Poster Contest Student Activities

The theme for this year's poster contest is "*Water Use: Then and Now*." Poster entries should explore one of the many ways in which water is used more efficiently now than it was in the past.

Poster Contest Entries: (See Call for Entries for additional details.)

- Based on the lessons learned from the activities and discussions, each student should create a poster on **11x14 paper, landscape (horizontal) orientation** which illustrates the theme.
- **All submissions must be received by the deadline, Friday, December 4th, 2015, at 4:30 pm**. Entries received after the deadline will be disqualified.
- An entry form must be filled out, signed by the parent or guardian, and taped to the back of the poster. ***Posters which are submitted without a legible entry form will be disqualified.***

The activities and information which follow are intended to help you discuss water and the importance of conservation with your students in preparation for creating poster contest entries.

Where does water come from and where does it go?

- Use Activity 1 (see page 2) to present additional information about the Earth's water supply.
- Discuss the Water Cycle (see page 5) and how "recycles" all of the water we use.
- Discussion point: How does water connect all Earth systems?

How do you use water now?

- In conjunction with Activity 2 (see page 3), talk about daily activities, both indoors and out, which use water: *Drinking, cooking, baths/showers, brushing teeth, flushing toilets, washing clothes, washing dishes, cleaning, taking care of pets, gardening, painting, playing (skiing, building a snowman, going to a water park, lake or ocean, etc).*
- Discussion points: Do you think water is used the same ways in other parts of the world? How do you think that you would use water differently if less water was available?

How has water use changed?

- Use Activity 3 (see page 4) to discuss how students use water differently than their parents or grandparents did when they were the same age.
- Discussion point: Many daily activities, such as playing, growing food, cooking, cleaning, and daily hygiene, use water. Think of some of the ways that water use can be reduced during these activities.

A glossary of water terms, water conservation tips, and references and resources list are included on pages 6-10.

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Activity 1-All the Water in the World:

Supplies needed:
1 - 1000 ml beaker or cylinder
1 – 100 ml cylinder
1 – 10 ml cylinder
1 – small cup
1 – pipette
1 – bottle of food coloring
6 – cards, printed with following:
All the Water in the World (1000 ml) = 100% of Total Water
Salt Water (970 ml) = 97% of Total Water
Fresh Water (30 ml) = 3% of Total Water
Frozen Water (24 ml) = 2.4% of Total Water
Non-Frozen Fresh Water (5.97 ml) = 0.597% of Total Water
Available Fresh Water (0.003 ml) = 0.003% of Total Water

1. Start by filling 1000 ml cylinder to top mark… this is all the water in the world!

   Ask the students where most of that water can be found. (Answer: Oceans)

2. Pour 30 ml into 100 ml cylinder. The remaining 970 ml in the 1000 ml cylinder is the 97% of the world's water which is salty.

   The 30 ml is the 3% of the world's water that is fresh. Ask the students where this water can be found. (Answers: Polar ice caps, glaciers, rivers, streams, lakes, wells, etc)

3. Pour ~6 ml into 10 ml cylinder. The remaining 24 ml in the 100 ml cylinder is 2.4% of total water that is frozen.

4. The 6 ml is 0.597% of non-frozen fresh water. Talk about sources of fresh water: surface water (rivers, lakes, streams), ground water (aquifers, wells).

5. With the pipette, take one drop of water out of the 10 ml cylinder and put in a cup. (If the students are very quiet, they might be able to hear the drop hitting the bottom of the cup.) This is 0.003% of total water that is available for our use.

   Talk about why so little is available. (Answers: Pollution, too deep to drill, too far from where water is needed, etc.)

Note 1: Especially for lower grade levels, the visual impact of the relative volumes is important. A few drops of food coloring added to the water make the water easier to see.

Note 2: A gallon milk jug (3780 ml) and clear measuring cups can be used instead of the cylinders; adjust amount of water for each step accordingly.

Other ways to use this activity:

- Have a globe or world map available for students to look at. Talk about where water is fresh, frozen, salty, etc.
- Make a pie chart of all the water and talk about the percentages.
- Talk about the properties of water, and the water cycle, and how it affects the water that is available for our use.

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Activity 2-Indoor Water Use*:

Supplies needed:
Whiteboard, markers and eraser

1. Talk about how water is used **inside their homes**. As students call out the categories mark them on the board.
    a. Toilet
    b. Clothes Washer
    c. Shower
    d. Faucet
    e. Leak
    f. Dishwasher
    g. Other Domestic (cooking, cleaning, drinking, etc)
    h. Bath

2. These indoor activities together average about 55 gallons per person per day. Talk about what percentage of 55 gallons they think belongs to each use and write the correct percentages (below) on the board:
    a. Toilet = 26.7%
    b. Clothes Washer = 21.7%
    c. Shower = 16.8%
    d. Faucet = 15.7%
    e. Leak = 13.7%
    f. Dishwasher = 1.4%
    g. Other Domestic = 2.2%
    h. Bath = 1.7%

This information can also be shown as a pie chart:

3. Talk about why saving water is important (reference Activity 1) given how little usable water we have out of all the water in the world, and about ways that students can use less water (taking fewer baths doesn't count!), and how a leak is a waste of water that could be used for other things. Discuss ways to look for and fix leaks as a conservation tool.

4. Students with higher level math skills might enjoy the challenge of calculating 13.7% of 55 gallons per day, as well as how many gallons per month, and year, are wasted by a leak. *(7.54 gallons/day, 226 gallons/month, 2752 gallons/year)*

*Note: this activity discusses direct usage only. It does not account for outdoor use, nor for "virtual water" which is used in agriculture, industry and power production.

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Activity 3-My Family's Water Footprints:
This activity is an adaptation of "My Water Footprint" from Project WET Curriculum and Activity Guide 2.0, pages 441-446.

Supplies needed:
2 sheets of paper and pencils, markers, crayons, etc.

Background:
Footprints are unique to the person leaving them. Most students will have observed their own tracks in sand, mud or snow. Just like those footprints, a person's water footprint is unique because it represents how a person uses water each day.

Activity (basic):

1. Have students trace their left foot on a piece of paper. Using scissors, they should cut out their footprint and label it with their name.
2. Ask the students to list the ways they use water on their left footprint. This is the student's water footprint. Although their footprint may look similar to others, the size, shape and ways that they use water may be different.
3. After the students have completed their lists on their footprints*, display all of the footprints on the classroom wall, leaving room beside each for another footprint.
4. Send a sheet of paper home with each student. The student should help an adult family member, like a parent or grandparent, to trace the adult's right foot on the paper. After cutting it out, the student should label the footprint with the adult's name and ask the adult for the ways that they used water when they were a child. The student should write the list of water uses on the adult's footprint*.
5. When the student brings the adult's right footprint back to class, hang it on the wall next to the student's footprint. Discuss the similarities and differences between how we use water now and how the parent or grandparent used water when they were the student's age.
   *Note: footprints may be decorated before hanging on the wall, if desired.

Activity (advanced):
Older students can calculate their usage to create their own water footprint:

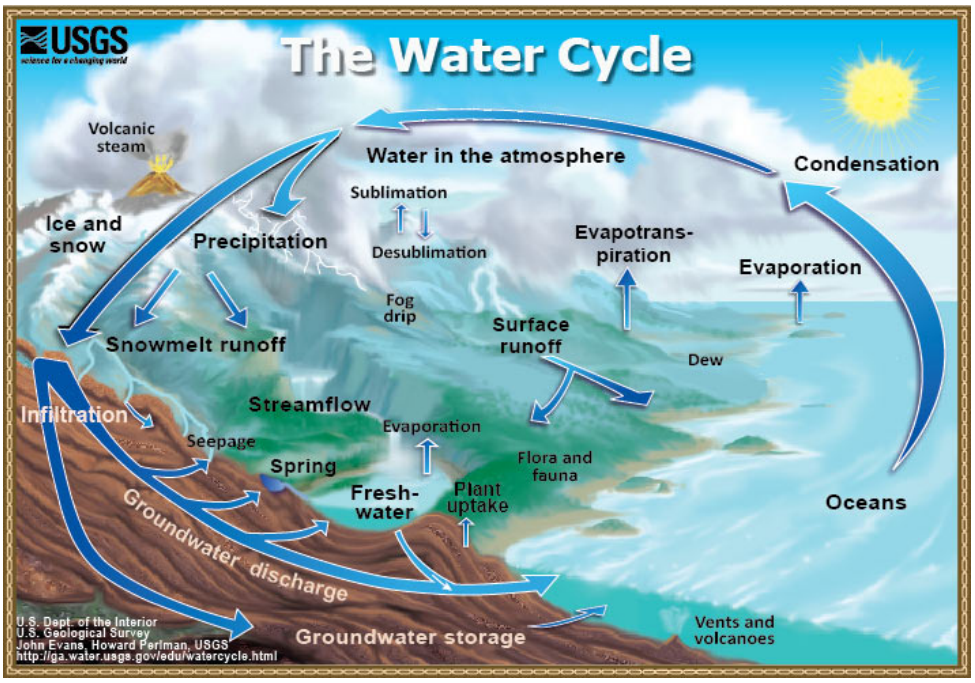
1. One way to calculate your water footprint is to look at the family water bill for a month. Divide the amount used by the number of days in the month and by the number of people in the family. This is the daily use per person in your house.
2. Another way to calculate your water footprint is to track your water use for a day. Each time you use water record how you used it, and how much you used. At the end of the day, total up how much water you used.

Flushing toilet	1.6 gallons per flush
Brushing teeth/drinking water	2.5 gallons per minute
Shower	2.5 gallons per minute
Dish washing by hand (water running)	2.5 gallons per minute
Dish washing by hand (sink with stopper)	10 gallons
Dishwasher	8 gallons per load
Load of Laundry	25 gallons per load

3. How does your use compare to the Indoor Water Use in Activity 2?

Water Cycle:
The Earth has a finite amount of water. All the water that we use is already here. This water is naturally recycled through a process called the hydrologic, or water, cycle. In this process, the water is collected, cleaned and distributed. (Our water treatment technology has been developed to mimic this process but at a much faster speed.)

Sun shines on the ocean causing water (liquid) to evaporate and form clouds (gas), which are pushed by the wind over land. As the water molecules in the clouds condense around tiny dust particles, the molecules become heavy droplets and gravity caused them to fall, releasing the water from the clouds as precipitation, either rain (liquid) or snow (solid), and the water falls on the land. Some of the water will make its way back to the ocean via streams and rivers, and some will infiltrate into the ground and may eventually make its way into an aquifer where it is stored until we pump it out. Some of the water may also be stored as snow and ice in glaciers or polar ice caps.



Plants, humans and animals contribute to the cycle as well. Plants draw water from the ground through their roots and up to their leaves where it is given back to the atmosphere through transpiration. In the process they produce food for humans and animals. Humans and animals take in water by drinking and eating, and give some water back to the atmosphere through respiration and perspiration. And so the cycle continues with the same water molecules taking on various phases and traveling through many different systems.

- Discussion points: How does weather affect water supply? What are our local sources of supply?

Additional information about City of Santa Fe water sources can be found at:
http://www.santafenm.gov/where_does_our_drinking_water_come_from or
http://savewatersantafe.com/water-supply-sources//

Glossary of Water Terms

(These terms come from the USGS Water Science School glossary found at http://water.usgs.gov/edu/dictionary.html)

acequia--acequias are gravity-driven waterways, similar in concept to a flume. Most are simple ditches with dirt banks, but they can be lined with concrete. They were important forms of irrigation in the development of agriculture in the American Southwest. The proliferation of cotton, pecans and green chile as major agricultural staples owe their progress to the acequia system.

acre-foot (acre-ft)--the volume of water required to cover 1 acre of land (43,560 square feet) to a depth of 1 foot. Equal to 325,851 gallons or 43,560 cubic feet.

aquifer--a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses.

capillary action--the means by which liquid moves through the porous spaces in a solid, such as soil, plant roots, and the capillary blood vessels in our bodies due to the forces of adhesion, cohesion, and surface tension. Capillary action is essential in carrying substances and nutrients from one place to another in plants and animals.

commercial water use--water used for motels, hotels, restaurants, office buildings, other commercial facilities, and institutions. Water for commercial uses comes both from public-supplied sources, such as a county water department, and self-supplied sources, such as local wells.

condensation--the process of water vapor in the air turning into liquid water. Water drops on the outside of a cold glass of water are condensed water. Condensation is the opposite process of evaporation.

conservation--the use of water-saving methods to reduce the amount of water needed for homes, lawns, farming and industry, and thus increasing water supplies for optimum long-term economic and social benefits.

consumptive use--that part of water withdrawn that is evaporated, transpired by plants, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed.

contaminant: Any substance that when added to water (or another substance) makes it impure or unfit for use.

conveyance loss--water that is lost in transit from a pipe, canal, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a ground-water source and be available for further use.

desalination--the removal of salts from saline water to provide freshwater. This method is becoming a more popular way of providing freshwater to populations.

domestic water use--water used for household purposes, such as drinking, food preparation, bathing, washing clothes, dishes, and dogs, flushing toilets, and watering lawns and gardens. About 85% of domestic water is delivered to homes by a public-supply facility, such as a county water department. About 15% of the Nation's population supply their own water, mainly from wells.

effluent--water that flows from a sewage treatment plant after it has been treated.

erosion--the process in which a material is worn away by a stream of liquid (water) or air, often due to the presence of abrasive particles in the stream.

evaporation--the process of liquid water becoming water vapor, including vaporization from water surfaces, land surfaces, and snow fields, but not from leaf surfaces. See transpiration

evapotranspiration--the sum of evaporation and transpiration.

greywater--wastewater from clothes washing machines, showers, bathtubs, hand washing, lavatories and sinks.

ground water--(1) water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper surface of the saturate zone is called the water table. (2) Water stored underground in rock crevices and in the pores of geologic materials that make up the Earth's crust.

hardness--a water-quality indication of the concentration of alkaline salts in water, mainly calcium and magnesium. If the water you use is "hard" then more soap, detergent or shampoo is necessary to raise a lather.Humidity: The degree of moisture in the air.

hydroelectric power water use--the use of water in the generation of electricity at plants where the turbine generators are driven by falling water.

hydrologic cycle--the cyclic transfer of water vapor from the Earth's surface via evapotranspiration into the atmosphere, from the atmosphere via precipitation back to earth, and through runoff into streams, rivers, and lakes, and ultimately into the oceans.

industrial water use--water used for industrial purposes in such industries as steel, chemical, paper, and petroleum refining. Nationally, water for industrial uses comes mainly (80%) from self-supplied sources, such as a local wells or withdrawal points in a river, but some water comes from public-supplied sources, such as the county/city water department.

infiltration--flow of water from the land surface into the subsurface.

injection well--refers to a well constructed for the purpose of injecting treated wastewater directly into the ground. Wastewater is generally forced (pumped) into the well for dispersal or storage into a designated aquifer. Injection wells are generally drilled into aquifers that don't deliver drinking water, unused aquifers, or below freshwater levels.

irrigation--the controlled application of water for agricultural purposes through manmade systems to supply water requirements not satisfied by rainfall.

non-point source (NPS) pollution--pollution discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff. Non-point source pollution is contamination that occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards. As this runoff moves across the land surface, it picks up soil particles and pollutants, such as nutrients and pesticides.

osmosis--the movement of water molecules through a thin membrane. The osmosis process occurs in our bodies and is also one method of desalinating saline water.

oxygen demand--the need for molecular oxygen to meet the needs of biological and chemical processes in water. Even though very little oxygen will dissolve in water, it is extremely important in biological and chemical processes.

percolation--(1) The movement of water through the openings in rock or soil. (2) the entrance of a portion of the streamflow into the channel materials to contribute to ground water replenishment.

permeability--the ability of a material to allow the passage of a liquid, such as water through rocks. Permeable materials, such as gravel and sand, allow water to move quickly through them, whereas unpermeable material, such as clay, don't allow water to flow freely.

point-source pollution--water pollution coming from a single point, such as a sewage-outflow pipe.

potable water--water of a quality suitable for drinking

precipitation--Water falling, in a liquid or solid state, from the atmosphere to earth.

reclaimed wastewater--treated wastewater that can be used for beneficial purposes, such as irrigating certain plants.

recycled water--water that is used more than one time before it passes back into the natural hydrologic system.

reverse osmosis--(1) (Desalination) The process of removing salts from water using a membrane. With reverse osmosis, the product water passes through a fine membrane that the salts are unable to pass through, while the salt waste (brine) is removed and disposed. This process differs from electrodialysis, where the salts are extracted from the feedwater by using a membrane with an electrical current to separate the ions. The positive ions go through one membrane, while the negative ions flow through a different membrane, leaving the end product of freshwater. (2) (Water Quality) An advanced method of water or wastewater treatment that relies on a semi-permeable membrane to separate waters from pollutants. An external force is used to reverse the normal osmotic process resulting in the solvent moving from a solution of higher concentration to one of lower concentration.

solution--a mixture of a solvent and a solute. In some solutions, such as sugar water, the substances mix so thoroughly that the solute cannot be seen. But in other solutions, such as water mixed with dye, the solution is visibly changed.

solvent--a substance that dissolves other substances, thus forming a solution. Water dissolves more substances than any other, and is known as the "universal solvent".

surface tension--the attraction of molecules to each other on a liquid's surface. Thus, a barrier is created between the air and the liquid.

suspended sediment--very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom. Such material remains in suspension due to the upward components of turbulence and currents and/or by suspension.

transpiration--process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores. See evapotranspiration.

wastewater--water that has been used in homes, industries, and businesses that is not for reuse unless it is treated.

water cycle--the circuit of water movement from the oceans to the atmosphere and to the Earth and return to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transportation.

water use--water that is used for a specific purpose, such as for domestic use, irrigation, or industrial processing. Water use pertains to human's interaction with and influence on the hydrologic cycle, and includes elements, such as water withdrawal from surface- and ground-water sources, water delivery to homes and businesses, consumptive use of water, water released from wastewater-treatment plants, water returned to the environment, and instream uses, such as using water to produce hydroelectric power.

Water Conservation Tips:

From Water Conservation Tips, Facts and Resources, http://wateruseitwisely.com.

- Turn off the water while you brush your teeth.
- Run your clothes washer and dishwasher only when they are full.
- Keep a pitcher or bottle of water in the refrigerator instead of running the tap for cold water.
- Check toilets with food coloring or dye tablets to make sure the flapper isn't leaking.
- Use water from fish tanks to water plants. It has lots of nutrients in it that the plants will love!
- Wash your car on the grass and give the grass a drink at the same time. Use a bucket and sponge to lather it up instead of running the hose. To rinse, make sure the hose has a shut-off nozzle so that the water doesn't keep running while you walk to the spigot to turn it off.
- If you have ice left in a take-out cup, dump it on a plant.

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References and Resources:

- City of Santa Fe Water Division, http://www.santafenm.gov/water_division.
- City of Santa Fe Water Conservation Office, http://savewatersantafe.com.
- Project WET International Foundation, Project WET Curriculum and Activity Guide 2.0.
- Water Cycle graphic from http://ga.water.usgs.gov/edu/watercycle.html.
- Project WET Worldwide Water Education, http://www.projectwet.org.
- WaterSense: An EPA Partnership Program, EPA WaterSense for Kids, Thirsty for Knowledge? http://www.epa.gov/WaterSense/kids/index.html.
- Water Resources Education, Albuquerque Bernalillo County Water Utility Authority, http://www.abcwua.org/education.
- USGS Education Resources, Science Resources for Grades K-6, U.S. Geological Survey, http://education.usgs.gov/primary.html.
- New Mexico Office of the State Engineer, Water Use and Conservation, Educators resources, http://www.ose.state.nm.us/wucp_educators.html.