Water

Objective:

1. Students will be able to explain how water impacts plant growth.
2. Students will be able to analyze data related to water uses.
3. Students will demonstrate an understanding of the water cycle and natural resources.
4. Students will make predictions related to the impact of natural events in the environment.
5. Students will explain the cause of erosion.
6. Students will be able to state a hypothesis, formulate questions and make predictions related to the use and conservation of water.

Grades 3-5

Key Vocabulary:

- **Transpiration**
- **Renewable**
- **Contaminate**

Related Literature:

Water is Water
Miranda Paul

Josh the Baby Otter
Blake Collingsworth

A Snowflake
Neil Waldman

Performance Objectives:

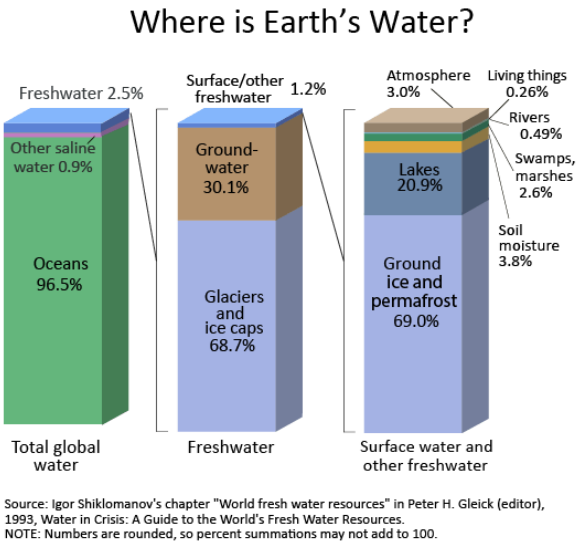
Grade 3: Strand 1: Concept 2 – PO 1-5; Strand 3: Concept 1 – PO 2
NGSS: 3-ESS2
Grade 4: Strand 6: Concept 1; Concept 2 – PO 1-6; Concept 3 – PO 1, 2 & 6
NGSS: 4-ESS2-1; 4-ESS3-1-A
Grade 5: Strand 1: Concept 1 – PO 1-2
NGSS: 5-ESS2

Background Information:

Water can be considered the most valuable resource on Earth. Approximately 70 % of the Earth's surface is covered with water. Do you know how much 70% is? Draw a globe and show how much water 70% would fill. Life on our planet would not exist without water. Only about 1% of that water is fresh. Scientists have found that most of the water on Earth is saltwater and about 2% of Earth's water is frozen in glaciers. Humans and most animal need fresh water to survive, because of this water conservation has become a worldwide concern.

What exactly is water and where do we get it? Water is made of two elements, hydrogen, and oxygen, commonly called H2O. Which is made up of two hydrogens and one oxygen. Water is found in three different forms: liquid, solid and gas. In general, the liquid form is referred to as water, the solid form of water is called ice, and the gas form of water is called steam or vapor. Can you name other liquids? Solids? Gases? Pure water has no smell or taste.

Water on Earth is constantly in motion. The water cycle demonstrates how water moves from one form to another. The natural cycle of water is known as hydrologic cycle, covers the movement of water on, above, and below the surface of the Earth. The Unites States Geological Survey (USGS) has documented the water cycle and the location of where water exists on Earth. The greatest percentage of water is saltwater and is located in the oceans of the world. Freshwater is divided into areas of groundwater, glaciers, lakes, and smaller bodies of water such as streams, swamps and rivers. The location of water is significant, but the percentage of usable water is the most important factor to human existence.



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources.
NOTE: Numbers are rounded, so percent summations may not add to 100.

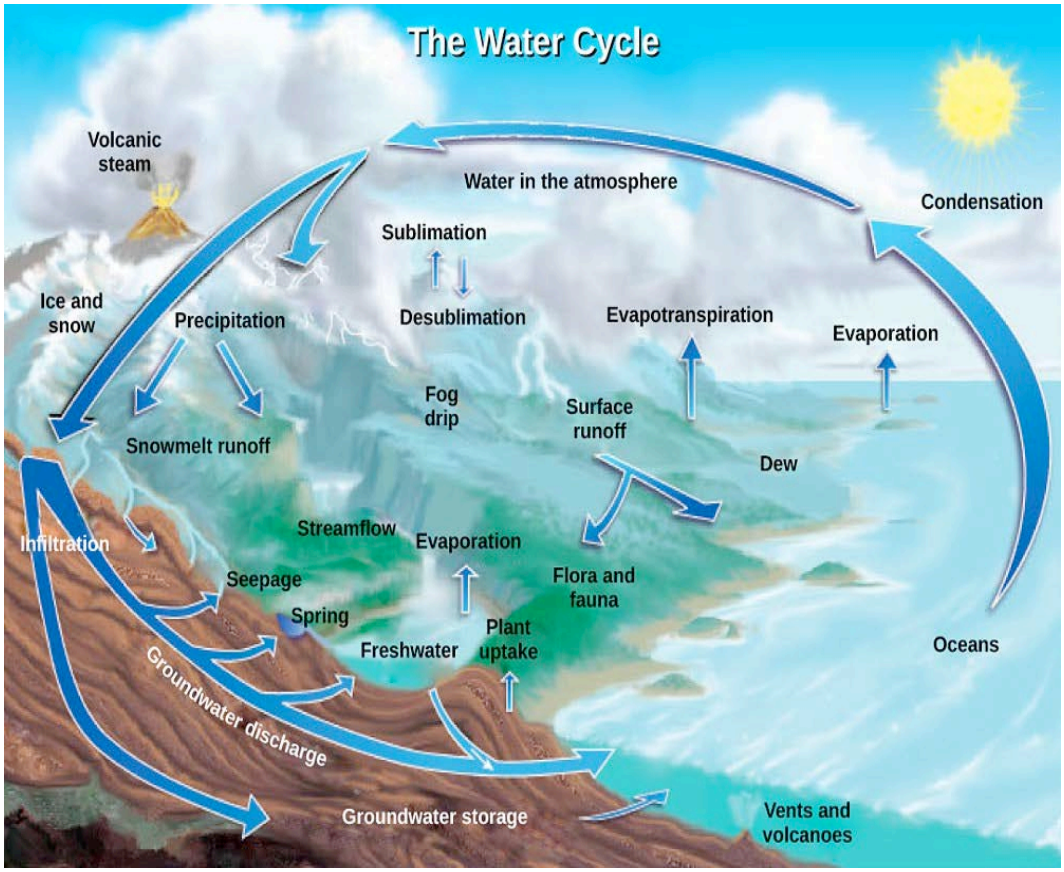
Freshwater resources are both above ground and underground. Water located in rivers and lakes is easy to see, but much more water is stored underground. Groundwater replenishes many rivers and lakes, and is part of water that has seeped into the ground to refill aquifers. An aquifer is underground layer of water-bearing rock, from which groundwater can be extracted using a water well. Groundwater is important to providing water to locations such as desert towns and places where water is scarce. Think about where we live? How does water get to us?

The water cycle is the path water takes as it moves around the Earth. A single drop of water is an essential part of the accumulation of water on the planet and how

water is replenished. Constantly changing from liquid to vapor to ice, water tells a story of life on earth. Beginning the ocean, a drop of water can be followed in the water cycle. A single drop of water at the ocean's surface is heated by the sun and the process of **evaporation** begins. The drop becomes water vapor and rises up into the air. Winds carry the vapor higher into the sky where the air is cool. As the vapor droplet gets cooler, it changes back into a liquid, which is called **condensation**. The vapor can condense and get cool enough that it joins other droplets and becomes part of a cloud. Soon that single drop of water from the ocean, joining others in the same way, will become bigger droplets and fall to the earth as rain. The process is called **precipitation**, which caused by gravity, and the rain drops may fall in various places. For example, rain falls back to the ocean, or it may fall on dry parts of land and soak into the ground. Rain may fall in rivers or lakes to refill them, or streams to allow them to flow faster. Rain may make a puddle in the street or fill a canal. Just think of all the places rain can fall and how it can change the landscape. The **collection** or storage of water is also a part of the water cycle. From areas of collection such as lakes or underground chambers, the water cycle begins again.

Plants are a part of the water cycle too, as moisture is carried through the plant from its roots to small pores on the underside of leaves where it changes to vapor and is released into the atmosphere. The process is called **transpiration**, which is essentially evaporation of water from plant leaves.

Water is a natural resource considered to be **renewable**. Looking at the water cycle explains how water can be renewable; however, consider again what percent of water in the cycle remains freshwater and suitable for human use. Now, consider how humans impact the use of freshwater and all of the ways humans can conserve water if they are careful.



The water cycle, USGS.

While water is considered a renewable resource, environmental and human factors can **contaminate** the water supply and pose a global concern regarding usable water for the future. The USGS asks these questions: “What is in the water? Is it safe for drinking? Can fish and other aquatic life thrive in streams and lakes that are affected by human activities? What is the water quality? To answer these questions, it is helpful to understand what "water quality" means, how it is determined, and the natural processes and human activities that affect water quality.”

What do we mean by "water quality"?

“Water quality can be thought of as a measure of the suitability of water for a particular use based on selected physical, chemical, and biological characteristics. To determine water quality, scientists, first measure and analyze characteristics of the water such as temperature, dissolved mineral content, and number of bacteria. Selected characteristics are then compared to numeric standards and guidelines to decide if the water is suitable for a particular use.” (USGS)

How is water quality measured?

Some aspects of water quality can be determined right in the stream or at the well. These include temperature, acidity (pH), dissolved oxygen, and electrical conductance (an indirect indicator of dissolved minerals in the water). Analyses of individual chemicals generally are done at a laboratory.

Source: USGS

There is no question that water is a natural resource that must be conserved and protected. Pollutants in the water, salt or fresh, create health concerns for all life on the planet. Scientists have found that water, as demonstrated in the water cycle, has been on earth for millions of years. Water has changed from liquid to gas over and over as is replenishes its source. Imagine that a dinosaur once drank the same water that you have in your drinking glass!

As far back as the ancient Egyptians, people have been concerned with clean drinking water. The first known filtering of pollutants, dirt, and sand was likely done by boiling water over a fire. Today, the task is much greater. Since only about 1% of the water on Earth is fresh water, pollutants making their way into the water are a critical factor in preserving life as we know it.

Pollution in water has a negative affect on plants, animals, and humans. Both marine animals and those living on the land are dependant on clean water. The ocean ecosystem, for example, is directly affected by pollution. Oil spills, sewage, chemicals, industrial waste and more have proven to be detrimental to the health of existing marine life and their future. Pollutants are not part of the natural ocean ecosystem and upset the balance in the environment. Many marine species live in the water, find their food in it, and raise their young in it. Pollution in the water causes enormous health-related problems for these animal species. Plant species are also at risk when pollutants invade their living spaces. Large amounts of harmful bacteria cause diseases and mutated cellular structures that alter the natural functions of both plants and animals.

Oil spills alone have created serious concerns in and around the areas of impact. Oil does not dissolve in water, but floats on the surface, causing the oil to become a thickened sludge. Ocean currents carry the oil sludge to distant locations, which becomes a deadly hazard to marine life. Industrial waste pollutants carry contaminants that are harmful to marine life. These pollutants are also carried to the fresh water supplies used by humans as well as animals. High levels of lead,

asbestos, and pesticides have been found in freshwater sources resulting in the contamination of streams, rivers, and groundwater. Chemicals seeping down into the groundwater leave a lasting impact within the wildlife ecosystems. In addition, industrial pollutants can rise into the air contaminating the water particles as they are carried through the water cycle.
"Water, water everywhere and not a drop to drink." Conservation, education, and human ingenuity can change that statement from a sad prediction to a happier wish for the future: "Water, water everywhere, and plenty for all to drink.!

Sources : United States Environmental Protection Agency (EPA); Unites States Geological Society (USGS); U. S. Department of Agriculture, Natural Resources Conservation Services.

Procedures and Activities:

1. State the learning objectives. Review previous instruction as it relates to the topic and objectives.
2. Review vocabulary.
3. Read related literature; follow up with discussion and open-ended questioning. Ask students what they know about water and how they use it each day. Ask questions related to conserving water each day. Discuss water resources in the local community and around the world. Discuss water as a natural resource and how it may be contaminated. Ask students what they know about water-related diseases and how they affect communities around the world. (give examples)
4. Review the sources of fresh water and how potential climate changes may alter the resource. Discuss ice caps and glaciers to clarify what they are and the location.
5. Discuss water-related power and the cause of erosion. Ask students to give an example of erosion. Discuss the Grand Canyon and how water helped form the canyon.
6. Read and discuss water pollution and ask students to give examples. Ask students to identify ways in which water pollution can be monitored, controlled, and stopped.

Activity: Ask students to think about how the Grand Canyon was formed and the impact water had and continues to have due to the power of the Colorado River and erosion. Then ask students to think about what might take place if the Colorado River stopped flowing through the canyon. Students use cause and effect, analysis and prediction in the process of discussion. This activity can be enhanced into a cause and effect writing project.

Activity: Students review and discuss the water cycle. Include the terms: evaporation, condensation, and precipitation. Students label the cycle and define the terms.

Activity: Students complete the activity called, 'The Water Cycle," by describing each stage and drawing their version of the water cycle. This activity may be used as a quiz to check for understanding.

Activity: Students discuss the concept of natural resources and the difference between those and man-made resources. Students complete the 'Natural Resources' worksheet. This may be a group or individual activity.

Activity: **Pre-Fieldtrip** – "Water in all forms" is an activity to allow students to begin thinking about water in places around the environment.

Activity: 'We use water for…' is a thinking activity to begin discussions about water conservation. Students can discuss water usage as a small or large group. Compare how people use water and how they might save water.

Activity: The water quiz may be used as a quiz or activity depending upon the discussion and level of understanding.

Activity: Students use technology to investigate the USGS web page. This activity can be done in small groups, pairs or individually. Allow students to select a topic, they investigate all of the information and make a presentation to the class. A written assignment may be added. Topics: Glaciers, Rainbows, Why is the ocean salty?, Hydroelectric power, Rain and ice, etc.

Activity: Lab – As a class or in groups, students investigate how differing amounts of water affect plants. Students plant the same type of plant (outdoor starter plants are best) in the same size containers using potting soil. Plastic drinking cups work well. Be sure to put two small holes in the bottom of each cup for drainage. Label each plant with a number or letter. Each group of students has 3 plants. Plant # 1 gets 1/4 cup of water each day. Plant # 2 gets ½ cup of water each day and plant # 3 gets ¾ cup of water each day. Students observe and take notes over a two week period. Notes should include the growth of the plants, condition of the plant and its leaves, condition of the soil, smell of the soil, and longevity of the plants. Data from the observations can be charted and analyzed for the final presentation to the class.

Materials: Starter plants, potting soil, containers for plants, measuring cups, tray for under plant containers, and sunny location for plants.

Activity: Students discuss water pollution and the impact on the environment. Ask students to give examples of water pollution and how it can be avoided or

resolved. Ask students to follow directions on the 'Water Pollution' activity and discuss the predictions.

Activity: Students select one of the pictures on the 'The Poetry of Water' page and write their original poem inspired by the picture.

Activity: As a class project, start a freshwater aquarium. Begin with students using technology to research how to calculate the amount of water needed for the selected size of an aquarium, what type and quantity of aquatic life to put in it, what type of gravel or material for the bottom, and what filtering system is needed for keeping the water clean. Students can chart the set up, care and success of the project.

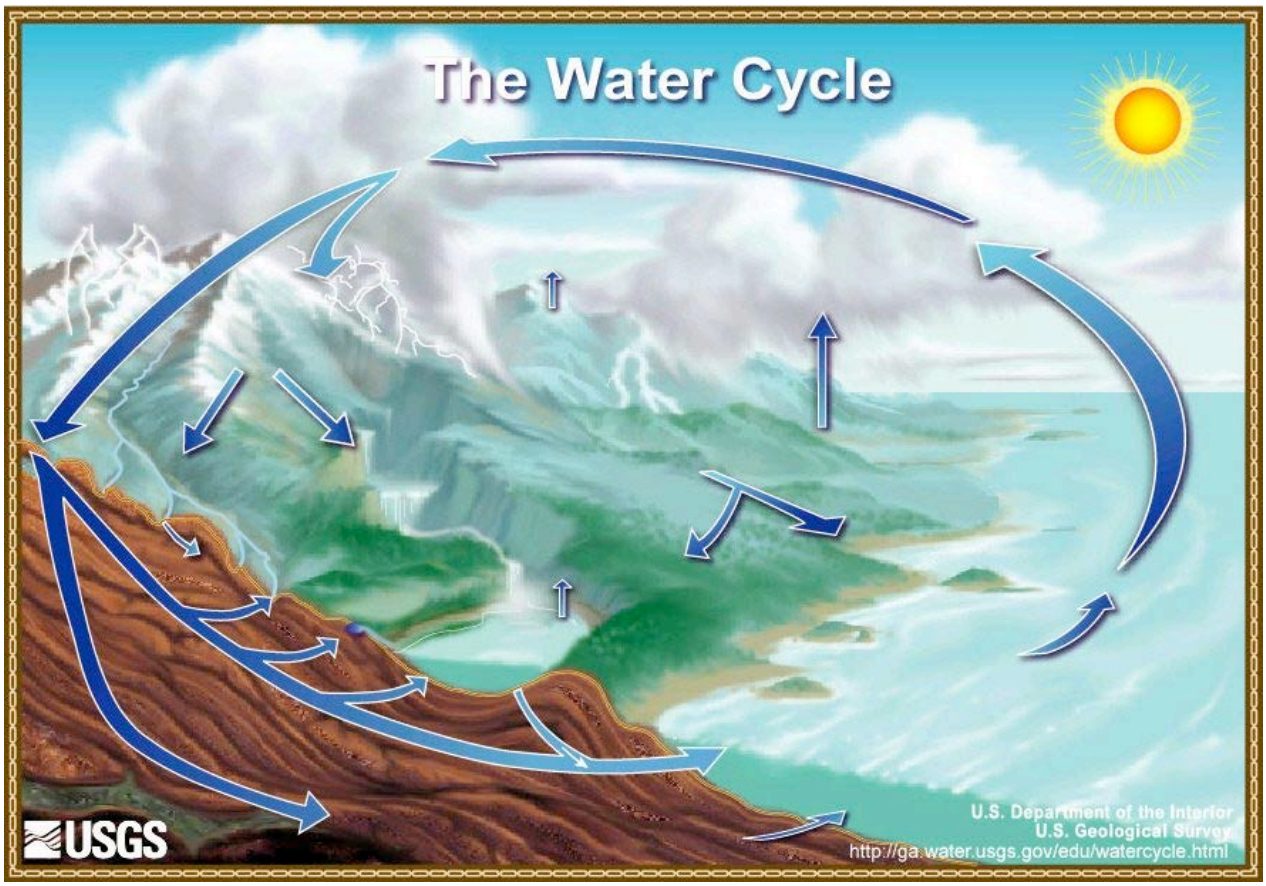
If an aquarium for the class is not an option, this activity can be a virtual aquarium or one the students imagine and draw. The process should be the same. The activity incorporates math, science, technology, and writing.

Reflections and Assessments: Students are assessed on varied levels depending on the activity. Participation, grade standards, and percentages may be applied to each activity. Activities are designed for flexibility and use pre or post fieldtrips.

Depending on the level of instruction prior to the field trip, many activities may be used as pre-visit or as a follow-up to the visit.

Most activities meet the **STEM** education guidelines involving problem solving, investigation, gathering data, analysis, using technology, application of math, integration of interdisciplinary instruction and inquiry.

Water Cycle Diagram



Label the diagram with the following parts of the cycle and define each term:

1. Evaporation _____
2. Condensation _____
3. Precipitation _____
4. Water run-off _____
5. Groundwater _____

Extra: Steam, Fresh water, Water in the atmosphere, Source of heat.

The Water Cycle

Describe the stages of the Water Cycle

Stage 1 Evaporation _____

_____

Stage 2 Condensation _____

_____

Stage 3 Precipitation _____

_____

Stage 4 Water Collection _____

_____

Draw a diagram of the water cycle:

Natural Resources

What is a renewable resource? (Give 2 examples)

1._____

2. _____

What is a nonrenewable resource? (Give 2 examples)

1. _____

2. _____

What is conservation of natural resources?

_____

_____

_____

_____

How can **you** conserve natural resources?

_____

_____

_____

_____

Water in all Forms

Water can be found all around the world, and in many different forms. Describe each body of water below and tell where the water originates:

1. A lake _____

_____

2. An ocean _____

_____

3. A pond _____

_____

4. A stream _____

_____

5. A puddle _____

_____

_____

We Use Water For….

We use water for

1. _____
2. _____
3. _____
4. _____
5. _____

How can we save our water?

1. _____
2. _____

_____

NAME _____

Water Quiz

1. What is water in solid form? _____

2. What is the name for water in liquid form? _____

3. What is the name for water in gas form? _____

4. Water covers what percent of the Earth's surface? _____

5. Raindrops do what when tit is hot outside? _____

6. When water forms into a cloud we call it _____

7. When water falls from clouds we call it _____

8. What 3 geographic locations can you find water? _____

_____ _____

9. What is the name for water that seeps down into the earth and collects?

_____

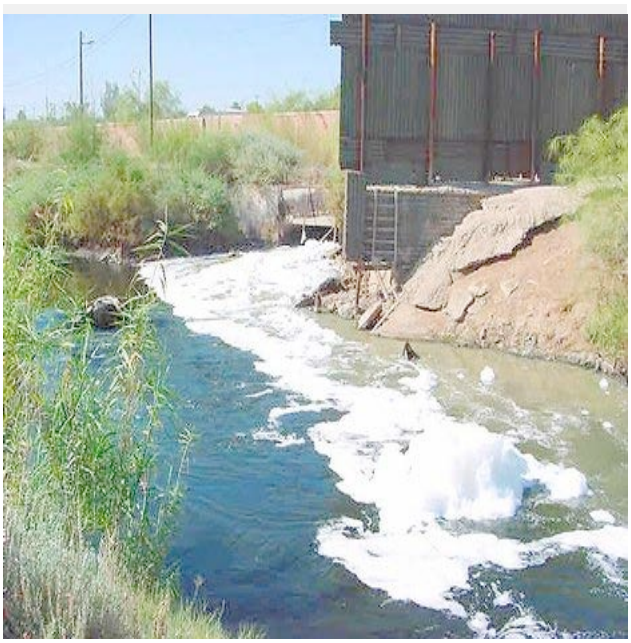
10. What is it called when water is saved and protected for future use?

_____

Water Quiz (KEY)

1. What is water in solid form? Ice
2. What is the name for water in liquid form? Water
3. What is the name for water in gas form? Vapor
4. Water covers what percent of the Earth's surface? 70%
5. Raindrops do what when tit is hot outside? Evaporate
6. When water forms into a cloud we call it Condensation
7. When water falls from clouds we call it Precipitation
8. What 3 geographic locations can you find water? Rivers
   Lakes Oceans
9. What is the name for water that seeps down into the earth and collects?
   Groundwater
10. What is it called when water is saved and protected for future use?
    Conservation

Water Pollution



Analyze the pictures of fresh water being polluted. List the four things you see that could be immediately changed to help each location be less polluted.

1._____

2. _____

3. _____

4. _____

If people use the water from either of the sources shown above, what do you predict will happen and why?

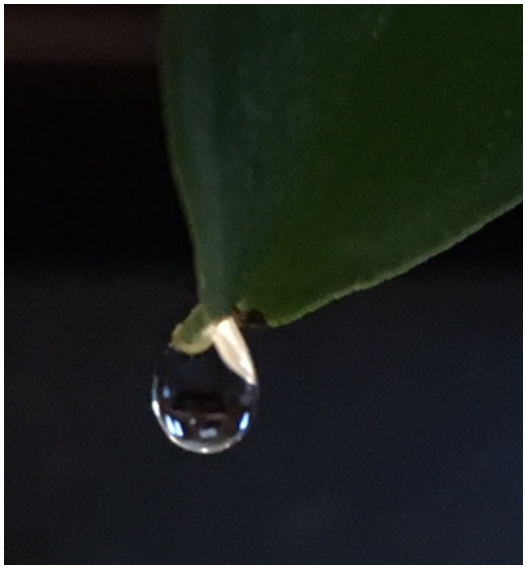
_____

_____

_____

_____

1. A single drop of water on the tip of a leaf



2. Natural rainbow over the ocean

Select one inspirational picture and write an original poem to express your thoughts about the picture.