

## MIT Edgerton Center “Grungy Groundwater” Teacher’s Guide

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The material which follows is to provide background on this activity for you as a teacher. We do not expect that students come to the Edgerton Center knowing this procedure and the material. Use this information with your students to prepare them for their visit and to follow up in class after the visit. We do encourage you to conduct an introductory lesson with a class before they come for a visit. We have found that even a brief lesson helps to maximize the class’ time during the visit and to further their level of understanding.

The **Grungy Groundwater** activity can serve many purposes in your curriculum:

- as an enrichment activity after the students have an initial understanding of groundwater
- as a culminating activity after students have completed the *Ecosystems* unit.
- as a review activity when beginning a unit which uses previous knowledge of groundwater

The **Grungy Groundwater** activity introduces or reminds students of the way in which water moves through different materials. If students have studied groundwater or water flow through materials, you may find it appropriate to interrupt explanations provided by the Edgerton Center Staff with questions relating this activity back to materials the students have studied. In addition to providing a small lesson and supervision, we will also give each student a handout to work from, complete with diagrams and instructions.

Concepts introduced and explained as part of **Grungy Groundwater** (as described in the Massachusetts State Frameworks for grades 3-5, Earth and Space Science Strand):

#5. Recognize and discuss the different properties of soil, including color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.

#10. Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.

### **Earth Science concepts:**

- the rate of flow of water through a material, its porosity and permeability, is dependent upon the particle size of the material
- when materials of different particle sizes are mixed, the rate of flow of water will be *between* that of the rate of flow from the larger particle size to that of the smaller particle size, and will be closer to the rate of the flow through the smaller particle size
- pollutants will flow through different materials at different concentrations and different rates

### **Materials used during the activity:**

- Ringstand with tubes of earth materials to learn about the rate of flow of water through different materials

- Fine sand, course sand, gravel, clay, the earth materials used
- Groundwater model to demonstrate the movement of water through earth materials
- Colorimetric scales to quantify the quantities of “pollutants” allowed through the different earth materials

### Schedule:

- 5 minutes Introduction to **Grungy Groundwater** and the Edgerton Center
- 50 minutes Students explore the rates of flow through different materials, measuring and recording the amount of liquid captured in a 10-20 second interval through each tube. Students will add a “polluted” solution to the same tubes to begin to notice how different materials “trap” pollution differently.
- 30 minutes Students are introduced to the Groundwater model. Students are asked to recreate a scenario that is given to them (via a drawing) with supplied earth materials. Students will choose a location to “bury pollution” within their model.
- 30 minutes Break. Students eat their brown bag lunches at this time.
- 50 minutes Students finish building their models. Students will observe how and where their buried pollutant affects the groundwater surrounding its location. The groups will then contaminate their models with a surface pollutant (mimicking fertilizer, road salt, etc.) or a “spill” of contaminant directly into their water source (mimicking a chemical spill).
- 15 minutes Students will display their model to the rest of the class, providing the background information that they received before the activity. Clean up models, and pack up.

Total time: 3 hours

## Step-by-Step Overview of Grungy Groundwater

### 1.) Introduction:

The concept of groundwater will be briefly introduced: its location in the layers of the earth, and the possible materials it works its way through and around will be mentioned. The water cycle will be discussed in order to demonstrate groundwater's place in the cycle.

### 2.) Learning about different materials:

Student table groups will be directed to the ringstands on the tables containing the different earth materials. They will be directed to pour specific quantities of water through the various tubes, measuring and recording the amount of time required for the water to flow through. Students will also learn how to use a colorimetric scale as they run through the activity a second time with "polluted" water.

### 3.) Building the groundwater model:

Using the materials provided, and the stratigraphy drawn out for them, each group will build their groundwater model. We provide hands-on instruction for each group.

### 4.) Testing the groundwater model:

Here the students test their design, and get a real sense of the way in which 2-3 different sources of pollution (loosely modeled on acid rain, an oil spill and buried pollution) work their way through groundwater. Each group will observe what drilling an investigation hole into the soil layers can do for civil engineers and what happens to the surrounding area.