Hello Water Testers!

Watershed Classroom

This testing kit, provided by Friends of the Petaluma River and the Watershed Classroom Program, is part of an ongoing investigation into the Petaluma River and its tributaries/streams. The results of the tests you take today will be uploaded onto the Watershed Classroom website for public viewing. Combined with the work of other students like you, it will paint a picture of the state of our watershed.

This data can be used to analyze the health of our local river system, to alert us of any rapid changes, and even to make important decisions affecting our watershed.

As part of our water testing team, you are contributing to one of the most ambitious youth water monitoring projects of its kind. It is important that you work carefully to get the best, most accurate results. You are not only learning about your local river and streams but you are playing an important role in helping your community and caring for our river!

Uploading Data to the Atlas

Now that you have conducted water testing it is time to share your results with your community. Here is how to upload the data you have collected onto the Watershed Classroom's Watershed Atlas.

1. Go online to watershedclassroom.org
2. Go to "The Atlas" which is under "The Watershed" tab on the homepage
3. Click on any monitoring location (water drop) on the Atlas
4. A list labeled "Monitoring Locations" will pop up to the left side of the Atlas. Below the title and brief description is a small link that says "TEACHERS: Please submit water quality data here." Click there.
5. Fill out the form. If you have multiple data sets from the same date and time you should average them and fill out the form only once. If you went multiple times over the course of the day, each time should be a different set.
6. Once you have completed the form, scroll back up to the top of the page and press "Submit for Review," which will be to the right.
7. A member of the Watershed Classroom staff will review the data and post it online once it is approved. Thank you for submitting!

Teachers…

Kit Contains Corrosive Chemicals

Some of the tests utilize corrosive chemicals so it is very important that students follow instructions carefully and use the gloves and goggles provided. If you run out of gloves or lose/break safety goggles, please inform Friends of the Petaluma River and we will bring you more.

If chemicals from the Dissolved Oxygen, Phosphate, Nitrate, or Ammonia kits get into a student's eyes, rinse with plenty of water for 15 minutes and then seek medical advice. If student has contact lenses, remove them after 5 minutes of rinsing and then continue to rinse.

Removing Caps from Test Tubes

The test tubes provided with kits are very fragile. Students should be instructed to carefully pull directly up when removing caps from the tubes. Extra tubes are provided in case of breaks. Please contact Friends of the Petaluma River if you are running low.

Ammonia (NH_3) Testing

API Kit

>>Please read all instructions before testing<<

1. Put on gloves and safety goggles.
2. Rinse the syringe and vial in the sample water.
3. Fill the test tube with 5 ml of water using the syringe (use measurements on the syringe and tube). Be careful when removing the cap from the test tube. Pull directly up to avoid breaking.
4. Add **8 drops** from **Ammonia Test Solution Bottle #1**, holding the dropper bottle upside down in a completely vertical position to assure uniform drops.
5. Add **8 drops** from **Ammonia Test Solution Bottle #2**, holding the dropper bottle upside down in a completely vertical position to assure uniform drops.
6. Cap the test tube & **shake vigorously for 5 seconds**.
7. Wait **5 minutes** for the color to develop.
8. Read the test results by comparing the color of the solution to the appropriate Ammonia Color Card. Use the Freshwater card in streams and the Saltwater card in the Petaluma River.
9. To compare colors, place the side of the tube against the white portion of the card.
10. The closest match indicates the ppm (mg/L) of ammonia in the water sample.
11. Rinse the test tube with clean water after use.

Why Test for Ammonia?

Ammonia is part of the nitrogen cycle, created through the process of ammonification, and is a form of nitrogen that is commonly found in water. It is a necessary nutrient for plants and animals but in high concentrations, it can be toxic to marine life.

When there is too much ammonia in the water, it can cause rapid overgrowth of aquatic plants and algae, turning the water a soupy green and forming a layer of green slime on the surface. This layer prevents light from reach plants below the water's surface and oxygen from reaching the water so that lifeforms below this layer are likely to die.

Ammonia is measured in mg/L. The EPA's recommended maximum ammonia concentration in freshwater is **1.9mg/L** and in general the Petaluma River and its tributaries should be well below this. Ammonia is produced naturally in small quantities by marine life, and larger quantities can be introduced into rivers from human sources such as sewage and fertilizer from agriculture. Ammonia levels may be slightly higher after it rains as stormwater can wash pollutants into the water, though it still should be well below the maximum of 1.9mg/L.

Conductivity Testing

With the HM Digital Meter

1. Remove the cap
2. Press the ON/OFF button and the display will turn on.
3. Make sure the units of measurement are µS (micro-siemens), displayed at the very top of the screen. If the units are not µS, press and hold the HOLD/MODE button to change units. Release when it says µS in top left corner.
4. Dip the meter into the water and lightly swirl.
5. With the meter still under water, tap the sides lightly with your fingers to release any air bubbles that might be trapped.
6. Keep the meter under water until the reading is stable (between 30 seconds and 2 minutes)
7. Quickly press and release the HOLD/MODE button to freeze the reading on the screen.
8. Remove the meter and write down the reading.
9. Press the ON/OFF button to turn meter off.
10. Shake any excess water off the meter and rinse it with fresh water.
11. Recap the meter before putting it away.

Why Test Conductivity?

Conductivity measures water's ability to carry an electrical current. The more dissolved solids in the water, the higher conductivity will be. Because of this, conductivity can be a good indicator for possible pollution. Almost all water conducts some electricity, and plants and animals are adapted to live with a certain level of total dissolved solids in their water. If the total dissolved solids in the water is too high, it can harm plant and animal life living in and around the river and streams.

Conductivity is measured in µS/cm (microSiemens per centimeter) Healthy freshwater streams should have between **150 to 500 µS/cm** but it is common for a stream to have a conductivity up to **2000µS/cm**. Saltwater has a conductivity of **55000µS/cm.** The Petaluma River is actually a slough, which means it has tides. Sometimes salt water is coming in from the ocean and sometimes freshwater is flowing outwards from the hills and surrounding land. That means the water in the river is brackish, a blend between salt and freshwater. Because of this, conductivity levels in the river may range anywhere from **500 to 55000µS/cm** depending on the tides. Conductivity is likely to be higher after it rains as stormwater can wash pollutants into rivers and streams. Conductivity also increases with temperature so if the water is warmer, conductivity will be higher.

Dissolved Oxygen (O_2) Testing

Salifert Kit

>>Please read all instructions before testing<<

1. Put on gloves and safety goggles.
2. Test directly from the river or stream or take and **test sample immediately** if using a bucket for testing.
3. Rinse the syringe and vial twice with sample water. Be **careful when removing the cap to the vial and try to lift directly up** or it might break.
4. Using the syringe, measure out 5 mL of water and slowly add it to the vial.
5. Add **5 drops** of **O2-1.** Immediately recap the bottle and swirl (DO NOT SHAKE or oxygen levels will change) for **20 seconds**.
6. Add **5 drops** of **O2-2**. Immediately recap the bottle and swirl for **15 seconds**.
7. Wait 1 minute.
8. Add **1 drop** of **O2-3** and swirl for **5 seconds**.
9. **Repeat step 8 four more times** for a total of **5 drops**. No need to cap the bottle until the last drop.
10. Place the vial on the white part of the color strip and **look down** through the vial.
11. Match the color in the vial to the closest color on the color strip to find out the amount of dissolved oxygen (measured in mg/L).

Why Test for Dissolved Oxygen?

Dissolved oxygen is crucial to the survival of aquatic life. Like humans, animals in the water need a certain amount of oxygen to survive and if oxygen levels are too low, these animals will die. Oxygen levels in water increase when water is moving quickly, so in parts of the river where water is not moving, we can expect dissolved oxygen levels to be much lower than in places where the river is flowing. Other chemicals and pollutants in the water can also cause a drop in dissolved oxygen.

Dissolved oxygen concentration is reported in units of mg/L (milligrams per liter). For marine life, the recommended minimum oxygen level is **7 mg/L**. Dissolved oxygen levels for the Petaluma River tend to be below this level because of slow currents.

Nitrate (NO_3) Testing

API Kit

>>Please read all instructions before testing<<

1. Put on gloves and safety goggles.
2. Rinse syringe and tube with sample water.
3. Use the syringe to fill the test tube with 5mL of water using the lines on the tube and syringe to measure.
4. Add **10 drops** of **Nitrate Solution #1**, holding the dropper bottle upside down in a completely vertical position to assure uniform drops.
5. Cap the test tube and invert it several times to mix.
6. Pick up **Nitrate Solution #2** and **vigorously shake for 30 seconds** or more. This is very important for accurate testing results.
7. Add **10 drops** of **Nitrate Solution #2** to the test tube, again holding the dropper bottle in a vertical position.
8. Cap the test tube and **shake vigorously for 1 minute**. This is very important for accurate results.
9. **Wait 5 minutes** for the color to develop.
10. Place the side of the test tube against the white part of the color sheet and compare it to the colors on the sheet. The closest color match indicates the mg/L (ppm) of nitrate in the sample water.
11. Rinse the test tube and syringe with clean water.

Why Test for Nitrate?

Nitrate is naturally found in water and is the final product of nitrification, an important bacterial process in the Nitrogen Cycle. Many creatures are sensitive to high levels of nitrate in the water.

Nitrates occur in small amounts in all aquatic environments and are necessary for maintaining the growth and metabolism of plants and animals. However, in excess amounts, they can prove to be quite harmful. High levels of nitrates can deplete dissolved oxygen levels by causing algae blooms and bacterial growth. This water is often scummy, cloudy, soupy-green in color, and overgrown with plants and algae. A layer of green slime forms across the surface of the water. This layer inhibits light movement into the water and also lessens the amount of oxygen that can get into the water from the air. Plants below the water's surface may die from lack of light, and the resulting decay and decomposition of these plants causes water to grow foul smelling and cloudy.

The maximum acceptable level for Nitrates is **.16mg/L** but truly there should be little to none. Nitrate levels tend to rise when there is a greater presence of manure or fertilizer pollution in the water. Nitrate level is likely to be slightly higher than normal after rain as stormwater can wash pollutants into the river. There should be close to no nitrate in the Petaluma River or its tributaries.

pH Testing

1. Dip the pH paper into the water sample and remove immediately.
2. Match the color of the strip to the color chart to find the pH level

Why Test for pH?

pH measures how acidic or basic the water is. A low pH means the water is more acidic and a high pH means the water is basic. pH determines the amount of substances that can be dissolved into water and how much of the nutrients in the water can be used by aquatic life. pH can be affected by chemicals in the water so it is an important indicator for pollutants. If water is too far from neutral it could mean that chemical pollutants are in the water.

pH is **neutral at 7** and that is usually about where you will find the Petaluma River. Most organisms can survive in levels **between 6.5 and 8.5**. pH is more likely to be abnormal after rain as stormwater can wash pollutants into the river and its tributaries.

Phosphate (PO_4) Testing

API Kit

>>Please read all instructions before testing<<

1. Put on gloves and safety goggles
2. Rinse the syringe and test tube with the sample water.
3. Using the syringe, measure out 5mL of water and add it to the test tube. Be careful when removing the cap from the test tube. Gently pull cap directly up to avoid breaking the tube.
4. Add **6 drops** of **Phosphate Test Solution Bottle 1** to the test tube. Hold the bottle straight up and down to ensure even drops.
5. Cap the test tube and **shake for 5 seconds**.
6. Add **6 drops** of **Phosphate Test Solution Bottle 2** to the test tube. Again make sure to hold the bottle vertically. (Bottle #2 holds a thicker solution and may require more pressure)
7. Cap the test tube and **shake for 5 seconds**.
8. Wait three minutes for color to develop
9. Remove the test tube cap and place it on the white surface of the color strip paper. Look down through the test tube and compare it to the strip of colors. Use the salt water sheet for the Petaluma River and freshwater for streams and creeks.
10. Record the value for the closest color match in mg/L (ppm).
11. Rinse all equipment twice before returning it to the kit.

Why Test for Phosphate?

Phosphate is a natural compound found in water but if it builds up, it becomes a pollutant. Phosphates occur in small amounts in all aquatic environments and are required to maintain the growth of plants and animals. However, in excess amounts, they can be harmful. High levels of phosphates have been known to deplete dissolved oxygen levels by causing algae blooms and bacterial growth. Water with high phosphate levels is often scummy, cloudy, soupy-green in color, and overgrown with plants and algae, which forms a layer of green slime across the surface. This layer inhibits light movement into the water and also lessens the amount of oxygen that can get into the water from the air. Plants below the water's surface may die from lack of light, and the resulting decay and decomposition of these plants causes the water to grow foul smelling and cloudy.

The best way to describe acceptable levels for phosphates is little to none. Maximum safe level for Phosphates in the Petaluma River is **30 µg/L** (micrograms/liter) that's **.0003mg/L.** Reasons why the phosphate level might rise would be a drop in the water level due to evaporation or an increase in pollutants containing phosphates due to stormwater washing human pollutants such as sewage, runoff from farms, or residential fertilizers into the river.

Salinity Testing

Hydrometer

1. Rinse the hydrometer once with sample water.
2. Fill the hydrometer by slowly dipping it into the water **bottom first**.
3. Tap the hydrometer gently to remove any bubbles from the pointer.
4. Set the hydrometer on a level surface and read the **outside number** that the needle points to (the inside number measures something different).

Why Test for Salinity?

Salinity is a measurement of the amount of salts that are dissolved in water. The salinity of a body of water greatly affects the aquatic life living in it because most species have adapted to live within a very limited range of salt concentration. Salinity is much lower in freshwater streams than in the ocean or in salt water sloughs like the Petaluma River. Two major factors that can affect levels of salinity are rainfall (decrease in salinity) and evaporation during a drought (increase in salinity).

Freshwater should have a salinity near zero and the average salinity of ocean water is around 35ppt (parts per thousand). The Petaluma River is what is called brackish water, which means it is a mix of salt and fresh water. Depending on if the tides are coming in or going out and how much rainfall there has been, the salinity in the Petaluma River can be anywhere from **0.5ppt to 30ppt**. Salinity in the streams should be close to **0ppt**.

Temperature Testing

Air Temperature

1. Hold thermometer by the top (not by the bulb).
2. Take the air temperature in the shade within a few feet of where the water is sampled. If there is no shade available, use your own shadow.
3. Be sure thermometer reading is stable for at least one minute before recording the temperature.
4. Record only in **degrees Celsius**.

Water Temperature

1. Hold thermometer by the top (not by the bulb).
2. Choose a place where water is flowing. If water has been pulled from the river, take the temperature as soon as possible.
3. Immerse only the red tip of the thermometer and be careful not to bang it on any rocks or sediment at the bottom of the water as it will break if handled roughly.
4. Be sure the temperature is stable for at least one minute before recording the temperature.
5. Record only in **degrees Celsius**.

Why Test Temperature?

Water temperature is important because of the effect that it can have on algae and wildlife that live in the rivers. This is because as water heats up, it loses some of its ability to hold oxygen, making it harder for fish and other water creatures to live in that area.

Salmonoid fish species like the Steelhead Trout native to the Petaluma River thrive better in waters between **15-17°C (59-63°C)**. In general, the temperature of the water will be **within 5°C** of the air temperature, though this is not always the case. If your measurements are far off from this or if your water temperature is higher than your air temperature, you may want to have a classmate remeasure before recording the results.

Turbidity Testing

Secchi Tube

>>2 people are needed for this test<<

1. Close the valve at the bottom of the secchi tube by folding over the rubber drainage tube and clamping it shut.
2. Collect a sample of water in a bucket in the deepest part of the river or stream that is safe to reach. Be sure not to scoop up any sediment from the bottom.
3. Fill the secchi tube to the top.
4. Find a shaded spot or stand with your back to the sun so you cast a shadow on the tube.
5. One person will look through the top of the tube while another person unclamps the valve at the bottom of the tube.
6. When the person at the top sees the black and white disk they say STOP! and the person at the bottom closes the valve by re-clamping the folded over rubber tube.
7. Record the height of the water remaining in the tube.

Why Test Turbidity?

Turbidity is the measure of water's cloudiness and an indicator for the amount of suspended and dissolved solids in water. Turbidity can be increased by runoff from human activity such as agriculture, mining, and construction. High turbidity decreases the amount of light which can reach aquatic life at the bottom of a river and can affect a fish's ability to absorb oxygen through its gills.

Turbidity is generally high in the Petaluma River, with Secchi discs disappearing **between 15 and 60cm**, though turbidity may be lower in surrounding creeks. Turbidity is likely to be higher after it has recently rained as stormwater washes sediment and other pollutants into the river and its tributaries.