University of Rhode Island Watershed Watch

Clean Up Sound and Harbors (CUSH) Monitoring Manual

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CUSH MONITORING MANUAL
Section 1

URI Watershed Watch

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1. WELCOME TO THE URI WATERSHED WATCH PROGRAM

URI Watershed Watch is a statewide volunteer water quality monitoring & citizen science program. The focus is on educating people and providing current information on the water quality of lakes, ponds, reservoirs, rivers and estuaries throughout Rhode Island. The heart of the program consists of weekly or biweekly monitoring at specified locations by trained volunteer monitors. Water quality is a reflection of the activities in the water itself as well as in the lands and waters that surround and lie upstream. It is our hope that this program will encourage communities, shore side homeowners, recreational users, and local residents to understand the need to cooperatively manage and improve the water. In this way we all will ensure that Rhode Island's water resources remain one of the state's great assets.

URI Watershed Watch one of several Cooperative Extension Water Quality Programs in the Department of Natural Resources Science in the College of the Environment and Life Sciences at the University of Rhode Island. URI Cooperative Extension provides much of the staff support and laboratory facilities. The program also relies on the time and financial support of many organizations throughout the state.

URI Watershed Watch (URIWW) works with municipalities, watershed organizations, land trusts, and the Rhode Island Department of Environmental Management to determine which water bodies should be monitored. This program began in 1988 as a cooperative effort between the URI's Natural Resources Science Department and the Wood-Pawcatuck Watershed Association. At this point more than eighty organizations throughout Rhode Island and eastern Connecticut have sponsored water quality monitoring efforts by many, many volunteers, more than 300 each year. Clean Up Sounds and Harbors, Inc. joined URIWW in 2008 to better understand the current, and hopefully improving conditions, of the critical coastal resources of Stonington and Mystic Harbors, the Mystic River, Pequotsepos and Wequetequock Coves, and the major freshwater streams that feed them. Each URIWW sponsoring organization financially supports monitoring on locations of particular concern or interest to them. URI Watershed Watch provides all monitoring equipment, supplies, and training, as well as conducting laboratory analyses, data analysis, and reporting results.

In 1992 the Rhode Island Department of Environmental Management (RIDEM) recognized the value of the quality data collected by the volunteers in the URI Watershed Watch program. It is considered equivalent to professional data and is used in reporting to the State as well as to federal agencies, by researchers and environmental consultants. In 2006 our analytical laboratory attained certification by the Rhode Island Department of Health as a licensed analytical laboratory and we work diligently to maintain that high quality that certification requires.

This manual provides the step-by-step instructions for water quality monitoring on sites selected and sponsored by CUSH. Coupled with field training and proper equipment, our dedicated volunteers are significantly expanding the water quality information and data available on our waterbodies, a critical first step to their protection, management and enhancement. *Without a doubt, it is the dedication of the volunteers that makes this program a success.*

Why Monitor?

Ecological monitoring* has been defined as repetitive measurements or observations recorded over time for the purpose of determining a condition or tracking a trend or change. Long-term ecological monitoring is necessary before drawing conclusions as to cause and effect of observed changes. These changes are often gradual and subtle. The question is whether they represent trends or natural fluctuations. In general, these studies have shown that:

- Complex ecological systems require long-term observation for understanding;
- A single sample says nothing about its environment – it only speaks about the sample itself;
- A sequence of only two to three years of data can be very misleading about the direction of changes in environmental quality;
- Environments have a "memory" or response time, which varies greatly. It takes a certain amount of time to detect a change – perhaps a decade for lakes and even a century for soil.

While those involved in citizen monitoring efforts are usually not trained scientists, they can, with relatively little training and simple equipment, collect information that can make a significant contribution.

Another important value of monitoring is revealed through changes in individual behaviors due to increased knowledge, appreciation, and stewardship of the environment being studied.

*exerted from the Great Bay Watch, University of New Hampshire Cooperative Extension

URI Watershed Watch Goals

The URI Watershed Watch program is an educational program with four main goals:

- Promote active individual participation in water quality protection;
- Educate the public about water quality issues;
- Obtain multi-year surface water quality information and data to ascertain current conditions and to track trends;
- Encourage management programs based upon sound water quality information

CUSH, INC.
CLEAN UP SOUND & HARBORS

Safety First

Being a Watershed Watch volunteer with the Clean Up Sound and Harbors usually involves going out on the water. It also involves using chemical reagents to perform water quality tests. For your protection, here are some simple rules to follow. The most important is to use common sense and ***remember that your safety is far more important than any monitoring data.*** *This list is not meant to be exhaustive. For more information see* https://www.uscgboating.org/recreational-boaters/

Before going to your monitoring location:

- ❑ Keep a first aid kit in your vehicle or vessel
- ❑ Check for beach closures and/or advisories at https://portal.ct.gov/DEEP/State-Parks/Recreation-Information/State-Swimming-Area-Water-Quality-Report
- ❑ Check the weather report for storm alerts, watches, or warnings
- ❑ If you are monitoring alone, alert someone in advance that you will be monitoring and check in when you are done
- ❑ Apply sunscreen, bug repellent, and wear a hat
- ❑ Make sure you have all your monitoring supplies
- ❑ Familiarize yourself with all monitoring instructions

Upon arrival at your monitoring location:

- ❑ Park legally, and as far off the roads as possible; leave your vehicle flashers on if you have any concerns. We can provide you with a laminated ID card for your vehicle if you wish.
- ❑ No trespassing! Please obtain property owner permission if you will be crossing or on private land.
- ❑ Think about your footing while traveling to your monitoring site, watch your step! Watch and plan for
    - Steep and eroding slopes,
    - Tree roots and debris, plants and vines that tangle and scratch, poison ivy,
    - Loose or wet slippery rocks,
    - Ticks, spiders, snakes, snapping turtles, unfriendly dogs or waterfowl

When readying to go on the water and when you are on the water:

- ❑ **Monitor with a partner if possible.** "Safety in numbers" and improved data collection too.
- ❑ Familiarize yourself with all monitoring instructions *before* you go on the water.
- ❑ **Wear a personal flotation device.**
- ❑ If your boat has a motor, bring along oars or paddles too
- ❑ Have an anchor with an attached anchor line on board
- ❑ **Bring along a supply of drinking water**, especially in the summer
- ❑ Watch out for other boats on busy days – especially those towing water-skiers!
- ❑ **Stay off the water if high winds, a storm, or lightning is expected soon or has started**
- ❑ Stay off the water if you do not feel well
- ❑ **Wearing plastic gloves when you monitor is advisable**, especially if monitoring within 24 hours of a storm, there are algae blooms, other debris, or you have any water concerns

Safety When using monitoring kits:

- ❑ Familiarize yourself with all instructions. Read and follow the material safety sheets and safety instructions that come with each kit.
- ❑ Follow the instructions step-by step, in the order written
- ❑ Keep a supply of paper towels, some dampened, on hand to quickly mop up spills
- ❑ Wear glasses or goggles and gloves when using test kit chemical reagents
- ❑ Avoid contact between chemical reagents and your skin, eyes, nose, mouth
- ❑ Use stoppers or bottle caps, not your fingers or hands, to cover bottles during shaking or mixing
- ❑ **If you spill anything on yourself, immediately flush thoroughly with *lots* of water. It is perfectly acceptable to use nearby lake, stream or salt water – do NOT wait until you get home or to a faucet!**
- ❑ Rinse and wipe up any regent chemical spills, liquids, or powder as they occur
- ❑ Thoroughly rinse all your testing apparatus with tap water after use
- ❑ Thoroughly wash your hands after performing your tests, even if you wore gloves
- ❑ Keep equipment and chemical reagents out of sunlight, extreme heat or cold (such as car trunks), or moist areas (such as under sinks)
- ❑ Keep all equipment and supplies away from children, just like you would household cleaning products

If you have *any* questions or concerns call URI Watershed Watch at (401)-874-2905

- If you believe that you have observed an algae bloom contact your or the CT Department of Energy and Environmental Protection (860 424-3020), or send an email to deep.algalblooms@ct.gov
- For Health Concerns: If you have questions about health effects or exposure concerns, contact the DPH Environmental Health Section's Public Beach Program (860 509-7758).

What We Monitor:

URI Watershed Watch water quality measurements for CUSH Sites Monitoring

BIWEEKLY

Algal Biomass* (estimated by chlorophyll content)
Water Temperature
Dissolved Oxygen
Salinity* (bottles collected and stored in your refrigerator)
Water Clarity (optional) (measured by Secchi Disk Transparency)

WATER COLLECTION DAYS

(Approximately every four weeks)
A suite of water samples is collected by program volunteers brought to a central collection area, and then to URI to be analyzed by URI Watershed Watch staff for:
Fecal coliform & Enterococci Bacteria
Total, Nitrate, and Ammonia Nitrogen
Total and Dissolved Phosphorus
Salinity *laboratory analysis of by WW staff

Where we monitor: Pinpointing your monitoring location

All URI Watershed Watch volunteers monitor a specific location for an entire monitoring season. Sites have been especially selected by Clean Up Sound and Harbors to address questions or concerns the group has based on local knowledge and decades of monitoring. Sites may need to be monitored from a boat or kayak, and others are monitored from a dock. Exact directions for locating your monitoring site will be provided by the CUSH coordinator.

2021 Clean Up Sound and Harbors Monitoring Locations:

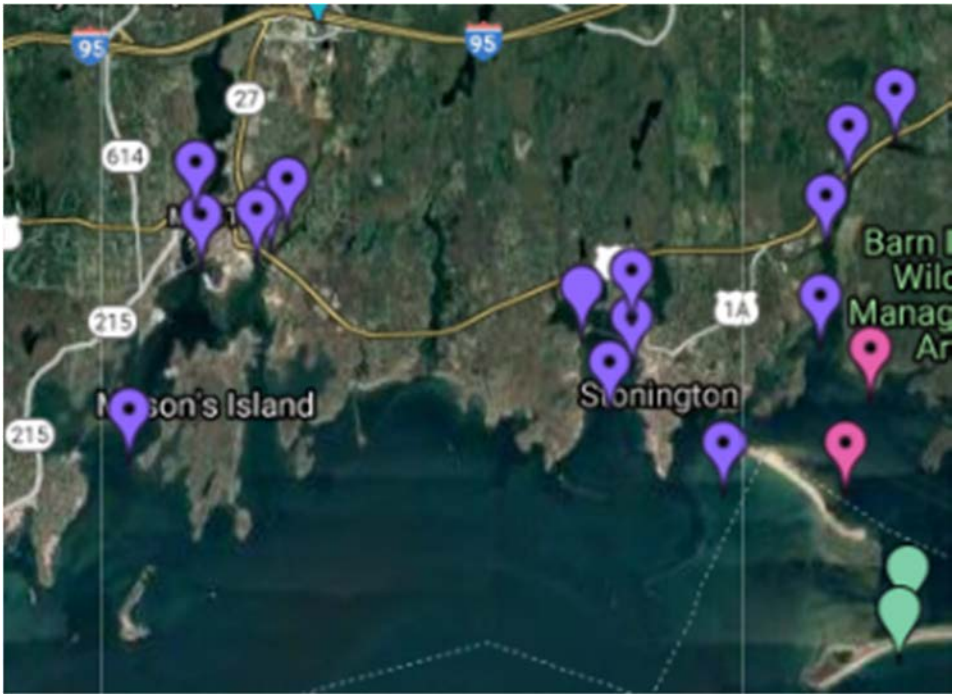
Mystic River
- Whitford Brook
- Mystic Seaport North
  (Latitude 41 floating dock N corner)
- CUSH - Mystic Seaport South
  (Shipyard Pt floating dock W end)
- Mystic River Park

Mystic Harbor
- Red Bouy 24
- Green Bouy 29
- Red Daybeacon 4
- Noank Village Boatyard

Pequotsepos Cove
- North of Route 1

Stonington Harbor
- Mid Harbor – Off Town Dock
- Sandy Point West (East of breakwater)

Wequetequock Cove
- Oxecosset Brook
- Inlet
- Head
- Mouth



(CUSH sites in purple)

CUSH Water Quality Monitoring Supplies

- ❑ Monitoring Manual
- ❑ URI Watershed Watch postcards
- ❑ Water sampler (for deep locations)

  LaMotte Sampler - clear w/ gray ends with calibrated line & weight
- ❑ Water sample bottles

Shallow Locations	Deep Locations
250 ml white plastic bottle with "sterile" label across lid	250 ml white plastic bottle with "sterile" label across lid
Plastic bottle, labeled for 0.5m pH (magenta label)	Plastic bottle, labeled for 0.5m pH (magenta label)
Brown glass bottle (250 or 120 ml) (magenta label), "0.5m unfiltered"	Brown glass bottle (250 or 120 ml) (magenta label), "0.5m unfiltered"
	Brown glass bottle (120 or 250 ml) (green label), "3.0m unfiltered"
	Plastic bottle, labeled for 3.0m pH (green label)
Small plastic or brown glass bottle(s) for lab measurement of salinity (magenta label)	Small plastic or brown glass bottle(s) for lab measurement of salinity (magenta & green label)

- ❑ Chlorophyll filtration apparatus (stored in a resealable plastic bag)
  - 2 - 250 ml chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
  - 60 ml syringe (marked at 50 ml)
  - 2 white plastic filter holders
  - glass fiber filters (stored in 35 mm film canister)
  - tweezers
  - squeeze bottle of magnesium carbonate
  - resealable bag containing desiccant chips (labeled with site name)
  - sheet of chlorophyll filter sample labels
  - blotting paper (supplied by volunteer - coffee filter, paper towel)
  - aluminum foil squares (supplied by volunteer)
- ❑ Thermometer (usually stored in bag of chlorophyll supplies)
- ❑ Dissolved Oxygen kit (stored in a plastic box)*:*
  - goggles and gloves for safety
  - clear glass dissolved oxygen bottles (2 or 3, site dependent)
  - 25 ml graduated cylinder for precision
  - Titrator vial (glass with plastic lid with a hole in it)
  - Titrator (small syringe with pink tip)
  - Reagents (#1 manganous sulfate solution, #2 alkaline potassium iodide azide)
  - Sulfuric acid
  - Sodium thiosulfate
  - Starch indicator

CUSH Water Quality Monitoring Check List

BIWEEKLY, ON THE WATER

Shallow locations

- pencil and notepad
- monitoring postcard
- personal flotation device
- location map
- plastic chlorophyll sample bottles (2)
- thermometer
- clear glass dissolved oxygen bottles (2)
- insulated cooler bag

Deep locations

- pencil and notepad
- monitoring postcard
- personal flotation device, anchor
- location map
- **water sampler w/attached line and weight**
- plastic chlorophyll sample bottles (2)
- thermometer
- clear glass dissolved oxygen bottles (3)
- insulated cooler bag

BIWEEKLY, ON SHORE

Set out these items either indoors or out of direct sunlight, *before* you go out on the water:

- ❑ *Chlorophyll filtration apparatus, which includes*
  - syringe
  - round white plastic filter holders
  - small filter circles (stored in 35mm film canister)
  - tweezers
  - white flip-spout squeeze bottle (labeled magnesium carbonate)
  - blotting/wrapping filters (your own-coffee filter, paper towel)
  - aluminum foil squares (your own)
  - sheet of location labels
- ❑ *Dissolved oxygen kit*
  - goggles and gloves, plus paper plate and paper towels for safety
  - 25 ml graduated cylinder for precision
  - Titrator vial (glass with plastic lid with a hole in it)
  - Titrator (small syringe with pink tip)
  - Reagents (#1 manganous sulfate solution, #2 alkaline potassium iodide azide)
  - Sulfuric acid
  - Sodium thiosulfate
  - Starch indicator
- ❑ *Field Data sheet*

****

***ON THE WATER COLLECTION DAYS,* biweekly supplies *and*:**

Shallow locations

- Dated sample bottles in plastic bag

Deep locations

- Dated sample bottles in plastic bag

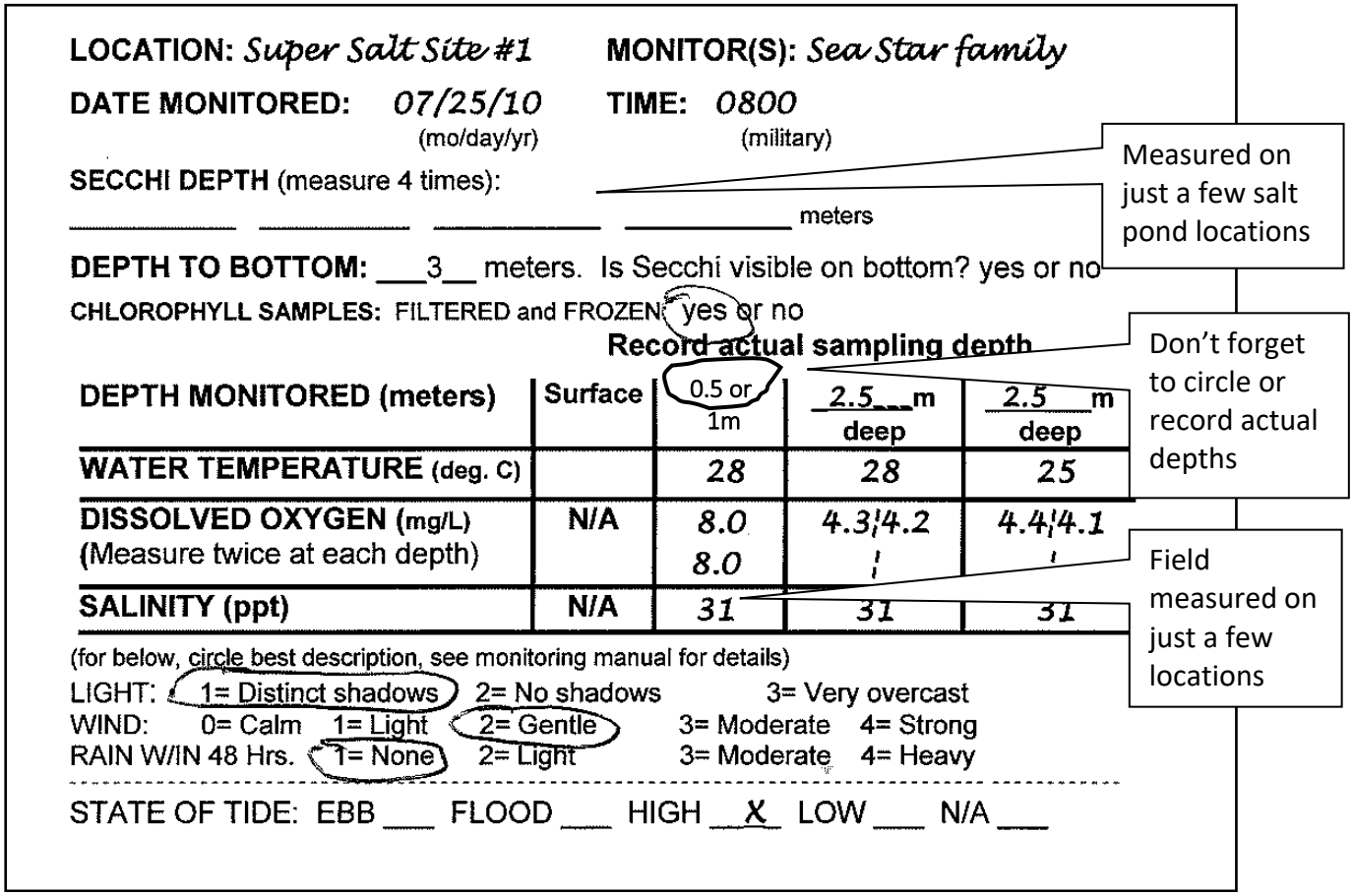
Monitoring Postcard Instructions

Your monitoring supplies contain a set of monitoring postcards. Please fill one out each time you complete your water quality monitoring. The postcards are pre-stamped.

Please be sure to mail it to us right away.

IT IS CRUCIAL THAT YOU WRITE YOUR NAME, YOUR LOCATION AND THE DATES ON THESE POSTSCARDS! Without this information, the valuable data you collected is useless. Please check over your postcard before you mail it to be sure you have included everything needed. **Don't forget to include actual sample depths and sampling time (when you started). Deep sampling depth should NOT be the bottom depth, your deep depth should be 0.5 – 1 meter FROM the bottom**. Shallow depths are typically 0.5 meters, about mid-biceps, or halfway to the bottom. Wrist depth is about 0.15 meters deep, elbow depth is about 0.3 m. Please write in the actual depth, especially if it is less than 0.5 m.

Monitoring Postcard:



LOCATION: *Super Salt Site #1* MONITOR(S): *Sea Star family*

DATE MONITORED: *07/25/10* (mo/day/yr) TIME: *0800* (military)

SECCHI DEPTH (measure 4 times): _____ _____ _____ _____ meters

DEPTH TO BOTTOM: ___3__ meters. Is Secchi visible on bottom? yes or no

CHLOROPHYLL SAMPLES: FILTERED and FROZEN: yes or no

Record actual sampling depth

DEPTH MONITORED (meters)	Surface	0.5 or 1m	2.5 m deep	2.5 m deep
WATER TEMPERATURE (deg. C)		28	28	25
DISSOLVED OXYGEN (mg/L) (Measure twice at each depth)	N/A	8.0 8.0	4.3¦4.2 ¦	4.4¦4.1 ¦
SALINITY (ppt)	N/A	31	31	31

(for below, circle best description, see monitoring manual for details)

LIGHT: 1= Distinct shadows 2= No shadows 3= Very overcast

WIND: 0= Calm 1= Light 2= Gentle 3= Moderate 4= Strong

RAIN W/IN 48 Hrs. 1= None 2= Light 3= Moderate 4= Heavy

STATE OF TIDE: EBB ___ FLOOD ___ HIGH __X__ LOW ___ N/A ___

Measured on just a few salt pond locations

Don't forget to circle or record actual depths

Field measured on just a few locations

Please read the monitoring postcard carefully. Some additional information is occasionally requested from certain monitors or groups and will have been described during your training. If you still have questions, call us at 401-874-2905.

Details of environmental codes are on the next page….

Codes for the Environmental Conditions:

These codes describe environmental conditions when you are monitoring. Please enter the code number that best describes the conditions on your monitoring postcard.

LIGHT CONDITIONS:

Code #	Description
1	Bright, distinct shadows
2	Cloudy-bright, no shadows
3	Heavily overcast

WIND SPEED:

Code #	Wind Velocity (mph)	Weather Term	Condition of Water surface
0	0	Calm	Completely calm
1	1 - 7	Light	Smooth or rippled to small wavelets
2	8 - 11	Gentle	Large wavelets, crests begin to break, few whitecaps
3	12 - 16	Moderate	Small waves, frequent whitecaps
4	17 - 24	Fresh	Moderate crested waves, many whitecaps
5	25 - 35	Strong	Large waves, white foam crests everywhere, wind blown spray – **too dangerous for monitoring!!!**

RAIN WITHIN 24 HOURS:

Code #	Description
1	None within the last 48 hrs
2	Light < 0.5 inch within the last 48 hrs
3	Moderate 0.5 – 1 inch within the last 48 hrs
4	Heavy > 1 inch within the last 48 hrs

Salinity is measured in the field at just a few locations. For CUSH sites you will be collecting and storing in your refrigerator samples that will be analyzed by the CUSH local coordinator or in the URIWW lab later. If you aren't measuring salinity yourself, leave those cells blank on the postcard.

Online Field Data Entry Instructions

(Field SOP 014) Updated 2021

Using URI Watershed Watch's Online Data Entry

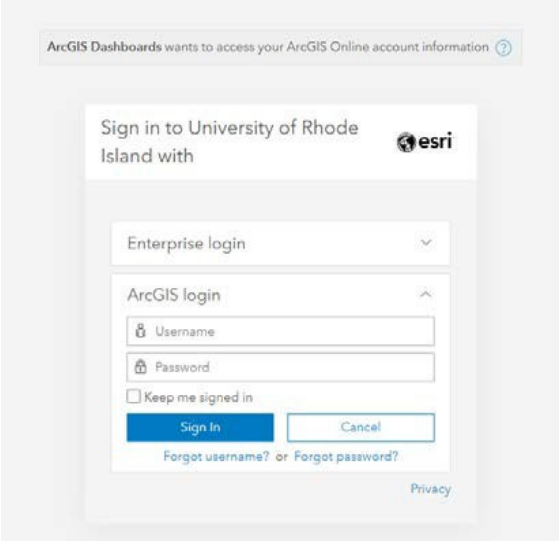
This platform performs best when accessed using either Firefox or Chrome web browser.

Navigate to the URIWW website

- **http://web.uri.edu/watershedwatch/**
- **Click "Data" from top menu > Choose "Online Data Entry"**

You will be prompted to **sign in to URI's platform**.

- Select **ArcGIS Login** using the following login credentials.
  - Username: **URI_WatershedWatch**
  - Password: **URI_ww_2021**



The Watershed Watch Monitor: Data Entry App will load. This may take a few seconds.

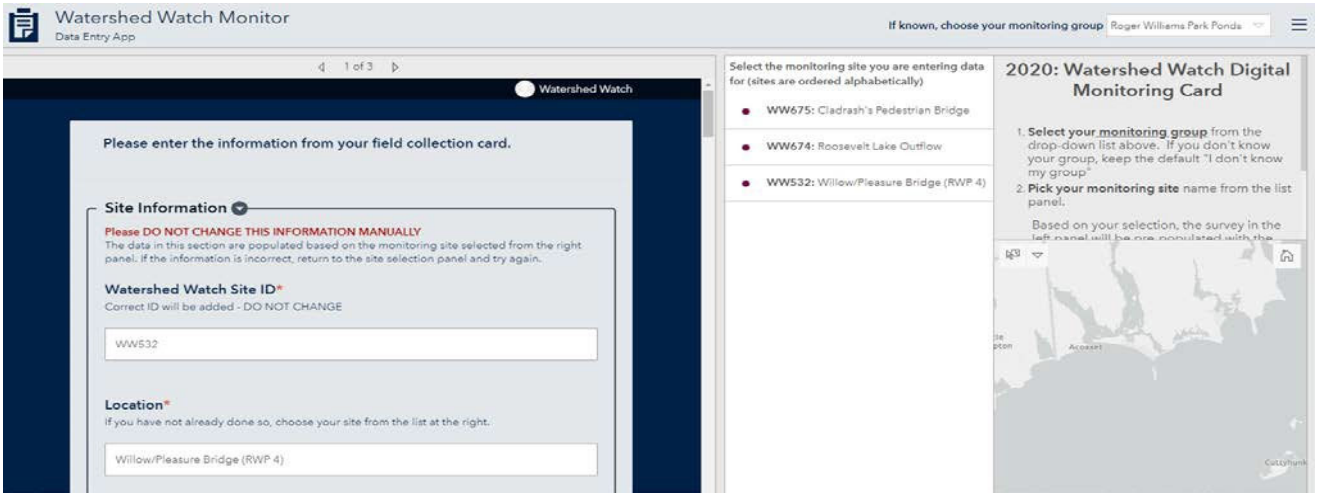
Watershed Watch Monitor: Data Entry App

Select your site using the site list panel

- Scroll through the alphabetized site name list panel to find your monitoring location

Or choose your **monitoring group** first to get a smaller list of sites.

- From the drop-down selection box in the upper right-hand corner, pick your group, *Clean Up Sound and Harbors – which is listed as CUSH.*



Entering Data

- Click on your monitoring site from the site list panel.
- The **field collection card** on the left is automatically populated with **Site information**.
    - Station ID (WW##)
    - Location
    - Monitoring Group

<u>Please do not change this</u>.

If your information is not there or is not quite correct, please contact us to adjust or to confirm your monitoring site.

Scroll through the **field collection card** to begin entering your information.

- **Field Collection Data**
    - **Monitor(s) Name:** Type your name, and that of any others monitoring with you.
    - **Date Monitored:** Select the monitoring date and time from the drop down.

Scroll through the survey to enter the remaining data into the appropriate fields from your monitoring postcard or field datasheet.

Note: there are required data fields that must be completed before the system will allow you to submit your data.

- **Picture of site conditions:** Photos of your monitoring site, especially if it is experiencing an algal bloom or other unusual condition are welcome and can be uploaded with this data.

Click "Submit" to upload your data to the data dashboard.

Please check "entered online" on your postcard, turn postcards in at water collections. We will use your hard copy to proof online results.

Please contact Elizabeth (874-4552 or eherron@uri.edu) if you have any questions or problems entering your field monitoring postcard data.

Example Water Quality Biweekly Monitoring Schedule

URI WATERSHED WATCH 2020 WATER QUALITY MONITORING SCHEDULE

Stonington Harbor, Sandy Point, and Wequetequock Cove (varies with sites)

All monitoring and water sample collections will take place between 6 and 8:00 am – please collect as close to red times as possible. Please contact **Jack Leary** (860-319-7568) Monitoring Coordinator for questions or concerns. Please contact Elizabeth Herron, URI Watershed Watch, (401) 874-4552 for sampling and testing methods questions or concerns. Also see the URIWW website http://web.uri.edu/watershedwatch/

Please maintain your monitoring equipment safe by wiping down with sanitizing wipes after each use.

Sampling Dates	**Biweekly monitoring: Collect & run samples in "WORK HORSE" BOTTLES for temp., salinity, chl-a, DO & turbidity**	**WATER COLLECTION DATES: Fill sample bottles & bring with frozen chl-a filters to the collection site for analysis of pH, nutrients, bacteria, salinity and turbidity**
June 3		**Volunteer equipment pickup**
June 10 **6 - 8** (E)	**X – plus water collection** 7:57 am low tide	**1st Monthly Collection:** Brown glass, bacteria & pH bottles, frozen chl-a filters, turbidity bottles, salinity bottles, postcards to collection site
June 24 **6:30 – 8** (F)	6:44 am low tide	Temperature, DO, chl-a filters into freezer, turbidity and salinity bottles into fridge
July 8 **6:30–8** (F)	**X – plus water collection** 6:36 am low tide	**2nd Monthly Collection:** Brown glass, bacteria pH bottles, frozen chl-a filters, turbidity bottles, salinity bottles, postcards to collection site
July 22 **6 - 8** (F)	5:31 am low tide	Temperature, DO, chl-a filters into freezer, turbidity and salinity bottles into fridge
August 5 **6 – 8** (F)	**X – plus water collection** 5:22 am low tide	**3rd Monthly Collection:** Brown glass, bacteria bottles, frozen chl-a filters, turbidity bottles, salinity bottles, postcards to collection site
August 19 **6 – 8** (F)	9:48 am high tide	Temperature, DO, chl-a filters into freezer, turbidity and salinity bottles into fridge
September 2 **6 – 8** (F)	9:45 am high tide	Temperature, DO, chl-a filters into freezer, turbidity and salinity bottles into fridge
September 9 **6 – 8** (E)	**X – plus water collection** 8:56 am low tide	**4th Monthly Collection:** Brown glass, bacteria bottles, frozen chl-a filters, turbidity bottles, salinity bottles, postcards to collection site
September 23 **6 – 8** (E)	9:00 am low tide	Temperature, DO, chl-a filters into freezer, turbidity and salinity bottles into fridge
October 7 **6 – 8** (F)	5:50 am low tide	Temperature, DO, chl-a filters into freezer, turbidity and salinity bottles into fridge
October 21 **6 – 7:30** EF)	**X – Plus water collection Return all monitoring equip.** 7:35 am low tide	**5th Monthly Collection:** Brown glass, bacteria bottles, frozen chl-a filters, turbidity bottles, salinity bottles, postcards to collection site **End of monitoring**

Handling and Transporting Water Samples

Keep 'em cold & NO Smoking!!!

How you handle your water samples once they are out of the water is extremely important in ensuring that the results of what you test truly reflect the condition of the water. Sunlight and warm air temperatures can dramatically affect your samples. Here are some important points for transporting your water samples:

Before you go on the water:

- Bring a cooler/bag and a frozen cold pack with you for chlorophyll monitoring and on water collection days.
- Have a zip lock bag and a separate cold pack on shore to store your chlorophyll filters in.
- On hot, sunny days store your deep water sampler in the cooler/bag while you are on your way out to your monitoring site. (The temperature of the sampler can raise the temperature of the water inside it.)

On the water, after you collect your water samples:

- Check the water temperature of one sample and then…
- Immediately put your two chlorophyll bottles in the cooler/bag.
- It is a good practice to store your dissolved oxygen bottles in the cooler/bag too!
- If you forget your cooler at least store your water samples out of the direct sunlight.

On-shore:

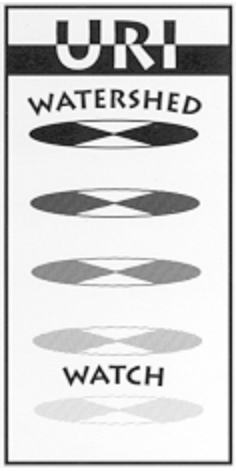
- ***NO SMOKING!*** It will affect the amount of ammonia-N in your water (no kidding!)
- Find some shade! Chlorophyll filtering must be done out of direct sunlight if outside and in subdued light if indoors.
- Keep the processed filters cold! If you filter your samples at home put the filters right in the freezer when you are done. If you aren't home, put the filters in a zip lock bag next to a cold pack. Do not store the filters directly on ice.
- Water samples should be stored in your refrigerator until you are ready to send them to the URI Watershed Watch laboratory.

Bringing your water samples and chlorophyll filters to the URIWW lab:

- ***KEEP 'EM COLD!*** Use an insulated cooler/bag with cold packs or ice. If you choose to use ice, please put the ice in *its own* zip lock bag *or* put your water bottles in a bag so that the melting ice doesn't cause the labels to slip off your bottles.
- Please put your bag of chlorophyll filters right next to a cold pack. Either put the pack inside the zip lock bag with your filters or use a rubber band to keep the chlorophyll bag right next to the cold pack

Clean Up Sound and Harbors coordinates sample delivery to URI Watershed Watch:

- Bring your samples to your designated site in a cooler.
- Pick-up your replacement bottles from the transport cooler or location.
- Contact Jack Leary (jack.leary@yahoo.com) in advance if possible if you have any questions or need any additional replacement supplies.



URI Watershed Watch
SALT WATER SITES MONITORING MANUAL
Section 2

How to Monitor - Monitoring Summaries

Table of Contents

How to Monitor: Dockside Locations - Biweekly

Biweekly (Every Other Week) Monitoring

Chlorophyll, Dissolved Oxygen, & Water Temperature

This section summarizes the monitoring procedures used for monitoring from the ends of docks. Detailed descriptions of each individual procedure can be found in *Section III, Specific Monitoring Techniques.*

Remember that some of the chemical reagents in your kits are dangerous. All of your supplies must be kept away from children. Use protective eyewear and gloves when performing the dissolved oxygen and salinity tests. Keep a supply of dry paper towels on hand to put under your bottles and wet paper towels to mop up spills. After you complete your monitoring tests the chemicals can be disposed of in the water or down the drain without causing harm.

If you spill anything on yourself be sure to thoroughly wash the affected area – using salt water is fine. The volume of chemical reagents in your kits will not affect the water quality of your water. You are much more important than any water sample!

Before going to your monitoring site:

Go over this checklist to make sure you have everything you need.

- ❑ 2 white lidded plastic chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
- ❑ 2 clear glass dissolved oxygen (DO) bottles from the DO kit
- ❑ Small plastic or brown glass bottle with magenta label, for salinity
- ❑ thermometer
- ❑ insulated cooler bag with freezer pack (your own)
- ❑ pencil and notepad
  - monitoring postcard
- ❑ personal flotation device (in case you fall off the dock!)

At your monitoring site:

1. Role up the sleeve of your sampling arm (your water sampler)!
2. **Rinse your chlorophyll and dissolved oxygen bottles.**
   - Reach down with each bottle to collect water.
   - Swirl water in bottles then discard all rinse water.
3. **Collect two chlorophyll samples.**
   - Hold your sample bottle completely upside down as you lower it into the water.
   - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
   - Fill both of the chlorophyll bottles.
     - Leave a little air space in the bottles. Cap them.
     - Place filled bottles out of direct sunlight.
4. **Measure and record the temperature** of the water in one of the chlorophyll bottles by placing thermometer in the bottle. Read it while it's in the bottle.
5. **Place your chlorophyll bottles in your cooler**.

6. **Fill both dissolved oxygen (DO) bottles to the brim.**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - **Fill both DO bottles to the very top and then cap them.**
    - Turn the bottles upside down to check for air bubbles.
        - *An air bubble will "contaminate" the sample with oxygen from the air.*
        - *If there is an air bubble, toss out the water and collect another sample.*
7. **Complete the label on your salinity bottle (date and depth).**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Pour off enough water to leave about a half inch of air space.
    - Cap and place in your cooler.

<u>On shore and out of direct sunlight:</u>

8. **Start your DO test** (detailed instructions are in Section III of the manual).
    - **BE SAFE!** Use gloves, goggles, run tests on paper plate or newspaper.
    - Remove cap from DO bottle.
    - Holding dropper upside down, add **8 drops of pink reagent 1** (manganous sulfate solution).
    - Holding dropper upside down, add **8 drops of clear reagent 2** (alkaline potassium iodide azide). Cap the bottle.
    - Shake well and let bottle sit while cloudy floc settles as per instructions in manual or for 15 minutes.
    - Uncap and holding dropper upside down, **add 8 drops sulfuric acid** (red cap).
        - **Shake thoroughly** to dissolve cloudiness.
    - Finish DO tests after filtering chlorophylls.

<u>At home (lights off) or on-shore in the shade:</u>

9. Prepare for testing:
    - Set out your monitoring manual
    - Cover test area with newspapers or paper towel
    - Set out paper towels/goggles/gloves
    - **Set out your chlorophyll filtering supplies** (stored in plastic bag)**:**
        - ❑ 60 ml syringe (marked at 50 ml)
        - ❑ 2 white plastic filter holders
        - ❑ glass fiber filters (stored in 35 mm film canister)
        - ❑ tweezers
        - ❑ squeeze bottle of magnesium carbonate
        - ❑ resealable bag containing desiccant chips
        - ❑ sheet of chlorophyll filter sample labels
        - ❑ *blotting paper (supplied by you- coffee filter, paper towel)*
        - ❑ *aluminum foil squares (supplied by you)*

- **Set out your dissolved oxygen test kit** (stored in a plastic lidded box)
  - ❑ Titrator vial (glass with plastic lid with a hole in it)
  - ❑ Titrator (small syringe with pink tip)
  - ❑ 25 ml graduated cylinder
  - ❑ Sodium thiosulfate
  - ❑ Starch indicator
- **Monitoring postcard**

Do the chlorophyll filtration *twice* on water from each bottle.
(step-by-step instructions are in Section III), remembering to

- Shake your bottle thoroughly before <u>each</u> filtering (i.e. between filterings),
- Rinse your syringe before using,
- Add the preservative (magnesium carbonate,)
- Fill out and attach a label – record the date and amount of water filtered,
- Put the wrapped packet in the desiccant chip plastic bag, and
- Put bag in your cooler and transfer to your freezer.

CAUTION: You should not have to push with all your strength in order to filter the water. If you see water drops coming out from between the top and bottom of the white plastic filter holder the filter has become plugged (with algae or sediment). You must start over with a fresh filter and water sample. Use less water, for example 25 ml, and record the amount used on your postcard and on the filter itself.

10. Finish the first set of DO tests from water in each DO bottle.
- Follow DO test instructions in Section III of your manual.

11. Make a second set of DO tests using some of the remaining water in DO bottles.
(Each DO bottle holds enough water for 3 tests.)
- You will have a total of four DO test results (two from each bottle).
- Record the results on your monitoring postcard

12. Record results and clean up.
- **Record your results on your monitoring postcard and your log sheet!**
- Flush reagent chemicals down the drain with plenty of water
- Rinse everything with tap water, let air dry
  - Reassemble loosely.
  - Store in a safe location.

13. Put the labeled salinity bottle in the refrigerator.

Enter data online and/or fill out and mail the monitoring postcard to URI.

How to Monitor: Dockside Locations - Monthy*:*

Monthly Monitoring & Water Collection

This section summarizes the monitoring procedures used for monitoring from the ends of docks. Detailed descriptions of each individual procedure can be found in *Section III, Specific Monitoring Techniques.*

Remember that some of the chemical reagents in your kits are dangerous. All of your supplies must be kept away from children. Use protective eyewear and gloves when performing the dissolved oxygen and salinity tests. Keep a supply of dry paper towels on hand to put under your bottles and wet paper towels to mop up spills. After you complete your monitoring tests the chemicals can be disposed of in the water or down the drain without causing harm.

If you spill anything on yourself be sure to thoroughly wash the affected area – using salt water is fine. The volume of chemical reagents in your kits will not affect the water quality of your water. You are much more important than any water sample!

Before going to your monitoring site:

Go over this checklist to make sure you have everything you need.

- ❑ 2 white lidded plastic chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
- ❑ 2 clear glass dissolved oxygen (DO) bottles from the DO kit
- ❑ thermometer
- ❑ insulated cooler bag with freezer pack (your own)
- ❑ pencil and notepad
  - monitoring postcard
- ❑ personal flotation device (in case you fall off the dock!)
- ❑ **water collection bottles (in bag with colored & dated labels)**
  - bacterial monitoring bottle (labeled "sterile" on top)
  - brown glass bottle(s), labeled "unfiltered 0.5 meter " (magenta label). You may have a duplicate bottle.
  - Orange capped plastic bottle, labeled “pH unfiltered 0.5 meter” (magenta label).
  - Small plastic or brown glass bottle with magenta label, for salinity

In general, expect to fill every bottle that is labeled with the collection date.

NO SMOKING – IT CAN AFFECT NITROGEN LEVELS IN WATER SAMPLES!

<u>At your monitoring site:</u>

14. Role up the sleeve of your sampling arm (your water sampler)!

15. Collect your bacteria sample, from water at arm's depth:

- Remove the "sterile" label just before sampling, roll up your sleeve
- Do not touch inside of bottle or lid.
- Do not put lid on boat seat, hold it carefully in your other hand.
- Do not use any water sampling device.
- Hold bottle upside down, push it deep into the water,
- Sweep it up and forward to fill, pour off a little water to leave an air space.
- Recap bottle immediately after sampling and put in cooler.

16. **Rinse your chlorophyll, dissolved oxygen and brown glass or plastic bottles.**
    - Reach down with each bottle to collect water.
    - Swirl water in bottles then discard all rinse water.
17. **Collect two chlorophyll samples**.
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Fill both of the chlorophyll bottles.
        - Fill all bottles only to the shoulder of the bottle.
        - Place filled bottles out of direct sunlight.
18. **Measure and record the temperature** of the water in one of the chlorophyll bottles by placing thermometer in the bottle. Read the temperature while it's in the bottle.
19. **Place your chlorophyll bottles in your cooler**.
20. **Collect and fill magenta labeled brown glass bottle(s) with 0.5m water.**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Pour off any water above the shoulder of the bottle.
    - Cap and place in your cooler.
21. **Complete the label on your salinity bottle (date and depth).**
    - Fill the bottle bottle in the same way as the above bottles.
    - Put it in the cooler.

22. Fill both dissolved oxygen (DO) bottles to the brim.

- Hold your sample bottle completely upside down as you lower it into the water.
- At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
- Fill both dissolved oxygen bottles to the very top and then cap them.
- Turn the bottles upside down to check for air bubbles.
    - *An air bubble will "contaminate" the sample with oxygen from the air.*
    - *If there is an air bubble, toss out the water and collect another sample.*

On shore and out of direct sunlight:

23. Start your dissolved oxygen (DO) test (detailed instructions are in Section III of the manual).
    - BE SAFE! Use gloves, goggles, run tests on paper plate or newspaper.
    - Remove cap from DO bottle.
    - Holding dropper upside down, add **8 drops of pink reagent 1** (manganous sulfate solution).
    - Holding dropper upside down, add **8 drops of clear reagent 2** (alkaline potassium iodide azide).
    - Shake well and let bottle sit while cloudy floc settles as per instructions in manual or for 15 minutes.
    - Holding dropper upside down, add **8 drops sulfuric acid** (bottle has red cap).
        - Shake thoroughly to dissolve cloudiness.
    - Finish DO tests after filtering chlorophylls.

At home (lights off) or on-shore in the shade:

24. Prepare for testing:

- Cover test area with newspapers, set out paper towels/goggles/gloves
- **Set out your chlorophyll filtering supplies** (stored in plastic bag):
    - ❑ 60 ml syringe (marked at 50 ml)
    - ❑ 2 white plastic filter holders
    - ❑ glass fiber filters (stored in 35 mm film canister)
    - ❑ tweezers
    - ❑ squeeze bottle of magnesium carbonate
    - ❑ resealable bag containing desiccant chips
    - ❑ sheet of chlorophyll filter sample labels
    - ❑ *blotting paper (supplied by you- coffee filter, paper towel)*
    - ❑ *aluminum foil squares (supplied by you)*
- **Set out your dissolved oxygen test kit** (stored in a plastic lidded box)
    - ❑ Titrator vial (glass with plastic lid with a hole in it)
    - ❑ Titrator (small syringe with pink tip)
    - ❑ 50 ml graduated cylinder
    - ❑ Sodium thiosulfate
    - ❑ Starch indicator
- **Monitoring postcard**

CAUTION: You should not have to push with all your strength to filter the water. If you see water drops coming out from between the top and bottom of the white plastic filter holder the filter has become plugged (with algae or sediment). You must start over with a fresh filter and water sample. Use less water, for example 25 ml, and record the amount used on your postcard and on the filter label.

12. **Do the chlorophyll filtration twice on water from each bottle.**
    (step-by-step instructions are in Section III), remembering to
    - Shake your bottle thoroughly before <u>each</u> filtering (ie. Between filters),
    - Rinse your syringe before using,
    - Add the preservative (magnesium carbonate,)
    - Fill out and attach a label – record the date and volume of water filtered,
    - Put the wrapped packet in the desiccant chip plastic bag, and put bag in your cooler/freezer.
13. **Finish the first set of DO tests on water in each bottle.**
    - Follow DO test instructions in Section III of your manual.
14. **Make a second set of DO tests using some of the remaining water in DO bottles.** (Each DO bottle holds enough water for 3 tests.)
    - You will have a total of four DO test results (2 from each bottle).
    - Record them on your monitoring postcard
15. **Record results and clean up.**
    - Record your results on your monitoring postcard and your log sheet!
    - Flush reagent chemicals down the drain with plenty of water
    - Rinse everything with tap water, let air dry
      - Reassemble loosely.
      - Store in a safe location.

Bring all water samples and your bag of accumulated chlorophyll filters and the salinity bottle(s) from your refrigerator to designated location or to URI. Use an insulated cooler with cold packs. Sandwich chlorophyll filters between 2 ice packs.

How to Monitor – Shallow On Water Sites - Biweekly

Biweekly (Every Other Week) Monitoring

Chlorophyll, Dissolved Oxygen, Salinity & Water Temperature

This section summarizes the monitoring procedures for *on-the-water* (as opposed to dockside) monitoring. Detailed descriptions of each individual procedure can be found in *Section III, Specific Monitoring Techniques. These locations are deemed too shallow to monitor at more than one depth.* ***Water samples are collected at arm's length, or halfway to the bottom, whichever is shallower. Your coordinator will tell you whether your location is deemed shallow or deep.***

Assume that the chemical reagents in your kits are dangerous. All of your supplies must be kept away from children. Use protective eyewear and gloves when performing the dissolved oxygen test. Keep a supply of dry paper towels on hand to put under your bottles and wet paper towels to mop up spills. After you complete your monitoring tests the chemicals can be disposed of in the water or down your drain without causing harm.

If you spill anything on yourself be sure to thoroughly wash the affected area – using salt water is fine. The volume of chemical reagents in your kits will not affect the water quality of your water. You are much more important than any water sample!

Before going out on the water:

Go over this on-the-water checklist to make sure you have everything you need.

- ❑ Secchi disk and two clothespins
- ❑ view tube
- ❑ 2 white lidded plastic chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
- ❑ 2 clear glass dissolved oxygen(DO) bottles from dissolved oxygen kit
- ❑ Small plastic or brown glass salinity bottle
- ❑ thermometer
- ❑ insulated cooler bag with freezer pack (your own)
- ❑ pencil and notepad
  - monitoring postcard
- ❑ personal flotation device
- ❑ anchor
- ❑ map of location with landmarks and location noted

On the water:

26. **Go to your sampling location.**
    - Anchor your boat.
    - **Make two sets of Secchi depth transparency measurements**.
    - Check and record depth to bottom.
    - Role up the sleeve of your sampling arm!
27. **Rinse your chlorophyll and dissolved oxygen bottles**
    - Reach down with each bottle to collect water.
    - Swirl water in bottles.
    - Discard all rinse water.

28. **Collect two chlorophyll samples.**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - **Fill both of the chlorophyll bottles**.
        - Fill the bottles, but leave an air space of at least half an inch.
        - Place filled bottles out of direct sunlight.

29. **Measure and record the temperature** of the water in one of the chlorophyll bottles by placing thermometer in the bottle. Read the temperature while it's in the bottle.
30. **Place your chlorophyll bottles in your cooler**.
31. **Fill in the date and sample depth on the salinity bottle.**
    - Fill the bottle from an arm's depth or halfway to the bottom, leaving an air space of about half an inch.
    - Tightly cap the bottle and put it in the cooler.
32. **Fill both dissolved oxygen (DO) bottles to the brim.**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Fill both dissolved oxygen bottles to the very top and then cap them.
    - Turn the bottles upside down to check for air bubbles.
        - *The presence of an air bubble will "contaminate" the sample with oxygen from the air.*
        - *If there is an air bubble, toss out the water and collect another sample.*
33. **Return to shore.**

<u>Back on shore and out of direct sunlight:</u>

34. **Start your dissolved oxygen (DO) test** (detailed instructions are in Section III of the manual):
    - **BE SAFE!** Use gloves, goggles, run tests on paper plate or newspaper.
    - Remove cap from DO bottle,
    - Holding dropper upside down, add **8 drops of pink reagent 1** (manganous sulfate solution),
    - Holding dropper upside down, add **8 drops of clear reagent 2** (alkaline potassium iodide azide), cap the bottle.
    - Shake well and let bottle sit while cloudy floc settles as per instructions in manual or for 15 minutes.
    - Holding dropper upside down, **add 8 drops sulfuric acid** (bottle has red cap).
        - **Shake thoroughly** to dissolve cloudiness.
    - Finish DO tests after filtering chlorophylls at home in shade or reduced light.

At home (lights off) or on-shore in the shade:

35. Set out your chlorophyll filtering supplies (stored in plastic bag)**:**

- ❑ 60 ml syringe (marked at 50 ml)
- ❑ 2 white plastic filter holders
- ❑ glass fiber filters (stored in 35 mm film canister)
- ❑ tweezers
- ❑ squeeze bottle of magnesium carbonate
- ❑ resealable bag containing desiccant chips
- ❑ sheet of chlorophyll filter sample labels
- ❑ *blotting paper (supplied by you- coffee filter, paper towel)*
- ❑ *aluminum foil squares (supplied by you)*

36. Do the chlorophyll filtration twice on water from each bottle.
(step-by-step instructions are in Section III), remembering to

- Shake your bottle thoroughly before each filtering,
- Rinse your syringe before using,
- Add the preservative (magnesium carbonate,)
- Fill out and attach a label – record the date & amount of water filtered,
- Put the wrapped packet in the desiccant chip plastic bag, and
- Put bag in your cooler and transfer to your freezer.

CAUTION: You should not have to push with all your strength in order to filter the water. If you see water drops coming out from between the top and bottom of the white plastic filter holder the filter has become plugged (either with algae or sediment). You must start over with a fresh filter and water sample. Use less water, for example 25 ml, and record the amount used on your postcard and on the filter itself.

37. **Finish the first set of DO tests.**
    - Follow DO test instructions in Section III of your manual.

38. **Make a second set of DO tests using some of the remaining water in DO bottles.** (Each DO bottles hold enough water for 3 tests.)
    - You will have four DO test results (2 from each bottle).
    - Record all the test results on your monitoring postcard.

39. **Record results and clean up.**
    - **Record your results on your monitoring postcard and your field data sheet.**
    - Flush reagent chemicals down the drain with plenty of water
    - Rinse everything with tap water, let air dry.
      - Reassemble loosely.
      - Store in a safe location.

40. **Store the tightly capped salinity bottle in your refrigerator, and make sure your labeled chlorophyll filter packs are in the desiccant chip bag in your freezer..**

Fill out and mail the monitoring postcard to URI or enter the data online.

How to Monitor – Shallow On Water Sites - Monthly

Monthly Monitoring & Water Collection

This section summarizes the monitoring procedures for *on-the-water* (as opposed to dockside) monitoring. Detailed descriptions of each individual procedure can be found in *Section III, Specific Monitoring Techniques*. *Water samples are collected at arm's length, or halfway to the bottom, whichever is shallower. Your coordinator will tell you whether your location is deemed shallow or deep.* **Only directions specific to the monthly water collections are in bold type.**

Assume that the chemical reagents in your kits are dangerous. All of your supplies must be kept away from children. Use protective eyewear and gloves when performing the dissolved oxygen test. Keep a supply of dry paper towels on hand to put under your bottles and wet paper towels to mop up spills. After you complete your monitoring tests the chemicals can be disposed of in the water or down your drain without causing harm.

If you spill anything on yourself be sure to thoroughly wash the affected area – using salt water is fine. The amount of chemical reagents in your kits will not affect the water quality of your water. You are much more important than any water sample!

Before going out on the water:

Go over this on-the-water checklist to make sure you have everything you need.

- ❑ Secchi disk and two clothespins
- ❑ viewing tube
- ❑ 2 white lidded plastic chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
- ❑ 2 clear glass dissolved oxygen(DO) bottles from dissolved oxygen kit
- ❑ thermometer
- ❑ insulated cooler bag with freezer pack
- ❑ pencil and notepad
  - monitoring postcard
- ❑ personal flotation device
- ❑ anchor
- ❑ map of location with landmarks and location noted
- ❑ **water collection bottles (in bag with colored & dated labels)**
  - **bacterial monitoring bottle (labeled "sterile" on top)**
  - **orange lidded plastic bottle (labeled "pH unfiltered 0.5 meter" magenta label)**
  - **brown glass bottle(s) (labeled "unfiltered 0.5 meter" magenta label).You may have a duplicate bottle.**
  - **Small plastic or brown glass bottle (labeled "Salinity 0.5 meter", magenta)**

In general, expect to fill every bottle that is labeled with the collection date.

NO SMOKING – IT CAN AFFECT NITROGEN LEVELS IN WATER SAMPLES!

On the water:

41. Go to your sampling location.
    - Anchor your boat.
    - **Make two sets of Secchi depth transparency measurements**.
    - Check and record depth to bottom.
42. **Collect your bacteria sample, from water at arm's depth:**
    - Remove the "sterile" label just before sampling, roll up your sleeve
    - Do not touch inside of bottle or lid.
    - Do not put lid on boat seat.
    - Do not use any water sampling device.
    - Hold bottle upside down, push it deep into the water,
    - Sweep it up and forward to fill.
    - Recap bottle immediately after sampling and put in cooler.
43. **Rinse your chlorophyll, dissolved oxygen , and brown glass bottles**
    - Reach down with each bottle to collect water.
    - Swirl water in bottles.
    - Discard all rinse water.
44. **Collect two chlorophyll samples**.
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Fill both of the chlorophyll bottles.
        - Leave a little air space in the bottles. Cap them.
        - Place filled bottles out of direct sunlight.

45. **Measure and record the temperature** of the water in one of the chlorophyll bottles by placing the thermometer in the bottle. Read it while it's in the bottle.
46. **Place your chlorophyll bottles in your cooler.**
47. **Fill both dissolved oxygen (DO) bottles to the brim**.
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Fill both dissolved oxygen bottles to the very top and then cap them.
    - Turn the bottles upside down to check for air bubbles.
        - *An air bubble will "contaminate" the sample with oxygen from the air.*
        - *If there is an air bubble, toss out the water and collect another sample.*
48. **Complete the label on your salinity bottle (date and depth).**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Pour off enough water to leave about a half inch of air space.
    - Cap and place in your cooler.

49. **Collect and fill magenta labeled brown glass bottle(s) and pH plastic bottle with water from a depth of 0.5m water as in step 3.**
    - Hold your sample bottle completely upside down as you lower it into the water.
    - At arm's length or halfway to the bottom, whichever is shallower, turn the bottle upright and scoop it up to the surface.
    - Pour off enough water to leave about a half inch of air space.
    - Cap and place in your cooler.
50. **Return to shore**.

Back on shore and out of direct sunlight:

51. **Start your dissolved oxygen (DO) test** (detailed instructions are in Section III):
    - BE SAFE! Use gloves, goggles, run tests on paper plate or newspaper.
    - Remove cap from DO bottle,
    - Holding dropper upside down, add 8 drops of pink reagent 1 (manganous sulfate solution),
    - Holding dropper upside down, add 8 drops of clear reagent 2 (alkaline potassium iodide azide), and cap.
    - Shake well and let bottle sit while cloudy floc settles as per instructions in manual or for 15 minutes.
    - Holding dropper upside down, add 8 drops sulfuric acid (bottle has red cap).
        - Shake thoroughly to dissolve cloudiness.
    - Finish DO tests after filtering chlorophylls at home in shade or reduced light.

At home (lights off) or on-shore in the shade:

52. **Prepare for testing:**
    - Cover test area with newspapers
    - Set out paper towels/goggles/gloves
    - Set out your chlorophyll filtering supplies (stored in plastic bag):
        - ❑ 60 ml syringe (marked at 50 ml)
        - ❑ 2 white plastic filter holders
        - ❑ glass fiber filters (stored in 35 mm film canister)
        - ❑ tweezers
        - ❑ squeeze bottle of magnesium carbonate
        - ❑ resealable bag containing desiccant chips
        - ❑ sheet of chlorophyll filter sample labels
        - ❑ *blotting paper (supplied by you- coffee filter, paper towel)*
        - ❑ *aluminum foil squares (supplied by you)*
    - **Set out your dissolved oxygen test kit** (stored in a plastic lidded box)
        - ❑ Titrator vial (glass with plastic lid with a hole in it)
        - ❑ Titrator (small syringe with pink tip)
        - ❑ 25 ml graduated cylinder
        - ❑ Sodium thiosulfate
        - ❑ Starch indicator
    - Monitoring postcard

CAUTION: You should not have to push with all your strength to filter the water. If you see water drops coming out from between the top and bottom of the white plastic filter holder the filter has become plugged (either with algae or sediment). You must start over with a fresh filter and water sample. Use less water, for example 25 ml, and record the amount used on your postcard and on the filter itself.

53. **Do the chlorophyll filtration *twice* on water from each bottle**.
(step-by-step instructions are in Section III), remembering to
    - Shake your bottle thoroughly before each filtering,
    - Rinse your syringe before using,
    - Add the preservative (magnesium carbonate,)
    - Fill out and attach a label – record the date and amount of water filtered,
    - Put the wrapped packet in the desiccant chip plastic bag, and
    - Put bag in your cooler.

54. **Finish the first set of DO tests from water in each DO bottle.**
    - Follow DO test instructions in Section III of your manual.

55. **Make a second set of DO tests using some of the remaining water in DO bottles.** (Each DO bottle holds enough water for 3 tests.)
    - You will have a total of four DO test results (two from each bottle).
    - Record the results on your monitoring postcard

56. **Record results and clean up.**
    - **Record your results on your monitoring postcard and your log sheet!**
    - Flush reagent chemicals down the drain with plenty of water
    - Rinse everything with tap water, let air dry
        - Reassemble loosely.
        - Store in a safe location.

57. **Put the labeled salinity bottle in the refrigerator.**

Bring all water samples, your bag of accumulated chlorophyll filters from your freezer and your salinity bottles from your refrigerator to designated location or to URI. Use an insulated cooler with cold packs. Sandwich chlorophyll filters between 2 ice packs.

How to Monitor – Deep On Water Sites - Biweekly

Biweekly (Every Other Week) Monitoring
Chlorophyll, Dissolved Oxygen, & Water Temperature

This section summarizes the monitoring procedures for on-the-water (as opposed to dockside) monitoring on deep sites. Detailed descriptions of each procedure can be found in *Section III, Specific Monitoring Techniques.* ***Water is collected using the deep water sampler pictured.***

Assume that the chemical reagents in your kits are dangerous. All of your supplies must be kept away from children. Use protective eyewear and gloves when performing the dissolved oxygen test. Keep a supply of dry paper towels on hand to put under your bottles and wet paper towels to mop up spills. After you complete your monitoring tests the chemicals can be disposed of in the water or down your drain without causing harm.

If you spill anything on yourself be sure to thoroughly wash the affected area – using salt water is fine. The amount of chemical reagents in your kits will not affect the water quality of your water. You are much more important than any water sample!

Before going out on the water:

Go over this on-the-water checklist to make sure you have everything you need.

- ❑ Secchi disk and two clothespins
- ❑ view tube
- ❑ water sampler & weight (deep sites)
- ❑ 2 white lidded plastic chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
- ❑ 3 clear glass dissolved oxygen(DO) bottles from the dissolved oxygen kit
- ❑ 2 small plastic or brown glass bottles labeled for salinity
- ❑ thermometer
- ❑ insulated cooler bag with freezer pack
- ❑ pencil and notepad
  - monitoring postcard
- ❑ personal flotation device
- ❑ anchor
- ❑ map of location with landmarks and location noted

On the water:

58. Go to your sampling location.

59. Anchor your boat.
60. **Make two sets of Secchi depth transparency measurements**.
61. Check & record depth to bottom.

62. **Rinse your water sampler, chlorophyll and dissolved oxygen bottles**

63. Close the lid on the sampler and plug with stopper.
64. Lower the sampler to below the surface of water.
65. Jerk to release plug, wait until no more bubbles come out.
66. Use this water to rinse the plastic chlorophyll and glass DO bottles.
67. Discard all rinse water.

3. **Collect two chlorophyll samples and measure water temperature.**
    - **Put spirit thermometer into sampler in its designated slot.**
    - Close the lid, and plug with stopper.
    - Lower quickly to 0.5 meter depth.
    - Jerk to release plug, wait until no more bubbles come out.
    - Rapidly raise sampler and bring into your boat.
    - **Record water temperature leaving thermometer in sampler.**
    - **Open sampler top, rinse and fill 1st chlorophyll bottle about ¾ full.**
    - Cap the bottle and put it in your cooler.
    - Repeat above steps to collect 2nd chlorophyll sample.
        - You do not need to measure water temperature of 2nd sample.
4. **Collect one shallow dissolved oxygen (DO) sample.**
    - **Put glass DO bottle into sampler,** first removing black bottle cap.
    - **Put tube in sampler lid into DO bottle**.
    - Close the lid, and plug with stopper.
    - Lower quickly to 0.5 meter depth.
    - Jerk to release plug, wait until no more bubbles come out.
    - Rapidly raise sampler and bring into your boat.
    - **Open sampler and reach in to cap DO bottle under water.**
    - Remove capped DO bottle.
    - Turn upside down to check for air bubble.
        - Add water from sampler if there is an air bubble.
        - If no air bubble put into cooler.
5. **Complete the label on your shallow salinity bottle (date and depth).**
    - Fill the salinity bottle with the excess water from filling your DO bottle.
    - Pour in enough water to leave about a half inch of air space.
    - Cap and place in your cooler.
6. **Collect first DEEP dissolved oxygen sample and measure DEEP water temperature.**
    - **Put glass DO bottle into sampler,** first removing black bottle cap.
    - **Put tube in sampler lid into DO bottle**.
    - Close the lid, and plug with stopper.
    - Lower sampler quickly to within *0.5m from the bottom*. DON'T HIT THE BOTTOM.
    - Jerk to release plug, wait until no more bubbles come out.
    - Rapidly raise sampler and bring into your boat.
    - **Open sampler and reach in to cap DO bottle under water**.
    - Remove capped DO bottle.
    - Turn upside down to check for air bubble.
        - Add water from sampler if there is an air bubble.
        - If no air bubble put into cooler.
    - **Record water temperature from thermometer in water in sampler.**
7. **Collect second DEEP dissolved oxygen sample.**
    - Repeat instructions in step 5 to collect a second deep DO sample.
8. **Collect a deep salinity sample as you did in Step 5.**
    - Don't forget to complete the label, cap and place in your cooler.
9. **Return to shore.**

Back on shore and out of direct sunlight:

- **Start your dissolved oxygen (DO) test** (detailed instructions are in Section III of the manual):
- **BE SAFE!** Use gloves, goggles, run tests on paper plate or newspaper.
- Remove cap from DO bottle,
- Holding dropper upside down, add **8 drops of pink reagent 1** (manganous sulfate solution),
- Holding dropper upside down, add **8 drops of clear reagent 2** (alkaline potassium iodide azide), cap the bottle.
- Shake well and let bottle sit while cloudy floc settles as per instructions in manual or for 15 minutes.
- Holding dropper upside down, **add 8 drops sulfuric acid** (bottle has red cap).
    - **Shake thoroughly** to dissolve cloudiness.
- Finish DO tests after filtering chlorophylls at home in shade or reduced light.

At home (lights out) or on-shore in the shade:

- **Set out your chlorophyll filtering supplies** (stored in plastic bag)**:**
    - ❑ 60 ml syringe (marked at 50 ml)
    - ❑ 2 white plastic filter holders
    - ❑ glass fiber filters (stored in 35 mm film canister)
    - ❑ tweezers
    - ❑ squeeze bottle of magnesium carbonate
    - ❑ resealable bag containing desiccant chips
    - ❑ sheet of chlorophyll filter sample labels
    - ❑ *blotting paper (supplied by you- coffee filter, paper towel)*
    - ❑ *aluminum foil squares (supplied by you)*
- **Do the chlorophyll filtration twice on water from each bottle.**
  (step-by-step instructions are in Section III), remembering to
    - Shake your bottle thoroughly before each filtering,
    - Rinse your syringe before using,
    - Add the preservative (magnesium carbonate),
    - Fill out and attach a label – record the date & amount of water filtered,
    - Put the wrapped packet in the desiccant chip plastic bag, and
    - Put bag in your cooler and transfer to your freezer.

CAUTION: You should not have to push with all your strength in order to filter the water. If you see water drops coming out from between the top and bottom of the white plastic filter holder the filter has become plugged (with algae or sediment). You must start over with a fresh filter and water sample. Use less water, for example 25 ml, and record the amount used on your postcard and on the filter itself.

- **Finish the first set of DO tests.**
  - Follow DO test instructions in Section III of your manual.
- **Make a second set of DO tests using some of remaining water in DO bottles.** The DO bottles hold enough water for 3 tests.
  - You will have 2 shallow and 4 deep DO test results, 2 from each bottle.
- **Record results and clean up.**
  - **Record your results on your monitoring postcard and your field data sheet**
  - Flush reagent chemicals down the drain with plenty of water.
  - Rinse everything with tap water, let air dry.
    - Reassemble loosely.
    - Store in a safe location.
- **Store the tightly capped salinity bottle in your refrigerator, and make sure your labeled chlorophyll filter packs are in the desiccant chip bag in your freezer.**

Fill out and mail the monitoring postcard to URI or enter the data online.

NOTES:

How to Monitor – Deep On Water Sites - Monthly

Monthly Monitoring & Water Collection

This section summarizes the monitoring procedures for on-the-water deep sites (as opposed to dockside) monitoring. Detailed descriptions of each individual procedure can be found in *Section III, Specific Monitoring Techniques*. Water is collected using a deep water sample.

Assume that the chemical reagents in your kits are dangerous. All of your supplies must be kept away from children. Use protective eyewear and gloves when performing the dissolved oxygen test. Keep a supply of dry paper towels on hand to put under your bottles and wet paper towels to mop up spills. After you complete your monitoring tests the chemicals can be disposed of in the water or down your drain without causing harm.

If you spill anything on yourself be sure to thoroughly wash the affected area – using salt water is fine. The amount of chemical reagents in your kits will not affect the water quality of your water. You are much more important than any water sample!

Before going out on the water:

Go over this on-the-water checklist to make sure you have everything you need.

- ❑ Secchi disk and two clothespins
- ❑ view tube
- ❑ water sampler & weight (deep sites)
- ❑ 2 white lidded plastic chlorophyll sample bottles (labeled #1 of 2, #2 of 2)
- ❑ 3 clear glass dissolved oxygen (DO) bottles from dissolved oxygen kit
- ❑ thermometer
- ❑ insulated cooler bag with freezer pack
- ❑ pencil and notepad
  - monitoring postcard
- ❑ personal flotation device
- ❑ anchor
- ❑ map of location with landmarks and location noted
- ❑ **water collection bottles (in bag with colored & dated labels)**
  - **bacterial monitoring bottle (labeled "sterile" on top)**
  - **2-3 brown glass bottles, labeled "unfiltered 0.5 meter" (magenta label), and "unfiltered-deep" (green label) You may have duplicate bottles for one of the depths – but would typically have 1 each for 0.5 meter from surface and deep samples**
  - **2 small plastic or brown glass bottles labeled for salinity (magenta and green for shallow and deep depths)**

In general, expect to fill every bottle that is labeled with the collection date.

NO SMOKING – IT CAN AFFECT NITROGEN LEVELS IN WATER SAMPLES!

<u>On the water:</u>

68. Go to your sampling location.
    - Anchor your boat.
    - **Make two sets of Secchi depth transparency measurements**.
    - Check & record depth to bottom.
69. **Collect your bacteria sample, from water at arm's depth:**
    - Remove the "sterile" label just before sampling, roll up your sleeve
    - Do not touch inside of bottle or lid.
    - Do not put lid on boat seat.
    - Do not use any water sampling device.
    - Hold bottle upside down, push it deep into the water,
    - Sweep it up and forward to fill.
    - Recap bottle immediately after sampling and put in cooler.
70. **Rinse your water sampler, chlorophyll and dissolved oxygen bottles as well as magenta labeled (shallow) water bottle.**
    - Close the lid on the sampler and plug with stopper.
    - Lower the sampler to below the surface of water.
    - Jerk to release plug, wait until no more bubbles come out.
    - Use this water to rinse all bottles.
    - Discard all rinse water.
71. **Collect two chlorophyll samples and measure water temperature**.
    - Put thermometer into sampler in designated slot.
    - Close the lid, and plug with stopper.
    - Lower quickly to 0.5 meter depth.
    - Jerk to release plug, wait until no more bubbles come out.
    - Rapidly raise sampler and bring into your boat.
    - Record water temperature leaving thermometer in sampler.
    - Open sampler top, rinse and fill 1st chlorophyll bottle about ¾ full.
    - Cap the bottle and put it in your cooler.
    - Repeat above steps to collect 2nd chlorophyll sample.
        - You do not need to measure water temperature of 2nd sample.
72. **Collect shallow dissolved oxygen (DO) sample**.
    - Put glass DO bottle into sampler, first removing black bottle cap.
    - Put tube in sampler lid into DO bottle.
    - Close the lid, and plug with stopper.
    - Lower quickly to 0.5 meter depth.
    - Jerk to release plug, wait until no more bubbles come out.
    - Rapidly raise sampler and bring into your boat.
    - Open sampler and reach in to cap DO bottle under water.
    - Remove capped DO bottle.
    - Turn upside down to check for air bubble.
        - Add water from sampler if there is an air bubble.
        - If no air bubble put into cooler.

73. **Collect and fill magenta labeled brown glass and orange lidded plastic bottle(s) with 0.5m water.**
    - Close the lid on sampler and plug with stopper.
    - Lower quickly to 0.5m meter depth.
    - Jerk to release plug, wait until no more bubbles come out.
    - Pour water into magenta labeled bottles.
74. **Complete the label on your shallow salinity bottle (date and depth).**
    - Fill the salinity bottle with the excess water from filling your DO bottle or one of the other water collection bottles.
    - Pour in enough water to leave about a half inch of air space.
    - Cap and place in your cooler.
75. **Collect first DEEP dissolved oxygen sample and measure DEEP water temperature**.
    - Put glass DO bottle into sampler, first removing black bottle cap.
    - Put tube in sampler lid into DO bottle.
    - Close the lid, and plug with stopper.
    - Lower sampler quickly to *0.5m from the bottom*. DON'T HIT THE SAMPLER ON THE BOTTOM
    - Jerk to release plug, wait until no more bubbles come out.
    - Rapidly raise sampler and bring into your boat.
    - Open sampler and reach in to cap DO bottle under water.
    - Remove capped DO bottle.
    - Turn upside down to check for air bubble.
        - Add water from sampler if there is an air bubble.
        - If no air bubble put into cooler.
    - Record water temperature from thermometer in water in sampler.
    - **Use remaining water in sampler to rinse green labeled DEEP brown glass bottle.**
76. **Collect a deep salinity sample as you did in Step 5.**
    - Don't forget to complete the label, cap and place in your cooler.
77. Collect second DEEP dissolved oxygen sample **and fill green labeled DEEP water sample bottle with water remaining in the sampler.**
    - Do this by repeating instructions in step 8.
78. Return to shore.

Back on shore and out of direct sunlight:

79. **Start your dissolved oxygen (DO) test** (detailed instructions are in Section III of the manual):
    - BE SAFE! Use gloves, goggles, run tests on paper plate or newspaper.
    - Remove cap from DO bottle,
    - Holding dropper upside down, add **8 drops of pink reagent 1** (manganous sulfate solution),
    - Holding dropper upside down, add **8 drops of clear reagent 2** (alkaline potassium iodide azide), cap the bottle.
    - Shake well and let bottle sit while cloudy floc settles as per instructions in manual or for 15 minutes.

- Holding dropper upside down, add **8 drops sulfuric acid** (bottle has red cap).
    - Shake thoroughly to dissolve cloudiness.
- Finish DO tests after filtering chlorophylls at home in shade or reduced light.

<u>At home or on-shore in the shade:</u>

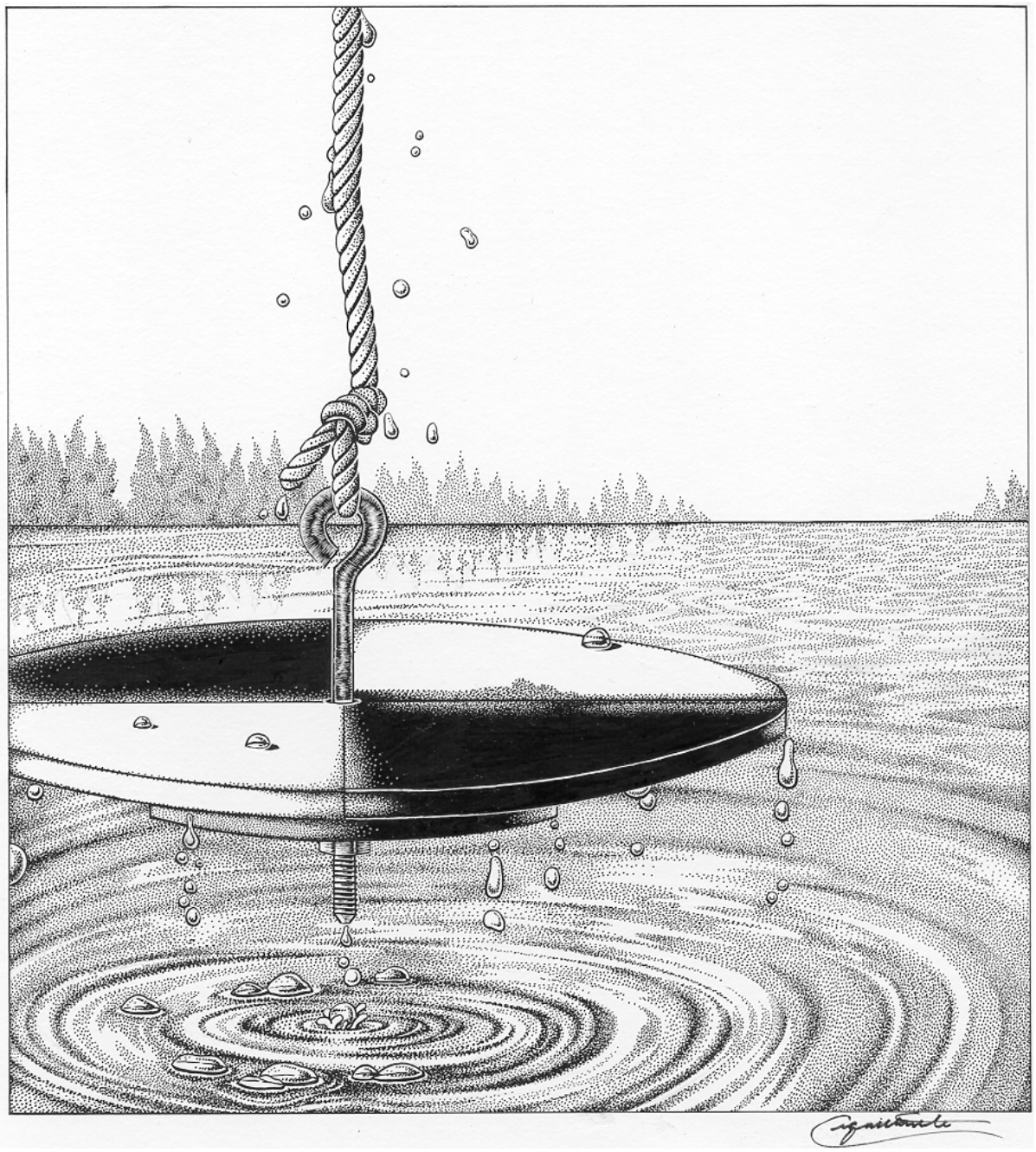
80. **Set out your chlorophyll filtering supplies** (stored in plastic bag):
    - ❑ 60 ml syringe (marked at 50 ml)
    - ❑ 2 white plastic filter holders
    - ❑ glass fiber filters (stored in 35 mm film canister)
    - ❑ tweezers
    - ❑ squeeze bottle of magnesium carbonate
    - ❑ resealable bag containing desiccant chips
    - ❑ sheet of chlorophyll filter sample labels
    - ❑ *blotting paper (supplied by you- coffee filter, paper towel)*
    - ❑ *aluminum foil squares (supplied by you)*
81. **Do the chlorophyll filtration *twice* on water from each bottle**.
    (step-by-step instructions are in Section III), remembering to
    - Shake your bottle thoroughly before each filtering,
    - Rinse your syringe before using,
    - Add the preservative (magnesium carbonate,)
    - Fill out and attach a label – record the date & amount of water filtered,
    - Put the wrapped packet in the desiccant chip plastic bag, and
    - Put bag in your cooler.

CAUTION: You should not have to push with all your strength to filter the water. If you see water drops coming out from between the top and bottom of the white plastic filter holder the filter has become plugged (with algae or sediment). You must start over with a fresh filter and water sample. Use less water, for example 25 ml, and record the amount used on your postcard and on the filter itself.

82. **Complete three sets of DO tests**.
    - Follow DO test instructions in Section III of your manual.
    - The DO bottles hold enough water for 3 tests if needed.
    - You will have 2 shallow and 4 deep DO test results.
83. **Record results and clean up**.
    - Record your results on your monitoring postcard and your log sheet!
    - Flush reagent chemicals down the drain with plenty of water
    - Rinse everything with tap water, let air dry.
        - Reassemble loosely.
        - Store in a safe location.

Bring all water samples, your bag of accumulated chlorophyll filters from your freezer and your salinity bottles from your refrigerator to designated location or to URI. Use an insulated cooler with cold packs. Sandwich chlorophyll filters between 2 ice packs.

3.0 Specific Monitoring Techniques



URIWW SALT WATER SITES Manual, Section 3

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Collecting Unfiltered Water Samples (Field SOP 009)

Unfiltered water samples are collected for a variety of laboratory analyses, as well as field processing for lab chlorophyll analysis and field analysis of dissolved oxygen. We collect water samples in plastic bottles for pH and alkalinity and in glass bottles (labeled unfiltered) for total phosphorus and nitrogen. We also save the filtered water from chlorophyll filtration in plastic bottles for analysis of nitrate- and ammonia-nitrogen, dissolved phosphorus and chlorides.

The sample bottles you are supplied with have been thoroughly cleaned to make sure that they are as free from contaminants as possible. Our Watershed Watch students occasionally even fill the shallow and deep samplers with ultra-pure water to check for residual contamination.

The most important step you can take to prevent contamination is to rinse your water sampling apparatus and any bottles (except your sterile one) before you use or fill it. This is called *conditioning*. And then rinse them with tap water *after* you use it and let it air-dry!

1. Rinse your water sampling apparatus (if you use one) with some surface water and then collect a shallow water sample by either scooping water directly into the sample bottles (shallow sites) or at deep sites using the deep water sampler (see Deep Water Sampler Operation Field SOP 012).
2. Un-cap and **rinse your unfiltered sample bottle(s**) with some of the collected water. Discard the water used to rinse the bottle.
3. **Fill your sample bottle(s)** to within approximately 0.5 inch of the bottle rim. This will leave an air space in the sample bottle to allow for mixing of the sample in the laboratory.

NOTE: <u>Dissolved oxygen bottles</u> must be filled to the brim,
NO air space or air bubbles allowed!

4. Cap your sample bottle and place it into your cooler.
5. Repeat as needed until all surface and/or deep unfiltered water sample bottles are filled.
6. Finish your other monitoring activities and return to shore.

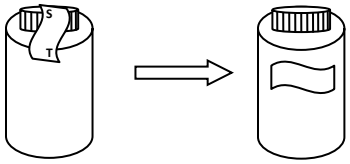
Bacterial Monitoring (Field SOP 008)

In bacterial monitoring maintaining sterile conditions is essential because bacteria are everywhere! **All the sample bottles that have been sterilized have a piece of tape with the word "sterile" across the bottle cap.** Since bacteria are everywhere – in the air, in the water, on our skin and on the outside of the sample bottles, it is important to avoid getting anything in the sample bottle, on the mouth of the bottle, or inside the lid except the water sample you are collecting. Bacteria samples are collected at the same monitoring location as the rest of your samples, but the sample is collected halfway to the bottom *or* at arm's length using your arm, never by using a water sampling device.

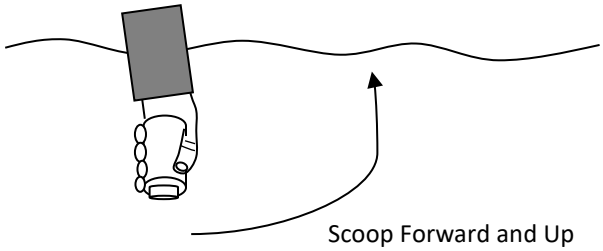
We recommended that you wear disposable plastic gloves to further avoid any contamination, either from you to the sample or from the water to you.

KEEP THE LID ON UNTIL YOU ARE ABOUT TO COLLECT YOUR SAMPLE.

1. Roll up your sleeve and put on your gloves.
2. When you are ready to sample, remove the "sterile" tape from the bottle cap and place it on the side of the bottle, as shown below.



3. Take the cap off the sample bottle. **Don't touch the inside of the cap or the rim of the bottle. Hold the lid in your other hand. Don't put the lid down.**
4. Grasp the middle of the bottle with your sampling arm.
5. **Holding the bottle upside down, push the bottle as far down into the water as you can reach.** Turn the bottle opening forward and scoop it forward and up out of the water. Do this in one sweeping motion. Make sure you sample forward and away from you so that there is no chance that you will contaminate the sample with bacteria from your arm. The figure below shows this motion.



6. **Pour off water in the bottle so the water level in the bottle is at the neck of the bottle**. This provides necessary space for mixing.
7. Cap the bottle. **Store the bottle in your cooler with ice or an ice pack.**
8. Bring your water sample in a cooler with an ice pack to the URI Watershed Watch laboratory as soon as possible.

If you don't have a deep sampler, you will use this same method to collect your water samples for chlorophyll, dissolved oxygen, pH and nutrients.

General Points to remember:

- Keep your thermometer out of direct sunlight when not in use. It will heat up and take longer to stabilize if not.
- **Your thermometer must be immersed in water while you read it.**
- Measure water temperature while on the water. Do not wait to come back to shore.
- If your river/stream site is shallow enough, as many streams are, hold your thermometer directly in the water, halfway to the bottom to measure water temperature.
- All thermometers are calibrated before being given out to ensure that they are accurate.

Using Liquid-filled Thermometers:

- Check your thermometer to make sure that the liquid (non-toxic alcohol) has not separated. If it has, please return it to URI Watershed Watch for a replacement.
- If your thermometer has a clear plastic cover it does not need to be removed before use. If you notice that water is not getting inside the cover, loosen it a bit. (You can also remove the cover, heat a pin over a flame and push it through the plastic cover to create a vent hole.)
- **Measure water temperature while the bulb of the thermometer is still in the water, or in a bottle with water from your sampling depth**. Swish the thermometer in the water until the temperature stops changing. It will respond quickly.
- The thermometer does not need to be completely submerged to take a reading.
- The thermometers we use measure temperature in degrees Celsius. On the next page is a conversion chart to Fahrenheit.
- It is best to store the thermometer upright, bulb end down.

(continue to next page)

Using Electronic (yellow lollipop) Thermometers:

- This thermometer can accidentally be turned on if the on/off button hits other equipment in your monitoring supply bag – so please be careful to check it before storing your supplies between sampling trips (the batteries will not last long if left on). We can give you replacement batteries.
- To operate the thermometer, press the on/off button.
- Once the thermometer is on, check to be sure the instrument is reading in degrees Celsius (°C), if not press the °F/ °C button. **URI Watershed Watch records temperature in °C**.
- Remove the plastic cover from the stem of the thermometer and insert it into the sample bottle or stream. Only the metal stem needs be submerged to obtain a temperature reading. **Measure the water temperature while the metal stem is in the water and the reading has stabilized.**

To determine water temperature from shallow lake and pond (including salt pond) locations:

1. Water temperature is measured at a depth of 1 meter from the surface on lakes & ponds unless otherwise specified.
2. Obtain a water sample using your sampler, typically filling your plastic chlorophyll bottle.
3. Put your thermometer into the water sample contained in the plastic chlorophyll bottle.
4. Wait for your thermometer to stabilize; this usually takes a minute or two. Record the temperature on your monitoring postcard and field data sheet.

To determine water temperature from deep lake and pond (including salt ponds and deep river) locations:

1. Your spirit-thermometer can fit into a place inside the clear LaMotte deep water sampler.
2. Put the spirit-thermometer in the sampler *before* you collect your water sample. Position it so that you can read the thermometer without taking it out.
3. Collect your shallow and deep-water samples as you would normally.
4. If you are collecting water for dissolved oxygen as well as temperature, please read the water temperature after you have capped the dissolved oxygen bottle.
5. Record water temperature for both 1 meter and deep sample depths on your monitoring postcard and field data sheet. The temperature at the 1-meter depth can be taken from the water sample in the plastic chlorophyll bottle (filled from a depth of 1 meter).
6. Alternatively, you can use an electronic thermometer by removing the cover and putting it inside the deep-water sampler *after* you collect your water sample.

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Comparison of Celsius and Fahrenheit Temperatures

Celsius Temperature (ºC)	Fahrenheit Temperature (ºF)
0	32.0
1	33.8
2	35.6
3	37.4
4	39.2
5	41.0
6	42.8
7	44.6
8	46.4
9	48.2
10	50.0
11	51.8
12	53.6
13	55.4
14	57.2
15	59.0
16	60.8
17	62.6
18	64.4
19	66.2
20	68.0
21	69.8
22	71.6
23	73.4
24	75.2
25	77.0
26	78.8
27	80.6
28	82.4
29	84.2
30	86.0
31	87.8
32	89.6
33	91.4
34	93.2
35	95.0

Chlorophyll (Algae) (Field SOP 007)

Equipment

- Insulated cooler/bag with freezer pack
- TWO (2) white lidded plastic bottles (labeled for chlorophyll) of sample water

Chlorophyll filtering apparatus:

- 60 mL plastic syringe, marked at 50 mL
- 2 round white plastic filter holders
- Small glass fiber filters (stored in 35 mm film canister)
- Wrapping paper: coffee filters or white only paper toweling (provided by you)
- Tweezers or large safety pin
- 4" squares of aluminum foil (provided by you)
- Sheet of chlorophyll labels
- Squeeze bottle containing magnesium carbonate ($MgCO_3$) – non-toxic
- Re-sealable plastic bag containing desiccant chips
- Plastic bottle with a yellow label "filtered" (used just during water collection days)

Getting Started **Remember, NO SMOKING ALLOWED**

Measuring chlorophyll tells us how much algae are in your water. Sample collection and filtering for chlorophyll is typically done on water from a 0.5-meter depth (approximately 2 ft).

Remember, it is very important to keep the water samples in an insulated cooler/bag and out of the light until you are ready to begin the chlorophyll filtration.

If you are doing this on a scheduled water collection day, you will save some of your filtered water in your yellow-labeled plastic bottle, if not you can discard it.

7. Before you go out on the water, on shore and out of direct sunlight, set out your filtering apparatus, making sure you have everything you need, including paper toweling for wrapping filters, aluminum foil for sealing them and labels for them.
8. **Collect TWO separate 0.5-meter water samples using your water sampler.** After rinsing your plastic chlorophyll bottle with water from the sampler, fill the first bottle with your first sample and the second bottle with your second sample. Cap the bottles and put them into your insulated cooler/bag.
   They must be kept out of sunlight.
9. Finish your other monitoring activities and return to shore.

Rinse and prepare the syringe.

10. Thoroughly shake one of the plastic bottles containing your water sample.
11. Using your syringe, draw up approximately 20 mL of water from the bottle into the syringe.
12. Rinse the syringe by pushing the water back and forth using the syringe plunger or by shaking the syringe.
13. Then, push the water out of the syringe. The syringe is now rinsed.
14. Take apart your syringe by pulling the plunger all the way out. (continue to next page)

Prepare the filtering apparatus (*out of direct sunlight*):

15. Open one round white filter holder assembly.
16. Using tweezers, remove 1 small filter circle from its container (35 mm film canister).
17. **Put the filter circle in the filter holder.**
    - Handle the filter circle with your tweezers, not your fingers.
    - Center the filter circle **rough side up, gridded side down**, on the metal screen on the bottom of the filter assembly. (Remember – grid to grid, or "roughed up," if you can't tell the difference, don't worry about it.)
    - Place the black rubber gasket on top of the filter and
    - Firmly screw the filter holder back together.
    - Repeat with your remaining filter holder.

Filter your water sample.

18. Attach the round white filter holder to the syringe by twisting it on. You will see that there is only one way in which it will fit, and only ¼ turn is needed to seat it.
19. Cap your sample bottle and shake well again.
20. Hold the syringe with filter holder facing down. Put your finger over the outlet.
21. Pour the mixed water sample into the syringe to the 50 mL line marked on the syringe.
22. Shake the flip top bottle of magnesium carbonate. Squeeze **four drops of magnesium carbonate** into the water sample in the syringe.
23. Remove your finger and carefully insert the syringe plunger. Holding the syringe vertically (filter holder outlet down) slowly push the water through the filter apparatus with steady, even pressure including all the air. Take your time! The water can be discarded down the drain or on the ground (not on plants that can't tolerate salt water please).

CAUTION: On some sites with intense algal blooms the algae will completely clog the filter before you have filtered all 50 mL of water. ***You should not have to push with all your strength to filter the water sample.*** *If this is the case or if you see water drops coming out from between the top and bottom of the white plastic filter holder* ***the filter has become clogged (with algae or sediment.) You must start over with a fresh filter and water sample.*** *Use less water, perhaps 25 mL, and record the amount used on your postcard and on the filter label itself. The amount of water filtered should be the same for all the filters in the foil packet for the same date. If the volumes are different, then package the filters separately with labels indicating the actual volume filtered.*

Filter three more water samples.

24. Shake your first water sample in the white plastic bottle again. Repeat steps 12 – 17 to filter a second sample of water from the first chlorophyll bottle.
25. **Repeat steps 9 – 17 twice more with the water from the second chlorophyll sample bottle, remembering to shake the bottle well each time before pouring it into the syringe.**

(continue to next page)

After you have filtered a water sample. *Out of direct sunlight*…

26. Take the filter holder off the syringe.
27. Unscrew the two halves. Using tweezers lift out the black rubber gasket.
28. Again, using tweezers (or the tip of a large safety pin), **lift out the filter circle by an edge**.
29. Place the filter circle on a piece of blotting/wrapping paper (paper towel/coffee filter). If the filter breaks while you are removing it, try to get all the pieces onto the blotting/wrapping filter paper.
30. Fold the filter in half with the rough sides together. **BE SURE TO FOLD THE FILTER SO THAT THE CHLOROPHYLL SAMPLE IS PROTECTED ON THE INSIDE – your filter MUST be a half circle, like pita bread!** Wrap the blotting/wrapping paper over the filter.
31. Place the folded filter paper on a piece of aluminum foil. Cover it loosely with foil.

✔ You will have filtered a total of 4 samples of water!

Finish processing the four filter circles.

32. Securely fold a piece of aluminum foil around the four filters.
33. Complete a chlorophyll label by filling in your name, the date, the amount of water you filtered (i.e. 50 usually), and the number of filters in the foil packet. Attach the label to the foil packet.
34. **Place the aluminum foil packet in the re-sealable plastic bag containing desiccant chips and then into your freezer**.

Rinse the filtering apparatus & fill out your postcard.

35. Take apart the syringe and filter assembly.
    - Rinse all apparatus with tap water - **DO NOT USE DETERGENTS.**
    - Place upside down on a paper towel to dry. Reassemble loosely when dry.
36. Circle "Yes" on your Monitoring Postcard in the section: "CHLOROPHYLL SAMPLES: FILTERED and FROZEN: yes or no.

Dissolved Oxygen (DO) Monitoring (SOP 010)

The most common deep-water sampler URI Watershed Watch uses is the LaMotte #3-0026 water sampler. Detailed instructions for this water sampler are in Deep Water Sampler Operation Field Standard Operating Procedure (SOP) 012. Briefly:

1. Remove the cap of a glass dissolved oxygen (DO) bottle and place it in the sampler.
2. Put the lid on the sampler making sure the inlet tube on the sampler lid goes into the glass bottle.
3. Put the black plug firmly into the hole in the top of the sampler lid.
4. Lower the sampler to the desired depth.
5. Jerk sharply on the sampler line to pop the plug out of the lid. Water flows through the inlet tube into the glass bottle and then overflows, flushing the glass bottle several times before filling it and the sampler.
6. As the water fills the sampler, a steady stream of air bubbles will rise to the water surface (how close to your boat depends on the water current). Sometimes you may not see them. Often, they come up under the boat and you may hear them popping softly.
7. Wait at least three minutes before bringing your sampler to the surface or until there are no more bubbles.
8. After the sampler is taken out of the water you can do one of two things. You can cap the glass bottle and then remove it from the sampler. Alternatively (and preferably) if no other sample is being taken re-insert the plug and keep the lid on the water sampler, leaving the DO bottle right in the sampler until you get to shore and are ready to start the DO tests.
9. Remember to read the thermometer right away when you pull your deep-water sampler onto the boat. More information on how to collect temperature samples is found in the "Water Temperature" procedure (SOP 006).

The most important first step is to make sure your DO bottle is filled to the brim and that there are no air bubbles. When obtaining water samples for DO measurement you must be very careful to **minimize contact of the water sample with air**. While our lake water samples will typically contain 0-12 ppm oxygen, the air we breathe contains about 210,000 ppm. This is especially important with deep samples since deep water can become depleted of much of its oxygen during the summer.

If you are collecting both a shallow and deep-water sample, collect the deep-water sample after collecting the shallow water sample. This way the deep-water sample does not sit in the boat as long, thereby decreasing the chances of introducing oxygen into the deep samples.

Back on shore, **the DO test must be started before any other measurements**.

We use LaMotte test kits. The specific instructions for the kit are on the next pages as well as in the kit itself. Please familiarize yourself with the procedure before you begin. The basic procedure involves "fixing" the oxygen by reacting it with several different chemical reagents. Once the DO is "fixed" atmospheric oxygen cannot affect the results.

Read the information contained on the Material Safety Data Sheets (MSDS) that come with each kit. **Glasses or safety goggles and gloves should be worn because of the chemical reagents used**.

The DO kits must be kept out of the reach of children. Keep a supply of paper towels on hand to mop up any spills right away.

After the tests are completed all the equipment must be carefully rinsed with tap water and allowed to air dry on a paper towel. The chemical reagents used in the analysis can safely be flushed down the drain with plenty of water or poured onto the ground. **Wash your hands thoroughly when you are done**.

If you spill any of the chemical reagents on yourself, immediately flush the affected area with lots of water. It is perfectly acceptable to use lake or stream water. *Do not wait to wash off until you are at a faucet.*

Remember to enter your DO data on the Monitoring Postcard (as shown below) or online and on your Field Data Sheet.

Monitoring Postcard example:

LOCATION: Easy Pond **MONITOR(S):** Monica Monitor

DATE MONITORED: 07/04/05 (mo/day/yr) **TIME:** 08:45 (military)

SECCHI DEPTH (measure 4 times):

4.0 4.0 4.1 3.9 meters

Depth to bottom is 6.0 meters. Is Secchi visible on bottom? yes or no

CHLOROPHYLL SAMPLES: FILTERED and FROZEN: yes or no

DEPTH MONITORED (meters)	Surface	1 meter	Record actual depth: 5.5 m deep	5.5 m deep
WATER TEMPERATURE (deg. C)	27	26	19	19
DISSOLVED OXYGEN (mg/L) (Measure twice at each depth)	N/A	10.0 10.0	8.0 ¦ 8.2	7.8 ¦ 8.0
SALINITY (ppt)	N/A	NA	NA	NA

(for below, circle best description, see monitoring manual for details)

LIGHT: 1= Distinct shadows 2= No shadows 3= Very overcast

WIND: 0= Calm 1= Light 2= Gentle 3= Moderate 4= Strong

RAIN W/IN 48 Hrs. 1= None 2= Light 3= Moderate 4= Heavy

STATE OF TIDE: EBB ____ FLOOD ____ HIGH ____ LOW ____ N/A _X___

Fill out this section with your Dissolved Oxygen data. The dotted line provides room for 2 results

Detailed dissolved oxygen instructions on the next pages

NOTES:

Dissolved Oxygen (DO) Testing with LaMotte DO Kit

- The following instructions are also on the inside of the lid of your dissolved oxygen kit. Familiarize yourself with the instructions before your use your kit. **Wear safety goggles and gloves while completing the procedure outlined below. Keep a supply of paper towels on hand to mop up any spills right away.**
- **Do the tests on paper towels or on a paper plate to make sure that none of the reagents stain your work area. Before you shake your bottles wrap them in paper towels to help prevent droplets spraying through the air.**

Make sure you completely fill your dissolved oxygen bottle.
Turn it over to check for air bubbles.

****Air bubbles will cause erroneously high results**
Please follow the steps in the order they are written

<u>Step 1.</u> "Fix" your sample in the glass bottle

a) Holding the reagent bottle completely upside down, **add 8 drops of Manganous Sulfate solution (labeled "1" on bottle)**
b) Holding the reagent bottle completely upside down, **add 8 drops of Alkaline Potassium Iodide Azide (labeled "2" on bottle)**
c) Cap and shake the bottle for 30 seconds. A white to brownish orange floc will cloud the sample bottle.
d) **Let the floc settle until the top half of the bottle is clear.** Shake again. Allow to settle again. (If you are testing salt water, wait 15 minutes before continuing since the floc may not settle)

<u>Step 2.</u> Add 8 drops of Sulfuric Acid 1:1 (red cap on bottle) and shake for 30 seconds. The solution will turn from cloudy to clear in color (**If you still see some dark solids in the solution add 1 more drop)**. **<u>Your sample is now "fixed"</u>**

<u>Step 3.</u> Prepare to test your fixed water sample.

a) Pour your fixed sample into the graduated cylinder to the 20 ml mark
b) Pour it into the titration vial (glass vial with white lines & flat plastic cap)

<u>Step 4.</u> Fill the titrator syringe (plastic syringe with the pink tip).

a) First push in the plunger to expel air
b) **Put the tip of the titrator into the hole in the top of the titrating solution (bottle labeled Sodium Thiosulfate 0.025N)**
c) Fill the syringe by turning the bottle upside down and slowly pull back on the syringe plunger until the tip on the bottom of the plunger is well past the zero mark on the scale on the titrator. You may have to push the plunger in and out a few times to get rid of any air bubbles in the syringe.
d) **Turn everything right side up.**
e) Slowly push the plunger until the **large ring on the plunger of the plastic titrator is right at the zero mark on the syringe barrel**. Remove the titrator from the sodium thiosulfate bottle.

Step 5. Titrate the sample.

a) Put the **tip of the titrator into the opening on the plastic cap** of the glass titration vial that holds your fixed sample.

b) **Add the titrating solution one drop at a time** by gently pushing the plunger. Swirl the solution between drops **until the sample has turned pale yellow**. If your solution is already pale yellow skip this step. If your solution is colorless you have zero mg/l dissolved oxygen (if this is the case you *may* proceed to step 6 for confirmation).

Step 6. Add starch indicator.

a) Pop off the plastic cap from the titration vial *without moving the titrator's plunger*.
b) Add 8 drops of starch indicator solution to the pale yellow sample in the titration vial. The sample should now turn deep blue or black.
c) Put the cap back on the titration vial.
d) Swirl to mix the contents.

Step 7. Finish the titration.

a) Continue to add sodium thiosulfate one drop at a time, swirling the solution between each drop**.**
b) Observe the color change from dark blue to light blue.
c) **Stop right when the solution turns from pale blue to colorless**.
d) If no color change occurs by the time the plunger tip reaches the bottom of the scale on the titrator, refill the titrator by filling with titrant to the zero mark and continue the titration. Include both titration amounts in the final test results.

Step 8. Read the test result directly from where the scale intersects the ring of the plunger for plastic titrator. The titrator is marked at 0.2 ppm increments. So if the titrator ring is touching the third line below the line marked "7" the result would be 7.6 mg/l dissolved oxygen. (If the titrator has been refilled once before, the result would be 17.6 mg/l dissolved oxygen.)

Step 9. Repeat steps 1 through 8 for a second test from the *same* DO bottle. If the results are more than 1 mg/l apart between the two tests, repeat the test again and record all three results on your monitoring postcard.

Step 10. Repeat steps 1 through 9 for a duplicate test with any other DO bottles. If the results are more than 1 mg/l apart between the two tests, repeat the test again and record all three results on your monitoring postcard.

Step 11. Record all results on your monitoring postcard &/or on-line.

Step 12. Clean-up.

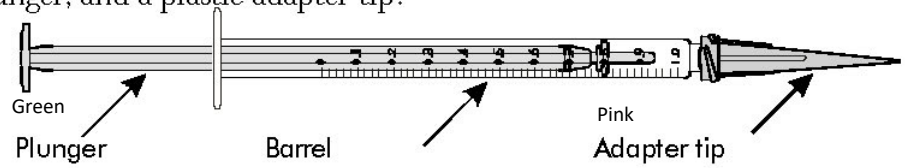
a) Dispense any remaining sodium thiosulfate in the syringe into the titration vial. *Never* put it back in the bottle it came from.
b) By the end of the test all the liquids are safe to pour into the ground or down the drain.
c) Rinse everything with tap water. Allow to air dry on a paper towel.

LaMotte **Product Upgrade Notice**

Direct Reading Titrator General Instructions

Code 1649

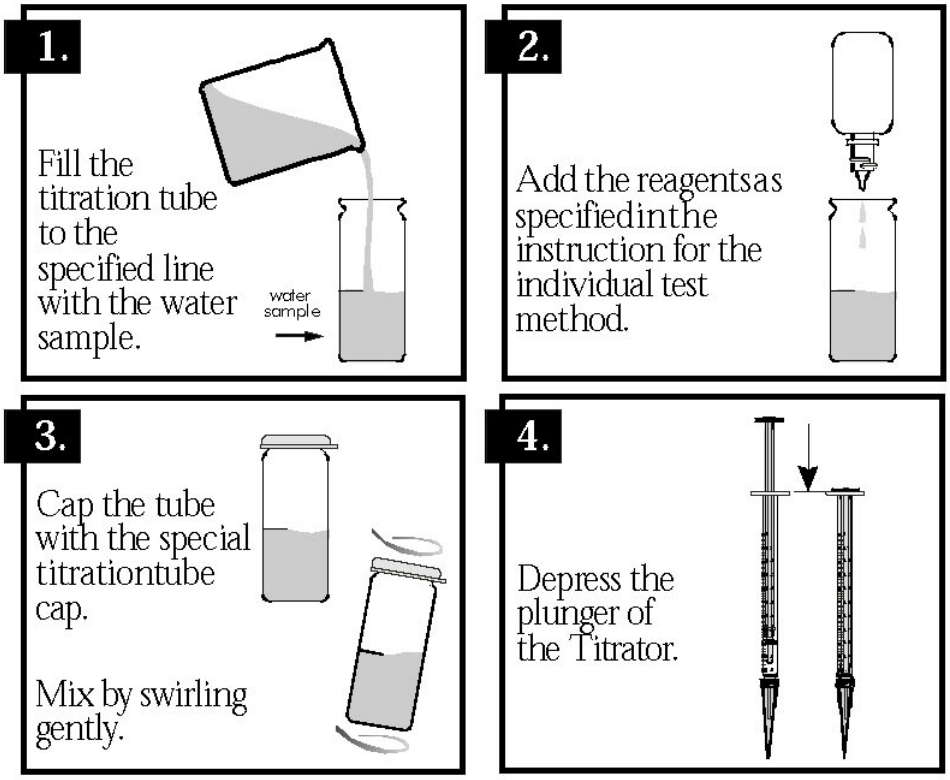
The new Direct Reading Titrator consists of a plastic barrel, a plastic plunger, and a plastic adapter tip.



The adapter tip reduces the size of the drops that are dispensed and increases the precision of the test results. DO NOT REMOVE THE ADAPTER TIP.

Instructions

These are general instructions for the use of the Direct Reading Titrator. The titrator in the illustrations is an example. Refer to individual test kit instructions for test procedures and the actual range and increment values.

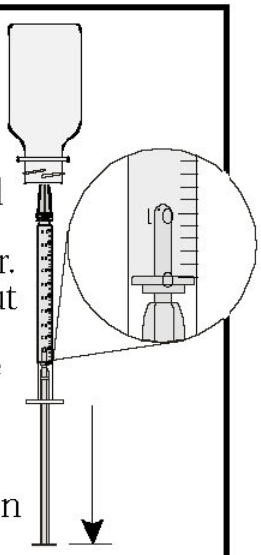


5.

Insert the adapter tip into the special plastic plug in the titrating solution bottle.

6.

Invert the bottle. Hold the bottle and the Titrator firmly together. Slowly pull out the plunger until the large ring on the plunger is opposite the zero (0) line on the scale.

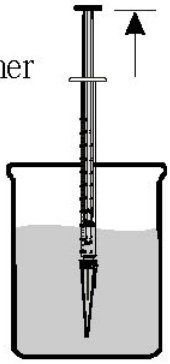


7.

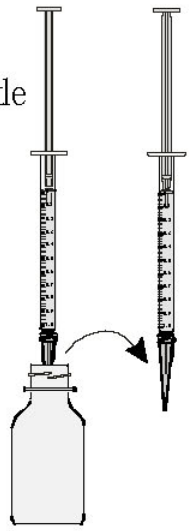
If an air bubble appears in the Titrator barrel or the adapter tip, partially fill the barrel and pump the titration solution back into the inverted reagent bottle to expel the bubble.

NOTE:

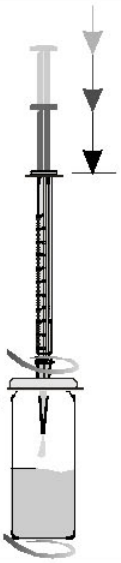
When filling the Titrator from a container without a special plug, submerge the adapter tip below the surface of the solution and pull out the plunger.



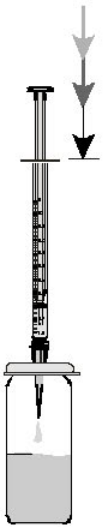
8. Turn the bottle right side up and remove the Titrator.



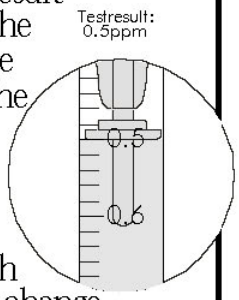
9. Insert the adapter tip into the opening in the titrator tube cap. Slowly depress the plunger to dispense the titrating solution. Gently swirl the tube to mix the solution.



10. Continue adding the titrating solution until the specified color change occurs. If the color change does not occur when the large ring on the plunger reaches the bottom of the scale, refill the Titrator to the zero line. Continue the titration until the color change occurs.



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



12. If no additional tests are to be made, discard the remaining titrating solution in the Titrator. Do not return the titrating solution to the reagent bottle. Thoroughly rinse the titration tube and the Titrator. Do not remove the plunger or the adapter tip from the Titrator.

FAQs about analyzing Dissolved Oxygen (DO)

This is related to your collected water sample(s) and already capped the bottle(s).

Should I pour off any of the water in my sample bottle before I add the reagents?
NO! If you pour off some water, you are introducing air (and oxygen). When you cap the bottle and shake it, this oxygen can cause erroneously high results. Put the bottle on a paper towel if necessary to catch any water that spills over when you add the reagents.

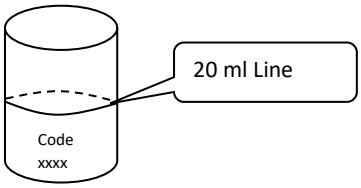
How should I hold the dropper bottles to dispense each reagent?
Hold the dropper bottles completely upside down. This ensures a uniform drop size. The liquid reagents won't come out until you squeeze the bottle.

Why must I shake the bottle and let the floc settle twice?
Doing this twice ensures that the chemical reactions are complete and that all the oxygen molecules have reacted with the chemical reagents.

Sometimes after I add the eight drops of sulfuric acid some brown particles remain. Is this OK?
The brown particles should be dissolved before you continue with your test. First, try shaking the sample bottle quite hard to see if they dissolve. If this doesn't work add one more drop of sulfuric acid (red capped bottle). Occasionally in water with an algae bloom, there may be some organic matter present in your sample. This won't dissolve. You should be able to tell the difference between this organic matter and the chemical particles.

What does it mean by saying that the sample is "fixed"?
In a practical sense it means that contact with atmospheric oxygen will not affect your test results. Fixed samples may be stored up to eight hours, if kept refrigerated and in the dark. The chemical reactions that occur in this analysis are explained after these questions.

What is the best way to measure the amount of fixed sample that I should titrate?
If you have a plastic graduated cylinder, use it to measure 20 ml of fixed sample. If you don't have one pour the fixed sample directly into the titration vial (glass bottle labeled 0299) to the white 20 ml line.



Titration Vial

Okay, now I've got my syringe filled and through the hole in the cap on the titration vial. Sometimes the drops don't seem to fall right into the water sample. Why?
Each cap should have a tiny vent hole in it so that as the sodium thiosulfate is added to the fixed water sample the displaced air can escape. If you don't have this tiny hole, when you add the sodium thiosulfate instead of it dropping into the liquid it will run down the side of the bottle. This will also happen if a drop of liquid on top of the cap covers the vent hole. So, make sure that: 1) your cap has a vent hole and 2) the cap remains unobstructed during the titration. If your cap doesn't have a vent hole, you can easily make one or enlarge an existing one by heating a pin and pushing it through the plastic.

The directions say to add sodium thiosulfate until the water samples turns a straw yellow. How much does the color matter? Why shouldn't I add the starch indicator all at once in the beginning?

We checked directly with the LaMotte Chemical Company. They think that if you add the starch indicator all at once you will be likely to overshoot the end point. The color change from dark blue to colorless is much more abrupt than the more gradual change from brown to yellow. The pale yellow color in itself is an indicator that you are nearing the end point of the titration. They suggest that the yellow color you should be looking for when adding the indicator is "a manila folder yellow" rather than a straw yellow. Linda has also found that in high oxygen water if you add the starch indicator in the beginning, the dark blue color seems to coat the sides of the titration vial, which makes the visual determination of the endpoint more difficult.

My water sample is pale yellow right after it is fixed. Do I still have to see it get lighter before I add the starch indicator?

If your water sample is already a pale yellow after it is fixed, add the starch indicator before you begin your titration. If your sample is completely colorless after it is fixed and remains that way after you add the indicator this means that there is no dissolved oxygen in your sample. If this is the case, you might want to check the dissolved oxygen content of the - meter water just to make sure that the reagents in your kit are still functioning properly. If the surface water also has no detectable dissolved oxygen, call URI Watershed Watch at 874-2905 so that we can check your reagents to make sure everything is OK.

How many times should I run the test on my water sample?

You should run the dissolved oxygen test at least **twice** on each of your water samples. If the results are more than 1.0 ppm apart run it a third time. Remember to report <u>all</u> the results on your monitoring postcard.

What should I do with any leftover sodium thiosulfate in the syringe?

Discard any remaining sodium thiosulfate into your titrator vial. Do not put it back into the bottle it came from. Then take apart your syringe and rinse it with tap water. Store it with the plunger backed off from the bottom of the syringe.

Chemical reactions on the next page

NOTES*:*

Chemical Reactions when Using the Azide Modification of the Winkler Method to Test for Dissolved Oxygen

(Originally from: Clean Water: A Guide to Water Quality Monitoring, by E. Stancioff, University of Maine Cooperative Extension. Updated by URIWW volunteer and retired chemistry teacher J. Watts.)

The first step in a dissolved oxygen (DO) titration is the addition of manganous sulfate solution (4167) and alkaline potassium iodide azide (7166) to the water sample. These reagents react with each other to form a precipitate, or floc, of manganous hydroxide, $Mn(OH)_2$. Alternatively, 1 mole of oxygen (O_2) is equivalent to 2 moles of $Mn(OH)_4$. Chemically the reaction is:

$$\mathbf{MnSO_4 + 2KOH \longrightarrow Mn(OH)_2 + K_2SO_4}$$

manganous sulfate + potassium hydroxide → manganous hydroxide + potassium sulfate

Immediately upon formation of the precipitate, the oxygen in the water oxidizes an equivalent amount of the manganous hydroxide to manganic hydroxide. In other words, for every atom, in the water one molecule of manganous hydroxide is converted to manganic hydroxide. The reaction is:

$$\mathbf{2\,Mn(OH)_2 + O_2 + 2H_2O \longrightarrow 2Mn(OH)_4}$$

manganous hydroxide + oxygen + water → manganic hydroxide

After the precipitate is formed a strong acid, sulfuric acid 1:1 (6141WT) is added to the water sample. The acid converts the manganic hydroxide to manganic sulfate. At this point the sample is considered "fixed". Any concern for additional oxygen being introduced into the sample is reduced. The chemical reaction is:

$$\mathbf{Mn(OH)_4 + 2H_2SO_4 \longrightarrow Mn(SO4)_2 + 4H_2O}$$

manganic hydroxide + sulfuric acid → manganic sulfate + water

Simultaneously, iodine from the potassium iodide in the alkaline potassium iodide azide solution is replaced by sulfate, releasing free iodine into the water. Since the sulfate for this reaction comes from the manganic sulfate which was formed from the reaction between the manganic hydroxide and oxygen; the amount of iodine released is directly proportional to the amount of oxygen present in the original sample. The release of free iodine is indicated by the sample turning a yellow-brown color. This chemical reaction is:

$$\mathbf{Mn(SO_4)_2 + 2KI \longrightarrow Mn(SO_4) + K_2SO_4 + I_2}$$

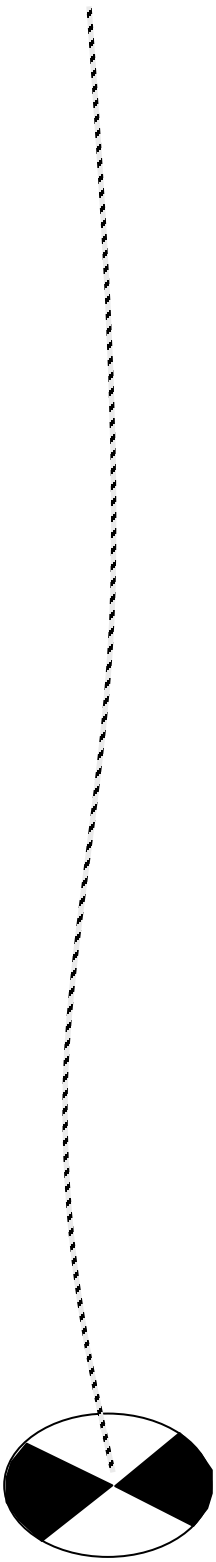
manganic sulfate + potassium iodide → manganous sulfate + potassium sulfate + iodine

The final step in the Winkler titration is the addition of sodium thiosulfate. The sodium thiosulfate reacts with the free iodine to produce sodium iodide. When all the iodine had been converted the sample changes color from yellow-brown to colorless. Often a starch indicator is added to enhance the final endpoint. This chemical reaction is:

$$\mathbf{2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI}$$

sodium thiosulfate + iodine ⟶ sodium tetrathionate + sodium iodide

Secchi Depth Transparency (Field SOP 005)



To learn what the end point (i.e. when the Secchi "disappears") check out the Maine Secchi simulator: http://www.mainelakedata.org/secchi-simulator/

Make your measurements **between 10 AM and 2 PM**, preferably at the same time, each time you go out.

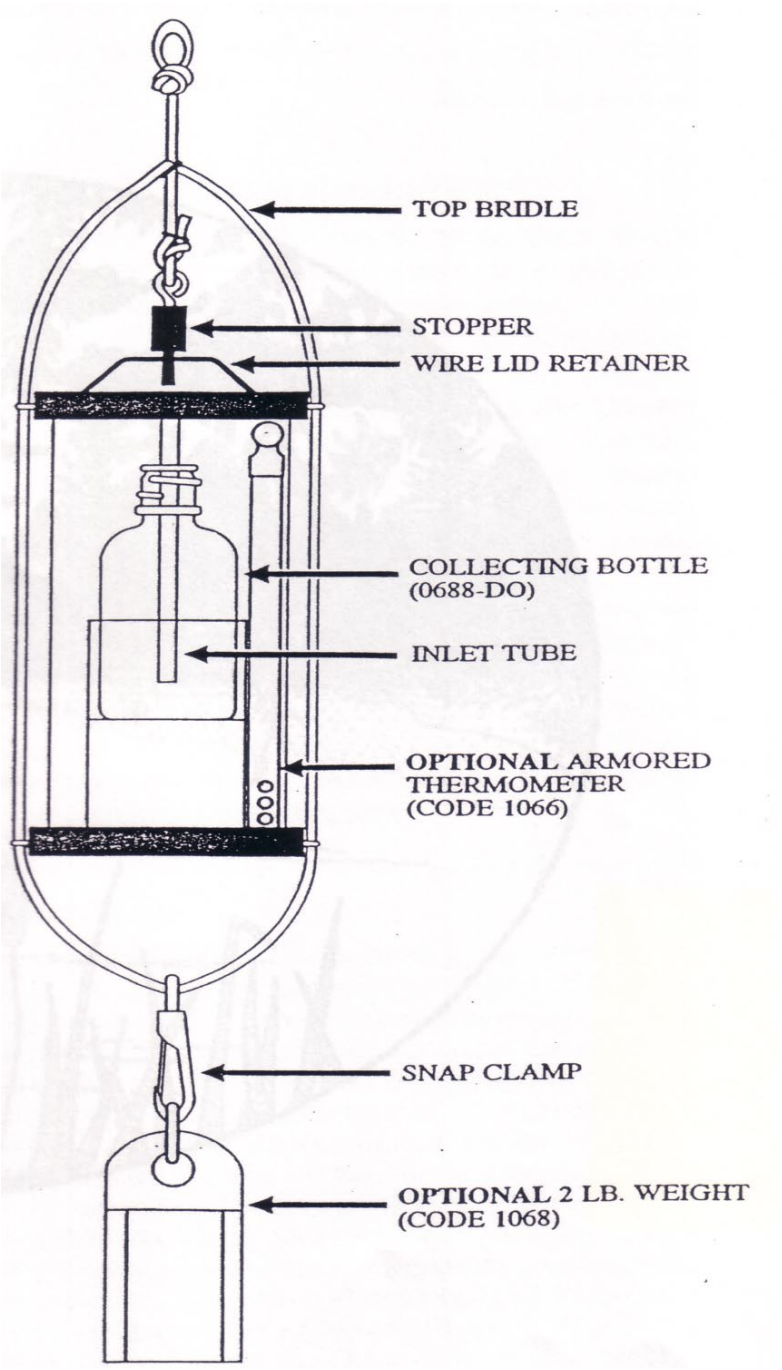
1. Position your boat over the deepest point in your pond and anchor it.
2. Secchi depth measurements are taken with the aid of a view tube.
3. Make your measurements from the sunny side of the boat. Wear your regular prescription glasses, but not sunglasses.
4. Hold the view tube vertically by the handle so that it extends into the water about 4 inches.
5. Using your free hand, lower the Secchi disk slowly until it just disappears from sight.
6. At this point mark where your line meets the water with a clothespin. This is the descending Secchi depth transparency.
7. Now, lower your line a few feet more, then slowly raise it. When you can just make out the Secchi disk, mark the line with another clothespin. This is the ascending Secchi depth transparency.
8. Bring your disk back on board your boat.
9. The engineering tape attached to your Secchi disk is marked in meters and tenth's of meters. (1 meter = 3 1/4 feet). *Measure the distance to each clothespin from the Secchi disk to the nearest 1/10 meter.*
10. Record your measurements in your field note pad, using a pencil. (Pencils write when wet, pens usually don't).
11. After any other monitoring procedures are competed, make a second set of Secchi depth transparency measurements following Steps 4-11. Record those measurements too.
12. After all monitoring procedures are completed determine bottom depth by dropping the Secchi disk all the way to the bottom of the pond. It is important to do this last because when the Secchi disk hits the bottom it will stir up sediment.

When you are back on shore, transfer your readings and other appropriate monitoring information to the pre-stamped postcard and drop it a mailbox as soon as possible. Postcards should be mailed weekly. Alternatively enter your field data on-line and save your postcard and hand it in at the end of the monitoring season.

Please remember to put your monitoring location, your name, date and time on your monitoring postcard. We can't use your data if we don't know from where and when it came!

Deep Water Sampler Operation (Field SOP 012)

The LaMotte Water Sampling Bottle (3-0026) is a unique device that collects water samples representative of specific depths and is particularly suited to the collection of dissolved oxygen samples. Samples may be taken at specific depths by using the attached stopper and attached calibrated line and (2 pound) weight. Simply lower the bottle to the sample depth. When the trip line is pulled the sample collection bottle will begin to fill, overflowing and flushing more than 5 times. During retrieval, decreasing water pressure prevents exchange of air and water with the sample. Excess water in the sample chamber can be used for other tests. The interior chamber also accommodates LaMotte Model 545 Armored Thermometer for accurate sample temperature readings. The thermometer can be pressed gently into a hole in the base of the sampler chamber, and the sample temperature can be read through the clear body of the sampler.



Note: The dark grey plastic that this sampler is made from absorbs heat, which could result in artificially higher water temperature values. Please be sure to keep the sampler in a cooler or out of the sun until you are ready to use it.

Operation

1. To release the wire lid retainer lift it up and away from the sampler.
2. Remove the plastic lid with attached inlet tube, by sliding it up the rope bridle.
3. Rinse the sampler with some surface water, discarding rinse water.
4. Insert a dissolved oxygen collecting bottle, with the cap removed, into the inner chamber of the sampler.
5. Replace the grey sampler lid, inserting the inlet tube into the collecting bottle.
6. Snap the wire lid retainer into the grooves on the lid by lifting up and in.
7. Attach a weight (two pound or more) to the snap clamp at the bottom of the rope bridle.
8. Press the black plastic stopper securely into the center inlet hole.

9. Lower the water sampling bottle quickly to the desired depth.
10. Jerk the calibrated line to remove the stopper from the inlet hole and start collecting your water sample.
11. Note: As air is displaced by water entering the sampler, bubbles will be observed rising to the surface (downstream). When the water sampler is filled, bubbles will no longer appear. Filling takes about a minute and the bubble rarely appear near the sampler line.
12. Once there are no more air bubbles, use a steady, hand-over-hand motion, to retrieve the water sampler.
13. If the thermometer is used with the sampler, read the temperature through the clear sample body *without* removing the thermometer from the sampler. Record the temperature.
14. Place the sampler on a flat surface.
15. Release the wire lid retainer and remove the plastic lid with inlet tube attached, sliding it up the rope bridle.
16. Cap and remove the dissolved oxygen bottle from the inner chamber of the sampler. If the dissolved oxygen test is to be performed on this sample, follow the directions in your dissolved oxygen test kit.
17. Use the remaining water in the sampler to rinse and fill your chlorophyll and sample bottles. You may need to collect more than 1 water sample to rinse and fill your bottles.
18. When you are back on shore, rinse your water sampler with tap water and let air dry.
19. For more information contact:

LaMotte Company

PO Box 329 Chestertown, MD 21620

1-800-344-3100

https://lamotte.com/

5.0 Supplemental Information

(This manual intentionally does not have a section 4)

Units of Measure

Acre (ac):

An area equal to 43,560 square feet, approximately 0.4 hectare. Acres / 2.5 = hectares.

Centimeter (cm):

One one-hundredth of a meter, equivalent approximately to two-fifths of an inch.

Concentration:

The ratio of the amount of one substance in another substance. For example, in seawater, the amount of chloride dissolved in water is approximately 18,000 milligrams per liter.

Gram (g):

One one-thousandth of a kilogram, approximately 28 g per ounce.

Hectare (ha):

Metric measurement for area equivalent to 10,000 square meters or approximately 2.5 acres. Hectares X 2.5 = Acres.

Kilogram (kg):

The base unit for mass in the metric system; 1000 grams or approximately 2.2 pounds; an 150-pound person weights 68 kilograms.

Liter (L):

A unit of metric measurement for volume; roughly equivalent to 1 quart or 0.25 gallon. There are 1000 milliliters in 1 liter. 1 liter of water weighs 1 kilogram.

Mass:

In common usage, mass is used synonymously with weight; the common English unit for mass is pounds (lb), whereas in the metric system the unit is the kilogram (kg).

Meter (m):

The basic metric unit for length; equivalent approximately to 3.25 feet; a 5-foot person is approximately 1.5 meters tall.

Metric System:

An international system of scientific measurements based on multiples of 10. The base unit for length is the meter and for mass, the kilogram.

Microgram (ug):

One one-millionth of a gram, one one-thousandth of a milligram.

Micrograms per liter (ug/L):

An expression for concentration, usually in reference to a liquid, roughly equivalent to parts per billion.

Milligram (mg):

One one-thousandth of a gram. Also equal to 1 milliliter (one thousandth of a liter)

Milligrams per liter (mg/L):

An expression for concentration, usually in reference to a liquid, roughly equivalent to parts per million; for example, 1 gallon of food coloring placed in 1 million gallons of water would result in a concentration of food coloring in the water of 1 mg/L.

Millimeter (mm):

One one-thousandth of a meter; a dime is approximately 1 millimeter thick; 1-inch equals approximately 25 millimeters.

Parts per billion (ppb):

An expression for concentration (see Micrograms per Liter); one one-thousandth of a part per million; the quantity of one substance contained in 1 billion units of another substance when both are measured by identical terms. The magnitude of this quantity can be related to 8 ounces of a substance dissolved in 4 inches of water ponded on a 1 square mile area; roughly equivalent in scale to 2 seconds in a lifetime.

Parts per million (ppm):

An expression for concentration (see Milligrams per Liter); the quantity of one substance contained in 1 million units of another substance when both are measured by identical terms. For solutions (substances dissolved in liquids), it is the number of units of the substance contained in 1 million units of solution.

Meters to Feet Conversion

0.025 meters =	1 inch
0.1 meters =	4 inches
0.5 meters =	1.6 feet
1.0 meters =	3.3 feet
1.5 meters =	4.9 feet
2.0 meters =	6.6 feet
2.5 meters =	8.2 feet
3.0 meters =	9.8 feet
4.0 meters =	13.1 feet
5.0 meters =	16.4 feet
6.0 meters =	19.7 feet
7.0 meters =	23.0 feet
8.0 meters =	26.2 feet
9.0 meters =	29.5 feet
10.0 meters =	32.8 feet

Temperature Conversions

-18 C = 0 F
-12 C = 10 F
0 C = 32 F water freezes
10 C = 50 F
15 C = 59 F
20 C = 68 F
25 C = 77 F
30 C = 86 F
35 C = 95 F
40 C = 104 F
50 C = 122 F
100 C = 212 F water boils

F = [9/5 (C)] + 32
C = 5/9 (F - 32)

A Glossary of Terms

Anoxia:

A condition of no oxygen in the water. Often occurs near the bottom of eutrophic, stratified lakes in summer; under ice in winter.

Algae:

Green plants that occur as microscopic forms suspended in water (phytoplankton), and as unicellular or filamentous forms attached to rocks and other substrates. About 15,000 species of freshwater algae are known.

Algal bloom:

A sudden increase in the abundance of suspended (planktonic) algae, especially at or near the water surface, producing a green scum or a "pea-soup" appearance.

Biomass:

The weight of biological matter.

Brown water lakes:

Lakes which are naturally rich in humic (organic) materials derived from plants, giving the water a "tea" color; "stained" lakes.

Chlorophyll:

Green pigments found in plants which are necessary for photosynthesis; may be utilized as an indicator of algal population levels.

Cultural eutrophication:

The accelerated enrichment of waters due to the activities of man, such that they support a higher amount of plant and animal matter than they would naturally.

Ecosystem:

A community of plants and animals interacting within the physical and chemical environment.

Eutrophic:

A term used to describe very productive or enriched lakes. These lakes tend to exhibit some or all of the following characteristics: an abundance of rooted plants; turbidity due to high algal populations; loss of oxygen in bottom waters during the summer months; rapid accumulation of soft bottom sediments; and abundant fish, which may include stunted and/or rough species in the most fertile lakes.

Eutrophication:

A gradual increase in the productivity of a lake ecosystem due to enrichment with plant nutrients, leading to changes in the biological community as well as physical and chemical changes. This is a natural process, but it can be greatly accelerated by man (see cultural eutrophication).

Flushing rate:

The number of times that the total volume of water in a lake is replaced in a year by inflowing streams, groundwater, precipitation, and overland runoff.

Epilimnion:

Uppermost, warmest, well mixed layer of a lake during summertime thermal stratification. The epilimnion extends from the surface to the thermocline.

Habitat:

The place where a plant or animal lives, which has all of the conditions necessary to support its life and reproduction.

Hypolimnion:

Lower cooler layer of a lake during summertime thermal stratification.

Mesotrophic:

A term used to describe lakes which are moderately productive. These lakes tend to exhibit some or all of the following characteristics: moderate growth of rooted plants and algae; some loss of oxygen from bottom waters during the summer months; some sediment accumulation; relatively good fish production of cool or warm water species, such as walleye, perch, bass, pike, and panfish. Most lakes are placed in this category.

Metalimnion:

The layer of rapidly changing temperature and density which separates the hypolimnion from the epilimnion.

Nitrogen:

An element necessary for the growth of the aquatic plants; may be found in several forms, including nitrates, nitrites, and ammonia.

Nutrient:

Any of a group of elements necessary for growth. Although over 15 elements have been identified as necessary for growth of aquatic plants, most are readily available in natural waters. Supplies of phosphorus or nitrogen may be depleted, however, thus limiting plant growth in surface waters.

Oligotrophic:

A term used to describe a relatively unproductive lake or one poorly supplied with plant nutrients. Because of low biological production, these lakes tend one poorly supplied with plant nutrients. Because of low biological production, these lakes tend to exhibit some or all of the following characteristics: clear waters; limited growth of algae or rooted plants; bottom waters well supplied with oxygen throughout the year; low rate of sediment accumulation; low fish production, but often of desirable species, such as trout, walleye, or perch.

Plankton:

The community of micro-organisms, consisting of plants (phytoplankton) and animals (zooplankton) inhabiting open-water regions of lakes and rivers.

Phosphorus:

An element necessary for the growth of aquatic plants. It is naturally present in low concentrations, and lack of phosphorus often limits plant growth. Thus, the addition of phosphorus can affect water quality by increasing the production of algae and rooted plants.

Producers:

Green plants that manufacture their own food through photosynthesis.

Productivity:

The amount or mass of living things which can be supported by an ecosystem (e.g., a lake) over a specified period of time.

Photosynthesis:

Conversion of water and carbon dioxide in the presence of sunlight to carbohydrates.

Residence Time:

The average time required to completely renew a lake's water volume is called the hydraulic residence time. Short residence times are ten days or less, long residence times are greater than one hundred days.

Secchi disk:

A simple device widely used to measure the transparency or clarity of water, consisting of a metal or plastic plate, usually 8" in diameter, painted black and white, on a calibrated line.

Secchi depth transparency:

The depth at which a Secchi disc disappears from view when lowered into the water. A measure of water clarity.

Sediment:

Solid material including both soil particles and organic matter which is suspended in the water and gradually deposited in the bottom of a lake.

Standard deviation:

A statistical term used to describe the amount of variation in a set of data; 68% of all measurements are expected to fall within plus- or minus-one standard deviation from the mean (average).

Thermocline:

A horizontal plane of water across the lake through the point of greatest temperature change. It is within the metalimnion.

Trophic state:

The level of productivity in a lake, or degree of eutrophication; generally described as eutrophic (very productive).

Trophic State Index (TSI):

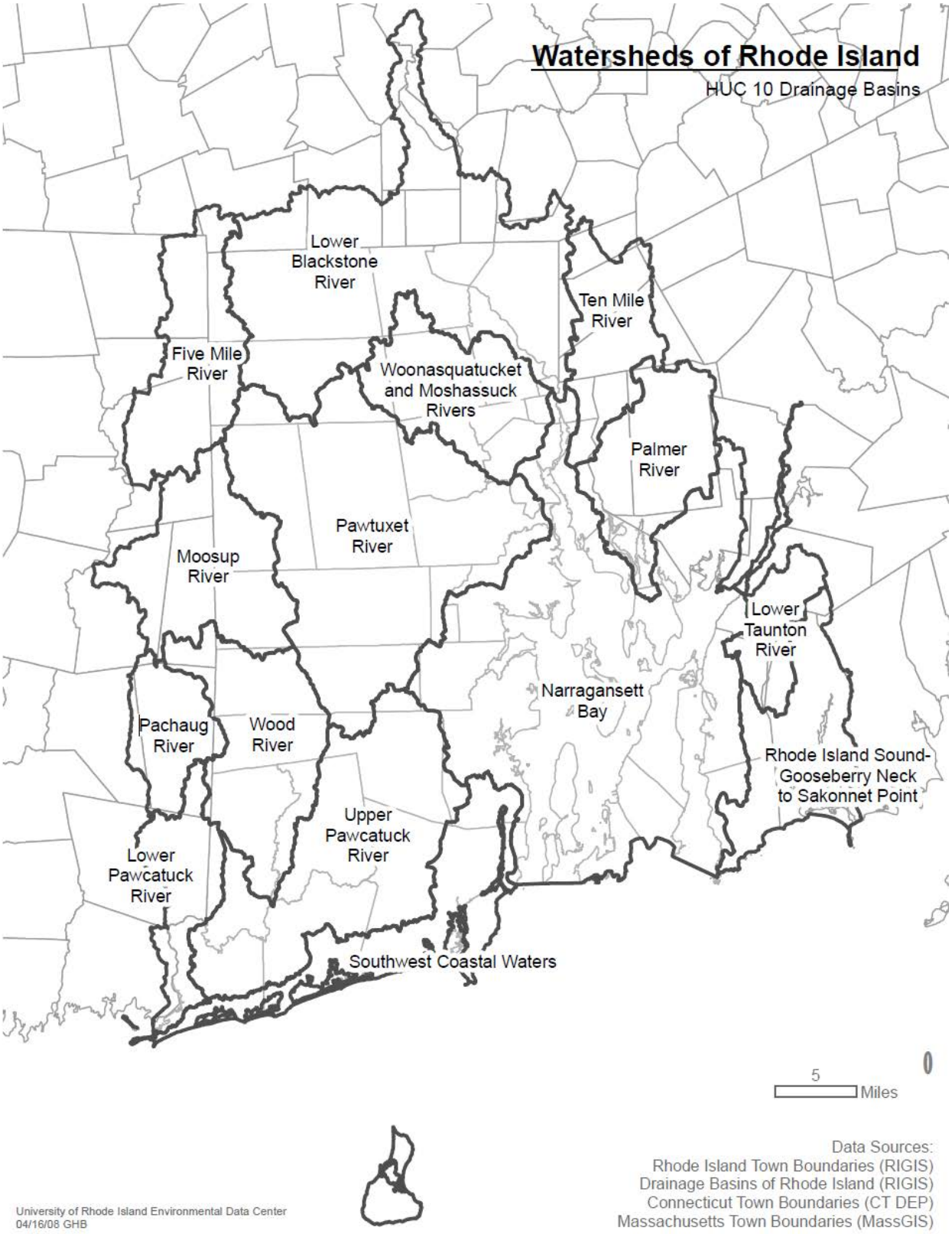
A numerical scale used to classify lakes according to productivity (the amount of living material supported by the lake). The TSI value (0-100) is calculated directly from Secchi depth transparency, phosphorus concentration, or chlorophyll a concentration.

Turbid:

Cloudy, not clear.

Watershed: A drainage area or basin; all land and water areas which drain or flow toward a central collector, such as a stream or a lake, at a lower elevation.

Watersheds of Rhode Island



Additional Resources on the URI WW website

- Monitoring Schedules - https://web.uri.edu/watershedwatch/monitoring/monitoring-schedule/
- Online data and data entry - https://web.uri.edu/watershedwatch/data/
- News - https://web.uri.edu/watershedwatch/news/
- Training Videos - https://web.uri.edu/watershedwatch/resources/training-videos/
- Water Quality Fact Sheets - https://web.uri.edu/watershedwatch/resources/water-quality-fact-sheets
- Hot Topics - https://web.uri.edu/watershedwatch/hot-topics/
- URI WW Quality Assurance Project Plans (QAPP) - https://web.uri.edu/watershedwatch/resources/quality-assurance/