

(post-tour) USE AND REUSE

CONCEPTS:

Students will learn:

- how much water is used per person per day
- the uses of recycled water
- ways to conserve water

Activity Overview:

Students will:

- calculate their daily use of water
- calculate water use across the state
- discuss recycled water
- plan ways they can personally conserve water

Vocabulary:

- conservation
- direct water use
- indirect water use
- water reclamation
- water recycling

Time Requirement:

- Approximately 50 minutes

Materials:

- n “River In A Concrete Box” poster
- n “Water You Use” worksheets previously filled in by students
- n “Water Recycling” Brochure
- n “Water You Can Save” worksheet
- n 2 clear containers – one with 100-ounces (12 ½ cups) of water and one empty (e.g., one-gallon water jugs)
- n 5 clear containers, each able to hold at least 22 ounces (e.g., quart or liter size bottles)
- n 1 cake pan filled with dirt
- n measuring cup

Preparation:

- n Read the “Background Information” at the end of this lesson.
- n Read the “Water Recycling” brochure
- n Make a copy for each student of the “Water You Can Save” worksheet
- n Be sure students have completed their “Water You Use” worksheets and brought them back to class
- n Label each of the 5 containers with one of the following:
 - TOILETS – 22 oz.
 - BATHING – 18 oz.
 - LAUNDRY – 12 oz.
 - DRINKING AND COOKING – 6 oz.
 - FAUCETS (dishwashing, teeth brushing, shaving) – 4 oz.
- n Label the cake pan:
 - OUTDOOR USES (watering lawns & gardens) – 38 oz.



PROCEDURES

I. CALCULATE WATER USE

(approximately 20 minutes)

A. Ask students to take out their “Water You Use” worksheets. If they haven’t already done so, tell them to figure the total number of gallons used for each activity and for the entire day. Compare their actual figures to their guesstimates and discuss the differences.

WATER YOU USE
(record for one day)

Name: _____ Date: _____

I guess that I will use _____ gallons of water.

Number of TOILET flushes	___ x	4 gallons	=	___ gallons
Number of minutes in SHOWER	___ x	4 gallons	=	___ gallons
Number of BATHS with tub full	___ x	30 gallons	=	___ gallons
Number of BATHS with tub half-full	___ x	15 gallons	=	___ gallons
Number of TEETH BRUSHINGS with water left on	___ x	4 gallons	=	___ gallons
Number of TEETH BRUSHINGS with water turned off	___ x	1/2 gallons	=	___ gallons
Number of HAND or FACE WASHINGS	___ x	2 gallons	=	___ gallons
TOTAL				___ GALLONS

Other uses of water:	Approximate number of gallons:
_____	_____
_____	_____
_____	_____
_____	_____

GRAND TOTAL FOR ONE DAY: _____ GALLONS

Amounts are approximate for Southern California.

B. Ask students what other uses of water they listed on their worksheets. Make a list on the chalkboard. Have teams of students write down how much water they think each uses and hold up their guess before you write the actual amount on the chalkboard for the following water uses.

- drinking 1/2 gallon
- washing dishes 8 - 13 gallons
- washing clothes 15 - 30 gallons
- cooking 5 - 10 gallons
- washing car 20 - 100 gallons
- water lawn 100 - 180 gallons

C. Discuss the reasons for the ranges in the amounts of water used. For example, washing dishes in a sink of water vs. letting the water run, washing a car with buckets filled with water vs. letting the hose run, watering a small yard vs. watering a large yard.

D. Based on the figures above, have students estimate the amount of water they used for each of the activities they listed. Then have them figure their grand total for one day. Discuss the results.

1. For each person, what uses the most water indoors each day?
(Flushing the toilet or perhaps bathing probably consumed the most.)

2. What uses the least amount of water indoors each day?
(For each person, brushing teeth with water off probably consumed the least.)

E. Tell students that **indoors**, each person in California uses approximately 100 gallons of water each day. Remind students that all this water goes down the drain to the wastewater treatment plant. Explain that on average, this is how the water use is divided:

Toilets	36%
Bath/Shower	28%
Laundry	20%
Faucets	13%
(e.g., drinking, cooking, brushing teeth, shaving)	
Dishwashing	3%

Point out that, on average, almost another 100 gallons of water is used per person each day outdoors.

- F. Use students’ personal use water figures to do some math exercises based on the level of the class.
 - Figure the total amount used for the class and then determine the average daily use per person.
 - Use the average daily use per person to estimate the total daily use for the entire school, for the community, for the state (approximately 35 million people).
 - Figure the number of gallons you would use in a year. In your entire life so far. By the time you are 50.

G. Point out to students that the water that each person uses individually is not all the water that is needed. Remind students of the list they made in Lesson 1 categorizing water use by sector (i.e., home, business, community, transportation, recreation, etc.). Explain that besides their **direct** use of water, they are also responsible for **indirect** water use, that is water used to generate electricity, grow food, make products.

II. DEMONSTRATE AND DISCUSS RECLAMATION / RECYCLING

(approximately 20 minutes)

- A.** Display the container with 100 ounces of water. Tell students that this water represents all the water in your community that can be used for domestic uses – which is all the uses they see labeled on the 5 containers and on the cake pan: toilets, bathing, laundry, drinking & cooking, various other uses (such as dishwashing, teeth brushing, shaving), and outdoor uses, such as watering yards. Explain that the amount listed on each container indicates the amount needed in the community for that particular use.
- B.** Have students use the measuring cup to fill each container with the appropriate amount of water. Then ask:
1. **What needed the most water?**
(*outdoor uses*)
 2. **Was there enough water for all the uses?**
(*Yes*)
- 3. For each use, what happens to the water?**
- (• *toilets, bathing, laundry, faucet uses: The water goes down the drain, into the sewer, then to the wastewater treatment plant.*)
 - (• *drinking & cooking: The water is consumed by us.*)
 - (• *outdoor uses: The water soaks into the ground or becomes runoff.*)
- C.** Have students pour the water that would go down the drain (that is, water from containers labeled “toilet, bathing, laundry, and faucets”) into the empty container. Have someone drink the water in the container labeled “drinking & cooking” (if you are sure that the water and the containers are clean).
- D.** Ask students to imagine that next year there’s a drought and that your community’s total supply of water for domestic uses is now only $\frac{3}{4}$ of what it was the year before. Refill the first container with 75 ounces of water. (**Note:** *If instead of a drought, the population increased, the original supply might stay the same – 100 ounces – but the amount needed for each of the uses shown on the containers would increase. The resulting effect would be the same.*)

WATER SUPPLY 100 OZ.



**TOILETS
22 OZ.**



**BATHING
18 OZ.**



**LAUNDRY
12 OZ.**



**DRINKING &
COOKING
6 OZ.**



**FAUCETS
4 OZ.**



**OUTDOOR USES
38 OZ.**



E. Have students again measure out the water needed for each of the uses into the appropriate containers, starting with the indoor uses. When the water supply is gone, ask students:

1. **Was there enough for all the uses?**

(No. There wasn't enough water for the outdoor uses.)

2. **How could the supply be extended to have enough?**

(Water that went down the drain to the wastewater treatment plant could be reclaimed and recycled to water lawns. Also, less water could perhaps be used for some of the other uses.)

3. **Is there enough water in the wastewater container to meet the outdoor needs?**

(Yes, with still some left over.)

4. **What are some uses approved for reclaimed water?**

(Reclaimed water can be recycled by using it to:

- irrigate crops
- water lawns
- wash cars in car washes
- fight fires
- cool equipment in factories
- clean streets
- flush toilets
- make snow
- refill groundwater basins that have had water pumped out)

5. **Do you recycle anything?**

(Most students probably do recycle items – either at home or at school. Typical items include aluminum cans, plastic bottles, glass jars and bottles, newspapers, and white paper. But students may also think of “reuse” as a form of recycling since it keeps the product in the cycle of use instead of in the trash. They may reuse margarine tubs, shoe boxes, plastic bags, clothing items.)

6. **Do you recycle any water at home?**

(Leftover drinking water might be used to water plants or fill pet dishes. Most water is not recycled in homes, although a few homes do have “graywater” systems in which water from sinks and showers – not from toilets – goes into a separate graywater tank, instead of the main sewer. This graywater can then be used to water lawns and gardens.)

7. **Why is it important to recycle water reclaimed at the wastewater treatment plant?**

(The population in California is continuing to grow and our supply of water is limited. In Southern California, to have enough water for all the people, we must import water – transport it through aqueducts from Northern California and from the Colorado River. Recycling water can help expand our supply of usable water.)

F. Have students find places on the “River In A Concrete Box” poster where recycled water is being used.

- to make paper at the Recycled Paper Co.
- to water greenbelt, golf course, farmland, schoolyard, park
- to make snow

G. Ask students if they see recycled water being used in their community. Explain that they will usually see signs that say something like “Reclaimed Water – Do not drink,” and they may see purple pipes, which indicate that reclaimed water is being used. Remind students that nature recycles water, too, through the water cycle.



III. PLAN WAYS TO CONSERVE WATER

(approximately 10 minutes)

- A.** Ask students if they think their use of water can make any difference. Use the following example to point out the effect that conservation of water by each person every day can make:

If everyone in California (35 million people) brushed their teeth twice a day...

- with the water left on —
8 gallons X 35 million = 280 million gallons
- with the water turned off —
1 gallon X 35 million = 35 million gallons

Turning the water off uses 245 million fewer gallons a day!

- B.** Ask students why using less water is important.
- (• *Using less water can help California have enough water for all the people that need it.*
 - *Using less water means importing less water into Southern California, which means using less energy to pump the water along aqueducts and into homes. And using less energy helps reduce air pollution.*
 - *Using less water reduces the amount of water that must be cleaned. That means using less energy and not having to build more wastewater treatment plants.)*

- C.** Have students look at their “Water You Use” worksheets. Ask them how they might be able to use less water.

WATER YOU USE	
(record for one day)	
Name: _____	Date: _____
I guess that I will use _____ gallons of water.	
Number of TOILET flushes _____ x	4 gallons = _____ gallons
Number of minutes in SHOWER _____ x	4 gallons = _____ gallons
Number of BATHS with tub full _____ x	30 gallons = _____ gallons
Number of BATHS with tub half-full _____ x	15 gallons = _____ gallons
Number of TEETH BRUSHINGS with water left on _____ x	4 gallons = _____ gallons
Number of TEETH BRUSHINGS with water turned off _____ x	1/2 gallons = _____ gallons
Number of HAND or FACE WASHINGS _____ x	2 gallons = _____ gallons
TOTAL _____ GALLONS	
Other uses of water: _____	Approximate number of gallons: _____
_____	_____
_____	_____
_____	_____
_____	_____
GRAND TOTAL FOR ONE DAY: _____ GALLONS	
Amounts are approximate for Southern California.	

- D.** Hand out a copy of the “Water You Can Save” worksheet to each student. Explain to students that they are going to make a plan to conserve water. Have students list changes they can make in the way they typically use water in order to use less water. Encourage students to think beyond just what they listed on their worksheet for that one day; for example, if they sometimes run the clothes washer for just one pair of jeans, they could wait until a full load needs to be washed. Remind students that they need to be practical (that is, they need to brush their teeth and wash their hands) and that “conservation” means using water wisely by not *wasting* it.

WATER YOU CAN SAVE		
Name: _____		Date: _____
Instead of:	I can:	I would save:
<small>Example:</small> Take a full bath - 30 gallons	Take a half bath - 15 gallons	15 gallons
Total Gallons Saved _____		

- E.** Ask some students to share what they listed on their plans. Ask all students how many gallons they could save and add up the total number of gallons saved for the class.

EXTENSIONS

- **Resurvey students** to see if they are following their conservation plans. After about a month, give each student another copy of the “Water You Use” worksheet to fill out. Compare this worksheet to their original ones. Are they using less water? Are they following their plans? If not, why not? Do they need to make new water conservation plans?
- **Develop a family conservation plan.** If students surveyed their family water uses, have them determine where water is being wasted and how water can be conserved. Have students develop family conservation plans that can be sent home.
- **Graph water uses.** From students’ “Water You Use” worksheets, have them determine average uses and create a class graph.
- **Research conservation products and report on water savings.** Find out what products have been designed to save water (e.g., low-flow shower-heads, aerators) and determine an average cost per product. Calculate how much water is saved and how long the product will take to pay for itself.
- **Investigate indirect uses of water.** Besides using water directly, each of us also uses water indirectly; that is, water is needed to grow the food we eat, to manufacture the clothes we wear, to irrigate the parks we play in, and to generate the electricity we use. Have students investigate how much water is needed for such indirect water uses as generating electricity, growing wheat to make bread, manufacturing a car, raising a cow, cleaning streets.
(See <http://ga.water.usgs.gov/edu/wateruse.html>)
- **Investigate droughts in California.** What defines a drought? When was the last one in California? What’s the history of droughts in California? How long do they last? What effects do they have on people, on the environment, on the economy?
- **Research and design a graywater reclamation system.** Find out what regulations must be followed, what problems might exist, what the guidelines are for using graywater, how various designs work. Have the class work in teams to design a system for a new home that is being built. Be sure they keep in mind not only the construction but also the use on a year-round basis. Have advanced students do a cost-benefit analysis.
- **Design a new wastewater treatment facility.** Ask students to imagine that their community needs a new wastewater treatment plant. Have the class work in teams to design a wastewater collection system and treatment facility. How large will it be? How will the water be treated? How will population growth affect the plant? How much recycled water will be used? Where will it be used?
- **Research the economics of recycling water.** Compare using recycled water to using imported water. What are differences in cost? What are the advantages and disadvantages of each? Compare using recycled water to using other forms of water, e.g., stored reservoir water, groundwater.

BACKGROUND INFORMATION

Southern California is a semi-arid desert. That means that it doesn't rain a lot. However, a lot of people live and work in Southern California. To meet the water needs of all these people, about $\frac{2}{3}$ of our water supply is imported from three areas:

- from the Colorado River through the Colorado River Aqueduct
- from Northern California through the State Water Project
- from the Eastern Sierras through the Los Angeles Aqueduct

This water has met the demand thus far; however, the population is increasing. Officials estimate that each year almost 2 million more people will live in Southern California. And as the population grows, so will the demand for water. Our supply from other areas is not always certain, and droughts are unpredictable, so how can we be sure to meet the demand for water in the future? Two primary options are recycling water and conserving water. By using – and reusing – water wisely and efficiently, we can stretch Southern California's water supply.

Recycling

After tertiary treatment at the wastewater treatment plant, water can be recycled – that means it can be reused without first going back into the environment. Recycled water can be used for all purposes except drinking:

- to water school grounds, cemeteries, golf courses, nurseries, parks, greenbelts
- to irrigate crops and pastures
- to make snow, fight fires, cool machinery, clean streets
- to flush toilets
- to recharge groundwater

For public health protection, reclaimed water is delivered through a distribution system that is separate from the system delivering potable water. The reclaimed water system is labeled and the pipes are usually purple. The need for separate pipes, pumps, and storage reservoirs can make recycled water expensive; however, as more facilities are built and more recycled water is used, the cost will decrease.

By 2020, state officials say that water recycling programs could provide an additional one million acre-feet of water annually. (*One acre-foot is 326,000 gallons, or an area about the size of a football field covered with one foot of water.*)

Conservation

Scientists estimate that 30-50% of the water supply used in the U.S. is wasted. Leaky pipes and faucets alone can waste up to 30% of the nation's water. Conserving water does not mean doing without water; it means using water efficiently. For example, using a low-flush toilet can cut water usage up to 75 percent. And since toilet flushing is the largest domestic water use, that would save a lot of water!

Water can be conserved in all sectors of society. Farms can capture and reuse irrigation runoff; industries can clean and reuse the water needed to make products; and individuals can practice many water-conserving habits, such as:

- turning off water when brushing teeth or shaving
- filling the sink instead of running water to wash dishes
- taking shorter showers
- washing only full loads in washing machines and dishwashers
- sweeping instead of hosing patios
- using a shut-off nozzle on hose when washing a car

The list goes on and on. Along with simple daily habits, appliances can also help us conserve water. Besides low-flush toilets, we can save water by installing low-flow showerheads, water-efficient dishwashers and washing machines, and faucet aerators, to name a few.

Conserving water is not only important to help us stretch our supply, it is also important economically and environmentally.

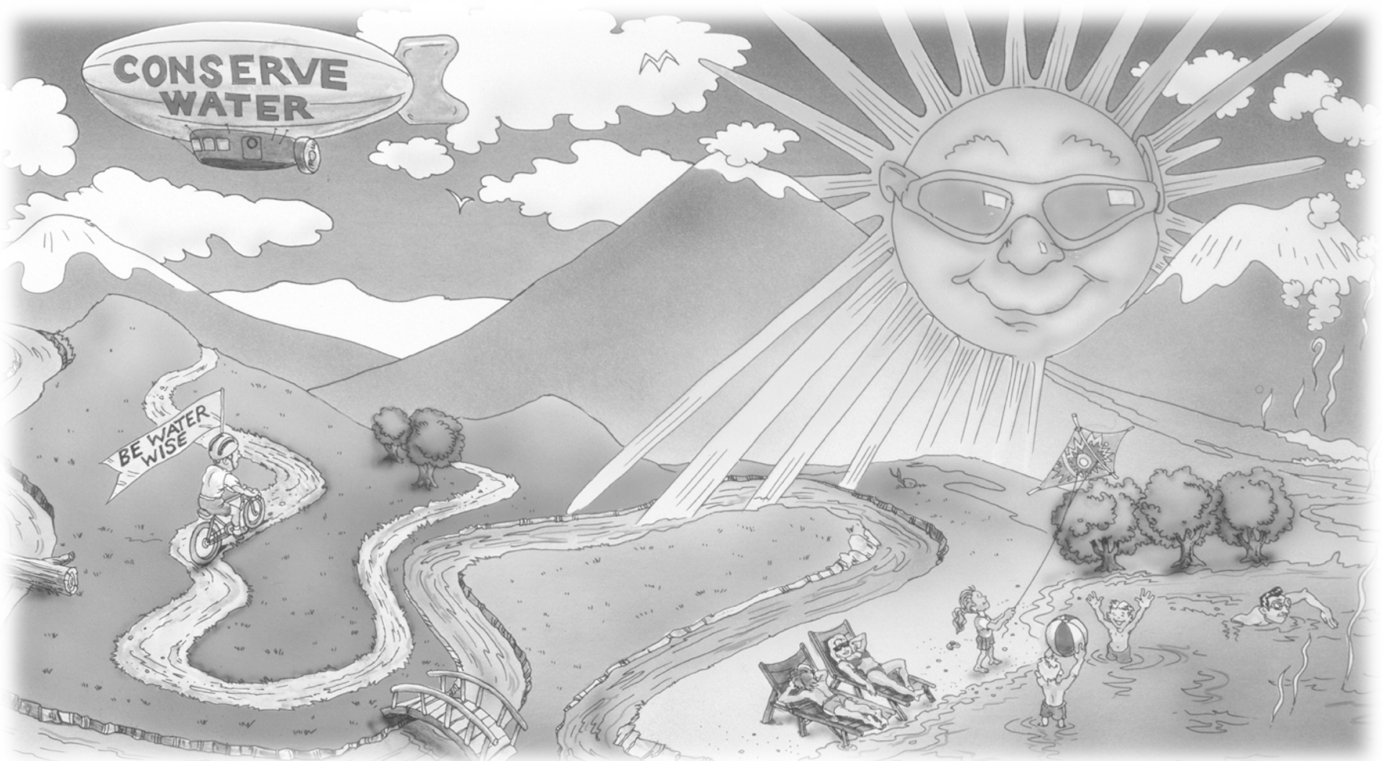
Environmentally, when we use less water:

- more water can stay in the natural environment
- less wastewater is created
- less land is disrupted by water transport and distribution systems.

Economically, water saved (or not wasted) means:

- water does not have to be purchased
- fewer drinking-water treatment plants have to be built
- less wastewater has to be cleaned.

Conserving water just makes sense – environmentally, economically, and ethically.



WATER YOU CAN SAVE

Name: _____ Date : _____

Instead of:

I can:

I would save:

Example:

Take a full bath -30 gallons

Take a half bath - 15 gallons

15 gallons

Total Gallons Saved
