WATER USES:

showering, laundry, drinking, drink for animals, cooking, watering crops, pools, firefighting, brushing teeth

WHAT IS WATER?

Water is a colorless, transparent, odorless, tasteless liquid that forms the seas, lakes, rivers, and streams, and falls to the ground as rain. Water is the basis of all living organisms.

All living things need water. Without water, there would be no life on Earth. Because of this, water is our planet's most precious resource. We use water in many different ways without thinking about it. Can you write down some ways that you used water today?

How do we use water in agriculture? Farmers and ranchers need water to raise the animals and crops that we use for food, fiber, and fuel. We have a limited supply of water, therefore we must conserve and use it wisely. What are some things you can do to make sure you do not waste water?

VOCABULARY

AQUIFER: any geological formation containing ground water, especially one that supplies water for wells and springs.

CONDENSATION: the process by which vapor cools and becomes a liquid.

EVAPORATION: the process by which water is converted from liquid form to vapor form and transferred from water masses to the atmosphere.

FLOOD: overflowing of a large amount of water beyond normal limits.

FRESH WATER: water that is not salty especially when considered as a natural resource.

H_2O: water molecule; made up of two hydrogen atoms and one oxygen atom.

HUMIDITY: a measure of the amount of moisture in the air.

HYDROPOWER: electricity produced from machines that are run by moving water.

IRRIGATE: to supply (land) with water by non-natural means, such as diverting streams, flooding, or spraying.

PRECIPITATION: rain, snow, sleet, or hail that falls to the ground.

RIVER: a large natural stream of water flowing in a channel to the sea, a lake, or another such stream.

VAPOR: a substance suspended in the air, especially one normally liquid or solid.

WATERSHED: an area or ridge of land that separates waters flowing to different rivers, basins, or seas.

STATES OF WATER

Water is a basic need of all living things and can be found in almost everything around us. It is also very important to agriculture. Farmers rely on rain for plants to grow and for animals to drink. Protecting the water we have and keeping it clean not only helps produce better foods, but keeps our earth healthy. Water may seem simple. It has no taste, no smell and no color. But water is more than it appears to be! Read on to find out why.

Water is known as the "universal solvent" because more substances dissolve in water than any other liquid. This means that wherever water flows, in the ground or through the human body, it picks up and carries along nutrients, chemicals and minerals.

Water is the only natural substance on Earth that can be found in all three physical states. Liquid water is found in rivers, lakes, streams, and even swimming pools. Vapor is moisture that forms in the clouds and in the air and is what makes us feel sticky on humid days. Ice is water that freezes. Ice cubes and the ice caps at the North and South Poles are examples of ice.

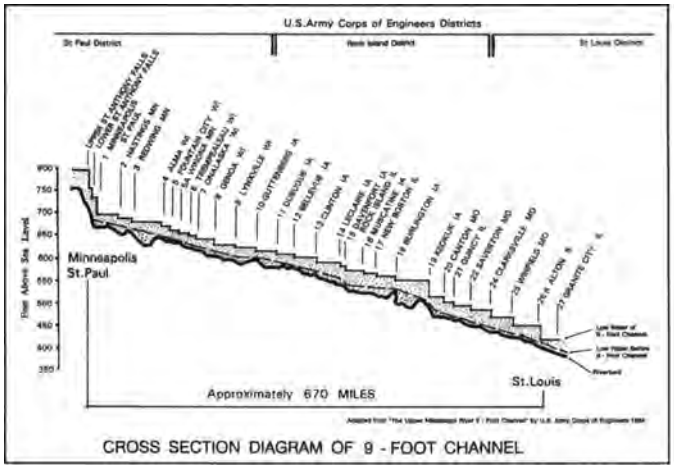
WATER

LOCKS AND DAMS

In 1930, U.S. Congress decided to make the Mississippi River wider and deeper so boats could move all the time. First, dams were built. Dams hold water back to make sure every part of the river is at least nine feet deep. That's deep enough to float heavy barges up and down the river. But how do barges get around the dams? Each dam has a lock. A lock is like an elevator – only slower. A tugboat pushes a barge into the lock (elevator). The doors close and water is put in or taken out of the lock. This raises or lowers the barge until it is at the same height as the water on the other side of the dam (elevator moves up or down). The doors open up and the barge goes on its way. The whole process can take up to two hours.

The Mississippi River is divided into the upper Mississippi (from Cairo, Illinois, up to its origin at Lake Itasca in Minnesota) and the lower Mississippi (from Cairo, Illinois, south to the Gulf of Mexico). There are 29 locks and dams on the upper Mississippi from just north of St. Louis, Missouri, to Minneapolis, Minnesota. There are no locks and dams south of St. Louis. Instead, there are wing dams to control the flow of water and levees to contain the river during flooding.

Why do engineers go to all this trouble? Why don't they just let boats travel freely along the Mississippi River? In what situations do boats need locks? Brainstorm ideas as a class and write answers on the board.



This graphic shows the lock & dam system on the Mississippi River. You can see the river bed as well as water depth both before and after the lock & dam system was built. The locks and dams maintain a nine foot channel which allows for shipping of goods on barges both up and down the river.

DRINKING WATER HISTORY

- **400 B.C.** — Hippocrates emphasizes the importance of water quality to health and recommends boiling and straining water.
- **1774 A.D.** — Chlorine is discovered in Sweden.
- **1804** — The first municipal water filtration works opens in Paisley, Scotland.
- **1835** — Chlorine is first applied to drinking water to control foul odors in the water.
- **1849** — The cholera epidemic of 1849 claims 8,000 lives in New York City and 5,000 in New Orleans.
- **1877-1882** — Louis Pasteur develops the theory that disease is spread by germs.
- **1882** — Filtration of London drinking water begins.
- **1890S** — Chlorine is proven an effective disinfectant of drinking water.
- **1896** — The Louisville Water Company introduces a new treatment technique that combined thickening with rapid-sand filtration. This new treatment technique eliminates cloudiness and removes 99% of the bacteria from the water.
- **1912** — Congress passes the Public Health Service Act which authorizes surveys and studies for water pollution - particularly as it affects human health.
- **1914** — The first standards under the Public Health Service Act become law. These introduce the concept of maximum contaminant limits for drinking water.
- **1962** — U.S. Public Health Service Drinking Water Standards Revision is accepted as minimum standards for all public water suppliers.
- **1972** — The Clean Water Act, a major amendment to the Federal Water Pollution Control Act, contains comprehensive provisions for restoring and maintaining all bodies of surface water in the U.S.
- **1977** — The Safe Drinking Water Act is amended to extend authorization for technical assistance, information, training, and grants to the states.
- **1996** — President of the U.S., Bill Clinton, signs the Safe Drinking Water Act Reauthorization that includes states implementing standards. The EPA (Environmental Protection Agency) also has newly developed rules.
- **TODAY** — A tremendous amount of time and technology goes into making surface water safe to drink. Because U.S. drinking water is heavily regulated, it is put through many processes before it reaches a consumer's tap. This lets us know we are drinking safe water in our homes!

WATER

CAREERS: hydrologist, water resources planner, irrigation consultant, lock and dam operator, water treatment technician, water quality specialist, reservoir manager, water conservation specialist

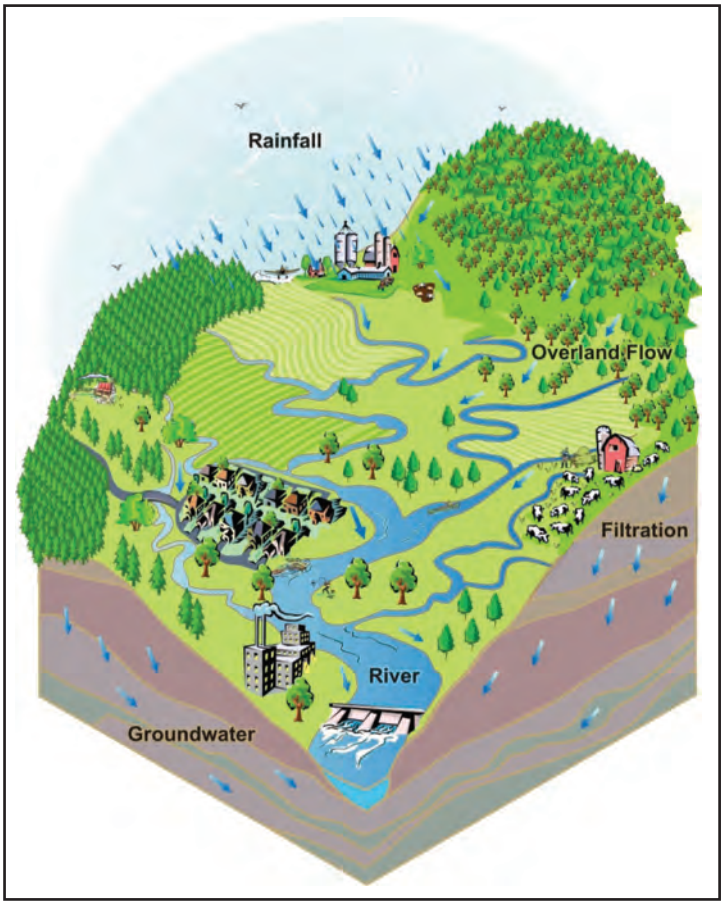
SPOTLIGHT ON CAREERS:

HYDROLOGIST—A **Hydrologist** measures, analyzes and models the occurrence and movement of water in the atmosphere (precipitation, evaporation), surface water (rivers and lakes), and groundwater. They map the distribution of water and measure the flow of water in the watershed. They also monitor, measure and/or predict changes in water volume and water flow in surface sources or groundwater levels due to precipitation, evaporation and snow melt. They must also analyze and determine the greatness and/or probability of occurrence for floods and droughts.

LOCK AND DAM OPERATOR—A **Lock and Dam Operator** opens waterways for container passage. A Dam Operator controls dams near bridges, locks, and lighthouses. Working with the **Dam Director** or Dam Supervisor, the Dam Operator manages daily operations to ensure that the dam runs properly. A Dam Operator draws on time management, critical thinking, and reasoning skills, along with their ability to follow directions. Additionally, he or she works with equipment such as control valves and dam gates as required to monitor and adjust pressure in the dam. Days are rarely the same. During times of high water flow, such as thunderstorms or snowstorms, the job gets much different. When the weather turns cold, depending on the region of your employment, you may also be required to deal with the presence of ice and the threats that come with it.

WATERSHED

A watershed is a geographic area where water, sediments and dissolved minerals all drain into a common body of water like a stream, creek, reservoir, or bay. A watershed includes all plants, animals, and people who 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.



WATER CYCLE

The sun heats up water in rivers, lakes and oceans and turns it into vapor. The water vapor leaves the river, lake or ocean and goes into the air. This step is known as evaporation.

Water vapor in the air cools and changes back into liquid, forming clouds. This is called condensation.

When water condenses and the air cannot hold it anymore, the clouds get heavy and water falls back to the earth in the form of rain, hail, sleet, or snow. This is called precipitation. When water falls back to earth as precipitation, it may fall back into the oceans, lakes, or rivers or it may end up on land. When it ends up on land, it will either soak into the earth and become part of the “ground water” used for plants and animals, or it may run over the soil and collect in the oceans, lakes, or rivers where the cycle starts all over again.

WATER

FUN FACTS:

- Water is composed of two elements, Hydrogen and Oxygen. 2 Hydrogen + 1 Oxygen = H2O.
- An acre of corn gives off 4,000 gallons of water per day in evaporation.
- Electricity can be created from hydropower, a process that uses water to drive water turbines connected to generators. There are many hydroelectric power stations around the world.
- A person can live about a month without food, but only about a week without water.
- Our bodies are 75% water and water makes up 50% of your bones.

WATER CYCLE BRACELET

This activity uses 10 beads that represent the water cycle. The beads are used to show the paths water takes through its various states (solid, liquid and vapor) as it moves throughout Earth's systems (oceans, atmosphere, ground water, rain, streams, etc).

Give each student a piece of yarn, leather, rope, or a pipe cleaner. Show the students that each colored bead represents a different stage of water in the Earth's systems. Ask the students to string one of each colored bead on their bracelet. Tell them to string the beads in any order they like. After the bracelets are complete, ask the students to show you their personal water cycle. For example, if their beads are in the following order: clouds, puddles, plants, etc, the students explain that the water started in the clouds, then it rained and fell into puddles on the sidewalk, then the water evaporated and collected on the plants overnight. Each student will have a different water story to tell.

The beads and what they represent are as follows:

- **SUN (YELLOW) –** the sun is the source of all energy on earth and powers the water cycle.
- **WATER VAPOR (CLEAR) –** the part of the water cycle where water is suspended in the air or is steam and humidity.
- **CLOUDS (GRAY) –** when water vapor condenses but is still in the air.
- **RAIN (SPARKLING CLEAR) –** moisture from clouds falls to the earth as a liquid.
- **SNOW (WHITE) –** moisture falling as a liquid in the frozen state.
- **EROSION (BROWN) –** rain causes erosion where soil is unprotected by vegetation. Soil particles are suspended in the water runoff.
- **OCEANS (DARK BLUE) –** Earth's weather factory. Moisture evaporates from the oceans by the sun's heat and is carried around Earth by winds.
- **LAKES (SPARKLING BLUE) –** the way we like to see a lake. Collects water from streams, and also evaporates water into the atmosphere.
- **PUDDLES (SPARKLING BROWN) –** rainwater collects in low spots, streets, and sidewalks, and it also collects pollutants (dirt, trash, car fluids, etc). Puddles evaporate or go into storm sewers.
- **PLANTS (GREEN) –** Plants take in water through roots and evaporate water into the atmosphere through leaves – a process called transpiration.

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