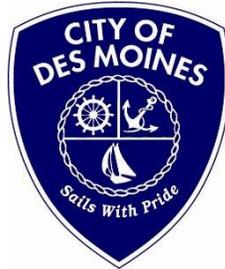


Watershed Model

StormFest Contributors



Curriculum adapted from Drain Rangers by



**ENVIRONMENTAL
SCIENCE CENTER**

Watershed Model-One Page Overview

Overview: Students will explore the concepts of a watershed and stormwater pollution using a 3D model (EnviroScape) as well as maps of local watersheds. The class will be broken into two groups which will rotate between activities: using the EnviroScape with model pollutants and exploring their local watersheds through maps.

Objectives: Students will

- be able to define the word watershed;
- use the EnviroScape model to understand how pollutants cause water quality problems downstream of the pollution source of the pollution; understand that this pollution can affect wildlife; and
- use maps of their local watershed to compare problems evident in the model to potential pollution sources in their communities.

Vocabulary Definitions:

- *Stormwater* - rain that falls on streets, parking areas, sports fields, gravel lots, lawns, rooftops, or other developed land and flows into nearby creeks, lakes, rivers, and Puget Sound
- *Pollutant*- any substance that harms the environment
- *Watershed*- an area of land that drains to a particular body of water

Lesson Overview:

Intro (5 min)

- What is stormwater?
- What is a watershed? Watershed hands activity (if watershed concept is new to them).
- Split students into Groups A and B. Switch activities after 15 min.

Activity A: EnviroScape Model (13 minutes)

1. Have students identify recognizable features (e.g., parks, houses, roads etc.)
2. Give small groups model pollutant bottles and have them decide where pollutants would be found. Add them to the EnviroScape. What will happen when it rains?
3. Have students rotate spray bottles, each getting a turn to add rain to the watershed.
4. Discuss where the pollutants end up, what effect they might have and how we could change this.

Station Rotation (4 minutes)

Activity B: Your Neighborhood Watershed (13 minutes)

1. Introduce smaller “neighborhood” watersheds. Describe how your local “neighborhood” watershed is a part of the Puget Sound watershed.
2. Break students into smaller groups of 2-3. Give them a map and have them identify where their school is and what watershed it is in. Each small group will add pollutant images to their watershed map.
3. Show storm drain image. Have students identify pollution sources on their map with their small group.
4. As a big group, list pollution sources on board.

Closure- at last station (5 minutes)

1. Now that we know the problems facing our watershed, what can we do to help?
2. Discuss solutions: what is one thing you can do to prevent pollution at your school or where you live?



Title: Watershed Model Lesson Plan

Overview

Students will explore the concepts of a watershed and stormwater pollution using a 3D model (EnviroScape) as well as maps of local watersheds. The class will be broken into two groups which will rotate between activities: using the EnviroScape with model pollutants and exploring their local watersheds through maps.

Objectives

Students will:

- be able to define the word watershed;
- use the EnviroScape model to understand how pollutants cause water quality problems within a watershed downstream of the source of the pollution; understand that this pollution can affect wildlife; and
- use maps of their local watershed to compare problems evident in the model to potential pollution sources in their communities.

Vocabulary

- *Watershed* - an area of land that drains to a particular body of water
- *Puget Sound* – large saltwater inlet or bay of the Pacific Ocean in Washington State. The Puget Sound Watershed includes lands west of the Cascade and east of the Olympic Mountains.
- *Pollutant* - any substance that harms the environment
- *Stormwater* - rain that falls on streets, parking areas, sports fields, gravel lots, lawns, rooftops, or other developed land and flows into nearby creeks, lakes, rivers, and Puget Sound

Materials

- Large laminated Puget Sound Watershed map
- EnviroScape Model
- Model Pollutants in labeled bottles
 - Pet Waste - ground & instant coffee mix
 - Pesticides - Kool-Aid powder
 - Fertilizer - fish flakes
 - Soap – diluted dish soap
 - Car Oil & other leaks - thick cocoa
- Spray Bottles (2) filled with water
- Small plastic animals
- A bucket to refill spray bottles as needed
- Towel to dry off materials
- Bucket for emptying dirty water from the EnviroScape Model
- Laminated maps (7) of the area with outlined local watersheds
- Laminated picture of a storm drain
- 7 small group boxes containing:
 - 5 velcro pollution images:
 - 1 cleaning cloth
 - 1 dry erase
- One medium-sized whiteboard
- 1 black dry erase for whiteboard
- Cloth to erase whiteboards and maps



Lesson

Station Preparation: Educators and station managers will make sure that the EnviroScape models are rinsed clean, and the water catchment basins are filled with a small amount of clean water. Educators will also ensure whiteboard and local watershed maps are erased. Be sure to use refill pollutant bottles as needed between demonstrations.

Station Educators: 2 individuals required.

Introduction: What is a Watershed? (5 minutes)

1. Introduce yourself and the station. (Hello! Welcome to our Watershed Model station. My name is _____ and during this activity we'll be focusing on how stormwater gets into and affects our watershed." Ask the students if they know what stormwater is. If they have been to other stations or have other prior knowledge they may already have a good understanding, otherwise give the definition. Introduce the chaperones at your station and remind them how they can help at this station.
2. Ask the class if they have heard of a watershed before. If yes, draw definition out of students, elaborating and refining as needed. If no, give the definition. Trace the outline of the Puget Sound Watershed on map. Have the students make "watershed hands" by cupping their hands like a bowl; hold up your hands and explain that your left thumb is the Olympic Mountains, your right thumb is the Cascade Mountains, and where your hands meet in the middle is the body of water we call Puget Sound. Your hands are the Puget Sound Watershed: "all the land that drains water into Puget Sound". Ask students to think of animals that live in the Puget Sound watershed (salmon, orcas, bears, birds, seals) and explain that the orange represents all of the people who live in the Puget Sound Watershed (approx. 4 million people). Ask the students if they think our actions affect those organisms. *Ex: what if one person's car leaks oil, what about four million cars? What if one person leaves dog poop, what about four million owners leaving poop? The actions each of us take each day positively or negatively affect our watershed.*
3. Explain to the students the outline of the station, that they will break into two groups (Groups A and B, unless they already have assigned groups and names), and rotate between two activities exploring watersheds and how they affect the movement and distribution of pollutants. If class has already been divided into six groups, have three of those groups per activity (two large groups).

Activity A: EnviroScape Exploration (13 minutes)

1. Have Group A gather around the EnviroScape Model, and point out key features: house, school, mountain, farm, golf course (little flags), river, and coastline. Ask the students if they can imagine what local places the model might represent (places they've been or know about, including neighborhoods, local bodies of water).
2. Show bottles of pollutants and explain that the names on the bottles are the real-life worst offenders in Puget Sound stormwater pollution. However, what is inside the bottles are not what the label says, but are models of real pollutants sometimes scientists use models to help them understand things about the real world. The students will probably want to know what is actually in each bottle, which is fine (emphasize that the things may smell good, but that they have been used by many people and are *not* edible!). Have students get into five groups of about three students each and give each group a bottle. Give them 30 seconds to decide as a group where on the model to place the pollutant. Each student may then take a turn to give their group's bottle a small squeeze or shake. They may choose to put their pollutant in a couple different spots.



3. Do we get a lot of rain in this area? Yes! Ask the students what they think will happen when it rains; will the pollutants stay in one place? Where will they end up? Choose two students as the first to use the spray bottles to make it rain on the model. Allow each student a certain number of sprays before passing it to the next student; five to ten sprays should work, depending on the number of students in the group. You want to ensure that the model is getting enough water on it to carry the pollutants into the basin without this part taking too much time. "It rains everywhere, so make sure you cover the whole model."
4. Ask the students what happened when it rained on the model. Was that what they expected? Where did the pollutants end up? What effect might this have on the water and the things that live in it? [Examples: fertilizer can cause algal blooms by providing too many nutrients, which can lead to eutrophication (lack of oxygen); soap, even biodegradable soap, harms fish scales] What other types of pollution have you seen/do you know about? (examples: trash, factory smoke) Might those end up in the watershed, too? What about carbon dioxide? Does that end up in the water? (The answer is always yes!)
5. We are also brainstorming solutions! What would you do differently here on our model? If we were to run the experiment again, what could you change? Ask each small group to consider what they would do differently with their pollutant (i.e. use less, use it somewhere else, stop using it altogether - if so, what are the alternatives?).
6. Educators and station managers will make sure that the EnviroScape models are rinsed clean, and the water catchment basins filled with a small amount of clean water. Be sure to refill pollutant bottles and help empty catchment containers.

Activity B: Your Neighborhood Watershed (13 minutes)

1. Explain that in this activity we will be figuring out what our local watershed is, using maps. We know that we all live in the Puget Sound watershed. When rain falls on our homes, where will it end up? Puget Sound! However, most of that water doesn't go straight into Puget Sound, but flows first into a local creek or river. Each of those creeks has its own little watershed. Hold up a map of the area and point out the outlined watersheds around each creek and river. (*Use one local watershed as an example to show how an area drains into a small creek and, if possible, trace it as it goes to Puget Sound.*) These little creeks will eventually flow into Puget Sound, so they are *also* a part of the Puget Sound Watershed. Acknowledge that it's a little confusing, but that they can think of these smaller watersheds within the Puget Sound Watershed like neighborhoods within a city. Time to find out what your "water neighborhood" is!
2. Have Group B break into 7 groups of 2-3 students each. Give each group one of the local watershed maps and challenge them to find their school on the map and determine what watershed their school is in.
3. "What happens when it rains at your school? Where does the water go?" Students might answer: in the ground, in the street, into the closest body of water. Remind them that we live in a pretty developed area and give the definition of stormwater again. Hold up the picture of a storm drain and ask if any of them have seen one before. Ask if someone could explain what it is and what it does. "So, even if there's not a creek right next to your school or your home, if you're next to a storm drain it's like being next to a creek, since the water that goes down it goes right to the same place. Are there any storm drains at or near your school or where you live? And I'll bet that some of you have seen things in or near storm drains that probably shouldn't be there!"
4. Next, explain to the students that we will be identifying potential sources of pollution within their watershed. If they have already done the EnviroScape activity, invite them to think of real live examples of the pollutants they used on the EnviroScape. Ask students areas where they like to hang out in their watershed (solicit a few answers from students). Hold up the five pollutant images and ask students if they've seen this near their school or areas they frequent daily: *dog waste, oil puddle, green lawn with someone spraying fertilizer, soap from car washing, and party picture with lots of plastic waste*. Explain that they will place the pollutant on the map where they have seen it or think it could be. Explain that after they



place the pollutant, they will trace on the map how the pollutant enters Puget Sound. Explain that they will be sharing their findings and solutions to pollutants with the group (*hint-possible solutions can be found on the back side of the card*). Hand out the envelopes containing Velcro images, cleaning cloth and one dry erase marker and give them some time to complete the activity.

5. When there are three minutes remaining, pull the group back together.
6. Ask a group to share one of the pollutants and how it got into Puget Sound. Place the image on the large white board. Ask everybody: "did anybody else find that pollutant on their map? Add a check mark for each group that found it. What's a solution for keeping it out?" (*hint-there are solutions on the back side of the images*). As they name solutions, instruct them to remove that pollutant and erase its path to Puget Sound. As time allows, ask for additional examples and follow the same protocol. Before they switch, have students place all remaining Velcro images, dry erase marker, and cleaning cloth back in their group's box and finish wiping down maps. If you're running short on time, you have each group quickly share their pollutant. If there is extra time, challenge groups to think of solutions they could engineer in their community. What could we change for the future?
7. Ensure whiteboard and local watershed maps are erased and ready for the next rotation.

After 13 minutes, Groups A and B switch (4 minutes for transition)

Closure: So what can we do? (5 minutes - at last station)

1. Tell them that we have just completed an exploration of watersheds, using models and maps. We know more about the Puget Sound Watershed and the local watersheds that we live and go to school in. Remind the students that we *all* live in a watershed, and that that watershed contributes pollution to creeks, rivers, and Puget Sound.
2. "I know it can feel like there are a lot of problems! But today is also about solutions." Ask the students to turn to the person next to them and discuss this question: What is one thing you can do to prevent pollution at your school or where you live? Give about 2 minute for this discussion; after a minute remind them to have each person share their idea if they have not yet. If running out of time, have students discuss this while they walk to the next station.