Hydroelectric Dam Energy Demonstration: Teacher Guide

In this activity your students will:

1. Predict which dam has the potential to create the greatest amount of force.
2. Understand that the shape of the reservoir behind a dam determines the stored potential energy.

Background:

This demonstration is designed to help students understand how the dimensions (width, length, and depth) of a dam model can influence potential energy production. This activity demonstrates how a dam stores potential energy for future release at times of greater energy need.

Materials (for one tray/model set up)

- 5 lbs. non-drying modeling clay
- 1 water-tight tray (minimum size- 9 X 13 x 2.5 inches)
- 1 liter water
- 1 light-weight plastic or balsa wood figurine
- Dam (gate)- piece of wood (see individual demo directions for dimensions)

1. Activity sequence:

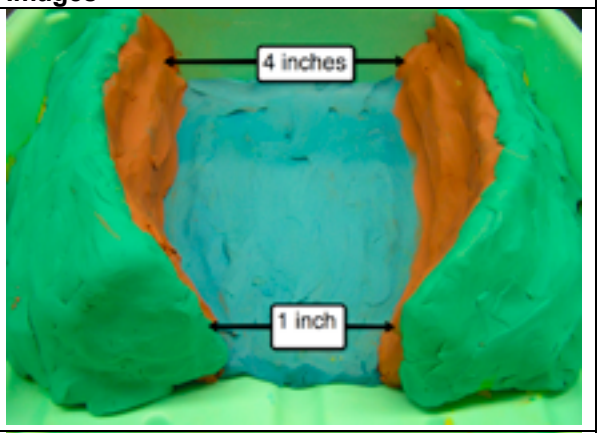
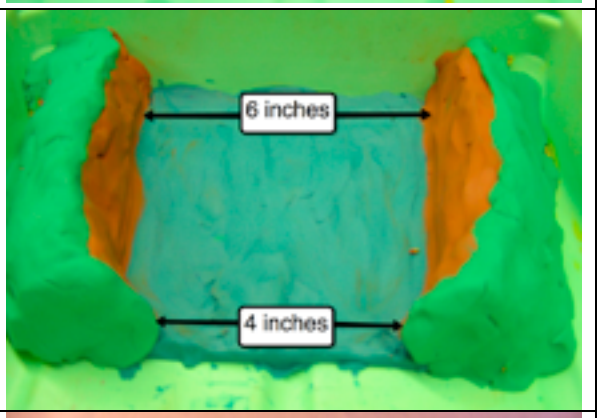
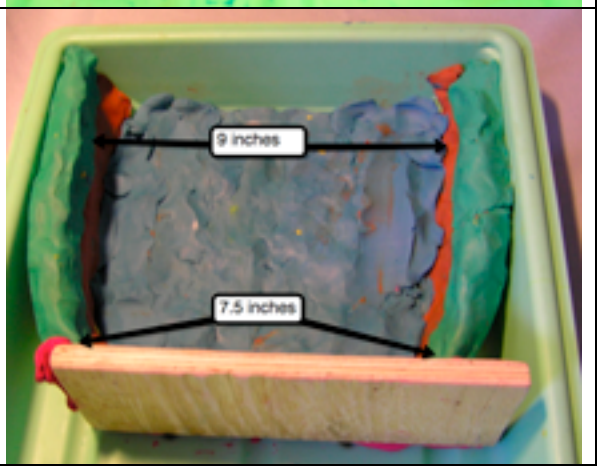
a. Teacher-lead demonstration:
   i. Place three model simulation trays on a single table.
   ii. Students gather around the demonstration table.
   iii. Ask students to predict which dam shape holds the greatest potential energy.
   iv. Release water, one tray at a time.
   v. Students make observations and discuss results.

OR

b. Student-lead investigation:
   i. Each student is given a prediction sheet.
   ii. Place each model simulation trays at workstations around the room.
   iii. Ask students to walk around classroom and make observations about each of the dams.
   iv. Ask students to predict which dam shape holds the greatest potential energy. Predictions should be written on the student prediction sheets.
   v. Regroup. Discuss predictions as a group.
   vi. Release water at individual stations, one at a time. Class moves from station to station.
   vii. Students make observations and discuss results

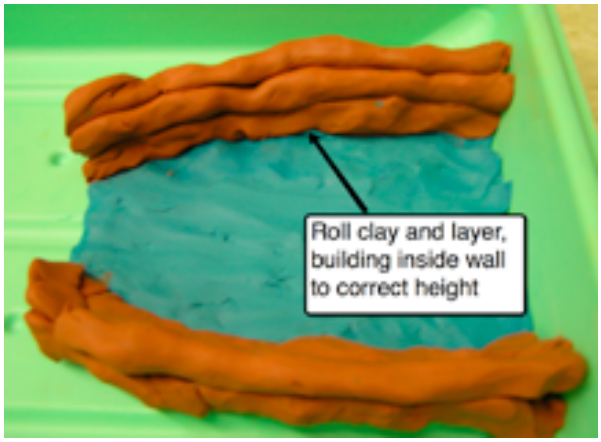
2. Reservoir construction

a. Press clay into the 3 configurations below. Be sure that the base of the clay is pressed firmly against the bottom and sides of the tray so water does not leak. If you are using a larger or deeper pan you may alter the dimensions proportionately.

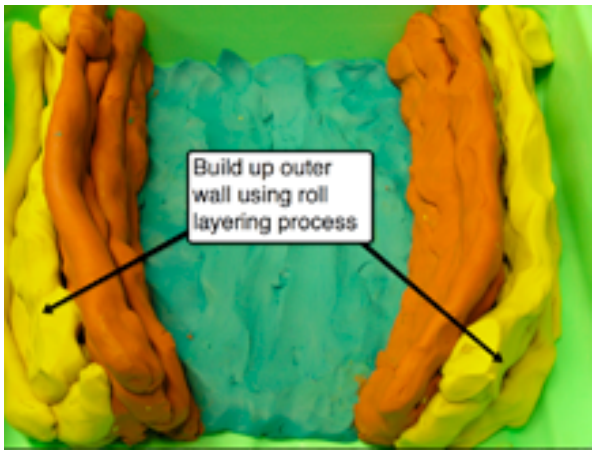
Description	Dimensions	Images
Dam #1 Narrow mouth Narrow body Long run Deep reservoir	• Mouth Width – 1” • Reservoir width– gently expanding to 4” • Reservoir length – 8” • Depth 2” • Dam gate - wood piece 3” x 3” x 1/4”	
Dam #2 Mid-size mouth Mid-size body Short run Mid-depth reservoir	• Mouth Width – 4” • Reservoir width– expanding to 7 inches • Reservoir length – 6” • Depth 1.5 inches • Dam gate - wood piece 3” x 6” x 1/4”	
Dam # 3 Wide mouth Wide body Long run Shallow reservoir	• Mouth Width – 7.5” • Reservoir width– expanding to 9” • Reservoir length – 8” • Depth 1” • Dam gate - wood piece 3” x 6” x 1/4”	

b. If the floor of your pan is not smooth you may want to line the reservoir area with clay to help seal the base of the dam and to equalize the release. Be sure to keep the base of your model level.

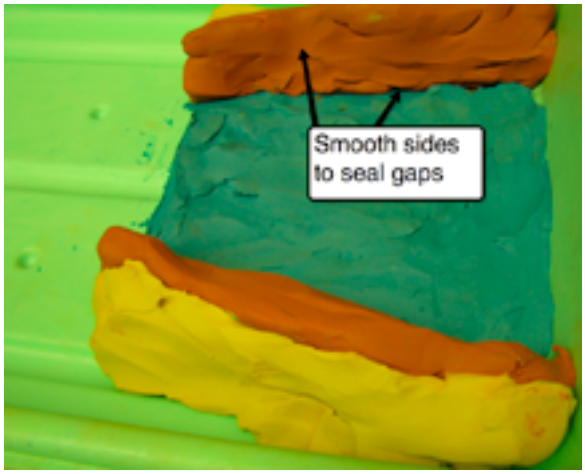
c. Build up the sides to specified height. Note: In the sample pictures the **brown layer** depicts the water fill depth of the reservoir basin.



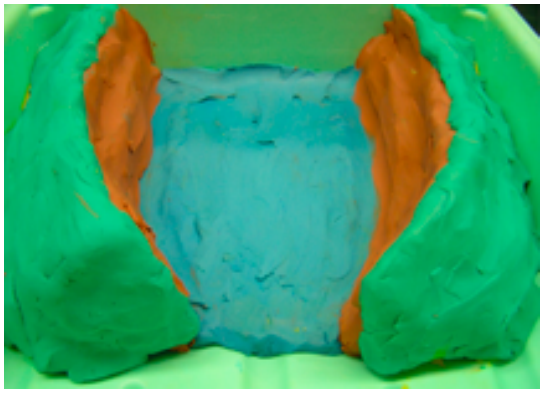
d. Build up the bank width by layering clay on the outside walls.



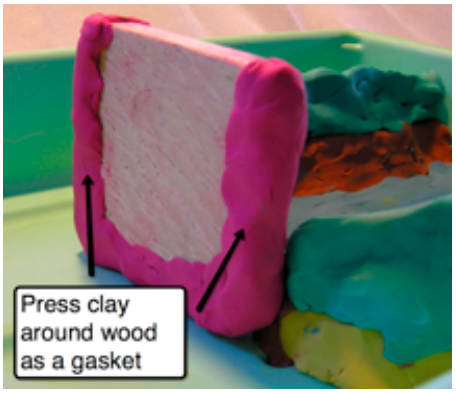
e. As you mold the reservoir, smooth the sides creating a gentle sloping from floor to bank. Maintain the specified width mid-way up the bank.

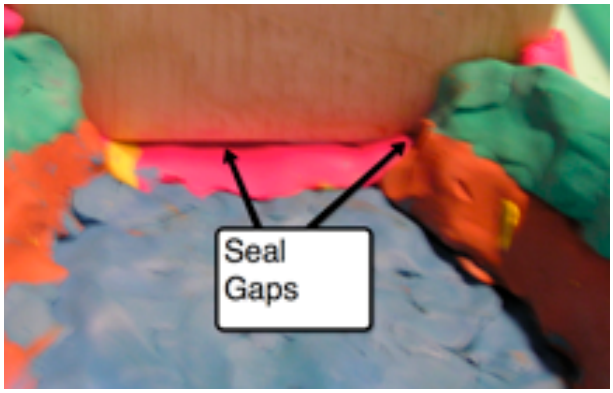


f. Press green clay into sheets. Cover banks with green clay. Smooth seams.



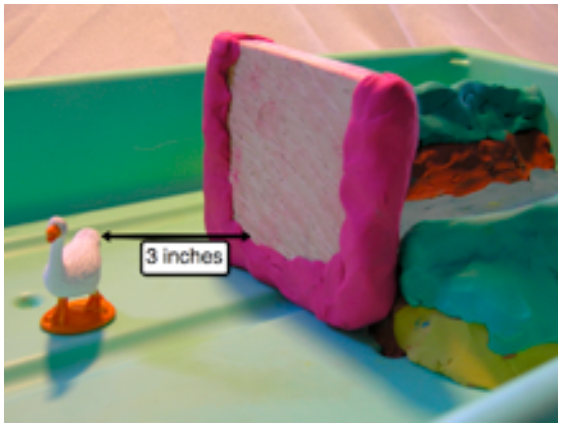
g. Make a gasket of clay to surround the edges of the dam opening; roll clay into approximately **1/2”** ribbons and press around dam gate.





h. Seal the dam gate to the mouth of the reservoir, pressing and smoothing to the body of the reservoir. Be sure to keep the internal mouth of the dam to the configurations stated above. Seal under the dam opening so water does not leak.

i. Place the plastic figure **3”** in front of the dam gate.



j. Move tray to display area.

k. Test-fill the reservoir. Identify leak areas and seal by pressing clay against wood or sealing gaps between clay layers.

l. When all leaks are sealed, empty the water from the tray. Do not fill tray for the demonstration until just before the release.

3. Predictions

a. Explain to students that the water in the reservoir has stored potential energy that can be converted to kinetic energy. Ask students how the potential energy in the reservoir is converted to kinetic energy. [*Removing the dam gate to allow the water to flow converts stored potential energy into kinetic energy.]*
b. Ask students to predict which dam shape stores the greatest potential energy. How could this be determined? [*The dam configuration that moves the plastic figure the furthest or fastest stores the greatest potential energy.]*

4. Demonstration

a. After students make their predictions, fill the first reservoir with water.
b. Ask a student to remove the wooden gate in front of the dam.
c. Repeat for the remaining two dams.
Note: Dam #2 and 3 may not use an entire liter of water.

5. Observation and discussion

a. Instruct students to make observations. Which dam release appeared to be fastest? Which dam release moved the plastic figurine the furthest?
b. Were your predictions correct? Ask students to explain why two dams did not release the water with as much force as the third.

6. Cleanup (If you choose to break-down the models)

a. Dry clay before removing from the trays.
b. Store clay in plastic bags to maintain pliability.
c. Scrape tray clean with a spatula. Wash tray with hot water and soap. Remove final residue with general household cleaner spray.

7. Assembled Tray Storage

a. Dry clay and tray
b. Cover with plastic wrap or wax paper. Do not use fabric. The clay will stick to the fabric.