

Teacher's Guide

Florida Watersheds Video

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

High School

Download at: <http://www.WaterMatters.org/watershedvideo>

Video Length: 11 minutes

Lesson Time: One block or class period (approximately 45 minutes)

Subject: Environmental Science and Biology

Grades: 9-12

Objective: Students will explain the function of a watershed and be able to describe ways that a water body can be contaminated. Water quality factors can impact the health of an entire ecosystem. Using real-world applications and hands-on activities, students will learn how to prevent water contamination and discuss human impacts on our environment.

Purpose: To explain what a watershed is, and how human actions affect the health of a watershed and the quality of water within the watershed.

Next Generation Sunshine State Standards:

- SC.912.L.17.2** Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity and temperature.
- SC.912.L.17.11** Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife and forests.
- SC.912.L.17.12** Discuss the political, social and environmental consequences of sustainable use of land.
- SC.912.L.17.16** Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.
- SC.912.L.17.17** Assess the effectiveness of innovative methods of protecting the environment.
- SC.912.L.17.18** Describe how human population size and resource use relate to environmental quality.
- SC.912.L.17.20** Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.
- SC.912.N.1.1** Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science.
- LA.910.1.6.1** The students will use new vocabulary that is introduced and taught directly.
- LA.910.5.2.1-2** The student will select and use appropriate listening strategies according to the intended purpose (e.g., solving problems, interpreting and evaluating the techniques and intent of a presentation).

Common Core Curriculum Standards:

- LACC.1112.RST.1** Key Ideas and Details
- LACC.910.RST.1.2** Key Ideas and Details
- LACC.910.WHST.1** Text Types and Purposes
- LACC.910.RST.3** Integration of Knowledge and Ideas
- LACC.1112.WHST.3** Research to Build and Present Knowledge

Additional Links:

Find out more about the basics of a watershed and take your class on a virtual watershed excursion at <http://watermatters.org/watershedlessons/>.

Request a free watershed poster and other free materials at <http://www.WaterMatters.org/publications/type/all/>.

Learn more about water quality testing at
<http://www.swfwmd.state.fl.us/education/kids/watermonitoring/>.

Search the SWFWMD's hydrologic and water quality data at
<http://www18.swfwmd.state.fl.us/ResData/Search/>.

Lesson Plan and Activities

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Vocabulary: watershed
aquifer
wetland
point source
nonpoint source
sedimentation
erosion
nitrates
phosphates
pH
runoff

Engage: (10 minutes) Review pre-discussion questions. Fact or Fib Review Challenge See Page 4 for instructions.

Explore/Explain: (15 minutes) Watershed video guided notes and discussion points.

Extend: (10 minutes) See the SWFWMD Classroom Activity Guide "Create Your Own Watershed" for directions included on page 13. Students will test their model with a spray bottle filled with water.

Evaluate: (10 minutes) Students will take pretest prior to watching the video and will take the posttest (same as pretest) after watching the video and completing the activity.

Extensions: Water Quality Lab for Biology and Environmental classes. See page 9 for instructions.

Please take a few minutes to complete the Florida Watersheds Video and Teacher's Guide user survey. Your feedback will help us improve and expand our resources for educators and students.
<http://www.surveymonkey.com/s/FloridaWatershedsVideo>

Pre- and Posttest of *Florida Watersheds*

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True or False

- ___ 1. Excess fertilizer and rainfall are types of point-source pollution.
- ___ 2. A wetland causes flooding and can destroy habitats.
- ___ 3. Excess pollutants, such as nitrates and phosphates, cause an overgrowth of algal blooms, green-color water and potential fish kills.
- ___ 4. A watershed is the area of land where water drains from the highest point to the lowest point to reach a water body.
- ___ 5. It's much cheaper to prevent pollution than to restore a natural system once it's been polluted.
- ___ 6. Dumping something down a storm drain does no harm to a watershed.
- ___ 7. Providing drinking water is not a main function of a watershed.
- ___ 8. Dissolved oxygen is a poor indicator of a water body's health.
- ___ 9. Turbidity is the cloudiness of water.
- ___ 10. Wetlands are like nature's kidney because they filter out impurities.

Answer Key for Pre- and Posttest

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1. False F
2. False F
3. True T
4. True T
5. True T
6. False F
7. False F
8. False F
9. True T
10. True T

Fact or Fib Review Challenge Engage

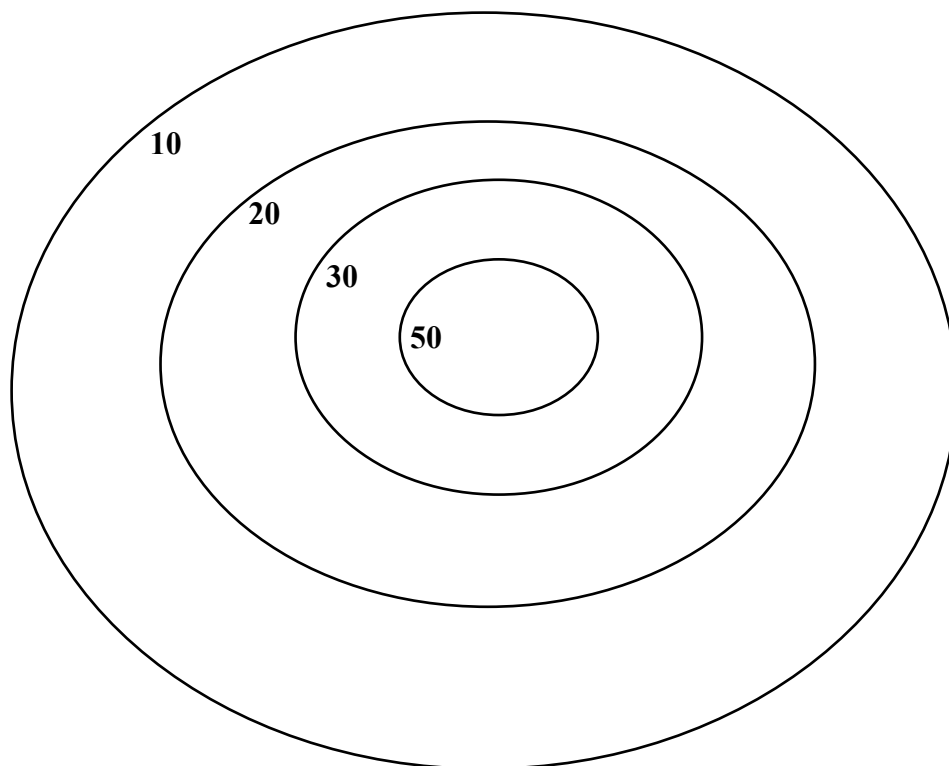
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Prepare:

- Step 1 Divide the class into groups of three or four students each.
- Step 2 Groups will list two facts and two fibs (each on a separate piece of paper) about the topics and vocabulary discussed in the video. Students should not write if the statement is a fact or fib on the paper. Each team will then crumple all its papers into paper balls.
- Step 3 Draw a target and assign points for each layer as shown below.

Play:

- Step 4 After moving closer to the target, members of Team #1 throw their fact/fib paper balls at the target (one at a time) to score points. Keep track of points for each team. Leave paper balls on the floor.
- Step 5 Team #2 selects team #1's paper balls (one at a time). As each is read, team members choose whether the statement is fact or fib. Team #2 receives 10 points for each correct answer. Then members of team #2 throws their paper balls (one at a time) and leaves them on the ground for Team #3.
- Step 6 Repeat with the remaining teams. Team #1 reads the last team's paper balls for Team #1's chance at bonus points.
- Step 7 The team with the most points wins!



Student Video Questions

Name _____ Period _____

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Video Notes:

1. Explain what a watershed is: _____

2. How can farmland contribute to water pollution? _____

3. What types of stormwater runoff does an apartment complex produce? _____

4. It is more cost effective to _____ than to treat water that has been contaminated.

Pause and Discuss #1 (4:10)

5. What watershed do you live in? _____

Video Notes (cont.):

6. One of the most important functions of a watershed can be to _____

7. One way to keep a watershed healthy is to reduce _____
8. The 3 major types of water pollutants are sediments, _____ and _____

Pause and Discuss #2 (7:24)

9. How does each of these major water pollutants affect water quality?

Sediments _____

Bacteria _____

Nutrients _____

Video Notes (cont.):

10. What is another name for Florida's wetlands? _____
Why? _____

Answer Key for Video Questions Explain/Explore

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Pre-Discussion:

Activate prior knowledge on watersheds using guiding questions — Where does the majority of our drinking water come from? How does water get to your home? How does a river or lake become polluted; What are some types of pollution?

Video Notes

1. Explain what a watershed is: A watershed is an area of land that water flows across as it moves toward a common body of water, such as a stream, river, lake or coast.
2. How can farmland contribute to water pollution? It often produces stormwater runoff such as fertilizer, pesticides and livestock waste.
3. What types of stormwater runoff does an apartment complex produce? Litter, oils from parking lots and pet waste.
4. It is more cost effective to protect our watersheds and water resources than to treat water that has been contaminated.

Pause and Discuss #1 (4:10):

5. What watershed do you live in? Just before first Pause and Discuss portion of the video, a map is shown on the video to determine the watershed in which your students live.

Video Notes (cont.):

6. One of the most important functions of a watershed can be to provide drinking water.
7. One way to keep a watershed healthy is to reduce pollutants.
8. The 3 major types of water pollutants are sediments, bacteria and nutrients.

Pause and Discuss #2 (7:24):

9. How do each of these major water pollutants affect water quality?

Sediments Sedimentation is caused by weathering and erosion from the land. As the sediments increase turbidity in a body of water, the aquatic life is covered, preventing sunlight from passing through for photosynthesis to occur. Sediments usually carry organic matter, wastes and nutrients. Sediments destroy spawning beds for fish and reduce survival of aquatic populations.

Bacteria Coliform bacteria is fecal matter from runoff, leaking septic tanks and animals. Recreational areas for swimming and fishing are tested for coliform bacteria because increased levels may cause health risks to humans. *Escherichia coli* (*E. coli*) is a species in the fecal coliform group and causes intestinal distress or serious illness.

Nutrients Excess nutrients such as nitrates and phosphates are harmful to the health of a water body. For instance, nutrients may cause an overgrowth of algae that decreases oxygen levels. The decay of algae depletes oxygen levels in water. An increase in nutrients also causes pH levels to become more acidic.

Video Notes (cont.):

10. What is another name for Florida's wetlands? **Nature's kidneys**. Why? **A kidney filters out waste products from the human body much like a wetland filters out pollutants before they reach a larger water body.**

Pause and Discuss #3 (9:35)

Wetlands Review: What are the benefits of wetlands? **Prevent flooding; store water for a drought; provide habitats; serve as a nursery to birds, fish, mammals and reptiles; stabilize shorelines; and provide recreations areas and activities.**

Conclusion Discussion: (10:03)

What can we do to protect our water resources? **Answers may vary. Examples: Don't litter, pick up after your pets, don't dump anything down a storm drain, use fertilizers and pesticides as directed.**

Water Quality Lab Extension

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Lab Time: 40 minutes

Teacher Notes: This lab is designed for use with the secondary water quality test kits provided free of charge from the SWFWMD while supplies last.

Ordering the test kits:

- Go to www.WaterMatters.org and click on “Order or Download FREE Publications.” **Order your free water test kits at least three weeks before implementing this lesson.**
- The secondary test kits are not listed on the menu of items. To order, select at least one item (or class set) to open a shopping cart. The poster *Typical Florida Watersheds* complements the video well. You can also browse “Teacher Resources” or “Pollution & Water Quality” under View by Subject for other complementing items.
- After selecting at least one other item, you’ve opened a shopping cart. There is a comment box on the shopping cart. In that comment box, type “secondary test kit for watershed video” and the number of kits you’ll need. Each group of five students needs its own test kit. Each group will conduct the tests on two different water samples. *Each kit has 10 reagent tablets for each test so each kit can be reused for up to five class periods.*
- Complete your order and the materials will arrive within 21 days.

Before conducting the lab:

- Collect two water samples. Suggested water sources are a fish tank or small pond (one with lots of algae) and a cleaner source such as a faucet. If a source with algae isn’t available, add fish food to one sample and set in sun for a few hours or leave on a counter overnight. Using two different samples will ensure that students can understand the quality of water in different sources. Comparing differences in the samples is part of the learning process.

Lab Set up:

- Divide students into groups of five. At each group, label two plastic cups, sample #1 (Fish Tank) and sample #2 (Faucet).
- At each group, place the instruction sheet (in a protective sleeve), the lab guides and paper towels for cleanup.
- From the test kits, each group will need three plastic tubes with caps, two nitrate tablets, two phosphate tablets, two pH tablets, one aluminum foil sleeve and one color key for reading test results.

Additional Water Quality Resource:

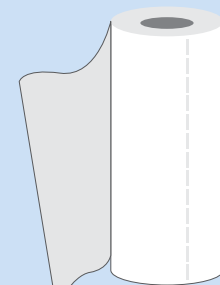
<http://www.swfwmd.state.fl.us/education/kids/watermonitoring/importance.html>

Materials Needed

- one test kit per group
- two clear plastic cups per group labeled sample #1 and sample #2
- paper towels



plastic cups



paper towels

Student Water Quality Lab Instructions

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Please note: Each group has only enough tablets to test each water sample one time. Carefully read the directions before starting the lab. Each team member has a group role explained on the group data sheet.

Nitrates	<ol style="list-style-type: none"> 1. The supply coordinator prepares all materials for the water tech. 2. Fill a test tube to the 5ml mark with a sample of water from cup labeled sample #1. 3. Add one nitrate tablet, put cap on tube and invert the tube until the tablet has mostly disintegrated. Let the inverted sample sit for five minutes. 4. While waiting for the nitrate sample to sit, start the phosphate test (see instructions in next row). 5. After the nitrate sample sits for five minutes, compare the color of the water to the color chart provided. 6. Record the levels.
Phosphates	<ol style="list-style-type: none"> 1. While the nitrate test is in process, take another sample of water from cup labeled sample #1. Fill another test tube to the 10 ml mark. 2. Slip the tube into the foil sleeve given to protect it from light. 3. Add one phosphate tablet, put cap on tube and invert it until the tablet has mostly disintegrated. Let the inverted sample sit for five minutes. 4. While waiting for the phosphate sample to sit, start the pH test (see instructions in next row). 5. After the phosphate sample sits for five minutes, compare the color of the water to the color chart provided. 6. Record the level. Use “0” to indicate clear.
pH	<ol style="list-style-type: none"> 1. While the other tests are in process, take a third sample of water from cup labeled sample #1. Fill a test tube to the 10ml mark. 2. Add one pH tablet, put cap on the tube and invert it until the tablet has mostly disintegrated. Let the inverted sample sit for five minutes, compare the color of the water to the color chart provided. 3. Record the level. Use “0” to indicate clear. 4. After the pH test is completed, read and record test results in your data collection chart.

Once all data have been recorded for the first water sample, the supply coordinator should thoroughly wash the test tubes and prepare to repeat the lab for the second water sample.

Group Data Sheet

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Group Roles:

Supply Coordinator Checks all materials and coordinates the group to help clean up

Water Tech Takes the samples of water and initiates the tests

Data Tech Reads and records data for tests

Director Reads directions to group out loud

Test	Sample Cup #1	Sample Cup #2
Nitrate		
Phosphate		
pH		

1. Name three local places where people swim or fish. What clues indicate that the water quality at those sites may or may not be healthy?
2. Looking at the data, compare the two samples. In which sample was the nitrate level higher? What things may cause nitrate levels to be higher?
3. Which sample had the highest phosphate level? What may cause phosphate levels to be higher?
4. In which sample was the pH level higher? What may cause pH levels to be higher?
5. After performing the water tests, what concerns do you have about water quality?
6. Why is water quality important?
7. What is a potential impact of poor water quality?
8. Name two human actions that negatively affect water quality.
9. Name two human actions that help protect water quality.
10. If nitrate levels are too high, and algae blooms are decaying quickly, how do you think the pH (acidity) levels may be affected? How will the aquatic life be affected?

Lab Answer Key

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- 1. Name three local places where people swim or fish. What clues indicate that the water quality at these sites may or may not be healthy?**

Some answers may include freshwater or saltwater ecosystems. The clues that may indicate good/poor water quality are the number of living things, amount of algae or sediments, how clear the water appears or the color of the water, the nearby land activities such as factories or farmlands, etc.
- 2. Looking at the data, compare the two samples. In which sample was the nitrate level higher? What things may cause nitrate levels to be higher?**

Answers will vary. High levels of nitrogen can occur where there is animal waste, leaky septic systems and over-fertilized agricultural runoff.
- 3. Which sample was the phosphate level higher? What may cause phosphate levels to be higher?**

Answers will vary. Phosphate levels may be higher due to non-point source pollution such as leaky septic tanks, excess fertilizer and stormwater runoff. Point-source pollution such as industrial waste may also increase phosphate levels.
- 4. In which sample was the pH level higher? What may cause pH levels to be higher?**

Answers will vary. pH levels are affected by the time of day the water sample was taken. pH levels increase throughout the day as the sun causes an increase in photosynthesis. Photosynthesis produces oxygen and increases the pH as CO₂ (carbon dioxide) is consumed by plants. A second factor affecting pH levels is CO (carbon monoxide) released from vehicles, manufacturing plants and other sources eventually becomes CO₂ and enters surface waters as rain. The presence of excess fertilizers can also increase the pH of surface waters.
- 5. After performing the water tests, what concerns do you have about water quality?**

Answers may include concerns about the amount of nutrients in the water they swim in or drink from because of risks to their health. They may include concerns about things that live in the water from which the sample came.
- 6. Why is water quality important?**

The quality of water is important because we have a limited amount on Earth that we can use, and if it is not protected, our health could be at risk. Water quality is important for a balanced aquatic ecosystem and the connecting ecosystems.
- 7. What is a potential impact of poor water quality?**

Some impacts may include spread of disease, lack of sanitation or clean drinking water, reduced sustainability of fish and other aquatic life and limited use of water for fresh food from farmlands.
- 8. Name two human actions that negatively affect water quality.**

Some answers may include overusing pesticides, herbicides and fertilizers; littering; dumping oil or chemicals on the ground/water; wasting water or water depletion; leaking septic tanks; or recreational activities such as boating.
- 9. Name two human actions that help protect water quality.**

Community involvement, education, water conservation awareness and practice, water quality monitoring, landscape management, etc.
- 10. If nitrate levels are too high, and algal blooms are decaying quickly, how do you think the pH (acidity) levels may be affected? How will the aquatic life be affected?**

pH levels will rise with an increase of nutrients. The aquatic life may not be supported. Fish eggs will not mature if the water is too acidic, for example.

Create Your Own Watershed **Extend**

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Now that you know about watersheds, how about making one of your own? Depending on your flair for creativity, you can make your watershed a simple or complex system.

Learning Goals

- To teach the function of watersheds
- To stimulate thought about the role watersheds play in the world

Subjects

- Science
- Social Studies

Activity

1. To set up the activity, crumple several pieces of newspaper or other paper. Place paper in cake pan to represent different elevation levels of land. Cover the paper with aluminum foil or plastic wrap. Position small model pieces as desired.
2. Use a spray bottle to spray clear water at the highest elevation. Observe results.
3. Add small amounts of colored powders to various places to represent different types of pollutants. For instance, cocoa powder may represent soil erosion, green fruit drink mix powder may represent fertilizer, etc.
4. Again, use the spray bottle to spray water at the highest elevation. Observe results.

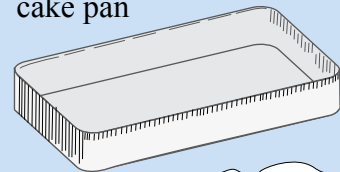
Discussion Questions

1. What happened the first time you sprayed clear water on your watershed model?
2. What happened to the pollutants when you sprayed water again?
3. What could be done to reduce the amount of pollutants affecting your watershed?
4. How does your watershed compare with watershed models made by other classmates?

Materials Needed

- large aluminum cake pan
- several pieces of crumpled paper
- large sheet of aluminum foil or plastic wrap
- variety of colored powders (cocoa, fruit drinks, etc.)
- clear water
- spray bottle
- small model pieces to represent homes, trees, cars, farm animals, etc.

cake pan



crumpled paper

