen to participate to collect two additional phosphorus samples – a field blank and a duplicate (also called a replicate) sample. Volunteers also collect a duplicate chlorophyll sample.

The phosphorus field blank is prepared using deionized water – this water is provided to the volunteer and comes from the State Lab of Hygiene (WSLH). Deionized water is ultra pure. The blank phosphorus sample that the volunteer submits should be a “clean” sample – there should be no nutrients in it (which means your equipment is clean and does not have residual phosphorus). The blank sample is processed the same way that you process your regular phosphorus sample except that you are using deionized water instead of lake water. The QA/QC procedures are meant to “mimic” the collection procedures that are used in phosphorus collection and processing.

Before going out in the field, you will prepare your blank sample by rinsing your Van Dorn or integrated sample with deionized water, and then placing deionized water in your integrated sampler or Van Dorn sampling bottle. This water will then be placed in the water collection bottle that you normally use. From the water collection bottle the water sample goes to a “phosphorus bottle” – the same kind you use to mail your water sample to the WSLH. This water sample is preserved with sulfuric acid. Ideally, when analyzed by WSLH, the sample will have no detectible phosphorus. If the blank sample does contain phosphorus it could be that your equipment contains residual amounts of phosphorus or that the sampling technique is faulty – for instance, phosphorus could show up in a blank sample if you used your finger to release the ball of your integrated sampler to release water. The field blank also tests laboratory processing once the sample arrives at the WSLH.

The duplicate phosphorus sample is taken from the same site, at the same time, using the same method as your normal phosphorus sample. The only difference is that you will use a separate water collection bottle for each sample collected using your integrated sampler. Your CLMN regional coordinator provides an extra water collection bottle for you to use. The original and duplicate samples are independently analyzed in the same manner. The duplicate sample can be used to detect both the natural variability in the environment and that caused by your collection method in the field.

(continued on next page)

Quality Assurance Sampling Protocol *(continued)*

The duplicate chlorophyll sample is taken from the same site, at the same time, using the same method as your normal chlorophyll sample. The original and duplicate samples are independently analyzed in the same manner. The duplicate sample can be used to detect both the natural variability in the environment and that caused by your collection method in the field.

If you are asked to participate in the QA/QC project you will be contacted by your CLMN regional coordinator who will explain the procedures and will provide you with the following:

Field Blank Sample – Total Phosphorus

Materials Provided by Your CLMN Regional Coordinator

- A container of deionized water. There will be enough water to rinse your integrated sampler or Van Dorn sampling bottle and fill it once and enough to rinse your collection bottle.
- An additional phosphorus bottle (250 ml).
- A phosphorus label for the bottle that says BLANK. You will fill out the rest of the label.
- A lab slip for the BLANK sample. Please fill out the lab slip.
- A vial of sulfuric acid to preserve the BLANK sample.

How to Collect Your BLANK phosphorus sample

Please prepare this sample on land or on the boat prior to collection of your regular samples.

- Use the deionized water provided to rinse your integrated sampler or Van Dorn sampling bottle (which ever you normally use to collect your water samples).
- Dump the rinse water out the top of the integrated sampler or drain the Van Dorn sampling bottle like you normally do.
- Rinse the water collection bottle with deionized water and dump the rinse water out. Do not rinse the water collection bottle with lake water like you normally do.
- Fill the integrated sampler or Van Dorn sampling bottle with the deionized water provided to you by pouring it in through the top of the sampler to approximately the 6-foot tape mark.
- Drain the water from the integrated sampler or Van Dorn sampling bottle into the water collection bottle (like you normally do).
- Fill a 250-ml “phosphorus” bottle with the water from the water collection bottle.
- Add a vial of sulfuric acid to the sample to preserve it.
- Fill out and attach the label that reads BLANK.
- Refrigerate sample until ready to mail.

(continued on next page)

Quality Assurance Sampling Protocol *(continued)*

Field Duplicate Sample – Total Phosphorus only Materials Provided by Your CLMN Regional Coordinator

- ✓ One additional phosphorus bottle (250 ml).
- ✓ Extra zip lock bag for phosphorus bottle.
- ✓ Extra label for bottle that says DUPLICATE (be sure to fill out the rest of the label).
- ✓ Extra lab slip, this will be for the DUPLICATE phosphorus **and** chlorophyll sample. (Please fill out the lab slip).
- ✓ Extra sulfuric acid vial for DUPLICATE phosphorus sample.
- ✓ If you sample more than one site, you may need an additional mailer.

Field Duplicate Sample – Chlorophyll – Materials Provided by Your CLMN Regional Coordinator

- ✓ An additional chlorophyll mailing tube.
- ✓ Additional chlorophyll filter.
- ✓ Extra zip lock bag for the DUPLICATE chlorophyll tube and DUPLICATE and BLANK lab slip.

How to Collect Your DUPLICATE Phosphorus and Chlorophyll Samples

These will be collected while you are out on the lake doing your normal water collection.

- ✓ Rinse integrated sampler or Van Dorn sampling bottle and water collection bottle as you normally do.
- ✓ Collect lake water with your integrated sampler or Van Dorn sampling bottle as you normally do.
- ✓ Empty water into the normal 2-quart water collection bottle to use for the phosphorus and chlorophyll sample.
- ✓ Collect a second water sample with your integrated sampler or Van Dorn sampling bottle and empty into the new water collection bottle that was provided to you.
- ✓ Process the samples from the first water collection bottle on shore.
- ✓ Refrigerate the phosphorus sample and freeze the chlorophyll sample until you are ready to mail them.
- ✓ Rinse all equipment with distilled water before processing the second set of samples.
- ✓ On shore, fill a second 250-ml bottle (phosphorus bottle) and preserve as you normally would. Place the completed DUPLICATE phosphorus label on the bottle. Refrigerate sample until ready to mail.
- ✓ On shore, filter the appropriate amount of water from the second sample and process the second chlorophyll sample. Place in a separate tube and place the completed DUPLICATE chlorophyll label on the tube. Freeze the sample until you are ready to mail.

(continued on next page)

Quality Assurance Sampling Protocol *(continued)*

How to Ship Your Regular, BLANK, and DUPLICATE Phosphorus and Regular and DUPLICATE Chlorophyll Samples

- ✓ You will have 3 lab slips (one for the BLANK phosphorus sample, one for your regular phosphorus and chlorophyll samples, and one for the DUPLICATE phosphorus and chlorophyll samples).
- ✓ Put your regular chlorophyll tube and regular lab slip in one plastic zip lock bag.
- ✓ Put your DUPLICATE chlorophyll tube and the DUPLICATE and BLANK lab slips in the second zip lock bag.
- ✓ Place your regular phosphorus, Duplicate phosphorus, and Blank phosphorus sample each in their own small zip lock bag and seal.
- ✓ Add ice to your large ice bag and put all three phosphorus samples into this bag and seal.

You will be mailing a total of three phosphorus samples and two chlorophyll samples. Each phosphorus bottle will be in its own small zip lock bag. These three will be placed in the ice bag. Two separate zip locks (each containing a chlorophyll tube and lab slip(s)) should be placed in the cooler. Put one on each side of the bag containing the ice cubes with the chlorophyll tube against the ice.

After the samples are analyzed by the WSLH the results of the QA/QC study will be published on the CLMN website. If there are specific problems with a volunteer sample, he/she will be contacted by the CLMN regional coordinator and together they will work to resolve the problem.

NOTES



5. DISSOLVED OXYGEN MONITORING:

Using a Digital Meter

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.



- **NOTE:** If you are using a dissolved oxygen meter you must read the manufacturers manual before use. Some meters require regular calibration and regular membrane changes.



- After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used.
- As always keep paperwork and envelopes separate from equipment. Be sure to turn off your meter and store out of direct sunlight.

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 #. Before you launch your boat, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Before using your dissolved oxygen meter, be sure to read the owner's manual. In order to get accurate data from your meter, you must learn how to calibrate your meter and use your meter properly. You may wish to keep a Calibration Log.

Sampling Overview

Dissolved Oxygen Meter

The CLMN allows volunteers to use their own dissolved oxygen meter to take your readings. If you choose to collect your dissolved oxygen data using this method, it is important to remember that some meters *must* be calibrated every time they are used. Please follow all instructions for care and maintenance found in the operation manual for your particular model as maintenance of the meter is imperative to get good data. If you choose this method you should inform your CLMN coordinator so they can flag the database with this information.

ON LAKE PROCEDURES

Dissolved Oxygen Monitoring

Dissolved Oxygen Meter

STEP 1. Your regional coordinator will assign 5 to 10 depths to sample for dissolved oxygen. Your meter will also record temperature. You will collect dissolved oxygen and temperature data at the same depths.

STEP 2. Follow manufacturer's instruction for calibration and use.

STEP 3. Lower the probe to the assigned depth. Record temperature and dissolved oxygen reading from the meter onto your data sheet.



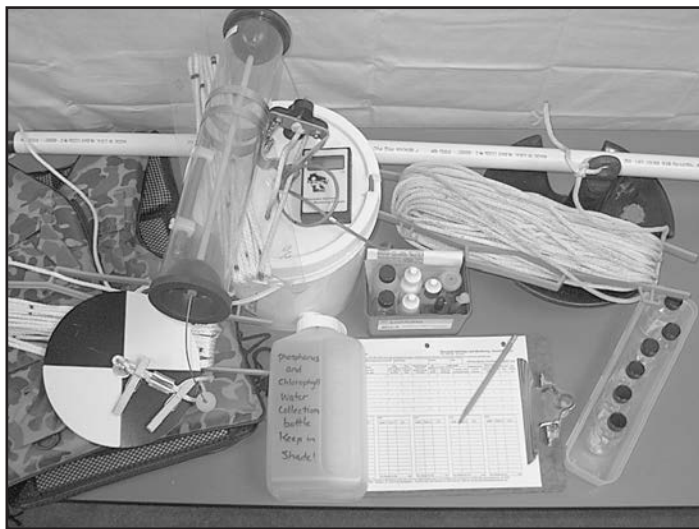
NOTE: Dissolved oxygen should be collected in the "mg/L" mode only. Some meters are calibrated in percent saturation, so be sure to use the mg/L mode while gathering data.

Record the type of meter you are using under "observations" on your data sheet.

6. DISSOLVED OXYGEN MONITORING:

Using the Titration Method

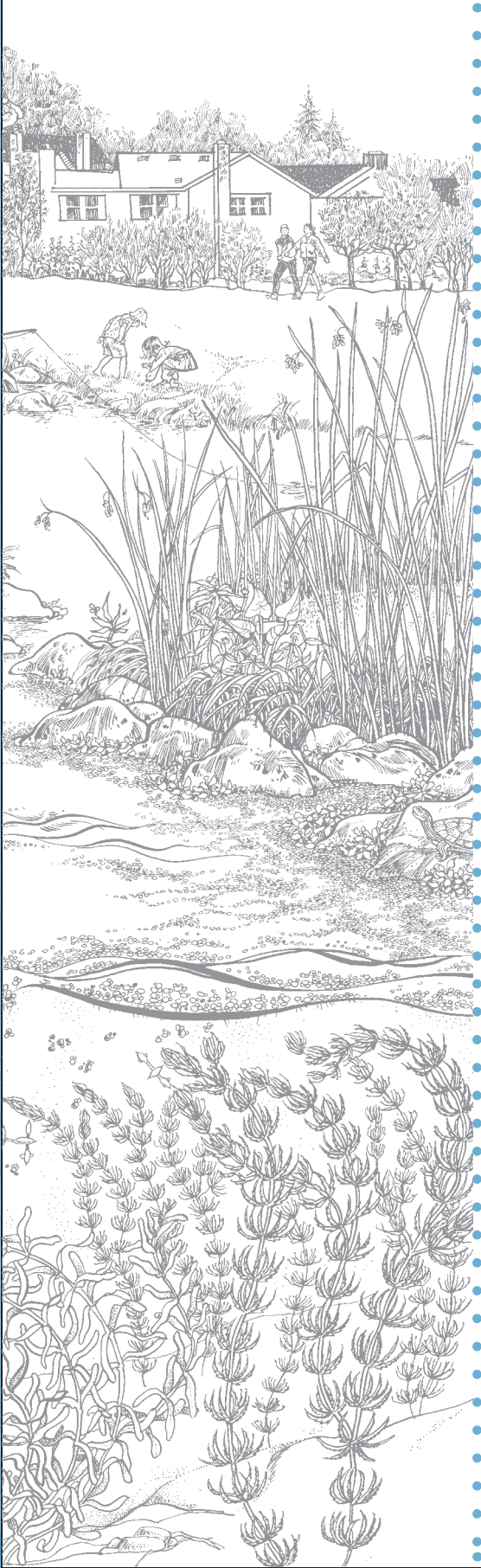
Before you start sampling, be sure to read the following pages to familiarize yourself with the equipment and the procedures that you will be using. All of the procedures that you will follow in sampling your lake are done for specific reasons. It is very important that you follow the sampling procedures 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.



Please remember to keep all sampling equipment and chemicals out of the reach of children. Many of the chemicals you will be using are hazardous (see Appendix 1). After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used. As always keep paperwork and envelopes separate from equipment.

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.
- Manual
- Lake map with sampling sites marked
- Life jackets (you provide)
- Anchor and rope (you provide)
- Field data sheets
- Van Dorn sampling bottle
- Safety gloves
- Safety goggles
- Chemicals and equipment in the LaMotte® titration kit (**note:** all chemicals should be replaced every year): manganous sulfate, alkaline potassium iodide azide, sulfuric acid, sodium thiosulfate, starch indicator solution, syringe, 25-ml graduated cylinder, eye dropper, dissolved oxygen sample bottles (labeled with appropriate depths) and rack, glass vial with plastic lid.



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 #. If you do not know what these numbers are contact your CLMN regional coordinator. If you are using the LaMotte® titration kit to measure dissolved oxygen, mark the bottles with appropriate pre-determined depths. Check to make sure all of your chemicals are fresh (they need to be replaced every year). Check your Van Dorn sampling bottle to make sure it is working properly. Once this is done, you can begin to load all of your sampling equipment into the boat. Before you launch, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Sampling Overview

Winkler Titration Method (LaMotte® Dissolved Oxygen Kit)

Sampling the dissolved oxygen in your lake can be tricky since oxygen in the air can easily contaminate your water sample. To create your dissolved oxygen profile, you will collect water samples at specified depths and measure the oxygen content of the water. Since you have no alternative but to bring your samples to the surface to measure the oxygen, you must take precautions to ensure that your samples do not get contaminated. When filling your collection bottles with your water samples, make sure that you allow the bottle to overflow at least 2 seconds before quickly capping the bottle. This will make certain that no air will get trapped in the bottle and contaminate your sample.

The LaMotte® kit uses the Winkler titration method for determining dissolved oxygen. With this method, reagents react with chemicals in your water sample causing a color change. The amount of reagent needed to create this color change helps you determine what your dissolved oxygen reading is. Use of the Van Dorn sampling bottle is necessary for determining your dissolved oxygen profile since it retrieves water samples from the desired depth to be tested.

NOTE: If you are collecting water samples using a Van Dorn sampling bottle, see page 39. You must use a Van Dorn sampling bottle to collect samples for dissolved oxygen analysis.

CAROL WATKINS, UW-EXTENSION, ENVIRONMENTAL RESOURCES CENTER

ON LAKE PROCEDURES

Winkler Titration Method (LaMotte® Dissolved Oxygen Kit)

STEP 1. Your regional coordinator will assign to you 5 to 10 depths at which you should sample for dissolved oxygen and will help you mark your sample bottles accordingly. These depths will be the same as the ones you measure for water temperature.

STEP 2. Use the Van Dorn sampling bottle to collect samples at your pre-determined depths.

STEP 3. Remove the cap of the appropriate dissolved oxygen sample bottle. Place cap topside down to avoid contamination.

STEP 4. If you did not already record a temperature profile of your lake using a digital probe, now is the time to record the water temperature using the thermometer in the Van Dorn sampling bottle. After recording the water temperature of your first sample, let out a small amount of water from the sampler to rinse out the rubber tube. Then insert the rubber tube all the way to the bottom of your sample bottle. Open the hose clamp, release the vacuum and allow the water you collected to flow into your sample bottle overfilling the bottle for at least 2 seconds.



STEP 5. While the water is still flowing, slowly remove the tube allowing your sample bottle to overfill. Water will actually appear above the top of the bottle.

STEP 6. Quickly cap your sample bottle. There is a nipple in the cap. This nipple will displace water in the bottle making room for you to add chemicals for your analysis.

STEP 7. Put on your gloves and safety goggles.



DNR PHOTOS

ON LAKE PROCEDURES

Winkler Titration Method (LaMotte® Dissolved Oxygen Kit) (continued)

STEP 8. Remove the cap from the sample bottle you just filled with lake water and add eight drops of the manganous sulfate solution from the squeeze bottle. Make sure to hold the squeeze bottle completely vertical (i.e. not at an angle) for consistent drop size and to avoid splatter.

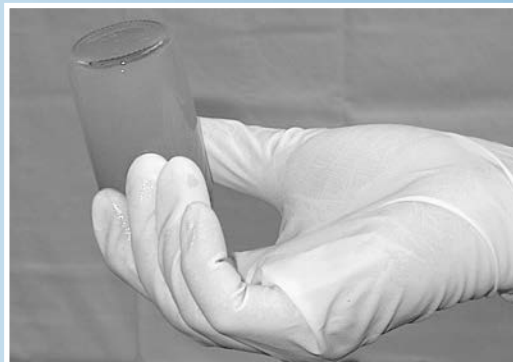
Note: Place cap topside down to avoid contamination.



STEP 9. Then add eight drops of the alkaline potassium iodide azide solution. Once again, make sure to hold the squeeze bottle completely vertical (i.e. not at an angle) for consistent drop size and to avoid splattering.



STEP 10. Cap your dissolved oxygen bottle and mix your sample by inverting the bottle 10 to 20 times. Put the bottle in the sample tray and allow the precipitate (e.g. the solid substance that is forming in your bottle due to a chemical reaction) to settle. This process may take a few minutes.

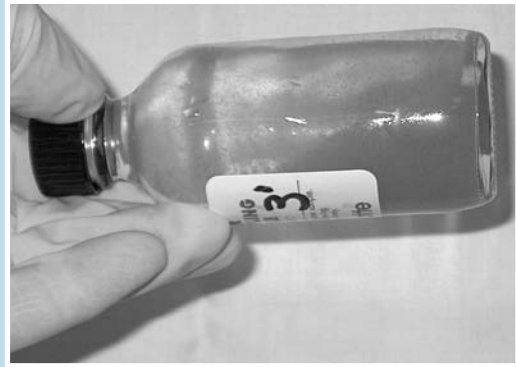


DNR PHOTOS

ON LAKE PROCEDURES

Winkler Titration Method (LaMotte® Dissolved Oxygen Kit) (continued)

STEP 11. Once the precipitate has settled, re-mix your sample by inverting the sample bottle another 10 to 20 times. Put the bottle in the sample tray and allow the precipitate to settle again.



STEP 12. Once the precipitate has settled for a second time, add eight drops of sulfuric acid (H_2SO_4) from the squeeze bottle. Cap your sample bottle and invert to mix. Continue mixing the bottle for several minutes until all the precipitate has dissolved. The sample is now “fixed”, meaning that the dissolved oxygen concentration cannot change.



DNR PHOTOS

STEP 13. Repeat steps 1-12 for each pre-determined depth that you are collecting a water sample.



NOTE: Your fixed D.O. sample will retain its dissolved oxygen level for up to 8 hours if the sample is refrigerated and kept in the dark. However, for best results, the sample should be titrated as soon as you return to shore.

Before you continue processing your dissolved oxygen samples, 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.



MENISCUS • The curved upper surface of a still liquid in a tube caused by surface tension; concave if the liquid wets the walls of the container, convex if it does not.

ON SHORE PROCEDURES

Winkler Titration Analysis (LaMotte® Dissolved Oxygen Kit)

Before you begin analyzing your samples on shore, here is a quick checklist to make sure that you have everything you will need.

- Manual
- Field Data Sheets
- Pencil
- Safety gloves
- Safety goggles
- LaMotte® titration kit

Note: All chemicals should be replaced every year.

Set up your LaMotte® dissolved oxygen kit in a place that has plenty of room and is convenient place to work. You should have already added eight drops of the manganous sulfate solution and eight drops of the alkaline potassium iodide azide solution to each of you samples in the field.



NOTE: If you did not “fix” your samples in the field (as outlined in step 12 on page 65), **make sure that you do it now** by adding the eight drops of sulfuric acid (H_2SO_4) to each of the dissolved oxygen samples you took. Invert the bottles enough to mix the acid and dissolve the precipitate.

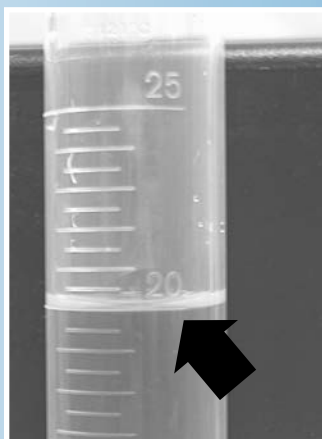
ON SHORE PROCEDURES

Winkler Titration Analysis (LaMotte® Dissolved Oxygen Kit)

STEP 1. Rinse the 25 ml graduated cylinder and the small glass vial with the center-hole plastic lid with distilled water.

STEP 2. Take out your first “fixed” dissolved oxygen sample. Uncap your sample bottle and fill the graduated cylinder with 20 ml of your “fixed” sample.

*Due to the adhesive nature of water molecules, when you look at the water level from the side, the liquid in the graduated cylinder will not be flat. Instead the liquid will sag downward. This curved surface is called the meniscus. Always read from the bottom of the **meniscus** when measuring the volume of liquid that you want. In this case you want the bottom of the meniscus to line up with the 20 ml mark on the graduated cylinder.*



STEP 3. Pour the 20 ml sample that you just measured from the graduated cylinder into the small glass vial. Cap the glass vial with the center-hole plastic lid. Please note that even though the glass vial may have volume measurement markings on it, the graduated cylinder is a more accurate measure of volume than pouring your “fixed” sample directly into the small glass vial.



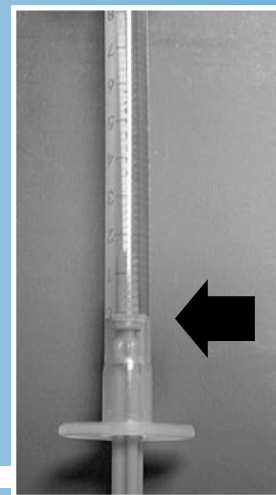
STEP 4. Insert the tip of the syringe into the sodium thiosulfate solution. Turn the bottle and syringe upside down and slowly draw the solution into the syringe past the line marked “0”. Remove any air trapped in the syringe by pushing liquid back into the bottle until the bubbles are expelled. You may need to tap the syringe while it is upside down to move the bubbles towards the tip. Remove the syringe. Store the sodium thiosulfate solution in a cool, dry place.



DNR PHOTOS

ON SHORE PROCEDURES**Winkler Titration Analysis (LaMotte® Dissolved Oxygen Kit) (continued)**

STEP 5. Pushing the plunger of the syringe and expelling any extra solution onto the ground, match up the top of the plunger with the line on the syringe marked "0" (see "Reading the Syringe" on page 71).



STEP 6. Insert the syringe into the hole in the cap of your glass vial containing your "fixed" sample. Very slowly, add the sodium thiosulfate solution drop by drop by pushing on the plunger of the syringe. Gently swirl your sample after each drop. It is possible to add as little as 0.1 units (half the distance between the lines on the syringe) with each addition.



STEP 7. Add the sodium thiosulfate solution until the color of your water sample has changed to a very faint straw yellow. To clearly see the color, it may be helpful to hold a sheet of white paper behind your sample vial after each addition. The exact color is not that important. The object is to add drops to lighten the color, but to stop before the sample becomes clear. The amount of sodium thiosulfate that you add will vary between your samples depending on the amount of dissolved oxygen that is in each sample.

Note: If the dissolved oxygen content of your sample is very high, it may not become a faint yellow color even after you have added the entire contents of the syringe! In this case, you will need to refill the syringe with the sodium thiosulfate solution by repeating steps 4 and 5. Make sure you note this on your data sheet!



DNR PHOTOS

ON SHORE PROCEDURES

Winkler Titration Analysis (LaMotte® Dissolved Oxygen Kit) (continued)

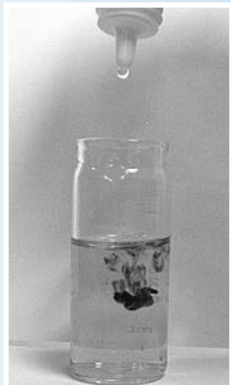
STEP 8. When you have achieved the straw yellow color, carefully remove the syringe from the vial and set the syringe aside. Do not empty the contents of the syringe as you will need it for step 11.



STEP 9. Remove the center-hole plastic lid from the glass vial.

STEP 10. Add eight drops of the starch indicator solution to your 20 ml sample in the glass vial.

Put the lid back on. Gently mix your sample by swirling the vial. Your sample will turn dark blue or black.



STEP 11. Reinsert the syringe that you set aside in step 8 into your sample vial. The syringe should still contain the sodium thiosulfate from steps 4 through 8.



DNR PHOTOS

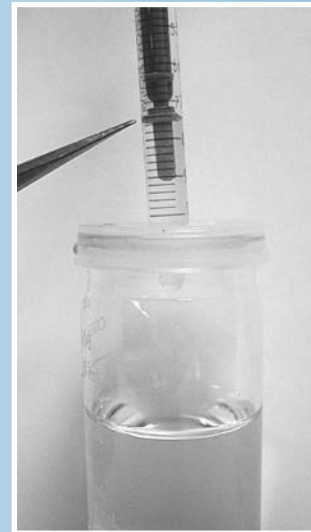
ON SHORE PROCEDURES**Winkler Titration Analysis (LaMotte® Dissolved Oxygen Kit) (continued)**

STEP 12. Very slowly, add the sodium thiosulfate solution to your sample one drop at a time. Take care to swirl the contents of the glass vial between drops. Add the sodium thiosulfate solution drop by drop until the blue or black color of your sample disappears when you swirl it. Swirling the contents of your sample vial allows time for the color to change between drops! Every drop counts so proceed slowly.



STEP 13. When your sample has turned clear, remove the syringe. Before expelling the remainder of the sodium thiosulfate solution in the syringe, read and record the volume of solution that you used (see “Reading the Syringe” on the next page).

This step is very important, as it is the “answer” to the dissolved oxygen content of your water sample! Once you have recorded the volume of solution that you used, you can discard the remaining solution by flushing it down a drain with lots of water. Do not return it to the sodium thiosulfate bottle!



DNR PHOTOS

STEP 14. Rinse the syringe with distilled water and wipe it off before repeating steps 1 through 13 for your next sample. Remember, since this analysis only uses 20 ml of your “fixed” sample, if at any time you feel that you made a mistake, you should have enough “fixed” sample water remaining to repeat the analysis.

Note: all chemicals should be stored out of the reach of children. Chemicals should be replaced every year.

STEP 15. Be sure to rinse all of your equipment with distilled water when you are finished.

READING THE SYRINGE

Once your sample in the glass vial has changed from blue to clear (steps 12 to 13), the dissolved oxygen titration is complete. To determine the amount of dissolved oxygen in your sample, record the position of the plunger in your syringe. The syringe is marked in 0.2 (two-tenths) intervals.

Example 1: The tip of the plunger is flush with the number 6.0 after step 12 (page 70). Since you started adding the solution when the plunger was flush with the number 0, your sample contains 6 **parts per million (ppm)** of dissolved oxygen.

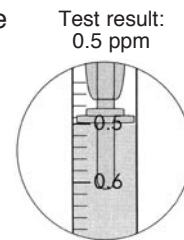
Example 2: Suppose you had to refill the syringe once with the sodium thiosulfate solution before your sample changed color to a faint straw yellow. After adding the sodium thiosulfate solution for a second time, the color of your sample changes from blue to clear. At this point the plunger is flush with the number 3.2. Therefore, the dissolved oxygen content of your sample is 13.2 ppm (10 ppm from the first syringe of sodium thiosulfate solution when the entire contents were added, plus 3.2 ppm from the second syringe of sodium thiosulfate solution).



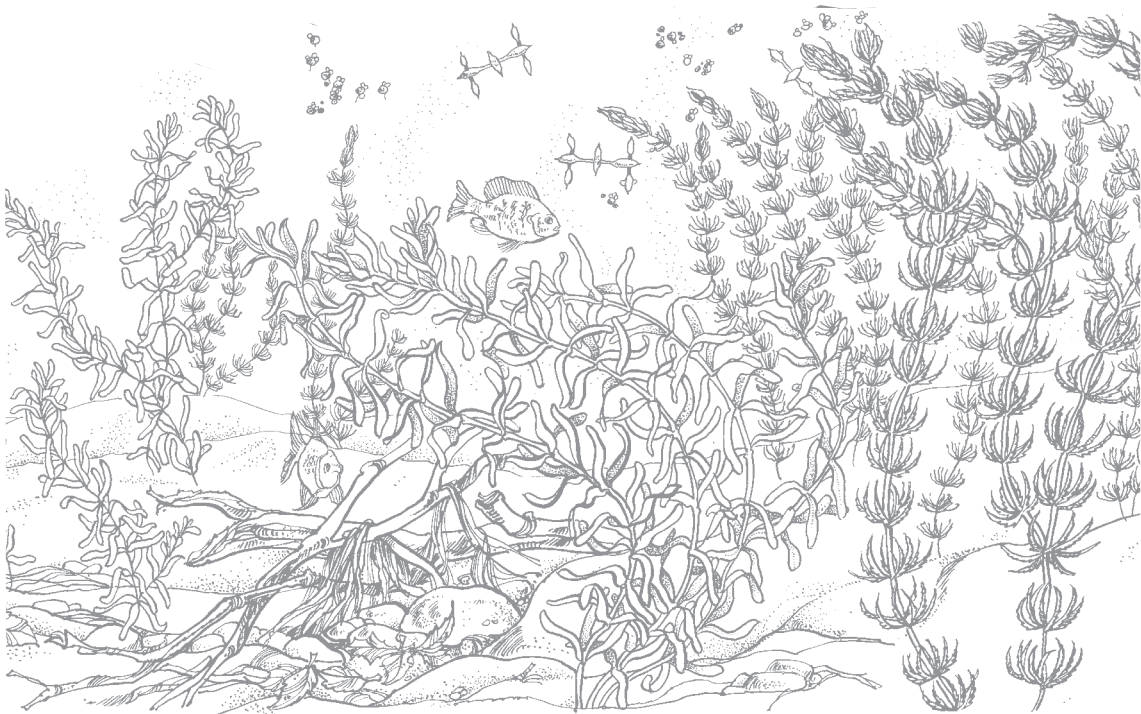
PARTS PER MILLION (ppm) • An expression of concentration indicating weight of a substance in a volume of one liter. Milligrams per liter (mg/l) is an equivalent unit.

Reading the syringe.

Read the test result directly from the scale where the large ring on the Titrator meets the Titrator barrel. If the Titrator was refilled to reach the final color change, add the total amounts of titrant used to determine the final test result.



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