Lesson 2: Watersheds

Primary Lesson Standard: 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Essential Questions:

1) Inquiry:
    a) What do you notice?
    b) What do you wonder?
2) How does my local watershed work?

Career Connections:

1) How do water quality scientists study and protect watersheds?

Stewardship:

1) How can we be stewards of the Salish Sea?

Learning Objectives:

Students will be able to:

1) Explain what a watershed is and how it works.
2) Understand how water quality scientists work in a watershed, and how they help keep watersheds healthy.

Key Concept: A watershed is like a giant natural sponge that collects rainwater and snowmelt, directing it to a common low point, like a river or lake. Everything within the watershed, like forests, fields, and towns, contributes to the water that flows through it. The water that collects in a watershed brings with it pollutants, sediments, soil, and nutrients. Watersheds are vital because they provide us with clean water for drinking, farming, and other activities. It's essential to take care of our watersheds by keeping them healthy and preventing pollution, as what happens in one part of the watershed affects the entire system.

Water quality scientists play a crucial role in monitoring and managing the health of watersheds. Here are some ways they work in a watershed:
Sampling and Testing: Scientists regularly collect water from different points within the watershed to test for various parameters such as pH, dissolved oxygen, nutrient levels, bacteria, and pollutants.

Data Analysis: After collecting samples, scientists analyze the data to understand water quality. They look for trends, anomalies, and potential sources of pollution. This analysis helps in assessing the impact of human activities on the watershed.
Monitoring Sources of Pollution: Scientists identify and monitor potential sources of pollution, such as industrial discharges, agricultural runoff, and urban development. By understanding these sources, they can recommend strategies to mitigate pollution and improve water quality.
Ecological Assessments: Water quality scientists study the impact of water quality on the ecosystem within the watershed. This includes assessing the health of aquatic life, biodiversity, and the overall ecological balance. Changes in water quality can have cascading effects on the entire ecosystem.

Public Education and Outreach: Scientists often engage in community outreach programs to educate the public about the importance of watershed health and ways to protect water quality.
Policy Recommendations: Based on their findings, water quality scientists may make policy recommendations to government agencies and stakeholders. This could include proposing regulations, best management practices, or strategies to promote sustainable land use and water resource management.
By integrating these approaches, water quality scientists contribute to the sustainable management of watersheds, ensuring that water resources remain safe, clean, and suitable for both human and environmental needs.

Vocabulary: Watershed, water quality, fecal coliform bacteria, non-point source pollution, point source pollution

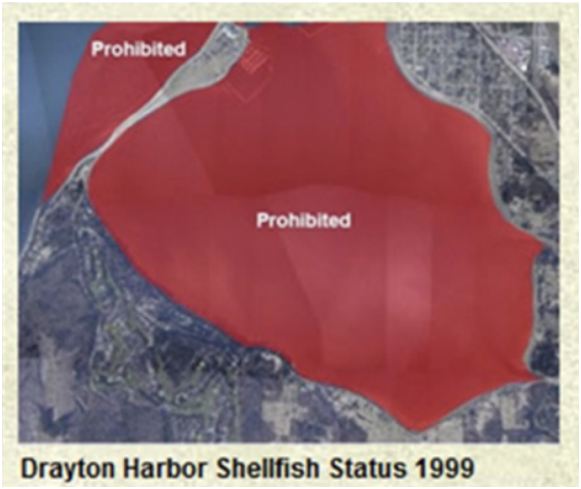
Assessment: Worksheets in GSSC Student Notebook.

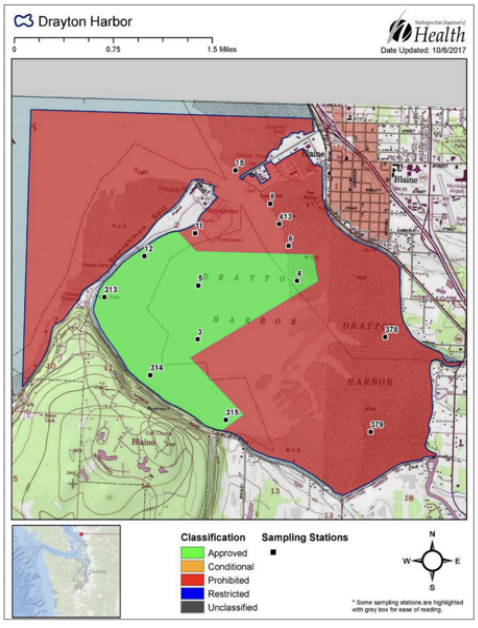
Lesson Instructions: *All parts of this lesson can be found in this document.*
Please read the page and click on the links as you go.
Teacher Prep/Considerations:
Set up computer and projector. Review the Power Point to be sure background information is adequately understood to explain to students. Have the slideshow chart from Lesson 2 ready to review and add to if necessary.
If you would like to use the optional demo, set up the watershed model using the materials and instructions provided by GSSC.

Watch: Why do watersheds matter?

Reading (Notebook pages 7-8): Pollution in Drayton Harbor

Twenty years ago, Drayton Harbor in Blaine faced a challenge: because of high levels of pet and farm animal poop washing into the water, there were unusually high levels of fecal coliform bacteria. This bacteria makes water unhealthy for both humans and animals, especially shellfish. Shellfish build up toxins in their bodies as they filter water, so the bacteria was showing up in high amounts in these shelled creatures. In response, the Washington State Health Department to restricted eating oysters and clams in the community, and no one could harvest shellfish in the area. The images below show the change in the water through time, with the left map showing the harbor's closure for harvesting shellfish in 1999, and areas marked in red are where shellfish harvesting was prohibited. Fast forward to 2004, when a repair fixed a leaky sewer pipe that crossed the harbor's mouth. Following this, a community oyster farm was established. The right map from 2017 shows a big transformation! All the areas marked in green open for shellfish harvest. The once community oyster farm is now owned by the Drayton Harbor Oyster Company, who have a restaurant in Blaine!





Why do you think starting an oyster farm in Drayton Harbor got rid of most of the

fecal coliform bacteria and made it healthy for shellfish harvest again?

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Watch: Watershed Video_Alderwood

Worksheet (Notebook pages 9-11): Healthy Watersheds Design

1. What are three sources of pollution you saw in the watershed model? Label them as non-point sources (NP) or point sources. (P)

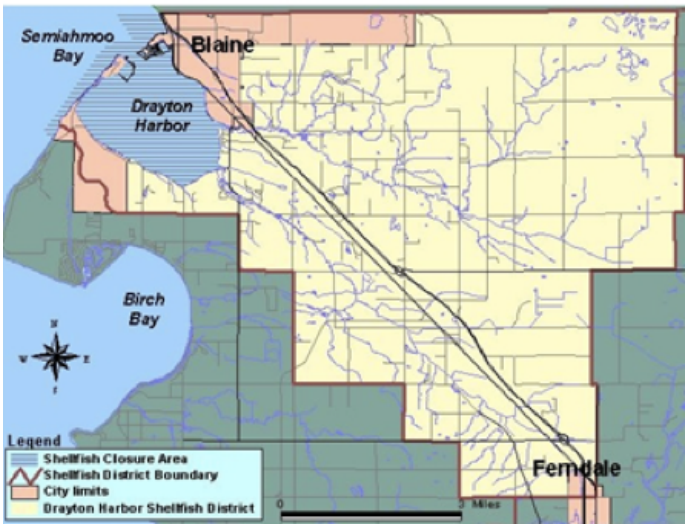
1. _____

2. _____

3._____

2. Label/outline as many landmarks as you can on the Drayton Harbor Watershed map in your favorite colors. Include 2 streams.

Drayton Harbor Shellfish Protection District



3. Name two things you can do to decrease the amount of pollutants that reach our intertidal zones

1._____

2._____

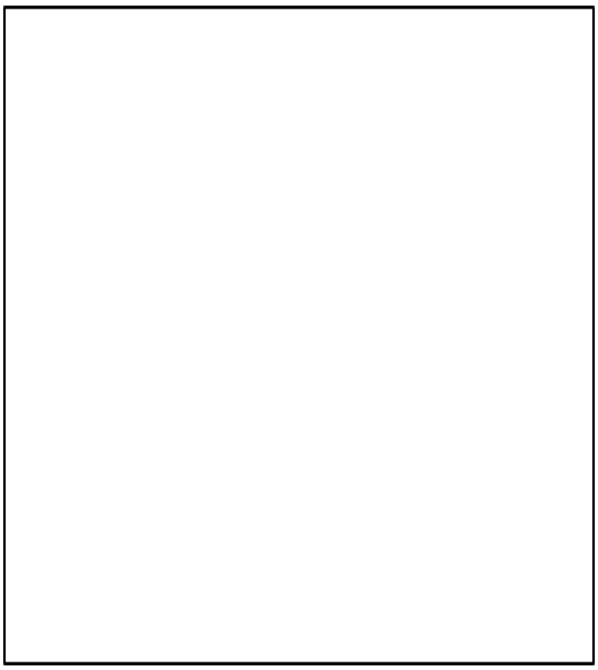
4. Design your own watershed on the next page (use the outline of Drayton Harbor Map if you'd like). Then, draw some farms and houses near any streams. Finally, add each item listed below on your map. Be prepared to explain your thinking to the group. Label everything!

Include:

- ☐ farms
- ☐ houses
- ☐ storm drains
- ☐ a bunch of cows on a dairy farm
- ☐ trees
- ☐ fields of grass
- ☐ at least two streams
- ☐ sidewalks and roads
- ☐ a plastic bag
- ☐ a stone pathway
- ☐ a kid with a dog
- ☐ fences

Extra: solar panels, gardens, an organic farm, a bicycle. How might each of these help reduce ocean water pollution?

My Watershed Design



(Optional) Demo: Watershed Model

1. Have students gather around the Giant Drayton Harbor Watershed demo that has already been set up.
    a. Put a paper map of the same watershed next to it with push pins.
    b. Ask students to locate orienting landmarks.
    c. As students recognize features and locations, have them add a push pin to the map.
2. Explain that 20 years ago, there was so much fecal coliform bacteria and other pollutants in the water the community was not allowed to harvest shellfish. Put food coloring on the watershed model and explain the following:
    a. Pet waste: This can be from people not picking up after their pets or farms that don't handle the waste properly. Have students add chocolate sprinkles and animal toys to the model. Mention that human waste can also have an impact if there are sewage leaks from faulty pipes or septic systems.
    b. Chemicals: This can include herbicides on lawns, pesticides on farms and other chemical sources. Have students add chemicals (red food coloring) to the model.
    c. Vehicles: Cars can create multiple pollutants such as car oil, antifreeze and

even the soap used to wash them. Have students add toy cars along with oil (worchestire sauce), antifreeze (blue food coloring), and soap (yellow food coloring).

   d. A pollutant is "any harmful substance added to the environment." This means dirt from erosion could also be a "pollutant" if it harms the ecosystem and the organisms in it, like fish.

3. Once the pollution sources are placed on the model create a "rain shower" by spraying water until the pollutants reach the ocean. Ask students to explain what happened to the pollution and how it might impact the life living in it.
   a. Point out to students that all of the water ran off directly into the ocean. This is because it is an impervious surface, which means that water can not get through it. The plastic represents roads, sidewalks, driveways, any surface where you see water slide off instead of soak into. We saw in the model that all the pollutants eventually run into the ocean. Can you think of a way that this community could try to keep all the pollutants from getting into the ocean?
      i. Yes, we could choose to have less roads/impervious surfaces and more exposed green spaces.
4. Place as many sponges as possible on the model, add more food coloring, and run the simulation again. Ask for student observations about how it was different than the first time.
   a. Did the vegetation soak up or filter the pollution before it reached the ocean? This is because it is acting like a pervious surface, which means water can pass through it. Vegetation and soil act as a "sponge" for pollutants, so they don't reach the ocean as quickly.
5. Extension (if time allows):
   a. There are also two different types of pollution: point and non-point pollution. Non-point pollution occurs when it rains and the storm-water runoff carries pollutants downstream. This can be pollutants like fecal coliform bacteria (poop) from broken septic systems in houses, animal waste from pets and livestock, chemical herbicides and pesticides from families and property owners spraying their lawns or farms spraying their blueberries, or soap from the family washing their car on the lawn. When these pollutants wash into the ocean it is called "non-point source pollution." This just means that it doesn't come only from one place, like from a pipe. It comes from many places, such as animal waste from pets and livestock.
   b. "Point source pollution" is when a large amount of pollution comes from one single location. I can "point" to the single source. It could also be a broken sewage pipe breaks, or a boat where the sewage tank valve is left open instead of using the pump- out at the marina. According to the EPA, water

pollution in the Salish Sea comes from multiple sources in the watershed.

Career Connection: Because all of the water we drink comes from a watershed, we need to make sure that it is high enough quality for us to use! Even water we don't use directly is tested to see how healthy it is before it enters the Salish Sea. The people who test our water are called water quality scientists, or specialists.

Water Quality Scientist at the San Antonio River Authority

Optional Extensions:

- 5th Grade STEAM Activities
- Explore the Salish Sea: A Nature Guide for Kids by Joe Gaydos (provided by GSSC upon request)
- Garden of the Land and Sea Worksheets additional materials
- Want to look at how kelp interacts with other sea creatures in the food chain? Watch this video.
- Want more worksheets and coloring pages? You can print and work through this seashore packet.
- Sea Creature Yoga Video - follow along with the yoga poses inspired by some of our favorite sea creatures, including kelp!
- Want to see up to date information about beach closures? Beaches close seasonally because of stormwater events, algae blooms, and other pollution. Click here for WA Dept. of Health's Shellfish Safety Map.
- Using paper mache, you can build your own watershed model. Here are some instructions Here are instructions.