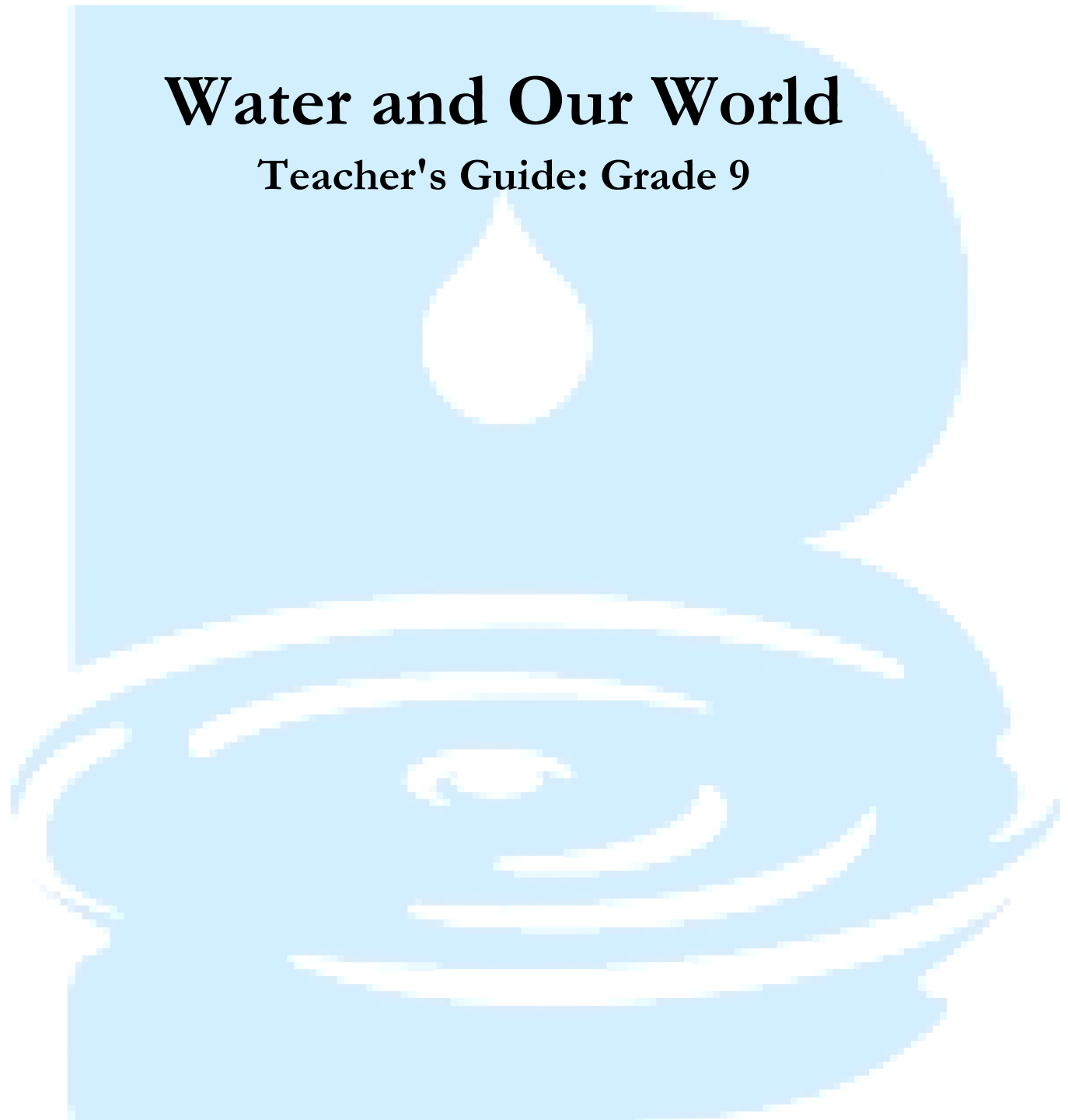


Water and Our World

Teacher's Guide: Grade 9



Beaver **Water** District

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Lesson 3: Ground Water Infiltration

Purpose

This lesson provides students with an opportunity to create their own investigation. They are presented with a problem and asked to design an experiment to discover the best way to filter storm water runoff before it enters the stream. Two 2-liter bottles, simulated pollution solution, and sand, silt, clay, and small/large gravel will be needed. Students will be exploring a new wave in residential and commercial development and understand green technology.

Objective

- The students will be able to design an experiment.
- The students will be able to identify which substances or combination of substances best filter polluted water.

Arkansas Framework Correlation

Science

9th Grade

SP.3.ES.2 - Investigate the relationships between human consumption of natural resources and the stewardship responsibility for reclamations including disposal of hazardous and non-hazardous waste.

SP.3.ES.3 - Explain common problems related to water quality:

- conservation
- usage
- supply
- treatment
- pollutants (point and non-point sources)

SP.3.ES.8 - Compare and contrast man-made environments and natural environments

NS.4.ES.1 - Collect and analyze scientific data using appropriate mathematical calculations, figures and tables

NS.5.ES.3 - Evaluate long-range plans concerning resource use and by-product disposal for environmental, economical and political impact

Problem Question

What are the best filtration substrate types for storm water runoff?

BACKGROUND INFORMATION

Teachers: This is a very basic lab with very basic materials. Research your biome soil type and topography for final comparison. Research the most common stream pollutants in your area to assemble your lab simulated pollutants. Investigate green technology for discussion.

Students: The students will need information on point and nonpoint pollution. The students will also need instructions on assembling their filtration column

Keywords

- Substrate: various materials that make up the layers of earth
- Point pollution: pollution coming from a specific source that can be identified clearly. (Ex. Pipe discharging directly into a stream)
- Nonpoint pollution: pollution from an unknown source that is washed into surface water by rainfall (Ex. Runoff from a cow pasture or parking lot)
- Filtration: the removal of substances in water by moving through porous layer

Timeline

This lab can be performed in one class period.

Materials

- Tap water
- Fertilizer
- Soil
- Silt
- Clay
- Sand
- Small gravel
- Large gravel
- Students bring in 2-liter bottles

Teacher Preparation

Have materials prepared and conduct in a safe location.

Additional Resources

Resources for materials not included:

UA Center for Math & Science Education

<http://www.uark.edu/~k12info/>

479.575.3875

Northwest Arkansas Education Co-Op

<http://starfish.k12.ar.us/web/>

479.267.7450

Beaver Water District

www.bwdh2o.org

479.717.3807

Know of other resources? Please let us know!

education@bwdh2o.org or 479.756.3651

7E's History of Water Treatment

Elicit

Have students brainstorm ideas for how to deal with storm runoff in a store parking lot. What might happen if the trash, oil, antifreeze, gas, etc. is washed directly into a creek? What might happen to the living things in the creek? Show pictures of parking lots or agricultural areas draining.

1. Explain to students that they are to design a filtration system to filter nonpoint pollution from a parking lot at a busy shopping center. The shopping center is trying to be more sustainable and wants to filter their storm water runoff before it enters the creek. Discuss what parking lot islands with planting beds and drains would look like.
2. Model the correct filtration column assembly.
 - a. Have students bring to class two empty 2-liter bottles rinsed and with the labels removed.
 - b. Cut bottle one in half. Top for a funnel and bottom for collection of filtered water.
 - c. Cut the top off of bottle two and discard. Puncture the base of bottle two several times to allow the water to slowly leak into the collection base of bottle one.
 - d. Take the base of bottle one and place under the bottom of bottle two for filtered water collection.
 - e. Invert the top of bottle one (funnel) and place into the top of bottle two.
 - f. Layers of substrate will be assembled in the bottle two base.
3. Show students the filtration materials you have in the classroom.
 - a. Obtain soil, sand, clay, small gravel, large gravel and place in containers in the classroom.

Engage

Have students organize the group's thoughts and ideas. Have students plan their filtering structure and predict outcome.

Explore

4. Have students collect desired materials to layer into their bottle assembly.
 - a. Prepare a simulated pollution sample.
5. Combine water (tap/chlorinated) and fertilizer.
6. Have students collect 20 ml of simulated pollution and use a testab water quality kit (includes instructions) to determine levels of phosphate and chlorine.
7. Have students prepare the filtration column with layers and complete assembly.
8. Have students pour solution into the top funnel piece and then remove bottom piece with filtered solution.
9. Have students perform water quality tests on filtered solution to obtain data on pollution levels.
10. Have students compare before-filtration levels to after-filtration levels.
11. Have students repeat procedure with four different filtration setups to determine best system. Perform four to five replications per design.

Explain

12. Have students do a lab write-up stating their objectives, hypothesis, procedures, results (graphs of data), and conclusion.
13. Each group presents their findings and suggestions.

Elaborate

Have students discuss importance of protecting water quality in local streams. Use a local store parking lot and its proximity to water to explain in detail possible solutions.

Evaluate

Assessment will be performed through grading their lab write-up and their group presentation.

Extensions

After their investigation, students can research current sustainability practices used by green technology and development. Students may want to explore if their system can filter other types of pollutants as well.