



## **PRE-VISIT AND POST-VISIT LESSONS** for grades 4-5

Developed by:

Environmental Education Exchange

738 N. 5th Avenue, Suite 100  
Tucson, Arizona 85705

Telephone: (520) 670-1442

<http://www.eeexchange.org>  
[outreach@eeexchange.org](mailto:outreach@eeexchange.org)

Dear Teacher:

**Welcome to Tucson Water's *Our Water, Our Future* program!**

- 👉 Please review this packet and familiarize yourself with all the materials. Plan about 60 minutes for each lesson. There are a total of four lessons. The first three lessons are best completed before Dr. Faucet's visit and the fourth lesson is best completed after the visit.
- 👉 We strongly encourage you to conduct at least the first two lessons prior to Dr. Faucet's visit, as they tie directly to what the students will do during that visit.
- 👉 *Remember:*  
**Please make advance arrangements to reserve a room where all of the presentations can take place.**  
The students from each class will rotate through this room. Students typically sit on the floor in front of the table.  
  
**On the day of the presentations, we'll also need:**
  - 👉 a large cleared table
  - 👉 the students' water-saving ideas on paper "drops" as per pre-visit Lesson 1.

Enjoy!

Dr. Faucet

*For more information or additional copies of this packet, please contact:*

Outreach Education Coordinator  
Environmental Education Exchange  
738 N. 5th Ave., Suite 100  
Tucson, AZ 85705  
(520) 670-1442  
outreach@eeexchange.org

*Our Water, Our Future is sponsored by:*

Tucson Water  
P.O. Box 27210  
Tucson, AZ 85726-7210  
(520) 791-4331



## OUR WATER, OUR FUTURE OVERVIEW

A water education program for 4th and 5th grade students in Tucson, Arizona. Developed and funded by Tucson Water, the City of Tucson public water utility.

Tucson Water's *Our Water, Our Future* is an interdisciplinary program that has been specifically designed for fourth and fifth grade learners and focuses on the water cycle, water supply, and water conservation in the Tucson Basin. It poses three questions:

- Where does our water come from?
- Where does it go?
- What can we do to conserve this vital natural resource?

In answering these questions, we will address the following concepts:

- water cycle
- water supply
- water as a limited resource
- water quality
- water use
- water conservation

## OUR WATER, OUR FUTURE IS A THREE-PART PROGRAM:

PART ONE includes three pre-visit classroom activities. Students will review the water cycle, discover Tucson's water history, and become "water smart."

PART TWO is a one-hour on-site presentation. Students play a water cycle game, participate in demonstrations with a groundwater model, and make their water conservation ideas count. At the end of the presentation, all students receive a five-minute shower timer to bring home.

PART THREE includes one post-visit classroom activity in which students write poetry to express their thoughts and feelings about water.

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## GLOSSARY OF WATER WORDS

<i><b>aquifer</b></i>	the underground layers of rock, sand, and gravel where water is stored over millions of years
<i><b>Central Arizona Project</b></i>	the 336-mile (541 km) canal that transports Colorado River water to Tucson
<i><b>Colorado River</b></i>	the largest river in the western United States (which flows through many states, including Arizona)
<i><b>condensation</b></i>	occurs when water vapor cools and becomes liquid; clouds are formed through this process (could be considered the opposite of evaporation)
<i><b>desert</b></i>	a dry region of the world that receives less than 12 inches (30.5 cm) of rainwater each year
<i><b>evaporation</b></i>	occurs when liquid water changes into water vapor, a gas (could be considered the opposite of condensation)
<i><b>groundwater</b></i>	water that exists beneath the Earth's surface in an aquifer
<i><b>natural resource</b></i>	any resource that we use or take from the natural environment; can include both materials and energy (such as air, water, trees, soil, natural gas, oil, or minerals)
<i><b>percolation</b></i>	the downward movement of water through soil
<i><b>precipitation</b></i>	water falling, in a liquid or solid state, from the atmosphere to the Earth (examples: rain, snow, hail, sleet, dew, and frost)
<i><b>recharge</b></i>	the addition of water, usually from rain and snowmelt, into the aquifer; may be artificially done by humans
<i><b>resource</b></i>	source, ability, or supply from which we draw in time of need
<i><b>runoff</b></i>	water from rain or snowmelt flowing downhill into washes, streams, and rivers
<i><b>Santa Cruz River</b></i>	the largest river in Tucson, which is now dry most of the year and only flows after significant rains
<i><b>transpiration</b></i>	the evaporation of water from plants; occurs primarily through the leaves
<i><b>water table</b></i>	the uppermost surface of groundwater in the aquifer
<i><b>well</b></i>	a hole dug or drilled down into the aquifer to locate and obtain water (deep water is usually brought up to the surface with a pump)

# ARIZONA DEPARTMENT OF EDUCATION ACADEMIC STANDARDS

The *Our Water, Our Future* program addresses the following Academic Standards. (Complete versions of the Academic Standards are available at <http://www.ade.state.az.us>.)

SCIENCE STANDARDS	Lesson 1	Lesson 2	Lesson 3	Lesson 4	PRESENTATION
<b>SC04-S3C1-01</b> Describe how natural events and human activities have positive and negative impacts on environments (e.g., fire, floods, <u>pollution</u> , dams).					✓
<b>SC04-S4C3-01</b> Describe ways various resources (e.g., air, <u>water</u> , plants, animals, soil) are utilized to meet the needs of a population.	✓		✓		✓
<b>SC04-S4C3-02</b> Differentiate renewable resources from nonrenewable resources.	✓				✓
<b>SC04-S4C3-03</b> Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.					✓
<b>SC04-S4C3-04</b> Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes).	✓		✓		✓
<b>SC04-S6C3-01</b> Identify the sources of water within an environment (e.g., ground water, surface water, atmospheric water, glaciers).	✓	✓			✓
<b>SC04-S6C3-02</b> Describe the distribution of water on the Earth's surface.		✓			
MATHEMATICS STANDARDS					
<b>M04-S1C1-01</b> Read whole numbers in contextual situations.			✓		
<b>M04-S1C1-02</b> Identify whole numbers in or out of order.			✓		
<b>M04-S1C1-03</b> Write whole numbers in or out of order.			✓		
<b>M04-S1C1-07</b> Compare two whole numbers.			✓		
<b>M04-S1C1-14</b> Use decimals in contextual situations.			✓		

## ARIZONA DEPARTMENT OF EDUCATION ACADEMIC STANDARDS CON'T

<b>MATHEMATICS STANDARDS</b> CON'T	Lesson 1	Lesson 2	Lesson 3	Lesson 4	PRESENTATION
<b>M04-S1C2-01</b> Add whole numbers.			✓		
<b>M05-S1C2-03</b> Multiply whole numbers.			✓		
<b>M05-S1C2-13</b> Multiply decimals.			✓		
<b>SOCIAL STUDIES STANDARDS</b>					
<b>SS04-S1C9-01</b> Describe changes (e.g., population growth, economic growth, cultural diversity, civil rights) that took place in Arizona during the postwar era.	✓				✓
<b>SS04-S1C10-01</b> Describe current events using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).					✓
<b>SS04-S1C10-02</b> Discuss the connections between current and historical events and issues from content studied in Strand 1 using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).	✓				✓
<b>SS04-S3C4-01</b> Discuss ways an individual can contribute to a school or community.			✓		✓
<b>SS04-S4C1-05</b> Describe characteristics of human and physical features: a. physical – (i.e., <u>river</u> , lake, mountain, range, coast, sea, <u>desert</u> , gulf, bay, strait, plain, valley, volcanoes, isthmus, canyon, plateau, mesa, oasis, dunes); b. human – (i.e., equator, four hemispheres, city, state, country, harbor, dams, territory, county).		✓		✓	✓

## ARIZONA DEPARTMENT OF EDUCATION ACADEMIC STANDARDS CON'T

SOCIAL STUDIES STANDARDS CON'T	Lesson 1	Lesson 2	Lesson 3	Lesson 4	PRESENTATION
<b>SS04-S4C1-06</b> Locate physical and human features using maps, illustrations, images, or globes: a. physical (i.e., <u>river</u> , lake, mountain range, coast, sea, <u>desert</u> , gulf, bay, strait) b. human (i.e., equator four hemispheres, city, state, country, roads, railroads).					✓
<b>SS04-S4C1-07</b> Locate physical and human features in Arizona using maps, illustrations, or images: a. physical (e.g., Grand Canyon, Mogollon Rim, <u>Colorado River</u> , Gila River, Salt River); b. human (e.g., Phoenix, Yuma, Flagstaff, Tucson, Prescott, Hoover Dam, Roosevelt Dam).					✓
<b>SS04-S4C2-02</b> Describe ways in which Arizona has changed over time from statehood to today.	✓				✓
<b>SS04-S4C3</b> Correlates with SC04-S3C1.					✓
<b>SS04-S4C3</b> Correlates with SC04-S6C3.	✓	✓			✓
<b>SS04-S4C5-01</b> Describe human dependence on the physical environment and natural resources to satisfy basic needs.					✓
<b>SS04-S4C5-03</b> Describe the impact of human modifications (e.g., dams, mining, air conditioning, irrigation, agricultural) on the physical environment and ecosystems.					✓
<b>SS04-S4C6-01</b> Describe the impact of geographic features (e.g., rivers, mountains, resources, deserts, climate) on migration and the location of human activities (e.g., exploration, mining, transportation routes, settlement patterns).	✓				✓

## ARIZONA DEPARTMENT OF EDUCATION ACADEMIC STANDARDS CON'T

<b>SOCIAL STUDIES STANDARDS CON'T</b>	Lesson 1	Lesson 2	Lesson 3	Lesson 4	PRESENTATION
<b>SS05-S1C10-01</b> Describe current events using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).	✓				✓
<b>SS05-S1C10-02</b> Discuss the connections between current and historical events and issues from content studied in Strand 1 using information from class discussions and various resources (e.g., newspapers, magazines, television, Internet, books, maps).	✓				✓
<b>SS05-S3C4-01</b> Describe ways an individual can contribute to a school or community.			✓		✓
<b>SS05-S4C1-03</b> Identify the location of significant geographic features from content studied on a physical or political map.					✓
<b>SS05-S4C1-04</b> Locate physical and human features (e.g., gulf, delta, isthmus, strait, bay, canyon, swamp, peninsula, province, cape, tree line) in the United States and world on an appropriate type of map.					✓
<b>WRITING STANDARDS</b>					
A variety of standards from Strand 1 (writing process), Strand 2 (writing elements) and Strand 3 (writing applications) may be addressed, based on how the activity is assigned by the teacher.				✓	
<b>READING STANDARDS</b>					
<b>R04-S1C5-01, R05-S1C5-01</b> Read from familiar prose and poetry with fluency and appropriate rhythm, pacing, intonation, and expression relevant to the text.				✓	

## ARIZONA DEPARTMENT OF EDUCATION ACADEMIC STANDARDS CON'T

READING STANDARDS CON'T	Lesson 1	Lesson 2	Lesson 3	Lesson 4	PRESENTATION
<b>R04-S2C1-09</b> Identify characteristics and structural elements (e.g., imagery, rhyme, verse, rhythm, meter) of poetry.				✓	
<b>R04-S2C1-10</b> Identify common forms of literature (e.g., poetry, novel, short story, biography, autobiography, drama) based upon their characteristics.				✓	
<b>R05-S2C1-08</b> Identify types of poetry (e.g., free verse, haiku, cinquain, limericks).				✓	
LANGUAGE ARTS STANDARDS					
<b>LS-E3</b> Interpret and respond to questions and evaluate responses both as interviewer and interviewee.			✓		
<b>LS-E4</b> Predict, clarify, analyze and critique a speaker's information and point of view.					✓
VISUAL ARTS STANDARDS					
<b>VA-S1C1, S1C2, S1C3, S1C4, S1C5</b> Create: Student will create artworks to communicate ideas, meanings, and/or purposes.		✓			

*Teacher Note:* Pursuing the suggested Extension ideas at the end of Lessons 1-3 will allow you to address additional ADE standards in a variety of subject areas.

# LESSON 1: WATER HISTORY AND SUPPLY: *TUCSON'S WATER STORY*

## Lesson Overview

Students participate in an activity that demonstrates where our water comes from and how we use it. While referring to a large container representing Tucson's water supply, students read a script that tells Tucson's water history. As students read their assigned roles, they remove or add representative amounts of water from the container. By the end of the story, the water supply has clearly decreased. Finally, the students write the next chapter in Tucson's Water Story on the enclosed "Every Drop Counts" paper drops.

**IMPORTANT:** Please bring the student-made paper drops to the on-site presentation.

## Arizona Department of Education Academic Standards

Please refer to the Arizona Department of Education Academic Standards section for the ADE standards addressed by this lesson.

## Learning Outcomes

Students will be able to:

- Define and use the terms aquifer, groundwater, reclaimed water, and recharge.
- List Tucson's current water sources.
- Describe how water has historically been used in the Tucson area.
- Explain ways that Tucson is assuring water availability for the future.

## Materials

- two one-gallon (3.79 l) containers:
  - one wide-mouthed, clear, empty jar, labeled "Tucson's Water Supply"  
(Students will need to be able to dip a ladle into the container. A cookie container or a fish bowl works well. The students need to be able to see the water level from the outside.)
  - one full gallon (3.79 l) of water, labeled "Aquifer"  
(This one may be any kind of one-gallon (3.79 l) container such as a bucket.)
- one cup (250 ml) liquid measuring container
- half a cup (125 ml) liquid measuring container
- one tablespoon (5 ml) measuring spoon
- ladle or other dipping device (the measuring cups could also be used for this)
- Tucson's Water Sources labels (provided)
- Tucson's Water Story script (provided)
- "Every Drop Counts" drops (photocopied for each student)

## Advance Preparation

- Obtain all jars, containers, and measuring devices (refer to materials list). Before class, place materials on a table where all the students can see them.
- Cut out the water supply labels and affix to appropriate containers.
- Fill the "Aquifer" container with water.
- Photocopy Tucson's Water Story and cut out as indicated on dotted lines. The script calls for eight students to read plus a narrator (played by the teacher). Have the master copy available for your reference.
- Photocopy "Every Drop Counts" drops - one per student, on heavy paper if possible.

## Duration

Total: 60 minutes

Introduction plus Tucson's Water Story: 40 minutes

"Every Drop Counts" activity: 20 minutes

## Suggested Procedure

- 1) Introduction. Explain to students that this is the first activity in Tucson Water's *Our Water, Our Future* program. This and the other pre-visit activities will prepare students with important vocabulary and information that they will need when a special guest arrives from Tucson Water. They should pay close attention to these lessons as the guest speaker may call on them to help with the presentation. This particular activity will help them understand Tucson's water supply, that is, where we get our water.
- 2) State that water is an important resource that we need in many ways. Define resource as a source or supply from which we can draw in time of need. Define natural resources as resources we take from the natural environment, mentioning water as an example.
- 3) Discuss Tucson's water sources. Referring to the clear gallon (3.79 l) container, "Tucson's Water Supply," explain that this jar represents Tucson's water. As students note that it's just an empty jar, ask: From what resources does Tucson get its water supply? Likely responses will be rain, runoff, groundwater, rivers, etc. Discuss the students' answers and say: Let's find out.
- 4) Water from the aquifer. Call on a volunteer to come up and help with Tucson's first, most important, source of water. Have the student read the label on the gallon (3.79 l) container representing the aquifer. After reading the label and definition, have the student pour all of the water from the "Aquifer" into the container representing "Tucson's Water Supply."
- 5) Discuss groundwater. Explain to students that originally all of Tucson's water supply came from groundwater resources. When the rivers in Tucson used to flow during most of the year, it was the result of an abundance of water in the aquifer that reached the ground surface in the riverbeds.
- 6) Review vocabulary. Review the difference between the aquifer (the underground layer of rocks, sand, and gravel where the groundwater is found) and groundwater (the water in the underground aquifer). Remind students that groundwater is Tucson's first and most important water source.
- 7) Who uses water? Now that students know about Tucson's original water source, ask: Who uses Tucson's water? As they offer responses, it will become evident that everyone uses water. Remind students that plants, animals, and people all require water to survive. Tell the students that, as a class, you will be doing a role-play activity to demonstrate how different people throughout Tucson's history have used water. Explain that the labeled jar (now full) represents "Tucson's Water Supply."
- 8) Assign roles for Tucson's Water Story. Assign the eight roles and distribute the associated readings from the "Tucson's Water Story" script. Retain the master copy for yourself as narrator/facilitator.
- 9) Read Tucson's Water Story. Have students read their script in sequence and measure the correct representative quantity of water to remove or add to "Tucson's Water Supply." Remove the "Aquifer" label from its container, and use this container to dump the water removed from "Tucson's Water Supply."

10) Discuss the water resources mentioned in the story. Write “Our Water Supply” on the board and ask students to recall the various water resources which are part of our water supply. Also write these on the board as students name them: groundwater, river water, and reclaimed water.

11) State that some resources are renewable and some are nonrenewable. For example, sunshine, wind, and trees are renewable, while copper, aluminum, oil, and natural gas are nonrenewable. Ask whether water is renewable or nonrenewable. Because water is continually moving through the water cycle, more water is brought to our area. Thus water is considered renewable. But it is important to realize that water is a limited resource! Although precipitation and natural recharge add to our supply, the total amount available is still limited.

12) “Every Drop Counts” Activity.

Once you have finished reading “Tucson’s Water Story,” ask the students: Who are the next players in Tucson’s Water Story? We are! Tell the students that Tucson Water would like to hear their ideas about how we can save water today so we will all have water in the future. What ideas do the students have to ensure Tucson’s water supply?

1. Hand out one drop to each student. Have students write their names and the name of the school on the back of the drop.
2. Explain to the students that they should write a single water-saving idea on the drop. (for example, I can save water today by turning off the faucet when I brush my teeth).

**IMPORTANT:** Please save the drops for the special guest visitor from Tucson Water!

**Extension:**

Have students create costumes and act out their roles in Tucson’s Water Story. Give a presentation to younger grades and/or other classes not participating in this program.

## TUCSON’S WATER STORY *SCRIPT*

**Instructions:**

Please note that the narrator/facilitator (played by the teacher) has an action to perform after each student speaks. To keep the story running smoothly, we suggest asking the eight chosen students to stand at the front of the classroom in order, according to the number on their script.

## TUCSON'S WATER STORY *SCRIPT*

**Narrator:** Tucson's water – humans have been relying on it for over one thousand years. This jar represents Tucson's water supply at the beginning of our story. The first humans to use much water in the area were an ancient group of Native Americans known as the Hohokam.

**1. Young Hohokam Native:** In the way you tell time, it is 1501. I am Hohokam. We are the people who live in the desert. Water is one of the most precious things in our lives. We use water from the few rivers and creeks that flow most of the year. Sometimes, when a river goes dry, we can dig a little ways down and find water, or walk to a secret spring. We use our water for drinking, cooking and also for our crops. We make irrigation canals that channel water to our fields. This spoonful of water represents our use of the available water resources.

**Facilitator:** Ask the student to remove 1 tablespoon (5 ml) of water from "Tucson's Water Supply." Ask the entire class: What is happening to Tucson's water supply?

**Narrator:** The Hohokam's impact on Tucson's water supply was minimal. Around 1540, the Hohokam left their farming practices in the area, about the time of the arrival of the early Spanish explorers.

**2. Juan - Young Spanish Settler:** It is 1771. My family and I came to Tucson from far away in New Spain, which later will become Mexico. It took us a whole year to get here. At first, I was lonely for friends but new families with children keep arriving. I like Tucson. There is a river here called the Santa Cruz where we can play when Mama washes our clothes. Papa dug a shallow well in our yard but it is very hard for me to bring up the heavy bucket of water. We use water for cooking, cleaning, and of course drinking! Our animals and plants need water too. This half cup (125 ml) represents our water use.

**Facilitator:** Ask the student to remove half a cup (125 ml) of water from "Tucson's Water Supply." Ask the entire class: What is happening to Tucson's water supply?

**3. Margaret - Young Anglo Settler:** Guess what? I have a new friend, Emily! She is 10 years old, just like me. Her family moved here from the East. I was born in Tucson in 1849. My parents came from Missouri when my father lost his job. He heard that there was a lot of work in the mines or on farms out here. These days, Father is very busy as more and more people move to Tucson. On Sundays, we go to the Santa Cruz River to play under the big trees and swim in the shallow water. My new friend said that where she is from, there is water everywhere! She thinks it is funny that we have water delivered to our homes in a horse-drawn wagon. As more people settle here, we are using more water. This one cup (250 ml) represents our use of water resources.

## TUCSON'S WATER STORY *SCRIPT*

**Facilitator:** Ask the student to remove one cup (250 ml) of water from "Tucson's Water Supply."  
Ask the entire class: What is happening to Tucson's water supply?

**Narrator:** In 1880, the railroad came to town. Industry and agriculture increased. In 1882, the Tucson Water Company delivered the first piped water to homes and businesses. This made life in Tucson a little easier. More people were attracted to the desert. In 1900, about 7,500 people lived in Tucson. In 1910, over 14,000 people called Tucson home. They came for the mild weather and jobs. These two cups (500 ml) represent water use in the early 1900's. (Narrator removes two cups from "Tucson's Water Supply.")

**Ben – Farmer's Son:** It is 1950. My father says that the soil in the Tucson area is good for growing cotton, alfalfa, and other crops. I help him on our cotton farm. I am proud of my work because growing plants is important. Our crops, like us, would die without water. We use irrigation canals to deliver the water to our fields. I am told that agriculture uses more water than all of the businesses and homes in the city. But people need food to eat and clothes to wear. These three cups (750 ml) represent water resources used for agriculture in the middle of the 20th century.

**Facilitator:** Ask the student to remove three cups (750 ml) of water from "Tucson's Water Supply."  
Ask the entire class: What is happening to Tucson's water supply?

**Narrator:** Is there something that adds to Tucson's water supply? I will give you some clues. Who am I? I start as rainwater or snowmelt. In town, I flow down the streets, into storm drains and gutters, and eventually, I reach the washes. In time, I sink through the ground. After a long time, if I sink deep enough, I reach the aquifer and become groundwater. I am called natural recharge! As we all know, Tucson receives less than 12 inches (30 cm) of rain a year - much less than the amount of water used by people. So unfortunately, I cannot replace all the water that people are now using. This half cup (125 ml) represents the annual rain and snowmelt that add water to Tucson's Water Supply. (Add half a cup of water to jar). What is happening to Tucson's water supply?

**5. Molly - Miner's Daughter:** Hey everyone, I am Molly and my Dad works at the copper mine south of town. Have you ever been there? There are mines all over Arizona. Mining is a very important industry because we all use minerals and metals for our electric and phone lines, to make pipes, pots and pans and to run our computers. But these industries and mines need a lot of water. This one and a half cup (375 ml) represents industry's use of water resources up to the 1980's.

## TUCSON'S WATER STORY *SCRIPT*

**Facilitator:** Ask the student to remove one and a half cups (375 ml) of water from “Tucson’s Water Supply.” Ask the entire class: What is happening to Tucson’s water supply?

**Narrator:** Even with natural recharge, the water level continues to drop. What are we going to do? People, plants, and animals all need water to live. Where is Tucson going to find more water? Perhaps our next two readers can help.

**6. Who am I?** Listen carefully to my story because you may not have heard of me. I am recycled water. After you use water and it goes down the drain, it goes to the wastewater treatment plant. That is where my life begins. I am called Reclaimed Water! I am a new water resource. I am wastewater that has been filtered and treated. Since 1980, I have been used to water parks, school grounds, and golf courses. In fact, more than 40 schools are using me to water their playgrounds. This half cup (125 ml) represents my contribution to Tucson’s Water Supply.

**Facilitator:** Ask the student to add half a cup (125 ml) of water to “Tucson’s Water Supply.” Ask the entire class: What is happening to Tucson’s water supply?

**7. Who am I?** I come to Tucson in a 336-mile (541 km) long canal from the Colorado River near Havasu, Arizona. That’s a long way to come, but Tucson really needs me. When I get to Avra Valley, near Tucson, I am put in a big basin to percolate down into the ground. I mix with groundwater and am then pumped back up. Can you guess who I am yet? I am Colorado River Water! Once I mix with Avra Valley groundwater, we’re called the Clearwater Blend. From there I go out into the delivery system pipes around Tucson. Soon, I will make up half of Tucson’s yearly water supply. I’m an important water resource! This cup and a half represents my contribution.

**Facilitator:** Ask the student to add one and a half cups (375 ml) of water to “Tucson’s Water Supply.” Ask the entire class: What is happening to Tucson’s water supply?

**Narrator:** So, now in the 21st century, we have three sources of water for Tucson’s water supply: (1) groundwater, (2) reclaimed water, (3) Colorado River water. All three sources are helping Tucson’s water future. We need all the help we can get because there are more of us than ever! Did you know that each year, about 14,000 more people move to Tucson? We use water for drinking, watering plants, washing, brushing teeth, filling pools, and bathing dogs. We use water for everything! These three cups (375 ml) represent the amount of water we are using each year. (Remove three cups of water from “Tucson’s Water Supply”) What is happening to Tucson’s water supply?

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## TUCSON'S WATER STORY *SCRIPT*

**8. Hi! It's me,** \_\_\_\_\_ (say your own name). Well, that's Tucson's Water Story. We have just learned about water use yesterday and today, but what about tomorrow? What can you and I do to help our water supply? How can we save water today so people will have water in the future?

**Narrator:** Remember, Tucson's Water Story is not over yet! We are all part of this story!

**TEACHER NOTE:** Please continue with the suggested procedure, step 12, "Every Drop Counts."



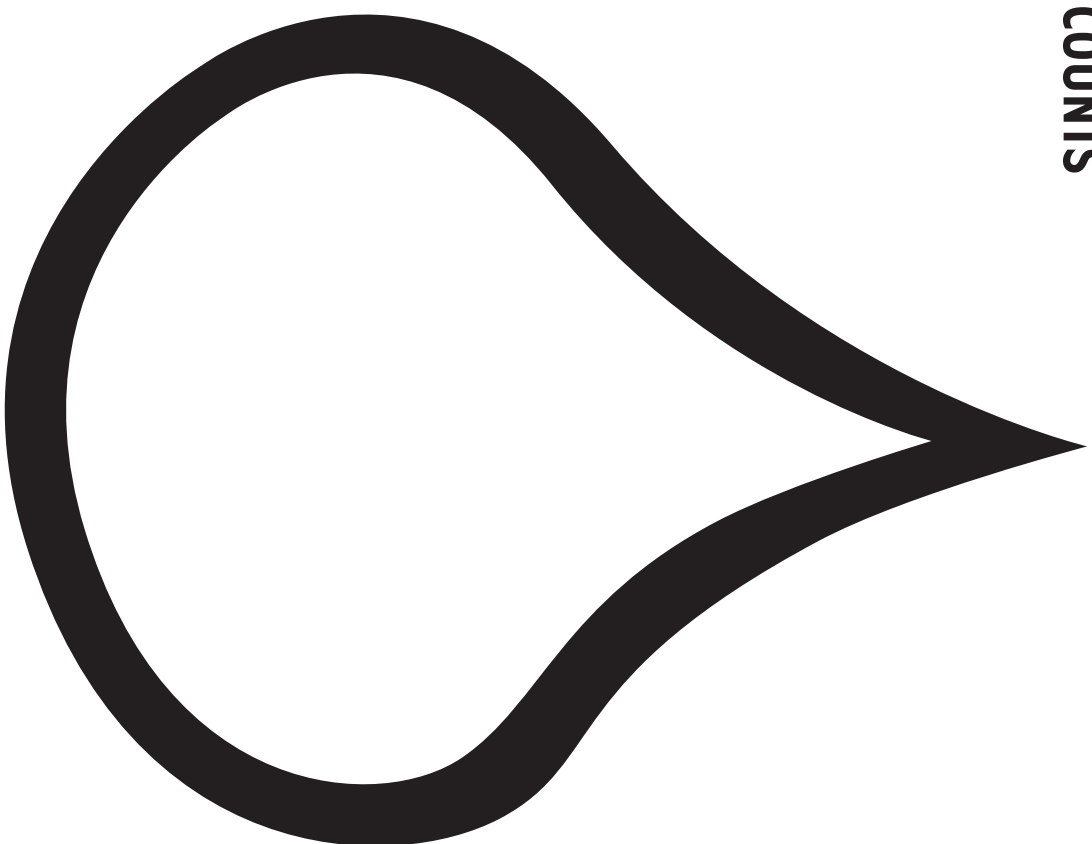
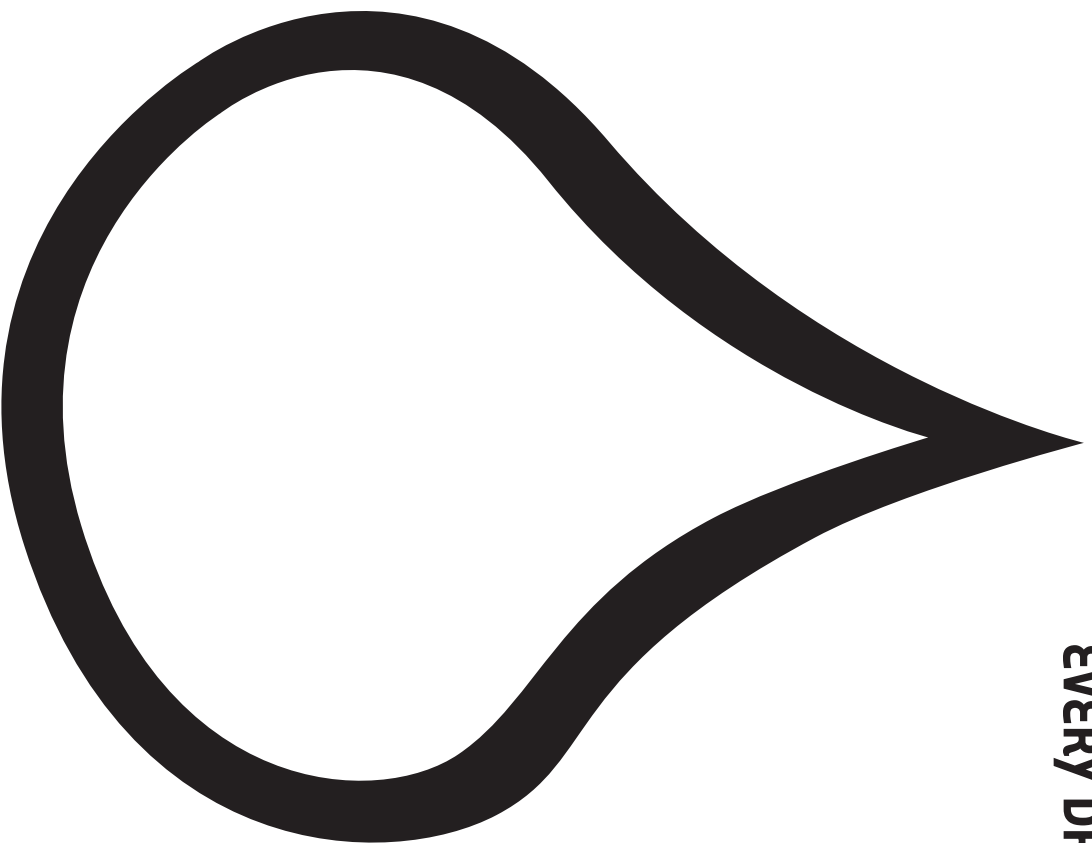
## **AQUIFER**

This container represents the aquifer. The aquifer is the underground layers of rock, sand, and gravel in which water is stored. Water that comes from the aquifer is called groundwater.



## **TUCSON'S WATER SUPPLY**

# EVERY DROP COUNTS



cut out each drop separately

## LESSON 2: WATER SYSTEMS: *OUR WATER CYCLE*

### Lesson Overview

Students review important vocabulary relating to the water cycle as they learn the “water cycle boogie.” An overhead transparency is then used to interactively present the water cycle as it appears in Tucson. Finally, students create their own labeled drawings to depict the water cycle and apply the words reviewed.

### Arizona Department of Education Academic Standards

Please refer to the Arizona Department of Education Academic Standards section for the ADE standards addressed by this lesson.

### Learning Outcomes

Students will be able to:

- Describe the water cycle and the various ways water moves between places in the environment.
- Define and use key water words such as transpiration, evaporation, condensation, percolation, and precipitation.
- Draw and label an image of the water cycle depicting water moving through the atmosphere, bodies of water, drainages, plants and animals.
- Describe the distribution of water on Earth’s surface.

### Materials

- overhead projector
- transparency master and key: The Water Cycle (provided)
- erasable transparency marker
- vocabulary and definition strips
- drawing paper, pencils, and/or markers

### Advance Preparation

- Photocopy the page of water cycle vocabulary.
- Cut out the five words into five strips.
- Set up an overhead projector and have ready the overhead transparency.

### Duration

Total: 60 minutes

Review of vocabulary and transparency: 35 minutes

Student water cycle drawings: 25 minutes

### Suggested Procedure

1) “The Water Cycle Boogie”: a review of water vocabulary.

In this activity, the students become the teachers and present key water cycle vocabulary to one another.

- Divide the class into five teams.
- Distribute one vocabulary word with its definition to each team.
- Challenge the teams to prepare a short, one-minute presentation to explain their word to the class, using one or more presenters. They should include a sound and body movement to demonstrate their word.

- Class presentations. Have each group present their word with matching sound and body movements.
- Review the words with the “water cycle boogie.” When all the groups have presented, call the words out, one at a time. Ask the students to stand up and act out the matching sound and body movements. Tie all the words together into a little dance.

**EXTENSION:** Create a rhyme or a song using the five words. Some suggested tunes: “Clementine,” “Row your Boat,” or “Itsy Bitsy Spider.”

2) The Water Cycle – overhead transparency review. The Water Cycle overhead illustrates the water cycle, using our region as an example. Explain to the students that the water cycle also happens on a global level. What differs from region to region are the plants, animals, bodies of water, and land through which water moves.

3) Fill in the blanks. Using The Water Cycle transparency, point out places water can be and ways water can move. For example, water can be in the clouds. One way that water gets to the clouds is through evaporation. As you point out the places where water can be (clouds, plants, river, Sea of Cortez, or soil), remember to discuss how it gets there (transpiration, evaporation, condensation, precipitation, and percolation).

Now, fill in the blanks with the appropriate words describing ways water can move. You may choose to call upon students to come up and fill in the blank or write the words in yourself. Next, ask students to name ways that water might move in our environment. Draw arrows on the transparency to show a range of possibilities. Be sure to mention that the water cycle is not a single large cycle but a complex system within which water moves in many ways.

4) Discuss the distribution of water on Earth’s surface. Over 97 percent is salt water, found in the oceans. Less than three percent is fresh water. But not all of the fresh water is available to us. Two percent of Earth’s water is in the polar ice caps. All of the moisture in lakes, rivers and streams, the atmosphere, and underground adds up to less than one percent of Earth’s water. Although our water supply is renewable to some extent, water is truly a precious and very limited resource!

5) Create your own water cycle. Now ask students to draw their own water cycle pictures. Their drawings should include the following:

- Things they see everyday in their environment that use and move water (e.g., a mesquite tree taking in water through its roots then transpiring water to the clouds; snow melting in the Catalina Mountains then running down the Rillito River and percolating into the ground and/or evaporating back into the clouds).
- Water vocabulary; students should appropriately depict and label the processes of transpiration, evaporation, condensation, precipitation, and percolation.
- A picture of themselves using water.

6) Display your drawings. Display the students’ drawings around the room.

## WATER CYCLE VOCABULARY



### Instructions

Photocopy this sheet. Cut out the five words and their definitions into five strips. Distribute one strip to each team in Lesson Two, Activity One: “The Water Cycle Boogie.”



**CONDENSATION:** occurs when water vapor cools and becomes liquid

*Examples of condensation:* when the steam from a hot shower forms water droplets on the mirror; when clouds form.



**EVAPORATION:** occurs when liquid water heats up, changes into water vapor (a gas), and rises into the sky

*Examples of evaporation:* when a wet towel dries, that water has evaporated into the air.



**PERCOLATION:** the downward movement of water through soil

*Example of percolation:* when rainwater from a puddle sinks down into the ground.



**PRECIPITATION:** water falling, in a liquid or solid state, from the atmosphere to Earth

*Examples of precipitation:* rain, snow, hail, sleet, dew, and frost.

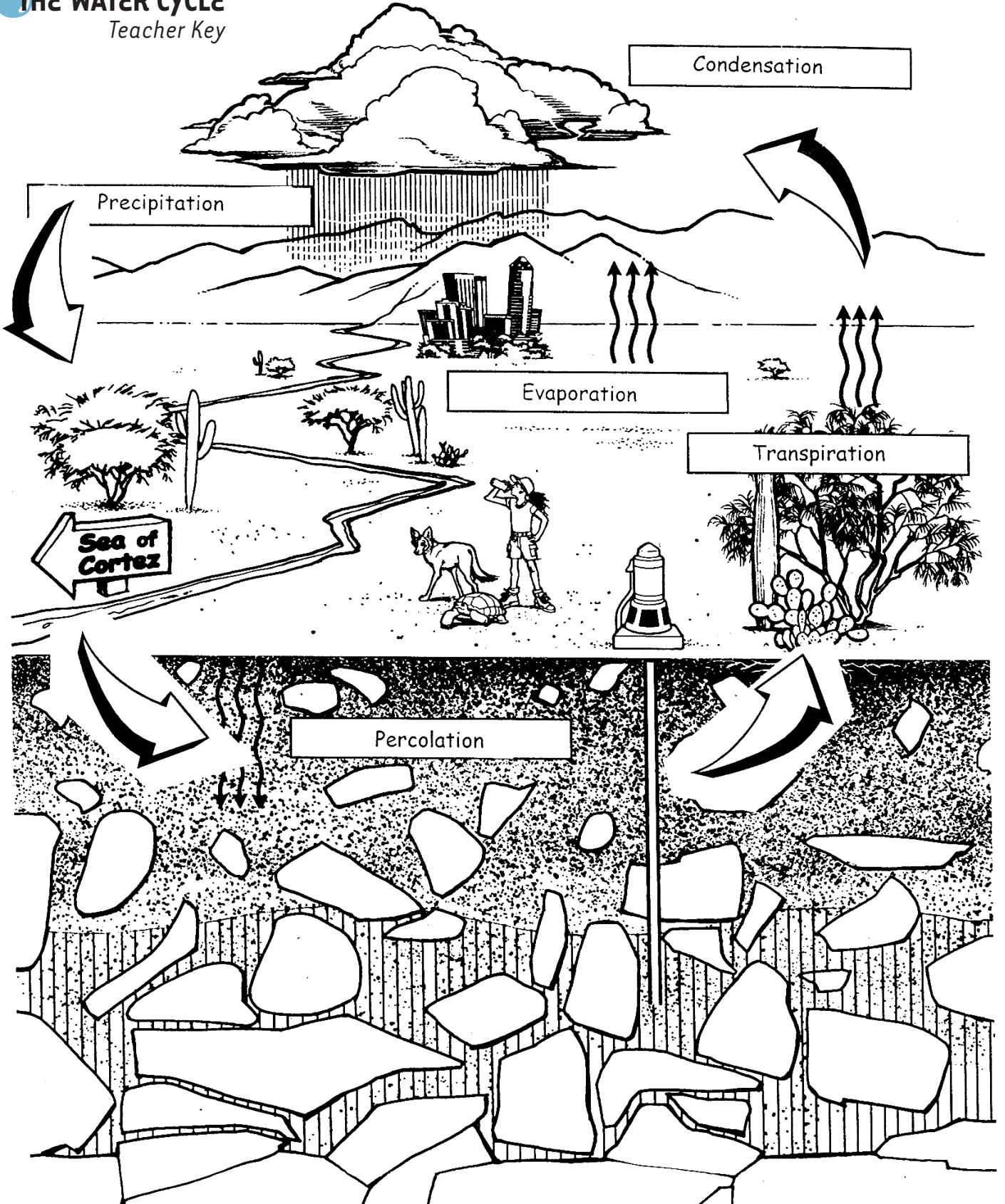


**TRANSPIRATION:** the evaporation of water from plants

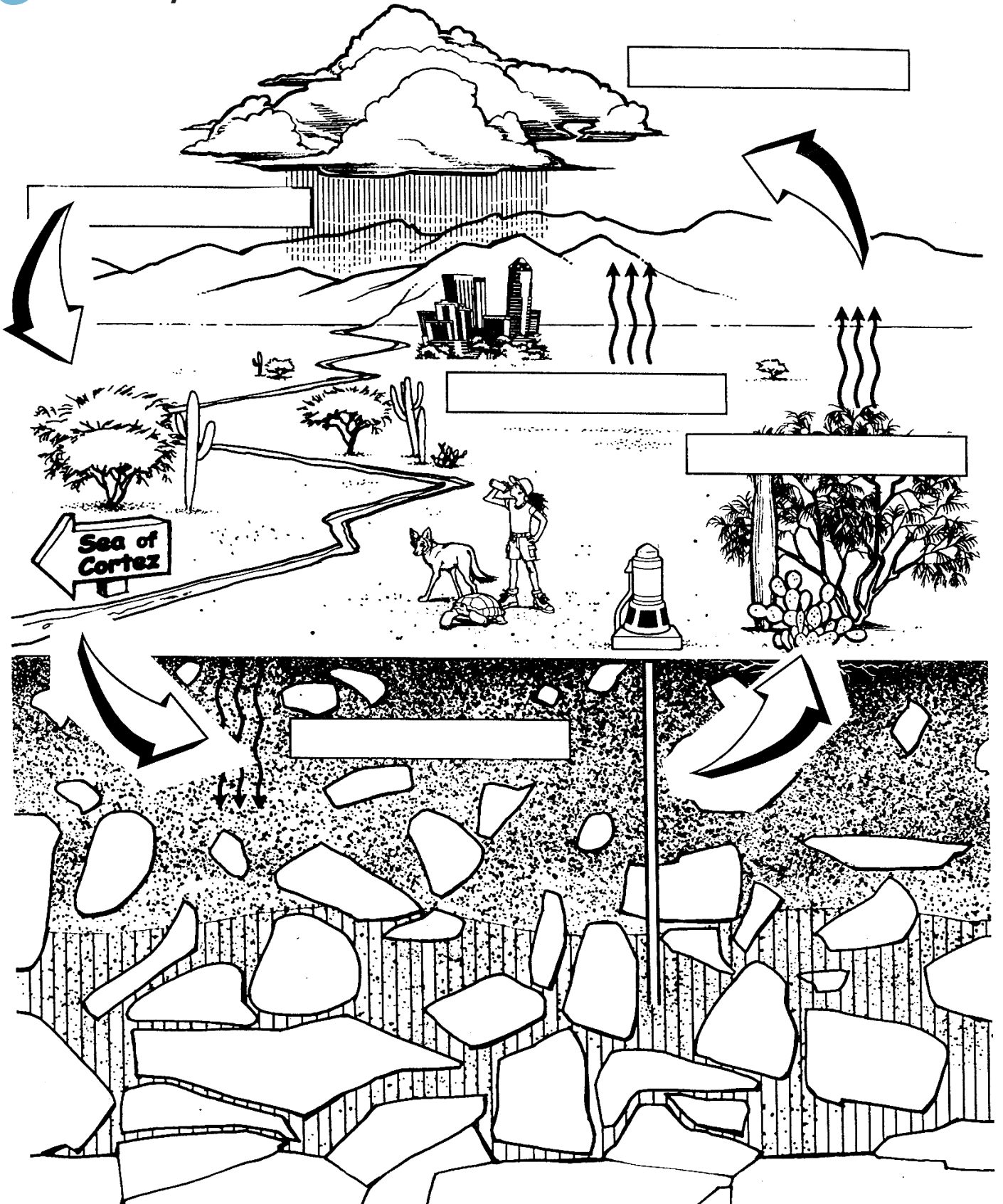
*Example of transpiration:* when a plant or a tree releases water into the atmosphere from tiny openings in its leaves.



**THE WATER CYCLE**  
Teacher Key



# THE WATER CYCLE



## LESSON 3: WATER CONSERVATION: *BECOMING WATER SMART*

### Lesson Overview

How many people does it take to make a difference? Just one. Students will analyze their daily water use and apply math skills to estimate the amount used per week and how much water they could conserve by becoming “water smart.”

### Arizona Department of Education Academic Standards

Please refer to the Arizona Department of Education Academic Standards section for the ADE standards addressed by this lesson.

### Learning Outcomes

Students will be able to:

- List ways they personally use water.
- Describe how water use habits affect the future availability of water.
- Use math skills to calculate total water use and estimate savings.
- List ways they can personally conserve water.
- Explain ways their families can conserve water.

### Materials

- transparency master: “Ways We Use Water and Water Smart Ways” (provided)
- overhead projector
- one gallon (3.79 l) empty container, for demonstration purposes
- “water smart survey” (provided)

### Advance Preparation

- Prepare the overhead projector and have ready the overhead transparency “Ways We Use Water and Water Smart Ways.”
- Photocopy “Water Smart Survey,” one per student

### Duration

Total: 60 minutes

Introduction and review of “Ways We Use Water” transparency: 40 min.

“Water Consultant” activity: 20 minutes

### Suggested Procedure

1) Review. Review with the students the past week’s study of water. Up to now, the water activities have focused on water supply and water cycle – where we get our water from and where it goes. In this activity, the class will take a closer look at how they personally use water and how their feelings and attitudes affect that use.

2) Water is a limited resource. Convey to the students that how we use water is influenced by how much water we think there is. Many people assume that there is an endless supply of water and so develop some pretty wasteful habits. But what if we understood that the supply of water is truly limited? The people who lived in Tucson long ago, the Hohokam, and the people that continue to inhabit the desert, the Tohono O’odham (whose name means Desert People) have long been aware of the scarcity of water here. Most plants and animals that live in the desert have adapted to their

arid environment by using less water. How can we adapt personally and as a class?

3) How we use water. Ask students to give examples of how they personally use water. List these examples on the board. Ask them if, when they use water in these ways, they ever consider how much water it really takes to do these things.

4) Ways we use water. Place the overhead transparency “Ways We Use Water and Water Smart Ways” on the overhead projector. Cover up everything except column 1 –“Activity.” It would be best to use two separate covers to be able to reveal each answer under column 2, “Typical Use” while keeping the other rows and column 3, “Water Smart” covered. Hold up the gallon (3.79 l) container to help students visualize a gallon. Ask the students how much water they think each of these activities takes. After a few guesses for each, reveal the answers under column 2, “Typical Use.” Then show the heading only of column 3, “Water Smart Way.” What do they think will be listed there? Review the entire table together.

5) Becoming water consultants. How many of these activities does each student do daily? How much water do they think they use on an average day? Explain that now their assignment is to become “Water Consultants” and interview a partner to find out how much water they use, and how much water they could save, on an average day.

6) Interview partners. Assign students to work in pairs and pass out the “Water Smart Survey” forms, one to a student. They will use these forms to interview their partner and calculate their partner’s water use based on the information in the overhead transparency. Their job as consultant is to add up how much water their partner uses and identify water use habits that can be changed to conserve water. In the “Water Smart Way” column, they should put how much water could be saved with a “water smart” activity.

7) How much can we save? Still in pairs, the students calculate how much water their partner could save using the information in the overhead transparency. They should then make recommendations to their partners, suggesting specific steps toward becoming “water smart.”

8) Closing discussion. Close the activity with a discussion of “water smart” water saving alternatives and students’ feelings about water. Encourage the students to consider what being “water smart” means. Use the following questions to guide the closing discussion:

Will the students’ increased wisdom about water affect their attitudes and habits about water?

How do they feel about the opportunities to save water suggested by their consultants?

How did it feel to be a consultant?

Refer back to Tucson’s Water Story Lesson One and the jar, which represented Tucson’s water supply. How could their consultant’s advice affect the water supply in that jar?

#### **EXTENSION:**

- As a class, calculate the total daily water use of the group. Then calculate the total possible water savings as a group, if everyone followed their consultant’s suggestions. Finally, multiply the findings by the number of students in the school to demonstrate the potential savings if each student learned to be “water smart.”
- Have students create surveys to conduct interviews at home to find out how their families use water. They may also serve as “water consultants” to their families.
- Conclude by emphasizing that to be truly water smart, we need to not only save water in the ways discussed today, but also be alert to even more ways to do our part.

# WAYS WE USE WATER AND WATER SMART WAYS

Overhead Transparency

<i>column 1</i>	<i>column 2</i>	<i>column 3</i>	<i>column 4</i>
<b>ACTIVITY</b>	<b>TYPICAL USE</b>	<b>WATER SMART WAY</b>	<b>AMOUNT WE COULD SAVE PER EVENT</b>
Brushing teeth	2 or more gallons (8 liters)  .25 gallon or less	(1 liter)  1.75 gallons (6.5 liters)	
Showering	50 gallons (189 liters)	12.5 gallons (47 liters)	37.5 gallons (142 liters)
Taking a bath	36 gallons (136 liters)	18 gallons (68 liters)	18 gallons (68 liters)
Washing hands	2 gallons (7.5 liters)	1 gallons (4 liters)	1 gallons (4 liters)
Flushing toilet	3.5 to 5 gallons (13 to 19 liters)	1.5 gallons (6 liters)	2 to 3.5 gallons (7 to 13 liters)
Washing dishes by hand	30 gallons (113.5 liters)	5 gallons (19 liters)	25 gallons (94.5 liters)
Washing dishes by machine	16 gallons (60.5 liters) 9 gallons	(34 liters) 7 gallons (26.5 liters)	
Washing clothes	35 gallons (132 liters) 25 gallons	(94.5 liters) 10 gallons (38 liters)	

# WAYS WE USE WATER AND WATER SMART WAYS

## Teacher Guide

<i>column 1</i>	<i>column 2</i>	<i>column 3</i>	<i>column 4</i>
<b>ACTIVITY</b>	<b>TYPICAL USE</b>	<b>WATER SMART WAY</b>	<b>AMOUNT WE COULD SAVE PER EVENT</b>
Brushing teeth	2 or more gallons (8 liters) tap running	.25 gallon or less (1 liter or less) tap off or with water smart cup	1.75 gallons (6.5 liters)
Showering 50 gal (189 l)	conventional showerhead: 5 gal (19 l) per minute for 10 minutes 12.5 gal (47 l) water saving	showerhead: 2.5 gal (9.5 l) per minute for 5 minutes 37.5 gal (142 l)	
Taking a bath	36 gal (136 l) full tub	18 gal (68 l) half-full tub	18 gal (68 l)
Washing hands	2 gal (7.5 l) water running 1 gal (4 l)	fill basin 1 gal (4 l)	
Flushing toilet	3.5 to 5 gal (13 to 19 l) per flush with conventional toilet	1.5 gal (6 l) per flush - low volume tank or 4 gal (14.5 l) per flush with tank displacement	2 to 3.5 gal (7 to 13 l) low volume tank
Washing dishes by hand	30 gal (113.5 l) tap running	5 gal (19 l) wash and rinse in filled basin	25 gal (94.5 l)
Washing dishes by machine	16 gal (60.5 l) per load - full cycle, partially loaded	9 gal (34 l) per load - short cycle, fully loaded	7 gal (26.5 l)
Washing clothes	35 gal (132 l) per load - highest level, partially loaded	25 gal (94.5 l) per load - adjust size to load	10 gal (38 l)

# WATER SMART SURVEY

Name of water user \_\_\_\_\_

Date \_\_\_\_\_

Name of water consultant \_\_\_\_\_

<i>column 1</i>	<i>column 2</i>	<i>column 3</i>	<i>column 4</i>	<i>column 5</i>
<b>ACTIVITY</b>	<b>AMOUNT USED (GALLONS OR LITERS)</b>	<b>TIMES PER DAY</b>	<b>TOTAL AMOUNT USED</b>	<b>WATER SMART WAY POSSIBLE SAVINGS</b>
<i>Brushing teeth</i> <input type="checkbox"/> tap on <input type="checkbox"/> tap off				
<i>Showering</i> <input type="checkbox"/> 10 minutes + <input type="checkbox"/> 5 minutes  <i>Bathing</i> <input type="checkbox"/> tub full <input type="checkbox"/> tub 1/2 full				
<i>Washing hands</i> <input type="checkbox"/> tap on <input type="checkbox"/> tap off				
<i>Flushing toilet</i> <input type="checkbox"/> conventional <input type="checkbox"/> water saving device				
<i>Washing dishes by hand</i> <input type="checkbox"/> running water <input type="checkbox"/> basin of water  <i>Washing dishes by machine</i> <input type="checkbox"/> partial load <input type="checkbox"/> full load				
<i>Washing clothes</i> <input type="checkbox"/> partial load <input type="checkbox"/> full load				
<b>TOTAL Water/Day</b>				

To be “water smart”, I recommend the changes in water use habits listed on the back of this page.

Signed \_\_\_\_\_

## LESSON 4: WATER POETRY: *RIVER OF WORDS*

### Lesson Overview

After the special presenter has visited the class, this post-visit lesson gives students the opportunity to explore what water means to them. Through poetry, the students express thoughts and feelings about the importance of water in the desert. Students will recognize the variety of ways that water affects them and may develop a deeper level of water appreciation and understanding.

### Arizona Department of Education Academic Standards

Please refer to the Arizona Department of Education Academic Standards section for the ADE standards addressed by this lesson.

### Learning Outcomes

Students will be able to:

- Describe the ways in which water affects their lives and all life in the desert.
- Describe their local environment in vivid, specific language.
- List some of the natural inhabitants of Tucson and the surrounding areas.
- Create similes, metaphors, and/or descriptive words and phrases.
- Revise and edit ideas and language.

### Materials

- sample poems, written by other students (provided)
- paper, pencils and/or pens
- chalkboard or white board with writing tools
- “A Word about Form”: The teacher’s mini-guide to poetry forms (provided)

### Advance Preparation

- Read through the Suggested Procedure to familiarize yourself with the kinds of questions that prompt poetic brainstorming.
- Have the enclosed poetry samples on hand to share with class.
- Read through “A Word about Form”. Choose one form for the whole class to mimic or allow students to individually select an appropriate form.
- Review River of Words contest materials.

### Duration

Total: 1 to 2 class periods

Poetry form discussion and “water-storming”: 30 minutes

Writing and revising poems: 30 minutes or more

### Suggested Procedure

Some of these suggestions come from *Life is the Teacher* by Sandford Lyne in *The River of Words’ Educator’s Guide*. (available on-line at [www.riverofwords.org](http://www.riverofwords.org))

1) Share Poetry Examples. Remind students that we live in two worlds – the outer world of the senses (what we can see, touch, taste, smell, hear) and the inner world of thought, emotion, imagination, and memory. One of the reasons

we write poetry is to go into these two worlds and find the places where they overlap. Just as no two people have the same fingerprints, no two people put poems together in the same way. Ask the students to listen for their favorite lines and images as you read one of the sample poems provided.

2) Discuss Poetry Form and Rhythm. Point out to the students that the poem you read does NOT rhyme. Poems do not need to rhyme in order to have rhythm. Such poems are called Free Verse poems (see “A Word about Form”). Discuss the students’ favorite lines and images. Read the poem a second time. Ask the students to pick out the words and sounds that give the poem its rhythm.

3) Make a Storm of Water Words. Beginning is the most difficult part of writing a poem. Create a list of words on the board to help make the river of words flow. IMPORTANT: Instead of writing general poems about water, encourage students to focus on water in their life experience or in real places. Have the students imagine their favorite place in the desert (such as the wash behind grandpa’s house, the yard after it rains). Write some of the students’ favorite places in the middle of the board. Now ask the following questions. Write the responses on the board for students to reference when they write their own poems.

 **What do these places make you think of? How do they make you feel?**

for example: wildflowers in bloom, fishing with my dad, walking with my grandma, swimming with my friends, fearless, free, full of joy, tiny, enormous, excited

 **What kinds of weather come to mind?**

for example: monsoon rains, loud thunder, lightning, hot, lazy sun

 **What animals and plants might live there? Can you name some?**

for example: saguaro cactus, coyote, prickly pear, kit fox, cactus wren, mountain lion, javelina, palo verde, mesquite tree, creosote bush, spadefoot toad, gila monster

 **When is your place quiet? What kind of sounds do you hear in that place?**

for example: early in the morning, after a storm, birds calling, coyotes howling, trees swooshing; when I slap a puddle with my feet, it explodes like firecrackers

4) The Writing Process. Using the Storm of Water Words, and other words they wish, students write their own poems. One easy way to do this is to write it together, line by line. For example, ask students to write the first line of their poem, placing themselves in their favorite place in the desert. Tell the students to add a second line, this time putting in something about the weather. In the next line, tell students to add something about an animal or a plant. Keep going, adding experiences and memories. This process might net this example:

*I am walking down a river of sand  
The air is cool on my neck  
A hungry fox sleeps in the shade of a mesquite tree,  
dreaming of rabbits and rain.*

**Some Suggestions:**

*Particular Poems Pack Power.* The best poems often make you feel like you are in a particular place at a particular moment. Remind students not to be afraid to use the names of places, people, animals, and plants. Using more spe-

cific words helps readers share your experience more vividly.

*Check the Sensory Circle.* After the first draft, ask the students whether they have checked the “sensory circle.” Can you see, hear, taste, smell, and touch the place the poet describes?

*Pencil, paper, ACTION!* Remind the students that poems do not have to be confined to the descriptive. Some of the best poems tell the story of an event, some even include dialogue. If a student does not know how to begin an action poem, try asking: It is a very hot summer day. Suddenly, it begins to rain. How would you celebrate? What would you do? Who would you be with? What would a rabbit do? A toad?

5) Share the poetry with the class. Students can read their poetry out loud, “publish” a class book of poems, or create a poetry bulletin board accompanied with their artwork.

6) Be a Contest Winner! We encourage you to submit the students’ poetry to Tucson’s River of Words Youth Poetry and Art Contest. For more info, please contact Wendy Burroughs at 877-6122 or [wburroughs@parks.co.pima.az.us](mailto:wburroughs@parks.co.pima.az.us).

### **A Word about Form**

The following explanations are adapted from *The Handbook of Poetic Forms*, Ron Padgett, Ed. The Teachers & Writers Collaborative. NY: 2000.

### **Free Verse**

Free verse is the name given to lines of poetry that are written without rules. All of the poems on the sample pages are Free Verse poems. These poems do not rhyme, nor do they have a regular beat. They are, however, filled with natural sounds and rhythms. Free Verse offers no opportunities for sloppy writing. In fact, it forces the poet to choose his or her words very carefully, and test the shape and sound of each line. One way to begin writing Free Verse is to write a paragraph about your special watery place and then break it up into lines afterwards.

### **Cinquain**

The Cinquain poem (‘sing-cane’) describes a natural place or object in five lines.

*Line 1)* Name your place/object in one word.

*Line 2)* Write two descriptive words about your object.

*Line 3)* Write three action words about your object.

*Line 4)* In four or five words, describe its relationship to the environment.

*Line 5)* Sum up your feelings about the object in one word.

example:

*Spring.  
deep, liquid  
seeps, soothes, releases,  
a gift in the desert,  
refuge.*

### **Concrete poem**

These poems use space and sound to shape the lines. Poets who use this form want to make their poems not only something to read but also something to look at. One way to write a concrete poem is to first choose a shape (rain drop, river, cloud). Draw the outline of this shape on a piece of paper. Now fill the shape with words and lines that come to you when you think about rain, or swimming, or your favorite place in the desert.

## Haiku

In Japan, people used to hold parties called “rengas” and write long poems made up of many short stanzas. The poets took turns writing about experiences or objects in nature. They used very few adjectives, preferring the power of verbs and descriptive nouns. Soon, people considered the short stanzas poems in themselves. They called them Haiku. Haiku captures the essence of a moment. To write a Haiku, write a list of thoughts about a moment in nature. Choose the strongest words that bring that moment alive. Now create three lines; the first and last lines should be a bit shorter than the middle line. Most Haikus follow a syllable pattern of 5, 7, 5. Here is a Haiku written in Spanish:

*El agua  
Floata, brilla, burbuja  
Se refleja nuestro mar*

Translation: *The water  
Floats, shines, bubbles  
Our sea is reflected*

## River of Words Sample Poems

(These poems were finalists in Tucson’s River of Words contest in previous years.)

### RIVER OF HOPE

*I am the Colorado River,  
the river that heals the  
dry throat of the desert.*

*The river that is clear and  
shiny, dark and murky.*

*I am worth gold,  
but only to those that treasure me.*

*I reflect beauty,  
but only to those that are pure hearted.*

*I have saved many,  
but only because they use me respectfully.*

*I make the sound,  
the sound that gives courage. In some parts  
of me I roar, in others  
I just merely trickle.*

*I only exist, because people have  
made a difference.*

**Gaizka Urreiztieta, age 10**  
**Harelson Elementary School**  
**Teacher: Janet Misiaszek/Peggy Martin**

### INSIDE A POEM

*Inside a poem, waterfalls are tumbling  
And storms are zapping.*

*Inside a poem, lizards are crawling  
And fires are roaring.*

*Inside a poem, mountains are growing  
And moons are slithering.*

**Galen Stewart, age 8**  
**DeGrazia Elementary School**  
**Teacher: Laura Bourguet**  
**Grand Prize Winner**  
**Category 2: Grades 3-6**

### EL AGUA EN ARIZONA

*El Agua en Arizona  
Tan necesaria  
Como la luz del sol  
Sin agua no podemos vivir  
Sin agua pura y cristalina  
Podemos Morir*

*El agua que baja  
Por las montañas  
Que corre por los arroyos  
Que corre por los rios  
Me siento tan feliz  
Donde hay agua  
Como en el lago de Monte Limon  
Que tan alto y tiene agua*

*Donde hay agua hay vida  
Tenemos agua tenemos vida*

**Roger Canchola, age 11**  
**Los Ninos Elementary**  
**Teacher: Jim Civetta**