150 East Gilman St. Suite 2600
Madison, WI 53703
P 608-255-1000
cleanlakesalliance.org

Yahara Lakes Water Quality Monitoring

Background

In 2013, Clean Lakes Alliance launched the Yahara Lakes Monitoring program in response to findings from a 2011 study by Richard Lathrop and Steve Carpenter who identified the importance of monitoring nearshore water quality conditions to safeguard public safety. Working with an array of unique partnerships including Wisconsin Department of Natural Resources, Public Health Madison & Dane County, UW- Madison Center for Limnology, Long Term Ecological Research, MIOsoft, Madison College, City of Madison lifeguards, UW Space Science and Engineering Center, and UW Morgridge Center for Public Service, Clean Lakes Alliance is entering the sixth year of implementation.

Clean Lakes Alliance recruits the support of Greater Madison citizens to measure and record various water quality parameters, including clarity, temperature, and various visual observations in the nearshore environment. These roughly 70 volunteers ranging from UW- Madison students to retired community members graciously donate their time on a weekly (and in some cases daily) basis during the summer season. This program wouldn't be possible without the dedication of the volunteers.

Since its inception, the program has expanded to include around 70 nearshore sites and 7 offshore sites and collected over 6,000 condition reports. Monitors are trained to distinguish and report green algae and blue-green algae blooms at their sites. The data collected by the monitors helps researchers understand the conditions that create damaging algal blooms and know where they are occurring to help inform and protect the public.

As part of a continued effort to provide information to the public, Clean Lakes Alliance created a mobile-ready website called LakeForecast.org. This website provides water quality conditions reported by Clean Lakes Alliance citizen monitors as well as other water condition information (i.e. beach closures) to the general public in real-time. This information increases public awareness of the conditions of the Yahara lakes and helps lake users choose where they'd like to spend time on the lakes. Clean Lakes Alliance broadcasts weekly Weekend Lake Reports during the summer on social media to increase lake awareness. During 2017, over 358,000 people were reached through web and broadcast stories about LakeForecast.org and over 4,000 people viewed the website.

In 2016, Clean Lakes Alliance added offshore monitoring to the program to help increase sampling frequency for water clarity and dissolved oxygen and water temperature profiles at depth at the center of each of the Yahara lakes. This program bolsters efforts by the Wisconsin Department of Natural Resources' Citizen Lake Monitoring Network and Long-Term Ecological Research Network.

In 2017, Clean Lakes Alliance deployed 14 continuous temperature data loggers to collect continuous data at various volunteer stations on lakes Mendota, Monona, and Waubesa. The use of these data loggers to supplement volunteer monitoring drastically increases sample size and improves the potential for future lake condition forecasting.

In 2018, Clean Lakes Alliance received the Wisconsin Citizen-based Monitoring Program of the Year award for the Yahara Lakes monitoring efforts. This award was presented by the Wisconsin Citizen-based Monitoring Network in March of 2018. Successes such as this would not be possible without the support and dedication of our monitors.

Clean Lakes Alliance has found that citizen monitoring can be a powerful tool in raising awareness and increasing public interest in water quality. This effort provides an opportunity to do so in a way that will meaningfully contribute to cleaning up our lakes.

2018 Goals

2018 project goals are to:

1. Maintain current number of volunteers to provide adequate spatial coverage around the Yahara Lakes
2. Deploy thermistors to test water temperature at a 3 ft. depth contour at up to 33 locations
3. Increase sampling season and frequency of nearshore monitoring to May 3rd through September 3rd with sampling twice weekly to strengthen monitoring datasets
4. Continue collaborating with City of Madison to have lifeguards monitor at four lifeguarded beaches at least two times per week
5. Encourage increased monitoring frequency following a reported blue-green algal bloom
6. Perform weekly offshore monitoring of water clarity, temperature, and dissolved oxygen at the deep hole on all five Yahara lakes
7. Increase the number of unique LakeForecast.org users to exceed 4,247

In partnership with government agencies, University of Wisconsin researchers, and water quality advocacy groups, Clean Lakes Alliance will train and equip volunteers and coordinate monitoring of nearshore water turbidity, temperature, and various qualitative measurements. The intent of the monitoring is to better track changing beach conditions and the formation and movement of potentially toxic blue-green algal blooms. Furthermore, continuing offshore monitoring will allow Clean Lakes Alliance and partners to compare nearshore and offshore lake conditions, and will follow a protocol consistent with the WI DNR's Citizen Lake Monitoring Network. Water clarity will be collected by use of a Secchi disk, while dissolved oxygen and temperature will be measured throughout the water column with a YSI 550A multi-probe. Additionally, HOBO Pendant temperature and light data loggers (thermistors) will be deployed at multiple citizen monitor piers to collect more continuous temperature readings throughout the summer. These thermistors will provide a more detailed temperature profile that can be used to supplement and strengthen the expanding citizen monitor dataset.

The data collected by citizen monitors and Clean Lakes Alliance staff will supplement the sampling

conducted by other entities, creating a more robust dataset for all parties to draw upon. This information will be used in research on blue-green algal blooms, and provide more timely and accurate beach assessments to inform area lake users. Additional benefits of citizen monitoring include increased engagement of Dane County residents with the lakes and an increased awareness of dynamic water quality issues.

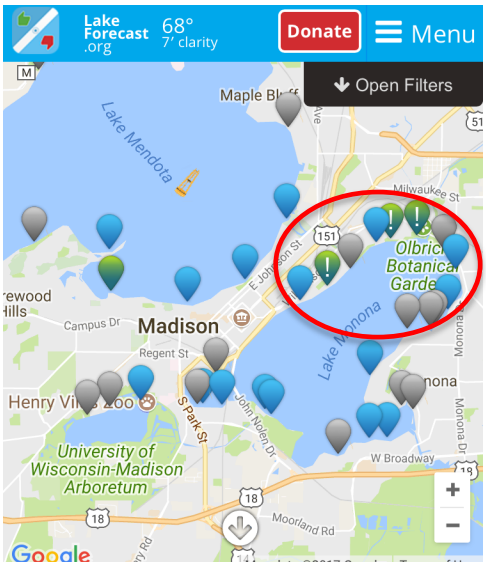
Implementation

Nearshore Monitoring

Regular monitoring will build awareness and educate the public about our lake ecosystems, particularly the quality of our waters. This will be accomplished through the reporting of temperature, turbidity, and qualitative observations (e.g. wave intensity, waterfowl presence, algal surface bloom presence, etc.) through a mobile-ready website at LakeForecast.org.

In 2018, all volunteers will collect quantitative and visual observations at least **twice a week** starting on May 3rd. The monitoring season will officially kick off on **Thursday, May 24th** with our annual community wide dip-in. In order to coordinate sampling times to get more accurate "snapshot" information, we are asking all volunteers to sample on **Thursday mornings between 7 a.m. and 12 p.m.** (if possible), and then pick at least **one additional day - either Tuesday and/or Saturday morning** (if possible) to sample. Sampling will end on Labor Day**, September 3rd.** However, volunteers will have the option to sample through the end of September as interest and time allows.

We are asking all volunteers to increase sampling frequency to two times per week or more. This will help increase the timeliness for providing information to the public for use when selecting where to participate in lake activities and help us start making stronger correlations between observed lake conditions and the different variables we're tracking. Additionally, the data you record will be used by the media to help create a Weekend Lake Report for lake users.



Many volunteers are open to starting the monitoring season earlier (i.e. late March/early April). Due to this interest and the benefits of lengthening the sample period, volunteers are invited to pick up their equipment and start monitoring in April. This additional information will strengthen datasets for researchers to analyze the changing lake conditions leading up to and during summer.

Blue-green algal blooms can form quickly and be pushed along the shoreline by wind on our lakes. In order to better track the movement of these blooms, we're encouraging volunteers to perform more frequent monitoring during periods when they're reported. Clean Lakes Alliance staff will inform volunteers via email when multiple volunteers and/or Public Health - Madison & Dane County reports a blue-green algal bloom

presence. Blue-green algal bloom reports will be incorporated into LakeForecast.org, displaying the observations with an exclamation point as shown above.

Quantitative parameters to be measured include: water turbidity (an indicator of clarity), water temperature, and air temperature. Water and air temperature will be measured using a digital thermometer (Appendix 1). Water turbidity will be determined using a 120cm turbidity tube (Appendix 2). Qualitative, visual observations will be collected for: wave intensity, waterfowl presence, surface bloom presence, algal bloom type, floating plant debris abundance, bather load (or the number of people in the water), and water clarity (Appendix 3). Volunteers will record their data on provided data sheets, and enter results into the web-based data entry system (Lakeforecast.org) (Appendix 4).

City of Madison Lifeguards

In 2018, City of Madison lifeguards will collect quantitative and visual observations as described in the above at least two times per week at four public beaches. More frequent monitoring will be encouraged, especially during periods when algal blooms are present.

Offshore Monitoring

In 2018, in order to better understand the interaction between the offshore and nearshore environment, volunteers will continue sampling the deepest point (deep hole) of all Yahara lakes. The offshore monitoring program focuses on two components: water clarity sampling and dissolved oxygen and temperature measurement. Data from offshore monitoring are compared to data from nearshore monitoring and help strengthen Long-Term Ecological Research Network and Wisconsin Department of Natural Resources' Citizen Lake Monitoring Network datasets.

Volunteers will use a Secchi disk to measure water clarity and a YSI 550A multi-probe meter to measure dissolved oxygen and temperature at multiple depths **once per week on Thursday mornings from April through September.** Secchi depth monitoring will take place at the deepest point of each lake. Clean Lakes Alliance staff will train volunteers using a Secchi depth monitoring protocol (Appendix 5) and dissolved oxygen and temperature protocol (Appendix 6). Volunteers will record results on a standard data sheet and submit those results to Clean Lakes Alliance weekly via email or phone.

Temperature can affect the life cycles and survival of organisms (including algae) and the ability of the water to hold oxygen. By building a vertical profile of temperature, we will be able to make inferences about lake mixing patterns. Dissolved oxygen, or oxygen present in the water, can also impact the type of aquatic life a water body can support. Low levels of dissolved oxygen can kill sensitive organisms and are generally undesirable as they can indicate that organic matter is decomposing in the water column (i.e. after an algal bloom dies). In the bottom of Lake Mendota, the presence or absence of dissolved oxygen determines whether phosphorus will remain bound to iron or be released into the water column.

Volunteers operating the YSI multi-probes will be trained by Clean Lakes Alliance staff, and will carry out appropriate calibrations before each measurement as outlined in Appendix 5. Results will be recorded on a standard data sheet and submitted to Clean Lakes Alliance weekly via email or phone.

Continuous Temperature Monitoring

In 2018, Clean Lakes Alliance will deploy up to 33 HOBO Pendant temperature and light data loggers (thermistors) to collect continuous temperature measurements at pier monitoring locations. These thermistor style data loggers will provide temperature recordings on a more detailed timescale than is feasible utilizing individual citizen monitors. Additionally, *in-situ* thermistors offer a distinct logistical advantage: once deployed, the thermistors will require minimal maintenance throughout the summer sampling period. Therefore, the thermistor pilot aims to strengthen our citizen monitoring dataset with continuous recordings without significant additional upkeep.

The data collected by the thermistors can be utilized to examine a variety of relevant issues. Primarily, the thermistors will track variations in nearshore temperature throughout the entire monitoring season. These data will provide a more precise look at water conditions when algal blooms are reported by our citizen monitors. Instead of examining temperature as a single data point during the report of an algal bloom, we can analyze all the temperature variations during the days leading up to and days after the formation of the bloom.

E. coli Bacteria Incubation Pilot

E. coli bacteria is one of the primary factors that leads to beach closures in our watershed. *E. coli* bacteria is an indicator for potential pathogens in the water. These bacteria are associated with the feces of warm-blooded animals and can be indicative of sewage contamination or polluted runoff. In 2018, Clean Lakes Alliance will pilot a *E. coli* bacteria sampling pilot to test the effectiveness of sampling from various volunteer locations around the watershed. A select few locations will participate in testing an approach to incubate and record *E. coli* levels from the comfort of their homes during the summer.

Volunteer Recruitment, Training and Support

Clean Lakes Alliance watershed coordinator, Katie Nicholas, and watershed engagement specialist, Luke Wynn, will carry out most project-management responsibilities. Nicholas and Wynn will perform tasks required to recruit, train and assist volunteers with performing water quality monitoring.

Returning volunteers will have the option to attend and all new volunteers will attend a volunteer training session. Trainings will be held at the Verex Plaza (150 E. Gilman St. Level B Madison, WI 53703) during the month of April. These training sessions will combine classroom and hands-on field experience to familiarize volunteers with sampling equipment, testing/reporting protocols, and identification of blue-green algae. All volunteers will receive the necessary sampling equipment, data sheets and procedural guidance at each training session. Volunteers should see the training video on Clean Lakes Alliance's Water Quality Monitoring webpage cleanlakesalliance.org/monitoring/ or on YouTube at youtube.com/watch?v=lGECFKXXha4 for a refresher on the protocols used during the sampling period.

Throughout the year, Nicholas and Wynn will provide assistance and support to volunteers. This support includes obtaining and disseminating equipment and supplies (e.g. monitoring equipment and manual), troubleshooting equipment issues, and performing periodic check-ins to answer questions.

Weekend Lake Reports

In 2018, Clean Lakes Alliance will continue to broadcast weekly Weekend Lake Reports on YouTube and Facebook. These reports include updates on beach closures and where to spend time on the lakes based on conditions reported by monitors and weather conditions. The reports had over 59,000 views in 2017. Continued efforts are being made to include these reports, once weekly, on a Madison TV station. To access the weekend lake reports, like Clean Lakes Alliance on Facebook or go to YouTube and search "Weekend Lake Report."

Annual Project Reporting

At the end of 2018, Clean Lakes Alliance will compile and interpret both individual and aggregated sampling results. These results will be presented to volunteers via mail and in an annual report format. The end-of-year summary for each year can be found on Clean Lakes Alliance's Water Quality Monitoring webpage cleanlakesalliance.org/monitoring/. The information will also be shared with UW-Madison researchers as we continue to work toward developing a predictive model for blue-green algal bloom formation. In addition, Clean Lakes Alliance will inform other water resources organizations of the data collected, and facilitate its timely distribution.

How to Support Our Monitoring Efforts

If you would like to help support the program in 2018, please consider becoming a *Lake Forecasting Steward* starting at $135 by going to our website cleanlakesalliance.org/product/lake-forecasting-steward/ or sending a check to Clean Lakes Alliance (150 E. Gilman St., Suite 2600, Madison, WI 53703) with memo "Lake Forecasting Steward." In 2017, 21 of your fellow lake monitors donated to help support this program.

Contact Information

Katie Nicholas
Watershed Coordinator
katie@cleanlakesalliance.org
(608) 255-1000

Luke Wynn
Watershed Engagement Specialist
luke.wynn@cleanlakesalliance.org
(608) 255-1000

Appendix 1

Instructions for Performing Digital Air and Water Temperature Measurements

Equipment/Materials Needed

- Digital Arrow-Shaped Thermometer (either Thermoworks or Fisher Scientific brand)
- Nearshore Water Quality Monitoring Data Sheet

General Rules of Sampling

- Sample air temperature as close to lake sample collection site as possible
- Collect data by removing the probe from the chamber and allowing the temperature reading on the probe to stabilize before recording.
- Pressing the "hold" button freezes the current temperature on screen for easier recording
    - Thermoworks thermometers do not have a "hold" button
- Remember to remove the plastic sheath that covers the temperature probe when sampling.
- You can switch between °C and °F by pressing the [°C/°F] button.
    - This button is located on the back of Thermoworks thermometers

Changing Battery

- You may need to replace the battery periodically during the sample season.
- To replace to battery, remove the screw cover with a small Phillips screwdriver, carefully remove the old battery and replace it with a new battery in the same position as the old battery, and rescrew the cover back on the thermometer.
- LR44 batteries are used in the Thermoworks thermometers and CR2032 batteries are used in the Fisher Scientific thermometers. Batteries can be obtained from a hardware store.

<u>Sampling Methods</u>

Step 1 – Air Temperature Measurement

1. Remove the temperature probe from the probe chamber.
2. Hold the thermometer so that it is shaded by your body
3. Press the [ON/OFF] button.
4. Allow the temperature to stabilize.
5. Record stabilized temperature in °F on water quality monitoring data sheet.

Step 2 – Water Temperature Measurement

1. Sample at ~3 feet total depth
2. Carefully move to the sampling location, while wading slowly in the water. If collecting samples from your pier, sample as above (3 feet total depth) but disregard the wading.
3. Remove the temperature probe from the probe chamber.
4. Press the [ON/OFF] button.
5. Insert thermometer vertically into the water, submerging the silver probe.
6. Allow the temperature to stabilize.
7. Record stabilized temperature in °F on data sheet.

Step 3 – Enter Data

1. After recording your measurements on the paper form, please enter the data into the online submission form on Lakeforecast.org (**https://lakeforecast.org/#/login**) using your username and password provided by Clean Lakes Alliance.

Appendix 2

Instructions for Performing Turbidity Measurements Using a 120cm Turbidity Tube

Turbidity is a measurement of how cloudy water appears. Turbidity is also a measure of how much light passes through water, and is caused by suspended solid particles that scatter light. These particles may be microscopic plankton, stirred up sediment or organic materials, eroded soil, clay, silt, sand, mud, industrial waste, chemical precipitates or urban runoff.

Equipment/Materials Needed

- 120cm turbidity tube
- Nearshore Water Quality Monitoring Data Sheet

General Rules of Sampling

- Do not wear sunglasses when sampling
- Record value when you can first see the white and black disk.

Cleaning the Turbidity Tube

- Although Clean Lakes Alliance cleans the tubes between seasons, you may want to periodically clean your tube if it starts collecting algae or other debris that obstructs view of the black and white Secchi disk.
- To clean your tube, it is best to use a long-handled brush that can be pushed to the bottom of the tube. An attached string or broom handle is necessary for easy removal. A small amount of environmentally friendly cleaner can help remove dirt and algae. Rinse well with a garden hose or your indoor sink.

Sampling Methods

Step 1 – Sample Collection

1. Sample at ~3 feet total depth, 6 inches below the surface
2. Dip the tube into the water at your sampling site and fill to the top

Step 2 – Turbidity Measurement

1. Take your filled turbidity tube to a shaded spot. If there is no shade around, use your body to block the sun from shining on the tube
2. Look down through the tube toward the target disk on the bottom of the tube.
3. If the disk is visible, record the water level as 120 centimeters
4. If the disk is not visible, slowly release water from the release valve until the disk at the bottom of the tube becomes visible. Record the water level in centimeters (cm).
5. Record all values on water quality monitoring data sheet

Step 3 – Enter Data

1. After recording your measurements on the paper form, please enter the data into the online submission form on Lakeforecast.org (**https://lakeforecast.org/#/login**) using your username and password provided by Clean Lakes Alliance.

Appendix 3

Instructions for Collecting Qualitative Data

Equipment/Materials Needed

- Nearshore Water Quality Monitoring Data Sheet
- Computer or smartphone

Qualitative, Visual Observations

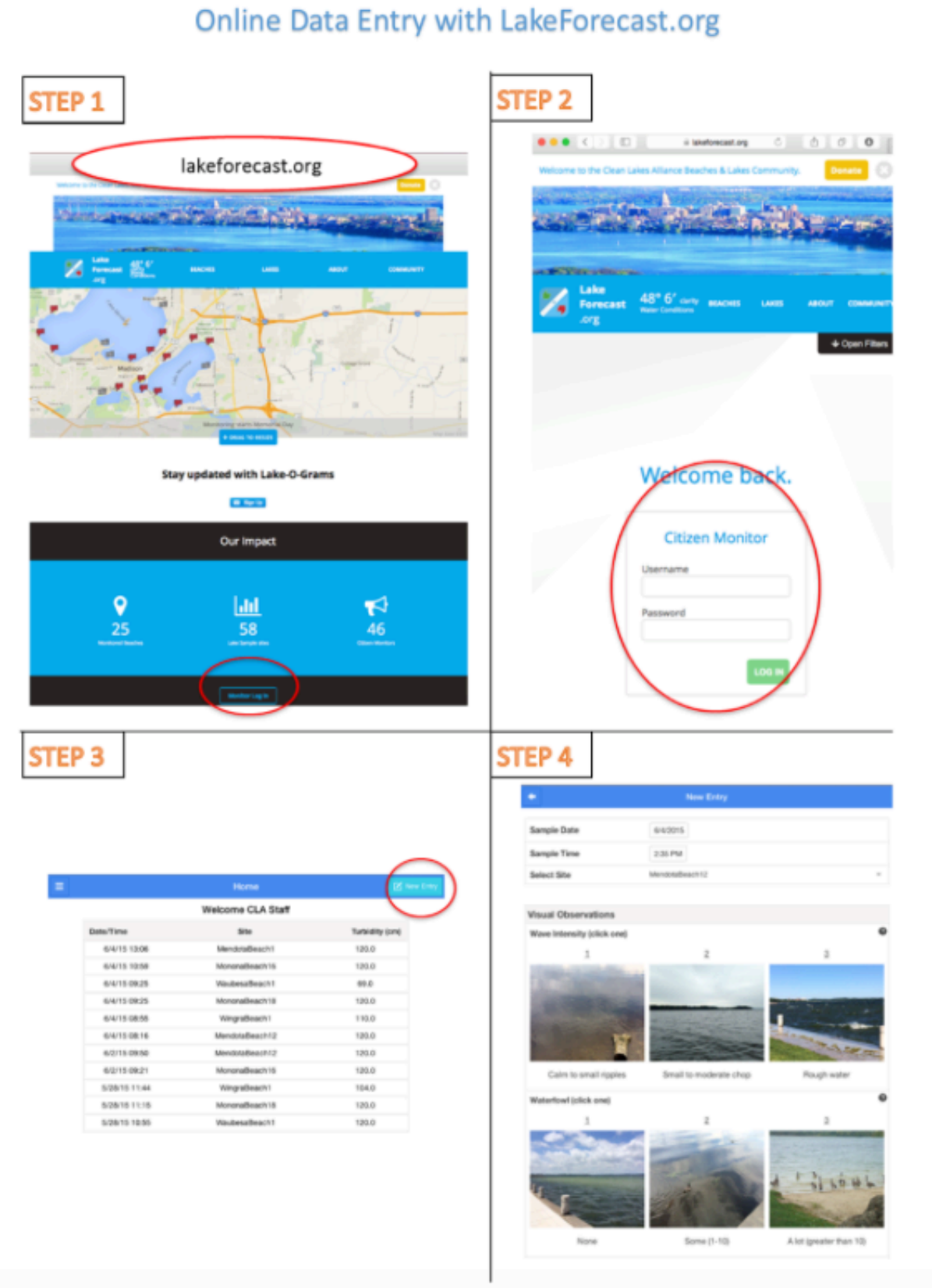
Step 1 – Collect Observations

1. Record all data on the nearshore water quality monitoring data sheet.
    a. Wave intensity on a scale of 1 - 3 (1 = calm to small ripples, 2 = small to moderate chop, 3 = rough water).
    b. Waterfowl presence in the water or at the lake edge, paying particular attention to geese/ducks (1 = none, 2 = some, 3 = a lot).
        i. "Some" signifies between 1 - 10 waterfowl are present.
        ii. "A lot" signifies greater than 10 waterfowl are present.
    c. Algal surface bloom presence (1 = none, 2 = some clear evidence, 3 = strong, extensive presence) within the general vicinity of the sampling area
    d. Algal bloom type (G = green algae, B = blue-green algae or both blue-green and green algae)
    e. Floating, uprooted plant debris abundance (1 = none, 2 = small coverage, 3 = heavy coverage)
    f. Bather load, or the number of people in the water (1 = none, 2 = some, 3 = a lot/crowded).
        i. "Some" signifies between 1 - 10 people are in the water
        ii. "A lot" signifies greater than 10 people are in the water
    g. Water clarity (Good= can see toes, fair= can barely see toes, murky= cannot see toes

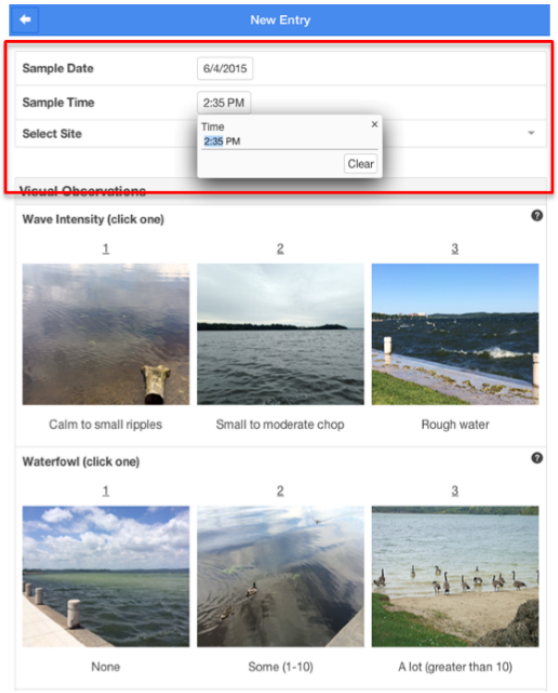
Step 2 – Enter Data

1. After recording your measurements on the paper form, please enter the data into the online submission form on Lakeforecast.org **(https://lakeforecast.org/#/login**) using your username and password provided by Clean Lakes Alliance.

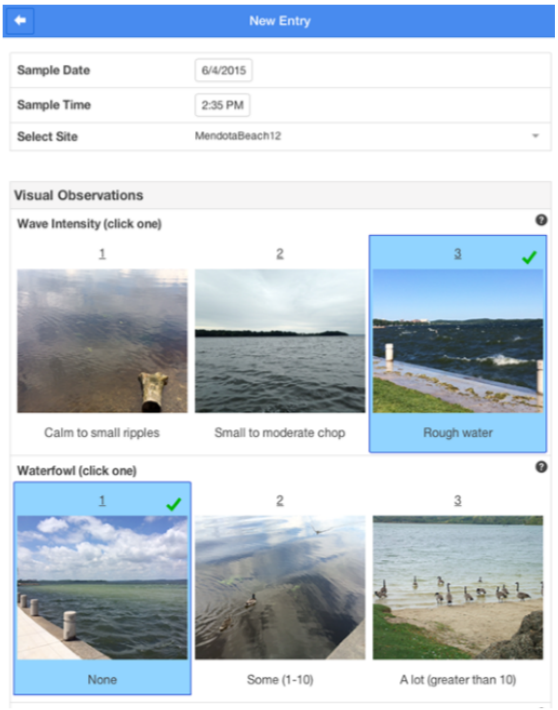
Appendix 4


Online Data Entry with LakeForecast.org
STEP 1
lakeforecast.org
Stay updated with Lake-O-Grams
Our Impact
25
58
46
STEP 2
Welcome back.
Citizen Monitor
Username
Password
STEP 3
Home
New Entry
Welcome CLA Staff
STEP 4
New Entry
Sample Date
Sample Time
Select Site
Visual Observations
Wave Intensity (click one)
Waterfowl (click one)

STEP 5

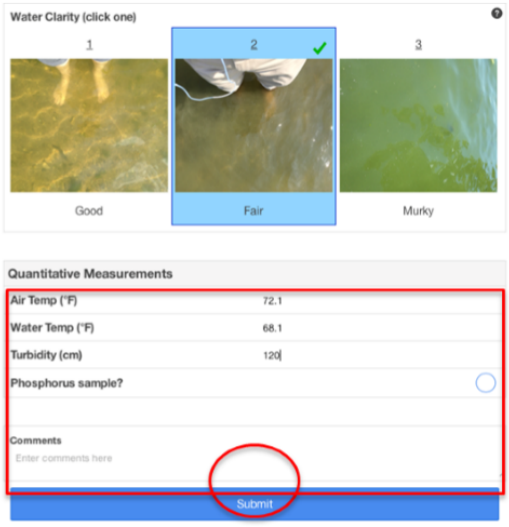


STEP 6



STEP 7

STEP 8



Appendix 5

Instructions for Sampling Secchi Depth (Water Clarity)

A Secchi disk is a black and white checkered disk that is lowered into the water column to measure water clarity. As one of the oldest formalized methods of measuring water clarity, taking Secchi depth allows us to compare water clarity today to measurements taken decades ago. It is also an inexpensive and accurate way to track changing conditions in the open waters of lakes.
This procedure has been adapted from the WI DNR Wisconsin Citizen Lake Monitoring Training Manual.

Equipment/Materials Needed

- Secchi disk
- Two clothespins
- Data recording sheet
- Pencil

General Rules of Sampling

- If waves are greater than about 5", **choose another day to monitor**. Large waves greatly reduce the accuracy of your Secchi reading.
- Similarly, readings are most accurate between 10 a.m. and 4 p.m., because of the angle of the sun. If at all possible, carry out your monitoring during those hours.
- Recording the initials of the sampler is critical, because of how eyesight varies among individuals.
- Always wear your PFD.
- Make sure to anchor your boat in the correct location.
- Take care when dropping the anchor to avoid disturbing sediment, which might then impact your Secchi depth reading.
- Remove your sunglasses before performing the monitoring.
- Sample on the shady side of the boat.
- Get as close to the surface of the water as you safely can.

Sampling Methods

1. Anchor your boat at the sampling location.
2. Fill in the "Sampler and Sample Information" portion of your data sheet.
3. Make the four visual observations found on your data sheet
    a. Cloud cover (estimate the percentage of sky covered by clouds to the nearest 25%)
    b. Wave intensity (1= calm to small ripples 2= small to moderate chop 3= rough water. If whitecaps are visible from your boat, mark a "3")
    c. Water appearance (Estimate whether the water is clearer or murkier than normal)
    d. Water color (it is easiest to judge water color against the white pattern of the Secchi disk at about 1 foot depth)
    e. Feel free to record other observations - such as presence of boaters, waterfowl, or algae blooms

4. Remove your sunglasses, lean over the shady side of the boat to get as close to the water as is safe, and slowly lower the Secchi disk into the water until the black and white pattern disappears.
5. Mark the surface of the water with a clothespin.
6. Lower the disk several more feet, then slowly reel in the rope until the disk reappears.
7. Mark the surface of the water with another clothespin.
8. Find the spot on the rope exactly between the two clothespins - this is your first Secchi reading.
9. Repeat steps 3 - 7 and average your two readings - this is the final value you will report.
10. Record the Secchi depth to the nearest quarter foot.

Data Submission

Please communicate the results of your offshore sampling to Clean Lakes Alliance on a weekly basis. You may call in your results to (608) 255-1000, email or send a picture or scan of your results to luke.wynn@cleanlakesalliance.org.

Satellite Monitoring

By taking readings at the same time as Landsat 7 or Landsat 8 are overhead, you can help improve the ability of this satellite to estimate water clarity on unmonitored lakes. The dates on which the satellite will be overhead of the Madison-area lakes are:

Sunday, May 20th
Monday, May 28th
Tuesday, June 5th
Wednesday, June 13th
Thursday, June 21st
Friday, June 29th
Saturday, July 7th
Sunday, July 15th
Monday, July 23rd
Tuesday, July 31st
Wednesday, August 8th
Thursday, August 16th
Friday, August 24th
Saturday, September 1st
Sunday, September 9th
Monday, September 17th
Tuesday, September 25th

Appendix 6

Sampling Dissolved Oxygen and Temperature with a YSI Multi-probe

The YSI 550A is a handheld instrument that can continuously measure dissolved oxygen (DO) and temperature. We'll be using it to take measurements at various depths at the deepest point of the lake. This instrument requires careful calibration before each use, as well as proper care and maintenance, to measure accurately. The nature of the probe requires that the user specify the altitude and salinity of the water body before operation. The full manual may be found at https://www.ysi.com/File%20Library/Documents/Manuals/605348-YSI-550A-Operations-Manual-RevB_001.pdf.

Equipment/Materials Needed

- YSI 550A case with probe
- Bottle of clean tap water
- Data recording sheet

Membrane Maintenance

The YSI 550A uses a thin semi-permeable membrane (found inside the probe housing) to isolate the electrodes while allowing gases to pass through. It is essential that this membrane is clean and properly installed. If the membrane seems dirty, clean it gently with a lint-free cloth and rubbing alcohol. Check that there are no bubbles under the membrane cap. If you see bubbles or tears in the membrane, please contact Clean Lakes Alliance staff immediately, as the membrane must be replaced.

Calibration

1. Remove the probe from the calibration chamber on the back of the YSI, and ensure that the sponge inside the instrument's calibration chamber is moist. Put the probe back into the calibration chamber.
2. Power the instrument on and allow the readings to stabilize (values do not change significantly over ~10 seconds). This may take 5 to 15 minutes, depending on the age of the instrument and condition of the probe.
3. Press and release both the UP arrow and DOWN arrow keys at the same time to enter the calibration menu.
4. Press the MODE key until "%" is displayed on the right side of the screen for oxygen units. Press ENTER.

5. The screen will prompt you to enter the local altitude in hundreds of feet. Use the arrow keys to increase or decrease the altitude. Our Yahara Lakes are between 840 - 850 ft. above sea level, so select “8” and then press the ENTER key.
6. CAL will now display in the lower left corner of the screen, the calibration value in the lower right corner and the current DO reading (before calibration) will be the main display. Once the current DO reading is stable (it is normal for this to take several minutes), press the ENTER button.
7. The LCD will prompt you to enter the appropriate salinity of the water you are about to analyze. Since we are analyzing freshwater, select “0” and press ENTER.
8. Press the MODE key so that the unit displays the dissolved oxygen reading in mg/L.
9. Look up the expected dissolved oxygen value for your elevation and temperature using the table titled “Dissolved Oxygen Saturation (mg/L) Based on Elevation or Ambient Barometric Pressure” found in the back pocket of your monitoring binder.
10. If the reading on the YSI screen is not within 0.3 mg/L of the value found on the chart, re-calibrate the YSI.
11. **DO NOT turn the unit off** until you are done collecting data for that day.

Calibration Drift Test

After calibration, the dissolved oxygen reading displayed on the screen should not change significantly, as long as the air temperature remains stable. Switch the probe to display dissolved oxygen in % saturation, and leave the probe for about 5 minutes - if the reading changes by more than 5%, please contact Clean Lakes Alliance staff immediately, as the probe likely needs to be cleaned.

Monitoring Procedure

1. We will be taking dissolved oxygen measurements in milligrams per liter, so once the unit is calibrated, verify it is displaying dissolved oxygen in mg/L. If the unit displays % saturation, use the MODE button to switch to mg/L.
2. Place the probe in the lake.
3. Stir the probe so that it is moving at about 1/2 foot per second. This is important because the probe consumes dissolved oxygen while measuring, so if the probe is left in the same place, readings will be artificially low.
4. Allow temperature and dissolved oxygen readings to stabilize. Record.
5. Rinse the probe with clean water, shake off excess water and then store the probe in the calibration chamber. Power off the YSI.

Data Submission

Please communicate the results of your offshore sampling to Clean Lakes Alliance on a weekly basis. You may call in your results to (608) 255-1000, email or send a picture or scan of your results to luke.wynn@cleanlakesalliance.org.

Notes

1. Pressing the down arrow and the MODE buttons at the same time will switch the temperature units between Fahrenheit and Celsius.
2. Pressing the button that looks a star will turn on the backlight.

Appendix 7

Instructions for Sampling *E. coli* Using a Coliscan Water Testing Kit

E. coli bacteria is one of the primary factors that leads to beach closures in our watershed. *E. coli* bacteria is an indicator for potential pathogens in the water. These bacteria are associated with the feces of warm-blooded animals and can be indicative of sewage contamination or polluted runoff.

The most important thing to remember in this procedure is to keep the sample bags, droppers, and petri dishes as sterile as possible--otherwise your sample might be contaminated with outside bacteria or mold that will affect the accuracy of your data.

Equipment/Materials Needed

- Sterile whirl-pak sample bag
- 3 mL Dropper
- Sterile Easygel petri dish
- Coliscan Easygel bottle
- Bleach (for cleanup)
- gallon ziploc bag (for cleanup)
- 2-gallon ziploc bag (for storage of unused petri dishes in blue petri dish bag)
- *E. coli* Count Data recording sheet

General Rules of Sampling

- Do not open the sample bag until just before obtaining your sample.
- Do not rinse the sample bag before obtaining your sample.
- Do not reuse sample bags.
- Do not remove the cover (larger lid) from the petri dish until just before plating your sample.
- Only hold the dropper by the bulb on the end--avoid touching its tip with your fingers.
- If you need to put the dropper down for any reason, place it back in its wrapper to keep it as sterile as possible.
- When labeling the petri dishes, use a black permanent marker, not blue or purple, to avoid confusion when counting the blue/purple bacterial colonies.

Sampling Methods

Step 1 – Coliscan Media Preparation

1. Store bottles of Coliscan in the freezer (this allows them to last up to a year).
2. Take Coliscan media out of the freezer to thaw on the day of sampling. If it is taken out before you leave to go sampling, it will likely be thawed when you get back.

Step 2 – Water Sample Collection

1. Label the white write-on strip with the date and sample site.
2. Sample at approximately 18 inches (knee deep) total depth.
3. Carefully move to the sampling location, while wading slowly in the water.

4. Open a sampling bag, grasp the edges of the opening, and plunge the opening downward into the water **away** from your body to a depth of 12 inches being careful to avoid surface scum and any bottom sediment disturbed by your feet.
5. Reposition the opening of the bag upright to the water surface and away from you. Allow the bag to fill only about ½ to ¾ full as you'll want an air gap to allow for mixing the sample later on.
6. Fold the closing tab over 4 or 5 times, depending on the volume of liquid in the sample.
7. If not testing the sample right away (i.e. if gel isn't quite thawed upon returning after sampling), keep the samples in a cooler with some ice or, for a longer period of time, store your samples in the fridge. If refrigerated, samples can be tested up to 24 hours after collection.

Step 3 – Plating The Petri Dish with Coliscan

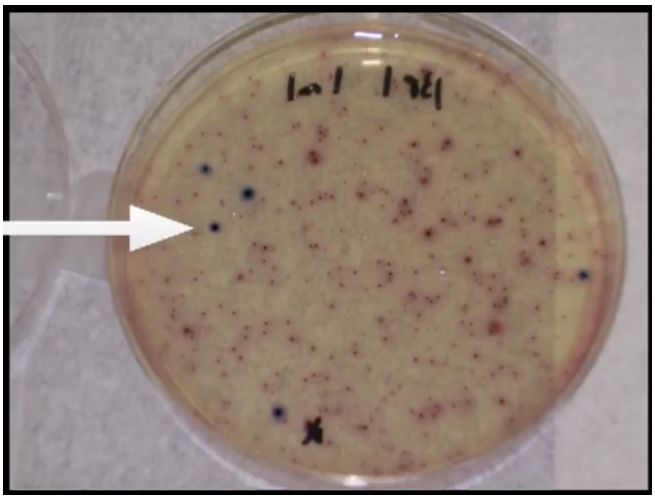
1. Flip the petri dish upside down and label the bottom (the smaller piece that fits inside of the larger lid) with a **black** permanent marker, keeping the petri dish closed as much as possible to avoid contamination. Record the **site number** and the **number of mLs of sample** you will use in the petri dish. The kit will not work for more than 5 mL, so aim to sample 2-3 mL at a time.
2. Turn the petri dish back up with the larger lid on top.
3. Open up one of the pipettes at the bulb end. Avoid touching the tip end. If you need to put the pipette down for any reason, place it back in the plastic wrapping and it will still be considered sterile.
4. Carefully shake the sample bag for 5 seconds, holding on to the closing tab to make sure it doesn't accidentally open.

For a 2 mL sample:

5. Open sample bag (hold it securely with your hand so it doesn't spill).
6. Squeeze the bulb end of your pipette and insert into the sample bag. Avoid touching the sides of the bag with the pipette. Slowly release the bulb to allow water to enter the pipette up to the 1 mL mark (you should see a small 1 mL marker at the base of the pipette bulb).
7. Once at the 1 mL mark, remove the pipette from the bag and release the bulb to allow the 1 mL of water to be sucked up into the bulb-end.
8. Close the tabs on the sample bag. Remove the lid from the Coliscan media bottle and squeeze all of the water in the pipette into the bottle, again making sure not to touch the sides of the bottle. Close the Coliscan media bottle lid.
9. Repeat steps 5-8 for the second 1 mL of sample.
10. When you've added 2 mL of sample to the Coliscan bottle, gently swirl (don't shake) the bottle for 5 seconds.
11. Remove the larger petri dish lid and transfer the Coliscan-sample mixture into the dish. Be sure to keep the lid as close to the petri dish as possible while adding the sample as this will minimize outside mold or bacterial contamination.
12. Swirl the petri dish once to assure the liquid evenly coats the bottom of the dish, and then leave the petri dish covered and undisturbed for about 60-90 minutes.
13. After 60-90 minutes, the liquid in the petri dish should have turned into a gel. Once the petri dish gel has solidified, **flip the petri dish upside down** (with the larger lid now on the bottom). Otherwise, condensation will form and drip onto your sample, affecting the accuracy of your data.

Step 4 – Incubating and Identifying the *E. coli* colonies

1. Store the petri dish at room temperature away from direct sunlight. Aim for somewhere with a little heat such as the top of your fridge, the top of your water heater, or just a countertop. Record the start date and time of the incubation on your data sheet. After about 2 days (44 - 54 hours at ~70°F) the colonies will be established enough for identification.
2. After the 2 days, you'll see both pink and dark purple/blue colonies on the petri dish. The pink colonies are coliforms found nearly everywhere, but the dark purple/blue colonies are *E. coli.* Record the end date and time of the incubation. Count the dark purple/blue colonies.
3. The standard unit of measurement for monitoring *E. coli* bacteria is the number of bacteria per 100 ml of sample. To do that, take the 'number of colonies counted' divided by the 'ml of sample', and then multiply that number by 100.



The white arrow is pointing at an *E. coli* colony. Note the darker color.
This plate has five *E. coli* colonies.

If this is a 1 mL sample, then you'd obtain your *E. coli* number by:

(4 colonies **/** 1 mL) ***** 100 **= 400 CFU/mL**

CFU= colony forming unit

Step 5 – Record your data

Record your measurements on the paper *E. coli* Count Data sheet. Notify Anna Weinberg via email at anna.weinberg@cleanlakesalliance.org if results are over 1,000 CFU/mL. Otherwise, continue to record your data and send your results once per month via email to Anna.

Step 6 – Cleanup

1. Once you've incubated your bacterial cultures and recorded your data, wipe down your incubation and sampling areas with bleach.
2. Put your used petri dishes into a gallon-sized ziploc bag. Add bleach and close the bag.
3. Shake the bag to coat the dishes with the bleach. Then, dispose of the closed bag into the trash.

Appendix 8

Instructions for Sampling Microcystin Using a QuickLyse Water Testing Kit

Microcystin is one of the primary toxins created by Cyanobacteria (blue-green algae) that leads to beach closures in our watershed.

The most important thing to remember in this procedure is to keep the sample vials and pipettes as sterile as possible--otherwise your sample might be contaminated with outside bacteria that will affect the accuracy of your data.

Equipment/Materials Needed

- Microcystin test strips
- Sample collection vials
- Lyse vials
- Graduated disposable pipets (1 mL)
- Forceps
- Reagent Papers
- Conical test vials
- Transfer pipet

General Rules of Sampling

- Do not open the sample collection vial until just before obtaining your sample.
- Do not rinse the sample collection vial before obtaining your sample.
- Do not reuse materials.
- Only hold the pipet by the bulb on the end--avoid touching its tip with your fingers.
- When labeling the petri dishes, use a black permanent marker, not blue or purple, to avoid confusion when counting the blue/purple bacterial colonies.

<u>Sampling Methods</u>

Step 1 – Collect Sample and Transfer

1. Fill sample collection vial with lake water
2. Using graduated pipette transfer 1 mL of sample to the lysis vial
3. Cap and shake lysis vial for 2 mins; let rest for 8 mins

Step 2 – Add Reagent Paper

1. Using the forceps provided, add 1 reagent paper to the lysis vial.
2. Cap and shake for 2 mins; let rest for 8 mins

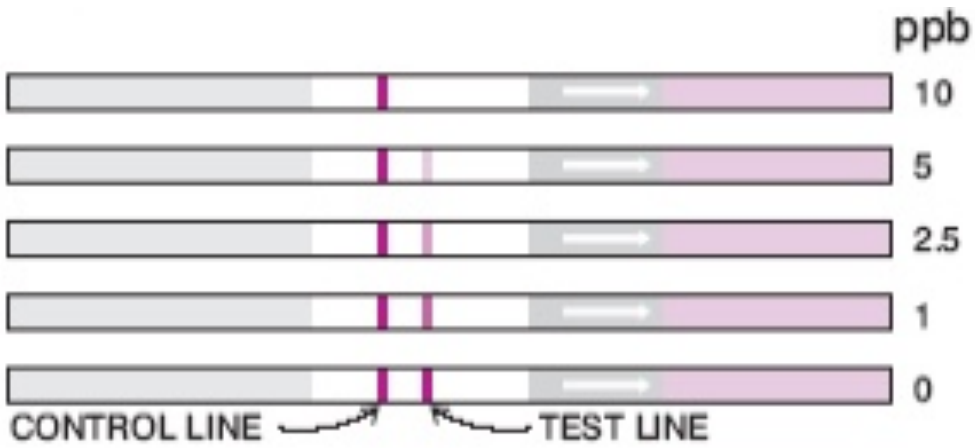
Step 3 – Transfer (conical tube)

1. Using the transfer pipette (NOT graduated) add 7 drops from lysis vial to the conical, flip-top tube
2. Close the conical tube and shake for 30 seconds
3. Sample should turn purple

Step 4 – Add Strip

1. Insert test strip into conical tube with the arrow pointing down
2. Let sit for 10 mins
3. Remove test strip, lay flat and allow to dry for 5 mins

Step 5 – Interpret



Make sure to perform the reading within 5 – 10 mins of removal from sample

Step 6 – Record

Record your measurements on the google form provided via email. If you are having trouble locating the correct form feel free to reach out to Bryan O'Reilly (beoreilly@wisc.edu) and he will send it to you.