STARTING AT THE SOURCE TEACHER GUIDE

TAMPA BAY WATER
Supplying Water To The Region

Tampa Bay Times NIE
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Newspaper in Education

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This teacher guide was funded by a Source Water Protection Mini-Grant from Tampa Bay Water. Tampa Bay Water supplies wholesale drinking water to Hillsborough County, Pasco County, Pinellas County, New Port Richey, St. Petersburg and Tampa. They supply water to more than 2.3 million people through the governments they serve. Tampa Bay Water's mission is to provide clean, safe water to the Tampa Bay region now and for future generations.

What is Source Water?

Source water refers to the water sources from which we get the water we drink and use. The drinking water in Tampa Bay comes from three sources: Groundwater, river water and desalinated seawater.

- Groundwater from the Floridan Aquifer, sourced from wellfields in Hillsborough, Pasco and Pinellas counties.
- River water from the Hillsborough and Alafia Rivers and the Tampa Bypass Canal
- Desalinated seawater from Tampa Bay

Because our region depends on surface and groundwater for most of our water supply, it is important to safeguard those sources from pollution and contamination. Source water protection includes a wide variety of actions and activities aimed at safeguarding, maintaining, or improving drinking water sources and their contributing areas.

This purpose of this teacher guide is to explore water source protection. Some of the information in this guide comes from the following Tampa Bay Times Newspaper in Education publications:

Answers on Tap
Do you Know Your H20?
Protecting our Pipes: What not to flush
Springs: Florida's Natural Wonders
Water Matters

Where does my water come from?

The major source of our water supply in Florida is the Floridan Aquifer. The aquifer is a huge underground reservoir, made up of porous limestone rock, which holds groundwater like a sponge.

The water in the aquifer comes from rainfall that soaks into the ground. Rainfall that is not absorbed is called surface or stormwater runoff. We take water from the aquifer for human use through springs (natural openings in the ground where water flows directly from the aquifer to the surface) and wells (artificial holes drilled into the aquifer).

Going beyond the text: Doing the research

Research the following terms:

- Freshwater
- Groundwater
- Potable water
- Wastewater
- Reclaimed water
- Spring water
- Stormwater runoff

Create a poster depicting the types of water and what the water is used for. Share the information you learn with your class.

Standards: SC.312.N.1.1; SC.312.N.1.2; SC.312.N.1.3; SC.312.N.1.4; SC.312.N.3.1; SC.712.E.6.6; SC.312.P.9.1; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Where the rain goes

Although west-central Florida receives an average of 53 inches of rainfall a year, only 2 to 40 percent of that will percolate down into the ground to help recharge the aquifer. Most of the rainfall we receive either returns to the atmosphere through evaporation or transpiration or runs off the land into surface water bodies and the ocean. In fact, did you know that about 97 percent of the water on Earth is found in our oceans? While oceans are important, they are filled with saltwater, which we cannot use for drinking or for our daily needs. Of the small portion of the Earth's water that is freshwater, most of it is frozen in glaciers, leaving only 1/100 of all the water on Earth available for use by people, animals and plants!

A thirst for water

Freshwater is an essential part of human life. We rely on freshwater for drinking, cooking, agriculture, recreation, businesses and more! With more than 328 million people, the population of the United States has doubled over the past 50 years, while our thirst for water has tripled, according to the Environmental Protection Agency. With nearly 21.5 million residents, Florida's population is on the rise as well. At least 40 states anticipate water shortages by 2024, making the need to conserve water very important.

Working together

As the number of people moving to Florida continues to grow, that means there will be more people who need to share the water that is available. Water conservation will help us to make sure we have enough clean, safe water for the future. To do this, state agencies, local water utilities, businesses and residents will all need to work together.

Sources: Source: United States Geological Survey, U.S. Environmental Protection Agency; U.S. Census Bureau; Southwest Florida Water Management District

Going beyond the text: Environment editorial

Think about the importance of water to our lives and how water, the aquifer, conservation and pollution relate to the future of mankind and the quality of life. Watch the NBC Learn/National Science Foundation video series "Sustainability: Water," https://www.nsf.gov/news/mmg/index.jsp?series_name=Sustainability:%20Water

With your class, make a list of the concepts and ideas you discover. Next, in a small group, look for articles in the Tampa Bay Times about water conservation, the environment, pollution or any other topics you discussed with your class.

Based on the information you read in these articles and watched in the video, write an editorial on the importance of water in your community and to the future of mankind. Use the editorials and letters to the editor in the Tampa Bay Times as models for your article.

Standards: SC.312.N.1.1; SC.312.N.1.2; SC.312.N.1.3; SC.312.N.1.4; SC.312.N.3.1; SC.712.E.6.6; SC.312.P.9.1; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Starting at the source

It all begins with a raindrop. But after that raindrop falls from the sky, where does it go? It depends on where that raindrop lands.

Tampa Bay Water, the regional wholesale drinking water utility, takes that raindrop — and millions more — from three different sources and blends them together. Those sources are groundwater, surface water and desalinated seawater. Tampa Bay Water is the only water utility in the United States to take advantage of these three sources of water combined.

Groundwater

If that raindrop falls onto the ground, it will soak into the earth and eventually be stored in the Floridan Aquifer, an underground layer of limestone that works like a sponge to store trillions of gallons of water. Groundwater was once the sole source of drinking water for the region.

Surface water or river water

If that raindrop falls into the Tampa Bypass Canal, the Alafia River or the Hillsborough River, it is considered surface water. When available, water is skimmed from these rivers. Some is treated for immediate use at the Tampa Bay Regional Surface Water Treatment Plant, and surplus water is stored in the 15.5-billion-gallon C.W. Bill Young Regional Reservoir to supply the water treatment plant during dry times.

Seawater from Tampa Bay

If that raindrop falls into the waters of Tampa Bay, it might be destined for the Tampa Bay Seawater Desalination Plant. This facility is a drought-proof, alternative water supply that provides up to 25 million gallons per day of drinking water to the region. Seawater coming into the plant goes through a rigorous pretreatment process, then freshwater is separated from the seawater using reverse osmosis. The end product is high-quality drinking water that supplies up to 10 percent of the region’s needs.

Source: Tampa Bay Water

Going beyond the text: Conserving water

Look for an article or photograph related to water use and/or conservation in current issues of the Tampa Bay Times. How are people using the water? Are they drinking it, using it for industrial production or enjoying it for recreation? Is water being used conservatively or does the article or photograph suggest the water is being wasted? What can you and your family do to help conserve water? Using the Letters to the Editor in the Tampa Bay Times as models, write a letter to the editor about this issue.

Standards: SC.7.E.6.6; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Follow water on its incredible journey

From raindrop to kitchen faucet…down the drain, and even back into the air, the water you drink every day has an amazing journey…that never really ends.

Rainfall
Rain drops onto Hillsborough, Pasco and Pinellas counties, where it seeps into the ground; fills the creeks, rivers, lakes and wetlands; or ends up in the waters of Tampa Bay.

Water sources
A variety of water sources ensures a diverse, reliable water supply network. Sources include groundwater from the Floridan Aquifer, seawater, river water and water stored in a reservoir.

Treatment
Water from the rivers, the Tampa Bypass Canal and a regional reservoir is pumped to a water treatment plant, where it is filtered and disinfected, then blended with desalinated seawater and treated groundwater.

Delivery
Treated, blended water is pumped to local utilities for any added treatment, such as softening or fluoridation.

At your house
High-quality drinking water is delivered to your house, available simply by turning on the faucet. Tampa Bay Water meets or surpasses all federal, state and local drinking water requirements.

From your drain
This water may go to a reclaimed water facility, where it is cleaned for lawn watering or disposal.

Watering your lawn
Some of the water used for sprinkling your lawn or landscape will eventually evaporate and return to the sky and fall as rain, and the water cycle will begin again.

Source: Tampa Bay Water

Going beyond the text: **Cause and effect**

Waste can result in a shortage of natural resources, including water. Wasting resources is increasing at an alarming rate in the world and in our neighborhoods. Waste can be the result of carelessness or convenience. Look for an article in the Tampa Bay Times that focuses on waste. Discuss the article with your class. Write down the main points presented in the article. Discuss the ways you can offset this problem. As a class, write down the steps you can take to offset the problem. Then break into small groups and create a poster outlining those steps to share with others.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

The water cycle

The water cycle, also called the hydrologic cycle, describes the continuous movement of water above, on, and below the surface of the Earth. To understand Florida's water resources and the importance of water conservation, we must first understand the water cycle and its impact on water availability.

- **Evaporation** – Water's journey through the water cycle begins with a process called evaporation. Evaporation is when water stored in surface bodies of water, such as lakes, rivers and the ocean is changed from a liquid into water vapor by the heat of the sun.

- **Transpiration** – Similar to evaporation, water is released into the atmosphere by trees and plants in a process called transpiration. Plants absorb water from the soil through their roots and then transpire this water back into the atmosphere through their leaves and stems. About 70 percent of all rainfall returns to the atmosphere in the form of evaporation and transpiration.

- **Condensation** – Condensation is when water vapor from evaporation and transpiration rises and meets the colder air higher in the sky, forming tiny droplets of water. These water droplets stick together to make clouds.

- **Precipitation** – When clouds become full and heavy, water falls back to Earth as precipitation. In Florida, precipitation is most often in the form of rain, but precipitation can also be snow, sleet or hail. Precipitation is needed to recharge, or refill, underground aquifers.

- **Runoff** – Precipitation that is not absorbed directly into the soil or through the roots and leaves of plants or accumulated into existing bodies of water such as lakes or rivers, is called surface, or stormwater, runoff.

- **Percolation** – Precipitation seeps underground through a process called percolation, when water travels downward through the tiny spaces between rocks and soil particles, and within the structure of the limestone. The water eventually saturates the underlying limestone in much the same way water fills the tiny holes of a sponge.

Source: Florida Department of Environmental Protection

Going beyond the text: Moving water

The world's water moves between lakes, rivers, oceans, the atmosphere and the land in an ongoing cycle called the water cycle. The water cycle describes how water evaporates from the surface of the Earth, rises into the atmosphere, cools and condenses into clouds and falls again to the surface as precipitation. Visit https://gpm.nasa.gov/education/videos/water-cycle-animation to watch an animation of Earth's water cycle. Next, create an artistic depiction showing the water cycle.

Standards: SC.312.N.1.1; SC.312.N.1.2; SC.312.N.1.3; SC.312.N.1.4; SC.312.N.3.1; SC.712.E.6.6; SC.312.P.9.1; SC.5.E.7.1; SC.912.L.17.10; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Safe drinking water

Before the early 1900s, many people in the United States died from diarrhea-causing diseases such as cholera and dysentery, as well as typhoid fever — all because of unsanitary drinking water. Yes, that's right…diarrhea can kill you!

Poor sanitary practices and a lack of treatment meant microbes and other parasites were often found in drinking water. Thousands of infants, children and adults died from contaminated drinking water.

All that changed in the early 1900s, when scientists found a way to disinfect drinking water using chlorine. Chlorination of drinking water has been called one of the most significant advances in public health protection. In fact, the U.S. mortality rate went down 50 percent in the 20th century, thanks to water treatment.

Getting the Act together

In 1974, the United States Environmental Protection Agency (EPA) passed the Safe Drinking Water Act to protect public health. The law sets health-based standards for drinking water and requires treatment and monitoring to meet those standards. The Safe Drinking Water Act establishes maximum contaminant levels and treatment techniques for chemicals, metals and pathogens. The regulation also includes penalties for utilities that don't comply with the standards

Going beyond the text: Safe drinking water

Explore Safe Drinking Water Act Criteria at https://www.epa.gov/dwreginfo/drinking-water-regulations. With your class, create a list of the Who, What, Why, Where, When and How points of the act. Discuss what the main ideas of the act are and why they are important to society.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: The dangers of unsafe drinking water

Read the article "Which Countries Have the Safest Drinking Water at https://www.aljazeera.com/news/2022/3/22/infographic-which-countries-have-the-safest-drinking-water-interactive. After reading the article, write down the main points on a piece of paper. Include the facts that are presented in the article regarding the main purpose of the article. Be sure to write down the facts regarding Who? What? Where? When? Why? and How? Share your thoughts about what you have learned with your classmates and teacher.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Safe Drinking Water Act

Research the Safe Drinking Water Act and its history. Why was the law implemented? What changes were made in 1986 and in 1996? Write a report with the information you find. Note the most interesting fact that you learned and share that with your class. Explain why you found that specific information interesting. Also, be sure to note what information you learned that you did not know prior to doing the research.

Standards: SC.7.E.6.6; SC.4.E.6.6; SC.4.P.8.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Working together

We all need to work together to protect our environment. Conserving water, recycling and protecting our wildlife are important for the future of Earth. Look for articles in the Tampa Bay Times that show or focus on examples of people, groups or organizations that are working to protect the environment. Make a list of those involved and the actions they are taking. Select one of the environmental groups or issues you have read about and do some research about it. Then think about what actions you can take to protect the environment. Share your ideas and what you have learned by writing a blog post or short essay that incorporates the information you have learned.

Standards: SC.7.E.6.6; SC.5.E.7.2; SC.912.E.7.1; SC.4.P.8.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Protecting drinking water starts with you

The pond behind your home…the river where you like to fish…the waters at your favorite beach…this water belongs to the state, and you as a user of this water must be considerate of what you do in and around it.

Safe drinking water

Now you know your drinking water comes from the Floridan Aquifer, rivers and even Tampa Bay. Protecting these sources from contamination protects your drinking water, the environment, and saves money and energy. The cleaner the source water, the less treatment that's required — which means less energy and chemicals are needed to clean the water.

Safeguarding rivers and Tampa Bay

Surface water, like Tampa Bay and area rivers and streams, are especially vulnerable to contaminants. Everything that happens on the ground can make its way to surface waters. When it rains, animal droppings, fertilizer, trash, petroleum and more gets washed into surface waters. This pollution not only hurts the creatures and plants living in these waters, but also impacts your drinking water sources.

It's everyone's job to protect Florida's waterways and to ensure there will be plenty of water for future generations.

. We all live in a watershed and everything we do on land can the health and well-being of our surrounding water bodies What you do in and around your home and in your community impacts our watershed. We all share the responsibility so we can all make simple changes to help prevent pollution and promote a healthy watershed for all of us.

Source: Tampa Bay Water

Going beyond the text: Analyzing information critically

It is time to use your critical thinking skills. Using the Tampa Bay Times, review the articles and ads for a one-week time period. Save all articles that focus on conservation and the environment.

Write down the main points for each article. Be sure to comment on whether the article is focusing on positive or negative choices. Choose one of the points represented in one of the articles to write a research paper. You can focus your research and paper on any aspect of the article. After your paper is written, create an oral presentation for your class.

Explain whether the information you found is positive, negative, helpful or harmful. Be sure to use specific examples from the article and your research in your paper and presentation.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Do the math

The average person uses 16 gallons of water per shower. If the average number of students in your class live in a household with three other people, what is the total number of people represented by your class. How many gallons of water does each household from your class use each day? What is the total amount of water used for showering for each household in a month? What is the total water used from showering by all of the households? Explain how you arrived at this answer.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text : Do the math

If the average-size dog produces ½ pound of poop each day and there are 500,000 dogs in the Tampa Bay area, how many total pounds of dog poop is produced each day? Each week? Convert both answers to tons. If 40 percent of dog owners don't pick up after their pets, how much dog poop is left on the ground each day?

Now that you know surface waters are vulnerable to contaminants, what happens to this poop that is left on the ground each day? Look in the Tampa Bay Times for articles about groundwater pollution. In addition, do research about this issue on the Internet. Use what you read to write a short editorial explaining how big the problem is and what residents can do about it. Use the editorials, columns and opinion articles in the Times as models.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Water treatment

With three different sources of supply, Tampa Bay Water has three different treatment processes, each engineered to clean and disinfect drinking water, so it meets the health-based standards for drinking water established in the Safe Drinking Water Act.

The area's **river water** treatment plant and **seawater** desalination plant use multi-step processes. Both facilities strain water to remove large debris, then use a conventional treatment process in which chemicals are added that cause small particles to clump together and settle out.

Groundwater requires less treatment than river water and seawater because nature does most of the cleaning for us. The Floridan Aquifer serves as a natural filter as water moves through it, leaving only the need to disinfect and stabilize water before it is blended with other sources.

At the **surface water treatment plant,** the water is disinfected using ozone, one of the most powerful disinfectants available in water treatment. The water is again filtered and disinfected with chloramines before being blended with other sources and distributed to Tampa Bay Water's member governments.

At the **seawater desalination plant**, after the conventional process, water flows through progressively finer filters to remove any remaining matter. Highly filtered seawater is then forced at high pressure through reverse osmosis (RO) membranes that remove salt. The size of each RO membrane pore is about .001 microns, which is about 1/100,000th the diameter of a human hair. Chemicals are added to stabilize the desalinated seawater, which is then disinfected with chloramines before being blended and distributed to Tampa Bay Water's member governments and eventually to you.

Seawater – the hardest to treat

- Seawater from Tampa Bay is strained to keep fish, shells and other debris out of the system.
- Chemicals are added that clump small particles together and make them sink.
- Seawater flows through progressively finer filters to remove any remaining matter.
- Highly filtered seawater is forced at high pressure through reverse osmosis membranes that remove salt. The size of each membrane pore is about .001 microns, which is about 1/100,000th the diameter of a human hair.
- Chemicals are added to stabilize the desalinated seawater, which is then disinfected with chloramines before being blended with Tampa Bay Water's other sources and distributed.
- Each gallon of seawater treated yields only about 57 percent freshwater. The 43 percent that is leftover is basically concentrated saltwater that must be diluted and then returned to Tampa Bay.

Source: Tampa Bay Water

Going beyond the text: Do the math

If the desalination plant can treat 44 million gallons of seawater each day, how much freshwater can be produced? How much concentrated seawater? Using the answer from the above problem, how much seawater is needed to dilute the leftover concentrated seawater if it is blended at a 70:1 ratio? How much total force (pounds) is applied to the surface area of 1 square foot of pipe if the water pressure is 50 psi inside the pipe?

Standards: MA.6.AR.3.1; MA.6.AR.3.3

Nine Principles of Florida-Friendly Landscaping™

Up to 50 percent of water used at home is used to water grass and plants. The nine Florida-Friendly Landscaping™ principles save water and money by reducing the amount of water needed to maintain your landscape.

1. **RIGHT PLANT, RIGHT PLACE:** Select plants that match your yard's soil type, amount of sun and shade, and amount of water received.
2. **WATER EFFICIENTLY:** Group plants with similar water needs together and only water in the early morning. Be sure to follow your local watering restrictions.
3. **FERTILIZE APPROPRIATELY:** Never fertilize within 10 feet of a water body or before it rains.
4. **MULCH:** Keep 2-3 inches of mulch in plant beds to hold in moisture, protect plants and prevent weeds. Leave 2 inches of space around trees to prevent rot.
5. **ATTRACT WILDLIFE:** Choose plants with seeds, fruit, foliage and flowers to attract wildlife and insects that eat pests and pollinate flowers.
6. **MANAGE YARD PESTS RESPONSIBLY:** Minimize pesticide use by choosing pest-resistant plants.
7. **RECYCLE YARD WASTE:** Try composting yard clippings and trimmings. You can mix grass, branches, weeds, eggshells, coffee grounds, tea bags, pine needles, corncobs and even shredded cardboard. Adding this mixture to your soil releases nutrients back into your yard for a healthy landscape – and less garbage in landfills.
8. **REDUCE STORMWATER RUNOFF:** Create permeable walkways and driveways to allow rain to soak into the ground.
9. **PROTECT THE WATERFRONT:** If you live on or near the water, create a 10-foot "maintenance free" zone around your landscape where you don't have to mow, fertilize or use pesticide. This will keep our waterways clean!

Going beyond the text: Everything is connected

Everything in the natural world is connected. Safe drinking water may start with a raindrop, but its journey to the tap is extensive. As inhabitants of Earth, it is our job to not only realize that, but also to make an effort to protect the parts, which contribute to the whole. An ecosystem is a biological community of interacting organisms and their physical environment. In other words, an ecosystem is a community of living and nonliving things that work together. Think about all of the different parts of the water ecosystems and how they interact. Look for articles and photos in the Tampa Bay Times about your community. Make a list of all the parts of your ecosystem. Choose some of the most important parts and create a cartoon depicting your personal ecosystem.

Standards: SC.5.E.7.2; SC.4.E.6.3; SC.412.N.1.1; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Types of water

What is potable water?

Potable water is water that is safe to drink. In Florida, our drinking water comes from the state's systems of rivers, streams, wetlands, lakes, springs, aquifers and estuaries.

In the United States, the Environmental Protection Agency (EPA) sets national standards for drinking water quality. In Hillsborough County, you can find your water quality report by visiting HCFLGov.net/water and clicking Water Quality. To find your water quality report in Pinellas County, go to https://pinellas.gov/consumer-confidence-reports/. In Pasco County, go to https://www.pascocountyfl.net/851/Water-Quality-Reports.

Going beyond the text: water quality

Look up your home's water quality report and compare it to your school's water quality report. Share your results with your class.

What is wastewater?

Wastewater is water that has been used in a home or business, including water from sinks, showers, bathtubs, toilets, washing machines and dishwashers. Wastewater also is produced by industries such as agriculture, manufacturing and mining.

Wastewater contains pollutants such as human and animal waste, food scraps, oils, soaps and chemicals.

If wastewater is not properly treated, these pollutants can find their way into waterways and the aquifer, which can harm the environment, wildlife and human health.

What is reclaimed water?

Reclaimed water is highly treated wastewater that can be used for industrial processes and the irrigation of lawns, landscapes and golf courses.

Where does our home wastewater go?

After wastewater leaves your home – for example, down your sink, shower drain or toilet – it travels through your home's pipes before joining wastewater from other homes, businesses and industries in sewers.

If you are on a municipal sewer system, all the drains in your house are connected to a single pipe that leads to the street. The pipe in the street collects the wastewater from all the homes in your area and flows to a larger pipe that collects water from other streets. The wastewater then flows into still bigger pipes that connect neighborhoods.

Eventually, all these pipes lead to a wastewater treatment plant, where the wastewater is treated and cleaned so that it can be put back into the environment safely.

Sources: Environmental Protection Agency, Florida Department of Environmental Protection, Hillsborough County Water Resources, National Geographic Kids, Southwest Florida Water Management District, United States Environmental Protection Agency, United States Geological Survey

Standards: SC.412.N.1.1; SC.5.P.8.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Water pollution
Materials needed

- A glass
- Water
- Red or blue food coloring.
- A knife
- A stalk of fresh celery with leaves

Procedure

1. Fill the glass with water.
2. Add two or three drops of food coloring to the water.
3. Describe or draw what happens.
4. Wash the celery, leaving the leaves on.
5. Cut about one inch off the bottom of the celery stalk. Describe or draw what the stalk looks like at this point.
6. Place the celery stalk in the glass filled with colored water.
7. Describe or draw what you think will happen.
8. Leave the celery in the glass overnight.
9. In the morning, describe what the water looks like.
10. Remove the celery stalk from the water.
11. Describe or draw what the celery stalk looks like at this point.
12. Use the knife to cut the stalk into slices. What do you find in the stalk? In the leaves? Describe or draw what you observe.

If the food coloring represents pollution in our water, what does this experiment suggest about the way it spreads through the environment and enters the food chain? Create a poster illustrating the experiment, its results and your conclusions. Using the news articles in the Tampa Bay Times as models, write a brief science article focusing on what you have learned. Share your poster and main points from the article with your class.

Adapted from: Kids Ecology Corps, “When You Use Water, You Use Everything In It”

Standards: SC.5.P.8.2; SC.412.N.1.1; SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

The unflushables: Your toilet is not a trash can!

Only two things should ever be flushed down your toilet: human waste and toilet paper. Sewers and wastewater treatment systems are designed to handle human biological waste and toilet paper only.

When other items are flushed, they clog pipes and pumps, causing sewage backups, forcing extra maintenance and repairs, destroying expensive equipment and driving up costs to utilities and consumers.

The largest problem facing sewer systems throughout the U.S. is "flushable" wipes. In recent years, baby wipes and cleaning wipes have become common household products. Although companies market these wipes as "flushable" or "sewer safe," wastewater professionals have discovered that they do not dissolve like normal toilet paper. Instead, they stay intact and do not disintegrate in the toilet or sewer system.

When you flush paper or plastic wastes that are not easily dissolvable, these items can get snagged and tangled up in sewer pipes. Eventually, they can block pipes entirely, causing raw sewage to back up into homes and businesses or overflow from manholes onto the street and into our waterways.

Additional problems are caused when wipes and other nonflushable items become entangled in sewer pumps – a process known as "ragging." If not removed, they will eventually destroy the pumps. Deragging pumps and unclogging pipes is labor intensive and significantly increases the cost of maintaining sewer systems.

Even small items can cause big problems. For example, dental floss is not biodegradable, so it also does not dissolve in sewer pipes. Instead, it wraps around other items to create blockages.

Sources: Hillsborough County, Michigan State University Extension, Washington Post

Going beyond the text: The human water cycle

Wastewater treatment is the process of removing contaminants from wastewater. Hillsborough County is doing its part by removing the physical, chemical and biological pollutants and then releasing the effluent for reuse as reclaimed water and into surface water through its wastewater treatment plants. That takes a lot of energy.

Kartik Chandran at Columbia University is changing the perception of wastewater by treating it more efficiently and creating energy from resources found in it. Learn what he is doing by watching the video "Human Water Cycle: Wastewater," produced by NBC Learn and the National Science Foundation at https://www.youtube.com/watch?v=328bJkcemHo

Write down all of the important things you have learned about wastewater and wastewater treatment. Highlight the information that was new or surprising to you. Next, look through the articles, photos and advertisements in the Tampa Bay Times. Do you see articles about or photos of people doing things that could harm our watershed? Do you see items in advertisements that need to be handled carefully? Create a report or blog to share with your class based on what you have learned.

Standards: SC.412.N.1.1; SC.5.P.8.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Microplastics – harmful to our environment

Plastic debris that is less than 5 millimeters long (about the size of a sesame seed) is called microplastic. Microplastics come from a variety of sources, including larger plastic debris that breaks up into smaller pieces.

Microplastics are dangerous to wildlife because they can be mistaken for food and eaten. Not only is plastic not nutritious, it also can be contaminated with toxins and metals from polluted water. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), plastic debris causes the deaths of more than a million seabirds and more than 100,000 marine mammals every year.

Scientists don't know yet what the long-term impact on human health of plastics in our food chain will be. Since plastics are largely nonbiodegradable, microplastic pollution is a long-term environmental problem.

In the last few years, wet wipes and facemasks have become significant microplastic pollution sources. Wipes and masks include plastic fibers, which easily fragment into billions of microplastic fibers.

Sources: Encyclopaedia Britannica, Environmental Protection Agency, Environmental Science and Pollution Research, The Lancet Planetary Health, National Oceanic and Atmospheric Administration, New York Times, TeachEngineering

Keep plastics out of our water supply

- Purchase products that have less plastic packaging
- Choose reusable products instead of single-use products
- Look for products that are packaged in recycled materials
- Recycle plastics whenever possible
- Never flush plastic down the toilet

Going beyond the text: Flushable or not?

In this activity, you will measure the speed at which common products break down in the presence of water. From these observations, you will be able to make suggestions about materials that should or should not be flushed down the toilet.

Materials needed:

- Ten one-quart jars, such as mason jars or empty mayonnaise jars.

Materials to test:

- Single-ply toilet paper
- Double-ply or super-soft toilet paper
- Wipes labeled as flushable
- Nonflushable baby wipes
- Facial tissue
- Newspaper
- Kitchen paper towels
- Cotton balls, swabs or Q-tips
- Copy paper

- Wax paper

Procedure

- First, predict what you think will happen to each sample material.
- Write down your predictions.
- Fill each jar with tap water and put one type of sample material in each.
- Label each jar with the name of the material it contains.
- Shake each jar to mix the contents. Shake each jar with the same force and for the same number of times.
- Over a period of two to six weeks, observe, draw and describe the changes in the materials. Create graphs of the changes in the materials over time.
- At the end of the observation period, draw conclusions based on your results. Are there any materials that completely dissolved? Are there any that did not appear to change in any way? Based on your observations and knowledge, which materials should be flushed? Why? Which should not be flushed? Why?
- Using the articles in the Tampa Bay Times as your models, write a special news report about what you have discovered. Enhance your article with a graph, chart or infographic.

Standards: SC.412.N.1.1; SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8; SC.5.P.8.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: The fatberg puzzle

Read the New York Times article "Scientists Solve a Puzzle: What's Really in a Fatberg" – https://www.nytimes.com/2019/10/04/world/europe/sidmouth-fatberg.html. On a piece of paper write down the main points of the article. What did you learn? What was surprising about the information you read? Share what you have learned with your class.

Standards: SC.412.N.1.1; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Fatbergs

When things that shouldn't be flushed down the toilet or dumped down drains are anyway, they can form fatbergs: large lumps of fat, oil and grease that combine with other insoluble items in the sewer, such as wipes and paper towels.

Read the Tampa Bay Times article "Pipe-busting waste called 'fatbergs' are growing in Tampa during the pandemic" at https://www.tampabay.com/news/tampa/2020/04/27/pipe-busting-waste-called-fatbergs-are-growing-in-tampa-during-the-pandemic/#.

Next, watch the Great Lakes Now video "Episode 1007: Waters Infected" at https://www.greatlakesnow.org/waters-infected-episode-1007/#videos

Working in small teams, create a public service announcement (PSA) informing people about fatbergs and explaining which materials should or should not be flushed down the toilet. You can create a video, image, radio announcement or infographic about fatbergs. Use the videos “The Clog Monster” and “Don’t Flush It” on the Hillsborough County Water Resources website at HCFLGov.net/water as examples.

Your PSA should include:

- Description of what a fatberg is and why they are a problem
- Explanation of how fatbergs are formed
- Summary of the findings from fatberg experiments
- Call to action for what the public should do, or not do, as a result of this knowledge

Present your PSA to your class.

Adapted from: “Fatberg, Right Ahead!”, Great Lakes Now

Standards: SC.5.P.8.2; SC.412.N.1.1; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Think before you flush

Around the world, governments are reminding people of the importance of fighting the Fatberg. For example, an Irish public awareness campaign titled “Think Before You Flush” uses a video to help spread the message (thinkbeforeyouflush.org), and the Australian Water Association reminds people that toilets are for the three Ps: pee, poo and paper (toilet paper only).

Now it is your turn. Based on what you have learned, you and your classmates are going to create a three-part campaign. Using the advertisements and advertorials in the Tampa Bay Times as models, you will first create a newspaper ad for your awareness campaign. Next, using the “Think Before You Flush” video for inspiration – https://thinkbeforeyouflush.org – create a short video ad. Finally, create a 30-second public service announcement that can be viewed on social media.

Standards: SC.5.P.8.2; SC.412.N.1.1; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

The wonders of springs

A spring is a natural opening in the ground where water flows directly from the aquifer to the earth's surface. The source of this freshwater is from seasonal rainfall that soaks into the ground, which is referred to as groundwater.

Springs form when groundwater is under pressure and flows up through an opening called a spring vent, supplying water flow to a river or other water body. Springs are vital headwaters, the upper tributaries, of many local rivers.

Springs are unique water resources that provide natural, recreational and economic benefits. For thousands of years people have been attracted to the natural beauty and habitat of these ecosystems.

Springs in west-central Florida are supplied from groundwater in the Upper Floridan aquifer — the same aquifer that provides the majority of the region's drinking water. However, these spring systems have been changing for nearly a century due to increases in nutrients, loss of habitat, increases in salinity and a decline in rainfall since the 1960s. Therefore, it is important to learn what we can do to help protect and restore these natural treasures.

Source: Southwest Florida Water Management District

The importance of springs

Florida has the largest concentration of springs in the world. There are more than 150 springs within the Southwest Florida Management District. Many of these springs are part of the five first magnitude spring groups — Rainbow River, Crystal River/Kings Bay, Homosassa River, Chassahowitzka River and Weeki Wachee River. The size of a spring is classified by its "magnitude." First-magnitude springs discharge 64.6 million gallons of water or more per day. Together, these five spring groups discharge more than 1 billion gallons of water per day.

Source: Southwest Florida Water Management District

Going beyond the text: Springs

Research springs on the Southwest Florida Water Management website – https://www.swfwmd.state.fl.us/watersheds/springscoast/what-spring. Have your teacher break your class into groups and assign one spring to each group. Create a Power Point presentation about the spring you have researched and share the information you have learned with your class.

Standards: SC.5.E.7.2; SC.4.E.6.3; SC.912.E.6.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Springs and springsheds

A springshed is the area of land that contributes water to a spring. This area includes much more than just land surrounding a spring. In fact, you can live miles away from a spring and still be located within its springshed.

Your actions at home can affect a spring miles away. Many of the problems affecting the springs occur many miles upstream in the spring recharge area. The water quality of springs can be harmed by a variety of actions, including incorrect fertilizing techniques, infrequent septic tank maintenance, improper disposal of garbage and untreated stormwater runoff. For example, the Rainbow Springs Group has a springshed that covers several hundred square miles and extends into three counties.

Activities within springsheds can, and do, have impacts on groundwater. Therefore, these activities affect the ecosystem of the spring and spring-fed river. A spring is only as healthy is its springshed, and protection of springs must occur before the water reaches the spring.

Find out if you live in a springshed — view the map of generalized springshed boundaries for the major springs in this region at https://www.swfwmd.state.fl.us/resources/data-maps.

Source: Southwest Florida Water Management District

Standards: SC.5.E.7.2; SC.4.E.6.3; SC.912.E.6.2; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: The connection between rainfall and flow

Rainfall patterns strongly influence the amount of groundwater that discharges from a spring. Beginning in the 1960s, there has been a trend of declining rainfall in west-central Florida, with a corresponding decrease in spring discharge. Discharge has the largest effect on flow in a spring system, and flow plays a significant role in maintaining the ecological health of many springs. Other factors that influence the flow of a spring include the river's width, depth and bottom type as well as aquatic vegetation. Increased sedimentation in a river can also negatively affect flow. Research rainfall patterns in Florida over the past decade and create a graph or chart depicting rainfall levels.

Standards: SC.912.CS-CS.1.1; SC.6.E.7.2; SC.6.E.7.3; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

From ground to faucet

With groundwater providing the majority of the public water supply in Florida, you may be wondering how we get water from underground aquifers into our homes. This is done using wells. A well is a hole drilled into the aquifer that can be used to pump groundwater up to the surface.

Think of a well like a giant straw that is put into the Earth to suck water up. In Florida, there are thousands of wells that pump water from five major aquifers or aquifer systems.

The Floridan aquifer system, which lies under the entire state and is the largest aquifer in Florida, is the major source of our groundwater supply used for drinking, household needs, irrigation and more. In the far western panhandle and in southern Florida, the Floridan aquifer system is deep and produces salty and mineralized water. In these areas, the shallower Sand-and-Gravel Aquifer in the west, and the Biscayne Aquifer in the south, are used for water supply instead.

Surficial and intermediate aquifer systems are not as deep as the Floridan aquifer and hold less water. These types of aquifers are used for households and smaller public supply wells. Intermediate aquifer systems are located in between the surficial aquifers that are close to the Earth's surface, and the deeper Floridan aquifer. Here, clay layers slow the movement of water as it flows underground.

The Florida Department of Environmental Protection defines the Floridan aquifer as "one of the highest producing aquifers in the world." It stretches 100,000 square miles beneath Florida and parts of Alabama, Georgia, and South Carolina. This aquifer system is made up of limestone and dolomite, which thickens from about 250 feet in Georgia to about 3,000 feet in south Florida.

Floridan aquifer system

The Floridan aquifer system has been divided into the Upper Floridan aquifer and Lower Floridan aquifer. The bottom of the Upper Floridan aquifer is made of impermeable rock that water cannot easily flow through. This separates the water in the upper aquifer from water in the lower aquifer. In other words, water becomes trapped in these lower aquifers. The Upper Floridan aquifer is the primary source of water supply in most of north and central Florida. In the southern portion of the state, the aquifer is deeper and contains brackish, or slightly salty water. This aquifer has been used for the injection of sewage and industrial waste. The Floridan aquifer is the source of many springs in Florida and is also connected to other surface water bodies.

Karst terrain

To better understand how the water cycle replenishes Florida's aquifers and surface water bodies, let's learn more about the landform that makes it possible. Much of Florida is composed of "karst" landforms. Karst terrain is a land surface produced when bedrock — mostly limestone in Florida — dissolves slowly over time as acidic rainwater passes through it. Karst terrain is characterized by springs, sinkholes, caverns and disappearing streams.

Florida's limestone bedrock is honeycombed with underground fractures, cavities and tunnels that allow water to move easily through them and into the aquifer. Water stored in the Floridan aquifer system provides 80 percent of the water supply in west-central Florida.

Florida residents depend on groundwater and the environment does, too. Weather conditions, such as a drought or a steady decline in rainfall, can reduce the amount of water available to refill groundwater or maintain the minimum water levels and flows required by surface water bodies. Too little water can have negative impacts on an area's ecology and recreational opportunities.

Source: Southwest Florida Water Management District; Florida Department of Environmental Protection

Going beyond the text*:* Springs water environment

Think about how the importance of a springs water environment relates to the future of mankind and the quality of life. With your class, make a list of ways these concepts are interconnected. Next, in a small group, look for articles in the newspaper about springs, water conservation, the environment, pollution or any other topics you discussed with your class. Based on the information you read in these articles, write an editorial on the importance of the springs in your community and to the future of mankind.

Standards: SC.5.E.7.2; SC.4.E.6.3; SC.4.L.17.4; SC.912.L.17.20; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

The flow of water

Land is very important to the water cycle. A watershed is any area of land that water flows across or through. Water in a watershed trickles and flows toward a common body of water, such as a stream, river, lake or coast. Watersheds capture water, store it and eventually release it farther downhill.

Healthy watersheds continuously keep recycling clean, fresh water. Swamps, marshes and other wetlands can filter polluted water and make it cleaner. Other parts of a watershed, such as streams, groundwater and even the beach, are important as well. That's one reason why we need to make sure to leave enough wetlands and other natural areas in each watershed.

Sometimes it's tricky to balance the needs of people with the needs of their watershed, but we must try to keep that balance. If we do it right, there's still room for plants and animals to live and everybody to receive the amount of clean water they need.

Source: Southwest Florida Water Management District

Going beyond the text*: How to help*

Look in the newspaper for articles about conservation and how you can help make your community environmentally sound. Using ads in the newspaper as models, create an ad to promote a conservation initiative. Look at the ads in the newspaper. Think about the dynamics of the ads (images, words, placement of items, colors). Think about ways to draw people's attention to your ad and message. Next, design an ad for the print edition of the newspaper and for the website. How is the ad on the print edition going to be different than the Web version of the ad? Write a fully developed paragraph showing the differences in the ads and what your main point of the ads is. Share your ad and the information in your paragraph with your class.

Standards: ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Water habitats

Research the following water habitats that are in our west-central Florida ecosystem: estuaries, lakes, wetlands, rivers and springs. Have your teacher split your class into five groups. Each group will research one of the water habitats, finding out the primary components of each habitat, what living organisms are in the habitat, why the habitat is important and how people can protect the habitat and the flora and fauna living within that habitat. Create a PowerPoint, Prezi or Google slides presentation with the information you have learned. In addition, using the advertisements in the Tampa Bay Times as models, create a full-page advertorial for the habitat. Share your presentation and advertorial with your class.

Standards: SC.5.E.7.2; SC.4.E.6.3; SC.4.L.17.4; SC.912.L.17.20; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Wonderful wetlands

Wetlands are areas of land that remain wet all, or part, of the year. They lie between dry lands, or uplands, and water or aquatic systems. Wetlands are either freshwater or saltwater, and they are essential to the diverse living organisms in the state.

Cypress swamps, hydric hammocks, hardwood swamps, marshes and wet prairies are freshwater wetlands. Saltwater wetlands include coastal saltwater marshes and forested wetlands known as mangrove swamps.

Each kind of wetland supports different animals and plants that have adapted to living in or close to water. While swamps are dominated by trees, marshes are dominated by grasses and plants.

Wetlands are important to Florida because they clean out pollutants and store extra water to protect the Sunshine State from floods. Wetlands also provide homes for plants and animals. Wetlands provide places for recreational opportunities and fishing. One acre of wetland can contain 300,000 gallons of water.

Source: Southwest Florida Water Management District

Going beyond the text: An alternate world

Now that you have learned about all of the importance of conserving water and keeping our water supply clean and monitored, imagine a future if people did not conserve resources and the Clean Water Act was repealed. What would that world look like? Working in small groups, create a future world that has been shaped by people disregarding the messages in this educational publication. Write a fully developed paragraph describing your world.

Using the front page of the Tampa Bay Times as a model, create a newspaper for this science fiction world you have created. Each student in your group should be responsible for different stories giving the reader a good view of this new world. Share the description of your world and your stories with your classmates.

Standards: SC.4.E.6.3; SC.4.L.17.4; SC.68.CS-CS.6.2; SC.912.L.17.18; SC.912.L.17.20; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Going beyond the text: Stormwater

Stormwater runoff is water that originates as rainfall and flows over the land. It can pick up sediment, pollutants and debris as it moves. The water quality of rivers, streams, lakes and ponds is impacted by contaminated stormwater runoff.

Landscape architecture is the design of outdoor spaces such as parks, gardens and streetscapes. One of the first things a landscape architect has to do in the design process is to complete a site inventory. A site inventory involves identifying, observing and recording different features on the site such as structures, stormwater flow, vegetation, sun and shade patterns, wildlife habitat and elevation changes.

In this activity, you will conduct a site inventory of a location of your choice, such as your yard at home or your school grounds. Draw a basic map of your site. Include structures, roads, paths and driveways, vegetation, sunny and shady areas, and ponds and streams. You may use a satellite map to help you represent the layout accurately.

Next, add stormwater elements to your map. Stormwater elements include downspouts, storm drains, areas of ponding (where water builds up due to poor drainage), impervious surfaces (surfaces that do not allow water to filter through, such as asphalt or concrete), and stormwater flow paths (the paths that stormwater takes when travelling across the landscape).

Once your map is finished, answer the following questions:

- What were some of the observations you made?
- Were there any areas of the property that you think are underutilized? How would you change them?
- Did you observe any drainage issues in the form of puddles, erosion or standing water anywhere on the site?
- If you were a landscape architect and you were told to re-design the site to improve stormwater flow, how would you design it? (Write or draw your answer).

Adapted from: “Site Inventory,” Stormwater Management Lesson Plans for Grades 3-12, University of Maryland Department of Plant Science and Landscape Architecture

Standards: SC.912.E.7.3; SC.4.E.6.3; SC.4.L.17.4; SC.912.CS-CS.1.3; SC.912.L.17.18; SC.912.L.17.20; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Why is fresh water in short supply

By extracting water faster than nature can replace it and by wasting, polluting, and underpricing this natural resource, we are using available fresh water unsustainably.

Fresh water is not evenly distributed over Earth’s surface—estimates show that one in nine people do not have access to clean, fresh water.

- The labs on the following pages test water quality such as pH, nitrates, phosphates, potash, dissolved oxygen, turbidity, etc.
- These labs are inquiry-based labs in which students are able to work individually or in small groups.

Standards: SC.7.E.6.6; SC.912.L.17.15; SC.5.P.8.2

Water Quality Lab
(Field and Science Lab-Classroom)

1. Collect water samples from the following sources:
    a. Hydroponics System
    b. Aquaponics (classroom)
    c. Outdoor Sink in Outdoor Classroom
    d. Soil (greenhouse)
    e. Freshwater source (off campus)

2. Test pH, Nitrate, Phosphate, and a third component of above samples of water and soil using the following and record in data table:
    a. pH strips
    b. pH meter

3. Take photos of at least three different species of plants and/or other biotic factors and share them with your class.

4. Obtain another sample of water to take back to the classroom for further testing.

5. Obtain a sample of soil to take back to the classroom for further testing.

6. Test the clarity of each water sample with a refractometer (R.I.) (and or the Neulog Sensor)

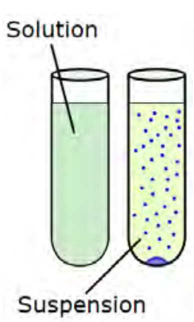
7. Record all data in the table below.

Sample	**pH Strips**	**pH Probe**	**R.I.**	**Rapi-Test (pH, Nitrate, Phosphate, & Potash)**	**Neulog Sensors(Oxygen, Carbon Dioxide, Total Solids etc.)**	**Observations of the sample collected**
Hydroponics (outdoor garden and greenhouse)						
Aquaponics (classroom)						
Outdoor Sink (outdoor classroom)						
Soil (greenhouse)						
Freshwater source (off campus- outside of Central)						

How to test your soil samples for pH, nitrates, and phosphates with the Rapitest Digital Soil Kit

pH Test:
Step 1. Remove the cap from the green test tube.
Step 2. Fill the test tube with soil to the first line.
Step 3. Carefully open a green capsule and pour powder into the test tube.
Step 4. Using the dropper provided, add water to the fourth line.
Step 5. Fit the cap onto the tube, making sure that it is seated properly and caps tightly. Shake thoroughly.
Step 6. Allow soil to settle and color to develop for 2 minutes.
Step 7. Insert the tube into the Optical Soil Test Chamber.
Step 8. Push the pH test button.
Step 9. Note the reading determined by the Digital Soil Tester.

Nitrogen, Phosphorous, and Potash (potassium) Tests:
Step 1. Fill a clean container with 1 cup of prepared soil and 5 cups of water. For best results use distilled water.
Step 2. Thoroughly shake or stir the soil and water together for at least one minutes; them allow the mixture to stand undisturbed until it settles. (30 minutes to an hour)
Step 3. Select the appropriate test tube for the test you wish to run. Remove the cap.
Step 4. Remove the appropriate colored capsules from its poly bag. Carefully open an appropriately colored capsule and pour the powder into the tube.
Step 5. Using the dropper provided, fill the test tube to the fourth line with liquid from your soil mixture. Avoid disturbing the sediment. Transfer only liquid.
Step 6. Fit the cap on the tube, making sure it is seated properly and caps tightly. Shake thoroughly.
Step 7. Allow color to develop for 10 minutes.
Step 8. If flakes of blue color appear to have settled to the bottom of the test tube during the Phosphorus test, shake the tube to suspend them into solution.



Step 9. Insert tube into the Optical Soil Test Chamber.
Step 10. Push the button for the appropriate test.
Step 11. Note the Reading.
Step 12. Follow the same easy steps for each of the other tests.

Soil Test	Reading	Observation (color change) Yes or No
pH		
Phosphate		
Nitrate		
Potash		

Standards: SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8;

Using: *Microsoft Word - AquaticSection.doc (flenvirothon.com)
Answer the following:

> **THE HYDROLOGIC CYCLE**
>
> The phrase **hydrologic cycle** describes the circulation and distribution of water on the surface of the land, underground and in the air. There are five basic processes in the hydrologic cycle. These can occur at the same time and, except for rainfall, happen continuously:
> - Condensation
> - Precipitation
> - Runoff
> - Evapotranspiration
> - Infiltration

1.Define the following terms:

a. Condensation
b. Precipitation
c. Runoff
d. Evaporation
e. infiltration

2. Define the following terms:

a. Unconfined aquifer
b. Confined aquifer
c. Shallow aquifer
d. Deep aquifer
e. Floridan aquifer
f. Water Table

3. Define the following terms:

a. Estuary
b. Habitat
c. Slope (of a River)
d. Watershed

Water and Soil Quality Testing Lab
Using LaMotte Water Quality Testing Kit/Biotic Indicators Kit/ Earth Force Estuary Kit/ and Rapi-Test (pH, Nitrate, Phosphate, and Potash)

1. With a group of 3-4, do the following:
    a. Grab the blue paper located on the front table.
    b. Choose either soil or water to test pH, nitrate, and phosphate. (For those that want to test turbidity, potash, and/or dissolved oxygen, please see the teacher for supplies.) It might count as extra credit!
    c. Copy this table:

	Soil	**Water**
pH		
Nitrate		
Phosphate		
Potash		
Dissolve Oxygen	N/A	
Turbidity	N/A	
Biotic Indicators		

    d. If you chose soil to test, you need to get the results for water, and if you chose water to test, you need to get the result for soil. (These results will be from your peers.)

    e. Describe how vegetation varies with longitude and latitude.

    ____
    ____
    ____

    f. Thinking back to your "Biome-in-a-box" project, answer the following question: How does pH, nitrate, and phosphate affect soil and water quality in your biome? (desert, tundra, grasslands, forests, etc.) (Answer in 3-5 sentences.)

    ____
    ____
    ____

g. How do humans impact your biome and ecosystems? What can we do to help with increasing vegetation? Explain your answer.

____
____
____

h. Describe the difference between point source and nonpoint source water pollution and give examples.

____
____
____

Answer Key

	Soil	**Water**
pH		
Nitrate		
Phosphate		
Potash		
Dissolved Oxygen	N/A	
Turbidity	N/A	
Biotic Indicators		

E. Climate and vegetation vary with altitude and latitude of an area. Latitude measures distance from the equator; altitude measures distance above sea level. Places located at high latitudes (far from the equator) **receive less sunlight** than places at low latitudes (close to the equator). The amount of sunlight and the amount of precipitation affects the types of plants and animals that can live in a place.

F. Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems. Together with phosphorus, nitrates in excess amounts can **accelerate eutrophication**, causing dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. Too much nitrogen and **phosphorus** in lakes, rivers, streams and coasts results in serious environmental, economic, and health **effects**. Phosphates are chemicals containing the element phosphorous, and they affect water quality by **causing excessive growth of algae**. **Higher nitrate concentrations can lower the pH**, making the water more acidic. Most aquatic life can only tolerate a pH from 6-9, but if pH fluctuates out of this range, it could signal either a change in nitrate concentration or a change in dissolved carbon dioxide concentration

G. Use public transport, cycle or walk instead of using a car. **Use facilities and trips run by local people whenever possible**. Don't be tempted to touch wildlife and disturb habitats whether on land, at the coast or under water. Be careful what you choose to bring home as a holiday souvenir.

"Biorama™ preparation. This collection of 14 organisms is an excellent tool for assessing the water quality of freshwater systems and a helpful guide for your water quality studies. The organisms are divided into 3 groups: those that are very sensitive, those that are somewhat sensitive, and those that are tolerant of pollution and turbidity. A mayfly nymph, stonefly nymph, and caddisfly larva serve as examples of very sensitive organisms; water quality must be good to support these organisms. A dragonfly nymph, backswimmer, water scavenger beetle, water strider, clam, grass shrimp, and crayfish are displayed as somewhat sensitive organisms; water must be healthy to support these organisms, but they can tolerate moderate levels of pollution and turbidity. The lunged snail, glassworm, mosquito larva and pupa, and leech represent organisms tolerant of pollution and turbidity. Fully labeled and mounted in a 12 x 8" Riker mount."

Biotic Indicators of Water Quality, Biorama™ Preparation | Carolina.com

“The Estuary Kit is specifically designed to provide simple, affordable, and nonhazardous methods of testing saline and brackish waters. Water quality tests include coliform bacteria, salinity, dissolved oxygen, nitrate, pH, phosphate, temperature, and turbidity. Supplied with reagents and components necessary to complete 10 tests for each of the water quality factors and 2 coliform bacteria tests.”

Standards: SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8;

Water conservation

Water plays an important role in our lives. Because we live in a state surrounded by so much water, we often forget about the importance of conservation.

- Take the Classroom Challenge | WaterMatters.org (state.fl.us)
- Calculate how much water you are using at home and share with the rest of the class your data.
- The objective is to conserve water by using water-saving appliances, using a broom instead of the hose outside on our porches and driveways, shutting off the water while we brush our teeth, running a full load of laundry, using rain barrels in our gardens, taking shorter showers, and doing more research on water conservation throughout this month and reporting back to your class on how you conserved water in your home and outside your home (This may consist of our surrounding community.)

Standards: SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8;; SC.412.E.6.6; ELA.312.C.1.3; ELA.312.C.1.4; ELA.312.C.2.1; ELA.312.C.3.1; ELA.312.C.4.1; ELA.312.R.2.2; ELA.312.R.2.3; ELA.312.R.2.4; ELA.312.V.1.1; ELA.312.V.1.3; ELA.312.F.2.1; ELA.312.F.2.2; ELA.312.F.2.3; ELA.312.F.2.4

Water Footprint Calculator:

WATER USE: (added to final total)

1. How many people are in your household? = ____________
2. In which state do you live? _____________ (18 for KY, LA, ND, WY, WV; 6 for all others) = _____
3. How much water is used to generate electricity? (multiply #1 x #2) = _________________

Domestic ("household") Water Use:

Use:	How Many:	Multiply by:	Subtotal:
Baths	(per week)	X 5	a.
Showers	(minutes)	X 3 (gallons/minute) X number of people: #1	b.
Toilets	(people - see #1)	X 12 (gallons/day/person)	c.
Sinks	(minutes)	X 3 (gallons/minute) X number of people: #1	d.
Laundry	(loads/week)	X 4	e.
Dishes	(loads/day)	X 10 (gallons/load)	f.

4. **Total for Domestic Water Use (add a through f) = ______________**
5. How many times each week do you water your lawn and garden? _________ x171 gal/day = _______
6. Do you have a pool? If yes, add 52 points. Do you cover it? If no, add 16 points = _________

Automobile:

Use:	How Many:	Multiply by:	Subtotal:
Gas	(cars)	X 5	a.
Car Washing	(cars)	X 21	b.

7. **Total for Automobile (add a and b) = ________________**

Diet:

Use:	How Many:	Multiply by:	Subtotal:
Meat Eating	(vegans)	X 446	a.
	(vegetarians)	X 516	b.
	(meat eaters)	X 1032	c.
Bottled Water	(people - see #1)	X 1.5	d.

8. **Total for Diet (add a through d) = ________________**

WATER SAVINGS: subtracted from final total

9. Recycling
   a. Paper: multiply #1 x 5 (gallons/day/person) = ______________
   b. Plastic: multiply #1 x 3 (gallons/day/person) = ______________
   c. Clothing: multiply #1 x 5 (gallons/day/person) = _____________
10. Graywater and Rainwater
    a. Does your household reuse greywater? If yes, multiply #1 x 40 = ____________
    b. Does your household collect rainwater? If yes, add 9. If no, add zero = ______________

TOTAL HOUSEHOLD WATER FOOTPRINT: (Add 3 – 8, Subtract 9 and10) = [ ]

TOTAL INDIVIDUAL WATER FOOTPRINT: (Divide above result by #1) =

WHAT DOES YOUR SCORE MEAN? The score for the average American is 1,190.

✓ **900 & below: Water Warrior**: Congratulations, you are doing better than most Americans! Give yourself a pat on the back for being water conscious. You have a thing or two to teach your neighbors, but there may still be ways to cut back on your water use.

✓ **901-1,300: Water Activist**: Not too shabby! Your water consumption is typical of most Americans. But as we know, Americans are among the highest water users worldwide. The good news is, there are many ways to use less water and decrease your footprint.

✓ **1,301 & above: Water Enthusiast:** Time for a water-use makeover! Your household is a thirsty one, even by American standards. Now is a great time to think of ways to reduce your water usage.

Once you have completed the water footprint calculator for your family, answer these questions:

1. What category has the largest number of points in your water footprint and why?

2. Change the numbers in three different categories. How does the water footprint change? Which category can make the biggest difference?

3. What can you do in your everyday life to reduce your water footprint?

Going beyond the text: Water quality experiment

Every day, the average American uses about 50 gallons of water for drinking, bathing and cooking. In the United States, about 88 percent of the population is supplied by community water supply systems. The other 12 percent is supplied by non-community means, such as campgrounds, resorts, and private wells. Sixty-four percent of public water systems use surface water as their source, the other 36 percent use groundwater from wells.

The aesthetic properties of the drinking water from these public systems is often affected by the source of the water. Ground water often has a slightly metallic taste and may contain high amounts of minerals. Surface waters, on the other hand, usually have a musty taste and look cloudy. Treatment techniques aim to produce a water that is: safe for human consumption; appealing and good tasting to the consumer and conforms with applicable government regulations at the lowest possible cost.

Objective: This taste test will illustrate the differences between groundwater and surface water, highlight some of the common contaminants in natural water.

Materials needed:

- 1 gallon of distilled water
- 1 gallon of tap water (identify the source)
- 1 gallon of mineral water (or private well water, if available)
- 1 gallon of filtered tap water
- Cups for the class

Procedure:

1. Mark a set of 4 cups for each student. Label each cup 1 through 4 and fill them with the different types of water. Make sure that similarly labeled cups contain the same type of water.
2. Indicate on the board the different types of water present in the four cups. Have the students work together in groups to try to identify different tastes, smells, and appearances in the water. Have each group write down their observations on each water sample, and identify which cup has which type of water.
3. After everyone has completed their observations, have the students mark their guesses on the board. Ask the students what types of impurities they would expect to find in the different types of water, and if their senses confirmed their intuitions. Record these observations on the board.
4. Reveal to the students which samples contained which type of water. Discuss with the students their observations and what other impurities might be found in these waters. Also discuss the source of water for the community. If anyone in the class lives in a location supplied by a private well, ask him/her to describe the water at their home, and how it compares to other water he/she drinks in the community.

Follow-up questions

1. What are some possible sources of water in your community?
2. Which type of water tasted best? Why?
3. Which type of water would you consider safer to drink, groundwater from a spring, or surface water from a stream?

Source: The Environmental Protection Agency

Standards: SC.412.N.1.1; SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8

Going beyond the text: Non-point source pollution

This activity is designed to demonstrate to students what an average storm drain collects during a rainfall event and how the water from storm drains can impact the water quality and aquatic environments of local streams, rivers, and bays.

Materials needed:

"Waterway"	**"Pollutants"**
Aquarium	Green Food Coloring (pesticides/fertilizer)
Rectangular Box	Vegetable Oil (motor oil)
Water	Soil/Sand/Pebbles (erosion)
Watering Can	Grass Clippings (or Shredded Paper) and Twigs
Spray Bottle	Cafeteria Waste and Trash

Preparation:

Fill the aquarium half-way with water and place it on an accessible area where it can be easily viewed by the students. Cut a hole in the bottom of the box and place the box on top of the aquarium. The box represents the storm drain and the aquarium represents the waterway that the storm water mixes into after entering the storm drain. Leave the sides of the aquarium uncovered so that the students can view its contents.

Procedure:

1. Introduce this activity with a discussion of storm drains and storm drain systems and their purposes. Discuss where the water and objects that float down into a storm drain go. Have students list all of the things that they can think of that might enter a storm drain during a rainstorm.
2. Assign a group of students to each pollutant. Discuss each pollutant, including its use or origin and how it could enter the storm drain.
3. Have each group of students place their pollutant into the storm drain. Use the watering can to create rain to wash the pollutant into the waterway. While washing each pollutant into the waterway, review the pollutant and its use or origin. Discuss the following questions: How does the pollutant damage the environment? Do the people who are responsible for the pollutant want to damage the environment? Why did they do what they did? How can this type of pollution be stopped?
4. After adding all of the pollutants, examine the contents of the waterway. Discuss how the waterway has changed and how viewing this change makes the students feel.

Follow-up questions

1. What types of the pollution are natural?
2. What types of pollution are added by people living in the local communities?
3. What could be done to stop pollutants from entering storm drains?

Variations: Have the groups of students responsible for the pollution think of ways to remove the pollution from the aquarium. Try some of the removal methods. Which pollutants were easy to remove? Which were difficult to remove?

Source: The Environmental Protection Agency

Standards: SC.412.N.1.1; SC.412.N.1.2; SC.412.N.1.3; SC.412.N.1.4; SC.412.N.1.5; SC.412.N.1.6; SC.412.N.1.7; SC.412.N.1.8