Teacher's Guide **Grade 8**

Water Matters!

Saving Your Water through Science

Southwest Florida
Water Management District

WATERMATTERS.ORG • 1-800-423-1476

Introduction

Welcome to the *"Water Matters!"* curriculum developed by the Southwest Florida Water Management District (SWFWMD). The SWFWMD manages the water resources for west-central Florida as directed by state law. It was established, in 1961, as a flood protection agency. Since then, its responsibilities have grown to include managing the water supply, protecting water quality and preserving natural systems that serve important water-related functions.

As a teacher, you have a very important role in preparing students to take on the responsibility of being stewards of the land and our water resources. By educating your students about the protection of Florida's water, you teach them to be responsible citizens actively involved in maintaining a clean and healthy environment.

This Teacher's Guide accompanies the eighth-grade module of the *"Water Matters!"* curriculum which is correlated to the Next Generation Sunshine State Standards. The Student Publication contains vocabulary words (italicized and bolded) with vocabulary activities and review questions after each section. The Teacher's Guide includes answers to student questions and additional content, activities and websites to explore.

We encourage teachers to use this guide electronically as there are hyperlinks available for easy access to other resources. In preparation for using the *"Water Matters!"* curriculum with your students, it will be helpful to read the entire Student Publication and Teacher's Guide and test or bookmark the hyperlinks in the Teacher's Guide. While using the curriculum —

- Read and discuss the material presented in the Student Publication with your students.
- Direct students to complete the vocabulary activities and questions at the end of each section of the Student Publication, and then discuss the results with students.
- Implement the extension activities you select from the Teacher's Guide.

Optional:
Have students build a foundation by reading the sixth- and seventh-grade modules of the *"Water Matters!"* curricula. The sixth-grade module includes the hydrologic cycle, weather and climate and extreme weather. Topics in the seventh-grade module are similar to those in the eighth-grade module and include watersheds, surface water, groundwater, Florida's karst terrain, weathering and erosion, and pollution and water quality.

Please note:
Suggested extension activities with an asterisk after the name reference Project WET activities. Project WET, which stands for Water Education for Teachers, is a series of hands-on, investigative and easy-to-use activities for teaching students about water resources. To receive a Project WET guide, teachers must attend a six-hour training. If you don't have a Project WET guide, check with your colleagues or order a free sample of the guide by emailing *WaterEducation@WaterMatters.org.* To learn more about Project WET, visit *ProjectWET.org.*

A variety of other publications and electronic resources are available from the SWFWMD. Visit *WaterMatters.org/Education* to learn more. For questions or comments, email *WaterEducation@WaterMatters.org.*

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Section One:
Review of Concepts from the Sixth- and Seventh-Grade "Water Matters!" Curricula

Key Ideas:

- The hydrologic cycle is a never-ending process of recycling Earth's water over and over again with no beginning and no end.
- The hydrologic cycle plays an important role in weather, and weather patterns affect how much and how frequently water returns to Earth.
- Groundwater is stored in aquifers and supplies most of west-central Florida's water supply.
- There are many pollutants that affect both groundwater and surface water.
- Watersheds, surface water and groundwater are all connected, and it's important we realize how our actions on land can negatively impact water resources.

Standards

SC.6.E.6.2
Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.

SC.6.E.7.2
Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.

SC.6.E.7.4
Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere.

SC.6.E.7.6
Differentiate between weather and climate.

SC.6.N.3.4
Identify the role of models in the context of the sixth grade science benchmarks.

SC.7.E.6.6
Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

SC.7.N.1.1
Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.7.N.1.5
Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.

Objectives

- The student will explain the process by which water on Earth is recycled in a never-ending process called the hydrologic cycle.

- The student will compare and contrast weather to climate.
- The student will identify the factors that impact weather.
- Describe how watersheds are connected to surface water bodies.
- Explain how surface water bodies and groundwater are polluted through human actions.

Additional objectives may be met based on activities selected from the sixth-and seventh-grade Teacher's Guides.

Vocabulary

evaporation
precipitation
climate
karst terrain
point-source pollution
transpiration
percolation
watershed
aquifer
nonpoint-source
condensation
weather
surface water
groundwater
pollution
stormwater runoff

Bellringer

List three ways the hydrologic cycle, weather and Florida's landforms are interconnected.

Engage

In groups, students will create and label a diagram to show the connections that exist between the hydrologic cycle, weather and Florida's landforms. Compile each groups' designs into one diagram on a SmartBoard or large chart paper. Discuss the group diagram and address any misconceptions.

Explore

Students should read Section One of the eighth-grade *"Water Matters!"* Student Publication.

For Explore activities, please refer to the Teacher's Guides for the sixth- and seventh-grade modules of *"Water Matters!"* You'll find many activities to review and reinforce the concepts presented in Section One.

Explain

Florida Watersheds video

Available at *WaterMatters.org/Podcasts* is an 11-minute video called *Florida Watersheds* that explains the function of a watershed and how human actions affect the health of a watershed and the quality of water within it. A coordinating teacher's guide for middle school grades accompanies the video.

Seeing Watersheds*

Project WET Curriculum and Activity Guide 2.0 version, page 187 or the 2.0 Sampler, page 27. Using topographical maps, students will characterize the movement of water in a watershed to determine water flow.

Preventing Stormwater Runoff

Have students visit this website to learn more about stormwater runoff, point- and non-point source pollution and actions we can all take to prevent these problems: *WaterMatters.org/Education/Kids/Stormwater*.

WaterWeb Extreme Weather and Mapping

Learn more about weather in SWFWMD's *WaterWeb Extreme Weather and Mapping* publication available at *WaterMatters.org/Publications*.

Elaborate

For Elaborate activities, please refer to the Elaborate sections of the Teacher's Guides for the sixth- and seventh-grade modules of *"Water Matters!"* You'll find many ideas to expand upon the concepts presented in Section One.

Evaluate

Ask students to write an essay explaining how the hydrologic cycle, weather and Florida's karst terrain are interconnected. You may also ask students to draw and label a diagram to illustrate their essay.

Section Two: Sustainability

Key Ideas

- Clean, fresh drinking water is necessary for life.
- As the demand for water increases, the supply has to be sustained.
- Conservation today is a key link to preserving our water supply in the future.

Standards

SC.8.N.1.1
Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.8.N.1.3
Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.

SC.8.N.1.4
Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.

SC.8.N.1.5

Analyze the methods used to develop a scientific explanation as seen in different fields of science.

SC.8.N.1.6
Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.

SC.8.N.2.2
Discuss what characterizes science and its methods.

SC.8.N.3.1
Select models useful in relating the results of their own investigations.

SC.8.N.3.2
Explain why theories may be modified but are rarely discarded.

SC.8.N.4.1
Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.

SC.8.N.4.2
Explain how political, social, and economic concerns can affect science, and vice versa.

Several sixth- and seventh-grade standards from Section One are also reinforced throughout this section.

Objectives

- Justify why we must all conserve and protect our water resources.
- Engage in a hands-on activity to illustrate water abundance and water scarcity.
- Describe how humans and natural influences impact our water supply.
- Identify human behaviors that affect the Earth's resources and landforms.
- Explain how political, social and economic concerns can affect the quality of water supplies.

Vocabulary

sustainability	land acquisition	conservation
reclaimed water	reservoirs	desalination
alternative water supplies		

Bellringer

Ask students to list three ways they can conserve water.

Engage

In groups, students will discuss their ideas of how to conserve water. Have each group share what they think are the two best conservation methods and why.

Test your Water Sense!
Print or project this quiz from the Environmental Protection Agency that allows students to find out if they're a WaterSense novice, expert or genius! Available at *EPA.gov/WaterSense/Text_Based.html*.

Explore

Students should read Section Two of the eighth-grade *"Water Matters!"* Student Publication.

Water Use Calculator
If everyone in our area reduced their water use by 10 percent, we'd save more than 44 million gallons of water per day! Visit *WaterMatters.org/ThePowerOf10***.**

Water Water Anywhere Lesson Plan
In this activity, students rotate through stations to simulate the effects of water scarcity. Available at *TheWaterProject.org/Resources/Lesson-Plans/Water-Water-Anywhere*.

Super Bowl Surge*
Project WET Curriculum and Activity Guide 2009 version, page 353 or the 2.0 version, page 405.
After learning how wastewater systems can be overwhelmed, students do in-depth research and present action plans to solve the problem of increased demands on a community's wastewater treatment plant.

Explain

Alternative Water Supply Podcast
Learn about alternative water supplies and the need to develop them, along with the importance of water conservation, through this podcast at *WaterMatters.org/Podcasts*. A coordinating teacher's guide for middle school grades accompanies the podcast.

Developing Sustainable Water Supplies Brochure
Download or order this brochure from *WaterMatters.org/Publications*, which provides an overview on developing sustainable water supplies to meet current and future demands in west-central Florida.

Reclaimed Water in Your Area
At *WaterMatters.org/Reclaimed*, learn all about reclaimed water including the wastewater-to-reclaimed water process, its uses and benefits, a map of reuse services and much more.

The Process of Desalination
Learn all about how the Tampa Bay Seawater Desalination Plant works including a diagram to visually take students through the process at *TampaBayWater.org/Tampa-Bay-Seawater-Desalination-Plant.aspx*. The plant offers educational tours if you are interested in a field trip.

Florida Waters Manual
Visit *WaterMatters.org/Publications*, or click here for a direct link to the *Florida Waters* Manual. As a class or individually, read about water quality in pages 74–85 of Chapter 5.

Elaborate

WaterWeb Publication
WaterWeb publications, for middle school students, contain articles on a variety of water resources topics and classroom activities. Check out the topics *Conservation & Water Supply* and *Sustainability* at *WaterMatters.org/Publications*.

Water Audit*
Project WET Curriculum and Activity Guide 2.0, page 469.
Students discuss water sources and water conservation concepts and conduct a home and school water audit. Students will then compare and contrast results with and without the implementation of water conservation practices. Students will also make recommendations for personal conservation strategies at home based on water and monetary savings.

Evaluate

Classroom Conservation Challenge
Take the SWFWMD's Classroom Conservation Challenge! The webpage also contains a variety of ideas to bring water conservation awareness to your school and community. Visit *WaterMatters.org/ClassroomChallenge*.

Section Three:
Rise in Sea Levels

Key Ideas

- Political, social and economic factors impact decisions made about natural resources, such as the supply of drinking water.
- Citizens should actively participate in community affairs to ensure decisions being made are in the interest of the entire community and the environment.

Standards

SC.8.N.1.1
Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.8.N.1.3
Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.

SC.8.N.1.4
Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.

SC.8.N.1.5
Analyze the methods used to develop a scientific explanation as seen in different fields of science.

SC.8.N.1.6
Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.

SC.8.N.2.2
Discuss what characterizes science and its methods.

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Select models useful in relating the results of their own investigations.

SC.8.N.3.2
Explain why theories may be modified but are rarely discarded.

SC.8.N.4.1
Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.

SC.8.N.4.2
Explain how political, social, and economic concerns can affect science, and vice versa.

Several sixth- and seventh-grade standards from Section One are also reinforced throughout this section.

Objectives

- Describe the effects of water on Florida's landform.
- Explain that science can be used to make informed decision making on local and state levels.
- Describe how humans and natural influences affect our supply of freshwater.
- Create an action plan to protect and conserve fresh water in the aquifer from saltwater intrusion.

Vocabulary

global warming fossil fuels thermal expansion saltwater intrusion

These words are not found in the Student Guide but the concepts are discussed if you want to expand:

salinity coastal development tide gauge readings potable water

Bellringer

Ask students to list three ways they can conserve water.

Engage

The Floating Egg

This comparative activity to demonstrate the density of fresh water and salt water is available at SteveSpanglerScience.com/Lab/Experiments/Floating-Egg. Use the demonstration response sheets in the Appendix for students to record their predictions, what they saw happen and why it happened.

Explore

Students should read Section Three of the eighth-grade *"Water Matters!"* Student Publication.

Interactive Sea-Level Rise Map of Florida's Coastline

This interactive map illustrates the effects of sea-level rise on the coastline of Florida. Available at Geology.com/Sea-Level-Rise/Florida.shtml.

Explain

Florida Waters Manual

Visit *WaterMatters.org/Publications*, or click here for a direct link to the *Florida Waters* Manual. As a class or individually, read about water supply and water quality in pages 86–95 of Chapter 6.

Elaborate

Back to the Future*

Project WET Curriculum and Activity Guide 2009 version, page 293 or the 2.0 version, page 307.
Students analyze stream flow by monitoring data to determine safe and beneficial locations for a growing community.

Evaluate

"Coastal City, Florida – A Community at Risk"

Describe to students that "Coastal City, Florida" is a fictitious city facing the increased threat of salt water entering the city's potable water supply. A concerned citizens group and the City Council are working together to develop an action plan addressing saltwater intrusion in Coastal City's future. Both groups will present their perspectives on sea-level rise and saltwater intrusion along with their action plan to address these issues. Encourage students to reference the topics discussed in Section Two and to think about what alternative water supplies are being used to develop a sustainable water supply. Remind students that alternative water supplies are far more costly than conserving our existing water resources!

Action Plan

Purpose: Develop a plan to sustain potable water for the citizens of Coastal City
Goal: Identify ways to ensure Coastal City has a reliable potable water supply in the future
Documentation: Students should cite resources used to support their action plan

Role-Playing Cards

Use the role-playing cards below. Photo copy the cards and base the number of cards distributed per role on the number of students in your class. Ask students to select a card determining what role the student will play.

City Council:	**Citizens' Group:**
Mayor	Business Owner
City Council Members	Developer
City Planner	Farmer
Environmental Scientist	Conservationist

Possible Questions to Get Students Thinking

Pose these questions, or your own questions, to students. Encourage students to develop other questions as they research the topics in greater depth.

- What are the facts about sea-level rise and saltwater intrusion?
- How will these issues impact residents in the city?
- What kinds of businesses will these issues impact?
- How will these issues impact the agriculture industry?
- How might the loss of coastlines and saltwater intrusion impact recreation?
- Can something be done to slow the threat of saltwater intrusion or sea-level rise? What will be done? Who will do it? What is the timeline? What will it cost? How will it be implemented?

Online Resources for Student Reference

- National Oceanic and Atmospheric Administration: Is Sea Level Rising?
- National Geographic: Sea Level Rise
- Source Water Stewardship: A Guide to Protecting and Restoring Your Drinking Water

An Action Plan to Sustain Coastal City's Drinking Water

Name: _____

Role: _____

Purpose: _____

_____

Goals:

_____

_____

Documentation to Support Plan:

_____

_____

_____

_____

_____

Recommendations:

_____

_____

_____

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_____

Mayor	**an official who is elected to be the head of the government of a city or town**
City Council Members	**the group of people who make and change the laws of a city**
Environmental Scientist	**a person who studies environmental issues**
Planner	**a person who helps determine the best way to use a city's land and resources taking into account the future needs of the city**

Business Owners	**a person who owns their own business**
Developers	**a person or company that builds and sells housing communities or commercial buildings on tracts of land**
Farmers	**a person who cultivates land or crops or raises animals**
Conservationists	**a person who advocates conservation, especially of natural resources**

Concerned Citizens	**an inhabitant of a city or town who care about the city's future**

"Water Matters!" Jeopardy Game

This game is a fun way for eighth-grade students to actively review the science standards from grades sixth-eighth. Or use it with sixth- and seventh-grade students to introduce new concepts.

To download the game PowerPoint, go to *WaterMatters.org/Publications*. Then search by keyword "jeopardy."

Directions to Play *"Water Matters!"* Jeopardy

1. Form two teams, and select a spokesperson for each team. Or call on students within each team to take turns answering questions.
2. Start each team with $3,000 (points). Keep tally of points.
3. For all slides to correctly advance, **click the lower left corner of the slide**.
4. Click through the categories to get to the game board.
5. When it's their turn, teams should select a question to answer. For example, "Hydrologic cycle for $200."
6. Click on the question. After the team answers, **click the lower left corner of the slide** for the answer to appear.
7. On each answer slide, there is a blue box in the **lower left corner**. Click this box to return to the game board.
8. If a team answers correctly, they score that number of points. Teams continue to answer until they get a question wrong. If a team answers incorrectly, that number of points should be deducted.
9. When finished with the first Jeopardy game, click the "STAR" at bottom right corner to begin Double Jeopardy.
10. After all Double Jeopardy questions are answered, click the "STAR" at bottom right-hand corner to begin the "Final Jeopardy Question."
11. Before you show the question, ask each team to write down their wager. Click only once and the final question will appear. Be careful not to click twice or the answer will appear. After students answer the question, a second click will take you to the answer.
12. The team with the most points remaining after "Final Jeopardy" wins.