LakeKeepers

Winter LakeKeepers Volunteer Instructions

Updated: December 16, 2021

This project supported with funding from

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ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEKEEPERS PROGRAM

Welcome to Winter LakeKeepers!

Thank you for expressing an interest in Alberta's aquatic environments and for participating in the Winter 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 the collection and preparation of scientific data important to assessing the health of your lake of interest. This manual is meant to be a reference for Winter LakeKeepers sampling protocol.

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

For field sheets, safety training, and the safety quiz, visit:

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

This manual was prepared by Caleb Sinn and Bradley Peter. For more information, please contact programs@alms.ca

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1) BEFORE YOU HEAD OUT:

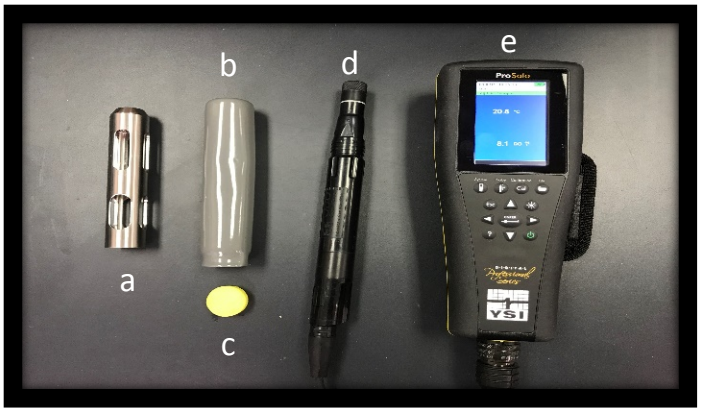
a) Fill your hot water bottle and place it in your YSI kit.

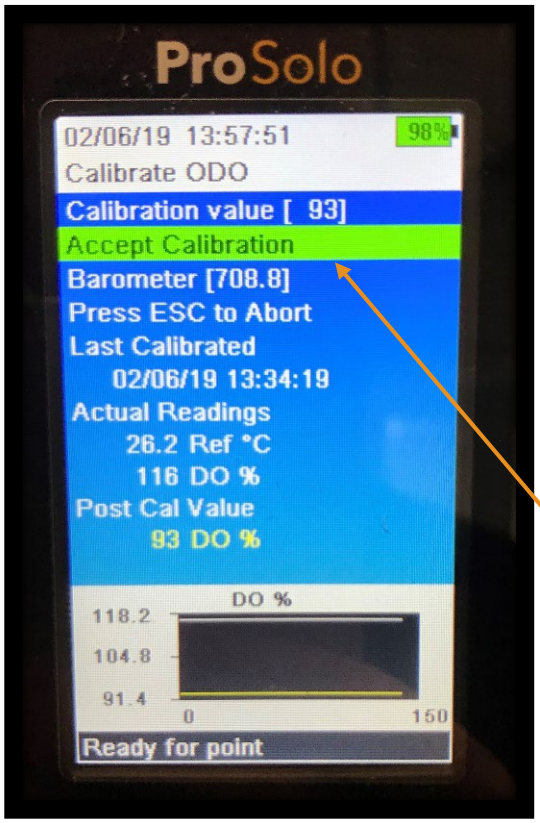
b) Make sure your probe is charged (see battery on top right of probe screen).

c) Complete the online safety quiz and informed consent form at www.alms.ca/winter-lakekeepers/

d) Confirm with ALMS (programs@alms.ca) whether you're following P1 or P2 protocols; look for P1 or P2 in the step name to know which steps to follow. Check the materials list on page 10 (Appendix step A2) to make sure you have all materials.

e) If you need help finding your GPS coordinates, follow the steps on page 9 (Appendix step A1). If you are sampling the same location at a lake more than once, refer to your initial GPS in **Table 2** on page 9 below (Appendix step A1) to aid in navigating to the same site location. Also, plan timeline for sample return with ALMS, depending on filtering for chlorophyll-a.





2) CALIBRATE PROBE AT THE LAKE (P1 & P2):

a) Calibrate your probe in your vehicle to avoid freezing.

b) Remove the **grey sleeve** (b) from your **probe** (d).

c) Remove the **metal probe guard** (a) and gently wipe any water droplets from the probe with a Kimwipe (supplied tissue).

d) Carefully place the metal guard back over your probe.

e) There is a yellow sponge inside the grey calibration sleeve. Using water from the calibration bottle, wet the **yellow sponge** (c) with a few millilitres of water.

f) Place the grey sleeve (with yellow sponge inside) over the metal guard.

g) Wait five minutes to allow the air in the probe to become saturated with moisture from the sponge.

h) Connect your probe to your **handheld unit** (e).

i) Press the green power button on your handheld unit.

j) Press Cal

k) Choose ODO or DO by pressing Enter

l) Choose DO % by pressing Enter

m) Wait one minute.

n) Record the Barometer value on the front of your field sheet.

o) Choose 'Accept Calibration' by pressing Enter.

p) Press escape until you see the 'log one sample ' screen.

q) Keep the probe in its grey sleeve and in the sampling kit until you are ready to collect data.

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3) RECORD BOTTOM DEPTH AND MEASUREMENTS (P1 & P2):

a) Fill in the Environmental Observations portion of your field sheet.

b) Use the 'tape and weight' to determine the bottom depth, and record the depth in the 'Approximate Bottom Depth' box on the back of the field sheet.

c) 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.

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

e) Record the temperature and dissolved oxygen measurements on your field sheet following the depths indicated in the 'Depth (m)' row (see Appendix step A3 on page 11 for guide on cord depth markings)

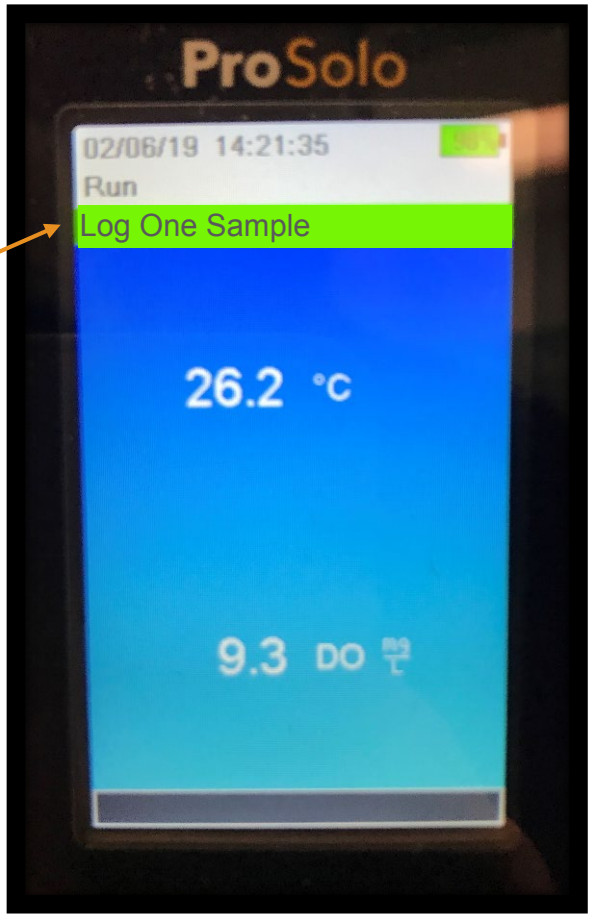
f) You may need to wait 30-60 seconds for your dissolved oxygen readings to stabilize at each depth.

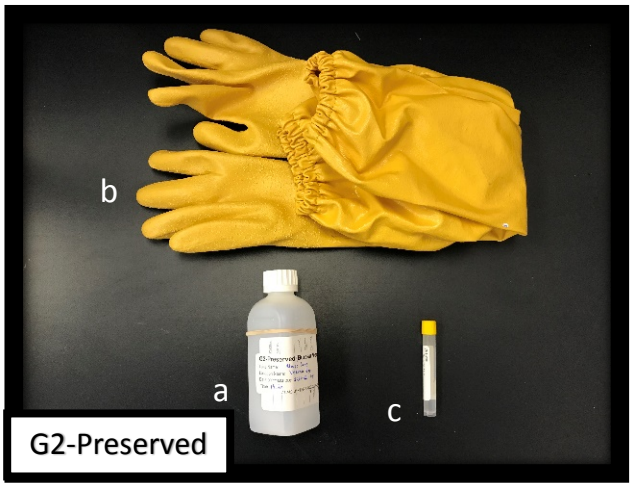
g) Continue this process until you have hit the bottom of the lake.

h) Record the bottom depth in the 'Approximate Bottom Depth' box on your field sheet.

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

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





4) COLLECT WATER SAMPLE WITH G2-Preserved BOTTLE (P1 & P2):

a) Using a Sharpie, label your **G2-Preserved Bottle** (a) with the Lake Name, Location Name, Date, and Time.

b) Wearing the **sampling glove** (b), rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **G2-Preserved Bottle** with water from below the surface.

d) Add one **yellow capped preservative** (c) to your **G2-Preserved Bottle** . Wear gloves and goggles as this preservative contains sulfuric acid.

e) Place the bottle into your warm sampling kit.

Preservative MSDS information can be found on the ALMS website at: https://alms.ca/winter-lakekeepers/

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5) COLLECT WATER SAMPLE WITH ISOTOPES BOTTLE

(P1 & P2):

a) Using a Sharpie, label your **Isotopes Bottle** (a) with the Lake Name, Location Name, Date, and Time.

b) Wearing the **sampling glove** (b), rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **Isotopes Bottle** with water from below the surface.

d) Place the sample into your warm sampling kit.

e) IF FOLLOWING P1, SKIP AHEAD TO STEP 11.

f) IF FOLLOWING P2, PROCEED TO STEP 6.

6) COLLECT WATER SAMPLE WITH G2-F BOTTLE

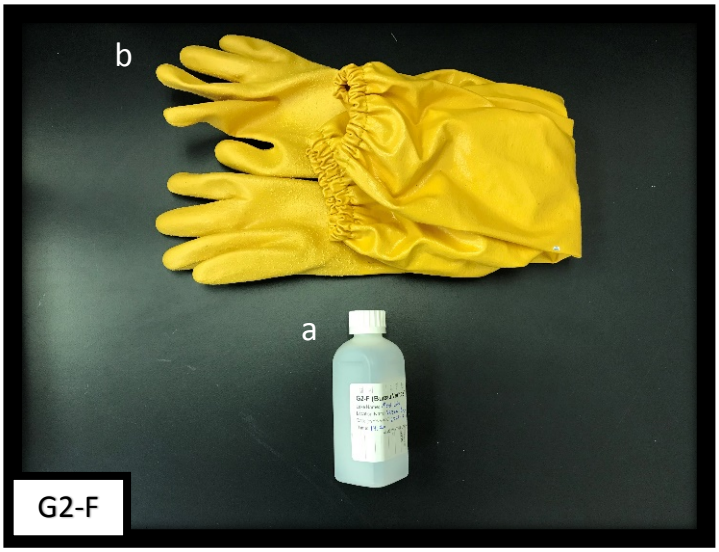
(P2):

a) Using a Sharpie, label your **G2-F Bottle** (a) with the Lake Name, Location Name, Date, and Time.

b) Wearing the **sampling glove** (b), rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **G2-F Bottle** with water from below the surface.

d) Place the sample into your warm sampling kit.



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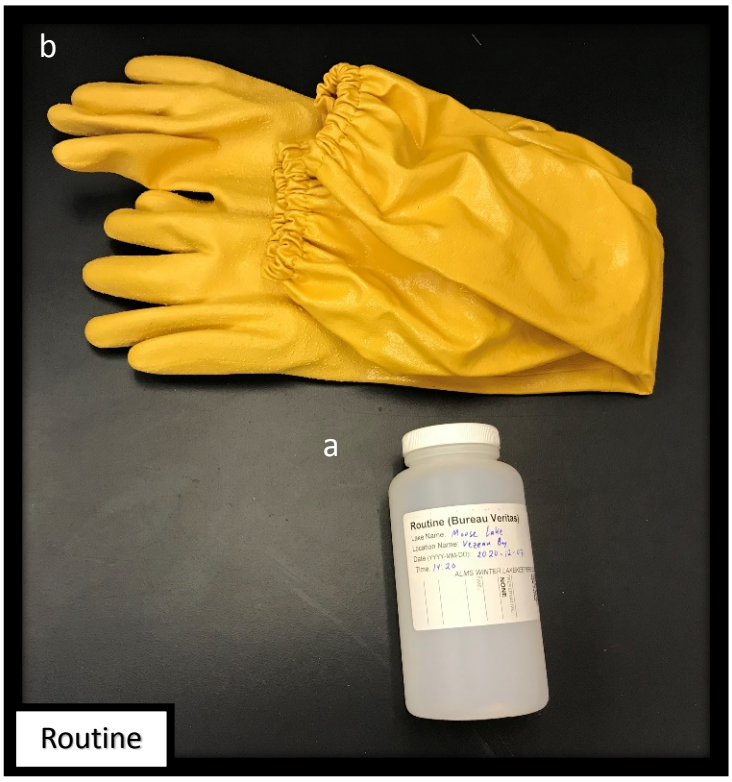


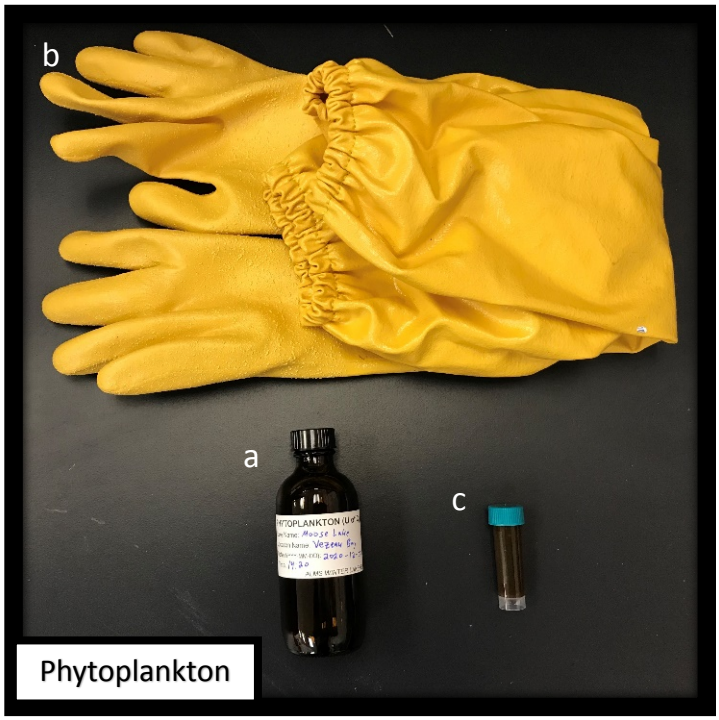
7) COLLECT WATER SAMPLE WITH ROUTINE BOTTLE (P2):

a) Using a Sharpie, label your **Routine Bottle** (a) with the Lake Name, Location Name, Date, and Time.

b) Wearing the **sampling glove** (b), rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **Routine Bottle** with water from below the surface.

d) Place the sample into your warm sampling kit.



8) COLLECT WATER SAMPLE WITH PHYTOPLANKTON BOTTLE (P2):

a) Using a Sharpie, label your **Phytoplankton Bottle** (a) with the Lake Name, Location Name, Date, and Time.

b) Wearing the **sampling glove** (b), rinse the bottle three times with water from below the surface.

c) After rinsing, fill your **Phytoplankton Bottle** with water from below the surface.

d) Add one **green capped preservative** (c) to your **Phytoplankton Bottle** . Wear gloves and goggles as this preservative contains iodine and glacial acetic acid, and easily stains.

e) Place the sample into your warm sampling kit.

Preservative MSDS information can be found on the ALMS website at: https://alms.ca/winter-lakekeepers/

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9) COLLECT WATER SAMPLE WITH CHLOROPHYLL-A BOTTLES (P2):

a) Using a Sharpie, label your two **Chlorophyll-A Bottles** (a) with the Lake Name, Location Name, Date, and Time.

b) Wearing the **sampling glove** (b), rinse the bottles three times with water from below the surface.

c) After rinsing, fill your **Chlorophyll-A Bottles** with water from below the surface.

d) Place the sample into your warm sampling kit.

e) IF FILTERING WATER FROM CHLOROPHYLL-A BOTTLES, PROCEED TO STEP 10. IF NOT, PROCEED TO STEP 11.

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10) FILTER WATER FROM CHLOROPHYLL-A BOTTLES (P2):

a) Filtering must be done away from direct light and on a level surface **within 24hrs of collecting water**. If delaying filtering because location is too cold, **keep sample refrigerated at home until filtering – keep sample from freezing.** Put on disposable gloves (a) to avoid contamination.

b) Set up the chlorophyll filtering apparatus as shown on page 6. Make sure the tubing is connected tightly. You will need the following pieces: ceramic Buchner funnel, rubber stopper, filter flask, hand pump, filter paper, graduated cylinder, pure water poured into your squirt bottle, tweezers and plastic weight.

c) Use the tweezers to place one filter paper on the Buchner funnel **covering all the holes.** Make sure the rubber stopper is secure.

d) Wet the filter paper with **pure water**, provided in the kit.

e) Place your plastic weight on top of the filter paper to prevent the filter paper from floating during filtering.

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) Pour both **Chlorophyll-A Bottles** in the **5L clear Composite Jug** (pictured on page 7)**.**

h) Shake a **Composite jug**, measure 100 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.

i) Repeat step **g** until there is only a SLIGHT green colour visible on the filter paper. Do not filter more than 600mL (since you only have 2L of water between both bottles). If you can't tell if the paper is green, pick it up and look at it.

j) Once enough lake water has been filtered, rinse the graduated cylinder and plastic weight 3x with **pure water** onto the filter paper (leave the plastic weight in the funnel while you rinse it). Pump as you go.

k) If the filter flask becomes full, remove the rubber stopper, discard the lake water, and continue filtering. **Make sure the glass doesn't get full enough to reach the pump tubing.**

l) Once you are done filtering and rinsing, fill in total volume of filtered sample water on field sheet.

m) Remove the plastic weight, and then add three drops of magnesium carbonate onto the filter paper, pumping as you go.

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. Using a sharpie, and the provided filter labels, label the dish with the lake name, location, date, and total volume of lake water filtered.

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.**

r) Excess water at the end of filtering can be discarded back into the lake, or outside; **not down the drain**.

s) Keep filters with other samples until returned home, then keep in baggie within **freezer.**

t) If sampling later in the season at the same site, rinse out **Chlorophyll-A Bottles** with tap water, and allow to dry. Re-label with additional chlorophyll-a bottle labels provided in your kit.

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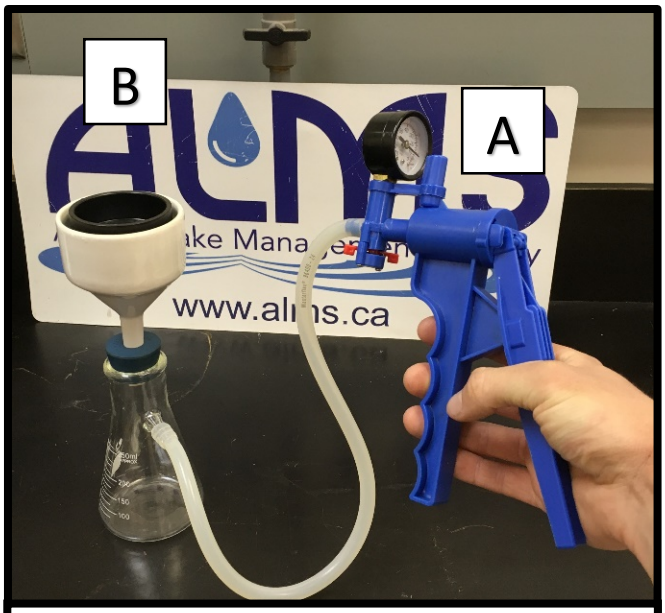
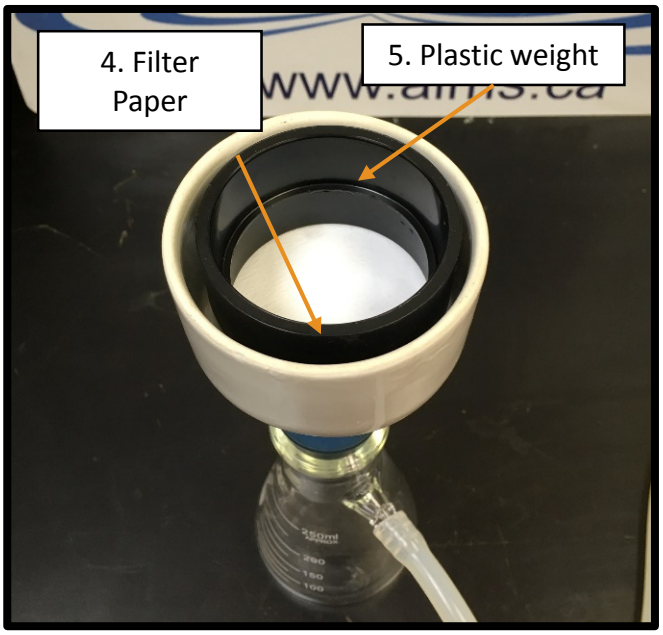
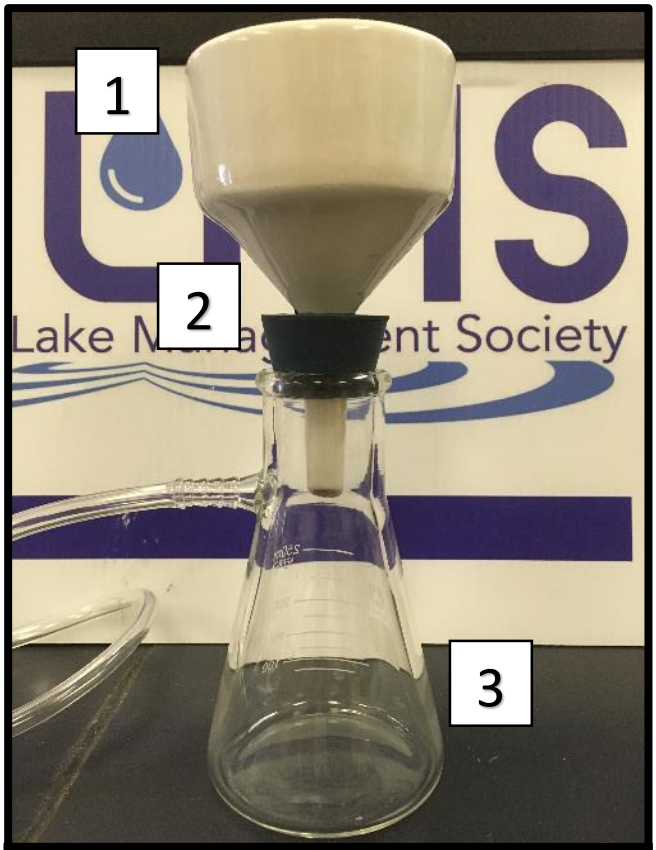


A. Hand pump connected with rubber tubing to filtration system
B. Filtration system





1. Ceramic Buchner funnel holding filter paper
2. Rubber stopper
3. Filter flask

6. 5L composite jug

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11) WHAT TO DO AFTER SAMPLING

Please follow the table below to know depending on your protocol steps, how quickly samples need to be returned to ALMS, and how to ship / deliver them.

Table 1. Shipment timing & process for Winter LakeKeepers 2020-2021

Protocol	Return Within:	How to ship:
P1	2 weeks	Keep **G2-Preserved** and **Isotopes** bottles cold.
P2	24hrs	Keep **G2-Preserved, G2-F, Isotopes, Routine,** and **Chlorophyll-A** bottles cold.
P2 + Chlorophyll-A Filtering	3 days	Keep **G2-Preserved, G2-F, Isotopes,** bottles cold. Keep **Chlorophyll-A filters FROZEN.**

FILL IN YOUR VOLUNTEER HOURS AT THE TOP OF THE FRONTSIDE OF THE FIELD SHEET

RETURNING YOUR SAMPLES & KIT IN PERSON:

- If you are returning your sampling kit in person to the ALMS office – please contact ALMS at 780-702-2567 or programs@alms.ca to arrange delivery timing. Delivery will be made outside of the building.
- The ALMS office is located at 4816-89 St. Edmonton, AB. T6E-5K1
- When returning the kit, park anywhere you like in the parking lot and buzz at the front door when you arrive.

RETURNING YOUR SAMPLES & KIT IN THE MAIL:

- Please use Purolator to ship your kit back to ALMS. Ensure the contents of the kit are secure, and that the pelican case has been taped closed with packing tape.
- To ship, use ALMS Purolator Account Number at 7010406 and choose Receiver Pays.
- If shipping, arrange with ALMS prior to sampling to have them provide cooler for shipping samples.
- For information on how to fill out your Shipping Form, see ALMS Winter LakeKeepers page at www.alms.ca/winter-lakekeepers/

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KEEPING YOUR KIT FOR FURTHER SAMPLING:

- If you plan on using this probe in another waterbody, ensure it has been cleaned with tap water. It is best if the tap water used to clean the probe is discarded outside and not down your drain.
- Do not use any cleaners on your probe – when storing the probe, ensure the yellow sponge is wet and the grey sleeve is over the probe.
- If you plan on using this probe again in the same waterbody, no cleaning is required.
- Even though you plan to continue sampling, your samples should be sent back to ALMS – see the 'in person' or 'in mail' options above, and make sure you process and ship your samples according to the timeline and processes outline in Table 1 above.

APPENDIX

A1) GPS Coordinates Instructions & Documentation

1. **Go to https://www.googlemaps.com/maps, and find your lake (search its name).**
2. **Using your mouse, right click on the location of the lake where you collected your sample.**
3. **Choose "*What's Here?*"**
4. **The GPS coordinates will appear at the bottom of your screen in the format of: 55.217876, -113.252806. Record these coordinates on your field sheet.**

IF YOU PLAN ON SAMPLING THE SAME SITE MORE THAN ONCE IN THE WINTER, USE THE TABLE BELOW TO RECORD YOUR SITE GPS FROM THE FIRST SAMPLING EVENT TO BE USED FOR THE NEXT SAMPLING EVENTS. USE BOTTOM DEPTH AS ANOTHER REFERENCE FOR LOCATING SAME APPROXIMATE SITE LOCATION.

Table 2. Site GPS log (reference for subsequent sampling events)

SITE (Lake, Location Name) Eg. Moose Lake, Vezeau Bay	Latitude	Longitude	Bottom Depth (m)

[1]Degree Minutes Seconds example: 53°29'06.5"N 113°27'54.6"W
[2]Decimal Degrees example: 53.485127, -113.465178
[3]Degree Decimal Minutes example: 53°29.1076'N, 113°27.9107'W

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A2) USE THIS TABLE TO MAKE SURE YOU HAVE EVERYTHING YOU NEED FOR SAMPLING

Table 3. Equipment & Material List

P1	P2	P2 + Chlorophyll-a Filtering
YSI ProODO Probe	*Same as P1	*Same as P1 & P2
Long Yellow gloves	G2-F Bottle	5L composite jug
G2-Preserved Bottle + yellow cap preservative (2mL sulfuric acid)	Routine Bottle	Buchner funnel & black plastic weight
Isotope Bottle	Two 1L Chlorophyll-a bottles	Rubber stopper
Hot water bottle	Phytoplankton Bottle + green cap preservative (3mL Lugol's Solution)	Hand pump & tube
Sharpies		Filter flask
Field Sheets		Graduated cylinder
Clipboard		Squirt bottle & pure water
Extra batteries for probe		Tweezers
Extra disposable gloves		Filter paper
Kimwipes (tissues)		Magensium Carbonate
Tape and Weight		Aluminum foil
		Petri dishes & baggies
		Chlorophyll-a filter & bottle labels

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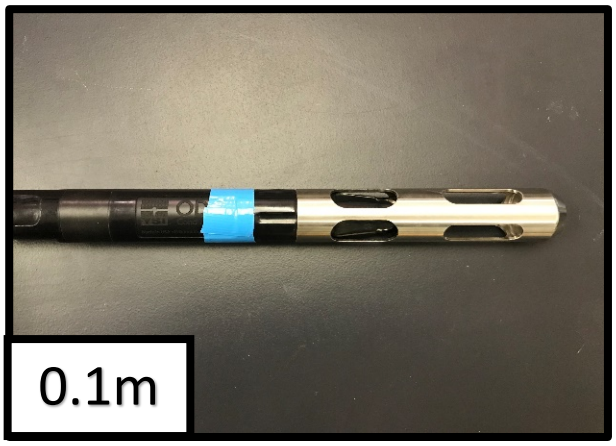
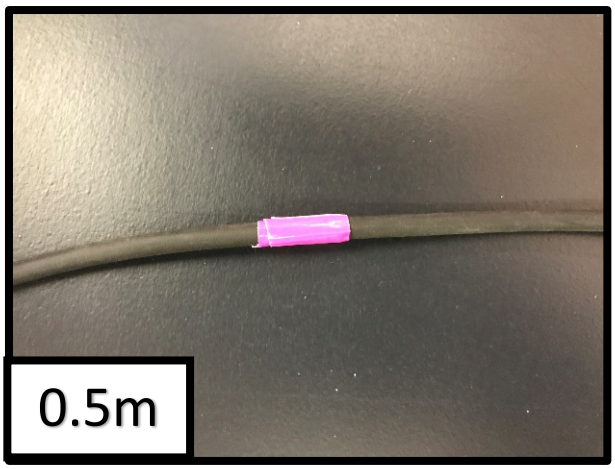
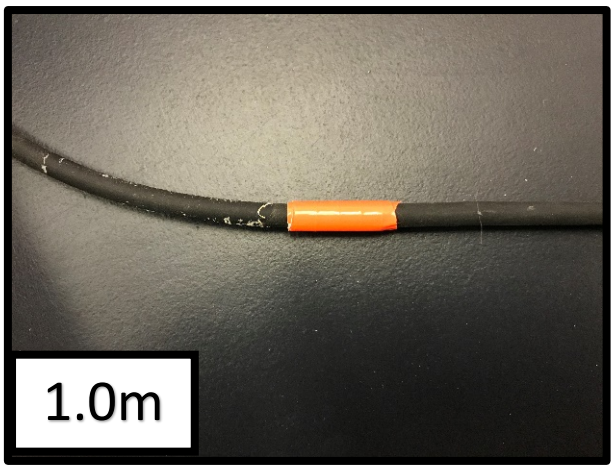
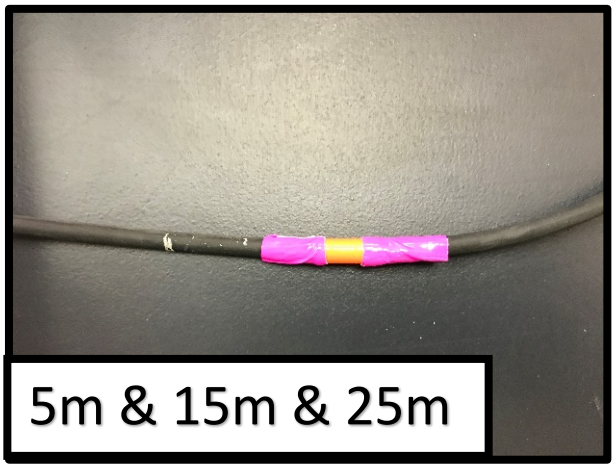
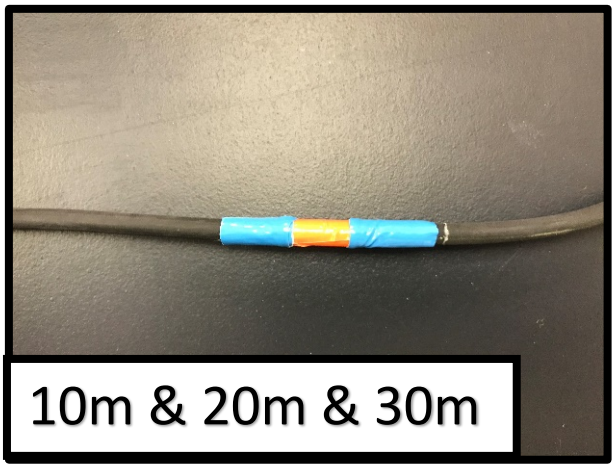
A3) YSI PROBE DEPTH MEASUREMENT MARKING GUIDE











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A4) DATA COLLECTION BACKGROUND

Below are descriptions of what the data and samples collected through Winter LakeKeepers will be used for, and how they relate to better understandings lakes in the winter. Also provided is where the data will eventually be used and reported.

- **Environmental Observations:** 'Ice Thickness,' 'Ice Colour,' 'Ice Covered in Snow?,' 'Snow Thickness,' 'Air Temperature,' 'Water Colour,' and 'Turbidity/Particles in Water' are all collected to put the data collected in context of the winter environment in which they were collected. Ice colour, thickness, and snow thickness (if present) can be used to understand how much light may be penetrating the ice. Recording water colour and the presence of particles or turbidity in the water can identify algae or cyanobacteria growth, and even the type of algae or cyanobacteria. Seeing how these parameters change may also help contextualize trends in other data collected through Winter LakeKeepers. Reported on in the ALMS Winter LakeKeepers reports.
- **GPS Coordinates:** Very important to collect, since the particular location on the lake where the sample is collected is used to contextualize all other data collected. Used to makes maps for presentations and reporting about Winter LakeKeepers.
- **Probe Calibration:** Used to ensure probes are reading accurately given local environmental conditions.
- **Lake Measurements:** Temperature readings from the top to bottom of the lake (lake profile) are used to understand lake mixing, dissolved oxygen levels, and for evaluating habitat for plants and animals. Dissolved oxygen readings are also taken through the lake profile to understand fish habitat. Winter can often be a stressful time for fish, as low oxygen levels often present at the end of winter can cause die-offs of certain species of fish. Determining the rate at which oxygen decreases through the winter season can also be used to understand the impact of summer algae and cyanobacteria growth, as greater growth will cause oxygen to be depleted more quickly as the algae and cyanobacteria decompose. Low oxygen levels are can impact nutrient levels, as lake sediments will release phosphorus into the lake if oxygen is absent – seasonal oxygen levels may contextualize seasonal nutrient changes. Reported on in the ALMS Winter LakeKeepers reports.
- **G2-Preserved:** Water from this bottle is used to determine total phosphorus and total nitrogen levels, which are important nutrients for algae, cyanobacteria, and aquatic plant growth. High levels of these nutrients may indicate pollution, and contextualize the amount and type of algae and cyanobacteria present. Reported on in the ALMS Winter LakeKeepers reports.

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- **Isotopes:** Isotopes of hydrogen and oxygen are used to understand lake – groundwater connectivity. Groundwater connectivity can contextualize lake water chemistry, and overall lake water quality or quantity. Samples will be sent to Alberta Innotech, where the isotope data will be used in their ongoing research about groundwater in Alberta.
- **Phytoplankton:** This bottle preserves the cyanobacteria and algae species that are present just below the ice, where their levels will be the highest. Knowing which species are present, and in what amounts, will help understand the biodiversity of algae and cyanobacteria, and their contribution to the winter lake food web. Information will also be used understand how nutrients levels impact algae and cyanobacteria in the winter. These samples will be archived and may be analyzed at a later date if chlorophyll-a levels are high.
- **G2-F:** Water from this bottle is used to determine total dissolved phosphorus and dissolved organic carbon levels, which are important nutrients for algae, cyanobacteria, and aquatic plant growth. High levels of these nutrients may indicate pollution, and contextualize the amount and type of algae and cyanobacteria present. Reported on in the ALMS Winter LakeKeepers reports.
- **Routine:** Water from this bottle is used to determine pH, a parameter that is used to understand the acidity of water, and is important for evaluating fish habitat and general lake water chemistry. Conductivity and chloride are also determined from the Routine sample bottle, and are parameters that help understand the levels of salts in lake water. As ice forms, salts are not incorporated into the ice, leading to elevated levels of salts in the winter. Salt levels are an important aspect of habitat for algae, cyanobacteria, aquatic invertebrates and fish. Levels can indicate groundwater connectivity, road salt pollution, and may also increase in lakes with large surface areas during times of low rainfall and snowmelt. Data determined from the routine bottle will be reported on in ALMS Winter LakeKeepers reports, as well as other provincial research on the impact of road salts.
- **Chlorophyll-a:** Water from this bottle is used to determine the levels of chlorophyll-a in lake water. Chlorophyll-a is a green pigment found in all algae and cyanobacteria, and is used in photosynthesis. Chlorophyll-a levels are used to understand the amount of algae and cyanobacteria in lake water. Higher levels, in conjunction with high nutrient levels, may indicate nutrient pollution, or reflect the lake's natural ability to support high levels of algal and cyanobacterial growth. Chlorophyll-a levels compared with ice conditions will also improve the understanding of what influences algae and cyanobacteria growth in Alberta Lakes in the winter. Reported on in the ALMS Winter LakeKeepers reports.