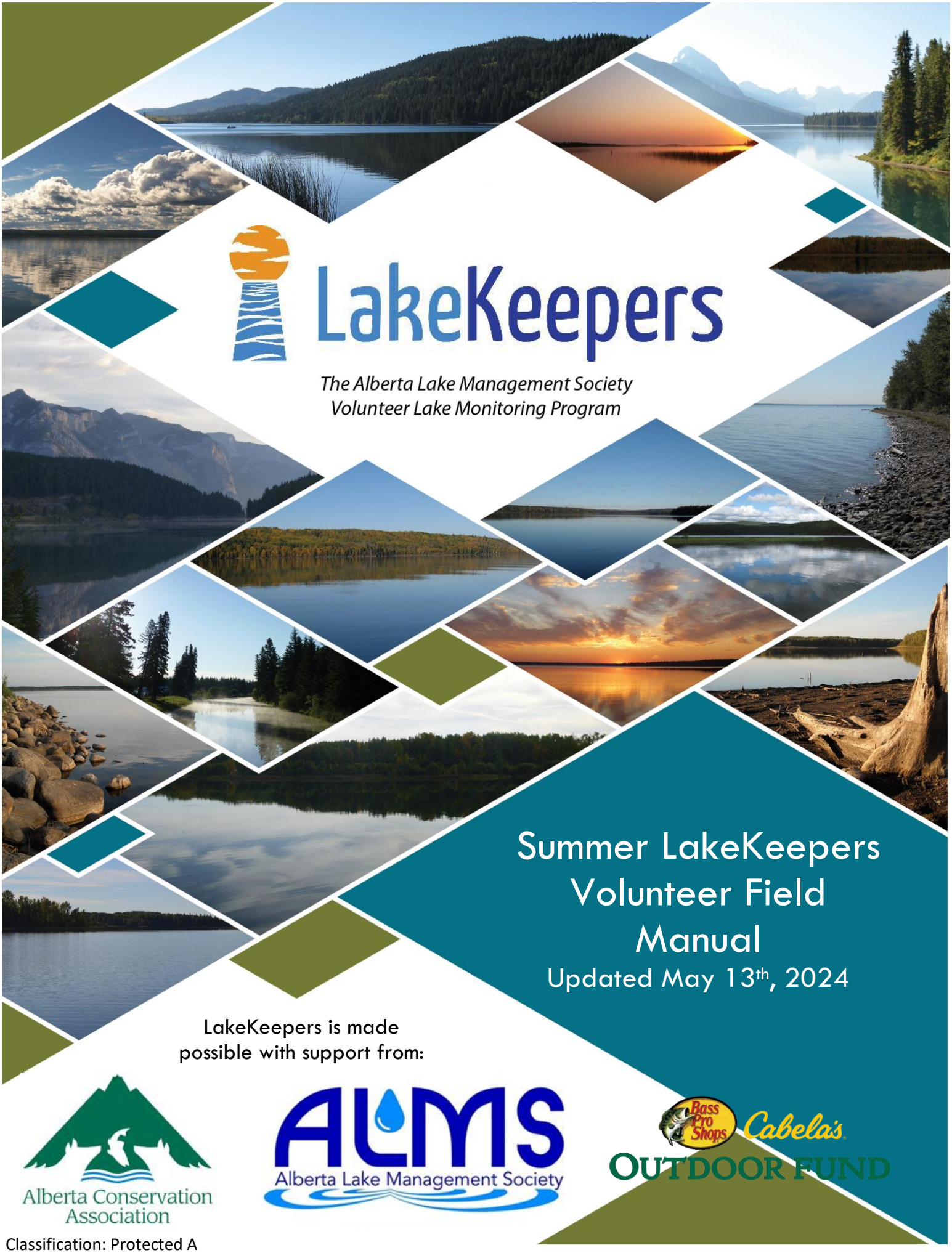


LakeKeepers

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Summer LakeKeepers Volunteer Field Manual

Updated May 13th, 2024

LakeKeepers is made possible with support from:

Alberta Conservation Association

ALMS Alberta Lake Management Society

Bass Pro Shops Cabela's Outdoor Fund

ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEKEEPERS PROGRAM

Welcome to LakeKeepers!

Thank you for expressing an interest in Alberta's aquatic environments and for participating in the LakeKeepers program. You have proven that ecological apathy can be overcome and give us hope that our water resources will not be the limiting factor in the health of our environment. Throughout this process, you will be involved in collecting and preparing scientific data important to assessing the health of your lake. This manual is meant to supplement hands-on training and communication with ALMS staff throughout the process.

LakeKeepers has several important objectives, one of which is to address gaps in lake water quality data that exist in many remote parts of Alberta. At ALMS, our mission is to promote the understanding and comprehensive management of lakes and reservoirs and their watersheds. With LakeKeepers, we hope to expand the breadth of lake monitoring, education, and management in Alberta.

For field sheets and more, visit:

https://alms.ca/summer-lakekeepers/

(Disclaimer: videos are now out of date, refer to this manual only for most up to date protocol for Summer LakeKeepers 2024)

This manual was last updated in May 2024 by Kurstyn Perrin. For more information, please contact lakekeepers@alms.ca

What's in my kit?

On the boat	On the shore
1. Manual and field sheets 2. Tape and weight 3. Secchi disk 4. YSI probe and handheld 5. Nitrile gloves 6. Cooler & Ice Packs 7. *1 L Chlorophyll-a bottle with extra labels 8. 1- 250 mL clear bottles for Total Phosphorus (TP) + preservative 9. 125 mL clear bottle for microcystin toxin	a) Chlorophyll-a filtering apparatus (Figure 6): • Buchner funnel • Rubber stopper • Hand pump and tube • Plastic filter flask • Graduated cylinder • Clear squirt bottle • Tweezers • Circular filter paper • Pure water • Gloves • Magnesium Carbonate • Aluminum foil • Petri dishes & filter labels ***Screw-on filter set (Figure 2) will not include Buchner funnel, rubber stopper, and filter flask (Figure 1) – refer to Appendix A2.**

When do I sample?

As a Summer LakeKeepers volunteer, you'll be conducting sampling on your lake on three occasions throughout the ice-off season: once in June, once in mid-July to mid-August, and once in September. These events are referred as sampling events, and you have the flexibility to choose dates that align with your schedule and weather conditions. However, we recommend allowing at least 2 weeks between each sampling event. It is important to avoid sampling during unsafe conditions or if such conditions are forecasted for the water body. If unsafe conditions arise during sampling, it must be halted immediately. Hazards related to unsafe conditions include extreme temperatures, wind, heavy rain, lightning, etc. Participants are responsible for ensuring they have appropriate personal protective equipment and that their boat is in good working condition. Before beginning sampling, volunteers must read and complete the Volunteer Informed Consent document.

BEFORE YOU HEAD OUT:

- Make sure your probe is charged.
- Calibrate Dissolved Oxygen & Conductivity on your probe (see instructions below).
- Complete your online informed consent form at https://alms.ca/summer-lakekeepers/
- Check the weather to ensure conditions will be safe on the boat throughout the entire trip.
- Make sure you have a cold ice pack to bring out with the bottle set in the cooler.
- While you're checking the weather, find the 24-hour rainfall accumulation for the area and mark this on your field sheet. It helps us understand the impact of rain on water clarity.

CALIBRATE DISSOLVED OXYGEN:

- Calibrate your probe within the hour before sampling:
- Remove the **grey sleeve** (b) from your **probe** (d).
- Remove the **metal probe guard** (a) and gently wipe any water droplets from the probe with a Kimwipe.
- Carefully place the metal guard back over your probe.
- There is a yellow sponge inside the grey calibration sleeve. Using water from the calibration bottle, wet the **yellow sponge** (c) with a little bit of clean water. The sponge should be wet, but not dripping.
- Place the grey sleeve (with yellow sponge inside) over the metal guard.
- Wait five minutes to allow the air in the probe to become saturated with moisture from the sponge.
- Connect your probe to your **handheld unit** (e).
- Press the green power button  on your handheld unit.
- Press Cal 
- Choose ODO or DO by pressing Enter.
- Choose DO (dissolved oxygen) % by pressing Enter.
- Wait one minute.
- **Record the Barometer on your field sheet.**
- Choose Accept Calibration by pressing Enter.
- Press escape until you see the 'log one sample screen.
- Keep the probe in its grey sleeve and inside the sampling kit until you are ready to collect data.

Figure 1. Probe components.

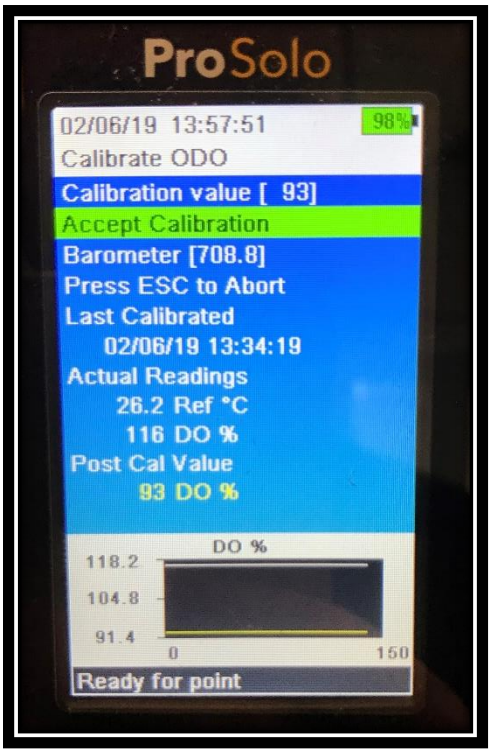
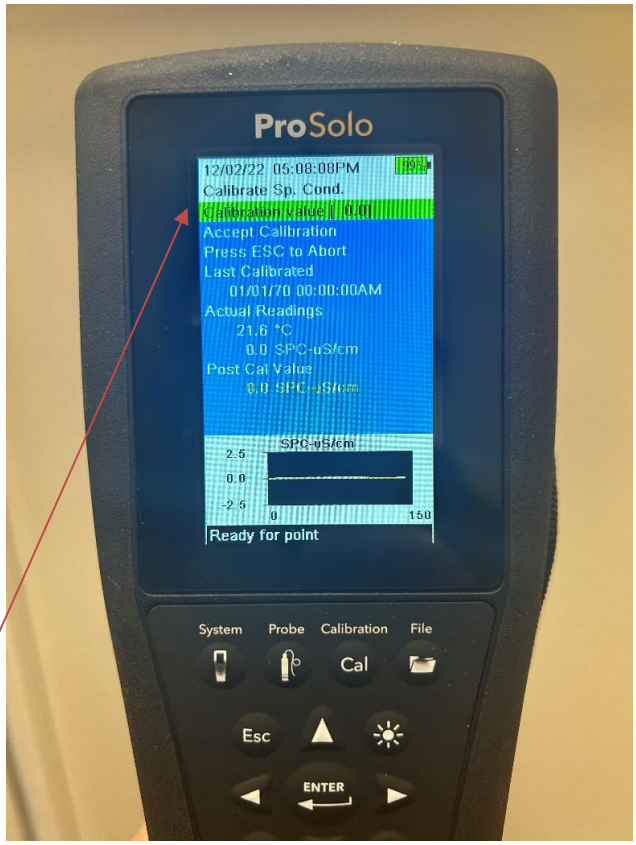


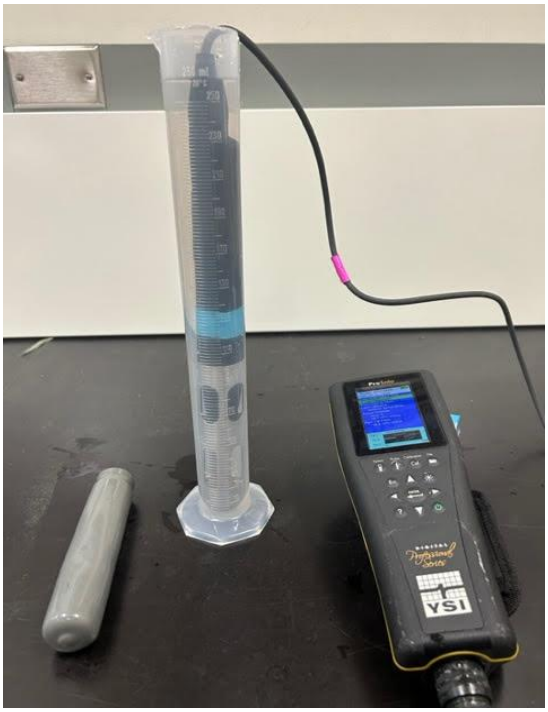
Figure 2. Probe screen while calibrating for ODO (optical dissolved oxygen)

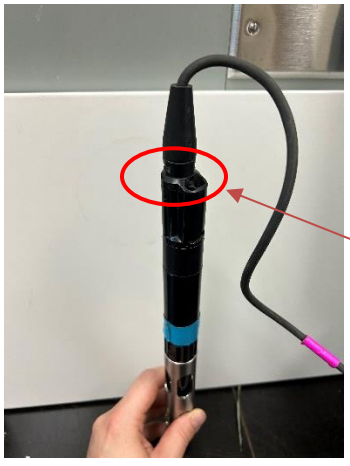
CALIBRATE CONDUCTIVITY:



- Calibrate your probe in your vehicle or at the lake on shore.
- Remove the **grey sleeve** (b) from your **probe** (d) and place inside the graduated cylinder.
- Fill up the graduated cylinder to the top with the conductivity calibration solution, so that the conductivity sensor (see below) is submerged. Let sit for 5 minutes.
- If not done already, connect your probe to your **handheld unit** (e).
- Turn on the handheld unit, and navigate to the conductivity calibration window: Press Cal
- Choose Conductivity by pressing Enter.
- Choose Sp. Conductance by pressing Enter.
- Change the “Calibration value” to the conductivity calibration solution used (this will be marked on the bottle, units are in µS/cm). **Record this value on the field sheet as well.**
- Watch the line on the bottom and wait 1 minute, or until the line stabilizes and then press “Accept Calibration”.
- Calibration is complete. Rinse the probe with water before putting the grey sleeve back on the probe.
- Press ‘ESC’ until back at the home screen. Power down the handheld.

Do not re-use the conductivity solution





Conductivity sensor

What are we collecting?

1. ***Secchi Depth:***

Water clarity is influenced by suspended materials, both living and dead, as well as, dissolved colored compounds in the water column. During the melting of snow and ice in spring, lake water can become turbid (cloudy) from silt transported into the lake. Lake water usually clears in late spring but becomes more turbid with increased algal growth as the summer progresses. The Secchi disk depth is the easiest and most widely used measure of lake water clarity. Two times the Secchi disk depth equals the euphotic depth – the depth to which there is enough light for photosynthesis.

2. ***Temperature:***

Water temperature in a lake dictates the behavior of numerous chemical parameters responsible for water quality. We will measure temperature 10cm below the surface, 0.5m below the surface, 1m below the surface, and then at 1m increments until 1 meter off the bottom.

3. ***Water Depth:***

Water depth puts the profile readings into context. You may use the tape & weight in the kit to record this depth, or a depth finder if your boat has one.

4. ***Water Chemistry***

a) **Chlorophyll-*a*:** Chlorophyll-*a* is a pigment that algae and cyanobacteria (blue-green algae) use to convert the sun's energy into food (photosynthesis). Chlorophyll-*a* can easily be extracted in the laboratory. Consequently, chlorophyll-a is a good estimate of the amount of algae or blue-green algae in the water.

b) **Microcystin:** Microcystin is a group of toxins produced by cyanobacteria (blue-green algae) which, when ingested, can cause liver damage in mammals. Microcystin is produced by many species of cyanobacteria which are common to Alberta's Lakes and are thought to be one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 10 µg/L.

c) **Total Phosphorus:** The nutrient phosphorus is important for the growth of algae and cyanobacteria in Alberta lakes. Even a slight increase of phosphorus in a lake can, given the right conditions, promote blooms that turn the water green and may impair recreational activities. Phosphorus may originate from lake sediments or externally from natural sources, or pollution such as human waste, animal waste, and fertilizers.

d) **Dissolved oxygen (DO):** measured in milligrams per liter and percent saturation to assess the amount of oxygen available in the water. This metric is crucial for understanding the lake's capacity to sustain aquatic life, including fish, as many organisms rely on oxygen for respiration. In deep lakes, it's typical for oxygen levels to decline rapidly at a certain depth, often coinciding with a sharp temperature decrease, known as a thermocline.

On the Boat:

Only use the provided equipment on the lake(s) you have been assigned to. Never use your sampling equipment for other water bodies. This will ensure you do not promote the spread of aquatic invasive species. For safety reasons, sampling should be conducted with at least two individuals.

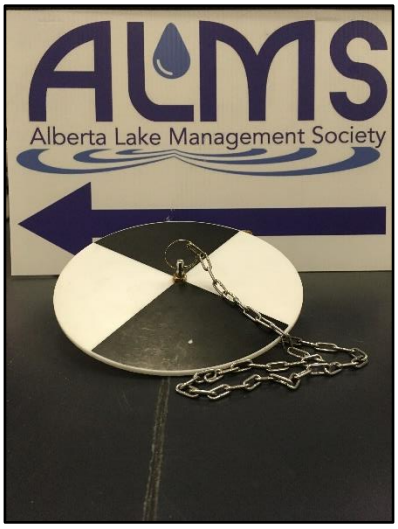
STEP 1. *Find your sample site.*

a) Navigate to the deepest part of the lake, preferably in the main basin as indicated on your map. Use your depth finder or the provided **tape and weight** to determine the lake's depth. Ensure that your measuring tape is held straight up and down when reading the depth and **record this bottom depth in the designated 'Bottom Depth' box on your field sheet.** Once you've reached the deepest part of the lake, drop your anchor, allowing out the anchor line at least twice as long as the lake's depth. In windy conditions, you may need to extend the anchor line further and consider driving a few meters into the wind before dropping anchor to drift back on the anchor line and stabilize above the deep spot. This anchoring procedure is crucial for minimizing drift during sampling. If the wind is too strong to prevent your boat from drifting while anchored, avoid sampling. If possible, use a GPS or smartphone to mark the deep spot for future reference. You may now **turn off your boat motor** to begin sampling.

b) **Record your GPS coordinates** and environmental observations on your field sheet: Air temperature, wind speed, wind direction, percent cloud cover, and evidence of cyanobacteria blooms.

c) Measure your **Secchi Depth** (see instructions on next page).

d) Take photos of the lake, shore, volunteers, or anything interesting on your day out. ALMS loves receiving photos which can be emailed to lakekeepers@alms.ca.



STEP 2. *Secchi Depth*

- After you have measured your bottom depth, grab your Secchi disk.
- On the **shady side** of the boat with your **sunglasses removed**, lower the Secchi disk until just below the surface of the water and hold here. (Note: depending on the angle of the sun, it may not be possible to locate a shady side of the boat. Choose the best spot.). Record the "**Colour of Secchi**" on your field sheet. Note what colour the water appears against the white stripes on the disk.
- Next, slowly lower the disk- make sure to keep track of your depth by looking at the different coloured zip ties, refer to the Secchi Chain Marking Guide. The chain is already marked in meters.
- Slowly lower the disk until the white stripes are no longer visible. Record this depth on the field sheet under '**Disappears**'.
- Slowly raise the Secchi disk back up until you can just see the white stripes again. Record this depth on the field sheet under '**Reappears**'.
- Take the Secchi disk out of the water and find the average of the above two depths you recorded; this will be your Secchi disk depth. Record this on your field sheet.

Example: Your disk disappears at a depth of 8.3 m and reappears at a depth of 7.7 m. Your Secchi depth would be 8 m.

Secchi Chain Marking Guide:

White: Every 0.1 m

Orange: Every 0.5 m

Pink: Every 1 m

Pink & Yellow: 5 & 15 m

Pink & Green: 10 m

In 2022, the Pigeon Lake Watershed Association made a Secchi depth training video. The link for this video can be found on the Summer LakeKeepers webpage on the ALMS website.

STEP 3. *Grab Sample*

a) At the deep spot, you will be collecting water from as deep as you can reach below the surface, or about 0.5m. Take out your **1 L brown bottle for Chlorophyll-a, one 250 mL white bottle for Total Phosphorus, and one microcystin bottle**. Your 250 mL bottle has a yellow-capped preservative attached to it. Keep it aside until step **3e.**

b) **Label these bottles with the same sampling date and time (the nearest 15 minutes is fine).**

c) After your bottles are labeled, rinse each bottle three times with water from 10 cm below the surface of the lake. Make sure you are rinsing the bottle's cap as well.

d) After rinsing, you are ready to take a grab sample. With the cap off and the bottle upside down, push the bottle below the surface as deep as you can reach, about 0.5m, and to a maximum of 1m. At this depth, let the air out of the bottle until it is full. Bring it back to the surface and place the lids back on the bottle. Do this with all three bottles.

e) Add the yellow-capped preservative (sulfuric acid) to your 250 mL bottles – please wear gloves to ensure the preservative does not encounter your skin. If you feel more comfortable adding the preservative on shore, please do so.

STEP 4. *Profile Measurements with the YSI probe*

a) With your probe turned on to the 'Log One Sample' screen, lower the probe until the 0.1 m marker is at the surface of the water. ***See Figure 8 for the probe marking guide.*** *

b) If your backlight turns off during sampling, press any key to reactivate it.

c) Record the temperature, dissolved oxygen, and conductivity measurements in the 0.1 m depth row on your field sheet.

d) You may need to wait 30-60 seconds for your dissolved oxygen readings to stabilize at each depth.

e) Continue this process at the 0.5 m mark, and then every meter increment until you have hit the bottom of the lake.

f) Record the bottom depth in the 'Bottom Depth' box on your field sheet, if you haven't already done so.

g) Hold the Power Button to turn off your probe.

h) Place the grey sleeve with a wet sponge inside the back over the metal guard. Return the probe to the sampling kit.

Figure 3. Probe screen while taking measurements.

STEP 5. *Microcystin Grab Sample*

a) From your deep spot, label the **125 mL clear microcystin bottle with the sampling date and time (the nearest 15 minutes is fine).**

b) **Using gloves**, rinse the bottle three times, then collect a grab sample of the bloom at the deep spot OR anywhere else on the lake with the **125 mL clear microcystin bottle. This bottle only needs to be filled ¾ full.** Cap the bottle tightly and place the bottle with the others that will be sent back to ALMS.

c) On the field sheet, describe the location of the microcystin sample (GPS coordinates preferred), as well as the **general extent of bloom across the lake (see Appendix 1 for Cyanobacteria Bloom ID**). If possible, take a picture of the bloom that was sampled, and send it to lakekeepers@alms.ca.

On the Shore:

STEP 1. ***Filtering chlorophyll- must be completed within 24 hours of collection.***

a) Filtering must be performed away from direct sunlight and on a level surface.

b) Put on your gloves to avoid contamination.

c) Set up the chlorophyll filtering apparatus as shown in Figure 6. Make sure the tubing is connected tightly. You will need the following pieces: plastic filter top, blue rubber stopper, plastic filter flask, hand pump, filter paper, graduated cylinder, pure water poured into your squirt bottle, tweezers, Magnesium carbonate, and a **1L Chlorophyll-a container** filled with lake water**. *Some filter kits will have a different set-up: a screw-on funnel and flask, and no plastic weight or rubber stopper is needed. See in Figure 8 below***

d) Unscrew the filter top and place a filter paper on the surface **covering all the holes**. Make sure the rubber stopper is secure.

e) Wet the filter paper with **pure water**.

f) Use the hand pump to gently increase pressure and allow water to filter through to the flask underneath. Try not to exceed 20 psi on the dial.

g) Shake the **Chlorophyll-a container**, measure 20 mL of lake water using the graduated cylinder and pour onto filter paper. **Maintain pressure while pouring lake water onto the filter paper.** Pump until all the water has drained.

h) Repeat step **h** until there is only a SLIGHT green colour visible on the filter paper. This may take up to 300 mL of water, depending on the lake. If you can't tell if the paper is green, pick it up and look at it.

i) Once enough lake water has been filtered, **record the volume of lake water filtered in the 'Filtering Chlorophyll' section on the back side of the field sheet.**

j) Then, rinse the graduated cylinder and inside the filter apparatus 3x with **pure water** onto the filter paper. Pump as you go.

k) If the plastic flask becomes full (or the bottom of the filter apparatus if applicable), remove the rubber stopper, discard the lake water outside, and continue filtering. **Make sure the plastic or screw-on filter bottom set does not get full enough to reach the pump tubing.**

l) Record the colour of the first filter paper on the backside of the field sheet.

m) Remove the top portion of the filter apparatus and add three drops of magnesium carbonate onto the filter paper, and pump to drain the liquid through.

n) Using tweezers, fold the filter paper in half twice. Avoid touching any portion of the paper that has chlorophyll.

o) Finally, place the folded filter paper into a petri dish using tweezers. Label the dish with your name, date, lake, and total volume of lake water filtered (using labels provided).

p) Wrap the petri dish in aluminum foil to protect it from light.

q) Place a new filter paper on the apparatus and repeat this procedure **two more times to obtain three filter papers total.**

r) Excess water at the end of filtering can be discarded back into the lake. Do not discard lake water down the drain to help prevent the spread of aquatic invasive species.

STEP 2. *Store the Bottles*

a) Place your **250 mL Total Phosphorus bottle** in a Ziploc bag and place it in **your fridge.**

b) Place your **three Chlorophyll-a petri dishes AND one 125 mL microcystin bottle** in a Ziploc bag and place in **your freezer.**

SAMPLE SHIPMENT:

STEP 3. *Deliver samples to ALMS office*

Samples collected with this program must be analyzed within 30 days of collection – this means you will have to courier or drop off your samples to the Alberta Lake Management Society in Edmonton at 4816 89 St NW. It is important that your samples remain cold and that they are received in a timely fashion**. Also, make sure that the petri dishes which hold the chlorophyll-a filters remain in a water-proof Ziploc bag when being shipped.** Please send a copy of the field sheet along with the samples, put the field sheet in a large Ziploc bag to keep the sheet dry. Refer to the **'Shipping Slip'** included in your kit for the Purolator account number and coordinate with ALMS at 780-702-2567 or lakekeepers@alms.ca to arrange for the shipping of samples.

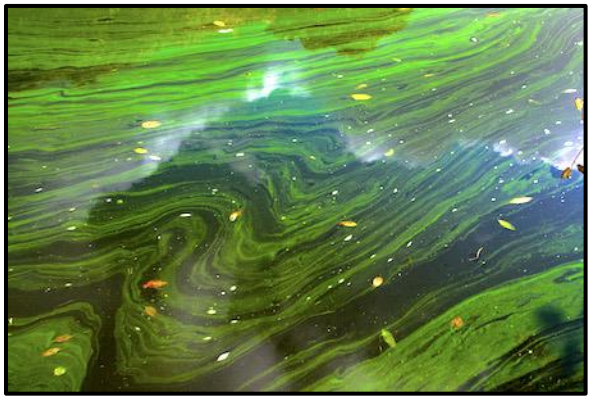
EQUIPMENT CLEANING:

If you are retaining your equipment for the summer without returning it to the office between sampling events, ensure the **Chlorophyll-a container** is cleaned between samples to maintain data integrity. Rinse the Chlorophyll-a container six times with hot water. Avoid placing it on unclean surfaces and refrain from using soaps or detergents for cleaning, as these may contaminate future samples. After rinsing, allow the container to dry on a clean surface like a paper towel or clean towels before returning it to your next sampling set. **Do not forget this bottle on your next sampling trip!**

A1) CYANOBACTERIA BLOOM IDENTIFICATION

Cyanobacteria or blue-green algae blooms often occur during the summer months due to warmer water and higher nutrient content in Alberta lakes. The most common genera of cyanotoxins in Canada are Microcystis, Anabaena, Aphanizomenon, Planktothrix and Gleotrichia. They can appear blue-green, brown, or pinkish red in colour and will usually smell grassy or musty. They will produce cyanotoxins and can be harmful to human, livestock, and pet health at certain concentrations. Blooms can appear in different ways depending on the type of cyanobacteria present. It can look like grass clippings or appear foamy.

Particles



Streaks

Scums

A2) CHLOROPHYLL-A FILTERING STEPS

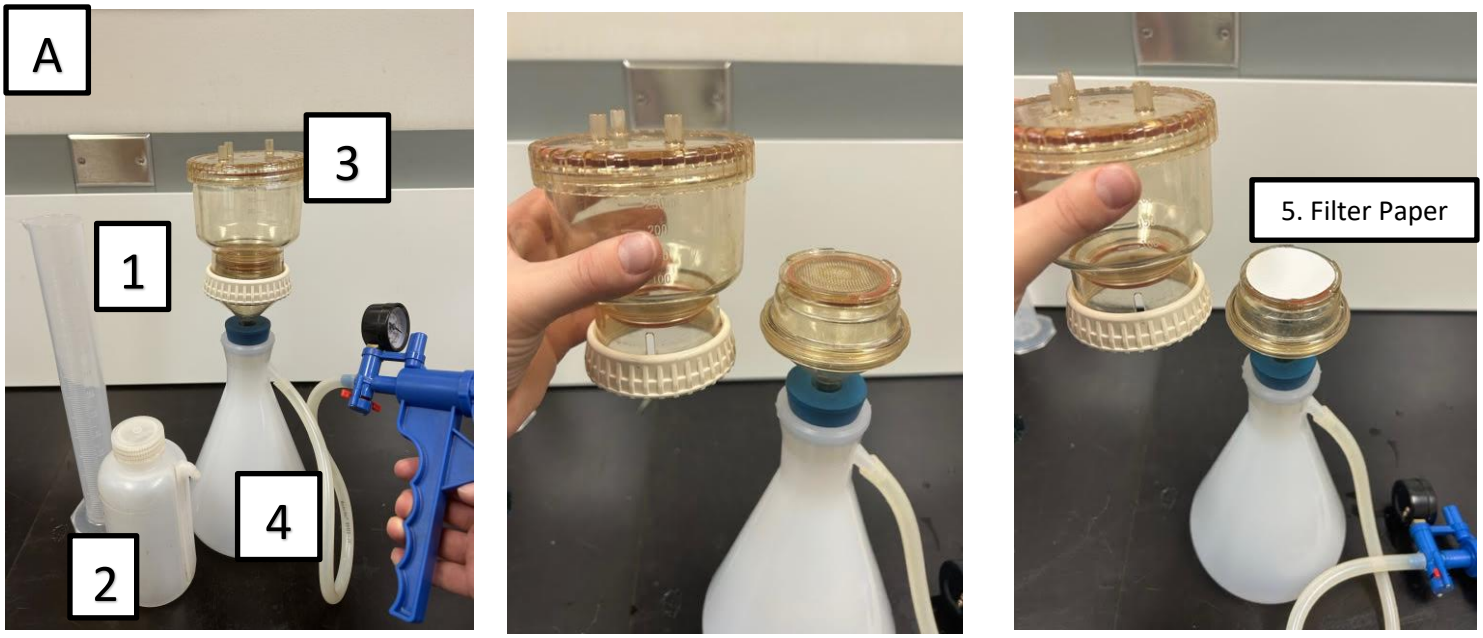


Figure 1. A) Hand pump connected with rubber tubing to B) filtration system including:

1. Graduated cylinder
2. Squirt bottle
3. Filter apparatus
4. 1000 mL flask
5. Filter paper

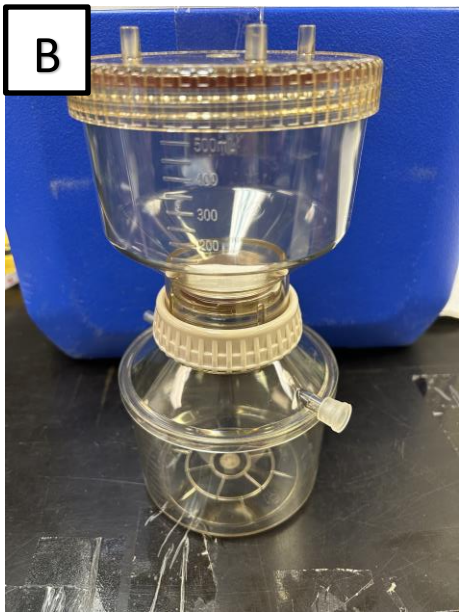


Figure 2. Screw-on filter set

A3) PROBE CORD MARKING GUIDE