

# 19. Filtering the Filth

## Skills:

Critical thinking, investigating, observing, organizing, measuring, comparing, evaluating, speaking

## Purpose:

The students will have an opportunity to witness one way to purify water, while understanding that clean water is an essential component to a healthy habitat.

## Time:

1 class period

## Setting:

Indoors

## Materials per group:

- Filtering the Filth Student Directions
- Clean, clear plastic 2-liter bottle, with ½-inch removed from the bottom of the bottle
- Cup or jar in which the 2-liter bottle can sit
- 2 cotton balls
- Enough pebbles to make a 2-inch layer in the bottom of the bottle
- Enough gravel to make a 2-inch layer in the bottom of the bottle
- Enough sand (or charcoal) to make a 2-inch layer in the bottom of the bottle
- Mixing bowl, filled with 1 cup of water
- 2 tablespoons of soil
- Spoon
- Ruler
- Fish in an aquarium (optional)
- Pictures of fish in various habitats (optional)
- Food coloring or powdered drink mixes (optional)

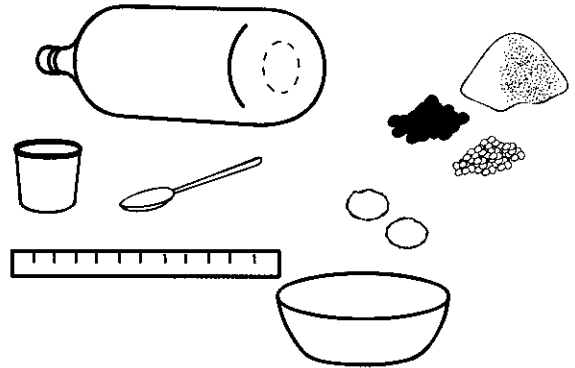
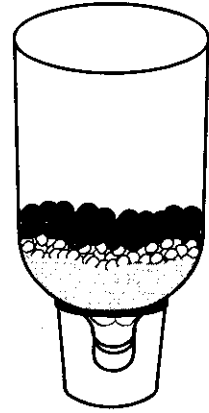
## Background:

In the United States, water for human consumption is cleaned using the following process:

- **Ozonation** - Ozone-rich air bubbles are forced up through the water in a series of ozone contact chambers. In addition to being a highly effective disinfectant, the ozonation process

destroys compounds that cause unpleasant tastes and odors in the water.

- **Coagulation/Flocculation** - After ozonation, the water moves through a flash mixer where chemicals called coagulants are added. These coagulants react with particles in the water, causing them to clump together. The water then goes to flocculation basins, which use the hydraulic energy of the water for mixing to create “floc” particles that are large and



heavy enough to settle to the bottom.

- **Sedimentation** - The water then moves onto a double-decked sedimentation basin, where the heavier floc particles settle to the bottom. Meanwhile, the clearer water moves on to be filtered. A vacuum system removes the settled solids and deposits them in a solids holding basin.
- **Filtration** - Following sedimentation, the clarified water is filtered through layers of anthra-

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cite coal and sand. This process removes any remaining particles that did not settle out previously. This “polishing” provides a high level of clarity. As the water leaves the plant, it receives a small dose of chlorine to keep it fresh and clean as it travels through the distribution system to customers. The pH of the water is adjusted for corrosion control and fluoride is also added to benefit the community’s dental health.

- Filter Press - The material removed in the sedimentation and filtration process contains a significant amount of water. In order to separate the water from the solids, so that it can be recycled, the material is sent to a filter press. The filter press squeezes out the remaining water. The compacted solids are then transported to a landfill for disposal.

## Procedures:

**1** Discuss with your students the components of a healthy habitat: availability of food, water, shelter, and places to raise young. What is a fish’s habitat? How do they find the requirements they need to survive? What would happen if they did not have clean water? How does their habitat get polluted? Can we do anything to prevent pollution? Can we do anything to help clean up our waterways?

**2** Divide your students into groups of 4 or 5, explaining that they are going to build a device that will clean water. Hand out the supplies, reminding students that they will need to take turns while building the device.

**3** After the experiment, have your students explain what happened to the polluted water. Is the water in the bottom of the cup different than when it was originally poured into the 2-liter soda bottle? Why or why not? Should water be filtered before it is pumped into our rivers or lakes? Why or why not? Will doing this help protect fish and

their habitat? Why or why not? What does this filtering system they created remind them of? (*A water treatment facility. Most people today get their water from public utility companies, which in turn get water from a natural source. Some of our water comes from surface water such as lakes and rivers. Other utility companies get water from underground sources (rock, clay, sand, gravel) called an aquifer. Utility companies must clean this water to make it safe to consume.*)

**4** Explain to your students that within an ecosystem, all living things depend not only on water, but on each other. Give examples of this interdependence between water, plants, and animals. Describe the consequences if the water in an ecosystem is either polluted or in short supply.

**5** Have the students write a short report on the importance of clean water for all living species.

## Extension:

Don’t pass out the Filtering the Filth Student Directions.

1. Using only the supplies you have provided, have your students design a filtering system that they think will clean polluted water.
2. Have students construct the filtering system they have designed.
3. After it has been constructed, have them demonstrate its effectiveness by taking the cup of soiled/polluted water.
4. If they are not happy with the results, have students evaluate their filtering system. What changes could have been made for it to filter more effectively? Have students make the changes and try again. When the group is satisfied that the water will be sufficiently cleaned, draw a model of the filtering system, labeling its components and their function in this process.

# FILTERING THE FILTH

Follow the steps to make your own filter for cleaning water. Be sure to take turns with your classmates while assembling the filter.

## **Steps for creating your filter:**

1. Place the clean 2-liter bottle, neck side down, into the cup or jar.
2. To keep the gravel, pebbles, and sand from falling out of the bottom, place the cotton balls into the neck opening to act as a stopper.
3. Place a 2-inch layer of sand on top of the cotton balls.
4. Place a 2-inch layer of the smaller rocks on top of the sand.
5. Place a 2-inch layer of the larger rocks on top of the smaller rocks.

Your filter is ready!

## **Steps for creating your polluted water:**

1. Add the soil to the mixing bowl with 1 cup of water.
2. Mix with the spoon.
3. (Optional) For a more visual demonstration, mix a few drops of food coloring or powdered drink mix to the water to simulate other pollutants.

## **Steps for using your filter:**

1. Choose 1 person in the group to pour the polluted water mixture onto the top layer of the rocks.
2. Observe what happens to the filter and the water.
3. Write a short report on what has happened, including how pollution can affect fish and why it's important to have clean water for all living species.