

Teacher's Guide for the children's activity booklet: "Give Water A Second Chance...Re-Cycle It!"

Introduction:

This activity booklet is designed for use by upper elementary school students. It can be used in conjunction with any water science unit of study. We hope that after working through the reading and activities in the booklet, students will have a greater appreciation for the finite amount of water on earth and the necessity to use it wisely.

Each lesson has specific learning objectives and is correlated to the California State Subject Area Standards as well as aligned to the California Education and the Environment Initiative's (EEI) Environmental Learning Objectives. (See chart below.) In addition, we have noted Project WET (Water Education for Teachers) lessons that can be used in the classroom to augment learning. Teachers can learn more about Project WET by visiting the website: <http://www.watereducation.org/projectwet.asp> . We also encourage educators to contact their local water utility for more water education information.

The introduction gives students background information about the amount of water on earth, how much is available for use and the basics of the water cycle. The concept of a watershed is introduced and surface water and groundwater are described.

The lessons have explanatory notes and directions for each activity. Teachers may want to introduce the topic of each activity and review some of the vocabulary with students (see glossary on page 13). Activities can be worked on by groups of students, or individually as follow-up to a lesson, or as homework reinforcement.

The goal of the booklet is to educate students about the process of recycling water and the uses of recycled water.

Learning Objectives:

- **Students will be able to name the parts of the water cycle.**
- **Students will be able to compare the operation of water cycle to water recycling.**

Lesson 2: Where Does Water Go When It Goes Down the Drain – Wastewater Treatment Plants – Water Laundries

- **Students will be able to trace the route of water as it travels from a home through the wastewater treatment plant process.**

Lesson 3: Marvelous Microbes: Our Fabulous Friends in the Microscopic Spotlight

- **Students will be able to identify common microorganisms important in cleaning up water during the wastewater treatment process.**
- **Students will be able to use internet websites to observe photomicrographs of these microorganisms.**

Lesson 4: Give Water a Second Chance

- **Students will be able to identify appropriate uses for recycled water.**

Lesson 5: What's The Problem?

- **Students will be able to identify potential problems for recycled water use.**
- **Students will be able to distinguish hard and soft water and identify the minerals responsible.**
- **Students will be able to follow a detailed experiment to identify the effects of salts on water use.**

***Teacher note: Answers to activity questions can be found on the back inside cover of the booklet.**

**Correlations to the California State Department of Education Science Standards,
Project WET activities and the Learning Objectives of the California Education and the
Environment Initiative**

4th Grade

Academic Content Standards	"Give Water A Second Chance" booklet	Project WET Activities	Current EEI Model Curriculum Learning Objectives
----------------------------	--------------------------------------	------------------------	--------------------------------------------------

Life Sciences (4th Grade)
2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:

<p>c. Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.</p>	<p>Lesson 3: Marvelous Microbes</p>	<ul style="list-style-type: none"> • Salt Marsh Players, (p: 99) • Macroinvertebrate Mayhem, (p: 322) • People of the Bog, (p: 89)* 	<ul style="list-style-type: none"> • Give examples of organisms that are decomposers. • Explain the role of decomposers in an ecosystem. • Recognize that the cycles and processes involving recycling of matter and transfer of energy among organisms are essential to the functioning of natural systems (ecosystem). • Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal and marine ecosystems (e.g., their role in food production and waste management). • Describe the dependence of human practices on the cycles and processes that occur in terrestrial, freshwater, coastal and marine ecosystems (e.g., the role of decomposers in: food production through soil formation and fertility; waste management through the decay of waste products).
--------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

5th Grade

Academic Content Standards	"Give Water A Second Chance" booklet	Project WET Activities	Current EEI Model Curriculum Learning Objectives
----------------------------	--------------------------------------	------------------------	--------------------------------------------------

Physical Sciences (5th Grade)

1. Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept:

<p>g. Students know properties of solid, liquid, and gaseous substances, such as sugar (C₆H₁₂O₆), water (H₂O), helium (He), oxygen (O₂), nitrogen (N₂), and carbon dioxide (CO₂).</p>	<p>Introduction and Lesson 1: The Water Cycle</p> <p>Lesson 4: Give Water A Second Chance</p>	<ul style="list-style-type: none"> • H2Olympics, (p: 30) • Molecules In Motion, (p: 47) • What's the Solution?, (p: 54) • Let's Even Things Out, (p: 72) • Geyser Guts, (p: 144) • Imagine!, (p: 157) • The Incredible Journey, (p: 161) • Poetic Precipitation, (p: 182) • Water Models, (p: 201) • A-maze-ing Water, (p: 219) • Water in motion, (p: 450) • Thirsty Plants, (p: 116) 	<p>(Nothing listed for this category.)</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------

Life Sciences (5th Grade)

2. Plants and animals have structures for respiration, digestion, waste disposal and transport of materials.

<p>a. Students know many multicellular organisms have specialized structures to support the transport of materials.</p>	<p>Lesson 3: Marvelous Microbes</p>	<ul style="list-style-type: none"> • Describe how respiration, digestion, waste disposal, and transport of materials result in byproducts. • Recognize that movement of matter and energy through ecosystems generates byproducts. • Describe how matter and energy flow in ecosystems. • Describe and discuss the concept of boundary in natural systems. • Recognize that natural systems are not separated by impermeable or permanent boundaries. • Provide examples of how the byproducts of human activities (e.g., carbon dioxide [CO₂]) enter natural systems (terrestrial, freshwater, coastal and marine ecosystems). 	<p>(Nothing listed for this category.)</p>
-------------------------------------------------------------------------------------------------------------------------	--------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------

<p>e. Students know how sugar, water, and minerals are transported in a vascular plant.</p>		<ul style="list-style-type: none"> • Thirsty Plants, (p: 116) • The Incredible Journey, (p: 161) • Water Address, (p: 122) 	<ul style="list-style-type: none"> • Provide examples of the role of materials transport in vascular plants on the movement of the byproducts of human activities (e.g., contaminants) into natural systems (e.g., entering plant tissue, soil).
<p>f. Students know plants use carbon dioxide (CO₂) and energy from sunlight to build molecules of sugar and release oxygen.</p>		<ul style="list-style-type: none"> • Salt Marsh Players, (p: 99) • Life Box, (p: 76) 	<ul style="list-style-type: none"> • Explain the role of photosynthesis in the functioning of terrestrial, freshwater, coastal and marine ecosystems. • Explain why photosynthesis is essential to the survival of humans and human communities. • Provide examples of how humans and human communities can influence the process of photosynthesis and thus the flow of matter and energy within natural systems.
<p>g. Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide (CO₂) and water (respiration).</p>		<ul style="list-style-type: none"> • Salt Marsh Players, (p: 99) • The Incredible Journey, (p: 161) • Thirsty Plants, (p: 116) 	<p>(Nothing listed for this category.)</p>

Earth Sciences (5th Grade)
3. Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept:

<p>a. Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.</p>	<p>Introduction and Lesson 1: The Water Cycle</p> <p>Lesson 4: Give Water A Second Chance</p>	<p>Drop in the Bucket, (p: 238)</p> <ul style="list-style-type: none"> • The Incredible Journey, (p: 161) • Imagine!, (p: 157) 	<ul style="list-style-type: none"> • Identify that humans are living things and clean fresh water is essential to their survival. • Recognize that because most of Earth's water is salt water located in the oceans, the vast majority of water is not available for human consumption. • Describe freshwater, coastal and marine ecosystems and compare the chemical characteristics of the water in these systems. • Provide examples of the goods that are produced by freshwater, coastal and marine ecosystems (e.g., clean fresh water, oxygen, food, energy resources). • Explain how humans and human communities can influence the quantity, distribution and chemical characteristics of the water in freshwater, coastal and marine ecosystems (e.g., global climate change, water management practices).
----------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<p>b. Students know when liquid water evaporates, it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water.</p>	<p>Introduction and Lesson 1: The Water Cycle</p> <p>Lesson 4: Give Water A Second Chance</p>	<ul style="list-style-type: none"> • Molecules in Motion, (p: 47) • Geyser Guts, (p: 144) • Imagine!, (p: 157) • The Incredible Journey, (p: 161) • Poetic Precipitation, (p: 182) • Water Models, (p: 201) • Hanging Together, (p: 35) 	<ul style="list-style-type: none"> • Describe the roles of evaporation, liquefaction and freezing in the water cycle. • Describe the role of the water cycle, evaporation, liquefaction and freezing in the functioning of natural systems. • Provide examples of the roles these cycles and processes play in human life and human communities.
<p>c. Students know water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet, or snow.</p>	<p>Introduction and Lesson 1: The Water Cycle</p> <p>Lesson 4: Give Water A Second Chance</p>	<ul style="list-style-type: none"> • Thirsty Plants, (p: 116) • Imagine!, (p: 157) • The Incredible Journey, (p: 161) • Old Water, (p: 171) • Poetic Precipitation, (p: 182) • Water Models, (p: 201) • Hanging Together, (p: 35) • Piece It Together, (p: 174) 	<ul style="list-style-type: none"> • Identify the role of precipitation (rain, hail, sleet, or snow) in terrestrial, freshwater, coastal and marine ecosystems). • Provide examples of how humans and human communities directly and indirectly depend on precipitation (rain, hail, sleet, or snow) and the water cycle (e.g., agricultural systems, water delivery systems). • Provide examples of how human activities can influence the quantity, distribution and chemical characteristics of precipitation.
<p>d. Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water.</p>	<p>Introduction and Lesson 1: The Water Cycle</p> <p>Lesson 4: Give Water A Second Chance</p>	<ul style="list-style-type: none"> • Imagine!, (p: 157) • Old Water, (p: 171) • Piece It Together, (p: 174) • The Long Haul, (p: 260) • Water Meter, (p: 271) • Water Works, (p: 274) • Every Drop Counts, (p: 307) • Money Down The Drain, (p: 328) • Water Concentration, (p: 407) 	<ul style="list-style-type: none"> • Identify sources of fresh water and describe the reservoirs of Earth's water. • Recognize that water moves from one reservoir to another over time. • Describe the ways in which humans, human communities and their practices use water. • Recognize that the supply of fresh water is limited at any given time and discuss how some resources within an ecosystem are finite in supply while others are less limited. • Describe the methods by which wastewater can be treated and cycled back into the environment. • Provide examples of how water use can be decreased by humans and human communities. • Explain potential consequences when the quantity, distribution or chemical characteristics of water are changed (e.g., contamination of an aquifer can compromise the use of the groundwater supply by humans and other organisms). • Describe how changes to the quantity, distribution and chemical characteristics of water in natural systems can influence the functioning of terrestrial, freshwater, coastal and marine ecosystems (e.g., acid precipitation affecting the growth of trees).

e. Students know the origin of the water used by their local communities.

Lesson 2: Give Water a Second Chance

- Irrigation Interpretation, (p: 254)
- The Long Haul, (p: 260)
- Water Meter, (p: 271)
- Water Works, (p: 274)
- Every Drop Counts, (p: 307)
- Super Bowl Surge, (p: 353)
- Water Concentration, (p: 407)
- Get The Groundwater Picture, (p: 136)
- Easy Street, (p: 382)
- Stream Sense, (p: 191)
- Water Celebration, (p: 446)
- Choices and Preferences, (p: 367)*
- Reaching Your Limits, (p: 344)
- The Incredible Journey, (p: 161)
- Imagine!, (p: 157)
- A-Maze-ing Water, (p: 219)
- Poison Pump, (p: 93)
- Sum of the Parts, (p: 267)
- Common Water, (p: 232)
- Water Works, (p: 274)

- Identify sources of fresh water in their local community.
- Describe the process by which water is supplied to students' homes and their community.
- Identify the steps used to make water potable in their community.
- Describe the ways in which humans use water in their local community.
- Provide examples of how human activities can influence the quantity, quality and reliability of water supplies.
- Explain how changes to the quantity, quality and reliability of water supplies can influence humans, human communities and their practices.

Investigation and Experimentation (5th Grade)

6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

The environmental principles and concepts provide fertile ground for the development of investigations and experiments that are directly related to achieving mastery of California's science content standards. As stated by the California State Board of Education, such "activities must be cohesive, connected and build on each other to lead students to a comprehensive understanding of the California Science Content Standards."

Lesson 5: What's The Problem?

Environment-based investigations and experiments can also help teachers conform to recommendations of the California State Board of Education that "hands-on activities compose at least 20 to 25 percent of the science instructional program (as specified in the California Science Framework.)"

Sixth Grade

Academic Content Standards	"Give Water A Second Chance" booklet	Project WET Activities	Current EEI Model Curriculum Learning Objectives
----------------------------	--------------------------------------	------------------------	--------------------------------------------------

Ecology (Life Science- 6th Grade)
5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept:

<p>e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.</p>	<p>Lesson 3: Marvelous Microbes</p>	<ul style="list-style-type: none"> • People of the Bog, (p: 89) • Water Address, (p: 122) • Piece It Together, (p: 174) • Common Water, (p: 232) • A Drop in the Bucket, (p: 238) • Irrigation Interpretation, (p: 254) • The Long Haul, (p: 260) • Where Are The Frogs?, (p: 279) • Macroinvertebrate Mayhem, (p: 322) • Choices and Preferences, Water Index (p: 367)* • Dilemma Derby, (p: 377) • Life in the Fast Lane, (p: 79) • Super Sleuths, (p: 107) • Poison Pump, (p: 93) • Super Bowl Surge, (p: 353) • Sparkling Water, (p: 348) • A Grave Mistake, (p: 311) • The Pucker Effect, (p: 338) • A-Maze-ing Water, (p: 219) • Reaching Your Limits, (p: 344) 	<ul style="list-style-type: none"> • Identify abiotic factors that affect ecosystems. • Classify components of ecosystems as either living (biotic) or non-living (abiotic). • Explain the effects of changing biotic and abiotic factors on an ecosystem (e.g., the effects of changing: quantities of light or water, and soil composition on plant growth; range of temperatures on the species composition of animals and plants). • Provide examples of how human practices and rates of consumption affect the biotic and abiotic components (e.g., the availability of resources) in a natural system, thus influencing the number and types of organisms an ecosystem can support. • Provide examples of how the quantities of resources consumed, and the quantity and characteristics of the resulting byproducts can affect natural systems (e.g., as a result of overgrazing by cattle, the ecological characteristics of rangeland can change making it less productive).
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Resources (6th Grade)

6. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept:

b. Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.

Lesson 2: Where Does Water Go When It Goes Down The Drain?

- Common Water, (p: 232)
- A Drop in the Bucket, (p: 238)
- Energetic Water, (p: 242)
- The Long Haul, (p: 260)
- Water Meter, (p: 271)
- Water Works, (p: 274)
- Pass The Jug, (p: 392)
- Geyser Guts, (p: 144)
- Get the Groundwater Picture, (p: 136)

- Identify different energy and material resources (e.g. air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests) that are provided by natural systems.
- Explain that: renewable resources are replaced over a relatively short time period (e.g., fresh water, hydroelectric power, or living resources); nonrenewable resources accumulate over such a long period of time that they must be considered as fixed (e.g., minerals or fossil fuels); and, inexhaustible resources have no practical limits (e.g., solar or hydrothermal energy).
- Classify energy and material resources as renewable, non-renewable, or inexhaustible.
- Identify energy and material resources that are essential to human life.
- Provide examples of how human practices and rates of consumption can affect the availability (quality, quantity and reliability) of energy and material resources that are essential to human life.

The development of this cross reference to the California Content Standards for Science and the Environmental Education Initiative's Standards-based learning objectives was funded by the WaterReuse Association, California Section, website: www.watereuse.org.

Teacher's Guide written by:

Judy Wheatley Maben

B.A. Biological Sciences, M.A., Secondary Science Education

California Teaching Credential (life) Secondary Science

Classroom Teacher (grades 6-12) - 12 years

Master Teacher - California State University, Sacramento

Education Director - Water Education Foundation - 20 years

California Coordinator - Project WET -10 years

Writing Team for Project WET

National Project WET Advisory Council - 5 years

Other curricula written: "California Water Story" (grades 4-5), "Project Water Science (grades 5-8), "California Water Problems" (grades 9-14), "Groundwater Education" (grades 6-10), "Fountains of Columbia" (grades 4-5), "Water Recycling" (grades 4-6).