Lesson 2: Watersheds

Subject
Watersheds

Materials/ Teacher Preparation

- Print a full class set of the Healthy Watershed Design Student Book page
- Optional: Print a class set of Cognitive Content Dictionaries (CCDs)
- Prepare the Watershed Model before lesson and try it out (GSSC provides lego model kit or paper mache model)
- Set the *Drayton Harbor Watershed Board* next to your Watershed Model for easy reference. Have push pins ready (provided in kit) for students to pin locations of the school, their homes, and other landmarks during the lesson.
- Write the target and success criteria on the whiteboard

Size/setting/duration
Full class/Indoor/50 minutes

Background
A watershed (also called a drainage basin or catchment) encompasses the area of land that drains to one location. Blaine Elementary School is a part of the Drayton Harbor watershed which drains from Cain Creek into Drayton Harbor. As water travels it often encounters pollutants and carries them into the ocean which can have negative impacts on the ecosystem. During heavy rain water runs off of impervious surfaces such as parking lots and roads and can carry pollution into the water whereas pervious surfaces, such as grass or gravel, let water filter through them.

Overview
Target:

- "I can describe how my local watershed works."

Success Criteria:

- Students draw a watershed, labeling the location of the school, the ocean, at least one river, and labeling at least one point source of pollution and one non-point source of pollution.

Procedure

1. Have students get their Salish Sea Notebooks/folders out
2. (5 min) Phenomena: 20 years ago there was so much poop (fecal coliform bacteria) in Drayton Harbor that the State Health Department said the community couldn't eat the oysters anymore. Show students the shellfish safety map. Zoom into Drayton Harbor. Explain that this picture was on one of the posters in the Poster Discussion. They all wondered what the colors meant and made guesses as to what the map represented. Explain that one of the maps showed that in 1999 most of Drayton Harbor was red, representing shellfish harvest was NOT allowed. Then, the second map, the one are looking at now online, shows a large area is green, or open for shellfish harvesting in 2017. *Why do you think this happened?* Turn and Talk.
3. Introduce Target: "I can describe how my local watershed works." Success Criteria: "students draw a watershed, labeling the location of the school, the ocean, at least one river, and labeling at least one point source of pollution and one non-point source of pollution.
4. Optional: (3 min) Add vocabulary to the Word Bank of Cognitive Content Dictionary (CCD) in students Salish Sea Notebooks:
    a. *fecal coliform bacteria*- tiny living things that live in poop. If eaten, often cause disease.
    b. Watershed - a system of land and waterways that drain into a central location.
5. (20 min) Watershed Model Demo
    a. Have students gather around the Watershed Model you've already set up. Connect your model with the Giant Drayton Harbor Watershed board next to you. Ask students to locate Blaine Elementary, their house and any other orienting landmarks (Edaleen Dairy, Blaine Library, California Creek, Dakota Creek, Canada, etc). As students recognize features and locations have them add a push pin to the map.
    b. 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:
        i. 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.

ii. Chemicals: This can include herbicides on lawns, pesticides on farms and other chemical sources. Have students add chemicals (red food coloring) to the model.

iii. 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).

iv. 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.

c. 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.

d. 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? Yes, we could choose to have less roads/impervious surfaces and more exposed green spaces."

e. 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. 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.

f. Extension (if time allows):

i. 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.

ii. "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.

g. Conclusion: What would you recommend our community members do, that includes us, so that the pollution doesn't get into the ocean? Answers include:
   i. Picking up after their pets
   ii. put a fence around livestock to keep them away from the streams
   iii. fixing up toilets right away (and maintaining septic systems based on Whatcom County maintenance requirements)
   iv. spraying non-chemical fertilizers and pesticides
   v. washing cars at a carwash not on the lawn
   vi. if you have a boat always dump at the harbor dump station

6. (15 min) Have students return to desks and pass out Healthy Watershed Design Student Book page. After reading the directions together, students can complete with a partner.

Next Generation Science Standards

Performance Expectations		
5-ESS3-1: Earth and Human Activity. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.		
Scientific and Engineering Practices	Disciplinary Core Ideas	Cross-cutting Concepts
Developing and using models	ESS3.C: Human Impacts on Earth Systems	Systems and System Models Science Addresses Questions About the Natural and

		Material World

Other Standards

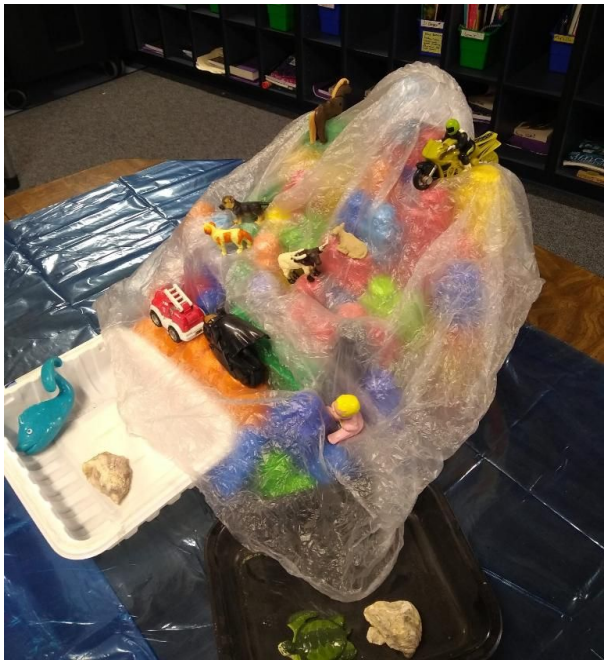
Standard 2: The Natural and Built Environment

Standard 3: Sustainability and Civic Responsibility

Graphics

Watershed map

Watershed Model Set-Up



Vocabulary

**Teacher Note: focus on students understanding of the big ideas. For example, rather than having them memorize "impervious," remind them of what effects those surfaces have.*

- fecal coliform bacteria: tiny living things that live in poop. If eaten, often cause disease
- Stormwater run-off: water that washes into a water body when it rains, carrying substances with it (for example: rain from our parking lot goes into the storm

drain outside our classroom and directly into Drayton Harbor)

- A “point source” : a direct deposit of a pollution into a waterway (example: pipe dumping waste into stream)
- A non point source: any pollutants washed into a waterbody when it rains (example: stormdrain)
- pervious surface - a surface that allows water flow through it (example: grass or gravel)
- impervious surface - a surface that does not allow water to flow through it (example: pavement or rooftops)
- Steward - someone that takes care of something

Extension

- Classes can choose to make their own paper mache models of the watershed and compare different factors that change the effects of pollution on the system. Students can work to design solutions to pollution problems in their models.

Worksheet

Healthy Watersheds Design

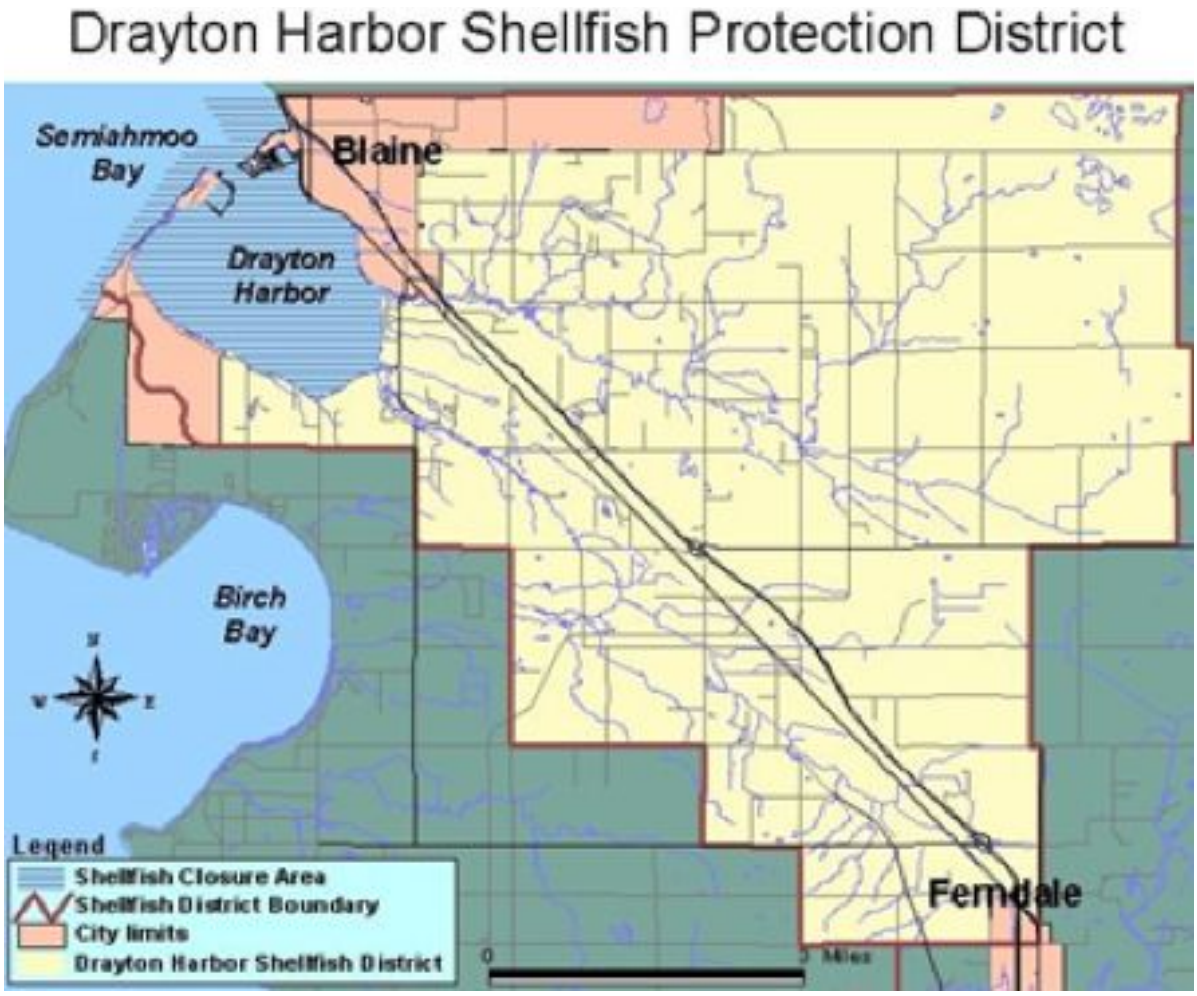
What are three sources of pollution you saw in the watershed model? Label them as non-point sources (NP) or point sources. (P)

1. _____

2. _____

3._____

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



Healthy Watersheds Design

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

1._____

2._____

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

Include: farms, houses, storm drain, a bunch of cows (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?