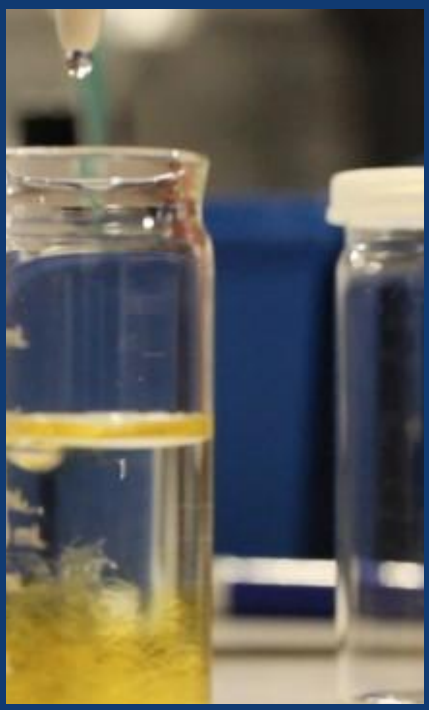
RIVERTRENDS METHODS MANUAL

ALLIANCE
for the Chesapeake Bay



Version 3

May 2026

Chesapeake
Monitoring
Cooperative

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Alliance for the Chesapeake Bay

CONTRIBUTORS

This document was created through a collaborative effort of three organizations: The Alliance for the Chesapeake Bay, Alliance for Aquatic Resource Monitoring, and the University of Maryland Center for Environmental Science.

chesapeakemonitoringcoop.org

ACKNOWLEDGEMENTS

Much of this manual was adapted with permission from the following sources:

RiverTrends Volunteer Water Quality Monitoring Manual. (2012). The Alliance for the Chesapeake Bay

Virginia Citizen Water Quality Monitoring Program Methods Manual. (2007).Virginia Department of Environmental Quality

EcoCheck. (2011). Sampling and data analysis protocols for Mid-Atlantic tidal tributary indicators. Wicks EC, Andreychek, ML, Kelsey RH, Powell SL (eds). IAN Press, Cambridge, Maryland, USA.

EcoCheck. (2013). Sampling and data analysis protocols for Mid-Atlantic non-tidal stream indicators. Wicks EC, Fries AS, Kelsey RH, (eds). IAN Press, Cambridge, Maryland, USA.

Chemical Monitoring Manual, (2010). Alliance for Aquatic Resource Monitoring

U.S. EPA. 1997. Volunteer Stream Monitoring: A Methods Manual. EPA 841-B-97-003.

U.S. EPA. 1996. Recommended Guidelines for Sampling and Analyses in the Chesapeake Bay Monitoring Program. EPA 903-R-96-006.

Front cover photo credit: Chesapeake Bay Program.

ABOUT THE CMC

We rely heavily on the Chesapeake Bay and all its tributaries for our drinking water, food sources, recreation, and navigation. Since the initiation of the Chesapeake Bay Program in 1983, the communities in the watershed have been working towards improving the health of these waters. A significant portion of that work is tracking our progress through water quality monitoring. There are many sources of water quality data—including data collected by volunteers, local governments, conservations districts, and nongovernmental groups such as academia and watershed organizations that were not being used by the Chesapeake Bay Program to track Bay health and determine success of restoration efforts.

The Alliance for the Chesapeake Bay (ACB), Izaak Walton League of America (IWLA), Dickinson College's Alliance for Aquatic Resource Monitoring (ALLARM), and the University of Maryland Center for Environmental Science Integration and Application Network (UMCES IAN), came together in 2015 to create the **Chesapeake Monitoring Cooperative (CMC)**. The CMC provides technical, logistical, and outreach support for the integration of volunteer and citizen-based water quality and macroinvertebrate monitoring data into the Chesapeake Bay Program (CBP) partnership.

This is the first regional effort to integrate participatory science water quality data that will inform policy management and water quality assessments into a federal program. Not only are these data available to the CBP through the CMC Data Explorer, but are also accessible to the public, local governments, universities, and others. The contributions of data by volunteer and community-based monitoring groups to the CMC and CBP monitoring network will provide valuable information that supports shared decision- making, adaptive management, and measuring progress towards the Chesapeake Bay Watershed Agreement.

Chesapeake Monitoring Cooperative

ABOUT RIVERTRENDS

RiverTrends is the Alliance for the Chesapeake Bay's longest-running Virginia-based volunteer water quality monitoring program. Since 1985, RiverTrends has trained hundreds of volunteers to collect baseline water quality data from the many streams and rivers that flow into the Chesapeake Bay. This data can be used to summarize stream conditions, track restoration progress, and identify waters needing improvements. RiverTrends provides training, equipment, and technical support to groups throughout the Chesapeake Bay portion of Virginia.

SAMPLING PARAMETERS

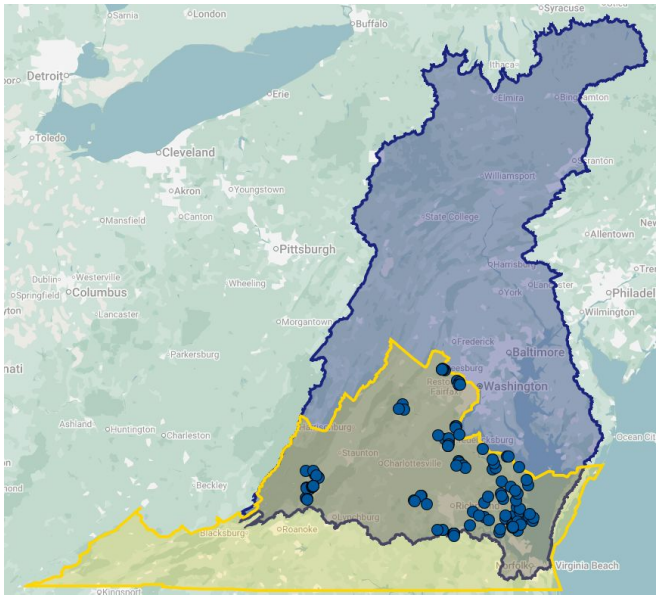
RiverTrends volunteers collect monthly data on the vital signs of waterways, including **visual observations, temperature, pH, dissolved oxygen, water clarity,** and **salinity.** Some monitors may also sample for **bacteria**. Sampling these specific parameters allow us to have a more complete view of how our waterways change over time.

OUR REACH

RiverTrends spans across the Chesapeake Bay portion of Virginia, covering 24,000 square miles, or 60% of the landmass of Virginia. This includes the Potomac, Rappahannock, York, and James River watersheds.

As of 2026, RiverTrends supports:

- **150** volunteer monitors
- **100** monthly sampling locations
- **20+** active partner groups



FUNDERS AND PARTNERS

Chesapeake Bay Program
Science. Restoration. Partnership.

VIRGINIA BAY-2K
FRIEND OF THE CHESAPEAKE

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Scotts

RIVERTRENDS PARAMETERS

VISUAL OBSERVATIONS

Visual observations and site conditions provide context to your water quality data. These include weather, rainfall, water depth, tide stage, and more. Visual indicators are valuable clues to understanding what might be influencing the data you collect.

WATER TEMPERATURE

Temperature measures how much heat is present in water or air. It naturally changes throughout the day and across seasons. Water temperature affects other indicators, like dissolved oxygen, and plays a role in determining which plants and animals can survive in the water.

PH

pH is the measure of acidity or alkalinity of water. The pH scale ranges from 0 (very acidic) to 14 (very alkaline, or basic) with 7 being neutral. Nutrients and other chemical substances can be toxic at pH levels outside of a healthy range.

DISSOLVED OXYGEN

Just like humans need oxygen to breathe, fish and other aquatic animals need oxygen in the water to survive. Moving water mixes in dissolved oxygen from the air and from plants in the water that produce it through photosynthesis.

WATER CLARITY

Water clarity and turbidity show how easy it is to see through water. Water clarity is a measure of how far light travels from the surface of the water. Turbidity measures the amount of cloudiness of the water, caused by material like sediment, plankton, and algae.

SALINITY

Salinity measures how much salt is dissolved in water. In an estuary like the Chesapeake Bay, salinity forms a natural gradient: waters near the mouth of the Bay are as salty as the ocean (around 35 parts per thousand or ppt), and the water becomes less salty as you move upstream, eventually reaching freshwater (close to 0 ppt).

BACTERIA

Bacteria are naturally found in our waterways. Though most are harmless, the presence of certain bacteria serve as indicators for other more harmful pathogens. Escherichia coli (E. coli) or enterococci are common bacteria that live in the intestines of humans and animals and are present in feces. High levels of E. coli or enterococci mean harmful bacteria could be present in the water.

VOLUNTEER EXPECTATIONS

We cannot fully understand the health of our watershed without the help of our trusted volunteers. RiverTrends welcomes a wide array of partners, including master naturalists, state parks, tribes, homeowners associations, schools, and community groups. We rely on your local knowledge to access sites and share concerns about locations that state and federal agencies may not have the resources to monitor regularly.

To maintain a positive volunteer experience and high scientific standards, RiverTrends monitors commit to the following:

- **Monthly Commitment:** Monitors are expected to visit their monitoring site(s) monthly throughout the year. A typical sampling event takes 2-4 hours, including travel, equipment calibration, sample processing, and data upload.

- **Initial Training and Recertification:** All monitors attend a comprehensive initial training workshop to learn protocols, then maintain an updated certification at annual check in sessions.

- **Quality Assurance Standards:** Monitors are required to follow all procedures outlined in the monitoring manual, including proper equipment calibration and maintenance. All results must be recorded on your field datasheet.

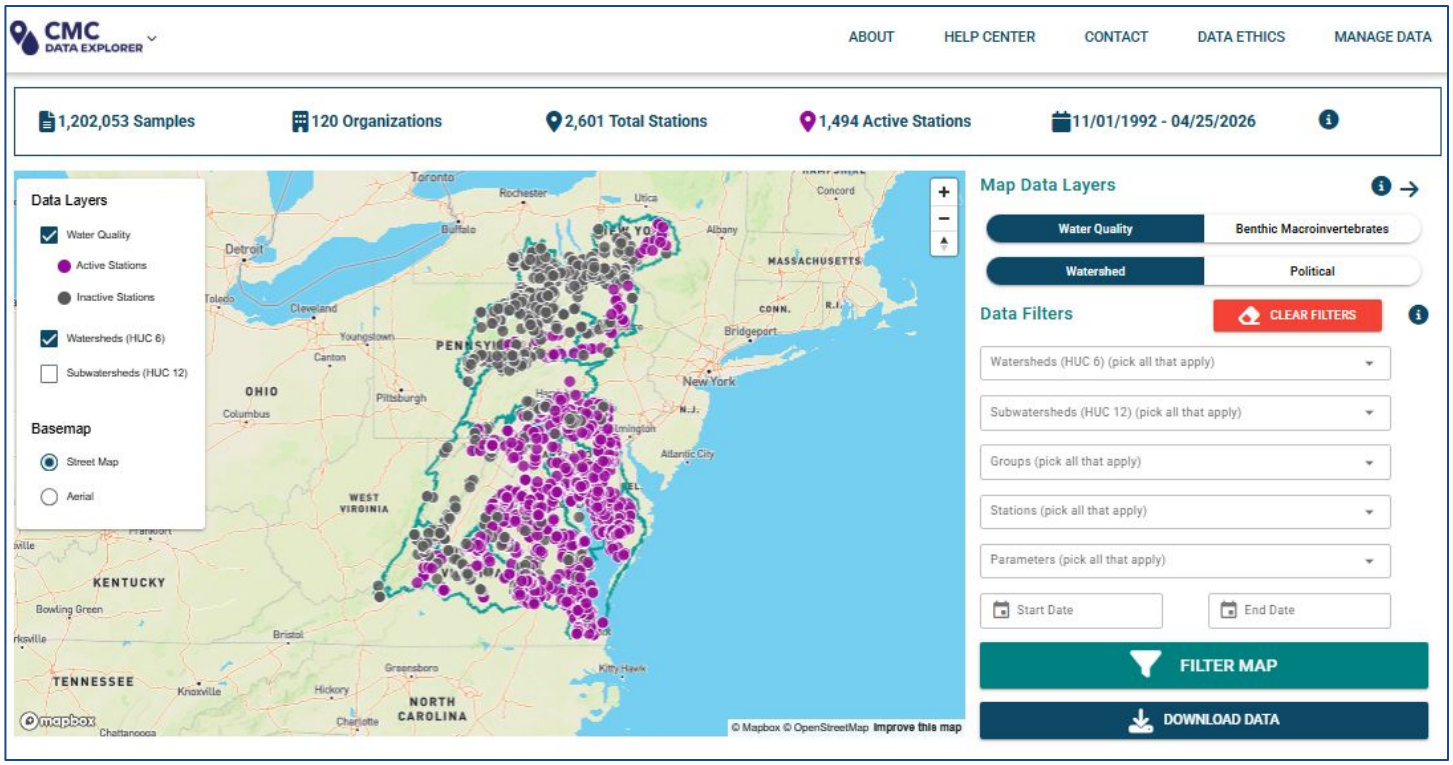
- **Data Submission:** Monitors are responsible for uploading their data to the CMC Data Explorer in a timely manner on a quarterly basis at minimum. All hard copies of datasheets must be mailed or emailed to the RiverTrends coordinator.

- **Equipment Maintenance and Care:** Volunteers are given a monitoring kit they are in charge of storing, caring for, and keeping track of expiration dates of materials.

CMC DATA EXPLORER

The **CMC Data Explorer** is a centralized, web-based platform that stores water quality and macroinvertebrate data collected by volunteer and community monitoring groups throughout the Chesapeake Bay watershed. There are standardization steps in place to ensure that community-contributed data is credible, organized, and ready for public use.

Users can interact with a live map by using filters to visualize local trends and download raw datasets. By bridging the gap between local volunteers and state and federal agencies, the CMC Data Explorer fills critical geographic data gaps, providing a more comprehensive picture of the Bay's health and directly informing restoration efforts across the region.



https://cmc.vims.edu/

DATA UPLOAD

As a RiverTrends monitor, you are required to electronically enter the water quality data that you collect on the CMC Data Explorer. RiverTrends has a system of checks to make sure that the data made available on the CMC Data Explorer is of the highest possible quality. All steps to upload your data are outlined later in this manual.

BEST PRACTICES FOR MONITORING

MONITORING PREPAREDNESS

SAMPLING FREQUENCY

RiverTrends sampling should be completed on a monthly basis at minimum. Pick a consistent sampling day and time (e.g. the first Tuesday of each month at 10AM). If you miss your day, try to sample within 2 days of your target date.

ACCESS AND PERMISSIONS

If sampling on private property, you must have a signed Landowner Permission form on file with the RiverTrends Coordinator. A blank version of this form is available in the "Additional Resources" section at the end of this manual.

EQUIPMENT PRE-CHECK

- Inspect equipment for wear and tear that might affect the quality of your measurements.
- Ensure your batteries are charged or carry spares.
- Perform all calibration and standardization checks before leaving for the field.

SAFETY PROTOCOLS

THE BUDDY SYSTEM

When possible, always sample with a partner for safety and an extra set of hands. At minimum, notify someone when you leave and return.

ENVIRONMENTAL HAZARDS

Safety first! Never monitor during inclement weather, under dangerous flow conditions, or if you are feeling unwell.

SAFETY PRECAUTIONS

- Though not required, you may choose to wear safety glasses or nitrile gloves when handling reagents or bacteria samples.
- Wear closed-toe shoes or waders when entering and exiting the waterway.
- Do not eat, drink, or smoke while testing.
- Wash hands immediately after contact with samples or reagents.
- Keep a first aid kit readily available.

BEST PRACTICES FOR MONITORING

FIELD COLLECTION PROTOCOLS

SAMPLING ORDER

Collect samples in the following order:

Bacteria → Air temperature → Water temperature → Dissolved oxygen → pH →

Salinity → Water clarity → Total water depth

HOW TO COLLECT YOUR SAMPLE

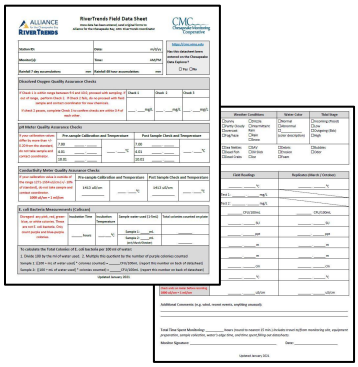
- Water samples should be collected from the middle of the waterway at the point where the water is the deepest and, when possible, the flow is the fastest.
- Do not sample stagnant water, pools, or eddies.
- The sample method (bridge, dock, wading in, or streamside) is chosen based on site accessibility. Use the same method of sampling each time you visit your site.
- Always sample **upstream** of yourself. Pour equipment rinses **downstream** of your collection point. If needed, sample from the streabank at the point of greatest flow. If sampling from a bridge, avoid collection where stormwater runoff may affect the sample. If sampling from a dock, move to the end to reach the main flow. Ensure you are upstream of any docked boats, engines, or direct sources of contamination.

If sampling using a bucket, scoop water mid-channel, careful not to stir up sediment. Rinse the bucket three times, emptying dowstream each time. Fill a fourth time with sample water.

If sampling directly in the waterway, take a few steps upstream before sampling to ensure any sediment stirred up is washed downstream.

RECORDING YOUR DATA

Record data on the provided field data sheet. Always record testing results immediately. Use the “comments” sections for observations about your site, such as erosion, weather, or equipment issues. Keep a backup copy of all data.



BEST PRACTICES FOR MONITORING

SAMPLE TRANSPORT AND HOLDING TIMES

Samples must be processed and analyzed within a certain time window in order for it to be a valid sample. Bacteria samples must be kept cool in a cooler with regular ice (not ice packs). Use zip-lock bags to prevent samples from being submerged or diluted by melting ice water.

PARAMETER	HOLDING TIME
Bacteria (R-Card)	24 hours
Dissolved Oxygen	Fix immediately, titrate within 8 hours
pH	analyze immediately
Salinity	
Water clarity	
Air and water temperature	

POST-SAMPLING AT THE LAB/HOME

TIMELY PROCESSING

- Process samples according to the “Holding Times” chart. Gently shake your sample before dispensing to ensure it is well-mixed.

REAGENT SAFETY AND DISPOSAL

- Do not dispose of reagents or waste on the ground or in the waterway. If permitted, pour the waste down your sink while flushing with cold tap water.
- If an accident or spill occurs while testing your sample, following the clean-up procedures listed in the directions.

EQUIPMENT CLEANING AND STORAGE

- Clean your equipment and glassware after each use by rinsing with warm tap water.
- If glassware starts to look discolored, soak in white vinegar then rinse with warm tap water. Dirty glassware can affect results significantly.
- Store equipment in a cool, dry, well-ventilated area away from children and pets. Protect reagents from direct sunlight, freezing, and extreme heat.
- Keep reagent containers tightly closed.

BACTERIA - R-CARD

EQUIPMENT LIST

- 1 1 mL sterile-wrapped pipette per site
- 1 3 mL ECC R-Card per site
- Clipboard
- Binder clip
- 1 blank sheet of paper to cover cards or opaque container
- Incubator with clear viewing window
- Small thermometer to remain in incubator
- Sharpie
- Bleach
- Latex glove- new glove for each site (single)

R-CARD STORAGE

- Store R-Cards in freezer when not in use.
- R-Cards may be stored for up to 1 year in a sealed container
- Mark card containers with expiration dates

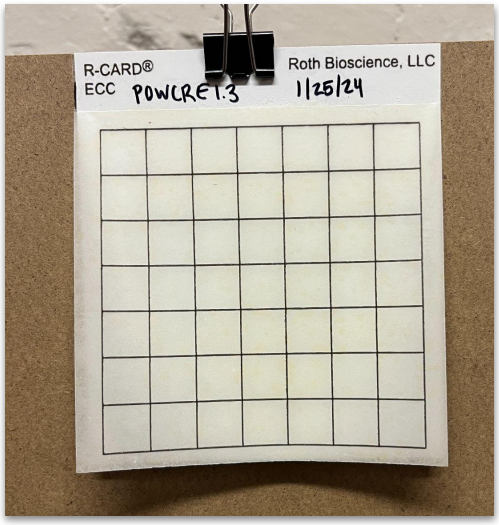
CHECK YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

1. Check expiration date on R-card and confirm cards are within the expiration date.
2. Remove the required number of cards from the package (1 per site, or two if collecting a replicate sample) and label each card at the top using a sharpie with your Site ID and date. If sampling more than one site, transport cards in separate containers by site.
3. Turn on the incubator before leaving to collect your samples. Your incubator should be set at 38°C. These temperatures simulate those of human and animal body temperatures and favor growth of E. coli. Temperatures above 44 °C may kill the bacteria; temperatures below 32°C may not allow for growth of colonies and could skew results.
4. Gather 1 sterile pipette per site. The same pipette may **not** be used at different sites.

BACTERIA - R-CARD

COLLECTING THE SAMPLE

When possible, bacteria samples should be taken directly from the stream. If sampling from a bucket, be sure to take bacteria samples before any other equipment is used in the bucket.



1. Place the R-card for the site on the clipboard, securing in place with your binder clip with one sheet of paper to cover the cards.

2. Confirm that the labeling information on the card matches your monitoring site. Place the clipboard on a level surface, or have a partner hold the clipboard steady.

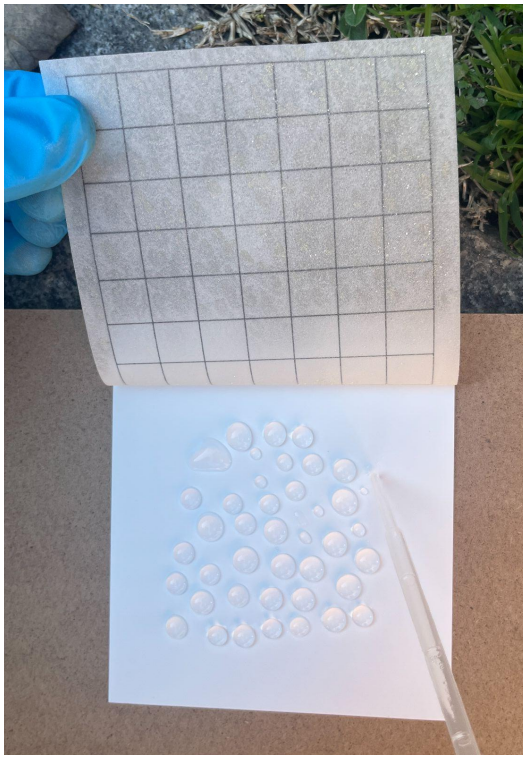
3. Collect samples upstream from where you are standing, or on the upstream side of the dock/boat 12-18 inches away from your body. **When possible, it is recommended to collect samples directly from the waterway.** If you are unable to do this, collect from your bucket only after rinsing the bucket thoroughly three times and before collecting other field samples.

4. Unwrap the sterile pipette from the bulb end and avoid touching the tip of the pipette with anything except sample water.
    a. Never use a previously unwrapped pipette.
    b. If collecting a duplicate sample, you may use the same sterile pipette if it has not come in contact with anything else except the sample water. Use a new pipette if it has been contaminated.

5. Squeeze the bulb of the pipette to remove air before submerging in the water. Insert the tip 2-3 inches below the water surface. Slowly release the bulb and expel excess water to the desired 1 mL sample volume. A small raised line near the bulb of the pipette denotes the 1 mL measurement.
    a. Be careful to not collect sediment from the bottom of the stream. Do not insert your hand into the water.

6. Using a gloved hand, grab the bottom corner of the top layer to separate the film from the card. Continue to hold the film up and slowly squeeze the pipette bulb to dispense the water sample in small droplets onto the card, focusing on the top two thirds. Attempt to disperse the sample following the grid pattern on the film.

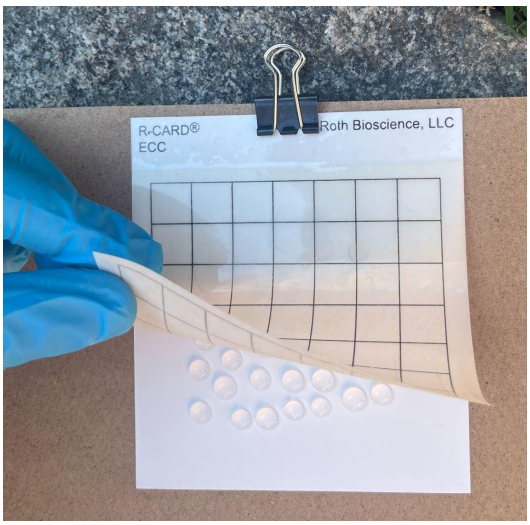
    a. Continue to hold the film up and **repeat this process two more times to dispense 3 mL of sample water total on your card.** Avoid placing droplets near the edges of the card.



7. Very slowly, roll the top film down onto the sample to prevent air bubbles. Allow the sample to spread between the top and bottom pieces. Do not use your hands to spread the sample.

8. Allow the sample to solidify for 1-2 minutes.

9. Place labeled cards with sample added under an opaque sheet of paper or into a small opaque container while transporting them to your indoor setting. Cards do not have to be transported on ice, just kept out of direct sunlight. After cards are solidified, they may be stacked on top of each other.



WHAT IF THE WATER SPILLS OFF THE EDGE?

If you frequently experience overflow of your sample to the edge of the card, or the amount of dark blue colonies growing are frequently too numerous to count, reduce the sample amount to 2 mL.

BACTERIA - R-CARD

INCUBATE SAMPLE

1. Place cards right-side up directly in your pre-heated incubator, maintaining its temperature at 38°C.

2. Incubate cards for 22-24 hours before counting colonies. Do not exceed 24 hrs of incubation time. This may cause additional colonies to grow that are not E. coli.

3. Colonies will start appearing a few hours after inoculation.

BACTERIA SAMPLE COUNTING

1. Record all additional necessary data on your datasheet, including sample amount, incubation time, incubation temperature.

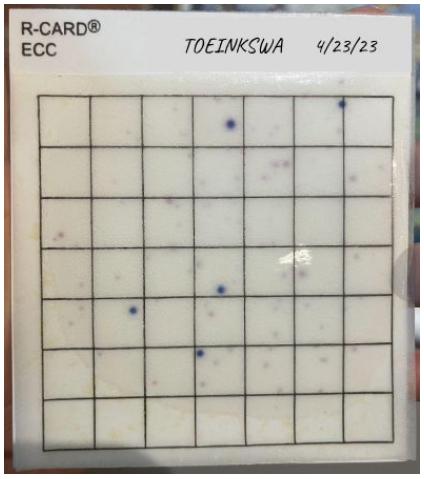
2. Count all dark blue-to-purple colonies on each card as E. coli. Do not count very small or “pinpoint” colonies smaller than the period at the end of this sentence.

3. Record the number of colonies in the column labeled “Total # of purple or dark blue colonies” on the datasheet.

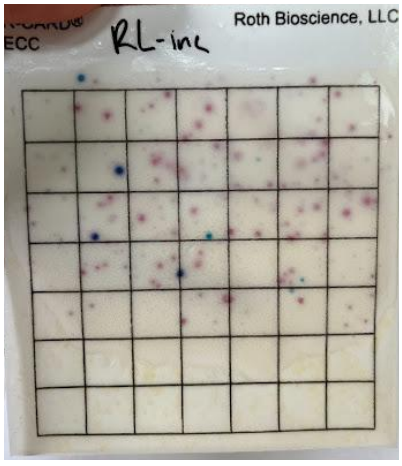
4. Calculate the number of E. coli per 100 milliliters of water (CFU/100mL) by using this equation:

   [100 ÷ (mL of sample added)] * total number of colonies counted

5. Record the calculated value on your field datasheet.



Example 1: 5 colonies are counted in the sample above. If 3 mL of sample water was used, your calculation would be **[100 ÷ 3] * 5 = 167 CFU/100mL**



Example 2: Only 5 colonies are counted in the sample above. Do not count pink or red colonies. Only count dark purple or blue colonies.

– AFTER SAMPLING –

EQUIPMENT CLEANING AND STORAGE

1. Throw used pipettes in the trash or recycling.

2. Lift up the top layer of each card used and add a few drops of dish soap, bleach, or rubbing alcohol to inhibit the growth of pathogens.

3. Dispose of cards in garbage.

– AFTER SAMPLING –

TEMPERATURE - DIGITAL THERMOMETER

EQUIPMENT LIST

- Digital thermometer
- Bucket (if using)

CHECKING YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

Check your thermometer before going out into the field.

- Look for any bends in the metal or exposed wires.
- Check the battery life.
- Make sure all openings are sealed tight.

CALIBRATION

You do not need to calibrate your thermometer before going into the field. Be sure to have you thermometer checked once a year by your monitoring coordinator.

TEMPERATURE - DIGITAL THERMOMETER

COLLECTING THE SAMPLE: AIR TEMPERATURE

1. Locate a place near your site out of the direct sun, or turn your back to the sun to create shade with your body.
2. Remove the black protective cap from the thermometer and wait a few minutes to allow the thermometer to equilibrate (the value should not change in 10 seconds).
3. Record air temperature reading in Celsius to the nearest 0.1° C on your datasheet.

TEMPERATURE TIPS

- Always measure air temperature before water temperature! A wet thermometer can alter your air temperature readings.
- Have your partner hold the thermometer and let equilibrate while filling out your observational data.

COLLECTING THE SAMPLE: WATER TEMPERATURE

Thermometers can be used directly in the waterway or from a bucket. Hang or hold the thermometer away from the sides and bottom of the bucket.

1. Place the tip of your thermometer beneath the surface of the water (approximately 0.3m). Do not submerge!
2. Wait for the thermometer to stabilize, approximately 15 seconds.
3. Record your reading in Celsius to the nearest 0.1°C on your datasheet.

TEMPERATURE - DIGITAL THERMOMETER

POST-SAMPLE CHECK

You do not need to perform a calibration check after sampling.

EQUIPMENT CLEANING AND STORAGE

1. Dry off all equipment.
2. Replace any protective caps.
3. Store equipment in a cool dry place.

DISSOLVED OXYGEN - WINKLER TITRATION

EQUIPMENT LIST

LaMotte Dissolved Oxygen Test Kit

- 2 60 mL glass sampling bottles (per site)
- 2 Titration tubes w/ caps
- Titrator syringe
- Eye dropper
- Manganous Sulfate solution
- Alkaline potassium iodide azide
- Sulfuric acid 1:1
- Sodium thiosulfate 0.025N
- Starch indicator solution
- Iodate Iodide standard solution (10 mg/L DO equivalent)

CHECKING YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

1. Check chemistry expiration dates. If chemicals are expired do not sample and contact your monitoring coordinator for replacements.
2. Check to ensure your sample bottle, titration tube, and titrator syringe are clean, dry, and not showing cracks and wear and tear.
3. Perform your sodium thiosulfate check, outlined on the next page.

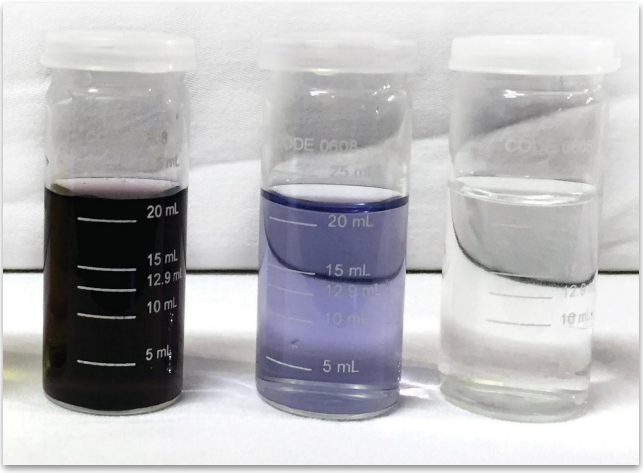
DISSOLVED OXYGEN - WINKLER TITRATION

STANDARDIZATION - SODIUM THIOSULFATE CHECK

Prior to each sampling event (either the night before or the day of), you must run a test to make sure your sodium thiosulfate is still fresh and functional. Sodium thiosulfate is fairly unstable and can degrade very suddenly, making it necessary to check before each DO sampling. **This must be performed in a room temperature environment around 20°C.**

1. Rinse the titrating tube (small glass vial with plastic lid with hole in it) with a small amount (~5 mL) of Iodate-Iodide Standard Solution (large amber bottle). Pour out into waste container.
2. Repeat this rinse two more times.
3. Pour 20 ml of the Iodate-Iodide Standard Solution into the rinsed titrating tube. 20 ml is when the bottom of the meniscus (curved surface of the liquid) of the standard is right on top of the 20 line of the titrating tube. If excess solution is in the tube, remove it using the eyedropper and discard down the drain. Never insert the eye dropper or any other item into the amber bottle or discard excess solution back into the amber bottle.
4. Add 8 drops of sulfuric acid by holding the dropper bottle upside-down to ensure equal drop size. Gently squeeze the bottle to dispense drops into the glass titration tube, then recap both the sulfuric acid and the titration tube.
5. Fill titrating syringe to the “0” mark with sodium thiosulfate. Check for and dispose of air bubbles in your titrating syringe by holding the syringe upside down and seeing if any air bubbles float to the top. If yes, depress plunger until air bubbles are gone while continuing to hold it upside down, then add additional sodium thiosulfate if needed.
6. **Titrate**, or slowly add, a few drops of sodium thiosulfate at a time to the titration tube until the solution turns a pale yellow, but not clear.
    a. Remove cap, leaving syringe in cap.
    b. Add 8 drops starch solution. Swirl titration sample gently to mix to a uniform blue color.
    c. Recap glass tube and continue titration process

SODIUM THIOSULFATE CHECK (CONT'D)



9. Continue slowly adding and mixing sodium thiosulfate until the solution turns from blue to clear. **When the solution starts to show clear water where the solution is being added, begin to add the sodium thiosulfate one drop at a time and mix well**. The solution is nearing the endpoint and a very small amount of sodium thiosulfate will turn the water colorless.
10. Just as the solution turns completely clear with no trace of blue by placing the titrating tube on or next to a white surface, stop titration and remove the syringe. Read the results on the syringe. Using the scale on the side of the syringe, read the total number of units of sodium thiosulfate used. Each line is 0.2 units.
11. Record your results on your field datasheet under the sodium thiosulfate check. If the result is within 9.4 and 10 mg/L, your Sodium Thiosulfate is good and you can collect your sample.
12. If the result is less than 9.4 mg/L or greater than 10.0 mg/L, perform a 2nd test and record in the space on datasheet marked "2nd check". If the second check is inside the 9.4 to 10 range, do a third check to make sure it is within range. If the third check is within range, you can collect your sample. Report the two closest results when uploading your data.
13. If the result is outside the 9.4 to 10 range, the sodium thiosulfate is bad and needs replacing. **Do not collect dissolved oxygen samples until fresh sodium thiosulfate is obtained and checked to be good.**
14. Dispose of the solution in titrating tube and syringe by pouring down sink and flushing with additional tap water.
15. Keep the amber bottle solution at home stored in a dark and cool place like a closet. Do not take the amber bottle or sodium thiosulfate out into the field.

DISSOLVED OXYGEN - WINKLER TITRATION

COLLECTING THE SAMPLE

Dissolved oxygen sample bottles can be filled directly in the waterway or from a bucket.

1. Thoroughly rinse both water sampling bottles with the sample water, filling and dumping the waste water downstream three times before collecting your sample.
2. Using the first sample bottle, hold the bottle horizontal and submerge about 1/2 of the bottle opening allowing the water to gently flow into the bottle. Try to fill the bottle without causing a lot of bubbles. As the bottle fills, gentle lower the bottom of the bottle until the bottle is filled and fully submerged under water.
3. Turn the submerged bottle upright and tap the sides of the bottle to dislodge any air bubbles clinging to the inside of the bottle. Cap the bottle while it is still submerged.
4. Retrieve the bottle and turn it upside down to make sure that no air bubbles are trapped inside. If any air bubbles are present, empty the sample bottle downstream or outside of the bucket and refill. Fill the second sample bottle. Once two satisfactory samples have been collected, proceed immediately the next section, *Fix Your Sample*.

WHY DO I NEED TO COLLECT TWO SAMPLES?

Don't forget to collect two samples with two sample bottles! Replicate tests are run simultaneously on each sample to guard against error, and gives the end data user a higher quality of data.

FIXING THE SAMPLE

1. Place both sample bottles on a flat surface and uncap. While holding the bottle vertical, add 8 drops of Manganese Sulfate Solution (usually has a pink cap). Always add the Manganese Sulfate first.
2. Add 8 drops of Alkaline Potassium Iodide Solution (usually has a blue cap) to each sample bottle.
3. Cap each sample bottle and mix by inverting gently several times. A precipitate will form. Allow the precipitate to settle to the shoulder of the bottle.
4. Mix both bottles again and allow the precipitate to settle to the shoulder again.
5. Uncap the bottles and add 8 drops of the Sulfuric Acid to both sample bottles.
6. Cap the bottles and gently shake using a waving motion ("making rainbows"), until both the reagent and the precipitate have dissolved. A clear yellow to brown orange color will develop. If brown flecks are present, keep mixing the samples until the flecks will not dissolve any further. Water that is below 10°C may take considerably longer to fully dissolve the brown flakes.



HOW LONG DO I HAVE TO TITRATE MY SAMPLE?

Following the completion of Step 6, the samples have been "fixed," which means that dissolved oxygen content cannot change in the sample. The titration procedure described in Titrate Your Sample may be performed at a later time, but must be performed within 8 hours of sample collection). This means that several samples can be collected and "fixed" in the field and then carried back home for the remaining steps.

TITRATE THE SAMPLE

1. Rinse the glass titration tube with about 5 ml of fixed solution three times to remove any residue from previous tests.

2. **Pour 20 ml of the fixed solution from one of the sample bottles** into one of the glass titration tubes with its plastic cap removed. Fill to the white line so that the bottom of the meniscus (the curved surface of the liquid in the tube) rests on the top of the white line marked with at 20. The amount is critical so be sure to use the glass dropper to add or remove and discard excess sample solution from the tube. Do not place removed solution back into the sample bottle. Place cap on the tube.

3. Fill syringe (titrator) to the 0 mark with Sodium Thiosulfate solution. Be sure that there are no air bubbles in the syringe. Refer to kit manual for instructions on how to properly fill syringe.

4. Begin titrating your sample, just as you did during the initial sodium thiosulfate check. Add 3-4 drops of Sodium Thiosulfate to test tube and gently swirl the glass tube to mix.

5. Add another 3-4 drops of the Sodium Thiosulfate and swirl the tube. Continue this process until the yellow brown solution in the glass tube turns a pale yellow. Once you reach this point, take the cap off while leaving the syringe in the cap.

6. Add 8 drops of Starch Solution to the glass titration tube. Swirl the tube gently to mix. The solution should turn from light yellow to dark blue.

7. Recap the glass tube and continue the titration process with the Sodium Thiosulfate remaining in the syringe (as described in Step 4 and 5). Once the solution turns light blue start adding the Sodium Thiosulfate one drop at a time until the solution turns from blue to clear. This is the endpoint and can occur quickly, adding one drop at a time is crucial to get the accurate endpoint. If the solution turns blue again, ignore it. Do not add any more Sodium Thiosulfate than is necessary to produce this first color change.

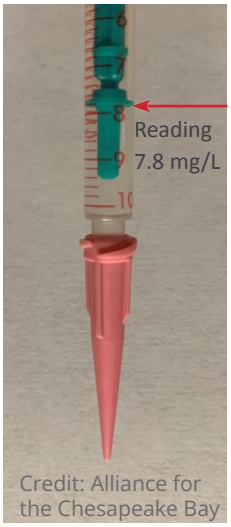
Credit: Alliance for the Chesapeake Bay

Continued on next page...

DISSOLVED OXYGEN - WINKLER TITRATION

TITRATE THE SAMPLE (CONT'D)

8. Using the scale on the side of the syringe, read the total number of units of Sodium Thiosulfate used. Each line is 0.2 units. This number equals the number of milligrams per liter (mg/) of dissolved oxygen in the water sample.
9. Carry out Steps 1 to 8 on the **second sample bottle** and second glass tube.
10. Record the results of the two tests on the datasheet. If the difference between Test 1 and Test 2 is more than 0.6 mg/L, conduct a third test and record the two results within 0.6 mg/L.



WHAT IF MY TITRATOR IS EMPTY BEFORE THE SAMPLE TURNS CLEAR?

When the dissolved oxygen level is above 10 mg/L, the solution in the tube will still be blue when the plunger tip of the titrator reaches 10. If it reaches this 10 line, do not go beyond that line. In this case, refill the syringe to the 0 line from the Sodium Thiosulfate bottle and continue adding a drop at a time and swirling until reaching the endpoint. Don't forget to add 10 mg/L to your final reading.

POST-SAMPLE CHECK

You do not need to perform a calibration check after sampling.

EQUIPMENT CLEANING AND STORAGE

1. Rinse your sample bottles, titration tubes, and caps with warm tap water three times and set out to dry. **DO NOT** use soap or any detergent products.
2. Dismantle your titrator syringe, rinse with water for 5 seconds and set to dry.
3. Store your chemicals in a cool dry place. They are sensitive to temperature fluxes and can expire early if not properly stored.

PH - DIGITAL PROBE

GATHERING MATERIALS AND EQUIPMENT LIST

- Oakton pH Testr30 digital probe
- tap water, or bottled distilled water if tap is well water
- Calibration solutions 7 and 4 or 10
- 50mL plastic beakers (3)
- scissors
- stir sticks

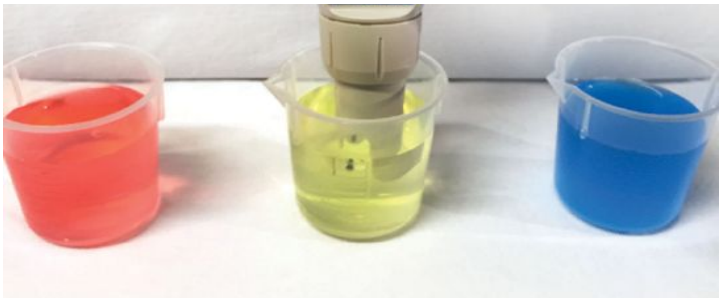
CHECK YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

- Check that the glass bulb of the electrode is not cracked or moldy.
- Make sure there is sufficient battery life for your field trip, check for battery leaks, and make sure all openings are sealed tight.
- Calibrate your meter before each sampling day.

CALIBRATION

Your meter must be calibrated each day you collect samples. Your pH meter can hold three pH calibration values, 4, 7 and 10. This program requires a two-point calibration. Every monitor will start calibrating with the 7 calibration solution, then use either 4 or 10 based on which value will bracket your normal field reading. For example, if your stream pH is often in the 6 range, you will calibrate using 7 and 4. If you are unsure, calibrate with all 3 calibration solutions.

Use fresh buffer solution when you calibrate the probe. Save and reuse these solutions for your post-sample check readings. Please record the probe readings to the nearest hundredth unit place (Ex. 7.01) when performing the calibration.



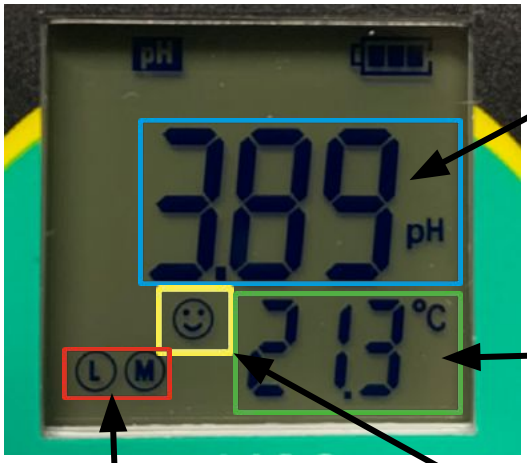
CALIBRATION TIP

Be sure to always start with calibration solution 7, otherwise you may receive an error message on your meter.

PH - DIGITAL PROBE

OAKTON PH TESTR 30 (2020 MODEL)

SAMPLE MODE



The pH reading

The temperature reading in *C

Calibrations completed:

L: Low, buffer 4

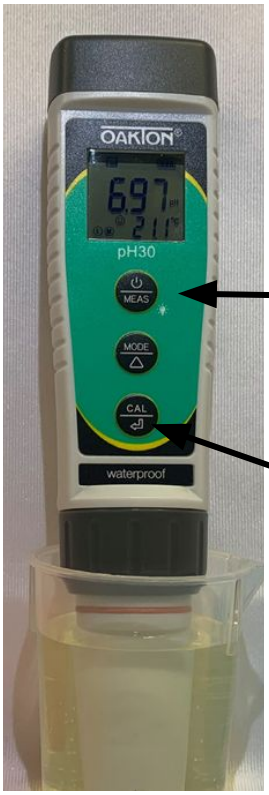
M: Middle, buffer 7

H: High, buffer 10

stability icon

CALIBRATION MODE

Calibration buffer solution present



KEY PAD FUNCTIONS

short press (1 second)

long press (>2 seconds)

Power Button

- Short press to turn on the tester
- Long press to turn off

Calibration Mode/Enter

- Long press to enter CAL mode. Screen will flash CAL
- Short press to confirm calibration after stability icon appears

– BEFORE SAMPLING–

PH - DIGITAL PROBE

CALIBRATING THE PH METER

1. Pour 50 mL of room temperature distilled or tap water into a small beaker. Cut open one pH 7 powder packet (yellow) for each calibration solution you are using and empty the entire packet into the water. Use a clean stir stick to mix the solution. Repeat the steps with the pH 4 (red) or pH 10 (blue) powder packets.
2. **Short press** the power button to turn on the probe. Immerse the probe in the 7.00 buffer solution. Gently swirl the probe in the buffer to obtain an accurate reading for ~1 minute. Record the temperature of the probe in the solution.
3. **Long press** the CAL button. The screen will light up. The bottom number will change to indicate the buffer solution present (should read 7.00 for the pH 7 buffer solution).
4. Wait for the reading to stabilize again. The stability icon will appear to the left of the bottom number when it has stabilized. When the stability icon appears and remains for a few seconds, **short press** CAL to confirm the calibration. The top value will flash quickly with a value that should be close to 7.00 pH units. Record your new pH value on the calibration section of your datasheet.
5. Rinse probe with tap water and blot dry with a clean cloth or paper towel.
6. To complete your second point calibration, **long press** CAL again until the screen flashes CAL, then release.
7. Immerse the probe in the 4 (or 10) buffer solution and gently swirl. Wait for the stability icon to appear and remain for a few seconds, then **short press** CAL to confirm the calibration. Record this value on your data sheet.
8. Repeat steps 6-8 if necessary for a third calibration with either 4 or 10 buffer solution.
9. Cover and set aside the calibration solutions for use when you return from sampling.
10. After calibration, replace the protective cap and turn off the probe while you travel to your site.

WHAT DO ER1 AND ER2 MEAN?

ER1 means that you are trying to calibrate your meter without starting with buffer 7 (yellow) solution. Be sure you are always calibrating with 7 before moving on to 4 or 10.

ER2 means that you did not wait for the stabilization icon to appear and stay before confirming your calibration. Once the code disappears, wait for the reading to stabilize again and **short press CAL** to confirm.

PH - DIGITAL PROBE

COLLECTING THE SAMPLE

pH meters can be used directly in the waterway or from a bucket. Hang or hold the probe away from the sides or bottom of the bucket. Do not submerge the probe.

1. Swirl the pH meter in the water for a few seconds to fully cover the probe, then wait until the stabilization icon appears.
2. Record your pH reading to the nearest hundredth on your datasheet.

PH METER POST-SAMPLE CHECK

To ensure the probe has maintained proper calibration, it is important to verify no significant probe drift has occurred. The procedures listed below will verify the probe did not drift outside QA/QC specifications. **DO NOT CALIBRATE** the probe during this check. Doing so will invalidate the data collected during the sample run.

1. Rinse off the probe and probe tip with tap water and wipe dry using a soft cloth. Washing the probe will remove any material that may reduce probe life.
2. Place the probe into the pH 7 buffer solution (yellow) used during calibration.
3. Swirl the probe gently waiting for the stabilization icon to appear and record the temperature and pH reading on your datasheet.
4. Rinse the probe and repeat the end of day check process using the 4 (red) or 10.00 (blue) buffer solutions.

POST-SAMPLE CHECK TIPS

If both calibration and post-sample checks are +/-0.20 units from the buffer values, the probe is within specifications. If the readings are more than +/-0.20 units, contact your program coordinator to resolve the issue. When uploading data, add a note in the comments field that the pH calibration is out of range. Also note “pH probe flag” at the top of the hard copy datasheet.

PH - DIGITAL PROBE

EQUIPMENT CLEANING AND STORAGE

1. Ensure the probe is cleaned and well maintained. After each sample run, rinse off the probe with water. Use a soft cloth and gently dry the probe and glass sensor.
2. Store the probe tip in the cap provided by the manufacturer. Place a small amount of 4 buffer solution (red) or white vinegar inside the cap to just below the black line on the cap. If possible, store your pH meter vertically to keep the glass sensor submerged. This will keep the probe in working condition until the next field sampling event.
3. If you see any biological growth like mold or algae, use warm water and a Q-tip to clean. You may pop off the protective cap over the glass sensor for cleaning access. Dry the probe, then place in fresh buffer 4 solution or white vinegar.
4. If the calibration or end of day check indicates there is a problem with the probe, and standard cleaning does not produce acceptable results, replacement of the sensor cap may be necessary. Contact your program coordinator for assistance.
5. Store the probe in a clean, cool, and dry space.

SALINITY - REFRACTOMETER

EQUIPMENT LIST

- Salinity refractometer
- Dropper
- Distilled water
- Microfiber cloth
- Small screwdriver

CHECK YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

- Examine the refractometer for wear or damage.
- Check the refractometer with distilled water. If it does not read 0 ppt, you must calibrate the instrument.

CALIBRATION

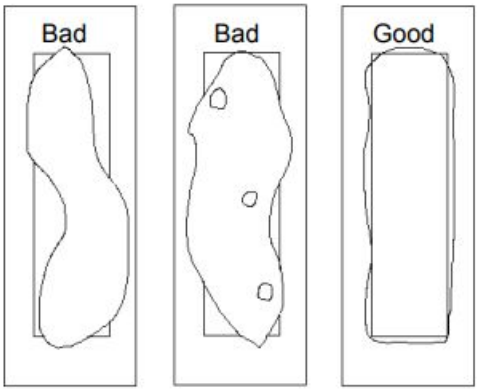
1. Check the refractometer with distilled water in a controlled environment at room temperature. **DO NOT PERFORM CALIBRATION IN THE FIELD.** Lift the cleat plate and add 1-2 drops of distilled water to the blue prism. Hold the prism at an angle close to parallel so the water drops do not run off.
2. Close the cleat plate gently. The water drops should spread and cover the entire prism. Repeat the process if there are any gaps or if the sample is only on one portion of the prism.
3. Look through the eyepiece. If the scale is not in focus, adjust it by turning the eyepiece either clockwise or counterclockwise.
4. The reading is taken at the point where the boundary line of the blue and white fields crosses the scale on the right hand side of the viewfinder.
5. If the reading is not at “0” turn the calibration screw with the included screwdriver while looking through the eyepiece until the boundary line falls on “0.”
6. When the measurement is complete, wipe the cleat dry with a microfiber cloth.

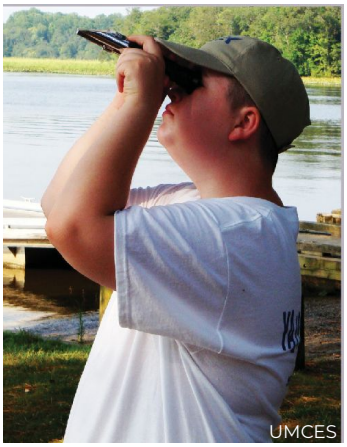
SALINITY - REFRACTOMETER

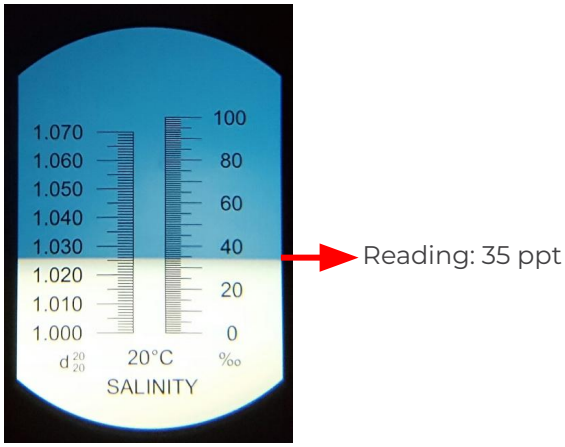
COLLECTING THE SAMPLE

Droppers may be filled used directly in the waterway or from a bucket. If using a bucket, be sure to take sample away from the edges or bottom of the bucket.

1. Rinse your dropper with sample water three times.
2. Open the lid on the refractometer and rinse the sample surface with sample water.
3. Collect your sample in the dropper, apply the drops on the refractometer to evenly coat the glass, then close the lid, ensuring no air bubbles are present.
4. Hold up to the light to note the salinity reading where the blue and white sections meet.
5. Record as parts per thousand (o/oo) using the scale located on the right hand side of the refractometer view scope.







SALINITY - REFRACTOMETER

POST-SAMPLE CHECK

You do not need to perform a calibration or check after sampling.

EQUIPMENT CLEANING AND STORAGE

1. Rinse with DI or distilled water.
2. Wipe dry with a clean non-scratching cloth.
3. Store in case.

WATER CLARITY - SECCHI DISK

EQUIPMENT LIST

- 8” Secchi disk with attached line

CHECKING YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

- Secchi depth should be measured using a weighted line with decimeter)tenth of a meter) markings.
- Examine the water depth line for wear or damage.
- Measure the increments against a meter stick to ensure line has not stretched.
- Ensure that the line is securely fastened to the Secchi disk.

SECCHI DISK TIPS

- Make sure the line is securely fastened to Secchi disk.
- Make sure the line is held securely in your hand. Do not let go of the line! Allow boat wakes and large waves to pass by before measuring Secchi depth.
- Lower the disk on the shady side of the boat.
- Remove your sunglasses.

WATER CLARITY - SECCHI DISK

COLLECTING THE SAMPLE

Secchi disks may only be used directly in the waterway. If you are only able to bucket sample, use a turbidity tube.

1. Remove sunglasses if you are wearing them and stand with the sun to your back. Try to lower the disk into a shaded area.
2. Lower the disk into the water until the disk barely disappears from sight. Note the depth reading in tenths of a meter based on the length of line submerged.
3. Slowly raise the disk and note the depth at which it reappears (i.e. is barely perceptible).
4. If possible, it is helpful to pinch the line exactly at the waterline before retrieving for measurement.
5. Average the two depth readings obtained above. The average of the two readings is considered to be the limit of visibility, or index of transparency. Record this average to the nearest tenth of a meter on your data form.

POST-SAMPLE CHECK

You do not need to perform a calibration or check after sampling. Your secchi disk will be checked annually to make sure the markings are accurate during your recertification training.

EQUIPMENT CLEANING AND STORAGE

Rinse line and disk with water to clean off any mud or debris clinging to the line. Dry the line and disk before storing it in a cool dry location. If algae begins to grow on the disk, wash with warm water and soap and scrub gently with a sponge.

WATER CLARITY - TURBIDITY TUBE

EQUIPMENT LIST

- Turbidity tube

CHECKING YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

- Check the turbidity tube for wear or damage.
- Check that the black and white secchi disk is clearly visible at the bottom of the tube.
- Check that the drain tube stays closed until released.

TURBIDITY TUBE TIPS

- Turbidity tubes are best for sampling sites where Secchi disks would be visible on the boat or where sites are shallow.
- If you are unsure of your measurement, take a second sample.
- Have a buddy help you out by controlling the water release crimp while you look down the tube.
- Measure the turbidity tube in the shade.
- Remove your sunglasses.

WATER CLARITY - TURBIDITY TUBE

COLLECTING THE SAMPLE

If collecting directly from the waterway, point the top of the tube in the upstream direction and allow water to fill the tube, careful not to disturb the stream bed. Once the tube is full, lift out of the water and exit the waterway.

If collecting from a bucket, use your sample water in your bucket by pouring it into the turbidity tube.

1. Ensure the drain tube is closed by squeezing the crimp, or if using a tube with the pressure valve, ensure nothing is clogging the valve.
2. Remove sunglasses if you are wearing them and move the tube to a shaded area or stand with the sun to your back.
3. Look down through the opening of the tube and look for the black and white pattern. If you can see the pattern with the tube full, record the highest value your turbidity tube goes to (often 120cm) on your field datasheet and check the **>** box below the value.

4. If you cannot see the pattern, partially open the drain crimp and slowly draw off sample (controlling the flow by squeezing the crimp). Depending on the model of tube, you may have to open the crimp with your hand, or apply pressure down on the tube to drain.
5. When the black and white pattern begins to appear, immediately tighten the crimp.

6. Record the level of water (in cm) remaining via the centimeter ruler on the side of tube.

WATER CLARITY - TURBIDITY TUBE

POST-SAMPLE CHECK

You do not need to perform a calibration or check after sampling.

EQUIPMENT CLEANING AND STORAGE

Rinse tube with water to clean off any mud or debris remaining. Allow for the tube to dry before storing it in a cool dry location.

TOTAL WATER DEPTH

EQUIPMENT LIST

- Weighted line with decimeter (a tenth of a meter) markings. This line can be the Secchi disk line if you don't have an additional weighted measuring line

  OR

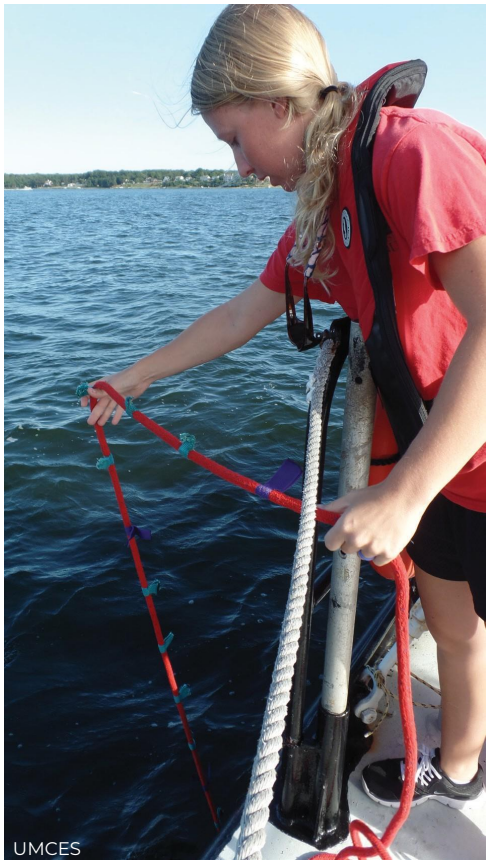
- Turbidity tube with lines marked on outside of tube

CHECK YOUR EQUIPMENT BEFORE GOING OUT IN THE FIELD

- Examine the water depth line for wear or damage.
- Ensure that the line is securely fastened to the weight.
- Annually measure the increments against a meter stick to ensure line has not stretched.

TIPS FOR READING WATER DEPTH

- Make sure the line is securely fastened to weight.
- Make sure the line is held securely on the boat (do not let go of the line).
- Allow boat wakes and large waves to pass by before measuring total depth.



TOTAL WATER DEPTH

COLLECTING THE SAMPLE

Total water depth may only be collected if you are able access the waterway directly, not using a bucket.

1. Slowly lower the measuring line into the water until it is resting on the bottom of the stream and the line has just become slack.
    a. If using a turbidity tube, place the turbidity tube on the bottom of the stream at the location where you collect you sample from.
2. Record the depth reading to the nearest tenth of a meter based on the length of the submerged line. If using a turbidity tube to take this measurement, be sure to convert to meters instead of centimeters.

POST-SAMPLE CHECK

You do not need to perform a calibration or check after sampling.

EQUIPMENT CLEANING AND STORAGE

Rinse line or tube with water to clean off any mud or debris remaining. Allow for the line or tube to dry before storing it in a cool dry location.

RIVERTRENDS DATA UPLOAD

MAKE AN ACCOUNT

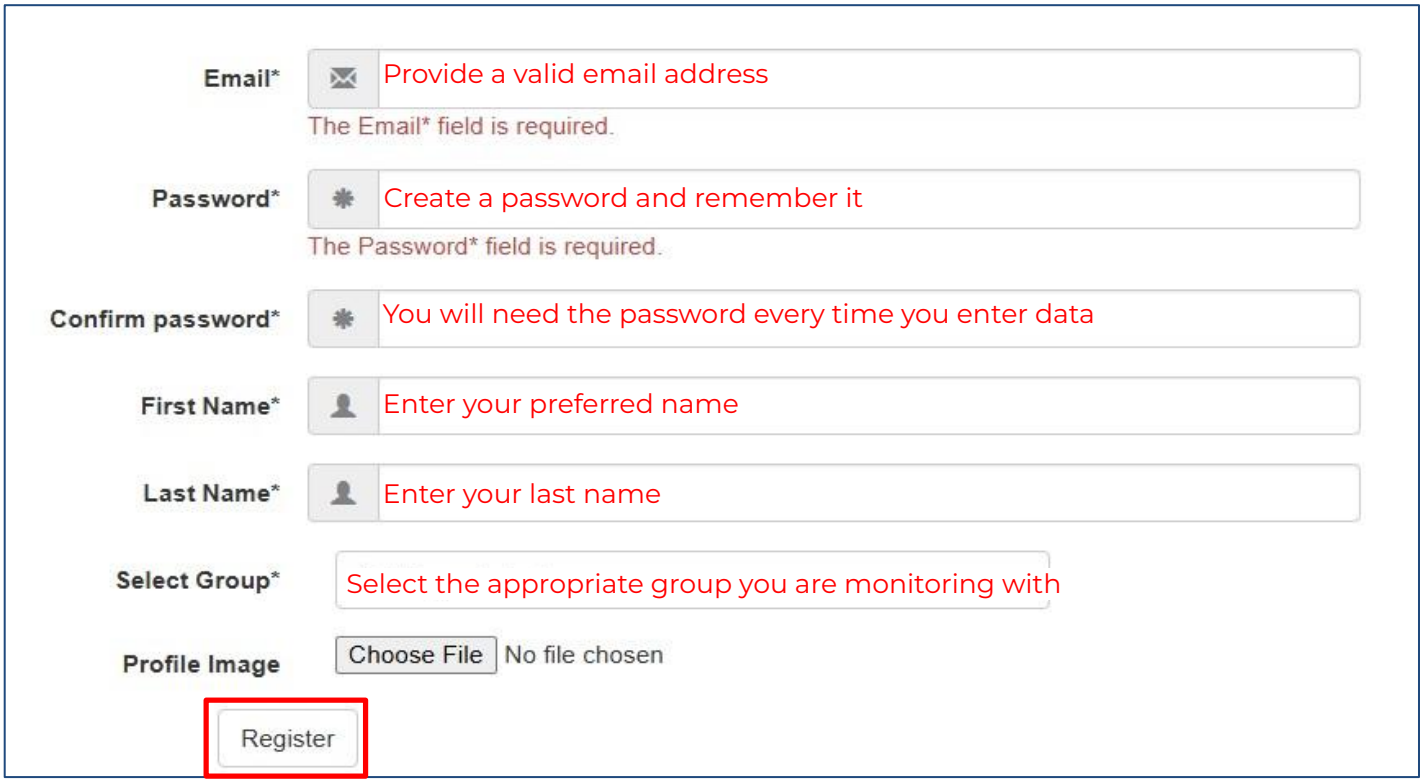
Before you can upload your data, you must register with an account on the CMC Data Explorer.

1. Visit the data explorer link and select **Manage Data** on the top of the page.

cmc.vims.edu

2. Select **Register** at the top right corner of the page.

3. Fill out the entire registration form with the following highlighted information.



**_Select Group_: select the group you are associated with. If you do not see your group listed, please select "Alliance for the Chesapeake Bay"

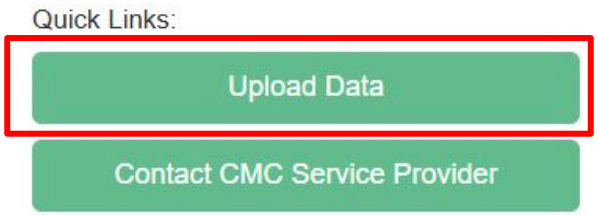
4. Click **Register** when completed, then go to your email and **click the link to confirm your email address**. An Alliance staff member will confirm your registration within 24 hours. You will then be able to login to upload data.

RIVERTRENDS DATA UPLOAD

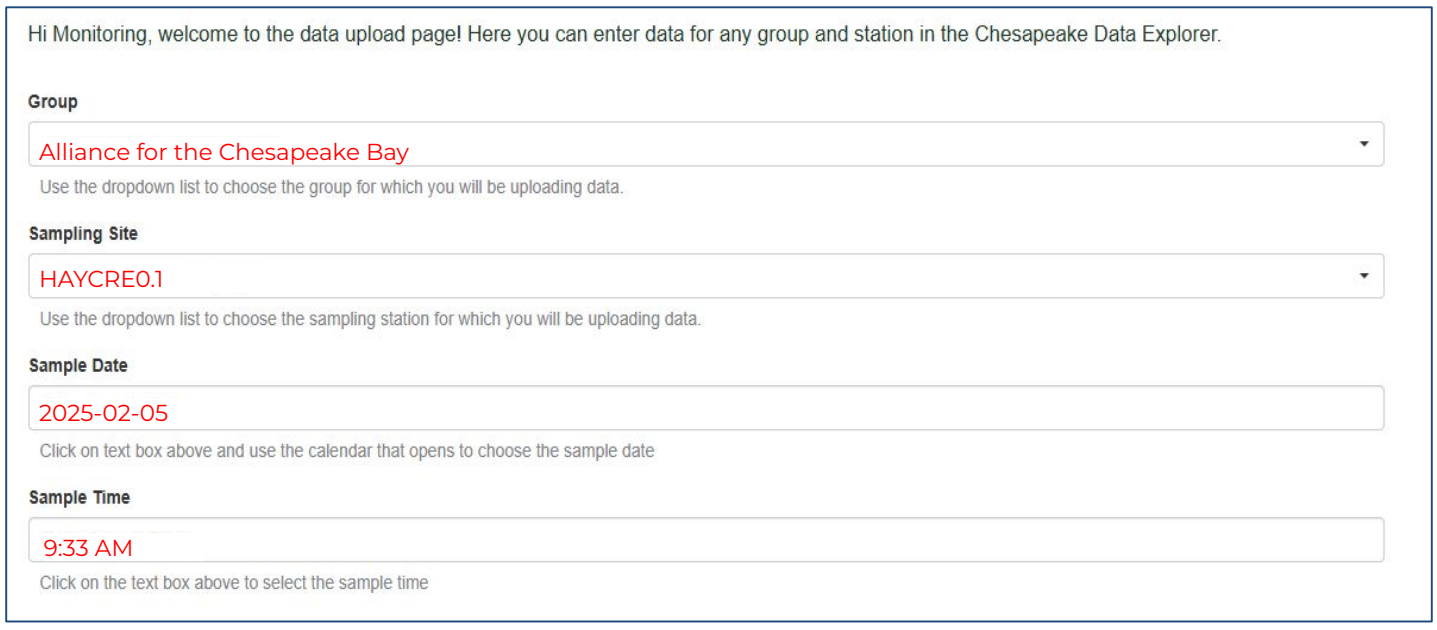
UPLOAD DATA

To upload data, first log in to your account on the CMC Data Explorer. Select **Manage Data** from the top menu, then select the **Upload Data** quick link.

cmc.vims.edu



Fill out the top section of the data upload form with the information corresponding to your datasheet.

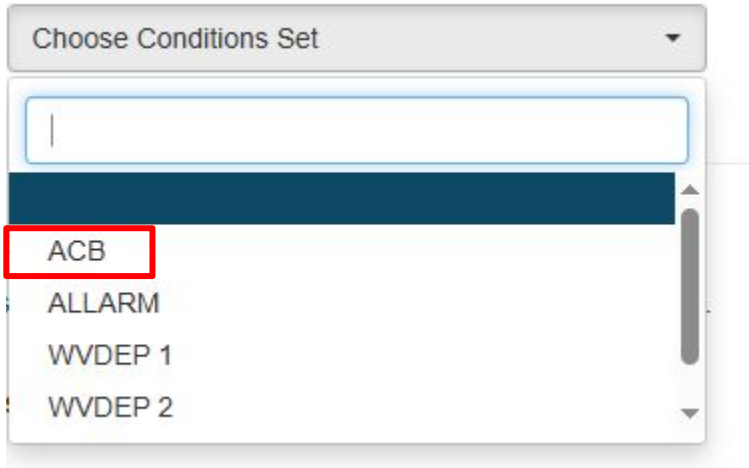


- **Group:** This will be selected for you based on the group you choose at registration.
- **Sampling Site:** Select your sampling site from the drop down list provided. If you do not see your station, contact the RiverTrends Coordinator.
    - Use caution as some sampling sites may have similar names. Double check you have selected the appropriate site
- **Sample Date:** Enter your sampling date from your datasheet (mm/dd/yyyy).
- **Sample Time:** Enter your sampling time from your datasheet (HH:MM AM/PM)

RIVERTRENDS DATA UPLOAD

ENTERING DATA: CONDITIONS DURING SAMPLING

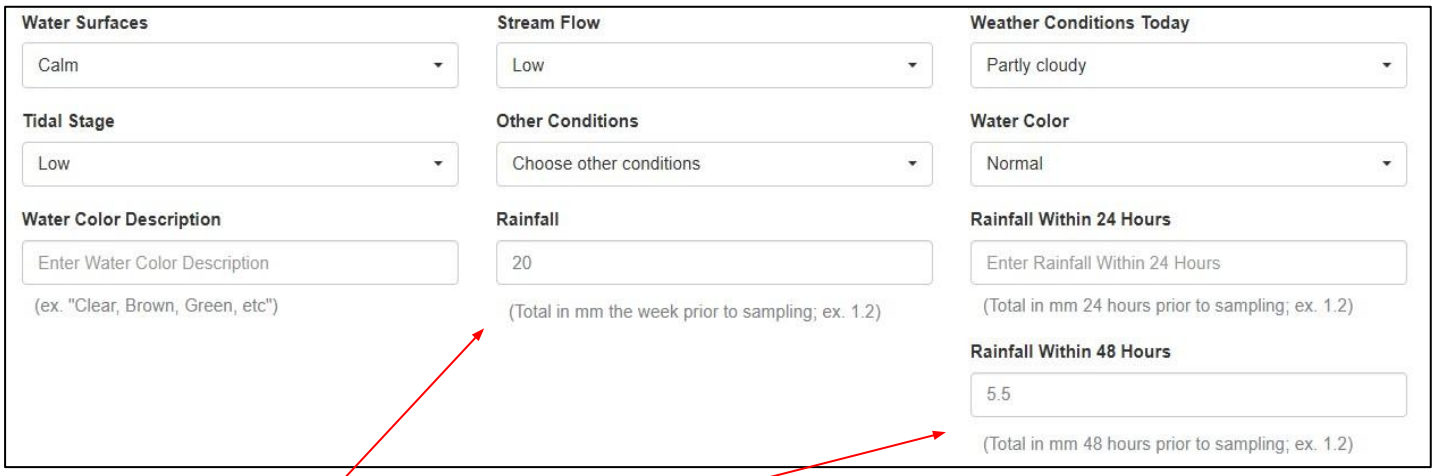
From the “Choose Conditions Set” drop down box, **select ACB.**



Fill out the conditions during sampling that correspond to your datasheet by using the dropdown menus or text boxes. Leave any unused fields blank.

RiverTrends monitors should have complete observational data for:

- water surface, stream flow rate, weather conditions today, water color, tidal stage (if applicable), other conditions (if applicable). The drop down menus correspond to observational data section on the back of your datasheet.



Rainfall Data:

To source your rainfall data, please visit the RiverTrends Resource Page and utilize Wunderground or your local rainfall station to collect accurate rainfall data.

- **Rainfall:** type in the weekly accumulation total (mm) before sampling
- **Rainfall Within 48 Hours**: type in the total of rainfall (mm) 48 hours before sampling

RIVERTRENDS DATA UPLOAD

ENTERING DATA: CALIBRATIONS AND STANDARDIZATIONS

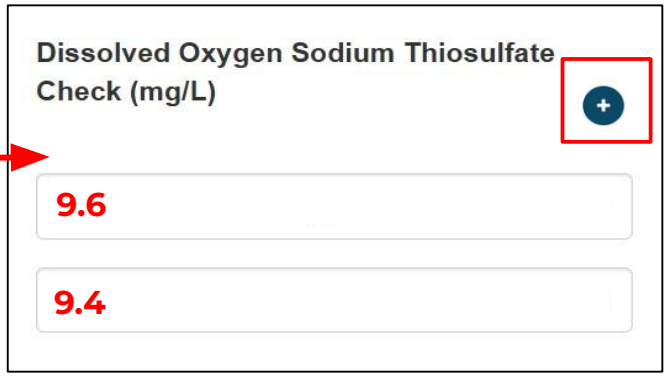
DISSOLVED OXYGEN

Sodium Thiosulfate Check (mg/L): Type in the value of your sodium thiosulfate check. If a second and third check were completed, report the two closest values. Click the blue plus sign to "add a second value" and type in the value for the second sodium thiosulfate check. If your sodium thiosulfate check is not between 9.4 and 10, submit a supply request for new sodium thiosulfate on the RiverTrends Resource Page.

Data Sheet:

Check 1	Check 2	Check 3
9.2 mg/L	9.6 mg/L	9.4 mg/L

Upload:



BACTERIA (R-CARD)

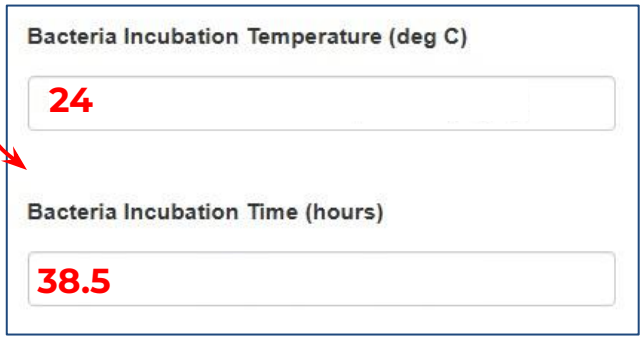
E. coli Bacteria Measurements (R-Card)				
Disregard any pink, red, green-blue, or white colonies. These are not E. coli bacteria. Only count purple and blue-purple colonies.	Incubation Time	Incubation Temperature	Sample water used (1-3mL)	Total colonies counted on plate
	24 hours	38.5 °C	Sample 1: _____mL	_____
			Sample 2: _____mL (only March/October)	_____

To calculate the Total Colonies of E. coli bacteria per 100 ml of water:

1. Divide 100 by the ml of water used. 2. Multiply this quotient by the number of purple colonies counted

Sample 1: ([100 ÷ mL of water used] * colonies counted) = _____CFU/100mL (report this number on back of datasheet)

Sample 2: ([100 ÷ mL of water used] * colonies counted) = _____CFU/100mL (report this number on back of datasheet)



ENTERING DATA: CALIBRATIONS AND STANDARDIZATIONS

pH

Type in the value of your pH meter quality assurance checks Most monitors complete a 2-point calibration, using pH 7 and pH 4 **or** pH 10. Leave the other one blank. Use the guide below to match up the numbers on your datasheet with the correct sections on the data upload page.

Data Sheet:

pH Meter Quality Assurance Checks					
If your calibration values differ by more than +/- 0.20 from the standard, do not take sample and contact coordinator.	Pre-sample Calibration and Temperature			Post Sample Check and Temperature	
	7.00	7.00	21.2 °C	7.00	7.02	23.0 °C
	4.01	____		4.01	____	
	10.01	10.00		10.01	10.01	

Upload:

pH Calibration Temperature (deg C)

21.2

pH Calibration Value (4) (SU)

Enter pH Calibration Value (4) (SU)

pH Calibration Value (7) (SU)

7.0

pH Calibration Value (10) (SU)

10.0

pH Post-Sample Check (4) (SU)

Enter pH Post-Sample Check (4) (SU)

pH Post-Sample Check (7) (SU)

7.02

pH Post-Sample Check (10) (SU)

10.01

pH Post-Sample Temperature (deg C)

23.0

RIVERTRENDS DATA UPLOAD

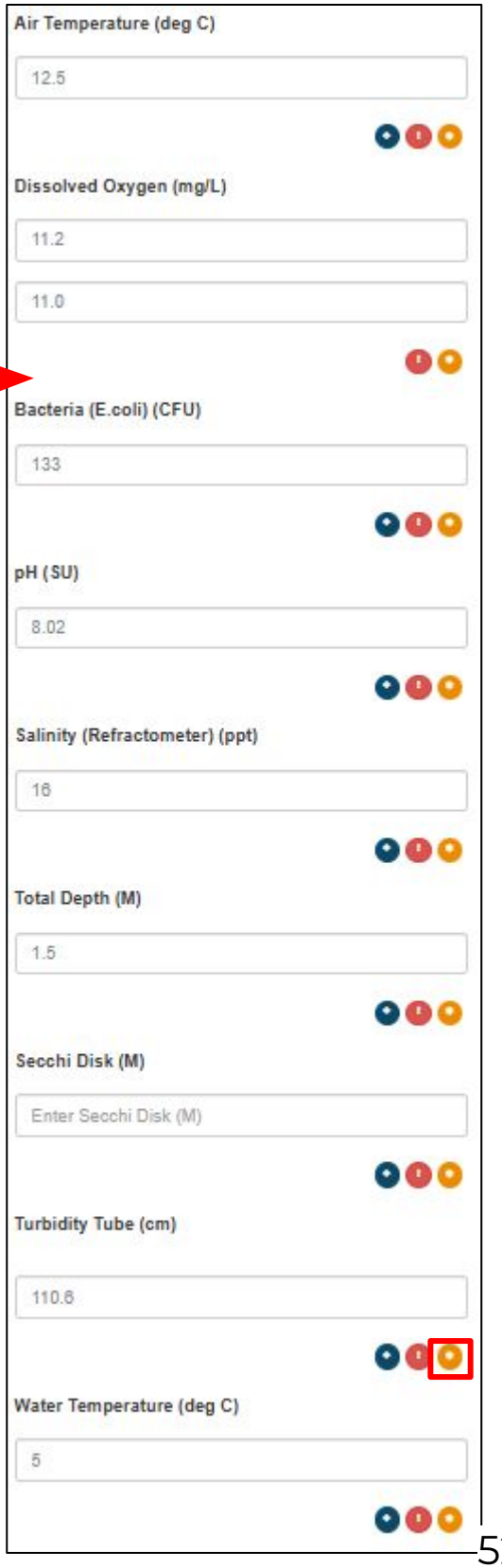
SURFACE SAMPLES

This section records the surface samples that correspond to the back of the RiverTrends datasheet, If you do not have data for a listed parameter, leave the box blank. Do not enter "0" unless that is the actual recorded value.

Data Sheet:

Parameter	Field Readings
Air Temperature (nearest tenth)	12.5 °C
Dissolved Oxygen Note: Tests should be within 0.6 of each other. If not, perform 3rd test and report two closest results.	Test 1: 11.2 mg/L
	Test 2: 11.0 mg/L
Bacteria	133 CFU/100mL
pH (nearest hundredth)	8.02 SU
Salinity (nearest tenth)	16.0 ppt
Total Depth (nearest tenth of meter)	1.5 m
Water Clarity - Secchi Disk (nearest tenth of meter)	_____ m ☐Check box if value is > than that recorded
Water Clarity - Turbidity Tube (nearest tenth of cm)	110.6 cm ☐Check box if value is > than that recorded
Water Temperature (nearest tenth)	5.0 °C

Upload:



REMINDERS:

- Upload TWO dissolved oxygen samples each month.
- Upload TWO samples for each parameter in March and October when you collect field replicates.
- Use QUALIFIER CODES when the reading is greater than your equipment is able to record. See next page for more information on how to use qualifier codes.

Click Save at the bottom of the page after entering your data.

DATA UPLOAD: REPLICATES AND QUALIFIERS

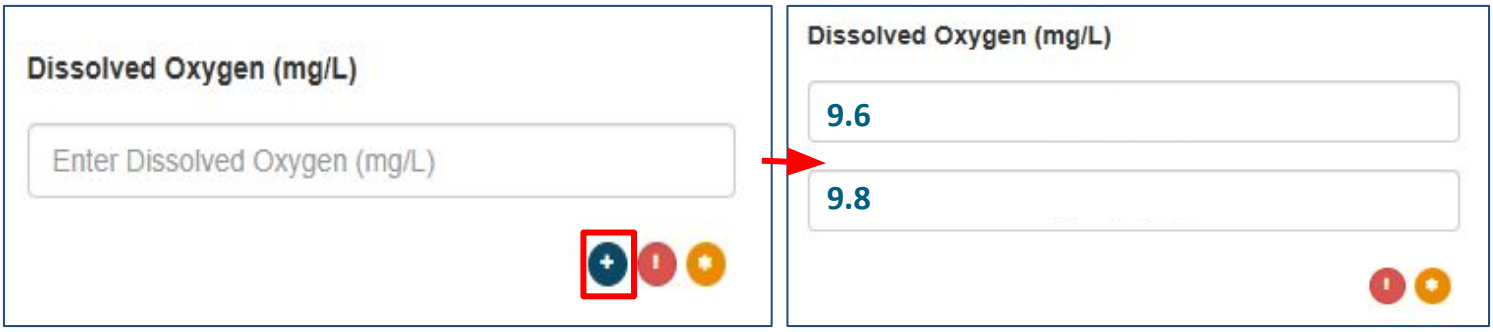
REPLICATE SAMPLES

RiverTrends monitors collect two dissolved oxygen samples each month, indicated by Test 1 and Test 2 on the field data sheet. Additionally, replicate samples of all parameters are collected in March and October. When this happens, both samples need to be uploaded to the Data Explorer by using the blue plus sign symbol to open a second value box.

Data Sheet:

Dissolved Oxygen Note: Tests should be within 0.6 of each other. If not, perform 3rd test and report two closest results.	Test 1: 9.6 mg/L
	Test 2: 9.8 mg/L

Upload:



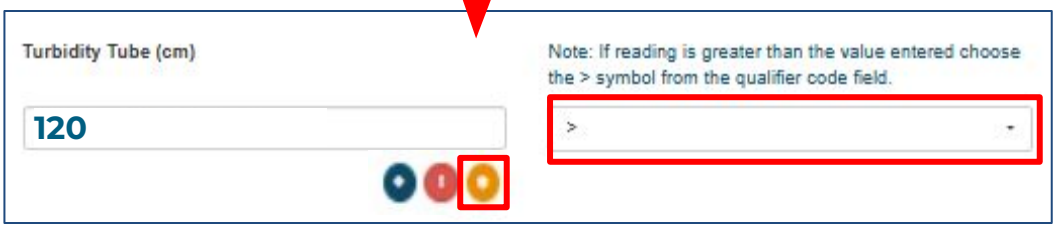
QUALIFIER CODES

For secchi disk or turbidity tube measurements, you may have a reading that is greater than the value able to be recorded by your equipment. If this happens, click the orange circle and select the ">" symbol from the drop down menu.

Data Sheet:

Water Clarity - Secchi Disk (nearest tenth of meter)	_____.____ m	☐Check box if value is > than that recorded
Water Clarity - Turbidity Tube (nearest tenth of cm)	120.0 cm	☑Check box if value is > than that recorded

Upload:



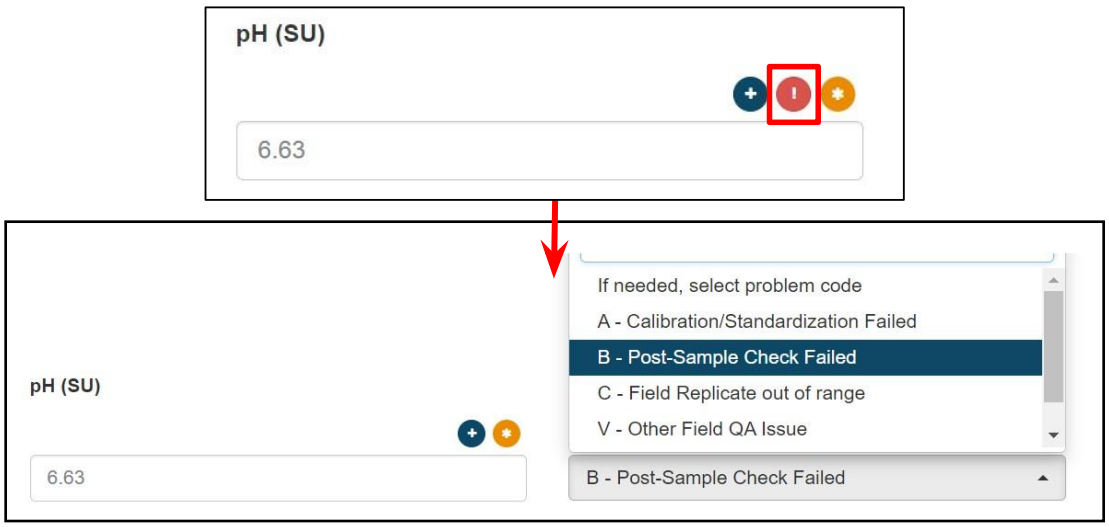
DATA UPLOAD: PROBLEM CODES

Occasionally you may notice that your data is not meeting quality assurance standards. When this happens, a problem code needs to be associated with the datapoint. RiverTrends volunteers may add the problem codes A, B , V or C themselves, or the RiverTrends coordinator will add it on the back end when reviewing data.

Code	Name	When should I use this?
A	Calibration or Standardization failed	Do not take your field reading if calibration or standardization fails. If you proceed with a field reading, the data will be flagged with this code. **Dissolved Oxygen:** Sodium thiosulfate check failed, reported lower than 9.4 **pH:** calibration failed (7, 4, or 10 more than 0.20 from standard value)
B	Post-sample check failed	**pH:** post-sample checks failed (7, 4, or 10 more than 0.20 from standard value)
C	Field replicate out of range	For use by RiverTrends Coordinator **only**
V	Other Field QA/QC issue	**pH:** calibration not performed or failed **DO:** Sodium thiosulfate check not performed, failed or are more than 0.4 mg/L apart **Bacteria:** incubation time greater than 24 hours, temperature incorrect outside of 38-40*C range
X	No routine sample taken - see comments	If you are unable to record a routine measurement, use X. This **must** be accompanied by an explanation in the comments section.

PROBLEM CODE USE SCENARIO

The pH meter post-sample checks were outside of the acceptable range for buffer 10, reading 9.78. This data must now have a problem code associated with it. Find the field reading of the pH value for this sampling event, select the red circle to open the problem code dropdown menu, then select the appropriate code. For this scenario, select problem code B to indicate that the post sample check failed.



PROPERTY OWNER PERMISSION FORM

As part of the **RiverTrends Monitoring Program with Alliance for the Chesapeake Bay (the Alliance),** trained local volunteers collect water quality samples on a **biweekly or monthly** basis at consistent specific sites. This agreement is intended to grant permission to volunteers to access private property for site-specific data collection, as well as to release and hold harmless the property owner from liability arising from that access.

Property Address:

_____

Access granted starting(Date):_____ Until (Date): _____

Station ID and Access Instructions: _____

_____

(If Station ID is unknown, include water body name)

SITE ACCESS PERMISSION

____I grant permission to water quality monitoring volunteers with **RiverTrends** to access my property for the sole purpose of conducting water quality monitoring activities at the above-mentioned site following the site access instructions.

LIABILITY RELEASE

____ I agree to hold **the Alliance**, its volunteers, and necessary project partners harmless from and forever discharge them from any and all liability for damages, injury, or loss which may be sustained as a result of their entry onto my property.

____ I acknowledge that I hold harmless and forever discharge me, the property owner, from any and all liability for any damage, injury, or loss which may be sustained as a result of entry onto my property.

CHESAPEAKE MONITORING COOPERATIVE DATA PERMISSION

____I grant my permission for the water quality monitoring site established on my property to be shown on the publicly accessible homepage of the CMC Data Explorer. This includes latitude and longitude coordinates and a pin on the homepage map indicating where the site is located. Specific address information or personal identifiers are not included.

Name (Printed): _____

Signature: _____

Date: _____

RIVERTRENDS
Alliance for the Chesapeake Bay

Stream Monitoring in Progress

Volunteer monitors are currently collecting water quality samples to learn about the health of this local stream and will return to the car shortly.

Monitor Name: _____

Contact Number: _____

Learn more about the RiverTrends Monitoring Project at allianceforthebay.org by scanning the QR code.

SITE CONDITIONS

What are site conditions?

Site conditions are observations that provide context to your water quality or benthic macroinvertebrate data. These include weather, rainfall, water depth, tide stage, and more. Visual indicators are valuable clues to understanding what might be influencing the data you collect.

How do we measure them?

This table describes some of the site conditions that are typically recorded. Each group may choose to add additional observations.

Indicator	Measurement/Observation
Water Depth	Use a secchi disk, depth finder, or weighted line to record a depth measurement in meters.
Water Stage (Height)	Use a marked gauge stick or tape measure to record a height measurement in feet.
Weather Conditions	Record the weather: sunny, partly cloudy, rain, snow, etc.
Water Color/Odor	Record a description of the water color or odor.
Tidal Stage	Reference a tide chart or observe conditions to determine the tidal stage: Incoming (Flood), Low, Outgoing (Ebb), High.
Rainfall	Record rainfall from a local weather station or personal rain gauge.
General Comments	Record anything noteworthy, such as debris or trash at the site, evidence of wildlife, fish or crab kills, algal blooms, and land use conditions and changes.

Why do we care?

Human Health

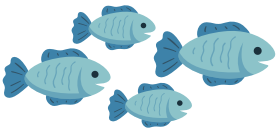
High bacteria values during wet weather indicate typical combined sewer overflows; high values during dry weather suggest infrastructure issues.

Pollution

Site conditions like unusual water color and odor can help identify urban pollution issues, like oil spills or discharges. Water color can also be a good first indication of algal blooms.

Aquatic Life

If your stream appears unusually cloudy or has a layer of fine sediment along the bottom, it could suggest upstream erosion or runoff. This can reduce habitat quality, resulting in fewer sensitive species.



Streamwater turned white, likely from carwashing. Photo by the Alliance for Aquatic Resource Monitoring.

PLEASE NOTE:

This fact sheet provides general information about site conditions, but monitoring in specific locations may require more detailed methods and considerations.

BACTERIA

What are bacteria?

Bacteria are naturally found in our waterways. Though most are harmless, the presence of certain bacteria serve as indicators for other more harmful pathogens. *Escherichia coli* (*E. coli*) or enterococci are common bacteria that live in the intestines of humans and animals and are present in feces. High levels of *E. coli* or enterococci mean harmful bacteria could be present in the water. Bacteria in water can come from many sources, like wastewater, agricultural runoff, or pet waste. Bacteria levels are usually higher after rainfall, when bacteria on land are washed into waterways.

How do we measure it?

Bacteria levels are typically monitored weekly from May through September or monthly year-round, depending on the monitoring goals. Enterococcus is sampled in tidal waters and *E. coli* is sampled in non-tidal waters. Samples can be measured at home using R-Card or Coliscan, or through lab analysis. Bacteria samples are collected in the field then grown in an incubator. Colonies are then counted to determine the number of colony forming units (CFU) or most probable number (MPN) per 100 mL of water, depending on the method used.

Equipment	Cost	Monitoring Time
R-Card (*E. coli* or enterococcus)	$	10 mins per site 24 hour incubation
Coliscan Easygel (*E. coli*)	$	20 mins per site 24–48 hour incubation
Lab analysis (*E. coli* or enterococcus)	$$$	5 mins per site 18–24 hour incubation

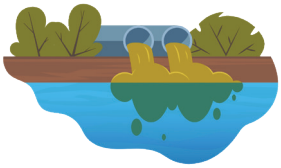
Why do we care?

Human Health

High bacteria levels in areas where people recreate could increase the risk of people getting sick from contact with the water.

Pollution

Sudden spikes in bacteria values, especially in dry weather, can indicate sources of pollution such as leaking septic systems, broken sewer lines, or livestock manure entering waterways.



How is my water?

Per the Mid-Atlantic Tributary Assessment Coalition (MTAC) protocol, 235 CFU/100mL is often used as a cutoff for *E. coli* using a single value, but standards vary by state. The use of averages is encouraged when looking at recreational health, please refer to your state's bacteria guidelines for more specific information.

Poor	Good
Enterococci: >104 MPN/100mL	**Enterococci: <104 MPN/100mL**
***E. Coli*: >235 CFU/100mL**	***E. Coli*: <235 CFU/100mL**

PLEASE NOTE:

This fact sheet provides general information about bacteria, but water monitoring in specific locations may require more detailed methods and considerations.

TEMPERATURE

What is temperature?

Temperature measures how much heat is present in water or air. It naturally changes throughout the day and across seasons. Water temperature affects other indicators, like dissolved oxygen, and plays a role in determining which plants and animals can survive in the water. States use temperature, and other indicators, to classify streams as coldwater or warmwater to protect species and ecosystems.

How do we measure it?

Air and water temperature (measured in degrees Celsius) can be collected using an armored glass thermometer, a digital thermometer, or a multiparameter probe. A single reading at the surface is often enough for streams and smaller waterways. In tidal areas, water temperature can vary with depth, so measuring at the surface and deeper in the water is helpful.

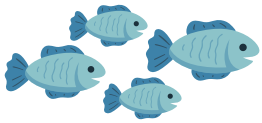
Equipment	Cost	Monitoring Time
Armored glass thermometer	$	3 mins per site
Digital thermometer	$	3 mins per site
Multiparameter probe	$$$	10–20 mins per site

Photo by the Alliance for the Chesapeake Bay.

Why do we care?

Aquatic Life

Different species have different temperature needs, and coldwater species are highly sensitive to small increases in water temperature. Coldwater streams are essential for supporting recreational fishing species.



Changing Climate

Temperature is a key indicator of climate change. Tracking water temperature over time helps us understand how ecosystems are shifting.

Ecosystem Health

In the Bay, layers can form when warmer, fresher water sits on top of colder, denser, saltier water. These layers prevent mixing, which can lead to low dissolved oxygen and negatively affect ecosystem health.

How is my water?

In tidal waters and the Bay, temperature thresholds vary depending on the species and habitat; for example, high temperatures can be harmful for seagrass (Eelgrass, > 28°C) or low temperatures can be harmful for fish (Spotted Seatrout, < 3°C). In non-tidal areas, the Mid-Atlantic Tributary Assessment Protocol (MTAC) provides thresholds for stream temperatures. Warmwater streams should be < 32°C (90°F). Coldwater streams should be < 20°C (68°F). State and local thresholds vary.

PLEASE NOTE:

This fact sheet provides general information about temperature, but monitoring in specific locations may require more detailed methods and considerations.

DISSOLVED OXYGEN

What is dissolved oxygen?

Think of dissolved oxygen (DO) as the "breath of life" for our water bodies. Just like humans need oxygen to breathe, fish and other aquatic animals need oxygen in the water to survive. Moving water mixes in dissolved oxygen from the air and from plants in the water that produce it through photosynthesis.

How do we measure it?

A Winkler titration kit, DO probe, or multiparameter probe are tools that can measure dissolved oxygen. Oxygen levels can be measured at the surface of the water, where oxygen is usually higher, or in deeper water, where levels can decrease due to biological activity and less mixing from wind, storms, and rain. Monitoring at the surface and in deeper water, typically using a probe, provides a fuller picture of oxygen conditions.

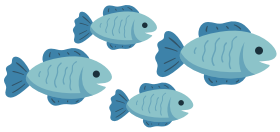
Equipment	Cost	Monitoring Time
Winkler titration kit	$	30 mins per site
Individual probe	$$	10–20 mins per site
Multiparameter probe	$$$	10–20 mins per site

Photo by the Chesapeake Bay Program.

Why do we care?

Aquatic Life

Healthy oxygen levels are crucial for fish, plants, and other aquatic animals to live and thrive.



Fish Kills

Low oxygen levels, especially in the summer, can kill fish and create unhealthy water conditions for fish nurseries.

Stream Health

Measuring dissolved oxygen helps us know if a water body is able to support a vibrant ecosystem.

How is my water?

Per the EPA, good oxygen levels are generally 5 mg/L or higher. DO can be indicative of habitat conditions at the site where you're monitoring, and you may observe higher or lower values based on conditions such as temperature, time of day, depth, and season. Consistently poor values can indicate stressful aquatic environments.

PLEASE NOTE:
This fact sheet provides general information about dissolved oxygen, but water monitoring in specific locations may require more detailed methods and considerations.

pH

What is pH?

pH is the measure of acidity or alkalinity of water. The pH scale ranges from 0 (very acidic) to 14 (very alkaline, or basic) with 7 being neutral. Each whole pH value is ten times stronger than the previous value. Nutrients and other chemical substances can be toxic at pH levels outside of a healthy range (6.5–8.5).

How do we measure it?

pH is measured in Standard Units (SU) on a scale from 0–14. When using a colorimetric kit, test strips, or an individual pH probe, pH can only be measured at the surface of the water. When using a multiparameter probe, pH can be measured throughout the water column.

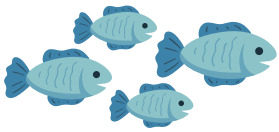
Equipment	Cost	Monitoring Time
Test strips	$	5 mins per site
Colorimetric kit	$	10 mins per site
Individual probe	$$$	10–20 mins per site
Multiparameter probe	$$$	10–20 mins per site

Photo by Loudoun Wildlife Conservancy.

Why do we care?

Aquatic Life

The pH of water determines the biological availability of nutrients, or how much of those nutrients can be used by aquatic life. Any changes in water pH will be harmful to the plants and animals living there.



Pollution

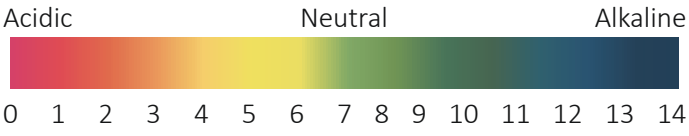
pH outside of the normal range can be a sign of pollution, which could be from mining or wastewater treatment plants.

Stream Health

Even slight changes in pH can cause toxicity, poor aquatic health, and imbalanced ecosystems.

How is my water?

Normal pH ranges from 6.5 and 8.5, so any values outside this range are concerning. Many states have more specific water quality standards for pH. Drastic changes in non-tidal water within this range could still be of concern.



PLEASE NOTE:

This fact sheet provides general information about pH, but water monitoring in specific locations may require more detailed methods and considerations.

SALINITY

What is salinity?

Salinity measures how much salt is dissolved in water. In an estuary like the Chesapeake Bay, salinity forms a natural gradient: waters near the mouth of the Bay are as salty as the ocean (around 35 parts per thousand or ppt), and the water becomes less salty as you move upstream, eventually reaching freshwater (close to 0 ppt). At a site, salinity can change based on factors like flow, depth, and tides.

How do we measure it?

Salinity is measured in parts per thousand (ppt) using different tools. One method is a handheld device called a refractometer, which uses light to measure salt concentrations. Salinity can also be estimated using a water quality probe that measures conductivity, since salty water conducts electricity more easily. In tidal areas, salinity can change with depth, so taking readings at the surface and deeper in the water is helpful.

Equipment	Cost	Monitoring Time
Refractometer	$	3 mins per site
Individual probe	$$	10 mins per site
Multiparameter probe	$$$	10–20 mins per site

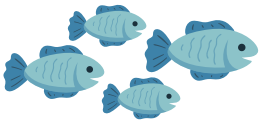
How is my water?

Salinity naturally varies dependent on location. For example, freshwater streams should be < 0.5 ppt, while brackish waters in tidal rivers range from 0.5–18 ppt. Near the mouth of the Bay, salinity is 18–35 ppt. Sudden changes from usual readings could reflect natural events or human-related impacts.

Why do we care?

Aquatic Life

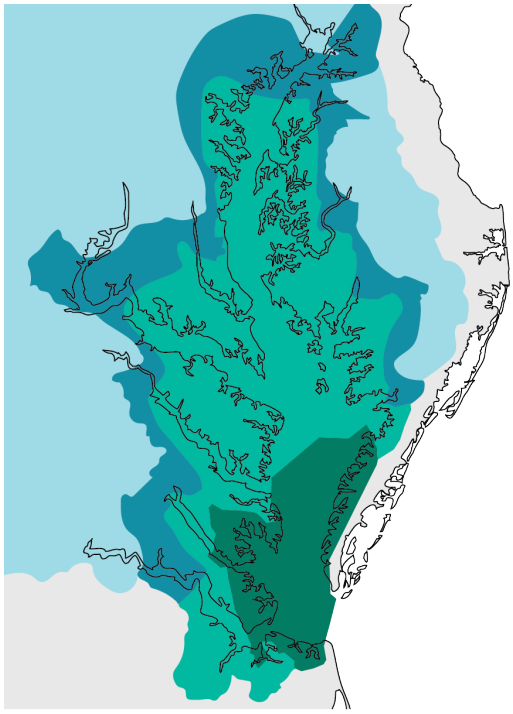
Many aquatic plants and animals are adapted for specific salinity measures, and changes in those conditions can harm the species that live there.



Pollution

An influx of salt into a freshwater stream can indicate pollution sources, such as road salt or mining activities.

Salinity Regimes



Freshwater (<0.5 ppt)

Slightly Salty (0.5–5 ppt)

Moderately Salty (5–18 ppt)

Very Salty (18–35 ppt)

PLEASE NOTE:
This fact sheet provides general information about salinity, but water monitoring in specific locations may require more detailed methods and considerations.

WATER CLARITY & TURBIDITY

What are water clarity and turbidity?

Water clarity and turbidity show how easy it is to see through water. Water clarity is a measure of how far light travels from the surface of the water. Turbidity measures the amount of cloudiness of the water, caused by material like sediment, plankton, and algae.

How do we measure them?

Water clarity (m) is measured at shallow, slow-moving tidal sites by lowering a Secchi disk into the water until it is no longer visible. At some sites, a transparency tube can be filled with water to measure clarity (cm). Turbidity is measured with a turbidity test kit (JTU) or a field colorimeter (NTU).

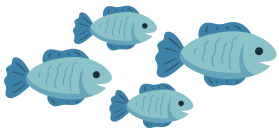
Equipment	Cost	Monitoring Time
Transparency tube	$	5 mins per site
Secchi disk	$	5 mins per site
Turbidity test kit	$	10 mins per site
Turbidimeter/ Field colorimeter	$$$	5 mins per site

Photo by the Chesapeake Bay Program.

Why do we care?

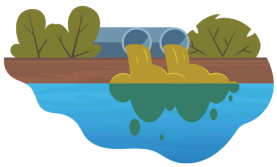
Aquatic Life

Clear water allows sunlight to reach aquatic plants, supporting photosynthesis. Crabs, fish, and other aquatic organisms rely on clear water to see the environment.



Pollution

Runoff of sediment and nutrients from land can result in poor water clarity and high turbidity.



How is my water?

Water clarity and turbidity measurements vary depending on the salinity, weather, and flow at a site. Poor water clarity values tend to be less than 45 centimeters (0.45 m); good water clarity values tend to be above 70 centimeters (0.7 m). Poor turbidity values tend to be higher than 10 NTUs, while good turbidity values tend to be below 3 NTUs.

Photo by the Chesapeake Bay Program.

PLEASE NOTE:

This fact sheet provides general information about water clarity and turbidity, but water monitoring in specific locations may require more detailed methods and considerations.