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Thank you for your interest in Central San's Water Wizards Classroom Education Program. The Central Contra Costa Sanitary District (Central San) has partnered with the Gardens at Heather Farm to provide this free program to third, fourth and fifth grade students in central Contra Costa County.* This program takes one hour of class time to complete, but please plan for pre-visit preparation and post-visit evaluation.

We look forward to helping you teach your students about the importance of protecting our water environment. This resource guide will provide an overview of preparing for the program as well as pre- and post-visit material to make this a fun and meaningful learning experience for your students.

** Alamo, Clayton, Clyde, Concord, Danville, Lafayette, Martinez, Moraga, Orinda, Pacheco, Pleasant Hill, San Ramon, Walnut Creek and unincorporated areas of central Contra Costa County*

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*The care of
rivers is not a
matter of rivers
but a matter
of the human
heart*

TANAKA SHOZO

PROGRAM OVERVIEW

The Water Wizards program was developed to provide you and your students with a basic water education program, with an emphasis on preventing water pollution. The program is designed to correlate with the California State Science Content Standards for grades 3 to 5. In addition to addressing key community water issues, the Water Wizards Program includes background on California history and Bay Area geography.

Here are some suggestions for how to prepare your students for the Water Wizards program, and what you can expect when the program comes to your classroom.

GOALS AND OBJECTIVES

This program will help students to:

- Learn the steps of the water cycle and the physical states of water.
- Develop an appreciation for the importance of water as a limited resource and our dependence on clean water.
- Discover the path of wastewater that flows through household drains and storm drains and how our daily activities affect water quality.
- Understand the role of the wastewater treatment plant and how water is cleaned.
- Identify some household products that can pollute water.
- Understand problems relating to water use, and what they can do to prevent water pollution.
- Gain confidence in their ability to positively affect water quality.

TEACHER PREPARATION

1. Please reserve a TV/Video player for the day of the presentation. We will be showing a short video to your students while the presenter sets up the display materials.
2. Have students fill out the pre-visit "Water Wizard's Challenge." We will pick these up on the day of the presentation.
3. Browse through the information in the 'Background Info' section of this guide. This will introduce you to Central San and will also help you to understand how wastewater gets treated and how the study of wastewater treatment ties into your science curriculum.

STUDENT PRE-VISIT ACTIVITIES

1. Let students know that a "Water Wizard" will be coming to their classroom. Pique their interest with some 'water' questions: Do you know what happens to the dirty water you use every day? What is something you use every day that is plentiful but rare at the same time? Do you know how to make pollution "disappear?"

2. Introduce some of the games and activities included with this resource guide.
3. Optional: Review 'glossary words' with students or use them as a vocabulary activity.

CLASSROOM PRESENTATION

1. Our Water Wizard will need about 10 minutes to set up for the class. During this time we will show a video to the students to take them on a wild ride through Central San's treatment plant.
2. Activities for each presentation will vary with the grade level. Demonstrations or hands-on activities will include:
 - The importance of water and the water cycle.
 - The flow of water from our homes to the Bay.
 - How wastewater is treated at Central San.
 - What we can do to prevent water pollution.

POST-VISIT

1. Review with students the "Drain Detectives" take home activity to be completed with parents/guardians.
2. Your presenter will leave you with an evaluation form and copies of a post-visit "Water Wizard's Challenge" for students. Please complete the evaluation and mail it along with the challenges to the Gardens at Heather Farm in the envelope provided.
3. Follow-up the program with some of the activities in this resource guide. These activities provide reinforcement and extension of the concepts covered during the program as well as an assessment tool for you.

SCIENCE CONTENT STANDARDS

Here are some of the State Science Content Standards covered during this presentation:

Grade 3: 1a, 1e, 1f, 1h, 3c, 3d

Grade 4: 2b, 2c, 2d, 3a, 3d, 3e, 5c

Grade 5: 1b, 1d, 3a, 3b, 3c, 3d, 3e, 4b



*The frog does
not drink up the
pond in which
it lives*

INDIAN PROVERB

TREAT IT RIGHT!

An Introduction to Water Pollution Issues

*If there is magic on this planet,
then it is contained in water.*

LOREN EISLEY

Water is the most common substance on Earth. We tend to think we have a limitless supply, but water is actually a really fragile resource. Although almost three-quarters of the planet is covered with water, very little of this water is fresh water available to living things. About 97% of the earth's water is salt water. Of the 3% that is fresh water, 2% is frozen in polar ice caps or glaciers, or is otherwise inaccessible. That means only 1% of our water is accessible to people and wildlife!

Water makes life possible on earth. Our bodies are almost three-quarters water – we don't just use water, we are water. We depend on it for drinking, cleaning, growing and processing food, industry, transportation, energy and recreation. It's almost impossible to think of something we do that doesn't involve water. It connects us to the natural world, and to the plants and animals that share this precious resource with us.

All the water we will ever have is here on Earth right now. We can't change the quantity of water we have, but through our everyday actions we can change the quality of our water.

WE ALL LIVE DOWNSTREAM

Watersheds have major impact on the water cycle and the way water can become polluted. Basically, a watershed is an area of land that drains its run-off water into a particular creek, stream or other body of water. The water we use in our houses, and the water we wash down storm drains eventually winds up in the Bay. Everything we do with our water - gardening, washing cars, cleaning house, construction, recreation - affects the people, plants, and animals that live in other parts of our watershed.

The chemicals we use in cleaners, paint and pesticides, and the oil and gasoline we use in cars all have the potential to cause serious damage to the wildlife that lives in our local waterways and the Bay. Since all the wastewater that goes down our household drains is treated, many people believe that it's okay to pour household hazardous waste into their sinks or flush these products down the toilet. Unfortunately, treatment plants are designed to remove solids and organics, and are not equipped to remove all toxics and heavy metals from the wastewater. The best solution to pollution is to keep it out of our water in the first place! Keeping pollutants out of the water is the least expensive and most reliable way to avoid this problem. As a result, Central San has become actively involved in educating the public about pollution prevention.

DOWN THE DRAIN – WHERE DOES YOUR WATER GO?

SEWAGE TREATMENT PLANT

Water that is used and flushed down drains in homes and businesses is called raw sewage or wastewater. Most wastewater in Central Contra Costa County is collected in underground pipes and transported to Central San for processing and treatment. If you could look beneath your feet you would see over 1500 miles of pipes ranging in size from 6 inches to 102 inches! Most of this pipeline is sloped downward to allow the wastewater to flow by the force of gravity. But it also takes more than 20 underground pumping stations to move the water over hills. This system transports up to 45 million gallons of wastewater per day.

STORM DRAINS

Storm drains are found along the sides of streets near curbs. They collect water from rainfall and runoff to prevent flooding. All the water that runs into the storm drains empties directly into creeks, streams, marshes and eventually the Bay. Any toxic materials that enter storm drains will enter our waterways untreated. Pesticides from lawns and gardens, oil leaked from cars, pet droppings and detergents can all be washed into storm drains. Nature has no chance to filter out and change these harmful substances before they reach the plants and animals that depend on the water.

POLLUTION PATHWAYS: SOURCES OF POLLUTION

POINT SOURCE POLLUTION

When we can trace the cause of pollution back to one definite source, it is called point source pollution. Because the source can be traced back to one pipe or outlet, this type of pollution is easier to locate and control.

NON-POINT SOURCE POLLUTION

When pollution comes from a combination of many different places, we call it non-point source pollution. Agricultural land, urban and suburban lands, roadways and parking lots are considered non-point sources of pollution because they may discharge pesticides, asbestos, fertilizer, heavy metals, salt, oil, grease and even air pollution that is washed out of the air as acid rain. Non-point source pollution is much more difficult to control than point source pollution and this is where most of our water pollution is coming from.

HOUSEHOLD HAZARDOUS WASTE

A growing source of non-point source pollution that is having a great impact on sewage treatment plants is toxic substances that are flushed down toilets and drains from our homes. The chemicals in products like cleaners, paints and pesticides cannot be removed at the treatment plant, and can impact the microorganisms used to treat wastewater and may end up in our waterways.

TROUBLED WATERS: TYPES OF WATER POLLUTION

The toxics that enter our wastewater and storm drains can be harmful to both people and wildlife. Some of these substances can become concentrated in the food chain and can eventually cause illness in people who eat contaminated plants or animals. Here are some pollutants that can cause problems:

BIODEGRADABLE WASTES

Human and pet wastes, food scraps and other types of organic materials can cause water pollution by introducing excessive nutrients. Bacteria eating the nutrients multiply too rapidly, using up the oxygen in the water so that aquatic life cannot survive. Some of this waste can also spread disease-carrying microorganisms.

CHEMICAL POLLUTANTS

Many of the products we use every day contain substances that are poisonous or harmful to people and wildlife. Heavy metals from cars, dust from brake pads, and chemicals in paints, pesticides and cleaners can poison wildlife, interfere with reproduction and accumulate to toxic levels in living tissue. Fertilizers and detergents add nutrients and phosphates to the water, which encourages algae to grow. As the algae dies and decomposes, it uses up the oxygen needed by aquatic life. Oil that enters the water has a devastating effect on wildlife – it can contaminate their prey, act as a poison, keep oxygen from entering the water, and coat fur and feathers so animals lose the ability to stay warm and dry. Just one quart of oil can contaminate 250,000 gallons of water.

ACID RAIN

Some airborne toxins are picked up in the atmosphere by rain and end up in our surface water. This polluted water can kill aquatic life by changing the pH of the water, by interfering with reproduction, and by building up in tissues and causing disease.

SEDIMENTS

Dirt and silt that is picked up by rain and runoff can enter our waterways through storm drains where it can block sunlight from aquatic plants, clog the gills of fish, and smother bottom-dwelling organisms.

GO WITH THE FLOW: HOW CENTRAL SAN CLEANS OUR WATER

It wasn't that long ago that people simply dumped their wastewater back into rivers and lakes. According to the World Health Organization, less than 20% of the world's population today has running water or a sanitary sewer system! We sometimes take for granted the essential role played by water treatment plants.

There are four basic steps to treating wastewater: primary treatment, secondary treatment, disinfection, and advanced or tertiary treatment.

PRIMARY TREATMENT

Primary treatment relies mainly on mechanical processes to clean water. As wastewater enters the plant it passes through a bar screen where large objects, like rags and pieces of wood, are removed and ground up. The wastewater moves to pre-aeration tanks and air is added to help particles settle to the bottom where they are removed. Then the wastewater flows to sedimentation tanks where solids, like sand, grit and dirt, sink to the bottom of the tanks and lighter materials, such as paper and grease, float to the top. These materials are removed from the water using skimming devices. The solid materials, called sludge, are incinerated. An amazing 30,000 – 40,000 pounds of sludge are incinerated each day. Once incinerated, the sterile ash is used as a nitrogen-based fertilizer and a foundation material for landfills.

SECONDARY TREATMENT

Secondary treatment uses a naturally occurring biological process to clean the water. Wastewater is pumped to tanks where microorganisms (tiny animals and bacteria) remove suspended material by breaking down and consuming the organic waste particles. Oxygen is added to the water and is used by the microorganisms to grow and multiply as they eat. As these "good" bugs consume the waste particles, they become heavy, sink to the bottom of the tanks and are removed through another settling process, called clarification. Some of the bugs (called waste-activated sludge) are returned to the tanks to restart the process, while the majority are incinerated.

DISINFECTION

Central San uses a state-of-the-art ultraviolet light system to disinfect the water. UV light bulbs, resembling fluorescent lamps used at home, are strategically positioned in wastewater tanks. When treated wastewater makes contact with ultraviolet light waves, the UV radiation attacks the DNA in the microorganisms, to prevent them from reproducing and they quickly die. Most of the treated and disinfected water is discharged into Suisun Bay, while the rest undergoes advanced treatment. Before treated wastewater is released, it is tested in Central San's lab to make sure it will not harm local marine life.

ADVANCED TREATMENT

Some of the treated wastewater undergoes additional filtration. This "recycled" water can be used for irrigating parks and golf courses or as industrial coolant.

THE SOLUTION TO POLLUTION

The everyday activities of each person can contribute to water pollution. But we can all be part of the solution to the problem. Even making simple changes in the way we use water can have a big impact on improving water quality for ourselves and for future generations.

Here are some tips for ways to reduce pollution and conserve water:

- Keep your car in good repair and leak-free. Recycle oil or take it to a hazardous waste disposal site. Don't pour it into household drains or storm drains.
- Use water-based paint and take leftover paint to the Household Hazardous Waste Collection Facility.
- Use non-toxic, phosphate-free cleaners and soaps.
- Reduce or eliminate your use of toxic pesticides. Use natural pesticides made from soaps or oils and choose plants that attract beneficial insects. Take any leftover pesticides to the Household Hazardous Waste Collection Facility – never pour them down the drain.
- Fertilize with organic fertilizers that release slowly over time.
- Water plants only when they need it, and use a mulch to conserve water and keep soil from washing into storm drains.
- Wash cars at a commercial car wash, or use a phosphate-free soap and park the car on grass so that it filters out the soap. Use a bucket, not a running hose, to save water.
- Clean your driveway with a broom, not running water.
- Use up hazardous products, give them to someone who can use them, or take leftover products to the Household Hazardous Waste Collection Facility.



*We call upon the waters
that run the Earth
Horizon to Horizon that
flow in our rivers and
streams
That fall upon our
gardens and fields
And we ask that they
teach us
And show us the way.*

CHINOOK INDIAN BLESSING

AWAY ON THE BAY

Overview

Students will learn about some of the ways people pollute water and the effects of water pollution. Then they create an illustrated book to share with younger grades.

Time: one to two hours

Materials:

- copies of “Away on the Bay” story
- drawing paper
- crayons, markers, or colored pencils
- scissors, glue, stapler

Setting: classroom

Background

When most people in the U.S. rinse something down their drain, flush their toilet, or do a load of laundry, the wastewater goes to sewage treatment plants to be purified. These plants remove dirt, biodegradable material such as food waste, and many other pollutants from the water before the water is dumped into waterways. They also treat the water to kill harmful bacteria and viruses. But most plants can't remove all the chemical pollutants. For example, chemicals that are used in paint thinners and phosphates that are used in many detergents pass right through some sewage treatment plants.

Pollutants can also enter our waterways through run-off. Oil, dirt, litter and anything else that's on the street washes into storm drains. In most parts of the Bay Area, these drains empty into creeks and streams and eventually into the Bay.

Factories that make chemicals, paper, medicines, and many other products can create a lot of pollutants. Pollution-control laws have greatly reduced water pollution, but not all types of industrial waste are regulated. Some experts feel that these regulations are not strict enough to protect aquatic systems.

When trash is blown into the Bay or gets thrown overboard from boats, it can create an ugly mess both in the water and on shore after it's washed up. Trash can also harm or even kill wildlife. For example, thousands of sea birds and marine mammals die each year after eating or becoming entangled in plastic debris floating in the ocean.

By listening to a rhyming story about water pollution in one community, your students can discover how pollution can affect waterways. They'll also discover that the waste we wash “away” can have harmful effects later on.

Activity

1. Before reading the story, ask students to name some of the ways they use water (for drinking, bathing, brushing teeth, cleaning clothes and dishes, and so on). Ask them what happens to the water that drains out of their washing machines and dishwashers or washes down their sinks. (This water goes to the sewage treatment plant.) Explain that many people never think about what happens to the water they use in their households each day. They also don't think about what happens to the water that runs off their streets and yards.
2. Explain to students that you're going to read them a story about a town called "Away" and about how people in the town polluted the water in a nearby bay without realizing what was happening. (Or pass out copies of the story and have students read it aloud.) Ask them to listen carefully to the story to find out just how the water in the Bay became polluted. Also, tell them to listen for the word "away." Each time they hear it they should make a "hitchhiking" motion over their shoulder with their thumb to represent something going away.
3. After you read the story, discuss it with your students. Ask them if waste from Away simply disappeared. What happened to the waste? (It ended up in the Bay.) Then go over the verses in the first half of the story to be sure they understood what was happening in each one.
4. Pass out copies of the story, crayons or markers and drawing paper, and have the kids draw pictures of the story. They might draw the people in the town, the Bay when it was polluted or the Bay when it was cleaned up again. Or you might want to create a classroom book of the story that students can share with younger grades. Students can illustrate a couple of lines or a verse from the story, and then glue their pictures onto sheets of construction paper along with the words of the verse. Pages can be stapled together to create a book.

Discussion

1. What is pollution? List some examples.
2. How do we each contribute to pollution?
3. What are some things we can do to help reduce pollution?
4. How does pollution affect living things and the environment?



This activity was adapted, with permission, from: "Away with Waste," **Ranger Rick's NatureScope Pollution Problems and Solutions**, National Wildlife Federation, McGraw-Hill, 1989.

Away on the Bay

This is the tale of a town called Away-
A town that was built on the shore of a bay
A town where the folks didn't think much about
What they dumped in their water day in and day
out

For one thing, a sink was an excellent place
To get rid of messes and not leave a trace.
Cleansers and cleaners and yesterday's lunch
Went **away** down the drain with a gurgly crunch.

At everyone's house there was laundry to do.
Day after day, how those laundry piles grew!
Load after load was washed, rinsed and spun
And **away** went the water when each load was
done.

On Main Street each day there were sidewalks to
sweep.
The litter and dirt were swept into the street.
And then when it rained, everything washed **away**
Into drains in the roads that dumped into the bay.

A mill there made "stuff" for the town folks to use,
But a pipe from the mill churned out oodles of
ooze.
And the ooze, well it goosed from the pipe to the
bay
Where it bubbled and glubbed as it drifted **away**.

When the weather was warm it was always a treat
To sail on the bay and bring picnics to eat.
But when folks were finished, they'd toss all their
trash
Overboard and **away** with a plop and a splash.

Then the folks started seeing that things weren't
quite right;
The bay had become an unbearable sight.
Beaches were covered with garbage and glop
That rolled in with the waves, and the waves didn't
stop.

The fish in the bay all seemed sluggish and sick,
The algae was everywhere – slimy and thick.
The birds near Away were all suffering too,
'Cause the fish they were eating were covered with
goo.

So a meeting was called to discuss the sick bay
And the townspeople came from all parts of
Away.

And during the meeting one person proclaimed,
"I know who's at fault: We all should be blamed."

"For years we've washed chemicals, dirt and debris
Down our sinks, off our streets, and out pipes – so
you see,
Although we all thought that our waste went
away,
It all ended up going into the bay."

"Now the bay is a mess – full of trash, soap and
goop,
The water's turned green – like a bowl of pea
soup.
And our wildlife is sick from the garbage and
grime;
The bay needs our help, right now while there's
time."

The folks were all silent - they knew it was true.
And they realized now what they all had to do.
It was time to get busy - the bay couldn't wait.
If they didn't act now, it might soon be too late.

So they signed an agreement that very same min-
ute
To care for the bay and to stop putting in it
The stuff that had made the bay icky and ill,
Like soaps that pollute and the ooze from the mill.

They also agreed to stop dumping their trash
Overboard and **away** with a plop and a splash.
And all of their efforts have been a success:
Today the bay's clean and no longer a mess.

And that is the tale of the town called Away-
A town where the people, to this very day,
Remember a saying that's simple and plain:
Nothing just goes **away** when it's washed down
the drain.

THE DOWN THE DRAIN GAME

Overview

Students play a game that illustrates how toxic substances enter our sewer system, and how our everyday actions can have an impact on the quality of water.

Time: one hour

Materials:

- Clean, empty containers from a variety of household products (toothpaste, shampoo, toilet tissue, detergents and cleansers, floor wax, cooking oil, motor oil, paint – anything that might end up down a drain.)
- Large box or container to represent a sink

Setting: classroom

Background

The water that goes down the drains in our household sinks is piped to the wastewater treatment plant and cleaned before it is released into the Bay. However, some of the household products we pour down our drains contain toxic substances that cannot be removed at the treatment plant, and these substances can have a harmful effect on aquatic life. This game will give students an idea of how many things people add to our wastewater every day, and how we can help to prevent this pollution.

Activity

1. Have students make a list of some of the ways they have used water in the last week. Where did the water go when they were done? Did they add anything to the water?
2. Have students make a circle, then pass out a household product to each student. To start, give one student the “sink”. Have them hold up their product, tell how they used it, and what was added to the water that went down the drain. For example: “I brushed my teeth and added toothpaste to the water.” Place the toothpaste container in the sink, and then pass the sink to the next person.
3. By the end, your sink will be full of containers illustrating how many different types of things might enter the sewer system from just one home! Can they think of anything else that might go down the drain?
4. Once the sink is full, remove each item and have students categorize them – which ones might be most harmful to wildlife and plants, which might be least harmful? Which ones can safely go down the drain? Which ones should never go down the drain?

5. Go through each item and have students make suggestions for how to dispose of things that shouldn't go down the drain. (For example, food wastes can be composted, paints and oil can go to the Household Hazardous Waste Collection Facility, etc.)
6. As a follow-up, have students come up with some ideas for educating others about what should go down the drain. Design posters, bumper stickers or slogans to share what you have learned.

Discussion

1. How many of these items do their families use around the house?
2. What would happen if these same products were poured or washed down a storm drain?
3. How can students help to teach their families about how to dispose of toxic substances?

Extension

Have students come up with some ideas for educating others about what should go down the drain. Design posters, bumper stickers or slogans to share what you have learned. Here are some examples of slogans written by kids:

- "If you waste water you're a fool, because water is as precious as a jewel." Leah H., Grade 2, O'Neill Elementary
- "Don't waste water or we're all sunk!" Sean B., Grade 4, Travis Ranch Elementary

UPSTREAM, DOWNSTREAM: CREATING A MINI-WATERSHED

Overview

Students create a miniature watershed model out of paper to demonstrate how water flows through our environment and the impact our actions can have on the quality of water far beyond our homes.

Time: one hour

Materials:

- 8 1/2" x 11" paper; one piece of paper for each student or team of students (you can recycle papers the students no longer need or cut up old grocery bags)
- Water soluble markers – at least 3 different colors
- Red water soluble markers (or flavored Jello powder) to use as pollution.
- Spray bottles of water

Setting: classroom or outdoors

Background

A watershed is a geographic area in which water, sediments and dissolved minerals all drain into a common body of water like a stream, creek, reservoir or bay. A watershed includes all the plants, animals and people that live in it, as well as the non-living components like rocks and soil. We are all part of a watershed, and everything we do can affect the surface and ground water that runs through this system. When you create your miniature watersheds, be sure to use water-soluble markers. As the markers bleed, they demonstrate how rain moving through the watershed affects soil erosion and carries pollution to the Bay.

Activity

1. Write the following sentence on the board: "We all live downstream." Have students discuss what this means. Explain that they will be doing an activity to show how we are all connected by the water in our watershed.
2. To create a watershed, have each student (or team of students) crumple a piece of paper up into a tight ball. Carefully open up the paper, but don't flatten it out. The highest points on the paper now represent mountain peaks, and the lowest wrinkles represent valleys.

3. Choose one color of marker and use it to mark the highest points on the map. These points are ridge lines of the mountains.
4. Choose a different color of marker and use it to mark places where bodies of water might be found, such as creeks, streams, and lakes.
5. Choose another color marker and mark three or four places where there might be buildings, such as houses, shopping centers, factories, schools, office buildings, skate parks.
6. Have students cover their desks with newspaper, or take the watersheds outside and lay them on grass. Using spray bottles, have students “rain” on their watershed models by lightly spraying water. What do they observe about the way water travels through a watershed?
7. As an option, have students use a red marker to add some “pollution” somewhere in their watershed (or lightly sprinkle some jello powder in one place on the watershed model). Then spray lightly again. Where did the pollution go? How much impact did it have on the rest of the watershed?

Discussion

1. Where did most of the rainfall go? Where did the water end up?
2. Did you notice any problems with erosion? What happened to the buildings or human settlements you added? How does the flow of the watershed impact where we put our buildings?
3. If we pollute the water in one place, does it have an impact on water in other areas of the watershed?

Follow-up

Have students imagine that they are a drop of water that has fallen on the watershed. Have them write a story about their trip through the watershed.

PASS THE JUG

Overview

Students take part in a simulation game to understand the history of water use in California, the ways water can become polluted, and the importance of protecting this shared, limited resource.

Time: one or two hour session

Materials:

- One paper cup or glass per student
- One water jug that holds 1 gallon of water
- Copies of the Water Users descriptions, cut into strips
- A funnel for pouring water back into the jug

Setting: classroom

Background

Living in California we can never take for granted what a precious resource fresh, clean water is. The way we divide up the freshwater that is available to us is a complicated process. One problem is that, most of the rainfall occurs in the northern part of the state, but the greatest demand for water is in the southern part of the state. This situation is made even more difficult because we never know how much rainfall we will have, or when we will experience a drought.

Being one of the most populous states in the nation, there are a lot of demands on our water. Farmers need water to produce food, cities need water for people's everyday lives, transportation, industry and energy production, and wildlife needs water to survive. Currently in California, agriculture uses 8 out of every 10 gallons of water!

Water rights allow a person, business, community or other group to use a specified amount of water. People receive only the right to use the water, they do not own the water. The water use laws in California came out of the needs of the settlers that came here during the Gold Rush. Miners used tremendous amounts of water for hydraulic mining – high pressure hoses that blasted rock out of the Sierra Nevada mountains. In order to insure that the first miners were given precedence over later miner's water claims, California instituted a "first in time, first in right" system of allocating water. This Prior Appropriation Doctrine allocates water based on who used the water first and so has the oldest claim. Even though agriculture has replaced mining in economic importance, this system still shapes our water decisions today.

Activity

Part 1:

1. Ask kids to imagine they have a bag of candy and six friends who want some. How will they divide it up? Will they give everyone an equal amount, will they give some to the first person who asks, or will they give their best friend more?
2. Arrange students' seats in a row (or around a table) and give each student a cup. Starting at one end, have the first student pour out as much water as she/he wants from the jug and pass the jug to the next student in line. (Because of the limited amount of water in the jug, there might not be enough to go around.)
3. Ask students how they feel about either receiving enough water or receiving no water. Explain that there is not always enough fresh, clean water available to meet everyone's needs.
4. Ask students what they could do as a group to make sure they all get water. Have them repeat the activity and put their plan into action.

Part 2:

1. Briefly explain riparian water rights. The Riparian Rights Doctrine gives people who own land bordering a water source the right to use that water however they choose. How does passing the jug relate to riparian rights? (A more recent version of this doctrine requires people to justify their uses as reasonable and insure that landowners downstream have their fair share of water.)
2. After students have emptied their cups and the jug as been refilled, inform them that they will now simulate the allocation of water rights in the west. Explain that the Appropriation Doctrine gives people who originally moved into an area and started using water the right to use their water first, whether or not their land borders the water source.
3. Have students form a line according their birthdays (from January to December). Divide the students into 10 groups, with group 1 being the first 2 or 3 students in line, group 2 being the next 2 or 3, etc. Explain that lining up according to age represents the "first in time, first in right" concept.
4. Pass out the Water User cards in order (Group 1 gets #1, etc.). Explain to the students that the descriptions are numbered according to who moved into the area first. Along with the right to use water, each description also states how the water is used and how much is needed.
5. Pass around the jug of water in the order of the numbered cards. Have students read aloud how they use the water. Each group takes the amount of water indicated on their card. (Some water users, such as fisheries and hydroelectric power plants, utilize water without reducing water quantity so students who represent these water users should pour water into their cups and then pour most of it back into the jug using the funnel.)

6. When water runs out, have students express their opinions about this system. What are the benefits and the shortcomings? How does this compare to riparian water rights? Why would Eastern states use riparian water rights while western states use the Prior Appropriations Doctrine? (amount and availability of water)
7. Explain that California uses a combination of riparian and Prior Appropriation Doctrine, but there are still major debates over the uses of California's limited water supply. How or why would students change these systems? How should water be divided among water users in the west?

Extension – Fresh Water to Wastewater

- Pass the jug again, but this time have each of the Water Users describe what they might be putting into water as they use it. For example, the homesteader might wash food from dishes into the river, the farmer might be using pesticides that wash into the river, and people living in the suburbs might dump cleaning products down their drains. Have students add a drop of food coloring to their cup then pour some of this used water back into the jug as they pass it to simulate wastewater and runoff.
- Where do these substances end up? What impact do they have on other people or wildlife? How important is the role of the sewage treatment plant?

Variations

- To simulate annual fluctuations in rainfall, change the amount of water in the jug each time you pass it. Simulate a drought by asking students not to drink water one or two hours prior to the activity.
- Demonstrate the needs of fish and wildlife by placing a fish bowl at the end of the line of students. Explain that at least one cup of water must be poured into the bowl to meet this requirement. What do you have to adjust to have enough water for this need?



This activity was adapted, with permission, from: "Pass the Jug," Project WET, the Watercourse and the Council for Environmental Education, 1995.

Water Users (Descriptions)

- | | | |
|-----------|---|------------|
| Number 1 | You are a descendent of the first homesteader that moved into the area. You grow alfalfa and corn. | use 2 cups |
| Number 2 | Your ancestor came to California during the Gold Rush and started a gold mining company. Your family runs this small, but lucrative, operation. | use 2 cups |
| Number 3 | Your great-great-grandma came out to teach the children of the gold miners. You still live on the property she bought and need water for personal use and crop irrigation. | use 1 cup |
| Number 4 | Your grandparents left their farm in the Midwest to start a farm here. You help meet the needs of the growing community by growing walnuts and almonds. | use 2 cups |
| Number 5 | You represent San Francisco, a town that grew into a city after the Gold Rush. You use water for homes and businesses in your city. | use 3 cups |
| Number 6 | You represent a hydroelectric company with a dam upstream of town. The water you use passes through the dam to generate electricity. Show this by pouring most of your three cups of water back into the jug. | use 3 cups |
| Number 7 | You are a high-tech farmer that grows a variety of crops on a large plot of land in the Central Valley. | use 5 cups |
| Number 8 | You represent the suburbs that grew as people moved out of the city to find housing. You use water for homes and lawns | use 2 cups |
| Number 9 | You represent a computer company that uses water for industrial purposes. | use 2 cups |
| Number 10 | You are an environmentalist that is fighting for water for the Bay's fisheries, especially for salmon. | use 2 cups |

WHAT A WASTE!

MAKING A MINI TREATMENT PLANT

Overview

Students use simple materials to design a mini water treatment plant then try to clean some 'polluted' water.

Time: one hour

Materials:

- Clear containers with "dirty" water – one for each team (add dirt, sand, pebbles, soap, leaves, etc. to water)
- A variety of materials to design mini-treatment plants: coffee filters, cheesecloth, paper towels, gravel, sand, cotton, rubber bands, spoons, etc.
- Funnels and extra empty containers (soda bottles, yogurt containers, etc.)

Setting: classroom

Background

In nature, as water moves through the water cycle, impurities are filtered out. But the water cycle cannot keep up with the number and types of contaminants people add to the water system. The water we flush down toilets or rinse down sinks doesn't just go away – it goes to the wastewater treatment plant where a number of processes are needed to clean the water. These methods of sewage treatment are costly and time-consuming, and some toxic substances, like pesticides, cannot be removed during the treatment process. We can each help to reduce this pollution problem by using non-toxic household and garden products and keeping household hazardous wastes out of drains.

As students design their treatment plants, be sure to remind them that they are trying to make the water look as clean as possible – but this water is not for drinking!

Activity

1. Set up a challenge for students: Imagine there has been a natural disaster that has caused a shortage of clean water. Their challenge is to design a mini-treatment plant for cleaning the water.
2. Divide students into teams and supply each team with a container of “dirty” water and a variety of materials for cleaning the water. Have students come up with a plan, then design and try out their treatment plant. Have teams demonstrate their designs to the class.

Variations

1. To make this activity more challenging, set up a price list for the materials students need to build their treatment plant. As engineers, students will have to submit a written plan/diagram of their design along with a budget. For example, a coffee filter might cost 5 cents, and a cup of sand 10 cents.
2. Try adding some oil to the water - how much harder is it to clean?

Discussion

1. How do the students’ water cleaning techniques compare to the steps in Central San’s wastewater treatment process?
2. What are some real-life situations when we need to clean/treat water? (Sewage from our homes, oil spills, water to drink when camping, etc.)
3. In the environment, what would be the actual source of each of the pollutants in the dirty water?
4. Which pollutants are the hardest to remove?
5. Are there some pollutants in water that we may not be able to see? How can we detect them?

WATER WISDOM: CALIFORNIA NATIVE AMERICAN STORIES ABOUT WATER

*Water is a mirror which reflects
the heart and soul of a people and their culture.*

KEITH WHITE WOLF JAMES (P'DAHO POMO)

Overview

Students analyze California Native American stories about water, then write their own myths and legends.

Time: two or three 1-hour sessions

Materials:

- Copies of the stories included with this activity
- Pencils, paper and art materials for illustrating stories
- Optional: books with Native American stories and myths

Setting: classroom

Background

The Native Americans that lived in California several hundred years ago relied on the natural resources around them for their survival. They had a great respect for nature and were careful not to deplete or abuse their resources. They understood how all of life was interconnected, and many tribes believed that both the living and non-living parts of their environment had a spirit, including water.

Water was central to the lives of the Native Americans. Their homes were usually located next to a source of water. Water was essential for drinking and food preparation, especially in leaching the tannins out of acorns. Water was needed for swimming and bathing, and was used for transportation. It provided them with food, like fish and waterfowl, was used in ceremonies, and poured on hot rocks in sweat lodges. The ocean provided shells to be used as money and decoration, and water was used for making essential items like baskets.

Stories were an important part of California Native American culture and were not just for entertainment. Since they did not have a written language, stories provided a way to record and pass on their history. Stories were used to teach about nature, to describe appropriate behavior, to explain creation and natural phenomena, and to pass on beliefs and values. As you study

these myths and legends, it is important to remind students that many Native Americans live in California today and lead lives very much like theirs. These stories help them keep their culture alive and pass on their history, beliefs and customs.

Activity

1. Ask students how California Native Americans that lived here hundreds of years ago might have used water. Make a list of their ideas, and then divide the list into different categories of usage such as food preparation, drink, transportation, crafts, ceremonies, etc. How do these uses compare to the way we use water today? How would proximity to water affect where Native Americans might make their homes? How could they transport water? Would any of their activities pollute the water?
2. Read the following excerpt from a speech that is attributed to Chief Seattle. What does it tell us about the Native American attitude toward water?

The shining water that moves in the streams and rivers is not just water, but the blood of our ancestors. If we sell you the land, you must remember that it is sacred, and you must teach your children that it is sacred, and that each ghostly reflection in the clear water of the lakes tells of events and memories in the life of my people. The water's murmur is the voice of my father's father.

The rivers are our brothers; they quench our thirst. The rivers carry our canoes and feed our children. If we sell you the land, you must remember to teach your children that the rivers are our brothers, and yours, and you must henceforth give the rivers the kindness you would give any brother.

3. Have students read the two stories included in this activity and discuss their interpretations of the stories. Do the stories teach a lesson? Do the stories teach about natural phenomena? What do the stories reveal about the attitude toward water? Do any ideas in the stories reflect our own beliefs, knowledge or attitudes toward water today?
4. Have the students come up with some ideas for stories they might tell about water. Have them brainstorm some properties or uses of water that might be explained through myths or legends. (For example, why rain falls to earth, how fish came to live in water, why the ocean is salty, etc.) Then have them write and illustrate their own stories.

Some helpful resources:

Storytellers

Invite a storyteller to come to your classroom. Contact the Contra Costa Tale Spinners for help in locating a teller: (925) 689-5138.

Books

Back in the Beforetime, Tales of the California Indians, Louise Curry, Aladdin Paperbacks, 2001

Keepers of the Earth: Native American Stories and Environmental Activities for Children, Michael J. Caduto and Joseph Bruchac, Fulcrum Inc., 1988.

The Natural World of the California Indians, Robert F. Heizer, UC Press, 1980.

Snail Girl Brings Water, A Navajo Story, Geri Keams, Rising Moon, 1998.

The Woman Who Outshone the Sun, Rosalma Zubizarreta, Children's Books Press, 1991.

How Raven Set Things Right

Long ago the land was different. The sun beat down on the land, and there was no water anywhere. There were no plants. It was so hot only the rock people could live. Then one day a white speck appeared in the sky. The beautiful white speck was a white bird named Raven. He landed right next to one of the rock people.

“Ah, ah, ah. This world is very boring! Ah, ah, ah,” said Raven. The rocks were shocked. They liked the world the way it was. “If I had a little water, I could make this place beautiful,” said Raven. The rocks told him they knew where to find water. “Look on Mount Diablo,” they told him. “It is not really a mountain. It is a house and you will find water inside. But beware, a giant guards the water.”

Once raven got an idea into his head, he had to act on it. So Raven flew over the mountain. He could see that it really was a house because it had a smoke hole in the top where the smoke from someone’s fire left the mountain. Raven found a door on the side of the mountain and knocked on it. From deep inside the mountain there was a rumbling noise. “Hello,” called Raven. “Ah, ah, ah. I am Raven. It is boring out here with just the rock people to talk to, so I thought we could talk.”

The door opened. “I don’t like to talk,” said the giant. “But you can come in.” Inside it was very dark, like a huge cave. Raven could hear the sound of water and soon he could see that the whole mountain was full of water. And standing next to the water was the giant who guarded it.

“What do you want to talk about?” said the giant.

“Well,” said Raven, “I am a storyteller and I can tell you a story. But usually when I tell a story I get something in return.”

“Well, I don’t have anything to give you except water,” said the giant.

“I don’t like water very much, but I will take a sip,” said Raven. He took a giant sip of water so big that his stomach started sticking out. When he moved, his stomach went kapish, kapish.

And so Raven began to tell a story that he had learned from the rock people. The story was so slow, the giant fell asleep. Raven ran back and drank up all the water.

Then the giant woke up. “Where is all my water?” he cried. Raven looked for a way to escape. He saw the smoke hole high up in the ceiling and flew to the hole. But he was so fat and full of water he became stuck. The giant could not reach him, so he built a large fire right underneath Raven.

Raven looked to the east and spit out some water. The water became rivers running down the mountain. Raven looked to the north and spit, and the water became Clear Lake, Lake Berryessa, and Lake Tahoe. Finally he looked to the west and spit, and the water became the Pacific Ocean. At last he was able to fit through the hole, but the smoke from the fire had turned him black.

That is how the water came to be, and why Raven is black. The giant still lives in the mountain, and when he hears the sound of the raven he gets so mad the ground starts to shake – and that is why we have earthquakes.

Raven Returns the Water

There came a time when all the water began to disappear on the Earth. The animals suffered because they had no water to drink. The fish suffered because they had no home. The plants began to wilt and the trees began to die. The People had no water to drink.

Raven knew she had to find water or the entire world would die. She put a round, smooth pebble under her tongue to make her mouth wet, and then flew in search of the missing water. She flew over high mountains and saw that the snow had melted and vanished. She flew over deep valleys and saw that the mighty rivers had dried. She saw fields where flowers once bloomed that were now barren and dry. She kept flying until her powerful wings began to ache.

One evening she saw some lights twinkling in the distance. She flew toward them and found the last green valley on Earth. To her surprise, she found a huge frog sleeping in the middle of the valley. This giant frog had a big, swollen body filled with water. Little drops of water were falling from the frog's mouth and that was what was shining in the last light of the setting sun.

Raven tiptoed quietly to Frog and sipped some water that was falling from the Frog's mouth. Suddenly Frog opened one eye and croaked, "That is my water you are drinking." He tried to knock Raven away with his tongue. Raven said, "It is not your water. Water belongs to the trees and to the flowers, to the fish, to the animals and to the people. No one person or thing can keep water for himself for it is life, and without clean water nothing can live." But Frog wasn't going to listen to her and tried to keep the water.

Raven wondered what to do. She did not want to fight with Frog, and she knew Frog had to learn to respect and share the water so there would be no more drought. Just then, Frog flicked out her tongue and quickly Raven dropped the stone she had put under her tongue into Frog's mouth. Frog swallowed it. Raven sat and looked and waited. Before long Frog croaked, "Oh my, I have a stomach ache." Raven said sweetly, "I think you have swallowed a rock."

Frog moaned and moaned and finally Raven said, "I don't think you can hold all that water and the rock, too. You have to give up one or the other."

"I want to keep the water," said Frog. "Won't you help me?"

"No," said Raven. "You are greedy and selfish to keep all the water." Finally, Frog decided he did not want his stomach to hurt anymore. So Raven took her sharp beak and poked Frog in the tummy, harder and harder. A big stream of water came from Frog's mouth, landed on the ground, flowed away and became a stream. Raven kept poking, and each time more water came gushing from Frog's mouth.

Soon the stream grew into a river and flowed out of the valley to the parched land beyond. The thirsty Earth soaked it up. Water poured into streams, creeks, ponds and the oceans. All the animals celebrated the return of the water. Soon Frog had no more water and he said, "I will not take the water again. Better to be in the water than to have the water in me."

Raven left a rock where Frog could see it so that he would always remember. Then she sat high in the branches of a tree and sent her sharp call to the skies in happiness. Frog climbed up on the rock and croaked, "Sorry, sorry." And to this day, as Raven flies over Frog sitting on his rock she calls, "Rock-rock-rock," just to remind Frog of his promise.

STILL WATERS RUN DEEP: WATER SAYINGS AND PROVERBS

Summary

Students interpret water-related sayings and proverbs to gain insights into the ways different cultures and regions view water, and how attitudes toward water can have an affect on how we take care of this precious resource.

Time: one hour

Materials:

- Copies of Water Sayings
- Drawing materials

Setting: classroom

Background

Proverbs and sayings exist in cultures all over the world. These short phrases or sayings often express a simple truth or idea rooted in a culture's beliefs. Sayings and proverbs have been used to teach a lesson or moral, tell a story, encourage correct behavior, debate an issue or pass on important knowledge. As students analyze these sayings, they learn about the values of people in different cultures and how these values are expressed through language.

Activity

1. Give students some examples of proverbs or expressions (see the list below) and ask them to share any water-related sayings they have heard. How do they interpret these sayings? What clues do these sayings give us about how people view water?
2. Have students compile a list of water-related sayings or proverbs, or use the list provided. Here are a number of activities you can do with your list of saying:
 - Analyze some of the sayings to determine how people see their connection to water. What do these sayings reveal about the way people value water? How do they relate to our value system today? What is the difference between the literal and figurative meanings? How do you think each saying got started?
 - Water Charades: Have teams of students pick a saying or proverb, then come up with a skit or charade and see if the class can guess their saying.

- As an oral history project, have students collect water sayings from family, friends and neighbors. Put the collection together to create a class book.
- Have each student illustrate a saying or proverb and compile a class book to share with other classes at school.
- Have students come up with some new sayings or proverbs that reflect our culture's beliefs and values today.
- Put up a map of the world. Write proverbs on separate pieces of paper, then put them on the map on the country they came from. Do the proverbs give you any clues to that country's weather, climate, history or wildlife?

Some helpful resources:

The Multicultural Dictionary of Proverbs, Harold Cordry, McFarland, and Co., 1997.

Bartlett's Familiar Quotations: A Collection of Passages, Phrases and Proverbs Traced to Their Sources in Ancient and Modern Literature, John Bartlett, Little Brown and Co. 1992.

Water Sayings and Expressions

Save it for a rainy day.

It's just a drop in the bucket.

Up the creek without a paddle.

That's water under the bridge.

It's raining cats and dogs.

You're in hot water.

Don't change horses in mid-stream.

Like water off a duck's back.

Feeling swamped.

Sink or swim.

Get your feet wet.

Wash your hands of the matter.

Make a big splash.

You're all wet.

Don't get steamed up.

One hand washes the other.

When it rains it pours.

She's still wet behind the ears.

Don't make waves.

Break the ice.

Don't throw the baby out with the bath water.

Have a ripple effect.

Wet your whistle.

Still waters run deep.

You're walking on thin ice.

On cloud nine.

Water Proverbs

- Don't make bamboo water containers before you see the river. (Thailand)
- Water that has been begged for does not quench the thirst. (Africa)
- Draw water from the new well but don't spit in the old one. (Bulgaria)
- One who bathes willingly in cold water doesn't feel the cold. (Africa)
- Distant water won't help to put out a fire close at hand. (China)
- Once you pour the water out of the bucket, it's hard to get it back in. (China)
- In the ant's house, the dew is a flood. (Persia)
- You can't learn to swim in a field. (Spain)
- No snowflake ever falls in the wrong place. (Japan)
- Water may flow in a thousand channels, but it all returns to the sea. (Africa)
- The frog does not drink up the pond in which he lives. (Indian)
- Filthy water cannot be washed. (Africa)

- Don't empty the water jar until the rain falls. (Philippines)
- A little rain each day will fill the rivers to overflowing. (Liberia)
- Till you are across the river, beware how you insult mother alligator. (Africa)
- If you saw what the river carried, you would never drink the water. (Jamaica)
- The stone in the water knows nothing of the hill which lies parched in the sun. (Africa)
- Rain does not fall on one roof alone. (Cameroon)
- A frozen water will break. (Korea)
- He who has water and peat on his farm has the world his own way. (Ireland)
- No one can see his reflection in running water. It is only in still water that we can see. (Taoist)
- A fool and water will go the way they are diverted. (Ethiopia)
- Beware of a quiet dog and still water. (Russia)
- You never miss the water 'til the well runs dry. (Ireland)
- Unfolded by the water are the faces of flowers. (Hawaii)
- Collect the water while it rains. (Burma)
- The fool is thirsty in the midst of water. (Ethiopia)
- Where the stream is shallowest, it is noisiest. (Irish)
- The fish that can see the water is getting shallower cannot be stranded. (Algeria)
- Do not disturb the water that is tranquil. (Hawaii)
- Don't think there are not crocodiles because the water is calm. (Malaysia)
- Don't throw away the bucket until you know if the new one holds water. (Sweden)
- You don't water a camel with a spoon. (Armenia)
- A deep well won't be affected by drought. (Korea)
- Falling water makes a hole on stone. (Korea)
- To rule the mountains is to rule the river. (China)

BRAIN DRAIN: MATH FOR WATER WIZARDS

1. **Did you know you are mostly water? Here's how to figure out how many pounds of water is in your body:**

I weigh _____ pounds

Multiply your weight by 2: _____ pounds x 2 = _____ pounds

Divide that number by 3: _____ pounds ÷ 3 = _____ pounds of water in your body!

2. **Scientists estimate that each person uses 150 gallons of water a day! How many gallons do you use in a week?**

150 gallons x 7 days = _____ gallons

How many gallons does your whole family use each day?

150 gallons x _____ = _____ gallons
(# of people in family)

How many gallons does your class use each day?

150 gallons x _____ = _____ gallons
(# of students in class)

3. **Did you know toilets use the most water in your house? The average toilet uses 5 to 7 gallons per flush. Here is how you can estimate how much water you flush away each day.**

6 gallons x _____ = _____ gallons flushed per day
(# of flushes per day)

A leaky toilet can waste up to 60 gallons of water a day! How much water would it waste in one week?

60 gallons a day x 7 = _____ gallons a week

4. **Central San cleans about 45 million gallons of water a day! How many millions of gallons do they clean in a week?**

45 million gallons x 7 = _____ million gallons

How many millions of gallons do they clean in one year?

45 million gallons x 365 = _____ million gallons

5. It takes a lot of water to grow, process and transport the food you eat. Use the information below to help you solve these math problems:

1 egg	40 gallons	Hamburger bun	22 gallons
1 orange	14 gallons	Tomato slice	3 gallons
2 slices of bread	15 gallons	Slice of cheese	56 gallons
1 cups of lettuce	3 gallons	Hamburger patty	616 gallons
1 apple	16 gallons	Lettuce leaf	1-1/2 gallons
1 cup milk	65 gallons	1 serving catsup	3 gallons
1 tomato	8 gallons	1 cup orange juice	49 gallons
one serving butter	92 gallons	1 can cola	10 gallons
cucumber	5 gallons	1 8 oz steak	1,232 gallons
celery	10 gallons		

How many gallons does it take:

1. To make a breakfast of 2 eggs, 2 slices bread and a glass of milk? _____
2. To make a hamburger and a cola? _____
3. To make a salad with lettuce, tomato and cucumber? _____

6. Your actions can make a big difference in saving water. If you turn off the faucet 2 times a day while brushing your teeth, you save 18 gallons of water.

How many gallons do you save in one year?

$$18 \text{ gallons} \times 365 = \text{_____} \text{ gallons}$$

If you did this for 10 years you would save enough water to fill an Olympic-sized swimming pool!



*When the well
is dry, we know
the worth of
water.*

BENJAMIN FRANKLIN

WATER RESOURCES FOR TEACHERS

CURRICULUM GUIDES

ALL ABOUT WATER, California Department of Water Resources, Publications Office, P.O. Box 942836, Sacramento, CA 94236-0001, 1991. (916) 653-1097.

Activities for grades K-3 cover properties of water, water cycles, how we use water, and how we can conserve and protect water resources.

CONSERVE WATER, The Watercourse, 201 Culbertson Hall, Montana State University, Bozeman, MT 59717-0570, 2000. (406) 994-5392

Good variety of water conservation activities with case studies of real-life water issues. Aimed at grades 6-12, but adaptable to younger grades.

RANGER RICK'S NATURESCOPE POLLUTION: PROBLEMS AND SOLUTIONS, National Wildlife Federation, McGraw-Hill Publishers, 11 West 19th Street, New York, NY 10011, 1989.

Creative, hands-on projects that teach about how to identify and prevent the many forms of pollution.

WATER, PRECIOUS WATER, Project AIMS, Aims Education Foundation, P.O. Box 8120 Fresno, CA 93747, 1988. (559) 255-4094

Elementary level activities introducing the properties and importance of water.

WATER SOURCEBOOK: A SERIES OF CLASSROOM ACTIVITIES FOR GRADES 3-5, Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314, 1994. (800) 666-0206

Extensive collection of hands-on activities covering water cycles, drinking water and waste water treatment, surface and ground water, and wetlands.

WATER WISDOM: A CURRICULUM FOR GRADES FOUR THROUGH EIGHT, Alameda County Office of Education, Media Sales, 313 West Winton Ave, Hayward, CA 94544, 1990. (510) 670-4168

Three instructional units cover the importance of water to life, water rights and responsibilities, and water symbolism in literature.

CHILDREN'S BOOKS

A DROP AROUND THE WORLD, Barbara Shaw McKinney, Dawn publishing, 1998. Imaginative story following the trip of a drip through the water cycle. Also available is A Teacher's Guide to a Drop Around the World, Bruce Malnor, Dawn Publishing, 1998.

THE DROP IN MY DRINK, Meredith Hooper, Viking Children's Books, 1998.

Explains the importance of water and the water cycle.

A DROP OF WATER WALTER, Walter Wick, Scott Foresman, 1990.

Amazing photographs of water in all its forms.

THE MAGIC SCHOOL BUS AT THE WATERWORKS, Joanna Cole, Scholastic Books, 1988.

Mrs. Frizzle and her students shrink to the size of a water droplet to follow water through a city's waterworks system.

THE MAGIC SCHOOL WET ALL OVER: A BOOK ABOUT THE WATER CYCLE, Patricia Relf, Scholastic Books, 1996.

Mrs. Frizzle takes her class on a wild ride through the water cycle.

A RIVER RAN WILD, Lynne Cherry, Gulliver Books, 1992.

Pictorial history of a river, the people that used the river through time, how the river became polluted, and the efforts to clean up the water.

SAVE OUR PLANET: SEVEN HUNDRED AND FIFTY EVERYDAY WAYS YOU CAN HELP CLEAN UP THE EARTH, Diane MacEachern, Dell Publishing Company, 1990.

What we can do at home, in our yards, at school and in the community to prevent and clean up pollution.

WATER – A RESOURCE IN CRISIS, Children's Press, Inc. 1991.

Good information on uses of water, water pollution and water treatment.

WATER DANCE, Thomas Locker, Harcourt, 1997.

Unusual introduction to the water cycle with beautiful artwork.

WATER MUSIC, Jane Yolen, Boyds Mill Press, 1995.

Collection of poems exploring the beauty, magic and forms of water.

WATER POLLUTION, Andrew Donnelly, Child's World, 1998.

How human activities can impact the environment, and simple ways we can help to reverse the pollution of our waterways.

WHERE THE RIVER BEGINS, Thomas Locker, Penguin Books, 1984.

A grandfather and grandson follow a river back to its source.

VIDEOS

Down the Drain, Children's Television Workshop, 1991. Available from 3-2-1- Contact, (800) 321-7511. (VHS, 30 minutes)

Where water comes from, how it gets clean, and what happens to it after we flush it down the toilet.

Journey of the Blob, National Film Board of Canada, 1990. Bullfrog Films, Inc., Olex, PA 19547, (800) 543-FROG. (VHS, 10 minutes)

Follow a "blob" of goo that a young boy dumps into a creek to learn about the water cycle, water pollution, and environmental responsibilities.

The Water Cycle, California Dept. of Water Resources, P.O. Box 942836, Sacramento, CA 92436-0001, (916) 653-4893. (VHS, 11 _ minutes)

Lively video depicts each phase in the water cycle and how water is cleaned, and demonstrates three easy water experiments kids can do.

Water Follies, Denver Water Department. S/P Associates, 1113 South Pearl Street, Denver CO 80210. (VHS, 7 minutes)

A humorous, animated video demonstrating how we use, and abuse, water.

Water – Who Needs It? California Dept. of Water Resources, P.O. Box 942836, Sacramento, CA 92436-0001, (916) 653-4893. (VHS, 14 minutes)

Shows kids the importance of water in their lives and what they can do to conserve water.

WEBSITES

California Department of Water Resources

<http://www.dwr.water.ca.gov>

California State Water Project

<http://www.dwr.water.ca.gov>

Central Contra Costa Sanitary District

<http://www.centalsan.org>

Educating Young People About Water

<http://www.uwex.edu/erc/ywc/>

Gardens at Heather Farm

<http://www.gardensathf.org>

Save the Bay

<http://www.savesfbay.org>

Water Education Foundation

www.water-ed.org

Water Environment Federation

<http://www.wef.org/>

Water Science for Schools

<http://water.usgs.gov/droplet>

ON-LINE WATER ACTIVITIES FOR KIDS**Bell LIVE!'s Online Ecology Games**

<http://www.bellmuseum.org/mnideals/watershed/watershed.html>

An interactive watershed game from Bell Museum of Natural History.

Droplet and the Water Cycle

<http://www.kids.earth.nasa.gov/droplet.html>

In this interactive game kids maneuver a water drop through challenging levels of the water cycle.

Earth's Water: 50 Games, Puzzles, Quizzes and Trivia

<http://www.membersaol.com/boweermanb/watergames.html>

A huge assortment of water and geography related games.

Go With the Flow

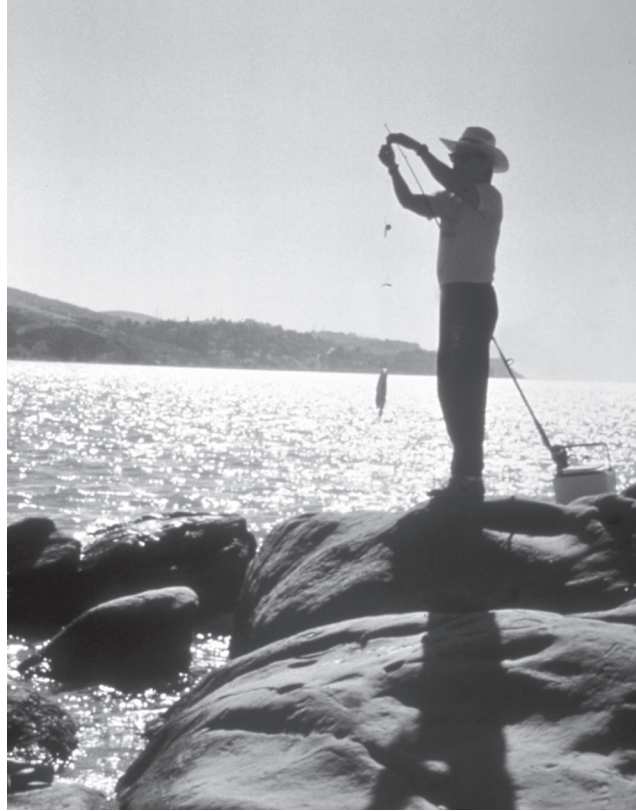
<http://www.wef.org/wefstudents/#>

Click on the 'Go with the Flow' image to take a tour of a wastewater treatment plant.

Water, Water Everywhere

<http://www.quia.com/custom/62main.html>

A variety of water games, including word searches, flashcards and concentration.



*We forget that
the water cycle
and the life cycle
are one.*

JACQUES COUSTEAU

GLOSSARY WORDS

WATER WIZARD WORDS

Aqueduct: a pipeline or canal used to transport water.

Aquifer: underground layers of sand, rock and gravel which hold water.

Atmosphere: the layer of air that surrounds the Earth.

Bacteria: microscopic, one-celled organisms; some are harmful, some are helpful.

Biodegradable: material which can be broken down into a usable form by bacteria or other organisms.

Cloud: visible collection of water droplets and water vapor suspended in air.

Condensation: process in which water vapor (gas) cools and turns into liquid form.

Conserve: to protect, manage and use natural resources in a way that doesn't harm them or use them up.

Cycle: a series of events that repeats over and over in the same way.

Delta: the triangle-shaped area formed where a river meets a larger body of water, like the ocean.

Dew: moisture that condenses on cool surfaces.

Disinfect: to destroy harmful microorganisms that might cause disease.

Ecosystem: the interactions between a community of plants and animals and the non-living parts of their environment.

Estuary: the place where fresh water empties into salt water.

Evaporation: the process in which heat warms water and changes it into a gas.

Groundwater: water that seeps into the earth and is stored in soil and rock formations below the surface.

Hail: precipitation in the form of solid balls of ice.

Household Hazardous Waste (HHW): substances used and disposed of by homeowners and business that can be harmful to human health and the environment.

Hydrologic Cycle: the movement of water from the earth to the atmosphere and back again through evaporation, transpiration, condensation, and precipitation; the water cycle.

Hydrology: the study of water on the earth and in the atmosphere.

Landfill: a place where we dump garbage.

Microorganisms: living things too small to be seen with the naked eye.

Natural Resources: materials found in nature that support life on earth such as air, water, minerals and plants.

Non-point Source Pollution: pollution that cannot be traced back to a single source because it comes from many different places, like farmland or cities.

Non-renewable Resource: resources that are found in limited amounts and cannot readily be replaced, such as oil, gas and coal.

Percolation: the process in which water seeps down into the earth.

Pesticide: a chemical or biological agent that kills plant or animal pests.

Point Source Pollution: pollution that can be traced back to a single origin, such as a pipe or culvert.

Pollutant: a substance that is harmful to people, animals or plants.

Precipitation: water that falls to earth from clouds as rain, hail, sleet, or snow.

Recycle: to put or pass through a cycle again; to use over again.

Renewable Resource: resources that can be replaced through natural cycles or human activities, such as sunlight, wind, water and trees.

Reservoir: a natural or artificial basin used to collect and store water.

Resources: supply of something that can be used or drawn on when needed.

Runoff: water that is not absorbed into the soil, but flows over land into streams or other bodies of water.

Sanitary Sewer System: the pipes that gather wastewater from homes and industry and bring it to a central treatment facility for cleaning.

Sewage: used water that must be treated and cleaned before reuse.

Sewage Treatment: the process of cleaning wastewater before it is reused or returned to water cycle.

Sleet: rain that freezes while falling through cold air.

Snow: precipitation in the form of frozen water crystals.

Storm Drain System: the system of pipes that drains rainwater from streets and sends it to creeks, the Bay or ocean.

Toxic: poisonous.

Toxin: a substance that is poisonous.

Transpiration: the process through which plants give off water vapor through pores in their leaves.

Vapor: liquid in the form of a gas.

Waste Stream: all the materials being thrown away, including items which could be recycle or reused.

Wastewater: water that has been used.

Wastewater Treatment Plant: a place where used water is cleaned and purified before it is returned to the water cycle.

Watershed: an area of land where all the water drains to the same stream, river, reservoir, marsh or other body of water.

WASTEWATER WIZARD WORDS

Aeration: adding air to water.

Aerobic Bacteria: microorganisms that live in the presence of oxygen.

Anaerobic Bacteria: microorganisms that can live without oxygen.

Bar Screens: filters that remove large debris like branches, rags and paper from wastewater at the treatment plant.

Biological Treatment: a process that uses living things, such as bacteria, to clean water.

Clarifier: a tank where bacteria settle and are removed during the process of treating water.

Coliform Bacteria: bacteria from the intestines of warm-blooded animals that are used as indicators of contaminated water.

Effluent: water that has been treated and is leaving the treatment plant.

Filtration: straining out impurities from water.

Grit: sediment removed from wastewater during treatment, such as sand gravel and rocks.

Heavy Metals: elements like cadmium, copper, lead, mercury and nickel used in manufacturing and agriculture that can be harmful to human health and the environment.

Incineration: the process of burning at high heat the solids from the wastewater treatment to produce dry, sterile ash.

Indicator Organisms: organisms sensitive to pollution that can be used to monitor the health of the water supply.

Primary Treatment: first stage of wastewater treatment - physical removal of solids from wastewater.

Secondary Treatment: second stage of wastewater treatment - biological removal of waste.

Sedimentation: settling out of solids suspended in a liquid.

Septic System: underground tanks used to hold household wastes that don't go to a treatment plant.

Sludge: solid matter removed during wastewater treatment.

Ultraviolet Light (UV): light waves which have greater energy than visible light waves; used during sewage treatment to disrupt cells so organisms cannot reproduce.