National Association of Conservation Districts

Curriculum Guide to ONE WATER

A project of National Association of Conservation Districts

National Association of Conservation Districts

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Each of the activities in this curriculum can be adapted to any grade level. The designated levels are simply a guide. There may also be other Next Generation Science Standards which can correlate to these activities and the suggested Enrichment and Assessment Opportunities. Feel free to explore where these activities lead.

You can find other NACD Stewardship Week materials and resources on the NACD Conservation Education Hub at: https://www.nacdnet.org/conservation-education-hub/

Let's Shed Water!

Overview:
Students will observe how gravity affects water as it runs downhill. Students will also discover the effects of pollutants in a watershed.

Grade Levels:
Lower Elementary (Grades K-2)

Next Generation Science Standards:
- K-PS3-1. – Energy - Make observations to determine the effect of sunlight on Earth's surface. *(Evaporation in the water cycle)*
- K-ESS3-3 - Earth and Human Activity - Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things
- in the local environment. *(What are some solutions for contamination/pollution in your watershed?)*
- 2-PS1-4. – Matter and Its Interactions - Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some
- cannot. *(What roles to heating and cooling play in the water cycle?)*
- 2-ESS2-2. – Earth's Systems - Develop a model to represent the shapes and kinds of land and bodies of water in an area. *(What does your watershed look like?)*
- 2-ESS2-3. – Earth's Systems - Obtain information to identify where water is found on Earth and that it can be solid or liquid. *(What do other watersheds at bigger scales and around the world look like? Does ice occur in your watershed? How is ice a part of the water cycle?)*

Learning Objectives:
Students will:
- Explore the water cycle and how it relates to their lives
- Explain the concept of a watershed
- Describe how water traveling over/through land drains to a specific body of water
- Evaluate the effect of pollutants on a watershed
- Discuss the correlation between human behaviors and habits and their effects on water quality
- Formulate solutions to reduce human impact on water quality

Background and Discussion:
Start by asking the students about water in their lives. How do they use it? Where does it come from? If the students answer "the sink" – Ask them how they think the water gets there. What about rain? How is rain connected to the water you drink?

Let's Shed Water!

Walk the students through the water cycle, starting with rain. Where does the rain go? Follow the water cycle as if the water lands in the ocean. Once you cover the basic processes and get back to precipitation, as the students what they think happens when the water falls on land.

Define "watershed" for students - the area of land the water moves over and/or through as it flows to a specific body of water like a river, pond, or underground aquifer. Discuss with students that all land is part of a watershed, including where they are right now. Discuss where the water in their watershed drains to. Name the source(s) of drinking water for the community.

Use the included Student Guide and Worksheets to help students engage with these concepts. Then complete the following "Let's Shed Water!" activity.

Key Terms:

water
cycle
earth
land
sun
rain
river
lake
pond
ocean
precipitation
body of water
contamination
pollution
groundwater
watershed

Activity Materials:

- large clear bowl/pan large colander
- 3 small cups
- 20 oz cold water crushed ice
- sugar or salt colored with food coloring
- small spoon

Activity Instructions:

1. Divide class into 3 groups.
2. Place colander over clear bowl/pan and fill with crushed ice. Explain to students crushed ice represents soil.
3. Have first student group fill their cup halfway and pour a small amount of cold water on top of the ice.
4. Prompt the class to observe how some water goes through the "soil" and ends up at the bottom of the container.
5. Compare this to precipitation soaking through soil until it reaches a body of water.
6. Have the second group of students mix salt/sugar with food coloring and distribute a spoonful over the ice.
7. Inform students that this represents materials and pollutants that are left on the ground in their watershed.
8. Instruct third group of students to pour water over the "contaminated" soil, salt/sugar mix.
9. Instruct students to observe the effect the "contaminants" have on the "body of water."

Enrichment and Assessment Opportunities:

- Facilitate a follow up discussion with students on the effect of their actions at home, school and in their communities on their watershed.
- Ask students to reflect on the activity and draw what they've learned.
- Ask students to reflect on the activity and write down what they've learned.

Let's Shed Water!

Wordsearch:

Circle the hidden words!

Water

Earth

Ocean

River

Soil

Land

Rain

Lake

Pond

Sun

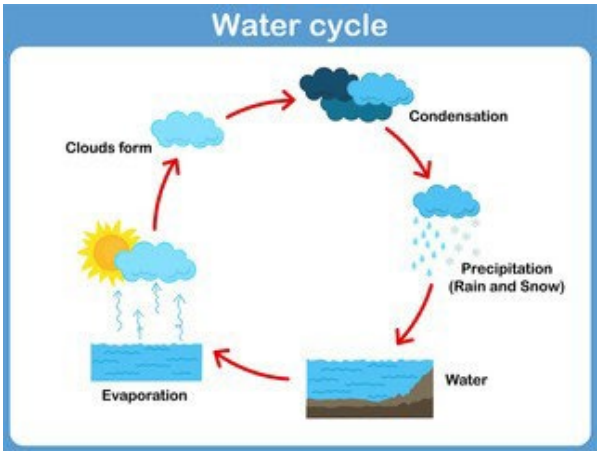
Draw It:

Draw 4 vocabulary words from the activity above in the boxes below.

ONE WATER

Every raindrop, every lake, every river, even the water we drink, is a part of **ONE** cycle, the **WATER** cycle.

That is why we must protect our watersheds.



What is the Water Cycle?

The Water Cycle is a never-ending circle that recycles water. That means the same water that was on Earth when the dinosaurs were alive is still here today!

What is a watershed? A watershed is a system of water that all comes together by draining into a larger body of water.

As the water here on Earth moves between rivers, lakes, oceans, and the sky, it can be a liquid (water), a gas (clouds, steam), or a solid (ice).

Can you draw water in the following forms?

Solid (Ice)

Liquid (Water)

Gas (Cloud)

A watershed can be big or small. We all live in a watershed. Animals and plants also live in our watershed. What kinds of animals and plants live in your watershed?

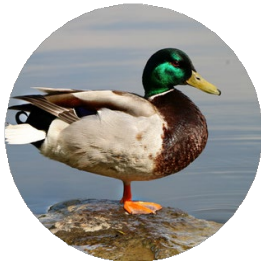
Circle the animals and plants that live in your watershed.












What Water Body?

Overview:
Students will investigate and identify various types of water bodies on Earth by developing models of lakes, oceans, and rivers.

Grade Levels:
Lower Elementary (Grades K-2)

Next Generation Science Standards:
2-ESS2-2. – Earth's Systems - Develop a model to represent the shapes and kinds of land and bodies of water in an area.
2-ESS2-3. – Earth's Systems - Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Learning Objectives:
Students will be able to:
- Identify different types of bodies of water from pictures or maps.
- Describe how water bodies differ from each other.
- Create a model representing a specific type of water body.

Background and Discussion:
Ask students to name as many different kinds of bodies of water as they can. Group similar types together (streams with creeks, etc.). Ask the students how these bodies of water are similar and different. How would they differentiate between a pond and a lake? An ocean and a river? Do any of the bodies of water connect to each other (rivers flow into lakes and the ocean, etc.)?

Define the following types of water bodies: Ocean (major body of salty water); Lake (a body of water, usually freshwater, of relatively large size contained inside a body of land); Pond (a body of water smaller than a lake, often of artificial origin); River (a natural waterway usually formed by water derived from either precipitation or glacial meltwater, which flows from higher ground to lower ground); Stream (a body of water with a detectable current, confined within a bed and banks); Puddle (a small accumulation of water on the surface).

Ask students which types of bodies of water they have seen and ask them to share one thing per student that they remember about that body of water. Show the students photos of local water bodies and have them identify what major type they are (for about ten photos). Next, pass out maps of the local area, and point out major landmarks and water bodies on a projector or smart board. Have the students locate these on their own maps.

What Water Body?

Key Terms:
ocean
lake
pond
stream
creek
river
freshwater
salt water

Activity Materials:
3 aluminum pans or shallow dishes
sand
pebbles
water
aluminum foil
salt
paper towels
student worksheet

Activity Instructions:
1. Split class into 3 groups (lake, ocean, river)
2. Show whole class various examples of water bodies, using pictures and maps. Ask students to name them while showing the corresponding picture of the body of water.
3. Explain to students that they will build a model of their assigned body of water. Provide each group with the materials they will need and point out how some materials can be used, such as aluminum foil folded can make a riverbed, etc.
4. Ask each group to discuss how they want to build their water body before they start building
5. After the groups have completed, have a group representative share their group's model with the class and describe the characteristics of their water body.
6. Using the student worksheet, have the students draw representations for each of the three bodies of water presented.

Enrichment and Assessment Opportunities:
- For each group, have the students describe what topographical characteristics are required for each type of water body (channel/banks for a river surrounded by higher ground, large depression for a lake, continental shelf for an ocean, etc.).
- Consulting their maps, ask students to name the closest lake, closest river, and closest ocean is to their location and/or school.
- Ask where students might encounter solid forms of water (snow/ice) and ask them to point to those locations on their local map (if there are areas nearby) or on a larger scale map for the whole class.

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What Water Body?

Draw a picture for each water body in the boxes below:

River

Lake

Ocean

River Basin Basics

Overview:
Students will explore their local river basin and how actions within the basin affect water quality.

Grade Levels:
Mid-Elementary (with modifications for lower and upper elementary)

Next Generation Science Standards:
K-ESS2-2. – Earth's Systems – Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. *(Digging of wells, development of manmade reservoirs, construction of plumbing systems, etc.)*
K-ESS3-1. – Earth and Human Activity - Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
K-ESS3-3. – Earth and Human Activity - Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
2-ESS2-2. – Earth's Systems - Develop a model to represent the shapes and kinds of land and bodies of water in an area.
2-ESS2-3. – Earth's Systems - Obtain information to identify where water is found on Earth and that it can be solid or liquid.
4-ESS2-2. – Earth's Systems - Analyze and interpret data from maps to describe patterns of Earth's features.
5-ESS3-1. Earth and Human Activity - Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Learning Objectives:
Students will be able to:
- Identify their local river basin.
- Describe the journey drinking water takes to arrive at the tap.
- Explain the concept of water quality.
- Construct a map of a small area within their watershed.
- Describe actions that affect water quality within their river basin.

Background and Discussion:
Students should be familiar with the water cycle and the concept of a watershed.

Ask the students what they think it means for water to be healthy. What qualities would they look for in healthy drinking water? Have students brainstorm a list of attributes of healthy water (not muddy, clear in color, no smell, etc.). Give the students several contrasting examples and ask if they think the water in these

examples is healthy: the water from your tap, a puddle in a parking lot, a sewer, a clear mountain stream, rain caught on a leaf, etc.)

Ask the students to describe their local watershed. Where does the water drain to? Introduce the concept of a river basin and guide the students in exploring this larger-scale watershed. Where does your local river basin ultimately drain to? The ocean? A larger river?

Key Terms:

- river basin
- aquifer
- watershed
- water quality
- well water
- municipal/city water

Activity Materials:

- state river basin map
- large state map showing major landmarks, cities, and counties
- large map of your local area (city/county)
- rulers
- crayons/markers
- large sheets of white paper
- student worksheets

Activity Instructions:

1. Display the large state map and ask students to identify where they are (from: https://water.usgs.gov/wsc/map_index.html). Pull up the large map of your local area, and ask the students to locate their school, homes, and other important places in the community. Ask students what some of their favorite things are to do and places to go within the community.
2. Mark locations on the map that correspond with student answers.
3. Locate on the map and discuss the bodies of water in the community, where water in the watershed drains to, and which river basin(s) the community is in.

4. Ask the students where their drinking water comes from. Do students have well water or municipal drinking water? Discuss landmarks associated with these types of drinking water (water towers for municipal water, well caps/pumps for well water) and why certain types of drinking water are used in certain areas.
5. Ask students to trace their water back to its source. Where does the water from their tap come from? Is a local lake used as a reservoir for drinking water? Where does the water that drains into that lake come from? How does water reach their household well?
6. Revisit the earlier discussion on water quality. Have any of the students visited local bodies of water? How would they rate their water quality, according to the criteria set out earlier by the students? (See Background and Discussion section.)
7. Ask the students how they think human activity affects water quality. Generate a class list of materials that are left on the ground, poured on the ground and any activities that students can think of that may affect water as it moves through the watershed.
8. Explain to students that, as a group, they will draw a map of small area within their watershed, for example, the school location, a street where they live, a yard, etc. Have students add pictures of buildings, people, animals, equipment, anything that is in the area they choose to draw.
9. Divide students into groups of 3-5 and distribute worksheets, paper, rulers, and markers/crayons.
10. When the students have finished their drawings, ask them to circle any items on their map that they think could harm water quality in red. Walk around to each group and challenge the students to think about the items on their maps in terms of water quality.
11. On a large table or the floor, arrange the students' smaller maps to form a large map of your local area. Ask the students to identify all of the item circled in red. Which items are the most common in your local watershed? Which have the biggest impact on water quality?

Enrichment and Assessment Opportunities:

- Follow Up Discussion – Was there anything that surprised the students about where their water comes from?
- Ask the students to chose one of the red circled items from their map that most closely relates to them and write a few sentences on their connection to the item, the item's connection to water quality, and therefore their connection to water quality.
- As a class, generate an additional list of steps that can be taken to protect the local watershed and drinking water.

List two of your favorite things to do in your watershed:

_____

_____

List two of your favorite places to go in your watershed:

_____

_____

Work with your group to draw a map of a small area in your watershed. What area is your map of?

_____

When rain or snow falls in your watershed, where does it go?

_____

Where does your drinking water come from?

_____

Draw a picture of something you can do to protect your watershed and help keep your drinking water clean.

ONE WATER

A watershed is land that water flows over.

Have you ever watched it rain? The raindrops fall on the soil and flow over it. Water can also flow THROUGH the soil.

Water flows through the soil until it reaches groundwater. Groundwater is the water that is contained in and moves through spaces in soil and rock underground. A lot of the water we use and drink every day comes from water in the ground. All the land on earth is made up of watersheds. We all live in a watershed.

We share **ONE WATER** in our watershed with other people, with animals and with plants.

A lot of rain, sleet and snow falls into oceans, rivers, lakes, ponds, and streams. Some of it lands on the ground in your watershed. The way we treat the land in our watershed can have a big impact on the water we drink.

Is there an ocean, lake, river, stream, or pond near where you live?

Yes ☐ **No** ☐

Gravity helps the rain, sleet, and snow flow from the ground to join the rest of the water in the oceans, lakes, rivers, streams, or ponds. Some of the water we drink comes from these lakes and rivers.

Some rain, sleet and snow flows over sidewalks and streets and runs into storm drains.

Is there a storm drain on your street?

Yes ☐ **No** ☐

Some rain, sleet, and snow soaks into the ground where it is stored as groundwater. Some of the water we drink comes from groundwater. If the water in your home comes from a well, it comes from groundwater.

Does the water in your home come from groundwater?

Yes ☐ **No** ☐

Draw a picture of where your drinking water comes from.

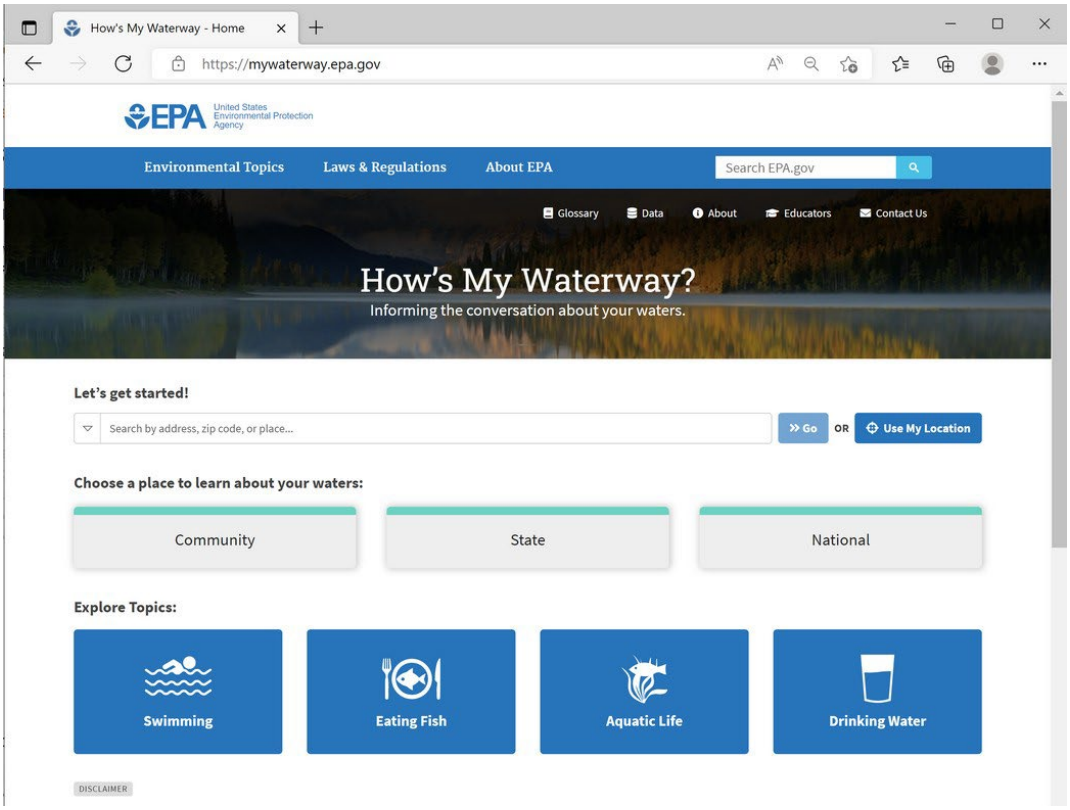
Find and circle these words in the puzzle:

CLEAN	RAIN
GROUND	RIVER
HEALTHY	SNOW
LAKE	STREAM
OCEAN	WATER
POND	WELL

P Q Z V N W A J M D E V F B A
R I V E R A H O W E L L N W O
W D J H I X E G J Z Y I I R W
H E Y F O W V C V E A N C V A
T K O S J X G F O R R U T D K
U O H L D R D O K U C F I N U
E V A N U K N J T F M F F F H
V K O H V H W A N I H X T W L
E P U Q N S E B E M A E R T S
M S D L E G W A W L V B D S I
E P K N E K Q R L X C S N Q Y
S L T D Q E Y E S T L H U S P
V S J D U O G T L N H D O N H
U R T S V G T A L X B Y R O H
M Z Z Z V P K W P Z V K G W E

How Big Is My Watershed?

Watersheds can be big or small. They usually have some high points of land like hills, mountains, or ridges. When rain, sleet or snow falls to the ground, it runs from the higher points to the lower points. Gravity pulls it downhill until it reaches a body of water. If the land in your watershed is steep, the water usually runs off into rivers or streams. If the land around you is level, the water will slowly flow into lakes or ponds, or seep into the soil and add to groundwater.



Visit https://mywaterway.epa.gov/ to see a map and the health of the watershed where you live!

Let's Get Salty

Overview:

Students will investigate the way plant cells respond to saltwater and explore the importance of adaptations in saltwater habitats.

Grade Levels:

Upper Elementary – Middle School

Next Generation Science Standards:

3-LS3-2. – Heredity: Inheritance and Variance of Traits - Use evidence to support the explanation that traits can be influenced by the environment.
3-LS4-2. – Biological Evolution: Unity and Diversity - Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
3-LS4-3. - Biological Evolution: Unity and Diversity - Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
4-LS1-1. – From Molecules to Organisms: Structures and Processes - Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
5-ESS2-2. – Earth's Systems - Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
MS-LS1-1. – From Molecules to Organisms: Structures and Processes - Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
MS-LS2-4. – Ecosystems: Interactions, Energy, and Dynamics - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS4-4. – Biological Evolution: Unity and Diversity - Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Let's Get Salty

Learning Objectives:

Students will be able to:

- Make observations in an experimental setting
- Explain how changes in the concentration of salts in water affect the water/salt balance in living cells
- Describe what adaptations are necessary for an organism to live in the fluctuating salinity of the estuarine environment

Background and Discussion:

The water in oceans and estuaries is very salty. Plants and animals that live in salt water must balance salt in their body tissues. Cells make up blood and tissue in animal bodies. Some salt marsh plants secrete or "sweat" extra salt out, while others draw more water into their bodies to balance salt that is already in their cells. Fish excrete super salty and concentrated urine to balance salt in their bodies. Female sea turtles that "cry" during nesting are using special lacrimal glands to secrete extra salt, not because they are sad. Animals that live in an estuary or salt marsh must have characteristics that allow them to adapt to changing salinity levels associated with tides, drought, or excessive rainfall.

Vertebrates (including humans) drink extra fresh water, excrete concentrated urine, sweat, and cry to balance salt in our body cells. Think about what you do when you are thirsty. Your cells are working well in advance of your behavior when it comes to balancing salt and water throughout your body. By the time you are thirsty, your cells are already dehydrated to some extent. It's very important for all animals to drink enough water for their bodies to function efficiently.

Let's Get Salty

Key Terms:

adaptation
habitat
salinity
solution
osmosis
membrane
water balance
estuary
marsh

Activity Materials:

1 large russet potato per student group, cut into French fry style slices
Table salt
Small cups
Water
Measuring spoons
Rulers
Markers
Lab books/notebooks/paper

Activity Instructions:

1. Divide students into groups of 3-5 and distribute the potato slices.
2. Have each group label one cup "fresh water" and a second cup "salt water".
3. Fill the "fresh water" cup with warm water from the tap – This will represent the conditions found in a river or lake.
4. Fill the "salt water" cup with warm water and 2 tablespoons of salt, making sure to stir until the salt is dissolved – this will represent the conditions in the ocean.
5. Have the students make the following observations about their potato slices: dimensions for each slice (length, width, height), color, and texture. Number each slice with a marker #1-6.
6. Ask the students to develop a hypothesis about what they think will happen to each set of potato slices. Have them write down their hypotheses in their notebooks or on paper.
7. Place 3 French fry slices into the "fresh water" cup and the other 3 slices into the "salt water" cup.
8. While the experiment is going, have the students complete the accompanying activity worksheets.
9. After 30-40 minutes, have the students record their observations again. What changed about the potato slices? What do they think caused this change? Is the potato more or less salty than freshwater? More or less salty than saltwater? Were their hypotheses correct? What conclusions can they draw from this experiment?
10. Have students diagram what they think is happening to the potato cells in both the fresh water and salt water scenarios. In which direction is the water traveling across the cell membranes?
11. Ask the students what they think would happen if a freshwater fish was placed in the ocean? If a saltwater fish was placed in a lake? How do adaptations help each of these species thrive in their normal habitat? How could these adaptations be a detriment in other habitats?

Enrichment and Assessment Opportunities:

- Certain kinds of fish spent part of their life cycle in freshwater and part of their lifecycle in saltwater (anadromous and catadromous species). Ask the students to predict what kinds of physical and behavioral adaptations these species have. Divide the class into groups and assign each group a type of fish to research, and have the groups report back to the class what they learned.
- Challenge the students to design another experiment to test a related question that arose in this experiment or a question they have about estuaries/salt water/fresh water.

Match the Term to the Definition:

adaptation habitat salinity solution osmosis
estuary salt marsh

Organisms adjusting to new environments or to changes in their current environment.

_____

Partially enclosed, coastal water body where freshwater from rivers and streams mixes with salt water from the ocean.

_____

Flooded coastal wetlands drained by salt water brought in by the tides.

_____

The movement of water molecules through a selectively permeable membrane from a region of high-water concentration to low water concentration.

_____

The dissolved salt content of a body of water.

_____

Home environment for a plant, animal, or other species.

_____

Mixture of two or more substances that stays evenly mixed.

_____

Let's Get Salty

Write a paragraph about wetlands using 4 of the vocabulary words below:

adaptation habitat salinity solution
osmosis estuary marsh

Overview:
Students will define and evaluate characteristics of watersheds, while using topographical maps and understanding the transport of sediment and pollution through runoff.

Grade Levels:
Upper Elementary – Middle School

Next Generation Science Standards:

Learning Objectives:
Students will be able to:
- Evaluate the interaction between precipitation and the topography of a watershed.
- Construct a watershed model.
- Observe the flow of precipitation through a watershed.

Background and Discussion:
Students should be familiar with the water cycle and the concept of a watershed.

Introduce the students to topographical maps, explaining what the lines mean and how to read them. Ask them in what situations or for what applications do they think topographical maps might be useful. How does topography affect how water behaves in the landscape? How does this affect our watersheds?

Key Terms:
contour lines
groundwater
storm drain
topography
water molecule
watershed
wetland
water table
watershed boundary

Activity Materials:
- Local watershed map (source: https://water.usgs.gov/wsc/map_index.html)
- Local topographic map
- plastic/metal trays
- permanent markers
- aluminum foil (at least a 12x12 inch section for each group)
- spray water bottle with blue food coloring/drink mix

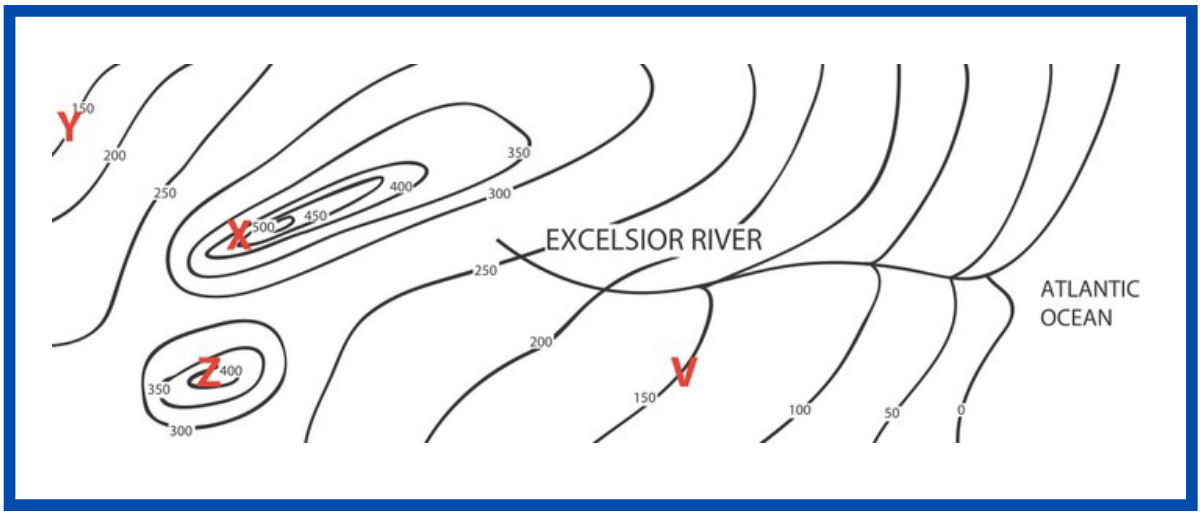
Activity Instructions:

1. Give each group a plastic/metal tray to place their watersheds on when completed.
2. Using permanent markers, have students create a sample watershed by drawing the following features on the aluminum foil, each in a different color:
   a. urban areas; cities, towns, neighborhoods, parks, factories, etc.
   b. agriculture areas; farms, ranches, fields, crops, etc.
   c. undeveloped areas; forest, wetlands, beaches, etc.
3. Have student crumple the foil into a ball and slightly smooth it out
4. Add following features to the crumpled foil in the valleys and depressions:
   a. creeks, rivers, ponds, lakes, an ocean, etc.
5. Place foil in center of newspaper. Have students add "rain: by spraying the cardstock with the blue colored water mixture until puddles form in the low areas. Have students observe how the water flows from the high points to the low points.
6. After observing the rain, have the students reflect on what they would change about where they placed the water features in their watershed. Is the small creek actually a big river because of the topography? Did some of their water bodies not actually receive any water? Why do they think that is?
7. Display the local watershed map for the students on a projector/smartboard, along with a local topographical map. Ask the students what connections they see. How do elevation and slope play a role in where water goes in a watershed?

Enrichment and Assessment Opportunities:

- Challenge the students to draw a 2D topographical map representation of their 3D foil watershed.
- Have the students introduce a source of pollutant in one area of their watershed (erosion from a construction site, fertilizer runoff from a golf course, etc.) by adding a small amount of red food coloring in that area of the map. Spray the watershed with the blue water "rain" and observe how the pollutant behaves and where it travels. Where does it mix with the water? What areas are untouched by the pollutant? How does the pollutant get diluted as it travels through the watershed?
- Challenge students to think of all the possible sources of pollution/contamination in their watershed and list them out. What actions could be taken to minimize or mitigate the effects of these pollutants?

Look at the map to answer the questions below:



Where is the lowest elevation on this map?

_____

What is the tallest point on this map?

_____

What two areas (marked by red letters) are the same height?

_____

At what elevation does the Excelsior River begin?

_____

Does the Excelsior River flow towards or away from the ocean?

_____

ONE WATER

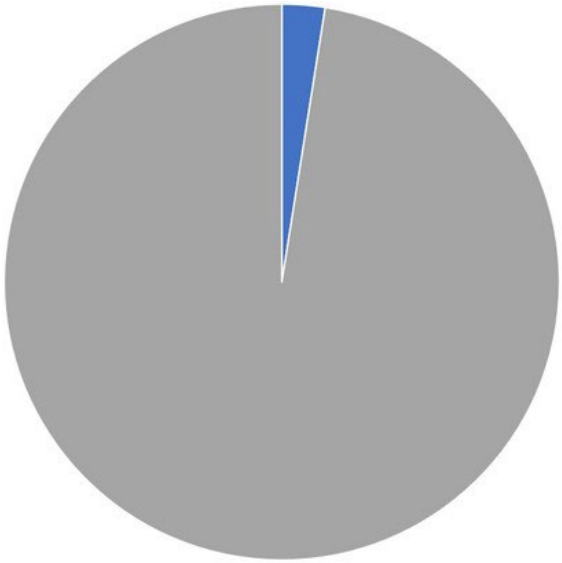
The location and size of your watershed is determined by the shape - topography - of the land. Water that falls to the ground is pulled by gravity downhill until it reaches a body of water like a lake, river, ocean, pond, or stream. The boundaries of a watershed are usually made up of high points of land like mountains, hills, or ridges.

A watershed is a little like a sink. It has high sides so the water stays inside. The water drains out of the sink and into a pipe. Water drains from a watershed into a body of water like a lake or river. When you wash your hands in the sink, the water carries the soap and dirt from your hands down the drain into the pipe.

If you can imagine the sink made of soil, you can see that water would also soak into the soil and move into groundwater. When water drains from a watershed, it can carry materials from the ground into the lake or river it drains into. This is called runoff.

About 2.5% of the water on our planet is suitable for human consumption. The average U.S. citizen uses approximately 80-100 gallons of water every day. Here are a few simple actions that you can take to conserve water in your watershed:

- Keep daily showers under 5 minutes
- Turn off the faucet while brushing your teeth
- Use a bucket and sponge to wash your bike instead of using the water hose



FRESH WATER 2.5% (Including ice caps and glaciers. Only a little more than 1.2% of all freshwater is surface water, which serves most of life's needs.)

SALT WATER 97.5%

What are some ways you can conserve water today?

_____

_____

_____

Overview:
Students will discover how climate, environment, and topography relate to watershed conditions.

Grade Levels:
Middle School

Next Generation Science Standards:
MS-PS1-4. – Matter and its Interactions - Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
MS-LS2-3. – Ecosystems: Interactions, Energy, and Dynamics - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-ESS2-4. – Earth's Systems - Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Learning Objectives:
Students will be able to:
- Explain how water is cycled among the land, the ocean, and the atmosphere.
- Describe the driving factors behind water cycle processes, including gravity and heat from the sun.

Background and Discussion:
The water on Earth is in constant movement. This movement is not limited to Earth's surface, but also includes the atmosphere and the subsurface. The water cycle describes how water moves within the atmosphere and on Earth and its transition from one state to another. The water cycle is dynamic and involves many different processes that contribute to water being moved from one place to another. Some of these processes are evaporation, condensation, precipitation, transpiration, and infiltration.

Key Terms

water cycle
evaporation
condensation
precipitation
transpiration
infiltration
runoff
surface water
groundwater
water vapor

Activity Materials (for each group of 3-5 students):

- Transparent plastic storage box
- 3-4 in diameter rock/stone (or modeling clay shaped into a mountain
- 2 cups sand or soil
- Warm water
- Heat lamp
- 1 cup ice cubes
- 2 snack-size Ziplock baggies
- Notebook/pencil
- Timer

Activity Instructions:

1. Divide your class into groups of 3-5 students. Provide each group with the materials they need to make their water cycle model. Students should choose collectively how they will arrange their landscape within the box.
2. Let each group prepare their landscape within the box. Then tell them to close the lid and place the heat lamp about 30 cm above the body of water in the box.
3. Fill zip-top baggies with ice cubes and place ice cube bags anywhere on the top of the lid except for directly under the heat lamp.
4. Have students start their timer/clock to monitor what happens in their water cycle model over time. As them to record their observations in 10- minute intervals. Allow them to touch the box from all sides with their hands to feel if anything changes, but students should not open the box lid during the experiment.
5. During the first 10-minute interval, ask students to form a hypothesis of what will happen to the water inside their model and what they might observe. They should also reflect on how the model they created

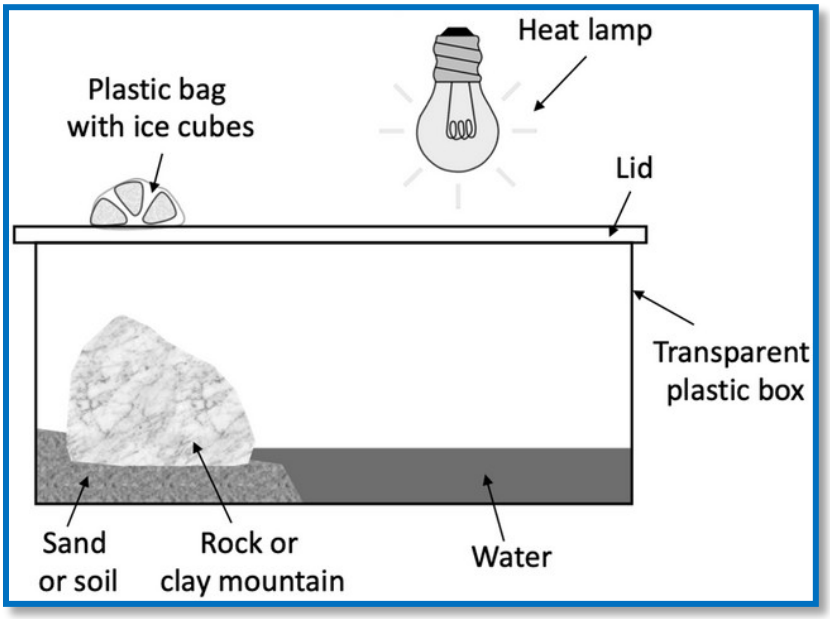
represents the real world by discussing the following questions:

   a. How does your model landscape reflect the real world?
   b. In your water cycle model, what does the lamp represent?
   c. In your water cycle model, what do the ice cubes represent?

6. In the second 10-minute interval, give students the opportunity to look at other groups' setups, which might be different from their own, and encourage them to exchange thoughts, as well as their observations. Have students record how other water cycle models differ from theirs.
7. In the third 10-minute interval, ask students to think about the following questions:

   a. What changes do you see occurring within your model?
   b. Do you see water appear or disappear within your model? If so, where?
   c. Can you name or describe some of the processes you are observing?
   d. Are there processes you think are happening but cannot observe directly?
   e. Why do you think these processes are happening?

8. Within this 30-minute period, students should be able to observe the condensation of water underneath the ice cubes on the lid, as well as precipitation of water from the lid onto the mountain (making surface runoff visible), onto the sand (making infiltration visible), or onto the water body. Based on these observations, they should be able to conclude that water must have gotten into the air due to evaporation from the water body.

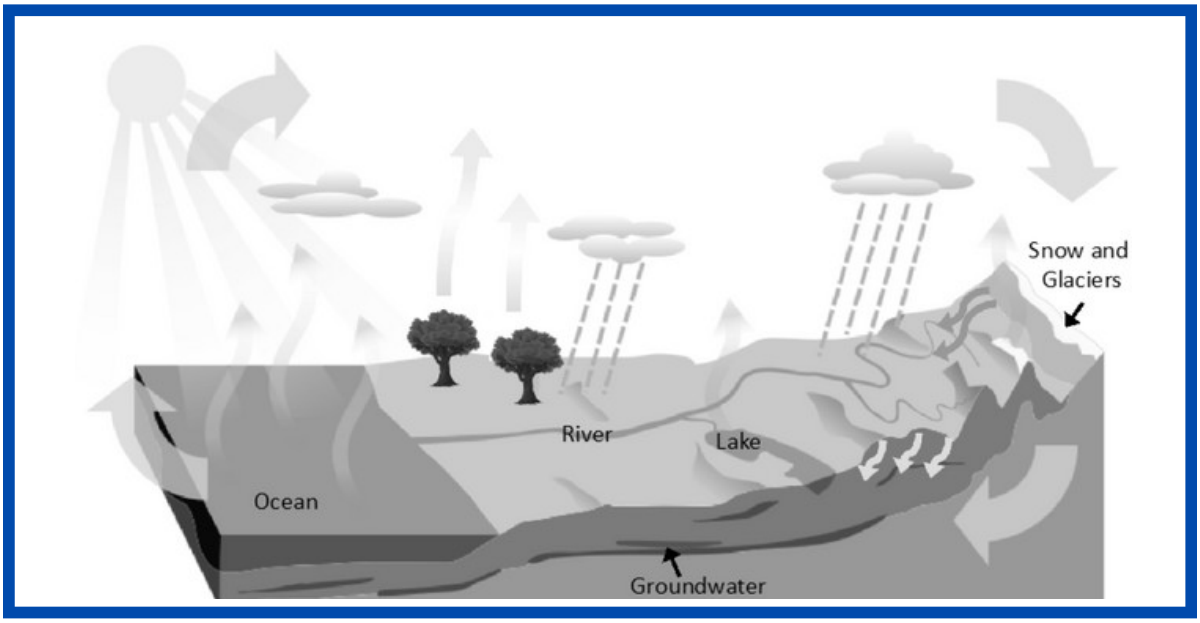


Enrichment and Assessment Opportunities:

- Challenge the students to come up with hypotheses about why they weren't allowed to open the box during the experiment. Discuss with the students about closed vs open systems, and explain how Earth is a closed system relative to space. Exchanges occur between the hydrosphere, cryosphere, atmosphere, and biosphere, but the amount of water on Earth stays the same. Repeat the experiment with the lid off to test the student's theories.
- Have the students come up with hypotheses about what would happen if the parameters of the experiment were changed: more/less heat, more/less ice, more/less water, etc.

The Water Cycle

In your group, match the definition, description, and picture of the different water cycle processes. Then label as many water cycle processes as possible in the diagram below.

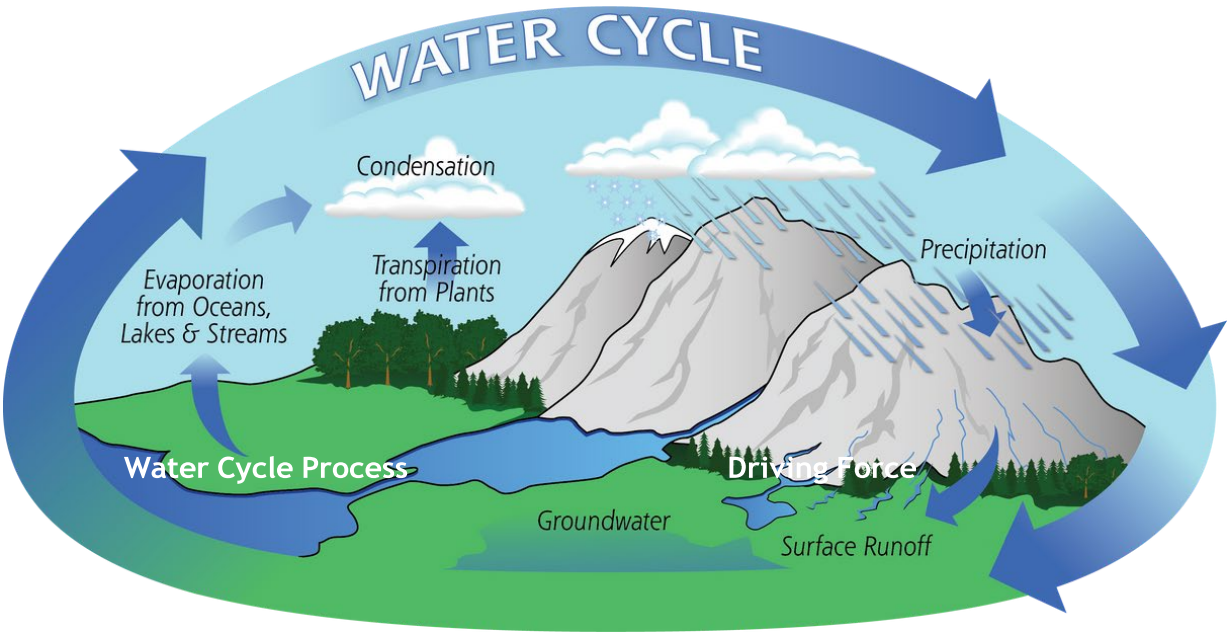


In the table below, write down what drives each of the listed water cycle processes. For example, the sun provides heat, and heat makes water evaporate. This makes sunlight the driving force of evaporation.

Water Cycle Process	Driving Force

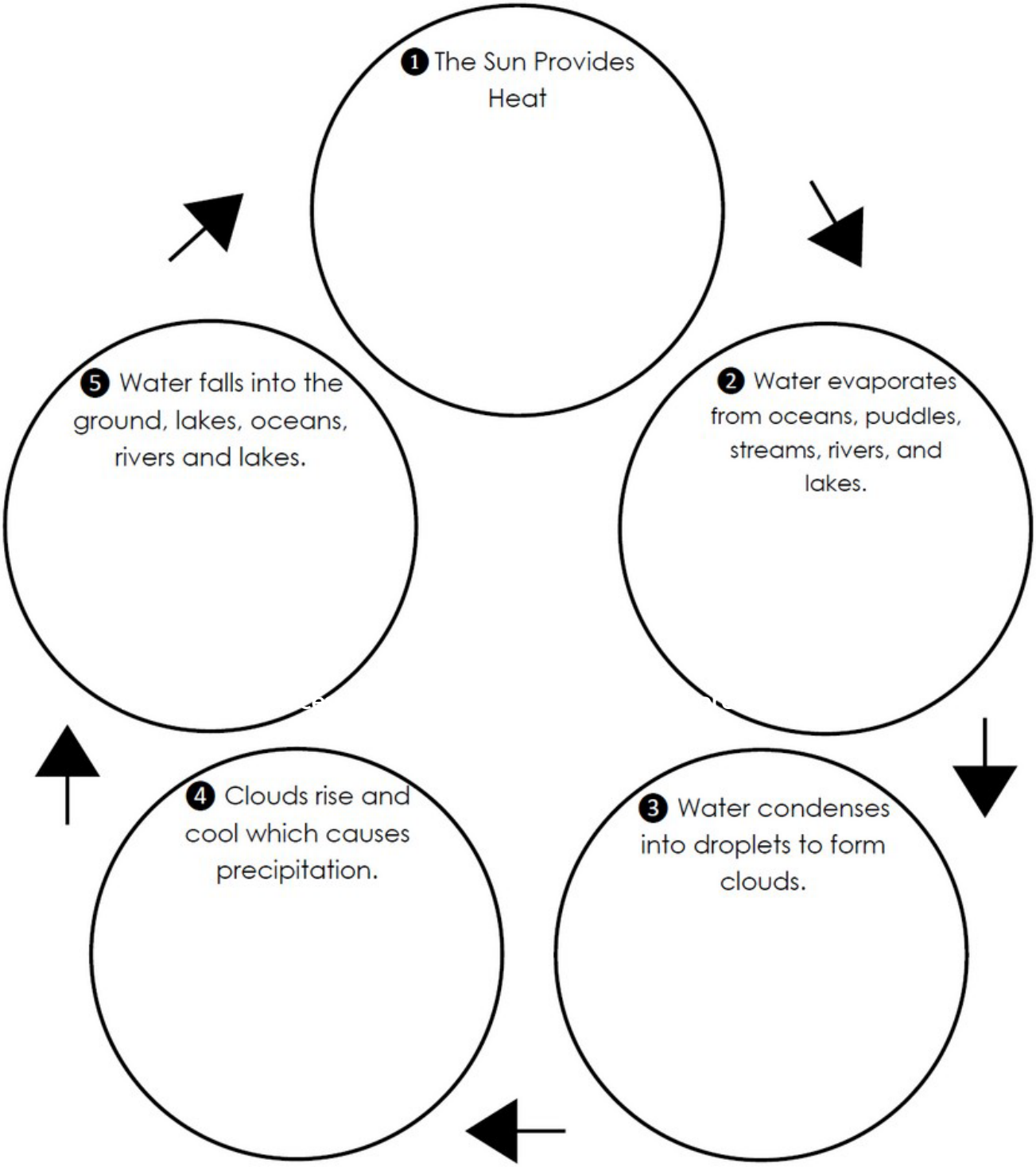
ONE WATER

Did you know that a drink of water, whether from a fountain, faucet, or bottle, could be thousands of years old and may have travelled around the world multiple times? Earth's fresh water supply is not new. Our water is constantly being recycled through the Earth's water cycle.



The above diagram illustrates how we end up drinking recycled water that has already been used because we only have **ONE** fresh **WATER** supply.

Illustrate the Water Cycle:



Answer Key

Let's Shed Water

Mapping Water

1. Atlantic Ocean
2. Point X
3. Point Y & Point V
4. 150
5. Towards

Let's Get Salty

adaptation
estuary
salt marsh
osmosis
salinity
habitat
solution

One Water Resources

U.S. Geological Survey
Science in Your Watershed
https://water.usgs.gov/wsc/

National Association of Geoscience Teachers
Build Your Own Stream Table
https://nagt.org/nagt/teaching_resources/teachingmaterials/9271.html

Environmental Protection Agency
Drinking Water Activities for Students and Teachers
https://www.epa.gov/ground-water-and-drinking-water/drinking-water-activities-students-and-teachers

US Water Alliance
One Water
http://uswateralliance.org/one-water

Project WET
Project WET 2.0 Guide
www.projectwet.org

National Association of Conservation Districts

About Us

The National Association of Conservation Districts is the non-profit organization that represents the nation's 3,000 conservation districts, their state associations and the 17,000 men and women who serve on their governing boards. For almost 70 years, local conservation districts have worked with cooperating landowners and managers of private working lands to help them plan and apply effective conservation practices.

Conservation districts are local units of government established under state law to carry out natural resource management programs at the local level.

NACD's mission is to serve conservation districts by providing national leadership and a unified voice for natural resource conservation. The association was founded on the philosophy that conservation decisions should be made at the local level with technical and funding assistance from federal, state, and local governments and the private sector. As the national voice for all conservation districts, NACD supports voluntary, incentive-driven natural resource conservation programs that benefit all citizens.

NACD maintains relationships with organizations and government agencies; publishes information about districts; works with leaders in agriculture, conservation, environment, education, industry, religion, and other fields; and provides services to its districts. NACD is financed primarily through the voluntary contributions of its member districts and state associations.

The association's philosophy is that conservation decisions should be made by local people with technical and funding assistance from federal, state, and local governments and the private sector. The association's programs and activities aim to advance the resource conservation cause of local districts and the millions of cooperating landowners and land managers they serve.
Visit www.nacdnet.org for additional information. To find your local district contact information, go to
http://www.nacdnet.org/about/districts/directory