

### Purpose

This lesson presents the concepts of permeability and impermeability and the related factors of infiltration and runoff. Students examine a map of their school grounds and make predictions on the permeability of each area. In doing so, they are encouraged to think critically about the permeability of their school grounds and possible implications. This activity can be used alone or as a precursor to the Permeability Field Investigation.

### Background

Harking back to the water cycle, when it rains, some of the rainfall runs into streams or lakes, some evaporates or transpires, and some *infiltrates* into the ground. The amount that infiltrates depends upon many factors, including land cover, the type of soil, and the *permeability* of the ground. Forests usually have permeable surfaces and subsurfaces, as both the surface and soil contain pores, or holes, created by leaves, roots, organisms, organic matter, and the spaces between mineral particles. Such permeable surfaces allow rain drops to soak into and through the ground, filtering pollutants before the water reaches the stream.

In contrast, surfaces such as roofs, roads, and sidewalks are not porous. Precipitation cannot infiltrate these *impermeable* areas. Compaction from vehicle and foot traffic also reduces soil porosity; therefore, lawns, football fields, and walking paths can become impermeable or semi-permeable. Rainwater runs off impermeable areas, carrying pollutants to the nearest storm drain or body of water. Such excess runoff in urban areas is called *stormwater runoff*.

**Skills Exercised:** mapping, math (percentages), critical thinking.

**Grades:** 6-8

**Time:** Preparation takes 10-15 minutes. The lesson requires 20-35 minutes. This lesson may be an in-class activity or given as a homework assignment.

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### Teacher Instructions

#### Preparation

Prepare a map of the school with a grid overlay dividing the school campus into small squares. (An example follows the teacher instructions.) A gridded map can be created using Microsoft Word, as described below:

1. Download a map of your school from Google Earth or Google Maps. (Use the screenshot function or the snipping tool to capture the image on the screen, and crop accordingly.)
2. Save the image to your computer.
3. Open Microsoft Word.
4. Adjust the page to landscape or portrait accordingly.
5. Insert a table. (In the example provided, the table is 19x12. The table should create squares that are large enough to see map details, but small enough to be specific and make a conclusion about the permeability of the area.)
6. Each of the cells in the table should be squares. To adjust this, select the entire table. Then go to Layout and change the height and width. (In the example, the cell height and width is 0.5")
7. Label the first row using numbers, and label the first column using letters, skipping the first cell.
8. Insert the image and change the Text Wrapping to *Behind Text*.
9. Move your image to fit appropriately.
10. Crop the image and/or adjust the margins if necessary.

### *The Activity*

The Student Permeability Prediction Handout provides instructions and follow-up discussion questions. Each student or team should be given a gridded map. Students will estimate the permeability of the area in each box of the grid by writing a rating of 0, 1, or 2 in each box:

- 0 = impermeable, meaning precipitation cannot enter the ground.
- 1 = semi-permeable, meaning that precipitation can enter the ground somewhat.
- 2 = permeable, meaning that precipitation enters the ground easily.

Once the students have completed the grid, they will answer the follow-up questions. The questions require that the students calculate percentages of impermeable and permeable surfaces and consider how impermeable surfaces would affect the quality of a local stream.

# Permeability Prediction

Teacher

