

# Watersheds & Water Quality

Curriculum to encourage the stewardship of  
our watersheds.



**Supporting materials available here:** <http://www.uri.edu/cels/ceoc/EducationResources.html>

THE  
UNIVERSITY  
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THINK BIG  WE DO

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## Lesson Plan 1: The Watershed Model

**Summary:** This lesson is designed to help students understand the importance of water and learn the parts of the water cycle. We will introduce the concepts of runoff/storm water pollution and illustrate examples of the sources of storm water pollution. When the activity is completed, students should be able to brainstorm ways to reduce human impact on water pollution.

**Materials for the lesson:** The Enviroscope® Watershed Model, water cycle diagram, water, water pitcher, 3 spray bottles for rainmakers, pollution sources (chocolate sprinkles=dog poop/cow waste, colored sprinkles=fertilizers, grass clippings=from lawn, food coloring and water= pesticides, paper towel=litter, hand soap=car wash soap, instant coffee= motor oil, sand=road salt and sand)

**Tips for teaching the lesson:** The Enviroscope® Watershed Model is available free, on loan from the URI Outreach Center by emailing [outreach@uri.edu](mailto:outreach@uri.edu) or calling (401)874-2900. This lesson plan was adapted from the accompanying Enviroscope® Curriculum.

Name: Watersheds and the Water Cycle	Topic: The Water Cycle, Nonpoint Source Pollution, Runoff
Subject: Earth Science, Life Science	Grade Level: K-12
Objective(s): To give students an understanding of the importance of water and what everyday practices can pollute our water sources.	
State Standard(s): ESS1 (K-4) INQ –2 Use results from an experiment to draw conclusions about how water interacts with earth materials (e.g., percolation, erosion).	

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*ESS1 (K-4) - 4b* Using or building models to simulate the effects of how wind and water shape and reshape the land (e.g., erosion, sedimentation, deposition, glaciation).

*ESS1 (5-8) SAE-2* Explain the processes that cause the cycling of water into and out of the atmosphere and their connections to our planet's weather patterns.

*ESS1 (5-8) SAE -2: 2a* Diagramming, labeling and explaining the processes of the water cycle including evaporation, precipitation, run-off, condensation, transpiration, and groundwater.

*LS2 (5-8) SAE-7* Given an ecosystem, trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition, recycling but not carbon cycle or nitrogen cycle).

*ET1.2 (5-6):2b* Researching and analyzing the effects on humankind and the environment that a particular technology has had over a period of time (e.g., landfill, dam on a river, desalinization plant).

*LS2 (5-6)-7a* Students demonstrate an understanding of recycling in an ecosystem by explaining the processes of precipitation, evaporation and condensation as parts of the water cycle.

*LS2 (7-8) -5a* Students demonstrate an understanding of equilibrium in an ecosystem by identifying which biotic (e.g., bacteria, fungi, plants, animals) and abiotic (e.g., weather, climate, light, water, temperature, soil composition, catastrophic events) factors affect a given ecosystem.

*LS2 (9-11) - 3* Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

Time	Action	Assessment	Materials
2 min.	<b>Water Cycle Activity:</b> Hold up water pitcher and ask introduction questions to the students.	Does anyone know how old this water is? Where do you think the water from our sinks come from?	Water, water pitcher, Enviroscape® Watershed Model
2 min.	Show the students the diagram of the water cycle and highlight the different parts. Introduce the Enviroscape® model as part of Rhode Island (i.e., Narragansett Bay	Does Rhode Island get a lot of precipitation or a little? (Average of 46 inches/year in RI).	Water Cycle Diagram, Enviroscape® Watershed Model

	or your local water body)		
2 min.	Explain the process of precipitation and have three students demonstrate rainfall by spraying the Envirosapes model. (You can have the other students pat their knees to simulate the sound of rainfall).	Where is the water going? Is it moving anywhere specific? What is precipitation?	Spray bottles, water
2 min.	Explain the other processes of the water cycle: evaporation, transpiration and condensation. All of these processes can be demonstrated/reviewed with your water cycle diagram.	Has anyone ever seen condensation? Where have you seen any of these stages?	Water cycle diagram
5 min.	<b>Runoff Activity:</b> In a natural setting, the rain will fall on forests and soil. Have a student demonstrate this by pouring some of the water from the pitcher onto the soil or grass. Ask them to observe where the water goes. It is absorbed into the ground and forms groundwater.	Where did the water go? Where would the water go if it was poured on the sidewalk or on the road?	Soil, water
1 min.	Have a student pour water onto a paved surface. Have the students point out the hard surfaces on the model that wouldn't allow water to soak through (roofs, streets, patios, etc.). As this water travels over the roof tops, streets and driveways, it mixes with what's there and picks up all sorts of	Where does the water go? Does it mix with anything else on the surface of the model? What do you think happens to the water that enters the storm drains or gutters? (Enters the storm drain and drains to the nearest body of	Water

	pollution on its way to the storm drain. We call this <b>storm water pollution</b> .	water).	
5 min.	<b>Storm water Pollution Activity:</b> Explain that there are some houses in the neighborhood that have dogs and they never clean up after them. Have a student sprinkle the animal waste near the dog figure. Also, the farmer lets his cows wade in the river near the farm. Have students add animal waste to the farm and the river.	What types of things do you see in the model of Rhode Island? (houses, farms, dogs, roads, cars, construction sites, golf courses, rivers to Narragansett Bay)	Sprinkles (animal waste)
5 min.	Explain that “Benny” always throws his candy wrappers and soda bottles on the ground. Have a student put crumpled up paper towel on the street. The people in their cars also throw their trash out the windows. Have a student put paper towels in the ditch near the road.	Why shouldn’t we litter?	Paper towels
5 min.	“Mrs. Pots” has a lawn and she uses a lot of fertilizer on it to try and make the grass greener. Have students sprinkle <i>fertilizer</i> on the lawns near the houses. The golf course and the farm use too much fertilizer. Sprinkle <i>fertilizer</i> there.	What happens when you use too much fertilizer?	Colored sprinkles (fertilizer)
5 min.	Explain when “Benny” mows the lawn he leaves the <i>grass clippings</i> on the street and in the driveway. Have a student sprinkle		Grass clippings

	grass clippings near the lawns.		
5 min.	“Mrs. Pots” has a rose garden at home and she uses too many <i>pesticides</i> to get rid of the insects that eat her flowers. Have a student squirt some pesticides on the lawns near the house. The farmer and the golf course use pesticides too. Have the students sprinkle pesticides on those areas as well.		Food coloring and water (pesticides)
5 min.	Mrs. Pots washes her car in the street and all the suds from the car wash soap wash right into the storm drain. Have a student pump the <i>car wash soap</i> onto the car.	Where does the soapy water and suds go when you wash your car in the street?	Hand soap (car wash soap)
5 min.	Mrs. Pots also changes her oil in her car. She dumps the extra oil directly down the storm drain. Have a student squirt some <i>oil</i> into the storm drain (tube in the model). Wally World has a lot of cars in their parking lot with leaking oil and automotive fluid. Have a student squirt some <i>oil</i> onto the parking lot near the “factory.”	Should we dump anything into the storm drain? Why or why not?	Instant coffee (motor oil)
5 min.	Road salt is another source of storm water pollution. Have a student pour <i>sand</i> on all of the roads.	Has anyone noticed all the road salt used in the winter? What do you think happens to it after the winter is over?	Sand (road salt)

5 min.	Mrs. Potts has a septic system and hasn't taken care of it and it overflowed. Have a student squirt some <i>motor oil/sewage sludge</i> on the lawn of the house.	Does anyone have a septic system?	Instant coffee (sludge)
5 min.	A storm is coming! Have three students use the squirt bottles and make it rain on the model.	What do you notice is happening to the landscape? Where is everything going?	Spray bottles, water

## Lesson Plan 1b: What's the Solution?

Objective(s): Students brainstorm ways they can reduce storm water pollution through everyday activities.			
Time	Action	Assessment	Materials
1 min	What are some ways to prevent our water from becoming polluted? Remind the students of each source and come up with a change in behavior on land that will lead to cleaner water quality.		
1 min	<b>Remind students of examples:</b> Scoop your dog's poop and throw it in the trash.		
1 min	Don't be a litter bug! Throw your trash in the recycling bin, compost bin or trash can.		
1 min	Farmer Rob could put a fence around his cows so they can't get into the river. Place the fence in front of the river on the farm. He can compost the manure and add it to the soil, reducing the need for fertilizers.		

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1 min	Tell your parents to reduce the amount of fertilizers and pesticides used on your lawn and garden. Adding clover to your lawn seed mixture reduces the need for fertilizer; and the process of integrated pest management allows you to use less chemicals to get rid of insect pests. Sweep up any spills.	
1 min	Sweep grass clippings back on to the lawn. They'll act as a natural fertilizer that way!	
1 min	Tell your parents to wash their car at a commercial car wash (where they must dispose of soapy water properly and use less water).	
1 min	Tell your parents to make sure your car isn't leaking any oil. If they change their own oil, recycle the used oil.	
1 min	Conserve water as much as possible. Collect water in rain barrels. Don't waste and use less water in your daily activities like watering the lawn.	



## Lesson Plan 2: Water Filtration

**Summary:** In this lesson, students are tasked with designing their own water filters out of common materials. This activity stresses the importance of preventing pollution rather than remediating, as well as giving students an idea about filtration techniques and the engineering career path.

**Materials for the lesson:** Scissors, box cutters, empty soda bottles, rocks, gravel, coffee filters, sand, grass, string, measuring cups, micropipettes, water quality test kits, and premade storm water. Storm water can be made from glitter, sprinkles, food coloring, instant coffee, etc.

**Tips for teaching the lesson:** Tell the students that they have been hired by a water company to convert polluted stormwater into clean, potable water. *Make sure the students know that although they filtered this water, it should not be consumed.* You can cut the top quarter off the soda bottles ahead of time. This lesson plan was adapted from TeachEngineering.org.

Name: Water Filtration	Topic: Watersheds and Water Quality
Subject: Science	Grade Level: 3-8
Objective(s): Understanding how filtration works, designing creative filters with the bottles, understanding the effects of water pollution, problem solving, and teamwork.	
<b>State Standard(s):</b> ESS1 (K-4) INQ –2 Use results from an experiment to draw conclusions about how water interacts with earth materials (e.g., percolation, erosion, frost). PS1 (K-4) INQ –1 Collect and organize data about physical properties in order to classify objects or draw conclusions about objects and their characteristic properties (e.g., temperature, color, size, shape, weight,	

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texture, flexibility).

*M(G&M)–6–7* Measures and uses units of measures appropriately and consistently, and makes conversions within systems when solving problem

*ET1.2 (5-8)* Describe and demonstrate the effects of technological systems on humankind in terms of a national scale.

*ESS1 (K-4) 2a* Conducting tests on how different soils retain water (e.g., how fast does the water drain through?).

*PS1 (K-4) -1: 1c* Observing and describing physical changes (e.g., freezing, thawing, torn piece of paper).

*ET1.2 (5-6):2b* Researching and analyzing the effects on humankind and the environment that a particular technology has had over a period of time (e.g. ,landfill, dam on a river, desalinization plant).

Time	Action	Assessment	Materials
3-5 min.	Using scissors or box cutters, cut the top off of the soda bottles so that there is about $\frac{3}{4}$ of the bottle useable for materials (this can be pre-prepared)		Scissors, box cutter, soda bottles
3-5 min.	Have a table set aside with materials such as sand, rocks, coffee filters, tissue paper, and various other found items (this can also be pre-prepared)		Rocks, gravel, coffee filter, sand, grass, etc
5-8 min.	Break students up into teams and have them gather the following materials: $\frac{1}{2}$ cup of sand, $\frac{1}{2}$ cup of rocks/gravel, string, coffee filters, and plastic bottle pieces		Measuring cup, sand, rocks, gravel, string, coffee filters, plastic bottle pieces
10 min.	Have the students place the top of the water bottle, which was cut off, into the body of the bottle to act as a funnel. Then have the students place a coffee filter in	What is a funnel? What is a basin? What materials are constant in each group's filter?	Bottle pieces, coffee filters

	the “funnel”. (The body of the bottle will be the basin that catches the filtered water)		
10 min.	Once the filter is in place, have the students work in groups to create the most effective filter by adding layers of the various materials such as sand, gravel, grass, etc. This will become their completed filter, and after this step they will be ready to experiment.	What type of materials do you think will work best? Which materials will be less effective? What makes these materials different? What will you use as your first layer?	Sand, rocks, gravel, grass, etc
10 min.	After the filters are completed, have the students test their filters with “polluted storm water.” How effective was your group’s filter in cleaning the water?	What materials and particle sizes worked the best? What would you change if you wanted to do this again? How important is clean water? What are some methods of preventing water from becoming polluted?	“Polluted storm water” made from a combination of water, glitter, sprinkles, food coloring, instant coffee, etc.

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