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## Water, Science, and Civics: Engaging Students with Puget Sound, An Interdisciplinary Curriculum Recommended for Grades 6–8

Facing the Future, Western Washington University

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# Water, Science, and Civics:

## Engaging Students with Puget Sound



An Interdisciplinary Curriculum  
Recommended for Grades 6–8



1-Week Curriculum Unit



# Water, Science, and Civics:

**Engaging Students with Puget Sound**

An Interdisciplinary Curriculum  
Recommended for Grades 6–8

## **Water, Science, and Civics:** Engaging Students with Puget Sound

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# Introduction for Educators

Imagine a classroom where students are mastering social studies and science content as they:

- create digital public service announcements that educate the local community about how to decrease water pollution
- propose solutions at town hall meetings to keep Puget Sound healthy

*Water, Science, and Civics* engages students in these types of lessons. Not only do students master standards, but they also develop 21st century skills related to digital literacy, media literacy, critical thinking, problem solving, collaboration with peers, and taking multiple perspectives. They become thoughtful leaders who participate in problem-solving activities similar to ones they will encounter as active citizens in the future.

Recent research suggests that student engagement can help support student achievement now and in the future. Students who are engaged are more likely to excel in the classroom.<sup>1</sup> Learning core content that helps them make real world connections can highly motivate students.

The series of five lessons in *Water, Science, and Civics* will lead your students through an exploration of the significance of Puget Sound both as a body of water and the geographic region that surrounds it. Students will learn specifically about the services the Sound provides for humans economically, socially, and environmentally. They will engage in activities that range from understanding the scientific impacts of human behavior on the Sound to considering the many points of view involved in Puget Sound pollution prevention. The culminating lesson is an action project in which students create solutions to reduce pollution in their local community.

Included in each lesson are ideas for **discussion questions, background readings, and additional resources.** All lessons are **SMARTBoard compatible** and have a number of integrated technology components including **Google Maps** and **PowerPoint.** Though the lessons are designed as a comprehensive unit, each lesson can also stand alone. The lessons were pilot tested and reviewed by Washington educators and are aligned to science, social studies, language arts, technology, and sustainability standards

Teaching your students about local and global issues that impact their lives can encourage them to create effective solutions. *Water, Science, and Civics* will help you do just that in a uniquely engaging way as students learn core social studies and science skills.



JOHN DURBAN

1 Center for Comprehensive School Reform and Improvement (April 2007). "Using Positive Student Engagement to Increase Student Achievement," [http://www.centerforcsri.org/index.php?option=com\\_content&task=view&id=446&Itemid=5](http://www.centerforcsri.org/index.php?option=com_content&task=view&id=446&Itemid=5).

# Unit at a Glance

**Grade Level:** 6-8

**Unit Length:** 1 week, plus time to create digital public service announcements

## Subject Areas

- Science
- Social Studies
- Technology
- Language Arts

## Key Concepts

- Ecosystem services
- Media literacy
- Point and nonpoint source pollution
- Stormwater runoff
- Sustainability
- Watershed
- Sustainable development

## Washington State Standards Addressed

- Science GLEs
- Social Studies GLEs
- Technology GLEs
- Language Arts GLEs
- Integrated Environmental and Sustainability Learning Standards



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# A Sound Introduction

An introductory slideshow activity challenges students to determine connections among various images of Puget Sound. Students distinguish different types of ecosystems included in the region. In a mapping activity, students learn about physical features of the region while identifying their own location within the region.





## Objectives

Students will:

- Recognize a variety of Puget Sound ecosystems
- Identify their location on a map of the Puget Sound region, using an online mapping tool

## Inquiry/Critical Thinking Questions

- What different types of ecosystems comprise the Puget Sound region?
- What kinds of species live in and around Puget Sound?
- How are we as individuals a part of the Puget Sound region?

## Subject Areas

- social studies (geography, civics)
- science (environmental, life)
- technology

## Time Required

30 minutes

## Key Concepts

**ecosystem**—an environment and the living organisms within that environment, interacting together as a functioning unit

## Additional Vocabulary

**sound**—an inlet from the sea; typically a long, fairly narrow, and deep body of water

## Washington State Science Standards Addressed

**6-8 LS2A:** An ecosystem consists of all the populations living within a specific area and the nonliving factors they interact with. One geographical area may contain many ecosystems.

## Washington State Social Studies Standards Addressed

**(Grade 6) 3.1.1** Constructs and analyzes maps using scale, direction, symbols, legends and projections to gather information.

**(Grade 6) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in the past or present.

**(Grade 7) 3.1.1** Analyzes maps and charts from a specific time period to analyze an issue or event.

**(Grade 7) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in Washington State in the past or present.

**(Grade 8) 3.1.2** Understands and analyzes physical and cultural characteristics of places and regions in the United States from the past or in the present.

**(Grade 8) 3.2.1** Analyzes how the environment has affected people and how people have affected the environment in the United States in the past or present.



## Washington State Integrated Environmental and Sustainability Standards

**Standard 1:** Ecological, Social, and Economic Systems

**Standard 2:** The Natural and Built Environment

**Standard 3:** Sustainability and Civic Responsibility

## Washington State Technology Standards

**(Grades 6-8)** 1.3.1 Locate and organize information from a variety of sources and media.

### Materials/Preparation

**Photo slideshow:** *How are these images connected?*

**Handout:** *Puget Sound Map*, 1 for each student

**Internet access** for Google Maps

## Activity

### Introduction (15 minutes)

1. Tell students that you are going to show a series of photos and will be asking them to determine what these pictures have in common.
2. Show the photos, by PowerPoint or document camera, slowly enough that students can take brief notes.
3. Give students a minute to think about what these pictures have in common. Then, have them partner with a classmate to exchange ideas.
4. Show the photos a second time.
5. Give student pairs another minute to discuss what element(s) might be in common among the photos.
6. If no one has guessed it, explain that these are all photos of the Puget Sound region, the area where we live.
7. Ask students to name different ecosystems pictured. You may want to have students first recall what an ecosystem is. *An ecosystem includes an environment and the living organisms within that environment.* (The pictures show marine, freshwater, and terrestrial ecosystems, as well as artificially constructed ecosystems such as farms, sports fields, and neighborhoods.)



DAVE WILTON

## Discussion Questions

1. What surprised you?
2. Which images did you find most interesting? Why?
3. What other images would you add?
4. How would you describe Puget Sound in your own words?

## Mapping Puget Sound (15 minutes)

1. Ask if any volunteers can describe a body of water known as a “sound.”
2. Share the following definition with the class: *A sound is an inlet from the sea. Sounds are typically long, fairly narrow, and deep bodies of water.*
3. Ask students to identify whether the water in a sound would be salt water or fresh water. *(Because a sound is an inlet of the sea, it is salt water or marine. The rivers and streams that lead into the sound, however, are freshwater.)*
4. Ask students if they know where Puget Sound is. Have they seen it? What does it look like? Could they point to it right now? What cities are located around the Sound?
5. If they are not sure about its location, let students know that Puget Sound is a body of water that lies between the Cascade Mountains (to the east) and the Olympic Mountains (to the west). People

often also use the term “Puget Sound” to identify the region that surrounds and includes the Sound. *(In fact, we are in the Puget Sound region right now.)*

6. Pass out a *Puget Sound Map* handout to each student.
7. Ask students to use a pencil to lightly place an “X” where they *think* they are located on the map at this very moment.
8. Have students follow these instructions to see their exact location using an online mapping program.
  - a. Click on the “Google Maps” link, or go to [maps.google.com](https://maps.google.com).
  - b. Type in your current address.
  - c. Zoom out slowly until you can see the entire Puget Sound region, including the San Juan Islands to the north and Tacoma to the south.
9. Ask students to confer with a partner and decide where on their map handout they are right now.
10. Instruct students to place a large “X” on their location on the map.
  - **Option:** Ask students to identify additional features of the area where they live. Use the “Satellite” feature in Google Maps for this task. Then, ask students to reflect on how these features may impact the Sound.



PUGET SOUND ENERGY

- a. Are there any streams nearby that connect to Puget Sound?
- b. How large is the buffer area between the Sound and the built environment (buildings, roads, etc.)?
- c. How much of the area around your home appears to be natural habitat or parks?
- d. Are there farms nearby?
- e. Are there many roads or only a few?

### Discussion Questions

1. Are you relatively close to or far from Puget Sound?
2. Even if you don't live right on Puget Sound, are there other bodies of water near you? How do they connect to the Sound?
3. How do you think the actions of other people in the Puget Sound region might affect the place where you live?
4. How might your actions affect Puget Sound and the people that live in the region?

### Technology Extension

Use any of the following mapping tools to further explore the Puget Sound and your relative location within the region. Identify the Olympic and Cascade mountain ranges and major cities along the Sound (including Tacoma, Seattle, and Everett).

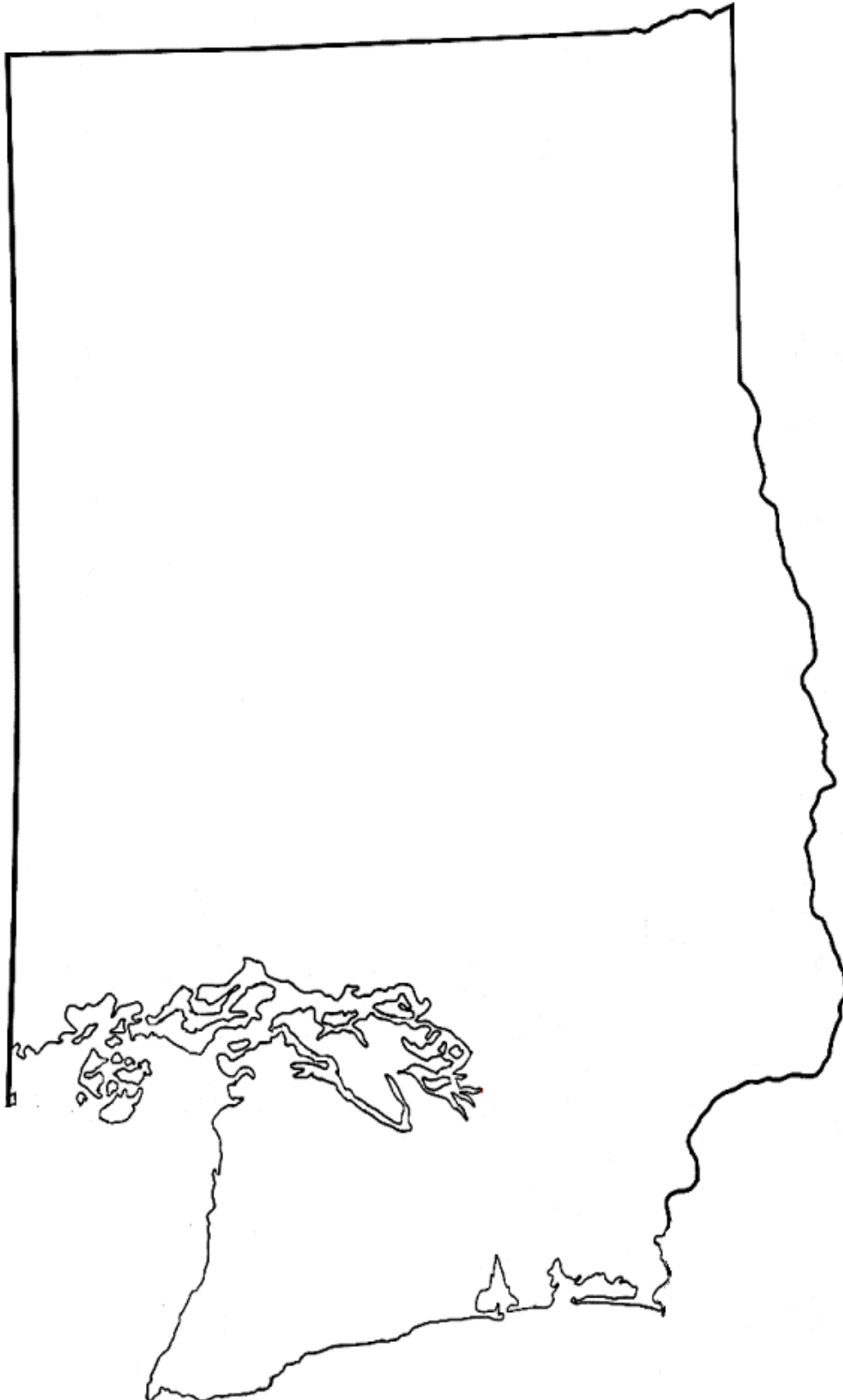
- **Google Earth:** <http://bit.ly/ju5PZp>  
Type in your address and identify your location. “Add Placemark” to place a yellow thumbtack on your location on the map.
- **Interactive maps** from Puget Soundkeeper Alliance: <http://bit.ly/lSgEds>
- **Interactive map** of Western Washington: <http://bit.ly/lmUCNr>

# How are these images connected?



FROM TOP LEFT HAND CORNER TO BOTTOM RIGHT: KIM RAKOW BERNIER, MALCOLM SURGENOR, JESSE STANLEY, LAURA SKELTON, JESSE STANLEY, LAURA SKELTON, LAURA SKELTON, JESSE STANLEY, STEVE BIBER, SHEEBA JACOB, WENDY CHURCH

# Puget Sound Map





# Ecosystem Services & Sustainability

Students discover the importance of ecosystem services in the Puget Sound region. Working in small groups, students critically analyze how various ecosystem services support environmental, social, or economic





## Objectives

Students will:

- Brainstorm ways in which their lives are supported by resources from Puget Sound
- Determine how ecosystem services provided by Puget Sound support the region's sustainability

## Inquiry/Critical Thinking Questions

- In what ways do various species rely on Puget Sound for their survival?
- How can our actions impact the ability of Puget Sound to provide ecosystem services?

## Subject Areas

- social studies (geography, civics)
- science (environmental, life)

## Time Required

30 minutes

## Key Concepts

**ecosystem services**—resources and processes supplied by nature

**sustainability**—the ability of people to meet their needs now without compromising the ability of people to meet their needs in the future

## Additional Vocabulary

**environment**—physical surroundings; environments can be natural or manmade/built

**society**—a group of people that share common interests or common culture

**economy**—the way a community, region, or country makes and uses money, goods, and services

## Washington State Science Standards Addressed

**6-8 LS2A:** An ecosystem consists of all the populations living within a specific area and the nonliving factors they interact with. One geographical area may contain many ecosystems.

## Washington State Social Studies Standards Addressed

**(Grade 6) 2.1.1** Analyzes the costs and benefits of economic choices made by groups and individuals in the past or present.

**(Grade 6) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in the past or present.

**(Grade 7) 2.4.1** Understands and analyzes the distribution of wealth and sustainability of resources in Washington State.

**(Grade 7) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in Washington State in the past or present.



**(Grade 8) 3.1.2** Understands and analyzes physical and cultural characteristics of places and regions in the United States from the past or in the present.

**(Grade 8) 3.2.1** Analyzes how the environment has affected people and how people have affected the environment in the United States in the past or present.

### Washington State Integrated Environmental and Sustainability Standards

**Standard 1:** Ecological, Social, and Economic Systems

**Standard 2:** The Natural and Built Environment

**Standard 3:** Sustainability and Civic Responsibility

### Materials/Preparation

**Handout:** *Puget Sound Ecosystem Services*, 1 per group of 3-4 students

**Handout:** *Three Sectors of Sustainability*, 1 per group of 3-4 students

## Activity

### Steps

1. In a think-pair-share format, ask students to think of one way that they personally rely on resources from the Puget Sound.
2. Let students know that they have just named some ecosystem services. Share the definition of ecosystem services with them: *Ecosystem services are resources and processes supplied by nature. They might include clean drinking water, decomposition of wastes, habitat for wildlife, and weather moderation.*
3. Divide students into groups of 3-4. Distribute 1 copy each of the *Puget Sound Ecosystem Services* handout and the *Three Sectors of Sustainability* handout to each group.
  - **Option:** Instead of using the *Puget Sound Ecosystem Services* handout, student groups could create their own lists of potential ecosystem services that are provided by Puget Sound.
4. Project the information provided on *Puget Sound Ecosystem Services* so that everyone can view it together. (Note: These include marine, freshwater, and terrestrial ecosystem services.)



5. Let students know that each of these ecosystem services is related to the sustainability of the region. (*Sustainability means that the needs of the present can be met without limiting the ability of people to meet their needs in the future.*) Sustainability refers not only to the health of the environment but also to the health of people/societies and economies. In a sustainable community, all 3 sectors—environment, society, and economy—are thriving.
  - **Note:** If students are not familiar with the terms *environment*, *society*, and *economy*, go over the definitions provided at the beginning of this lesson with them.
6. Have each student group determine where in the Venn diagram each ecosystem service fits. Does a particular service contribute to environmental sustainability? If so, then students should write it in the “environment” circle. If an ecosystem service contributes to sustainability in more than one category, it should be listed where those categories overlap.
  - **Option:** Go through an example together with students. Take the ecosystem service of providing food, for example.
    - i. Ask students to think about what kinds of foods are provided by Puget Sound ecosystems. (*fish, shellfish, berries, etc.*)
    - ii. Next, ask them to consider how this might help sustain the environment. (*Wildlife are supported by this food.*)
    - iii. Does it help sustain people or societies? (*People eat the food.*)
    - iv. Does it help sustain local economies? (*People earn a livelihood from farming or catching fish and shellfish.*)
    - v. Write the word “food” in the area of the Venn diagram where it best fits. (*In this example, it would fit in the center because it supports all 3 sustainability sectors.*)
    - **Note:** This is a critical thinking exercise. Answers are not necessarily “right” or “wrong.”
7. Share student ideas and ask students to respectfully challenge other groups when they disagree about how an ecosystem service has been categorized.



## Discussion Questions

1. In your opinion, does an ecosystem service need to directly benefit humans to be valuable? Explain why or why not.
2. How do ecosystem services support the sustainability of a region or community?
3. Which ecosystem service provided by the Puget Sound is most important to you, and why?
4. What do you think might happen to our community if these ecosystem services are not protected?
5. What activities or events could impact ecosystem services in Puget Sound, either positively or negatively?

## Communications Extension

Use information and ideas generated from this activity to come up with a 1-sentence “catch phrase” (or marketing slogan) that could encourage people to get involved in protecting and enhancing Puget Sound.

- **Option:** Incorporate one of these slogans into a video in Lesson 5.

# Puget Sound Ecosystem Services

- **food**

Examples: fish, berries

- **fiber/timber**

- **water for drinking**

- **hydroelectric power**

- **flood and storm protection**

Natural areas keep floodwaters from reaching streets and homes.

- **wetlands for water purification**

Land areas where water collects act as natural filters.

- **shoreline stabilization/erosion control**

Trees and plants along stream banks can prevent soil from falling into the water.

- **places for hiking, camping, and outdoor recreation**

- **waterways for kayaking and canoeing**

- **waterways for boats**

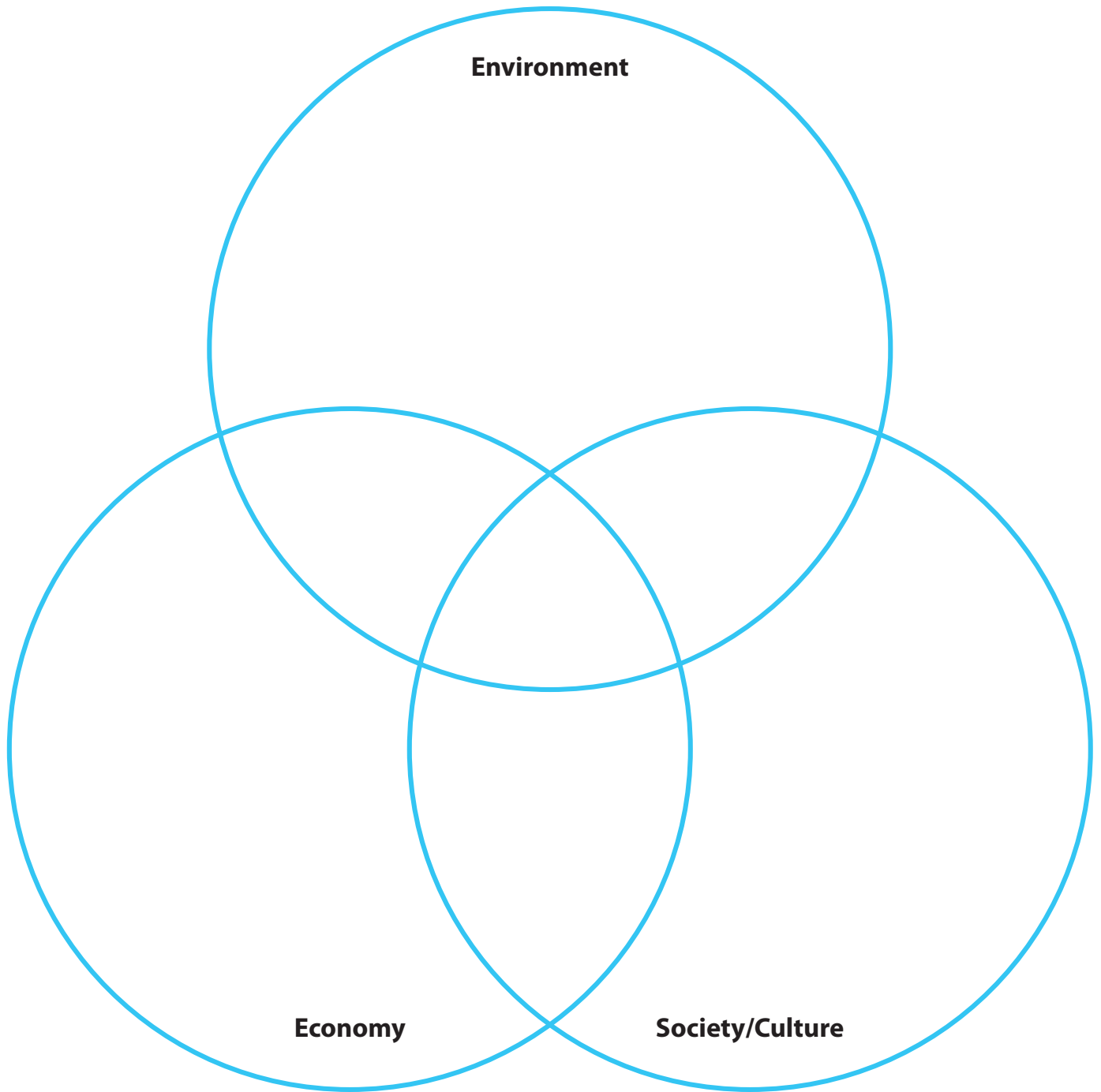
Examples: ferries, cruise ships

- **spiritual/cultural meaning from nature and wildlife**

Example: A tribe may consider salmon a fundamental part of their identity and life.

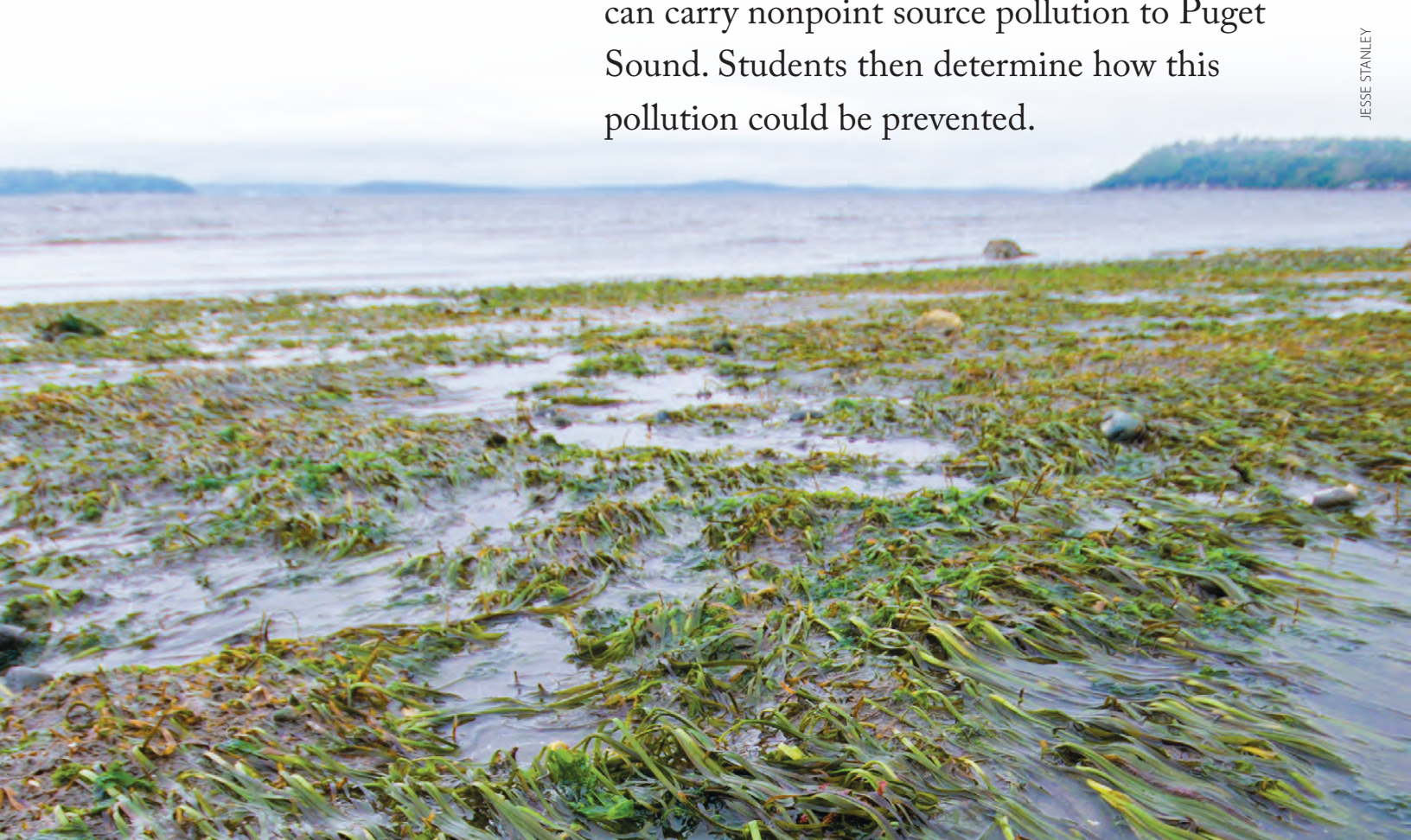
List adapted from Puget Sound Partnership: [http://www.psp.wa.gov/aa\\_ecosystem.php](http://www.psp.wa.gov/aa_ecosystem.php)

# Three Sectors of Sustainability



# Pollution in My Backyard? No Way!

Students learn to distinguish between point and nonpoint source pollutants while they learn about real pollutants in Puget Sound. Through a demonstration exercise, students understand how stormwater runoff can carry nonpoint source pollution to Puget Sound. Students then determine how this pollution could be prevented.







LAURA SKELTON

## Objectives

Students will:

- Differentiate between point and nonpoint source pollution
- Understand how nonpoint source pollution reaches Puget Sound through stormwater runoff
- Consider ways to prevent nonpoint source pollution

## Inquiry/Critical Thinking Questions

- What pollutants are found in Puget Sound, and how do they relate to human activities in surrounding neighborhoods?
- How does nonpoint source pollution reach Puget Sound?
- How could students help to prevent nonpoint source pollution?

## Subject Areas

- social studies (geography, civics)
- science (environmental)

## Time Required

45 minutes

## Key Concepts

**point source pollution**—harmful substances released from an identifiable source

**nonpoint source pollution**—harmful substances released from many different sources that cannot be individually identified

**stormwater runoff**—unfiltered water that reaches natural bodies of water by flowing over impervious surfaces

## Washington State Science Standards Addressed

**6-8 INQE:** Models are used to represent objects, events, systems, and processes. Models can be used to test hypotheses and better understand phenomena, but they have limitations.

**6-8 LS2E:** Investigations of environmental issues should uncover factors causing the problem and relevant scientific concepts and findings that may inform an analysis of different ways to address the issue.

## Washington State Social Studies Standards Addressed

**(Grade 6) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in the past or present.

**(Grade 7) 1.4.1** Understands the effectiveness of different forms of civic involvement.

**(Grade 7) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in Washington State in the past or present.

**(Grade 8) 3.2.1** Analyzes how the environment has affected people and how people have affected the environment in the United States in the past or present.



## Washington State Integrated Environmental and Sustainability Standards

**Standard 1:** Ecological, Social, and Economic Systems

**Standard 2:** The Natural and Built Environment

**Standard 3:** Sustainability and Civic Responsibility

### Optional Background Reading

- Sandra Hines, “Spicy Puget Sound: Fish Swim in ‘Big, Dilute Latte,’ Research Shows,” *University Week*, December 4, 2008, <http://bit.ly/IRaiTI>—Spices detected in Puget Sound’s waters after Thanksgiving show how our activities directly impact the Sound.
- “Environmental Spices,” Aquatic Organic Geochemistry, University of Washington Keil Lab, <http://bit.ly/mNuGX1>—An explanation of the research methods performed by Rick Keil’s lab to measure spices found in the Sound.

### Materials/Preparation

**Handout:** *Puget Sound Pollutants*, 1 per student pair

**Large clear plastic bowl** or other container, filled no more than  $\frac{1}{4}$  full with water

**Aluminum foil:**

- Cover the surface of the large plastic bowl, and create a slight depression in the

surface by gently pinching the foil down along the inside rim of the bowl

- Cut a small hole in the center of the foil

**Masking tape**

- Tape the edges of the foil to the outside of the bowl, to keep the foil cover in place
- Trim any excess foil below the masking tape, to ensure a clear view through the bowl to the water

**Simulated pollution materials**

- Vegetable oil (motor oil)
- Green food coloring (pesticide)
- Red colored sugar (fertilizer)
- Chocolate sprinkles (pet waste)
- Small scraps of plastic and paper (litter)
- Soil and/or yard waste (erosion, sediment)

**Rain simulator cup**, made from a disposable plastic cup with holes poked in its bottom

- Other rain simulators might be a watering can, a dropper, or a squeeze bottle

**Additional water** for pouring in rain simulator cup





KEN MCCOWN

## Activity

### Introduction (15 minutes)

1. Ask students if they think that Puget Sound is pure and pristine, or if they think it is polluted in any way.
  2. Let students know that pollution can (and does) end up flowing into the Sound. Sometimes these pollutants, which include trash and toxic chemicals, are emptied directly into the Sound. Other times they travel over long distances and eventually end up washing into the Sound.
  3. Tell students that there are two types of pollutants: *point source* and *nonpoint source*. Write these words on the board.
  4. Group students into pairs. In a think-pair-share exercise, ask students to formulate possible definitions for the words *point* and *nonpoint*, where pollution is concerned. The words themselves (*point*, *nonpoint*) provide clues to their meanings.
  5. Have each group share their definitions. Write key words on the board as they call out their definitions.
  6. If no one deduced the correct meanings, share with them the correct definitions. Point source pollution comes from an identifiable source. (You can *point* to it because it comes from a single *point*.)
- Nonpoint source pollution comes from many different sources that cannot be individually identified. Usually runoff (rainfall that moves over land) is the culprit of nonpoint source pollution because it washes over many different pollutants from different places and carries them to nearby bodies of water.
7. Give each student pair a copy of the handout *Puget Sound Pollutants*, or use a projection device to display the images.
  8. Ask students to consider all of the images displayed. Tell them that you will be asking them to sort the images into two categories: point source and nonpoint source pollution.
  9. Have each pair sort the images, either by cutting them out and placing them into 2 groups, or by labeling each picture either *point source* or *nonpoint source*.
  10. On the board, create 2 columns. Label 1 column *point source pollutants* and the other column *nonpoint source pollutants*.
  11. Have each student pair list 1 pollutant under the heading where they think it belongs.
  12. If anyone disagrees with a pair's selection, allow students to voice their differences of opinion.
  13. Once all images/pollutants have been categorized, ask volunteers if they can think of other kinds of substances that



might be considered either point or nonpoint source pollution. Add these to the columns on the board. (*Point source pollution comes from factories/industrial discharges, ships, and sewage treatment plants. Most other pollutants will be categorized as nonpoint.*)

14. Let students know that nonpoint source pollution accounts for most of the pollution that reaches Puget Sound.

### Demonstration (30 minutes)

1. Ask students how they think the pollutants categorized as “nonpoint source pollution” reach Puget Sound.
2. Let students know that you will be doing a demonstration of how pollutants enter waterways.
  - **Note:** You could do this as a whole-class demonstration, or you could have students carry out this exercise in small groups as a lab activity.
3. In a place where all students can see it, place your clear plastic bowl/container with water. It should be already covered with foil, according to the directions in the Materials/Preparation section.
4. Explain to students that this is a model. The foil represents a street or other ground surface that does not absorb
  5. Ask students to think of different kinds of pollutants that might end up on an impervious surface such as a street, driveway, or sidewalk. (*For example, litter, motor oil, and pet waste.*)
  6. As students call out each pollutant, have a student volunteer come up and place a small amount of that simulated pollutant on your foil surface.
  7. Once your foil surface is sufficiently covered with common pollutants, tell students that it’s about to rain. Ask them to guess what is going to happen:
    - What will happen to the items they’ve placed on the foil surface?
    - What will happen to the waterway below?



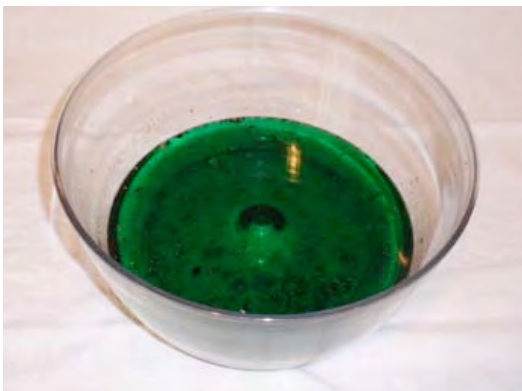


LAURA SKELTON

8. Ask a volunteer to come up and hold the rain simulator cup or watering can. While the student holds the cup, pour water into it so that it starts to rain. Ask the student to move the cup around so that the entire area receives some rain.



- **Option:** Allow students to come up one at a time to see what happened both on the ground and in the waterway.



9. Ask students how the pollutants got into the waterway. (*The rain washed them from the ground into the waterway, through the open storm drain.*)

- **Explanation:** This is what actually happens in our region. In some places, storm drains are not connected to the sewer system, meaning that water that enters storm drains does not get treated or cleaned. Instead, it flows directly to nearby waterways, which eventually enter Puget Sound. In other places, storm drains connect to sewer systems. Heavy rains can contribute more water than the sewer or wastewater treatment facility can handle, causing the water to empty directly into nearby waterways without being treated. Even when stormwater does get treated, not all toxins are removed by the process. **Stormwater runoff is the largest source of pollution to Puget Sound.**

10. In a think-pair-share exercise, ask students to think of one way that this pollution could be prevented from entering the water.
11. Ask student pairs to share their ideas for stopping pollution from entering Puget Sound.



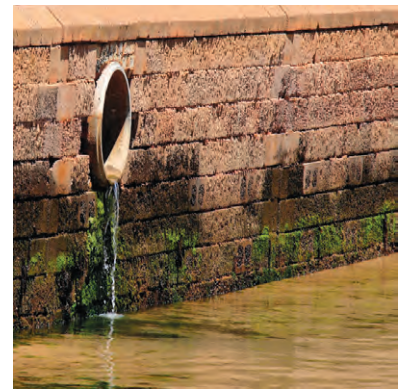
## Discussion Questions

1. How does the health of the Sound affect your life? Your community or neighborhood?
2. What sources of nonpoint source pollution have you seen in your neighborhood? (*Pet waste, litter, and motor oil could all be carried away by runoff.*)
3. If many sources of pollution are already well-known, why do you think pollution still ends up in Puget Sound?
4. How would this simulation have been different if instead of the foil, which is an *impervious* surface, a different type of ground surface allowed the stormwater to be absorbed?
5. What could you do in your neighborhood to help prevent pollution from reaching Puget Sound through stormwater runoff?

## Science Extension

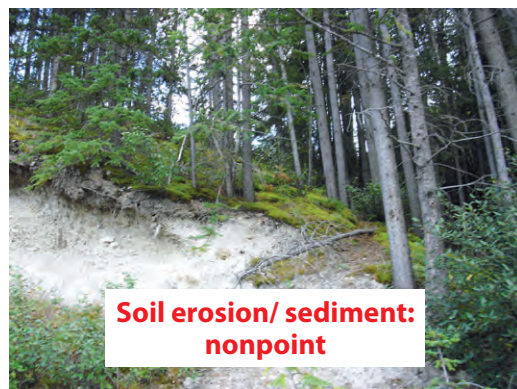
Why does water flow from freshwater streams and rivers to oceans and sounds? This phenomenon is caused by land elevation differences. Create a model of a region with several hills and valleys, using clay. Use a dropper to see how water flows from different elevations within the model.

# Puget Sound Pollutants



FROM TOP LEFT HAND CORNER TO BOTTOM RIGHT: LAURA SKELTON, KILH49, R. KLISE, KARL VOELKER, AARON CARUANA, STOCKSNAPPER, KY KNOORD, NO CREDIT, JON ROSS

# Teacher Master: Puget Sound Pollutants



FROM TOP LEFT CORNER TO BOTTOM RIGHT: LAURA SKELTON, KLH49, R. KLISE, KARL VOELKER, AARON CARUANA, STOCKSNAPPER, KY KNOORD, NO CREDIT, JON ROSS



# Town Hall Meeting

Students take on perspectives of different stakeholder groups involved in determining how to decrease the amount of pollution in Puget Sound. Stakeholder groups are encouraged to form alliances in order to reach consensus on a plan that will be the best for the entire community.





## Objectives

Students will:

- Take on perspectives of community stakeholders
- Understand interconnected economic, social, and environmental factors related to keeping Puget Sound healthy
- Formulate realistic solutions for cleaning up or preventing Puget Sound pollution
- Recognize that Puget Sound pollution prevention is a multi-faceted effort that involves consideration of multiple perspectives

## Inquiry/Critical Thinking Questions

- How does pollution of Puget Sound impact people, environments, and economies in the surrounding area?
- What are solutions to improving the health of Puget Sound?
- What are pros and cons of different approaches to reducing Puget Sound pollution?

## Subject Areas

- science (environmental)
- social studies (civics)

## Time Required

- Two 45-minute class periods

## Key Concepts

**watershed**—an area of land where all of the water that is under it or drains off of it goes into the same place

**stormwater runoff**—unfiltered water resulting from rainfall or snowmelt that reaches bodies of water by traveling over impervious surfaces

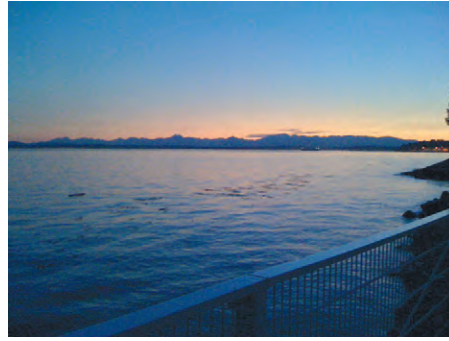
**sustainable development**—practices in agriculture, economic development, health care, and education that lead to progress and meet the needs and desires of the current generation without decreasing the ability of future generations to meet their needs

## Additional Vocabulary

**impervious surfaces**—structures such as paved roads and sidewalks that are covered by impenetrable materials like asphalt, concrete, and stone; water can move *on top of* impervious surfaces but not *through* them

## Washington State Science Standards Addressed

**6-8 LS2A:** An ecosystem consists of all the populations living within a specific area and the nonliving factors they interact with. One geographical area may contain many ecosystems.



**6-8 LS2D:** Ecosystems are continuously changing. Causes of these changes include nonliving factors such as the amount of light, range of temperatures, and availability of water, as well as living factors such as the disappearance of different species through disease, predation, habitat destruction and overuse of resources or the introduction of new species.

**6-8 LS2E:** Investigations of environmental issues should uncover factors causing the problem and relevant scientific concepts and findings that may inform an analysis of different ways to address the issue.

### Washington State Social Studies Standards Addressed

**(Grade 6) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in the past or present.

**(Grade 7) 1.4.1** Understands the effectiveness of different forms of civic involvement.

**(Grade 7) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in Washington State in the past or present.

**(Grade 8) 3.2.1** Analyzes how the environment has affected people and how people have affected the environment in the United States in the past or present.

### Washington State Integrated Environmental and Sustainability Standards

**Standard 1:** Ecological, Social, and Economic Systems

**Standard 2:** The Natural and Built Environment

**Standard 3:** Sustainability and Civic Responsibility

### Optional Background Reading

- Sandi Doughton, “Runoff Turns Elliott Bay into Murky Stew,” *Seattle Times*, January 19, 2011, <http://bit.ly/l1EjDC>— After several days of heavy rainfall, stormwater runoff turns Elliott Bay a murky brown color.

### Materials/Preparation

**Handout:** *Puget Sound Quiz*, 1 per student pair

**Handout:** *Town Hall Scenario*, 1 per student

**Handout:** *Keeping the Sound Healthy*, 1 per group of 4-5 students



## Activity—Day 1

### Introduction (10 minutes)

1. Explain to students that they are going to take a quiz with a partner to see if they know specific facts related to Puget Sound.
2. Hand each student pair a *Puget Sound Quiz*.
3. Have pairs answer the questions.
4. Review the answers with them.<sup>1</sup>
  1. There are over 4 million people living in Puget Sound. Approximately how many cars, buses, and trucks are registered to owners in Puget Sound?
    - a. 3.2 million
    - c. 5.8 million**
    - b. 1.1 million
    - d. 8.4 million
  2. When drivers of cars, buses, and trucks hit their brakes, dust grinds off the brake pad and gets mixed with stormwater into water. Copper from this dust can harm fish and aquatic life. How many pounds of copper wash into Puget Sound each year through stormwater?
    - a. 32,000 pounds
    - c. 12,000 pounds**
    - b. 70,000 pounds**
    - d. 5,000 pounds
  3. How many lakes, streams, and rivers in Puget Sound are impacted by poor water quality?<sup>2</sup>
    - a. 245
    - c. 549**
    - b. 805
    - d. 715

5. Ask students if any of the facts surprised them.

### Meeting Preparation

(35 minutes)

1. Provide each student with a Town Hall Scenario so they can read along.

**Scenario:** *According to the Washington Department of Ecology, millions of pounds of toxic pollution enter Puget Sound every year.<sup>2</sup> A number of aquatic species—including fish, birds, and barnacles—have become endangered because of this pollution. Government officials, large companies, tribal groups, concerned citizens, and nongovernmental organizations have all been asked to attend a town hall meeting in order to determine what next steps to take to keep the Sound healthy. **Your group has been asked to present a well-articulated, compelling plan to help decrease pollution in the Sound.***

2. Divide the class into seven equivalently sized groups. Each group will represent a group of people connected to Puget Sound conservation and pollution issues.

<sup>1</sup> Lisa Stiffler, “Tapping the Brakes on Copper Brake Pads,” *Sightline Daily*, February 11, 2010, <http://bit.ly/krNC4h>.

<sup>2</sup> Puget Sound Starts Here, “Problem Below the Surface: Numbers Prove It,” accessed May 24, 2011, <http://bit.ly/ldO8mu>.



WENDY CHURCH

3. Explain to students that they are going to participate in a town hall meeting where they will represent various stakeholder groups connected to Puget Sound. If they are not familiar with the term “stakeholder,” explain that stakeholders are people with an interest or concern in something. Each group will present their proposed pollution prevention plan to you and the rest of the groups.
4. Briefly review the different groups so students are clear about who will participate in the meeting: an association of Puget Sound tribal groups, a cruise line association, concerned citizens for Puget Sound, a northwest environmental organization, oil refinery representatives, an office of economic development, and a housing development company.
5. Explain to students that at this town hall meeting, any solutions to pollution prevention in the Sound should focus on “sustainable development.”  
*(Sustainable development includes practices in agriculture, economic development, health care, and education that lead to progress and meet the needs and desires of the current generation without decreasing the ability of future generations to meet their needs).*
6. Pass out a different *Keeping the Sound Healthy* handout to each group. There are seven in total.
7. Explain that each group will answer specific questions about Puget Sound pollution prevention.
8. Have each group choose 1 representative to be the recorder for the handout. Explain that each person must speak at least once during the group presentation to the rest of the class.
9. Allow groups the rest of the class period to complete their worksheets. Explain that they will present the information they come up with during the next class period.

## Activity—Day 2

### Steps (45 minutes)

1. Ask students to return to their groups from Day 1.
2. Have each group write their group name/identity on a sheet of paper folded like a tent on 1 of its members’ desk so others know who they represent.
  - **Option:** Have students come up with other creative ways to illustrate who they are. Consider putting desks in a circle or semi-circle so students can see each other.
3. Before the meeting begins, explain to students that conflicts may arise because different groups have different needs. To prevent conflicts, you may want



to create ground rules about what is expected at the meeting.

4. Each group will have 3 minutes to present information from their handout. When presenting, explain that group members will take on the character of their group identity during the meeting. For example, when they have statements to make, they can begin by saying, “As an oil refinery representative...”
  - **Option:** Give students a chart in which they can record each group’s name and their “big idea” to clean up Puget Sound as each group presents.
5. After groups present, allow other groups to ask questions about opinions and ideas they expressed.
6. After everyone has presented, ask groups to consider whether their goals are similar or complementary to any of the other groups’ goals.
7. Go around the room and ask groups what other groups they would form alliances with.
8. Allow 10 minutes for groups to meet with each other and form an alliance with at least 1 other group. They should revise their recommendations based on these alliances.
9. After groups have revised their recommendations to accommodate the needs of at least 1 other group,

have each allied group share their recommendations.

10. Have all students vote individually on each of the final recommendations to see which is most popular.
11. After a reasonable time, whether or not a decision has been reached, stop the process and begin a discussion using the following questions.

### Discussion Questions

1. Who do you think should be responsible for decreasing the amount of pollution in Puget Sound? Citizens? The Government? Oil refinery companies? Cruise ship companies? Developers?
2. Was it difficult to form an alliance with certain groups? Why?
3. Are there any other groups who should have attended the town hall meeting? Why?
4. What is another possible approach to pollution prevention that none of the groups mentioned?
5. What government policies do you think could be adopted to prevent pollution from reaching the Sound?
6. How does considering sustainable development help to think of solutions that work for multiple stakeholders?



## Additional Resources

- **Video:** “Poisoned Waters”  
This documentary tracks how both industrial polluters and everyday consumers are polluting our waterways. A specific focus is on the Puget Sound and the Chesapeake Bay. <http://to.pbs.org/jmVI2H> (1 hour, 56 minutes)
- **Video:** “Watershed Address”  
The Watershed Report was created through Friends of the Cedar River Watershed. It is meant to inspire the next generation of watershed stewards. Students of the Watershed Report present positive green trends in Seattle’s schools, government buildings, and businesses. <http://bit.ly/m3mipl> (9 minutes)
- **Website:** <http://pugetsound.org/>  
People for Puget Sound is a citizens’ group that protects and restores the health of the Sound through education and action. They offer a number of programs that citizens can get involved in, ranging from habitat restoration to lobbying elected representatives around issues affecting the Sound.

## Puget Sound Quiz

1. There are over 4 million people living in Puget Sound. Approximately how many cars, buses, and trucks are registered to owners in Puget Sound?  
a. 3.2 million      b. 1.1 million      c. 5.8 million      d. 8.4 million
2. When drivers of cars, buses, and trucks hit their brakes, dust grinds off the brake pad and gets mixed with stormwater into water. Copper from this dust can harm fish and aquatic life. How many pounds of copper wash into Puget Sound each year through stormwater?  
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## Town Hall Scenario

According to the Washington Department of Ecology, millions of pounds of toxic pollution enter Puget Sound every year. A number of aquatic species—including fish, birds, and barnacles—have become endangered because of this pollution. Government officials, large companies, tribal groups, concerned citizens, and nongovernmental organizations have all been asked to attend a town hall meeting in order to determine what next steps to take in order to keep the Sound healthy. **Your group has been asked to present a well-articulated, compelling plan to help decrease pollution in the Sound.**

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## Keeping the Sound Healthy

### Group 1: Association of Puget Sound Tribal Groups

Tribal groups like yours have lived in the Puget Sound area for over 11,000 years. Rivers, lakes, and seas have all been important to your tribes' survival throughout this time. Your communities continue to depend largely on cod, salmon, and shellfish for food and also for economic and spiritual reasons.<sup>1</sup> To some tribes, salmon is considered sacred because this natural resource helps them to survive. In recent years, species including the Chinook salmon have become endangered. Fish depletion has happened as a result of an increase in commercial fishing and because activities like housing development have damaged or destroyed fish habitats.

Historically, your tribes used to catch fish with spears, hook lines, and baskets. When commercial fishing was introduced, salmon numbers dropped. Fishermen could catch more fish through larger fishing operations, leaving fewer salmon in the wild to reproduce.

Destruction of salmon habitat in the Sound through forest removal, water pollution, and creation of dams has also led to a decrease in fish populations. Forests near streams and rivers are important because they shade streams, provide food for smaller fish, and create still water areas where salmon can reproduce.<sup>2</sup>

Today, the Puget Sound Chinook salmon population is just 10% of historic numbers.<sup>3</sup> There have also been toxic levels of the chemical PCB (polychlorinated biphenyls) discovered in fish.<sup>4</sup> The chemical is found in products like paint and enters the Sound through stormwater pollution.

Shrinking salmon populations mean less food for tribal communities, less income for tribal fishermen, and a decrease in biodiversity in the Sound. You believe that in order to improve fish population numbers—and to protect the biodiversity of Puget Sound—the concerns of the many tribes must be addressed.



1. What do you think should be done to improve the health of Puget Sound?
2. What other stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will benefit from this plan?

- 1 Northwest Indian Fisheries Commission, "About Us—Fisheries Management," accessed February 1, 2011, <http://bit.ly/iDxL5l>.
- 2 John Retherford, "Salmon and the Health of North West Indigenous Cultures," accessed February 1, 2011, <http://scr.bi/mm6p20>.
- 3 Jessica Ferrell, "NMFS Proposes Billion Dollar Recovery Plan for Puget Sound Chinook Salmon," Marten Law Newsletter, February 15, 2006, <http://bit.ly/jgxzhe>.
- 4 Department of Ecology, "Washington State toxics Monitoring Program: Contaminants in Fish Tissue from Freshwater Environments in 2004 and 2005," accessed May 9, 2011, <http://1.usa.gov/jZz1iD>.

## Keeping the Sound Healthy

### Group 2: Cruise Line Association

The cruise line industry in Seattle has had much success over the last several years. In 2010, the business made \$425 million for the region and provided over 4,000 local jobs. These jobs provide a stable income for local citizens. Surprisingly, cruise trips have increased when the economy as a whole has not been doing so well. Over 900,000 passengers traveled on these cruise lines in 2010.<sup>1</sup> The local economy benefits enormously from the cruise line business. The 900,000 tourists who board the ships at the piers in Seattle typically come early and stay overnight at hotels and dine at local restaurants.

You realize that cruise ships contribute to water pollution in Puget Sound. Based on a report by the Environmental Protection Agency, the average cruise ship emits the following directly into Puget Sound waters:<sup>2</sup>

- 21,000 gallons of sewage
- 170,000 gallons of wastewater from sinks, showers, and laundry
- More than 25 pounds of batteries, fluorescent lights, medical wastes, and expired chemicals

You have worked with the city of Seattle to take steps towards becoming “greener.” Some of your cruise lines have invested millions of dollars in creating an advanced wastewater purification system on ships to decrease the amount of polluted water released into to the Sound. You’ve also worked with port authorities to make sure that when boats dock at ports they use lower sulfur fuel to decrease air pollution.

Restoring Puget Sound health is important. At the same time, you don’t want to spend so much money on pollution prevention that it makes cruise travel more expensive for your customers. A decrease in sales would have a huge impact on the local economy. You do believe there is potential to



LAURA SKELTON

decrease pollution through green education campaigns for both your passengers and staff. Determining ways to keep Puget Sound healthy while also increasing sales will be the challenge.

1. What do you think should be done to improve the health of Puget Sound?
2. What stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will benefit from this plan?

<sup>1</sup> Port of Seattle, “Port of Seattle Sets New Cruise Ship, Passenger Records in 2010,” accessed January 30, 2011, <http://bit.ly/lxsy1g>.

<sup>2</sup> EPA, “Cruise Ship Discharge Assessment Report,” EPA report link, accessed January 29, 2011, <http://1.usa.gov/mmgYEy>.

## Keeping the Sound Healthy

### Group 3: Concerned Citizens for Puget Sound

Certain populations of Orca whales have become endangered in Puget Sound.<sup>1</sup> Harbor seals in Puget Sound have significantly higher levels of toxic chemical contamination than those living in the waters off Canada's coast just to the north.<sup>2</sup> The number of marine birds in the Sound has decreased by 47% in the last thirty years.<sup>3</sup>

Human activities have had a large effect on the health of Puget Sound. Some of these activities generate nonpoint source pollution from suburban and urban areas.

A growing population in the Sound has decreased the amount of wildlands—including prairies and forests—and increased the amount of pavement and buildings.<sup>4</sup> Rain and snowmelt typically soak into forest and prairie soils, but when these ecosystems are converted into built environments, storm drains carry water from buildings and streets to nearby waterways. In fact, impervious surfaces such as roads produce five times more stormwater runoff than a forest.<sup>5</sup>

Often, this water runoff is polluted with chemicals and oil. The pollution can come from a variety of sources: lawn fertilizers, car washes at home, improperly discarded toxins like paint and motor oil, pet waste, and eroded soil. Once this polluted water enters rivers and streams through storm drains, it threatens aquatic life within the Sound.<sup>6</sup>

You believe the key to decreasing pollution in Puget Sound is to educate people in the region about the impacts of pollution and the daily decisions they can make to prevent pollution. You've seen successful education programs in other cities like Washington, DC; there, conservation organizations work with homeowners to teach them how to build rain gardens and install rain barrels in order to reduce stormwater runoff.<sup>7</sup> While big stormwater management projects are expensive, local ones such as community education campaigns or turning existing roofs into green



LAURA SKELTON

roofs can effectively prevent pollution. This type of care could provide you, your children, their children, and the greater Puget Sound community with a higher quality of life.

1. What do you think should be done to improve the health of Puget Sound?
2. What stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will benefit from this plan?

- 1 NOAA Fisheries: Office of Protected Services, 'Killer Whale: Orcinus Orca,' accessed May 25, 2011, <http://1.usa.gov/lrp52a>.
- 2 People for Puget Sound, "Some Facts about Puget Sound," accessed January 30, 2011, <http://bit.ly/kuRkCo>.
- 3 Puget Sound Partnership, "Marine Birds," accessed May 5, 2011, <http://bit.ly/iVta91>.
- 4 Robyn Carmichael et al., "Public Stormwater Outfalls to Puget Sound," People for Puget Sound, April 2009, <http://bit.ly/mh6aUt>.
- 5 EPA, "Protecting Water Quality from Urban Runoff," accessed January 27, 2011, <http://1.usa.gov/l6WlyU>.
- 6 Pierce County Public Works and Utilities, "What is Nonpoint Source Pollution?" accessed January 26, 2011, <http://bit.ly/jRwt36>.
- 7 EPA, "RiverSmart Homes: Getting Smart about Runoff in Washington, DC," accessed January 27, 2011, <http://1.usa.gov/kIP89L>.

## Keeping the Sound Healthy

### Group 4: Northwest Environmental Council

You are a regional government organization working to ensure that Puget Sound is healthy to support both wildlife and human communities. You do so in a number of ways. You distribute money to different organizations working to protect the Sound, including state, local, and tribal groups. In recent years, you have given money to groups that have conducted studies to research the following questions:<sup>1</sup>

- Where is pollution in the Sound coming from?
- What are the effects of contaminants on Puget Sound salmon?
- How can citizens protect watersheds and wetlands while still supporting population growth?

Your work also involves holding large companies accountable for water pollution. For example, oil spills from ships traveling to oil refineries in the Sound have been a major concern; if they spill their oil, ecosystems in the Sound could be devastated. You believe it's the responsibility of large companies that pollute waters to clean them up; that's why you think polluters should be fined. You offer incentives to companies that have taken steps to reduce their pollution. For example, if a company develops programs that prevent future environmental pollution, you offer to reduce or waive certain penalties issued to the company for prior pollution. You also provide training and tools to help these companies learn about what they need to do to meet environmental requirements to keep the Sound healthy.<sup>2</sup>

There are eighteen major watersheds in Puget Sound. The land and water covers over 1.6 million acres. Within this area, there are 211 fish species, 100 seabird species, and thirteen marine mammals.<sup>3</sup> The Sound has a tremendous value, and you want to do everything in your power to ensure that it continues to be an incredible place. By rewarding



JESSE STANLEY

organizations working to protect the Sound and penalizing companies that continue to pollute, you believe pollution in Puget Sound can be significantly reduced.

1. What do you think should be done to improve the health of Puget Sound?
2. What stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will benefit from this plan?

<sup>1</sup> EPA, "Puget Sound Protection Efforts Get Nearly \$13 Million Boost from EPA Science Grants," EPA News Release, September 8, 2010, <http://1.usa.gov/IVY4oj>.  
<sup>2</sup> EPA, "Compliance," accessed March 11, 2011, <http://1.usa.gov/ioQg97>.  
<sup>3</sup> State of Washington Department of Ecology, "Saving Puget Sound," accessed January 26, 2011, <http://1.usa.gov/lBubPb>.

## Keeping the Sound Healthy

### Group 5: Oil Refinery Representatives

600 oil tankers and 3,000 oil barges come through the Puget Sound annually. They carry approximately 15 billion gallons of oil to five oil refineries.<sup>1</sup> These refineries process 561,000 barrels of crude oil each day.<sup>2</sup> This crude oil becomes gas, diesel oil, and jet fuel that citizens use for transportation. 64.7 million gallons of gasoline are consumed every day on the West Coast of the United States alone.<sup>3</sup> Oil is an extremely important natural resource to people in the Sound and around the country.

Economically, the oil industry has had a significant impact on Washington State. In 2009, oil refineries provided 30,000 jobs; these jobs contributed 1.7 billion dollars in personal income that year.<sup>4</sup> Environmental groups have pressured you by advocating for new laws that would make oil refineries pay for water pollution created by oil barges, tankers, and refineries. This tax would come to approximately \$350 million per year.<sup>5</sup> You do not see the need for such a large tax, especially because you are working with other groups to prevent future oil spills.

You understand the impact that oil spills have had on Puget Sound. You've worked with the Department of Ecology to identify key pollution prevention practices and priorities for the refineries. Your refineries have taken steps to decrease oil leaks and spills. They have also worked to reduce point source pollution and wastewater flow.<sup>6</sup>

Oil is a natural resource needed by millions of people throughout the United States. You believe the precautions you have taken thus far will decrease the amount of oil that spills from your ships. Point source pollution will also decrease from your refineries. Increased taxes will not only hurt the oil industry; almost everyone will be affected by higher gas prices.<sup>7</sup> Balancing environmental priorities with economic priorities is the most important thing to do at this time.



WYATT WELLMAN

1. What do you think should be done to improve the health of Puget Sound?
2. What stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will benefit from this plan?

- 1 "Congress Authorizes Oil Spill Prevention, Fishing Vessel Safety Upgrades," *Environment News Service*, October 4, 2010, <http://bit.ly/ka37JA>.
- 2 "The Economic Contribution of Washington State's Petroleum Refining Industry in 2009," Washington Research Council Economic Profile, August 2010, <http://bit.ly/klX9Eu>.
- 3 Western States Petroleum Association, "Energy Facts," accessed February 4, 2011, <http://bit.ly/mDjbxF>.
- 4 "The Economic Contribution of Washington State's Petroleum Refining Industry in 2009," Washington Research Council Economic Profile, August 2010, <http://bit.ly/klX9Eu>.
- 5 Erik Smith, "Olympia's Next Big War—A Steep Hike in Oil Taxes for Puget Sound Cleanup," *Washington Wire*, February 2, 2010, <http://bit.ly/lST8tJ>.
- 6 "Water Pollution Prevention Opportunities in Petroleum Refineries," Washington State Department of Ecology, November 2002, <http://1.usa.gov/l61FE4>.
- 7 Erik Smith, "Olympia's Next Big War—A Steep Hike in Oil Taxes for Puget Sound Cleanup," *Washington Wire*, February 2, 2010, <http://bit.ly/lST8tJ>.

## Keeping the Sound Healthy

### Group 6: Office of Economic Development, Seattle

You work at the Office of Economic Development in Seattle. The goal of this office is to make Seattle a place where there are jobs available for everyone. For example, by cooperating with and supporting local businesses and restaurants, you increase both employment opportunities and tourism. One benefit of increasing the amount of employment opportunities through successful businesses and restaurants is that you are also able to increase tourism. In one year, over 8 million tourists visited the area and the local economy made over \$4 billion from these visitors.<sup>1</sup> This is the type of growth that supports Seattle as a city. In addition to the tourist industry, your office supports employment related to film and music, maritime industries (fishing, water transportation, ship building, etc.), and global health.

You understand that stormwater runoff in Seattle is a major concern and that businesses contribute to this pollution. Businesses you work with have the potential to decrease their contributions to stormwater pollution, but you know it will require some training for them to understand how to do so. You have worked with a few government organizations to support this plan. For example, Seattle Public Utilities provides a number of programs for business owners to learn how to reduce pollution. They offer inspections for these businesses and work with them to prevent pollutants from entering private and public storm drains. Seattle Public Utilities also supports businesses in maintaining best management practices such as:<sup>2</sup>

- moving waste away from storm drains
- having a spill kit readily available to deal with any kinds of spill, including oil spills
- covering soil to prevent erosion, which can muddy streams

You have also worked with the Office of Sustainability and the Environment to learn more about green building construction in order to



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reduce stormwater runoff. While you see the value in businesses using these types of building methods, you know it could be expensive. Still, you are in favor of some initial steps, such as creating green roofs on buildings that would soak up water to reduce stormwater runoff.

You know there is a connection between the health of Puget Sound and economic growth over the next several decades. If species start to disappear or water quality becomes worse, this could have a significant consequence on any type of growth. Therefore, involving businesses in decisions about how to prevent pollution will be crucial.

1. What do you think should be done to improve the health of Puget Sound?
2. What stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will benefit from this plan?

<sup>1</sup> Office of Economic Development, City of Seattle, "Tourism," accessed March 11, 2011, <http://1.usa.gov/mwk7wK>.  
<sup>2</sup> Seattle Public Utilities, City of Seattle, "Pollution Control," accessed March 11, 2011, <http://1.usa.gov/lierfO>.

## Keeping the Sound Healthy

### Group 7: Housing Development Company

The population in Puget Sound is approximately 3.5 million. By the year 2020, this number is projected to increase to 5.2 million people.<sup>1</sup> In order to comfortably meet the needs of people living in the area, your development company works hard to ensure new housing options are readily available. The amount of urban areas where residential development is permitted has increased from 77% during the 1980s to over 85%.<sup>2</sup> This has required clearing forests, farmland, and other habitats to make room for new homes. In the last forty years, over 1.7 million acres of forest have been converted for other uses.<sup>3</sup>

You understand the impact development can have on natural resources and the health of the Sound. You know that new development increases the number of roads, sidewalks, parking lots, and rooftops, and that these types of surfaces increase the amount of stormwater runoff because storm drains carry water from buildings and streets to nearby waterways. However, the reality is, people need homes. You believe there are solutions that can help prevent pollution while allowing the region to accommodate new and expanding businesses and homes. One of the major ways your industry could support Puget Sound's long-term health is through a number of low-impact development techniques. Your company has implemented the following practices to protect the Sound from the harmful effects of stormwater runoff:<sup>4</sup>

- creating pervious roads and sidewalks by adding grass and gravel that allow water to filter through; this practice helps filter out some of the pollutants before they reach the Sound
- developing a rooftop rainwater collection system that collects stormwater and prevents a large amount of runoff from picking up contaminants and emptying them into the Sound



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- replanting substantial portions of vegetation on newly developed sites, allowing runoff to flow directly into these planted areas

You believe that these low-impact development techniques will be highly effective at decreasing post-construction pollution. You understand that the more you can develop land in ways that reflect how nature usually retains water, the less flooding, pollutants, and stormwater runoff you will create.<sup>5</sup>

1. What do you think should be done to improve the health of Puget Sound?
2. What other stakeholders can support you in keeping the Sound healthy?
3. Aside from the general public, who will directly benefit from this plan?

<sup>1</sup> Stewardship Partners, "Low Impact Development," accessed April 27, 2011, <http://bit.ly/ixjaA6>.

<sup>2</sup> B-Sustainable Information Commons, "Goal: Responsible Land Use," accessed April 27, 2011, <http://bit.ly/krbFdY>.

<sup>3</sup> Ibid.

<sup>4</sup> Puget Sound Action Team, "How Can We Protect Puget Sound as We Grow?" accessed April 27, 2011, <http://bit.ly/jHoe38>.

<sup>5</sup> Ibid.



Lesson

# Make a Sound Impact!

Students develop strategies to prevent pollution and improve water quality in Puget Sound. They create digital public service announcements (PSAs) to inform others how they can be part of solutions.

LAURA SKELTON





LAURA SKELTON

**Note:** Teachers in Puget Sound with students 13 years and older interested in having their students submit a digital public service announcement to the *Facing the Future* video contest can do so between June 14, 2011 and November 28, 2011. For more information about guidelines, how to post videos, and other details, please visit <http://bit.ly/jZXIMj>.

### Objectives

Students will:

- Create a short video or digital story to educate others about 1 issue that impacts the health of Puget Sound and one action that addresses the issue in order to bring about positive change
- Understand economic, social, and environmental factors related to keeping Puget Sound healthy

### Inquiry/Critical Thinking Questions

- What are ways to improve the health of Puget Sound?
- How does the health of the Sound impact people, environments, and local economies?
- How can media be used to influence people to take action against pollution?

### Subject Areas

- science (environmental)
- social studies (civics)
- language arts (communication)
- technology

### Time Required

Two 45-minute class periods to outline and plan video, in addition to time to create video

### Key Concepts

**point source pollution**—harmful substances released from an identifiable source such as a factory or wastewater treatment plant

**nonpoint source pollution**—harmful substances released from many different sources such as lawn fertilizers or motor oils, and that cannot be individually identified

**watershed**—an area of land where all of the water that is under it or drains off of it goes into the same place

**stormwater runoff**—unfiltered water that reaches natural bodies of water by flowing over impervious surfaces

**media literacy**—the ability to access, analyze, evaluate, and create messages in a variety of forms that communicate information

### Washington State Science Standards Addressed

**6-8 LS2A:** An ecosystem consists of all the populations living within a specific area and the nonliving factors they interact with. One geographical area may contain many ecosystems.

**6-8 LS2D:** Ecosystems are continuously changing. Causes of these changes include nonliving factors such as the amount of light, range of temperatures, and availability of water, as well as living factors such as the



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disappearance of different species through disease, predation, habitat destruction and overuse of resources or the introduction of new species.

**6-8 LS2E:** Investigations of environmental issues should uncover factors causing the problem and relevant scientific concepts and findings that may inform an analysis of different ways to address the issue.

### Washington State Social Studies Standards Addressed

**(Grade 6) 2.1.1** Analyzes the costs and benefits of economic choices made by groups and individuals in the past or present.

**(Grade 6) 3.1.1** Constructs and analyzes maps using scale, direction, symbols, legends and projections to gather information.

**(Grade 6) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in the past or present.

**(Grade 7) 2.4.1** Understands and analyzes the distribution of wealth and sustainability of resources in Washington State.

**(Grade 7) 3.2.1** Understands and analyzes how the environment has affected people and how people have affected the environment in Washington State in the past or present.

**(Grade 8) 3.1.2** Understands and analyzes physical and cultural characteristics of places and regions in the United States from the past or in the present.

**(Grade 8) 3.2.1** Analyzes how the environment has affected people and how people have affected the environment in the United States in the past or present.

### Washington State Language Arts Standards Addressed

**(Grades 6-8) 3.2.1** Uses available technology and resources to support or enhance a presentation.

**(Grades 6-8) 3.3.1** Applies skills and strategies for the delivery of effective oral communication and presentations.

### Washington State Technology Standards Addressed

**(Grades 6-8) 1.1.1** Generate ideas and create original works for personal and group expression using a variety of digital tools.

**(Grades 6-8) 1.2.1** Communicate and collaborate to learn with others.

### Washington State Integrated Environmental and Sustainability Standards

**Standard 1:** Ecological, Social, and Economic Systems

**Standard 2:** The Natural and Built Environment

**Standard 3:** Sustainability and Civic Responsibility



### Optional Background Reading

- Lance Dickie, “Cleaning up Washington Waterways—the Mess Is Ours,” *Seattle Times*, January 20, 2011, <http://bit.ly/ktkSNZ>—This editorial speaks to how it is the responsibility of citizens to help clean up pollution in the Sound.

### Materials/Preparation

- **Handout:** *Make a Sound Impact!*, 1 per student or student group

### Activity

**Note:** *This lesson can be taught independently of lessons 1–4. If you did not already teach lesson 1 (“A Sound Introduction”), you can briefly introduce students to Puget Sound by sharing the introductory part of lesson 1 with them.*

#### Introduction (30 minutes)

1. Have students brainstorm all the different words that come to mind when they hear the name “Puget Sound.”
2. Share the following facts about Puget Sound:
  - Contaminants that were banned from use 30 years ago can still be found today in underwater sediments of Puget Sound.
  - Certain populations of Orca whales are endangered in Puget Sound.<sup>1</sup>

- Millions of pounds of toxic pollution enter Puget Sound on a yearly basis.
- Puget Sound has a number of different kinds of beaches: mud, gravel, rock, and sand.
- In recent years, shellfish production in Washington State has generated nearly \$100 million in sales.<sup>2</sup>
- The tourism industry brings billions of dollars to Seattle each year.<sup>3</sup>

3. Share a public service announcement with your students for them to analyze. A number of such announcements can be found on the following websites:

- Student PSAs can be found on <http://bit.ly/kZm6sO>. Type in “student PSA” to find these videos.
- The Ad Council, which has created PSAs since 1942, features many different examples on their website: <http://bit.ly/mFEVJ>
- EPA has hosted water quality video contests with a focus on environmental stewardship: <http://1.usa.gov/kwR45q>

- 1 NOAA Fisheries: Office of Protected Services, “Killer Whale: Orcinus Orca,” accessed May 25, 2011, <http://1.usa.gov/lrp52a>.
- 2 Pacific Shellfish Institute, “Washington State Shellfish Production & Restoration—Environmental and Economic Benefits & Costs,” accessed May 5, 2011, <http://bit.ly/kSsnh4>.
- 3 Office of Economic Development, City of Seattle, “Tourism,” accessed March 11, 2011, <http://1.usa.gov/mwk7wK>.



4. Ask students the following questions:
- What is the overall message of the video?
  - What audience is the PSA reaching?
  - What persuasive techniques are used to convince people of the overall message?
  - Do you find this PSA convincing?

## Steps

(60 minutes, plus time to create PSA)

1. Explain to students that PSAs can take on many different forms: print media, radio, and television.
2. Ask students the following question: If you wanted to deliver a message related to keeping Puget Sound healthy, how would you do it?
3. Explain that PSAs persuade viewers (or listeners) to take an action or to adopt a specific point of view on an issue, cause, or service.
4. Tell students they will have the opportunity to create their own public service announcement to persuade others why they should keep Puget Sound clean. This video will take a digital format.
5. Ask students why they would want to convince others to care about the health of Puget Sound.
6. Ask students what kind of positive impact a digital PSA could have (i.e., a digital PSA could reach a larger audience because many people can view the message if it's available on the internet).
7. Inform students about some persuasive strategies they can use to convince people of their message. For example:
  - appeal to the audience's emotions
  - build trust and credibility
  - build a sense of urgency
  - use logic and numbers to support the argument
  - **Option:** Visit the ReadWriteThink website from IRA/NCTE to inform students about these and other strategies they can use to create their PSA: <http://bit.ly/kcihYg>.
8. Have students brainstorm a list of possible topics for a PSA about keeping Puget Sound healthy (topics could include: decreasing stormwater runoff, saving endangered species, upholding tribal traditions, holding certain groups accountable for keeping the Sound clean, educating people about the importance of a clean Sound).
  - **Option:** Create a rubric with students to help them effectively produce a PSA.



9. Explain to students that they can either create the PSA on their own or they can work with others.
10. Pass out a copy of the handout *Make a Sound Impact!* to each group or individual. This handout will guide them in creating their own PSAs.
11. Explain that page 2 of the handout will help them to storyboard their PSA. Storyboards explain what each scene in their PSA will include (words, images, music, etc.) The more they can create a detailed explanation of what their video will look like within their storyboard, the clearer the message in their PSA will be.
12. After they have completed the handout, explain that they will work in their groups (or individually) both in and out of class to create digital videos or stories.

**Note:** There are a variety of tools students can use to create the video PSA: cell phones, flip cameras, digital cameras, and video cameras. If students don't have a means to record videos, they can create digital stories using still photographs and computer programs such as Microsoft Photo Story, Windows Movie Maker, and Apple iMovie. Digital stories can incorporate text, music, and images to create a compelling PSA.

The following links offer detailed instructions for:

### Creating a digital story

- Windows Movie Maker  
<http://bit.ly/k8U3OD>
- iMovie  
<http://bit.ly/l4acqP>
- Puget SoundOff  
<http://bit.ly/IDxXgY>

### Creating a video

- Flip Video tips on how tell a good story  
<http://bit.ly/jFvJzE>
- Flip Video tips on how to shoot a good story  
<http://bit.ly/j4MF96>
- Puget SoundOff ideas on how to use a video camera effectively  
<http://bit.ly/ioxahj>



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## Additional Resources

- **Website:** <http://bit.ly/mPWutl>  
People for Puget Sound features “Sound Citizen Voices.” This part of the website focuses on what people are saying about the Sound and why it’s important to them. Students may gather ideas from this site for the theme of their video. They can also add their perspective on why the Sound is important.
- **Website:** <http://bit.ly/jxhbqd>  
YTech is a program created through the YMCA in which young people create digital media, engage in civic debate, and learn skills and confidence to compete in the 21st century.

## Make a Sound Impact! page 1

**Directions:** Complete the following outline. This outline will help you create your own public service announcement (PSA).

Issue your PSA will address:

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Three facts about the issue:

References:


Why should people care about the issue?

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What persuasive techniques will you use to convince your audience they should care about the issue?

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What format are you going to use for your PSA?

- Video (i.e., Flip Video, video camera, cell phone)
- Digital story using photos and voice to tell a story (i.e., Movie Maker, iMovie)



## Make a Sound Impact! page 2

Title of your video:

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Scene	Script for scene	Words/graphics/images to appear during scene
Scene 1:		
Scene 2:		
Scene 3:		
Scene 4:		
Scene 5:		
Scene 6:		
Scene 7:		
Scene 8:		
Scene 9:		
Scene 10:		

# **Water, Science, and Civics:** **Engaging Students with Puget Sound**

