

## How Much Water Do You Use?

<b>Topic:</b> Human Impacts on Watersheds, Seeking Solutions to Problems		<b>Timeframe:</b> 2-3 class periods (after students have collected data for 2 weeks)
<b>Brief Description:</b> Students monitor and estimate their weekly water use for both themselves and their family. They problem-solve about ways to reduce water consumption individually and schoolwide. Students then create posters supporting and promoting water conservation.		
<b>Performance Expectations</b> <b>Students who demonstrate understanding can:</b> Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (4-ESS3-2)  Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (building toward 4-ESS3-1)		
<b>Science &amp; Engineering Practices</b>	<b>Disciplinary Core Ideas</b>	<b>Crosscutting Concepts</b>
<b>Constructing Explanations and Designing Solutions</b> Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.  <b>Obtaining, Evaluating, and Communicating Information</b> Obtain and combine information from books and other reliable media to explain phenomena.	<b>ESS3.B: Natural Hazards</b> A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (4-ESS3-2)  <b>ETS1.B: Developing Possible Solutions</b> Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)  <b>ESS3.A: Natural Resources</b> Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (building toward 4-ESS3-1)	<b>Cause and Effect</b> Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3-2, 4-ESS3-1)  <b>Connections to Engineering, Technology, and Applications of Science</b> <b>Influence of Science, Engineering, and Technology on Society and the Natural World</b> Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2) Over time, people's needs and wants change, as do their demands for new and improved technologies (building toward 4-ESS3-1)
<b>Common Core State Standards for ELA:</b> <b>RI.4.1</b> Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2) <b>RI.4.9</b> Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2) <b>W.4.7</b> Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS3-1) <b>W.4.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS3-1) <b>W.4.9</b> Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1)		

**Common Core State Standards for Mathematics:**

**MP.2** Reason abstractly and quantitatively.

**MP.4** Model with mathematics.

**4.OA.A.1** Interpret a multiplication equation as a comparison Represent verbal statements of multiplicative comparisons as multiplication equations.

**Alaska State Science Content Standards:**

E1 Science and Technology

[4] SE2.2 Students develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social by identifying multiple explanations

A1 Science as Inquiry and Process

[4] SA1.1 Students demonstrate an understanding of the process of science used to investigate problems, design and construct repeatable scientific investigations, and defend scientific arguments by asking questions, predicting, observing, describing, measuring, classifying, generalizing, inferring, and communicating.

**Anchorage School District SEL Standards:**

1D. Student has a sense of personal responsibility.

2C. Student uses effective decision-making skills.

3B. Student demonstrates consideration for others and a desire to positively contribute to the community.

4A. Student uses positive communication and social skills to interact effectively with others.

**Teacher Background Information:**

**Note: Please take into consideration that students need to collect data of individual and/or home use water for two weeks following the Engage part of this investigation**

An average family uses about 300 gallons of water per day. Water use can be reduced by a variety of water conservation measures, such as reusing “gray water” for a variety of purposes including gardening, low-flow faucets and toilets, bricks in the toilet, etc.

**Possible Learner Preconceptions / Misconceptions and Instructional Clarifications**

Learner Misconception: Because water is constantly being recycled in the water cycle, it’s not necessary to worry about conserving water through reducing waste (unnecessary uses) or using it more than once.

Instructional Clarification: Fresh water is a limited resource that usually requires treatment before it is clean and safe for human use. Treating and distributing water and disposing of wastewater requires energy that comes from other natural resources like oil and gas.

**Prior Student Knowledge:**

Relative scarcity and availability of water globally (See Water, Water Everywhere investigation) and where the water that comes out of their tap comes from.

**Materials List:**

Water Use Worksheet (see below)

**Teacher Preparation:**

1. Make copies of the Water Use Worksheet (2 copies for each student).

**Vocabulary:**

**wastewater:** water that has been used by people and requires treatment before returning it to the

environment

**conservation:** rational or wise use of natural resources to avoid having too little to meet human needs over the long-term

**ENGAGE:** (5-10 min)

1. Pass out the Water Use Worksheets and ask students to estimate the amount of water they think they typically use in a week. Have them also calculate an estimate for their entire family for the week. *Hint: For students needing assistance with this, consider modeling with your own water usage. Project a copy of the worksheet onto the whiteboard and 'think out loud' as you fill in the sheet for yourself for the day and the week.*
2. Students should then glue their estimates into their Science Notebook and title it appropriately: Estimated Water Usage. *Note: there are no right or wrong numbers. The usage may vary widely within your class.*
3. Ask students to start a log of their own water use in their home and at school.
  - a. Brainstorm first as table groups, then as a class, a list of all the places/activities they may use water.
  - b. List these on the whiteboard. *Note: some students may go swimming regularly, while others do not. Not all activities in the list need to pertain to all students.*
  - c. Students then create a data table in their science notebooks to allow them to track and tally how many times a day they run water for drinking, to wash their hands, to take a shower, flush the toilet, eat a meal cooked with water, etc.
4. If they can estimate amounts (e.g., a cup of water), they should add that information to their log.

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**Water Use Worksheet**

Activity	Number of times activity performed each day	Quantity of water used each time	Number of Days	Total amount of water used per activity over time
Bathroom				
Flushing Toilet		x 5 gallons	x ____ days	= ____ gallons
Showering		x 30 gallons	x ____ days	= ____ gallons
Bathing		x 40 gallons	x ____ days	= ____ gallons
Brushing Teeth		x 1 gallon	x ____ days	= ____ gallons
Kitchen/Laundry				
Washing dishes by hand		x 30 gallons	x ____ days	= ____ gallons
Dishwasher		x 15 gallons	x ____ days	= ____ gallons
Washing machine		x 30 gallons	x ____ days	= ____ gallons
Outdoors				
Washing car		x 30 gallons	x ____ days	= ____ gallons
Watering lawn/garden (30 min.)		x 15 gallons	x ____ days	= ____ gallons
Other		x 30 gallons	x ____ days	= ____ gallons
Grand Total =				____ gallons

*My Water Usage*

Activity	Tally	Quantity of water	# of days	Total amount of water
shower				
brushing teeth				
toilet				
dishes				
watering plants				
laundry				
using sponge				
drinking fountain				
washing hands				

**EXPLORE:** (two weeks)

1. After two weeks of monitoring their individual water use, students tally up their totals and compute the water usage for each activity.
2. Next, working in table groups, students compare their total water use in different categories.
3. As students discuss their data, circulate around the room probing with questions such as:
 

*What types of uses occurred most often?*

*What patterns do you see in water usage?*

*How do their usage patterns differ?*

**EXPLAIN:** (20 minutes)

1. Students construct a claim about their individual water usage, based on evidence from their data and the data of others.
2. Students share their claim with their table group.
  - a. As students obtain, evaluate, and communicate information and engage in argument from evidence in their table groups, circulate around the room probing for deeper understanding.
3. Review what the students learned about water usage.
4. Ask: *Why might we all want to use less water if possible and avoid wasting water?*
  - a. Ask students to argue from their observations and evidence collected earlier (the

- demonstration of the relative scarcity of fresh water in the world that is readily available for human uses, where water comes from in their watershed, the needs of other species for water as a component of their habitat.)
- b. If they don't think of it, describe the energy required to distribute water around their watershed.
5. Ask the students to review their data about their water use in their table groups again.
- a. discuss ways they could reduce their use of water.
  - b. groups pick their 3 top ideas of water conservation to share with the class
    - i. explain their reasoning why these became their top 3 ideas.
    - ii. groups back up reasoning with evidence.

**ELABORATE: (25 minutes)**

1. Students develop ways and set up experiments to measure the quantities of water they actually use.
  - a. For example: one group may wish to figure out the amount of water used when a faucet runs for one minute when fully open or when only half open into a sink. Students figure out a way to capture and measure the water flow in a given time, then estimate their total daily water use over 3 days by themselves (and their family) to compare with their first estimate in Engage based on consumption of water, on average, by different activities.
  - b. Another group may wish to set up a similar experiment with water coming from a water fountain.
  - c. Another group may measure how much water is needed to fill a sink for washing dishes and then how much water is really used for rinsing them.
  - d. Allow your students to be creative in thinking about water usage and how to measure it!
2. Students present their results in a manner that demonstrates understanding of human use (overuse?) of resources.

**OPTIONAL ELABORATE:**

Invite a guest speaker from a local water department or utility to come to your class to provide more detailed information about the process of getting water to student homes and the school, water conservation practices, and ways to ensure enough water is left in streams and lakes for fish and wildlife.

**EVALUATE: (20 minutes)**

1. Each student creates a poster with messages about water use in their home or at school and post them in appropriate places (e.g., bathrooms, over water fountains, etc.). Each poster should include one reason for conserving water.
2. Each student monitors their own use of water in the school for another week
  - a. record usage in science notebooks
  - b. report changes and/or success in reducing their own individual water use
  - c. observe whether other students respond to the messages i.e.- does messaging make a difference? How do we measure or affect change to reduce the impacts of humans on the Earth?

Adapted from [Water Conservation lesson plan](#), Teacher's Domain, PBS Learning Media, WGBH, by Alaska Sea Grant and the Anchorage School District STEM Department for the Anchorage School District 4<sup>th</sup> grade Interdependence STEM kit.

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\* Quantities given are estimates.