Nashua River Watershed Investigations for Grades K-8

Lesson # 5-1

Title: 5-1 Modeling a Watershed: gravity, tributaries, water runoff, and potential pollution challenges.

Grade Level & Standard: Grade 5
5-ESS2-1 Use a model to describe the cycling of water on earth between the geosphere, biosphere, hydrosphere and atmosphere through evaporation, precipitation, condensation, transpiration, and surface runoff.

Objective:
Students will construct a model to explore basic concepts of watersheds including that (1) water flows downhill, (2) ridges of higher land can divide watersheds, (3) lower-lying areas can create pools, and (4) water quality is affected by what is upstream.
Students will be able to define the concept of a watershed and learn about the role of runoff in the cycling of water. Students will also be able to explain that water quality is affected by what is upstream.

Vocabulary:

- **Watershed** - An area of land that drains into a particular river or body of water. Watersheds are usually divided by elevated land such as mountains, hills, or ridges.
- **Surface runoff** - The part of the water cycle that flows over land as surface water instead of being absorbed into groundwater or evaporating.
- **Polluted runoff** - As surface runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.

Discussion Points:
What is a watershed? What is surface runoff? What are some ways in which humans can reduce pollution from reaching a water body such as a river, stream or pond

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Materials:

- 5 large sheets of paper for drafting topographical map
- 5 aluminum baking pans or plastic basins
- Heavy Duty aluminum foil (about 60 cm per group)
- newspaper
- plastic sheeting for 5 stations
- “pollutants” such as instant coffee grounds (soil and silt), soy sauce (oil), Kool-Aid powder (chemicals such as fertilizer, pesticides & herbicides) Cocoa Puffs (pet & farm animal waste)
- 25 small cups for containers for pollutants
- 5 blue sharpies
- 5 pipettes
- paper towels
- 5 spray bottles with blue food coloring in water
- Popsicle sticks as tools for making tributaries
- toothpicks
- miscellaneous craft materials for making houses, animals, fences, trees, grass, etc. (i.e. oil based clay in various colors, gravel, sticks, foam trays, toothpicks, cubed sponge pieces, pipe cleaners, green felt strips)
- Investigations watershed map

5-1 Modeling a Watershed lesson materials

Photo taken by Carolyn Perkins

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Procedure (40 minutes to 60 minutes):

1. Review precipitation and surface runoff in the water cycle.

2. Introduce the idea of a watershed using photographic images of landscapes and the Nashua River Watershed topographic map. Define land elevation, topography, water bodies, and tributaries. Discuss how the shape of the land affects how water travels through it. Illustrate how rivers and streams are connected within a watershed and how highlands separate watersheds. Consider having students work in pairs or small groups to come up with a common definition of **watershed**.

3. Divide class into 5 groups. Students will work in teams to make their model watershed.

4. Using the large sheet of paper, each group drafts a map that includes 2-4 hills of various heights, 4-5 tributaries, one large river,and one pond. Students will make a three-dimensional model that matches this map.

5. Arrange crumpled newspaper in the aluminum tray to represent the hills. This is a model of a landscape with hills, valleys, and connections between them.

6. Add the surface of the land to your model: Use a large sheet of heavy duty aluminum foil (place dull side up for this activity) and mold it to fit over the landscape created with newspaper. In this model, the aluminum foil represents the surface of the land. Adjust the shape of the foil to match the shape of the land surface that you need so that rivers flow as they do on your map.

7. Draw the waterways on your model. Think about rain falling in your model watershed. Where would the rainwater go? Where would rivers and streams form? Would there be any waterfalls? Where will the water create lakes or ponds? Draw the locations where you think rivers and lakes would form with a permanent marker.

8. Now arrange some modeled houses, trees, wetlands (sponge pieces), and gravel in locations that make the most sense. Add some modeled “fish” into water bodies. Using a toothpick, poke several (6-8) small holes in the model to represent soil absorption during run-off.

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9. It's time for some rain! Use the spray bottle with blue water to “rain” on the top of your “mountains”. Continue raining until the water forms streams, rivers, and lakes.

10. Observe where the water goes including tributaries and rivers. Note collection areas such as ponds or wetlands.

11. Introduce the “pollutants” (already listed on white board) as part of human activity. Add pollutants in small pinches and sprinkle over watershed area. Instruct students to take turns making it rain again and see where the pollution travels. Observe movement of pollutants.

12. Using Modeling a Watershed data sheet, sketch your watershed model and note what you observe. Brainstorm solutions to reduce pollution runoff and be prepared to share ideas.

Students’ Instructions for Lab - Make a Watershed

1. Arrange newspaper in the aluminum tray to represent the hills. This is a model of a landscape with hills, valleys, and connections between them.

2. Add the surface of the land to your model: Use a large sheet of heavy duty aluminum foil (place dull side up for this activity) and mold it to fit over the landscape created with newspaper. In this model, the aluminum foil represents the surface of the land. Adjust the shape of the foil to match the shape of the land surface that you need so that rivers flow as they do on your map.

3. Draw the waterways on your model: Think about rain falling in your model watershed. Where would the rainwater go? Where would rivers and streams form? Would there be any waterfalls? Where will the water form lakes or ponds? Draw the locations where you think rivers and lakes would form with a permanent marker.

4. Now arrange some modeled houses, trees, wetlands (sponge pieces), and gravel in locations that make the most sense. Add some modeled “fish” into water bodies. Using a toothpick, poke several (6-8) small holes in the model (foil) to represent soil absorption during run-off.

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5. It's time for some rain! Use the spray bottle with blue water to “rain” on the top of your “mountains.” Continue raining until the water forms streams, rivers, and lakes.

6. Observe where the water goes including tributaries and rivers. Note collection areas such as ponds or wetlands.

7. Introduce the “pollutants” (already listed on white board) as part of human activity. Add pollutants in small pinches and sprinkle over watershed area. Make it rain again, this time with uncolored water. Observe movement of pollutants.

8. Sketch your watershed model and note what you observe. Brainstorm solutions to reduce pollution runoff and be prepared to share ideas.

Data Sheet: (attached)

- Modeling a Watershed

Evaluation: Use the NRWI Lesson 5-1 Modeling a Watershed data sheet as a reflection of participation.

Extension: Mass GIS Oliver (online mapping)
http://maps.massgis.state.ma.us/map_ol/oliver.php
Teachers and students can create a contour map online.
Data layers on this map can include watershed boundaries, topography lines, school location, and other GIS features. *Example attached.*

This is a link from paul.nutting@mass.gov. It is a map with contour labels. This can be sent to teachers for easier connection.
http://maps.massgis.state.ma.us/map_ol/oliver.php?lyrs=Detailed%20Features~Basemaps_MassGISBasemapWithLabels2~|Contours%203m%20Labels%20Feet~massgis:GISDATA.CONTOURS5K_ARC~GISDATA.CONTOURS5K_ARC::Labels_Feet&bbox=-71.39010211963888,42.52529184405457,-71.363687725258883,42.53658191588877&coordUnit=m&measureUnit=m&base=MassGIS%20Statewide%20Basemap&center=-7945639.597172,5240846.0536118&zoom=16&opacity=1,1&baseO=1&filt=undefined|undefined

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Modeling a Watershed **NRWI Lesson 5-1**

Name_____

1. Draw your watershed model above. Label mountains, rivers, pollutants and other features.

2. Where do you see polluted run-off causing problems in the “community”? Locate three locations (hint: check “groundwater”).

3. Brainstorm three solutions to prevent polluted runoff.

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